



July 24, 2026

Jill Thayer
Chief Legal Counsel
Bureau of Legislative Research
State Capitol Building, Room 315
500 Woodlane Street
Little Rock, Arkansas 72201

Re: Final Report and Presentation Slides – Nuclear Feasibility Study

Dear Ms. Thayer:

EXCEL Services Corporation has completed the technical feasibility study on new nuclear energy generation in the State of Arkansas. This letter transmits the final report and the slide deck for the August 6, 2026 presentation to the Joint Committee on Energy.

The final report includes the Executive Summary, Chapters 1 through 7, and the supporting attachments on transmission, water, financing, and proposed legislation. As you requested in your June 19, 2026 email, we are sending the slide deck now so the chairs can review it before the presentation.

I thank my colleagues Erica Combs, Simon Forster, Pete Shaw, and Ismael Yabda for their work on this study.

We appreciate BLR's support throughout the study and look forward to presenting the final report to the Committee on August 6 at 10:00 a.m.

Respectfully,

Brian Meadors
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Attachments: Final Report and August 6 presentation slides

cc: Michelle Nelson
Marty Garrity



Executive Summary

Arkansas Nuclear Feasibility Study

The Joint Committee on Energy of the Arkansas General Assembly directed a technical feasibility study of new nuclear generation in Arkansas as described in Act 707 of 2025. The study's conclusion: new nuclear is feasible and advisable in Arkansas. The state needs the energy, workable sites exist, federal support is the strongest it has been in decades, and state law needs only modest changes. This summary presents the findings and the recommended course.

1 The Case for Nuclear

Arkansas power demand is surging. Entergy Arkansas says Arkansas's power needs are projected to grow by more than 35 percent over the next five years, with longer-term projections indicating that the growth figure could more than double as technology, lithium, steel, manufacturing, aerospace, defense, forestry, and other major industries consider locating or expanding in the state. The Arkansas Electric Cooperative Corporation, whose system peaks near 3,000 megawatts (MW), is evaluating roughly 4,000 MW of prospective load requests. Some existing generation is being retired at the same time. Under a Clean Air Act settlement, Entergy will cease burning coal at White Bluff by the end of 2028 and at Independence by the end of 2030.

Nuclear fills that gap better than any alternative.

- + **Baseload.** The U.S. nuclear fleet ran at a 91 percent capacity factor in 2025, the highest of any generation source, against roughly 25 percent for utility-scale solar and 35 percent for onshore wind. Nuclear runs around the clock, in any weather.¹
- + **Non-emitting.** Nuclear produces no carbon dioxide during operation, and its lifecycle emissions are comparable to wind and generally less than solar generation.
- + **Smallest footprint.** A 1,000 MW nuclear plant occupies about 1.3 square miles. An equivalent solar farm needs about 75 square miles, a wind farm about 260.
- + **Safer.** Nuclear has one of the lowest mortality rates per unit of energy of any electricity source. The worst commercial nuclear accident in U.S. history, Three Mile Island in 1979, caused no deaths and no detectable health effects. By comparison, the Buffalo Creek coal-waste dam failure killed 125 people in 1972.
- + **Secure.** Uranium can be stockpiled on site for 18 to 24 months of operation. No fossil plant can match that. Winter Storm Uri showed in 2021 what a gas-supply disruption does to grids across the South-Central United States, including Arkansas.

A plant also transforms its host economy. A small modular reactor (SMR) could create about 237 permanent positions for the life of the plant. A large reactor employs 500 to 800 workers once operating and as many as 4,500 at peak construction, and a typical large plant generates roughly \$470 million a year in local sales of goods and services and pays about \$16 million a year in state and local taxes. Arkansas

¹ "Capacity factor" is a measure of how much an electric generator is running. Running at full power all the time is a 100% capacity factor. Wind and solar's numbers are much less, because the sun does not always shine, nor the wind always blow.

Nuclear One (ANO) shows the effect: about 1,048 direct jobs, an annual payroll near \$84 million, and a strong economic pillar of Pope County.

2 Prepare Sites Now, Build at NOAK Prices

Three elements must mature before reactor deployment becomes widespread: reactor designs, supply chains, and financing structures. No current project is fully mature today in all three categories, though some are closer than others. The first units of any design pay for the improvement in maturity. Vogtle Units 3 and 4 in Georgia, the only new large reactors completed in the United States in decades, cost about \$35 billion against an original \$14 billion estimate and finished nearly seven years late.

Repetition cures this. Analysis of future AP1000 builds shows overnight cost falling from a first-of-a-kind (FOAK) anchor near \$15,000 per kilowatt to roughly \$6,200 by the fourth two-unit plant, trending toward \$4,700 at nth-of-a-kind (NOAK). A FOAK build should therefore be expected to cost about three times, and take about twice as long as, a later build of the same design. The study puts the crossover at about the fifth plant of a given design, the tenth at most.

Buyers and lenders know this. Financiers stay in a FOAK mentality on cost and schedule until several units of a design are complete, and most utilities are waiting for that certainty. A few are pressing forward now: TVA with the BWRX-300 at Clinch River, TerraPower's Natrium plant in Wyoming, which received its construction permit in March 2026, and X-energy's Xe-100 units for Dow in Texas.

Arkansas does not have to choose between building first at triple cost and doing nothing. The state can position itself for the NOAK price by supporting the acquisition, characterization, and permitting of sites now. An early site permit resolves site suitability years before a reactor design is selected, and FOAK risk falls as the interval between the reference plants and the Arkansas units grows. A project entering site selection in 2027 could reach commercial operation in the mid-2030s.

3 Siting

The study screened six candidate areas using the Electric Power Research Institute siting methodology.

Transmission came first, because a site that cannot inject its power into the grid cannot host a plant regardless of its other merits. A grid screening evaluated injection capability at the state's 230 to 500 kilovolt nodes, treating 600 MW, about two 300 MW small modular reactor (SMR) units, as the project floor.

Seismic, water, flooding, and population screens followed. The six areas: Flint Creek in Benton County (1), Arkansas Nuclear One in Pope County (2), Central Arkansas south of Little Rock (3), Southwest Arkansas near Camden (4), Phillips County near Helena-West Helena (5), and the Craighead and Mississippi County area in the northeast (6).

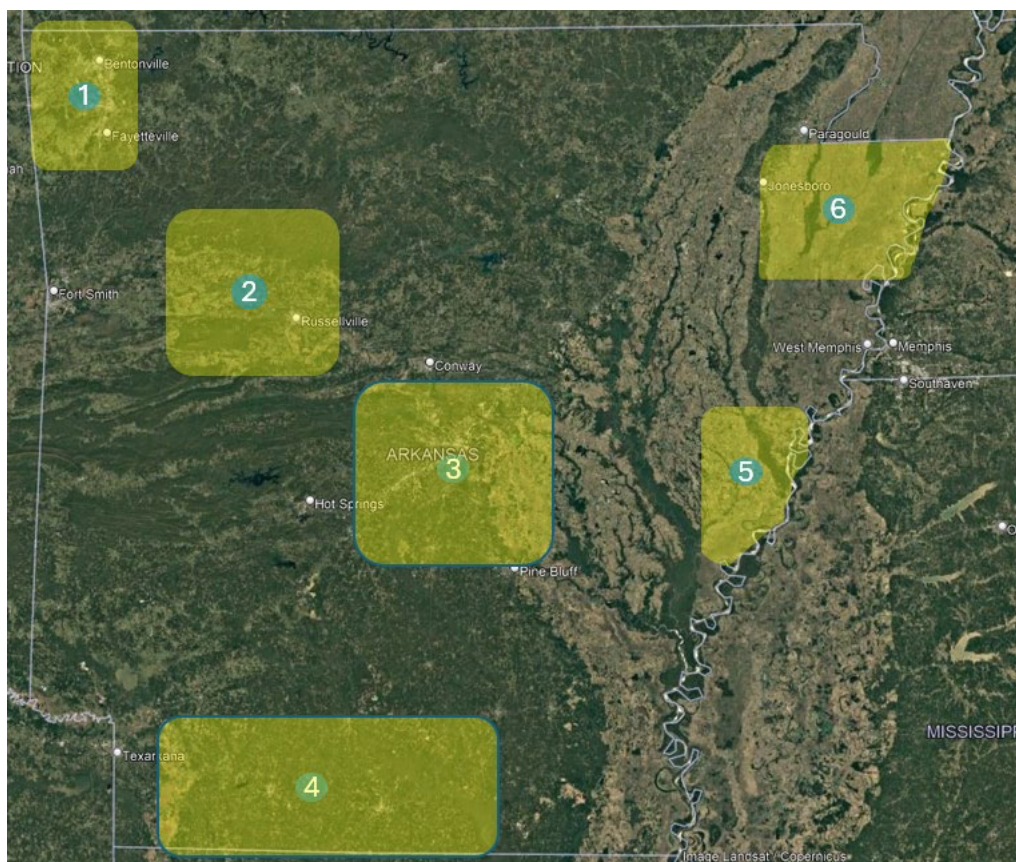


Figure 1. Candidate Regions

Southwest Arkansas (4) and Central Arkansas (3) screen best. Both sit below the seismic screen, are near rivers carrying enough water, and have access to transmission, roughly 1,003 MW of injection capability near Camden and 768 to 929 MW across three Central Arkansas nodes. Both sit near growing demand: the Smackover lithium development in south Arkansas and the retiring White Bluff plant in Jefferson County.

The ANO area (2) is well suited because two reactors already operate there and much of the regulatory record exists. However, its transmission node supports about 614 MW, so a larger build would require transmission upgrades.

Flint Creek (1) is weaker. It falls below the transmission floor, and the water assessment identified no excess surface water there.

Northeast Arkansas would be a strong location on its industries alone. Mississippi County is the largest steel-producing county in the United States, a multibillion-dollar Google data center campus is coming to West Memphis, and the northeast node posts the largest injection capability measured in the state, roughly 2,424 MW. However, the New Madrid seismic hazard makes it challenging. Serving that load means siting just outside the high-hazard zone or selecting a design whose site-specific seismic analysis accommodates the ground motion. The study eliminated Phillips (5) and the northeast area (6) for most reactor designs and carried them provisionally for advanced designs whose seismic bases may accommodate the local ground motion.

The candidate areas are not the only path. Retiring coal plants offer ready sites. White Bluff and Independence keep their grid interconnections, cooling water access, and switchyards, and reusing them shortens development. Military bases are another route. The proposed bill (see Chapter 6) directs the state to consider sites at military installations, and microreactors for base energy resilience are a recurring theme in other states' studies. Those projects would run through the Department of Defense.

West and Southwest Arkansas beyond the studied areas warrant further study. Little River County at Millwood Lake and Scott County may support new nuclear and should be evaluated in the future.

One siting rule change helps SMRs statewide. A 2023 federal rule sizes the emergency planning zone by more flexible means rather than a fixed ten-mile circle, so a qualifying SMR may be able to site closer to towns and load centers than a large reactor.

4 Financing

The financing portion of the study starts with a hard fact: passive investors are reluctant to fund nuclear development or construction. A nuclear project is like a stadium. The developer spends money for years, including tens of millions of dollars for site studies, engineering, approvals, and long-lead equipment, before selling a single ticket. Financing costs generally decline after the plant begins operating and delivery risk largely disappears.

Financing must change as the project advances. Development, from the present through issuance of a construction permit, relies on sponsor equity, a state bridge loan, and potentially export credit financing for early engineering. Construction relies on sponsor equity, Department of Energy debt, export credit debt, and protection against cost overruns. Once the plant is operating, a long-term contract with a creditworthy power purchaser can support refinancing at a lower cost. The target capital structure is approximately 60 percent debt and 40 percent equity.

The legislature can support each stage of the project with different financing tools. Act 373 of 2025 already authorizes recovery of construction work in progress, special rate contracts, and alternative financing for nuclear strategic investments. Additional tools could include a bridge loan program for early development work, a cost-overrun mechanism, a state guarantee supporting export credit agency debt, state tax incentives, and assistance securing a long-term buyer for the power.

The record of using construction cost recovery to support nuclear projects is mixed. Georgia's cost-recovery mechanism helped carry the Vogtle project through its contractor's bankruptcy to completion. South Carolina's V.C. Summer project had similar rate support but was abandoned after severe cost, schedule, and contractor failures. Construction cost recovery may be necessary, but it is not sufficient without strong project controls and disciplined execution.

Refinancing after commercial operation lowers the cost of capital and retires the state's commitments, including any overrun protection. State support matters most in three places: early development, completion of the plant, and assistance with the long-term contracts that keep the project viable.

5 Legal Recommendations

Arkansas Code § 15-10-305 already authorizes the Governor to appoint a Coordinator of Atomic Development Activities. The role has existed on paper for decades and gone unused. The study recommends the Governor appoint the Atomic Coordinator and the General Assembly fund the position. The role would focus on economic development, coordination, and public engagement, not safety regulation, which stays with the Nuclear Regulatory Commission. Activating it uses authority the state already has. Texas, Virginia, New Hampshire, and New York have created comparable offices.

The proposed Arkansas Nuclear Competitiveness Act, attached to the study, makes five changes. It defines nuclear as clean energy under the Clean Energy Development Act, which has no immediate in-state effect but aligns Arkansas law with federal clean energy programs. It expands the Atomic Coordinator's duties to cover siting, workforce, supply chain investment, and federal program tracking, with staff support. It creates the Arkansas Nuclear Energy Development Fund to pay for siting studies, license applications, workforce training, and supply chain development. It requires the state to prepare a Low-Level Radioactive Waste Management Plan within eighteen months. And it amends Arkansas law to permit licensing of a private, in-state, low-level waste disposal facility, subject to health, safety, and financial assurance requirements.

6 Next Steps

We recommend the following next steps:

- 1. Enact the proposed legislation and fund the Atomic Coordinator position.** The Arkansas Nuclear Competitiveness Act activates the Atomic Coordinator, the development fund, and the waste amendments in a single bill.
- 2. Fund supply chain entry.** Appropriate money to the Arkansas Economic Development Commission or other appropriate agency to help Arkansas industries enter the nuclear supply chain by obtaining nuclear quality assurance certifications, NQA-1 and ISO 19443. The study's supplier survey found no Arkansas firm holding nuclear-grade fabrication certification today.
- 3. Prepare sites with willing counties.** Work with counties receptive to new nuclear industry on serious siting preparation, including the siting studies and licensing that turn a candidate area into a permitted site. When nth-of-a-kind costs arrive, projects could go first to the states with permitted sites in hand.

* * *

Out of scope, but important: During the course of the study, the authors learned about HCR 1015 of 2019 and Act 1092 of 2021, both supporting used nuclear fuel recycling. That topic was beyond the scope of the study and therefore not formally analyzed. However, nuclear fuel recycling would be a substantial economic boon to Arkansas, on the order of tens of billions of dollars of investment. Arkansas would be wise to take meaningful steps to study and, if shown to economically feasible, pursue nuclear fuel recycling.



Chapter 1:

The Case for New Nuclear Power in Arkansas

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Acronyms

Acronym	Definition
AEC	Atomic Energy Commission
ANO	Arkansas Nuclear One
ATU	Arkansas Tech University
COLA	combined license application
CO ₂	carbon dioxide
DOE	Department of Energy
ESP	Early Site Permit
FOAK	first-of-a-kind
gCO ₂ e/kWh	grams of CO ₂ equivalent per kilowatt-hour
IAEA	International Atomic Energy Agency
IRA	Inflation Reduction Act
kWh	kilowatt-hour
MOX	mixed oxide fuel
MWe	megawatt electric
MWt	megawatt thermal
NEUP	Nuclear Energy University Program
NPT	Non-Proliferation Treaty
NRC	Nuclear Regulatory Commission
PWR	pressurized water reactor
SEFOR	Southwest Experimental Fast Oxide Reactor
SMR	small modular reactor
U.S.	United States

1 Evolution of Nuclear Power

1.1 BRIEF HISTORY OF NUCLEAR POWER IN THE UNITED STATES

1.1.1 Origins & the Manhattan Project (1939–1945)

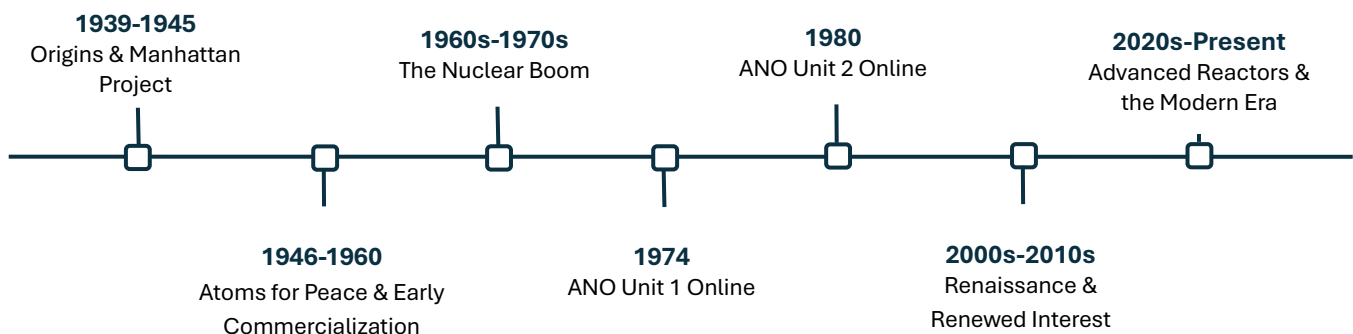
The modern U.S. nuclear era began with the Manhattan Project, the secret wartime effort launched in 1942 to build the atomic bomb before Nazi Germany could. The program drew on a national scientific, engineering, and industrial base and brought together leading physicists of the 20th century. (Rhodes, 1986)

On December 2, 1942, Enrico Fermi and his team achieved the first self-sustaining nuclear chain reaction at the University of Chicago's Chicago Pile-1, proving that controlled nuclear reactions were possible. (Fermi, 1952) The bombings of Hiroshima and Nagasaki in August 1945 ended World War II and revealed both the catastrophic power of the atom and its potential uses. (U.S. Department of Energy, 2015)

1.1.2 Atoms for Peace & Early Commercialization (1946–1960)

After the war, the U.S. began shifting from military applications toward civilian nuclear power. President Eisenhower's 1953 *Atoms for Peace* speech described nuclear energy as a tool for peace, science, and economic progress. (Eisenhower, 1953) The Atomic Energy Act of 1954 ("the Act") opened the door to private nuclear development and set the stage for a commercial industry. (U.S. Congress, 1954)

In 1957, Shippingport Atomic Power Station in Pennsylvania became the U.S.'s first full-scale commercial nuclear power plant. Built as a joint project between the federal government and Duquesne Light Company at a cost of approximately \$72.8 million, it marked a decisive milestone in the transition from weapons technology to civilian electricity generation. (U.S. Atomic Energy Commission, 1958) The Atomic Energy Commission (AEC) supported the emerging sector through research funding, enriched uranium supply, and regulatory oversight.



1.1.3 The Nuclear Boom (1960s–1970s)

The 1960s and early 1970s were a period of rapid expansion. Utilities placed large numbers of reactor orders, encouraged by expectations of inexpensive, abundant electricity. By 1974, more than 200 reactors were on order or under construction, reflecting broad confidence in the technology. (U.S. Nuclear Regulatory Commission, 2023) Federal support also played a major role. The Industrial Participation Program and the Cooperative Power Reactor Demonstration Program together invested about \$1.76

billion in public-private partnerships to build 11 demonstration reactors. ([Electric Power Research Institute, 2017](#)) The 1973 oil crisis intensified interest in nuclear power to improve energy security and reduce dependence on imported fuels. ([U.S. Energy Information Administration, 2012](#))

1.1.4 Setbacks & Stagnation (1979–1990s)

After these events, rising construction costs, tighter regulation, and competition from cheaper natural gas made new plants far less attractive. No new nuclear plants were ordered in the U.S. after 1978, and the industry entered a long period of stagnation. Many planned plants were cancelled or converted to other uses.

The near meltdown at Three Mile Island in Pennsylvania on March 28, 1979, became a turning point for public trust in nuclear power. Although there were no attributable deaths, the accident triggered major regulatory reforms, higher costs, and widespread project cancellations. ([U.S. Nuclear Regulatory Commission, 2023](#)) The 1986 Chernobyl disaster stoked global fears. ([World Nuclear Association, 2023](#))

1.1.5 Renaissance & Renewed Interest (2000s–2010s)

In the early 2000s, nuclear power regained attention as concerns about climate change, energy security, and fossil fuel volatility grew. The Energy Policy Act of 2005 provided loan guarantees, production tax credits, and insurance against regulatory risk, encouraging utilities to file Combined License Applications with the NRC. ([U.S. Congress, 2005](#))

That optimism faded again after the 2008 financial crisis, the shale gas boom, and the 2011 Fukushima Daiichi disaster in Japan, which was triggered by an earthquake and tsunami. Most planned projects were delayed or cancelled, with Vogtle Units 3 and 4 in Georgia becoming the only new reactors to move forward, but at substantial cost overruns. ([Georgia Power, 2024](#))

1.1.6 Advanced Reactors & the Modern Era (2020s–Present)

Today, the industry is centered on advanced reactor designs such as small modular reactors (SMRs) and microreactors, which aim to reduce costs, shorten construction timelines, and improve deployment flexibility. Companies including NuScale, TerraPower, X-energy, and Kairos Power are pushing designs toward commercialization, while technology companies such as Microsoft, Google, and Amazon have signed nuclear power agreements. ([U.S. Department of Energy, 2024](#))

As of 2025, the U.S. operates 94 reactors at 56 sites, producing about 19 percent of the nation's electricity and remaining the largest source of carbon-free power in the country. ([U.S. Nuclear Regulatory Commission, 2025](#))

A new nuclear resurgence is underway, driven by the need for grid stability, rising electricity demand from AI and data centers, and renewed energy security concerns. The Inflation Reduction Act (IRA) extended and expanded nuclear tax credits, while the ADVANCE Act streamlined NRC licensing and helped accelerate next-generation projects. ([U.S. Congress](#))

1.2 NUCLEAR POWER IN ARKANSAS

Arkansas has a rich but compact nuclear history, from an experimental fast breeder reactor in the Ozarks to a two-unit commercial plant that has powered the state for over 50 years. The state's nuclear story

reflects the broader arc of American nuclear development: early federal investment, commercial expansion, regulatory evolution, and a renewed focus on advanced reactor deployment.

1.2.1 SEFOR: Arkansas's First Nuclear Reactor (1969–1972)

The Southwest Experimental Fast Oxide Reactor (SEFOR) was Arkansas's first nuclear facility. Located near Strickler in rural Washington County, approximately 20 miles southwest of Fayetteville, SEFOR was completed in 1969 under the direction of the AEC to test the feasibility of fast breeder reactor technology. The reactor was privately operated by General Electric and funded through the Southwest Atomic Energy Associates, a nonprofit consortium of 17 Southwest Power Pool utilities and European nuclear agencies, including the Federal Republic of West Germany.

([Southwest Experimental Fast Oxide Reactor \(SEFOR\), 2019](#))

SEFOR used mixed oxide (MOX) fuel and liquid sodium cooling, generating 20 MW of thermal energy but no electricity. Its primary purpose was to test the inherent safety characteristics of oxide fuel and sodium cooling, particularly the stabilizing effect of thermal expansion during accident scenarios, a hypothesis that SEFOR confirmed. Notably, SEFOR demonstrated the feasibility of using uranium-plutonium MOX fuel.

([Southwest Experimental Fast Oxide Reactor \(SEFOR\), 2019](#))

SEFOR operated from 1969 to 1972, when its original research program concluded. A proposal to extend operations through 1977 was rejected. The University of Arkansas acquired the site in

1975 for instrumentation research, which ceased in the early 1980s. The facility was decommissioned between 2016 and 2019 through a collaboration between the U.S. Department of Energy's Office (DOE) of Environmental Management and the University of Arkansas, with EnergySolutions serving as the decommissioning contractor. ([U.S. Department of Energy, Office of Environmental Management, 2019](#))

SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR (SEFOR)



- + Located in Washington County
- + 20 MWt experimental sodium-cooled fast breeder reactor
- + Operated from 1969 – 1972
- + Produced no electricity
- + Confirmed theoretical predictions about breeder reactor safety and proved the feasibility of plutonium-based MOX fuel
- + Findings became foundational for subsequent breeder reactor designs globally
- + Acquired by University of Arkansas in 1975 for research
- + Fully decommissioned by 2019

**ARKANSAS NUCLEAR ONE (ANO),
UNIT 1 AND UNIT 2**



- + Located near Russellville, AR
- + Two (2) PWR units with a combined capacity of 1,824 MWe
- + In operation since 1974
- + License Expiration: Unit 1 – 2034; Unit 2 – 2038
- + 56% of Entergy Arkansas Supply

1.2.2 Arkansas Nuclear One: The State's Commercial Nuclear Plant (1974–Present)

Arkansas Nuclear One (ANO) is the state's only commercial nuclear power facility, located on the northeast shore of Lake Dardanelle near Russellville in Pope County. Owned by Entergy Arkansas and operated by Entergy Nuclear, ANO comprises two pressurized water reactor (PWR) units, both engineered by Bechtel Power. ([Arkansas Nuclear One, 2019](#)) Combined, the two units have a nameplate capacity of 1,824 MWe and generate approximately 13,555 GWh annually, supplying roughly 56 percent of Entergy Arkansas's 735,000 customers' total energy demand. ANO has been in continuous operation for over 50 years as of December 2024. ([U.S. Energy Information Administration, 2026](#)) ([Entergy Arkansas, 2026](#))

Arkansas's existing nuclear infrastructure, including ANO's operational expertise, trained workforce, transmission interconnections, and established regulatory relationships, provides a foundation for future advanced reactor deployment. Act 707 of the 2025 Regular Session directed a technical feasibility study to evaluate sites and technologies for new nuclear generation in the state. ([Arkansas General Assembly, 2025](#))

Table 1-1. Arkansas Nuclear One Timeline (Unit 2 reached commercial operation in 1980. The 1978 entries below mark its construction completion, first criticality, and operating license.)

Milestone	Unit 1	Unit 2
Construction permit issued	1968	1971
Construction starts	1968	1971
Construction completion	1974	1978
First criticality	1974	1978
Operating license issued	1974	1978
License renewal issued	2001	2005
Current license expiration	2034	2038

2 Advantages and Disadvantages of Nuclear

2.1 ADVANTAGES AND BENEFITS OF ADVANCED NUCLEAR TECHNOLOGY

Nuclear power ranks among the most energy-dense, reliable, and low-carbon electricity sources. As the energy system moves away from fossil fuels, advanced reactor designs combine attributes that few other technologies match. ([World Nuclear Association](#))

1 uranium pellet	Carbon-Free, Clean Energy Nuclear fission produces no direct carbon dioxide (CO₂) emissions during operation. Over its full lifecycle, including construction, fuel processing, and decommissioning, nuclear generates about 6 grams of CO₂-equivalent per kilowatt-hour (gCO₂e/kWh) as a lifecycle median, similar to wind and below all forms of solar. (Ritchie, Hannah and Roser, Max, Our World in Data, 2020)
149 gallons of oil	In the U.S., nuclear power is the single largest source of carbon-free electricity, supplying about 19 percent of total generation and the largest single share of the country's carbon-free electricity. (U.S. Energy Information Administration, 2026)
2,000 pounds of coal	Reliability & Baseload Power Nuclear plants operate continuously, providing firm, dispatchable baseload power that is not dependent on weather conditions. In 2023, the global nuclear fleet achieved an average capacity factor of 81.5 percent, among the highest of any electricity generation technology. (World Nuclear Association, 2024)
17,000 cubic feet of natural gas	By comparison, utility-scale solar averages approximately 25 percent and onshore wind approximately 35 percent. This reliability makes nuclear uniquely suited to anchor grid stability, particularly as variable renewable penetration increases and the need for firm, always-on power grows. (World Nuclear Association, September 2025)

Energy Density & Land Use

Nuclear fuel is energy dense. A single uranium fuel pellet the size of a fingertip contains as much energy as 17,000 cubic feet of natural gas, one ton of coal, or 149 gallons of oil. ([U.S. Department of Energy, Office of Nuclear Energy, 2024](#)) This energy density translates directly into a minimal land footprint: **a 1,000 MW nuclear plant occupies roughly 1.3 square miles, compared to approximately 75 square miles for an equivalent solar farm or 260 square miles for a wind farm.** ([U.S. Nuclear Regulatory Commission, 2023](#)) For states like Arkansas with significant agricultural and forested land, this distinction is particularly relevant.

Energy Security & Fuel Diversity

Nuclear power reduces dependence on imported fossil fuels and insulates electricity consumers from commodity price volatility. Uranium is sourced from a geographically diverse set of nations, including

Canada, Australia, Kazakhstan, and Namibia, and the fuel cost represents only a small fraction of total nuclear operating costs, making electricity prices highly stable over time. ([World Nuclear Association, 2026](#)) The U.S. Department of Energy (DOE) has identified nuclear energy as a critical component of national energy security strategy, particularly given growing geopolitical risks to natural gas and oil supply chains. ([U.S. Department of Energy, Office of Nuclear Energy, April 2026](#))

Economic & Job Creation Benefits

Nuclear plants are significant economic engines. A typical 1,000 MW nuclear plant generates approximately \$470 million in annual economic output for its host community, supports roughly 400 to 700 permanent high-wage jobs, and contributes \$16 million per year in state and local tax revenues. ([Nuclear Energy Institute, 2024](#)) The nuclear supply chain supports tens of thousands of additional jobs in manufacturing, engineering, and professional services. Advanced reactor projects, particularly SMRs, are expected to generate substantial construction employment and long-term operational jobs in host communities.

Nuclear's Role in a Net-Zero Future

The IEA's Net Zero by 2050 scenario calls for a doubling of global nuclear capacity by 2050. The DOE's *Pathways to Commercial Liftoff: Advanced Nuclear* ([U.S. Department of Energy, 2024](#)) identifies advanced reactors as critical to meeting U.S. decarbonization, energy security, and industrial competitiveness goals, with about 200 GW of new nuclear capacity by 2050, which would roughly triple total U.S. capacity to about 300 GW. ([U.S. Department of Energy, 2024](#))

2.2 DISADVANTAGES OF NUCLEAR TECHNOLOGY AND DERISKING

Nuclear power carries well-documented challenges: high upfront costs, long construction timelines, radioactive waste, and public perception. Each has mitigation strategies. ([Georgia Power, 2024](#))

High Capital Costs & Construction Risk

Nuclear power plants require enormous upfront capital investment. The Vogtle Units 3 and 4 project in Georgia, the only new large reactors completed in the U.S. in decades, ultimately cost over \$30 billion, more than double the original estimate of \$14 billion, and came online years behind schedule. ([Georgia Power, 2024](#)) High financing costs, complex regulatory requirements, and first-of-a-kind (FOAK) construction challenges have made large nuclear projects among the most capital-intensive infrastructure investments in the world. ([World Nuclear Association, 2024](#))

MITIGATION STRATEGIES:

- + **Standardized designs:** Repeating the same reactor design across multiple units reduces engineering costs and construction risk, as demonstrated by South Korea's fleet approach (approximately \$2,300/kW overnight cost in 2010). ([U.S. Department of Energy, 2024](#))
- + **SMRs & factory fabrication:** Small Modular Reactors built in factories and assembled on-site promise lower per-unit capital requirements and shorter construction timelines. ([World Nuclear Association, 2026](#))

- + **Public-private risk sharing:** Government loan guarantees, production tax credits (IRA 2022), and strategic investment frameworks like the Arkansas Act 373 of 2025 reduce the cost of capital and share construction risk. ([Arkansas General Assembly, 2025](#))

Long Construction Timelines

Large nuclear plants typically take 10 to 20 years from planning to commercial operation in Western countries, compared to 2 to 4 years for utility-scale solar or wind. ([Congressional Research Service, 2025](#)) This timeline mismatch creates challenges for utilities seeking to meet near-term targets and makes nuclear less responsive to rapidly changing electricity demand.

MITIGATION STRATEGIES:

- + **Streamlined licensing:** The ADVANCE Act (2024) reformed NRC processes to reduce licensing timelines and allow approved designs to remain valid longer. ([U.S. Congress](#))
- + **Advanced reactor designs:** SMRs and microreactors are designed for faster deployment, some targeting construction timelines of three to five years. ([U.S. International Trade Commission, 2024](#))
- + **Early site permitting:** Utilities can obtain Early Site Permits (ESPs) from the NRC years in advance, separating site approval from reactor design review.

Radioactive Waste Management

Nuclear power generates radioactive waste at every stage of the fuel cycle, from low-level waste (contaminated tools and clothing) to high-level waste (spent nuclear fuel), which remains hazardous for tens of thousands of years. ([U.S. Nuclear Regulatory Commission, 2024](#)) The U.S. has no permanent repository for high-level nuclear waste. The proposed Yucca Mountain repository in Nevada was effectively abandoned in 2010, leaving about 86,000 metric tons of spent fuel stored at reactor sites across the country. ([U.S. Government Accountability Office, 2021](#))

MITIGATION STRATEGIES:

- + **Consolidated interim storage:** Facilities like those proposed by Holtec International and Orano would consolidate spent fuel away from reactor sites while a permanent solution is developed.
- + **Advanced fuel cycles:** Fast reactors and molten salt reactors can use recycled spent fuel, reducing waste volume and radioactivity timescales. (Dixon, 2021)
- + **Legislative action:** The Nuclear Waste Policy Act requires updating to reflect current realities; several bipartisan proposals have been introduced in Congress to restart the repository siting process. (U.S. Nuclear Waste Technical Review Board, 2021)

Nuclear Safety & Accident Risk

Nuclear power has one of the lowest mortality rates per unit of energy produced of any electricity source. Nevertheless, the high-profile events at Three Mile Island (1979), Chernobyl (1986), and Fukushima (2011) have had lasting impacts on public trust and regulatory frameworks. ([Frontiers in Nuclear Engineering, 2025](#)) The consequences of a severe accident, while rare, can be geographically widespread and economically devastating.

MITIGATION STRATEGIES:

- + **Passive safety systems:** Advanced reactor designs use passive safety features, such as gravity, natural convection, and inherent physics, that shut down the reactor automatically without operator intervention or external power. ([U.S. International Trade Commission, 2024](#))
- + **Smaller reactor sizes:** SMRs and microreactors have smaller cores and lower decay heat, reducing the consequences of any potential accident.
- + **Stronger regulatory oversight:** Post-Fukushima NRC reforms strengthened requirements for backup power, hydrogen management, and spent fuel pool safety. ([U.S. Nuclear Regulatory Commission, 2023](#))

Public Perception & Social Acceptance

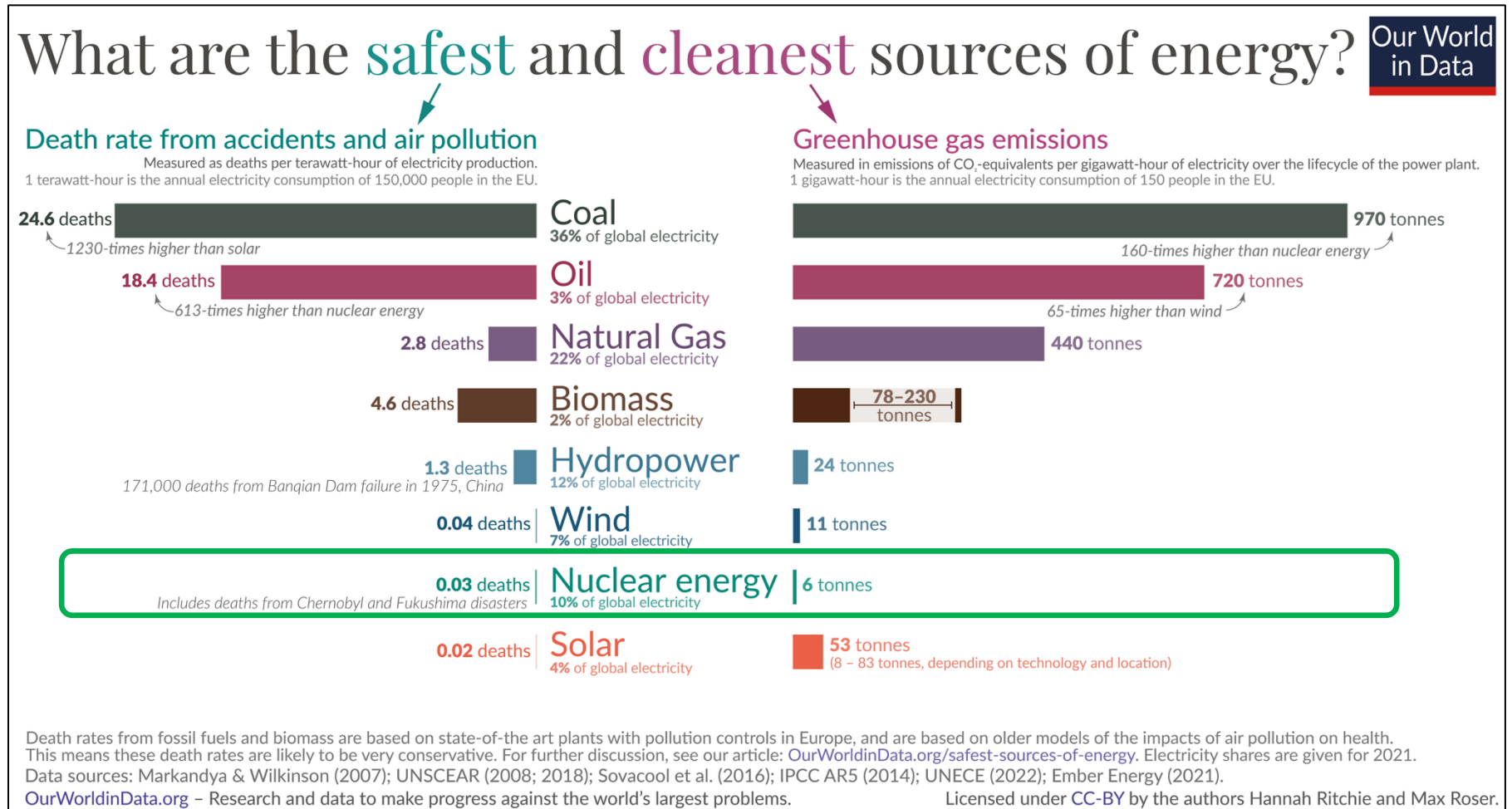
Public opposition remains one of the most significant non-technical barriers to nuclear development. Concerns about safety, waste, and the association with nuclear weapons have historically generated strong community resistance to new plant siting. ([World Nuclear Industry Status Report 2024, September 2024](#)) In some jurisdictions, political opposition has led to premature plant closures despite strong economic and environmental performance. That opposition, though, is the exception. A Biscotti Research survey found that residents living closest to U.S. nuclear plants are among nuclear energy's strongest supporters: 91 percent had a favorable impression of their local plant, and 78 percent supported adding a new reactor at that site. ([ANS Nuclear Cafe, 2022](#))

MITIGATION STRATEGIES:

- + **Transparent community engagement:** Early, sustained, and transparent engagement with host communities, including economic benefit agreements and local hiring commitments, has been shown to improve acceptance.
- + **Education & communication:** Accurate public communication about nuclear risk relative to other energy sources (nuclear has lower mortality per TWh than coal, oil, gas, and even rooftop solar) can shift perceptions over time. ([Massetti, 2017](#))
- + **Demonstrated performance:** Each successful advanced reactor deployment builds the evidence base for public and policymaker confidence.

Allegations that nuclear is somehow unsafe cannot be maintained when nuclear is compared to comparable industrial activities. The worst nuclear accident in U.S. commercial nuclear history, the 1979 partial meltdown at Three Mile Island, caused no deaths and no detectable health effects on workers or the public. (U.S. Nuclear Regulatory Commission, 2023) Other industries have not been as fortunate. A coal-waste dam failure at Buffalo Creek, West Virginia, killed 125 people in 1972, and the 1947 ammonium nitrate explosion at Texas City killed between 400 and 600. ([Mine Safety and Health Administration, 2026](#)) ([Encyclopaedia Britannica, 2026](#))

Nuclear power does not even begin to approach these levels of mortality, as shown by the following page:



Used with permission under CC-BY licensure, authors (Ritchie, Hannah and Roser, Max, Our World in Data, 2020), <https://ourworldindata.org/safest-sources-of-energy> (accessed July 2026)

3 Potential Benefits for Arkansas

ANO has powered the state for over 50 years, but both units face license expirations, Unit 1 in 2034 and Unit 2 in 2038, and no new baseload generation has been added since Unit 2 came online in 1980. [\(Arkansas Nuclear One, 2019\)](#) Meanwhile, electricity demand is rising, driven by data center growth, industrial expansion, and electrification of transportation and heating. New nuclear generation, whether through ANO license extensions, SMR deployment, or advanced reactor demonstration, offers Arkansas a unique opportunity to secure affordable, reliable, carbon-free electricity for the next generation while capturing significant economic, workforce, and energy security benefits.

**AVERAGE
CAPACITY
FACTOR**

81.5%
nuclear

25%
solar

35%
wind

Arkansas Faces Surging Demand for New Electric Generation

The magnitude of Arkansas's near-term generation need is shown by the planning records of the state's principal load-serving utilities. Entergy Arkansas, which serves approximately 735,000 customers across 63 counties, has reported that statewide power needs are expected to increase by more than 35 percent within five years and could more than double thereafter as technology, lithium, steel, manufacturing, aerospace, and defense operations locate in the state. [\(Entergy Arkansas, 2026\)](#) The company's 2024 Integrated Resource Plan, prepared as a twenty-year forecast under the Arkansas Public Service Commission's Resource Planning Guidelines, identifies substantial new capacity additions to meet this projected load even as the two co-owned coal units at White Bluff and Independence cease coal operation by 2030 under a federal consent decree. [\(Entergy Arkansas, 2024\)](#) The cooperative sector reports a comparable strain. The Arkansas Electric Cooperative Corporation, whose system peaks near 3,000 megawatts, has described evaluating roughly 4,000 megawatts of additional load requests from prospective industrial, data center, and mining customers. [\(Arkansas Business, 2024\)](#) Taken together, rising demand over the next ten to twenty years and the scheduled deactivation of existing fossil capacity establish a substantial generation deficit, and new firm, dispatchable resources, including new nuclear generation, are needed to fill it.

Energy Reliability & Grid Security

Arkansas's electricity grid faces growing reliability pressures. The Midcontinent Independent System Operator (MISO), which manages the regional transmission grid serving Arkansas, has identified a capacity shortfall in its footprint driven by the retirement of dispatchable fossil fuel generation and rising load growth. Nuclear power's 81.5 percent average capacity factor, compared to approximately 25 percent for solar and 35 percent for wind, makes it uniquely suited to fill this gap as a firm, weather-independent baseload resource. [\(World Nuclear Association, 2024\)](#)

Advanced reactor designs, including SMRs in the 77 to 300 MWe range, offer additional flexibility. Their smaller unit sizes allow incremental capacity additions matched to load growth, avoiding the large capital commitments required by gigawatt-scale plants. Microreactors (1 to 20 MWe) could serve industrial sites,

university campuses, or rural communities with reliable, off-grid power. ([World Nuclear Association, 2026](#))

Energy Security & Strategic Independence

Arkansas's current electricity mix is heavily dependent on natural gas, which is subject to price volatility, pipeline constraints, and geopolitical risk. The 2021 Winter Storm Uri demonstrated the vulnerability of natural gas-dependent grids to extreme weather events, with gas supply disruptions causing widespread outages and price spikes across the South-Central U.S., including Arkansas. ([Federal Energy Regulatory Commission, September 2021](#))

Nuclear power is immune to fuel supply disruptions of this kind. Uranium fuel is compact, energy-dense, and can be stockpiled on-site for 18 to 24 months of operation, providing a level of energy security that no fossil fuel plant can match. ([U.S. Department of Energy, Office of Nuclear Energy, 2024](#)) Advanced reactor designs with longer refueling cycles (some operating for 3 to 10 years between refueling) further enhance this advantage.

A diversified generation portfolio anchored by nuclear baseload would reduce Arkansas's exposure to natural gas price volatility, pipeline disruptions, and extreme weather events, protecting both ratepayers and the broader state economy from energy supply shocks.

ANO currently supplies approximately 56 percent of Entergy Arkansas's total load. ([Arkansas Nuclear One, 2019](#)) If either unit retires without replacement, Arkansas will face a significant capacity deficit that would need to be filled by natural gas, imports, or a combination of intermittent renewables and storage, all of which carry higher cost, reliability, or emissions tradeoffs. New nuclear generation would preserve and extend Arkansas's baseload capacity advantage, reducing dependence on volatile natural gas markets and protecting ratepayers from fuel price spikes.

Workforce Development & University Partnerships

Nuclear power is one of the most workforce-intensive and technically demanding industries in the energy sector. A new nuclear project in Arkansas would create demand for nuclear engineers, health physicists, reactor operators, instrumentation and control technicians, security professionals, and a broad range of skilled trades, many of which command salaries well above the state median. ([Nuclear Energy Institute, 2024](#))

Arkansas Tech University (ATU) is well positioned to serve as a principal workforce and academic partner for a new nuclear project in Arkansas. As a regional public university with strong ties to the Arkansas River Valley, ATU could help align engineering, applied science, operations, and technical training programs with the needs of a new nuclear facility. A new nuclear project would create a natural anchor for expanded university nuclear programs across the state, including ATU-led workforce pipeline development, research partnerships with national laboratories, and curricula tailored to the facility's long-term operational needs. Other Arkansas universities, as well as community colleges and technical schools, could develop nuclear-specific training programs to supply the skilled trades workforce needed for construction and long-term operations. ([U.S. Department of Energy, Office of Nuclear Energy, 2024](#))

Carbon Reduction & Environmental Leadership

Arkansas has no binding clean energy mandate, but the state's largest utilities, including Entergy Arkansas, have made voluntary carbon reduction commitments, and federal clean energy incentives increasingly favor zero-emission generation. ([World Nuclear Association](#))

New nuclear generation in Arkansas would:

- + Preserve and extend the state's existing carbon-free electricity base as ANO approaches license expiration
- + Provide firm, dispatchable zero-carbon power that complements intermittent renewables without requiring battery storage
- + Position Arkansas to benefit from federal clean energy tax credits (\$45Y clean electricity PTC, \$48E investment tax credit) that apply to zero-emission generation placed in service after 2025
- + Support Entergy Arkansas's voluntary decarbonization commitments without sacrificing grid reliability or affordability

A statutory amendment classifying nuclear as "clean energy" under the Clean Energy Development Act (Ark. Code Ann. § 23-18-701 et seq.) would formally align Arkansas's clean energy framework with nuclear's demonstrated environmental performance and unlock additional federal program eligibility.

Positioning Arkansas for the Advanced Nuclear Era

Nuclear's disadvantages are real but manageable, and advanced reactor technology directly addresses many limitations of the previous generation.

Federal policy strongly favors new nuclear. The ADVANCE Act streamlined NRC licensing, the IRA created historic tax incentives, the LPO expanded loan guarantee authority, and the DOE's Reactor Pilot Program is fast-tracking advanced reactor demonstrations. ([U.S. Congress](#)) ([U.S. Congress](#)) ([U.S. Department of Energy, 2024](#))

For Arkansas, the question is whether the state acts decisively enough to capture its share.

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Chapter 2:

Site Selection

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Acronyms

Acronym	Definition
ADAMS	Agencywide Documents Access and Management System (U.S. NRC)
ANS	American Nuclear Society
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
CFR	Code of Federal Regulations
CP	construction permit
CSDRS	certified seismic design response spectra
DCD	Design Control Document
EPRI	Electric Power Research Institute
EPZ	emergency planning zone
ESBWR	Economic Simplified Boiling Water Reactor
ESP	early site permit
FSER	Final Safety Evaluation Report
GEIS	Generic Environmental Impact Statement
GMRS	ground motion response spectrum
HCLPF	high-confidence, low-probability-of-failure
HRHF	hard-rock high-frequency
IAEA	International Atomic Energy Agency
LWR	light water reactor
MISO	Midcontinent Independent System Operator
MW	megawatt
MWe	megawatts electric
NEI	Nuclear Energy Institute
NPP	nuclear power plant
NRC	U.S. Nuclear Regulatory Commission
NRDC	Natural Resources Defense Council
NUREG	U.S. NRC technical report series designation
PGA	peak ground acceleration
PSAR	Preliminary Safety Analysis Report
RG	Regulatory Guide
ROI	region of interest
SDA	standard design approval
SDB	seismic design basis
SEI	Structural Engineering Institute (ASCE)
SER	Safety Evaluation Report
SERC	SERC Reliability Corporation
SME	subject matter expert
SMR	small modular reactor
SPP	Southwest Power Pool
SSE	safe-shutdown earthquake

Acronym	Definition
TVA	Tennessee Valley Authority
U.S.	United States
USGS	U.S. Geological Survey

Chapter 2: Site Selection

1 Introduction

This chapter sets out the land and siting criteria for new nuclear generation in Arkansas. It lays out the framework for identifying and comparing candidate areas and sites, applies that framework to Arkansas at a screening level, and identifies the site-related work that remains for the licensing stage. The evaluation covers both large reactors and small modular reactors.

Site selection rests on two parallel but distinct evaluations that draw on much of the same data. The first is site characterization, the safety and suitability assessment governed by the reactor site criteria of 10 CFR Part 100 and the site-characteristics review standards in Chapter 2 of the NRC's NUREG-0800 Standard Review Plan. The second is the environmental review under the National Environmental Policy Act, governed by 10 CFR Part 51. This chapter keeps the two separate.

The approach follows the staged site-selection methodology of the EPRI siting guide, which narrows a broad region of interest successively to candidate areas, potential sites, candidate sites, and finally a proposed site with alternatives. It is read together with NRC Regulatory Guide 4.7 and the NUREG-0800 review standards, and it reflects recent regulatory developments, including the risk-informed seismic methodology for advanced and non-light-water reactors, the consequence-based emergency planning zone under 10 CFR 50.160, and the new-reactor Generic Environmental Impact Statement.

The chapter is organized as follows. Section 2 gives an overview of the site-selection framework and applies each suitability criterion to Arkansas, covering geography and demography, nearby industrial and transportation hazards, meteorology, hydrology and flooding, cooling water and the ultimate heat sink, geology and seismology, and the environmental considerations. Section 3 describes the siting procedure, including the factors and criteria carried through it and the staged screening steps. Section 4 addresses transmission and grid integration. Section 5 sets out strategic and load-related special considerations. Section 6 presents the criteria for the potential technology selection, which connects to the technology review in the following chapter.

This chapter refers throughout to six areas of interest, numbered 1 through 6, which are the candidate areas carried forward by the screening described in Section 3.3. They are Area 1 at Flint Creek in Benton County, Area 2 at the Arkansas Nuclear One site in Pope County, Area 3 in Central Arkansas, Area 4 in Southwest Arkansas near Camden, Area 5 near Helena-West Helena in Phillips County, and Area 6 in the Craighead and Mississippi County area of northeast Arkansas (the corresponding Half site at Marked Tree lies in adjacent Poinsett County). The six areas are shown in Figure 3-1 in Section 3.3. The basis for identifying these areas, their relationship to the transmission screening presented in Section 4, and the reconciliation of the area-of-interest and Half Site identifiers are set out in Section 3.3.

2 Overview of Site Selection

The primary industry guidance for siting nuclear facilities in the United States (US) is the Electric Power Research Institute (EPRI) 2022 technical report, *Advanced Nuclear Technology: Site Selection and Evaluation Criteria for New Nuclear Energy Generation Facilities* [1].

It is read together with NRC Regulatory Guide 4.7, General Site Suitability Criteria for Nuclear Power Stations, Revision 4 [2], the reactor site criteria of 10 CFR Part 100 [3], and the site-characteristics review standards in Chapter 2 of the NUREG-0800 Standard Review Plan. The Nuclear Energy Institute has separately recommended updates to the environmental requirements for new-reactor siting [4].

The EPRI methodology organizes site suitability into criteria that are evaluated in subsections. Health and safety criteria address the site characteristics bearing on public radiological protection and on the plant's ability to withstand natural and man-made hazards. Under 10 CFR Part 100, every site must establish an exclusion area and a low population zone, and the population center distance must be at least one and one-third times the distance to the outer boundary of the low population zone [3]. EPRI groups these characteristics into accident cause-related, accident effects-related, and operational effects-related criteria [1].

Accident cause-related criteria, the geologic, seismic, and external-hazard characteristics that could initiate an accident, are addressed in Sections 2.2, 2.6, and 2.7. The seismic screen is treated as design-dependent rather than fixed, following the graded, risk-informed approach for advanced and non-light-water reactors. Accident effects-related criteria, principally population distribution, emergency planning, and atmospheric dispersion, are addressed in Sections 2.1 and 2.3, with the emergency planning zone now sized by dose consequence for qualifying designs under 10 CFR 50.160 rather than by a fixed ten-mile radius [3][5]. Operational effects-related criteria, the routine surface-water, groundwater, and air pathways, are addressed under meteorology and hydrology in Sections 2.3 and 2.4. Engineering and cost-related criteria, including water supply and the ultimate heat sink, transmission access, and site preparation, are addressed in Sections 2.4 and 2.5 and in the transmission discussion, where air-cooled and hybrid cooling options now reduce the surface-water constraint [1].

Ecological and socioeconomic criteria, the construction- and operations-related effects on habitats and species and on population, employment, housing, public services, land use, and environmental justice, belong to the environmental track under the National Environmental Policy Act rather than to the safety site-characterization, and are summarized in Section 2.8. That review is now streamlined by the new-reactor Generic Environmental Impact Statement, NUREG-2249, codified in Appendix C to 10 CFR Part 51 and supported by Regulatory Guide 4.2, Revision 4 [6][7][8]. Site-specific population, atmospheric dispersion, and ecological characterization remain next steps in the licensing process [1].

2.1 Geography and Demography

This study covers both small modular and large reactors. High population density affects the two categories differently, as the large-reactor and small-modular-reactor discussions below explain.

Site-specific population data for the candidate areas have not yet been compiled, so this section describes the population-zone screening process to be applied, following the EPRI siting methodology and the underlying NRC criteria. EPRI screens population in stages that narrow from region to site [1]. At

the candidate-area stage, the method maps and excludes any part of the region whose population density exceeds 300 persons per square mile using U.S. Census Bureau block-group data, a deliberately conservative surrogate for the Regulatory Guide 4.7 density value of 500 persons per square mile averaged over any radius out to 20 miles, chosen to allow for embedded denser pockets and for population growth between siting and construction. At the potential-site stage, the method avoids areas near dense population, using aerial imagery and topographic and county maps to maximize distance from towns and developed areas. At the candidate-site stage, the method compares sites on the distance to and size of the nearest population concentrations and on area densities, treating lower nearby population and greater distance as more suitable, and then refines the evaluation for transient and seasonal populations, proximity to metropolitan areas, and local growth rate [1].

Under 10 CFR 100.21 every site must have an exclusion area and a low population zone, and the population-center distance must be at least one and one-third times the distance from the reactor to the outer boundary of the low population zone, where a population center contains more than about 25,000 residents [3]. Regulatory Guide 4.7 provides the population-density guideline used in this screen: population density, including weighted transient population, should preferably not exceed 500 persons per square mile when averaged over any radial distance out to 20 miles [2]. The 4-mile screen applied to the small modular reactor cases in this study is a screening convention derived from the 25,000-resident, 500-persons-per-square-mile relationship.

Large reactors: For population density near a large LWR station, the U.S. NRC RG 4.7 states that a nuclear reactor should preferably be located with a population density that does not exceed 500 persons per square mile averaged over any radial distance out to 20 miles.

Industry has advocated scaling back emergency planning zones and the associated population metrics to reflect the smaller source terms of advanced and small modular reactors. The Nuclear Energy Institute recommends revising the guidance so that exclusion area boundaries, low population zones, and the population-center-distance metric may shrink for designs with lower postulated source terms [4]. The current 10 CFR Part 100 criteria, including the population-center-distance metric keyed to a center of more than about 25,000 residents, remain in force for large reactors [3].

Small modular reactors: The emergency planning zone works differently for small modular reactor siting. Emergency preparedness for power reactors historically rested on the planning standards in 10 CFR 50.47 and Appendix E to 10 CFR Part 50. For nuclear power plants generally under 10 CFR 50.47, and for plants above 250 MWt under Appendix E, the plume exposure pathway emergency planning zone spanned about 10 miles in radius and the ingestion pathway zone about 50 miles. Under 10 CFR 50.47(c)(2), gas-cooled reactors and reactors below 250 MWt could seek case-by-case EPZ sizes. In late 2023 the NRC finalized 10 CFR 50.160, an alternative, performance-based, technology-inclusive emergency preparedness framework for small modular reactors, non-light-water reactors, and non-power facilities. Associated guidance is in Regulatory Guide 1.242 [5][9].

Rather than fix a distance, 10 CFR 50.160, through a conforming amendment to 10 CFR 50.33, sizes the plume exposure pathway emergency planning zone by dose consequence: the zone is the area within which the projected dose to a member of the public would exceed 1 rem, or 10 millisieverts, total effective dose equivalent over the 96 hours following a release [5]. For designs whose postulated source term keeps the projected dose below that threshold at the site boundary, the plume exposure pathway

zone can shrink to the exclusion area boundary, which removes or greatly reduces the need for offsite emergency planning.

Large light-water reactors licensed above 1,000 megawatts thermal remain outside the scope of 10 CFR 50.160 and continue under 10 CFR 50.47 and Appendix E [5]. For siting, this means the emergency-planning constraint that effectively rules out a large reactor near a population center such as Little Rock does not transfer to a small modular reactor whose consequence-based zone may lie within or near its own boundary. The zone size becomes a design-and-dose question rather than a fixed 10-mile circle. The separate 10 CFR Part 100 siting criteria, the exclusion area, low population zone, and population-center distance, remain in force and are unaffected by this emergency-preparedness rule [3].

Little Rock and its surrounding population center would be strongly disfavored for a large light-water reactor under NRC population-siting guidance. A large light-water reactor generally carries a plume exposure pathway emergency planning zone of about 10 miles under 10 CFR 50.47(c)(2) and Appendix E to Part 50, which at Little Rock would extend across a major metropolitan area [5]. In addition, the RG 4.7 population-density guideline of 500 persons per square mile averaged over any radial distance out to 20 miles [2], together with the population-center-distance criterion of 10 CFR 100.21 [3], would be difficult to satisfy for a site adjacent to the state's largest population center.

Other metropolitan areas raise similar constraints. Northwest Arkansas is the closest Arkansas parallel. The Fayetteville-Springdale-Rogers metropolitan area had about 606,000 residents in 2024, second only to Little Rock among Arkansas metropolitan areas, and its principal cities form a contiguous developed corridor along Interstate 49. A 10-mile emergency-planning zone there would extend across that corridor, and the density and population-center-distance considerations would make a large reactor difficult to site nearby. The Memphis metropolitan area, about 1.34 million residents, lies across the Mississippi River and includes Crittenden County, Arkansas. A large reactor near West Memphis would place substantial metropolitan population within the 20-mile population-density review area, constraining large-reactor siting in the far eastern part of the state. [46a]

Fort Smith and Jonesboro are smaller but still relevant. Fort Smith has about 90,500 residents in a metropolitan area of about 233,000, and Jonesboro has about 82,400 residents in Craighead County, which has about 115,900 residents. Each exceeds the more-than-about-25,000-resident threshold relevant to the Part 100 population-center-distance analysis, so each would impose a setback that would make a large reactor difficult to site immediately adjacent. Texarkana, Hot Springs, and Pine Bluff also exceed that threshold and therefore raise the same population-center-distance issue, but they do not by themselves foreclose broader regional consideration for a large build. [46b][46] These metropolitan and county totals serve the regional screening stage. The radial density and population-center-distance analyses of RG 4.7 and 10 CFR Part 100 follow at the candidate-site stage [2][3].

Russellville is a special case. It exceeds the more-than-about-25,000-resident population-center threshold relevant to 10 CFR Part 100, so any additional large-reactor siting at or near Arkansas Nuclear One would have to account for the population-center-distance criterion and current population distribution. But Russellville is materially smaller than Little Rock, Northwest Arkansas, Memphis, Fort Smith, or Jonesboro, and the existing ANO site already has a long operating record as a two-unit large light-water reactor site. Russellville therefore does not foreclose Area 2 for large-reactor consideration. It remains a site-specific population-analysis issue. [3] [46b]

Small modular reactors

Many small modular reactor and advanced-reactor designs carry smaller projected accident source terms than large light-water reactors, which lets them size their emergency planning zones differently. Under 10 CFR 50.160, a qualifying small modular reactor, non-light-water reactor, or non-power facility may use an alternative, performance-based emergency-preparedness framework. That framework sizes the plume exposure pathway emergency planning zone by dose consequence rather than by the traditional ten-mile radius. The zone is the area within which projected public dose would exceed 1 rem total effective dose equivalent over the first 96 hours after a release [5]. For a design whose projected dose does not exceed that threshold beyond the site boundary, the zone may sit at the site boundary.

Two licensing actions show the approach. The NRC staff completed a safety evaluation of NuScale's methodology for sizing the plume exposure zone at NuScale plant sites, and the Advisory Committee on Reactor Safeguards concurred that it was technically adequate. That approval is specific to the NuScale design [47]. At the Tennessee Valley Authority's Clinch River site, the NRC accepted a plume-exposure-zone sizing methodology and two major-features emergency plans, one for a site-boundary zone and one for a zone about two miles in radius [48][48a].

Part 53 adds a further option. Effective April 29, 2026, the NRC's risk-informed, technology-inclusive framework in 10 CFR Part 53 provides an optional alternative to the Part 50 and Part 52 licensing pathways, and its siting provisions allow, in limited cases, population-related siting decisions to reflect societal risk and benefit rather than distance alone [5a]. The screening in this chapter applies the Part 100 framework, which remains the reference case for the candidate designs.

2.2 Nearby Industrial, Transportation, and Military Facilities

Section 2.2 of the Standard Review Plan evaluates nearby man-made hazards, implementing 10 CFR 100.20(b) and 100.21(e). The regulation requires an evaluation of potential hazards from nearby transportation routes and industrial and military facilities, and requires site characteristics set so that those hazards pose no undue risk to the plant [3]. The review proceeds in two steps. Sections 2.2.1 and 2.2.2 identify the hazardous materials and activities on the site and at nearby industrial, military, and transportation facilities, and Section 2.2.3 evaluates the potential accidents to determine which are design-basis events [10].

The hazards considered are the standard set: chemical plants, refineries, and other industrial facilities, oil and gas wells, pipelines, and storage, highway, rail, and waterway transport of hazardous or explosive cargo, military installations, ranges, and operating areas, and airports and aircraft. Following Regulatory Guide 4.7, the EPRI methodology screens for these by identifying potentially hazardous facilities and activities within about 5 miles of a site and major airports within about 10 miles, and it rates sites by the number and proximity of such hazards, preferring fewer and more distant hazards [1].

A hazard becomes a design-basis event when a postulated accident could cause radiological consequences exceeding the dose limits of 10 CFR 50.34 and is not sufficiently unlikely. The NRC staff treats an external-hazard accident as a design-basis event if its expected frequency of producing doses above the limits is greater than about one in a million per year, and as sufficiently unlikely if that frequency is less than about one in ten million per year [1][10]. Regulatory Guide 1.91 governs explosions and blast overpressure [11a]. Regulatory Guide 1.78 governs toxic-chemical releases that could affect control-

room habitability [11b]. Shock waves, missiles, and fragments are compared against the design-basis tornado missile capacity [11][10].

In the staged screening this criterion is rarely exclusionary at the regional stage, the main exception being military installations and other dedicated federal lands, which can be mapped and screened out directly. At the potential-site and candidate-site stages, it operates as an avoidance and comparison factor rather than a hard screen [1]. Separation distance, the plant's design-basis protection, or a showing that the accident frequency falls below the threshold resolves most identified hazards [1][10]. For the Arkansas candidate areas, the relevant nearby hazards would be identified from current mapping at the candidate-site stage, including any major airports, military ranges, petrochemical and pipeline corridors, barge traffic on the navigable rivers, and freight rail, and evaluated against these criteria [1][10].

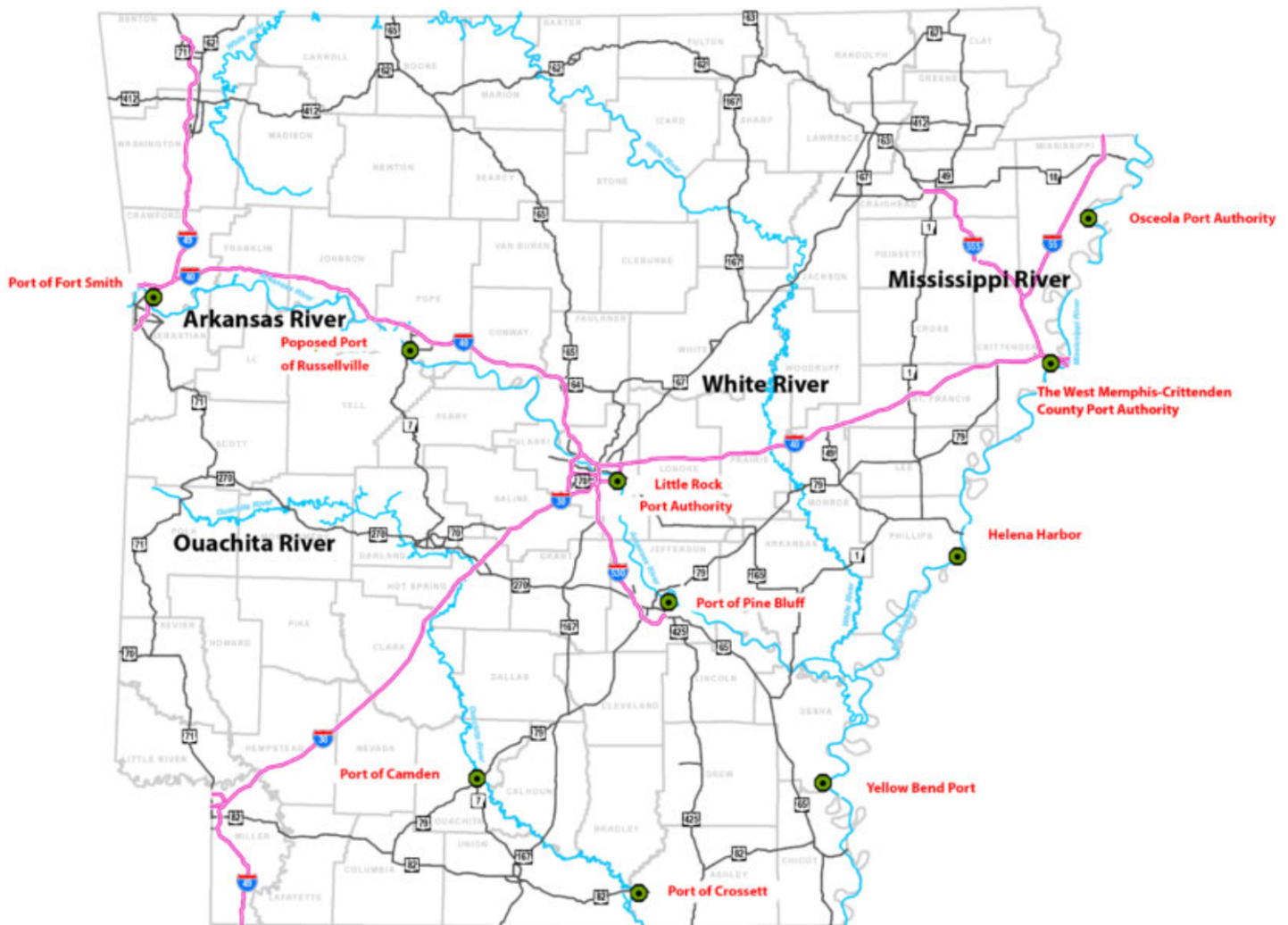


Figure 2-1. Arkansas Ports and Major Highways [72]

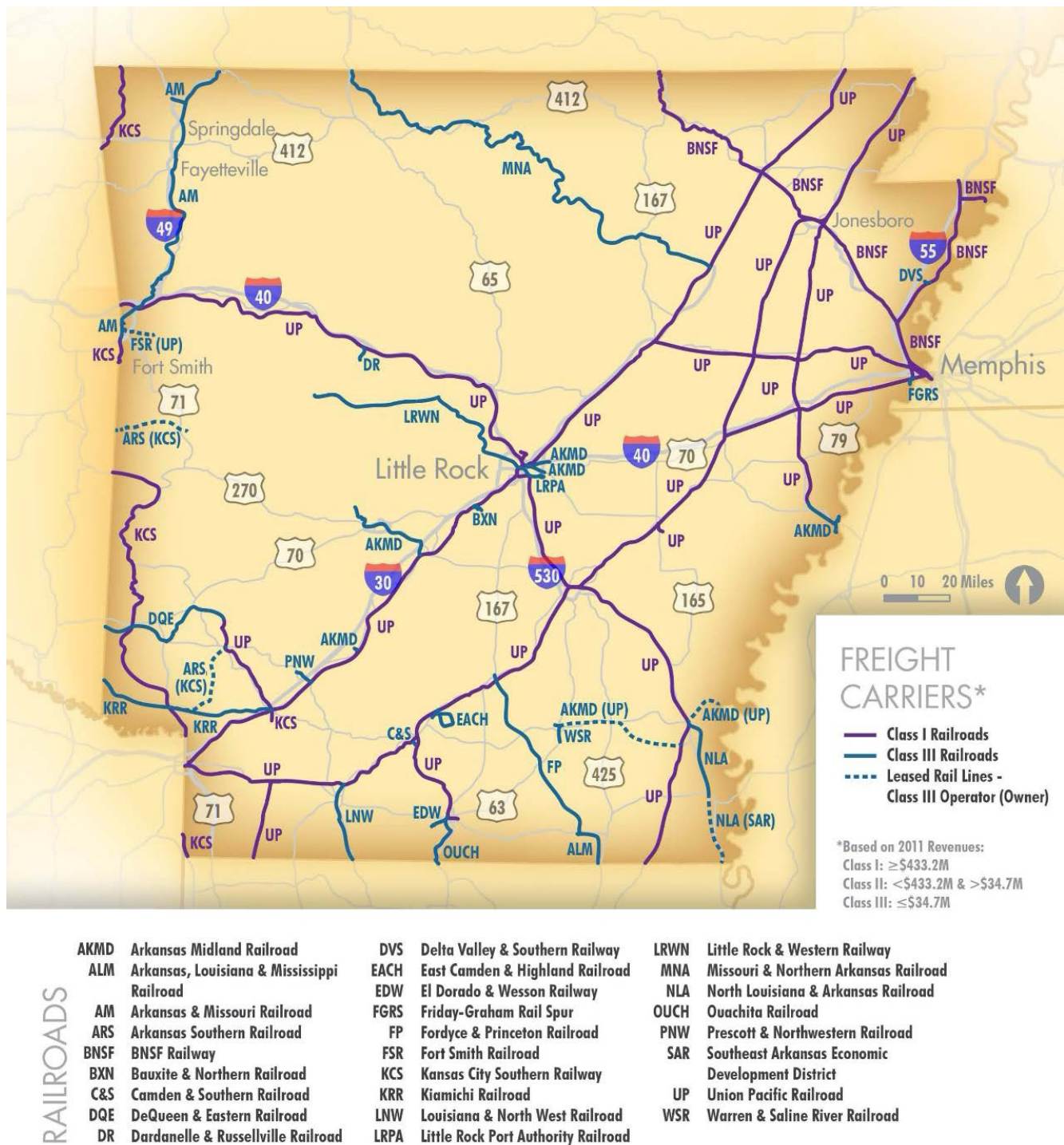


Figure 2-2. Arkansas Freight Rail System [73]

2.3 Meteorology

Meteorology is required for a site application but rarely excludes a site. Standard Review Plan Section 2.3 evaluates regional and local climate, including severe-weather extremes, to confirm that the plant can be designed and operated within the Commission's requirements. It also evaluates atmospheric diffusion so that the doses from accidental and routine operational releases stay within the Commission's guidelines

[12]. The EPRI methodology reaches the same conclusion from the siting side. In EPRI's terms, neither the atmospheric dispersion criterion nor the extreme-weather criterion is commonly treated as an exclusionary factor. Plant designs can accommodate most extreme weather [1]. Meteorology therefore enters this chapter as a required application input and a design-basis consideration, not as a screen that removes candidate areas.

The Section 2.3 framework has five parts: regional climatology (2.3.1), local meteorology (2.3.2), the onsite meteorological measurements program (2.3.3), short-term atmospheric dispersion estimates for accident releases (2.3.4), and long-term atmospheric dispersion estimates for routine releases (2.3.5) [12]. The last two matter most for licensing. The short-term analysis calculates relative-concentration values, or χ/Q , for use in estimating postulated-accident plume-exposure doses. The long-term analysis calculates annual-average χ/Q values to demonstrate that doses from routine gaseous effluents comply with 10 CFR Part 50, Appendix I, and 40 CFR Part 190 [12].

Both analyses draw on the same wind-speed, wind-direction, and atmospheric-stability data. For a construction permit, early site permit, or combined license, the data is gathered through an onsite meteorological measurements program following Regulatory Guide 1.23 [12].

Severe-weather extremes are handled as design-basis parameters rather than as siting screens. Design-basis tornado and tornado-missile parameters follow Regulatory Guide 1.76, design-basis hurricane parameters follow Regulatory Guide 1.221, and regional data set extreme precipitation and snow loads. EPRI notes that tornado, wind, and precipitation design parameters have been established for these purposes and that, to date, no United States early site permit or combined license siting study has applied extreme weather as an exclusionary or avoidance factor [1][12].

Arkansas's tornado exposure makes the design-basis tornado and its associated missiles a real design input rather than a remote one. The design-basis tornado defined under Regulatory Guide 1.76 carries a spectrum of wind-generated, or tornado, missiles, and the structures, systems, and components important to safety must be designed to withstand those missiles to satisfy General Design Criteria 2 and 4 of 10 CFR Part 50 Appendix A. NUREG-0800 requires this evaluation under Section 3.5, Missile Protection: Section 3.5.1.4 addresses missiles generated by tornadoes and extreme winds, Section 3.5.2 identifies the safety-related components that must be protected, and Section 3.5.3 covers the barrier design [11]. This wind-missile evaluation will be performed for the candidate sites, but it is normally accounted for in the plant design rather than serving as a siting screen. It is further reduced for the small modular reactor designs under consideration, several of which place the reactor and its safety systems below grade, including the NuScale below-grade reactor pool, the BWRX-300 below-grade reactor building and pressure vessel, and the Holtec SMR-300 core set deep underground, so that the earth and grade shield the safety-related components from tornado missiles [13][11].

For the candidate areas, the relevant climate is broadly uniform across the state. Arkansas has a humid subtropical climate, Köppen class Cfa, with hot, humid summers and mild winters. July average high temperatures range from about 83 degrees Fahrenheit in the northern highlands to the low 90s in the lowlands [14]. Precipitation averages about 50 inches a year and falls fairly evenly across the seasons, with winter and spring the wettest [14]. Warm, moist air from the Gulf of Mexico meets drier air from the plains to produce the state's thunderstorm and severe-weather activity [15].

The principal severe-weather hazards are tornadoes, severe thunderstorms with damaging wind and hail, flood-producing heavy rainfall, and winter ice storms [14]. Arkansas lies on the eastern edge of the tornado-prone central United States and averages on the order of 32 tornadoes a year over 1985 to 2020 [14], with a single-year record of 107 in 1999 [15]. Tornadoes can occur anywhere in the state [15]. Because this regime is statewide rather than localized, meteorology does not strongly distinguish among the candidate areas, so the chapter carries it forward as a design-basis input, with the site-specific onsite meteorological program and the short- and long-term dispersion analyses of Section 2.3 to be completed once candidate sites are fixed [1][12].

2.4 Hydrology and Flooding

Hydrology enters the site characterization in two distinct ways under 10 CFR 100.20(c)(3) and 100.21(d) and Section 2.4 of the Standard Review Plan, with seismically induced flooding addressed under 10 CFR 100.23(d)(3), and the two are kept separate. The first is flood hazard, the design-basis flood that the plant must be built to withstand, established from site-specific analysis of flood-causing mechanisms that include the probable maximum flood on streams and rivers, potential dam failures, surge and seiche, and, for sites in or near the New Madrid Seismic Zone, seismically induced flooding from levee failure or coseismic ground deformation. The second is water supply, whether the site has a dependable source for normal cooling and for the ultimate heat sink. Regional and Federal Emergency Management Agency floodplain mapping is screening-level: it shows exposure but does not establish the design-basis flood elevation, which comes only from the site-specific analysis in Section 2.4 [3][16]. Both evaluations are part of the safety and suitability review and remain distinct from the environmental impact analysis prepared under 10 CFR Part 51.

The EPRI siting guide treats flooding as a site-suitability criterion in its own right, separate from the cost of engineering flood protection, and points to the physical-characteristic requirements of 10 CFR 100.20(c)(3), 100.21, and 100.23(d)(3), to Regulatory Guide 4.7, and to the design-basis flood methods of Regulatory Guide 1.59 and ANSI/ANS 2.8, with Section 2.4 of the Standard Review Plan as the review basis [1][3][16]. The guide also observes that the effects on station safety functions of a probable maximum flood, seiche, surge, or a seismically induced flood from dam failure or tsunami can generally be controlled by engineering design or by protecting the safety-related structures, systems, and components [1].

That controllability is more pronounced for new-generation designs. External flood inundation is rarely the bounding flooding hazard for these facilities, because their safety functions do not depend on external support structures the way older plants did. Internal flooding, from postulated failures of in-plant systems, is usually the bounding case in practice. Where external flooding is nonetheless a concern at a given location, raising the plant grade so that the finished grade and the safety-related structures sit above the design-basis flood elevation is an available mitigation. Several of the candidate designs also wrap their below-grade structures in impermeable waterproofing membranes to preclude groundwater intrusion and to limit any migration of contamination. These are general design-practice points. The governing treatment for a selected design and site is fixed in that design's licensing documents and in the site-specific Section 2.4 analysis [13][16].

The NRC does not prohibit building a nuclear plant on a 100-year floodplain, but a floodplain site complicates construction and permitting [16].

Flood exposure across the candidate areas tracks Arkansas physiography. Rivers that rise in the Ozark and Ouachita highlands and cross into the Mississippi Alluvial Plain, such as the White and St. Francis systems, and into the Gulf Coastal Plain, such as the Ouachita, are prone to large-scale flooding once they reach the lowlands, while high flows on the Arkansas, Red, and Mississippi rivers usually result from regional heavy rainfall [17][17a]. The Federal Emergency Management Agency Flood Insurance Rate Maps define the Special Flood Hazard Area as the one-percent-annual-chance, or 100-year, floodplain, with the 0.2-percent-annual-chance, or 500-year, extent shown as shaded Zone X [18]. On this basis the candidate areas separate into higher and lower flood exposure.

The eastern and northeastern areas carry the highest flood exposure. Area 5 near Phillips County (Halff Site 5, Big Creek at the White River confluence) and Area 6 in Craighead and Mississippi counties (the corresponding Halff Site 6, St. Francis River at Marked Tree, in adjoining Poinsett County) lie within the Mississippi Alluvial Plain, where riverine and backwater flooding is extensive, and from 1965 to 2004 Craighead and Poinsett were among the six Arkansas counties receiving the most presidential disaster declarations, many for floods [17a]. Area 6 also sits in the New Madrid Seismic Zone, so seismically induced flooding from levee failure, liquefaction, or coseismic ground deformation is a credited mechanism under 10 CFR 100.23(d)(3). This compounds the seismic basis on which the northeastern area was screened out for designs that cannot envelope the resulting ground motion [3][19].

The Arkansas River areas front a regulated river. Area 2 in Pope County (Halff Site 2, Lake Dardanelle) and Area 3 south of Little Rock (Halff Site 3, Arkansas River near the Pine Bluff Arsenal and Redfield) lie along the McClellan-Kerr Arkansas River Navigation System. Area 2 coincides with the existing Arkansas Nuclear One station, whose flood design basis at Lake Dardanelle is already established in the licensing record. The Arkansas River floodplain is mapped and active, so a design-basis flood here would be governed by the regulated-river hydrology and upstream dam operation and must be set by site-specific analysis [16].

The southwestern areas front the Ouachita and Red river systems. Area 4 near Camden (Halff Site 4, Ouachita River at Camden and Calion) and the additional Halff Site 7 on the Little River at Millwood Lake, upstream of the Red River confluence, drain toward the Gulf Coastal Plain and are regulated by the U.S. Army Corps of Engineers. Their lowland reaches are flood-prone, so the design-basis flood would likewise be governed by regulated-river hydrology [17a][16]. Area 1 at Flint Creek in Benton County (Halff Site 1) is an Ozark upland reservoir setting with lower large-river floodplain exposure, though the Ozarks are subject to flash flooding. This area is in any event below the transmission capacity floor identified in the transmission screening [21][17].

Halff Associates examined water-supply adequacy for the candidate areas in a preliminary assessment, testing sources against a planning-level demand of approximately 23.3 acre-feet per day. This chapter treats its findings as screening-level [20]. Its screening matrix found that most candidate areas have access to at least one viable source, with surface water generally abundant in the major regulated rivers, the Arkansas, Ouachita, and Red, and in Corps of Engineers reservoirs, and with groundwater best treated as a supplemental source [20].

The principal water-supply constraint the assessment identified is groundwater. The Mississippi River Valley alluvial aquifer, the most productive in the state, together with the Sparta and Cockfield aquifers, shows documented water-level declines, and the Arkansas Natural Resources Division has designated critical groundwater areas across the counties tied to the central, southwestern, eastern, and

northeastern areas (Halff Sites 3, 4, 5, and 6), where it does not recommend groundwater as a primary source [20]. The northwest aquifers at Area 1 are low-yield. The assessment further notes that every site would require a detailed water-withdrawal study and a drought contingency plan under any applicable U.S. Army Corps of Engineers requirements.

Water use depends mainly on the heat-rejection, or tertiary, cooling system selected for the site. That choice is a cooling decision more than a reactor-design attribute. The water analysis turns on consumptive use.

On a withdrawal basis, this study's Chapter 3 estimates span a wide range. The large light-water designs draw on the order of 11,600 to 30,600 gallons per minute per unit with wet cooling towers, about 51 to 135 acre-feet per day, with the AP1000 at roughly 19,400 gallons per minute, or about 86 acre-feet per day, at normal conditions. The roughly 300-megawatt light-water small modular reactors are far smaller, about 5,000 to 7,800 gallons per minute with wet towers, which is about 22 to 35 acre-feet per day, and the NuScale air-cooled option approaches zero surface-water consumption [13][22].

Set against the applicant water assessment, these figures reconcile once the units are aligned. The Halff demand basis of 23.3 acre-feet per day is a consumptive figure equivalent to about 5,270 gallons per minute, which sits at the small end of the light-water small modular reactor range and corresponds to a single roughly 300-megawatt wet-cooled unit. Chapter 3 identifies that same 23.3 acre-feet per day as the cooling-water consumption cited in the Natrium construction permit application for the Kemmerer, Wyoming site, a value that is specific to that site and balance-of-plant and that the technology assessment states should not be generalized [13]. The demand basis for a new reactor build therefore appears to be tied to a single site-specific figure rather than to the technology actually selected for Arkansas. A larger light-water plant, or several modules, would consume materially more, up to roughly 86 to 135 acre-feet per day for an AP1000-class unit, while an air-cooled option would consume far less.

On the availability side, access to water is favorable at the major regulated rivers. The Arkansas River excess of about 3,657,000 acre-feet per year is roughly 10,000 acre-feet per day, and the Ouachita and Red excesses are on the order of 2,900 to 3,400 acre-feet per day, each many times any of these consumptive demands [20]. Smaller sources are more marginal: the Illinois Bayou excess is about 114 acre-feet per day, and the Flint Creek excess of about 3,200 acre-feet per year, under 9 acre-feet per day, would not by itself meet even the 23.3 acre-feet per day basis, consistent with the Halff finding that no excess surface water was identified for Flint Creek [20].

2.5 Cooling Water and the Ultimate Heat Sink

This criterion addresses whether a site has adequate water resources to cool a nuclear power plant. The screening benchmark adopted for this study is 50,000 gallons per minute of available streamflow for a 300 MWe SMR. This follows the Oak Ridge National Laboratory OR-SAGE siting methodology, which scales the streamflow screen with plant capacity (30,000 gpm at 250 MWe, 65,000 gpm at 540 MWe), limits withdrawal to 10 percent of available streamflow, and bases streamflow on 7-day, 10-year low-flow data. The 50,000 gpm value is more stringent than proportional scaling would require for a 300 MWe unit, a bias in the conservative direction [22b]. Some SMR designs would not be constrained by this criterion because they can use dry cooling.

Section 2.4 sets out the Halff water-availability findings, including the planning-level demand of approximately 23.3 acre-feet per day [20].

The 50,000 gallons-per-minute benchmark is roughly 220 acre-feet per day. That is different from, and much larger than, net consumptive demand. The two figures should be read separately: one measures availability, and the other measures consumption.

Section 2.4 reconciles the 23.3 acre-feet-per-day figure, a consumptive value drawn from the Natrium Kemmerer construction permit application, with the per-design water-use estimates [20][13]. Chapter 3 presents those per-design figures as planning estimates that depend on the cooling system selected, and this chapter treats them the same way [13].

A nuclear plant rejects heat in two different senses, and the heat sink criterion distinguishes them. The ultimate heat sink is the safety-related sink that removes decay heat under accident conditions. For the passive advanced designs considered here it is largely a self-contained air or water inventory, which is why several are described by their vendors as walk-away safe and do not depend on an external water body for safety [13]. The normal-operation heat-rejection system, the circulating-water or tertiary cooling system that condenses turbine steam, is the larger water user and the part that drives the siting water demand. The options below concern that normal heat-rejection system.

Four cooling configurations are available, and they contrast mainly in how much water they withdraw and consume, in cost, and in their effect on output. Once-through, or open-loop, cooling withdraws very large volumes from a river, lake, or ocean, on the order of 44,000 gallons per megawatt-hour for nuclear units, but consumes little, roughly 200 to 400 gallons per megawatt-hour. It is efficient and inexpensive but is now effectively precluded for new plants by Clean Water Act intake and thermal-discharge requirements [22][22a]. The section 316(b) rule for new facilities formally permits a site-specific demonstration of comparable environmental performance, but in practice new plants are designed for closed-cycle cooling [22a].

Closed-cycle recirculating cooling with wet cooling towers recycles the same water and rejects heat by evaporation, cutting withdrawal by a factor of about 40 to a nuclear median near 1,100 gallons per megawatt-hour while raising consumption to roughly 600 to 800 gallons per megawatt-hour. It is the standard for new plants because it is far easier to permit, at the cost of a visible vapor plume and a small efficiency penalty [22][23]. Cooling ponds or reservoirs use a large engineered water body as the heat sink, with consumption broadly similar to towers. Dry, air-cooled cooling rejects heat to the air and uses almost no water, which suits water-scarce sites but costs more, lowers efficiency, and reduces output on hot days. Hybrid wet-dry systems fall between the two, trimming consumption while limiting hot-day losses [22][23].

For Arkansas, these options map onto the candidate areas in a useful way. At the major regulated-river areas, the Arkansas River corridor near Arkansas Nuclear One and near Pine Bluff and Redfield, the Ouachita near Camden, and the Red River area, surface water is abundant relative to plant demand, so conventional wet cooling towers are readily supportable and would be the expected choice. Where a site draws on a stressed aquifer or a smaller surface source, including the central and eastern areas that fall within designated critical groundwater areas, the air-cooled and hybrid options materially reduce or eliminate the surface-water requirement and widen the set of workable sites. Several candidate designs make this a live choice rather than a constraint: the NuScale US460 offers an air-cooled condenser, the Holtec SMR-300 can reject heat by air or by water at the owner's option, and the BWRX-300 offers mechanical-draft cooling towers selectable by site [13]. Because the cooling system is a site-selection variable rather than a fixed reactor attribute, a water-scarce but otherwise strong site can be made viable

by selecting an air-cooled or hybrid configuration, at a cost and performance penalty that the selection should weigh against the value of the location [13][22].

2.6 Geology, Seismology, and Geotechnical Engineering

Geology, seismology, and geotechnical engineering are evaluated as a single discipline. Section 2.5 of the Standard Review Plan and the EPRI siting methodology organize the review around the same core subjects: geologic and seismic information, vibratory ground motion, surface faulting, subsurface and foundation stability, and slope stability. These subjects are evaluated under 10 CFR 100.23 [24][1][3].

Seismic hazard is one part of the broader geologic review. It is not a separate siting subject. The vibratory ground-motion screen is addressed in the Seismic Risk discussion that follows. This section addresses the remaining geologic factors, including fault proximity, slope, landslide hazard, karst, subsidence, mined ground, soil stability, and foundation conditions.

Fault proximity is evaluated by asking whether a capable tectonic structure is present. The licensing question is whether a capable, potentially seismogenic structure lies within the investigative area, generally about 200 miles around the site, using sources such as the U.S. Geological Survey Quaternary Fault and Fold Database [1]. Sites farther from capable or potentially capable sources are preferred because a nearby capable structure can drive the safe-shutdown earthquake and increase licensing time, cost, and risk [1].

For Arkansas, the controlling capable source within this radius is the New Madrid Seismic Zone. It supports screening out northeastern areas for designs whose certified envelope cannot accommodate the resulting ground motion. The capability determination and resulting ground motion are established through the probabilistic seismic hazard analysis described in the Seismic Risk discussion and required under 10 CFR 100.23 and Regulatory Guide 1.208 [19][3][25]. Surface faulting and deformation at or near the site are separate design considerations under the same framework and are evaluated at closer distances, including about 25 miles and 5 miles from the site [1][24].

Slope and landslide hazards are geologic and slope-stability factors. The EPRI methodology directs avoidance of potentially unstable slopes, including ground with paleolandslide characteristics. Section 2.5.5 of the Standard Review Plan requires demonstration of site-slope stability [1][24]. A screening threshold such as slopes greater than about 12 percent is best understood as a constructability and stability flag, not a safety limit. Steeper terrain increases grading and foundation cost and raises slope-stability questions. Low-relief sites are generally preferred.

In Arkansas, these factors track the physiographic provinces. The Ozark Plateaus and Ouachita Mountains have steeper slopes and higher landslide susceptibility. The Arkansas River Valley, Mississippi Alluvial Plain, and West Gulf Coastal Plain are generally lower relief. Those lower-relief areas carry different geotechnical issues, including soft alluvial soils and, in the New Madrid region, liquefaction potential. Those issues are addressed under subsurface-material and foundation stability [17b][24].

Other geologic hazards are evaluated on the same basis. These include karst and other potential-collapse features in soluble formations, subsidence from fluid withdrawal, mined ground, soil stability, and foundation conditions. Competent bedrock or dense, uniform soils are preferred [1][24].

Except for clearly mappable features such as capable faults, these factors rarely operate as regional exclusions. They are comparison and avoidance factors. They are refined through site-specific

investigation, including borings and geophysical surveys, during candidate-site review. The most favorable area is one with relatively simple, well-characterized geology because it is faster, cheaper, and less uncertain to license [1][24].

2.7 Seismic Risk

The 2022 EPRI siting guide treats seismic screening as design-dependent, not fixed [1]. It carries forward the EPRI Utility Requirements Document value of 0.3g as the plant siting envelope for large light-water designs. It also recognizes that newer advanced reactors may support higher ground motions [1].

The guide states that site peak ground acceleration must ultimately be compatible with the selected design. Typical screening thresholds range from about 0.3g to 0.6g. Without design-specific information, EPRI recommends 0.3g for large light-water and other large designs. For smaller advanced reactors, it identifies about 0.5g as a reasonable screening value, based on recent NRC advanced-reactor license applications [1].

The NuScale US460 reflects that higher envelope. It has a certified seismic design response spectra horizontal peak ground acceleration of 0.5g [26][27]. Other designs have seismic margin above the 0.3g screen without changing the design basis. The certified AP1000, for example, is designed to a 0.3g safe-shutdown earthquake, while its seismic margin assessment demonstrates a high-confidence, low-probability-of-failure capacity of at least 0.5g. That is margin above the design basis, not the design basis itself [28].

Consistent with the EPRI guide, areas where peak ground acceleration exceeds the applicable design threshold at a 2 percent probability of exceedance in 50 years should be excluded for that design [1]. For this initial screen, the candidate designs span both the 0.3g and 0.5g classes. The conservative 0.3g value was therefore retained as the common screen, while higher-envelope designs were carried forward where their design basis may support a higher site value.

The reference basis for peak ground acceleration is the U.S. Geological Survey National Seismic Hazard Model. It maps PGA for a 2 percent probability of exceedance in 50 years, approximately a 2,475-year return period, on firm rock with a shear-wave velocity of 760 meters per second. The 2023 50-state update is the current model [29].

On that basis, eastern and northeastern Arkansas have materially higher seismic hazard because of the New Madrid Seismic Zone. A USGS urban seismic hazard study for the nearby Memphis and Shelby County area, a Tennessee urban study used here as a regional indicator, found an average 2 percent-in-50-year PGA of about 0.58g, with mapped values ranging widely across the county [30]. Calculations from the 2023 National Seismic Hazard Model at representative area coordinates confirm the screen: the Phillips area is above the 0.3g screen but at or below about 0.5g, while the Craighead/Mississippi area is well above both values, with the highest hazard along the fault axis [29]. That places the eastern Arkansas areas of interest, including the Phillips and Craighead/Mississippi areas, at or above the 0.3g screen. The western, central, and southern areas fall below it, with only the easternmost Central Arkansas node at Keo approaching the screening value [29].

These are regional, firm-rock, probabilistic values. They are not site-specific licensing results. The exact PGA for each candidate location must be calculated at its coordinates using the USGS Unified Hazard Tool. The Safe Shutdown Earthquake Ground Motion used for licensing must then be developed through a

site-specific probabilistic seismic hazard analysis under 10 CFR 100.23, not read directly from the national map [3].

Uncertainty in the New Madrid hazard is significant. Knowledge-based uncertainty near the zone can have a coefficient of variation above 0.6 [31]. Before applying the 0.3g screen, the return period and site class for the screening value should be confirmed on the same basis as the mapped values. The per-coordinate hazard values, return period, and site-class assumptions are confirmed at the application stage through the site-specific probabilistic seismic hazard analysis and development of the Safe Shutdown Earthquake Ground Motion under 10 CFR 100.23, Regulatory Guide 1.208, and NUREG-0800 Section 2.5 [3][25][24].

How reactor seismic hazard is determined

Seismic design for a nuclear power plant proceeds in two linked steps. First, the design response spectra define the shaking the plant is built to withstand. Regulatory Guide 1.60 provides a standardized, smooth, broadband design response spectrum anchored to a design peak ground acceleration, and it forms part of the licensing basis for many plants built in the 1970s and 1980s. For modern certified designs, the certified seismic design response spectra are derived from the RG 1.60 shape with broadened high-frequency content to reflect the higher-frequency ground motions observed at central and eastern United States rock sites [32].

Second, the site demand is established separately. Under Regulatory Guide 1.208, an applicant conducts site- and region-specific geological, geophysical, seismological, and geotechnical investigations, characterizes the seismic sources, performs a probabilistic seismic hazard analysis, analyzes how the site soil and rock transmit and amplify ground motion, and from these derives a performance-based, site-specific ground motion response spectrum that satisfies 10 CFR 100.23 [25][3]. That spectrum leads to the Safe Shutdown Earthquake Ground Motion required by Appendix S to 10 CFR Part 50, and a standard plant is acceptable at a site only if the site ground motion response spectrum is enveloped by the certified design spectra [32][25].

A different path applies to non-light-water reactors such as the Sodium sodium fast reactor and the Xe-100 high-temperature gas reactor. Rather than a single plant-wide safe-shutdown earthquake that a certified spectrum must envelope, these designs are licensed under the risk-informed, performance-based methodology of NEI 18-04, which the NRC endorsed in Regulatory Guide 1.233 [33]. Under that graded approach, structures, systems, and components are first classified by safety significance, then assigned a seismic design category and a corresponding seismic design basis under ANS 2.26 and ASCE/SEI 43-05, so that more safety-significant items are designed to more severe ground motion and a lower target probability of failure. The adequacy of the result is judged against the methodology's frequency-consequence target rather than against one design response spectrum. The site ground motion still comes from a site-specific hazard analysis consistent with 10 CFR 100.23, but it is applied in a graded way, which is why these designs publish no single transferable peak ground acceleration and instead state their seismic basis as a set of design categories tied to the host site [3][33].

For this reason the USGS National Seismic Hazard Model values used above are appropriate for screening and relative comparison but are not a site seismic design criterion. The national model reports ground motion at a fixed firm-rock condition on a coarse grid using generic regional sources. It does not incorporate the site-specific soil column, soil amplification, liquefaction potential, slope stability, or local source characterization that 10 CFR 100.23 requires. The governing site values cannot be fixed until the

geological and geotechnical investigations and the site-specific hazard analysis required under Part 100 and described in RG 1.208 are completed [3][25]. The PGA figures recorded above should therefore be read as planning-level estimates that informed the elimination of high-hazard areas, not as the licensing-basis ground motion for any retained site.

Northeast Arkansas counties within and adjacent to the New Madrid Seismic Zone carry the highest seismic hazard in the state. The zone extends from Cairo, Illinois to Marked Tree in Poinsett County and is among the most hazardous earthquake zones in the country [19]. The 2023 National Seismic Hazard Model places much of the northeastern area, including the Craighead and Mississippi County node, at or above the 0.3g screening value used in this chapter [29]. That hazard removes the area from consideration for designs whose certified seismic envelope cannot accommodate the local ground motion, but it does not categorically exclude every design. An SMR or advanced reactor may still meet the seismic criteria at a northeastern site if it supports a bounding seismic analysis, either by carrying a higher certified seismic tolerance whose certified seismic design response spectra envelope the site-specific ground motion, or by applying the risk-informed, performance-based graded methodology of NEI 18-04 as endorsed in Regulatory Guide 1.233. In either case the site-specific ground motion must be developed through the probabilistic seismic hazard analysis required by 10 CFR 100.23 and Regulatory Guide 1.208 and shown to be enveloped by, or accommodated within, the design basis [33][3][25].

Reactor design seismic basis

The reactor designs under consideration carry published or estimable bounding seismic values, summarized in Table 2-1. Three points of context apply when comparing these values to an Arkansas site. First, a certified design or a standard design approval establishes a standard-plant seismic envelope, expressed as certified seismic design response spectra anchored to a design safe-shutdown earthquake. A site is acceptable for that standard plant only if its site-specific ground motion response spectrum falls within the certified envelope. Where the site exceeds the envelope, the standard design cannot be deployed there without additional evaluation [28][26]. In Table 2-1, Confidence reads High where the seismic basis rests on certified or approved design documents and Medium, preliminary where it rests on application-stage documents under NRC review.

Second, a bounding seismic capacity can in some cases be increased for a particular site through design hardening, for example by founding safety structures on rock, applying the hard-rock high-frequency envelope, or strengthening selected structures, systems, and components. Such measures are site-specific engineering decisions that lie outside this screening, so the standard-plant values should be read as a starting envelope rather than a fixed limit [28].

Third, the construction permit dockets cited here, for the BWRX-300 at Clinch River, the Natrium plant at Kemmerer, and the Xe-100 at Seadrift, characterize seismic demand and design for those specific host sites. Their values reflect the seismicity and geology of those sites and do not represent a standard design that can be transferred to an Arkansas site. For screening purposes they indicate the design approach and approximate capability, not a bounding value applicable in Arkansas [34][35][36].

Table 2-1. Reactor-design seismic bases and NRC cross-references (screening-level summary).

Design	Licensing instrument and status	Seismic design basis	NRC cross-reference (ADAMS)	Confidence
AP1000	Certified design (10 CFR Part 52)	SSE 0.30g PGA; margin assessment HCLPF at least 0.5g; hard-rock high-frequency envelope	DCD Rev. 19 (ML11171A500); FSER NUREG-1793 Supp. 2 (ML112061231) [28]	High
APR1400	Certified design (10 CFR Part 52)	RG 1.60 design response spectra anchored to 0.3g PGA	DCD Rev. 3 (ML18228A667), Tier 2 Ch. 3 (ML18228A650); FSER Ch. 3 (ML18215A242); HRHF Rev. 3 (ML18078A709) [37] [49] [50] [51]	High
ESBWR	Certified design (10 CFR Part 52)	CSDRS are the certified foundation-level SSE response spectra at 5% damping; RG 1.60 spectra anchored to 0.3g for the low-frequency range, enveloped with the North Anna hard-rock high-frequency spectra; DCD Figures 2.0-1 (horizontal) and 2.0-2 (vertical), Table 2.0-1 (c)	DCD Rev. 10 (ML14104A929), Chs. 2 and 3 (ML14100A504, ML14100A506); FSER NUREG-1966 Supp. 1 (ML14265A084) [38] [52] [53] [54]	High; RG 1.60 anchored to 0.3g
NuScale US460	Standard Design Approval (issued 2025)	CSDRS anchored at 0.5g horizontal, 0.4g vertical (site-independent envelope); bounds RG 1.60 at 0.1g; verified in the approved US460 SDA Revision 2, Section 3.7 (value originates in the	FSER (ML25086A073); SDA issued 2025 (ML25129A004); SDAA Rev. 2 (ML25099A236); US600 precursor (ML20225A154, ML20247J564); dockets 52-050, 99902078 [26] [27] [55] [56] [57] [58]	High

		certified US600 precursor design)		
BWRX-300	Construction permit under review (Clinch River, TVA)	Preliminary; the vendor lists a generic SSE of 0.3g; site-specific GMRS for Clinch River in the PSAR and early site permit; design derives from the certified ESBWR	CP PSAR Rev. 1 (ML26119A628); CP SER (ML26168A505); ESP-006 and ESP SER Sec. 2.5.2 (ML17289B253); dockets 50-615, 52-047 [34] [48] [59] [60] [61]	Medium, preliminary
Natrium	Construction permit issued 2026 (Kemmerer)	Site-specific, CP-stage; no generic advertised PGA; risk-informed graded seismic design basis (ASCE 43-05 categories) with site-specific ground motion at Kemmerer; in the PSAR and staff safety evaluation; sodium fast reactor (non-LWR)	PSAR (ML24088A059); SER (ML25329A252); CP CPAR-1 (ML26034B247); Order CLI-26-5 (ML26063A399); docket 50-613 [33] [35a] [62] [63] [64] [65]	Medium, preliminary
Xe-100	Construction permit under review (Dow, Seadrift)	Site-specific, preliminary; no single generic PGA; graded ASCE 43-05 seismic design bases (e.g., SDB 5D for Seismic Category I) with site-specific ground motion at Seadrift; in the PSAR; high-temperature gas-cooled reactor (non-LWR)	CP application and PSAR (ML25090A057, ML25090A061); Xe-100 seismic methodology white paper (ML23044A310); NRC staff observations (ML23188A092); docket 50-614 [33] [36] [66] [67] [68] [69]	Medium, preliminary

The matrix below cross-references the six areas of interest against the seven reactor designs on a seismic screening basis. It is a planning-level indication only. The color reflects whether the site estimated PGA falls within the design seismic basis at the 0.3g screen: green indicates screening compatibility and red a site estimated PGA at or above the 0.3g screen. Yellow is an unresolved result. In the yellow cells, Margin

means a certified design envelope exceeds the 0.3g screen but site compatibility has not been demonstrated, and Prov. means the design basis is preliminary or is not a transferable standard. In both yellow cases no compatibility conclusion is drawn and site-specific analysis is required. The colors are a planning aid, not licensing outcomes. The footnotes carry the qualifications established above and apply wherever a site equals or exceeds the seismic PGA screen. [29].

Table 2-2. Site-by-technology seismic screening matrix (planning-level, see footnotes).

Area of interest	Est. PGA	AP1000	APR1400	ESBWR	NuScale US460	BWRX-300	Natrium	Xe-100
Area 1, Flint Creek	Below 0.3g	Pass	Pass	Pass (c)	Pass	Prov. (b)	Prov. (b)	Prov. (b)
Area 2, Arkansas Nuclear One	Below 0.3g	Pass	Pass	Pass (c)	Pass	Prov. (b)	Prov. (b)	Prov. (b)
Area 3, Central Arkansas	Below 0.3g	Pass	Pass	Pass (c)	Pass	Prov. (b)	Prov. (b)	Prov. (b)
Area 4, Southwest Arkansas	Below 0.3g	Pass	Pass	Pass (c)	Pass	Prov. (b)	Prov. (b)	Prov. (b)
Area 5, Phillips	At or above 0.3g	Exceeds (a)	Exceeds (a)	Exceeds (a)	Margin (a)	Exceeds (a)	Prov. (a)(b)	Prov. (a)(b)
Area 6, Craighead/Mississippi	At or above 0.3g	Exceeds (a)	Exceeds (a)	Exceeds (a)	Margin (a)	Exceeds (a)	Prov. (a)(b)	Prov. (a)(b)

(a) Site estimated PGA is at or above the 0.3g project screen, and these eastern areas were eliminated at screening. The USGS values are planning-level estimates, not site criteria. A site-specific probabilistic seismic hazard analysis under 10 CFR 100.23 and RG 1.208 is required before any value is treated as a design input. The NuScale US460 carries a higher 0.5g horizontal design envelope (CSDRS) that may accommodate these areas subject to that analysis, shown in yellow. The AP1000 retains seismic margin, with an HCLPF capacity of at least 0.5g above its 0.30g design basis. Neither changes the 0.3g screening outcome [3][28][32][25][27].

(b) Construction-permit-stage or non-light-water design. The seismic basis is preliminary and site-specific, not a transferable standard design. The BWRX-300 carries a generic vendor SSE of 0.3g listed in the IAEA ARIS catalogue, with the licensing value being the site-specific Clinch River ground motion. The Natrium and Xe-100, as non-light-water designs, use risk-informed, graded ASCE 43-05 seismic design bases with site-specific ground motion at Kemmerer and Seadrift rather than a single transferable PGA. Because that basis is set by the site-specific ground motion and the methodology frequency-consequence target rather than by the 0.3g screen, the Natrium and Xe-100 are shown provisional rather than excluded in the eastern areas at or above the screen, subject to confirmation by the site-specific probabilistic seismic hazard analysis under 10 CFR 100.23. Screening results are therefore provisional [34][35][36][33][39].

(c) The ESBWR certified seismic design response spectra (CSDRS) are specified graphically in DCD Figures 2.0-1 (horizontal) and 2.0-2 (vertical) and Table 2.0-1 rather than as a single quoted number. Per the ESBWR Design Control Document, Tier 2, Section 3.7.1 (Document 26A6642AJ, Revision 10), the standard-plant SSE design ground motion follows RG 1.60 ground spectra

anchored to 0.3g for the low-frequency range, enveloped with the North Anna early site permit hard-rock high-frequency spectra to form the single CSDRS at 5% damping, defined as free-field outcrop spectra at the foundation level. The CSDRS are higher than RG 1.60 spectra anchored to 0.1g, satisfying the 0.1g minimum peak ground acceleration required by Appendix S to 10 CFR Part 50 for the horizontal component of the SSE [38].

2.8 Environmental Considerations

Environmental considerations enter new reactor siting through a regulatory track separate from the safety and suitability site characterization that governs the rest of this chapter. Site characterization, under 10 CFR Part 100 and the Standard Review Plan, asks whether a site is safe and suitable for a reactor. The environmental track, under the National Environmental Policy Act as implemented in 10 CFR Part 51, asks what the effects of building, operating, and decommissioning the plant would be and whether they are acceptable. The two evaluations share much of the same field data but remain distinct. Under Part 51 an applicant for an early site permit, construction permit, operating license, or combined license submits an Environmental Report, whose content 10 CFR 51.45 and related sections set, along with the guidance in Regulatory Guide 4.2, and the NRC then prepares an environmental impact statement [6][7].

The environmental review for new reactors has recently been streamlined. In April 2026 the NRC published the final Generic Environmental Impact Statement for Licensing of New Nuclear Reactors, NUREG-2249, and codified its generic findings in a new Appendix C to 10 CFR Part 51 [8][6]. The GEIS was developed on a technology-neutral, performance-based basis so that it could apply to any new reactor design, not only advanced reactors, provided the project fits within two bounding descriptions: a plant parameter envelope, which sets bounding values for reactor design features regardless of site, and a site parameter envelope, which sets limiting site conditions such as the site size, the size of the water body supplying the plant, and the extent of wetlands and floodplains [8]. Using these envelopes, an interdisciplinary team of NRC and national-laboratory subject matter experts evaluated 119 environmental issues across 15 resource areas [8].

The GEIS sorts those issues into categories. It found 100 to be Category 1, meaning the impact can be resolved generically, either because it is beneficial or because it is SMALL and adverse for any project bounded by the relevant envelope values. It found 17 to be Category 2, requiring a project-specific analysis of site conditions. It classified the remaining two, both electromagnetic-field issues, as not applicable because the science is uncertain [8]. An applicant whose project fits within the plant and site parameter envelopes may cite the codified generic finding for a Category 1 issue with no further analysis, unless new and significant information would change the conclusion, and must supply a site-specific analysis only for the Category 2 issues and for any issue where the project falls outside the envelopes [8][6]. The NRC then documents the result in a project-specific supplemental environmental impact statement, and the codified findings are committed to review on a ten-year cycle [6].

For siting, the environmental analysis is a required part of any new-reactor application, but it rarely eliminates a site. The generic framework treats the common impacts of a bounded project as not environmentally significant so long as the project remains within the generic plant and site parameter envelopes. Facility design, operational controls, and mitigation typically resolve the remaining issues, including the 17 Category 2 issues that require project-specific analysis. The Commission's long-standing position, upheld in *Baltimore Gas and Electric Co. v. NRDC*, 462 U.S. 87 (1983), is that such generic environmental findings are a reasonable basis for licensing [6]. In practice, environmental considerations shape how a plant is designed and operated and what mitigation the applicant commits, and they can

favor one candidate area over another, but the NRC seldom excludes a nuclear plant outright on environmental grounds. The screens that actually remove candidate areas in this chapter are the safety and suitability criteria, principally seismic hazard and, for large reactors, proximity to population centers.

This environmental track is presented here as context for the site selection rather than as part of the safety screening. The hydrologic, meteorological, ecological, and population data developed for site characterization also feed the Environmental Report and the supplemental environmental impact statement, but the two analyses answer different questions and are kept separate, consistent with the treatment throughout this chapter [6][8].

3 Siting Procedure

The siting procedure consists of the following five primary process steps.

These steps follow the EPRI site-selection methodology [1] and align with the site-selection guidance in NUREG-1555 [44] and Regulatory Guide 4.2, Revision 4 [7], the 2026 revision reflecting the new-reactor Generic Environmental Impact Statement codified in Appendix C to 10 CFR Part 51 [8]: Except where noted, the procedural descriptions in Sections 3.1 through 3.6 paraphrase those sources.

1. Identify the region of interest (ROI).
2. Screen to candidate areas.
3. Identify potential sites.
4. Screen to candidate sites.
5. Identify proposed and alternative sites.

Three analytical processes are applied in executing the procedure, as follows:

- + Siting criteria: application of criteria that represent regulatory, facility design, and environmental requirements, which affect site suitability and are considered in site selection.
- + Criterion scoring: development of utility functions that quantify the relative suitability of a site with respect to a single criterion.
- + Criteria and importance weighting: development of weight factors that reflect the relative importance of individual criteria in siting and development of a composite suitability value that reflects siting tradeoffs among criteria.

Several criteria now screen differently because of recent regulatory and technology changes. Seismic screening is design-dependent, not fixed, consistent with the graded, risk-informed approach for advanced and non-light-water reactors. For qualifying small modular reactors, emergency planning zones are now sized by dose consequence under 10 CFR 50.160 rather than by a fixed ten-mile radius, which reduces the population-screening burden. Environmental review is also narrower because of the new-reactor Generic Environmental Impact Statement, NUREG-2249, now codified in Appendix C to 10 CFR Part 51 and supported by Regulatory Guide 4.2, Revision 4.

The cooling and heat-sink criterion is also technology-dependent. Air-cooled and hybrid designs can reduce, or in some cases largely remove, the surface-water constraint. The scoring weights should reflect these design-dependent and technology-specific differences [1][13][5][7][8].

The criteria applied in the scoring step fall into three groups: socioeconomic factors, proximity factors, and safety factors. The candidate factors in each group are listed below. The safety factors correspond to the site-characterization criteria developed in the opening sections of this chapter, while the socioeconomic and proximity factors capture the economic, infrastructure, and community considerations weighed alongside them. The factor set draws on the EPRI siting guide and published siting-screening criteria [1].

3.1 Factors Affecting Siting

3.1.1 Socioeconomic Factors

- Nuclear Restrictions
- Energy Prices
- Net Electricity Imports
- Nuclear Sentiment
- Nuclear Inclusive Policy
- Market Regulation
- Construction Labor Rate

3.1.2 Proximity Factors

- Population
- Operating Nuclear Facilities
- Nuclear Research and Development
- Substations
- Generator Retirement
- Transportation
- Streamflow

3.1.3 Safety Factors

- Social Vulnerability Index
- Protected Lands
- Hazardous Facilities
- Fault Lines
- Landslide Hazard
- Safe Shutdown Earthquake
- 100-Year Flood
- Open Waters and Wetlands
- Slope

3.2 Identification of the Region of Interest

The process starts with the Region of Interest (ROI). Each step successively narrows the area and then the number of sites until it identifies alternative sites and a proposed site. The process also uses resources efficiently in characterizing sites, so the results of each step show where resources are best invested for the next step. Starting from the ROI, each stage reduces the area under consideration and applies more detail to the areas and sites that looked more favorable in the earlier stages.

3.3 Identification of Candidate Areas

At this stage, the ROI is screened to remove unfavorable areas and identify candidate areas for later canvassing. The first screen applies exclusionary factors. These eliminate areas where a nuclear facility is not feasible because of regulatory, institutional, design, or environmental constraints.

The remaining area may then be screened with avoidance factors. These remove areas that are feasible but less favorable, further narrowing the search. The process is iterative. If the remaining area is too small to produce an adequate number of potential sites, the avoidance factors may be relaxed and the screen repeated. If the remaining area is too large, and additional avoidance factors can be justified, the criteria may be tightened and the screen repeated.

Avoidance screening continues until the candidate areas are large enough to support multiple siting options, but not so large that the next step becomes unmanageable. It also ends when no more restrictive avoidance factors can be defensibly applied.

Application to Arkansas

Drawing on EXCEL's knowledge of the State¹ and interviews with stakeholders, the EXCEL team screened Arkansas to the six candidate areas shown in Figure 3-1 below. Other areas could also be good candidates, such as Little River and nearby counties or Scott County. Those areas require additional analysis in future studies.

The transmission screen informed selection of the candidate areas. Grid interconnection capacity (and to some extent water availability) is the constraint on small modular reactor deployment in Arkansas. A site without access to firm injection capacity cannot, absent an expensive and time-consuming transmission build-out, host new generation regardless of its other merits. The transmission screening performed by Nucleon and described in Section 4 evaluated incremental injection capability at 230 to 500 kilovolt nodes under single-contingency conditions and grouped the nodes able to accommodate the screening threshold into six areas of interest. The 600 megawatt injection floor used in that screen is a representative project threshold rather than a regulatory standard. Area 1 at Flint Creek falls below it and was retained at EXCEL's request because stakeholder interviews identified Northwest Arkansas as a load pocket, an area of high demand relative to local generation. The statewide screen applied the transmission criterion uniformly. Scoring and weighting of the remaining criteria would occur at the candidate-site stage described in Section 3.5.

¹ One of the authors is an Arkansas native.

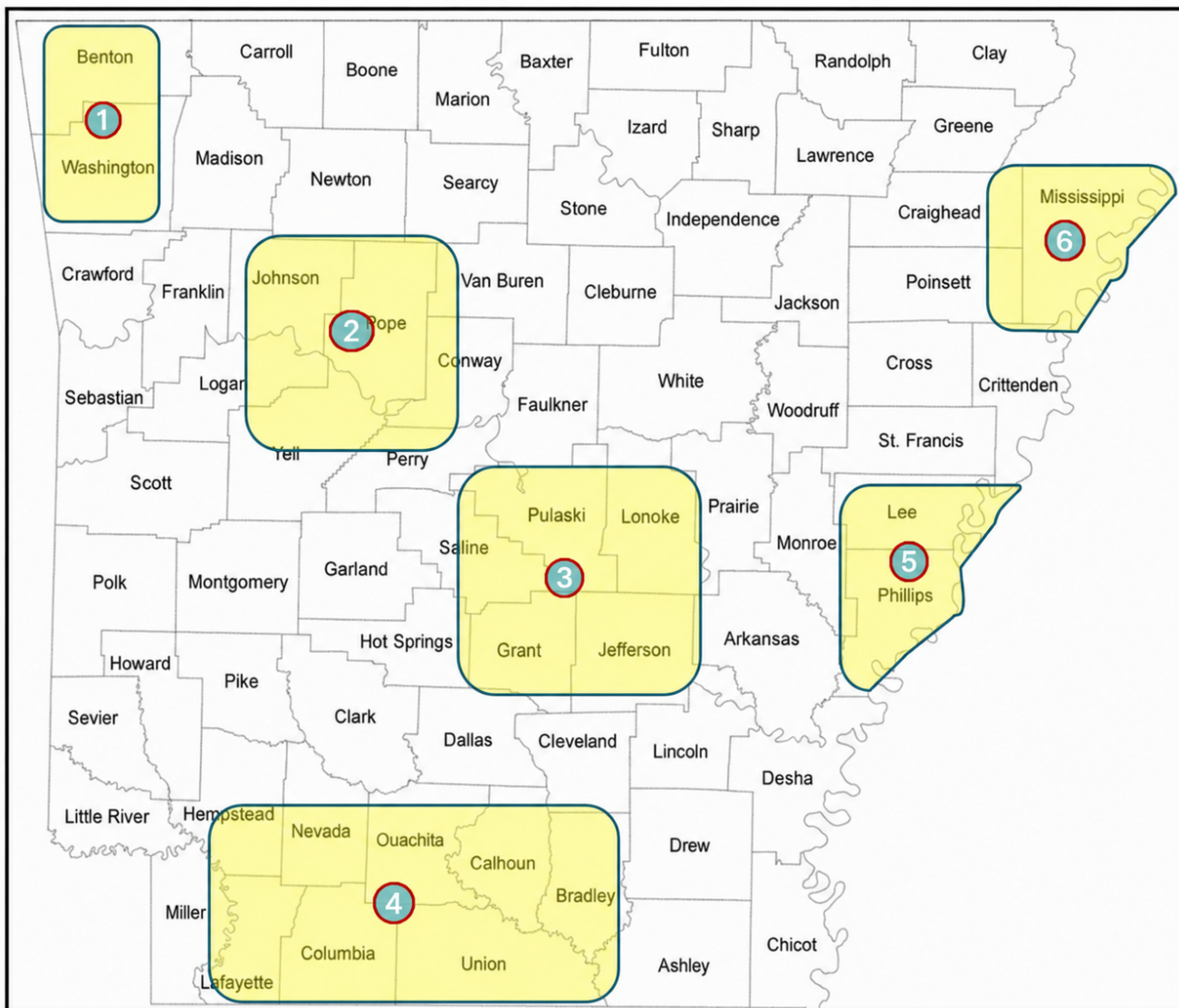


Figure 3-1. The six areas of interest selected as candidate areas for a new nuclear build.

Using the transmission screen as a filter helps the siting methodology, because several of the resulting areas also coincide with cooling-water sources. Area 2 is the existing Arkansas Nuclear One site in Pope County, which carries an established licensing and operating record. The central and Arkansas River areas align with the McClellan-Kerr Arkansas River Navigation System and with the retiring White Bluff plant in Jefferson County, which has its own transmission infrastructure. The southwestern areas include the Ouachita and Red River systems. Locating candidate areas where interconnection, cooling water, and in some cases existing infrastructure are already present reduces development time and cost, and it concentrates further investigation where it is most likely to be productive.

The remaining suitability criteria were then applied to the six candidate areas as avoidance and exclusion factors, and the results are developed in Section 2. This sequence accounts for the differentiated outcomes reported in this chapter. Area 1 lies below the transmission injection floor. Areas 5 and 6 lie at or above the 0.3g seismic screening value because of the New Madrid Seismic Zone, and they were eliminated for the designs whose certified seismic envelope cannot accommodate the local ground

motion and carried only provisionally for the risk-informed advanced designs. The central, Arkansas River, and southwestern areas fall below the seismic screen and were carried forward. The flooding, population, and water-availability criteria further differentiate the areas as set out in Sections 2.1 and 2.4.

Two sets of identifiers appear in the supporting material and are reconciled here. The transmission screening labels the regions as areas of interest 1 through 6. The preliminary water-availability assessment prepared by Halff Associates labels locations as Halff Sites and includes a seventh location, Halff Site 7 at Millwood Lake, which has no corresponding transmission area of interest and is therefore not carried as a separate candidate area in this chapter. (Although, as noted above, Little River County may be an acceptable siting location and future analysis should consider it). Except for that seventh location, the Halff Sites correspond to the areas of interest by number, so that Halff Site 1 lies within Area 1 and the remaining sites follow in the same order. References in this chapter to a Halff Site identify the water-assessment location within the corresponding area of interest.

3.4 Identification of Potential Sites

Potential sites are identified by canvassing the candidate areas from Step 2 to locate discrete areas that appear favorable as nuclear plant sites. Professional judgment should be incorporated into defining potential sites to ensure they are feasible, optimized to the extent possible, and allow flexibility in the site layout process.

A typical process for conducting this canvassing of candidate areas is as follows:

1. Satellite imagery of the candidate areas is viewed using Google Earth. Potential sites of the target size are identified by applying the considerations described in the next list.
2. U.S. Geological Survey (USGS) topographic maps of 1:100,000 and 1:24,000 scale and other source maps, as available, are examined to identify areas for potential sites and to clarify and optimize locations identified from satellite photography. The information on identified sites is supplemented using state maps and atlases, as feasible
3. The latitude and longitude of the approximate geographic center point of each potential site are noted.

Specific considerations applied in identifying potential site locations, as feasible and as applicable to the owner-operator's ROI, are as follows:

- + At least one potential site for each major water source or group of sources (note that some advanced reactors may need significantly less water).
- + At least one potential site in each candidate area.
- + Location in lower seismic risk areas.
- + Proximity to transmission (reactors of lower power may need less transmission line injection capacity, so existing transmission capacity is more likely to work, and a larger number of lower-voltage lines may satisfy this objective).
- + For non-electrical missions such as process heat, proximity to end users.
- + Proximity to load centers.
- + Avoidance of high-population and high-population-density areas
- + Avoidance of ecologically sensitive and special designation areas.
- + Avoidance of wetlands to the extent practical.

- + Avoidance of special dedicated land uses (such as national parks, Indigenous lands, historic areas, and cemeteries).
- + Proximity to transportation and heavy-haul infrastructure (such as rail lines and barge terminals).
- + Diversity of potential sites within large candidate areas.
- + Potential sites that are particularly compatible with the owner-operator's business objectives.

The resulting set of potential sites should be large and diverse enough for the owner-operator to demonstrate that the results represent the major siting trade-offs in the ROI and reflect the best sites that can reasonably be found there. Recent site selection studies have typically included 10 to 20 potential sites at this stage, based on ROIs limited to the owner-operator's service territory [1].

3.5 Identification of Candidate Sites

The goal of Step 4 is to show and rank a relatively small number of candidate sites (from the set of potential sites) for a more detailed study and to identify the proposed and alternative sites. Although there is no firm requirement for the number of candidate sites, NUREG-1555 provides the guidance that, in general, "three to five alternative sites in addition to the proposed site could be viewed as adequate" [44].

Depending on the number of potential sites identified in Step 3, this screening process may be conducted in multiple steps. This approach is used as a resource optimization technique in which the full set of potential sites is analyzed using an initial set of screening criteria. The sites determined to be best in this step are carried forward for detailed analysis in the next substep, so that increasingly detailed criteria and analyses are applied as the number of sites under consideration is successively reduced until a set of candidate sites is identified.

Many owner-operators have conducted the "potential site-to-candidate site" screening using a two-step process. This two-step process screens potential sites, identifying primary sites (i.e., the top potential sites). A larger, more detailed set of general siting criteria is then applied to the primary sites to identify candidate sites. The following discussion is organized around this approach. However, owner-operators should use as many, or as few, steps as are appropriate for the number of sites under consideration and the issues affecting their site identification process.

For each of these substeps, the overall process for evaluation of sites consists of the following elements:

- + Develop criterion ratings by assigning each potential or primary site a rating (for example, 1 to 5, where 1 = least suitable, 5 = most suitable) for each of the criteria evaluated in the substep.
- + Develop weight factors reflecting the relative importance of each criterion.
- + Develop composite site-suitability ratings that reflect the overall suitability of each site by multiplying criterion ratings by the criterion weight factors and summing over all criteria for each site.

Screening criteria are derived from the larger set of more detailed criteria applied in this chapter. They are intended to provide insights into the overall site suitability tradeoffs between the potential sites and to take advantage of data available at this stage of the site selection process.

Although the individual criteria selected for the screening to primary sites should reflect issues and data availability specific to the owner-operator's ROI, the following is a typical set of screening criteria used in recent applications:

- + Seismic
- + Water supply for cooling or ultimate heat sink (as necessary for the technologies under consideration)
- + Flooding
- + Population
- + Hazardous land uses
- + Ecology and wetlands
- + Railroad, barge, and highway access
- + Transmission corridors
- + Existing land ownership or potential for acquisition

Table 2-3. Template for Site Screening Criteria

Site Name	Seismic	Cooling Water Capacity	Flooding	Population	Hazardous Land Uses	Ecology	Wetlands	Heavy Haul Access	Transmissi on Access	Land Acquisition	Site Rating

3.6 Proposed & Alternative Sites

Once candidate sites have been identified, the process of selecting a proposed site is unique to the owner-operator's:

- + Business plan for the new nuclear plant.
- + Existing knowledge of the sites under consideration.
- + Level of confidence needed to make a management decision on a proposed site.
- + Characteristics of the candidate sites themselves (such as ownership, seismic, and meteorological).

4 Transmission & Grid Integration

Grid integration depends both on the character of the existing Arkansas bulk power system and on where that system can absorb new generation. Arkansas sits at the boundary of two regional transmission organizations: the eastern two-thirds of the state lies in the Midcontinent Independent System Operator (MISO) South subregion, where Entergy Arkansas is a member, and the western and northwestern portions lie in the Southwest Power Pool (SPP), served principally by Southwestern Electric Power Company, the Arkansas Electric Cooperative Corporation, and Oklahoma Gas and Electric, together with rural cooperatives. The bulk system operates within the Eastern Interconnection under North American Electric Reliability Corporation standards, with regional-entity oversight principally by the SERC Reliability Corporation for the MISO footprint and the Midwest Reliability Organization for the SPP footprint [40d].

Entergy Arkansas owns the bulk of the state's high-voltage network, roughly 5,100 circuit miles of transmission lines and 151 transmission substations, from the 500 kV backbone down through the 161 kV and lower network [40b]. The 500 kV backbone runs diagonally across the state, linking generation in the Arkansas River Valley, including Arkansas Nuclear One near Russellville, northeast to the TVA interconnection near Memphis and south into the Entergy system in Louisiana. The Entergy Arkansas portfolio reaches approximately 7,300 MW of resources by 2026, and the 2024 Integrated Resource Plan's reference-case peak forecast approaches 8,000 MW over the planning horizon, driven by large new loads [40].

Two features of the present system bear on siting. The MISO South subregion has historically been capacity-constrained relative to MISO North, with limited north-to-south transfer capability between the subregions, a constraint documented by MISO's Independent Market Monitor, which reports transfer limits of 2,500 MW south-to-north and 3,000 MW north-to-south [40c]. At the same time, several near-term investments are planned or underway, including the Ironwood simple-cycle combustion turbine (Lake Catherine Unit 5), which will replace Lake Catherine Unit 4 in Hot Spring County [40e], Entergy's southeast Arkansas reliability program, a 500 kV loop near West Memphis, MISO's Long-Range Transmission Planning for the South subregion, and SPP's High Impact Large Load interconnection framework, proposed in 2025 and approved by FERC in January 2026, offering a faster combined process for large new loads and generation [40][40a]. These developments would shape the transmission conditions at the candidate areas over the project timeline.

Nucleon Energy Inc. ("Nucleon") was subcontracted to perform a transmission-based screening of the Arkansas bulk power system to identify areas where the existing and planned grid could host new small modular reactor (SMR) generation under a 2035 planning outlook [21].

The Nucleon screening used the Eastern Interconnection Reliability Assessment Group (ERAG) Summer and Winter 2035 power-flow cases to evaluate the incremental megawatt (MW) injection capability at 230 to 500 kV transmission nodes within Arkansas under single-contingency (N-1) conditions. Nucleon treated nodes able to accommodate at least 600 MW of N-1 injection without exceeding facility thermal ratings as viable and grouped them into broader Areas of Interest [21]. The 600 MW threshold corresponds to a representative multi-unit SMR project, on the order of two 300 MW units, and is a screening floor rather than a regulatory standard. The Nucleon report confirms this threshold and the use of the ERAG Summer and Winter 2035 cases, Series 2025, and it treats single-contingency thermal limits as the defining constraint with no transmission reinforcements or operational mitigations assumed [21]. The report notes that the areas are compatible with configurations built up from 300 MW units, with the higher-capacity areas able to host multiple units and a broader range of designs and the lower-capacity areas favoring smaller initial unit counts [21]. Area 1, at approximately 531 MW of N-1 injection capability, sits below the 600 MW two-unit floor and supports a single 300 MW unit without reinforcement [21].

The screening identified six Areas of Interest, summarized in Table 2-4: Flint Creek in northwest Arkansas, Arkansas Nuclear One in Pope County, Central Arkansas including the Hot Spring, Sheridan, and Keo 500 kV substations, Southwest Arkansas near Camden, Phillips near Helena-West Helena, and Craighead/Mississippi in northeast Arkansas [21].

Table 2-4. Indicative SMR interconnection capacity by Area of Interest (representative N-1 minimum injection), per Nucleon [21].

Area of Interest	Representative substation	Nominal kV	Representative N-1 injection (MW)
1. Flint Creek	Flint Creek Power Station	345	~531 (below the 600 MW floor; tracked at EXCEL's request)
2. Arkansas Nuclear One	Arkansas Nuclear One 500 kV substation	500	~614
3. Central Arkansas	Hot Spring, Sheridan, and Keo substations	500	~768 to 929 (three nodes)
4. Southwest Arkansas	McNeil substation (near Camden)	500	~1,003
5. Phillips	Ritchie substation (near Helena-West Helena)	230	~716
6. Craighead/Mississippi	Sandy Bayou substation	500	~2,424

The Nucleon assessment is a screening-level, transmission-thermal study. Formal interconnection scope, cost, and timing for any specific project would be established only through the applicable Southwest Power Pool or Midcontinent Independent System Operator interconnection process. The next-stage analyses, namely steady-state voltage and reactive-power studies and dynamic-stability analysis, together with the formal generator interconnection studies, would be performed through that process once a specific site and design are fixed [21].

Several of the transmission Areas of Interest coincide with identified cooling-water sources evaluated in the supporting water assessment, including Arkansas Nuclear One with Lake Dardanelle and the Arkansas River corridor near Redfield [21][20].

5 Special Considerations

Beyond the technical screening criteria, several strategic and load-related considerations bear on where new nuclear generation in Arkansas would be most useful. These are not site-suitability criteria in the regulatory sense. They reflect where electrical demand is growing, where existing infrastructure could be reused, and where a known constraint must be weighed against that demand.

South Arkansas is a candidate area for supporting regional industrial load. The region has an established defense manufacturing presence, and it is now the center of emerging lithium development: the Smackover Lithium South West Arkansas project, a Standard Lithium and Equinor joint venture in Columbia and Lafayette counties, received final integration approval from the Arkansas Oil and Gas Commission in October 2025 [41a][41b] and is targeting first commercial direct-lithium-extraction production in 2028 [41][41a][41b]. Direct lithium extraction and downstream battery-material processing are electricity-intensive, so a firm low-carbon supply in south Arkansas would align generation with anticipated industrial growth.

Northeast and eastern Arkansas is a second area of strong load growth. Mississippi County is the largest steel-producing county in the United States, with continuing investment in steelmaking and processing, and the eastern part of the state is attracting large data-center projects, including a multibillion-dollar Google campus at West Memphis served by Entergy Arkansas [42][42a]. The special consideration for this area is seismic risk. The New Madrid Seismic Zone places much of northeastern Arkansas at or above the 0.3g screening level used in this chapter, which is why the Phillips and Craighead/Mississippi areas of interest were screened out for most designs and carried only provisionally for the risk-informed advanced designs. Siting to serve this load would therefore depend either on locating generation just outside the high-hazard zone or on a design whose site-specific seismic analysis can accommodate the local ground motion.

Retiring coal units offer ready sites for replacement nuclear generation. Under a Clean Air Act settlement filed in federal court, Entergy Arkansas will cease burning coal at the White Bluff station by the end of 2028 and at the Independence station by the end of 2030 [43][43a]. Reusing a retiring thermal site can shorten development by taking advantage of established cooling-water access, switchyards, and, most importantly, existing grid interconnection, which is consistent with the transmission constraints discussed earlier in this chapter.

Additional units at Arkansas Nuclear One are a further option. The existing two-unit site in Pope County carries an established licensing and operating record under the site-related criteria evaluated in this chapter, which makes it attractive for expansion. The transmission screening identified roughly 614 MW of single-contingency injection capability at the ANO node, enough for a two-unit 300 MW project without reinforcement [21]. Adding generation beyond that level would require transmission upgrades, with actual requirements determined through the formal interconnection process [21]. The feasibility of a larger build at the site is therefore tied to those upgrades rather than to site suitability alone.

6 Engineering Services Required

A new nuclear project in Arkansas will procure engineering services in five classes, running from site characterization through construction oversight. [20][21].

Site characterization. Confirming a candidate site requires geotechnical investigation, a site-specific seismic hazard analysis under 10 CFR 100.23, hydrologic and flooding analysis, an onsite meteorological measurement program under Regulatory Guide 1.23, and environmental baseline surveys. Sections 2.3 through 2.7 of this chapter describe the regulatory basis for each. These services produce the site data a license application must contain.

Licensing engineering. An applicant prepares a safety analysis report and an environmental report. 10 CFR 51.45 requires the environmental report to accompany the application [70]. Preparing these documents and responding to NRC requests for additional information is specialized work. Chapter 7 describes the available license types: the early site permit, the construction permit, the combined license, and the Part 53 and Part 57 pathways.

Transmission and interconnection engineering. The project needs interconnection studies through the MISO or SPP queue, transmission planning, and switchyard design. Nucleon reports that interconnection and project planning can take 3 to 4 years to reach reasonable certainty [21], so this work starts early.

Design, procurement, and construction. The reactor vendor supplies the nuclear reactor plant design. An architect-engineer completes the balance-of-plant design, and an engineering, procurement, and construction (EPC) contractor executes the build. Recent projects show the pattern: Bechtel holds the EPC role at the Natrium plant in Kemmerer, Wyoming (Chapter 3). Chapter 7's Vogtle case study shows what the EPC relationship can do to a project when the contractor fails. EPC contract structures, vendor financial health, and contingency planning must be carefully considered before contracting (Chapter 7).

Owner's engineer and quality assurance. The project owner needs engineering capability independent of the vendor and the constructor. Chapter 7's Vogtle lessons state the point directly: strong owner's engineer capability and independent monitoring are essential, not optional. All safety-related design and construction services must run under a quality assurance program meeting 10 CFR Part 50, Appendix B, which "establishes quality assurance requirements for the design, manufacture, construction, and operation of those structures, systems, and components" [71]. Suppliers of safety-related pressure-retaining components must hold special nuclear certifications.

Arkansas firms can currently perform portions of this work. The nuclear-grade services, licensing engineering, safety analysis, and Appendix B design work, currently would come from national or

international companies. Arkansas companies could enter further into the nuclear supply chain were they to obtain the necessary nuclear certifications. Licensing consultants like EXCEL can help with that.

7 Potential technology selection

The screening criteria are largely subjective. A few can be expressed objectively through calculations, but most require judgment on subjective factors. Many of the technologies are still evolving, so credible information is limited for some, which forces subjective extrapolation and prediction. The criteria below are the study team's assessment framework.

- A. Suitability to the Siting Scenario
- B. Design Maturity
- C. Ability to Commercially Perform
- D. Safety Philosophy
- E. Supply Chain
- F. Fuel Cycle
- G. Licensing Progress
- H. Schedule Expectations
- I. Indicative Economics

These criteria frame the technology evaluation that follows. The next chapter, Chapter 3, surveys the candidate reactor technologies against which they apply, giving a high-level technical review of the Western reactor designs currently under development or regulatory review in the United States, the United Kingdom, and Canada [13]. Chapter 3 organizes those designs into Generation III-plus large reactors, light-water small modular reactors, and non-light-water small modular reactors, and it develops the design-specific parameters, including the seismic, cooling-water, and licensing-status information referenced in this chapter, that are needed to judge each candidate technology against the criteria listed above.

Applying these criteria to the site characteristics in this chapter and the technology review in Chapter 3 supports conclusions at the specification level.

- + **Seismic capability.** For most of Arkansas, a design screened at 0.3g satisfies the siting envelope. Serving northeast Arkansas load requires either siting outside the high-hazard zone or a design whose site-specific seismic analysis accommodates New Madrid ground motions, which favors the roughly 0.5g-class advanced designs carried provisionally for those areas (§§ 2.7, 5).
- + **Water demand.** Cooling water is a controlling siting variable. A design with lower withdrawal requirements, including the gas-cooled designs with minimal water demand, widens the set of viable candidate areas beyond the main-stem river corridors (§§ 2.4, 2.5; Ch. 3 comparative tables).
- + **Unit size.** The transmission screening treated 600 MW of single-contingency injection as the viability floor, on the order of two 300 MW units. A project sized in blocks of roughly 300 to 600 MW matches existing grid capability at the identified areas of interest without reinforcement. A larger plant is feasible where transmission upgrades fit the schedule and budget (§ 4).

- + **Industrial uses.** Serving process-heat loads requires a design that delivers high-temperature heat. Among the reviewed designs, the high-temperature gas reactors, with core outlet temperatures near 750 °C, best support that use. All designs can support electricity production (Ch. 3; § 5).
- + **Maturity.** Design maturity and the ability to commercially perform favor a design holding NRC design approval, an active and well-populated NRC licensing docket, under construction, or operating.

This study does not select a reactor, as that question cannot be fully answered unless a site and power off-taker are determined.

8 Development Timeline

The phases below assemble the schedule evidence from this study into one view. Durations are ranges drawn from the cited chapters, not commitments.

Phase	Duration	Basis
Feasibility and policy foundation	Complete	This study, delivered under Act 707. Chapter 6 recommends additional legislation.
Site selection, characterization, and interconnection	2 to 3 years	Chapter 2 siting procedure. Historically, this would have taken 3 to 4 years, but the authors believe that energetic development combined with a federal administration promoting nuclear can shorten the timeline.
NRC licensing (initial construction permit)	Roughly 1.5 to 4 years, likely closer to 1.5 years given recent reforms at NRC	Hermes 2 construction permits issued 16 months after application, after pre-application engagement since 2018. Vogtle COL: application 2008, licenses 2012 (Ch. 7).
Construction	4 to 11 years depending on design and project discipline	Vogtle: first nuclear concrete 2013, commercial operation 2023 and 2024 (Ch. 7). SMR and microreactor targets of 3 to 5 years are targets, not yet demonstrated in the U.S. (Ch. 1).
Total, planning to operation	10 to 20 years for large plants, shorter (6-12 years) for SMRs ²	Chapter 1 (Congressional Research Service, 2025). The authors also have personal experience in estimating these times for reactor vendors and utilities.

Thus, an Arkansas project entering site selection in 2027 could reach commercial operation in the mid-2030s.

² Note that some portions of the phases can run in parallel, e.g., awaiting permissions to begin construction can occur while also finalizing site permissions.

Acceleration and Efficiencies

- **Reuse retiring thermal sites.** Entergy Arkansas ceases coal at White Bluff by the end of 2028 and at Independence by the end of 2030. Reuse shortens development through established cooling-water access, switchyards, and existing grid interconnection (Ch. 2, § 5).
- **Expand at Arkansas Nuclear One.** The site carries an established licensing and operating record. Transmission screening found roughly 614 MW of single-contingency injection capability at the ANO node without reinforcement, thus transmission upgrades will be needed (Ch. 2, § 5).
- **Separate site approval from design choice.** An early site permit resolves site suitability years before the reactor design is selected or construction started (Ch. 1).
- **File for interconnection early.** SPP's High Impact Large Load framework, approved by FERC in January 2026, offers a faster combined process for large new loads and generation, and the 3-to-4-year certainty horizon makes the queue a schedule driver (Ch. 2, § 4 and Appx. B).

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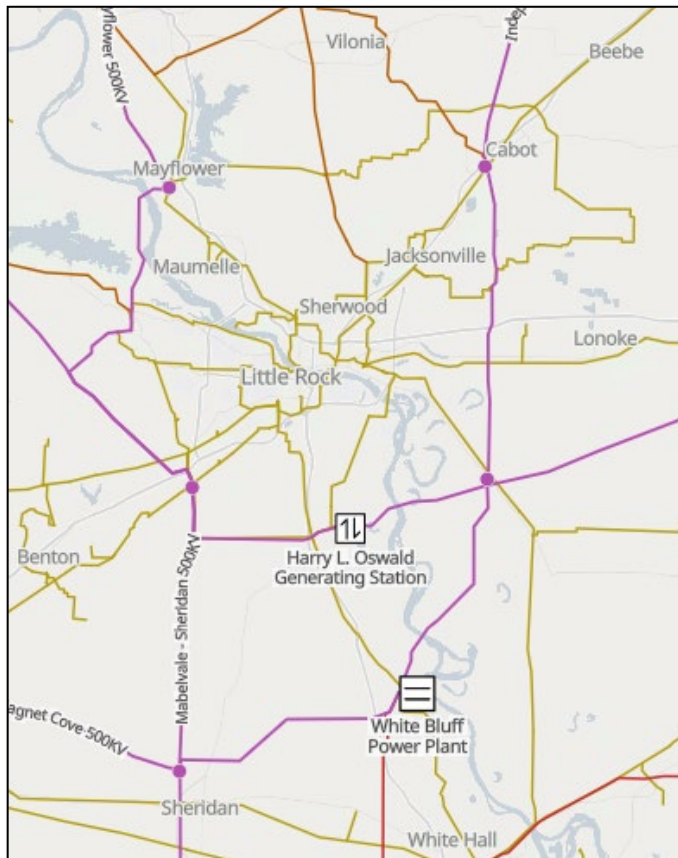
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TRANSMISSION-BASED IDENTIFICATION OF
AREAS OF INTEREST FOR SMR SITE PROSPECTING
IN ARKANSAS (2035 OUTLOOK)

ABSTRACT

This report provides a transmission-based screening of the Arkansas electric grid to highlight locations with relative potential to host future small modular reactor (SMR) development. Using ERAG power flow cases, the analysis compares incremental MW injection capability at major transmission nodes under N-1 conditions and identifies Areas of Interest capable of supporting modular SMR deployment. Results are intended for early-stage prospecting only and reflect best-available system information at the time of study.

Nucleon Energy Inc.



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Glossary of Terms

AC	Alternating Current
ATC	Available Transfer Capability
BTS	Bulk Transmission System
DC	Direct Current
ERAG	Eastern Interconnection Reliability Assessment Group
GI	Generator Interconnection
ISO	Independent System Operator
MISO	Midcontinent Independent System Operator
MW	Megawatt
OTDF	Outage Transfer Distribution Factor
PTDF	Power Transfer Distribution Factor
SMR	Small Modular Reactor
SPP	Southwest Power Pool

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Executive Summary

This report presents a transmission-based screening of the Arkansas electric grid to identify Areas of Interest with relative potential to support future small modular reactor (SMR) development. The assessment is intended for early-stage prospecting and prioritization and does not represent project siting, feasibility determination, or interconnection analysis.

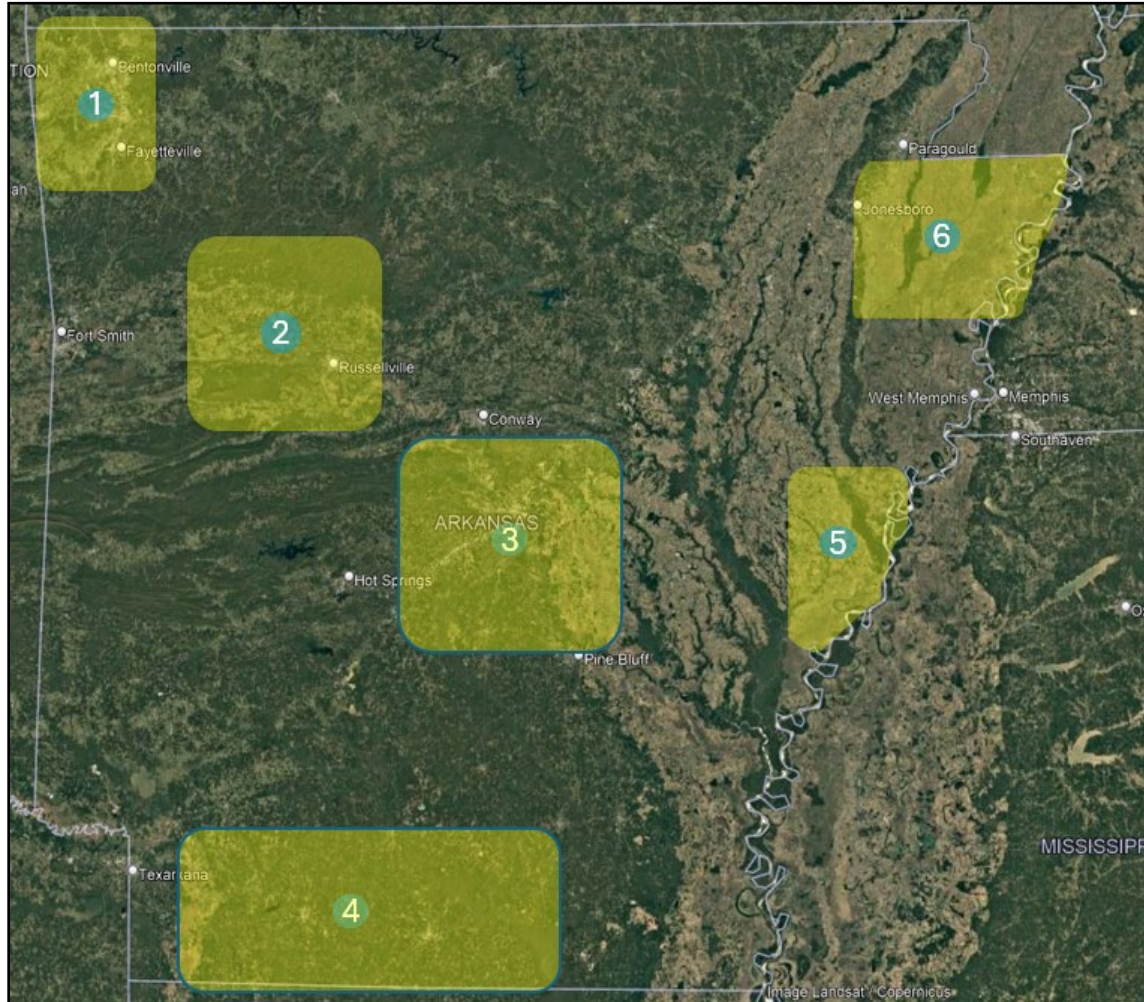
Using ERAG Summer and Winter 2035 power flow cases, the analysis evaluates incremental MW injection capability at 230–500 kV bulk transmission nodes within the Arkansas state footprint under single-contingency (N-1) conditions. Locations demonstrating at least 600 MW of N-1 injection capability are grouped into broader Areas of Interest based on shared transmission characteristics and common limiting interfaces.

The results identify multiple Areas of Interest, as noted on Figure 1, across Arkansas where the existing and planned transmission system is capable of supporting generation additions consistent with SMR deployment, particularly when configured in staged or paired unit increments on the order of 300 MW. Differences among Areas of Interest reflect variations in network topology and interaction with bulk transmission interfaces rather than site-specific feasibility.

The Areas of Interest reflect ERAG’s best available planning assumptions informed by RTO and transmission owner inputs. While future load growth, generation mix changes, or transmission investments may alter system conditions, the results provide a consistent and technically sound basis for comparing relative transmission potential across the state and guiding early-stage development discussions.

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Figure 1: Map of the Six Areas of Interest



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1. Introduction

Arkansas is well positioned to support a range of future energy development opportunities as electric demand patterns evolve and the generation portfolio continues to diversify. Anticipated changes in load characteristics, the potential emergence of new large-scale industrial and data-center demand, and growing interest in firm, low-carbon generation technologies—such as small modular reactors (SMRs)—have increased the importance of understanding how the state’s transmission system can support long-term growth. In this context, a forward-looking perspective on transmission capability provides valuable insight for early-stage prospecting and development discussions.

This report presents a transmission-focused, planning-level screening of the Arkansas electric grid to highlight locations with relative potential to accommodate future SMR generation. The assessment is intended to support early-stage prospecting and prioritization, offering a consistent framework for comparing transmission conditions across the state. It does not represent project siting, feasibility determination, or a generator interconnection study, nor does it evaluate specific facility designs or commercial arrangements. Rather, it provides a system-level view of how existing and planned transmission infrastructure may influence future development pathways.

The analysis concentrates on the bulk transmission system, evaluating incremental MW injection capability at 230–500 kV transmission nodes within the Arkansas state electrical footprint. A 2035 planning horizon is used to align with realistic development timelines for SMR resources and to reflect the most comprehensive forward-looking transmission topology and load information currently available. Power flow simulations are performed using ERAG Summer and Winter 2035 cases (Series 2025), which incorporate planning inputs from applicable Regional Transmission Organizations (RTOs) and transmission facility owners and represent the best available system data at the time of study.

To ensure clarity and consistency, the assessment applies a structured screening methodology that evaluates incremental MW injections under both system normal (N-0) and single-contingency (N-1) conditions and treats (N-1) thermal limits as the defining system capability for prospecting purposes. No transmission reinforcements or operational mitigations are assumed. Locations demonstrating sufficient injection capability are grouped into broader Areas of Interest, reflecting shared transmission characteristics and common system interactions rather than individual project sites. This approach enables meaningful comparison while preserving flexibility for future development options.

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Over the next decade, it is important to recognize that both load characteristics and generation composition in Arkansas are expected to continue evolving. Incremental growth from electric vehicles, the potential development of large industrial or data-center facilities, and advancements in generation technology—including the possible introduction of SMRs—may influence how supply and demand are distributed across the state. The results presented in this report therefore reflect current planning assumptions and provide a constructive, informative basis for understanding relative transmission conditions under these assumptions.

The sections that follow describe the modeling framework, screening methodology, and results. Together, they offer a coherent and technically sound foundation for early-stage exploration of long-term generation development opportunities in Arkansas, while clearly distinguishing prospecting insights from project-specific or interconnection-level evaluations.

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2. Transmission and Interconnection Assessment

This section provides a transmission-focused overview of how the existing Arkansas transmission system and projected electrical loads influence the relative potential of different locations across the state to accommodate future small modular reactor (SMR) development. The analysis is intended for prospecting purposes only and does not represent project specific siting, feasibility determination, or interconnection assessment. The discussion is limited to transmission considerations and highlights areas where the existing and planned network, as reflected in the 2035 planning outlook, appears most capable of supporting large incremental generation. The results illustrate comparative transmission conditions under current planning assumptions and do not preclude additional locations that could become suitable through future transmission investments or system reinforcements.

2.1 Areas with Transmission Access Potential

This section presents eight locations and illustrates six Areas of Interest where the existing transmission system can physically accommodate new SMR generation, based solely on the 2035 load characteristics and grid topology. The analysis screens only for electrical hosting capacity physical characteristics of the network and does not consider other siting constraints such as cooling water, land use, environmental sensitivities, or community acceptance.

The six “Areas of Interest” are defined at a regional scale and are numbered and named as follows: Area 1 – Flint Creek; Area 2 – Arkansas Nuclear One; Area 3 – Central Arkansas; Area 4 – Southwest Arkansas; Area 5 - Phillips; and Area 6 – Craighead/Mississippi.

Across the state, the existing transmission system is capable of supporting incremental generation additions in modular blocks consistent with multiple-unit SMR configurations. While the maximum injection capability varies by location, all but one of the areas evaluated can accommodate development scenarios comprising multiples 300 MW units. Locations with higher hosting capacity can accommodate a broader range of grid-scale SMR technologies, while locations with more limited near-term capacity may favor smaller initial unit sizes. In practice, economically efficient configurations typically involve paired or modular unit groupings—such as N×100 MW or N×300 MW—with the ultimate scale determined by local transmission conditions and future system enhancements.

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The capacities summarized below reflect the 2035 transmission topology and base case load forecast; combinations of additional transmission investment and new large loads can change these values over time and may introduce new opportunity areas or expand existing ones.

Figure 2. Transmission Interconnection Opportunity Areas for SMRs in Arkansas

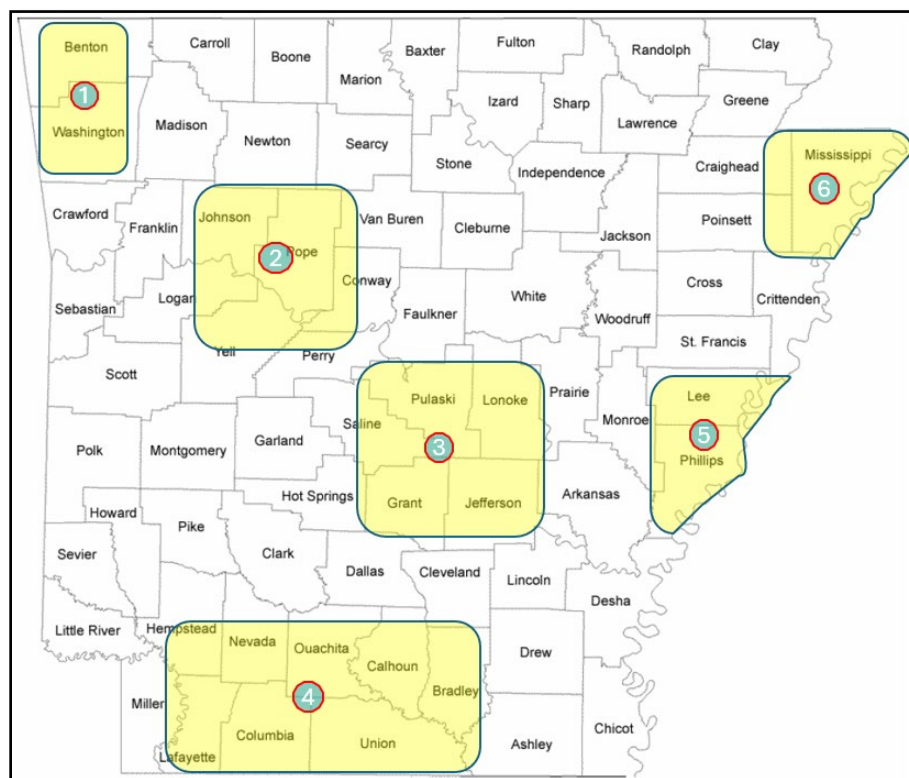


Table 1. Indicative SMR Interconnection Capacity by Opportunity Area

Area Information		Electrical Characteristics			MW Injection Limits					Geographical Information		
Area of Interest	Site No.	Bus	Bus Name	Nom kV	SUM (N-0)	WIN (N-0)	SUM (N-1)	WIN (N-1)	Min (N-0 & N-1)	Station / Type	Sub	Nearby
1 - Flint Creek	1	506935	FLINTCR7	345	1101	1356	531	620	531 ¹	Coal	Flint Creek Power Station	Near Flint
2 - Arkansas Nuclear One	2	337909	8ANO%	500	2421	2624	614	718	614	Nuclear	Arkansas Nuclear One Substation 500 kV	Near Arkansas Nuclear One
3 - Central Arkansas	3	337754	8ETTA%	500	2427	2381	929	1003	929	Gas	Hot Spring Substation 500 kV	Hot Spring Generating Station
3 - Central Arkansas	8	337643	8SHERIDAN%	500	2268	2458	870	938	870	Switching Station	Sheridan Substation 500 kV	Sheridan, Arkansas
3 - Central Arkansas	7	337957	8KEO%	500	1982	2148	768	823	768	Substation	Keo Substation 500 kV	Keo, Arkansas
4 - Southwest Arkansas	4	337515	8MCNEIL%	500	2736	2966	1003	1060	1003	Substation	McNeill Substation 500 kV	Near Camden, Arkansas
5 - Phillips	5	337998	6RITCHIE-1!	230	1072	1216	716	821	716	Substation	Ritchie Substation 230 kV	West Helena, Arkansas
6 - Craighead / Mississippi	6	338400	8SANDYBAYOU%	500	3176	3266	2424	2750	2424	Load	Sandy Bayou 500 kV Substation	Osceola, Arkansas

¹ At EXCEL Services Corporation's request, the analysis also tracked injection levels below 600 MW at and around the Flint Creek coal plant.

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Taken together, the map and table provide a clear, high-level view of how existing transmission infrastructure may support future SMR development and at what approximate scale. Figure 2 highlights counties where the grid appears well positioned to accommodate new SMR projects or phased capacity additions, while Table 1 summarizes representative interconnection points, injection capacity and their associated transmission voltage levels.

This section remains intentionally narrow in scope. It identifies where the grid can accept new nuclear generation, but it does not state where SMRs should be built.

2.2 Transmission Modeling Approach and Assumptions

This study is a systematic, screening-level assessment of where Arkansas’s existing and planned bulk transmission system (BTS) appears most capable of supporting SMR development. The analysis is intended to identify transmission locations and broader areas that can accommodate additional firm generation without overloading the BTS under both normal and single-contingency operating conditions. It is not intended to replace the formal interconnection studies conducted by the Regional Transmission Organizations (RTOs); rather, it informs where those efforts may be most productively focused by providing a relative signaling of MW injection capability.

For readers who require additional technical detail, a full description of the modeling assumptions, data sources, and analytical steps—including case construction, ATC configuration, and contingency treatment—is provided in the Appendix A1. The discussion below is intended as a non-technical overview of the approach and its implications for SMR siting prospecting.

2.2.1 Study Scope and Injection Framework

The MW injection assessment considers only 230–500 kV bulk transmission system nodes within Arkansas, which are treated as candidate injection points in each 2035 seasonal case. Incremental generation is injected at each node and balanced against a distant reference point (a regional swing bus in Alabama) to reflect system-wide power redistribution. Thermal loading is monitored on transmission lines and transformers within Arkansas as well as at interstate boundary interfaces as injection levels increase.

2.2.2 Contingency Treatment and Injection Limits

Injection capability is evaluated under both normal operating conditions and standard N-1 contingency conditions, assuming the loss of any single major transmission element. The N-1 thermal limit—defined as the maximum injection that can be accommodated without

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violating facility ratings following a contingency—is reported as the injection limit for each node. Nodes with an N-1 injection capability of 600 MW² or greater are identified as viable SMR candidates and aggregated into broader, transmission-supported areas.

2.2.3 Monitoring Scope and Bulk System Context

To ensure that bulk-system-level constraints associated with large MW injections are accurately identified without expanding the study scope beyond screening-level relevant facilities, transmission monitoring for thermal violations for this screening is limited to 161 kV and above.

Within the Arkansas transmission system, 161 kV facilities commonly function as the interface between the bulk transmission network and underlying load-serving systems, whereas facilities at 138 kV and below are predominantly configured to support localized load delivery, incremental system reinforcement, and radial or weakly meshed network segments rather than long-distance bulk power transfer. Although these lower-voltage facilities are essential to reliable local service and interconnection feasibility, their limitations are highly dependent on final point-of-interconnection details and near-term system conditions; as a result, they are more appropriately evaluated through project-specific interconnection studies than through forward-looking transmission screening intended to assess bulk system capability.

The modeling was carried out using PowerWorld Simulator (Version 24) and its Available Transfer Capability (ATC) analysis module. The underlying power flow cases represent not only the Arkansas BTS network, but the broader Eastern Interconnection. As a result, when additional generation is injected at a node in Arkansas, the resulting power flows are allowed to follow realistic regional paths across neighboring states and along major transmission BTS backbones, rather than being artificially confined to the state. This regional context helps ensure that the thermal limits identified in the study are consistent with how the grid is expected to perform in practice, given the interconnected nature of the system. For clarity, the analysis explores the “physics” of the power flow and does not address or model transmission rights.

² At EXCEL Services Corporation’s request, the analysis also tracked injection levels below 600 MW at and around the Flint Creek coal plant.

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2.2.4 Planning Horizon, Models, and Tools

The analysis relies on outlook cases for Summer and Winter 2035³ Series (2025). These cases incorporate the expected transmission topology, generation mix, and load levels for that planning horizon. The choice of 2035 reflects the practical development timeline for SMR projects: several years are required for feasibility work, regulatory approvals, and project structuring, followed by an additional 2½–4½⁴ years for generator interconnection studies and approvals under the tariffs of the Midcontinent Independent System Operator (MISO) and the Southwest Power Pool (SPP). A project initiated in the near term is therefore more likely to reach commercial operation in the early-to-mid 2030s than earlier. Using 2035 cases aligns the screening with the system conditions that are expected to prevail when an SMR could realistically enter service.

To ensure that the analysis focuses on constraints that are meaningfully driven by the candidate SMR location, thermal monitoring is limited to transmission lines and transformers that carry a material share of the incremental injection, as indicated by Power Transfer Distribution Factor (PTDF) or Outage Transfer Distribution Factor (OTDF) values of approximately 5 percent or greater. This threshold screens out remote or weakly affected facilities and concentrates attention on elements that are demonstrably influenced by the new injection. For each injection node, the analysis evaluates single-contingency conditions and identifies the five most limiting cases—those producing the lowest allowable N-1 injection levels. The minimum of these values is reported as the representative N-1 injection limit for that node. No system reinforcements are assumed at this stage; once a thermal rating is reached, it is treated as a binding constraint for screening purposes. Any network upgrades or remedial measures that could increase hosting capacity are appropriately deferred to subsequent interconnection or transmission planning studies.

2.2.5 Identification of Areas of Interest and System Sensitivities

The resulting N-1 limits provide a clear view of both the inherent relative strength of each nodal location and its sensitivity to single-element outages. In addition, the frequency with which lines or transformers appear as limiting elements across many different nodes and

³ The files were secured from the EASTERN INTERCONNECTION RELIABILITY ASSESSMENT GROUP (ERAG) and downloaded from Reliability First at www.rfirst.org.

⁴ Lawrence Berkeley National Laboratory, *Queued Up: 2024 Edition: Characteristics of Power Plants Seeking Transmission Interconnection*, April 2024, https://emp.lbl.gov/sites/default/files/2024-04/Queued%20Up%202024%20Edition_1.pdf.

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scenarios is tracked. For the 2035 Summer and Winter cases, the thirty most frequently binding constraining events are identified. This information helps highlight “chronic” constraints on facilities that repeatedly limit injection capacity and may warrant closer attention in future planning if significant new generation is contemplated.

The nodal N-1 injection limits are then used to identify and map candidate SMR locations, i.e., areas of interest. All nodes with an N-1 capability of at least 600 MW are catalogued and grouped into six hosting areas or areas of interest, based on both their geographic proximity and the similarity of their hosting capacity. These areas should be understood as general locations where the existing and planned 2035 BTS appears comparatively well-positioned to accommodate SMR additions, from a thermal perspective. The areas of interest are not prescriptive site selections.

2.2.6 Interpretation, Limitations, and Forward-Looking Context

There are important boundaries to this approach. The analysis is based on DC ATC modeling and considers only thermal loading on lines and transformers. It does not explicitly evaluate voltage performance, reactive power margins, or dynamic stability. Generation dispatch and load levels are fixed to the 2035 planning cases; the study does not attempt to simulate all possible operating patterns or market outcomes. In addition, the study uses a fixed set of planned facilities as represented in the ERAG-based planning models and, for new generation, explicitly the analysis only contemplates what is embedded in those cases.

For these reasons, the electrical results in this report should be understood as technically sound but intended for directional guidance only. The results represent a relative screening of the transmission system’s ability to accommodate SMR injections at various locations, not a substitute for an interconnection study. The areas identified in this assessment are expected to overlap with locations that a formal SPP or MISO study would view as relatively strong candidates, because they are based on the same underlying system. However, the exact upgrade scope, cost allocation, and timing for any specific SMR project will only be established through the applicable SPP or MISO interconnection process, using their tariff-defined study procedures.

When considering the locations and areas of interest identified in this assessment, it is appropriate to recognize that the results reflect a planning-level view consistent with current utility and regional planning perspectives. Over the next decade, Arkansas load levels and load composition may evolve as end-use patterns change, with incremental

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growth from electric vehicles and greater uncertainty associated with the potential siting of large industrial and data-center loads. The timing, magnitude, and geographic distribution of such loads are inherently uncertain; however, if realized, they could materially influence local and regional transmission requirements. Over the same planning horizon, the generation portfolio is also expected to evolve, as changes in resource mix and technology may alter the geographic distribution of generation, including the potential introduction of new firm, low-carbon resources such as small modular reactors. Accordingly, the results presented here reflect ERAG's best available modeling assumptions at the time of study, informed by RTO and transmission owner planning inputs. While future system developments may differ from current projections, this analysis provides a consistent and technically sound basis for understanding system behavior under present planning assumptions and for identifying transmission sensitivities relevant to long-term system planning.

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Appendix A1 -- Power Flow Modeling Assumptions

The following includes the power flow modeling approach and frequency of thermal violations.

POWER FLOW MODELING APPROACH & TRANSMISSION THERMAL FREQUENCY VIOLATIONS

1. Study Objective and Scope

The assessment of the electric transmission system in this study is based on simulating nodal MW injections across the high-voltage transmission network in Arkansas. Injections were performed at nodes operating at 230 kV, 345 kV, and 500 kV, followed by contingency analysis (simulating a line or transformer outage) on the high-voltage network as previously defined.

The objective of the analysis is to determine, at each node, the maximum MW injection that can be accommodated before a thermal violation occurs under both system-normal (N-0) and contingency (N-1) conditions. Unless otherwise noted, the “injection limit” reported in this study refers to the N-1 (contingency) limit. Nodes meeting the acceptance criterion—an N-1 injection limit of 600 MW or greater—are flagged as viable. The viable nodes are then visually grouped into broader areas that present favorable conditions appropriate for SMR prospecting and development.

For node and area screening, the focus of this assessment is strictly on the thermal performance of transmission lines and transformers; voltage profiling, voltage stability, and dynamic behavior are outside the scope of this screening assessment.

2. Analysis Staging

To manage analytical scope while preserving rigor, a three-ring framework was adopted to structure MW injection screening, contingency analysis, and branch-violation monitoring for the Arkansas and neighboring transmission system.

Ring 1 – Injection Footprint

Ring 1 defines the MW injection footprint and is limited to 230–500 kV buses located within the Arkansas electrical footprint. This ring establishes where candidate MW injections are applied and ensures that the analysis remains focused on in-state injection scenarios rather than interregional transfers.

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Ring 2 – Contingency Core

Ring 2 defines the primary contingency analysis core, based on electrical distance from an indicative Arkansas electrical center rather than administrative boundaries. Within this ring, single-element contingencies are applied to bulk-transmission lines and transformers located within an approximate 225-mile radius, a threshold derived from the spatial distribution of Arkansas ≥ 161 kV buses in the forward-looking (2035) planning case. This ring therefore captures the portion of the network where contingencies outside the core (Ring 1) could give rise to binding N-1 constraints. To avoid artificial truncation at the Arkansas boundary, boundary-crossing branches and immediately adjacent transmission elements within the same radius are included in the Ring-2 contingency set.

Ring 3 – Extended Monitoring Envelope

Ring 3 provides an extended monitoring envelope to capture broader system interactions. It includes all elements in Rings 1 and 2 and extends monitoring to branch elements located within approximately 350 miles of the Arkansas electrical center. The purpose of Ring 3 is not to expand the contingency set, but to observe how Arkansas-based MW injections—particularly at higher injection levels—may interact with regional transmission facilities and, where applicable, reveal injection limitations driven by infrastructure outside the state. Ring 3 monitors all branches with node 161 kV and above.

Taken together, the three-ring framework balances completeness and efficiency: Ring 1 confines injections to the Arkansas footprint, Ring 2 focuses contingency analysis on system elements most likely to govern bulk transfer capability, and Ring 3 provides situational awareness of broader regional interactions. This structure avoids oversizing the monitored set while remaining consistent with transmission planning practice and the objectives of early-stage, non-interconnection-grade screening.

3. Modeling Platform and Base Case

The analysis was performed using PowerWorld Simulator Version 24, utilizing the Available Transfer Capability (ATC) analysis module to automate the nodal injection and thermal screening process.

3.1 Future Outlook Cases (2035 Summer and Winter)

The study relies on outlook cases for both summer and winter 2035 Series (2025), reflecting the expected transmission topology, generation mix, and load levels for that planning horizon. These seasonal scenarios were selected to capture conditions under

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which thermal limits are most likely to be stressed. These are typically higher loading and lower ratings in summer, and different dispatch patterns to represent winter loading conditions. Using both seasons allows the screening results to reflect a range of plausible operating conditions rather than a single, season-specific snapshot.

For each 2035 seasonal case, all nodes energized at 230 kV to 500 kV in Arkansas were included as potential injection points, and contingencies applicable to those voltage levels were modeled. Thermal loading was monitored on transmission lines and transformers with voltage levels greater than 161 kV within Arkansas, inclusive of the interstate boundaries and on adjacent-system elements that could become a limiting element because of Arkansas injections.

Within the Arkansas transmission system, 161 kV facilities commonly function as the interface between the bulk transmission network and underlying load-serving systems, whereas facilities at 138 kV and below are predominantly configured to support localized load delivery, incremental system reinforcement, and radial or weakly meshed network segments rather than long-distance bulk power transfer. Although these lower-voltage facilities are essential to reliable local service and interconnection feasibility, their limitations are highly dependent on final point-of-interconnection details and near-term system conditions; as a result, they are more appropriately evaluated through project-specific interconnection studies than through forward-looking transmission screening intended to assess bulk system capability.

3.2 PTDF/OTDF Screening Threshold

To ensure that only thermally limiting elements causally driven by the nodal injection were retained, a 5% PTDF/OTDF threshold was applied. A thermal violation was only flagged and recorded if the corresponding limiting element exhibited a Power Transfer Distribution Factor (PTDF) or Outage Transfer Distribution Factor (OTDF) magnitude of at least 5% with respect to the specific nodal MW injection being studied. This criterion excludes remote or weakly affected facilities and focused the analysis on constraints that are materially influenced by the candidate generation site.

In simple terms, a PTDF tells you how much of the injected power uses a particular line under normal system conditions—for example, a 5% PTDF means that 5 MW will flow on that line for every 100 MW injected at the node (with withdrawal at the sink). An OTDF is the same concept applied after a contingency and shows how much flow will appear on a line when another element is out of service. Using these factors ensures we only count

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constraints on lines that meaningfully “see” the proposed injection, both in normal operation and under N-1 conditions.

Across the 2035 outlook cases, the analysis identified recurring pairs of contingencies and thermally limiting elements, which are interpreted as consistent constraints likely already recognized by regional planning authorities. For each case, summer or winter, the 30 most frequently occurring thermal violations were tracked, including their end-to-end nodal identification and the frequency of occurrence for the events assessed. This information is presented to help highlight the facilities that most often limit incremental MW injections from prospective new generation additions. The same PTDF/OTDF $\geq 5\%$ criterion was applied when compiling these statistics to ensure that only materially affected elements were included.

3.3 Generator Interconnection Timeline and Justification for 2035 Outlook

The generator interconnection (GI) process commonly spans multiple years due to the detailed and iterative nature of cluster-based study methodologies. Based on the Lawrence Berkeley National Laboratory’s *Queued Up: 2024 Edition*, projects built in 2023 required a median of nearly five years from interconnection request to commercial operation, reflecting a continued lengthening of interconnection timelines over time. Within this end-to-end duration, the study and agreement phase alone—particularly in cluster environments such as SPP’s DISIS and MISO’s Definitive Planning Process (DPP)—frequently extends beyond nominal schedule targets due to queue backlog, withdrawal-driven restudies, and model complexity. As a result, a practical planning assumption is that approximately 2½–4½ years⁵ may elapse from initial application to a construction-ready interconnection agreement. “Construction-ready” is interpreted as completion of all required studies and execution of the generator interconnection agreement (GIA), at which point physical network upgrades and construction procurement can commence. This range is consistent with observed study durations across large RTO queues and explains why overall interconnection timelines have increased from less than two years for projects built in the early 2000s to more than four years for projects built between 2018 and 2023.

In the context of advancing a Small Modular Reactor initiative, selecting a 2035 power flow outlook over a 2030 outlook is a practical and justifiable choice. Developing an SMR project

⁵ Lawrence Berkeley National Laboratory, *Queued Up: 2024 Edition: Characteristics of Power Plants Seeking Transmission Interconnection*, April 2024, https://emp.lbl.gov/sites/default/files/2024-04/Queued%20Up%202024%20Edition_1.pdf.

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requires significant preparation time, including feasibility studies, regulatory approvals, and project planning, which can take 3 to 4 years to achieve reasonable certainty of advancing the initiative. Once the project is ready to enter the GI process, the additional 2½–4½ years required for interconnection studies and approvals further extends the timeline. Taken together, these durations imply that a project initiated in the near term would be expected to reach commercial operation closer to the 2035 horizon than to an earlier planning year. By selecting the 2035 outlook, the planning process aligns with the realistic timeline for SMR development and interconnection, ensuring that the power flow screening data reflects the conditions under which the SMR would be operational. This approach provides a more accurate and reliable basis for assessing the transmission system’s capacity and for planning any necessary upgrades to support the SMR.

4. ATC Setup and Transfer Configuration

ATC simulations were performed using DC-based, multi-directional injection analysis. The sink for all transfers was a fixed swing bus located in Limestone County, Alabama. This distant, deeply embedded swing location aligns with the expected export direction from Arkansas and allows AC power flows to follow their natural network paths under both N-0 and N-1 ATC scenarios, rather than forcing them through an artificial local sink. In the absence of detailed information on phase-shifting transformer operating policies for exports the taps were considered fixed, this setup offers a practical and transparent way to reflect how flows would be distributed across the AC system.

Both load and generator dispatch were held fixed throughout the analysis to respect the underlying forecast and dispatch assumptions of the study cases. Only the ATC injection bus and the Alabama swing bus were permitted to vary, allowing thermal limits to be identified strictly as a function of incremental ATC MW injection.

Because the analysis used DC ATC modeling, generator voltage regulation, reactive power capability, and transformer tap positions (including phase shifters) were not adjusted. Existing voltage control and reactive support were implicitly treated as fixed or proportionally tied to active power output. As a result, the study does not evaluate reactive power margin, voltage profiles, or voltage stability limits.

Tie lines to neighboring states were not explicitly and continuously monitored as a separate category, but any thermal violations occurring on these facilities under either N-0 or N-1 conditions would be automatically flagged and recorded.

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5. Determination of Nodal Injection Limits

5.1 System-Normal (N-0) Injection Limits

For every node, MW injection was first increased under system-normal (N-0) conditions until a thermal limit was reached; this established the base (system-normal) injection limit for that node. At this point, at least one monitored transmission element reaches its thermal rating. Thermal limits were evaluated against the applicable ratings specified in the 2035 base cases, consistent with the underlying planning assumptions.

For clarity, while a prescriptive nodal injection approach was part of the analysis and placing injections at a specific node—such as a midpoint connection on a line—is a common and reasonable practice, midpoint connections were intentionally treated as out of scope for this study.

5.2 Contingency (N-1) Injection Limits

In parallel, a full N-1 contingency analysis is performed for each injection node. For any contingency that produces a thermal violation at the base injection limit, the injection is reduced to the level just before that violation occurs, establishing the contingency-limited injection level. Each contingency therefore defines its own thermal limit for that node.

Point of clarification: For the N-1 analysis, in the absence of a utility-curated contingency file, the PowerWorld automatic contingency engine was used and it assumes that any line between two nodes can be isolated by interrupting breakers. In practice, this means that special multi-terminal or three-terminal line configurations are modeled as being interrupted on an element-by-element basis, rather than as a concurrent outage of all associated elements.

For this study, we tracked the five most constraining contingencies for each node injection and its associated thermal violations to assess the range of available MW injection limits. “Most constraining” refers to those contingencies that produce the lowest N-1 injection levels at a given node. Among these five, the lowest resulting injection limit is taken as the representative node-specific N-1 thermal injection limit. This value reflects the MW injection that can be accommodated at that node while maintaining the thermal integrity of the transmission system during severe but credible single-element outages, without triggering infrastructure upgrades. In other words, the reported N-1 limit represents the maximum injection that can be hosted on the existing network without requiring new reinforcements.

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For this assessment, the specific nature or remediation of each thermal limitation was not evaluated. Instead, whenever a thermal violation occurred, the corresponding minimum N-1 injection level was recorded as the allowable MW injection, providing a conservative basis for screening. It is anticipated that some thermal limitations could be addressed through cost-effective upgrades or reinforcements; however, these opportunities are best examined as part of site-specific assessments or during the formal interconnection process.

6. Interpretation of N-0 vs N-1 Capability

This approach allows a clear comparison between the relatively higher system-normal injection limits and the lower contingency-based limits, providing a meaningful range that captures both normal operating capability and performance under N-1 stress conditions. This ensures that each node is evaluated for its ability to host generation without compromising the thermal characteristics of the network.

From this evaluation, we observed recurring contingency/thermal-violation pairs, which we assume reflect known constraints already recognized by Arkansas transmission planners. These repeated limiting elements provide practical insight into where reinforcement or remedial measures may be considered to increase hosting capacity beyond the injection levels identified. In this study, the results are intended to support screening and planning discussions, while any detailed reinforcement planning or project-specific solutions are expected to be developed through subsequent, more targeted studies and formal interconnection processes.

7. Constraint Characterization

For the Summer and Winter 2035 cases, the 30 most⁶ frequently occurring thermal violations were identified and their frequency of occurrence tracked. For each violation, the limiting element and its frequency of occurrence across all nodal injections and contingencies were recorded. This allowed us to:

- Identify “chronic” constraints that repeatedly limit injection, and
- Understand how often specific facilities limit plausible MW injection patterns.

⁶ The 30 most frequently occurring events, corresponds to the node sample the meet and exceed the 600 MW injection criterion, inclusive of the Flint Power Station site which is just under 600 MW. Also note, that this is a subset only, there are other limiting events for other node site injection under 600 MW.

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These statistics provide a useful bridge between nodal-level results and system-level planning, highlighting which facilities are most likely to constrain future SMR or other large-scale generation additions under the modeled conditions.

8. Injection Capacity Screening Criteria for Candidate SMR Sites

Nodes demonstrating N-1 injection capability greater than 600 MW⁷ were tagged as potential sites⁸, catalogued, and mapped across Arkansas. These nodes were then grouped into six “injection areas” or Areas of Interest by clustering locations with similar N-1 capability and geographic proximity. The resulting Areas of Interest illustrate broader regions where SMR siting appears compatible with the thermal limits of the existing transmission system. They are intended to guide further investigation, rather than to serve as prescriptive site-specific recommendations. Also note, the Areas of Interest present a standalone potential; however, while Areas of Interest can be combined, determining their combined injection capability is outside the scope of this assessment.

A minimum screening threshold of 600 MW was applied as an indicative floor for a viable SMR site, and many locations exceeded this threshold by a significant margin. This value represents the lower end of commercially feasible SMR project sizes currently being explored by EXCEL Services Corporation and reflects a practical minimum for meaningful grid-connected nuclear development.

Nodes located near populated areas were not excluded from siting consideration. However, it is expected that any new SMR initiative in Arkansas will, at a minimum, match or exceed the existing separation between Arkansas Nuclear One and nearby communities. The areas of interest were defined using an indicative 30-mile setback from the nodal injection point to outline the footprint of potential host counties and to account for other setback considerations, all within a practical connection cost and distance for an SMR investment of this magnitude.

9. Summary of Key Assumptions and Limitations

- DC ATC-based analysis (no explicit treatment of reactive power or voltage stability).
- Fixed generation dispatch and load forecast consistent with the 2035 seasonal planning cases (summer and winter).

⁷ At EXCEL Services Corporation’s request, we also tracked injection levels below 600 MW at and around the Flint Creek coal plant.

⁸ For this analysis only 8 sites as tracked as per scope of work.

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- Incremental injection at each node balanced by a distant swing bus in Alabama.
- Nodal screening selection by the most restrictive N-1 thermal limits.
- Candidate SMR sites screened on a 600 MW or greater N-1 injection threshold.
- Only constraints with PTDF/OTDF magnitude greater than 5% relative to the nodal injection were retained, ensuring a causal relationship between the candidate site and the limiting element.
- Thermal violations were assessed against the normal ratings embedded in the 2035 base cases, consistent with the underlying regional planning assumptions.
- The Areas of Interest present a standalone potential; however, while Areas of Interest can be combined, their combined capability is outside the scope of this assessment.

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CONSTRAINED ELEMENTS: THERMAL VIOLATIONS AND FREQUENCY OF OCCURRENCE

This subsection summarizes the transmission elements that most frequently govern incremental generation capability in the 2035 Summer and Winter outlook cases. For each season, the table below identifies the transmission lines and transformers that most often reach their thermal ratings during the N-1 nodal injection screening. The “Frequency” columns indicate the number of times each element emerged as the binding constraint across the evaluated scenarios.

Collectively, these results highlight transmission facilities that consistently influence how additional MW injections are accommodated under current planning assumptions. These elements represent recurrent limiting interfaces that shape the amount and geographic distribution of SMR or other large-scale generation that can be integrated across Arkansas without additional reinforcement.

The reported frequencies reflect only the subset of nodes demonstrating N-1 injection capability of 600 MW or greater, which form the focus of this screening-level assessment. Nodes with lower injection capability would be associated with a broader range of limiting elements; however, those limitations would typically be addressed through targeted network upgrades as part of project-specific interconnection or transmission planning processes and were therefore not carried forward in this prospective analysis.

Table 2. Thermal Violation Frequencies

ID	Thermal Violations (Summer)	Frequency	Thermal Violations (Winter)	Frequency
1	[338056] (CHALKBLUFFPV) to [338283] (8GALET%) ID = 1	10	[337892] (8J1710POI%) to [337957] (8KEO%) ID = 1	10
2	[338160] (5EBONY%) to [338412] (5WM LEHI-W) ID = 1	5	[338188] (8SANS SOUCL%) to [338198] (8DRIVER%) ID = 1	3
3	[337160] (6TUNICAL) to [337998] (6RITCHIE-1!) ID = 1	2	[337100] (6CROSSROADS!) to [337125] (3CLARKMUN) ID = 1	2
4	[337633] (6WOODWARD%) to [337635] (6WOODSTR) ID = 1	2	[338401] (6SANDYBAYOU%) to [338406] (8SANDSTR) ID = 1	2
5	[338401] (6SANDYBAYOU%) to [338405] (8SANDSTR) ID = 1	2	[337515] (8MCNEIL%) to [337516] (3MCNEIL!) ID = 1	1
6	[337515] (8MCNEIL%) to [337516] (3MCNEIL!) ID = 1	1	[337562] (7EL DORADO) to [337580] (8EL DSTR) ID = 2	1
7	[337562] (7EL DORADO) to [337567] (8EL DSTR) ID = 2	1	[337633] (6WOODWARD%) to [337654] (6WHT BLUFF!) ID = 1	1
8	[337754] (8ETTA%) to [337755] (8DUKE HS-1!) ID = 1	1	[337754] (8ETTA%) to [337755] (8DUKE HS-1!) ID = 1	1
9	[337921] (5MORILTON.E!) to [337927] (5GLEASON) ID = 1	1	[337921] (5MORILTON.E!) to [337927] (5GLEASON) ID = 1	1
10	[338157] (5POWERLN_RD%) to [338170] (5JONESBORO!) ID = 1	1	[337961] (6TARLETON!) to [337968] (6RICUSKEY%) ID = 1	1
11	[338197] (6BRS) to [338199] (6DRIVER%) ID = 1	1	[338170] (5JONESBORO!) to [338703] (5JONSBORO.N#) ID = 1	1
12	[338199] (6DRIVER%) to [338258] (8DRIVSTR) ID = 1	1	[338191] (5BLY ELM ST%) to [338193] (5BLY I-55!) ID = 1	1
13	[506934] (FLINTCR5) to [547504] (GTY458 5) ID = 1	1	[338197] (6BRS) to [338199] (6DRIVER%) ID = 2	1
14	[507455] (TURK 7) to [507466] (TURK STR) ID = 1	1	[338198] (8DRIVER%) to [338400] (8SANDYBAYOU%) ID = 1	1
15	Total	30	[338199] (6DRIVER%) to [338258] (8DRIVSTR) ID = 1	1
16			[504000] (AVOCA 5) to [506931] (EROGERS5) ID = 1	1
17			[507455] (TURK 7) to [507466] (TURK STR) ID = 1	1
			Total	30

REPORT

Preliminary Industrial Water Availability Planning Report

for the

EXCEL Services Corporation

Prepared by

Halff

**AVO 64420
May 28, 2026**

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Halff shall not be responsible for any failure or delay in performance resulting from causes beyond its reasonable control, including without limitation acts of God, nature, governmental actions, or failures of third-parties.

Executive Summary

This preliminary industrial water availability planning study, initiated by Excel Services Corporation, and conducted in partnership with Halff, aimed to evaluate available water supply sources and reliability within the state of Arkansas. The study's goal was to screen up to seven sites across the state with the intent to identify risks and provide data to support reliable, and sustainable water supply planning. During the site assessment process, the sites were refined to include subsites of Sites 3 and 4.

The following sites were identified and evaluated as part of this study:

1. Site 1: Lake Flint Creek
2. Site 2: Lake Dardanelle
3. Site 3.1: Arkansas River – Pine Bluff Arsenal
4. Site 3.2: Arkansas River – Redfield
5. Site 3.3: Saline River – Haskell
6. Site 3.4: Lost Creek – Sheridan
7. Site 4.1: Ouachita River – Camden
8. Site 4.2: Ouachita River – Calion
9. Site 5: Big Creek – Confluence with White River
10. Site 6: St. Francis River – Marked Tree
11. Site 7: Millwood Lake

An overview map of the sites can be found in Figure 1 and Appendix A.

Overall, the study indicates that Arkansas has substantial surface water and groundwater resources capable of supporting future industrial development; however, water availability, infrastructure access, regulatory requirements, and long-term sustainability vary by region and site location. The findings presented in this report provide a planning-level overview of potential water supply opportunities and constraints and are intended to support future site evaluation, coordination, and detailed engineering analyses.



1.0 Introduction

1.1 STUDY LOCATION

This water availability study encompasses the evaluation of 11 sites in five different regions of Arkansas. Of the 11 sites, one is in northwest Arkansas, five are in central Arkansas, three are in southwest Arkansas, one is in eastern Arkansas, and one is in northeast Arkansas. A study area map displaying the site perimeters provided by Excel is shown in Figure 1.

1.2 PURPOSE AND STUDY SCOPE

This study was conducted to evaluate available water supply sources, availability, and reliability within each potential project location area in Arkansas. The study also aimed to identify constraints and risks to each site location as part of this evaluation.

To complete this effort, any recent and relevant information necessary to evaluate water availability and supply alternatives will be compiled and reviewed. Key references include the Arkansas State Water Plan (AWP), US Army Corps of Engineers (USACE) report, groundwater availability reports, and other applicable state and federal resources.

The scope of this study includes the following major tasks:

- Data Collection and Review
- Agency Coordination
- Existing System and Source Characterization
- Water Supply Availability Evaluation
- Environmental and Regulatory Review
- Alternatives Screening
- Report on Findings

1.3 SITE CRITERIA AND CONSTRAINTS

Potential sites were evaluated based on three planning level criteria to identify locations capable of supporting the facility and associated infrastructure requirements. The evaluation considered both utility availability and site suitability factors necessary for reliable operation and future implantation.

A previous utility assessment identified eight potential transmission systems with sufficient capacity to receive and distribute the electrical output generated by a potential power generation facility.

The primary evaluation criteria include the following:

- Water Availability: Maximum of 23.3 acre-feet per day (acre-ft/day)
- Proximity to Existing Transmission Infrastructure and Utility Corridors (within 10 miles)
- Required Electrical Capacity: 500kV per the preliminary transmission report

Throughout the following sections, evaluation criteria will be divided into regions and site-specific locations. Some site locations will have overlapping geographic areas, sources, and existing water uses which will be discussed within each section.

2.0 Alternative Site Evaluation

This section provides an overview of the alternative sites evaluated throughout Arkansas and summarizes the regional characteristics, available surface water and groundwater resources, and major and future water users associated with each location. This initial assessment focused on seven regional sites across the state. However, during the assessment process, sites 3 and 4 were refined to include subsites 3.1-3.4 and 4.1-4.2. Discussions for each site include nearby surface water features, groundwater aquifers, regional land use, proximity to nearby transmission stations, and notable municipal, industrial, and agricultural water demands. Basemaps for each site can be found in Appendix B and a basemap showing the transmission locations can be found in Appendix C. Detailed discussions of the site including water sources and existing users will be provided in sections 3 and 4.

2.1 NORTHWEST ARKANSAS

Site 1 is located in northwest Arkansas and primarily consists of the upland, rugged terrain of the Ozark Mountains featuring deep valleys, oak-hickory forests, and prominent sandstone/limestone bluffs. Topography is commonly characterized by steep slopes and narrow stream corridors. Land cover consists primarily of forested uplands, pastureland, and agricultural areas with scattered urban development.

Site 1: Lake Flint Creek

Lake Flint Creek is the primary surface water source associated with Site 1. Located approximately 2.25 miles west of Gentry, Arkansas, the reservoir encompasses approximately 500 acres and has a normal pool storage volume of approximately 18,300 acre-feet (acre-ft) with a maximum storage capacity of approximately 24,400 acre-ft. The lake is owned and operated by Southwestern Electric Power Company (SWEPCO) and currently serves as the primary cooling water source for the Flint Creek Power Plant. As identified in the preliminary transmission report, the Flint Creek Power Plant also serves as the transmission station associated with Site 1.

The primary groundwater resource within the vicinity of the site is the Springfield Plateau Aquifer. Regional use of the aquifer is generally limited to rural municipal systems, private wells, and agricultural applications due to its relatively limited yield potential compared to larger regional surface water supplies.

Major municipal water users within Northwest Arkansas include the cities of Springdale, Rogers, Fayetteville, and Bentonville. These municipalities primarily receive water through the Beaver Water District, which sources and treats water from Beaver Lake. As a result, regional municipal demand is largely dependent on surface water resources rather than groundwater supplies within the study area.

The region also contains several major industrial and agricultural water users, particularly within the food processing and poultry industries. Significant industrial users include facilities operated by Tyson Foods, George's Inc., and Simmons Foods, all of which contribute to regional water demand within Northwest Arkansas.

2.2 CENTRAL ARKANSAS

Sites 2 and all subsites within Site 3 are located in central Arkansas within the transition zone between the Interior Highlands and the Gulf Coastal Plain. Central Arkansas is characterized by rolling terrain, broad river valleys, and a mixture of upland ridges and relatively flat alluvial areas associated with the Arkansas River and its tributaries. Land cover through the region consists primarily of mixed hardwood and pine forests, pastureland, agricultural areas, and expanding urban development in Little Rock and the surrounding area.

Site 2: Lake Dardanelle

Site 2 is located near Lake Dardanelle, east of Russellville, Arkansas. Lake Dardanelle is the main source of surface water for this site with a surface area of approximately 34,300 acres. Lake Dardanelle is part of the McClellan-Kerr Arkansas River Navigation System (MKARNS) and is owned and operated by the

United States Army Corps of Engineers (USACE) Little Rock District. The lake holds a normal storage of approximately 420,900 acre-ft with a maximum storage capacity of approximately 486,200 acre-ft.

The primary water users on this site are Arkansas Nuclear One and the Dardanelle Hydroelectric Power Plant. Arkansas Nuclear One utilizes surface water at the confluence of Illinois Bayou and Lake Dardanelle but no formal allocation is stated in USACE documentation. The Dardanelle Hydroelectric Power Plant uses releases through the dam to generate hydroelectric power as part of the MKARNS system. The preliminary transmission report identified Arkansas Nuclear One as the transmission station capable of serving Site 2.

In addition to Arkansas Nuclear One and the Dardanelle Hydroelectric Power Plant, additional water users in the region primarily consist of local municipal water supplies. Several municipalities within the Arkansas River Valley rely on surface water from the Arkansas River and Lake Dardanelle for municipal and industrial supply purposes.

Site 2 lies within the limits of the Ozark Aquifer, a resource that covers much of northern and western Arkansas. Within the location of this site, groundwater is generally used as a supplemental water supply with yields being lower and less consistent than other regions in Arkansas.

Sites 3.1-3.4: Arkansas River – Pine Bluff Arsenal, Arkansas River – Redfield, Saline River – Haskell, Lost Creek – Sheridan

All evaluation points within Site 3 are south of Little Rock, Arkansas, located near the Arkansas River, Saline River, and Lost Creek. The three streams mentioned act as the main source of surface water for their respective location. Of the three, the Arkansas River provides the highest year-round water quantity as it has the largest drainage area, and flows are regulated by a series of locks and dams. The Saline River and Lost Creek are smaller tributaries with flows primarily resulting from regional drainage and are dependent on seasonal rainfall patterns.

Main water users in this area primarily consist of agricultural uses, particularly irrigation for row crop production and livestock. Many municipalities in the area rely on private reservoirs or groundwater sources for municipal water supply. Industrial water users in the region also include facilities such as Pine Bluff Arsenal, which uses water to support manufacturing and operational activities.

In addition, a proposed large-scale data center south of Little Rock represents a potential future water user in the region. If developed, the facility would require water demand for cooling systems and operational support infrastructure.

Each of the four locations has access to different groundwater aquifers. Sites 3.1 and 3.2 are influenced by the Mississippi River Valley alluvial aquifer which has high groundwater yields and is widely used for municipal and agricultural supply. Sites 3.3 and 3.4 are underlain by the Sparta and Cockfield aquifers which are more limited compared to the Mississippi River Valley aquifer.

The transmission infrastructure associated with Site 3 includes the Hot Springs Generation Station, Sheridan Substation, and Keo Substation, which collectively support regional power delivery and grid interconnection in the area.

2.3 SOUTHWEST ARKANSAS

Sites 4.1, 4.2 and 7 are located in southwest Arkansas within the West Gulf Coastal Plain region. Southwest Arkansas is characterized by gently rolling terrain, broad stream valleys, and extensive pine and mixed hardwood forests. Topography is generally less rugged than the upland regions of northern Arkansas and is dominated by low gradient streams, wetlands, and forested watershed associated with the tributaries of the Red River and Ouachita River systems. Land use through the region includes timber production, agricultural areas, scattered rural development and numerous lithium mines and leases.

Sites 4.1-4.2: Ouachita River – Camden, Ouachita River – Calion

Sites 4.1 and 4.2 are located along the Ouachita River near Camden and Calion, Arkansas respectively. The Ouachita River serves as the primary surface water source for both locations, providing a reliable regional water supply created by upstream reservoirs and tributary inflows.

Several municipalities in central and south Arkansas rely on the Ouachita River system as its source of water supply including El Dorado, Camden, Hot Springs, and the Saline Regional Public Water Authority. The river system also supports industrial water demand including manufacturing facilities, timber and paper related facilities, and energy related operations in south Arkansas. In addition to typical industrial needs, south Arkansas is home to several large lithium leases which often require water usage for processing, on-site cooling, and separation systems.

Groundwater supply in southern Arkansas is sourced from a combination of shallow alluvial deposits and deeper confined aquifers within the Gulf Coastal Plain. The Mississippi River alluvial aquifer provides high yield groundwater and supports many municipal, agricultural, and industrial wells. Deeper aquifers such as Sparta and Cockfield aquifers serve as sources in upland areas.

The transmission infrastructure serving this area includes the McNeil Substation, which functions as a regional electrical interconnection point supporting power distribution throughout the surrounding network.

Site 7: Millwood Lake

Site 7 is located near Millwood Lake approximately 19 miles west of Hope, Arkansas. Millwood Lake is owned and operated by USACE Little Rock and functions as a multipurpose reservoir providing flood risk reduction, water supply regulation, and recreation. The lake provides normal storage of approximately 172,000 acre-ft and a maximum storage of approximately 1,855,000 acre-ft.

Millwood Lake has a total of 150,000 acre-ft of storage dedicated to water supply. The Southwest Arkansas Water District is the main contract holder and holds all current and future allocations for the entirety of the available storage. However, a reallocation study may be requested from USACE.

The Quaternary Aquifer system is the main groundwater source for Site 7, with high water yields being obtained at relatively shallow depths. Yields of 150 to 1000 gallons per minute (gpm) have been reported from this system with well depths averaging 60 feet. The communities of Ashdown, Foreman, and Wilton along with the Millwood State Park derive their water supply from this aquifer.

Per the preliminary transmission report, no transmission stations were identified in the vicinity of Site 7 based on the available planning data.

2.4 EAST ARKANSAS

Site 5 is located in east Arkansas within the Mississippi Alluvial Plain region of the Gulf Coastal Plain. Eastern Arkansas is characterized by relatively flat terrain, broad agricultural floodplains, and low gradient stream systems associated with the Mississippi River and its tributaries. The region primarily consists of extensive row crop agriculture, bottomland hardwood forests, and wetlands. Due to low relief and poorly drained soil, the region is susceptible to prolonged inundation and overbank flooding.

Site 5: Big Creek – Confluence with White River

Site 5 is located along Big Creek, near the confluence of Big Creek and the White River. The White River serves as the primary surface water source for both sites and commonly supports navigation, agriculture, recreation, and regional water supply needs.

Agricultural irrigation is the largest water demand in the region with other users consisting of smaller municipalities and industry. Industrial development in eastern Arkansas includes a proposed data center in the West Memphis Area, representing a future large water consumer.

Both sites provide access to the Mississippi River Valley alluvial aquifer. This aquifer is one of the most productive groundwater sources in Arkansas and is heavily used for agricultural irrigation, municipal use and industrial water supply throughout eastern Arkansas. The large sand and gravel deposits provide high yield groundwater production capable of supporting large scale demands across the region.

The primary transmission infrastructure associated with these sites includes the Ritchie Substation, located near West Helena, Arkansas.

2.5 NORTHEAST ARKANSAS

Site 6 is in northeast Arkansas withing the Mississippi Alluvial Plain and Crowley's Ridge regions. Northeast Arkansas is predominantly flat agricultural floodplains interrupted by elevation associated with Crowley's Ridge. The lowlands surrounding Crowley's Ridge contain extensive row crop agriculture, wetlands, and low gradient drainage systems associated with the St. Francis River, Black River, and Mississippi River floodplains. Like eastern Arkansas, this region is susceptible to prolonged flooding due to the flat topography.

Site 6: St. Francis River – Marked Tree

Site 6 is located along the St. Francis River near Marked Tree, Arkansas. The St. Francis River supports regional agricultural irrigation, drainage conveyance, and flood control. Like the sites located in eastern Arkansas, Site 6 is located in the Mississippi River Valley alluvial aquifer which is used for agricultural irrigation, public water systems, and industrial uses.

The largest water consumers in northeast Arkansas consist of agriculture processes and heavy industry, particularly the steel manufacturing facilities located in Mississippi County. Agricultural irrigation accounts for a substantial portion of the regional water demand due to extensive row crop production while steel mills require significant water supplies for production activities.

The Sandy Bayou Substation, located near Osceola, is the primary transmission infrastructure identified by the draft transmission identification report.

3.0 Water Supply Source Evaluation

Adequate water supply is vital to the evaluation of potential site locations. This section will outline the water sources available throughout each study location and discuss both the availability and constraints limiting the use of each source. It should be noted that all data presented in this discussion is based on best available data sources and should be considered as approximate for use as a screening level assessment. No detailed water calculations were performed as part of this report.

3.1 GROUNDWATER

Groundwater usage across the state of Arkansas varies by region and by industry. However, the eastern and southern portions of Arkansas are the highest users of groundwater. Several aquifer systems were identified as potential water sources, Springfield Plateau Aquifer (SPA), Ouachita Mountain Aquifer System (OMA), Western Interior Plains (WIP), Arkansas River Valley Alluvial Aquifer (ARA), Cockfield Aquifer (CFA), Wilcox Aquifer (WXA), Sparta Aquifer (SA), the Mississippi River Alluvial Aquifer (MRA), and additional cluster of aquifers in Site 7. The following section will assess the viability of these systems with consideration of the study regions. This analysis will pull from best available data including the 2014 Arkansas Water Plan (AWP), 2024 Arkansas Groundwater Protection and Management Report, 2026 Arkansas Water Plan Provisional Data, and USGS groundwater publications as noted in Section 8 References. A map of aquifers across Arkansas is included as Figure 2 below and in Appendix D.

3.1.1 Springfield Plateau Aquifer – Site 1

The Springfield Plateau aquifer (SPA) is the uppermost aquifer of the Ozark Plateau system encompassing northwest Arkansas and portions of Missouri, Kansas, and Oklahoma. The SPA is the groundwater source available to Site 1 Flint Creek. USGS reports that average yields of 10 gallons per

minute are common with some locations able to access greater yields. The SPA serves as the only source of water for large areas across the Boston Mountains in northwest Arkansas. Water use from the SPA varies across the region including domestic, public-supply, commercial and industrial purposes. Water levels across the SPA are difficult to analyze as there are limited data and limited reporting stations. USGS reports that there is considerable variability in water levels and well depths across the SPA due to the geologic variation and shifting confining layers across the aquifer. Based on this data review, we are unable to estimate total groundwater usage for the site location as many small and local well systems do not self-report as they serve less than 50,000 gal/day (gpd). The combination of limited data reporting and low average yields is a concern for this suitability of the SPA as an adequate supplemental water source for this analysis.

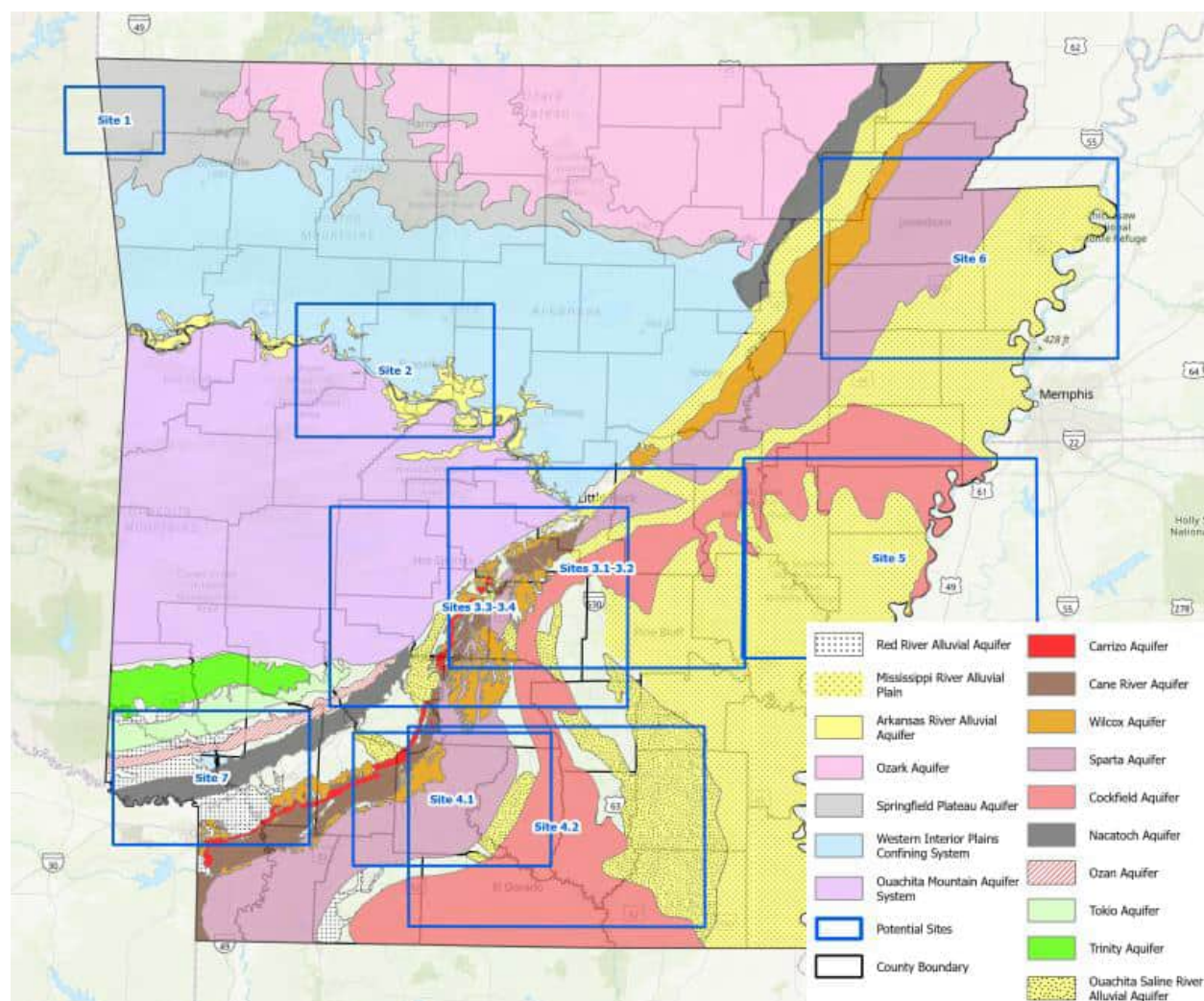


Figure 2. Arkansas Aquifers

3.1.2 Ouachita Mountain Aquifer System– Site 2

The Ouachita Mountain Aquifer System (OMA) is shallow aquifer formation through the Ouachita Mountains in west central Arkansas. This system is highly dependent on surface water recharge from the Arkansas River and direct precipitation infiltration. Ground water levels within this system are relatively shallow, averaging 20 feet below land surface, which allows for high recharge rates and makes the system more vulnerable to the seasonal variability of surface water recharge. The 2014 Arkansas Water

Plan notes that most wells in the system report relatively low yield with most yielding 10 gpm. Current groundwater users in this region are primarily for rural and small community water supply wells.

3.1.3 Western Interior Plains Confining System – Site 2

The Western Interior Plains Confining System (WIP) is comprised of a portion of the Boston Mountains Plateau and a portion of the Arkansas River Valley. These formations come together to form many shallow rock sections throughout the region and provide groundwater for domestic and small municipalities. This system is recharged through direct precipitation runoff to the small shallow pockets. Typical well yields range from 1 to 5 gpm and the 2014 Arkansas Water Plan notes that it is not uncommon for wells to go dry, especially during dry and drought conditions, making this a not sustainable and recommended water source.

3.1.4 Arkansas River Valley Alluvial Aquifer – Site 2

The Arkansas River Valley Alluvial Aquifer is a largely unconfined aquifer able to store large volumes of groundwater throughout the region of western central Arkansas along the Arkansas River. Water recharge is provided by direct infiltration from precipitation runoff. This aquifer is characterized by its sandy and gravel layers with saturated layers being 30 to 60 feet deep, on average, across the aquifer and some locations downstream of Fort Smith having thicker saturated layers. The ARA is one of the most vital groundwater sources in the region and is a primary source for municipal water. Wells in the ARA have reported yields between 300 to 700 gpm. Currently, the City of Dardanelle is a primary municipal water supply user and reports that their wells have a combined yield of approximately 5.5 MGD. While municipal water supply is the primary use, agricultural and irrigation are also key users of groundwater. The 2014 Arkansas Water Plan states that in 2010, the reported use for irrigation from the ARA was 2.6 MGD. There is limited state and federal monitoring across the three aquifers in Site 2 as they are not considered Critical Groundwater Areas. The ARA has the potential to provide additional groundwater for use in this project.

3.1.5 Cockfield Aquifer – Sites 3.1, 3.2, 4.2 and 5

The Cockfield Aquifer (CFA) extends from east Arkansas through central and towards the south-central region of the state and into Louisiana. It is the only source of serviceable ground water for communities in the counties of southern Arkansas. Recharge to the CFA occurs primarily through direct infiltration, stream recharge from the Ouachita River valley, and through water movement from the SA. Withdrawals from the CFA during 2010 totaled approximately 19.2 MGD and have been primarily used for industrial and public supply use. Withdrawals are also used for agricultural, commercial and domestic use; however these uses are less. USGS reports that usage has increased in the public water-supply and industrial sectors for these areas as this is the primary source for water in these portions of the state. USGS reports that aquifer yields vary across the aquifer due to the variation in thickness from north to south. While most wells within the aquifer system produced small yield volumes, water supply systems in south Arkansas and Mississippi were averaging 10.4 MGD.

Historically, water level have trended downward across the CFA. In a 2012 USGS Groundwater Report, water monitoring wells across the region were overall trending downward across the CFA. Since this report, improvement has been seen across the southern portion of the state as reported in the 2024 Arkansas Groundwater Report. These well reporting sites of recharge are located with Site 4.2 of this site evaluation. Well reporting sites in the northern portion, Site 5, have continued to report a downward trend.

3.1.6 Wilcox Aquifer – Sites 3.1, 3.2, and 6

The Wilcox Aquifer (WXA) runs parallel to the Sparta along its western edge and stretches from northeastern Arkansas to southwestern Arkansas. The WXA is confined between several aquifer systems throughout the state. The WXA is a discontinuous aquifer that is categorized into northeastern and southern segments. Recharge for the northeastern segment is primarily from direct infiltration. Discharges for the northeastern portion through well use have historically yielded 100 to 2,000 gpm. In the southern

segment, recharge occurs through direct infiltration as well through inflow from overlying alluvial deposits. Well yields in the southern segment are much lower and range from 10 to 100 gpm.

The 2024 Arkansas Groundwater Report indicates that groundwater levels within the Wilcox Aquifer have generally shown increasing trends over the 12-year evaluation period. However, monitoring wells within the northeastern portion of the aquifer, including the vicinity of Site 6, exhibit greater variability in groundwater levels and a higher percentage of wells reporting declining water level trends compared to the southern segment. These localized variations suggest that long term groundwater availability within the northern portion of the aquifer may be less reliable as a consistent water supply source for the study area.

3.1.7 Sparta Aquifer – Sites 3.1, 3.2, 4.1 and 6

The Sparta Aquifer (SA) is a confined aquifer system stretching from northeast Arkansas to southwest Arkansas and running along the western side of the Mississippi River Alluvial Aquifer. The SA also continues into Tennessee, Louisiana, Mississippi, and Missouri. This sandy aquifer ranges in thickness from 200 feet along the outcrop and up to 900 feet in the southeastern part of the state and is overlain by the MRA throughout central and northeastern Arkansas. The SA system is a well-monitored aquifer system with over 200 wells reporting and providing dataset records. Water use for the Sparta is primarily for agricultural irrigation purposes, public water supply and industrial use. Many communities within Arkansas are exclusively dependent on the SA for public water supply. Well depths across the SA range on average between 200-600 feet and in some areas as deep as 1,000 feet. Yields for individual wells have produced up to 1,200 gpm.

Historically, the SA system experienced consistent water level declines until public policies shifted to limit water quality usage. Many counties throughout the State have been identified as critical groundwater areas meaning that usage at the time of designation was not sustainable. Policy programs have been enacted throughout the region of the SA emphasizing conservation and reductions of groundwater usage. These programs have been successful at leveling water usage through the southern region which impacts sites 4.1 and 4.2. Groundwater levels through the northern portion of the SA continue to steadily decrease. The ANRD presumes in the 2024 Groundwater Report that this may be due to the unconfined nature of the aquifer through this segment, the continued stresses on the overlying MRA system and continued increases in groundwater use.

3.1.8 Mississippi River Alluvial Aquifer – Sites 3.2, 4.2, 5 and 6

The Mississippi River Alluvial Aquifer (MRA) is the uppermost aquifer of the Mississippi Embayment. It is considered one of the most important aquifers in terms of total groundwater use in the state and the footprint of the aquifer stretches to several neighboring states. The MRA is recharged through direct infiltration and is greatly impacted by precipitations variations over time. ANRD reports that years of higher than average rainfall saw decreases in groundwater use and more recharge to the system vs years of average or below average rainfall. Water uses for the MRA are primarily for agricultural irrigation purposes, water supply and industrial. Irrigation purposes makeup the majority of water usage for MRA groundwater. In 2010, over 47,000 wells in the system reported approximately 7.400 MGD of use. Water use has steadily increased with irrigation. In 2010 the average use per county was 148.64 MGD. It should be noted that this is not consistent across all counties within the MRA and is in fact isolated to several high use and intensively farmed counties.

Well monitoring over the last decade indicates consistent decline in water levels with 46.8% of total reporting wells showing a decline in water levels over the time period of 2014 – 2024. The implementation of the Grand Prairie and Bayou Meto irrigation projects may decrease ground water usage throughout central Arkansas (Site 3.2). If there is strong and sustainable recovery reported in the MRA, then it has the potential to be a source for supplemental water use.

Several counties within both the MRA and SA systems have been identified by ANRD as critical groundwater areas and are listed in Table 1. Under the Groundwater Protection and Management

program, critical groundwater areas are locations identified by Arkansas Natural Resources Commission to have significant and sustained groundwater depletion and degradation of groundwater quality. Declines in water levels must be considered significant and documented through extensive monitoring. This designation indicates that groundwater is being used faster than it can be recharged and limits the long-term use of this water source. Areas identified as critical areas impact the overall project locations within sites 3, 4, 5 and 6.

Table 1. Critical Groundwater Areas

County	Study Site ID
Jefferson	Site 3
Lonoke	Site 3
Pulaski	Site 3
Arkansas	Site 3 and 5
Prairie	Site 3 and 5
Bradley	Site 4
Calhoun	Site 4
Columbia	Site 4
Ouachita	Site 4
Union	Site 4
Lee	Site 5
Monroe	Site 5
Phillips	Site 5
St. Francis	Site 5
Craighead	Site 6
Cross	Site 6
Greene	Site 6
Poinsett	Site 6

3.1.9 Gulf Coastal Plain Aquifer Cluster - Site 7

Five narrow aquifer formations can be found in the greater region of Site 7 in far southwestern Arkansas. These aquifers are a part of the Gulf Coastal Plain Aquifer system. These aquifers are the Nacatoch, Ozan, Tokio, Trinity and Red River Alluvial Aquifers. The Carrizo and Cane aquifers were not considered as viable groundwater sources for this assessment due to their relatively narrow size in relation to surrounding groundwater sources thus limiting their usage potential. All aquifer systems, except the Ozan have been or are currently used for water supply purposes in the region. The Ozan has very limited reporting data as it generally produces very low yield and water tests show that the water is not suitable for drinking water purposes. The Tokio and Trinity aquifers are characterized by many reported artesian wells throughout the southwest region. Additional groundwater users include crop irrigation, domestic water supply and wetland management. All aquifers within this site are recharged primarily through direct precipitation infiltration and water levels may fluctuate with seasonal conditions. Table 2 below is a summary of the historical yields for each of these sources within Site 7.

Table 2. Historical Yield for Gulf Coastal Plain Aquifers

Aquifer	Historical Yield Range (gpm)
Nacatoch	1 - 300
Ozan	1
Tokio	20 - 300
Trinity	5 - 200
Red River Alluvial	200 – 1,200

3.1.10 Groundwater Assessment

The 2014 Arkansas Water Plan completed a Mississippi Embayment Regional Aquifer Study (MERAS) model to assess the availability of groundwater by aquifer and location. The MERAS model (extents shown in (Figure 3) simulated four scenarios to consider both wet and dry conditions as well sustainable pumping vs mining or high usage pumping. This model was also used to determine the sustainable yield, which is the well yield to maintain or sustain water level provided a specific set of pumping and usage conditions. The sustainability yield determined for the SA and MRA systems is shown in Table 3 below. The 2014 AWP also completed a demand and gap analysis on a regional scale throughout the MERAS study area. This analysis highlights the projected groundwater availability and gaps for the year 2050 as shown in

Since the publication of this analysis, conservation efforts have taken place in the lower portions of the Sparta with recovery efforts taking place in Union County. It is estimated that the in-progress Bayou Meto and Grand Prairie projects will also reduce groundwater usage up to 15 percent in eastern Arkansas. Additional MERAS studies have not been published with the 2026 Arkansas Water Plan update, however recent trends indicate that Arkansas groundwater gaps exist and will remain in the future. A summary of groundwater trends as reported in the 2014 Arkansas Groundwater Report can be found in Appendix E.

Groundwater supply and availability vary considerably across the state. In assessing the long-term potential for groundwater, those locations identified as critical groundwater areas are not recommended for primary water use; however, may be appropriate for limited and supplemental use for this proposed project. Based on data reviewed, groundwater availability in Site 2 may present a more feasible option for primary groundwater use, but more detailed analysis of feasibility and long term use may be required.

Table 4 below. Additional details for this analysis can be found in the 2014 Arkansas Water Plan as referenced in Section 8. The MERAS groundwater study extents are shown in Figure 3. The results of the previous MERAS study indicate that even under sustainable conditions there is a significant groundwater gap projected for 2050 with only about 20 percent of the groundwater demand can be met with groundwater resources in the year 2050.

Table 3. Sustainability Yield for Sparta and Mississippi River Alluvial Aquifers (Sites 3.1, 3.2, 4.1, 4.2, 5, and 6)

Aquifer	Sustainable Yield (MGD)
Mississippi River Alluvial Aquifer	3,374
Sparta	87

Since the publication of this analysis, conservation efforts have taken place in the lower portions of the Sparta with recovery efforts taking place in Union County. It is estimated that the in-progress Bayou Meto and Grand Prairie projects will also reduce groundwater usage up to 15 percent in eastern Arkansas. Additional MERAS studies have not been published with the 2026 Arkansas Water Plan update, however recent trends indicate that Arkansas groundwater gaps exist and will remain in the future. A summary of groundwater trends as reported in the 2014 Arkansas Groundwater Report can be found in Appendix E.

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Table 4. Arkansas Water Plan Regional Projected Groundwater Availability and Supply Gap for Year 2050

Planning Region	Groundwater Availability (Acre-ft/Year)*	Groundwater Supply Gap (Acre-ft/Year)~
East	1,809,405	(7,259,810)
North	78,782	(661,869)
West-Central+	9,900	(56,932)
South-Central+	38,560	(132,391)
Southwest+	3,642	(70,219)

* Projected availability assuming water elevation equal to half the aquifer thickness in the alluvial aquifer and the top of formation in the confined aquifers. Assumes Dry climate conditions.

~ Based on dry conditions for aquifers within MERAS model area.

+ Approximate groundwater estimates for locations outside the MERAS study area are constrained by limited well reporting in those locations. Estimates for regions containing areas partially outside the MERAS study area are based only on the analysis within the MERAS study areas resulting in a constraint on applicability of results to the entire planning region.

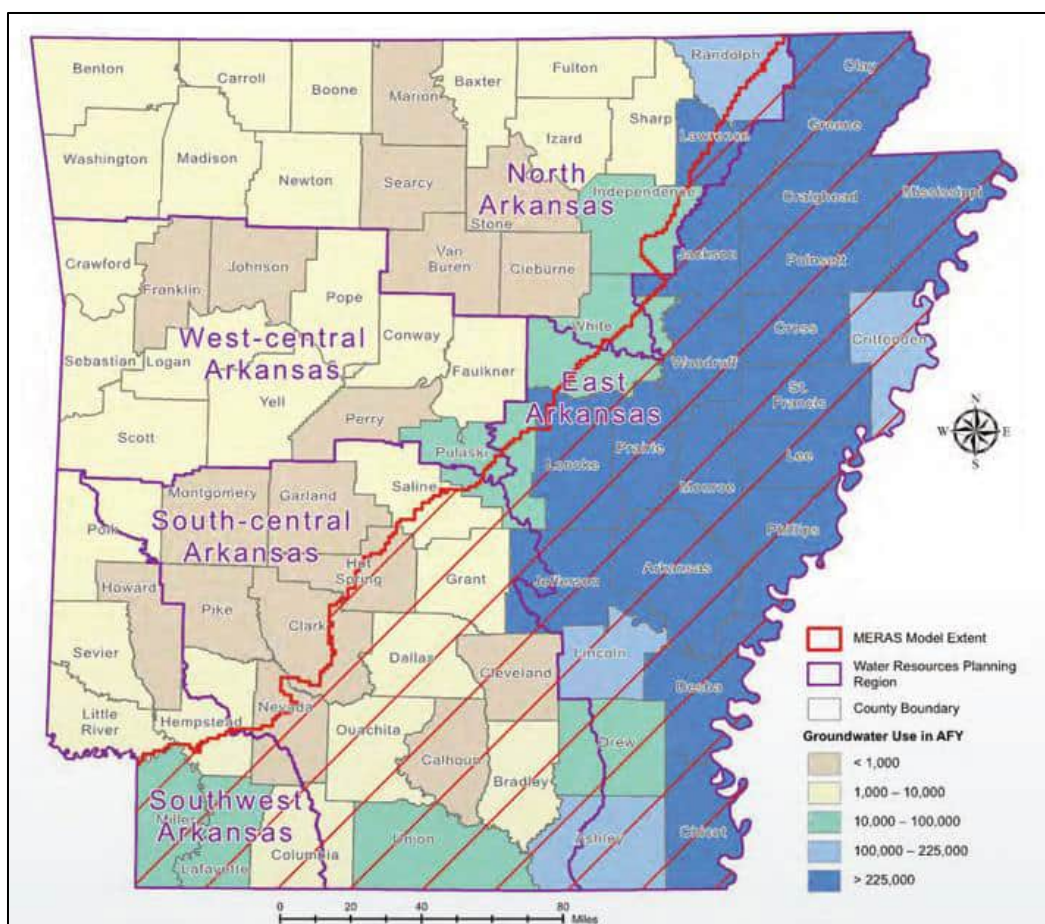


Figure 3. MERAS Groundwater Study Extent (2014 Arkansas Water Plan)

3.2 SURFACE WATER

Arkansas has an abundance of surface water resources including rivers, streams, lakes, and reservoirs. Surface water across the state is used for a variety of resources including recreation, water supply, agricultural irrigation and industrial uses. This section will discuss the surface water sources available for use as well as outline the constraints with each source. Due to the significant number of water sources available, this section will be subdivided into water sources (i.e river/streams and lakes/reservoirs). It should be noted that this water availability assessment is based on best available data and no detailed water calculations were completed. Sources for this section include the 2014 Arkansas Water Plan, the 2026 Provisional Arkansas Water Plan Data, USACE water control manuals, and numerous USGS Gage datasets.

3.2.1 Rivers and Streams

Rivers and streams represent one of the most significant and widely utilized surface water resources in Arkansas. These systems often provide water for municipal supply, industrial operations, agricultural irrigation, recreation, hydropower generation, and ecological and habitat support. Streamflow varies across the state due to watershed size, topography, geology, precipitation patterns, and upstream regulation. Hydrologic conditions within these systems are monitored through a network of USGS stream gages, many of which record discharge data that can be used to evaluate seasonal and long-term flow characteristics. Average streamflow at each site varies throughout the year due to seasonal variability, while regulated streams typically exhibit less fluctuation because of controlled reservoir releases

upstream. Available average streamflow data for gages located near each study site are included in Appendix F. It should be noted that discharge data were not available for all gages referenced in the following sections.

The following sections summarize the major river and tributary systems evaluated for potential water availability and supply. For each source, available information regarding hydrology, excess surface water availability, operational constraints, navigation requirements, and existing water demands is discussed based on the best available data. A map displaying the location of each source discussed, is shown in Figure 4.

Flint Creek – Site 1

Flint Creek is located in northwest Arkansas and is part of the larger Illinois River watershed. Streamflow in the watershed is monitored through USGS gages 07195800 and 07195855. Due to the steep terrain of the Ozark Highlands, peak streamflow can be substantial during storm events.

Flint Creek is not a navigable waterway and therefore does not have any navigation-related operation constraints. Per the 2014 Arkansas Water Plan (AWP), Flint Creek has an excess surface water of 3,200 acre-ft per year which can be allocated to non-riparian users through an allocation study.

Illinois Bayou – Site 2

The Illinois Bayou is a tributary of the Arkansas River with its confluence located near Russellville, Arkansas. Streamflow in the Illinois Bayou is highly variable and often dependent on precipitation events with limited sustained baseflow during dry periods. Streamflow is monitored by USGS Gage 07257500 which is approximately 30 miles upstream of the confluence with the Arkansas River. Per the 2014 AWP, Illinois Bayou has approximately 41,700 acre-ft of surface water available for allocation.

The upper portion of the Illinois Bayou is not considered a navigable waterway by USACE; however, the lower 12 miles starting at the Batesville Water Supply Dam in Shiloh, Arkansas is on the navigable waterways list. Water use in the basin is generally limited compared to larger river systems with the main use being localized agricultural withdrawals, although some municipalities use the river for their public water supply.

Arkansas River – Site 3

The Arkansas River is one of the largest and most significant sources of surface water in Arkansas. Streamflow within the river is monitored by several USGS gages with gage 07263620 being near Site 3. Due to its large drainage basins and regulated system of locks and dams, flows in the river are generally more stable, resulting in less seasonal variability. Per the provisional data included in the 2026 AWP, the Arkansas River has an estimated 3,657,00 acre-ft of excess surface water per year which can be allocated to new users.

The Arkansas River maintains a navigable channel from Oklahoma to the Mississippi River through a series of locks and dams operated by USACE as part of the MKARNS system. As a result, navigation requirements represent a major operational constraint on the system which has a direct influence on flow management.



Figure 4. Rivers and Streams

Significant water users include Arkansas Nuclear One, multiple municipal water suppliers, industrial facilities (including potential data centers), agricultural irrigation systems, and hydroelectric generation facilities associated with USACE reservoirs. Future demands are expected to increase due to continued development and municipal expansion.

Lost Creek – Site 3

Lost Creek is a tributary of the Saline River with its confluence located near Sheridan, Arkansas. Lost creek is not monitored by USGS Gages and flows are dependent on precipitation events which can fluctuate significantly during seasonal storm activity.

Flint Creek is not a navigable waterway and therefore does not have any navigation-related operation constraints. Water use within the watershed is generally limited and consists primarily of localized agricultural withdrawals, rural domestic supply, and small-scale recreational use. Due to the predominantly rural nature of the basin and relatively low development intensity, existing water demands are relatively modest compared to larger river systems in Arkansas.

Ouachita River – Site 4

The Ouachita River flows from the Ouachita Mountains through a series of reservoirs and ultimately into northern Louisiana. The watershed is primarily forested uplands in the upper reaches and transitions into more agricultural and mixed used in the lower basin. Streamflow is regulated by a series of USACE reservoirs, including Lake Ouachita, which controls flooding and helps maintain downstream flows. USGS gaging stations around Site 4 include USGS gage 07362000. Due to the reservoir operations, the lower Ouachita River maintains a stable baseflow with moderate peak flows during precipitation events.

The Ouachita River supports a variety of uses including municipal water supply, agricultural withdrawals, and hydropower generation. Blakely Mountain Dam powerhouse is owned and operated by USACE and is the main source of hydropower generation along the Ouachita River system. The river does not function as a major commercial navigation corridor in its upper reaches in Arkansas; however, it is maintained as a federally navigable waterway for approximately 337 miles, starting in Camden, Arkansas and extending to Jonesville, Louisiana. After accounting for all current allocations and in-stream flow requirements, the river still has a yearly excess water yield of approximately 1,070,000 acre-ft available for additional allocation.

Saline River (Ouachita River System) – Site 4

The Saline River – Ouachita River is a tributary of the Ouachita River located in central and southern Arkansas. The watershed primarily consists of forested areas transitioning into agricultural and low density developed areas closer to its confluence with the Ouachita River. Streamflow in the river has moderate variability with periods of elevated flow during storm events and limited baseflows during dry conditions. The streamflow in the river is monitored by USGS gages 07363000, 073632000, 07363500 and 07364000 near Site 4.

The Saline River is not a navigable waterway and does not support commercial navigation. Primary water demands from the river are associated with agricultural irrigation, livestock, and rural municipal supply. Despite flows from the Saline River playing a role in the hydropower generation on the Ouachita River system, the Saline River has an annual excess surface water yield of approximately 270,000 acre-ft of according to the 2014 AWP.

Mississippi River – Site 5

The Mississippi River forms the eastern boundary of Arkansas and is one of the largest and most significant river systems in North America. Originating in Minnesota, the river flows south approximately 2,300 miles before discharging into the Gulf of Mexico. Within Arkansas, the surrounding landscape is characterized by broad alluvial floodplains, intensive agricultural production, and large industrial developments, specifically in northeast Arkansas. Streamflow in the river is monitored by a series of USGS gages, with gage 07047970 located near Site 5. Seasonal flooding and prolonged high-water events are common along the Mississippi River due to the large contributing basin.

The Mississippi River is a federally maintained navigation corridor and serves as one of the most important commercial transportation systems in the United States. Navigation is maintained through channel stabilization structures, dredging operations, and river management by USACE. As a result, navigation requirements play a role in consideration for water management along the river. The river supports a high volume of barge transportation associated with agricultural commodities, steel manufacturing, and other industrial goods. Numerous industries are located along the Arkansas side of the river, particularly near Osceola, Blytheville, and other communities within Mississippi County.

Significant water users along the Mississippi River include steel manufacturing facilities, agricultural irrigation systems, municipal water suppliers and other miscellaneous industrial processing facilities. The river also provides indirect hydrologic support to the Mississippi River Valley Alluvial aquifer through groundwater recharge and hydraulic interaction with the alluvial floodplain.

L'Anguille River – Site 5

The L'Anguille River begins in northeast Arkansas near the Missouri border and flows south before joining the St. Francis River in eastern Arkansas. The watershed lies almost entirely in the Mississippi Alluvial Plain and is characterized by flat topography, extensive row crop agriculture, and heavily modified drainage patterns. Streamflow in the basin is heavily influenced by seasonal precipitation, agricultural runoff, and floodplain storage with monitoring at several USGS gages along the stream. Due to the flat nature of the basin, floodwaters can remain within the system for extended periods of following major rainfall events.

The L'Anguille River is generally not a navigable waterway; however, it is considered navigable for approximately 9 miles downstream of Marianna, Arkansas. Outside of this reach, the river is not used for commercial navigation and is primarily used for drainage and flood control purposes. The system has been significantly modified over time to support agricultural production and water management infrastructure plays a key role in maintaining field drainage throughout the basin.

The river is primarily used for supporting agricultural irrigation throughout the region. Row crop agriculture is the main water demand in the basin, with reliance on both surface and groundwater resources. The river also contributes to the hydrologic function of the Mississippi River Valley Alluvial aquifer through aquifer recharge and floodplain interaction. After all other allocations have been met, the L'Anguille River has a yearly excess surface water yield of approximately 90,000 acre-ft per the 2014 AWP.

Cache River – Site 5

The Cache River originates in southeast Missouri with approximately 90% of its system contained within eastern Arkansas. The watershed is characterized by low gradient terrain, extensive wetlands, and agricultural lands. Streamflow is highly variable depending on the season and precipitation, with backwater from the White River resulting in slow drainage and prolonged inundation during major storm events. The river is monitored near Site 5 at USGS gages 07077555.

The Cache River is not included on the navigable waterway list and does not support federal navigation infrastructure. Instead, the system is influenced by flood control and drainage improvements, including levees, channelization, and pumping stations design to support agricultural operations. Aside from agricultural uses, the basin also provides important ecological habitat, particularly within the Cache River National Wildlife Refuge. The Cache River has a yearly excess surface water yield of approximately 160,00 acre-ft according to the 2014 AWP.

Big Creek – Site 5

The Big Creek is a tributary stream located in northeast Arkansas. The watershed consists of flat topology, intensive agricultural land use, and an extensive network of drainage improvements typical with the Arkansas Delta region. Streamflow in the basin is generally flat and slow moving, with flow strongly influenced by rainfall, agricultural runoff, and backwater effects from downstream receiving streams.

Big Creek is not a navigable waterway and does not support commercial navigation or barge traffic. The system is primarily managed for agricultural drainage and flood control with channel modifications and pumping infrastructure commonly used throughout the watershed to support row crop production.

St. Francis River – Sites 5 and 6

The St. Francis River originates in southeast Missouri and flows south through Arkansas before joining with the Mississippi River in northeastern Arkansas. The landscape is characterized by extensive agricultural development, low-relief topology, and highly modified drainage systems. The river is monitored by a series of USGS gages with gages 07040450, 07047000, and 07047500 located near Site 6.

The navigability of the St. Francis River varies throughout the system. The upper and middle reaches are generally not commercially navigable and are primarily used for recreation. The lower portion of the river

below the confluence with the Little River is considered navigable and can support barge traffic near its confluence with the Mississippi River. Flood control and agricultural drainage are major operational considerations within the basin, with extensive levees, drainage ditches, and pumping infrastructure constructed to support agricultural productivity throughout the Delta region.

Significant water users in the basin include row crop irrigation operations and industrial facilities associated with northeast Arkansas manufacturing and processing industries. The river also provides hydrologic support to the Mississippi River Valley Alluvial aquifer, which serves as the primary groundwater source for much of eastern Arkansas. After accounting for in-stream flow requirements and all other allocations, the annual excess surface water yield is approximately 670,000 acre-ft according to the 2014 AWP.

Red River – Site 7

The Red River begins in the Texas Panhandle and flows east, entering southwest Arkansas and ultimately travels through Louisiana, joining the Mississippi River. In Arkansas, the watershed is primarily rural with agricultural and forested areas with small communities scattered throughout the watershed. Streamflow is monitored by USGS gages 07337000 and 07341500 and is highly variable. Dry conditions often bring periods of low flow followed by significant flood peaks during major storm events across the basin.

The Red River is part of the federally maintained Red River Waterway, supporting navigation from the Mississippi River to inland ports in Arkansas, Louisiana, and Texas. As a result, navigation is an important operational constraint, impacting reservoir releases and in-stream flow requirements. Major uses in the Red River include agricultural irrigation and industrial supply with pulp and paper mills being a major source for the water demand. Even with current allocations and in-stream flow requirements, the Red River has an estimated excess surface water of approximately 1,250,000 acre-ft per year.

Saline River (Red River System) – Site 7

The Saline River – (Red River) is a tributary of the Little River lies in southwest Arkansas and originates in the Ouachita Mountains, flowing southeast until its confluence with the Little River. Streamflow is highly variable and rainfall driven, with flashy responses to storm events and little baseflow during dry conditions. Streamflow is monitored by USGS gage 07341200 is approximately 15 miles upstream of the river's confluence with Millwood Lake.

The Saline River – (Red River) is not part of the federal navigation system and does not support commercial navigation though it does play a key role in the water availability in the Little River and Red River systems. The river has limited water withdrawals, primarily for agricultural irrigation and localized rural water supply. Pulp and paper mills downstream of Millwood Lake often rely indirectly on flows from the Saline River for use in their operations processes. Despite the demand and existing uses, the Saline River – (Red River) has an annual excess surface water yield of approximately 35,000 acre-ft according to the 2014 AWP.

Little River – Site 7

The Little River is a tributary stream, beginning in the Ouachita Mountains and extending to Texas, joining the Red River. The watershed has a mix of forested uplands in the headwaters and agricultural and rural land in the lower portion. The river experiences high seasonal variability, responding quickly to rainfall events with limited sustained baseflow during dry periods. Streamflow is monitored by USGS gages 07340000, 07341300, and 07341301 in southwest Arkansas near Site 7.

The river is not a navigable water way but does include major reservoirs such as Millwood Lake that provide flood control and downstream water supply support. Other uses include agricultural irrigation, municipal supply, and recreational uses. In addition, the SWEPCO Turk Coal Plant uses the Little River as its main source of water for cooling and plant operations. Water availability in the basin is influenced by reservoir operations, drought conditions and downstream flow requirements associated with the Red

River system. Per the 2026 AWP provisional data, the Little River has an excess surface water of 350,000 and 390,000 acre-ft upstream and downstream of Millwood Lake respectively.

3.2.2 Lakes and Reservoirs

Lakes and reservoirs represent another key category of surface water resources across Arkansas. These systems are typically managed by federal, state, municipal, or private entities, with many larger reservoirs operated by USACE. Of the six reservoirs evaluated below, four are owned and operated by USACE. Unlike streams, reservoirs provide regulated storage that can help stabilize seasonal variability in flows; however, their availability is often governed by operational pool requirements, watershed hydrology, existing allocations, drought response strategies, and downstream release obligations. Table 5 displays the number of agreements and daily yield required for the four reservoirs owned and operated by USACE and a full list of the agreements and yields can be found in Appendix G. The following sections provide a more detailed summary of the primary lakes and reservoirs evaluated within each study area. The location of each reservoir can be found in Figure 5.

Table 5. Reservoir Project Yields

District	Division	Project	No. of Agreements	Yield (MGD)
Mississippi Valley Division	Vicksburg	Blakely Mountain Dam – Lake Ouachita, AR	2	31.00
Mississippi Valley Division	Vicksburg	DeGray Lake, AR	8	152.00
Southwestern Division	Little Rock	Dardanelle Lake, AR*	1	0.00
Southwestern Division	Little Rock	Millwood Lake, AR	17	265.00

* Arkansas Nuclear One uses Lake Dardanelle as surplus water however there is no identified yield for this agreement

Lake Flint Creek – Site 1

Lake Flint Creek is a 500-acre privately owned and operated dam by the Southwestern Electric Power Company (SWEPCO) and was built to provide cooling water to the Flint Creek Power Plant. The lake allows public access, however as the lake is privately owned and operated, water usage would be limited. The maximum capacity or storage of the lake is 24,400 acre-ft with a contributing drainage area of 14.4 square miles as reported by the National Inventory of Dams (NID). Limited information is available for this lake as it is a privately owned reservoir. Additional data and analysis would be required to determine if storage capacity could be maintained with additional allocations and water use.

Lake Dardanelle – Site 2

Lake Dardanelle is formed along the Arkansas River by the Dardanelle Lock and Dam in Pope, County Arkansas. The lock and dam is part of the McClellan-Kerr Arkansas River Navigation System (MKARNS) and is owned and operated by the United State Army Corps of Engineers (USACE) Little Rock District. The lake itself has a max storage of 486,200 acre-ft with a contributing basin of 153,703 square miles which is attributed to its location along the Arkansas River and many contributing tributaries. Currently Lake Dardanelle is used to provide water supply to the Arkansas Nuclear One (ANO) facility located on the northern side of the lake and at outlet of Illinois Bayou. The USACE is tasked with maintaining the navigation channel of the Arkansas River but does not provide a direct allocation of water from the lake to ANO. Inflow and storage records support the use of Lake Dardanelle as a potential water supply source, however, a detailed analysis would need to be completed to better understand lake conditions and ensure sufficient capacity is available to maintain current use by ANO and to maintain the navigable channel section. A drought analysis would also need to be completed to understand the storage and usage during drought conditions. Additional constraints for water use of Lake Dardanelle include federal permitting including Section 10 and Section 408 of the Rivers and Harbors Act. These will be highlighted in future sections.

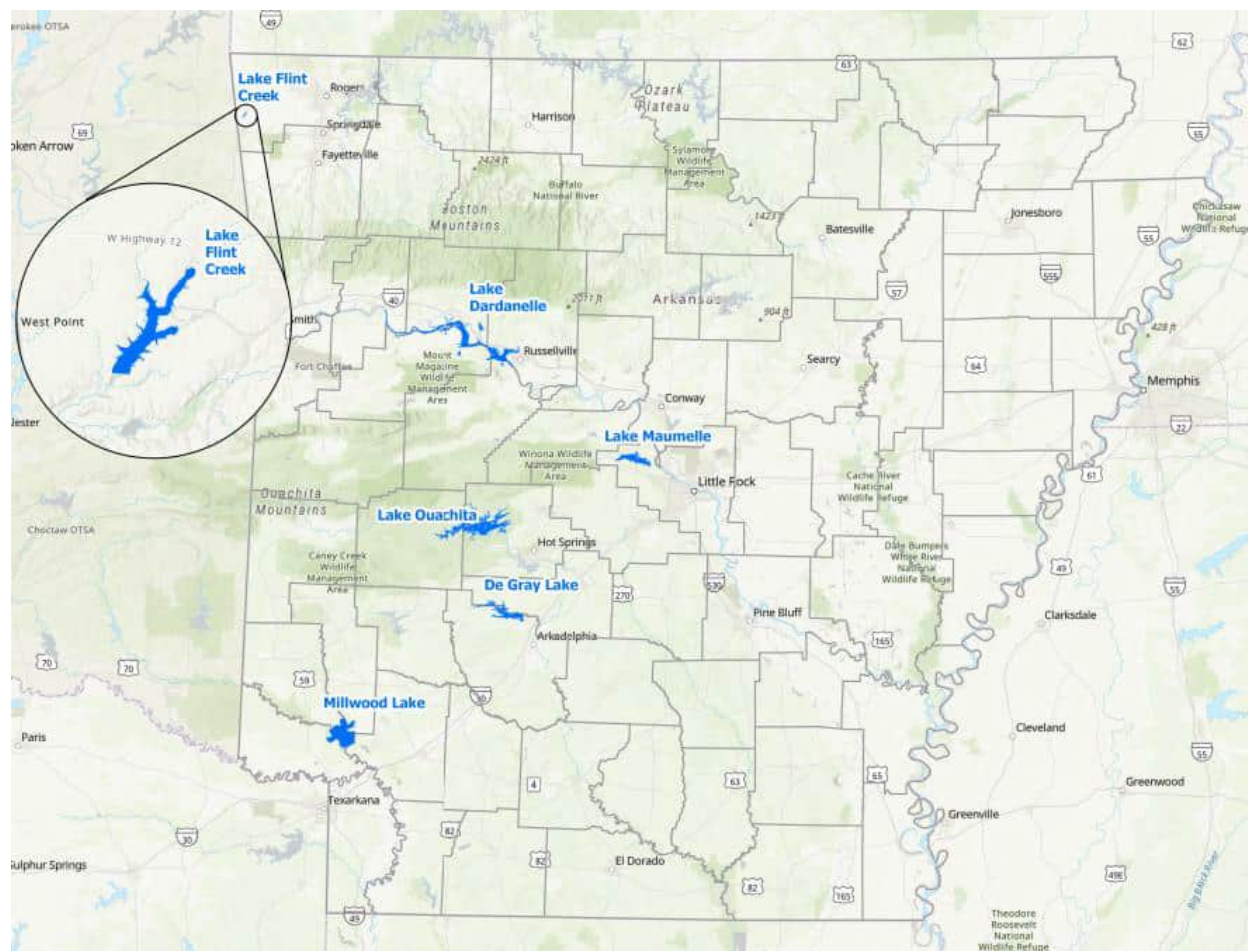


Figure 5. Lakes and Reservoirs

Lake Ouachita – Site 3.1

Lake Ouachita is a hydroelectric, water supply and recreational lake formed by Blakely Mountain Dam on the Ouachita River. The dam is owned and operated by the USACE Vicksburg District. The lake currently maintains a water allocation and power pool for hydroelectric generation. The current annual generation for this system is 158.1 GWh. Electricity generated is managed by the Southwestern Power Administration (SWPA). The top of power pool storage level is 2,151,000 acre-ft with a top of flood storage of 2,768,500 acre-ft. Minimum lake levels in Lake Ouachita must be maintained to guarantee sufficient water to maintain power generation. With a contributing basin of 1,105 sq. miles, the system may support additional water uses but would require a reallocation request to USACE and a reallocation study to determine if water may be allocated. A drought contingency plan would also be required by USACE. Site constraints surrounding the lake would limit access to the lake storage and any water withdrawals would require transport through pipe network to the final site location.

Lake DeGray – Site 3.1

Lake DeGray is a reservoir on the Caddo River constructed by the USACE for purposes of water supply, power generation and recreation. The lake currently maintains a joint power and water supply pool

elevation of 407 feet with a top of power pool storage of 654,700 acre-ft. Located outside of Arkadelphia, this location may support supplemental water use via withdrawals but is constrained by the relatively small drainage area of 453 square miles. Water level data provided by USACE indicates that water levels vary significantly with weather conditions and are easily impacted by drought conditions. As this lake is currently operated by the USACE and maintains a water allocation for power generation and water supply, a new water allocation study would need to be requested and completed prior to any surface water withdrawals. A drought contingency plan would also be required for permitting water use.

Lake Maumelle – Site 3.2

Lake Maumelle is privately owned and operated by the water utility Central Arkansas Water (CAW). They provide drinking water throughout the central Arkansas area. The lake is maintained in cooperation with the Arkansas Game and Fish Commission. Water is withdrawn from Lake Maumelle at the dam and transported via water line to other locations. CAW currently owns or maintains the contributing watershed to the lake, limiting use of surface water direct from the Maumelle River upstream of the lake. The lake levels are also fully maintained and water rights owned by CAW which would present a challenge with obtaining water allocation for this project. Immediately downstream Lake Maumelle is the Arkansas River, further limiting withdrawals from the Maumelle River.

Millwood Lake – Site 7

Millwood Lake is a USACE owned and operated lake on the Little River in southwest Arkansas. This lake was built primarily for flood control purposes; however, the lake maintains a water allocation for water supply to surrounding communities. This mid-sized lake has a relatively large contributing basin of 4,144 square miles collecting flows from the Little River and stretching into Oklahoma. The current Little River Drought Contingency Plan (June 1991) detail the historical average lake inflows and estimate a total average yearly inflow volume of 4,115,200 acre-ft. It is noted in this report that low flow conditions historically occur in August and September and that this volume is not equally distributed across each month.

Historical inflow volume supports that water storage from this lake could be utilized for water use in this project. At this time, a full allocation has been made for the conservation pool. A reallocation study would need to be requested of USACE and if approved a new reallocation study would need to be completed prior to use. A drought contingency plan would also be required.

A brief overview of lake characteristics and allocation notes for each site can be found in Table 6 below.

Table 6. Lake and Reservoir Overview

Lake/Reservoir	Owner/Operator	Purpose	Surface Area (acre)*	Normal Storage (acre-ft)*	Maximum Storage (acre-ft)*	Contributing Drainage Area (sq. mi)*	Known Water Allocation Notes
Lake Flint Creek	SWEPCO	Water supply and Recreation	500	18,300	24,400	14.4	Water used for SWEPCO cooling pond and discharged back into lake.
Lake Dardanelle	USACE - Little Rock	Navigation, Water Supply, Hydroelectric, Recreation	34,300	420,900	486,200	153,703	Pool storage currently supplies water to ANO for cooling. Additional capacity analysis and drought analysis needed. USACE operated and potentially requires reallocation request and study.
Lake Ouachita	USACE - Vicksburg	Hydroelectric, Recreation, Water Supply	40,100	2,151,100	3,760,700	1,105	Water allocation for power generation for SWPA. Would require a reallocation request to USACE and reallocation study.
Lake DeGray	USACE - Vicksburg	Hydroelectric, Recreation, Water Supply	13,400	654,700	1,377,100	453	Current water allocation for water supply and power generation. A combined pool level must be maintained to meet this allocation. Would require reallocation request to USACE and reallocation study.
Lake Maumelle	Central Arkansas Water	Water supply	8,900	221,00	221,00	137.3	Privately owned and operated for Central Arkansas water supply.
Millwood Lake	USACE - Little Rock	Water Supply and Flood Risk Reduction	29,000	172,000	1,854,930	4,144	Current water allocation for water supply for surrounding communities. Current allocation is fully utilized. Would require reallocation request to USACE and reallocation study.

* Data provided by the USACE National Inventory of Dams

3.2.3 Excess Surface Water Assessment – Arkansas Water Plan

A surface water availability assessment update is in progress as part of the 2026 Arkansas Water Plan update. Provisional data has been provided to Halff by the Arkansas Natural Resources Division for this assessment. As defined in Arkansas Code 15-22-304, excess surface water is calculated from average annual basin yield, existing use, instream flow and future water demand. Total available surface water is the remaining surface water made available after consideration is given to the instream flow requirements and future demands analysis. Of the total available surface water, 75% is not legally viable for non-riparian users while 25% is legally available and is considered the “excess surface water” available. For this analysis, excess surface water is quantified on an average annual basis and does not provide detail on the availability of water for a specific time of year or under specific flow conditions. Figure 6 demonstrates this calculation of surface water. This section will provide an overview and summary of both the provisional data received by ANRD as part of the 2026 AWP update and data received from the previous 2014 AWP. Data provided by the 2026 update is considered provisional and is subject to change. 2026 AWP data was provided to the public at stakeholder meetings in early 2026 and presentations are included as a reference and in Appendix H of this report.

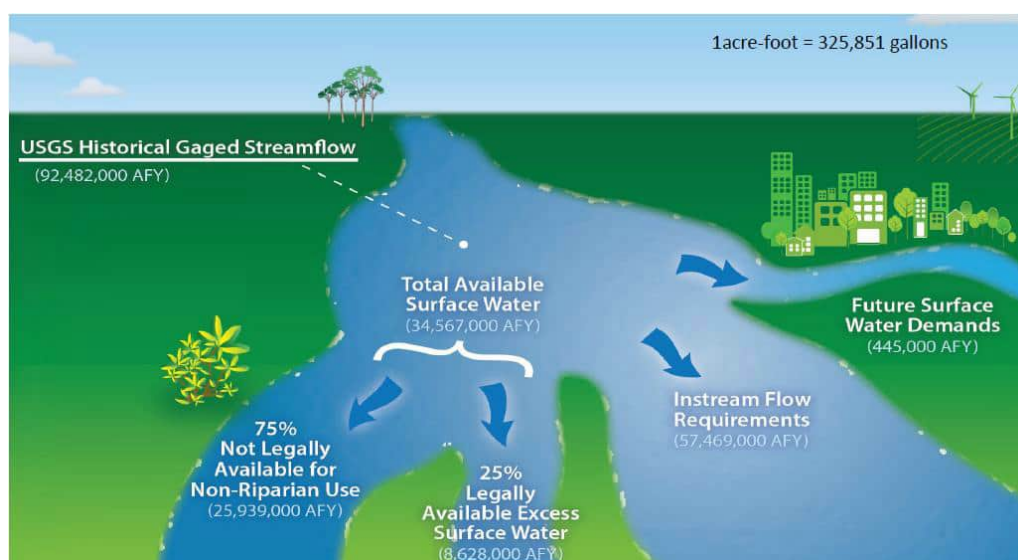


Figure 6. Surface Water Availability (2026 Provisional Water Plan Update Presentation “2026 Draft Water Demand and Water Supply Analyses, February 2026”)

As part of this analysis, ANRD utilized USGS and USACE continuous time-series of daily streamflow data to determine surface water availability across the state. The results of this analysis show that several surface water systems (streams) across the study areas have excess water available that may be used for this project. Provisional data presented with the 2026 AWP update is detailed in Table 7. Additional excess water analysis locations reported from the 2014 AWP are found in Table 8. The limitations and details of the excess water estimates are provided in the 2014 AWP Appendix F – Draft Gap Analysis.

Table 7. 2026 Provisional AWP Data Surface Water Availability Analysis at Study Sites

River Location	Site Location ID	AWP 2014 Excess SW Yield (acre-ft per year)	AWP 2026 Excess SW Yield (acre-ft per year)*
Arkansas River at Murray Dam	Site 3	3,256,854	3,657,049
Ouachita River at State Line	Site 4	977,583	1,071,865
Cache River at Confluence	Site 5	160,881	169,568
Saline River above Millwood Lake	Site 7	38,743	35,685
Little River above Millwood Lake	Site 7	378,698	351,752
Little River at Confluence (below Millwood Lake)	Site 7	N/A	393,591
Red River at State Line	Site 7	1,139,715	1,272,811

*Provisional Information and Data; Subject to Change

Table 8. 2014 AWP Data Surface Water Availability Analysis at Study Sites

River System	Site Location ID	Calculated Excess Surface Water (acre-ft per year)
Flint Creek	Site 1	3,200
Illinois Bayou	Site 2	41,700
Arkansas River at Murray Dam	Site 3	3,256,900
Ouachita River	Site 4	1,026,600
Saline River (Ouachita River System)	Site 4	272,200
Cache River	Site 5	160,900
L'Anguille River	Site 5	90,800
Little River	Site 7	378,700
Red River	Site 7	1,221,700
Saline River (Red River System)	Site 7	38,700
St. Francis River	Sites 5 and 6	670,500

Through discussions with Excel, a constraining factor of this analysis was a maximum water usage of 23.3 acre-ft/day that would be considered a total loss and will not be recirculated with usage. It is assumed for this analysis that a consistent 23.3 acre-ft per day is used with a total yearly volume of 8,505 acre-ft of water is required per year. Excess surface water availability at all sites noted in tables above meet or exceed this threshold except for Flint Creek (Site 1) where additional water sources may be necessary to supplement water usage. It should be noted that surface water withdrawals in Arkansas remain subject to regulatory requirements, permitting considerations, and operational constraints that may affect the availability and allocation of water resources at each site.

4.0 Existing System and Source Characterization

The provisional 2026 Arkansas Water Plan provides a breakdown of water demand data based on five planning regions: North, East, South Central, Southwest, and West Central. Figure 7 and Appendix I show the regions used in the water plan.

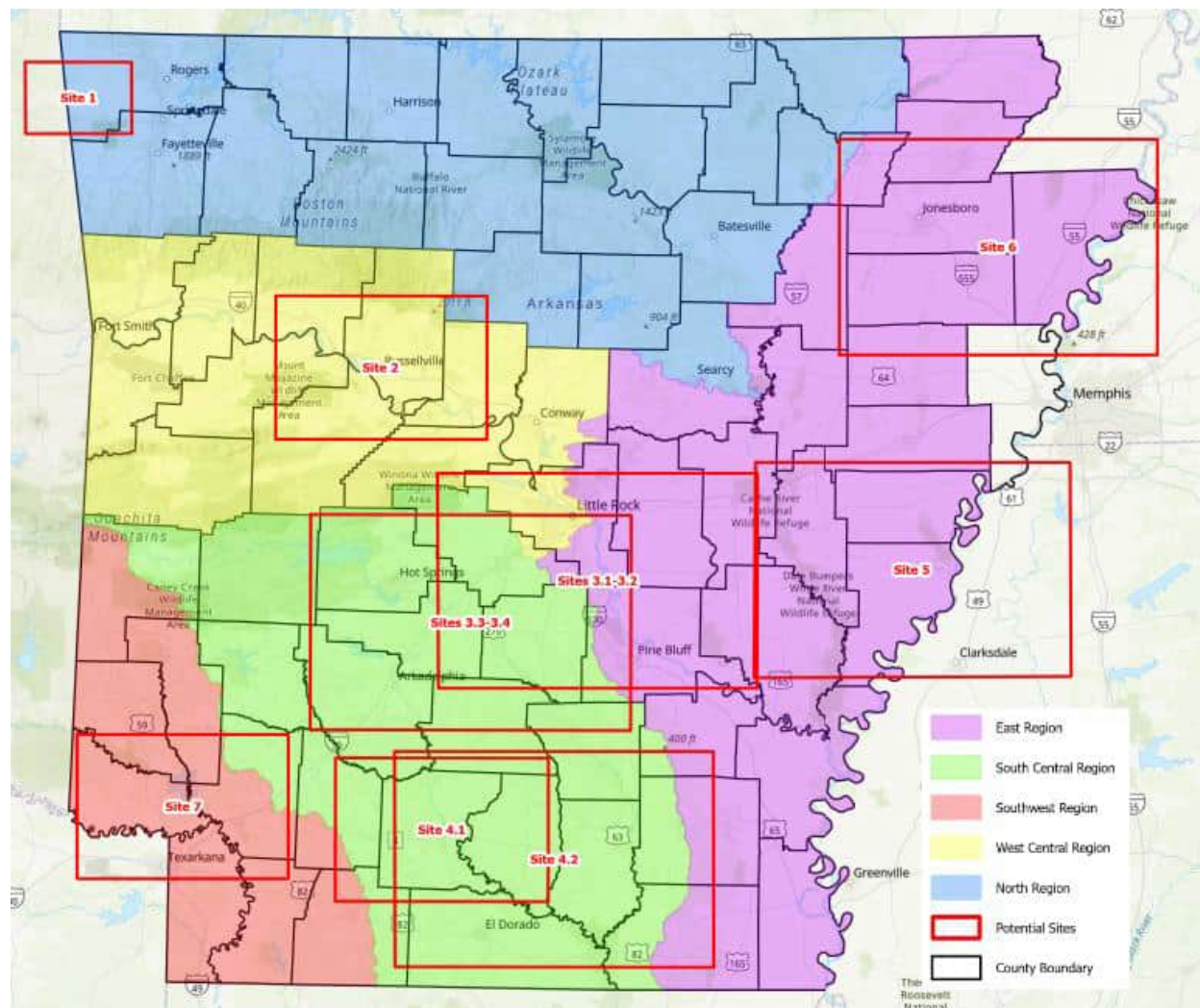


Figure 7. Arkansas Water Plan Regions

Within those five regions, the study looked at four main types of water demand and projected the demand of each region over the next 25 years into 2050. The four types of water demand analyzed were: municipal, thermoelectric, industrial, and agricultural. The following sections detail the findings and results presented in the Provisional 2026 Arkansas Water Plan.

4.1 AWP MUNICIPAL WATER DEMAND

Table 9 presents the current and projected municipal water demand for each region over the next 25 years.

Table 9. 2020-2050 Municipal Water Demands (Million Gallons per Day)

Region	2020	2030	2040	2050	30-Year % Change
North	97	114	130	149	54%
East	15	16	17	18	20%
South Central	21	21	22	22	5%
Southwest	22	22	23	24	10%
West Central	97	103	107	111	14%

The North and West Central regions have the largest municipal water demand of the five planning regions due to the presence of major population centers including Little Rock, Fayetteville, Bentonville, and Rogers. Both regions rely primarily on surface water supplies obtained from reservoirs within the region. The primary water supplier for central Arkansas (Little Rock) is Central Arkansas Water, which utilizes Lake Maumelle as the principal source of supply. In northwest Arkansas, municipal water is primarily supplied by Beaver Water District, which relies on Beaver Lake as its primary source.

4.2 AWP THERMOELECTRIC WATER DEMAND

Thermoelectric power generation refers to the production of electricity using heat energy to drive turbines and generators. Common thermoelectric systems include natural gas, coal fire, and nuclear power plants. These facilities require significant water demand to support cooling systems within the plant. Table 10 displays the current and projected water demand for thermoelectric facilities in the five study regions. The Southwest region is home to the SWEPCO Turk Coal Power Plant however projected use is minimal, with no usage data being presented in the Provisional 2026 Arkansas Water Plan data.

Table 10. 2020-2050 Thermoelectric Water Demands (Million Gallons per Day)

Region	2020	2030	2040	2050	30-Year % Change
North	252	272	320	361	43%
East	14	17	17	17	21%
South Central	40	41	57	61	53%
Southwest*	0	0	0	10	-
West Central	848	936	1076	1213	43%

* Limited projected use from the SWEPCO Turk Coal Plant

The largest thermoelectric power generation facilities in Arkansas are the Flint Creek Power Plant in the North region and Arkansas Nuclear One in the West Central region. The Flint Creek facility utilizes Lake Flint Creek as its primary water supply source, while Arkansas Nuclear One relies on the Illinois Bayou and Lake Dardanelle for cooling water and plant operations. Other smaller thermoelectric facilities are distributed throughout the state and contribute to the overall water demand; however, Flint Creek and Arkansas Nuclear One account for most of the thermoelectric water use in Arkansas.

4.3 AWP INDUSTRIAL WATER DEMAND

Data for current and project industrial water demands can be found in Table 11.

Table 11. 2020-2050 Industrial Water Demands (Million Gallons per Day)

Region	2020	2030	2040	2050	30-Year % Change
North	22	25	26	27	23%
East	58	63	70	77	33%
South Central	27	28	30	31	15%
Southwest	69	74	81	85	23%
West Central	39	43	48	53	36%

The East region's industrial demand is heavily influenced by the continued expansion of steel manufacturing facilities in northeast Arkansas, particularly in Mississippi County and surrounding areas. In the Southwest region, projected industrial demand is driven by the development and expansion of lithium extraction and processing operations. These operations often rely on a saltwater brine from the Smackover Formation.

Other users throughout the state include paper manufacturing in south Arkansas, timber and wood manufacturing throughout the state, and aluminum and other metal manufacturing facilities in central and eastern Arkansas. These estimates and projections also account for future demand from currently proposed data centers.

4.4 AWP AGRICULTURAL WATER DEMAND

The 2026 AWP did not provide 30-year projections for agricultural water, but it did provide historical agricultural usage dating back to 2008. Historical agricultural water usage data can be found in Table 12. The data provided in Table 12 was compiled using provisional estimates for poultry and are subject to inaccuracies since no final usages were available at the time of this study.

Agricultural water use in the five study regions is supplied by a combination of surface water and groundwater sources. Groundwater serves as the primary source of irrigation water in three of the regions while surface water is the main source in the remaining two regions. Table 13 presents historical average distribution of agricultural water use by source for each region.

Table 12. 2008-2023 Agricultural Water Usage (acre-ft)

Year	North	East	South Central	Southwest	West Central
2008	615,000	8,550,000	220,000	185,000	80,000
2009	625,000	7,490,000	180,000	165,000	80,000
2010	710,000	9,190,000	175,000	145,000	80,000
2011	705,000	7,500,000	205,000	160,000	80,000
2012	785,000	9,150,000	180,000	205,000	80,000
2013	605,000	9,140,000	165,000	140,000	80,000
2014	690,000	8,880,000	200,000	120,000	80,000
2015	590,000	8,210,000	320,000	-60,000	80,000
2016	795,000	9,640,000	200,000	160,000	225,000
2017	635,000	9,340,000	220,000	125,000	160,000
2018	725,000	9,565,000	245,000	160,000	225,000
2019	525,000	7,970,000	180,000	125,000	140,000
2020	565,000	8,780,000	225,000	60,000	140,000
2021	690,000	8,695,000	185,000	120,000	180,000
2022	670,000	8,550,000	200,000	125,000	200,000
2023	710,000	9,400,000	240,000	105,000	180,000

Table 13. Regional Agricultural Water Supply Sources (%)

Region	Surface Water	Groundwater
North	35	65
East	15	85
South Central	30	70
Southwest	55	45
West Central	60	40

5.0 Environmental and Regulatory Considerations

The following sections will provide a high-level planning overview of the potential regulatory requirements that may impact water usage and permitting for this project. The summary of each item is based upon data collected from state and federal agencies as well as discussions with state and federal personnel. This does not presume to provide timelines for completing permitting, costs associated, or the full scale of effort required to accomplish and complete these permitting items.

5.1 STATE WATER PERMITTING

5.1.1 Surface Water Use – Title 3: Rules for Utilization of Surface Water

Arkansas water rights are based on a regulated riparian system that blends traditional riparian principles with a dynamic supervisory, administrative, and legal structure. The baseline rule is that water rights are attached to the land adjacent to the water (riparian user) and that use should be reasonable and not unreasonably interfere with other users. If a riparian user withdraws one acre-feet or more of water per year, monthly uses must be reported to Arkansas Natural Resources Commission (ANRC). The use must occur on the parcel of land abutting to the water source.

Use of water on land that does not border the source or involves transfer away from the parcel is considered non-riparian. Non-riparian users do not have inherent rights to surface water. Non-riparian use must be permitted through the ANRC as a Non-Riparian Water Use Permit issued under Title III of the Rules for the Utilization of Surface Water. This permit authorizes use of excess surface water for activities on land. The department will determine that water used is considered excess water, the use is reasonable and beneficial, and that diversion of water will not cause significant adverse environmental impacts. Industrial processes for water use are classified as applicable and would require a permit.

As described in the above sections, the ANRD may authorize the transportation of excess surface water to non-riparian uses, where excess surface water is 25% of the amount of water available on an average annual basis from any watershed. Excess water calculations are annual averages and do not consider the seasonal variability in streamflow. In the case of low flow or drought conditions, the ANRD is within its authority to limit water withdrawals, allocate water among users and may prioritize certain uses. Details of the permitting process can be found at the Arkansas Natural Resources website [Non-Riparian Water-Use Certification Program - Arkansas Department of Agriculture](#).

A list of the applicable Surface Water Use Code is as follows:

- Registration of surface water withdrawals – Arkansas Code §15-22-215
- Minimum streamflows – Arkansas Code §15-22-222
- Surface water transfers to non-riparian users – Arkansas Code §15-22-304
- Regulation of dam construction – Arkansas Code §15-22-210 - 214
- Allocation during periods of water shortage - Arkansas Code §15-22-217

5.1.2 Groundwater Use – Title 4: Rules for the Protection and Management of Groundwater

Arkansas Water Code outlines the states' powers to regulate and monitor the use of groundwater in Arkansas. The Arkansas Water-Use Registration Program provides protections to the groundwater resources in the state. In accordance to state law, any non-domestic user of groundwater that has the potential to withdraw at least 50,000 gpd (35 gpm flow rate) must report monthly withdrawals. Non-agricultural groundwater users should complete a registration packet with the ANRD. Act 154 of the state requires a regulatory program and issuance of water rights for use in those areas deemed as Critical Areas only. Critical groundwater water areas are listed in Table 1 of this report. No withdraw of groundwater may occur from an existing well or construct a new well within the critical groundwater area without first obtaining a water right.

A list of the applicable Groundwater Use and Well Construction Code is as follows:

- Registration of groundwater withdrawals – Arkansas Code §15-22-302
- Groundwater protection program (Arkansas Groundwater Protection and Management Act)– Arkansas Code §15-22-901 et seq.
- Arkansas Water Well Construction Commission Rules and Regulations Arkansas Code §17-50-201 et seq.

5.1.3 Water Allocation During Shortages – Arkansas Code 15-22-217

Arkansas Water Code states that if a shortage of water in a stream or part of a stream exists to the extent that there is not sufficient water in the stream to meet the requirements of all water needs, the Arkansas Natural Resources Commission may allocate the available water from the stream among the uses of water affected by the shortage of water in a manner that each of the needs affected by the shortage of water may obtain an equitable portion of the available water. During shortages, the state may allocate water using priorities of essential needs (water supply) first with domestic and federal rights protected.

This assessment assumes that all water usage will be considered a loss and that no waters will be discharged back into the system. If water discharges are to occur, a review of applicable water quality

regulations will be required. Statewide water quality regulations are in line with federal Clean Water Act regulations.

5.2 FEDERAL WATER ALLOCATION STUDY

USACE reservoirs are owned and operated by the USACE. Many such reservoirs are noted in this report as potential water sources for this assessment. While the USACE does not have jurisdiction over the water, it does have contracting authority for storage volume in the reservoirs and users must enter into a water supply contract with USACE for use. All surface water withdrawals from a USACE reservoir are subject to registration and or permitting, as applicable. The following will provide a brief outline of the Conventional Water Supply Contract (waters within conversation pool) process. The following overview utilizes information provided by the USACE Little Rock for the 2014 Arkansas Water Plan Update as well as review of USACE Easements and Federal Code.

5.2.1 Conventional Water Supply Contract – 33 CFR Part 234

The Water Supply Act of 1958 is a U.S. federal law that established a policy framework for integrating water supply development into major federal water projects. 33 CFM Part 234 details the framework for USACE to execute its Civil Works mission in accordance with the Water Resources and Development Act of 2007. When there is a portion of the USACE managed conservation pool of a reservoir that is unallocated, an entity may make a request to USACE to make withdrawals from the unused portion through a reallocation request.

1. This process would be initiated by a written request to the USACE. A reallocation study and an EA would be required. These studies are carried out by the USACE (or by one of its contractors). Historically, studies have been conducted either 100% government funded or 50% cost share. There is a mechanism by which the requesting party can fully fund the studies. The permitting and contracting process typically takes a minimum of 3 years and up to 7 years. The process cannot begin until the reallocation request has been approved to proceed and the study is fully funded. The process timeline is dependent on the complexity of system and varies from reservoir to reservoir.
2. To complete the process, a Water Reallocation Study must be conducted and the report approved by the Assistant Secretary of the Army (ASA) for Civil Works. A reallocation study should include the following:
 - a. Identify and quantify the new use of the storage and name of the user
 - b. Impact evaluation to other project purposes and users
 - c. NEPA Documentation or EA with FONSI or Environmental Impact Statement
 - d. Determination of price to be charged to new user
 - e. Determination of appropriate compensation, if any to existing users.
3. A reallocation Action will consider the immediate need and will not be completed until a water supply agreement for those immediate needs is approved. This agreement can be approved at the District level up to the ASA. A new reallocation agreement must provide the states or other entities with financial incentives not available elsewhere and the use of existing storage in USACE facilities must be cheaper for the potential user than the construction of a new or additional facilities. Reallocation to water supply can include the permanent transfer of storage from authorized uses such as flood control, hydropower, or other conservation or sediment pools.
4. The user must also pay an annual operation and maintenance cost associated with this allocation in perpetuity.
5. Once contracted, an ongoing accounting of inflows, outflows, losses, and user withdrawals is made. An entity retains 100% of its allocation as long as the water surface is above the top of the conservation pool. When the water is below the top of the conservation pool, the contracted storage remaining for a given entity is computed based upon allocation agreements.

Per guidance provided by the USACE, it is estimated that a water allocation study will cost on the order of \$3 million and take a minimum of 3 years to complete. The above summary is considered a high level

overview and is not a detailed permitting process review. It is recommended that specific details of the water allocation agreement process should be taken directly from USACE permitting officials through formal discussions.

5.3 FEDERAL PERMITTING

Additional Federal permitting would be required for any construction and withdrawal projects throughout the study areas. The following sections will highlight three key regulations which would present a permitting challenge for all study sites. This permitting review is meant to present key challenges this project at a high level screen level and does not provide an in depth discussion of the permitting process.

5.3.1 Section 404 Clean Water Act

Section 404 of the Clean Water Act (CWA) regulates the discharge of dredged or fill materials into Waters of the United States (WOTUS) including wetlands. This is applicable to this assessment in that any construction of infrastructure, stream modification, or development that may impact jurisdictional waters or wetland areas. Permitting for Section 404 is managed through the USACE Division in which the project is located. The USACE will evaluate the project under EPA's Section 404(b)(1) guidelines which require that project avoid or minimize impacts to waters and provide compensation for mitigation.

5.3.2 Section 408 Rivers and Harbors Act

Section 408 of the Rivers and Harbors Act governs any modifications and activities that may impact USACE civil works projects such as levees, dams, floodwalls, channels and reservoirs. All activity must be permitted through USACE in separate from, but in conjunction with Section 404 permitting. This is applicable to this assessment as any infrastructure construction needed to pump water from USACE managed project (ex. Arkansas River or Lake Ouachita) may potentially impact navigation and performance. This requirement includes all encroachments, utility crossings, levee modifications, outfalls, or development near or within the USACE right of way/easement. This permitting often requires NEPA review and may require an Environmental Assessment (EA).

Section 408 permitting will also require a Drought Contingency Plan (DCP). This study is required when reservoir storage levels, stream flows or demand thresholds may be impacted by the action. Actions that may trigger the necessity of a DCP include, but are not limited to, new intakes, pump stations, channel modifications or levee penetrations. DCPs should be developed in conjunction with other requirements and in close coordination with the USACE. They are a necessity for USACE projects to remain resilient during low flow and drought conditions.

5.3.3 Section 10 of Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act regulates development and structures in and around navigable waters of the United States. Any activity including, but not limited to, infrastructure construction (piers, bridges, pipelines, transmission lines) dredging, excavation or channel modification in, over, or under a navigable water of the US would fall under this regulation. This act aims to prevent actions from interfering with navigation and compromising public use of waterways. An example of a navigable waterway in Arkansas would be the Arkansas River in which a navigable channel is maintained along the MKARNS system. Other navigable waterways have been identified in the study locations. USACE will review the impacts of the proposed action and permitting will be completed in conjunction with Section 404 and 408 permitting.

5.3.4 Additional Applicable Federal Laws and Responsible Agencies

The following table (Table 14) is a list of additional federal laws and their corresponding federal agency which may be applicable to this project and is included for informational purposes. This list should not be considered a comprehensive list and additional detailed review of all applicable laws and regulations should be completed.

Table 14. Federal Law and Corresponding Federal Agency

Federal Law	Responsible Federal Agency
Clean Water Act	USACE
Safe Drinking Water Act	EPA
Endangered Species Act	USFWS
Soil and Water Resources Conservation Act	USDA
National Environmental Policy Act	EPA, Council on Environmental Quality
Flood Control Act/ Water Resources Development Act	USACE
Arkansas Wilderness Act/National Forest Management Act	USDA Forest Service
Rivers and Harbors Act	USACE
Migratory Bird Hunting and Conservation Stamp Act	USFWS
Emergency Wetlands Resources Act	USFWS
Dam Safety and Security Act	FEMA
National Parks Acts	USDI - National Parks Service
Migratory Bird Conservation Act	Migratory Bird Conservation Commission
National Wildlife Refuge System Improvement Act	USFWS
National Flood Insurance Act	FEMA

5.3.5 Arkansas River and Red River Compact

The Arkansas River Compact of 1970 is an interstate compact providing an equitable apportionment of the water of the Arkansas River between the State of Arkansas and Oklahoma. It provides an entity for the administration of the water apportionment agreed to by the states concerned, describes which state may use specific waters, and promotes the orderly development of the river ([ANRD](#)). The apportionment of the waters of the Arkansas River basin is defined in Article IV of the compact. Each state has the right to develop and use water of apportioned basins with limitations to the annual yield, as defined by the compact and shall not deplete beyond those percentages. The annual yield of the interstate compact areas is determined by December 31st of each year and flows are calculated on an annual basis as outlined in the annual Arkansas Compact Commission report.

Arkansas has also entered into the Red River Compact with the states of Oklahoma, Texas, and Louisiana. The purpose of the Red River Compact is to promote interstate comity and remove causes of controversy between each of the affected state by governing use, control, and distribution of the interstate water of the Red River and its tributaries. The compact also serves as a joint planning action by identifying and providing an equitable apportionment of water among the compact states. The compact provides an active program for water conservation, protection of lives and property from floods,

improvement of water quality, and development of navigation and regulation of flows in the Red River basin.

6.0 Alternative Screening

Using the data collected during this assessment study, a screening matrix was developed to provide a consistent and comparable evaluation of each site and associated water source. The matrix looks at key criteria related to surface water availability, groundwater conditions, and general site feasibility. Each site and source was evaluated based on 13 indicators, 5 for surface water, 4 for groundwater, and 4 for general site feasibility.

Surface water screening criteria include:

- Has excess surface water been identified?
 - Has excess surface water been estimated and established by the ANRD?
- Do average streamflows meet water demand?
 - Average streamflows based on gaged data.
- Could this site be a riparian source?
 - Do current land development conditions support property purchase abutting the water source thus meeting the requirement of a riparian user?
- Could this site be a non-riparian source?
 - Do current land development conditions not support property purchased abutting the water source thus making it a non-riparian user? Water withdrawals would need to be transported to final project site via pipeline.
- Is this source being used as a supply for another entity?

Groundwater screening criteria include:

- Which groundwater source is available?
- What are the groundwater level trends?
 - Are historical water levels trending upwards or downwards?
- Is there a projected groundwater gap?
 - Does the 2014 MERAS study report a gap in demand vs. available groundwater?
- Is the site located in an identified Critical Groundwater Area?
 - Have any counties within the sites been designated as Critical Groundwater Area by ANRD?

General site assessment screening criteria includes:

- Is the site located within 10 miles of an identified transmission point location?
 - Identified transmission points as noted in the supplied transmission screening report.
- Would further transmission analysis be needed?
 - Would further analysis of unlisted transmission points and capacity be needed?
- Will a detailed study be required for water withdrawals?
 - If the surface water source is a federally managed (USACE) reservoir or navigable waterway, then a detailed study must be completed. For reservoirs, this may include a reallocation request to USACE and a reallocation study. For navigable waterways this would include detailed analysis to meet Section 10 and Section 408 of the Rivers and Harbors Act.
 - A detailed study may be required for non-navigable waterways.
- Will a federal drought contingency plan be required?
 - A drought contingency plan will be required for all surface water sources. Any federally managed sources will require a drought contingency plan through the permitting process.

The full screening matrix can be found in Table 15 and in Appendix J. The screening matrix is intended as a planning-level tool to support relative comparison between alternatives rather than provide a final determination of feasibility.

7.0 Conclusions

This water availability study evaluated 11 potential project sites across five regions of Arkansas to assess the availability of surface water and groundwater resources capable of supporting a planning level demand of approximately 23.3 acre-ft per day. The analysis incorporated data from the 2014 and provisional 2026 Arkansas Water Plans, USGS stream and aquifer information, and USACE reservoir and navigation system records. Overall, surface water resources across the state are generally abundant, particularly within major regulated river systems and USACE managed reservoirs. Several systems consistently show significant excess annual yield though surface water availability is influenced by navigation requirements, existing allocations, and permitting constraints. Smaller tributary systems exhibit greater variability and reduced reliability due to seasonal, precipitation-driven streamflow.

Groundwater conditions vary significantly by aquifer system. The Mississippi River Valler Alluvial Aquifer remains the most productive groundwater source in Arkansas but shows long term declines in water levels. The Sparta and Cockfield aquifers provide important regional supply but are subject to documented declines and regulatory restrictions in designated critical groundwater areas. Aquifers in northwest Arkansas exhibit relatively low yields and limited reliability compared to aquifers in eastern Arkansas. Across all systems, groundwater is viewed as a supplemental source rather than a primary source for large-scale water demand.

Considering both surface and groundwater conditions, most study sites have access to at least one viable water source with sufficient capacity to meet the planning-level demands; however, feasibility is ultimately governed by the interplay of hydrologic availability, existing water use commitments, long-term sustainability trends, and regulatory requirements at both the state and federal levels. Generally speaking, sites with excess surface water available show the greatest potential for use of this project when considering the water use constraint of 23.3 acre-ft per day. Additional considerations should be given to locations that can support both surface and groundwater sources as well as limited transport of water.

An implementation roadmap was prepared to provide an overview of the steps to move forward with this development with regards to site and water source selection. The roadmap can be found in Appendix K. Advancement of potential water supply development should proceed through phased evaluations beginning with regional screening and continuing with preliminary site selection, detailed site assessments, and permitting efforts to finalize the site selection. Upon initial preliminary site selection, the detailed assessment and permitting process should begin simultaneously. Permitting through local programs up through federal programs is anticipated to take between 3 to 7 years. It is recommended that this process begin as early as possible and that frequent communication occur between the entity requesting the project and regulating authorities. Additional detailed analyses such as water allocation studies, geotechnical and seismic evaluations, environmental assessments, and drought contingency planning can be ongoing throughout the permitting process and should be completed in conjunction with the regulating authorities to ensure that appropriate analysis is completed for evaluation. Lastly, stakeholder engagement and risk management should be conducted through the entirety of the project roadmap and should include public outreach, hazard mitigation planning and risk communications.

Table 15. Screening Matrix

	Site 1		Site 2	
Water Source:	Flint Creek	Lake Flint Creek	Illinois Bayou	Lake Dardanelle
Surface Water Availability				
Has excess surface water been identified for this stream/river?	No	n/a	Yes	n/a
Do average streamflows meet water demand?	Yes	n/a	Yes	n/a
Could this site be a riparian source?	No	n/a	Yes	Yes
Could this site be a non-riparian source?	Yes	n/a	Yes	Yes
Is this source being used as a supply for another entity?	No	Yes	Yes	Yes
Groundwater Availability				
Which groundwater source is available?	Springfield Plateau		Western Interior Plains Confining System	
What are the groundwater level trends?	n/a		n/a	
Is there a projected groundwater demand gap?	No		No	
Is the site located in an identified Critical Groundwater Area?	No		No	
General Site Assessment				
Is the site located within 10 miles of an identified transmission point location?	Yes	Yes	Yes	Yes
Would further transmission analysis be needed?	No	No	No	No
Will a detailed study be required for water withdrawals?	Yes	Yes	Yes	Yes
Will a Federal Drought Contingency Plan be required?	Yes	Yes	Yes	Yes

Table 15. Screening Matrix (Continued)

	Site 3				
Water Source:	Arkansas River	Lake Ouachita	Lake DeGray	Lake Maumelle	Lost Creek
Surface Water Availability					
Has excess surface water been identified for this stream/river?	Yes	n/a	n/a	n/a	No
Do average streamflows meet water demand?	Yes	n/a	n/a	n/a	n/a
Could this site be a riparian source?	Yes	No	No	No	Yes
Could this site be a non-riparian source?	Yes	Yes	Yes	Yes	Yes
Is this source being used as a supply for another entity?	Yes	Yes	Yes	Yes	No
Groundwater Availability					
Which groundwater source is available?	Mississippi River Alluvial Plain				
What are the groundwater level trends?	Decreasing				
Is there a projected groundwater demand gap?	Yes				
Is the site located in an identified Critical Groundwater Area?	Yes				
General Site Assessment					
Is the site located within 10 miles of an identified transmission point location?	No	No	No	No	Yes
Would further transmission analysis be needed?	Yes	Yes	Yes	Yes	No
Will a detailed study be required for water withdrawals?	Yes	Yes	Yes	Yes	Yes
Will a Federal Drought Contingency Plan be required?	Yes	Yes	Yes	Yes	Yes

Table 15. Screening Matrix (Continued)

	Site 4		Site 5		
Water Source:	Ouachita River	Saline River	St. Francis River	L'Anguille River	Cache River
Surface Water Availability					
Has excess surface water been identified for this stream/river?	Yes	Yes	Yes	Yes	Yes
Do average streamflows meet water demand?	Yes	Yes	Yes	Yes	Yes
Could this site be a riparian source?	Yes	Yes	No	No	Yes
Could this site be a non-riparian source?	Yes	Yes	Yes	Yes	Yes
Is this source being used as a supply for another entity?	Yes	Yes	Yes	Yes	Yes
Groundwater Availability					
Which groundwater source is available?	Mississippi River Alluvial Plain		Mississippi River Alluvial Plain		
What are the groundwater level trends?	Decreasing		Decreasing		
Is there a projected groundwater demand gap?	Yes		Yes		
Is the site located in an identified Critical Groundwater Area?	No		Yes		
General Site Assessment					
Is the site located within 10 miles of an identified transmission point location?	Yes	No	No	No	No
Would further transmission analysis be needed?	No	Yes	Yes	Yes	Yes
Will a detailed study be required for water withdrawals?	Yes	Yes	Yes	Yes	Yes
Will a Federal Drought Contingency Plan be required?	Yes	Yes	Yes	Yes	Yes

Table 15. Screening Matrix (Continued)

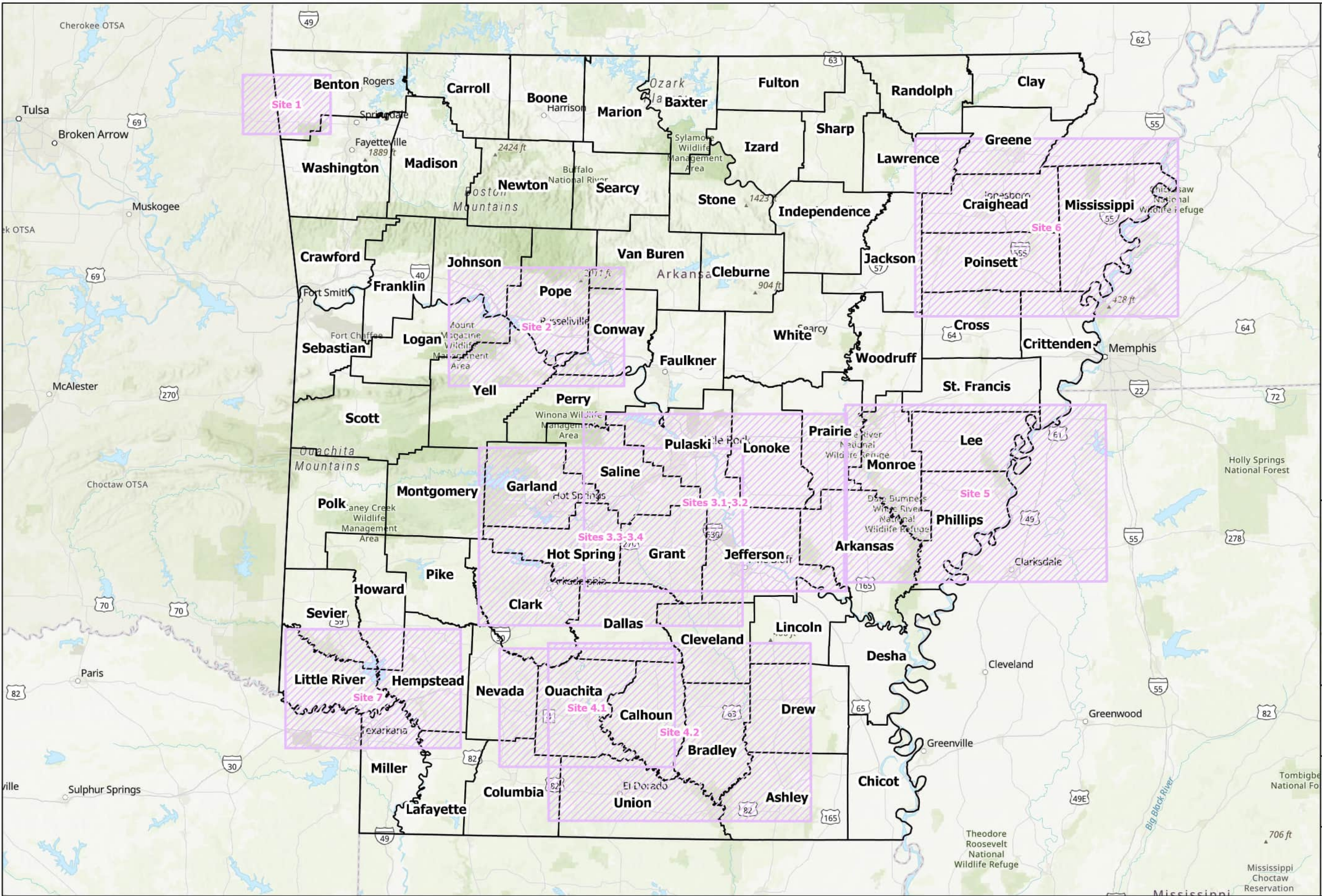
	Site 5	Site 6	Site 7		
Water Source:	Big Creek	St. Francis River	Little River	Red River	Millwood Lake
Surface Water Availability					
Has excess surface water been identified for this stream/river?	No	Yes	Yes	Yes	No
Do average streamflows meet water demand?	Yes	Yes	Yes	Yes	n/a
Could this site be a riparian source?	Yes	No	Yes	Yes	Yes
Could this site be a non-riparian source?	Yes	Yes	Yes	Yes	Yes
Is this source being used as a supply for another entity?	Yes	Yes	Yes	Yes	Yes
Groundwater Availability					
Which groundwater source is available?	Mississippi River Alluvial Plain	Mississippi River Alluvial Plain	Red River Alluvial Aquifer		
What are the groundwater level trends?	Decreasing	Decreasing	Decreasing		
Is there a projected groundwater demand gap?	Yes	Yes	Yes		
Is the site located in an identified Critical Groundwater Area?	Yes	Yes	No		
General Site Assessment					
Is the site located within 10 miles of an identified transmission point location?	No	No	No	No	No
Would further transmission analysis be needed?	Yes	Yes	Yes	Yes	Yes
Will a detailed study be required for water withdrawals?	Yes	Yes	Yes	Yes	Yes
Will a Federal Drought Contingency Plan be required?	Yes	Yes	Yes	Yes	Yes

8.0 References

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APPENDIX A

Site Location Overview



Potential Sites

County Boundary

Panel 1 of 1

Datum: NAD 1983
Vertical Datum: NADV 1988
Projection: Arkansas State Plane North Feet
FIPS 0301

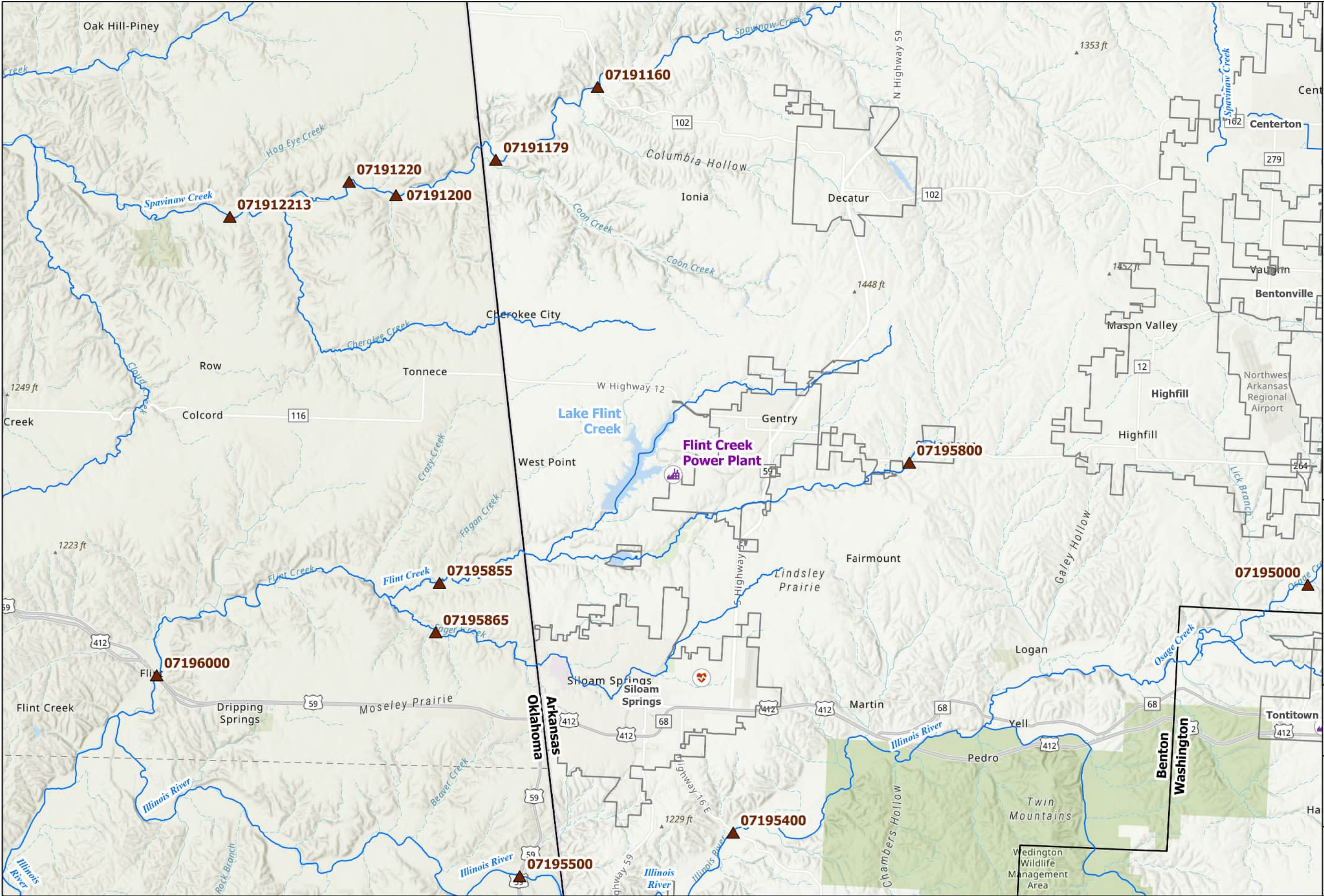
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APPENDIX B

Basemaps



Hospitals

Power Plants

USGS Gages

Streamlines

County Boundary

City Boundaries

Lakes and Reservoirs

State Boundaries

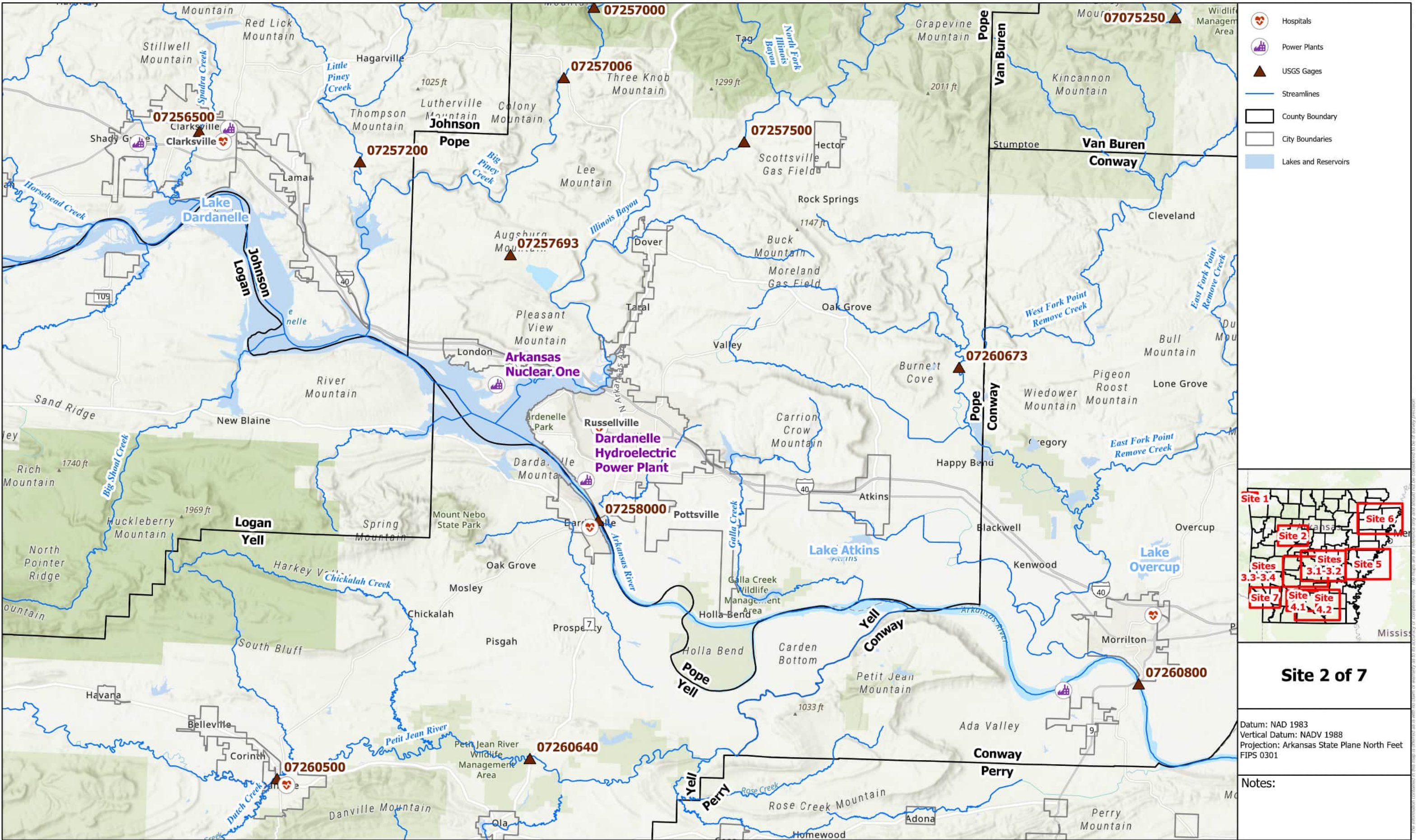
Site 1 of 7

Datum: NAD 1983
Vertical Datum: NADV 1988
Projection: Arkansas State Plane North Feet
FIPS 0301

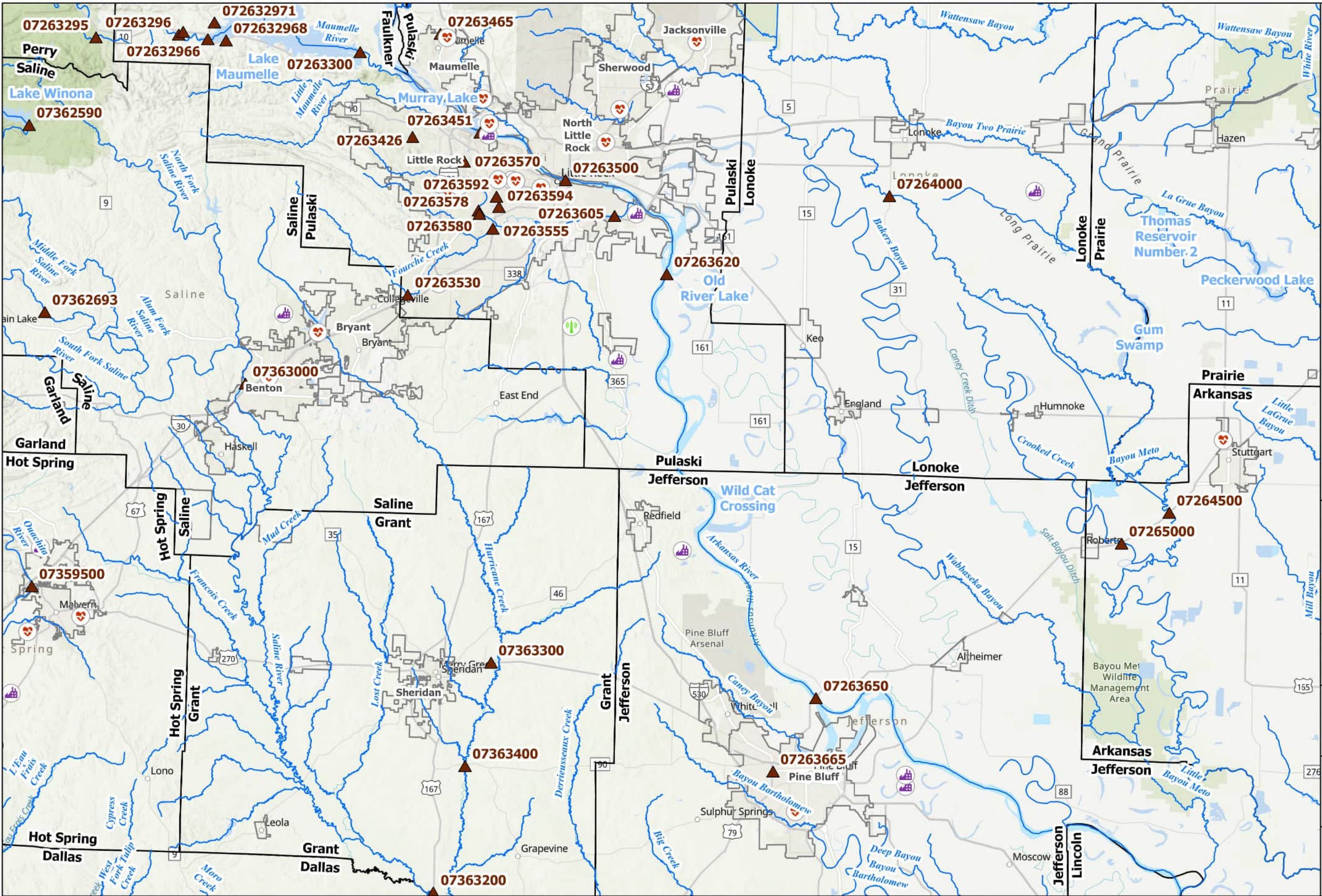
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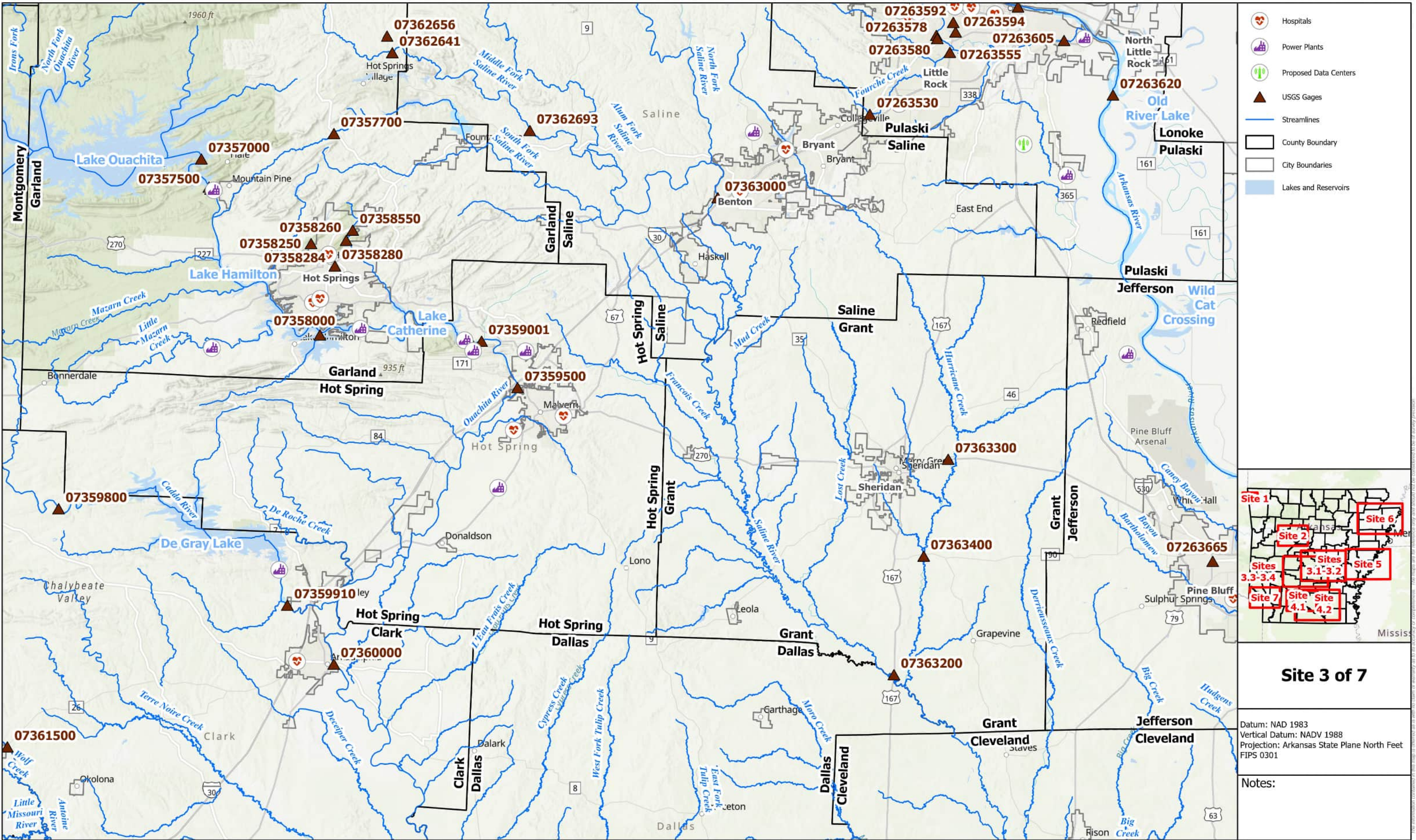
- Hospitals
- Power Plants
- Proposed Data Centers
- USGS Gages
- Streamlines
- County Boundary
- City Boundaries
- Lakes and Reservoirs

Site 3 of 7

Datum: NAD 1983
Vertical Datum: NADV 1988
Projection: Arkansas State Plane North Feet
FIPS 0301

Notes:

Printing Date: 5/27/2026 4:23 PM
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- Hospitals
- Power Plants
- Proposed Data Centers
- USGS Gages
- Streamlines
- County Boundary
- City Boundaries
- Lakes and Reservoirs



Site 3 of 7

Datum: NAD 1983
Vertical Datum: NADV 1988
Projection: Arkansas State Plane North Feet
FIPS 0301

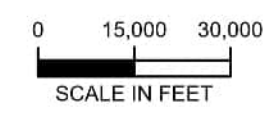
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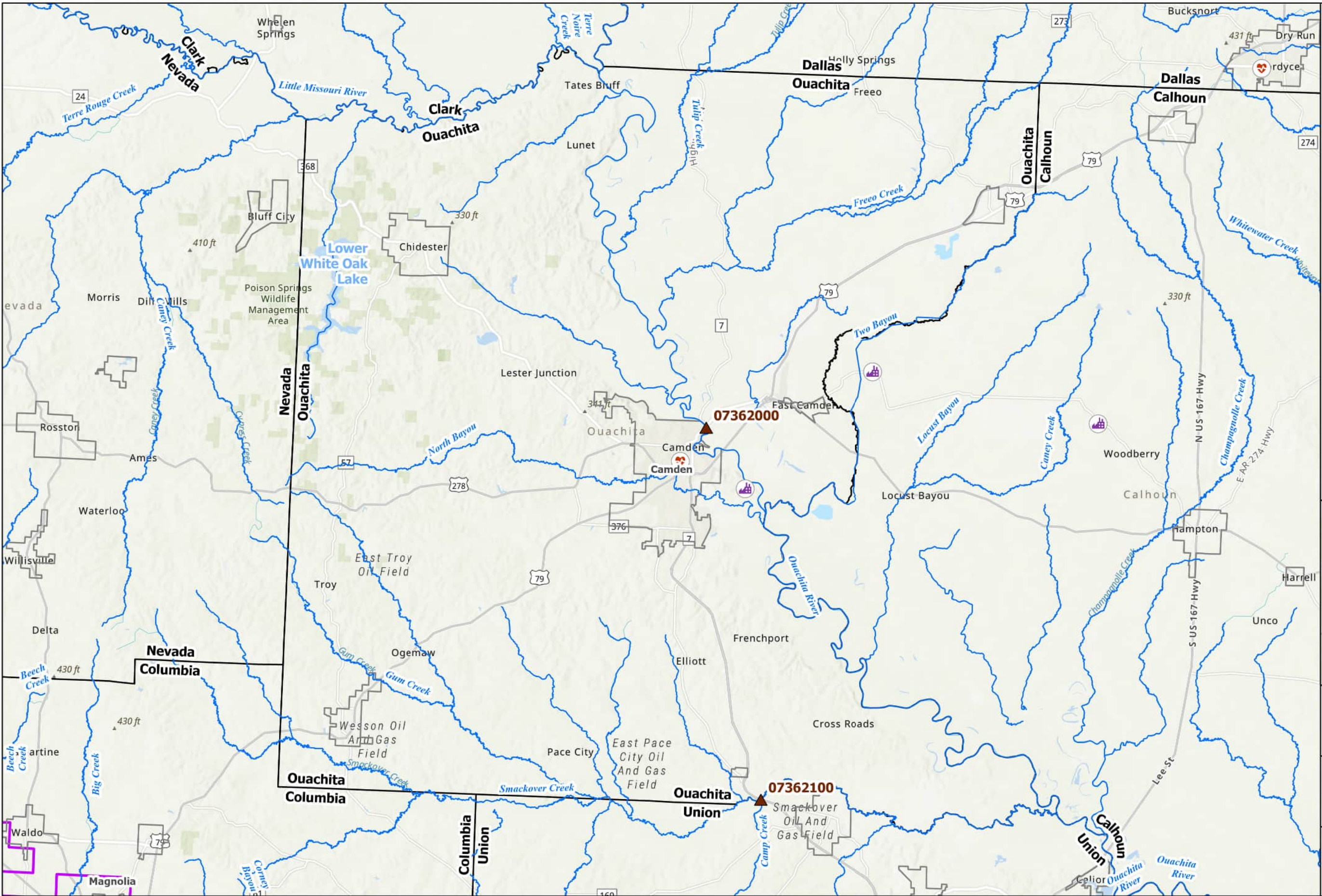
10800 Financial Centre Pkwy
Suite 500
Little Rock, Arkansas 72211



Site 3.3-3.4: Central Arkansas



64420.001
Industrial Water Availability Planning
149



Hospitals

Power Plants

USGS Gages

Streamlines

County Boundary

City Boundaries

Lithium Leases

Lakes and Reservoirs

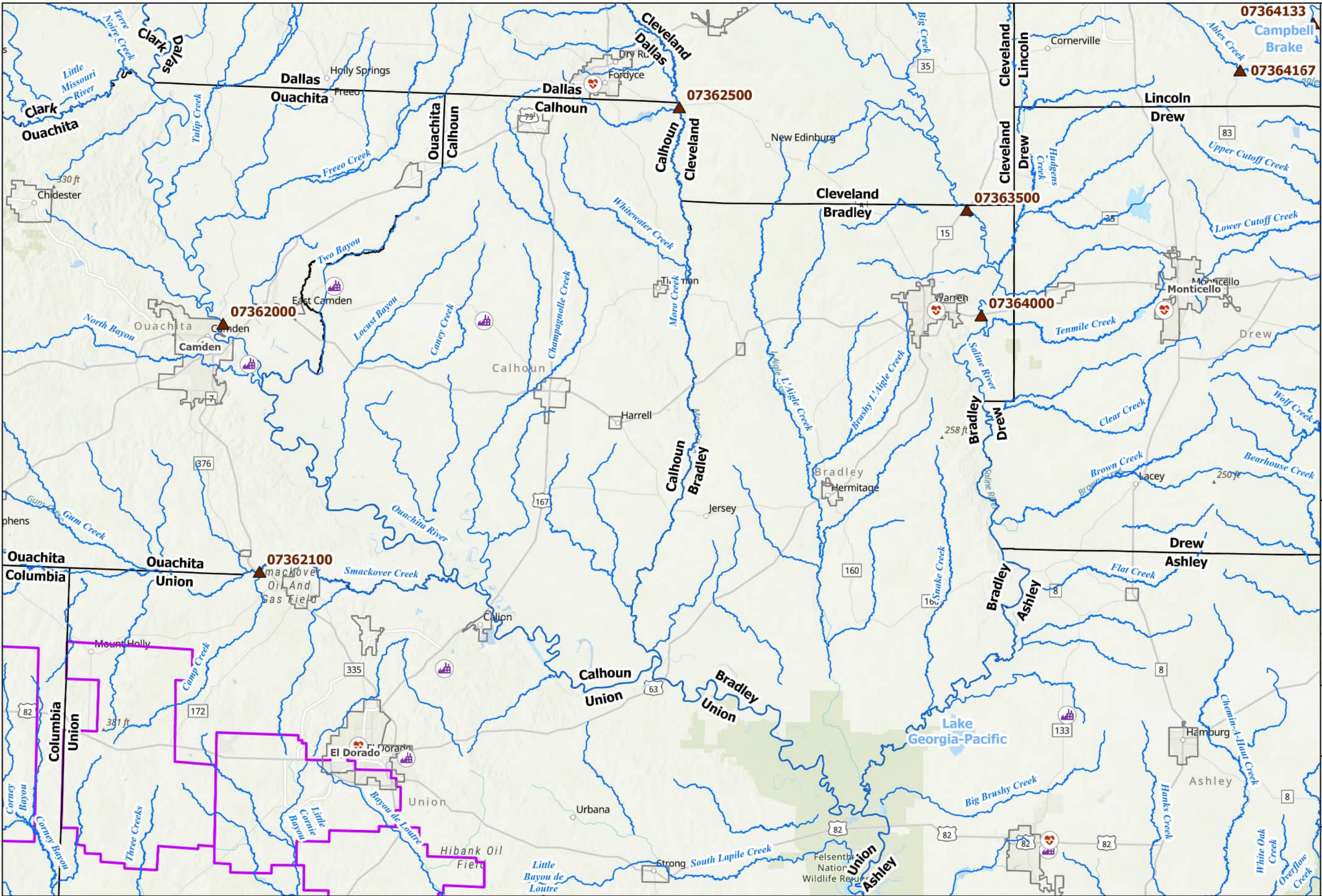
Site 4 of 7

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Projection: Arkansas State Plane North Feet
FIPS 0301

Notes:

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- Hospitals
- Power Plants
- USGS Gages
- Streamlines
- County Boundary
- City Boundaries
- Lithium Leases
- Lakes and Reservoirs
- State Boundaries

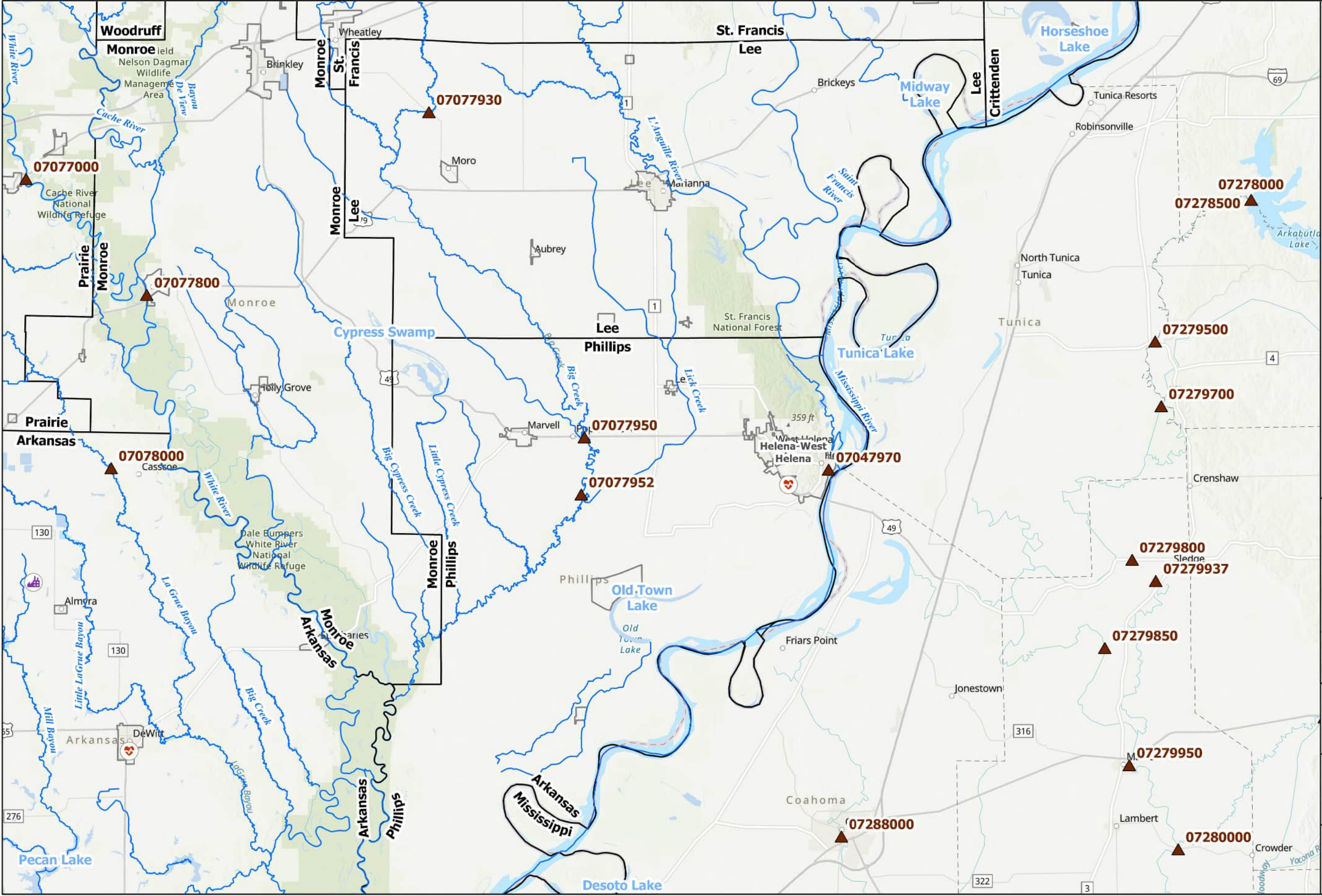


Site 4 of 7

Datum: NAD 1983
Vertical Datum: NADV 1988
Projection: Arkansas State Plane North Feet
FIPS 0301

Notes:

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- Hospitals
- Power Plants
- USGS Gages
- Streamlines
- County Boundary
- City Boundaries
- Lakes and Reservoirs
- State Boundaries

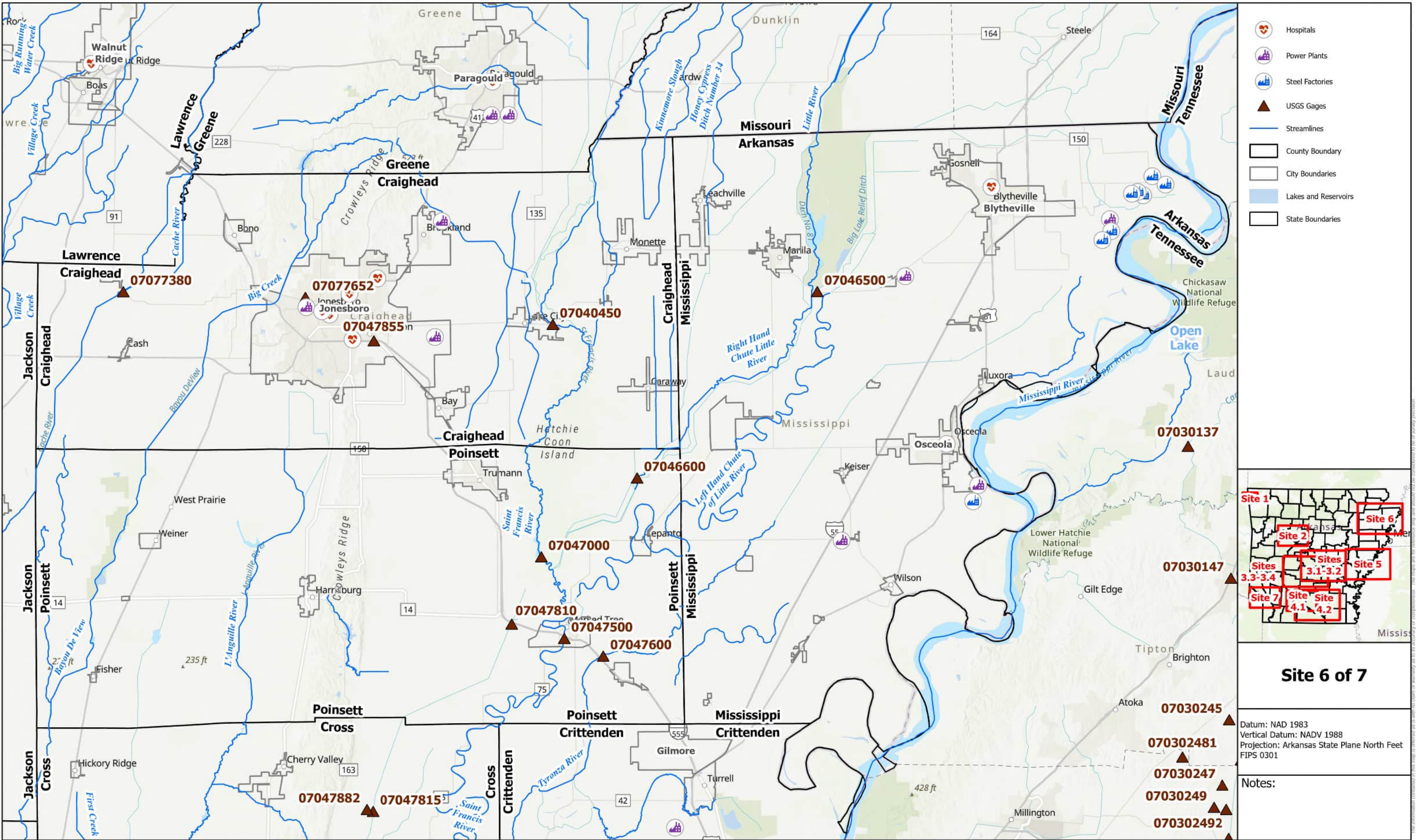


Site 5 of 7

Datum: NAD 1983
Vertical Datum: NADV 1988
Projection: Arkansas State Plane North Feet
FIPS 0301

Notes:

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- Hospitals
- Power Plants
- Steel Factories
- USGS Gages
- Streamlines
- County Boundary
- City Boundaries
- Lakes and Reservoirs
- State Boundaries



Site 6 of 7

Datum: NAD 1983
Vertical Datum: NADV 1988
Projection: Arkansas State Plane North Feet
FIPS 0301

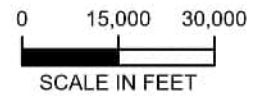
Notes:



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Suite 500
Little Rock, Arkansas 72211



Site 6: Northeast Arkansas



64420.001
Industrial Water Availability Planning



- Hospitals
- Power Plants
- USGS Gages
- Streamlines
- County Boundary
- City Boundaries
- Lakes and Reservoirs

Site 7 of 7

Datum: NAD 1983
Vertical Datum: NADV 1988
Projection: Arkansas State Plane North Feet
FIPS 0301

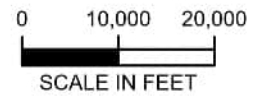
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Suite 500
Little Rock, Arkansas 72211



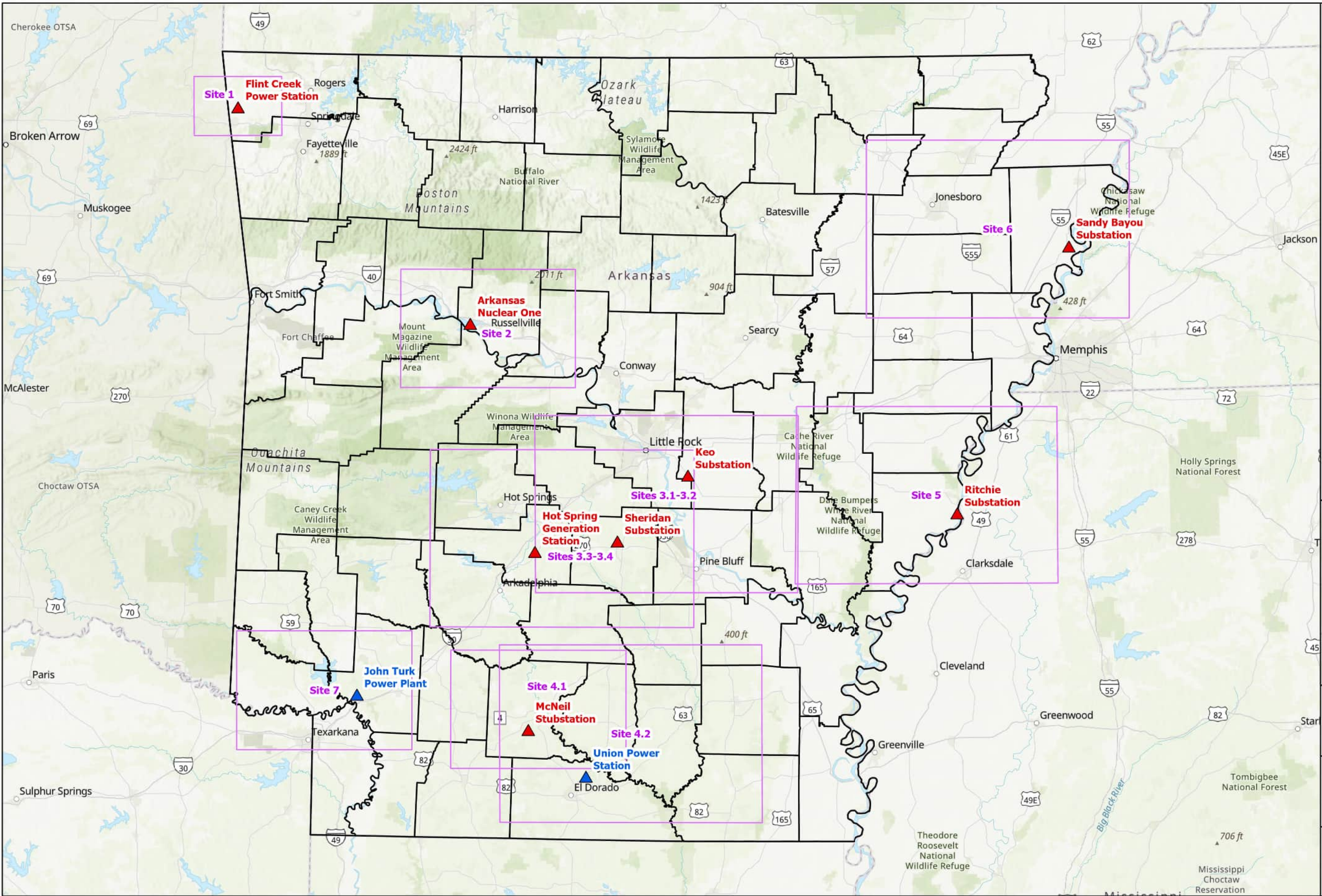
Site 7: Millwood Lake



64420.001
Industrial Water Availability Planning

APPENDIX C

Transmission Station Locations



▲ Verified Transmission Stations

▲ Potential Transmission Stations

□ Potential Sites

□ County Boundary

Panel 1 of 1

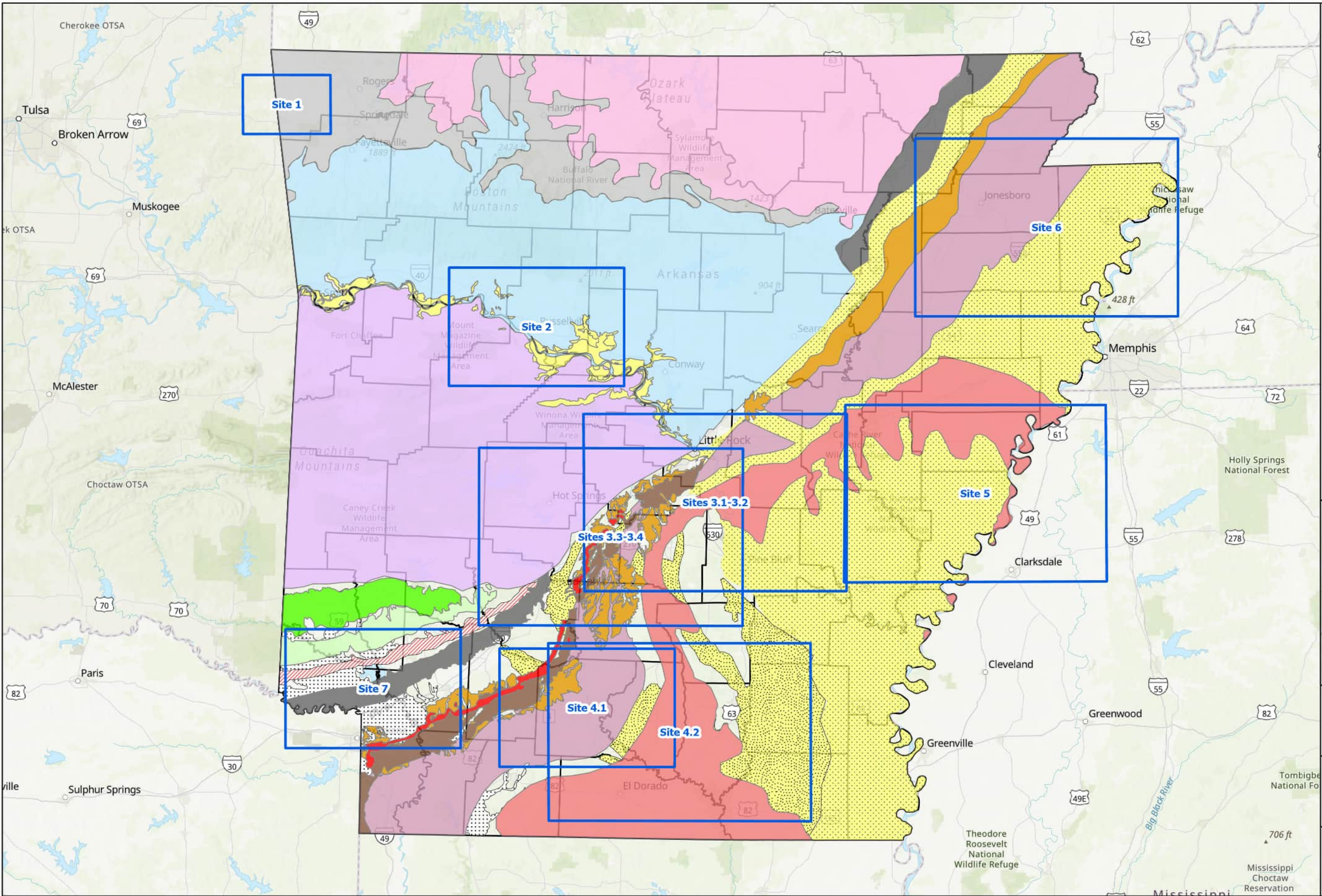
Datum: NAD 1983
Vertical Datum: NADV 1988
Projection: Arkansas State Plane North Feet
FIPS 0301

Notes: Verified Transmission Stations have been studied and are verified to have adequate power capacity. Potential Transmission Stations have not been studied and their capacities are unknown.

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APPENDIX D

Arkansas Aquifers Map



Carrizo Aquifer

Cane River Aquifer

Wilcox Aquifer

Sparta Aquifer

Cockfield Aquifer

Nacatoch Aquifer

Ozan Aquifer

Tokio Aquifer

Trinity Aquifer

Ouachita Saline River Alluvial Aquifer

Red River Alluvial Aquifer

Mississippi River Alluvial Plain

Arkansas River Alluvial Aquifer

Ozark Aquifer

Springfield Plateau Aquifer

Western Interior Plains Confining System

Ouachita Mountain Aquifer System

Potential Sites

County Boundary

Site 1

Site 2

Sites 3.1-3.2

Sites 3.3-3.4

Site 4.1

Site 4.2

Site 5

Site 6

Site 7

Mississippi

Panel 1 of 1

Datum: NAD 1983

Vertical Datum: NADV 1988

Projection: Arkansas State Plane North Feet

FIPS 0301

Notes:

Printing Date: 5/27/2026 4:27 PM
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APPENDIX E

Groundwater Availability Trends

Alluvial Aquifer 5 Year Change 2019 - 2024

**Alluvial Aquifer
5 Year Change:**

**Average Change: -1.28 Ft.
83 of 131 Wells Showed
Declines**

**Percent of Total Wells in
Decline: 63.36%**

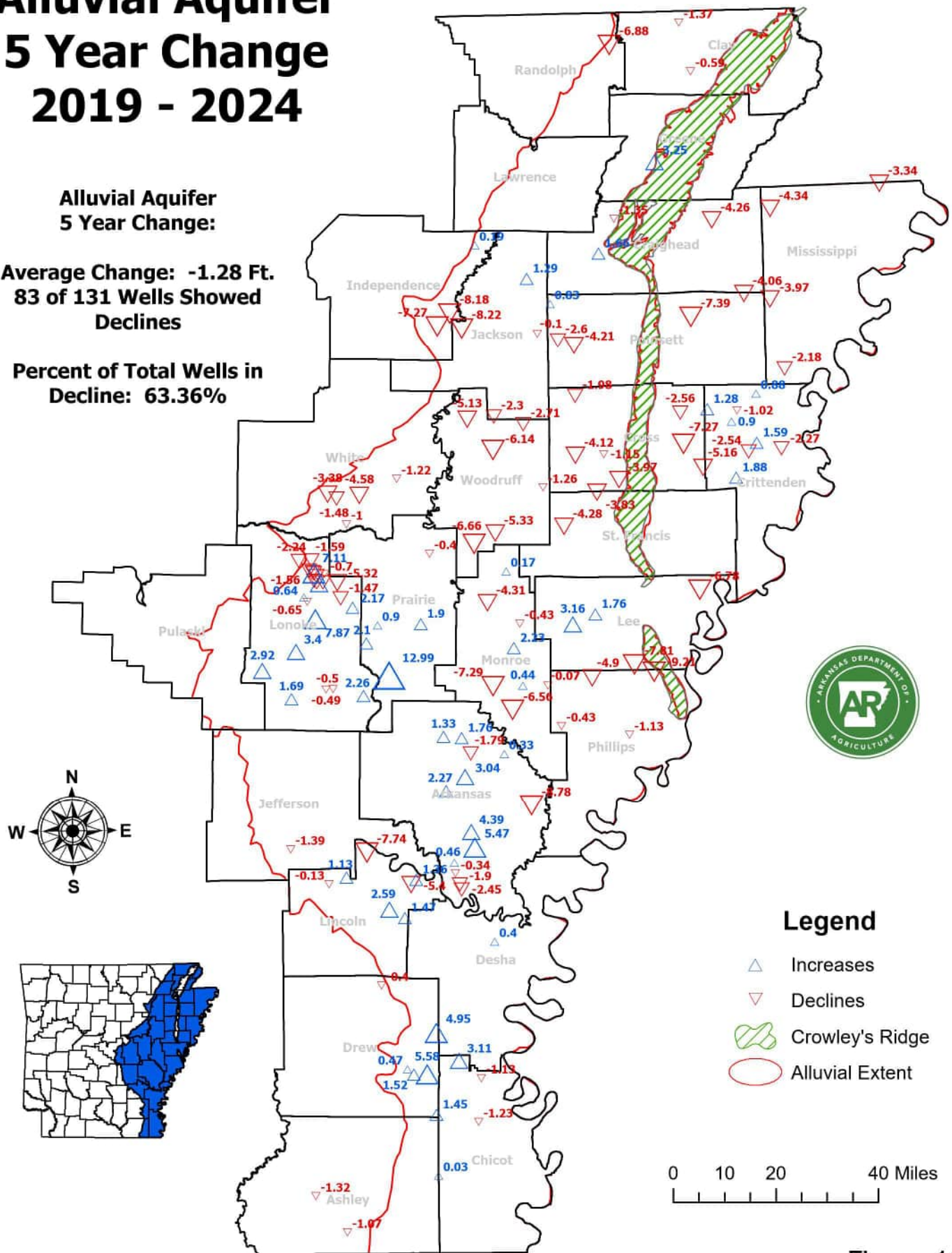


Figure 10

Alluvial Aquifer 2019-2024 Water Level Change (Cache)

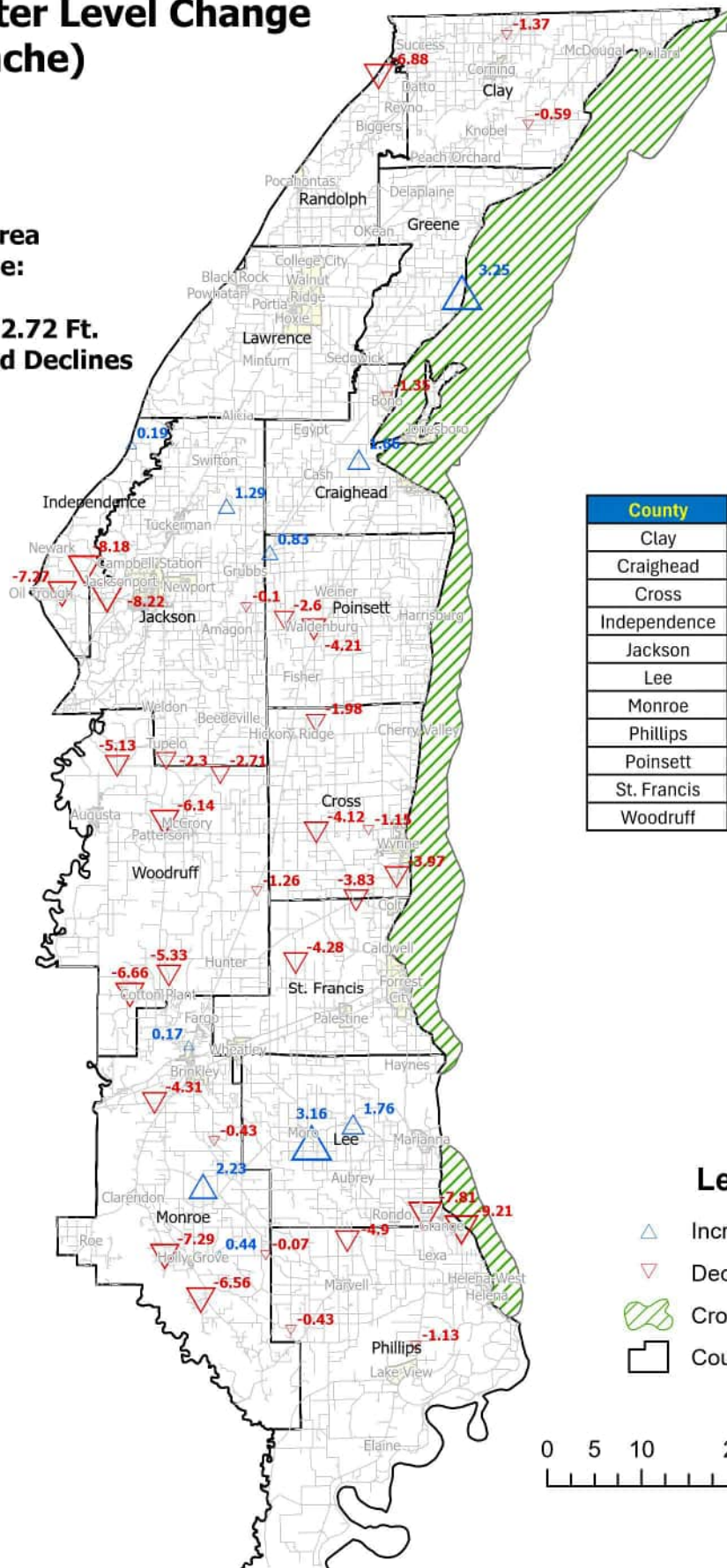
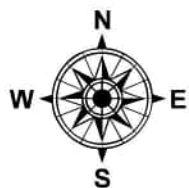


**Cache Study Area
5 Year Change:**

**Average Change: -2.72 Ft.
33 of 43 Wells Showed Declines**



County	Avg. Change, Ft.
Clay	-0.98
Craighead	+0.16
Cross	-2.81
Independence	-5.09
Jackson	-2.33
Lee	-0.96
Monroe	-1.98
Phillips	-3.92
Poinsett	-1.99
St. Francis	-4.06
Woodruff	-4.54



Legend

- ▲ Increases
- ▼ Declines
- ▨ Crowley's Ridge
- County Boundaries

0 5 10 20 Miles

Figure 15

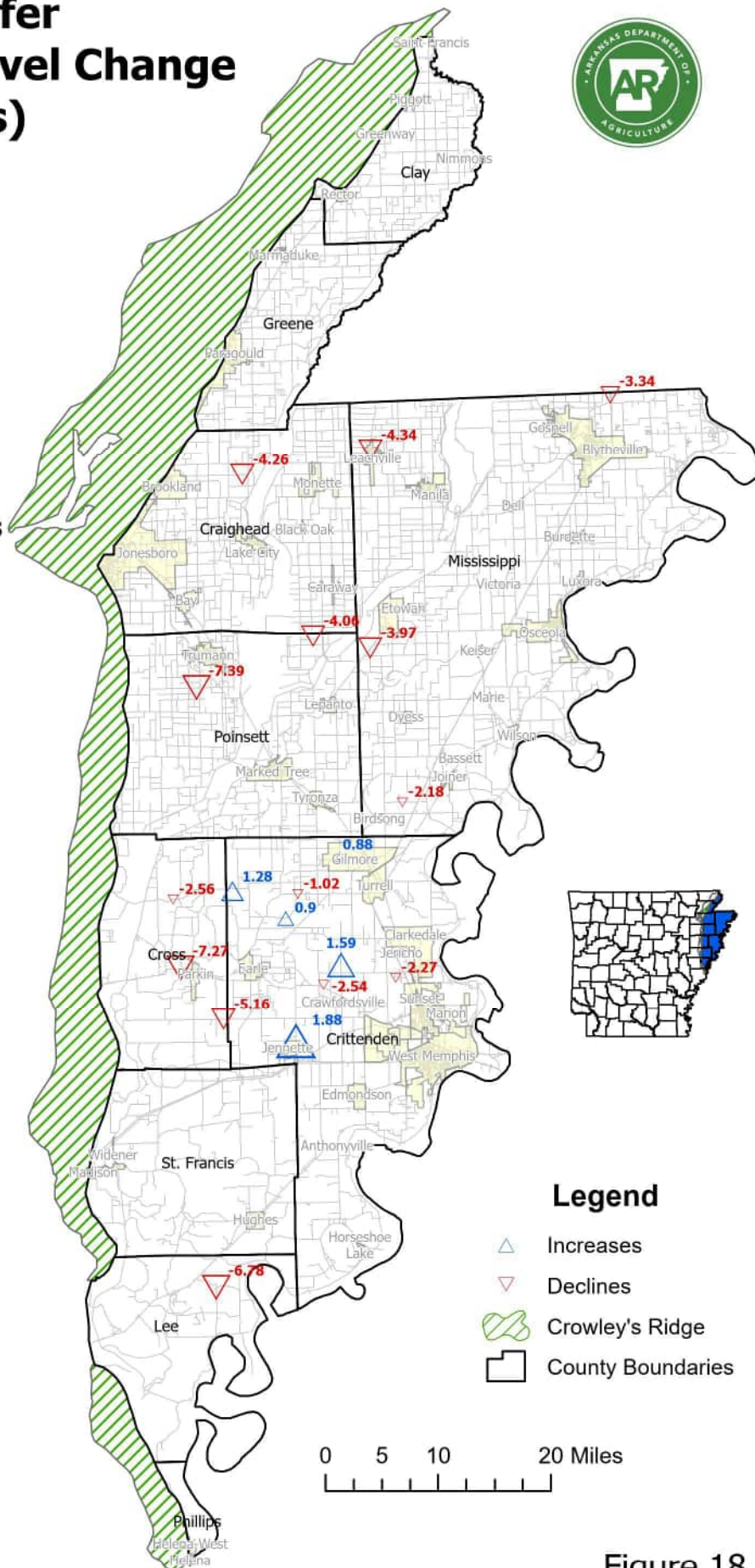
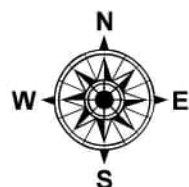
Alluvial Aquifer 2019-2024 Water Level Change (St. Francis)



**St. Francis Study Area
5 Year Change:**

**Average Change: -2.66 Ft.
14 of 19 Wells Showed Declines**

County	Avg. Change, Ft.
Crittenden	+0.09
Cross	-5.00
Mississippi	-3.46
Poinsett	-5.73



Legend

- △ Increases
- ▽ Declines
- ▨ Crowley's Ridge
- County Boundaries

Figure 18

Alluvial Aquifer 2019-2024 Water Level Change (Grand Prairie)



**Grand Prairie Study Area
5 Year Change:**

**Average Change: +0.30 Ft.
27 of 48 Wells Showed Declines**

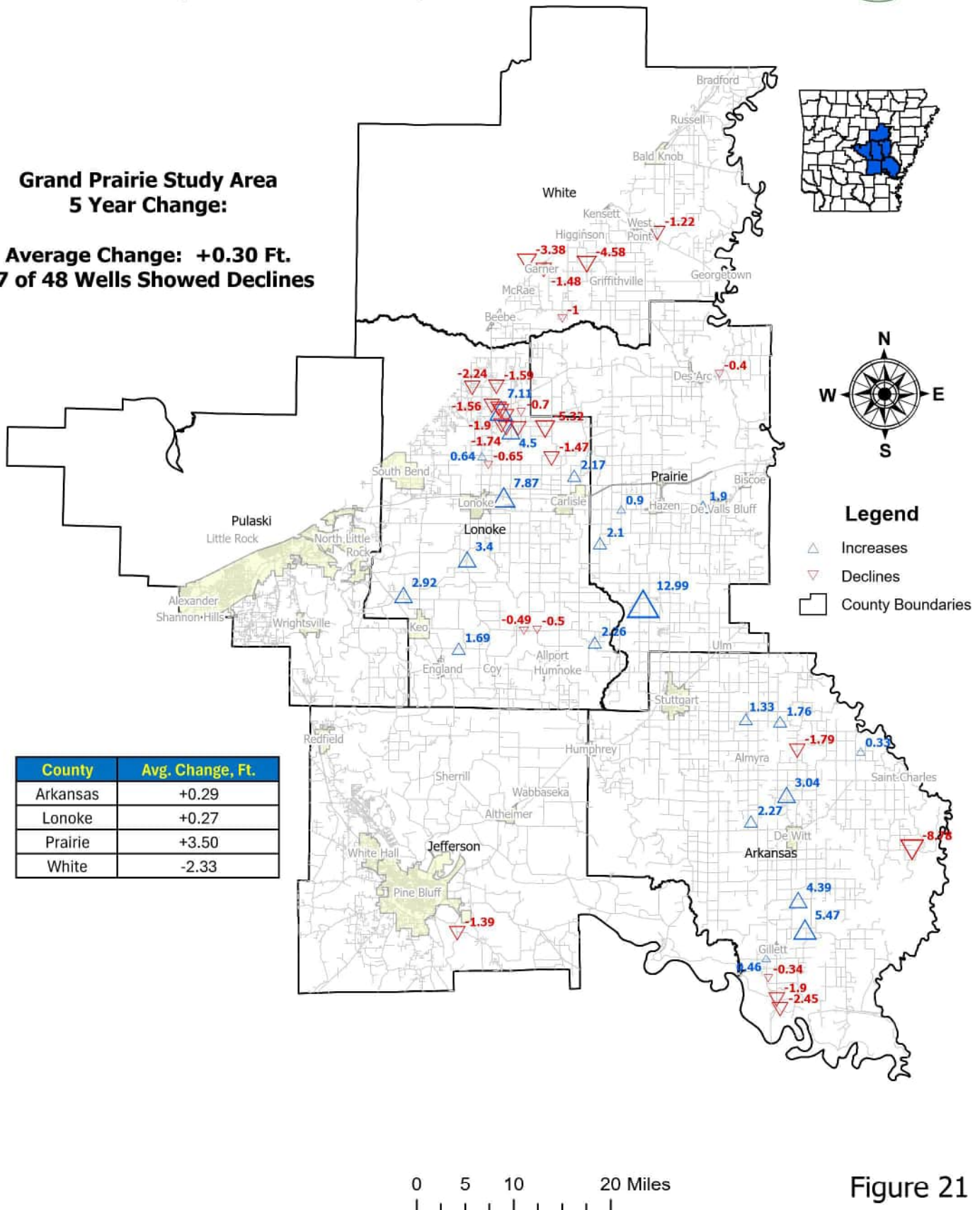


Figure 21

Alluvial Aquifer 2019-2024 Water Level Change (Boeuf - Tensas)

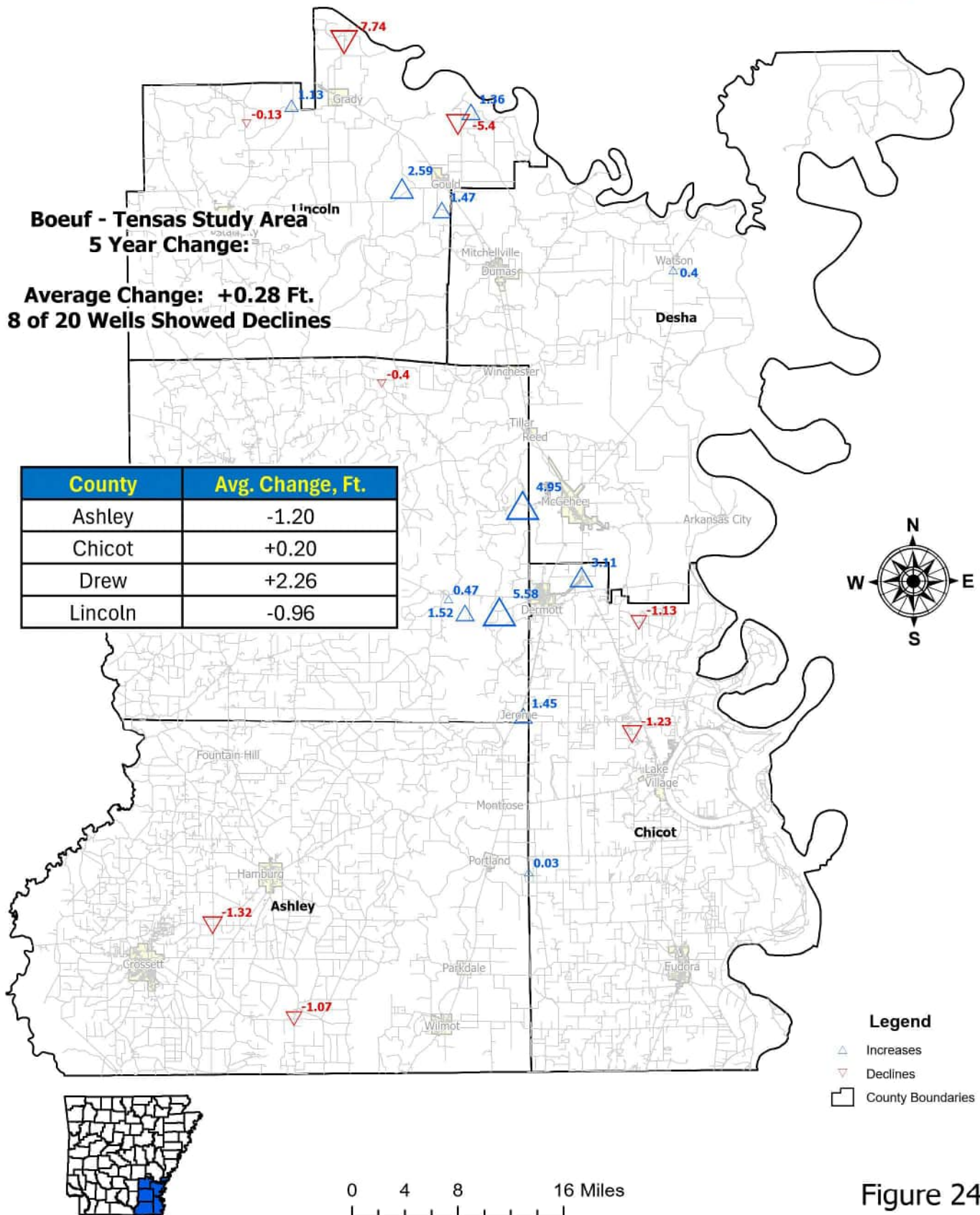


Figure 24

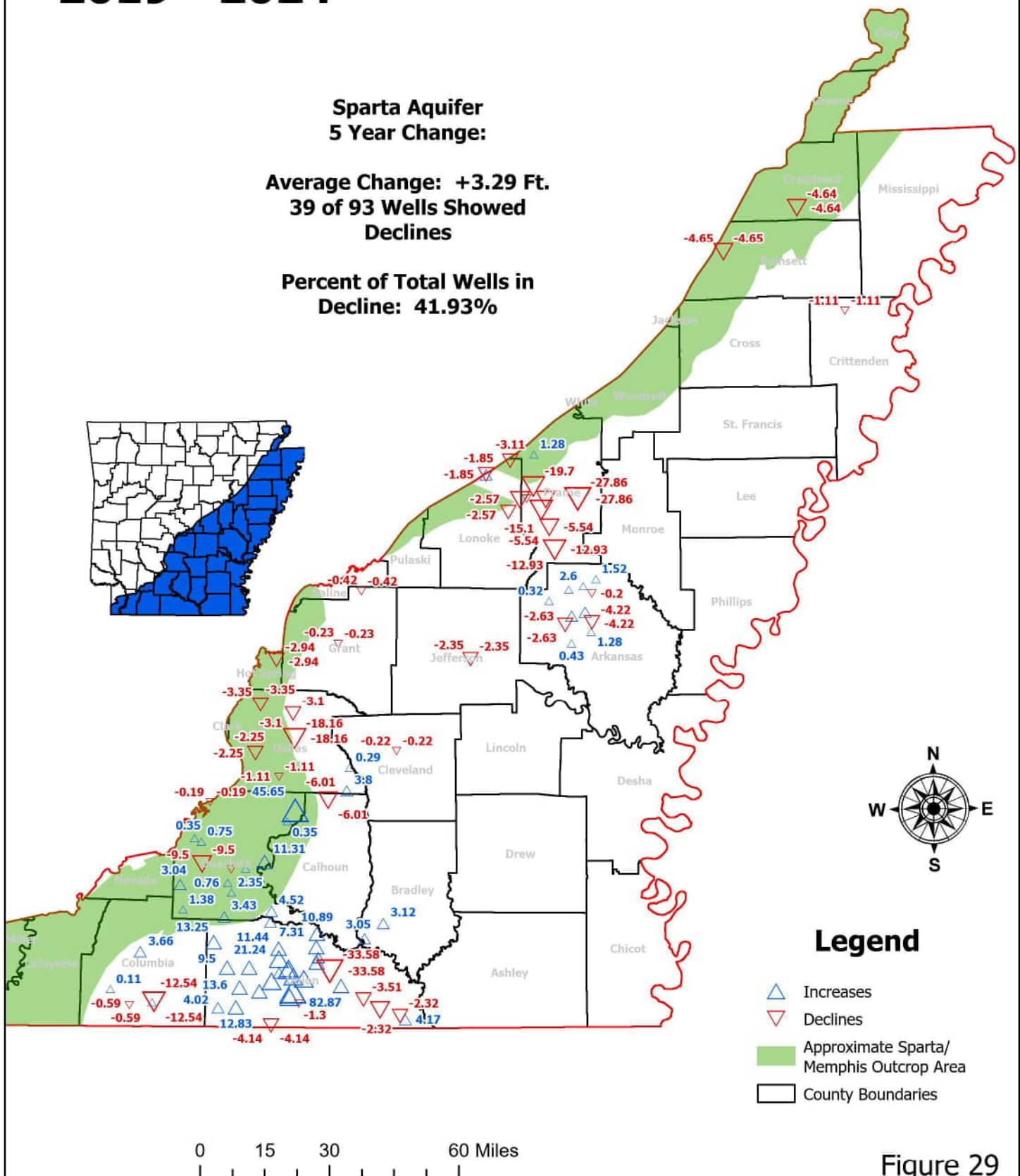
Sparta Aquifer 5 Year Change 2019 - 2024



Sparta Aquifer 5 Year Change:

Average Change: +3.29 Ft.
39 of 93 Wells Showed Declines

Percent of Total Wells in Decline: 41.93%

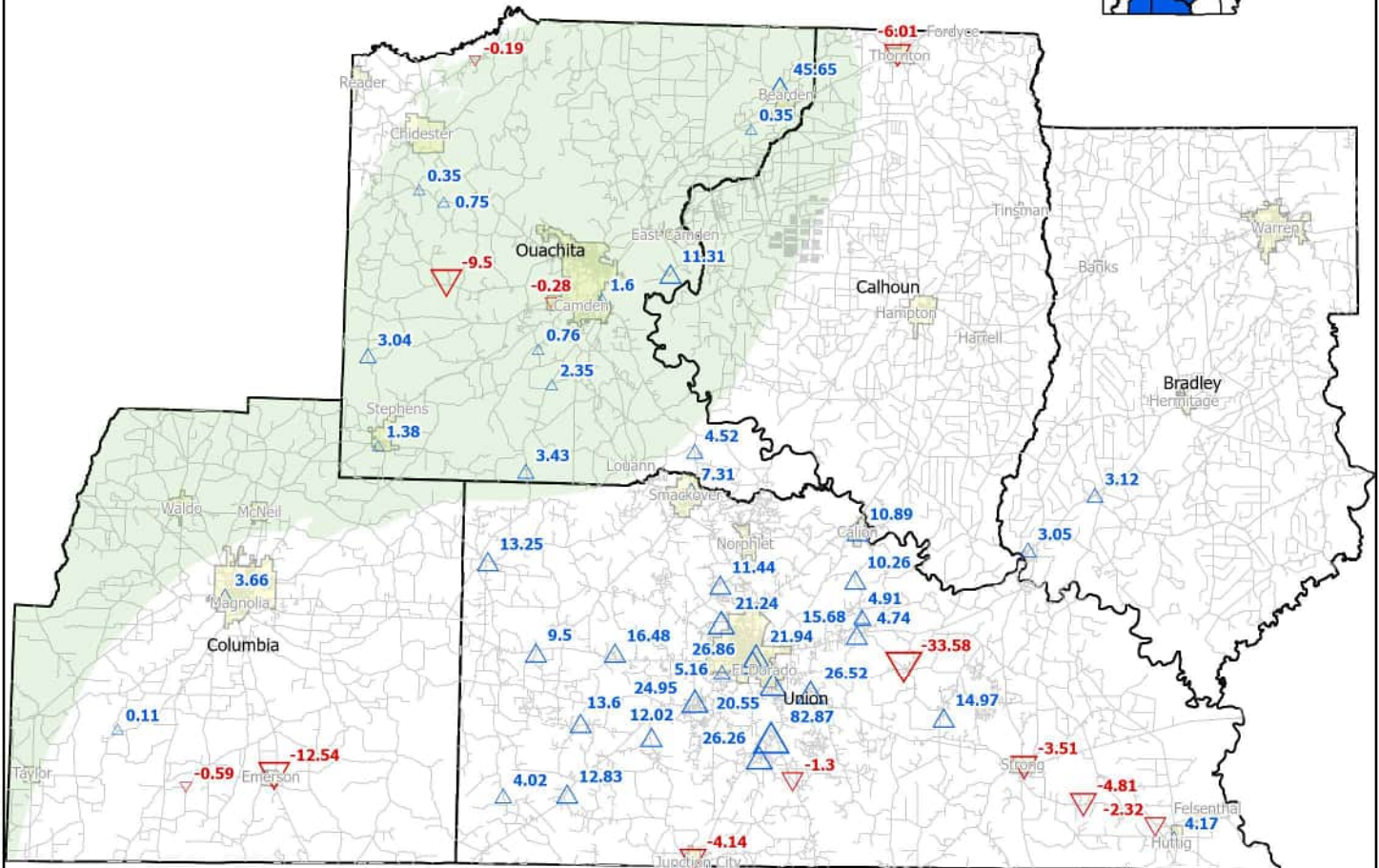


Sparta Aquifer 2019-2024 Water Level Change (South Arkansas)

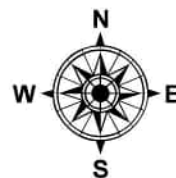


**South Arkansas Study Area
5 Year Change:**

**Average Change: +7.99 Ft.
12 of 54 Wells Showed Declines**



County	Avg. Change, Ft.
Bradley	+3.09
Columbia	-1.37
Ouachita	+4.37
Union	+12.02



- ▲ Increases
- ▼ Decreases
- Approximate Sparta Outcrop Area
- South Arkansas Area

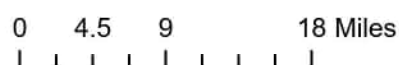
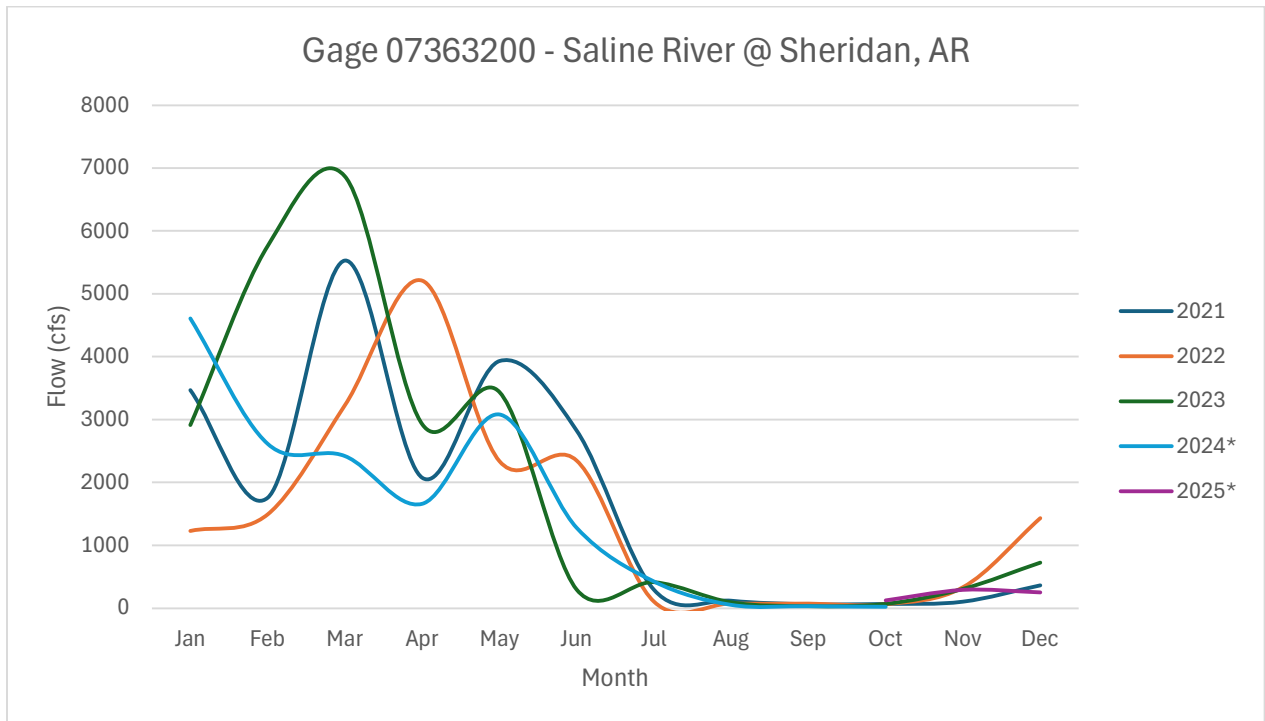
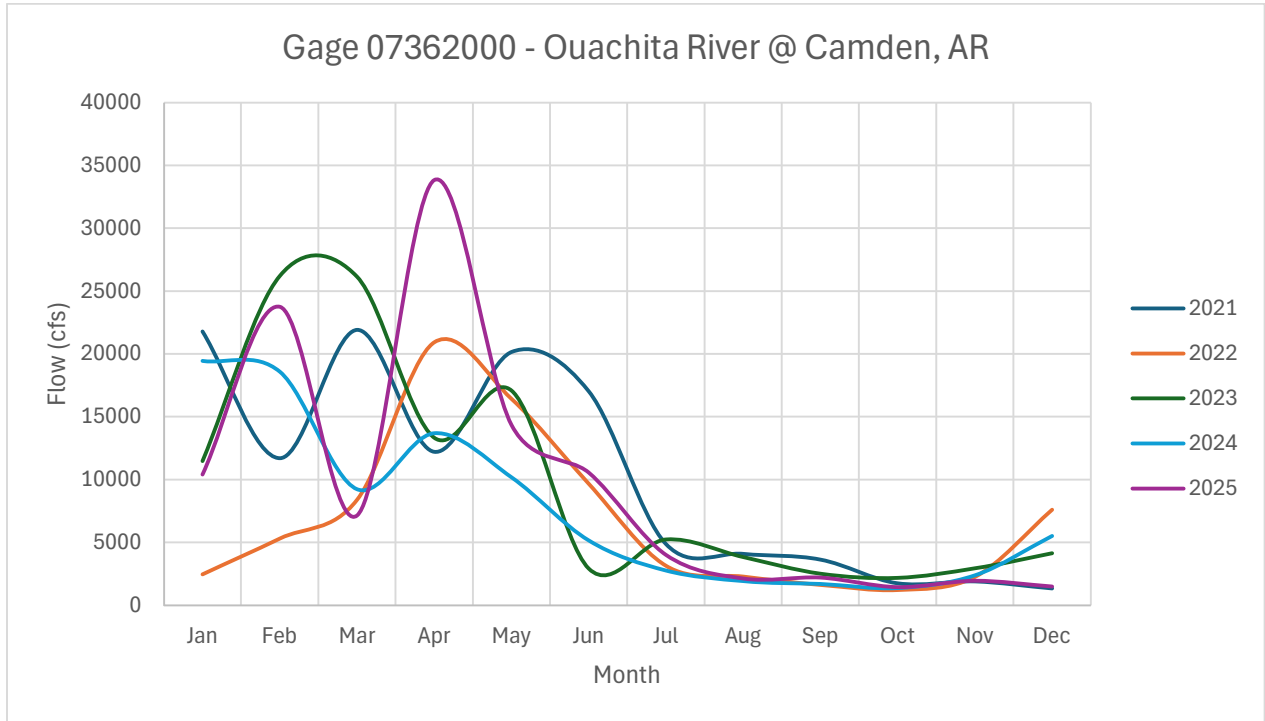


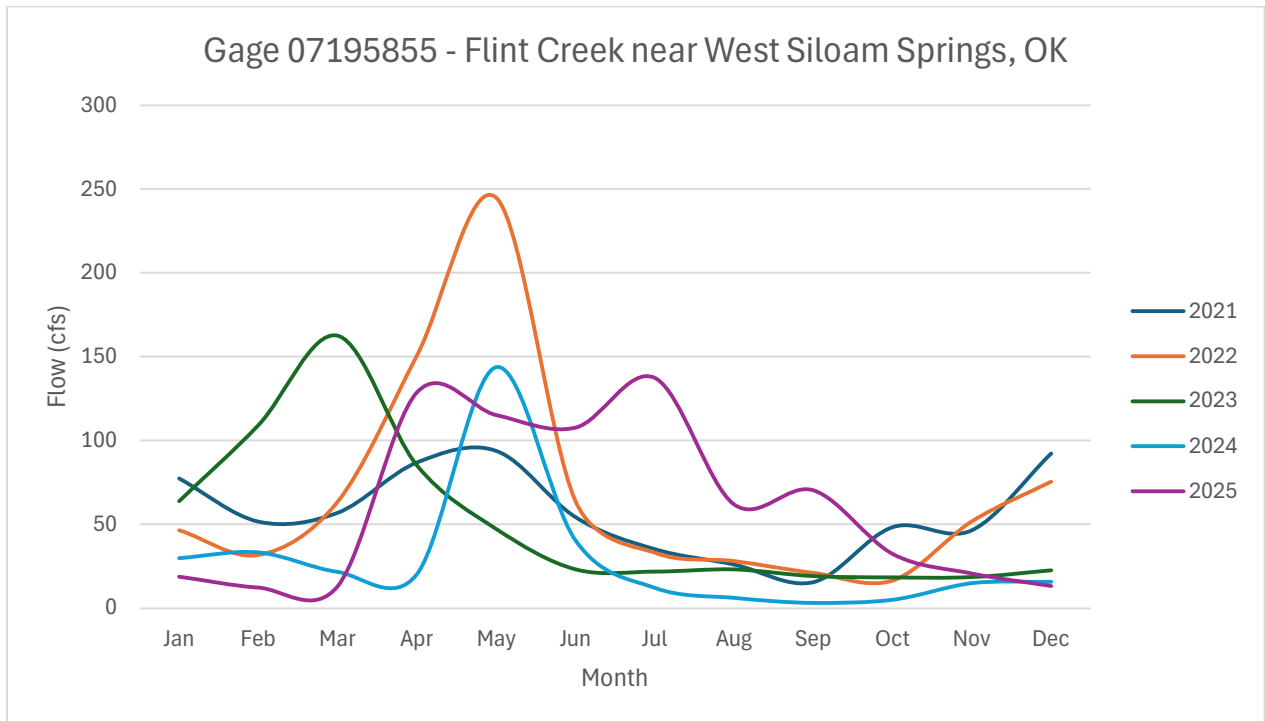
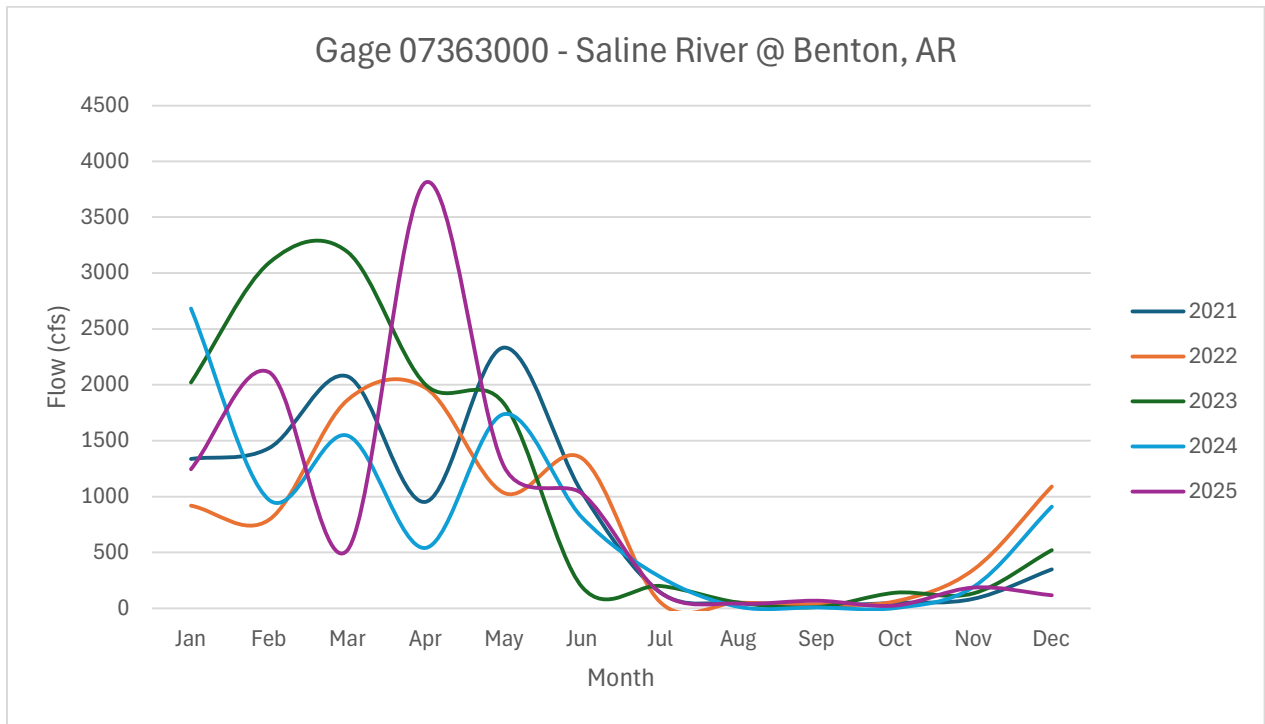
Figure 33

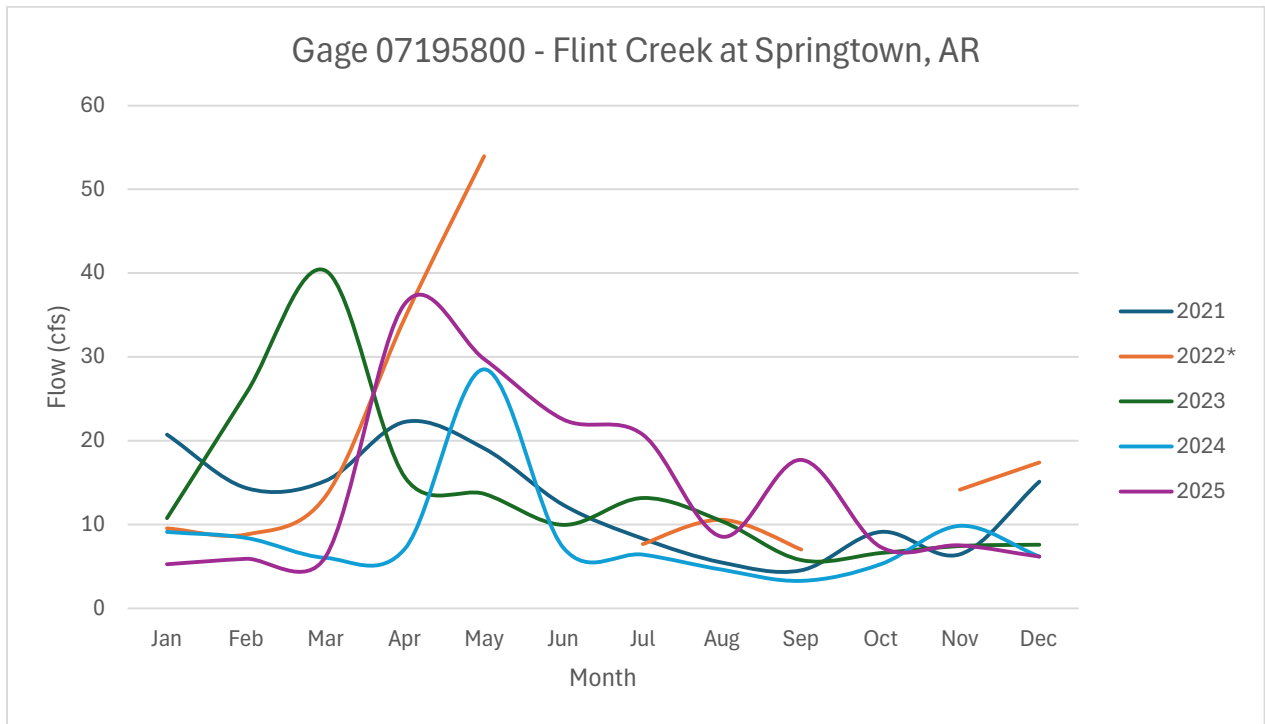
APPENDIX F

USGS Average Monthly Streamflow

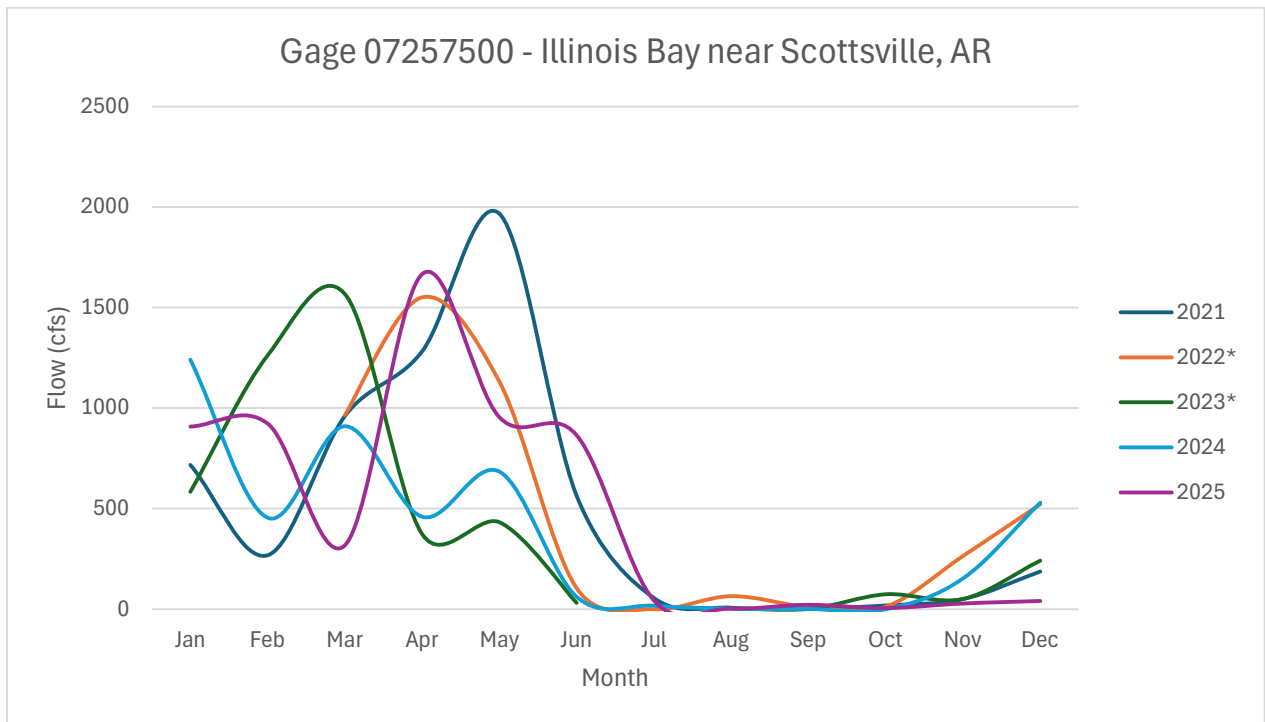


*Data for Nov.-Dec. 2024, Jan.-Sep. 2025 unavailable for USGS Gage 07363200

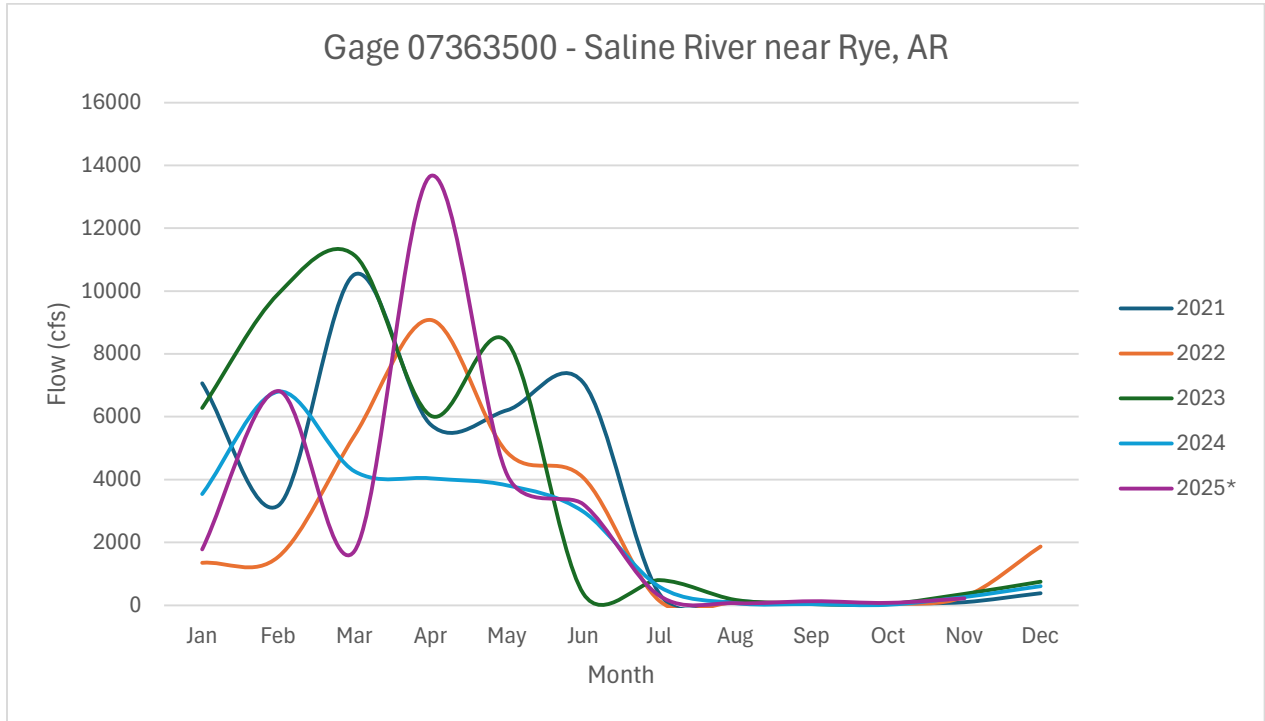




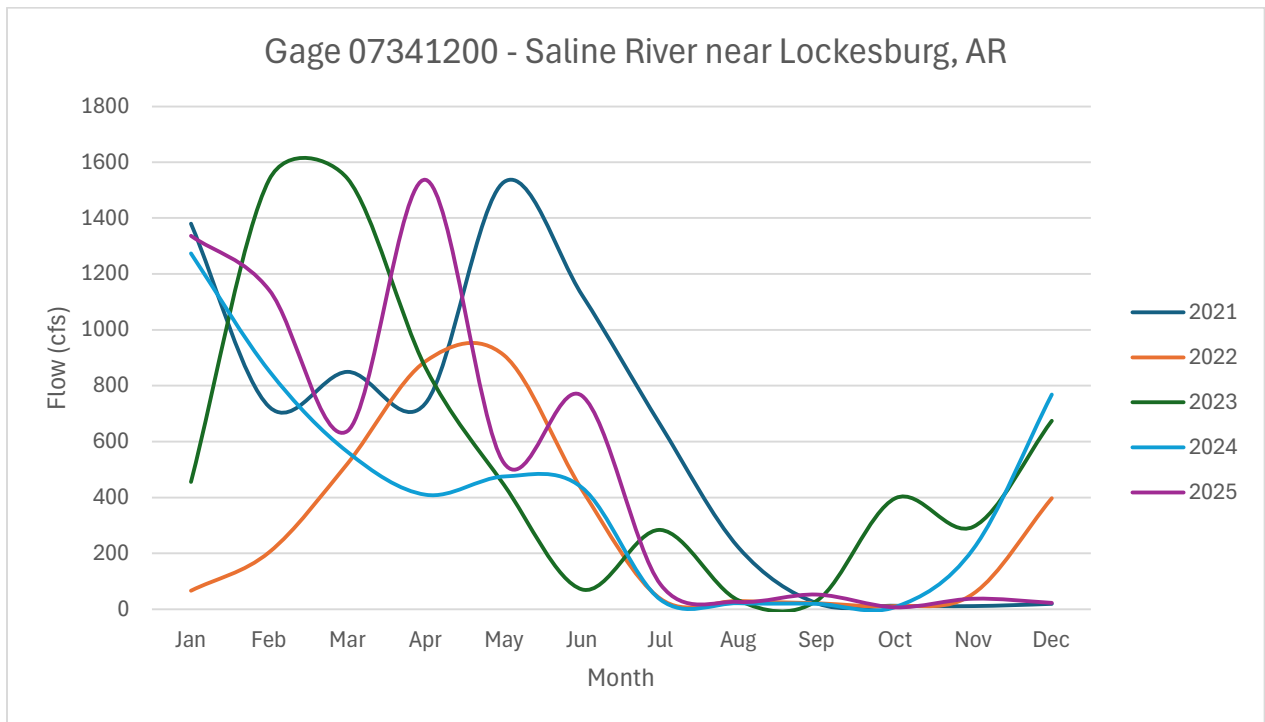
*Data for Jun. and Oct. 2022 unavailable for USGS Gage 07195800

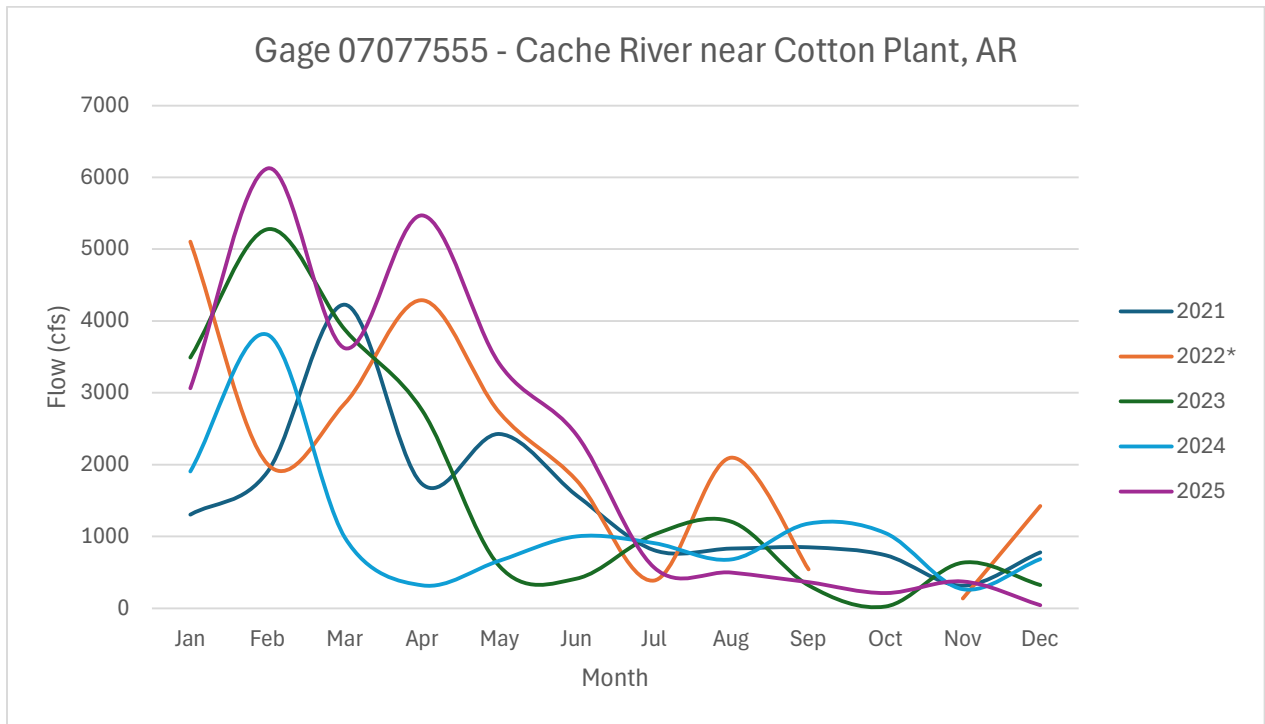


*Data for Feb. 2022, and Jul. 2023 unavailable for USGS Gage 07257500

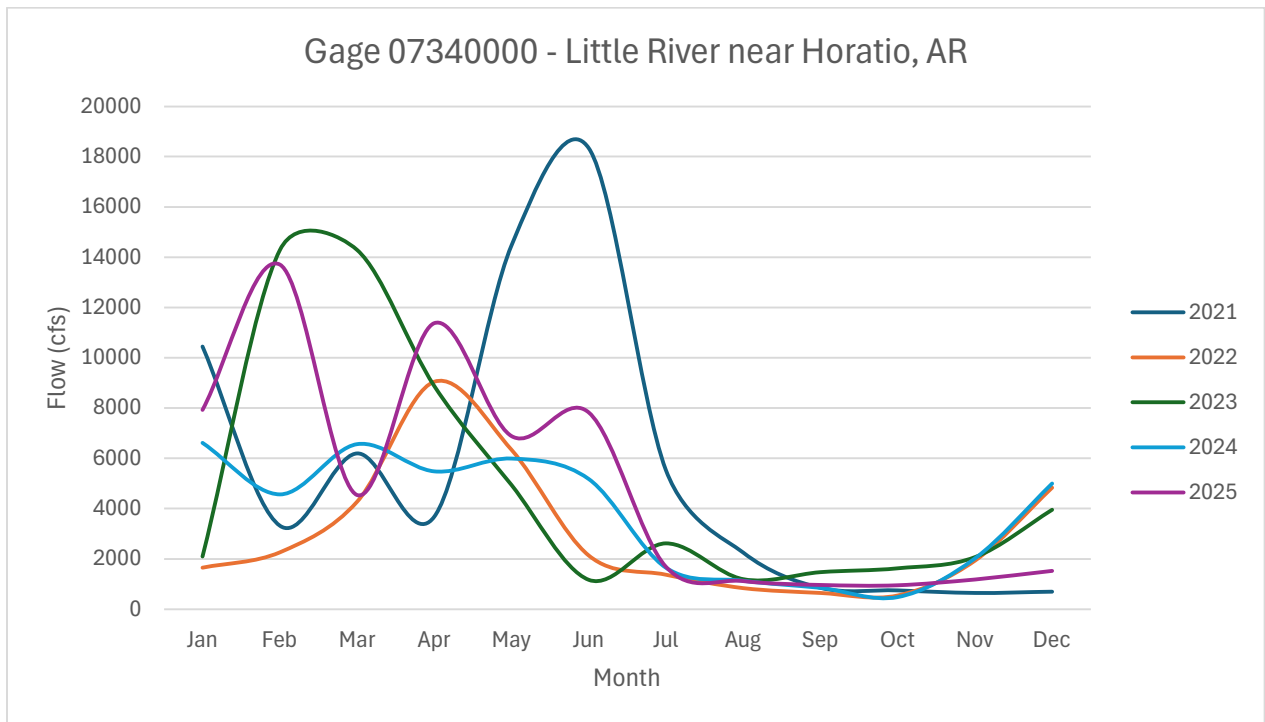


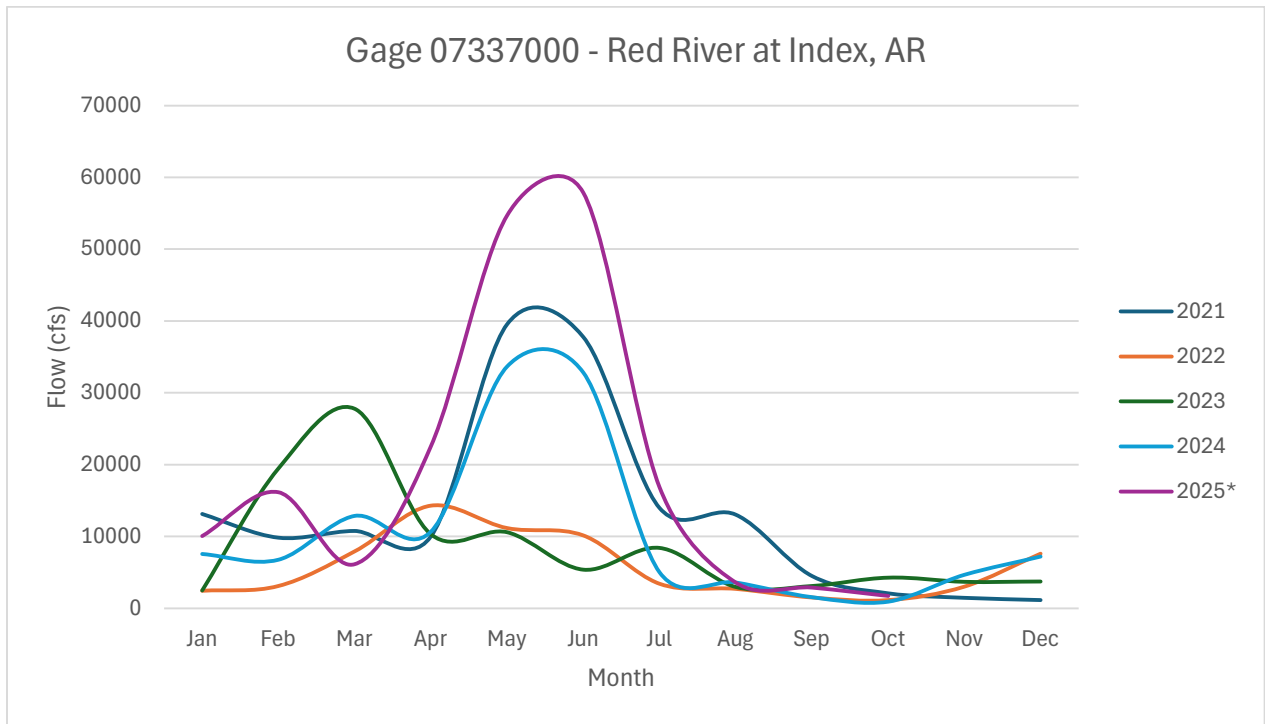
*Data for Dec. 2025 unavailable for USGS Gage 07363500



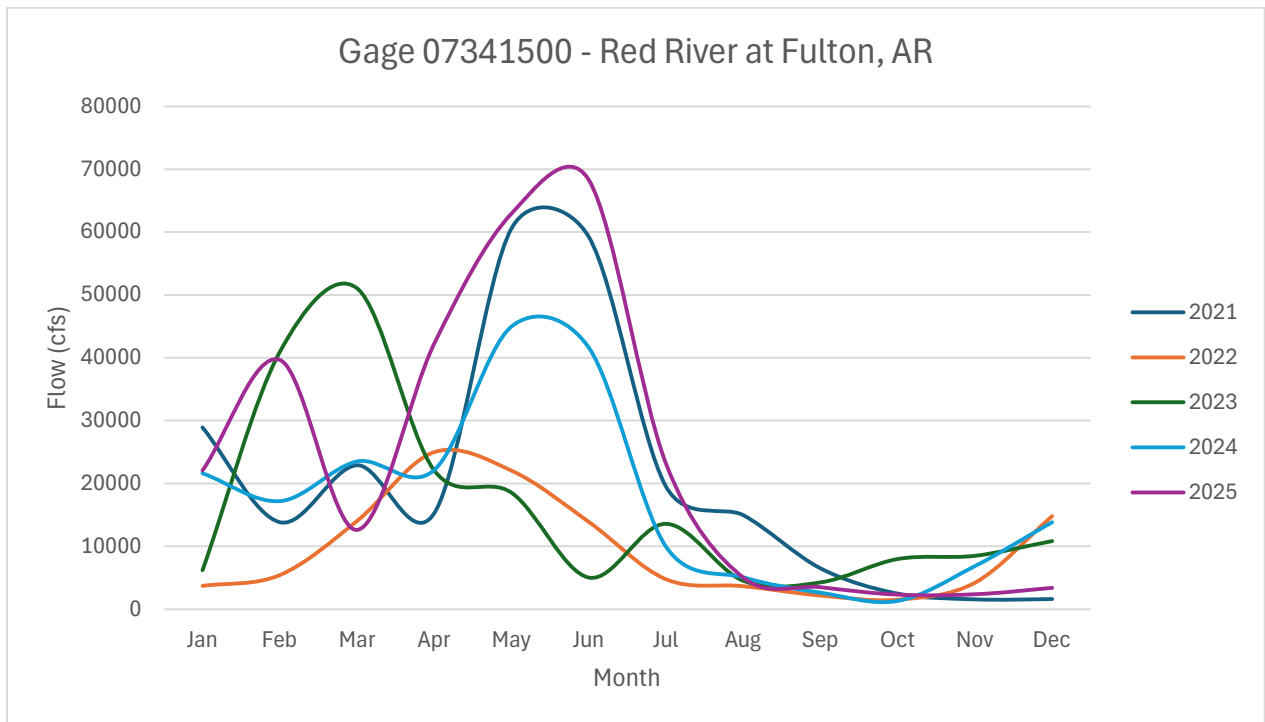


*Data for Oct. 2022 unavailable for USGS Gage 07077555





*Data for Nov.-Dec. 2025 unavailable for USGS Gage 070337000



APPENDIX G

Reservoir Yields

Project	User	Date	Type	Yield (MGD)
Blakely Mountain Dam - Lake Ouachita, AR	Mid Arkansas Water Alliance	2017	Reallocation	30
	North Garland County Regional Water District	1996	Reallocation	1
Degray Lake, AR	Bryant, Arkansas	2010	Originally Authorized	15
	Central Arkansas Water	2019	Originally Authorized	100
	City of Hot Springs	2019	Originally Authorized	20
	Ouachita River Water District	1992	Originally Authorized	1
	Ouachita River Water District	1998	Originally Authorized	0.5
	Ouachita River Water District	2001	Originally Authorized	1
	Ouachita River Water District	2011	Originally Authorized	6
	Ouachita River Water District	2013	Originally Authorized	8.5
Millwood Lake, AR	Southwest Arkansas Water District #1	1961	Originally Authorized	10.6
	SWAD Storage Space 2	1975	Activate Future	14.4
	SWAD Storage Space 3	1979	Activate Future	25
	SWAD Storage Space 4	1984	Activate Future	3
	SWAD Storage Space 5	1986	Activate Future	5
	SWAD Storage Space 6	1991	Activate Future	20
	SWAD Storage Space 7	1991	Activate Future	0.7
	SWAD Storage Space 8	2010	Activate Future	21
	SWAD Storage Space 9	2012	Activate Future	2
	SWAD Storage Space 10	2012	Activate Future	1.4
	SWAD Storage Space 11	2012	Activate Future	8
	SWAD Storage Space 12	2016	Activate Future	5
	SWAD Storage Space 13	2016	Activate Future	5
	SWAD Storage Space 14	2016	Activate Future	9
	SWAD Storage Space 15	2016	Activate Future	35
	SWAD Storage Space 16	2016	Activate Future	99.8
	SWAD Storage Space 17	2016	Activate Future	0.1

APPENDIX H

Arkansas Water Plan Presentations

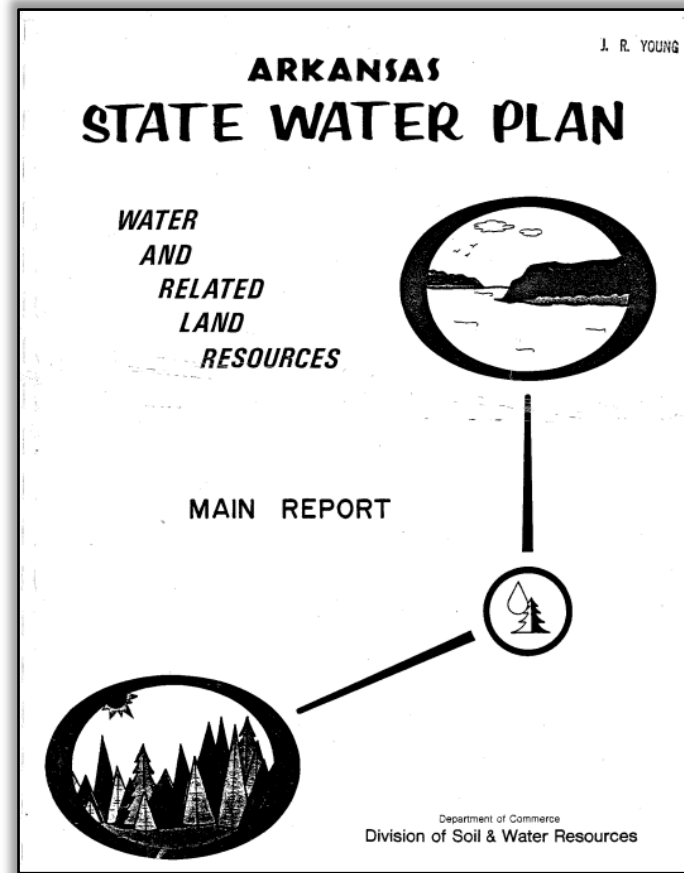
WATER FOR ARKANSAS

2026 Update



Draft Water Demand and Water Supply Analyses

Arkansas Water Plan History



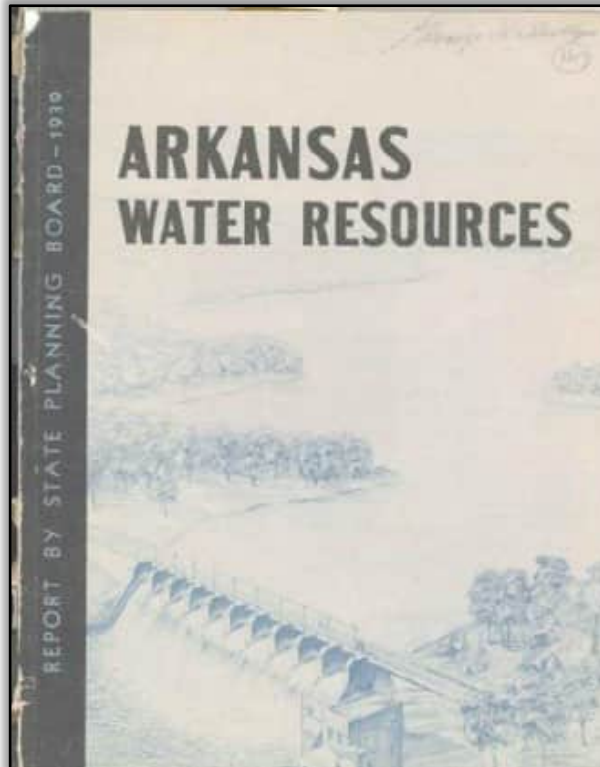
- In 1969, the Arkansas General Assembly passed Act 217, which made the Arkansas Natural Resources Commission (Commission) responsible for water planning at the state level and the development of the Arkansas State Water Plan.
- The first plan was published in 1975.
- In 1985, the legislature enacted Act 1051, which directed the Commission to update the plan so it would remain a valid and reliable document.
- Under the Transformation and Efficiencies Act of 2019, the Commission was transferred to the Arkansas Department of Agriculture.



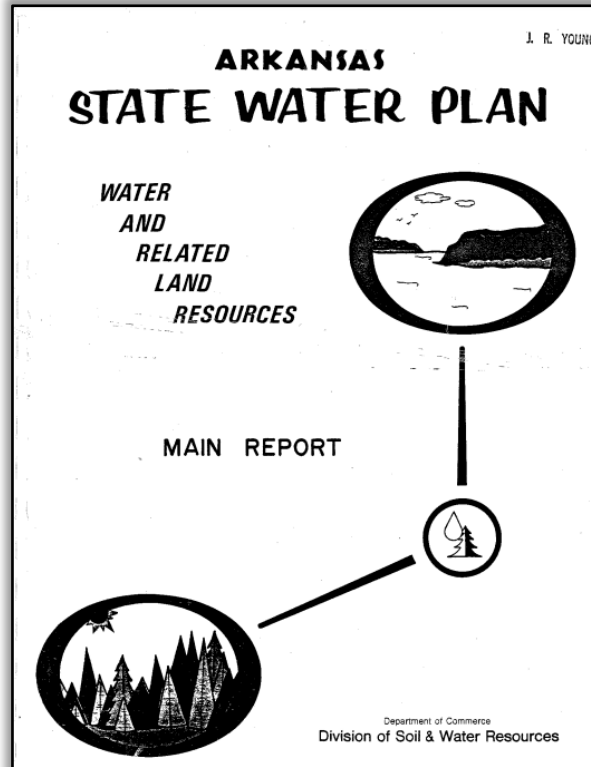
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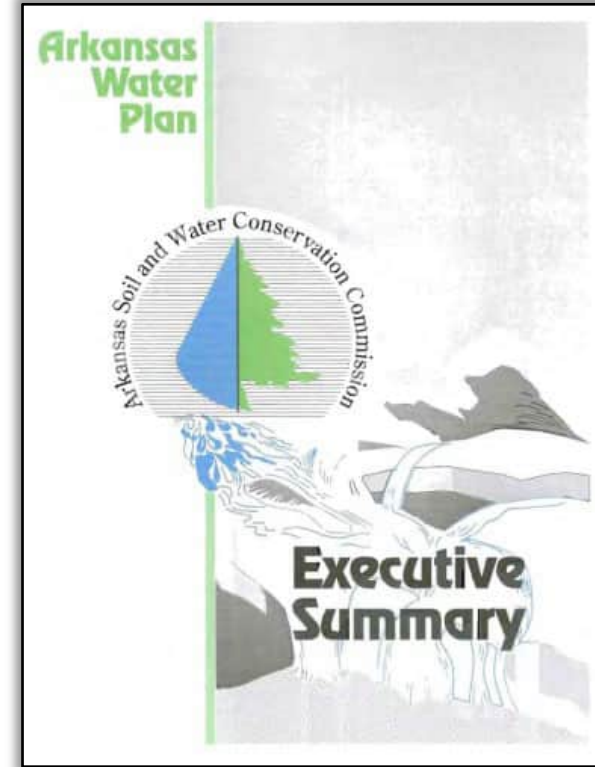
Arkansas Water Planning



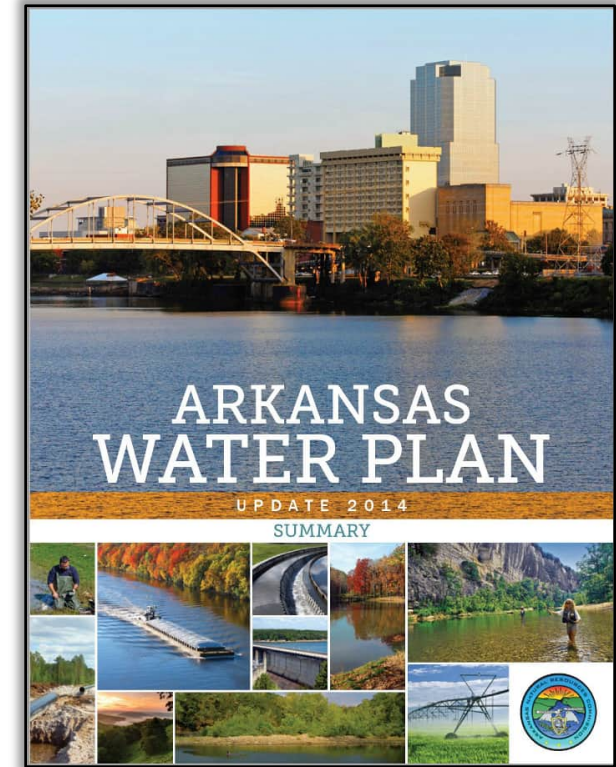
1939



1975



1990



2014



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• What is the Arkansas Water Plan?

- “A comprehensive program for the orderly development and management of the state’s water and related land resources”
Arkansas Code § 15-22-503(a)

• Purpose

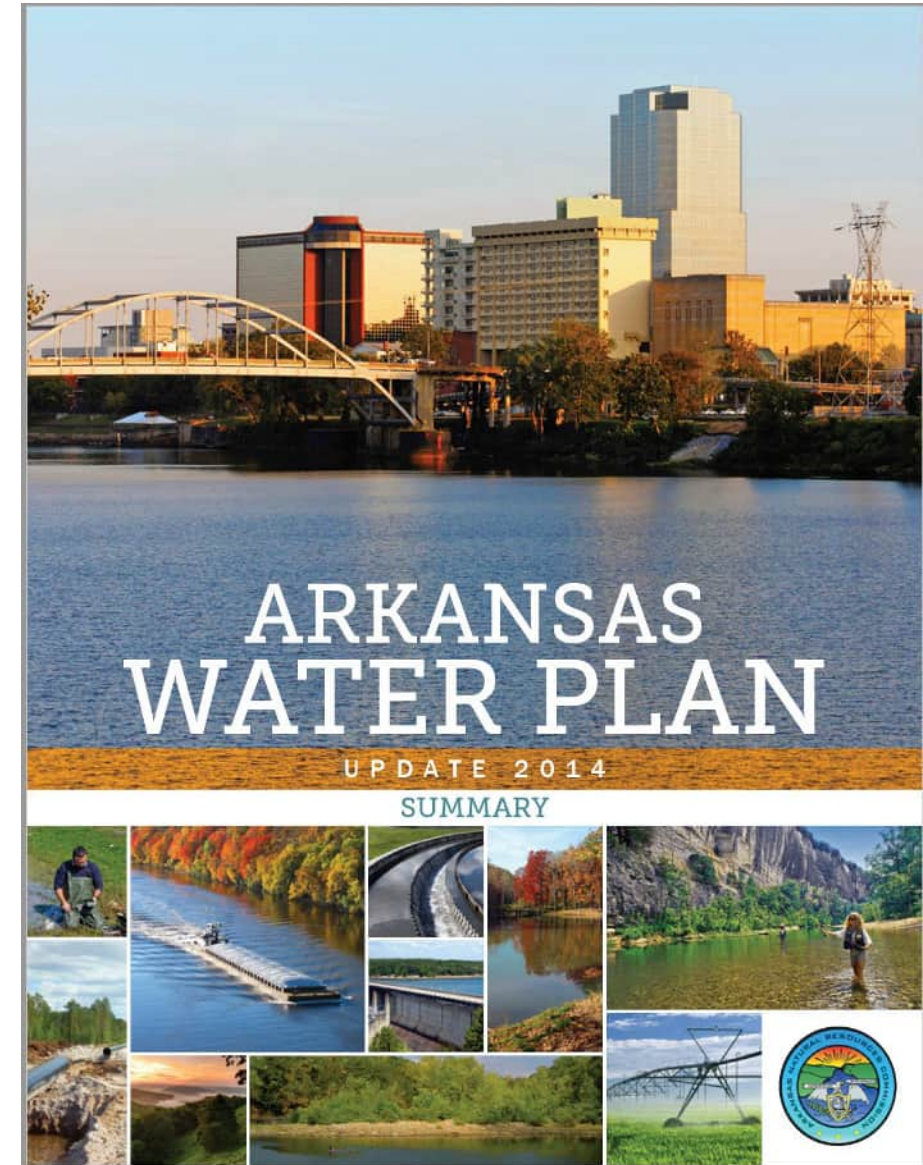
- To assess quantity and quality of water in Arkansas
- To be ready for growth, declines, and new challenges

• Structure (Basins / Geographical Regions)

- Supply
- Demands
- Issues
- Recommendations

• Public Involvement / Stakeholder Engagement

- Approx. 250 Meetings and Presentations for the 2014 update



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Issues Identified in 2014 Water Plan Update

- Groundwater depletion
 - By 2050 Approx. 8.2 million AFY above sustainable yield
 - Primarily East Arkansas and in the Mississippi Alluvial Aquifer
- Infrastructure construction, maintenance, and replacement
 - Projected a need to spend \$5.74 Billion on Water and \$3.76 Billion on wastewater by 2024 to build, maintain and replace required infrastructure
- Use of excess surface water
 - Sufficient surface water exists to close groundwater gap
 - Lack the appropriate infrastructure
- Maintaining and improving surface and groundwater quality
 - 59% of assessed streams supported all uses
 - 64% of assessed lakes supported all uses



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Current Water Plan Update



Governor Sander's Executive Order 23-27 directed the Arkansas Department of Agriculture and its Natural Resources Commission to update the Arkansas Water Plan.



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Phases

- **Phase I - Scoping Process (Completed 2024)**
 - Data Collection
 - Vision, Goals, and Objectives / Need / Scope of Work
 - Gaps/Changes from 2014
 - 7 Stakeholder Meetings (March and May 2024)
- **Phase II – Updates to the Plan - (3rd Qtr. 2024 - 2026)**
 - Updates to Water Supply / Demands / Forecasts
 - Infrastructure / Water Quality Assessments
 - Project and Program Assessments
 - Water Management Policy
 - Focus Group Meetings (March 2025)
 - Surveys
 - Stakeholder Engagement Feb – May 2026
- **Plan Completion – Aug/Sept 2026**



Our Charge

1. Model and assess water availability, water demand projections, and water quality trends, and identify basins with projected challenges or opportunities where significant changes are known or expected from the 2014 Arkansas Water Plan;
2. Evaluate, develop, and recommend water management strategies for all water-use sectors and develop innovative new funding mechanisms to support their implementation; and
2. Conduct statewide engagement throughout the process to identify the most pressing current issues and develop the best practicable solutions in collaboration with representatives from all water use sectors, including, but not limited to, interested water planning groups, state and federal agencies, legislators, and local entities.
3. Deliver the plan update by the summer of 2026



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2026 Water Plan Goals

- Goal 1. Provide drinking water that supports public health and well-being.
- Goal 2. Provide water that supports environmental and economic benefits to the state and support interstate agreements.
- Goal 3. Use the best available science, data, tools, practices, and technologies to support water resource planning and management for current and future needs.
- Goal 4. Maintain and improve water supply, wastewater, stormwater, and flood control infrastructure and plan for future infrastructure needs.
- Goal 5. Maintain, protect, and improve water quality to support designated uses of waterbodies.
- Goal 6. Reduce the impacts of future flooding events on people, property, infrastructure, industry, agriculture, and the environment.



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Water Plan Components



Water Supply

Data collection, weather extreme supply scenarios and availability analysis from different sources.

Infrastructure Assessment

Evaluate the existing infrastructure and update the needs assessment.

Water Demand

Confirm water sectors for demand analysis and update the water demand by sectors.

Water Quality Analysis

Evaluate the quality of water.

Gap Analysis

Evaluate the available excess surface water and assess supply/demand scenarios to forecast shortages.

Mitigation Strategies

Identify focus basins to mitigation strategies, water reuse action plan, and groundwater treatment methods.

Updated Water Plan Document

A comprehensive water plan report that includes a summary of the key findings, analysis and proposed mitigation strategies.



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Water Plan Components

- Water Supply – US Army Corps of Engineers
- Water Demand – US Army Corps of Engineers
- Water Quality – Michael Baker Int.
- Infrastructure Assessment – Michael Baker Int.
- Gap Analysis – US Army Corps of Engineers / Michael Baker Int.
- Mitigation Strategies – US Army Corps of Engineers / Michael Baker Int.
- Flooding – Olsson
- Report Writing – US Army Corps of Engineers / Natural Resource Division
- Not inclusive of all studies or actions (e.g., Levee Inventory, NWA Water Reclamation, etc.)



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Water Demand and Supply

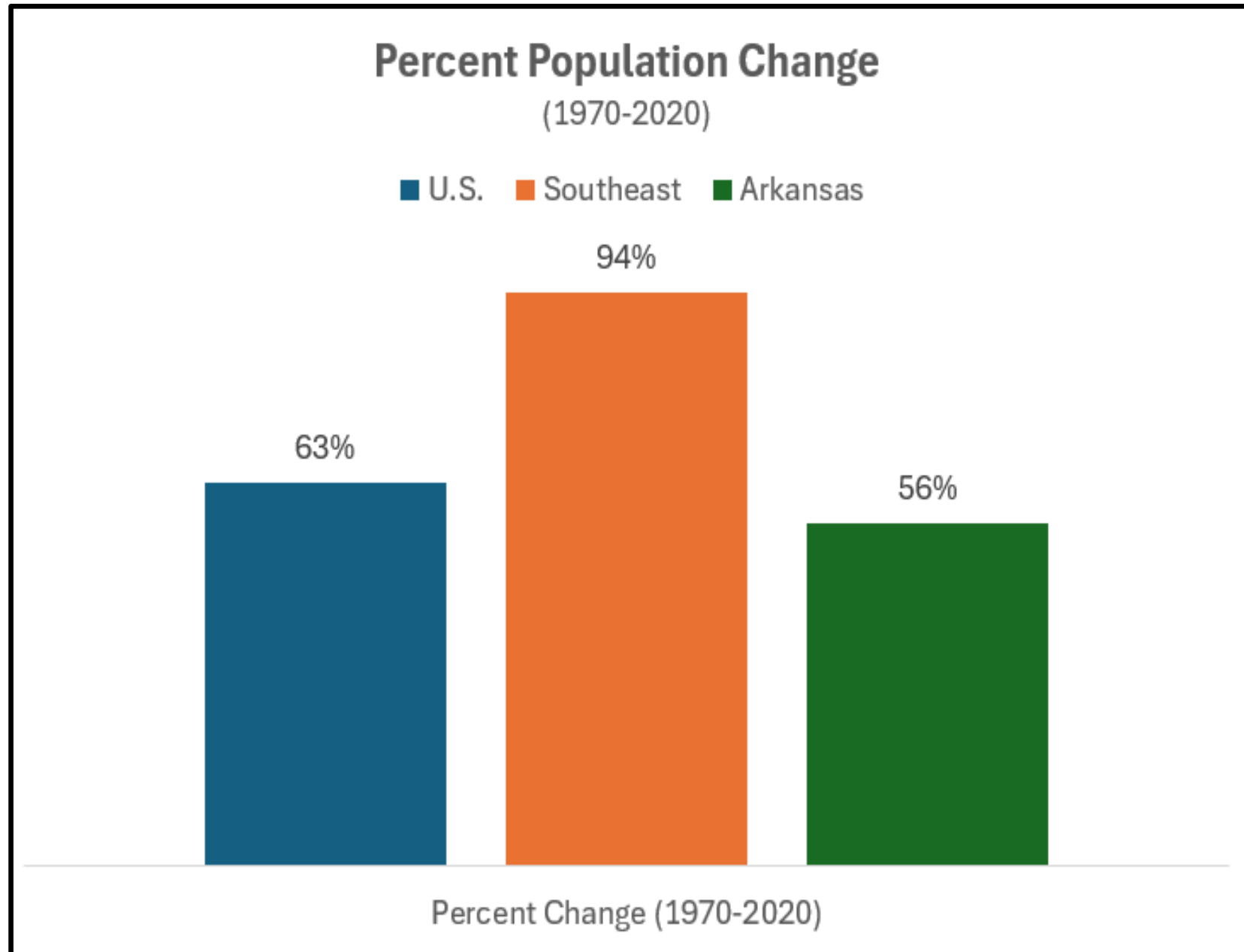
- 1) Historical Demographic Trends
- 2) Summary of State Level Demands 2014 and 2026
- 3) Non-agricultural Demands
- 4) Agricultural Demands
- 5) Ground and Surface Water Supply Analysis

Draft Estimates

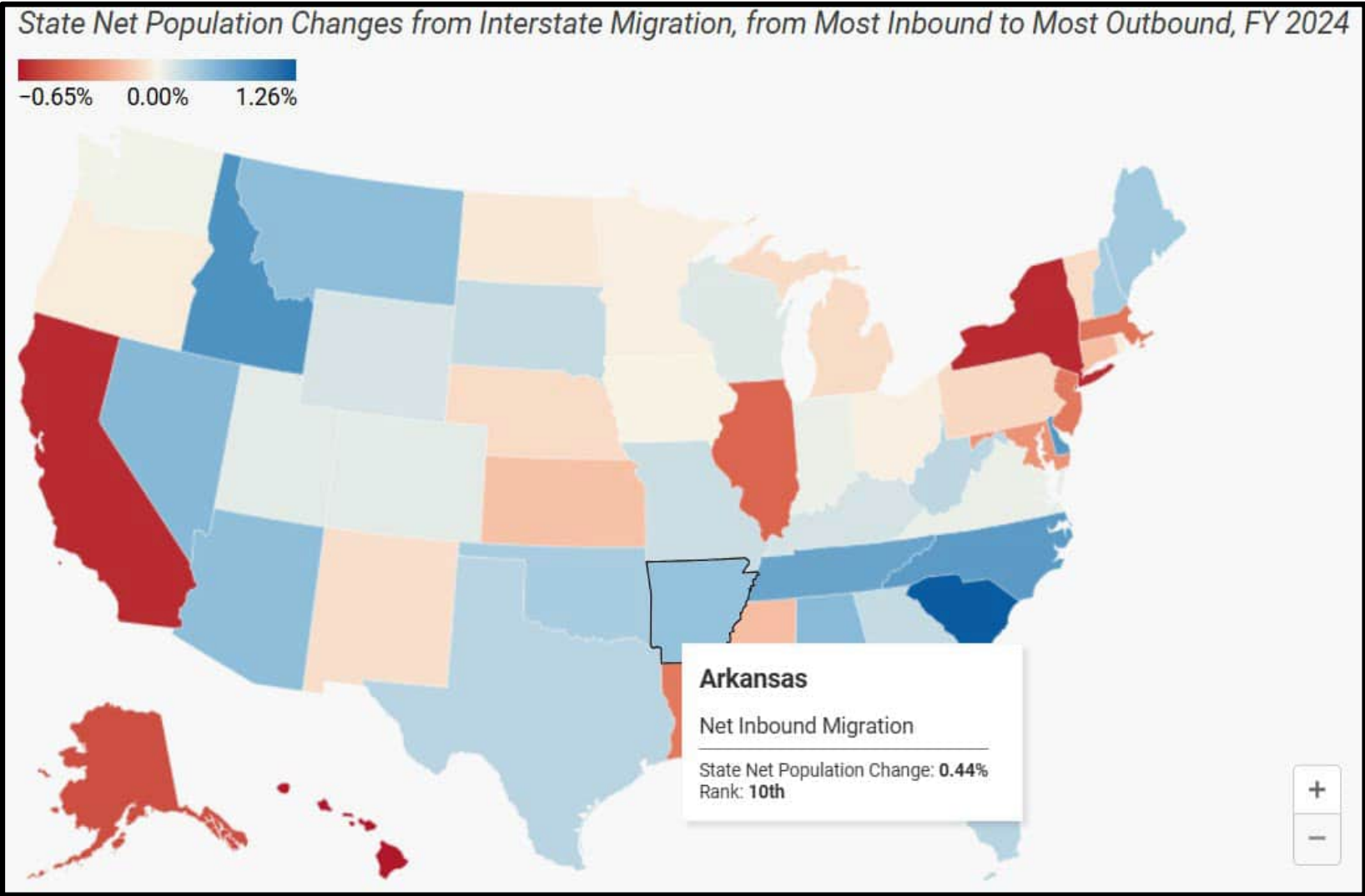
Some additional research, review and refinement
Gain input from our customers (Arkansas taxpayers)

Demographic Changes

*Provisional Information and Data: Subject to Change



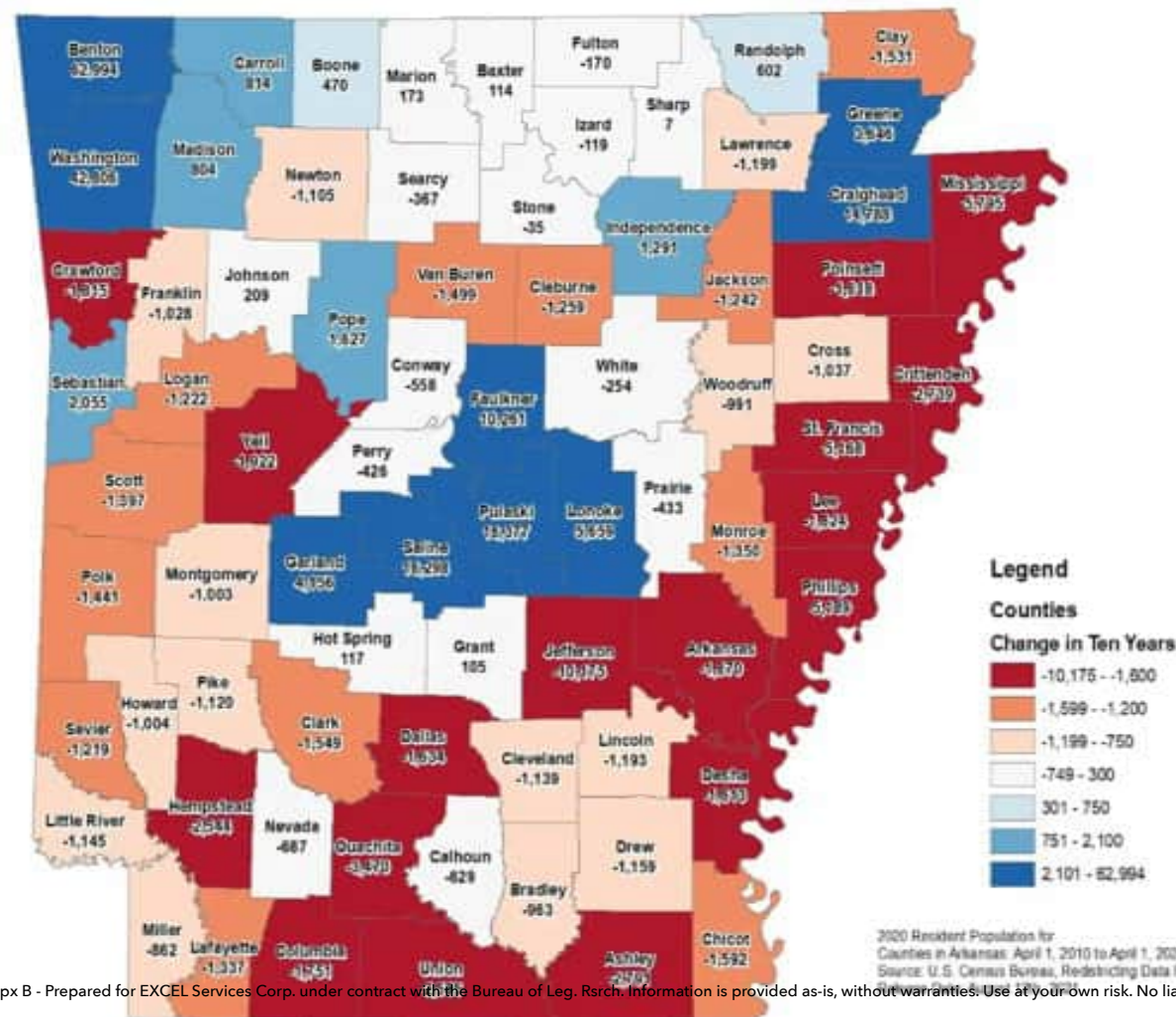
Population Shifting in U.S.



US Army Corps
of Engineers

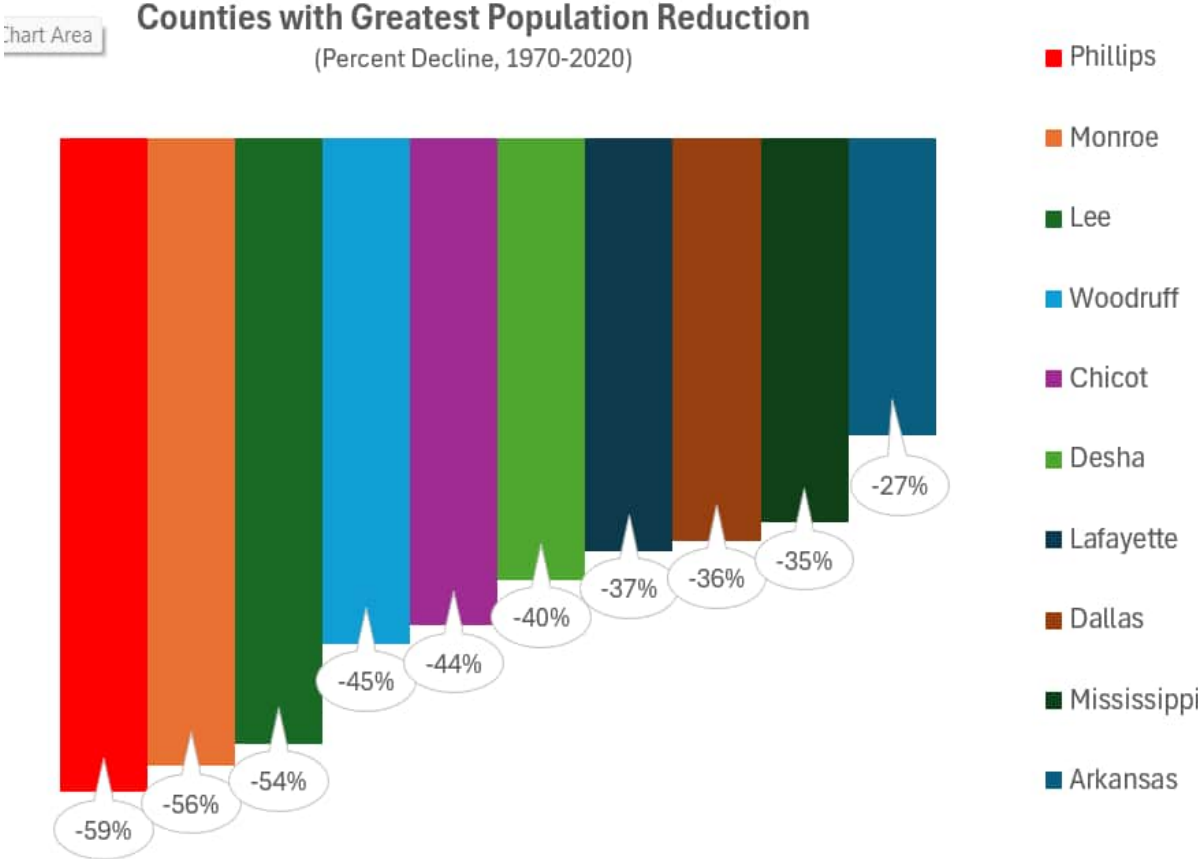
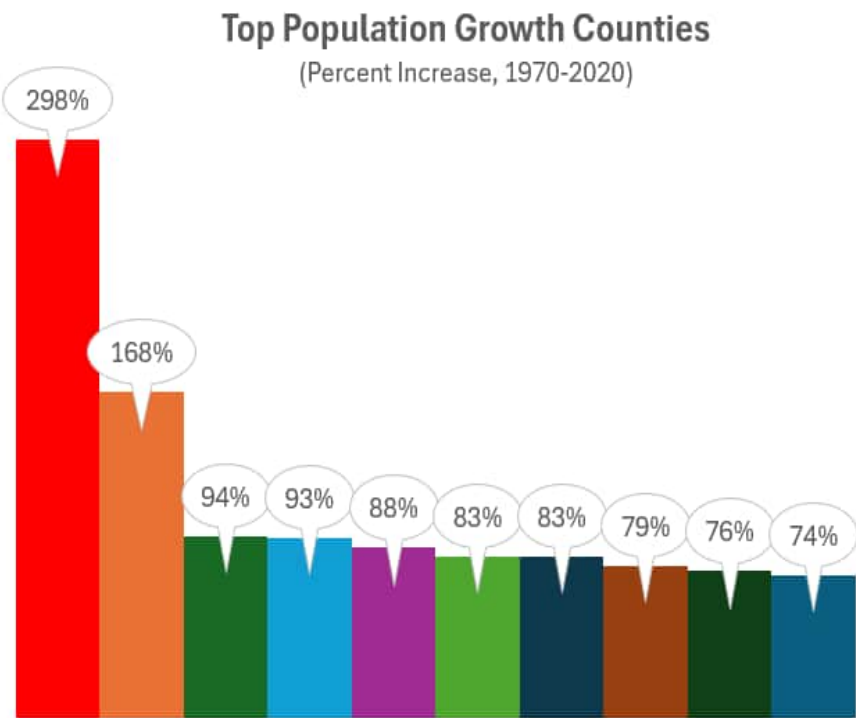
Population Shifting within Arkansas

Change in County Population in Arkansas 2010 Census versus 2020 Census



US Army Corps
of Engineers

Population Shifting within Arkansas

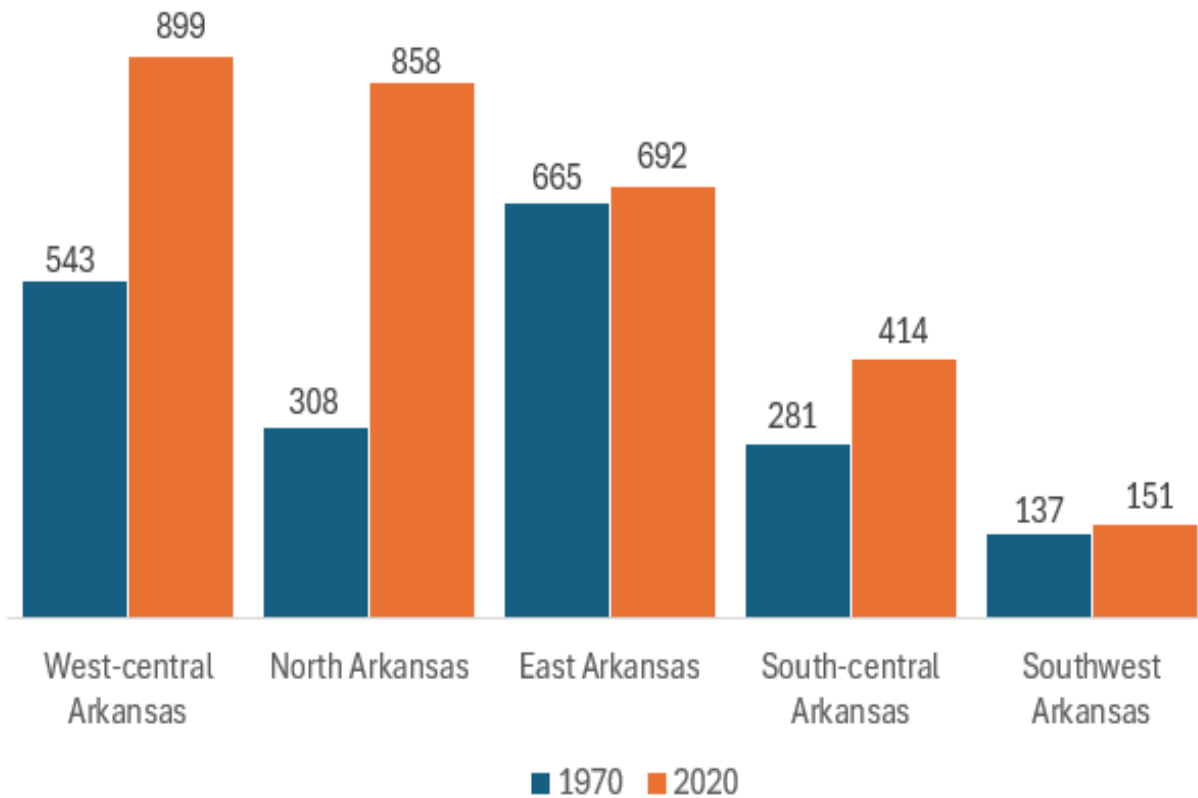


Source: US Census



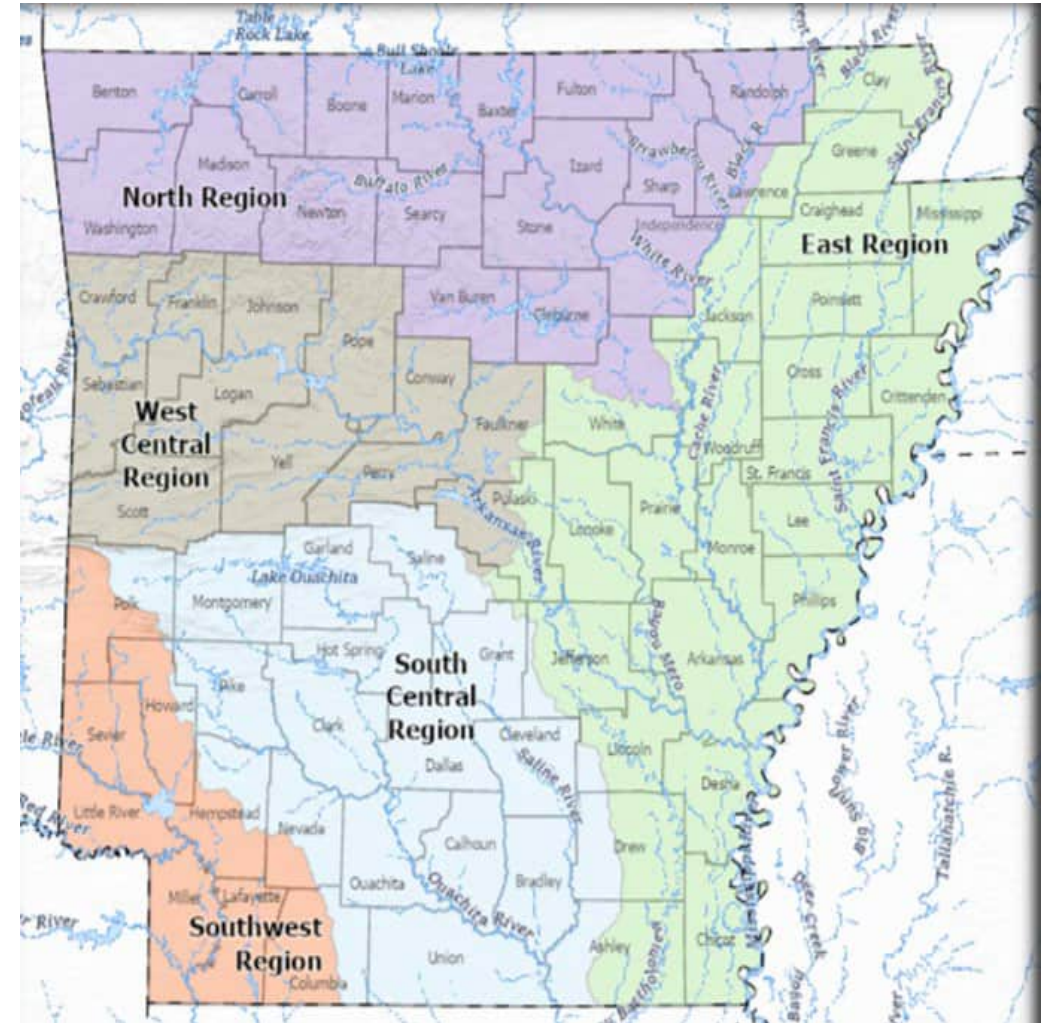
Population Change by Water Planning Region

Population Change by State Water Planning Region
(1970-2020)

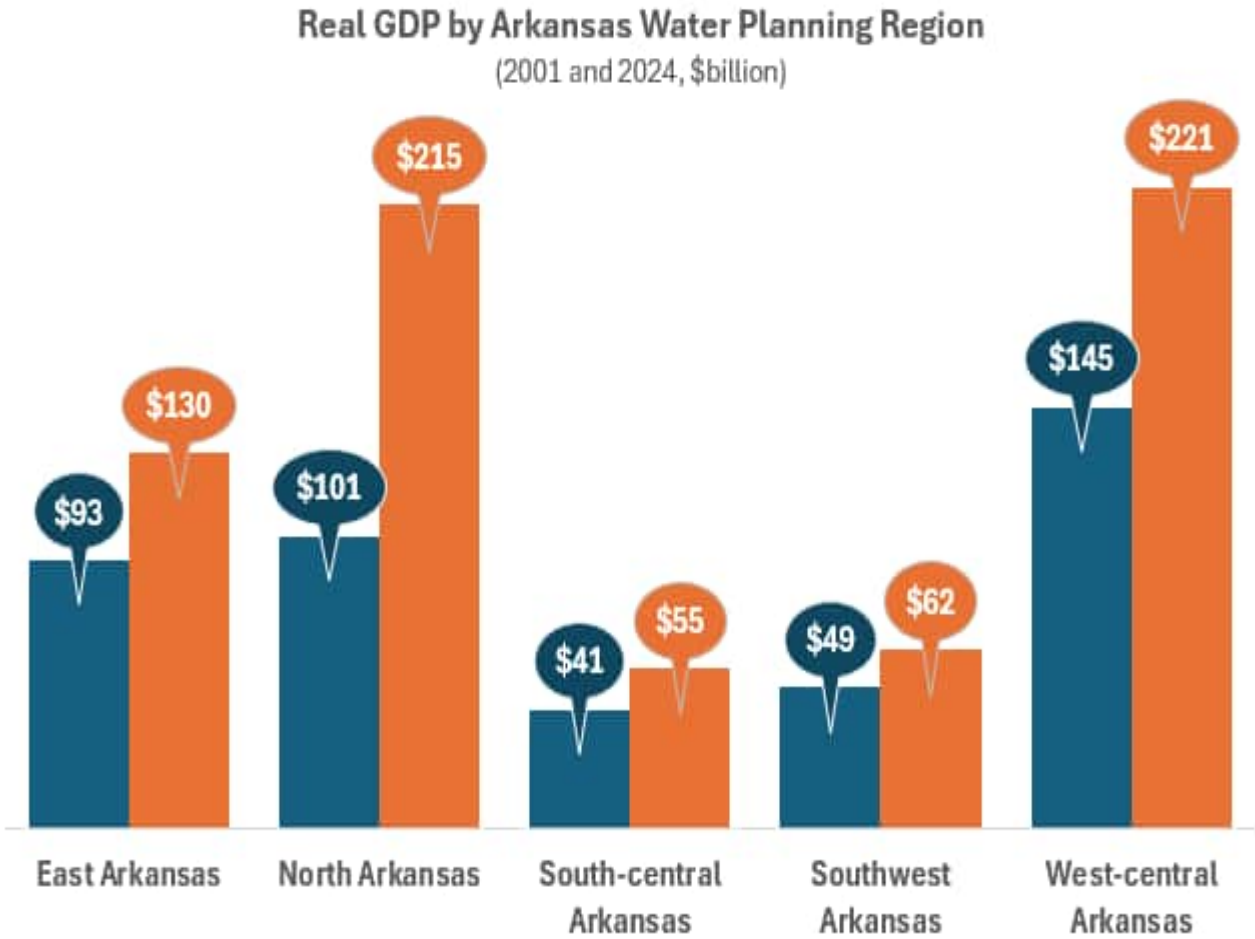


■ 1970 ■ 2020

Source: US Census



US Army Corps
of Engineers®



Source: U.S. Bureau of Economic Analysis



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of Engineers®



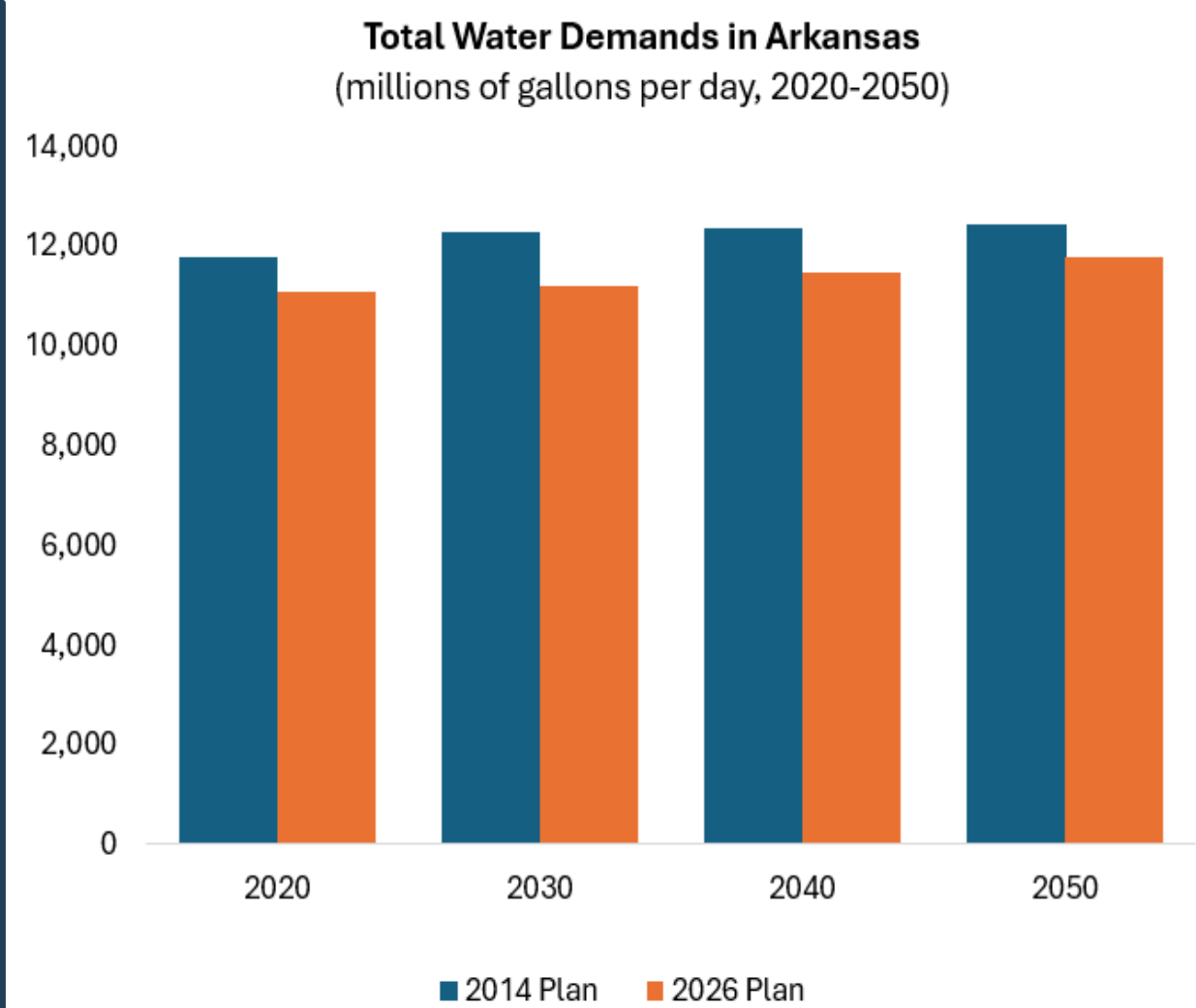
Draft Non-Ag Water Demands

- **Municipal (Utilities, Private Domestic Wells, Self-supplied Commercial)**
- **Thermoelectric Generation**
- **Industrial**
 - Manufacturing
 - Mining (oil and gas)
 - Emerging Industries (data centers and lithium)

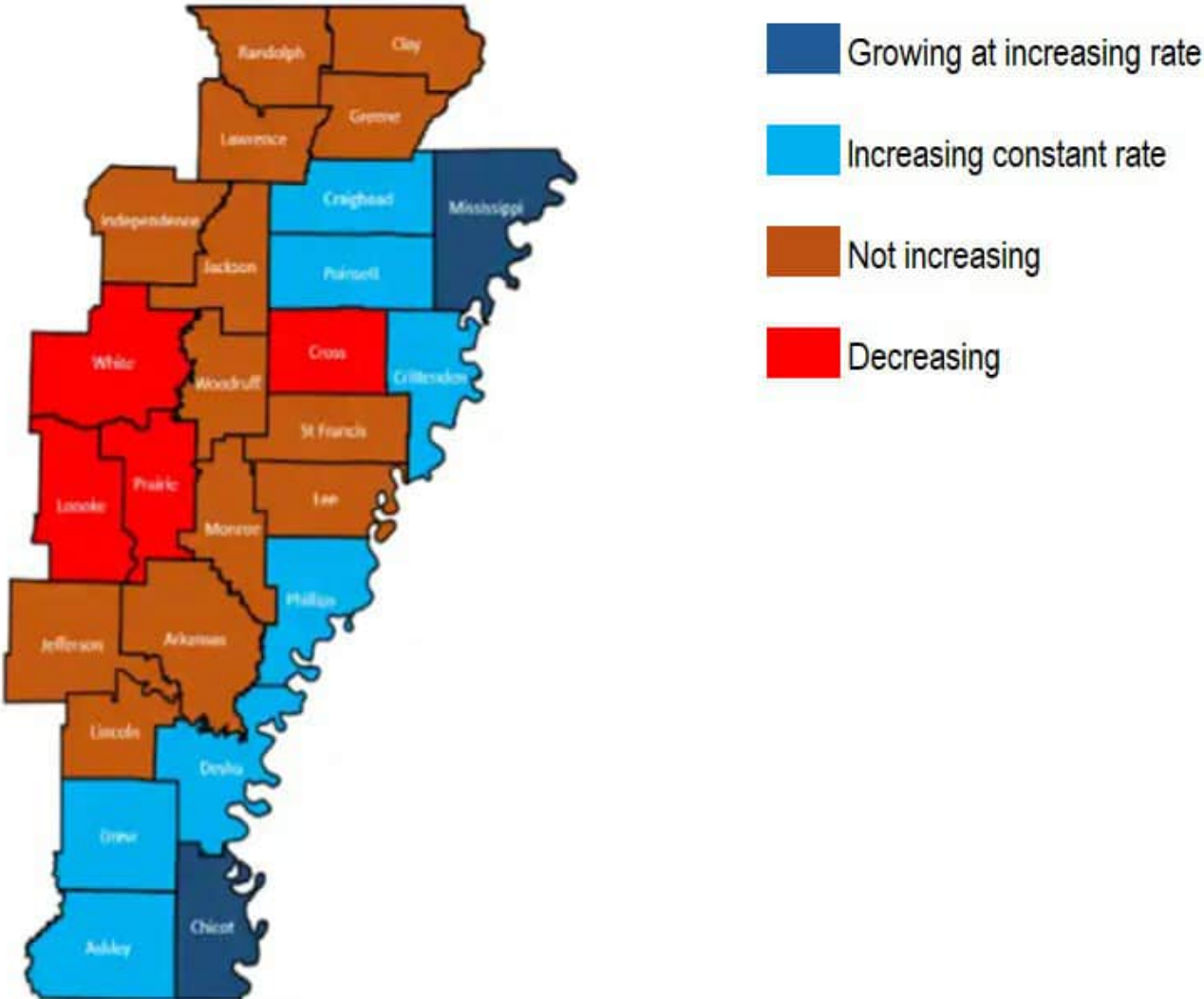


DEMANDS 2014 UPDATE VERSUS 2026 UPDATE

2014 Plan	2020	2030	2040	2050
Crop Irrigation	9,507	9,941	10,020	10,040
Thermoelectric	1,274	1,337	1,349	1,355
Industrial	308	288	258	235
Municipal	424	450	483	524
Water Fowl Habitat and Management	259	259	259	259
Livestock and Aquaculture	132	132	132	132
Total	11,772	12,275	12,369	12,545
2026 Update	2020	2030	2040	2050
Crop Irrigation	8,668	8,668	8,668	8,668
Thermoelectric	1,210	1,293	1,493	1,693
Industrial	217	234	255	274
Municipal	395	421	444	467
Water Fowl Habitat and Management	259	259	259	259
Livestock and Aquaculture	414	437	478	523
Total	11,162	11,312	11,597	11,884
Percent Difference	2020	2030	2040	2050
Crop Irrigation	-9%	-13%	-13%	-14%
Thermoelectric	-5%	-3%	11%	25%
Industrial	-30%	-19%	-1%	17%
Municipal	-7%	-7%	-8%	-11%
Water Fowl Habitat and Management	0%	0%	0%	0%
Livestock and Aquaculture	214%	231%	262%	296%
Total	-5%	-8%	-6%	-5%



Trends in Irrigated Acreage (1980-2023)



Municipal 2026 Update

***Provisional Information and Data: Subject to Change**

■ **Public Water Systems (water utilities)**

- Provide water for human consumption and regulated by AR Dept of Health (at least 15 connections and serve on average 25 people)
- About 1,130 in Arkansas
- Range from 25 customers to more than 310,000 plus (Central Arkansas Water)

■ **Private Domestic Wells**

- Serve single family residences or small groups of residences that do not meet above criteria

■ **Small Private Commercial Systems**

- Campgrounds, RV parks etc.

■ **Method**

- Developed a database using information from 2014 Update, AR Dept. of Natural Resources Water Use database (WUDS), AR Dept. of Health and other sources such as USACE National Structure Inventory (geospatial dataset)
- Change in water use over planning period driven by projected population change
- Basic per capita use model
 - Gallons per capita per day x projected population
 - Simple and good for state and regional water planning



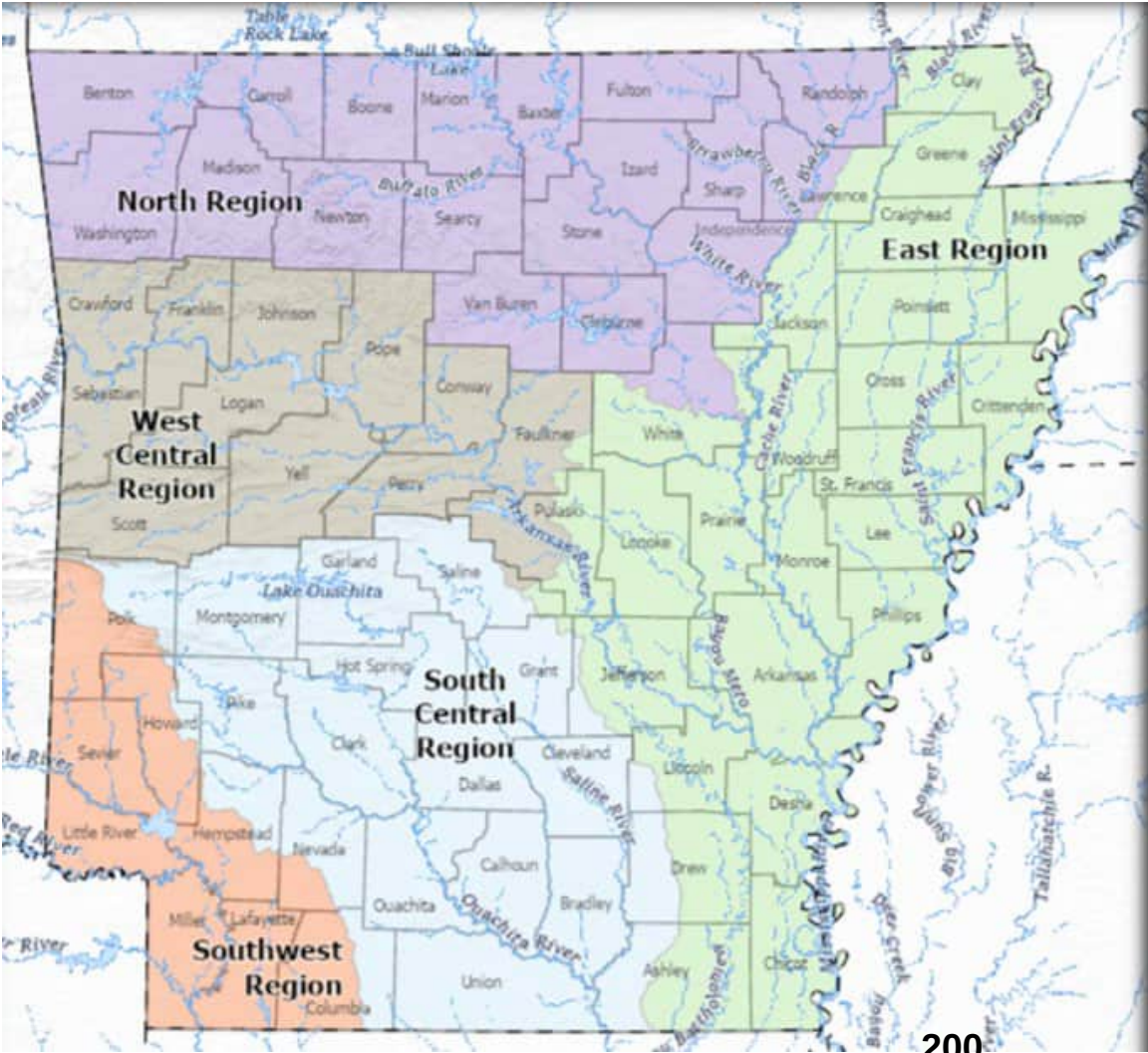
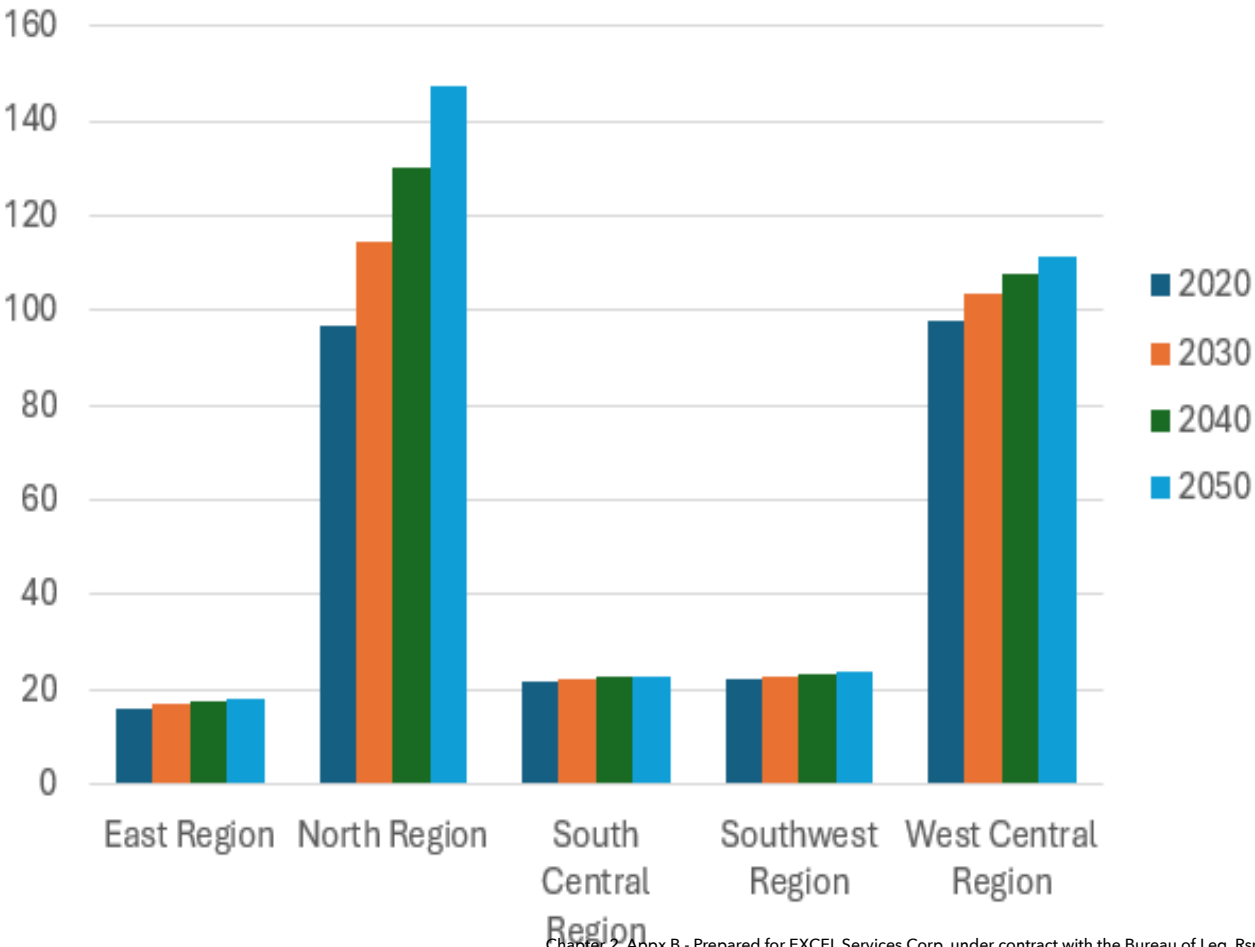
MUNICIPAL DEMANDS

Population	2020	2030	2040	2050
2014 Projections	3.25	3.59	3.92	4.10
2026 with 2020 Census and Projections	3.01*	3.20	3.36	3.51
Percent Difference	-7%	-11%	-14%	-14%
*Census Data				
Demands	2020	2030	2040	2050
2014 Plan Municipal Demands	424	450	483	524
2026 Plan Municipal Demands	395	421	444	467
Percent Difference	-7%	-9%	-10%	-11%



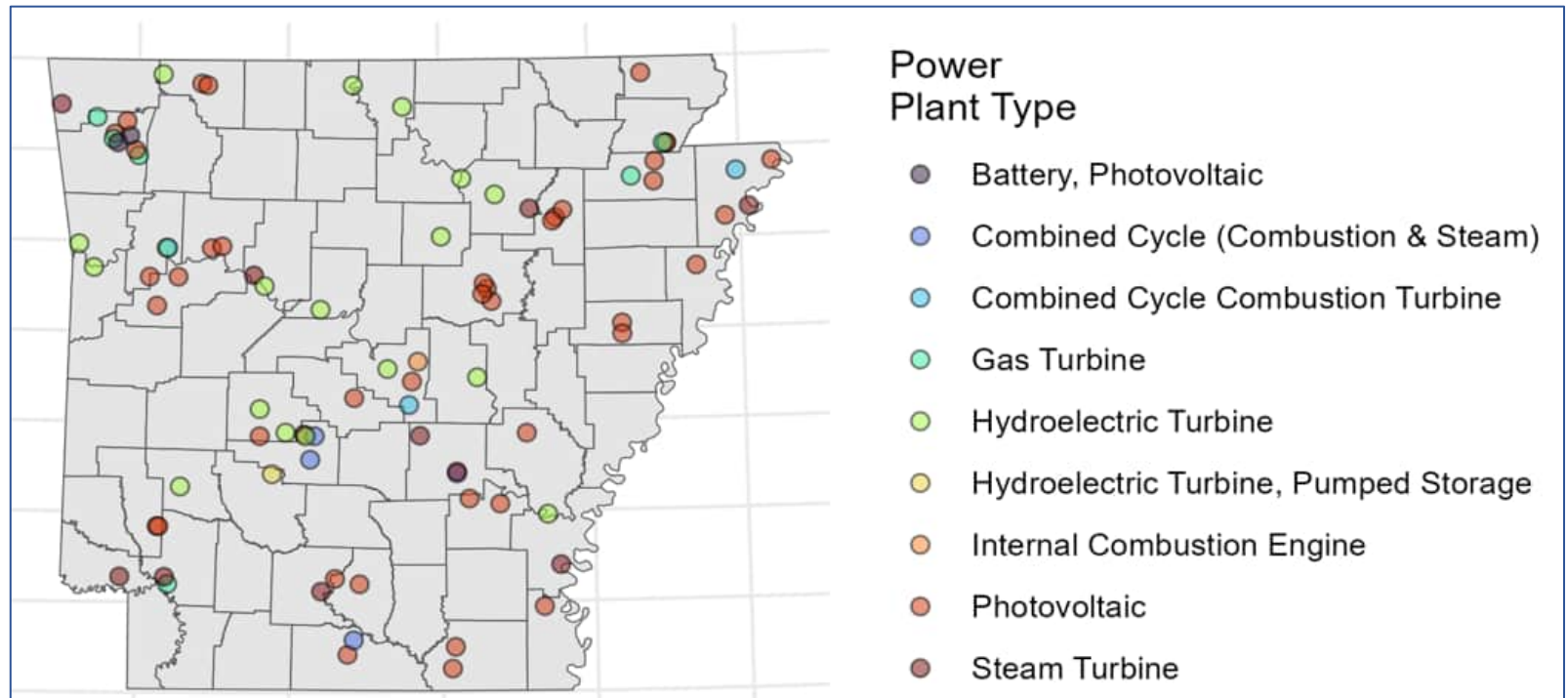
2026 UPDATE MUNICIPAL AND DOMESTIC DEMANDS

Municipal Water Demands by Planning Region
(Millions of gallons per day, 2020-2050)



Thermoelectric 2026 Update

*Provisional Information and Data: Subject to Change



- Steam turbines are the primary users of cooling water
- Figures presented include demands with withdrawals
 - Consumptive/evaporative cooling losses are about 6 percent of withdrawals in the aggregate
- Figures include utility generation only
 - cogeneration (“cogen”) included in industrial water
- 2 plants account for 90 percent of withdrawals
- 10 plants account for 90 percent of consumptive use

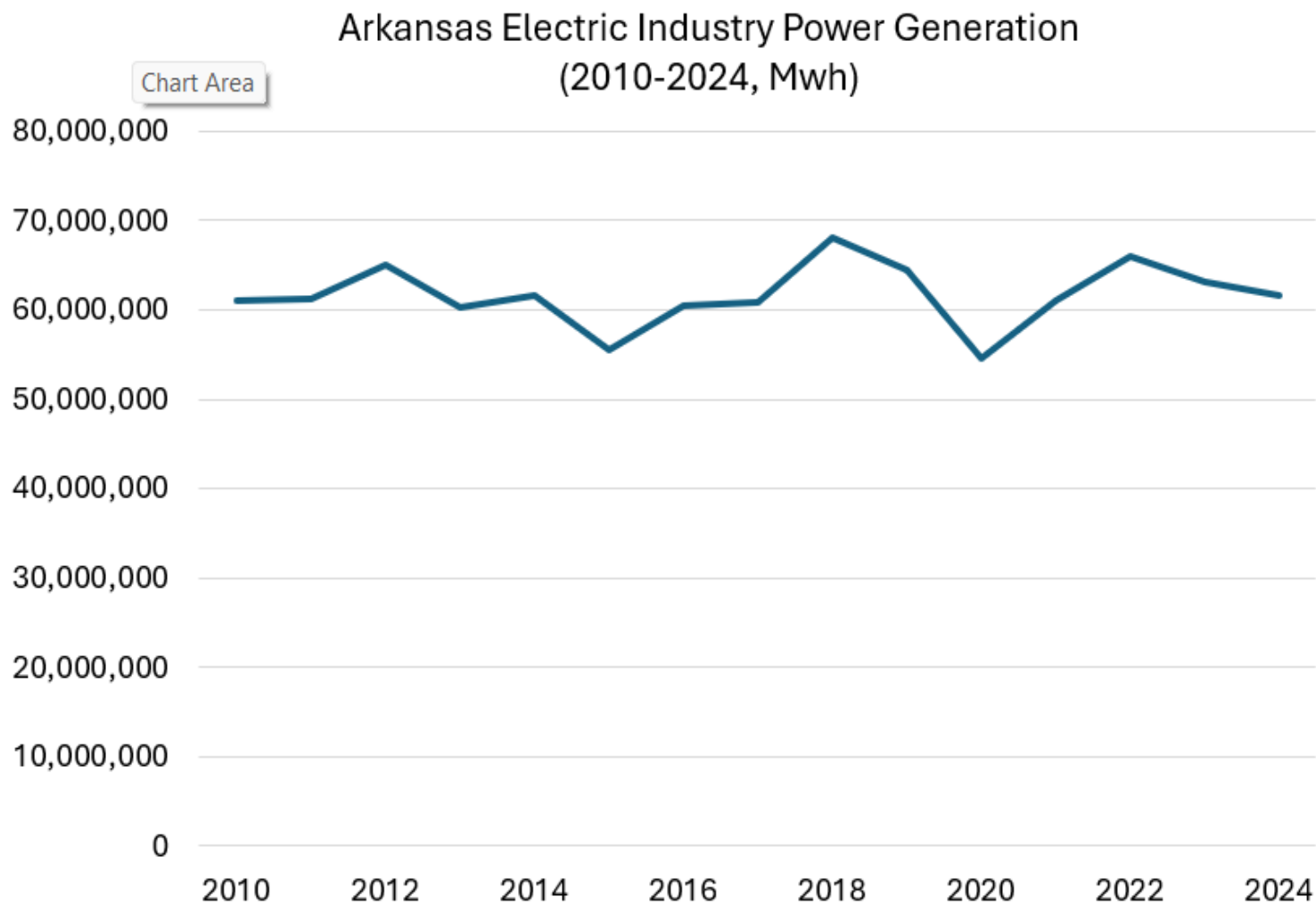
THERMOELECTRIC

- **Developed database of individual plants with EIA information**
 - Facility location and owner/operator
 - Cooling system
 - Fuel and prime movers
 - Annual gross and net generation
 - Water use coefficients measured in gallons per kilowatt hours
- **Analyzed trends in state generation and generating technology mix**
- **Assessed impact of emerging industries on potential future generation and water use**

Generator & Cooling Type	Withdrawals Gal/MWh	Consumptive Gal/MWh
Nuclear/ Once-through	40,000	580
Natural Gas/Once-through (Stand-by Generators)	40,000	400
Natural Gas/Once-through	35,000	400
Coal/ Once-Through (cooling pond)	35,000	350
Natural Gas/Once-through	35,000	350
Natural Gas/Once-through	35,000	300
Natural Gas/Cooling Tower	800	800
Nuclear/ Cooling Tower	750	750
Natural Gas Combined-Cycle Steam Turbine/Cooling Tower	700	700
Coal/Cooling Tower	600	600
Coal (ultra supercritical)/Cooling Tower	550	550
Natural Gas Combined-Cycle Combustion Turbine	50	50
Natural Gas/Combustion (Gas) Turbine	50	50
Natural Gas Combined-Cycle Combustion Turbines	50	50



THERMOELECTRIC GENERATION TRENDS



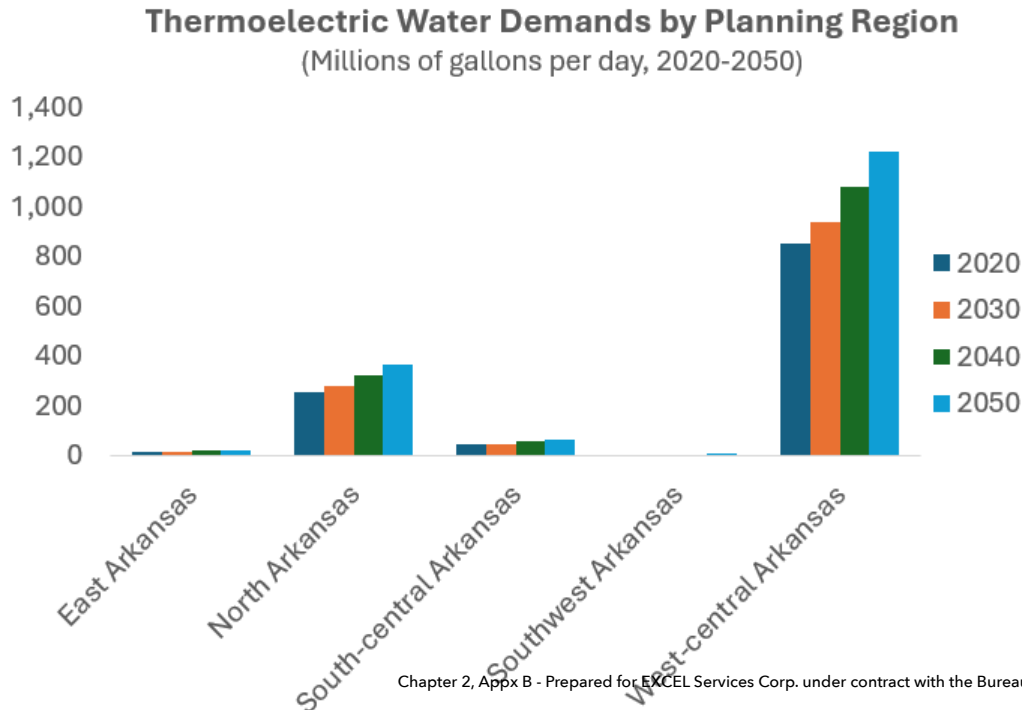
THERMOELECTRIC GENERATION TRENDS

Fuel	Generation (megawatt hours)		
	2010	2024	% Change
Coal	28,152,445	15,660,355	-44%
Hydroelectric Conventional	3,658,962	3,134,464	-14%
Natural Gas	12,469,077	24,725,307	98%
Nuclear	15,022,678	14,762,779	-2%
Other	28,421	7,143	-75%
Other Biomass	56,959	27,168	-52%
Petroleum	45,179	54,566	21%
Pumped Storage	521	76,525	14788%
Wood and Wood Derived Fuels	1,566,984	765,087	-51%
Solar Thermal and Photovoltaic	0	2,329,090	A lot
Total	61,000,184	61,542,484	1%



THERMOELECTRIC PROJECTIONS (WITHDRAWALS)

	2020	2030	2040	2050
2014 Plan	1,274	1,337	1,349	1,355
2026 Plan	1,210	1,293	1,493	1,693
Percent Difference	-5%	-3%	11%	25%
*Consumptive/evaporative cooling losses are about 6 percent of withdrawals				



Industrial Demands 2026 Update

*Provisional Information and Data: Subject to Change

■ Manufacturing

■ Mining

- Oil and Gas Extraction
- Emerging Lithium Hydroxide Mining
- Other Mining

■ Data Centers

- Rapidly developing in U.S. and Arkansas to support Artificial Intelligence



MANUFACTURING



■ Methods and Data

- Approach relied on identifying major industries by county using data from Arkansas Economic Development, WUDS and other sources (general research of major firms)
- Developed a database (firm level with employment, SIC code, products, production etc.)

■ Water Use Coefficients

- Gallons per Employee per Day (GED)
 - Pacific Institute
 - IWR-Main Water Demand Forecasting Suite

■ Includes Water Use for Industrial Cogeneration

- Some large facilities, particularly pulp mills, generate on site power for internal use and sales to grid

■ Growth over Planning Horizon

- Research indicates expansion in some major sectors and some growth since
 - ✓ Example: In 2024, Georgia-Pacific announced a \$90 million investment in its Crossett mill to expand its retail consumer tissue business
 - ✓ Expansion in emerging industries – Lithium and data centers

HIGH VOLUME MANUFACTURING SECTORS (BASELINE VALUES)

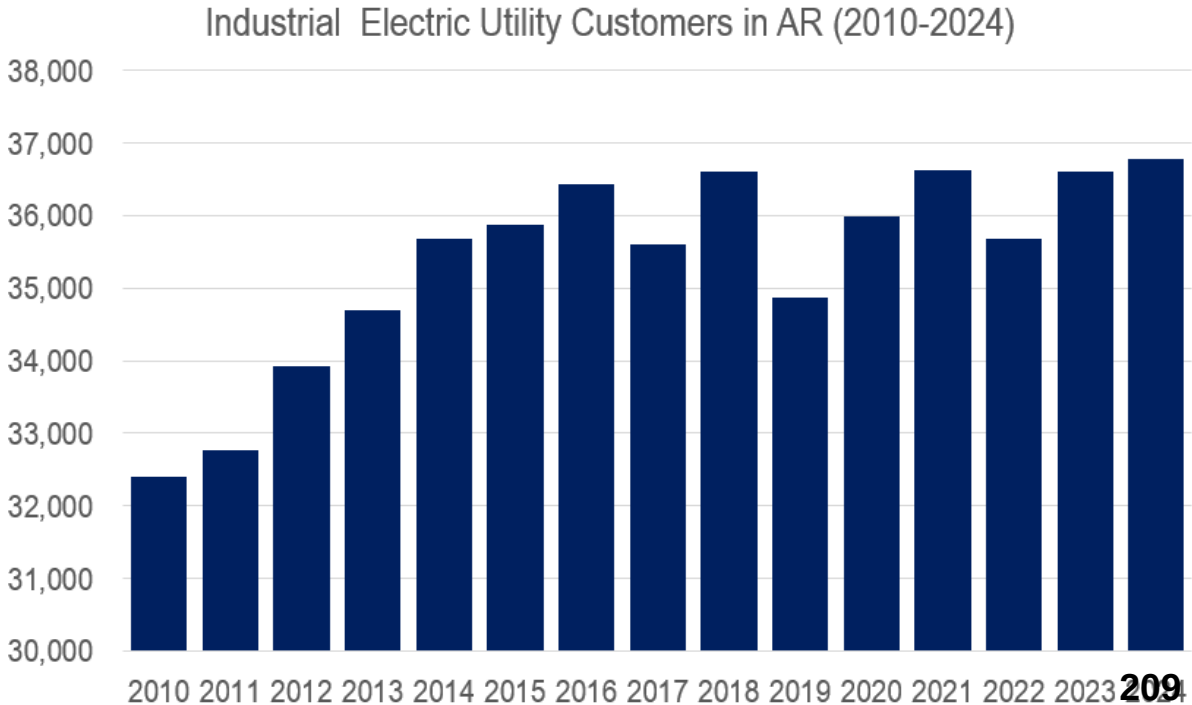
Sector	Process Water Only	Process and Cogen
Pulp and Paper Mills	40.63	131.30
Poultry Processing	36.67	36.67
Other Food Processing	11.71	11.71
Petroleum Refining and Products	5.80	5.80
Machinery and Equipment	5.79	5.79
Metal Processing and Products	4.94	4.94
Plastic and Rubber Products	3.77	3.77
Chemicals	3.64	3.64
Rice mills	2.89	2.89
Beverage	1.29	1.29
Textiles and Clothing	0.58	0.58
Cement and Ceramics	0.33	0.33
Textiles	0.24	0.24

MANUFACTURING TRENDS

■ **Growth**

- ✓ Research indicates considerable expansion in some major sectors and aggregate growth from 2010-2016
- ✓ Example: In 2024, Georgia-Pacific announced a \$90 million investment in its Crossett mill to expand its retail consumer tissue business.
- ✓ Employment projections not a good driver for projected water use

Historical Manufacturing Employment (1000s, Woods and Poole)			
	1980	2025	% Change
U.S.	19,475	13,700	-30%
Southeast	4,381	3,404	-22%
Arkansas	201	169	-16%



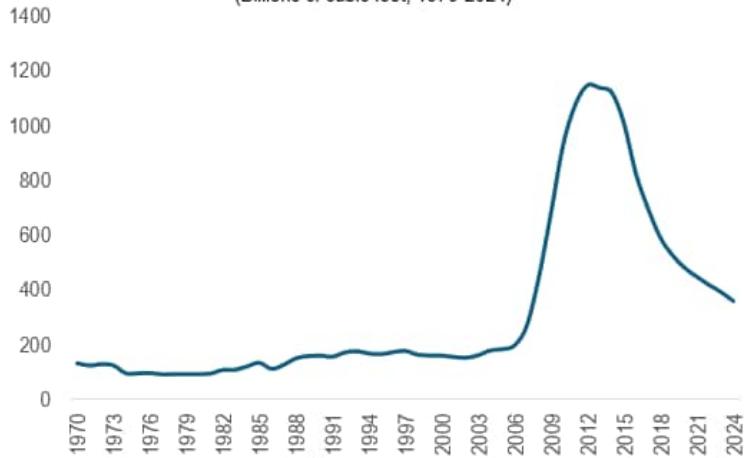
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MANUFACTURING DEMAND PROJECTIONS

	2020	2030	2040	2050
Statewide				
2014 Plan	291	273	249	224
2026 Plan	209	209	209	209
Percent Difference	-28%	-23%	-16%	-7%
Top Counties				
Little River	64.07	64.07	64.07	64.07
Ashley	22.97	22.97	22.97	22.97
Desha	16.63	16.63	16.63	16.63
Jefferson	11.95	11.95	11.95	11.95
Sebastian	8.08	8.08	8.08	8.08
Washington	7.42	7.42	7.42	7.42
Union	7.21	7.21	7.21	7.21
Conway	7.09	7.09	7.09	7.09

OIL AND GAS EXTRACTION (SHALE GAS)

North Arkansas Gas Production
(Billions of cubic feet, 1970-2024)



South Arkansas Gas Production
(Billions of cubic feet, 1970-2024)



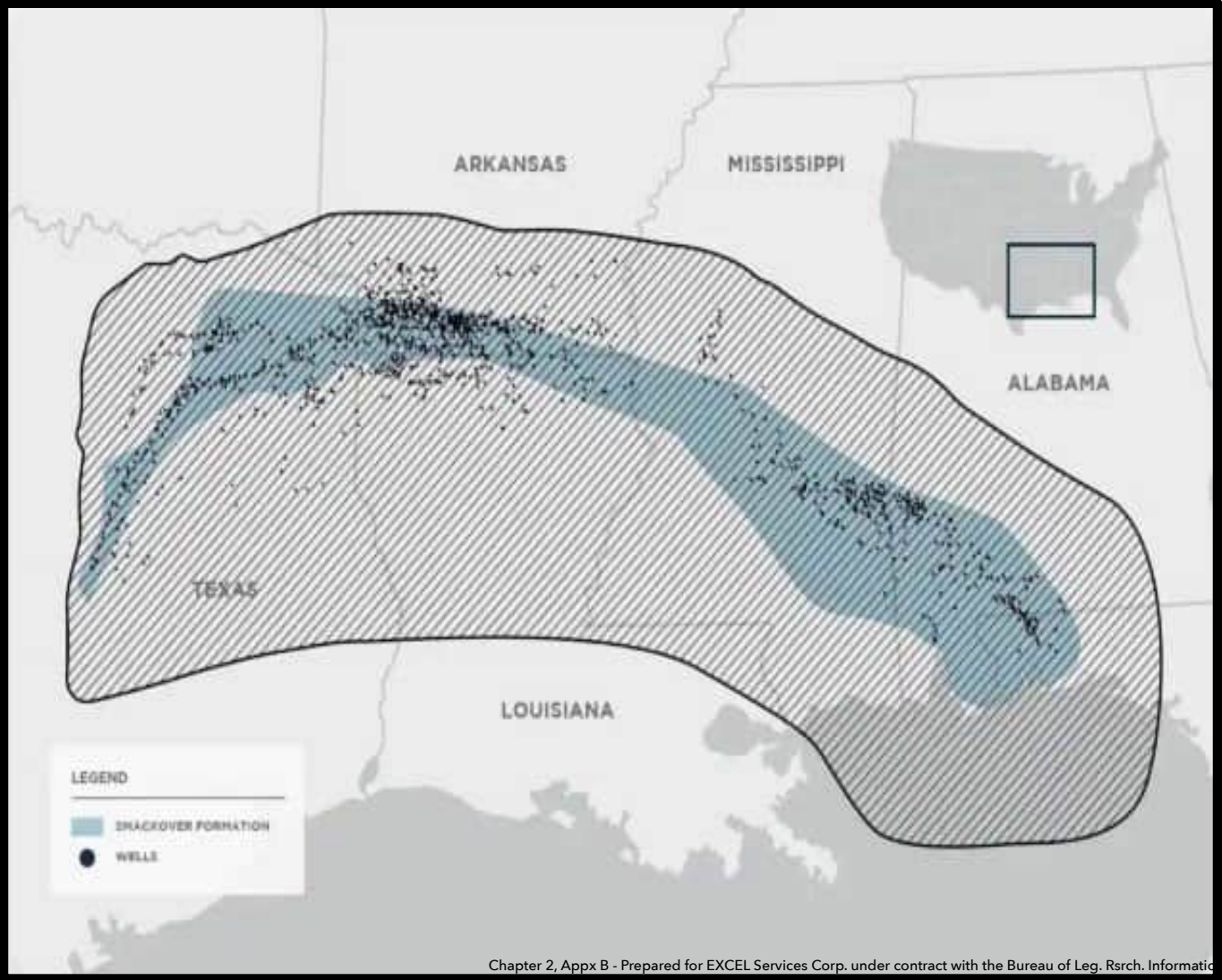
- **Water used for fracking occurs during well drilling**
 - 5 to 6 million gallons per well
- **Production and well drilling activity has declined significantly**
 - Relatively small volumes included in 2026 industrial water demand forecast

Oil and Gas Well Permits Issued in Arkansas
(1970-2024)

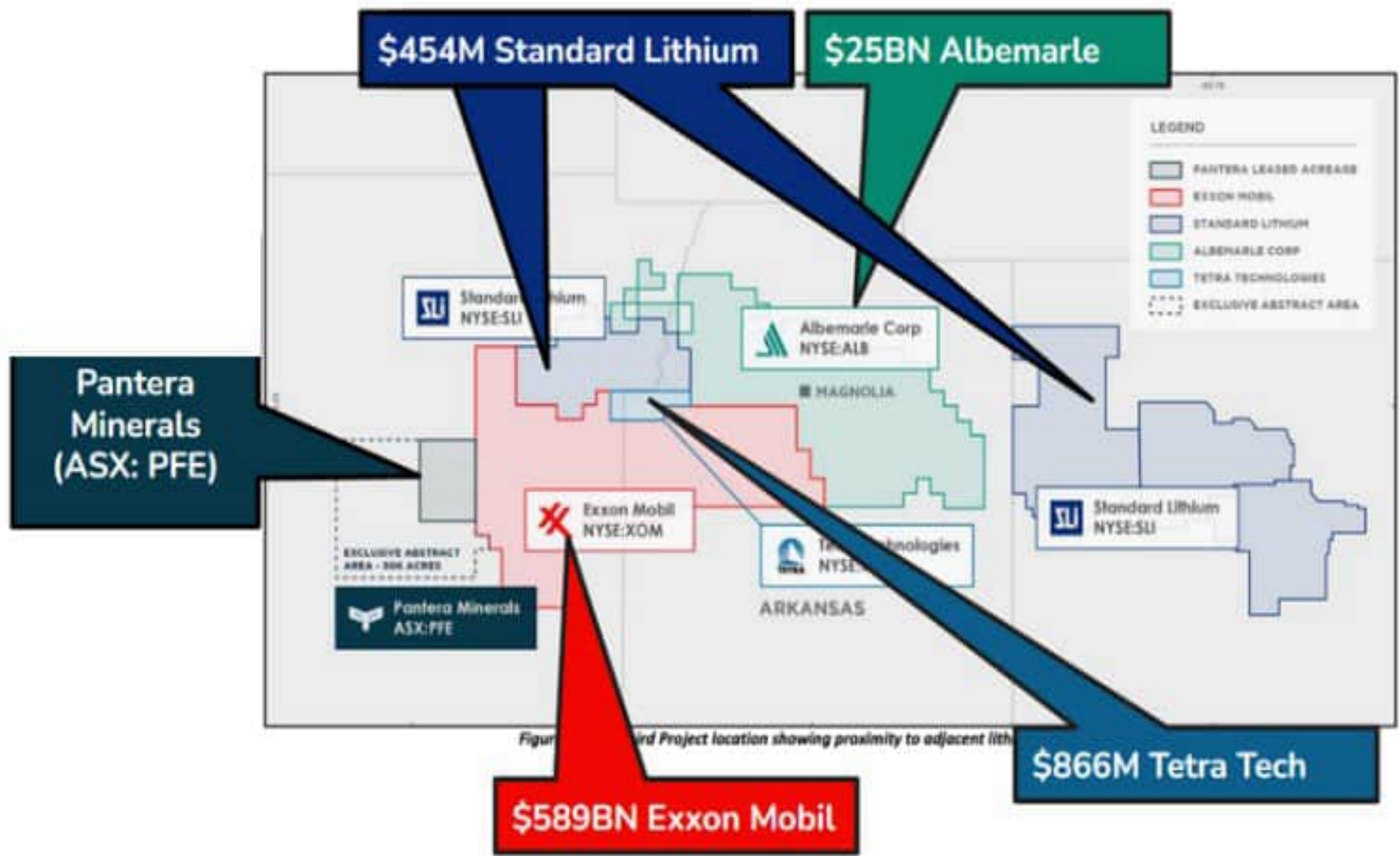


LITHIUM MINING

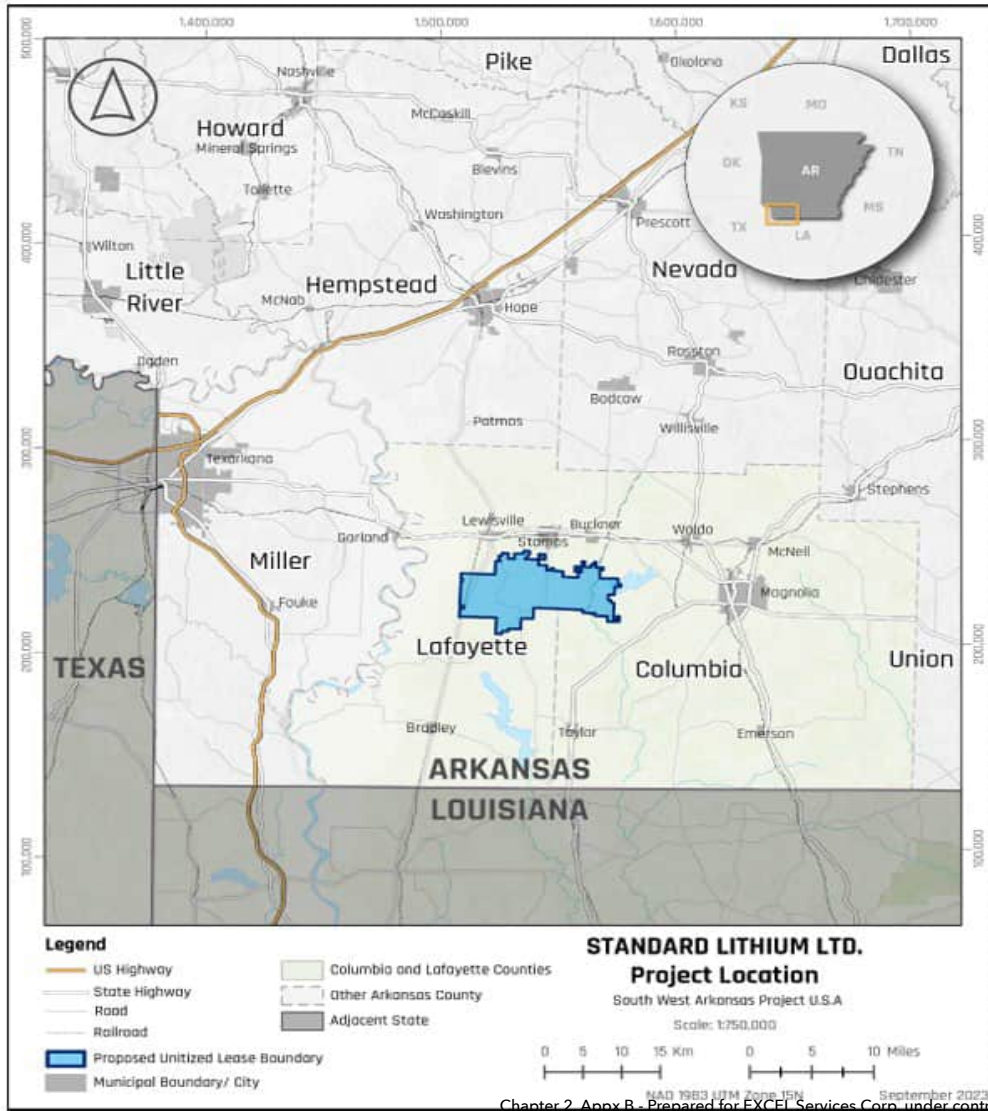
- South Arkansas Smackover brines contain between 5.1 and 19 million metric tons of in-place lithium



MAJOR PLAYERS IN ARKANSAS LITHIUM



STANDARD LITHIUM AND EQUINOR



- Standard Lithium: Partnered with Equinor on the Southwest Arkansas (SWA) Project, targeting first production in 2028 – pre-feasibility with leases in place
- 15 miles west of Magnolia in Lafayette County is most developed effort
- Six freshwater wells drilled to 300 feet below grade with a capacity 3,387 ac-ft/y
- Water supply - Sparta Aquifer (Lafayette County)

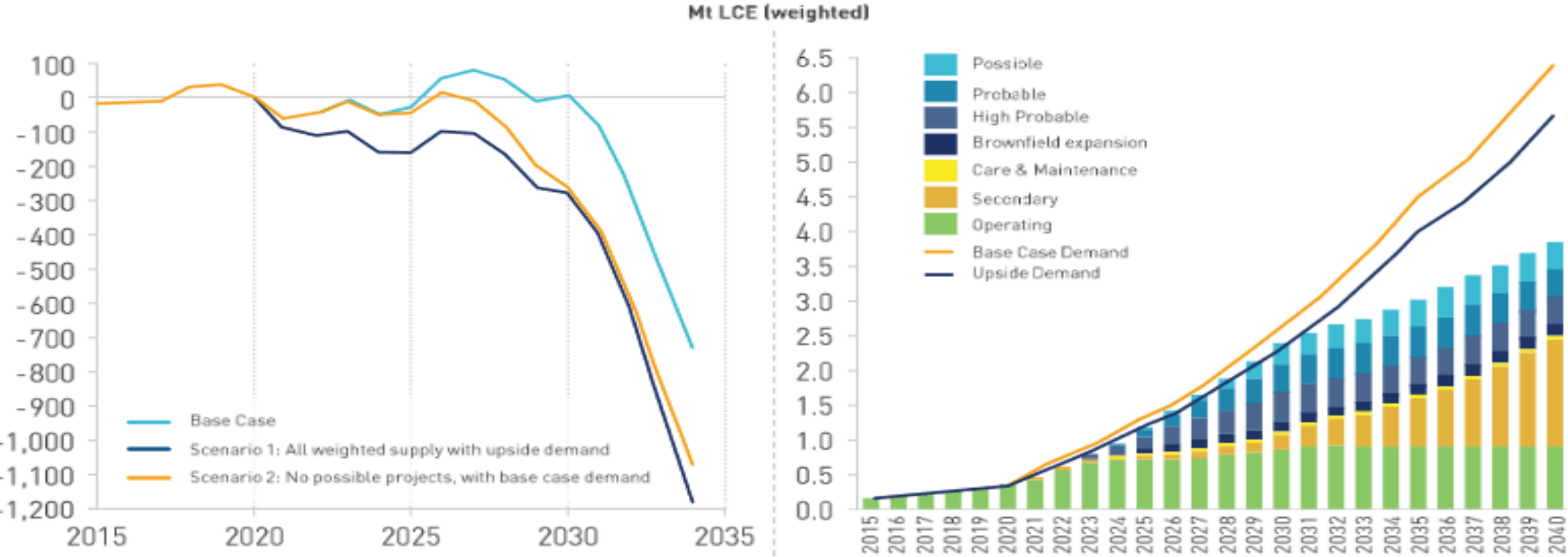
WATER REQUIREMENTS LITHIUM MINING

Extraction Method	Gallons per Metric Ton	
	Low	High
Solar Evaporation Ponds	118,000	500,000
Direct Lithium Extraction (DLE)	22,000	27,000
Hard Rock Mining	20,300	
Advanced DLE (with water recycling)	530	3,000



GLOBAL LITHIUM MARKET PROJECTIONS

LITHIUM MARKET IMBALANCE



Source: Benchmark Mineral Intelligence Q2 2022 Forecast



LITHIUM WATER USE PROJECTIONS

Year	2020	2030	2040	2050
Production (tons per year)				
Columbia	0	22,500	57,500	80,000
Lafayette	0	45,000	87,500	120,000
Union	0	5400	10,000	20,000
Total Production Arkansas	0	72,900	155,000	220,000
Water (MGD by county)				
Columbia	0	1.94	4.96	6.90
Lafayette	0	3.88	7.54	10.34
Union	0	0.47	0.86	1.72
Total Water Arkansas	0	6.28	13.36	18.96

Data Centers



Amazon's new \$11 billion data center in New Carlisle, Indiana 2,200 MW capacity is enough to power 1.6 million homes



Estimated design water use is about 21.0 MGD of groundwater-enough to satisfy water demands of roughly 70,000 homes

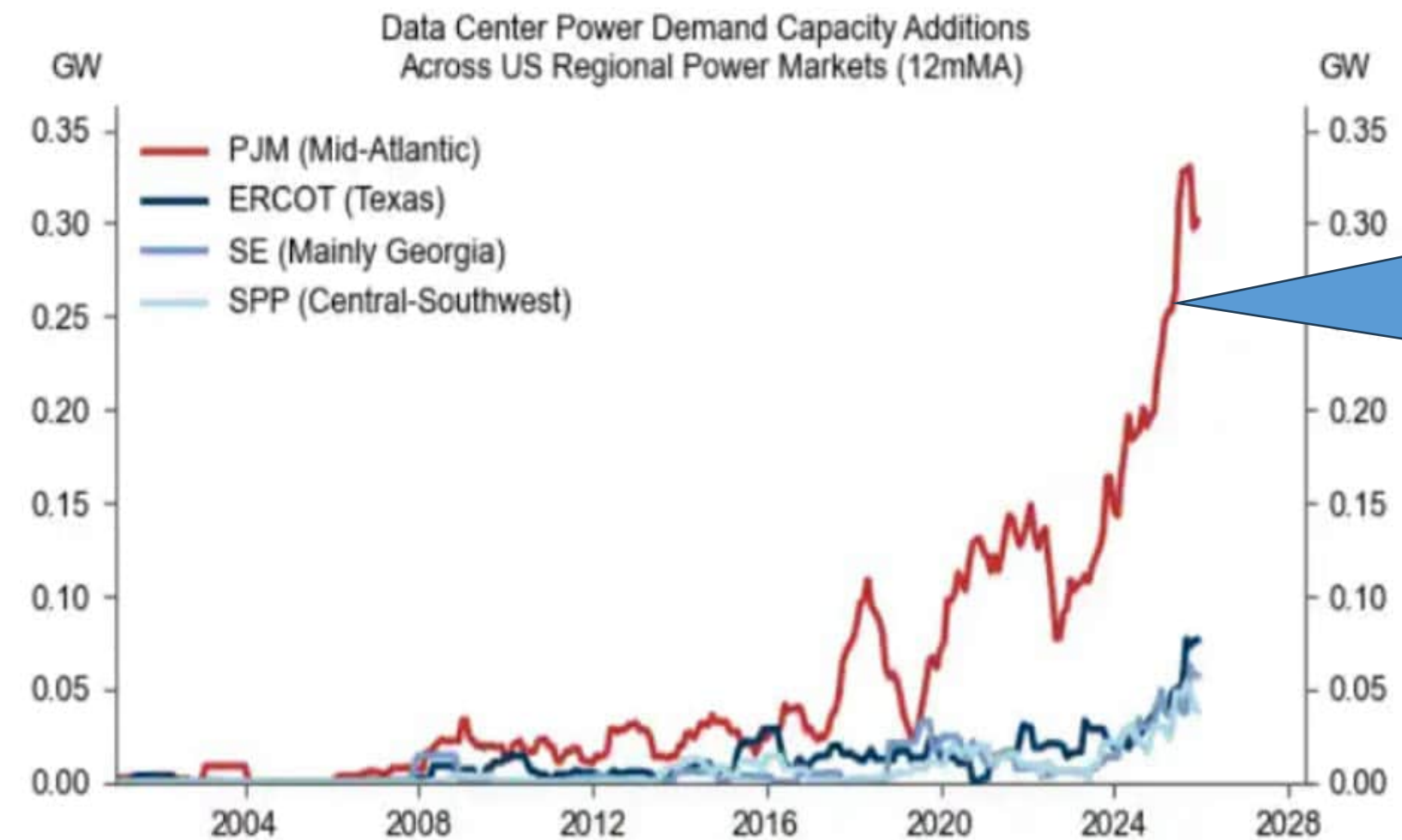
Types of Data Centers

- Enterprise Data Centers: Owned by a single organization, typically located on-premises
- Colocation Data Centers: Facilities where multiple organizations share space and resources
- **Cloud Data Centers:** Operated by cloud service providers, offering virtualized resources to multiple customers
- **Hyperscale Data Centers:** Large facilities designed for massive scale, often used by major tech companies
- Edge Data Centers: Located closer to end-users to reduce latency and improve performance

Key Components

- Infrastructure
- Servers: Process and manage data
- Storage Systems: Hold and retrieve data
- Networking Equipment
- **Reliable electricity supply**
- **Cooling Systems: Maintain optimal operating temperatures**

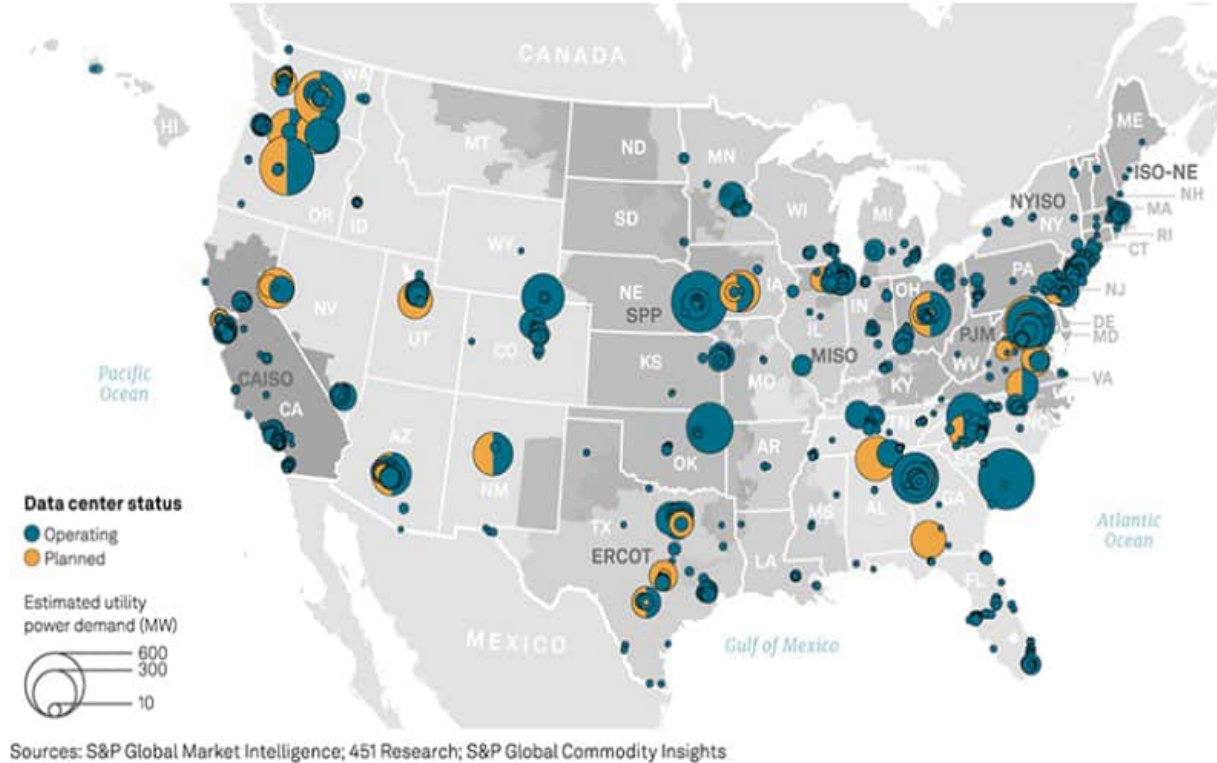
Data Centers Trends



*Data centers now account for more than **25% of annual electricity consumption in Virginia***



Data Centers Trends



Source: McKinsey & Company

- Outside of power, fiber optics transmission is one of the most important factors determining the productivity and location of data centers

Data Centers Cooling Systems

- **Closed Loop** - Sealed system circulates a fixed amount of coolant and heat is rejected via air-cooled radiators (dry cooling)
- **"Hybrid" Closed Loop** - Internal closed loop transfers heat to an external open loop with a cooling tower, where water is lost to evaporation
- **Standard Evaporative** - Directly uses evaporation in cooling towers
- **Air Cooling** - Uses outside air to cool the data center (very energy-intensive but no water)

Data Centers Planned Projects

City	County	Firm	Size	Target Completion	Initial Baseload (megawatts)	Buildout Baseload (megawatts)
Little Rock	Pulaski	AVAIO	760-acre campus	2028	150	1,100
West Memphis	Crittenden	Google	900,000 sq/ft	2027	270*	-
Conway	Faulkner	-	300,000 sq/ft	2028	90*	-
Clarksville	Johnson	ServerFarm	6 x 360,000 sq/ft	-	-	-

Energy Requirements	Watts per sq/ft
Low	High
150	300

*Estimated assuming based on reported energy requirements in watts per sq/ft



Data Centers Baseline Parameters

Baseline Estimates	Initial Megawatt hours	Initial MGD	Potential Megawatt hours	MGD Potential	Hyperscale
Little Rock	1,314,000	1.71	9,636,000	12.57	Yes
Conway	788,400	1.03	5,781,600	12.57	Yes
West Memphis	2,365,200	3.08	9,636,000	7.54	Yes
Clarksville	1,314,000	3.08	9,636,000	12.57	Yes

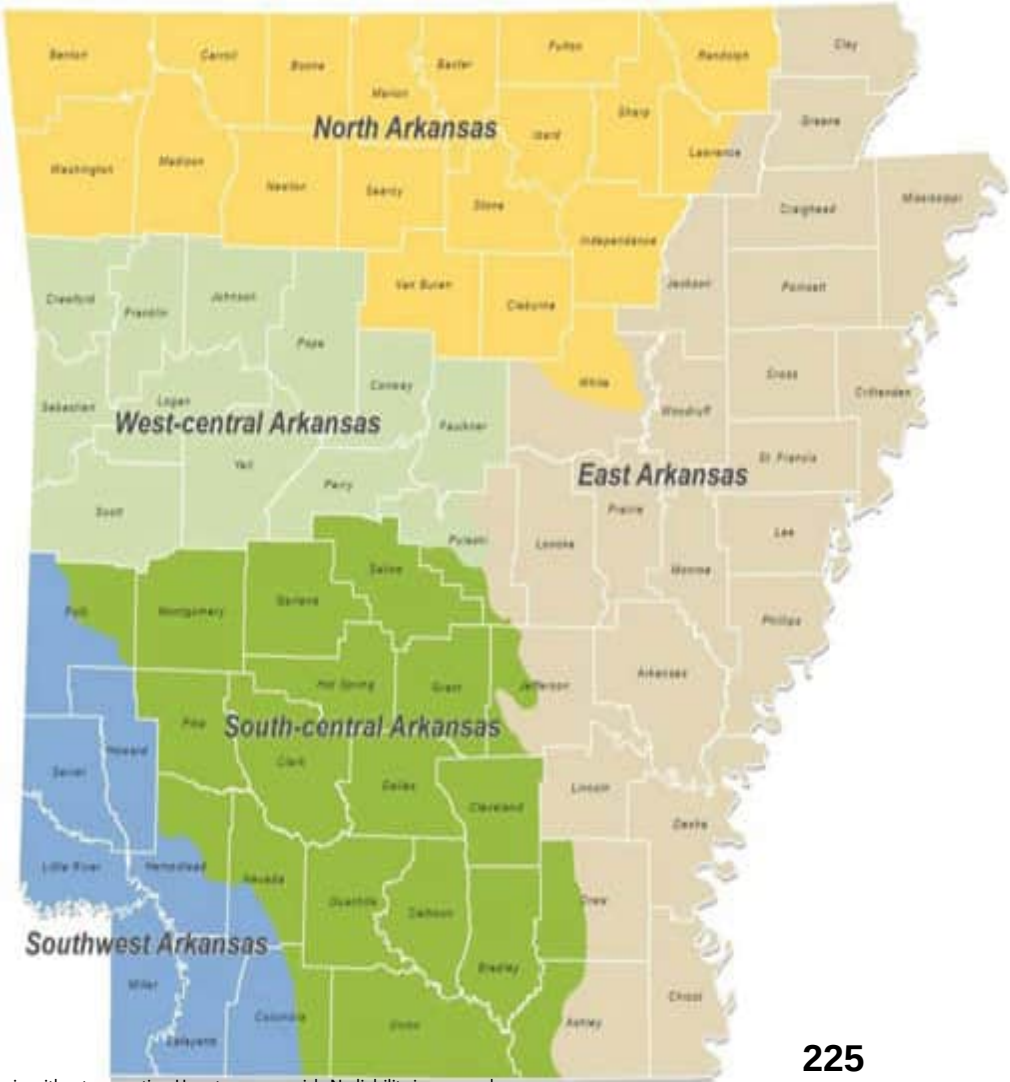
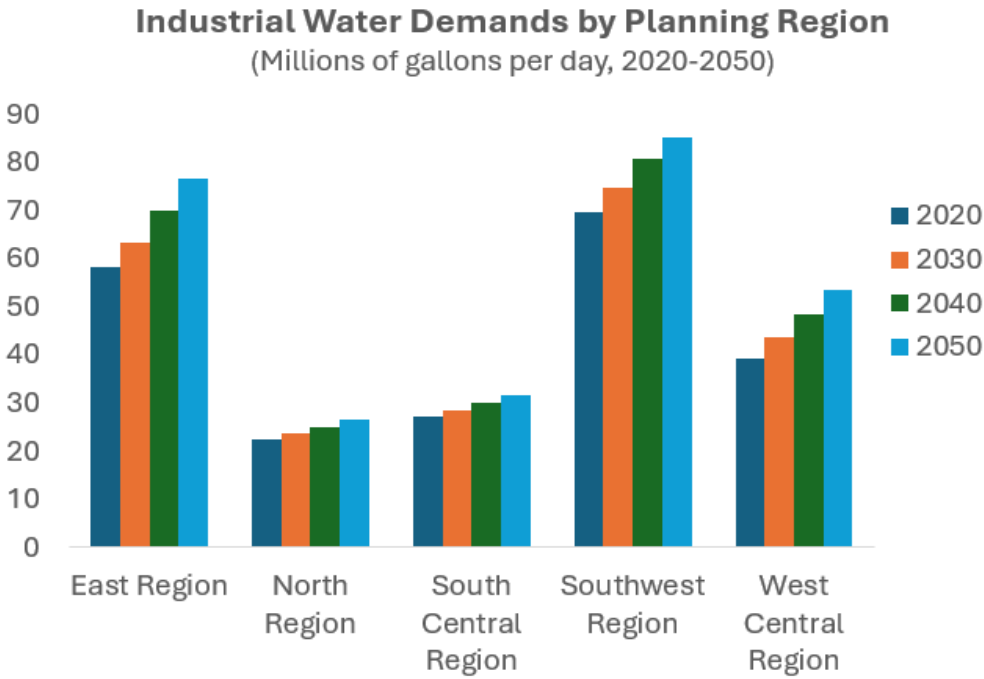
Consumptive water	Gallons per Megawatt hours
Industry Average	476
TWDB (estimate for new Texas data centers)	770

Data Center Projections

Data Centers (MGD)	2020	2030	2040	2050
Pulaski	0	1.71	4.97	8.23
Crittenden	0	3.08	5.93	8.23
Faulkner	0	1.03	2.98	4.94
Johnson	0	3.08	5.93	8.23
Total	0	8.91	19.81	29.61

Total Industrial Projections

	2020	2030	2040	2050
2014 Plan	308	288	258	235
2026 Plan	217	234	255	274
Percent Difference	-30%	-19%	-1%	17%



Arkansas Water Plan 2026



Agricultural Demands and Supply Analysis



U.S. ARMY



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Arkansas Water Plan Update – Presentation Outline

- Agricultural Demands Update
 - Updated methods
 - Results by crop type, water source, and planning region
 - Comparison to 2014 AWP
- Total demand
 - Updated Methods
 - Results by source, sector, and planning region
- Surface Water Availability Update
 - Updated Methods
 - Results for major basin
 - Comparison to 2014 AWP
- Groundwater Availability Update

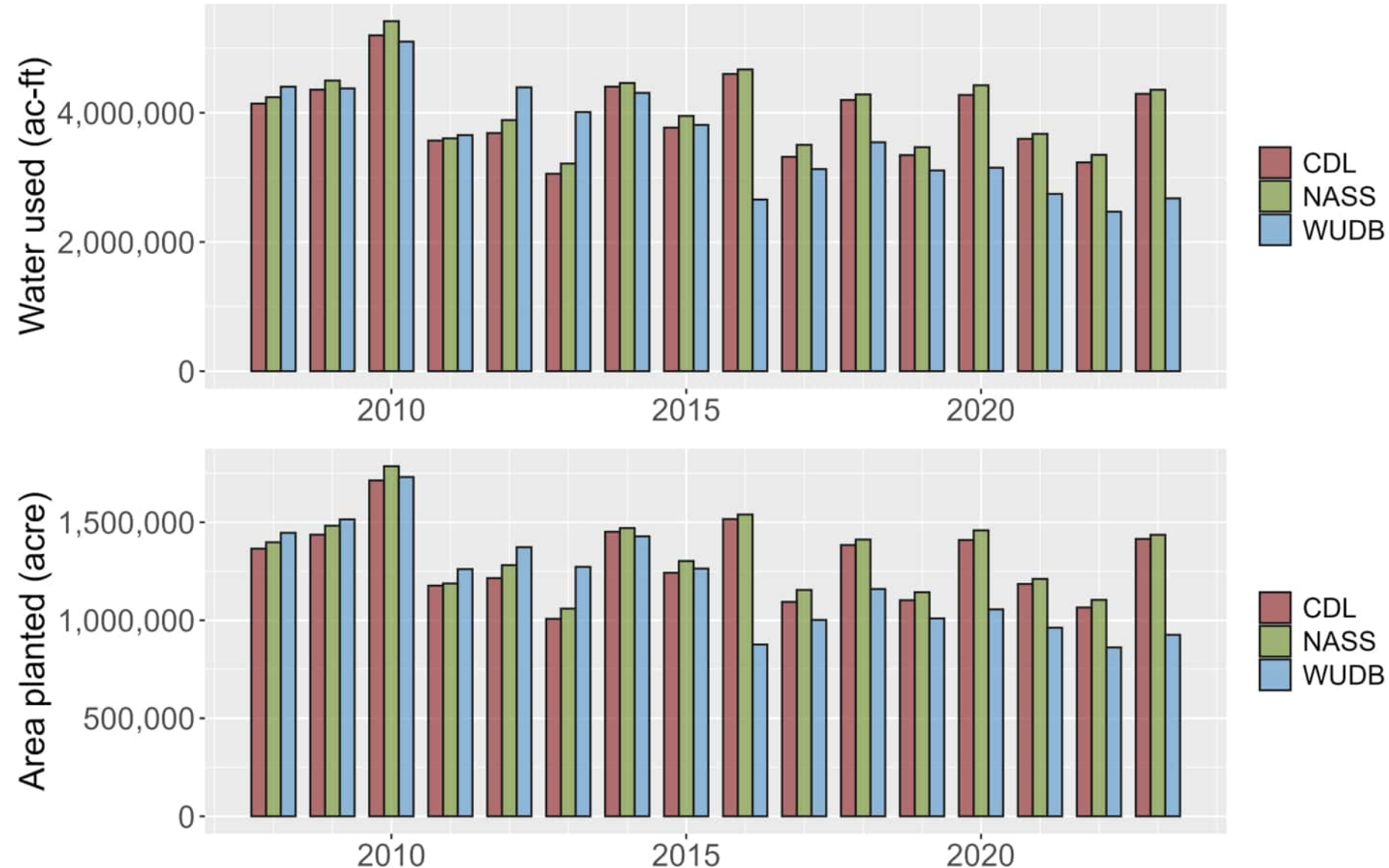


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Agricultural Water Use - Rice Comparison

- There appears to be some lag in reporting following the 2016 AR WUDB crash and COVID disruptions beginning in 2020.
- Other sources of data were explored for major water use crops across the state.
 - CDL data was used for acres planted Rice, Soybeans, Corn and Cotton from 2016 to 2023
 - NASS data was used to determine livestock quantities and percentage of acres for major crops irrigated by County
 - Published applications rates (Massey et al, 2017) were used to compute water use for major crops from 2016 to 2023.

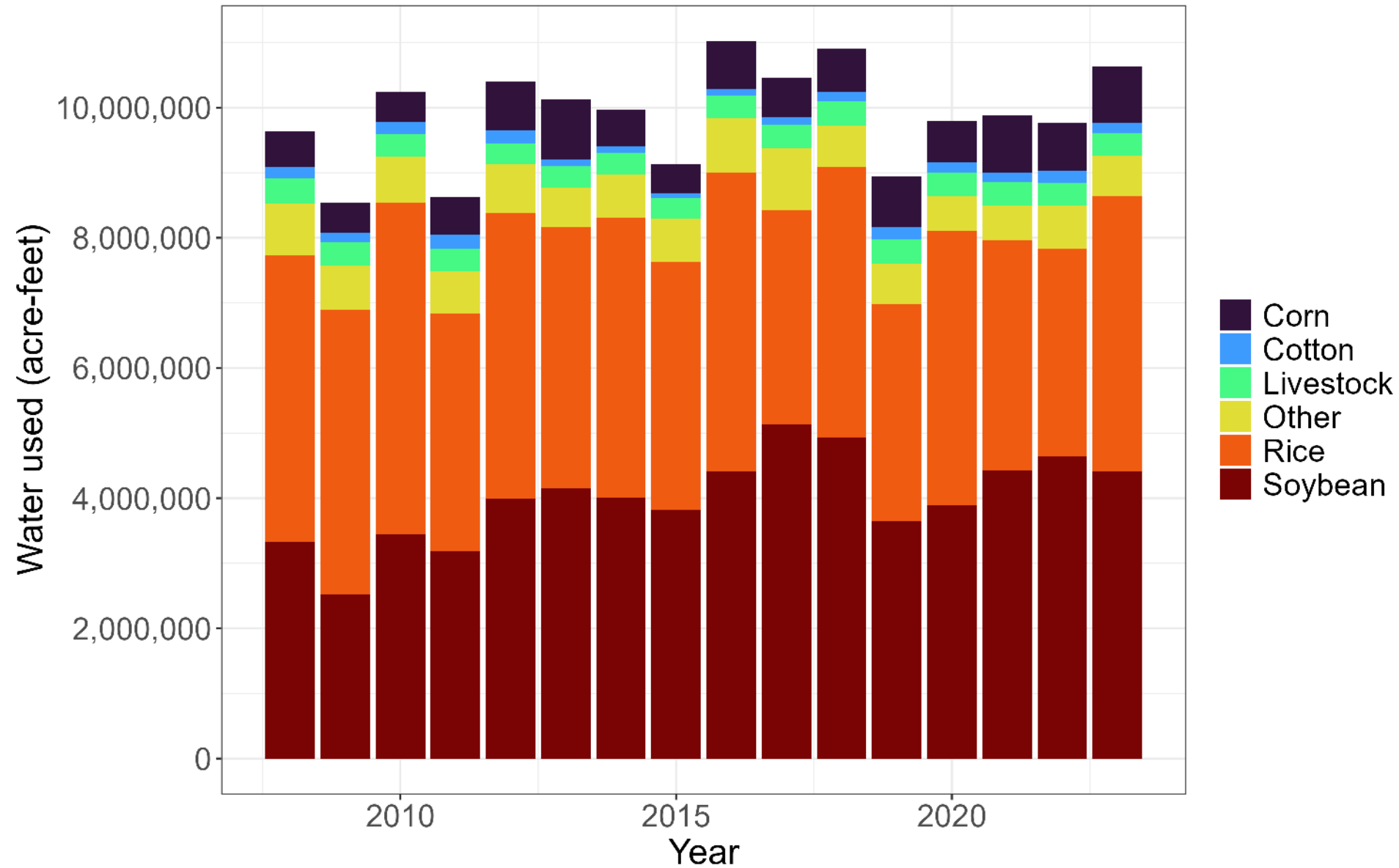


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Agricultural Water Use – By Product

- This data includes water use estimates for poultry that are subject to change based off Arkansas Dept of Agriculture recommendation
 - The estimates for poultry were split 75% surface water and 25% groundwater sources

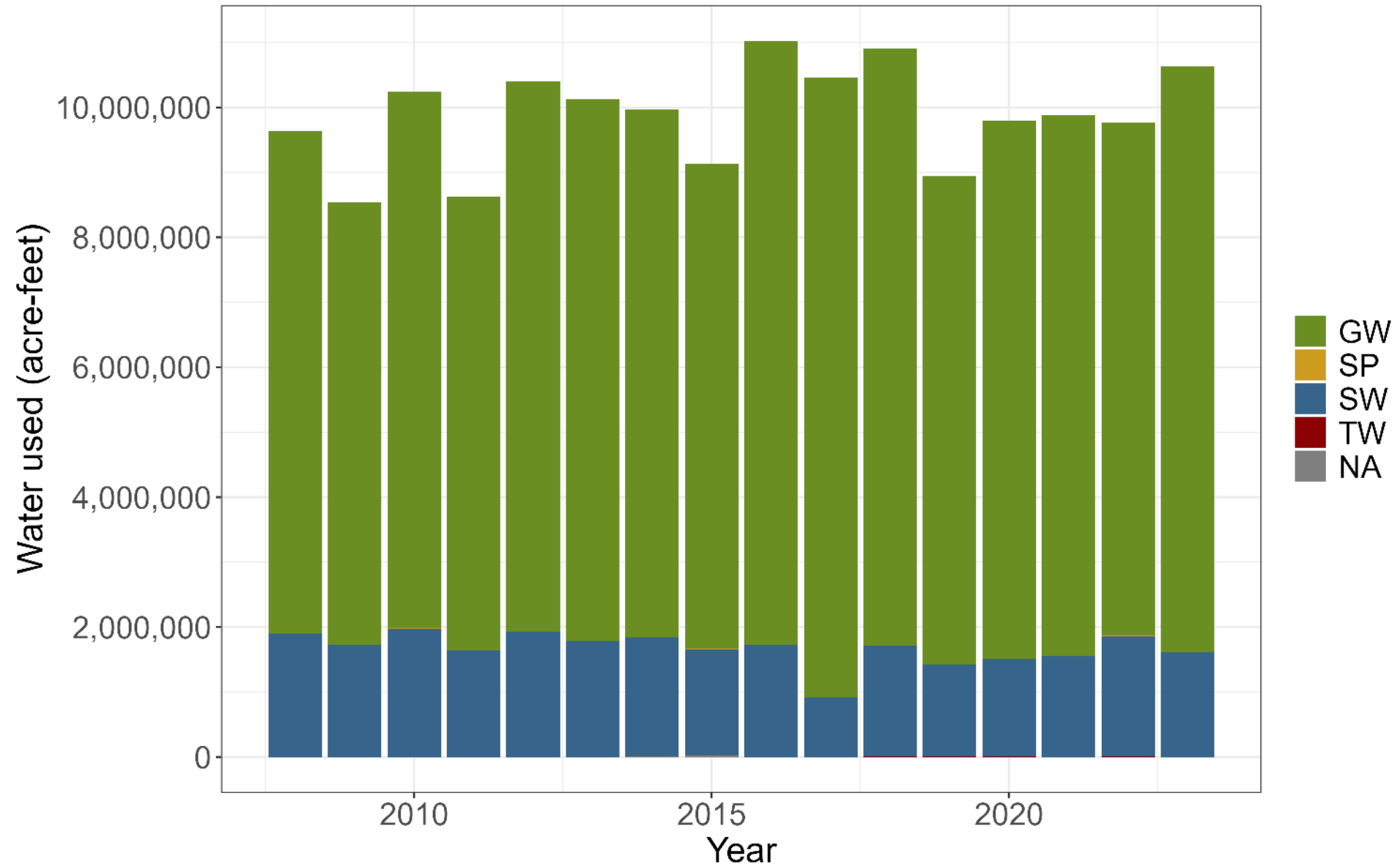


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Agricultural Water Use – By Source

- This data includes water use estimates for poultry that are subject to change based off Arkansas Dept of Agriculture recommendation
 - The estimates for poultry were split 75% surface water and 25% groundwater sources

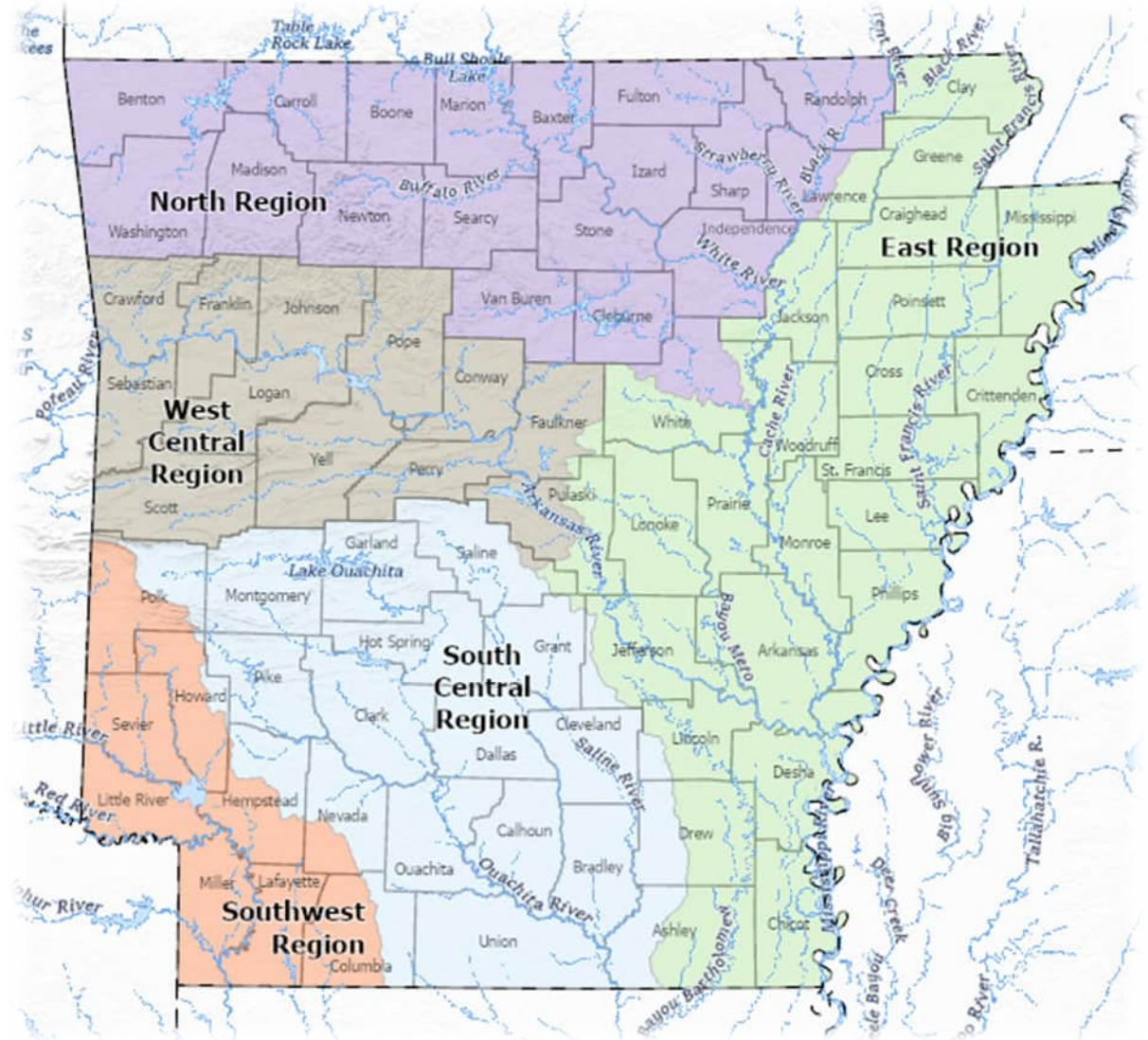


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Planning Regions

- Some minor modification were made to planning region boundaries as to make planning regions better conform to watershed boundaries

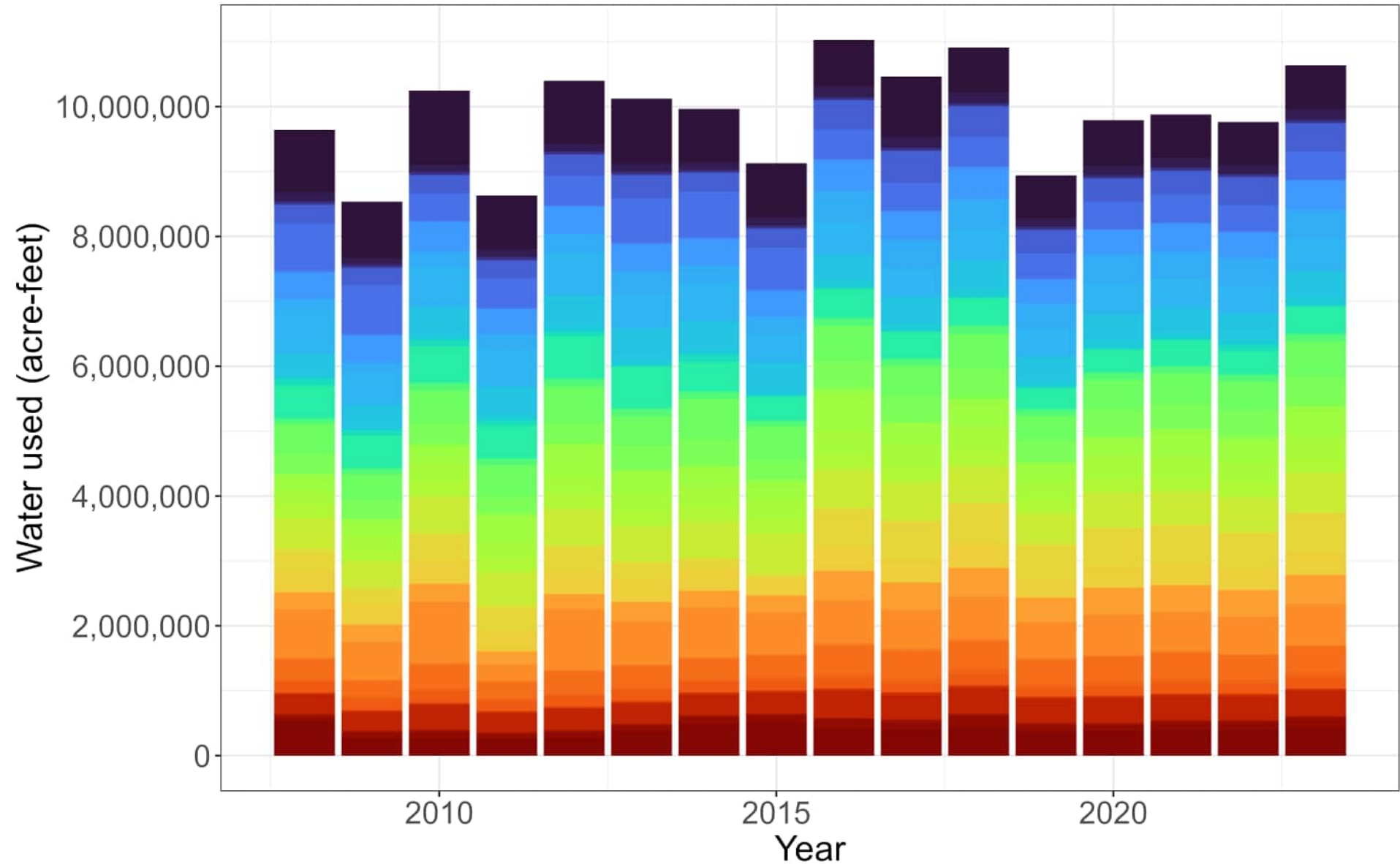


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Agricultural Water Use – By County

- This data includes water use estimates for poultry that are subject to change based off Arkansas Dept of Agriculture recommendation
 - The estimates for poultry were split 75% surface water and 25% groundwater sources

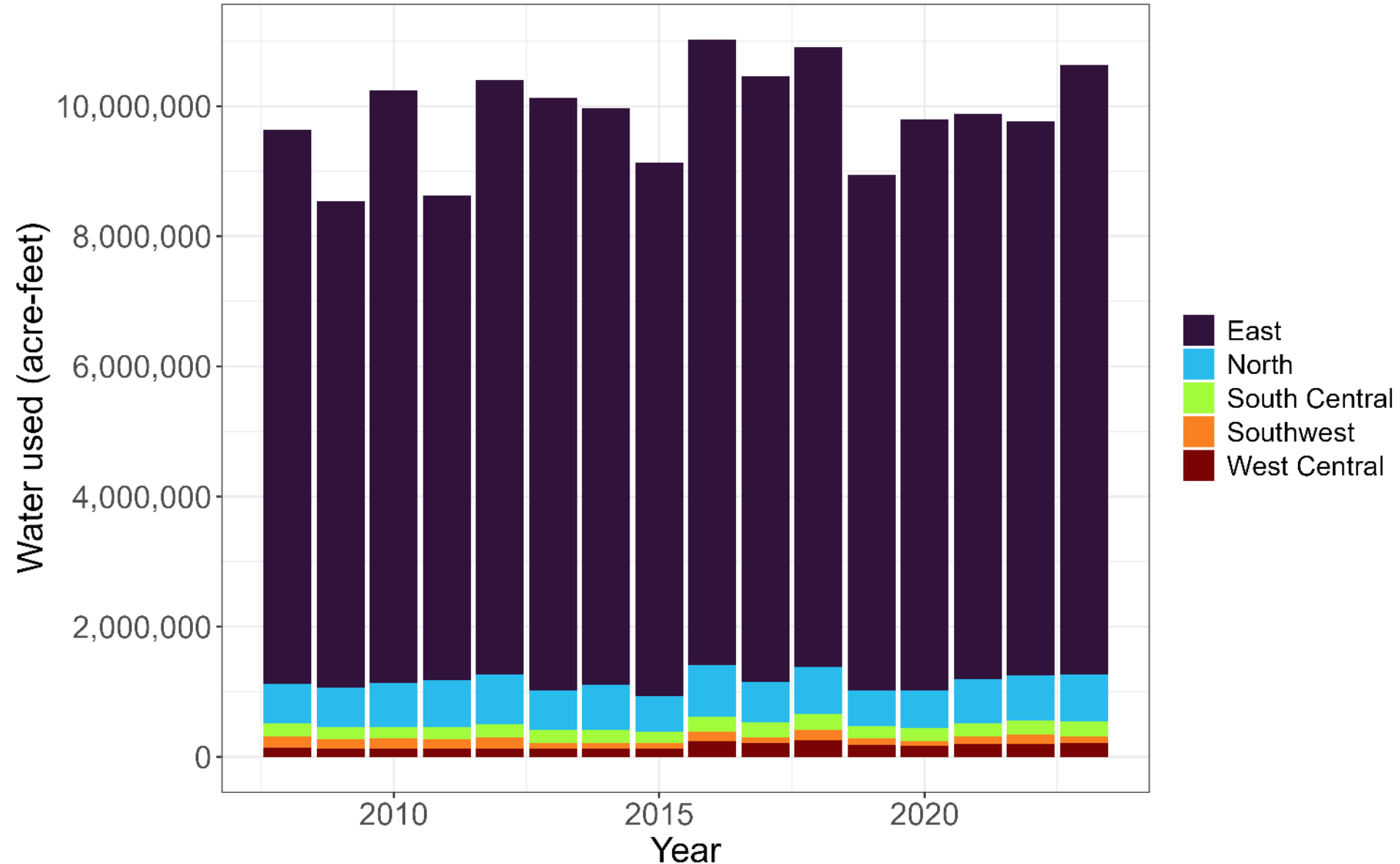


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Agricultural Water Use – By Planning Region

- This data includes water use estimates for poultry that are subject to change based off Arkansas Dept of Agriculture recommendation
 - The estimates for poultry were split 75% surface water and 25% groundwater sources

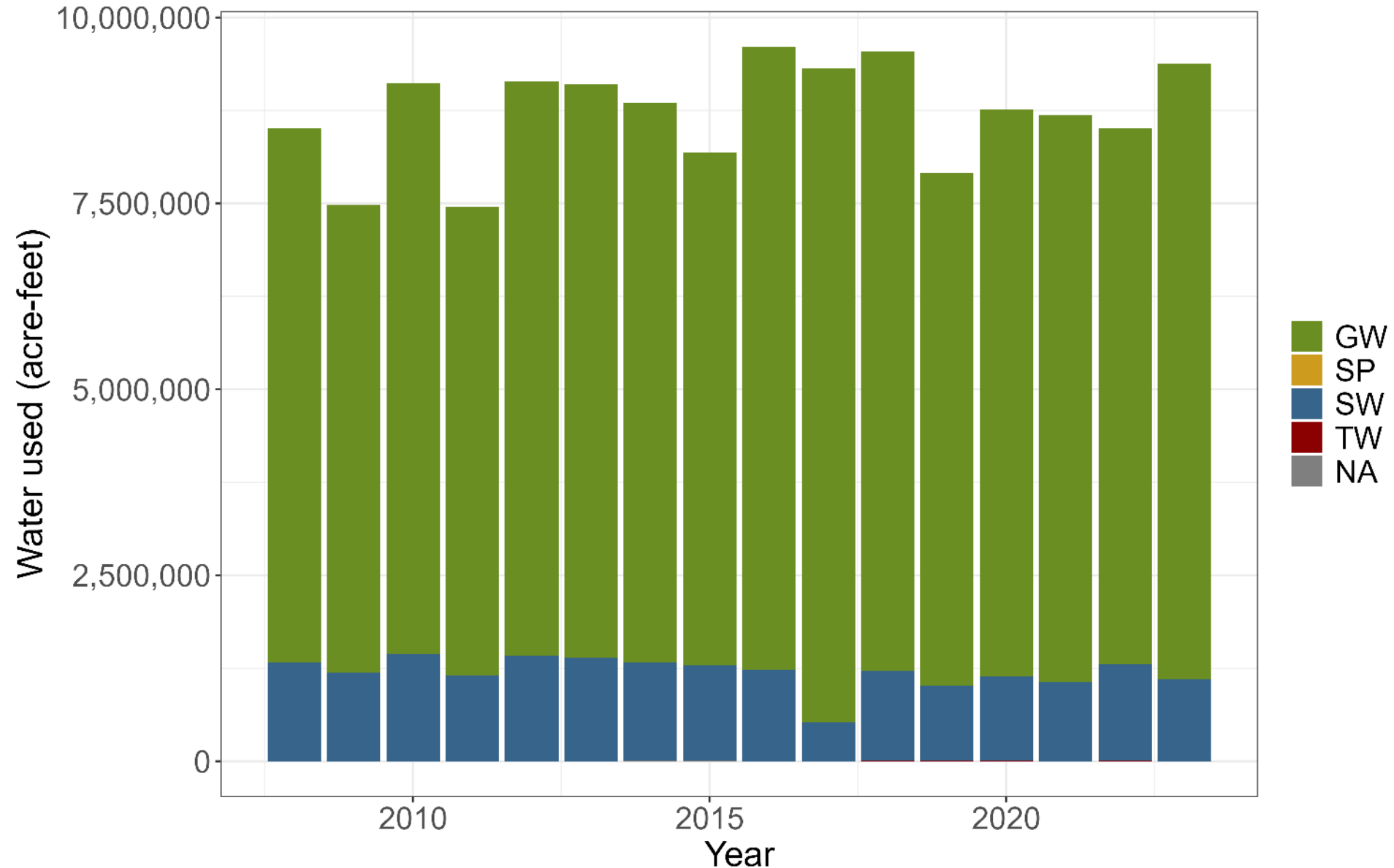
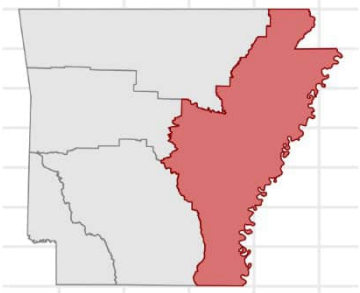


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Agricultural Water Use – East Region

- This data includes water use estimates for poultry that are subject to change based off Arkansas Dept of Agriculture recommendation
 - The estimates for poultry were split 75% surface water and 25% groundwater sources

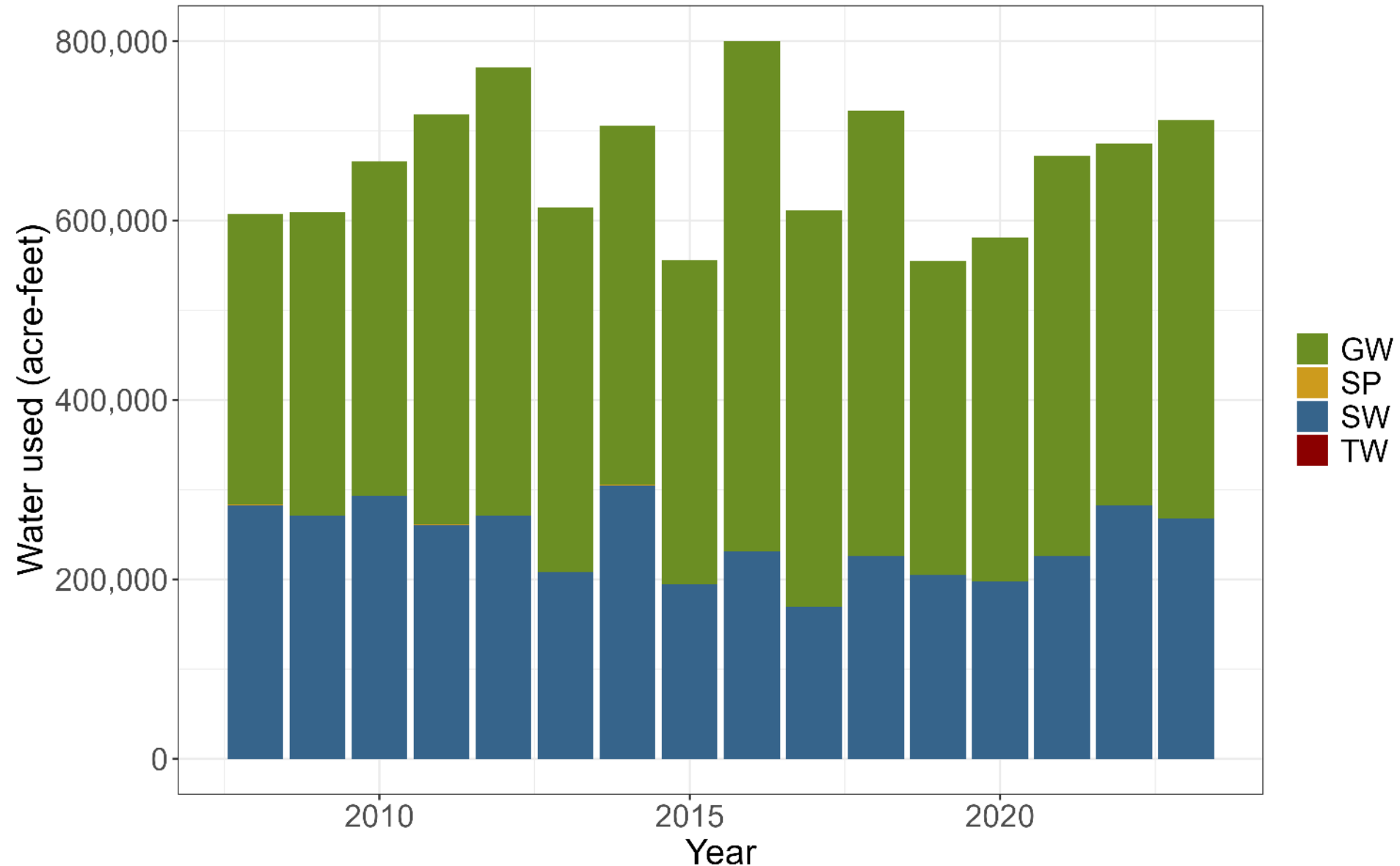
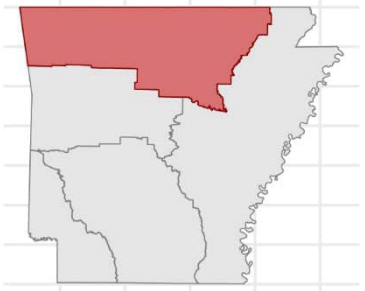


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Agricultural Water Use – North Region

- This data includes water use estimates for poultry that are subject to change based off Arkansas Dept of Agriculture recommendation
 - The estimates for poultry were split 75% surface water and 25% groundwater sources

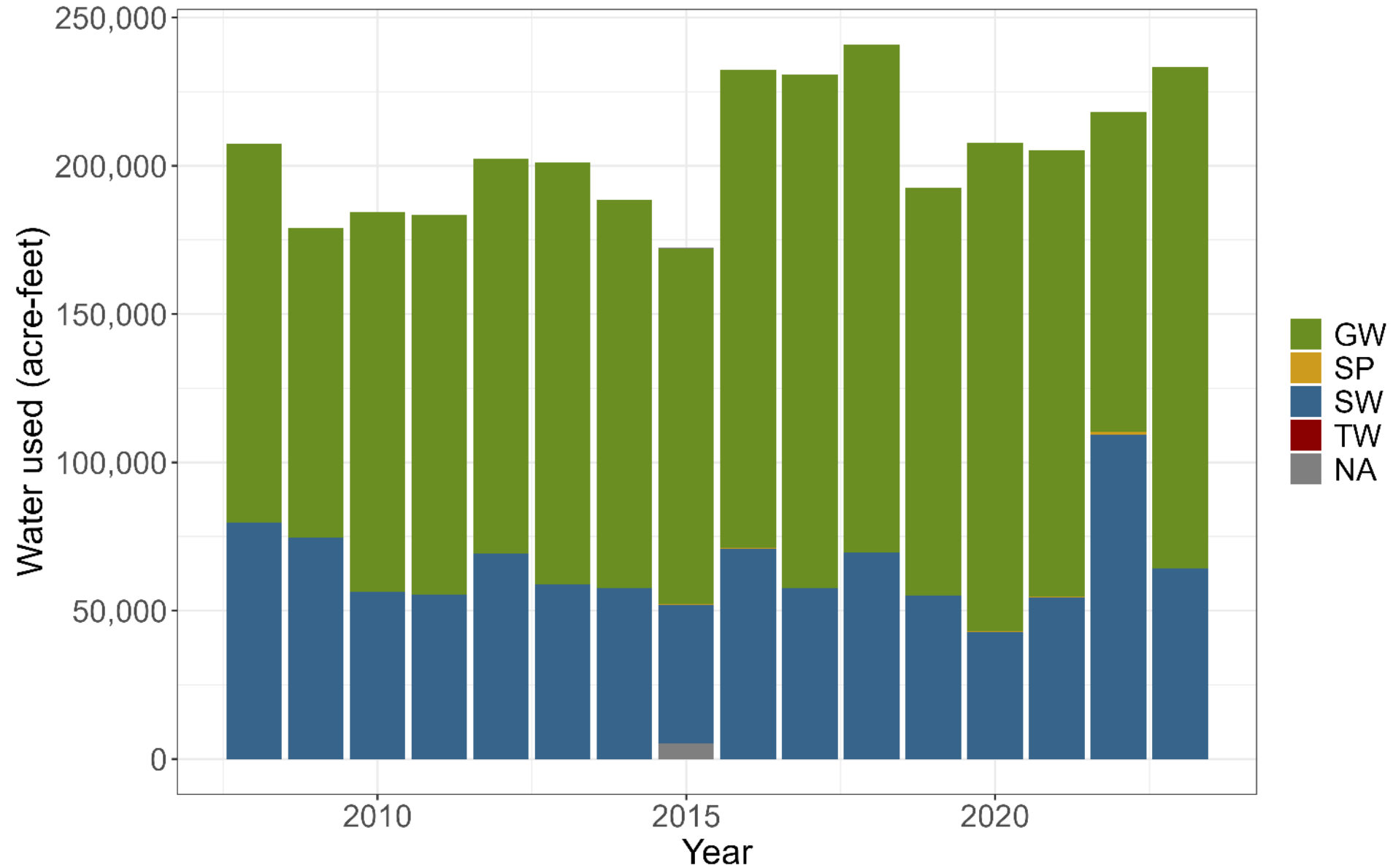
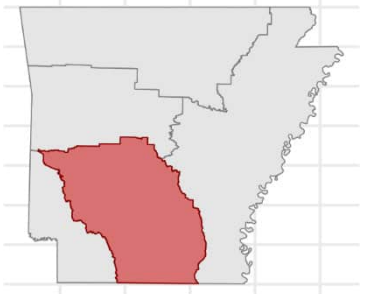


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Agricultural Water Use – South Central Region

- This data includes water use estimates for poultry that are subject to change based off Arkansas Dept of Agriculture recommendation
 - The estimates for poultry were split 75% surface water and 25% groundwater sources

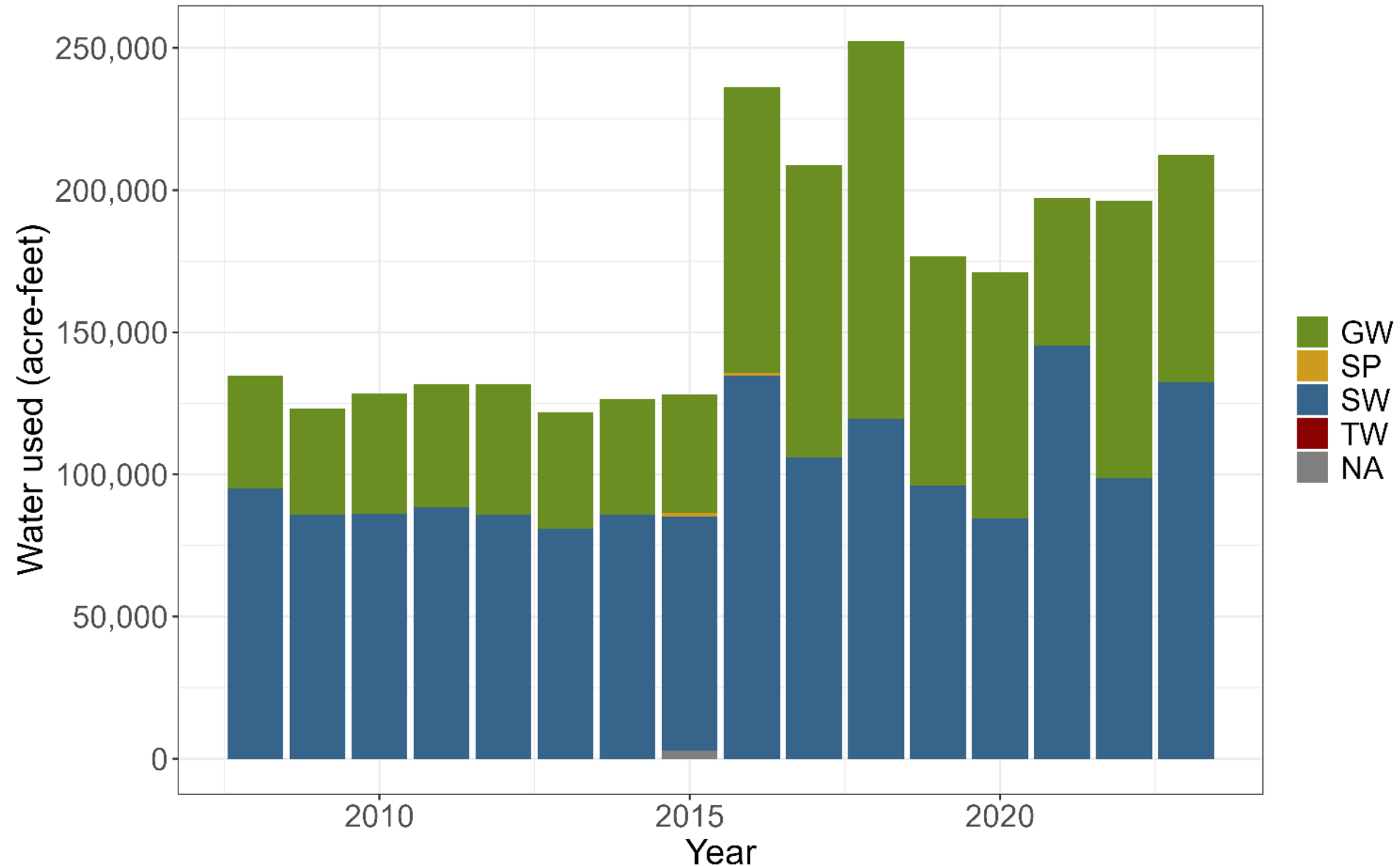
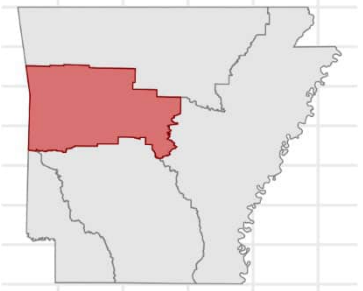


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Agricultural Water Use – West Central Region

- This data includes water use estimates for poultry that are subject to change based off Arkansas Dept of Agriculture recommendation
 - The estimates for poultry were split 75% surface water and 25% groundwater sources

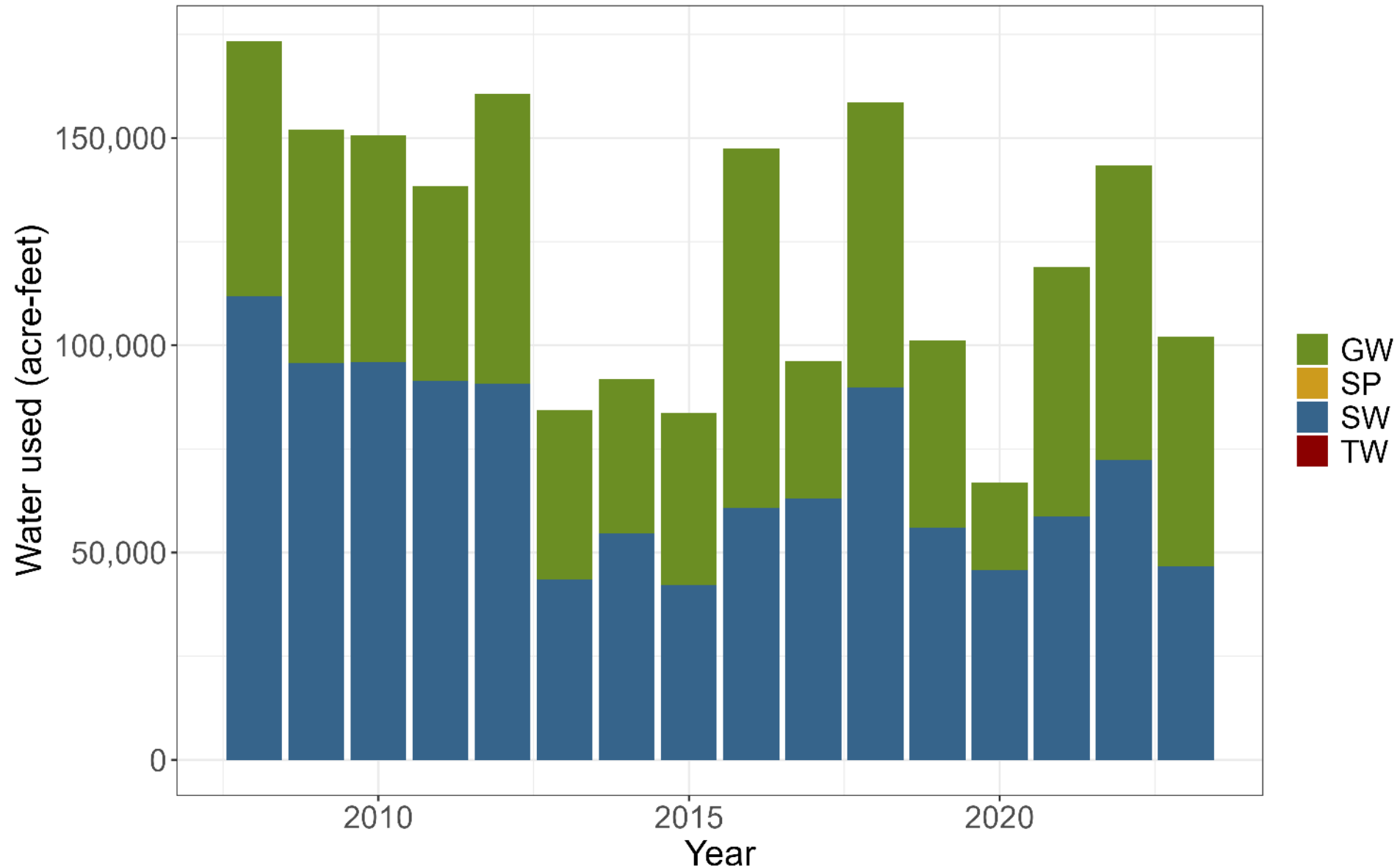
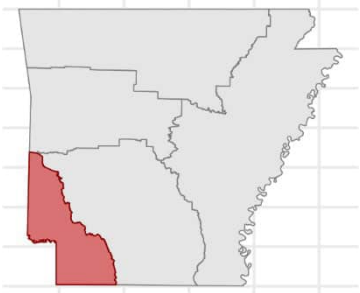


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Agricultural Water Use – Southwest Region

- This data includes water use estimates for poultry that are subject to change based off Arkansas Dept of Agriculture recommendation
 - The estimates for poultry were split 75% surface water and 25% groundwater sources



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Comparison to 2014 AWP Agriculture Values

- The current AWP update includes estimates for poultry which are provisional and subject to change based on recommendation from Arkansas Dept of Agriculture.
- Currently, the updated analysis shows ~2.5% increase in agricultural water use between the 2014 AWP base period and the update base period.
 - These estimates include irrigation and livestock.

Base Period	Water Use (acre-feet per year)
2014 AWP	10,310,953
Updated AWP	10,574,169

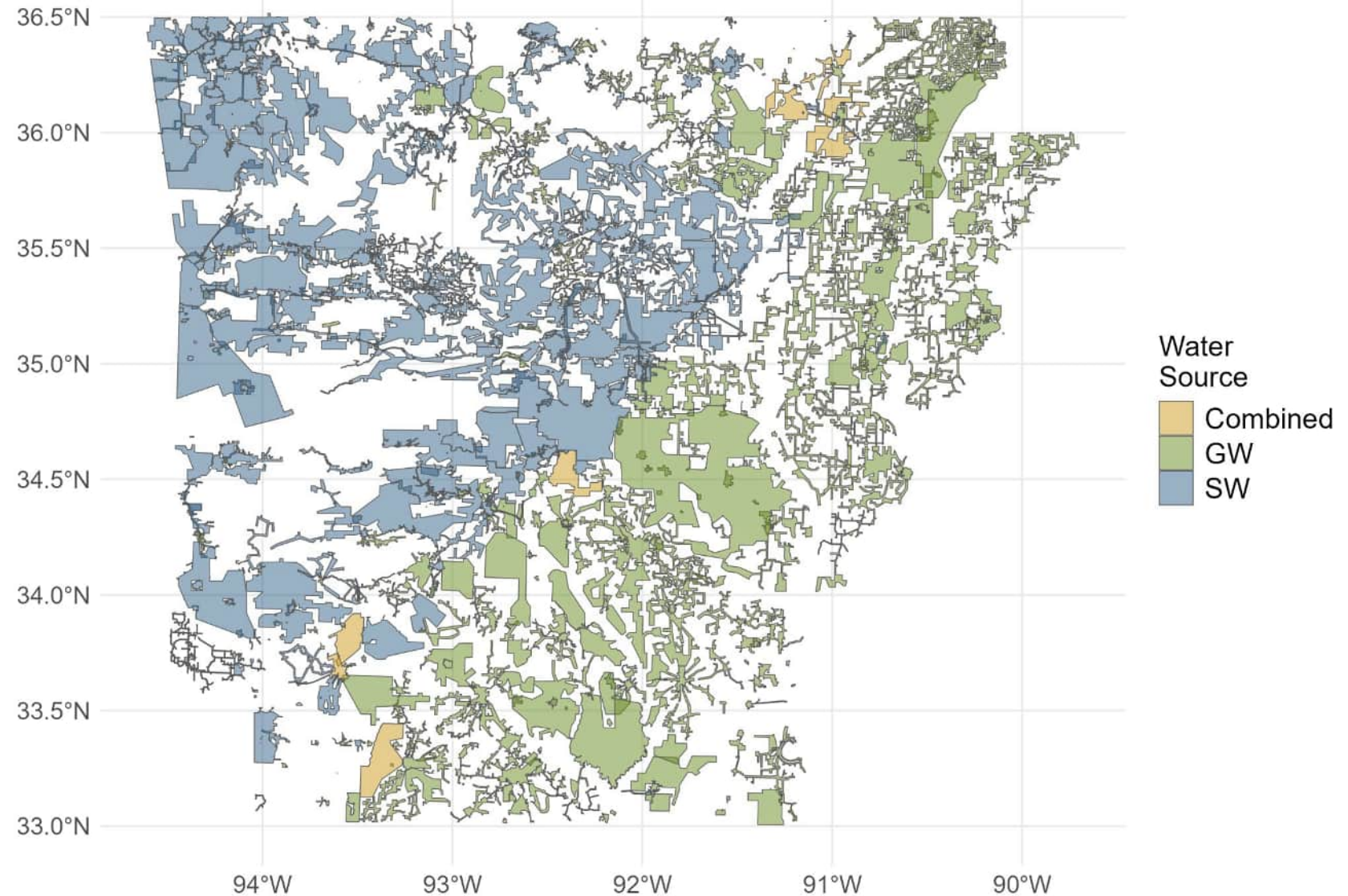


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Arkansas Water Use – Water Supply Sources

- AI was used to find the sources of water for the 788 Water Supply Polygons from Arkansas Dept of Health
 - Several polygons were cross checked.
 - ~6% of polygons were found to be erroneously sourced and were corrected manually.

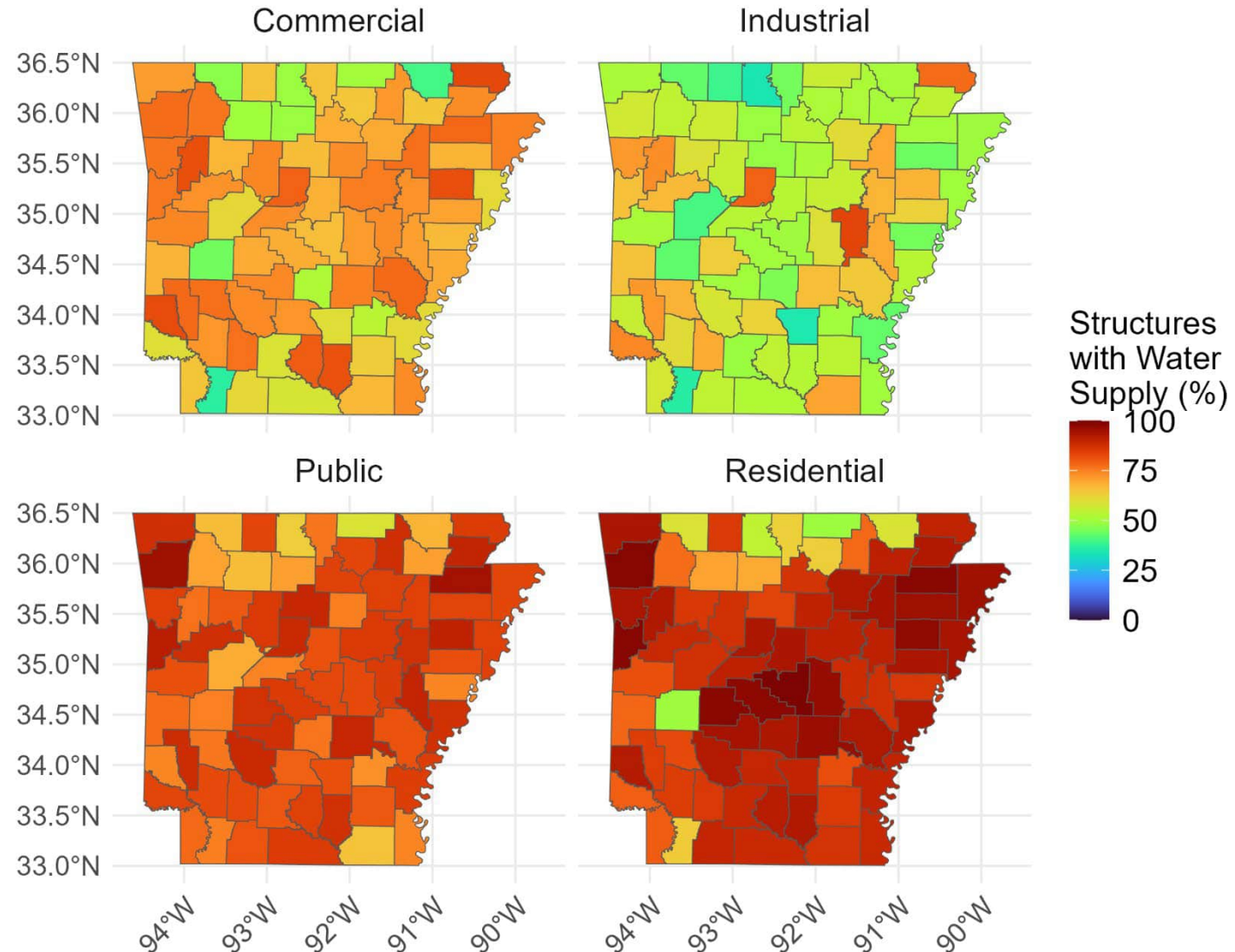


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Arkansas Water Use – Water Supply Sources

- The National Structure Inventory (NSI) was used along the ADH water supply polygons to determine whether structures of different categories existed within a water supply polygon and to determine the source of water for the structure.
- This helped us to estimate what percentage of the population within AR uses water from a surface water source or a groundwater source from difference sectors.

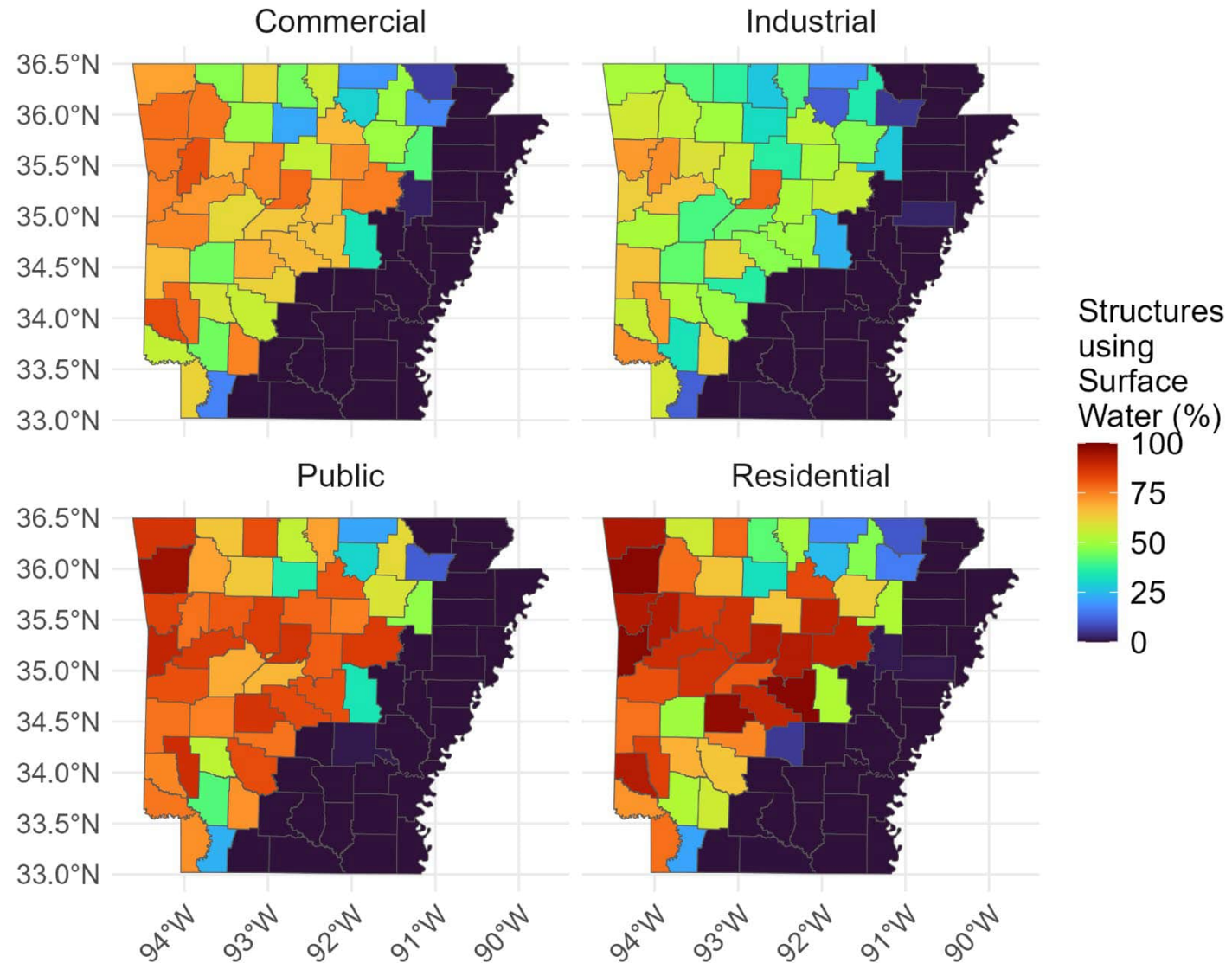


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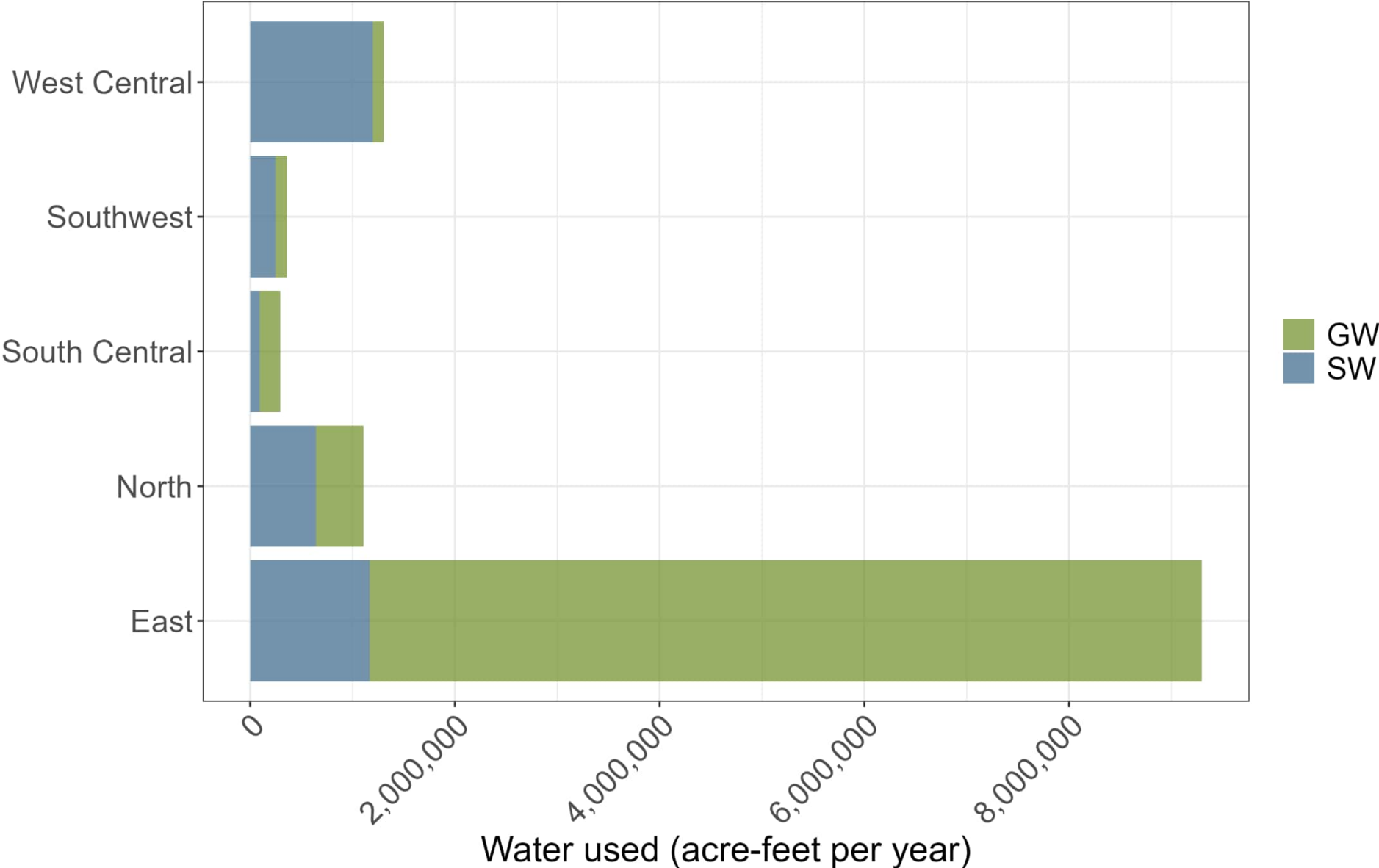


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Arkansas Water Use – Region and Source

- Current estimates of water use for the new base period for the AWP

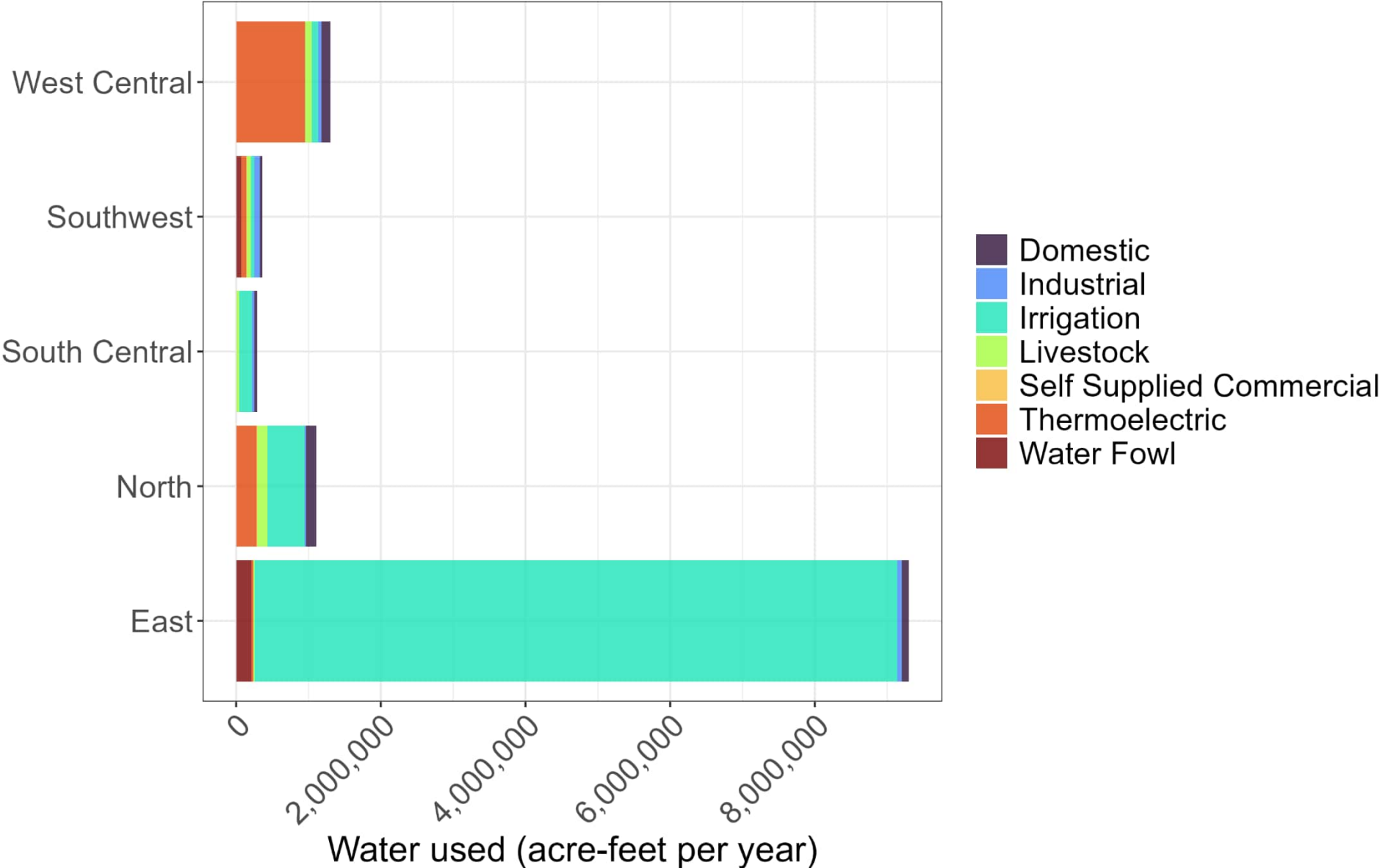


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Arkansas Water Use – Region and Use Type

- Current estimates of water use for the new base period for the AWP

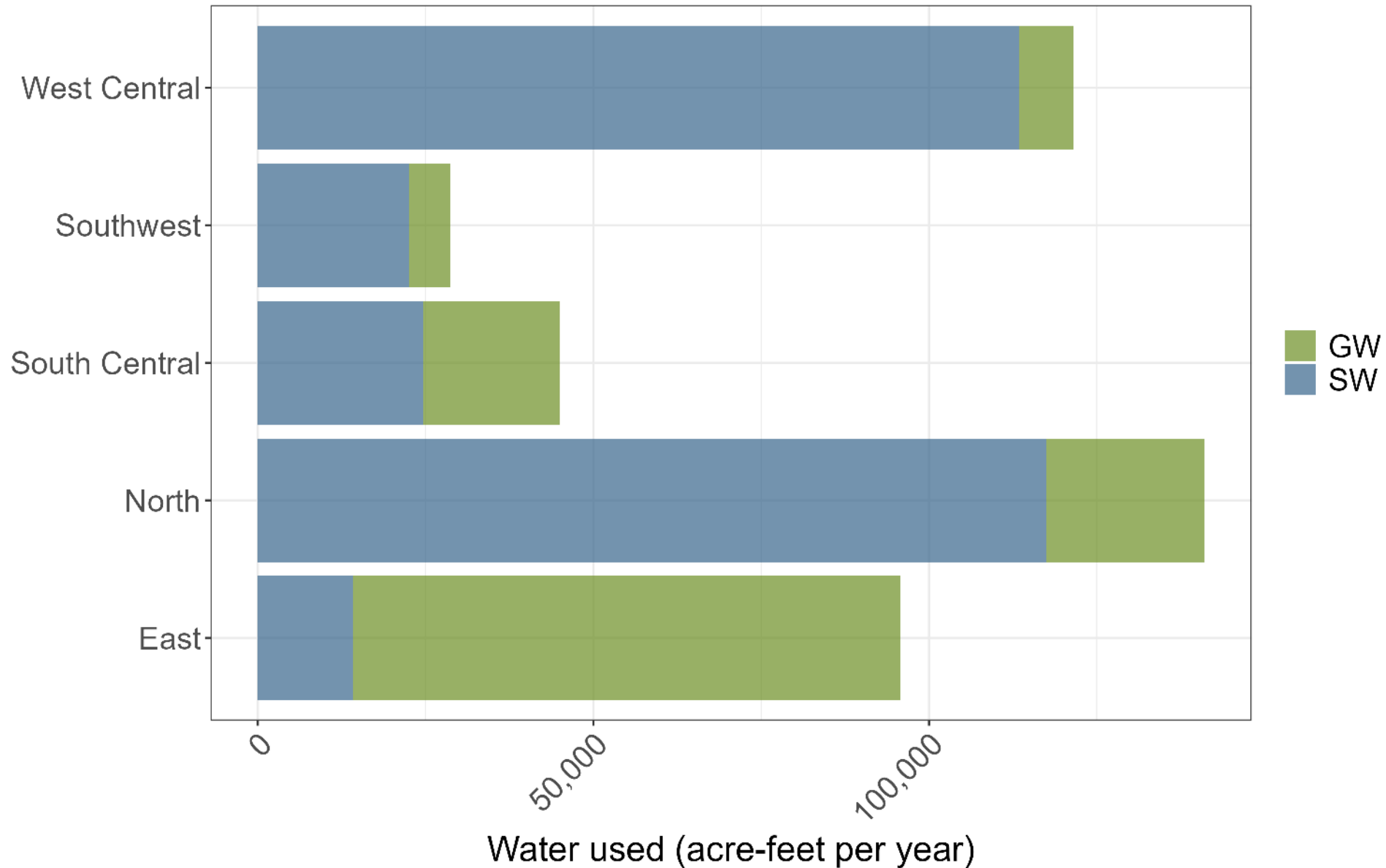


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Arkansas Water Use – Domestic Use by Source

- Current estimates of water use for the new base period for the AWP

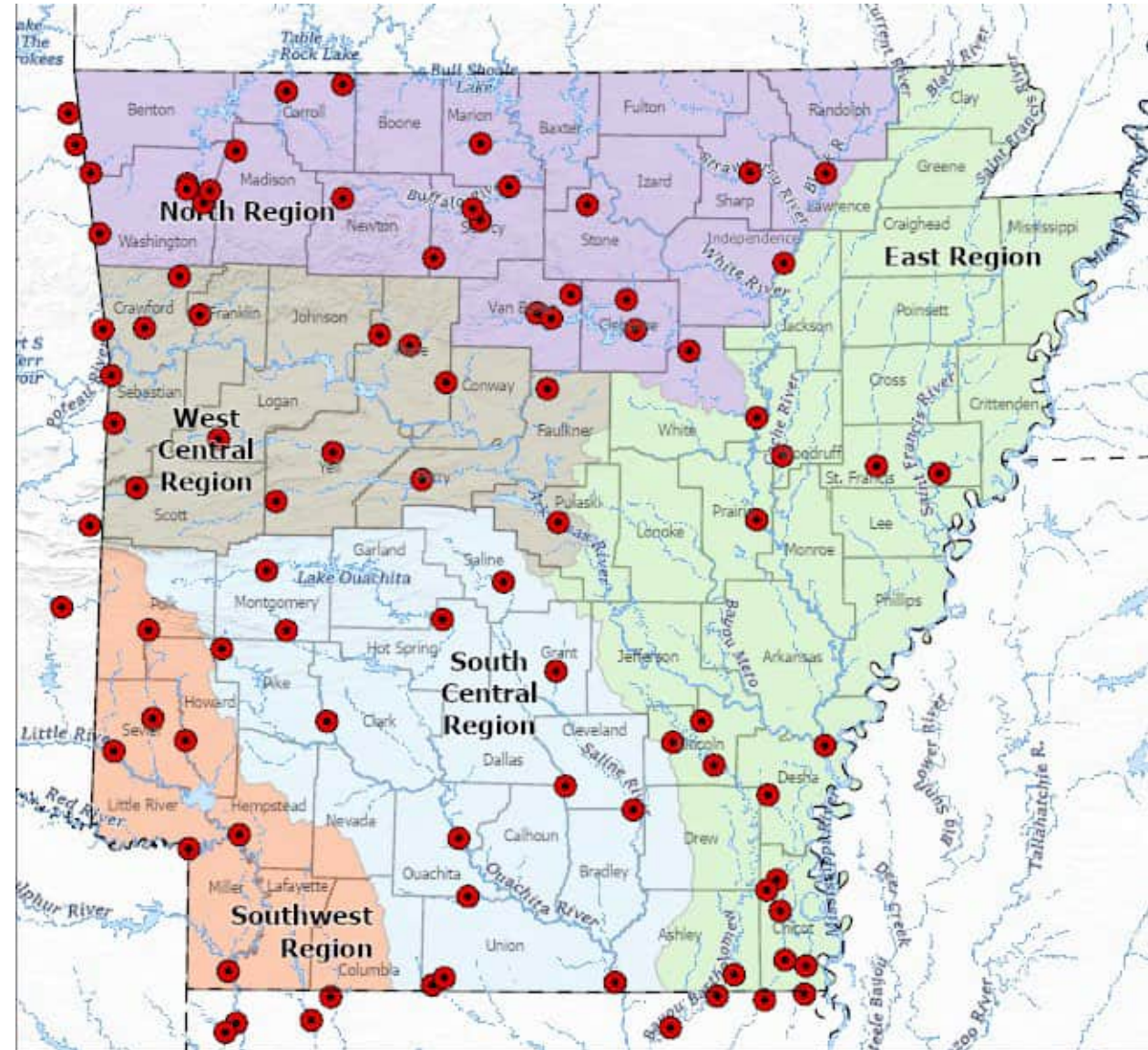


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Surface Water Availability Update - Streamgages

- USGS and USACE continuous time-series of daily streamflow data from these locations were used to determine surface water availability across Arkansas
- Resulting from the methods applied for the analysis (next slides), daily time-series of streamflow are available for all these locations from 1915 to 2024.



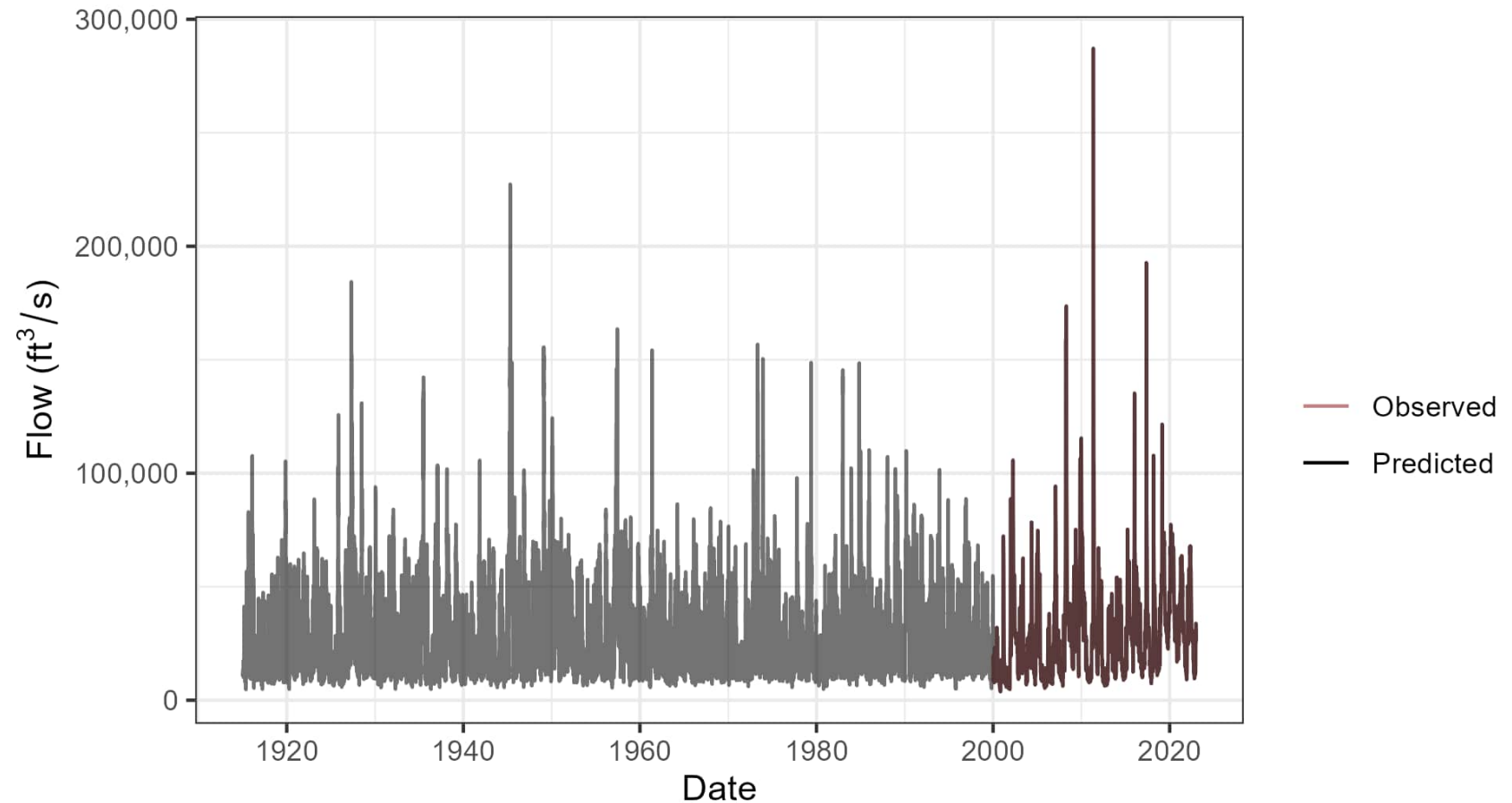
U.S. Army
Corps of Engineers

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Surface Water Availability Update - Methods

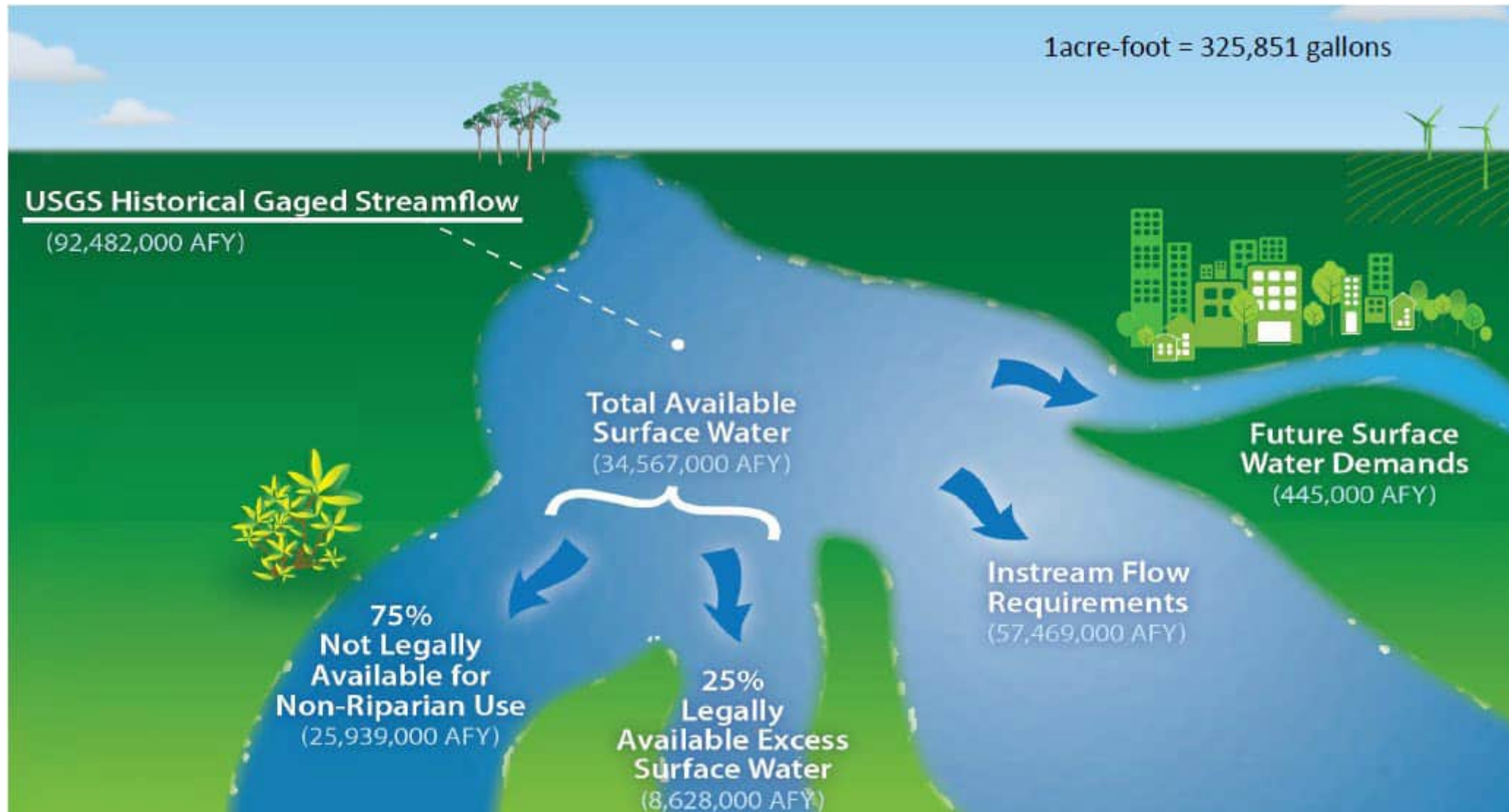
- USGS gages vary widely in length and completeness.
- Many critical planning locations have short, interrupted records that do not capture a full range of climate variability that may occur within a region.
- Short records can misrepresent:
 - Drought severity
 - Low-flow thresholds
 - Wet/Dry-period variability
 - Long-term sustainable yield
- The Arkansas Method for allocation requires stable long-term statistics that short records often cannot provide.
- As a part of the current update to the AWP, machine learning methods were used to extend period of record for all daily streamflow locations from 1915 to 2024.



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Surface Water Availability Update - Methods



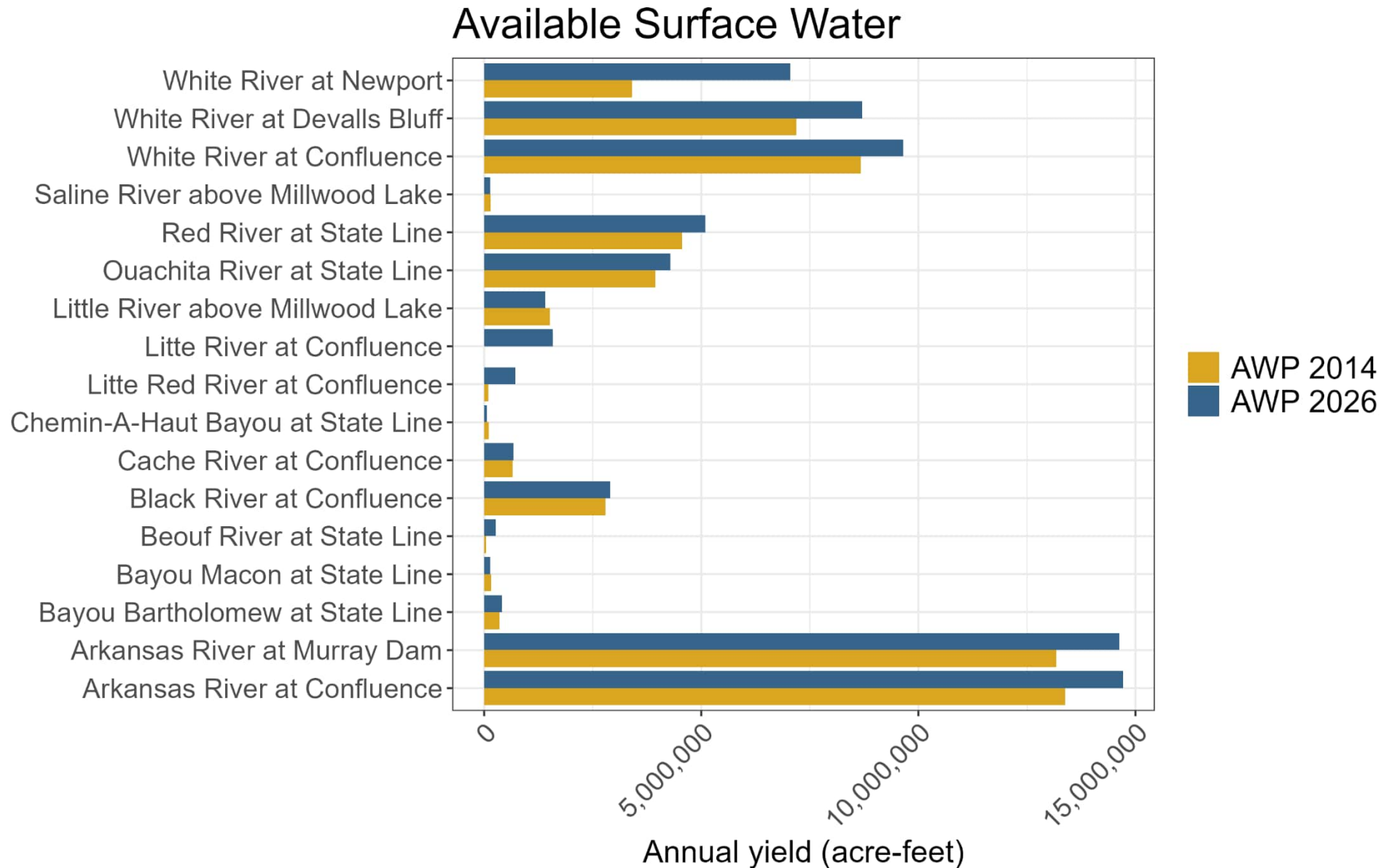
US Army Corps
of Engineers

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Surface Water Availability Update - Results

- Computations for White River at Newport from the 2014 AWP appear to remove the drainage area from the Black River, resulting in some computational differences.

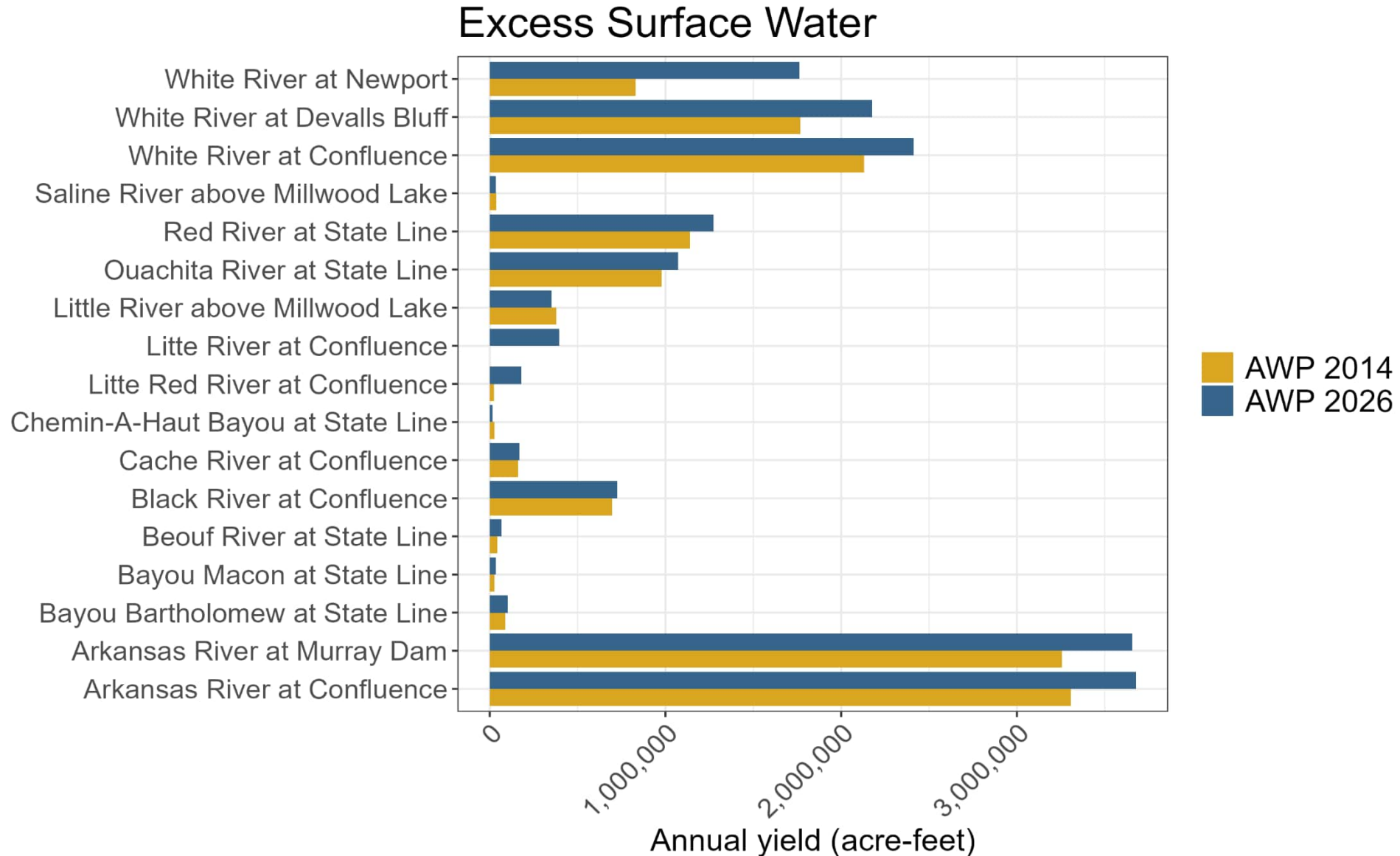


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Surface Water Availability Update - Results

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Surface Water Availability Update - Results

Location	AWP 2014 Excess SW Yield (acre-feet per year)	AWP 2026 Excess SW Yield (acre-feet per year)	Percent Difference
Arkansas River at Murray Dam	3256854	3657049	12
Arkansas River at Confluence	3307616	3677155	11
Chemin-A-Haut Bayou at State Line	25460	16631	-42
Bayou Bartholomew at State Line	89057	102931	14
Bayou Macon at State Line	27132	34632	24
Beouf River at State Line	42293	67300	46
Ouachita River at State Line	977583	1071865	9
Little River above Millwood Lake	378698	351752	-7
Little River at Confluence (Below Millwood Lake)		393591	
Saline River above Millwood Lake	38743	35685	-8
Red River at State Line	1139715	1272811	11
Black River at Confluence	694462	725025	4
Cache River at Confluence	160881	169568	5
Little Red River at Confluence	24594	179574	152
White River at Newport	830591	1761999	72
White River at Devalls Bluff	1769141	2176745	21
White River at Confluence	2131256	2412326	12



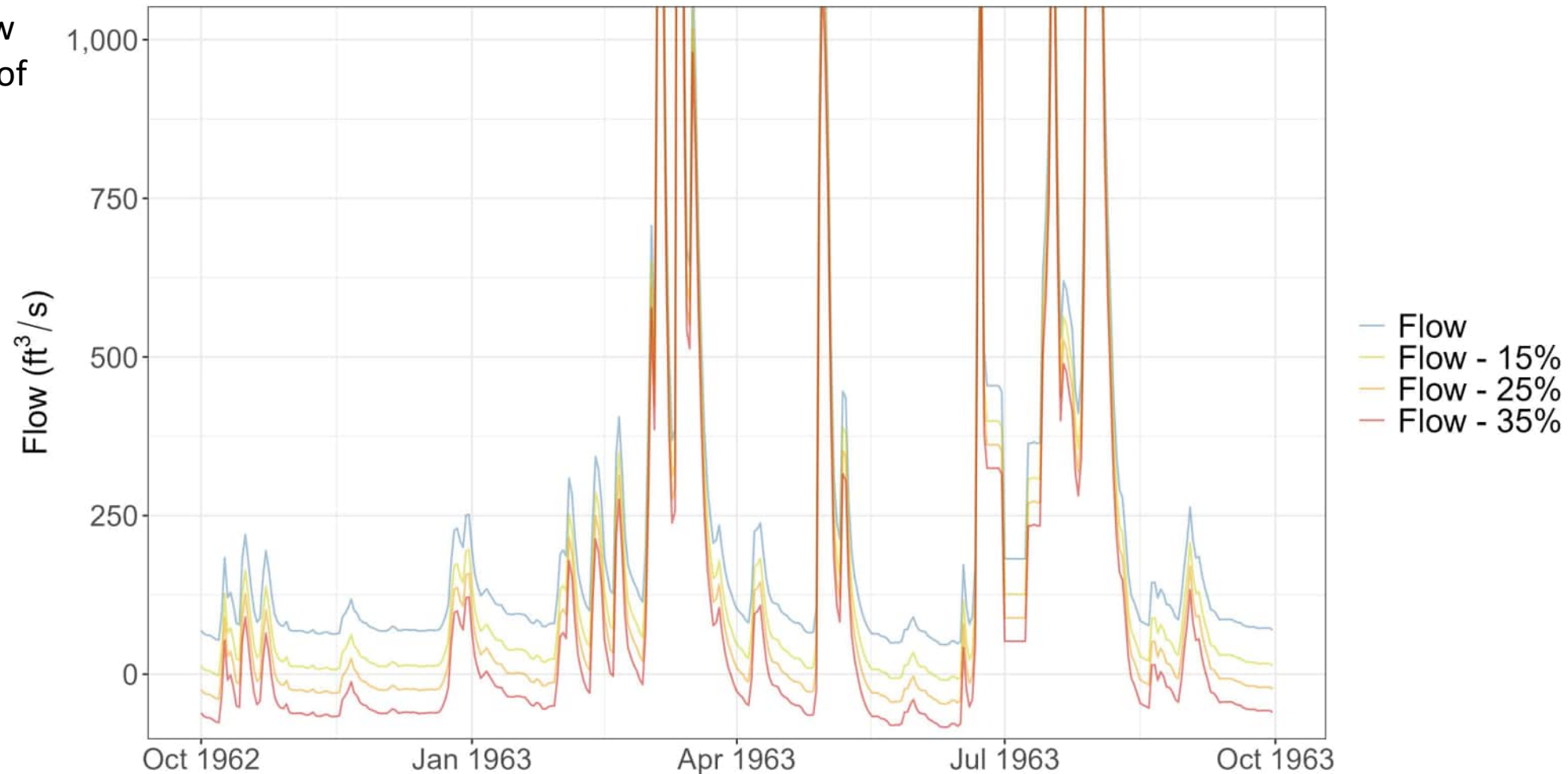
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Surface Water Availability Update - Results

Beouf River at AR/LA State Line

- Updated methods allow for consistent drought of record computations across basins



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Surface Water Availability Update - Results

- Updated methods allow for consistent estimates of potential shortfalls related to allocated non-riparian withdrawals

Beouf River at AR/LA State Line

Minimum Flow	353 ft ³ /s
Percent of Days Below Allocation - Excess 15%	10%
Percent of Days Below Allocation - Excess 25%	26%
Percent of Days Below Allocation - Excess 35%	36%



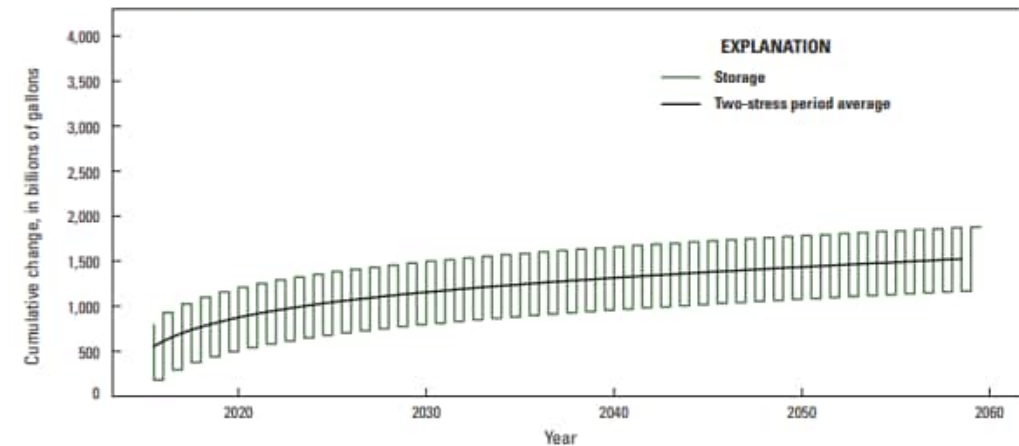
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Groundwater Availability Update

- Only one study related to groundwater availability in Arkansas has been published since the 2014 AWP.
 - Clark, B.R., Duncan, L.L., and Knierim, K.J., 2019, Groundwater availability in the Ozark Plateaus aquifer system: U.S. Geological Survey Professional Paper 1854, 82 p., <https://doi.org/10.3133/pp1854>
- 3 scenarios were developed to project groundwater availability to 2060

A. Ozark Plateaus aquifer system



B. Ozark aquifer

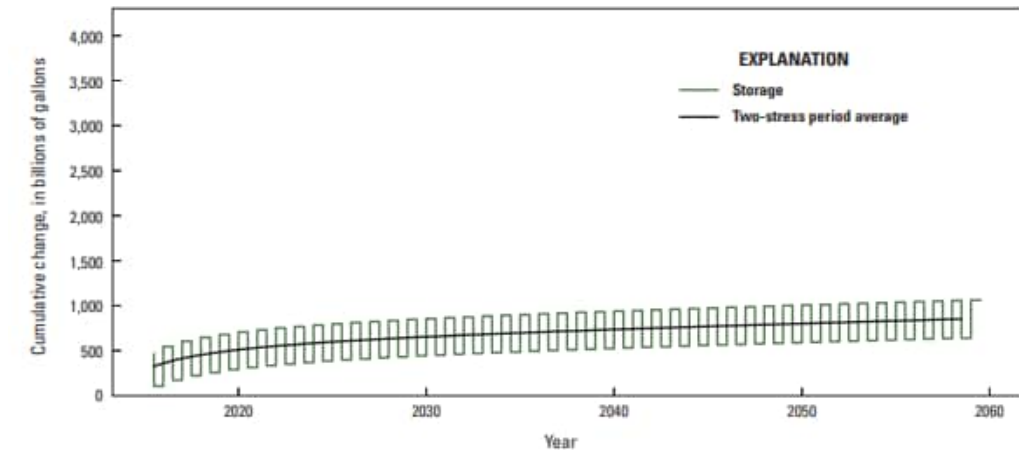


Figure 20. Storage change from 2015 to 2060 for the pumping scenario for the A, Ozark Plateaus aquifer system and B, Ozark aquifer.



Groundwater Availability Update

- For other major aquifers within Arkansas, 2014 AWP values may be used.
- USGS is working on an update to the MERAS model.
 - If results from the MERAS model update are available in time, they will be used for the AWP update

Table 2-2. Summary of Model Results for Sustainable and Mining Scenarios for the Alluvial, Sparta, and Wilcox Aquifers

Scenario	Pumping Level Limitation	Climate Assumption	Groundwater Demand 2050	Available Groundwater Capacity	Groundwater Supply Gap 2050
1	None	Dry		3,070 mgd	5,890 mgd
2		Wet		3,320 mgd	5,640 mgd
3	Water level declines limited to original water in the original thickness of the aquifer	Dry	8,960 mgd	1,770 mgd	7,190 mgd
4		Wet		2,030 mgd	6,930 mgd



Questions or Comments?



Stakeholder Feedback & Engagement

Input submitted through: March 20, 2026 - Agri.WaterPlan@arkansas.gov

Recordings available:

<https://agriculture.arkansas.gov/natural-resources/arkansas-water-plan/>

Water Plan Preliminary Timeline



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Thank You!

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501-682-3961

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Arkansas Department of Agriculture – Natural Resources
Division

<https://www.agriculture.arkansas.gov/natural-resources/>

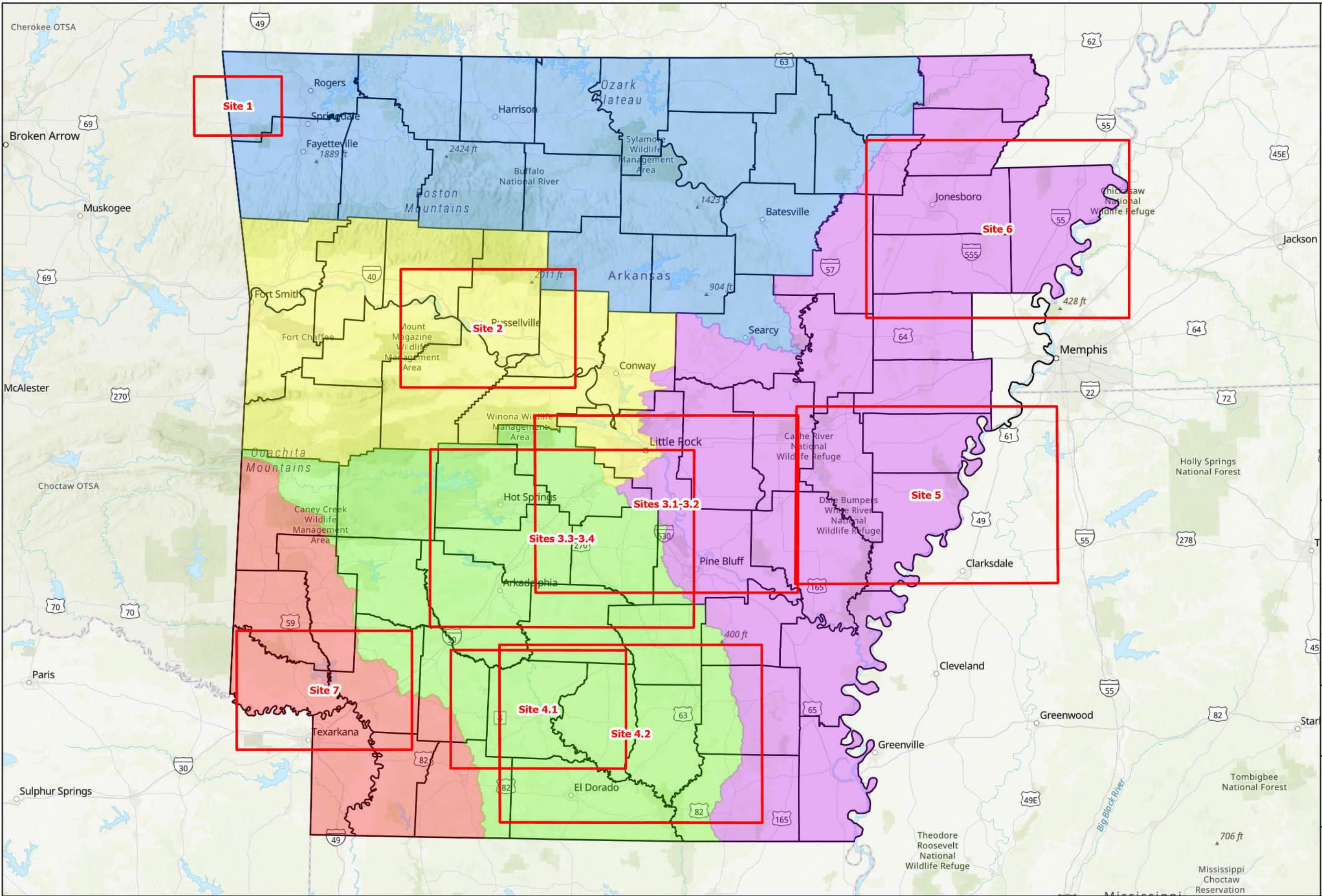
Submit Input by March 20, 2026

Agri.WaterPlan@arkansas.gov



APPENDIX I

Arkansas Water Plan Regions



- East Region
- South Central Region
- Southwest Region
- West Central Region
- North Region
- Potential Sites
- County Boundary

Panel 1 of 1

Datum: NAD 1983
 Vertical Datum: NAD 1988
 Projection: Arkansas State Plane North Feet
 FIPS 0301

Notes:

Printing Date: 5/27/2026 4:29 PM
 File: A:\64000s\64420\001\GIS\APRX3\Excel_NW\Excel_NW.aprx

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APPENDIX J

Screening Matrix

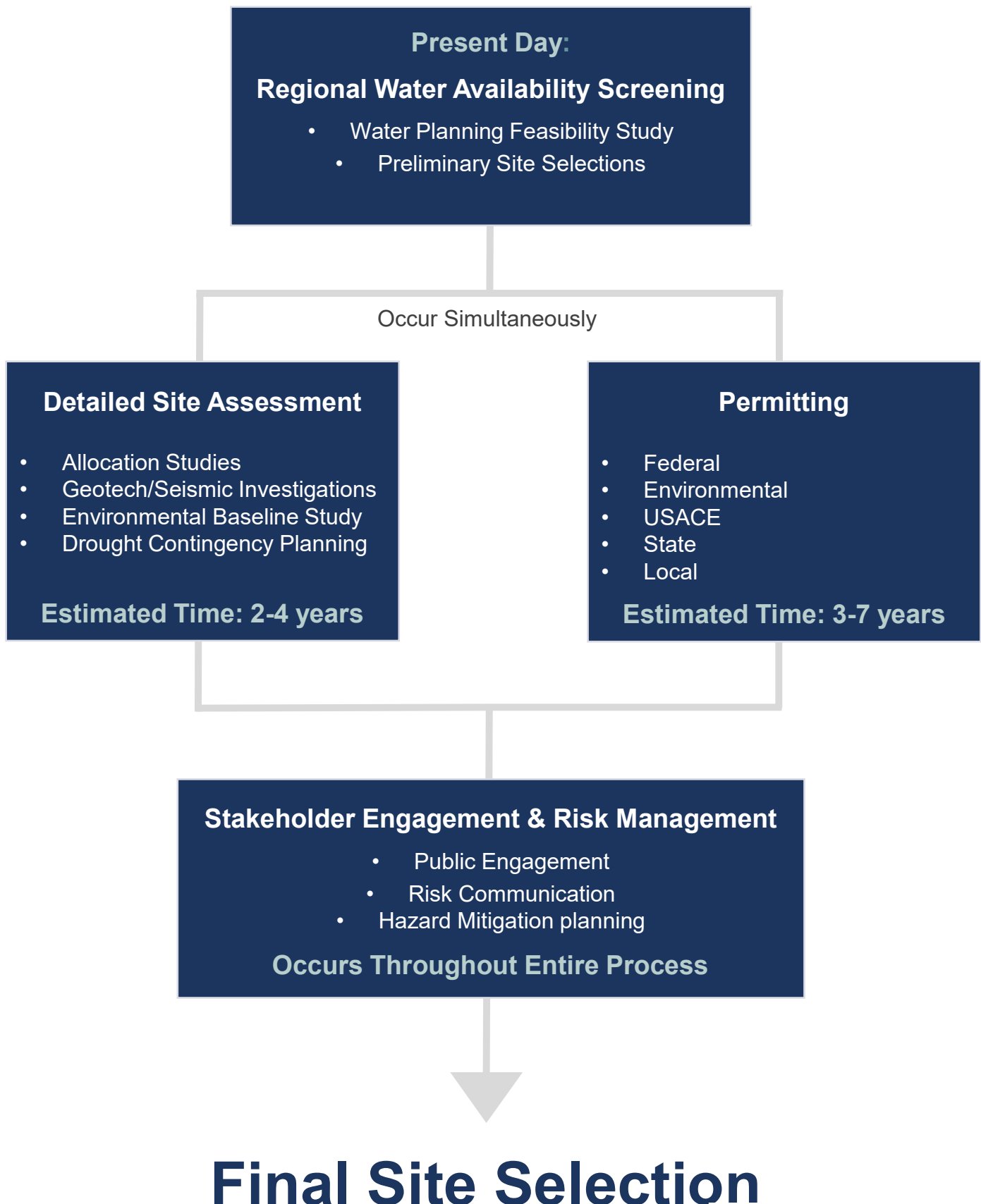
	Site 1		Site 2		Site 3					Site 4		Site 5				Site 6		Site 7		
Water Source:	Flint Creek	Lake Flint Creek	Illinois Bayou	Lake Dardanelle	Arkansas River	Lake Ouachita	Lake DeGray	Lake Maumelle	Lost Creek	Ouachita River	Saline River	St. Francis River	L'Anguille River	Cache River	Big Creek	St. Francis River	Little River	Red River	Millwood Lake	
Surface Water Availability																				
Has excess surface water been identified for this stream/river?	No	n/a	Yes	n/a	Yes	n/a	n/a	n/a	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	
Do average streamflows meet water demand?	Yes	n/a	Yes	n/a	Yes	n/a	n/a	n/a	n/a	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	n/a	
Could this site be a riparian source?	No	n/a	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	
Could this site be a non-riparian source?	Yes	n/a	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Is this source being used as a supply for another entity?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Groundwater Availability																				
Which groundwater source is available?	Springfield Plateau		Western Interior Plains Confining System		Mississippi River Alluvial Plain					Mississippi River Alluvial Plain		Mississippi River Alluvial Plain				Mississippi River Alluvial Plain		Red River Alluvial Aquifer		
What are the groundwater level trends?	n/a		n/a		Decreasing					Decreasing		Decreasing				Decreasing		Decreasing		
Is there a projected groundwater demand gap?	No		No		Yes					Yes		Yes				Yes		Yes		
Is the site located in an identified Critical Groundwater Area?	No		No		Yes					No		Yes				Yes		No		
General Site Assessment																				
Is the site located within 10 miles of an identified transmission point location?	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	
Would further transmission analysis be needed?	No	No	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Will a detailed study be required for water withdrawals?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Will a Federal Drought Contingency Plan be required?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

*The results presented in this table are based on a planning-level assessment and were not developed from a detailed water demand analysis. Accordingly, the results should be used solely for preliminary evaluation and guidance for future study and development.

APPENDIX K

Implementation Roadmap

Implementation Roadmap





CHAPTER 3:

Technology Overview

Acronyms

Acronym	Definition	Acronym	Definition
ABWR	advanced boiling water reactor	KHNP	Korea Hydro & Nuclear Power
AC	alternating current	KP-FHR	Kairos Power fluoride salt-cooled high-temperature reactor
ADAMS	Agencywide Documents Access and Management System (NRC)	KTA	German nuclear safety standards (Kerntechnischer Ausschuss)
AECL	Atomic Energy of Canada Limited	LMP	Licensing Modernization Program
ARDP	Advanced Reactor Demonstration Program	LW-SMR	light-water small modular reactor
BWR	boiling water reactor	LWR	light water reactor
CANDU	Canada Deuterium Uranium (reactor)	METCON	steel-and-concrete composite construction (Holtec)
CFR	Code of Federal Regulations	MOU	Memorandum of Understanding
CNSC	Canadian Nuclear Safety Commission	MWe	megawatts electric
COL	combined license	MWh	megawatt-hour
COLA	combined license application	MWth	megawatts thermal
DC	direct current	NEA	Nuclear Energy Agency
DCD	Design Control Document	NLWR	non-light-water reactor
DOE	U.S. Department of Energy	NPM	NuScale Power Module
EA	Environment Agency (UK)	NRC	Nuclear Regulatory Commission
EBR-II	Experimental Breeder Reactor-II	NREL	National Renewable Energy Laboratory
EDF	Électricité de France	OPG	Ontario Power Generation
EIS	environmental impact statement	PEJ	Polskie Elektrownie Jądrowe (Polish nuclear utility)
EPC	engineering, procurement, and construction	PHWR	pressurized heavy water reactor
EPRI	Electric Power Research Institute	PRA	probabilistic risk assessment
ESBWR	Economic Simplified Boiling Water Reactor	PWR	pressurized water reactor
ESP	early site permit	RCC-M	French design and construction code for nuclear mechanical components
EUR	European Utility Requirements	SDA	standard design approval
FLiBe	lithium fluoride and beryllium fluoride (molten salt coolant)	SFR	sodium-cooled fast reactor
GBE-N	Great British Energy Nuclear	SMR	small modular reactor
GDA	Generic Design Assessment	TRISO	tri-structural isotropic

Acronym	Definition	Acronym	Definition
GEH	GE Vernova Hitachi Nuclear Energy	TVA	Tennessee Valley Authority
HALEU	high-assay low-enriched uranium	UAE	United Arab Emirates
HTGR	high-temperature gas-cooled reactor	UAMPS	Utah Associated Municipal Power Systems
IAEA	International Atomic Energy Agency	UK	United Kingdom
INL	Idaho National Laboratory	U.S.	United States
KEPCO	Korea Electric Power Corporation		

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Chapter 3: Technology Overview

1 Introduction

This document provides a high-level technical overview of reactor technologies and designs currently under development or regulatory review in the United States (U.S.), United Kingdom (UK), and Canada. This study considers Western designs judged to have more regulatory and/or design maturity than designs that do not (colloquially known as “paper reactors”).

2 General Overview of Reactor Technology

An initial list of advanced nuclear energy technologies was compiled using the Nuclear Energy Agency (NEA) Dashboard, supplemented by the International Atomic Energy Agency (IAEA) publication *Small Modular Reactors: Advances in SMR Developments 2024*. Additionally, a global market scan was conducted to create a comprehensive list of advanced nuclear energy technologies for the evaluation [65][66].

Characterization of nuclear reactor technology

Nuclear reactor designs are grouped by various characteristics, such as:

- + core thermal power,
- + neutron spectrum, and
- + coolant type.

In this section, the major categories are explained to inform the target audience, which may be unfamiliar with the terminology.

A. Core thermal power

Reactor technologies can be categorized by thermal capacity, which generally equates to “the size” of the reactor. This is the total amount of heat generated by fission reactions in the reactor fuel per unit time, measured in watts. The kinetic energy from the fission fragments and radiation (i.e., heat) is transferred to a primary coolant, such as water, ultimately producing steam for electricity generation or industrial processes. Thermal capacity can be roughly divided into the following groups:

Microreactors (MMR)

~ 5 MWth to ~50 MWth

Small modular reactors (SMR)

~ 75 MWth and ~400 MWth

Generation III+ (GenIII+)

~ 800 MWth and above

There are no precise industry definitions of microreactor and SMR sizes, and these sizes may vary by source. For instance, some sources identify an additional category for medium-sized reactors [67].

The categories have been defined above for ease of reference in this evaluation. The U.S. Nuclear Regulatory Commission (NRC) proposed rule, 10 CFR Part 57, does not define microreactors by thermal capacity, but by accident dose and physical fuel inventory. This definition could enable some SMR designs to be considered in the microreactor category. For this study, thermal power is defined as it is above. The bands are set for this evaluation. The more common industry convention defines SMRs by electric output, up to about 300 MWe per unit, roughly

1,000 MWth. The Rolls-Royce SMR, at 470 MWe and 1,358 MWth, exceeds the band but is marketed and reviewed as an SMR [67][68].

B. Neutron spectrum

Reactor technology can also be categorized by neutron spectrum. Neutrons are produced with a wide range of energies, and their interactions with matter depend strongly on their energy. Reactor technologies are typically divided into two categories based on the average energy of the neutrons causing fission in the reactor core:

Thermal spectrum:

Uses low-energy, or thermal, neutrons to sustain the chain reaction

- Because neutrons produced by fission are born as fast neutrons with high kinetic energy, reactors using a thermal spectrum require a neutron moderator, such as water, to slow neutrons down to an energy level that can continue the fission reaction chain.
- The neutrons slow down as they travel through the moderator and impart a fraction of their kinetic energy each time they collide with another (water) molecule.
- Plants currently operating in the U.S. use thermal neutrons to sustain their reactors.

Fast spectrum:

Uses high-energy neutrons and does not require a moderator

- Fast neutrons produce more neutrons per fission than thermal neutrons, allowing:
 - more efficient use of the fuel,
 - reducing the size and complexity of the reactor core, and
 - extending refueling periods.
- Neutron spectra in fast reactors vary with a given reactor coolant. For example, gas-cooled reactors have harder (faster) neutron spectra than those in sodium-cooled reactors.

Liquid metal and molten salt reactors (LMRs & MSRs):

Use liquid metal or molten salt as the primary coolant, fuel, or both

- high-temp, low-pressure operation
- Compared with water-cooled reactors, liquid-metal reactors use coolants with strong heat-transfer characteristics and can operate at high temperature and low pressure. Sodium provides the best heat-transfer performance among common liquid-metal coolants; lead and lead-bismuth trade some heat-transfer performance for lower chemical reactivity with air and water.

C. Coolant type

Reactor technologies can be divided into categories based on coolant type. Coolant is the medium that transfers heat from the nuclear fuel. In some cases, the coolant and the moderator are the same medium (e.g., water). These categories are:

Water-cooled reactors (WCRs):

Use water to transfer heat from the fuel

- Water can be either heavy (deuterium) or light water
- WCRs are further divided into pressurized water reactors (PWRs), (coolant does not boil in the core) and boiling water reactors (BWRs), in

Gas-cooled reactors (GCRs):

Use gas to transfer heat from the fuel

- Helium is a common gas coolant
- GCRs are also described by operating temperature as high-temperature (HTGR) and very-high-temperature gas-cooled reactors (VHTGR).

3 Gen III+ Large Reactors

This section reviews “Gen III+” large reactors (excluding Chinese and Russian technologies). These are large reactors based on existing, operating nuclear power plants in the United States and abroad, enhanced with passive safety features. All but one are light water reactors. The Enhanced CANDU 6 uses heavy water. “Passive” safety features are those that happen naturally without intervention by humans or machines. For example, a marble in a mixing bowl passively returns to the bottom of the bowl, even if disturbed. But that marble on an inverted bowl would require active safety features to keep it on top [69].

3.1 Advanced Passive (AP1000) | Westinghouse

Design Overview

The AP1000 is a Generation III+ pressurized water reactor (PWR) developed by Westinghouse, tracing its lineage through more than five decades of continuous PWR evolution. Its most direct predecessor is the AP600, a 600-MWe passive PWR that received NRC Design Certification in 1999. The AP600 and AP1000 were developed from Westinghouse’s own two-loop PWR fleet experience, which had accumulated decades of operation in the United States and internationally [70][71].

Westinghouse scaled the AP600 passive safety architecture up to approximately 1,100 MWe in the AP1000 while retaining the two-loop configuration and passive safety philosophy. The AP1000 holds NRC Design Certification, and in March 2026 Westinghouse submitted Revision 20 of the AP1000 Design Control Document to incorporate the as-built lessons from the Vogtle Units 3 and 4 in Georgia and establish that plant as the validated U.S. reference design for future applicants [71][72].

- + Fully passive core and containment cooling using gravity, natural circulation, compressed gas, and stored water, with no reliance on safety-grade AC power for 72 hours [71]
- + Two-loop nuclear steam supply system with canned-motor reactor coolant pumps that reduce large-bore primary piping [71]
- + Extensive modular construction using structural and equipment modules fabricated off-site [71]
- + The only Generation III+ design in this review holding both U.S. design certification and a recently completed U.S. construction [70][73]

Safety Methodology

The AP1000 passive safety systems rely on stored water, gravity, natural circulation, compressed gas, and containment heat removal rather than safety-grade AC power or operator action during the initial response period. The passive core cooling system includes core makeup tanks, accumulators, the in-containment refueling water storage tank, the passive residual heat removal heat exchanger, and the automatic depressurization system. The core makeup tanks provide high-pressure borated-water injection from tanks connected to the reactor coolant system, and as system pressure decreases the accumulators add further borated-water injection using nitrogen pressure [71].

The passive residual heat removal heat exchanger removes decay heat from the reactor coolant system and transfers it to the in-containment refueling water storage tank, while the passive containment cooling system removes heat from containment through natural circulation of air and water flowing over the outside of the steel containment vessel. Together these systems allow the AP1000 to maintain core cooling for up to 72 hours without operator action or AC power, limiting offsite dose by keeping the core covered and the containment intact through the design-basis response period [71].

Design Maturity & Licensing Status

The AP1000 is the most regulatorily and industrially mature large reactor option for U.S. deployment. It holds an active NRC design certification and recently completed U.S. construction, which should substantially reduce first-of-a-kind regulatory and execution uncertainty for a follow-on project [70].

Key Considerations:

- + U.S. certification record: active NRC design certification, with a Revision 20 update filed in March 2026 to make the as-built Vogtle units the reference design, and a certification renewal application under NRC review after a timing exemption was granted in June 2026 [72][74]
- + Construction record: four units operating in China (2018 to 2019) and Vogtle Units 3 and 4 in Georgia (2023 and 2024), the latter completed roughly seven years behind the original schedule [73][75]
- + Capital cost: about \$35 billion for the two Vogtle units, with DOE analysis projecting follow-on overnight costs declining from about \$10,000 per kWe for a second plant to about \$6,200 per kWe by a fourth [76][77]
- + Other: a domestic supply chain and trained workforce now exist from the Vogtle program, though continued stabilization remains important for cost and schedule predictability [77]

Deployment Feasibility and Timelines

The AP1000 has the most extensive recent construction record of any technology in this assessment. Four units were built in China at Sanmen and Haiyang, achieving commercial operation between 2018 and 2019 and providing the first at-scale validation of the passive safety design and modular construction approach. In the United States, Vogtle Units 3 and 4 in Georgia entered commercial operation in 2023 and 2024, the first U.S. reactors newly ordered and built from the ground up in more than 30 years, completed roughly seven years behind schedule and at a final cost of about \$35 billion for the two units. Westinghouse and Bechtel have documented the Vogtle lessons learned in supply chain development, modular fabrication sequencing, and workforce training, and DOE analysis projects that successive U.S. AP1000 builds could achieve declining overnight capital costs, supporting Nth-of-a-kind economics if a fleet is sustained [73][75][76][77].

The AP1000 pipeline is the most active of any large LWR currently available for U.S. deployment. In Poland, the three-unit AP1000 plant at Lubiatowo-Kopalino (Choczewo) advanced materially through early 2026: the Polish state

utility Polskie Elektrownie Jądrowe (PEJ) and the Westinghouse-Bechtel consortium amended their Engineering Development Agreement in December 2025 to continue design work, the U.S. Export-Import Bank concluded a first credit agreement supporting the project in January 2026, and PEJ submitted a construction license application for the 3,750-MWe plant in March 2026, with the EPC contract now targeted for late 2026 and first-unit commercial operation targeted for 2036. In the Czech Republic, Westinghouse has signed cooperation agreements for potential future AP1000 projects, though the initial Dukovany expansion was awarded to a competing bidder. In the United States, Fermi America signed an agreement in 2025 to deploy four AP1000 reactors in Amarillo, Texas for data center power supply, and a joint venture was formed in May 2026 to complete the partially built V.C. Summer Units 2 and 3 in South Carolina, a restart that would require a new combined license application because the original license was terminated [78][79][80][81][82][83][84].

3.2 APR1400 | Korea Electric Power Corporation

Design Overview

The APR1400 is an advanced PWR developed by Korea Electric Power Corporation (KEPCO) and Korea Hydro and Nuclear Power (KHNP), tracing its lineage through a formally structured Korean nuclear technology development program that began in the 1970s. The design is a direct evolution of the OPR-1000 (Optimized Power Reactor 1000), itself derived from the U.S. Combustion Engineering System 80 and System 80+ designs, for which KEPCO received technology transfer rights [85].

The Combustion Engineering System 80+ design was NRC-certified in 1997, providing a directly U.S.-licensed predecessor to the nuclear steam supply system architecture of the APR1400. The APR1400 received Korean Institute of Nuclear Safety type certification in 2002 and NRC Design Certification in 2019, and it has been built at two domestic Korean sites and at the Barakah site in the UAE [70][85][86].

- + Two-loop PWR rated at approximately 1,400 MWe, evolved from the OPR-1000 and the Combustion Engineering System 80+ lineage [85]
- + Passive fluidic device in the safety injection tanks that limits injection flow without active flow-control components [85]
- + Four-train active safety architecture with high redundancy and a diverse actuation system backing the digital protection system [85]
- + Holds NRC design certification (2019) and a proven recent export construction record at Barakah, UAE [70][86]

Safety Methodology

While the APR1400 is primarily an active-safety design with high redundancy rather than a passive-dominant design, it incorporates several passive or simplified safety features beyond its System 80+ predecessor. The design includes a passive fluidic device in the safety injection system that eliminates active flow-control components and provides inherent flow limitation under high-pressure conditions, and passive autocatalytic recombiners that manage hydrogen accumulation in containment following severe accidents without power or operator action [85].

The in-containment refueling water storage tank sits inside the steel-lined concrete containment and provides a protected source of borated water for safety injection and long-term cooling. Severe-accident mitigation features for containment protection and hydrogen control are supported by active containment spray and related systems, and a diverse actuation system provides an independent backup to the digital protection system, addressing common-cause failure concerns associated with digital instrumentation and control. The safe-shutdown path therefore

combines a highly redundant set of active trains with these passive backstops to keep accident frequency low and limit offsite release [85].

Design Maturity & Licensing Status

The APR1400 is a mature, certified design with one of the strongest recent export construction records of any large reactor, though its U.S. deployment is complicated by an intellectual-property relationship with Westinghouse and the absence of any U.S. project to date [70][87].

Key Considerations:

- + U.S. certification record: holds NRC design certification (2019), but no U.S. combined license application referencing the APR1400 has been submitted [70][159]
- + Construction record: four units delivered at Barakah, UAE (2021 to 2024) on a relatively predictable schedule, with additional units operating and under construction in South Korea [86]
- + Capital cost: ~\$20 billion contract value for four APR1400 units at Barakah, implying roughly \$3,600/kWe on a 5.6-GWe basis; broader all-in project-cost figures are higher depending on whether financing, initial fuel, escalation, and related program costs are included; cost lower than recent Western large-reactor builds [86]
- + Other: a January 2025 intellectual-property settlement with Westinghouse, rooted in the System 80 heritage, reportedly bars independent KHNP bids in the United States and constrains where KHNP can bid [87][88]

Deployment Feasibility and Timelines

The APR1400 has one of the strongest international construction delivery records of any technology evaluated in this document. Four units were built at the Barakah site in the UAE under a contract of approximately \$20 billion led by KEPCO, with Units 1 through 4 entering commercial operation between 2021 and 2024 on a schedule substantially more predictable than contemporaneous Western builds. In South Korea, APR1400 units have been built at the Shin Kori and Shin Hanul sites, with several in commercial operation and additional units under construction. The Barakah project demonstrated the consortium's ability to execute a first-of-a-kind export build in a new regulatory environment, staffing the project with up to 18,000 workers at peak and training a national nuclear workforce, which supports its Nth-of-a-kind delivery thesis [86].

The APR1400 pipeline remains active internationally. Shin Hanul Units 3 and 4 in South Korea received construction permits in September 2024, and construction of Unit 3 began in May 2025 and Unit 4 in May 2026, with commercial operation targeted in the early 2030s. In Poland, KHNP has been involved in discussions for deployment at the Patnow site, though the AP1000 was separately selected by the Polish government for its primary three-unit program. In the Czech Republic, KHNP was selected in July 2024 to supply two APR1000 units at Dukovany. The APR1000 is an approximately 1,000-MWe export design evolved from the OPR-1000 and incorporating advanced safety features drawn from the APR1400, rather than the APR1400 itself. The engineering, procurement, and construction contract, valued at approximately \$18.6 billion, was signed in June 2025 after the Czech Supreme Administrative Court lifted an injunction that EDF had obtained, and construction is targeted to begin in 2029 with first-unit trial operation by 2036. In December 2025 the European Commission opened an in-depth state-aid investigation into the project's public financing. No U.S. combined license application referencing the APR1400 has been submitted, although the APR1400 design itself holds NRC design certification. The APR1000 is a separate design and does not hold NRC certification. Its principal overseas credential is the European Utility Requirements compliance it received in 2023, so a prospective U.S. deployment of the Dukovany design would have no existing NRC-certified basis to reference [70][89][90][91][92][159][160].

3.3 European Pressurized Reactor (EPR) | Framatome & Siemens AG

Design Overview

The EPR (European Pressurized Reactor, also marketed as the Evolutionary Power Reactor) is a large four-loop PWR developed jointly by Framatome (now part of EDF) and Siemens AG in the 1990s in response to European Utility Requirements and post-Chernobyl regulatory demands in France and Germany [69].

The design descends from two parallel national PWR lineages: the French N4, the design class of Chooz B1 and B2 and Civaux 1 and 2, and the German Konvoi series built at Isar 2, Emsland, and Neckarwestheim 2. It was designed to meet both the French RCC-M and German KTA codes, producing a highly redundant four-train safety architecture that exceeds the two-train arrangement of most operating Western PWR designs [69][93].

- + Large four-loop PWR rated at approximately 1,600 to 1,650 MWe, the highest unit output of any reactor in this assessment [69]
- + Fully passive ex-vessel core catcher that captures and cools molten core material in a severe accident [69]
- + Four independent safety trains housed in physically separated safeguard buildings for protection against external hazards [69]
- + Double-wall containment combining an inner pre-stressed concrete structure and an outer reinforced concrete shield building [69]

Safety Methodology

The EPR safety philosophy relies primarily on high redundancy and diversity in active safety systems rather than on passive natural forces, a deliberate design choice that differs from the AP1000. It nonetheless incorporates several notable passive enhancements beyond its N4 and Konvoi predecessors. The core catcher is a fully passive ex-vessel system that captures and retains molten core material in a severe accident, using passive flooding from a dedicated water basin that gravity-feeds a layer of sacrificial material and then a spreading compartment where the corium is passively cooled, eliminating the need for active ex-vessel cooling. Passive autocatalytic recombiners distributed through the containment manage hydrogen accumulation without power or actuation [69][94].

The four-train safety system places each train in a physically separate reinforced concrete safeguard building, providing structural protection against aircraft impact, seismic events, and flooding beyond any predecessor French or German design, and the emergency feedwater system provides four separate motor-driven trains, backed by emergency diesel power, that start automatically on loss of main feedwater. The double-wall containment, an inner pre-stressed concrete structure within an outer reinforced concrete shield building, protects against both internal pressure events and external impact loads. These layers are intended to keep accident frequency very low and, through corium retention and double containment, to limit offsite dose even in severe-accident sequences [94].

Design Maturity & Licensing Status

The EPR is a fully developed and now-operating design, but its European construction history has been marked by severe delays and cost overruns, and it has no active U.S. certification [95][96][97][157].

Key Considerations:

- + U.S. certification record: no active U.S. design certification; AREVA's U.S. EPR certification application was suspended and never completed [95]

- + Construction record: Olkiluoto 3 (Finland) reached commercial operation in 2023, roughly 14 years behind its original schedule; Flamanville 3 (France) reached full power in December 2025; Taishan 1 and 2 (China) were the only units delivered on a more predictable timeline [\[96\]\[97\]\[98\]\[157\]](#)
- + Capital cost: among the highest of any technology assessed; Hinkley Point C is now estimated near 35 billion pounds for two units, while Olkiluoto 3 and Flamanville 3 each exceeded 11 billion to 13 billion euros [\[99\]](#)
- + Other: design complexity, multi-jurisdiction code differences (EUR, RCC-M, KTA), and the loss of continuous construction skills have been recurring causes of delay

Deployment Feasibility and Timelines

The EPR has a challenging construction history. Olkiluoto 3 in Finland began construction in 2005 with a planned 2009 completion at a cost of about 3 billion euros. It did not reach commercial operation until April 2023, nearly 14 years behind its original 2009 target and at a final cost exceeding 11 billion euros. Flamanville 3 in France began construction in 2007, received authorization for first criticality in September 2024, and reached full nuclear power in December 2025, roughly 12 years behind its original schedule and at a cost exceeding 13 billion euros against an original estimate of 3.3 billion euros. Two units at Taishan in China entered commercial operation in 2018 and 2019 on a more predictable timeline, though one was shut down for about a year starting in 2021 due to fuel rod damage. The pattern of delays has been attributed to design complexity, weaknesses in project organization, and the loss of continuous construction skills [\[93\]\[96\]\[97\]\[98\]\[157\]\[158\]\[161\]](#).

Hinkley Point C in Somerset, England, is the furthest-advanced EPR construction project in Europe. The two-unit, 3,260-MWe plant began construction in 2018 and 2019 and as of early 2026 is targeting first power from Unit 1 in 2030, at a total project cost revised to approximately 35 billion pounds. EDF is also developing the EPR2, a revised four-loop design with a simplified three-train safety architecture, rated at approximately 1,700 MWe per unit, for which France is planning six units at the Penly, Gravelines, and Bugey sites with construction targeted to begin in 2027, subject to a final investment decision. Sizewell C in the UK, designed as a near-replica of Hinkley Point C, reached its final investment decision in July 2025 and financial close in November 2025 at an estimated cost of approximately 38 billion pounds, with the UK government as the largest shareholder, and is now in early construction with completion expected around 2039. The EPR's delay record weighs against a near-term U.S. deployment absent a completed, repeatable reference build [\[93\]\[99\]\[100\]\[101\]](#).

3.4 ABWR | GE Vernova Hitachi

Design Overview

The ABWR is a boiling water reactor developed jointly by General Electric, Hitachi, and Toshiba as a Generation III evolution of the BWR/6, the sixth generation of GE's original BWR concept first commercialized at Dresden Unit 1 in 1960. Its direct predecessor, the BWR/6, was built at plants including Grand Gulf, Clinton, and Perry and formed the basis for the Mark III containment system [\[102\]](#).

The ABWR incorporates design improvements from the U.S., Japanese, and Swedish BWR fleets and was developed under a formal GE-MITI program in Japan with substantial government research investment. The U.S. ABWR is the first Generation III+ reactor operating in the world, reaching commercial operation at Kashiwazaki-Kariwa Unit 6 in Japan in 1996. It received NRC Design Certification in 1997 [\[70\]\[102\]](#).

- + Direct-cycle BWR rated at approximately 1,350 MWe, evolving the BWR/6 with a compact reinforced concrete pressure-suppression containment [\[102\]](#)

- + Ten reactor internal pumps located within the reactor pressure vessel, eliminating the large external recirculation piping and its associated loss-of-coolant risk [102]
- + First Generation III+ reactor operating in the world, at Kashiwazaki-Kariwa Unit 6 (1996), with NRC design certification (1997) [70][102]
- + Demonstrated rapid modular construction, with Japanese units completed in roughly four to five years [102]

Safety Methodology

The ABWR improved on the BWR/6 by adding diverse and semi-passive safety features while retaining the direct-cycle efficiency common to all BWRs. The ten reactor internal pumps that replace the large external recirculation pumps are located entirely within the reactor pressure vessel, eliminating the large-diameter recirculation piping that was a significant loss-of-coolant accident contributor in earlier BWRs. A reactor core isolation cooling system, an active system with steam-driven turbine-pumps, operates without AC power to provide makeup water during station blackout, and an active standby liquid control system injects borated water to shut the reactor down under any reactivity transient without relying on control rod insertion [102].

The reinforced concrete containment vessel retains the proven pressure-suppression concept with a large pool volume for passive heat absorption during transients, and an emergency core cooling network of two high-pressure core flooders, the steam-driven reactor core isolation cooling system, and three low-pressure flooder modes of the residual heat removal system provides redundant cooling. Together these features are intended to achieve safe shutdown with diverse and redundant means and to keep the suppression containment intact, limiting offsite release across the design-basis event set [102].

Design Maturity & Licensing Status

The ABWR is a certified and operationally proven design with the longest Generation III operating record, but it has limited recent new-build momentum outside Japan [103].

Key Considerations:

- + U.S. certification record: holds NRC design certification, renewed by the NRC in 2021 and extended in duration by the NRC's 2025 rule. The combined licenses issued in 2016 for South Texas Project Units 3 and 4, the only U.S. COLs referencing the ABWR, were later withdrawn [104][105][106]
- + Construction record: four units built in Japan, with two more under construction at Shimane and Ohma. Lungmen Unit 1 in Taiwan was completed but never fueled, and Unit 2 was never finished [103][107]
- + Capital cost: not available for a current Western build, as no recent ABWR cost has been validated by a completed project; the only documented U.S. reference point is the cancelled South Texas Project ABWR estimate of about \$3,700 per kW in 2010, while Japanese builds were historically faster and the Lungmen project in Taiwan saw costs roughly double amid delays [107][108]
- + Other: GEH's active large-reactor commercial focus has shifted to the BWRX-300, so the ABWR supply chain would require reactivation for a new U.S. build [1]

Deployment Feasibility and Timelines

The ABWR has the longest operating track record of any Generation III design, with the first unit at Kashiwazaki-Kariwa reaching commercial operation in 1996. Four ABWR units have been built in Japan, with two more under construction at Shimane and Ohma. In Taiwan, Lungmen Unit 1 was essentially completed but never loaded with fuel due to political opposition, Unit 2 was never finished, and both were placed in long-term preservation. In the

United States, no ABWR has been built. The NRC issued combined licenses in 2016 for South Texas Project Units 3 and 4, the only U.S. application referencing the design, and the licenses were withdrawn in 2018 after Toshiba exited the project [102][103][107].

The ABWR has no active new-build projects outside Japan. Hitachi-GE completed the UK Generic Design Assessment for the UK ABWR in 2017, but Hitachi suspended the Horizon Nuclear Power program in January 2019 after failing to secure financing for units at Wylfa and Oldbury, and those sites were reassigned. GEH's commercial focus has shifted to the BWRX-300, which is derived from the ESBWR. As a result, while the ABWR is a proven Nth-of-a-kind design in the Japanese market, its near-term new-build prospects for U.S. or other international deployment are limited and would require supply chain reactivation [1][109][110].

3.5 Enhanced CANDU 6 (EC6) | Atomic Energy of Canada, Ltd (AECL)

Design Overview

The CANDU EC6 (Enhanced CANDU 6) is a pressurized heavy water reactor (PHWR) developed by AECL (Atomic Energy of Canada Limited) and its successor AtkinsRealis (formerly SNC-Lavalin Candu), the most recent evolution of the CANDU family that originated in the late 1950s at Chalk River. Its direct predecessor is the CANDU 6, a standardized roughly 700-MWe PHWR built at Cernavoda, Wolsong, Qinshan, Gentilly-2, Point Lepreau, and Embalse, accumulating more than 150 reactor-years of operation across multiple jurisdictions [111].

The EC6 adds post-Fukushima safety enhancements, improved fuel flexibility, an extended 60-year design life, and digital instrumentation and control beyond the CANDU 6 standard, while retaining the defining CANDU principle of online refueling under full-power operation [111].

- + Pressurized heavy water reactor that can use natural-uranium fuel and refuel online at full power [111]
- + Large low-pressure heavy water moderator that acts as an independent passive heat sink surrounding all fuel channels [111]
- + Two independent, physically separate passive shutdown systems: gravity-driven shutoff rods and gadolinium injection [111]
- + Not a light-water reactor (it uses heavy water) and not NRC-certified, with no U.S. licensing precedent for the design class [70][111]

Safety Methodology

The CANDU EC6 benefits from inherent and passive safety characteristics that arise from its heavy water moderated, pressure-tube design. The large volume of low-temperature, low-pressure heavy water moderator in the calandria vessel surrounds all fuel channels and absorbs decay heat passively by convection and boiling for an extended period following a loss-of-coolant event, without active cooling. This passive moderator heat sink can terminate a severe accident and cool a damaged core even if both the primary heat transport system and the emergency core cooling system have failed, a defense-in-depth layer not present in light water designs [111].

Two independent, physically separated passive shutdown systems are provided: gravity-driven shutoff rods that fall into the low-pressure moderator on loss of power or signal, and direct injection of gadolinium nitrate into the moderator by pressurized gas, giving a fully diverse secondary shutdown capability. The EC6 adds a passive calandria vault flooding system that floods the space surrounding the calandria to cool the vessel exterior without pumps or operator action. The moderator operates near atmospheric pressure and provides a passive heat sink that light water designs lack. The primary heat transport system still operates at high pressure, so large pipe breaks

remain design-basis events, but the moderator backstop supports a low accident frequency and limited offsite consequence [111].

Design Maturity & Licensing Status

The CANDU family is operationally proven, but the EC6 specifically has never been built, and as a heavy water design it has no U.S. regulatory precedent [111].

Key Considerations:

- + U.S. certification record: no NRC certification and no U.S. licensing precedent for a PHWR; any U.S. deployment would require a multi-year NRC process from a standing start [70]
- + Construction record: the CANDU family has been deployed in seven countries, with 25 reactors operating in five countries today, but no EC6 unit has been built; the most recent new CANDU was Cernavoda Unit 2 in 2007 [111][112]
- + Capital cost: the Cernavoda 3 and 4 completion, which involves partially built CANDU 6 units rather than new EC6 units, carries an engineering, procurement, and construction management contract of roughly 3.2 billion euros, now in a limited notice-to-proceed phase, backed by about 3 billion CAD in Canadian export financing; a greenfield EC6 cost has not been established by a completed project [113][114]
- + Other: AtkinsRealis is pursuing a CANDU new-build expansion strategy, but no EC6 new-build contract has been signed in any jurisdiction [111]

Deployment Feasibility and Timelines

The CANDU technology family has an extensive operational record, with 25 reactors operating in five countries and a deployment history spanning seven. In Romania, the Cernavoda plant operates two CANDU 6 units that entered commercial operation in 1996 and 2007. In Canada, multiple CANDU units operate at the Darlington, Pickering, and Bruce sites, and a life-extension program completed the Darlington refurbishment in March 2026 and is refurbishing units at Bruce, for roughly 30 additional years of operation. The most recent new CANDU construction was Cernavoda Unit 2 in 2007. The EC6 is an evolutionary upgrade of the CANDU 6, but no EC6 unit has been built. The design completed the three-phase CNSC pre-licensing vendor design review in Canada in 2013 without progressing to a construction permit application as of July 2026 [112][115][116][117].

The most significant forward CANDU project is the completion of Cernavoda Units 3 and 4 in Romania, partially constructed CANDU 6 reactors whose construction was suspended in 1991. In November 2024 an engineering, procurement, and construction management contract of approximately 3.2 billion euros was signed with a joint venture of Fluor, AtkinsRealis, Ansaldo Nucleare, and Sargent and Lundy, beginning with a limited notice-to-proceed phase ahead of a final investment decision, with Unit 3 targeted for commercial operation in 2030 and Unit 4 in 2031, supported by CAD 3 billion in Canadian export financing. Site construction for Units 3 and 4 has not begun. AtkinsRealis describes these as the first step in a broader CANDU new-build strategy, but no EC6 new-build contract has been signed, and a U.S. deployment would require a multi-year NRC licensing process with no established precedent, making it unsuitable for a near-term Nth-of-a-kind commitment in the United States [113][114][115].

3.6 ESBWR | GE Vernova Hitachi Nuclear Energy (formerly GE-Hitachi)

Design Overview

The ESBWR is a 1,520-MWe boiling water reactor developed by GE Vernova (GEH) as the passive-safety successor to the ABWR, drawing on more than six decades of BWR development [118].

The ESBWR uses GE14 and GNF2 fuel assemblies common across the operating BWR fleet. GEH received NRC Design Certification for the ESBWR in 2014 under 10 CFR Part 52, Appendix E [70][118].

- + 1,520-MWe natural-circulation BWR that eliminates all reactor recirculation pumps and associated piping [118]
- + Isolation Condenser and Gravity-Driven Cooling Systems that provide decay heat removal and emergency core cooling with no pumps or AC power [118]
- + Among the lowest published core damage frequencies of any Generation III or III+ reactor, per GE Vernova, about 1.7×10^{-8} per reactor-year [118]
- + Passive coping capability exceeding 72 hours without operator action or external power [118]

Safety Methodology

The ESBWR represents the most comprehensive application of passive safety of any NRC-certified boiling water reactor, and in several respects exceeds even the AP1000 in the degree to which active safety systems have been eliminated. Natural circulation replaces all reactor recirculation pumps and associated piping, reducing primary-system complexity by roughly 25% relative to the ABWR and eliminating the recirculation-related loss-of-coolant scenarios that are a significant risk contributor in earlier BWRs. The Isolation Condenser System uses independent passive heat exchangers that condense steam from the reactor and return condensate by gravity without pumps, active valves, or AC power, providing extended decay heat removal following reactor isolation, with a 72-hour passive basis and vendor-claimed capability beyond seven days [118].

The Gravity-Driven Cooling System uses elevated water pools inside containment that drain by gravity into the reactor vessel on loss of coolant, providing emergency core cooling without pumps or active actuation beyond passive squib-valve opening, and the Passive Containment Cooling System uses heat exchangers submerged in an elevated suppression pool to condense released steam without active systems. Collectively these systems provide a demonstrated station blackout coping capability exceeding 72 hours with no operator action or AC power, giving the ESBWR the lowest published core damage frequency of any Generation III or III+ reactor, as published by GE Vernova, about 1.7×10^{-8} per reactor-year, and a basemat core catcher (BiMAC) passively retains and cools core debris in a severe accident, limiting offsite dose [118][119].

Design Maturity & Licensing Status

The ESBWR holds a U.S. design certification but has never been built, and its supply chain is largely dormant as GEH has shifted its commercial focus to the BWRX-300 [1][70].

Key Considerations:

- + U.S. certification record: holds NRC design certification (2014, Appendix E), providing a defined licensing basis, but no combined license referencing it has proceeded to construction [70]
- + Construction record: no reference build exists; the NRC issued combined licenses referencing the ESBWR for Fermi 3 (2015) and North Anna Unit 3 (2017), but neither plant was built [120][121]
- + Capital cost: not validated by any completed project, so construction schedule and cost estimates carry first-of-a-kind execution risk
- + Other: the GEH supply chain for the ESBWR is largely dormant, and reactivating it and NRC staff familiarity would require substantial pre-project investment

Deployment Feasibility and Timelines

The ESBWR has no construction experience. GEH received NRC Design Certification in 2014, but no combined license application referencing the design has proceeded to construction. The NRC issued the North Anna Unit 3 combined license to Dominion in June 2017 and the Fermi 3 license in May 2015, but neither project proceeded to construction, and other early ESBWR COL applications were withdrawn. The passive architecture draws on the ABWR platform, for which GEH has extensive Japanese construction experience, but the ESBWR's specific innovations, including the elimination of all recirculation pumps, the gravity-driven cooling system, and the isolation condenser configuration, have not been validated at commercial scale [70][102][120][121].

There are no active forward ESBWR construction projects as of July 2026, and no international deployment program has been announced. The technology's most direct commercial descendant is the BWRX-300, which uses the ESBWR's design certification as a licensing starting point and is scaled down to approximately 300 MWe. For a prospective Arkansas deployment, the ESBWR represents a certified but commercially dormant option, and any project referencing the certification would need to confirm that it remains current and that GEH has sufficient design-engineering and supply chain resources, neither of which favors a near-term Nth-of-a-kind commitment [1].

4 Light Water Small Modular Reactors

These designs each represent a distinct approach to achieving compact, modular, and passively safe nuclear power generation. The LW-SMR reactors leverage existing, known technology bases that likely have the least to prove with additional reactor qualifications. Advanced non-light water reactor designs include many provisions for materials, fuel, and accident analysis verification that may take additional time, possibly delaying fleet deployment for those reactors. The summaries and comparative table presented below are intended to support informed decision-making for U.S.-based clients evaluating SMR deployment options.

LW-SMR technologies have consistent considerations that make them attractive for deployment.

- + Their smaller core inventory corresponds directly to lower doses in an accident
- + Smaller cores are easier to cool with passive equipment leading to lower accident probabilities
- + They build on lessons learned from Gen III+ designs and use similar analytical methods
- + Fuel performance targets are well known from decades of experimental validation
- + Licensing pathways already exist in 10 CFR 50 and 10 CFR 52, though many have exemptions from onerous legacy requirements

Each design is a light-water reactor (either pressurized water reactor [PWR] or boiling water reactor [BWR]) and relies on established nuclear fuel cycles and supply chains. Key differentiating factors include power output, regulatory status, site footprint, and cooling water requirements. Where official data are unavailable, estimates have been derived from analogous operating plants or published industry benchmarks and are noted accordingly.

4.1 NuScale Power Module (US460) | NuScale Power, LLC

Design Overview

The NuScale Power Module (NPM) is a small, integral, light-water-cooled PWR. NuScale plants are scalable and configured with multiple NPMs to meet demand, with standard configurations of four modules at 308 MWe, six modules at 462 MWe (the reference US460 plant), and twelve modules at 924 MWe. Each module integrates the reactor core, steam generator, and pressurizer within a single pressure vessel housed in a below-grade, shared reactor pool [9][20].

Each NPM operates independently while all modules are managed from a single control room, and each is connected to a dedicated turbine-generator. The design uses natural circulation for core coolant flow, eliminating reactor coolant pumps, and supports load-following and process-heat applications. NuScale states that passive systems allow unlimited core cooling after a beyond-design-basis accident without AC or DC power, operator action, or makeup water, and air-cooled condenser configurations can eliminate the large surface-water withdrawals typical of conventional light water reactors [20][122].

- + Factory-fabricated, integral compact modules housed in a shared below-grade pool [20]
- + Natural-circulation primary flow in all operational states, with no reactor coolant pumps [9]
- + High-design-pressure containment vessel evolved from the previously certified US600 design [9][123]
- + Received an NRC Standard Design Approval for the uprated 77-MWe module design in May 2025 [9]

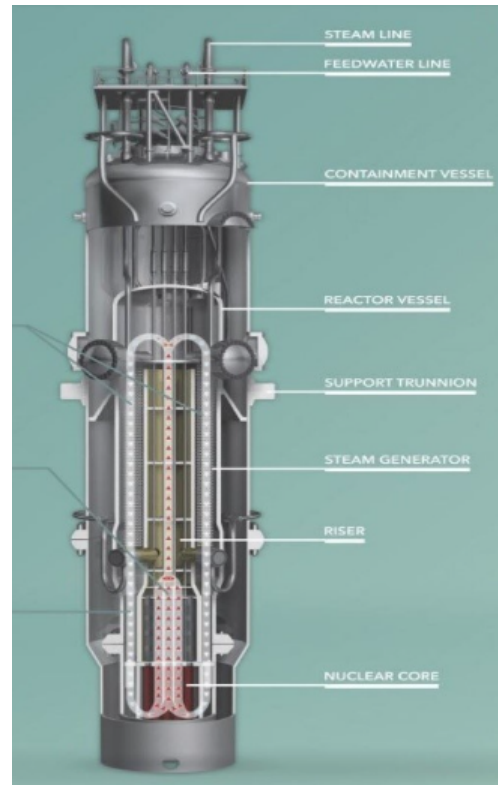


Figure 1. NuScale's Integrated NPM

As shown in Figure 1, each NPM is a fully self-contained module that integrates the reactor core, steam generator, and pressurizer within a single pressure vessel and is housed in a below-grade reactor pool shared by all modules at a given site. Each NPM operates independently of the other modules in a multi-module plant, while all modules are managed from a single control room. Each power module is connected to a dedicated turbine-generator unit and balance-of-plant systems [20].

Safety Methodology

NuScale's defense-in-depth methodology relies on multiple independent and redundant passive safety systems within a robust, high-design-pressure containment. The NPM is described as walk-away safe: the fully passive design shuts the reactor down and self-cools without operator or computer action, AC or DC power, or added water [122].

The water inventory provided for postulated accidents supplies on the order of 30 days of cooling, after which decay heat is removed by natural-convection air cooling indefinitely. There are no design-basis accidents that uncover the core or require operator action, which keeps accident frequency low and limits offsite dose. Reflecting this

simplified safety case, the NRC has approved operation of up to twelve modules by three operators and eliminated the shift technical advisor requirement [122].

Design Maturity & Licensing Status

The US460 is among the most regulatorily mature SMR designs in the United States, holding an NRC Standard Design Approval issued in May 2025, the second for a NuScale SMR design, evolved from the previously certified US600 configuration [9][123].

Key Considerations:

- + U.S. certification record: received NRC Standard Design Approval in May 2025 for the updated US460, following the approval the NRC issued for NuScale's 50-MWe-module design in September 2020; the approved design may be referenced directly in construction permit or combined license applications [9][123]
- + Construction record: no NuScale plant has yet been built; the predecessor UAMPS Carbon Free Power Project was cancelled in 2023 before construction began [18]
- + Capital cost: not publicly disclosed for the current US460 offering; the cancelled UAMPS project had reached an estimated figure on the order of \$9 billion for a six-module plant before termination [18][19]
- + Other: NuScale estimates about 36 months of on-site construction for a first-of-a-kind plant using the approved standard design and factory-fabricated modules [20]

Deployment Feasibility and Timelines

Using an approved standard design and factory-fabricated modules, NuScale estimates about 36 months of on-site construction for a first-of-a-kind plant. On the deployment side, NuScale's exclusive global partner ENTRA1 Energy and the Tennessee Valley Authority are advancing planning for up to 6 GWe of NuScale capacity, which the company describes as the largest SMR deployment program in U.S. history. Securities suits filed in early 2026 challenge NuScale's representations about ENTRA1. In Romania, Nuclearelectrica's shareholders took a conditional final investment decision for the six-module RoPower project at a former coal site in Doicești in February 2026. These remain pre-construction commitments, so the design's Nth-of-a-kind economics are not yet demonstrated by a completed build [16][17][20][124][125].

4.2 BWRX-300 | GE Vernova Hitachi Nuclear Energy

Design Overview

The BWRX-300 is a 300-MWe boiling water reactor developed by GEH as a simplified derivative of the NRC-certified 1,520-MWe ESBWR and the tenth generation of the GEH boiling water reactor design line. It uses a below-grade reactor pressure vessel four meters in diameter, compared with the ESBWR's 7.1 meters, enabling a substantially reduced above-grade footprint [1][21].

The design relies on natural circulation for primary coolant flow in normal and accident conditions, with no pumps required to circulate reactor coolant, and the reactor building is constructed below grade, supporting seismic performance and passive decay heat removal. GEH has not published a total-site acreage figure, but GEH materials describe the power block as fitting within one to two football fields, and cooling configurations, including mechanical-draft cooling towers, are selectable by site [1][21].

- + Tenth-generation BWR design derived from the certified ESBWR, providing a licensing-pedigree advantage [1]
- + Natural-circulation primary flow with no safety-significant pumps [21]

- + Below-grade reactor pressure vessel for seismic protection and passive decay heat removal [21]
- + GEH claims roughly 90% lower plant volume and 50% less concrete per unit of energy than a conventional large BWR [22][23]

Safety Methodology

The safety strategy conforms to IAEA Fundamental Safety Principles and is built around the three Fundamental Safety Functions: control of reactivity, removal of heat from the fuel, and confinement of radioactive material, implemented through five defense lines per IAEA SSR-2/1 [21].

Natural-circulation cooling and the below-grade vessel support passive decay heat removal without reliance on active pumps or AC power during the design-basis response, and the design inherits the passive isolation-condenser heritage of the ESBWR lineage. Together these features are intended to keep accident frequency low and confine radioactive material within containment to limit offsite dose [21][22].

Design Maturity & Licensing Status

The BWRX-300 is the only SMR in this review based on a previously certified BWR design, and the Darlington unit is the first commercial SMR under construction in North America [1][2].

Key Considerations:

- + U.S. certification record: leverages the ESBWR's NRC design certification as a licensing starting point; TVA submitted the first U.S. BWRX-300 construction permit application for Clinch River in May 2025 and holds the only NRC early site permit for an SMR site [24][25]
- + Construction record: OPG received its Canadian Nuclear Safety Commission licence and began construction of the first unit at Darlington in 2025, the first grid-scale SMR construction in North America [2][126]
- + Capital cost: the first-of-a-kind unit at the OPG Darlington project, now under construction, is reported at about \$7.7 billion CAD, with a four-unit plant reported near \$20.9 billion CAD in 2024 dollars; these are owner and project figures rather than vendor estimates, though they remain estimates until the build completes [26][27]
- + Other: an open-top modular construction approach targets a 24 to 36 month nth-of-a-kind build following site preparation [1]

Deployment Feasibility and Timelines

Construction uses a modular, open-top approach with an estimated 24 to 36 month nth-of-a-kind build following site preparation. The first Darlington unit is on a longer first-of-a-kind schedule. The OPG Darlington project in Canada and the TVA Clinch River site in the United States are the two most advanced deployment commitments for the BWRX-300. OPG received its CNSC licence and began construction of the first unit at Darlington in 2025, the first grid-scale SMR construction in North America, with that unit targeted for completion around 2029 to 2030. TVA, which holds the only NRC early site permit for an SMR site, submitted the first U.S. BWRX-300 construction permit application for the Clinch River site in May 2025. NRC staff completed the safety evaluation and recommended issuing the permit in June 2026, with the mandatory hearing set for August 2026. A completed Darlington unit would provide the first reference build to anchor Nth-of-a-kind cost and schedule expectations [2][24][25][127].

4.3 AP300 | Westinghouse Electric Company

Design Overview

The Westinghouse AP300 is a single-loop PWR introduced at 300 MWe in May 2023 and now specified by Westinghouse at 330 MWe as a scaled-down derivative of the NRC-certified, commercially operating AP1000. Westinghouse describes it as the only SMR in development derived directly from an operating Nth-of-a-kind plant, with four AP1000 units operating in China and two at Vogtle in Georgia [10][128].

The AP300 preserves the AP1000's passive safety architecture while reducing the primary system to a single loop, with one steam generator, two reactor coolant pumps, and associated piping. It features an exceptionally compact nuclear island, a safety-related footprint of roughly 0.4 acres, and is marketed for brownfield deployment at retiring coal sites where existing grid infrastructure can shorten development timelines [14][15][128].

- + Single-loop scaled derivative of the certified, operating AP1000 [10]
- + Full reuse of the AP1000 passive safety architecture, codes, and licensing methodology [10]
- + Exceptionally compact nuclear island, about 0.4 acres of safety-related footprint [15]
- + Designed for brownfield deployment at retiring coal-plant sites [14]

Safety Methodology

The AP300 carries over the AP1000 passive safety architecture, resting on a defense-in-depth approach with multiple independent layers housed within a robust steel containment designed for extreme external hazards. The advanced passive system automatically achieves safe shutdown without operator action and eliminates the need for backup power and cooling, relying on gravity, natural circulation, and condensation rather than active pumps or AC and DC power [10].

A central element of the safety methodology is regulatory reuse of the AP1000 safety basis: Westinghouse intends to apply the same safety analysis codes and licensing methodologies already accepted for the AP1000, with departures limited to footprint optimization and the single-loop arrangement. This reuse is intended to preserve the AP1000's low accident frequency and offsite-dose performance while simplifying the safety case [28][29].

Design Maturity & Licensing Status

Design maturity is advancing through a phased program, with the conceptual design completed at the end of 2023 and the program in a basic design and licensing phase, but the AP300 remains in NRC pre-application engagement without a docketed application [28][29].

Key Considerations:

- + U.S. certification record: no docketed design certification or standard design approval application; Westinghouse submitted a pre-application Regulatory Engagement Plan in May 2023 and continues white-paper review, with design certification a vendor target for 2027 [28][29]
- + Construction record: no AP300 has been built, though the design draws directly on the operating AP1000 fleet and its established supply chain [10]
- + Capital cost: not available; the only published figure is a Westinghouse vendor target of about \$1 billion per unit (\$3,400 per kWe), which is not relied upon here because vendor cost projections for unbuilt reactors are historically unreliable, and no independent or contracted cost exists for the design [14]

- + Other: licensing leverage from AP1000 approvals in the U.S., UK, and China and EUR compliance. The AP300 was approved to enter the UK Generic Design Assessment in 2024, but the assessment has not started [129]

Deployment Feasibility and Timelines

The deployment thesis for the AP300 is built on supply-chain maturity and reduced first-of-a-kind risk rather than novel technology. Because the unit reuses AP1000 equipment and components, incumbent AP1000 suppliers can furnish major equipment, and the design draws on constructability lessons and operating procedures from the existing AP1000 fleet. Westinghouse targets an 80-year life and a refueling cycle of 36 to 48 months. Westinghouse has published a per-unit cost target, but as a vendor projection for an unbuilt design it is not treated as a reliable cost basis in this assessment [10][128].

Commercial interest has accumulated across multiple markets, though the agreements to date are framework arrangements rather than construction commitments. In the United Kingdom, Westinghouse and Community Nuclear Power have agreed to deploy four AP300 units in North Teesside, described as the UK's first privately financed SMR fleet. Data center developer Data4 selected the AP300 under a March 2025 memorandum of understanding, Westinghouse has signed a memorandum of understanding with Ukraine's Energoatom, and in Canada it has pursued the technology in Ontario and New Brunswick, including a January 2026 memorandum of understanding with Tetra Tech Canada. Because no AP300 has been built, its Nth-of-a-kind case rests on the maturity of the parent AP1000 rather than on a completed SMR reference [11][30][31][32][33].

4.4 SMR-300 | Holtec International

Design Overview

The Holtec SMR-300 is a 300-MWe (net) PWR designed for dual-unit deployment. Holtec's current materials cite 340 MWe gross per unit and about 680 MWe for the dual-unit plant. It uses a forced-circulation primary loop with two reactor coolant pumps, backed by passive, gravity-driven safety systems, within a proprietary METCON steel-and-concrete Containment Enclosure Structure designed to withstand aircraft impact, high winds, and seismic events [34][130].

The design uses standard Westinghouse-type 17x17 PWR fuel assemblies (Framatome GAIA) below 5% enrichment, avoiding the high-assay low-enriched uranium supply chain that constrains several advanced designs. A distinguishing feature is that the SMR-300 is expressly built to operate without proximity to a large body of water: waste heat can be rejected by direct air cooling or by conventional water sources at the owner's option, enabling siting in water-scarce regions [4][131].

- + Dual-unit PWR, 300 MWe net per unit (340 MWe gross per Holtec's current materials), about 680 MWe per site, within a METCON aircraft-impact-resistant containment [34][130]
- + Optional direct air cooling, enabling siting in arid regions without a large water body [3][4]
- + Standard 17x17 PWR fuel below 5% enrichment, avoiding dependence on HALEU [4]
- + Spent fuel pool located inside containment so the full irradiated-fuel inventory is passively protected [13][36]

Safety Methodology

The SMR-300 incorporates a suite of engineered safety feature systems, all passive, relying on gravity, pressure, and temperature differences to shut down the reactor and keep it safe without pumps, electrical power, or operator action. These include the Plant Safety System for reactor trip and actuation, primary and secondary decay heat removal systems, an automatic depressurization system that enables passive injection during a loss-of-coolant

accident, a passive core makeup system, and a passive containment heat removal system serving as the ultimate heat sink, each designed so that a single failure does not inhibit its function [3].

The design is characterized as walk-away safe: the core sits deep underground within the steel-and-concrete containment, the annular space between the containment vessel and the enclosure holds demineralized water as a passive cooling reservoir that removes decay heat without an external water source, and a large water inventory keeps the core submerged so that no operator action is required during postulated events [3].

The most distinctive safety element is the treatment of spent fuel: drawing on Fukushima lessons, the spent fuel pool is located inside the containment so that the full irradiated-fuel inventory is passively protected, in contrast to conventional designs that store spent fuel outside containment. Together these features support a low accident frequency and limit offsite dose toward the plant boundary [13][36].

Design Maturity & Licensing Status

The SMR-300 reflects roughly 15 years of development and has advanced beyond pre-application to a docketed construction permit application, a more mature regulatory posture than most non-certified SMRs [13][132].

Key Considerations:

- + U.S. certification record: on December 31, 2025, SMR, LLC, a Holtec International company, filed the first part of a phased construction permit application for a dual-unit plant at Palisades (Pioneer Units 1 and 2), which the NRC accepted for review, and the NRC began the environmental review in June 2026 [35][132][133]
- + Construction record: no SMR-300 has been built; preparatory civil work at Palisades is expected once the restarted plant is reconnected to the grid and subject to a limited work authorization [35]
- + Capital cost: not publicly disclosed; Holtec reports having invested over \$500 million in development, and a \$400 million DOE award announced in December 2025 supports first-of-a-kind deployment rather than representing the plant capital cost [13][34]
- + Other: optional air cooling and standard low-enriched uranium fuel reduce siting and fuel-supply constraints; the UK Generic Design Assessment completed Step 2 in March 2026 with no shortfalls identified [134]

Deployment Feasibility and Timelines

The lead deployment is the Pioneer dual-unit SMR-300 plant co-located with the Palisades plant on Lake Michigan. On December 2, 2025, Holtec was selected for a \$400 million DOE Tier 1 First Mover award under the Generation III+ SMR Pathway to Deployment Program to catalyze the first-of-a-kind deployment, directed toward licensing, pre-construction, and supply-chain mobilization. Holtec intends to act as technology vendor, supply chain vendor, constructor in partnership with Hyundai Engineering and Construction, operator, and electricity merchant, and proposes a multi-site, fleet-scale model to drive down cost through standardization [13][34].

Holtec is targeting the Pioneer reactors coming online in the first years of the 2030s, with preparatory civil construction expected once the restarted Palisades plant is reconnected to the grid and a limited work authorization is in place. The company has identified its Oyster Creek site in New Jersey as a candidate for additional deployment, and in May 2026 the SMR-300 was selected for the Green River Advanced Nuclear Project in Utah, a next-of-a-kind deployment supporting the state's Operation Gigawatt initiative that would use the air-cooled condenser option for an arid site. Because no unit has been built, the fleet economics remain a forward projection [34][37].

4.5 Rolls-Royce SMR | Rolls-Royce SMR Ltd.

Design Overview

The Rolls-Royce SMR is a 470-MWe PWR developed by Rolls-Royce SMR Ltd., a consortium-backed entity targeting the UK and export markets. It is a three-loop, close-coupled reactor producing 1,358 MWth, the highest rated single-unit output among the SMRs in this study, with load-following capability for grid electricity, industrial power, hydrogen, and synthetic fuels [7][8].

The design adopts a boron-free primary circuit, eliminating the boric acid used for reactivity control in conventional PWRs, which reduces water consumption and removes a hazardous waste stream, with an Alternative Shutdown Function delivering boron via high-pressure injection as a backup. It uses a distinctive bermed site configuration: the full bermed site is about 24.7 acres, the power station footprint about 5.3 acres, and the commonly cited operational envelope about 10 acres [7][8].

- + Three-loop, 470-MWe PWR, the highest rated single-unit output among the SMRs in this study [7]
- + Boron-free primary circuit, reducing water use and eliminating a hazardous waste stream [8]
- + Proprietary factory-fabricated modular build targeting a 500-day nuclear-island schedule [8]
- + Uses proven components (U-tube steam generators, steel containment, seal-less coolant pumps) to reduce novel-feature testing [7]

Safety Methodology

The Rolls-Royce SMR uses a modular PWR island with multiple active and passive safety systems with internal redundancy, providing several defense-in-depth layers. The residual heat removal system and a gravity-driven water-cooling system are passive, reducing reliance on operator action and active components during accident conditions [7].

The reactor core is protected against external hazards and ground movement, and internal safety systems can function autonomously to bring the core to a safe state without external intervention for at least three days, supporting a low accident frequency and confinement of radioactive material to limit offsite dose [7].

Design Maturity & Licensing Status

The Rolls-Royce SMR is in detailed design and advanced UK regulatory engagement and, as of 2026, is the UK government's selected SMR technology, though no unit has yet been built [38].

Key Considerations:

- + U.S. certification record: no NRC application; the design's NRC pre-application docket holds a Design Overview White Paper, a regulatory engagement plan, and two topical reports, indicating prospective interest in U.S. certification concurrent with UK Generic Design Assessment completion [7][135]
- + Construction record: no unit has been built; the design is in Step 3 of the UK Generic Design Assessment administered by the Office for Nuclear Regulation, the Environment Agency, and Natural Resources Wales [136]
- + Capital cost: not available; Rolls-Royce's published target of about 1.8 billion pounds per unit at fleet scale is a vendor estimate that is not relied upon here, and while the UK government allocated about 2.6 billion pounds to the initial program, that is a program funding commitment rather than a validated per-unit build cost [41][137]

- + Other: Rolls-Royce states that about 90% of manufacturing and assembly activities occur in factory conditions, and the use of proven primary components reduces first-of-a-kind testing [\[138\]](#)

Deployment Feasibility and Timelines

The design targets a 500-day nuclear-island construction schedule once site preparation is complete, within a total project duration of about four years, using a factory-fabricated module strategy in which major components are assembled off-site and delivered to the bermed site. The University of Sheffield's Advanced Manufacturing Research Centre is producing working module prototypes as the first phase of a broader work package to de-risk the program [\[8\]\[139\]](#).

Rolls-Royce SMR was selected in June 2025 as the UK government's preferred bidder through Great British Energy Nuclear (GBE-N), following a competition from which Westinghouse withdrew in April 2025. In April 2026, RR SMR and GBE-N signed a contract to begin work at the decommissioned Wylfa site on the island of Anglesey in North Wales for an initial three units, with the site assessed as able to host up to eight, supported by up to 599 million pounds from the National Wealth Fund within a broader program allocation of about 2.6 billion pounds. In the Czech Republic, a contract with the ČEZ Group allows design work to begin at the Temelín site. Because no unit has yet been built, the design's Nth-of-a-kind cost and schedule remain to be demonstrated [\[38\]\[39\]\[40\]\[41\]\[42\]\[43\]](#).

5 Non-Light Water Reactor Small Modular Reactors

The regulatory framework for nuclear power is changing. The NRC has drafted new requirements to adopt a technology-inclusive regulatory framework. One of the most important distinctions is the safety analysis and consequence regulations that have departed radically from previous LWR designs that have decades of analytical and experimental validation. Whereas prior LWR fuel behavior, temperature limits, and postulated accidents had strong extrapolations to newer LWR designs, non-LWRs behave differently [\[140\]](#).

The NRC and an industry group coordinated by NEI created a new framework with frequency-consequence basis licensing to provide the flexibility to redefine what safe performance objectives are and how new plants are to be evaluated for safety. These changes began with the transitional DANU-ISG-2022-0X series of guides for applications under 10 CFR Parts 50 and 52 and are now codified in 10 CFR Part 53. This regulation builds on the lessons learned of the development of those requirements. These reactors nonetheless represent a new horizon of regulation with some uncertainty. Work is underway with new experimental validation and analysis of fuel performance and qualification, hardening of safety-related features and design basis accident sequences, and material performance for new reactor designs, hence their separate classification here [\[140\]\[141\]\[142\]](#).

This report provides high-level summaries of four non-light-water (NLWR) small modular reactor (SMR) designs currently at varying stages of development and regulatory engagement in the United States and internationally. These designs represent technologies in transition from legacy reactor licensing via the 10 CFR 50 two-step license, and the 10 CFR 52 one step license. The NRC provided transitional guidance for the first NLWR reactors to transition from light water reactor (LWR) licensing to the Licensing Modernization Program (LMP) which introduced a technology-neutral methodology for safety analysis and license applications. X-energy, Kairos Power, and TerraPower are using the guidance from the NRC [\[141\]](#).

5.1 Xe-100 | X-energy

Design Overview

The Xe-100 is an 80-MWe (200-MWth) pebble-bed high-temperature gas-cooled reactor (HTGR) developed by X-energy, designed for deployment in standardized four-unit plants producing a combined 320 MWe. The design uses TRISO (tri-structural isotropic) coated fuel particles consolidated into billiard-ball-sized graphite pebbles and is cooled by pressurized helium. The reactor operates at a core outlet temperature of approximately 750 degrees Celsius, which supports both grid-scale electricity generation and the delivery of high-temperature process heat for industrial applications such as hydrogen production and chemical manufacturing [44][45][154].

X-energy has not published a definitive total-site acreage figure for a four-unit Xe-100 plant, and a non-light-water design of this type does not map cleanly onto the footprint conventions used for the light-water SMRs in Section 4. Cooling water requirements have likewise not been formally characterized in public sources. As a gas-cooled, high-temperature design, the Xe-100 rejects heat at higher thermal efficiency than a comparable light-water reactor, which would be expected to reduce per-MWe cooling water demand, but site-specific water use will be established only through the environmental review supporting each deployment.

- + Pebble-bed HTGR using TRISO-coated fuel particles in graphite pebbles, cooled by pressurized helium [44][45]
- + 80 MWe per unit, deployed in standardized four-unit plants of about 320 MWe combined [44]
- + Core outlet temperature near 750 degrees Celsius, suitable for electricity and high-temperature industrial process heat [44][154]
- + Online pebble refueling and one of two designs selected under the DOE Advanced Reactor Demonstration Program [45][143]

Safety Methodology

The Xe-100 safety case rests on the inherent characteristics of TRISO fuel rather than on engineered active systems. Each TRISO particle encapsulates the fuel kernel within layers of carbon and silicon carbide that function as a miniature containment, retaining fission products at temperatures well above those reached during postulated accidents, and the design is intended to be physically incapable of the fuel-melt accident progressions that govern light-water reactor safety analysis [45].

Decay heat is removed passively by conduction, radiation, and natural convection to the surrounding structure, without active cooling or operator action. Because the accident phenomenology differs from that of light-water reactors, the licensing basis events and safety classifications are derived using the technology-inclusive methodology rather than from the light-water regulatory framework [45][140][141].

Design Maturity & Licensing Status

The Xe-100 is among the most regulatorily advanced non-light-water designs in the United States, with a docketed construction permit application and favorable early NRC findings, though no unit has yet been built [46].

Key Considerations:

- + U.S. certification record: applicant Long Mott Energy LLC, a Dow subsidiary, had its construction permit application for the Seadrift, Texas site docketed by the NRC in May 2025, followed by a draft safety evaluation and an Environmental Assessment with a Finding of No Significant Impact [46][47]

- + Construction status: a construction permit decision for Seadrift is possible between late 2026 and early 2027, and X-energy and Energy Northwest are in the pre-application phase for possible builds near Richland, WA [46][48]
- + Capital cost: not available; X-energy has not publicly disclosed a commercial plant capital cost; the design's development is supported by cost-shared DOE ARDP funding [143]
- + Other: X-energy has broken ground on the TRISO-X HALEU fuel fabrication facility in Oak Ridge, addressing a fuel supply chain that constrains several competing designs [144]

Deployment Feasibility and Timelines

The Seadrift project is the lead deployment and, as of this study, the only Xe-100 site with an active NRC application. X-energy has separately broken ground on the TRISO-X fuel fabrication facility in Oak Ridge, Tennessee, intended to produce the HALEU-based TRISO pebble fuel required for the Seadrift units and subsequent deployments, addressing a fuel supply chain that constrains several competing advanced designs. Commercial operation at Seadrift is targeted for the early 2030s. Additional deployment discussions with utilities and industrial customers have been reported, but Seadrift remains the only site with a docketed application, and those further arrangements should be regarded as commercial interest rather than committed projects, so a repeatable Nth-of-a-kind record is not yet established [46][47][144].

5.2 ARC-100 | ARC Clean Technology Inc.

Design Overview

The ARC-100 is a 100-MWe sodium-cooled fast reactor (SFR) developed by ARC Clean Technology Inc. The design derives directly from Argonne National Laboratory's Experimental Breeder Reactor-II (EBR-II), which operated for approximately 30 years, and it uses a metallic uranium alloy fuel with a long refueling interval reported at up to 20 years. The reactor operates at near-atmospheric pressure, which removes the high-pressure coolant boundary and associated systems required by pressurized water-cooled plants, and the sodium coolant permits high operating temperatures at low pressure while supporting natural-circulation decay heat removal [49][50].

As with the other non-light-water designs in this section, ARC Clean Technology has not published a total-site acreage figure or formal cooling water requirements suitable for direct comparison with the light-water SMRs in Section 4. These parameters would be established during a future licensing proceeding and remain open items at the current design stage.

- + Sodium-cooled fast reactor rated at 100 MWe, derived from Argonne's Experimental Breeder Reactor-II [145]
- + Metallic uranium alloy fuel with a long refueling interval reported at up to 20 years [145]
- + Near-atmospheric-pressure primary system, removing the high-pressure coolant boundary [145]
- + Sodium coolant enabling high operating temperatures and natural-circulation decay heat removal [145]

Safety Methodology

The ARC-100 safety approach relies on the inherent physical behavior of a pool-type, metallic-fueled sodium fast reactor. The low operating pressure means there is no large stored energy in the coolant to drive a loss-of-coolant accident. The design is intended to achieve passive shutdown and natural-circulation cooling through inherent reactivity feedback. During pre-application interactions the NRC has examined the proposed shutdown

architecture. The design's licensing basis and safety classifications would be developed through the technology-inclusive methodology rather than the light-water framework [140][141][145][146].

Design Maturity & Licensing Status

The ARC-100 is at a basic design stage with respect to U.S. regulatory maturity, but it carries meaningful licensing pedigree from its Canadian engagement [49][146].

Key Considerations:

- + U.S. certification record: a DOE ARDP awardee engaged in NRC pre-application under an assigned project number, but no U.S. construction permit application has been submitted [146][147]
- + Construction record: no ARC-100 has been built; it completed Phase 2 of the Canadian Nuclear Safety Commission Vendor Design Review in July 2025, a first for an advanced sodium-cooled fast reactor per ARC, with the CNSC finding no fundamental barriers to licensing [49]
- + Capital cost: not available; no commercial plant capital cost has been publicly disclosed
- + Other: the design draws on the roughly 30-year operating heritage of Argonne's EBR-II, but a U.S. deployment would trail the Canadian program absent a docketed NRC application [50]

Deployment Feasibility and Timelines

The primary proposed deployment site is the Point Lepreau nuclear power plant in New Brunswick, Canada, where NB Power submitted a license-to-prepare-site application to the Canadian Nuclear Safety Commission (CNSC), targeting commissioning around the end of the decade. ARC has also formed a partnership to evaluate additional deployment sites in Alberta, Canada. For a prospective U.S. deployment, the ARC-100 would need to translate its Canadian regulatory progress into NRC licensing. At this time, there is no docketed U.S. application for the ARC-100 [49][51][146].

5.3 KP-FHR (Hermes / Hermes 2) | Kairos Power

Design Overview

Kairos Power's fluoride salt-cooled high-temperature reactor (KP-FHR) uses solid TRISO pebble fuel in a low-pressure molten fluoride salt coolant (FLiBe, a mixture of lithium fluoride and beryllium fluoride). Unlike a molten salt reactor, the fuel is solid and only the coolant is a salt. The commercial KP-FHR is designed to produce approximately 75 MWe per unit. Rather than proceeding directly to a commercial plant, Kairos Power is advancing the technology through an iterative series of sub-scale demonstration reactors at its Oak Ridge, Tennessee campus, using each to generate operating data that informs the next [148].

- + Fluoride salt-cooled high-temperature reactor using TRISO pebble fuel in low-pressure FLiBe coolant [148]
- + Approximately 75 MWe per commercial unit, operating at low pressure and high temperature [148]
- + Iterative sub-scale demonstration strategy (Hermes, then Hermes 2) at Oak Ridge to generate operating and licensing data [52][53]
- + Combines the inherent fission-product retention of TRISO fuel with a high-heat-capacity liquid-salt coolant [148]

Safety Methodology

The KP-FHR combines TRISO fuel's fission-product retention with a low-pressure liquid-salt coolant that boils well above normal operating temperature. That combination reduces the stored-energy concern that drives light-water-reactor loss-of-coolant accidents. The salt's high heat capacity, together with natural circulation, supports passive decay heat removal. As a non-light-water reactor, the KP-FHR's licensing-basis events and safety classifications are developed using a technology-inclusive methodology [140][141][148].

Design Maturity & Licensing Status

Kairos Power holds the most significant non-light-water construction precedent in the United States, advancing an iterative series of demonstration reactors that build a documented operating and licensing record ahead of a commercial application [53][54].

Key Considerations:

- + U.S. certification record: the Hermes Low-Power Demonstration Reactor received an NRC construction permit in December 2023, the first non-light-water construction permit the NRC had issued in more than 50 years, and Hermes 2 holds its own NRC construction permit [52][53][54]
- + Construction record: Hermes began nuclear safety-related construction in May 2025 and Hermes 2 broke ground in April 2026, the most advanced non-light-water construction record in the United States [55]
- + Capital cost: not available for a commercial KP-FHR; the demonstration program is supported by up to \$303 million in DOE ARDP cost-share alongside private investment, which does not represent a commercial plant capital cost [57]
- + Other: an iterative demonstration strategy intended to de-risk cost, licensing, and construction ahead of a commercial application [148]

Deployment Feasibility and Timelines

Hermes construction completion is now expected in 2028, and the NRC extended the permitted completion date to April 2029, with Hermes 2 expected to follow toward the end of the decade. In August 2025, Kairos Power, Google, and the Tennessee Valley Authority announced a power purchase agreement under which Hermes 2 would supply approximately 50 MWe to the TVA grid in support of Google data centers. Reactor components are fabricated at Kairos Power's manufacturing campus in Albuquerque, New Mexico and shipped to Oak Ridge for assembly. The program is supported by up to \$303 million from the DOE ARDP alongside substantial private investment. Commercial KP-FHR deployment is anticipated from the early 2030s, with the Hermes series intended to de-risk cost, licensing, and construction for the commercial fleet [56][57][149][150].

5.4 Natrium | TerraPower, LLC

Design Overview

The Natrium reactor, developed by TerraPower in partnership with GE Vernova Hitachi Nuclear Energy, is a 345-MWe sodium-cooled fast reactor coupled to a molten salt thermal energy storage system that can temporarily raise plant output to 500 MWe to follow peak grid demand. The architecture deliberately separates the nuclear island from the energy island, which reduces the quantity of nuclear-grade material and allows the non-nuclear power and storage systems to be built to conventional industrial standards [58][143][155].

Unusually for a non-light-water design, the Natrium program has produced a public water-use estimate through its construction permit application for the Kemmerer site, which cites cooling water consumption on the order of 23.3 acre-feet per day drawn from local water rights. This figure is specific to the Kemmerer site and its balance-of-plant configuration and should not be generalized to other sites [151].

- + Sodium-cooled fast reactor rated at 345 MWe, able to reach 500 MWe peak via integrated thermal storage [58]
- + Molten salt thermal energy storage that decouples reactor output from grid delivery for load-following [58]
- + Deliberate separation of the nuclear island from the non-nuclear energy island, reducing nuclear-grade scope [58][155]
- + Uses HALEU metal fuel and is developed with GE Vernova Hitachi Nuclear Energy [58][143][156]

Safety Methodology

The Natrium safety case rests on the inherent behavior of a pool-type sodium fast reactor operating near atmospheric pressure, with passive reactivity feedback and natural-circulation decay heat removal intended to bring the reactor to a safe state without active intervention. The near-atmospheric primary system removes the stored coolant energy that drives light-water loss-of-coolant accidents [58][155].

The molten salt storage loop is non-nuclear and thermally decoupled from the reactor, isolating the energy-island systems from the nuclear safety case. As a non-light-water design, the Natrium's licensing basis events and safety classifications were developed through the technology-inclusive methodology, and the NRC's review of the construction permit application exercised that framework in a formal licensing proceeding, supporting a low accident frequency and limited offsite consequence [58][140][141][152][155].

Design Maturity & Licensing Status

Key Considerations:

- + U.S. certification record: in March 2026 the Kemmerer Power Station Unit 1 received an NRC construction permit, the NRC's first construction approval for any commercial reactor in nearly a decade and the first construction permit for a commercial non-light-water power reactor in the NRC's history; the design was also accepted into the UK Generic Design Assessment in early 2026, with the assessment beginning in June 2026 [58][62][152][153]
- + Construction record: TerraPower began construction on April 23, 2026 at Kemmerer, Wyoming, with Bechtel as the engineering, procurement, and construction contractor, the only commercial non-light-water reactor under construction in the United States identified in this review [59][60][61]
- + Capital cost: a total estimated project cost in excess of \$4 billion, supported by a DOE ARDP cooperative agreement providing up to \$2 billion in federal funding over seven years, matched by TerraPower [59][60][156]
- + Other: uses HALEU metal fuel, a supply-chain constraint that has prompted substantial domestic enrichment investment [58][156]

Deployment Feasibility and Timelines

Commercial operation at Kemmerer is targeted for approximately 2030 to 2031. The project is supported by a DOE ARDP cooperative agreement providing up to \$2 billion in federal funding over seven years, matched by TerraPower, for a total estimated project cost in excess of \$4 billion. The reactor uses high-assay low-enriched uranium (HALEU) metal fuel, a supply chain constraint that has been the subject of substantial domestic enrichment investment.

TerraPower’s Kemmerer project is the lead Natrium deployment. TerraPower has also signed a commercial agreement with Meta for up to eight additional Natrium plants and an MOU with Evergy to evaluate potential Kansas sites. Those agreements position Natrium as a fleet design, but they should be treated as commercial intent, not committed construction [58][63][64][156].

6 Microreactors and 10 CFR Part 57

Microreactors are the largest emerging class of new nuclear technologies and companies, but near-term deployment carries considerations and cautions. Microreactor technologies have been in consideration for remote, independent operation facilities where importing fuel supplies is either costly, a security concern, or both.

The key operating principles of a microreactor include some, but not necessarily all of the following:

- + Transportable
- + No Refueling
- + Remote Operation
- + Limited Footprint

Microreactors will most likely be licensed under the NRC’s proposed 10 CFR Part 57 rule, published May 1, 2026, with the public comment period closed June 15, 2026. The proposed rule does not define a “microreactor” by a specific power threshold. Instead, it uses risk-informed criteria based on potential consequences and reactor core inventories. As a result, 10 CFR Part 57 alone does not provide a clear dividing line between microreactors and larger advanced reactors [68].

For purposes of this report, microreactors are treated as reactors with thermal outputs below 50 MWth. That definition narrows the discussion but also highlights a practical limitation. At that scale, microreactors may be less attractive for end users seeking bulk power.

The size of the reactor presents a tradeoff between safety case, siting flexibility, and power produced per acre. Large passive light-water reactors, such as the AP1000 and ESBWR, can provide high power output on a relatively compact site. That makes them useful where load demand is large and acreage is constrained. The tradeoff is that their licensing and safety analyses require substantial front-end work. This does not mean those reactors are unsafe. It means their safety case depends on detailed analysis and regulatory acceptance of the resulting risk profile.

SMRs, including both light-water and non-light-water designs, represent the next step in deployment scale. They generally produce fewer MWh per acre than large light-water reactors. Their advantage is a larger safety margin and the potential for smaller emergency planning zones. In some cases, the plant hazard may be limited to the facility boundary, with no postulated public risk outside the site boundary. That can allow SMRs to be located closer to end users and may expand siting options where reduced power is acceptable.

Microreactors push that tradeoff further. Their smaller cores reduce the potential consequence footprint, including for onsite workers, in a manner similar to small research reactors operated by universities and research facilities. But the power-density penalty becomes more significant. It remains uncertain whether reactors below 50 MWth can support grid-scale deployment or whether they will remain limited to localized applications, such as spacecraft, islands, and remote outposts.

For that reason, this report excludes further discussion of microreactors. The technology should continue to be monitored as the Part 57 rulemaking develops and as vendors demonstrate viable deployment models.

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Comparative Summary Tables

This table compares the six large reactor designs reviewed in the Generation III+ Technology Review, drawing on the data established in this assessment and on the primary and independent sources listed below. The water-use figures should be read together with the discussion of cooling systems that follows the table.

Table A1. Large Reactor Design Comparison: Selected Technical Parameters

Full Name	Producer	Type	MWe	Design Status	Water Demand (Cooling, withdrawal basis), normal / max	Site Footprint (est.) ²³⁴	Construction Land Disturbance
Advanced Passive (AP1000)	Westinghouse	PWR (Gen III+)	~1,100	NRC certified (Rev 20 DCD filed 2026); operating (Vogtle 3 & 4; China)	~19,400 / 30,600 gpm ¹	~20-25 acres	Over 1,000 acres (2 units; ~670 acres cleared) ⁸
APR1400	KEPCO / KHNP	PWR	~1,400	NRC certified (2019); operating (Barakah; South Korea)	~23,000 gpm (est.)	~22-25 acres	Not available (no U.S. COLA)
European Pressurized Reactor (EPR)	Framatome (EDF)	PWR	~1,650	No active U.S. certification; operating (Taishan, OL3, Flamanville 3)	~27,500 gpm (est.)	>30 acres	No completed U.S. application
ABWR	GE Vernova Hitachi	BWR	~1,350	NRC certified (1997; renewed 2021); operating (Japan)	~11,600 / 24,500 gpm ⁵	~17-25 acres	~540 acres (2 units; 300 permanent + 240 temporary) ⁵
Enhanced CANDU 6 (EC6)	AECL / AtkinsRealis	PHWR (heavy water)	~700	Not NRC-certified; pre-licensing only; no EC6 unit built	~13,000 gpm (est.)	~17-25 acres	Not available (no U.S. COLA)
ESBWR	GE Vernova (GEH)	BWR	1,520	NRC certified (2014); not yet built	~15,400 / 22,300 gpm ⁷	~17-25 acres	~196 acres (Units 3 & 4 ESP site; 128 permanent + 68 temporary) ⁹

Water Use (Cooling): planning-level water demand per unit on a withdrawal basis, shown as normal / maximum. The AP1000, ABWR, and ESBWR values are the normal and maximum plant water-use rates reported in the combined license applications. The reported bases differ by site: the Vogtle values reflect river withdrawals for cooling-tower makeup, while the South Texas Project and North Anna values reflect reservoir and hybrid-tower configurations that report closer to consumptive rates. Evaporative consumption for a conventional wet-tower plant is roughly 600 to 800 gallons per MWh of generation, with the balance returned to the source as blowdown. Vogtle Units 3 and 4 report 38,825 gpm (normal) and 61,145 gpm (maximum) for the two units, about 19,400 and 30,600 gpm per unit, with natural-draft cooling towers on the Savannah River. South Texas Project Units 3 and 4 report 23,190 and 49,000 gpm for the two units, about 11,600 and 24,500 gpm per unit, served by the site Main Cooling Reservoir. North Anna Unit 3 reports 15,384 and 22,268 gpm for the single ESBWR unit, with hybrid wet-dry closed-cycle cooling on Lake Anna. The lower use at South Texas Project and North Anna reflects their cooling and site-water choices, not the reactor type. The APR1400, EPR, and Enhanced CANDU 6 have no comparable U.S. application data and are shown as single benchmark estimates using a recirculating-cooling planning benchmark of about 1,000 gallons per

MWh on a withdrawal basis, which the Vogtle normal value of about 1,040 gallons per MWh supports for conventional cooling towers. The Enhanced CANDU 6 is a heavy-water reactor with a higher cooling demand per MWe.

Site Footprint: approximate developed power-block area per unit (the operating plant: nuclear island plus turbine and support buildings), shown as an estimate. These acreages are not drawn from a single primary land-use record for each design; the AP1000 estimate is consistent with its design control document site characteristics, and the relative ranking, AP1000 most compact and EPR largest, follows independent comparisons[\[A1-3\]](#)[\[A1-4\]](#). The other values are planning estimates pending confirmation against each design's certified site plan. This power-block footprint is far smaller than the construction land disturbance shown in the next column or the total owner-controlled site; for context the four-unit Vogtle site covers more than 3,000 acres[\[A1-6\]](#) and the two-unit South Texas Project site about 12,200 acres.

Construction Land Disturbance: total land cleared and graded for the project during construction, including the power block and temporary laydown, parking, access roads, and batch plants. It is a project-level, site-specific quantity that depends heavily on whether an existing site is reused. The Vogtle 3 and 4 build disturbed more than 1,000 acres of largely new ground (about 670 acres cleared); South Texas Project 3 and 4, sited within an already developed station that reuses an existing cooling reservoir, projected about 300 acres of permanent and 240 acres of temporary disturbance. The North Anna early site permit EIS projected about 52 hectares (128 acres) of permanent and 27.5 hectares (68 acres) of temporary disturbance, roughly 196 acres in all for the two proposed Units 3 and 4, entirely within the already-developed, industrially-zoned existing North Anna station. The APR1400 and Enhanced CANDU 6 have no U.S. combined license application, and the U.S. EPR applications were suspended without completion, so no comparable figure is available for them.

Sources (Table A1)

1. NRC, [Final Supplemental Environmental Impact Statement for Vogtle Units 3 and 4 \(NUREG-1947\)](#), reviewing the COLA water-use analysis
2. Westinghouse AP1000 Design Control Document, Rev. 16, Tier 2, Chapter 2, Site Characteristics (NRC ADAMS ML071580872)
3. MIT Center for Advanced Nuclear Energy Systems, [Overnight Capital Cost of the Next AP1000 \(footprint and concrete-volume comparison\)](#)
4. P. Gaio (Westinghouse), [AP1000: The PWR Revisited, IAEA Proceedings P1500 \(compact station footprint\)](#)
5. [South Texas Project Units 3 and 4 Combined License Application, Environmental Report \(NRC ADAMS ML11252A900\)](#)
6. [Georgia Power, Plant Vogtle Units 3 and 4 FAQs \(total site area\)](#)
7. [North Anna Unit 3 Combined License Application, Environmental Report, Rev. 0 \(ESBWR\) \(NRC ADAMS ML073321238\)](#); Final SEIS NUREG-1917
8. [Vogtle Units 3 and 4 site-preparation record \(Morgan Corp.\)](#), reporting land disturbed during construction
9. U.S. NRC, [Environmental Impact Statement for an Early Site Permit at the North Anna ESP Site \(NUREG-1811\)](#), Section 4.1.1, p. 4-2 (construction land disturbance, proposed Units 3 and 4)

Cooling Systems and Water Use

A nuclear unit converts only about a third of its reactor thermal power into electricity and rejects the remaining two-thirds as waste heat, nearly all of it through the cooling system. The cooling system, rather than the reactor type, is therefore the main driver of how much water a plant uses, and it sets the split between two distinct quantities. Withdrawal is the volume drawn from a water body, most of which can be returned. Consumption is the portion permanently lost, mainly to evaporation. The two move in opposite directions across cooling technologies, so a plant with very high withdrawal can have low consumption, and the reverse[\[A2-1\]](#)[\[A2-4\]](#).

Four mechanisms dominate. Once-through (open-loop) cooling draws large volumes from a river, lake, or ocean, passes the water through the condenser once, and returns it a few degrees warmer; for nuclear units the median withdrawal is on the order of 44,000 gallons per MWh while consumption stays low, roughly 200 to 400 gallons per MWh[\[A2-1\]](#). Its advantages are high efficiency and low cost; its drawbacks are very large intakes that draw in and kill aquatic organisms, thermal discharge, and exposure to drought and heat. Closed-cycle recirculating cooling with wet cooling towers recycles the same water and rejects heat by evaporation, cutting

withdrawal by about an order of magnitude, to a nuclear median near 1,100 gallons per MWh, but raising consumption to roughly 600 to 800 gallons per MWh[A2-1]. It is the standard for new plants because it is far easier to permit, at the cost of a visible vapor plume, drift and blowdown, and a small efficiency penalty. Cooling ponds or reservoirs use a large engineered water body as the heat sink, with consumption broadly comparable to cooling towers but varying widely with pond size and climate[A2-1]. Dry, air-cooled cooling rejects heat to the air and uses almost no water, which suits arid sites, but it costs substantially more, lowers efficiency, and loses output on hot days[A2-1][A2-2]. Hybrid wet-dry systems combine the two, reducing consumption relative to all-wet cooling while limiting hot-day losses, at higher cost and complexity[A2-2].

The shift toward closed-cycle cooling is largely regulatory. Section 316(b) of the Clean Water Act requires that cooling-water intake structures reflect the best technology available for minimizing harm to aquatic life, which in practice steers new reactors toward cooling towers rather than once-through intakes[A2-3][A2-4]. This explains the pattern in Table A1: the operating and proposed U.S. units listed there use cooling towers or a cooling reservoir, so they show modest withdrawals but meaningful evaporative consumption. It also explains why two plants of similar size can differ, since South Texas Project draws on a large cooling reservoir and North Anna 3 was designed with closed-loop towers, each consuming less than a conventional natural-draft tower plant such as Vogtle 3 and 4.

Table A2. Cooling System Water-Use Signatures for Nuclear Units

Cooling System	Withdrawal (gal/MWh)	Consumption (gal/MWh)	Primary Advantage	Primary Disadvantage
Once-through (open-loop)	~25,000-60,000	~200-400	Highest efficiency; lowest cost; little consumption	Very large intakes harm aquatic life; thermal discharge; drought-vulnerable; precluded for most new plants
Recirculating (wet cooling tower)	~800-2,600	~600-800	About 95% less withdrawal; easier to permit; new-build standard	High evaporative consumption; vapor plume; drift and blowdown; small efficiency penalty
Cooling pond / reservoir	Intermediate (varies)	Comparable to towers	Buffers supply; can reuse an existing reservoir	Large land and water area; evaporative loss; site-specific
Dry (air-cooled condenser)	~0	~0	Minimal water; siting flexibility in arid areas	Higher capital cost; efficiency penalty; output falls on hot days
Hybrid (wet-dry)	Between wet and dry	Below all-wet (varies)	Balances water savings and hot-day performance	Higher cost and complexity

Withdrawal and consumption ranges are nuclear-specific operational factors compiled by NREL from the primary literature, rounded here; once-through and recirculating medians are about 44,000 and 1,100 gallons per MWh for withdrawal and about 270 and 670 gallons per MWh for consumption respectively[A2-1]. Dry cooling uses essentially no water and hybrid systems fall between wet and dry[A2-2]. Values vary with plant thermal efficiency, climate, and water type, so site figures can differ from these medians[A2-1][A2-4].

Sources (Table A2)

1. [NREL, J. Macknick et al., A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies \(NREL/TP-6A20-50900, 2011\)](#)
2. [U.S. Energy Information Administration, Today in Energy: Some U.S. electricity generating plants use dry cooling \(2018\)](#)
3. [U.S. Department of Energy, Cooling Water Issues and Opportunities at U.S. Nuclear Power Plants](#)
4. [IAEA Nuclear Energy Series, Efficient Water Management in Water Cooled Reactors \(IAEA-NP-T-2.6\)](#)

Light-Water Small Modular Reactor Designs

This table compares the five light-water small modular reactors reviewed in the SMR Technology Review. Its basis differs from the large-reactor table above: none of these designs has a built U.S. plant or a completed combined license environmental record, so the reliable axes are reactor type, module output, plant configuration, and regulatory standing, while the cooling-water and footprint values are design-stage estimates and are flagged as such.

Table A3. Light-Water Small Modular Reactor Comparison: Selected Technical Parameters

Design	Developer	Type	Module Output (MWe)	Plant Configurations	U.S. Regulatory Status & Lead Project	Cooling Water Demand (withdrawal basis, est.)	Site Footprint (full site, est.)
NuScale Power Module (US460)	NuScale Power, LLC	Integral PWR (natural circulation)	77 per module	4 / 6 / 12 modules = 308 / 462 / 924 MWe (US460, 462 MWe, reference)	NRC Standard Design Approval, May 2025 (NuScale's second SMR SDA, the first issued 2020); none built (UAMPS project cancelled 2023); TVA program and Romania RoPower advancing (pre-construction) ¹	Wet tower est. ~7,700 gpm (six-module plant). Air-cooled condenser option available (no surface-water withdrawal)	< 35 acres (~14 ha)
BWRX-300	GE Vernova Hitachi Nuclear Energy	BWR (natural circulation; ESBWR-derived)	~300	Single unit (multi-unit sites planned; Darlington = 4 units)	First U.S. light-water SMR construction permit application under NRC review (TVA Clinch River CRN-1; site permit held; staff recommended the permit June 2026, hearing August 2026); under construction at Darlington, Ontario (first of four; construction complete ~2029, in service ~2030) ²	~5,000 gpm (est.; 300 MWe) ⁵	Not published (full site)
AP300	Westinghouse Electric Company	PWR (one-loop; AP1000-derived)	~330	Single unit	NRC pre-application (regulatory engagement plan, white papers); design certification targeted ~2027 (developer); no U.S. site committed ³	~5,000 gpm (est.; 300 MWe) ⁵	Not published (full site)
SMR-300 (Pioneer)	Holtec International	PWR (compact loop)	300 net (340 gross)	Single or dual unit (Palisades = 2 units)	U.S. construction permit application (Part 1, with Limited Work Authorization) docketed Feb 2026;	~5,700 gpm (est.; 340 MWe, per unit) ⁵	~15 acres (single unit) / ~30 acres (dual unit)

Design	Developer	Type	Module Output (MWe)	Plant Configurations	U.S. Regulatory Status & Lead Project	Cooling Water Demand (withdrawal basis, est.)	Site Footprint (full site, est.)
					dual-unit Pioneer 1 & 2 at Palisades, Michigan; operation targeted ~2030-2031 (developer) ⁴		
Rolls-Royce SMR	Rolls-Royce SMR Ltd.	PWR (three-loop)	470	Single unit (fleet sites planned; Wylfa = 3+ units)	No U.S. NRC application; UK GDA Step 3 (completion targeted Dec 2026); UK preferred SMR technology, Wylfa site (3+ units), final investment decision ~2029 ⁵	~7,800 gpm (est.; 470 MWe) ⁶	~24.7 acres (~10 ha)

Module Output is the gross electrical output of one reactor module or unit, the increment in which these plants are deployed. Plant Configurations shows the module counts each developer offers and the resulting plant totals. NuScale is the only design here built from multiple small modules sharing one plant; the US460 plant of six 77-MWe modules (462 MWe) is its commercial reference. The others are single larger units, several planned for multi-unit sites such as four BWRX-300 units at Darlington and a dual SMR-300 plant at Palisades.

Cooling Water is an estimate only. No light-water SMR has a U.S. combined license or built-plant water record. For the four designs shown with a wet cooling tower, each value applies an industry recirculating-cooling benchmark of about 1,000 gallons per MWh on a withdrawal basis, drawn from independent literature, to the per-unit reference output. Evaporative consumption for a wet-tower plant is roughly 600 to 800 gallons per MWh, with the balance returned to the source as blowdown. Actual use would depend on the cooling system finally chosen and the site. The NuScale entry shows both the conventional wet-tower planning value, on the order of 7,700 gpm for the six-module US460 plant, and the air-cooled condenser option, which largely eliminates surface-water withdrawal.

Site Footprint values are developer-stated full-site areas, shown only where a reasonably specific full-site figure has been published. They are design-stage estimates whose basis varies between developers and should be confirmed against IAEA ARIS or a project environmental report. No full-site figure is published for AP300. For BWRX-300, the only public site figure is the 935-acre Clinch River early-site-permit site, which covers two or more units and overstates a single-unit footprint, so it is omitted here.

Sources (Table A3)

1. U.S. NRC, NuScale US460 Standard Design Approval (issued May 29, 2025), applicant project page, with program and construction-record status per main references [\[16\]](#)[\[17\]](#)[\[18\]](#)
2. World Nuclear News, TVA Clinch River BWRX-300 construction permit accepted for NRC review (2025); Ontario Power Generation building four BWRX-300 units at Darlington; NRC staff safety evaluation and August 2026 hearing per main reference [\[127\]](#)
3. U.S. NRC, Westinghouse AP300 pre-application activities (300 MWe one-loop PWR)
4. U.S. NRC, SMR-300 (Pioneer Units 1 and 2) Limited Work Authorization / construction permit application docketed February 13, 2026 (91 FR 9892, published February 27, 2026); operating-date target per main reference [\[34\]](#)
5. World Nuclear News, UK selects Wylfa for at least three Rolls-Royce SMRs; Rolls-Royce SMR (470 MWe three-loop PWR) in UK Generic Design Assessment
6. NREL (Macknick et al.), Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies (recirculating wet-tower consumptive-use benchmark)

Non-Light-Water Small Modular Reactor Designs

This table compares the four non-light-water small modular reactors reviewed above. Their basis differs again from the light-water tables: coolant, fuel, and neutron spectrum are the defining axes, and core outlet temperature, which enables high-temperature process heat, is reported where designs publish it. All four are advancing under the NRC technology-inclusive framework (the Licensing Modernization Program, the transitional DANU-ISG guidance, and 10 CFR Part 53) and hold DOE Advanced Reactor Demonstration Program awards. Two of the four, Natrium and the Kairos Hermes reactors, already hold construction permits and are building, a more advanced U.S. construction status than any light-water SMR, so the regulatory-status column is the most firmly grounded, while cooling and outlet-temperature values are design-stage where flagged. Site footprint and construction land disturbance are omitted because they are not published for these designs and do not map onto the light-water footprint conventions.

Table A4. Non-Light-Water Small Modular Reactor Comparison: Selected Technical Parameters

Design	Developer	Reactor Class & Coolant	Fuel, Enrichment & Spectrum	Output	Core Outlet Temp.	U.S. Regulatory Status & Lead Project	Cooling & Water
Xe-100	X-energy	Pebble-bed high-temperature gas reactor (HTGR); helium-cooled	TRISO pebble fuel; HALEU; thermal spectrum	80 MWe / 200 MWth per module; standardized four-module plant about 320 MWe (800 MWth)	~750 °C	Construction permit application docketed (Docket 50-614, May 2025); NRC environmental review complete (EA and FONSI, May 2026); final safety evaluation targeted November 2026 and a permit decision possible by late 2026; no unit built; lead project Long Mott Generating Station at Dow Seadrift, Texas; DOE ARDP demonstration award ¹	Minimal water; helium-cooled design with no cooling towers or water intake structures; NRC EA found water-resource impacts small ²
ARC-100	ARC Clean Technology	Sodium-cooled fast reactor (SFR); pool-type, near-atmospheric pressure	Metallic uranium-alloy fuel; HALEU; fast spectrum	100 MWe	~500 °C (est.) ³	No U.S. application; U.S. NRC pre-application only (DOE ARDP award); first sodium fast reactor to complete CNSC (Canada) Vendor Design Review Phase 2 (July 2025, no fundamental barriers to licensing); lead project NB Power Point Lepreau, New Brunswick (site-preparation	Not characterized in the U.S. (no U.S. environmental review; lead project in Canada)

Design	Developer	Reactor Class & Coolant	Fuel, Enrichment & Spectrum	Output	Core Outlet Temp.	U.S. Regulatory Status & Lead Project	Cooling & Water
						licence sought); commissioning targeted about 2029 ³	
KP-FHR (Hermes / Hermes 2)	Kairos Power	Fluoride salt-cooled high-temperature reactor (FHR); low-pressure FLiBe coolant	TRISO pebble fuel; HALEU; thermal spectrum	About 75 MWe per commercial unit; Hermes 1 = 35 MWth demonstration (no electricity); Hermes 2 = two 35 MWth units sharing one power system	~650 °C ⁸	Construction permits issued: Hermes (CPTR-6, December 2023, first non-light-water permit in over 50 years) and Hermes 2; both under construction at Oak Ridge, Tennessee (Hermes safety-related construction began May 2025; Hermes 2 broke ground April 2026); Hermes construction completion expected about 2028 (NRC permit deadline extended to April 2029); DOE ARDP award ⁴	Non-water-cooled; air-based heat rejection (first non-water-cooled reactor approved for U.S. construction in over 50 years); no water-side cooling figure by design ⁴
Sodium	TerraPower (with GE Vernova Hitachi)	Sodium-cooled fast reactor (SFR); pool-type, with molten-salt thermal energy storage	HALEU metal fuel; fast spectrum	345 MWe (840 MWth); up to 500 MWe peak via molten-salt storage	~500 °C (est.) ⁷	Construction permit issued March 2026 (Kemmerer Power Station Unit 1; first commercial non-light-water construction permit in the NRC's history); construction began April 2026 at Kemmerer, Wyoming; only commercial non-light-water reactor under construction in the U.S. identified in this review; accepted into UK GDA 2026; operation about 2030 to 2031; DOE ARDP award ⁵	Water-cooled; about 23.3 acre-feet per day consumptive cited in the construction permit application, drawn from local water rights ⁶

Spectrum distinguishes thermal reactors, in which neutrons are slowed by a moderator (graphite in the Xe-100 and KP-FHR), from fast reactors, which use unmoderated neutrons (the two sodium designs). None of the four is marketed as a breeder. The two sodium fast reactors are breeder-capable in principle, and ARC-100 derives from Argonne's EBR-II breeder reactor, but both are configured as converters running on HALEU rather than as net fissile breeders. All four use HALEU-class fuel, enriched above the 5 percent light-water limit and up to about 20 percent.

Output is gross electrical output in MWe, with thermal output in MWth and plant configuration shown where published. Xe-100 is deployed in standardized four-module plants. Natrium produces 345 MWe continuously and can reach about 500 MWe for several hours using its molten-salt thermal storage. Hermes 1 is a 35 MWth non-power demonstration reactor that generates no electricity and is therefore shown by its thermal rating; Hermes 2 is two such units sharing one power system; the commercial KP-FHR targets about 75 MWe per unit.

Core Outlet Temp. is the reactor coolant outlet temperature, a measure of high-temperature and process-heat capability. Xe-100 is shown at about 750 degrees Celsius from its design record, supporting hydrogen and industrial process heat. KP-FHR is shown at about 650 degrees Celsius (source 8). The two sodium fast reactors are shown at about 500 degrees Celsius as a class-typical value, since independent summaries give 500 to 600 degrees Celsius for sodium fast reactors (source 7) and neither developer publishes a single design figure in the reviewed sources; the design-specific Natrium value would appear in the Kemmerer core report. Both sodium values are flagged as estimates.

Among these designs, only Natrium uses conventional water-side heat rejection, which is why it is the one with a reviewed consumptive figure. Xe-100 is characterized as a minimal-water design with no cooling towers or water intake structures, a developer design characteristic corroborated by the NRC finding of small water-resource impacts rather than by a published consumption figure, and the Kairos FHR is air-cooled, the first non-water-cooled reactor approved for U.S. construction in over 50 years, so neither carries a comparable consumptive number. ARC-100 has no U.S. environmental review. The Natrium figure traces to the Kemmerer construction permit application and should be read against the final EIS (NUREG-2268).

Sources (Table A4)

1. [U.S. NRC, Long Mott Generating Station \(Xe-100\) construction permit applicant project page \(Docket 50-614\)](#)
2. [U.S. NRC / Federal Register, Long Mott Generating Station Environmental Assessment and Finding of No Significant Impact, May 2026 \(91 FR 29515\): impacts SMALL for each resource](#)
3. [World Nuclear News, ARC-100 completes Canadian Nuclear Safety Commission Vendor Design Review Phase 2 \(July 2025; no fundamental barriers to licensing\); NB Power Point Lepreau lead project; U.S. pre-application status per main reference \[146\]](#)
4. [World Nuclear News, NRC approves Hermes construction permit \(Dec 2023; first non-water-cooled reactor approved for U.S. construction in over 50 years\); Hermes 2 permits, construction milestones, and the 2029 completion-date extension per main references \[54\]\[55\]\[149\]\[150\]](#)
5. [U.S. DOE Office of Nuclear Energy, NRC issues construction permit for TerraPower Natrium advanced reactor, March 2026 \(first commercial non-light-water permit\); construction start and UK Generic Design Assessment entry per main references \[59\]\[60\]\[62\]\[153\]](#)
6. [U.S. NRC / Federal Register, Kemmerer Power Station Unit 1 Final Environmental Impact Statement \(NUREG-2268\), October 2025 \(840 MWth sodium fast reactor, up to 500 MWe net\)](#)
7. [National Academies of Sciences, Engineering, and Medicine, Laying the Foundation for New and Advanced Nuclear Reactors in the United States \(2023\), appendix: Summary of Advanced Reactor Design Concepts \(sodium fast reactor outlet temperatures 500 to 600 degrees Celsius\)](#)
8. [Kairos Power thermal-hydraulics research and development \(KP-FHR normal operating outlet temperatures up to 750 degrees Celsius\)](#)



Chapter 4:

Impact of Nuclear Power on the State of Arkansas

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Acronyms

Acronym	Definition
ABET	Accreditation Board for Engineering and Technology
ADAMS	Agencywide Documents Access and Management System
ADEQ	Arkansas Department of Environmental Quality
ADVANCE Act	Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy Act of 2024
ALARA	As Low As Reasonably Achievable
ANO	Arkansas Nuclear One
ANS	American Nuclear Society
ARDP	Advanced Reactor Demonstration Program
AREOR	Annual Radiological Environmental Operating Reports
AS	Associate of Science
ASME	American Society of Mechanical Engineers
ATU	Arkansas Tech University
BSEE	Bachelor of Science in Electrical Engineering
BSME	Bachelor of Science in Mechanical Engineering
CGID	commercial-grade item dedication
CNC	computer numerical control
CWIS	cooling water intake structure
DOE	U.S. Department of Energy
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statement
FONSI	Finding of “No Significant Impact”
GW	gigawatt
GWe	gigawatt electric

Acronym	Definition
ha	hectare
HALEU	high-assay low-enriched uranium
HTGR	high-temperature gas-cooled reactor
I&C	instrumentation and control
IAEA	International Atomic Energy Agency
IJA	Infrastructure Investment and Jobs Act
IMPLAN	Impact Analysis for Planning (input-output economic model)
INL	Idaho National Laboratory
IRA	Inflation Reduction Act
LEU	low-enriched uranium
LWR	light-water reactor
MOX	mixed oxide fuel
MT	metric ton
MW	megawatt
MWe	megawatt electric
MWth	megawatt thermal
NEI	Nuclear Energy Institute
NEIMA	Nuclear Energy Innovation and Modernization Act
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPP	nuclear power plants
NRC	U.S. Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
PSC	Public Service Commission
PWR	pressurized water reactor
REMP	Radiological Environmental Monitoring Program
RERR	Radioactive Effluent Release Reports
RPV	reactor pressure vessel
SAU Tech	Southern Arkansas University Tech
SEFOR	Southwest Experimental Fast Oxide Reactor

Acronym	Definition
SMR	small modular reactor
SouthArk	South Arkansas College
STEM	science, technology, engineering, and mathematics
TRISO	tri-structural isotropic (fuel)
TWh	terawatt-hour
U of A	University of Arkansas, Fayetteville
U.S.	United States
UALR	University of Arkansas at Little Rock
UF6	uranium hexafluoride
USGS	U.S. Geological Survey
WNN	World Nuclear News

PART I: SOCIOECONOMIC IMPACT ANALYSIS

Nuclear generation has shown substantial socioeconomic benefits. It employs tens of thousands in positions that pay well above prevailing wages [4]. Individual plants pay millions of dollars a year in state and local taxes and generate large local output through procurement and payroll [6][93]. Nuclear units run at the highest capacity factors of any generation source [1].

1 Employment Effects

Nuclear generation is a concentrated source of durable, high-skill employment. The U.S. nuclear energy sector directly employs more than 70,000 people in long-term positions, a figure that rises to roughly 250,000 when secondary employment is included [4].

Each operating plant employs 500 to 800 workers, and because plants can run for 80 years or more, a single facility can employ workers across multiple generations. Building a large reactor employs as many as 4,500 workers at peak construction per reactor [4]. NEI estimates that every 10 direct nuclear jobs support 18 additional jobs in the local community [5].

For advanced and small modular designs, NEI estimates that a small modular reactor could create about 237 permanent positions for the life of the plant [5].

2 Wages

Nuclear employment pays a premium over comparable work. Drawing on the Wages, Benefits, and Change report, NEI reports that in 2021 the median hourly wage in the nuclear generation industry ran 52 percent higher than the median hourly wage across all jobs in the electric power generation industry, and 116 percent higher than the national median hourly wage across all industries [4]. Section 6 applies regional multipliers to capture how that wage premium flows into local secondary employment.

3 State and Local Fiscal Contribution and Local Output

Nuclear plants are major taxpayers at both the state and the local level, benefiting the host county and its school districts. NEI's economic benefits analysis found that the average nuclear plant paid approximately \$16 million in state and local taxes annually, supporting local schools, roads, and other infrastructure, and approximately \$67 million in federal taxes annually [6][93]. The same analysis found that every dollar the average unit spent produced \$1.04 in the local community, \$1.18 in the state economy, and \$1.87 in the U.S. economy, and that a typical plant generated roughly \$470 million in local sales of goods and services and nearly \$40 million in total labor income [6]. The point holds even as the dollar figures age. Nuclear facilities concentrate procurement, payroll, and local tax payments over an operating life that regularly extends to 60 years and beyond [6][25][93].

4 Reliability as an Economic Input

This study treats reliability as an economic input: baseload availability cuts the cost and risk of meeting demand. Nuclear units operate more intensively than other generation types. The average annual

capacity factor for U.S. nuclear plants was 91 percent in 2025, higher than the capacity factor for any other type of power plant, and the fleet has sustained an average capacity factor near or above 90 percent for more than two decades [1][8]. As of mid-2025 the United States operated 94 commercial reactors [2], and nuclear supplied approximately 19 percent of U.S. electricity generation in 2024 [1][2][3]. The United States is the world's largest producer of nuclear electricity, accounting for about 30 percent of the global nuclear total in 2023 [2].

5 The Arkansas Energy Economy

The utilities sector, covering electricity generation and natural gas distribution, contributes about 2.5 percent of Arkansas gross domestic product, roughly \$4 to \$5 billion annually [9]. The state's electricity workforce runs on the order of 18,000 jobs across generation and delivery, part of a broader energy sector that the U.S. Department of Energy counts at more than 60,000 workers statewide when fuels, efficiency, and vehicles are included [9].

In 2024, Arkansas industrial electricity rates averaged about 6.6 cents per kilowatt-hour against a national average of about 8.1 cents, a margin the state must defend because neighboring states such as Tennessee, Louisiana, and Oklahoma offer comparable or lower rates [9]. The Arkansas Economic Development Commission ranks the state eighth in the nation for lowest industrial electricity rates and seventh for lowest residential rates [9]. Manufacturing produces about \$25 billion of Arkansas GDP, and in 2024 companies announced roughly \$1.5 billion in new capital investment in the state [9].

The household dimension reinforces the same point. Arkansas residential electricity rates averaged about 12.3 cents per kilowatt-hour in 2024, among the lower rates in the nation and below the national average of about 16.5 cents, which for a typical Arkansas household means a monthly electric bill near \$129 against a national average near \$142 [9]. All else equal, those lower bills leave more household income available for other needs. Energy-sector employment also pays well above the state average, with private utility-sector wages averaging about \$110,000 a year in 2024 against a statewide average across all industries of about \$58,000 [9].

6 Socioeconomic Contribution of Arkansas Nuclear One

Arkansas Nuclear One (ANO) provides roughly 1,820 megawatts of baseload capacity and meets approximately 56 percent of Entergy Arkansas customer demand [10]. Nuclear fuel costs are also more stable than fossil fuel costs [89], insulating the fuel component of the plant's cost of power, though not its total cost, from fossil-price swings. Arkansas Business reports ANO's economic value at roughly \$190 million a year to the state's gross domestic product [75].

Based on the employment, payroll, procurement, and tax contributions described below, this study regards ANO as the economic cornerstone of Pope County. The plant directly employs about 1,048 full-time workers [10] at an annual payroll of approximately \$84 million [75]. Entergy describes itself as one of the area's premiere employers [10], and dividing that payroll across the workforce puts payroll per full-time employee near \$80,000, well above the Pope County median household income of \$57,344 [10][75][76]. Refueling and maintenance outages, which U.S. plants typically schedule every 18 to 24 months [94], bring about 1,000 additional workers to the region [75]. Applying regional multipliers of 1.5 to

2.0 additional jobs per direct job, an assumption of this study, to roughly 1,050 direct positions implies a total employment footprint on the order of 2,600 to 3,100 jobs. Procurement adds another layer, at approximately \$12 million spent annually across more than 175 Arkansas companies, and the plant pays about \$15 million a year in state and local taxes [75].

These contributions also measure what is at risk if the plant were to close without replacement. In this study's assessment, the immediate loss of roughly 1,050 direct positions, concentrated in Russellville, would cascade through the supplier base, the outage-dependent service economy, the housing market, and a local tax base on which schools and emergency services depend. The same multiplier assumption puts total job losses, direct plus indirect and induced, on the order of 2,600 to 3,100 positions. After Vermont Yankee closed in Vernon, Vermont, the surrounding region suffered employment and wage losses that a 2019 regional assessment found not yet fully recovered, with mitigation planning aimed at losses estimated at \$500 million a year across the tri-state region [77]. The closure of Crystal River Unit 3 cost Citrus County, Florida, 585 jobs, and Duke Energy moved to pay \$19 million of the plant's \$35 million property-tax bill, which had accounted for 26 percent of the county's tax base [78]. Post-closure outcomes vary, and a study of nine U.S. nuclear host communities found mixed results rather than uniform decline, so the local effect of a closure is not the same everywhere [91]. This study nevertheless concludes that continued operation, including timely license extension, is likely necessary to preserve Pope County's existing base of employment and tax revenue.

PART II: ENVIRONMENTAL ANALYSIS

1 Surface Water Impacts

1.1 COOLING WATER ABSTRACTION AND DISCHARGE

ANO's two units draw cooling water from Lake Dardanelle, a reservoir on the Arkansas River formed by the Dardanelle Lock and Dam. The two units use different cooling systems. ADEQ, working with the EPA, regulates their abstraction and discharge under the National Pollutant Discharge Elimination System (NPDES) permit program to control thermal discharges, entrainment, impingement, and chemical effluents [20].

Unit 1 uses a once-through system, drawing cooling water from the lake at about 48.1 cubic meters per second (1,700 cubic feet per second), with circulating-water pumps rated near 195,550 gallons per minute each. Unit 2 uses a closed-cycle system served by a natural-draft cooling tower and withdraws far less, taking makeup water from Lake Dardanelle at an average of about 1,000 liters per second (roughly 16,000 gallons per minute, or 23 million gallons per day). The intake structures are subject to the EPA's Section 316(b) cooling water intake structure rules [21][20].

Heated water from Unit 1 returns to the lake through a discharge canal under the plant's NPDES permit, which sets thermal limits and monitoring requirements. Thermal-plume modeling and the required monitoring show that discharge temperatures have generally stayed consistent with pre-operational predictions and with Arkansas water quality standards, apart from brief exceedances of the end-of-pipe permit temperature limit in the summer of 2023 that ANO self-reported to ADEQ. Unit 2's cooling tower rejects most of its heat to the atmosphere and adds a negligible direct thermal load to the lake [20][21].

1.2 THERMAL, ENTRAINMENT, AND CHEMICAL IMPACTS

Environmental monitoring at ANO has run continuously since pre-operational baseline studies in the early 1970s, required under the plant's NRC Technical Specifications and documented in Final Environmental Statements. Successive NRC assessments, including the Generic Environmental Impact Statement supplements, rate most surface-water impacts as SMALL, with no significant long-term population-level effects on fisheries or endangered species [21].

The NUREG-1437 supplements rate entrainment and impingement at ANO as small, with no long-term, population-level effect on Lake Dardanelle fisheries, and Unit 2 has a smaller effect than Unit 1 because it withdraws far less water. Chemical effluents, such as chlorine from anti-fouling treatment and other chemical and biocide wastes combined with the cooling-water discharge, are controlled under the NPDES permit and confined to the immediate area of the discharge [21][20].

The NRC's license-renewal reviews concluded that ANO's cooling water abstraction and discharge have impacts on Lake Dardanelle that are minor, localized, and well controlled, with no significant, persistent, or cumulative adverse effects documented at the ecosystem level. EPA and ADEQ regulate the cooling-water intake and discharges through the NPDES program [20][21].

2 Groundwater Impacts

2.1 REGULATORY MONITORING AND FINDINGS

NRC regulations require radiological effluent and environmental monitoring at ANO under the Radiological Environmental Monitoring Program (REMP), and the plant also participates in the industry’s voluntary NEI 07-07 Groundwater Protection Initiative. These programs track potential radiological releases, including tritium into groundwater [13].

Routine groundwater monitoring at ANO’s REMP wells has shown tritium and other radionuclides at or below background, well below the EPA’s drinking water standard of 20,000 pCi/L, and off-site groundwater samples remain indistinguishable from natural background [13][55]. In 2024, ANO reported an abnormal release of about 440 gallons of radioactive water from the Unit 1 borated water storage tank, which contaminated soil and shallow groundwater in the immediate area of the tank. Entergy remediated the release by excavating the affected soil and adding groundwater monitoring. Off-site monitoring wells and off-site environmental samples showed no contamination attributable to the release, and the resulting off-site dose to the public was a negligible fraction of regulatory limits [13].

Groundwater around Lake Dardanelle is shallow and generally moves toward the lake [92]. No migration of contaminants beyond the site boundary has been detected at the ANO power plant [13].

2.2 KEY STUDIES AND INVESTIGATIONS

The key studies, investigations, and reports, drawing on NRC archives, annual radiological effluent releases, and environmental operating reports, are summarized below.

ANO’s reports cover operational data, license renewals, NRC inspections, and national reviews. Beyond NRC oversight, this review identified no independent academic or third-party studies (e.g., from EPA or USGS) specific to ANO groundwater impacts. The record shows decades of substantial regulatory compliance, with impacts generally rated small and the one notable exception being the remediated 2024 borated water storage tank release described above [13][14][15][16][17].

Annual Radioactive Effluent Release Reports (RERR) and Annual Radiological Environmental Operating Reports (AREOR) [13]

Report	Annual Radioactive Effluent Release Reports and Annual Radiological Environmental Operating Reports for Arkansas Nuclear One. The NRC posts the reports from 2005 forward on its plant-specific page.
Scope	Mandatory annual submissions under NRC Technical Specifications. Includes on-site/off-site groundwater sampling (at least quarterly), tritium analysis, and dose assessments. The online collection covers 2005–2025. This review drew on the reports through 2024.

Findings	+ Routine REMP groundwater wells: below the lower limit of detection (2023 Radiological Environmental Operating Report, ADAMS ML24134A272). Separately, onsite wells monitored under the voluntary groundwater-protection program detected tritium and gamma-emitting radionuclides associated with the localized 2024 borated water storage tank release. + Off-site wells (within 10-mile emergency planning zone): indistinguishable from background, with no detections of plant-specific isotopes such as cesium-137 or cobalt-60. + One reportable release occurred in 2024: about 440 gallons from the Unit 1 borated water storage tank contaminated nearby soil and shallow groundwater with tritium and gamma isotopes, remediated by soil excavation and a new monitoring well. Routine liquid effluents are otherwise directed to surface water via monitored paths. + Total-site dose to the public: about 0.27 millirem whole body and 1.23 millirem maximum organ in 2024 (2024 Radioactive Effluent Release Report, ADAMS ML25111A232), versus 40 CFR 190 limits of 25 millirem (whole body or any organ except thyroid) and 75 millirem (thyroid). Natural background is roughly 300 millirem/year.
Notable Years:	+ 2023–2024: routine REMP groundwater wells remained below detection. The 2024 report (ADAMS ML25134A078) also documents the Unit 1 borated water storage tank release and its soil and groundwater remediation.

NRC Groundwater Protection Questionnaire Response (2006) [13]

Report	ANO's response (July 31, 2006) to the NRC's groundwater protection questionnaire on tritium monitoring. ADAMS ML062200381.
Scope	Site-specific review of systems containing radioactive liquids and potential leak paths.
Findings	In its July 2006 response, ANO reported it did not then have a dedicated groundwater monitoring program and relied on surveillance of radioactive systems and operator walkdowns. The response disclosed a May 2006 spent-fuel-pool tilt-pit overflow that contaminated areas outside the radiological controlled area. ANO later implemented onsite groundwater-protection wells under the industry's voluntary initiative, reported in the annual reports above.

NRC License Renewal Environmental Reviews (2001, 2005) [14][15]

Report	Unit 1 Renewal: NUREG-1437, Supplement 3 (2001, ADAMS ML011170034). Unit 2 Renewal: NUREG-1437, Supplement 19 (2005, ADAMS ML051080538).
Scope	Comprehensive impact assessment under 10 CFR Part 51 (the NRC's NEPA regulation), including groundwater hydrology, radionuclide transport modeling, and the 20-year license-renewal term.
Findings	"SMALL" impact category for groundwater (no changes from Category 1 generic findings). No detectable radiological effects; thermal discharges affect surface water only. Cumulative impacts with other regional sources (e.g., coal plants) are negligible.

NRC Inspections and Event Notifications (1974–2025) [16]

Scope	Routine resident inspector reviews (annual) and event reports under 10 CFR 50.72/73.
Findings	This review identified no NRC event report of groundwater contamination at ANO. Inspection reports and event notifications for both units are public in NRC ADAMS (Docket Nos. 50-313 and 50-368).

3 Air Quality

3.1 REGULATORY MONITORING AND FINDINGS

ANO's main air emissions are trace radioactive gases, including krypton, xenon, iodine, and tritium, plus airborne particulates from routine operations and maintenance. Federal and state limits regulate these emissions, and the annual reports posted by the NRC show them well below limits [13].

Since 1974, ANO's operations have had a negligible negative impact on air quality and a positive indirect one by displacing fossil-fuel generation. Entergy's 2019 data show that ANO's generation avoided more than 6,000 short tons of SO₂, about 4,500 short tons of NO_x, and more than 8 million metric tons of CO₂ [10]. Using EPA's data, the avoided CO₂ was equivalent to taking between 1.5 and 2 million passenger vehicles off the road for one year [97].

In license renewal assessments, including those for extended operations through 2034 (Unit 1) [14] and 2038 (Unit 2) [15], the NRC has consistently found no significant environmental impacts from ANO's air emissions.

3.2 STUDIES AND INVESTIGATIONS

Several key studies have evaluated ANO's air emissions and environmental impacts since 1974, mainly through NRC environmental reviews and an industry benchmarking report. Together they address radiological and non-radiological air pathways and appear in the following table [14][15][56][57].

Summary of Air Pollution Investigations

Study/Investigation	Year(s)	Key Focus & Findings	Conducting Entity
NUREG-1437, Supplement 3: Generic EIS for License Renewal – ANO Unit 1	2001	Comprehensive review of operational impacts since 1974, including air emissions. Concluded radiological airborne effluents pose "small" impacts; no significant changes in air quality from plant operations.	NRC
NUREG-1437, Supplement 19: Generic EIS for License Renewal – ANO Unit 2	2005	Similar to 2001 supplement; analyzed emissions data through 2004. Found no adverse air quality effects; emissions controls (e.g., for diesel generators) adequate.	NRC
Environmental Assessment for Extended Power Uprate – ANO Unit 2	2002	Evaluated increased thermal output's effects on air emissions. No significant increases in noble gases, iodine, tritium, or particulates; off-site doses remained far below limits.	NRC
Benchmarking Air Emissions Report	Ongoing. Latest edition published in 2025, using 2024 data.	Benchmarks Entergy's fleet emissions against the 100 largest U.S. power producers. Entergy ranks among the lower-emitting large producers, reflecting its substantial nuclear generation.	ERM (formerly M.J. Bradley & Associates), with NRDC and Constellation

The studies draw on historical effluent data, modeling (e.g., for plume dispersion), and comparisons to federal standards under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 and the Clean Air Act. The NRC's license-renewal environmental reviews found air-quality impacts to be small, confirming that operations since 1974 have not degraded air quality [14][15].

3.3 ONGOING MONITORING

Air quality monitoring around ANO runs continuously, ensuring compliance and early detection of any issues. Key programs include:

- + **Radiological Environmental Monitoring Program (REMP):** The NRC mandates this program under 10 CFR 50, Appendix I. Entergy collects air-particulate and iodine samples at five on-site and off-site

locations, part of a broader environmental monitoring network that also tracks direct radiation, water, fish, and vegetation within and around the 10-mile radius. Quarterly and annual reports analyze tritium, gamma emitters, and dose pathways. Results consistently show levels indistinguishable from background, a small fraction of public exposure limits. The reports are available via NRC's ADAMS database [13][19].

- + **ADEQ Air Permit:** ANO holds a minor-source air permit (0090-AR-8), issued by the ADEQ Office of Air Quality, covering non-radioactive sources such as the emergency diesel generators. The permit sets opacity and operating limits and relies on inspector observation and recordkeeping rather than stack testing or continuous emission monitors, and a NAAQS evaluation is not required for a minor source under the Arkansas State Implementation Plan [58].
- + **State radiological monitoring:** the Arkansas Division of Emergency Management's Nuclear Planning and Response Program conducts continuous environmental monitoring and sampling around ANO and coordinates emergency planning with the four counties in the 10-mile emergency planning zone (Johnson, Logan, Pope, and Yell) [79]. The Arkansas Department of Health's Radiological Emergency Response Team responds to potential off-site releases from ANO [59].
- + **Entergy/NRC Effluent Reporting:** Annual Radioactive Effluent Release Reports (under 10 CFR 50.36a) document gaseous releases of fission and noble gases, with the resulting total off-site dose well below regulatory limits, at roughly 0.3 mrem per year against the 25 mrem annual limit [13][19].

4 Land, land-use, and soils impacts

4.1 HISTORICAL BACKGROUND

Arkansas Power & Light Company (now Entergy Arkansas) selected the site in August 1967, broke ground on Unit 1 in October 1968, and started Unit 2 in December 1968 [60].

The 1,100-acre site occupies a peninsula on the northeast shore of Lake Dardanelle, which supplies the plant's cooling water. This location has limited the plant's land and soil impacts, which peaked during construction and have stayed minimal during operations. Environmental assessments, including the NRC Final Environmental Statement (FES) from the 1970s and the Generic Environmental Impact Statements (GEIS) for license renewals (NUREG-1437 Supplements 3 and 19, issued in 2001 and 2005), find no significant ongoing adverse land and soil effects. Quantitative data from these sources show limited disturbance at the site since operations began [14][15][61].

4.2 LAND IMPACTS

Land impacts at ANO cover direct physical alteration, habitat loss, and visual changes. Water bounds the plant on three sides and Interstate 40 lies to the north, which limits expansion. Before construction, the area was a mix of forested and agricultural land typical of the Arkansas River Valley. NRC license-renewal assessments find limited disturbance at the site since operations began [14].

Construction Phase (1968–1980)

- + **Direct Land Clearing and Disturbance:** Construction converted part of the site from natural or agricultural use to industrial purposes, including reactor buildings, cooling infrastructure, and transmission lines. Active disturbance stayed localized, supporting the reactors, the Unit 2 hyperbolic cooling tower, emergency cooling ponds, and access roads [14].
- + **Habitat Loss:** The site is a mix of pine-hardwood forest and early-successional habitat, with wetlands making up about 1 percent of the site. NRC license-renewal assessments identified no federally listed plant species within the site boundary, and the site's peninsular geography limited wildlife displacement [14].
- + **Perspective:** The disturbed area is a small fraction of the 1,100-acre site, and the overall land-use conversion covers a minority of it. The rest of the site is landscaped or kept undeveloped [14].

Operational Phase (1980–Present)

- + **Ongoing Land Use:** The plant keeps a stable industrial footprint, with no further large-scale disturbance, and the NRC's license-renewal review rated continued land-use impacts SMALL [14]. Refueling outages at U.S. plants typically come every 18 to 24 months [94]. The NRC's generic finding for license renewal is that onsite land-use changes from continued operations stay SMALL and involve only land the licensee controls [95]. The renewed licenses extend operations to 2034 for Unit 1 and 2038 for Unit 2 [12].
- + **Visual and Aesthetic Impacts:** The 450-foot cooling tower is a prominent feature on the site, visible to the thousands of motorists who pass daily on Interstate 40 [11].
- + **Perspective:** During operation, the NRC's renewal review identified no major refurbishment or modifications needed for continued operation, and no further land disturbance beyond routine maintenance [14]. Nuclear generation also uses far less land per unit of output than the alternatives: a typical 1,000-megawatt nuclear plant needs a little more than one square mile, while solar photovoltaic plants require about 75 times more land and wind farms about 360 times more to produce the same electricity [74].

4.3 SOILS IMPACTS

The soil impacts and associated mitigation measures for construction and operation of the ANO power plant are summarized below.

Construction Phase

- + **Disturbance and Erosion:** Construction-era soil disturbance was limited, and Entergy has since initiated an onsite reforestation project [14].

Operational Phase

- + **Erosion and Stability:** Normal operations at ANO pose a low risk to soils. The one documented soil impact is the localized contamination from the 2024 borated water storage tank release, which Entergy remediated by excavation [13].

- + **Contamination:** Low-level radioactive effluents from the site produce off-site doses well below federal limits [13]. The main soil-contamination event on record is the localized 2024 release from the Unit 1 borated water storage tank, which Entergy remediated by excavating the affected soil [13].
- + **Perspective:** Soil disturbance at the site has been limited [14].

4.4 LAND-USE IMPACTS

The ANO power plant's land-use shift from rural and natural to industrial stayed localized, but transformed Pope County's economy across both the construction and operational phases, as described below [11].

Construction Phase

- + **Conversion and Zoning:** Construction converted part of the site from natural or agricultural use to industrial purposes [14], and building a large reactor employs several thousand workers at the peak of construction [4].
- + **Socio-economic shift:** The ANO project brought construction and operations employment to the Russellville area and added a major industry to the local economy, the largest economic development project in state history at the time [11].

Operational Phase

- + **Current land allocation:** Development covers a minority of the site, with the remainder landscaped or left undeveloped as a buffer for safety and ecology [14].
- + **Future considerations:** Decommissioning after the plants' licensed lives would proceed under NRC requirements and trust-funded financial assurance, with the site released for unrestricted use once residual radiation meets the NRC's criteria [62].
- + **Perspective:** The plant altered only a small share of Pope County's land while having a major and continuing effect on the area's economy [11].

An NBC News analysis of 2010 Census data counted 44,139 residents within 10 miles of ANO [18], and this review identified no notable land-use conflicts between the plant and surrounding communities.

5 Impacts on flora and fauna

5.1 BACKGROUND

The ANO power plant sits on the northeast shore of Lake Dardanelle, a 13,900-ha (34,300-acre) man-made reservoir on the Arkansas River, roughly 80 km (50 miles) long with a 505 km (315 miles) shoreline [63]. The reservoir dates to the mid-1960s, making it a little older than the ANO power plant. Because the reservoir and the plant are of similar age, this review cannot fully separate the ecological effects of impounding the Arkansas River from those of building and operating ANO.

Lake Dardanelle, though a young feature of the Arkansas landscape, hosts a wide range of flora and fauna that rely on its water and riparian zone for refuge, nutrition, and reproduction. The ANO power plant likewise depends on Lake Dardanelle for its safe and continued operation. Nature conservation and

power generation depend on the same aquatic resource, and in times of stress the two uses could compete for it, a tension this study flags as a planning consideration.

The lake ecosystem forms part of the Arkansas River Valley, with diverse habitats including riparian forests, wetlands, and open water that support a diverse fish community including largemouth bass, white bass, crappie, bream, and catfish [96][14], along with aquatic invertebrates, amphibians, reptiles, birds (both endemic species and winter visitors), and mammals. The surrounding forest lies within the oak-hickory biome, dominated by oaks and hickory [14].

Since the mid-1960s, ANO's primary ecological impacts have come from habitat clearance during construction, entrainment/impingement of aquatic organisms during cooling-water abstraction, warm cooling-water discharges, and minor radiation releases. The NRC regulates the plant's radiological and nuclear-safety impacts, while EPA and ADEQ regulate its cooling-water intake and discharge under the Clean Water Act [20][21].

Renewal environmental impact statements (EISs, NUREG-1437 Supplements 3 and 19), annual radioactive effluent reports, and related studies show small-to-moderate impacts, with no long-term declines in fauna or flora populations attributable to ANO [14][15].

The following sections describe how building and operating the ANO power plant have affected local fauna and flora, and the measures taken to monitor and report those impacts. They also outline the mitigation actions developed to keep those impacts minimized.

5.2 CONSTRUCTION PHASE (MID-1960S TO EARLY 1980S): INITIAL HABITAT DISRUPTION

Construction converted a mix of forested and agricultural land to industrial use for the plant site, access roads, and transmission lines [14]. The NRC's license-renewal reviews found no long-term, population-level effects on Lake Dardanelle's fisheries and rated the aquatic impact small [21].

5.3 OPERATIONAL PHASE (1974–PRESENT): AQUATIC IMPACTS

Thermal discharges

Unit 1's once-through cooling system discharges warmed water to the lake, forming a localized thermal plume. Unit 2's cooling tower rejects most of its heat to the atmosphere, so its blowdown adds little direct thermal load [21].

NRC modeling for the 2001 and 2005 license renewals found the combined plume from Units 1 and 2 produced only a small, localized temperature rise that met the applicable thermal limit at the edge of the mixing zone [21]. The plume's consequences for the lake's fauna and flora are described below:

- + **Faunal impacts:** The Arkansas Game and Fish Commission describes Lake Dardanelle as supporting a robust largemouth bass population along with bream, crappie, white bass, and catfish [96], and the NRC's license-renewal reviews found no long-term, population-level effects on the lake's fisheries [21].

- + **Floral impacts:** By the NRC’s criteria the thermal impact of the cooling-water discharge is small, affecting only a small fraction of lake-wide habitat [21].

Entrainment and Impingement

The cooling intakes screen the withdrawn water, so plankton, larvae, and juvenile fish can be entrained in the abstraction works or impinged on the mesh screens. Entrainment and impingement at ANO were monitored between 1977 and 1987 under the plant’s original NRC Technical Specifications, and the NRC’s license-renewal review assessed the results [21].

The intake structure has not changed since construction, and the NRC’s license-renewal review found no long-term, population-level effect on Lake Dardanelle’s fisheries [21]. The impact of ANO on the fauna of Lake Dardanelle is rated small [21].

Operational Phase: Terrestrial Impacts

The NRC’s license-renewal reviews rated terrestrial impacts at the site and along its transmission corridors small, with no significant effect on local wildlife populations [14][15][95]. The NRC found no significant impact to on-site vegetation over the operating period [21].

5.4 RADIATION EFFECTS (1974–2025)

ANO’s controlled releases of radioactive gases and liquids produce off-site doses well below natural background. Annual NRC effluent reports show no detectable bioaccumulation of plant-related radionuclides in Lake Dardanelle’s biota, and no radiation-induced effects on wildlife have been documented [13][55].

5.5 LONG-TERM TRENDS AND MITIGATION (1980S–2025)

Over decades of operation, the NRC’s license-renewal reviews rated ANO’s applicable ecological impacts small [14][15].

6 Nuclear Waste

6.1 SPENT NUCLEAR FUEL

Nuclear waste at ANO comprises high-level spent nuclear fuel (SNF) in used fuel assemblies and low-level waste from plant operation and maintenance. As of a 2021 estimate, about 1,725 MTU of spent fuel is stored at the site, on the order of 2 percent of the U.S. commercial total [22].

All spent fuel remains on-site. Recently discharged assemblies cool in a steel-lined, borated spent-fuel pool before transfer to dry-cask storage at an Independent Spent Fuel Storage Installation (ISFSI) licensed under 10 CFR Part 72. NEI estimated about 1,725 MTU of spent fuel stored at the site in 2021, and Entergy reported 102 dry-storage casks as of May 2023, with additional recently discharged fuel remaining in the spent-fuel pool [22].

6.2 LOW-LEVEL WASTE AND MANAGEMENT

10 CFR Part 61 classifies low-level waste (LLW) into Classes A, B, and C by radionuclide concentration and half-life [90]. ANO generates mainly compactible dry active waste along with resins, filters, and sludges, ships it to licensed off-site disposal facilities, and has reduced volumes over time through source reduction and compaction [13].

ANO manages its spent fuel on-site under NRC oversight. It holds about 2 percent of the roughly 90,000 MTU of commercial spent fuel stored nationally, which continues to accumulate on-site pending a federal disposal or recycling pathway [22].

7 Summary

Since the 1960s, building and operating ANO have had minimal impact on land, land use, and soils, affecting only a minority of the 1,100-acre site [14][15][61]. Construction caused most of the change, and operation has stayed stable, with no documented persistent or widespread degradation of land or soil [14][15]. Eventual decommissioning and site release will be governed by the NRC's decommissioning and license-termination requirements, including the radiological criteria in 10 CFR Part 20, Subpart E [62].

The NRC rated the plant's thermal, entrainment, and chemical effects on Lake Dardanelle SMALL in its license-renewal reviews, and EPA and ADEQ regulate the cooling-water intake and discharges through the NPDES program [21][20]. ANO holds its spent fuel on-site in pools and dry casks pending a federal disposal or recycling pathway, and Arkansas has shown interest in recycling used nuclear fuel through Act 1092 of 2021 and Act 259 of 2023 [64][65].

PART III: SUPPLY CHAIN ANALYSIS

1 Introduction

This part of the chapter examines the U.S. nuclear supply chain, the risks spread across it, and how Arkansas participates. Executive Order 14017, “America’s Supply Chains,” issued in February 2021, directed federal agencies to assess and strengthen supply chains in critical sectors [24]. In response, the U.S. Department of Energy (DOE) published the Nuclear Energy Supply Chain Deep Dive Assessment in February 2022, which supplies much of the analytical backbone here [23].

Nuclear energy supplies a large, reliable share of U.S. electricity. It accounted for about 19 percent of generation in 2024 and remains the country’s single largest source of carbon-free electricity [1][25]. By the Nuclear Energy Institute’s accounting, the sector directly employs more than 70,000 workers, a total that climbs to about 250,000 including secondary jobs, and contributes billions of dollars a year in labor income and tax revenue [4]. The DOE Strategic Vision organizes federal effort around four goals: sustaining the existing fleet, enabling advanced-reactor deployment, developing advanced fuel cycles, and maintaining U.S. leadership in nuclear technology [23].

2 U.S. Nuclear Fleet Overview

The United States operates the world’s largest commercial nuclear fleet. The Energy Information Administration (EIA) counts 96 operating reactors at 57 plants as of March 2026, with an average reactor age of about 44 years [1]. The DOE Deep Dive Assessment counted 93 operating reactors when it published in 2022 [23]. Most reactors received initial 40-year operating licenses, the large majority have been renewed to 60 years, and a growing number are pursuing or have received subsequent renewals to 80 years [26]. DOE reported, as of its July 2022 update, that 20 reactors, more than a fifth of the fleet, planned or intended to operate up to 80 years [25].

How long the fleet operates drives supply-chain demand: DOE’s 2024 Pathways to Commercial Liftoff analysis reported that 84 of the then-94 operating reactors hold licenses expiring before 2050, and 24 hold licenses expiring before 2035, so subsequent license renewals are essential to keep the fleet through mid-century [28]. A peer-reviewed analysis found that the first 20-year extension, from 40 to 60 years, yields roughly \$330 billion in avoided decarbonization costs on its own, with further savings from additional extensions and new build [27]. The fleet has also grown for the first time in decades. Contrary to descriptions of Plant Vogtle Units 3 and 4 as under construction, both AP1000 units are now complete, Unit 3 entering service in 2023 and Unit 4 in April 2024 [3].

3 Supply Chain Mapping

3.1 NUCLEAR FUEL CYCLE

U.S. dependence is most pronounced at the front end of the fuel cycle. The United States produces well under 1 percent of global uranium and relies on imports for about 99 percent, with Kazakhstan, Canada,

and Australia the leading suppliers [34][29]. Conversion of uranium oxide to uranium hexafluoride is a global bottleneck served by only a handful of large facilities worldwide [29][32].

URENCO, France's Orano, Russia's Rosatom, and China's CNNC dominate commercial enrichment. Russia holds roughly 44 percent of world enrichment capacity and supplied about 35 percent of U.S. enriched-uranium imports before the ban took effect [31]. The Prohibiting Russian Uranium Imports Act, signed in May 2024 and effective in August 2024, bars imports of Russian low-enriched uranium, subject to a temporary waiver mechanism [30]. High-assay low-enriched uranium (HALEU), which many advanced designs require, has no established U.S. commercial supply, and Russia's Tenex has been the sole large commercial source [23][29]. To build domestic capacity, Congress appropriated \$2.72 billion through the 2024 Consolidated Appropriations Act, and in December 2024 DOE named six companies, including American Centrifuge Operating (a Centrus subsidiary), General Matter, and Orano Federal Services, to compete for enrichment contracts, complementing a \$700 million HALEU Availability Program funded by the Inflation Reduction Act [32].

On fabrication, three domestic facilities currently make light-water-reactor fuel: GNF in Wilmington, North Carolina, Westinghouse in Columbia, South Carolina, and Framatome in Richland, Washington [23]. Advanced fuels are less mature: BWXT restarted its TRISO manufacturing facility in 2020, X-energy holds DOE funding to stand up commercial-scale TRISO fabrication, metallic fuel is associated with TerraPower, and molten-salt fuels remain pre-commercial [23]. At the back end, about 86,000 metric tons of commercial spent fuel sit on-site at roughly 75 reactor sites in 33 states, growing by about 2,000 metric tons a year, with no permanent repository. DOE terminated its Yucca Mountain licensing effort in 2010. The repository was never licensed or built, and the federal government has paid utilities billions of dollars for its failure to take title to the fuel [33].

3.2 PLANT EQUIPMENT AND COMPONENTS

The United States does not produce the largest forgings needed for gigawatt-scale reactor pressure vessels, a capacity concentrated in Japan and South Korea, and the gap is a recognized vulnerability for large light-water builds [23]. Small forgings and piping are within domestic capability, though many nuclear components require applicable nuclear-quality certifications, including ASME N-stamps for covered work [23]. Among bulk and specialty materials, the United States is import-reliant for several inputs, including nickel, at roughly 40 to 50 percent net import reliance, and chromium, while lithium-7, used in pressurized-water-reactor coolant chemistry, is enriched almost exclusively in China and Russia [34][23]. Advanced designs add further dependencies: the United States is 100 percent import-reliant for natural graphite, with China the dominant global supplier, and for yttrium, about 93 percent of which comes from China, and it also depends on helium, sodium, and molten-salt constituents [34][23].

3.3 REACTOR TECHNOLOGY SEGMENTS

Large light-water reactors such as the AP1000 draw on a global supply chain spanning South Korea, Japan, Italy, Switzerland, Brazil, and Canada [23]. Small modular reactors, rated below 300 megawatts electric, rest on a factory-fabrication model, but dedicated fabrication facilities do not yet exist. Microreactors, in the range of roughly 1 to 20 megawatts electric, are designed to be transportable and largely self-contained, and they likewise lack established fabrication capacity [23].

4 Supply Chain Risk Assessment

4.1 FINANCIAL VIABILITY

More than a dozen reactors have retired since 2012, driven by low wholesale electricity prices, competition from subsidized renewables, and aging equipment [23][1]. To slow premature closures, the Infrastructure Investment and Jobs Act of 2021 created a \$6 billion Civil Nuclear Credit Program for economically at-risk reactors [41]. Market conditions have since shifted toward retention and expansion: DOE's Liftoff analysis targets growing U.S. nuclear capacity from about 100 gigawatts in 2023 to roughly 300 gigawatts by 2050 [28].

4.2 URANIUM AND FUEL RISKS

Negligible domestic uranium production and deep import reliance form the central front-end risk [31][34], and for HALEU specifically, DOE's assessment found enrichment capability only in Russia and China [23]. DOE analysis indicates that domestic conversion capacity would need to expand from about 10,400 metric tons per year toward 70,000 to 95,000 metric tons per year to support 300 gigawatts of capacity [32].

4.3 CRITICAL MINERALS

U.S. Geological Survey data show graphite and yttrium each at 100 percent net import reliance, with China the dominant supplier [34]. Other high-reliance inputs include niobium and indium, each at 100 percent, along with chromium at 77 percent, lithium at more than 50 percent, and nickel at 48 percent [34].

4.4 WORKFORCE

Direct nuclear employment runs more than 70,000 [4] and carries an aging profile, with a significant share of the workforce likely to retire over the next decade [44]. A 2026 industry assessment identifies a critical shortage of nuclear-qualified welders, machinists, inspectors, and nondestructive-examination specialists, compounded by competition from other industries and a federal push toward 300 gigawatts of capacity by 2050 [38]. Demand runs large: each 1,000 megawatts electric of new capacity built generates roughly 200,000 job-years of employment [39].

4.5 CERTIFICATIONS AND QUALITY

Many nuclear-grade components require specialized certifications such as the ASME N-stamp, and the limited pool of certified vendors constrains how quickly the supply base can scale [23]. Counterfeit and fraudulent parts are a recognized quality risk, and licensees use commercial-grade item dedication and reverse-engineering to manage component obsolescence while meeting nuclear quality requirements [23][80].

4.6 HEAVY MANUFACTURING GAP

No domestic facility can currently produce the largest reactor pressure vessels. The very heavy forging capacity in operation today sits in Japan, China, South Korea, France, and Russia, with Japan Steel Works the largest and best-known supplier and South Korea's Doosan a major one [23][81].

4.7 CYBERSECURITY AND CLIMATE RESILIENCE

Grid disruptions have become more frequent, and the February 2021 Texas grid crisis is a frequently cited example of climate and reliability stress on the broader power system [23]. Cyber risk spans plant protection and control systems as well as supply-chain exploits, with resources to address it including the Idaho National Laboratory's Cybercore Integration Center and the Electric Power Research Institute's technical assessment methodology [23].

4.8 NATIONAL SECURITY

Civil nuclear capability supports energy security, the defense industrial base, and U.S. influence in international nuclear governance [23]. The principal geopolitical risks include past reliance on Russian fuel services, now restricted by statute, which includes a provision barring circumvention through substitute supply, along with heavy reliance on a small set of uranium-importing partners, among them Canada, Australia, and Kazakhstan [23][30][31].

5 Global Competitiveness

U.S. vendors, principally Westinghouse, Combustion Engineering, and General Electric, led the first global wave of reactor exports from the 1960s through the 1980s but ceded ground in later decades [23]. China has roughly doubled its nuclear capacity over the past decade and now holds the world's largest reactor construction pipeline, while progressively localizing its domestic supply chain and pursuing reactor exports [37][82][83], and in December 2023 its HTR-PM, a Generation IV design, entered commercial operation as the world's first modular high-temperature gas-cooled reactor plant [35]. Russia's Rosatom exports reactors under state-backed financing to countries including Turkey, Bangladesh, Egypt, and Hungary [84], and deployed the floating small modular plant Akademik Lomonosov, grid-connected in December 2019 [36]. U.S. strengths include the NRC's standing as a gold-standard regulator, a deep national research base, and civil-nuclear cooperation agreements under Section 123 of the Atomic Energy Act covering dozens of partner countries, while persistent weaknesses include cost and schedule overruns on recent builds and long development timelines [23].

6 U.S. Opportunities and Challenges

6.1 NEAR-TERM PRIORITIES

The DOE Deep Dive identifies two near-term priorities: establishing domestic HALEU supply and demonstrating advanced-reactor designs under the Advanced Reactor Demonstration Program, with X-energy and TerraPower among the awardees [23]. Both have advanced since the assessment: DOE moved to fund domestic enrichment in 2024 [32], and in March 2026 the NRC issued a construction permit for

TerraPower's Sodium reactor, the first construction permit for a commercial advanced, non-light-water reactor in more than 40 years [7].

6.2 LONG-TERM OPPORTUNITIES

The source literature identifies several longer-term opportunities: continued light-water-reactor operation through subsequent license renewals, construction of small modular reactors and microreactors, repowering of retiring coal sites (roughly 100 gigawatts of coal capacity is projected to retire by 2030), nuclear heat for industrial processes, hydrogen, ammonia, and synthetic fuels, government procurement for federal facilities, military installations, and remote communities, and expanded U.S. nuclear exports [23][28].

7 Economics of the Nuclear Supply Chain

McKinsey estimates that building out the nuclear fuel supply chain to support roughly 300 gigawatts of incremental domestic capacity would require on the order of \$105 to \$170 billion of investment across mining and milling, conversion, enrichment, and fabrication, with reprocessing estimated to add roughly \$20 billion to \$45 billion more [85]. The conversion segment shows the scale: domestic capacity would need to expand by a factor of roughly seven to nine to serve that level of deployment [32]. The United States runs a once-through fuel cycle, and DOE's assessment notes that closed cycles could recover more energy and reduce long-term waste but are not economically viable under current market conditions [23]. The same analyses indicate that overnight capital costs would need to fall by roughly 30 percent, toward about \$5,000 per kilowatt, for nuclear to reach a 40 percent share of U.S. electricity by 2050 [23].

8 Arkansas Nuclear Supply Chain Participants

8.1 DIRECT NUCLEAR OPERATIONS

Entergy Arkansas operates ANO, whose two pressurized-water reactors entered commercial service in 1974 and 1980 and together meet roughly 56 percent of the energy demand of Entergy Arkansas's roughly 730,000 customers [10]. The station employs about 1,048 full-time workers, and Entergy describes itself as one of the area's premiere employers [10]. It reports community contributions that include annual grants and United Way support [10].

8.2 NUCLEAR PRODUCTS AND RADIATION SHIELDING

El Dorado Metals, based in El Dorado, supplies radiation shielding and related industrial products to the nuclear, healthcare, mining, and specialty-chemical sectors [54].

8.3 PRECISION MANUFACTURING AND ENGINEERING

In this study's assessment, several Arkansas manufacturers hold capabilities relevant to nuclear-adjacent work without being dedicated nuclear suppliers. Taber Extrusions in Russellville serves defense, aerospace, and industrial markets and has announced the largest direct extrusion press in North America [66]. Maynard, Inc., of Fayetteville makes fabricated and machined components and assemblies,

NADCAP accredited and AS9100D certified [67]. Airtech Supply of Hot Springs is a build-to-print contract manufacturer for defense and commercial aerospace [68], and Russellville Steel Company in Russellville fabricates structural and miscellaneous steel [69].

8.4 ENGINEERING AND CONSTRUCTION SERVICES

Precision Surveillance Corporation, which announced a Russellville manufacturing facility in 2012, has supplied post-tensioning services to the nuclear industry since 1986 and provides design and engineering, heavy-lift and rigging design, fabrication, and construction services [70]. Lintec Corporation provides engineered lining and corrosion-protection solutions for fossil and nuclear power plants [71].

8.5 WORKFORCE AND EDUCATION PIPELINE

Arkansas Tech University in Russellville provides engineering and technical education that feeds the regional nuclear workforce. ANO's site leadership credits ATU with about 30 percent of the plant's degree-holding staff [42][45].

8.6 KEY OBSERVATIONS

In this study's mapping, ANO anchors the state's nuclear-related industrial activity: El Dorado Metals supplies radiation shielding to the nuclear industry [54], Precision Surveillance provides nuclear-industry construction services [70], Lintec serves fossil and nuclear plants [71], and aerospace- and defense-grade manufacturers in Russellville, Fayetteville, and Hot Springs hold capabilities adjacent to nuclear work [66][67][68][69]. The supplier survey conducted for this study identified no in-state firms holding ASME N-stamp certified fabrication capability or nuclear-grade material supply. The federal government is pursuing a consent-based siting process for consolidated interim storage of used fuel [86], and Arkansas has separately authorized study of interim storage and recycling of spent fuel through Act 1092 of 2021 and Act 259 of 2023 [64][65]. The state's rail network and Arkansas River barge access via the McClellan-Kerr Arkansas River Navigation System support transport of heavy and bulk materials [87][88].

9 Policy Recommendations

The DOE Deep Dive Assessment and related analyses identify measures to strengthen domestic supply-chain resilience. They are options drawn from the source literature, not recommendations of this analysis. They include supporting suppliers in acquiring and maintaining nuclear-grade certifications such as the ASME N-stamp, using federal offtake and anchor demand to support new conversion and enrichment capacity, maintaining diverse foreign uranium supply from producers such as Canada and Australia, enforcing the Russian uranium ban, including its anti-circumvention provisions, using structured offtake agreements and tax incentives to support domestic production, investing in next-generation technologies such as laser enrichment and advanced fuel forms, developing a regulatory framework for reprocessing and a closed-fuel-cycle strategy, and building a workforce pipeline that runs from students through master tradespeople and engineers [23][30][31][38][85].

10 Conclusion

The U.S. nuclear supply chain faces real but addressable vulnerabilities across fuel, materials, heavy manufacturing, workforce, and geopolitics [23]. The verified record shows the most acute dependencies lie in front-end fuel services, namely conversion, enrichment, and especially HALEU, and in critical minerals such as graphite and yttrium, where China and Russia hold dominant positions [31][34]. The source literature associates closing these gaps with targeted policy action, public and private investment, and international collaboration [23]. Arkansas participates in this supply chain primarily through Arkansas Nuclear One [10] and the firms described in Section 8 [54][66][67][68][69][70][71], and in September 2025 the legislature’s Joint Energy Committee voted to approve a contract for a feasibility study of expanded nuclear deployment [40].

PART IV: WORKFORCE ANALYSIS

1 Introduction

New nuclear generating capacity in Arkansas will depend on a skilled, stable workforce, and a nuclear project demands more of the labor market, in scale and character, than other generation.

For new nuclear builds, construction employment is large and temporary, and operating employment is smaller, specialized, and durable [43]. Construction demands skilled trades, including welders, pipefitters, electricians, ironworkers, and heavy-equipment operators, along with engineering, project-management, and quality-assurance personnel.

Operation requires licensed reactor operators, health physicists, instrumentation and control technicians, mechanical and electrical maintenance personnel, and engineers across several disciplines.

This part of the impact analysis examines the workforce that new reactor construction and operation in Arkansas will require, the institutions that supply that workforce, and the gaps the state will need to address. The analysis moves from national workforce projections to the education and training pipeline Arkansas has built over five decades of nuclear operations at Arkansas Nuclear One. Arkansas holds a mature foundation for nuclear workforce development, anchored by the relationship between Arkansas Tech University and Arkansas Nuclear One, and the state can extend that foundation through coordinated investment across its universities, regional colleges, and technical institutions.

2 Workforce Requirements for New Nuclear Construction and Operation

2.1 NATIONAL WORKFORCE CONTEXT

The national nuclear workforce holds roughly seventy thousand direct jobs and faces two structural pressures that bear directly on Arkansas. The first is demographic. A large share of the existing workforce is approaching retirement, so the industry must replace experienced personnel even as it expands. The second is the scale of labor new construction demands. A joint NEA-IAEA assessment puts a single new gigawatt-scale reactor at roughly two hundred thousand labor-years of direct, indirect, and induced employment over its full life cycle, from construction through five decades of operation, decommissioning, and waste management, and the broader expansion of nuclear capacity will require hundreds of thousands of additional skilled tradespeople, including a substantial number of certified welders [4][38][43][44].

Small modular reactors and advanced reactors change the composition of this demand without eliminating it. Factory fabrication moves part of the manufacturing labor from the construction site to a centralized facility [23]. The operational workforce stays specialized: NEI's advanced-nuclear analysis still counts about 237 permanent positions for a small modular plant [5]. For Arkansas, workforce planning

must address both the near-term construction demand of any new build and the long-term operational demand that will continue for the licensed life of the plant [5][23].

2.2 OCCUPATIONAL CATEGORIES

This study maps the workforce a nuclear project requires into four broad groups and the training segment each draws on. The state's baccalaureate and graduate engineering programs supply the engineering and technical professional roles, including nuclear, mechanical, electrical, and civil engineers. Licensed operations and health physics roles draw on a mix of associate-level technical education, employer training, and federal licensing. Technical and community colleges, apprenticeship programs, and the organized trades supply the skilled craft and trades roles that dominate the construction phase. Support and administrative roles draw broadly from the regional labor market. The following sections describe the Arkansas institutions that serve each category, beginning with the one most directly connected to the state's nuclear operations.

3 The Arkansas Education and Training Pipeline

3.1 ARKANSAS TECH UNIVERSITY

Arkansas Tech University sits in Russellville, the same city as Arkansas Nuclear One, and has one of the state's closest documented relationships with the existing nuclear workforce. The university and the plant have kept a working relationship that produces qualified personnel. Plant management reports that roughly thirty percent of Arkansas Nuclear One staff who hold college degrees earned them at Arkansas Tech, and that the university has supplied engineers and management-team members throughout the organization [42].

Arkansas Tech University

B.S., Mechanical Engineering

- Nuclear concentration

B.S., Electrical Engineering

B.S., Computer Engineering

2-yr programs:

A.S., Nuclear Technology [45][72]

The university's academic offerings align closely with what a nuclear operator needs. Through its Department of Engineering and Computing Sciences in the College of STEM, Arkansas Tech offers Bachelor of Science programs in Mechanical Engineering and Electrical Engineering, both accredited by the Engineering Accreditation Commission of ABET. It is one of only a small number of publicly funded Arkansas institutions to hold ABET accreditation in both disciplines. The mechanical engineering program lets students concentrate in nuclear systems, among other areas, during their junior and senior years. The department also offers Computer Engineering and computing-sciences programs that supply engineering-adjacent talent [45][72].

The university's Associate of Science in Nuclear Technology, a two-year program, prepares students for technician-level careers in the nuclear field and is directly relevant to nuclear operations. ATU describes the program as giving students "the knowledge base and training necessary to work in one of the many areas in the nuclear field" [45]. Accredited engineering degrees, a nuclear technology associate program, and a long-standing relationship with the plant operator together give Arkansas Tech a central role in the state's nuclear workforce development [42][45].

For any new reactor built in Arkansas, and especially a project sited in the Arkansas River Valley, Arkansas Tech University is the most immediate and capable source of operational engineering and technician talent. Strengthening the university's nuclear capabilities would be a direct, cost-effective investment in the state's nuclear future.

3.2 UNIVERSITY OF ARKANSAS, FAYETTEVILLE

The University of Arkansas in Fayetteville's College of Engineering, organized in 1913 [46], offers undergraduate programs across eight areas, from chemical and civil to industrial and mechanical engineering [73], along with graduate programs including the M.S. and Ph.D. in Microelectronics-Photonics [46], though it has no nuclear engineering major.

The University of Arkansas contributes to nuclear workforce development in two main ways. First, it supplies degreed engineers across disciplines from chemical and civil to electrical and mechanical [73], and these graduates supply the broad engineering base a nuclear project relies on. Second, its graduate programs and research infrastructure provide advanced technical capacity in materials and related fields [46], capacity this study regards as relevant to licensing analysis and design review. The university is also a destination for cooperative dual-degree arrangements: Ouachita Baptist students can complete engineering degrees there, as at Louisiana Tech and Missouri University of Science and Technology [49].

University of Arkansas, Fayetteville

Undergraduate degrees:

- Mechanical engineering,
- Electrical engineering,
- Civil engineering,
- Chemical engineering, and
- Industrial engineering

Graduate degrees:

- M.S. and Ph.D. programs,
- including Microelectronics-Photonics [46][73]

3.3 OTHER PUBLIC UNIVERSITIES

Two more public universities run engineering colleges that add to the state's engineering workforce. Arkansas State University, in Jonesboro, operates a College of Engineering and Computer Science with ABET-accredited civil, electrical, and mechanical engineering programs, and its leadership reports strong internship and job placement for its graduates [47]. The University of Arkansas at Little Rock operates a School of Engineering and Engineering Technology that provides a multidisciplinary engineering education in the state's largest metropolitan area [48]. Neither institution focuses specifically on nuclear technology, but both supply mechanical and electrical engineering graduates that a nuclear project can recruit and train through employer programs. Their locations in Jonesboro and Little Rock spread this capacity across the eastern and central parts of the state [47][48].

3.4 PRIVATE LIBERAL ARTS COLLEGES

Two private liberal arts institutions add to the engineering pipeline through cooperative dual-degree arrangements rather than standalone engineering colleges. Ouachita Baptist University, in Arkadelphia, offers a program in Engineering Physics along with cooperative dual-degree, or three-two, arrangements under which a student completes preparatory study at Ouachita and then earns an engineering degree from a partner institution, including the University of Arkansas, Louisiana Tech University, and the

Missouri University of Science and Technology. Students on this pathway typically graduate with degrees from both institutions in about five years, and some continue into graduate engineering study [49].

Hendrix College, in Conway, runs a comparable dual-degree engineering program with engineering schools at Columbia University and Washington University in St. Louis. Students take three years at Hendrix, apply to the engineering school during their third year, and finish with a B.A. from Hendrix and a B.S. in engineering from the partner institution [50].

3.5 TECHNICAL AND COMMUNITY COLLEGE TRAINING IN SOUTH ARKANSAS

The state's technical and community colleges principally serve the skilled trades and technician categories that dominate a nuclear project's construction phase. In south Arkansas, Southern Arkansas University Tech, in East Camden within the Highland Industrial Park, provides relevant vocational and technical training. Founded to supply a technically trained workforce for the industrial park, the institution delivers, through its Workforce Training Department, credit and non-credit programs in skilled trades, including a manufacturing apprenticeship program developed with a major defense contractor that has graduated classes of computer-numerical-control machinists. The institution also houses statewide training academies in fire and environmental disciplines, and it has positioned itself as a regional workforce training hub for south Arkansas [51][52].

South Arkansas College, in El Dorado in Union County, complements this capacity. Formed from the merger of a vocational-technical school and a university branch campus, the college offers technical certificate and associate-degree programs, skilled-trades courses, and non-credit continuing education for the regional workforce. El Dorado is also home to a manufacturer of radiation shielding products that participates in the nuclear supply chain [54]. The training capacity at these institutions is general rather than nuclear-specific. In this study's assessment, employer and apprenticeship programs could add nuclear-specific certification on top of that base. A new reactor project would benefit from formal partnerships with these institutions to expand their training capacity in the relevant trades [53][54].

4 Assessment and Recommendations

Arkansas enters any consideration of new nuclear construction with a workforce foundation stronger than its size alone would suggest. The state has run a commercial nuclear plant for more than five decades, and that operation has produced a settled body of operational knowledge, an established employer relationship with a regional university, and a population of experienced personnel who can train successors. The Arkansas Tech University connection to Arkansas Nuclear One is the central asset in this foundation, and any state workforce strategy should treat it as such.

Several gaps nonetheless need attention. The state's nuclear-specific educational capacity sits in a single associate program and a single nuclear-systems concentration, both at Arkansas Tech, and it would need to expand to support a new build. The supply of certified welders and other nuclear-grade tradespeople is constrained nationally and would require deliberate investment in the technical and community college system to meet a construction surge. The operational workforce, though well served by existing institutions, depends on retaining experienced personnel and transferring their knowledge in an orderly way to new entrants.

The following measures would strengthen the state's nuclear workforce readiness:

1. Expand the Arkansas Tech University nuclear technology program and nuclear-systems engineering concentration.
2. Support nuclear-grade welding and craft certification at SAU Tech, South Arkansas College, and similar institutions.
3. Direct and support the State's public universities as they research advanced reactor licensing, materials, and systems.

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Chapter 5:

Finance

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1 Introduction

This chapter addresses the financing of new nuclear reactor builds in Arkansas. Murphy Energy & Infrastructure Consulting, LLC prepared an independent financing study for the State. The study examines the conditions a nuclear power project needs to be developed, constructed, and operated. The study also surveys the financing structures and sources of capital now available to support one. The study appears in full as an appendix to this report. This chapter summarizes the study and consolidates its recommendations.

1.1 Executive Summary of the Financing Study

1.1.1 Passive investors are unlikely to fund development or construction.

Financing a nuclear power plant remains difficult despite growing domestic enthusiasm for nuclear energy. Utilities historically financed plants in the United States through regulated, rate-based structures, but deregulation has made those structures unavailable in many markets. The study evaluates the financing structures and sources now in use domestically and assesses their applicability to Arkansas.

The study finds that private, non-utility, passive investors are unlikely to invest in a nuclear plant during development and construction, despite recent growth in investor interest in nuclear technology. Investors who back the technology speculatively or strategically will not necessarily fund an individual project. The study therefore concentrates on sourcing the funds needed to bring a project into operation. Once the plant operates, delivery risk disappears and additional capital can be mobilized.

1.1.2 Financing must match the project phase.

The study matches financing sources to the three phases of the project lifecycle.

- For the Development Phase, from now through issuance of a construction permit, the study recommends sponsor equity, a State bridge loan, and possible export credit agency financing for early engineering. Where those fall short, other private capital can come through an equity raise or separate bridge financing secured by existing generation. Long-lead items are the biggest concern of this phase given the size of the expenditure. Prepayments under a power purchase agreement may help meet needs before the investment decision.
- For the Construction Phase, from the construction permit through the commercial operations date, the study recommends sponsor equity, Department of Energy debt, export credit agency debt where available, and State cost overrun protection.
- For the Operation Phase, from the commercial operations date forward, the study stresses a long-term, guaranteed, investment-grade offtake structure. That structure makes the project more investable, supports any bond issuance, and enables refinancing of the initial debt and equity, which the study recommends.

1.1.3 Tax and regulatory support improves commercial viability.

To improve commercial viability, the study recommends federal and state tax incentives, removal of unfavorable market dispatch restrictions, and pass-through of construction-work-in-progress costs to

ratepayers. For small modular reactors, a fleet approach adds financing benefits: electricity revenue from completed units can support additional units, and refinanced capital can be redeployed to build them.

1.1.4 Green bonds, bundled offtake, and industrial hubs add options.

The study describes additional options that depend on the sponsor group and the State's ambitions: nuclear green bonds, bundling existing nuclear generation into power purchase agreements for high-intensity energy users with the revenue directed to new reactors, and an energy and industrial hub that co-locates electricity end users and opens the possibility of equity participation by those users.

1.1.5 The state support needed is limited but essential.

The study limits the State's financing role and targets State support where unique risks exist or where only government can act. It still finds State support necessary for any nuclear project to succeed, in three areas: project development before construction, completion of the facility, and the long-term economic structures that sustain viability. The study favors a public-private partnership in which government support is targeted and limited in time, the resulting stability incentivizes the corporate parties, and additional private capital is mobilized at later stages.

1.1.6 Arkansas can learn from other states.

The study summarizes actions other states have taken to develop or expand their nuclear programs and to attract nuclear-specific investment. It closes with recommended next steps for the State, consolidated below.

1.2 Recommendations from the Financing Study

The financing study makes the following recommendations for the State, consolidated here. The full reasoning and supporting detail for each recommendation appear in the appendix.

1.2.1 Recommended Considerations and Approaches

1. **Adopt a public-private partnership.** Structure the project so the State and the sponsor align their differing objectives, with government taking the long-term view of energy security, decarbonization, workforce, and economic growth, and the sponsor focused on a viable, profitable project.
2. **Demonstrate value for money.** Use economic impact analysis to show benefits that do not appear in the project's financial model, and weigh value for money as part of a broader industrial and economic growth strategy, including energy and industrial hubs.
3. **Match financing to project phase.** Different financing is available in the Development, Construction, and Operation phases. Pursue the most efficient and economic sources in each phase, sequentially or in parallel.
4. **Fund the Development Phase through a combination of sources.** Cover site work, engineering, regulatory activities, and long-lead items with sponsor equity, a State bridge loan, and possible export credit agency financing for early engineering. If needed, add other private capital, bridge financing secured by existing generation, or power purchase agreement prepayments.

5. **Target a realistic ratio for base equity.** Treat a 60/40 debt-to-equity ratio as the target and 70/30 as a stretch goal. Lenders will set the ratio based on sponsor, technology, and offtake risk. If the sponsor cannot fund the equity, plan to reduce or stagger the unit count or have the State cover the shortfall.
6. **Source debt through export and development finance.** Pursue Department of Energy and export credit agency debt for long-term, low-cost financing. A State guarantee would backstop the export credit agency portion.
7. **Provide a cost overrun facility.** Lenders will require completion support or cost overrun protection given the industry's history of budget and schedule overruns. The State should provide that protection.
8. **Secure a robust offtake structure.** A long-term, creditworthy offtake agreement, priced to encourage investment, is essential to financing the project and supporting later refinancing.
9. **Pursue favorable tax treatment and regulatory action.** Qualify the project for federal and state tax incentives, including investment and production tax credits and potentially zero emissions credits and capacity payments. Expand state incentives such as income, sales, and use tax credits and existing economic development programs. Pursue accelerated depreciation. Remove unfavorable market dispatch restrictions before the plant operates. Authorize construction-work-in-progress cost recovery from ratepayers where needed, applied before commercial operation so rate increases come in smaller steps.
10. **Plan for refinancing.** Structure the project to refinance after the commercial operations date, lowering the overall cost of capital and removing any State financial commitment, such as cost overrun protection.
11. **Apply fleet considerations for small modular reactors.** Where a fleet is deployed, keep electricity revenue from completed units in the project to support additional units, and refinance unit by unit to redeploy capital to subsequent units.
12. **Consider the bundled offtake approach.** An existing operator bundles generation from its current nuclear plants and sells it to high-intensity users under power purchase agreements, giving offtakers price stability and the operator a premium.
13. **Consider nuclear green bonds.** An existing utility could issue the bonds before commercial operation, or the project or holding company could issue them after.
14. **Consider energy and industrial hubs.** Place the project at the center of a hub that co-locates heavy industry or data centers under a behind-the-meter or co-location structure.
15. **Manage first-of-a-kind risk.** The risk decreases as the interval between the reference plant and the Arkansas units increases.
16. **Recognize the necessity of government support.** Corporate sponsors will develop, own, and operate the project, but State support is necessary for the project to succeed.

1.2.2 Suggested Next Steps

The study recommends the State consider the following steps to advance its nuclear program and to prepare the budget discussions, policies, and relationships a successful project will require.

- Inventory existing state and local grant, loan, tax, and other incentive programs a nuclear project could use, and treat that inventory as the baseline for revising or expanding them.
- Identify peer states with pragmatic, attainable nuclear programs, regulatory language, and incentives, and engage their counterparts to learn from their experience. States compete to attract vendors and developers.
- Engage utilities and developers operating in Arkansas to gauge their interest, financial capacity, and timeline for a nuclear power project.
- Open a working dialogue with corporate and energy-intensive industry leaders in Arkansas and the region to signal the State's intent to power new industry with nuclear energy, and begin aligning potential projects and hubs with those companies' planned growth.
- Survey creditworthy leaders in targeted industries and work with State partners to address gaps in incentives, with the goal of commitments to build additional energy-intensive demand centers.
- Build an initial financing and development plan for circulation in the legislature, with potential sites, estimated cost, timeline, and a shortlist of potential participants, to develop support for any State grant, loan, or tax incentive used to attract developers.
- Explore federal and foreign export credit agency funding for part of a project's needs, including outreach to signal the State's interest, particularly where a project pairs small modular reactors with industrial end use such as data centers or metals manufacturing.
- Consider joining the Advanced Nuclear First Mover Initiative as a participating or observer state to build expertise and access knowledge-sharing.
- Consider participating in the U.S. Conference of Mayors, which has recognized the workforce and economic benefits of nuclear energy, or a similar gathering, to learn from peers and build relationships for regional hub partnerships.
- Conduct an economic impact assessment for Arkansas that considers different reactor options and fleet sizes.
- Develop an initial project risk register and project development plan, and update both as work progresses.
- Build preliminary financial models for a small modular reactor project and a large reactor project, and update them as work progresses.
- Develop a reactor technology selection process that addresses the choice between large and small reactors, includes technology readiness level assessments for first-of-a-kind designs, and weighs credibility and deliverability.
- Develop a legal and regulatory plan that establishes the path for any adjustments the chosen approaches require.

1.3 Appendix

The complete financing study by Murphy Energy & Infrastructure Consulting, LLC, titled Financing Considerations for Nuclear Power Plant Deployments in the State of Arkansas, appears in full as an appendix to this report. The appendix contains the study's full analysis: financing readiness, development and financing risks, small modular reactor considerations, state energy regulation, financing options grouped by the level of state resources required, case studies, a summary table of state actions, opportunities for time and cost savings, project economics, and concluding thoughts. It also contains the study's supporting appendices: a glossary, a summary of state actions, a sample project risk register, a sample project development plan outline, and a sample project information memorandum outline.

2 References

[1] Murphy Energy & Infrastructure Consulting, LLC, "Financing Considerations for Nuclear Power Plant Deployments in the State of Arkansas" (2026)

FINAL REPORT¹

FINANCING CONSIDERATIONS FOR NUCLEAR POWER PLANT DEPLOYMENTS IN THE STATE OF ARKANSAS

Prepared by Murphy Energy & Infrastructure Consulting, LLC (Lindsay Hall, Paul Murphy)

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Executive Summary

In preparing this Report on Financing Considerations for Nuclear Power Plant Deployments in the State of Arkansas (the “**Report**”), the author was mindful of the following issues:

- The State of Arkansas has experience with nuclear energy.
- The State of Arkansas is considering deployment of first-of-a-kind (“**FOAK**”) technology, in conjunction with expansion of its existing traditional nuclear reactors.
- Like many state governments, the State of Arkansas is resource-constrained, and options for developing nuclear power capacity through non-governmental, external capital means will likely have greater probability of implementation success and will likely receive greater local political support.
- The Trump Administration is supportive of nuclear energy, and while programs and funding sources are shifting, there are significant opportunities to seek out federal partnerships in state-level energy infrastructure expansions. Historically, nuclear energy has maintained bipartisan support, going back to the latter stages of the Obama Administration, thus spanning multiple political cycles – which bodes well for future planning.
- Artificial intelligence (“**AI**”) and technology firms are moving quickly to secure low-carbon, baseload power. There are unprecedented levels of financial capital moving towards building and supporting digital infrastructure. Such parties are also under increasing pressure to locate data centers, given considerations about impacts on electricity pricing, noise, and water demands.
- Multiple states are taking steps to promote nuclear power plant (“**NPP**”) development, creating a competitive environment for attracting reactor vendors and nuclear developers.

The main findings of the Report are as follows:

1. Despite growing domestic enthusiasm for nuclear power, developing and financing an NPP remains challenging. This Report discusses why these challenges are present.
2. Historically, NPPs have been financed through regulated, rate-based structures. For example, the entire reactor fleet in the U.S. was financed under such an approach at the time each reactor was built. However, as certain energy markets have been deregulated domestically, such approaches often are not available for NPP development. This Report examines a number of financing structures and sources of financing that are being utilized domestically at present, evaluating them for potential applicability to the State of Arkansas’ program.
3. The Report also discusses why private, non-utility, “passive” investors are unlikely to invest in a NPP during development and construction phase, despite recent increasing investor interest in nuclear technology investment (i.e., the difference between speculative or strategic technology investment and project-focused investments). Noting this current state of investment relative to the sector, this Report looks at ways to source the necessary funds to get a project into operation, after which point other sources of capital can be mobilized as the delivery risk has then been eliminated.
4. Mindful of (a) the electricity market structure currently prevalent in the State of Arkansas and (b) other nuclear development efforts (noted above), this Report suggests several options for the State of Arkansas and for potential future project sponsors to consider.

-
5. For the Development Phase (from today through the State’s issuance of a construction license), this Report recommends a combination of funding sources:
 - a. Equity from the project Sponsor;
 - b. A State-provided bridge loan;
 - c. Possible Export Credit Agency (“**ECA**”)-sourced early-stage financing for engineering activities (to the extent available and dependent upon the delivery consortium and supply chain sourcing of the reactor technology);
 - d. If the aforementioned sources are not available or are insufficient, a developer could explore other types of private capital through an equity raise, or a developer or a State or regional utility could pursue separate bridge financing, with such bridge financing possibly secured by electricity sales from their existing generation fleet;²
 - e. With long-lead items being the biggest concern during the Development Phase, due to the magnitude of the expenditure, particular attention will be needed on this issue (with the aforementioned bridge financing (debt or equity) as a possible solution); and
 - f. Potential funding from Power Purchase Agreement (“**PPA**”) prepayments to support pre- Final Investment Decision (“**FID**”) needs, particularly concerning long-lead items.
 6. For the Construction Phase (from the regulator’s issuance of a construction license through the Commercial Operations Date (“**COD**”), this Report recommends:
 - a. Equity from the project Sponsor;
 - b. A Department of Energy-provided debt facility;
 - c. An ECA-provided debt facility (dependent upon the delivery consortium and supply chain sourcing of the reactor technology); and
 - d. A State-provided cost overrun facility.
 7. During the Operation Phase (from COD to cessation of operations), this Report stresses the importance of a long-term, guaranteed, investment-grade counterparty offtake structure. Such an approach will enhance the “investability” of the project and will increase the attractiveness of any bond issuance and support refinancing of the initial debt and equity, which is strongly recommended.
 8. To enhance the commercial viability of the project, the Report recommends:
 - a. Qualification for federal and state tax incentives;
 - b. Removal of any unfavorable market dispatch restrictions; and
 - c. Approval of pass-through construction-work-in-progress to ratepayers.
 9. Should small module reactors (“**SMRs**”) be pursued, this Report notes several financing benefits relative to “fleet” financing, regarding both use of revenues from electricity generation and from refinanced units to support additional units in the fleet.
 10. The Report discusses several additional options for consideration, depending on the composition of the Sponsor group and ambitions of the State of Arkansas:

² See the portfolio approach taken in the Exeltium example in [Section 4.7.8](#) below.

-
- a. Nuclear green bonds;
 - b. Bundling of existing nuclear generation into PPAs for high-end energy users, with such revenue then designated to support new reactors; and
 - c. The possibility of creating an energy and industrial hub (i.e., co-located end users of the electricity generated from the NPP), which opens up the possibility of equity participation from such end users.
 11. Overall, the Report looks at ways to limit the financing roles of the State of Arkansas in a project, targeting its support in areas where either (a) unique risks exist; and/or (b) only government can execute the activity. However, an overarching theme in the discussion in this Report is the role of government in the overall success of a project. While government support can take a variety of forms, the support of the State of Arkansas will be absolutely necessary for a NPP project to succeed.
 12. The Report notes three key areas for government support at the state level:
 - a. Project development activities prior to the Construction Phase;
 - b. Completion of the facility; and
 - c. Long-term economic structures for the project's economic viability.
 13. This Report includes a summary of actions other state governments have taken to develop or expand their nuclear programs and to attract additional nuclear-specific investment. The State of Arkansas could take lessons learned from peer jurisdictions, and/or seek to model additional programs based on successful programs deployed elsewhere. While Arkansas' economy might not match larger states like California and Texas, nuclear energy can support an overall economic , energy, and industrial strategy that can promote overall development at the state level, which, in turn, can help to justify State actions to promote nuclear energy.
 14. This Report concludes with a recommended series of "Next Steps" for the State of Arkansas to consider.

1.0 Introduction

Like any large-scale infrastructure, financing and bringing an NPP online is a long-term, complex process. It involves the successful coordination among diverse stakeholders, development and deployment of both financial and political capital, and sufficient flexibility to adapt to inevitable unforeseen circumstances.

This Report begins with an introductory background on bankability and project diligence to serve as a reference guide for those seeking to build their familiarity on nuclear industry-specific considerations, while later providing a menu of potential options that the State could choose to pursue as it moves forward in expanding its existing nuclear infrastructure. It is important for State actors to continue to develop their understanding of existing programs, funding sources, key actors, and potential structures and stay up-to-date on market trends, regulatory developments, and other dynamics in the industry.

2.0 Purpose & Scope

This Report is designed to support the State of Arkansas in its development and deployment of additional nuclear capacity in the state. The Report examines multiple aspects of financing NPPs and addresses a number of

challenges and considerations related to the financing of NPPs. It is important to establish this foundation before examining financing techniques, as these challenges and considerations help provide a lens through which to view the various options that are currently in use, with the goal of finding a set of options that would be most practical for the State of Arkansas.

In developing this Report, significant consideration has been given to the current market status of SMRs, specifically, that SMRs are still in FOAK status. FOAK technologies bring additional considerations for financing at the project level, recognizing that financiers are generally reluctant to take FOAK risks. Further to the views of financiers, the Report contains a discussion of the expectations of the financial community and the process for obtaining financing for an NPP.

Ultimately, the Report is not structured to settle on one specific financing approach. Instead, it is organized in a manner that provides the State with a number of options for further consideration, research, and deliberation. While it is a menu of choices, the Report establishes certain core principles that would underpin the overall financing strategy, including an examination of how financing sources change over the course of the project's three key phases: Development, Construction, and Operation.

3.0 *Assumptions & Limitations*

3.1 ASSUMPTIONS

The following assumptions have been made in producing the Report:

- The State of Arkansas is considering support for both SMRs and traditional, large-scale reactors.
- Financial Close on the main debt facility would occur concurrently with issuance of the construction license(s) for the project(s).
- Any proposed tax structures would be structured and implemented in accordance with State budgetary and regulatory requirements.
- The State wishes to prioritize the nuclear industry consistent with, or more so than, other energy sources, such that it will not have dispatch strategies that incentivize use of other electricity sources before the use of nuclear power.
- To the extent that outside equity sources are available, ownership structures will be designed (in compliance with State and Federal laws and regulations, now existing or to be amended / developed) to enable such external investment.
- Multiple units are being considered.

3.2 LIMITATIONS

The following limitations have been made in producing the Report:

-
- Only U.S. reactor technologies have been considered in this document as examples, though the principles may be applied to other technologies, with appropriate adjustments on the sourcing of certain components for eligibility to receive export credit finance.
 - Any consideration of laws and regulations of the State of Arkansas is beyond the scope of the Report, other than for contextual reference. Local counsel should be engaged for this purpose.
 - The information contained in this Report is current as of the date of first issuance of this Report. Programs, policies, incentives, and funding sources may change in the future.

4.0 Discussion

4.1 GETTING READY FOR FINANCING

Financing the project will require the consideration of the unique aspects of each major phase of the project's lifecycle: Development, Construction, and Operation. We note that Decommissioning is also a major phase, but it is not the focus of this Report.

While a project's sponsors can engage in market soundings with potential debt lenders and equity investors to understand overall interest in the project and current market trends and conditions, the formal start of the financing process requires a certain level of project preparation. Such preparation entails a number of activities, but several are highlighted below and then discussed in greater detail later in this section:

1. Pre-Project Preparation
2. Project Risk Register
3. Project Development Plan
4. Project Information Memorandum

(1) Step 1: Pre-Project Preparation:

When preparing to engage in formal financing discussions, it is critical to observe three key conditions:

- Preparation: The project's Sponsor, or key financial and strategic advocate for the project and often an owner or significant investor, should not commence formal financing discussions until the project is "ready." Readiness is a somewhat subjective concept, but one key aspect is ensuring that the Sponsor understands the lenders' requirements and processes, including the technical, legal, and commercial diligence that will occur. If the first interactions with the lenders reveal that the Sponsor is unable to answer a number of basic questions, it will be hard for the project to recover. To be clear, that does not mean that all issues have to be fully completed or resolved – the lenders will appreciate that some project activities and issues are "work in progress;" however, the lenders will expect that there is an informed plan to resolve open issues in accordance with a reasonable project schedule. The lenders will also expect that the Sponsor has a realistic and informed view of project development and delivery issues.
- Timing: Timing involves several issues.

- *First*, the Sponsor will need to recognize that financing is a lengthy process, which varies significantly between credit agencies and commercial lenders. For example, to close on a main debt facility with an Export Credit Agency (“ECA”), a minimum of an eighteen (18) month period should be assumed.
- *Second*, for the lenders to commence their diligence process, they need to have something to diligence, requiring that the main project documents (for example, an Engineering, Procurement, and Construction (“EPC”) contract and a Power Purchase Agreement (“PPA”)) are ready for review, and an accessible data room needs to be populated with key documentation. Therefore, the Sponsor needs to arrange the project’s development schedule in a manner that supports the financing process.
- *Third*, achieving “Financial Close”, or the point at which loan documents are signed and any pre-disbursement conditions are met, allowing funds from the main debt facility to be legally disbursed to the borrower, will be difficult in the absence of a construction license from the nuclear safety regulator. The lenders will want to observe that the project is aligned and proceeding with the nuclear regulatory process, and issuance of the construction license will, most likely, be a precondition to disbursements under the loan facilities of external lenders (as opposed to the State government, which might view the project differently). This third aspect of the timing issue creates a challenge for the project relative to the ordering of long-lead items such as key equipment, which will be a significant cost to the project and, probably, done in the absence of external debt financing.
- Credibility and Commercial Viability: Financiers will want to observe that the project “makes sense” (i.e., that it is commercially viable and, thus, financeable). Elements include, but are not limited to:
 - *Deliverability*: Has the project been built before? Even if it has been built before, what are the regulators’ experience with the chosen nuclear power technology?
 - *Experience*: Does the delivery consortium have the right experience and the right leadership team to deliver the project?
 - *Schedule*: Are the target milestone dates achievable?
 - *Cost*: Is the cost realistic? What happens if the project goes over budget? Where is the credit (i.e., balance sheet) in the deal?
 - *Economics*: How is the electricity being sold? At what price? Is there creditworthy offtake? Does the offtake structure support financing?
 - *Regulations*: Are the relevant regulatory entities independent and experienced? Do they understand the technology? Will they exercise their authority when the situation requires?
 - *Operations*: Is the licensee capable (including in experience, authority, and financial viability) to operate and maintain the nuclear power plant?

(2) Step 2: Project Risk Register (“PRR”):

The PRR is a document that assists the project’s leadership with overall project planning, by identifying, assessing, allocating, managing, and mitigating risks within the project. It is done by phase: Development, Construction, Operation, and Decommissioning.

The PRR can be organized in a variety of ways, but the principal elements should include:

- List of potential risks to manage
- Assessment of likelihood of the risk
- Assessment of impact of the risk

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- Allocation of the risk (including potential price impact and possible risk sharing approaches)
 - Mitigation of the risk
 - Management of the risk

The PRR should be prepared early in the Development Phase of the project, but it is then updated throughout the Development and Construction Phases. As such, it is a “living” document, as the project progresses. Once COD is achieved, it should then be updated again, especially if refinancing strategies are to be implemented. It is a lengthy, but valuable and beneficial, process that is interdisciplinary (technical, commercial, financial, legal), and often, external advisors are used in its development. PRR preparers should also consult with key external stakeholders (government relations, public relations, local communities, key government departments, regulatory bodies, electricity market authority, national industry bodies and trade associations, etc.).

The PRR should be supported by a robust “Lessons Learned” Analysis, both positive and negative, that covers: (a) prior nuclear power projects in the State of Arkansas; (b) recent nuclear power projects outside of the State in peer jurisdictions; and (c) recent large non-nuclear infrastructure projects in the State of Arkansas. Such analysis enables the incorporation of international “best practices” into the planning process.

Overall, the PRR has a “double check” effect, creating alignment and common understanding among key internal and external stakeholders. The PRR can serve to isolate where real problems may exist. Ultimately, the PRR influences project structuring, project documentation, financing, economics, government support, and insurance programs.

For financing, the financiers will want to observe that all risks have been identified and thoughtfully evaluated, resulting in management and mitigation plans to drive project success. In particular, lenders will not wish to take risks on the project, and they will look to their external technical, financial, and legal advisory teams to assess the project’s overall viability and, thus, financeability.

Given the complexities in NPP development, the risk allocation desired or agreed might not support a financeable, or an investable project. In the nuclear context, the “best” allocation of risk from a risk-sharing view may, in fact, not necessarily be the most desirable from a total project cost and/or investment pricing point of view. In such context, the NPP owner needs to acknowledge the fact that the “optimum” mitigation is ultimately the one which can combine and balance the procurement and the successful delivery of the project in a manner that is financeable.

For reference, a sample PRR is contained in Appendix 3 attached hereto. It is not specific to the State of Arkansas.

(3) Step 3: Project Development Plan (“PDP”):

A PDP outlines a series of activities that are fundamental to the development of the nuclear power project in any jurisdiction. The PDP is not unique to NPPs. While it is of general applicability to the development of complex infrastructure projects, it should be tailored to the unique considerations regarding NPPs, also recognizing the current level of technological and market maturity when talking about certain nuclear technologies, such as SMRs specifically.

The PDP is meant to be a flexible tool, not a rigid structure that is applied universally for all project types and situations. Activities are not intended to be performed in series; they can be performed in parallel, as

applicable. A formal PDP would integrate the elements discussed in the PDP into an integrated planning schedule, which would establish timelines and reflect linkages and dependencies across activities. Ultimately, execution of the PDP is a function of three key elements: (1) human resources; (2) budgetary resources; and (3) “planning in reverse”. The final PDP should be reflected in a schedule with key timelines, identifying “critical path” activities as applicable.

The PDP does not incorporate all elements of the IAEA’s Milestones Approach³; however, such omissions are not intended to minimize the importance of these Milestone elements, all of which should continue to be considered. Instead, the focus is on project deliverability within the context of financing. Nevertheless, there are issues that are of tremendous importance to overall programmatic success that will need to be addressed outside of the PDP and, if desired, they can be incorporated into the PDP.

For reference, a sample PDP outline is contained in Appendix 4 attached hereto. It is not specific to the State of Arkansas.

(4) Step 4: Project Information Memorandum (“PIM”):

The PIM is the document that presents the financing opportunity to financiers. It tells the project’s story to potential investors and lenders. Ultimately, the PIM is an exercise in project structuring.

A well-developed PIM serves to organize the conversation with financiers, and it serves as the starting point for the diligence on the project that will be undertaken by the financiers (probably led by their external advisors). By reading the PIM, the financiers will be able to get a complete picture of the project, all its elements, and key participants. By getting that picture, it provides the proper context from which the technical, legal, and financial diligence can then occur.

For reference, a sample PIM outline is contained in Appendix 5 attached hereto. It is not specific to the State of Arkansas.

4.1.1 What do Financiers Need to See?

Financiers, with an emphasis on debt lenders, want to fundamentally know that they are involved with a “good project” – a concept that is inherently subjective. Broadly speaking and at the highest level, there are two questions to be answered: (1) will I get paid back and how; and (2) is this a “good project”?

Both are equally important. The first question relates more to the financial model and lending/investment terms, while the second is a broader inquiry that involved a series of factors, referenced in this Report. Lenders may consider the following elements in their analysis of the project proposal.

4.1.1.1 Prudent Industry Practice

One of the goals for nuclear power project development is for the project to fit within industry benchmarks. Often in the nuclear context, the phrase “prudent industry practice” is used. What does “prudent industry practice” mean? The following definition is taken from a well-respected international nuclear transaction that was supported by a U.S. government financing institution and drafted by a U.S. law firm. This concept can serve as the starting point for a more detailed look at available benchmarks for nuclear power project development.

³ <https://www.iaea.org/topics/infrastructure-development/milestones-approach>.

“Prudent Industry Practice” means the standards, practices, methods and procedures consistent with that degree of skill, diligence, judgment, prudence and foresight which would ordinarily be expected from an international skilled and experienced owner, contractor, equipment manufacturer or, as the case may be, operator, engaged in designing, engineering, constructing, developing, commissioning, repairing, refurbishing, operating, insuring, maintaining and/or decommissioning a nuclear power plant, in each case taking into account and giving appropriate consideration to all applicable standards and guidelines and local conditions.

The International Atomic Energy Agency (“IAEA”), an instrumentality of the United Nations, is viewed as the leading international organization for the nuclear industry. The IAEA puts out significant guidance regarding, among other things, nuclear power project development, and it is a reference point for project development and prudent industry practice, especially for certain entities like export credit agencies.

Lenders love to say, “Does the project comply with IAEA guidelines and standards?” The challenge is that this condition is nebulous, recognizing that IAEA pronouncements in the area of NPP development are not laws, they might not be applicable in all cases, they evolve over time, and the body of IAEA work is too extensive to assess in its entirety against a particular project. Project participants, lenders, and their technical and legal advisory teams will need to establish a meaningful set of evaluation criteria vis-à-vis the IAEA’s body of guidance and other applicable benchmarks to reach a concrete understanding on how such standards will be applied to the specific NPP in question, and the consequences for non-compliance therewith.

4.1.1.2 Delivery to Support Viability

As enthusiasm for nuclear energy rises, a fundamental question arises around project delivery. The ability to source craft labor, especially certain specialty crafts (i.e., advanced welding); the ability to identify experienced EPC contractors; and the ability to sequence and to grow a supply chain to support the needs of projects in development are all concerns that financiers will investigate as they assess the overall “deliverability” of a project.

Lenders will look to assess overall project delivery, especially in instances where new technologies are proposed for deployment. Deliverability is a heightened concern in the nuclear sector, considering the long history of nuclear projects going over schedule and over budget.

4.1.1.3 Revenue to Support Financeability

One of the key features of any project, and more so for a nuclear power project, is the certainty of the revenue stream once a project is operational. The certainty of the revenue flows also helps shape the project’s financial structure and leverage (strong revenue certainty = less equity required) and the amount and strength of any incremental support mechanisms for cost overruns or delivery uncertainty that may lead to delays in project completion and commencement of operations, and thus revenue generation.

This “certainty” is achieved by entering into PPAs with creditworthy offtakers, or through other supporting mechanisms like the Contract for Difference (“**CfD**”, discussed [later in this Report](#)) model, whereby the main funders of the project, the debt providers, can get comfortable that the revenue generated to service their debt is stable and will endure for the life of the debt tenor. Lenders are not prepared to accept or take “market risk” as the means to secure revenue generation, regardless of the state or region’s electricity market.

While debt providers need to see revenue certainty to ensure debt service obligations are met, equity investors also require a return that is commensurate with the risk that they are expected and willing to take. The revenue certainty for equity comes from the ultimate tariff received that will incorporate the agreed return element regardless of whether it is recovered from a Contract for Difference “Strike Price” (as defined in [Section 4.5.3](#) below), or once COD is achieved and the plant is operational, a PPA (upon delivery of power).

4.1.1.4 *Quality of the Project Teams*

Diligence will also assess the quality of the project teams, both on the owner/operator side and on the project delivery consortium side. Diligence will include, among other questions:

- Has the technology successfully been built before?
- Who are the suppliers and contractors?
 - What have they done?
 - Who is their project team?
 - What is their capacity?
- Who is the operator?
 - Is the operator experienced?
- Who is the developer / owner?
 - What experience does the developer have in putting together this type of project?
 - What is the strength of the balance sheet?
 - Is there a sovereign guarantee?
 - Does it have a financial / economic model that works?

4.1.2 **How do Financiers Think?**

Lenders are conservative by nature; consequently, they will undertake a rigorous review of various elements of the project. The focus will be on minimizing and mitigating project risks. Several categories of analysis are listed below for reference. The lists are not meant to be exclusive, but they are representative of the concerns from the financing community, which, in turn, the project Sponsor and host government⁴ will need to address.

From a financing perspective, a non-exclusive list of concerns would be as follows:

- Long development / construction periods
- High capital costs
- Regulatory uncertainty
- Reputational risk
- Human resources
- First-of-a-kind risk (both technology and project)
- Safety culture
- Operational success
- Supply chain capacity
- Sustainability of government commitment

⁴ The phrase “host government” is intended to reference federal, state, and local-level entities that would have regulatory oversight of the project.

- Fuel cycle concerns
- Environmental responsibility
- Commitment to best practices
- Geopolitics

In addition, a non-exclusive list of why projects have experienced problems would be as follows:

- Regulatory changes
- Estimating errors (both generally and due to overall length of construction period)
- Lack of / lost execution experience
- Reactor technology knowledge vs. project delivery experience
- Supply chain failures
- Inexperienced subcontractors (and the challenges of localization)
- Lack of jurisdiction-specific experience by the delivery team
- Site specific changes (vs. reference plant)
- First-of-a-kind issues
- Changes in public / government support
- Political / jurisdictional risk factors
- Lack of an “informed customer” (note the importance of a competent Owner’s Engineer)
- Labor availability (esp. specialty crafts)
- Commodity price fluctuations
- Lack of a project management “A Team” (either due to inexperience or capacity challenges)
- Geopolitics

Finally, focus areas for a project Sponsor or project participant, when considering the opportunities and challenges in a particular jurisdiction, include:

- State and local stability (both economic and political)
- Host government credit rating
- Exchange rate fluctuations (relevant if any Export Credit Agencies are involved, see [Section 4.6.1](#) below)
- Tax policy
- Licensing and regulatory requirements
- Consistency (vs. unpredictability) in the legal and regulatory regime
- Geopolitical dynamics (including any bilateral linkages between the host country and country of origin of certain financing, technology, and/or components)
- Rule of law
- Ethical behavior (e.g., host government’s rating on levels of corruption)
- Contractual terms and conditions
- Availability of skilled labor
- Prior experience with nuclear technology and power generation
- Commitment to multiple NPPs (as opposed to a “one-off” project)

Taken together, these note the importance of risk assessment, mitigation, and management across diverse stakeholders, which, in turn, places emphasis on the development of a robust Project Risk Register and Project Development Plan. Financiers will want to see that these areas of concern are addressed by the project Sponsor.

4.2 CHALLENGES OF DEVELOPING & FINANCING NUCLEAR POWER PROJECTS

4.2.1 Primary Development and Financing Risks

To understand why no NPP has thus far been project financed, it is important to understand first why developing and financing NPPs has historically been very difficult. In this Section, we look at the unique challenges of developing NPPs, including:

- (1) Regulatory uncertainty;
- (2) High capital costs;
- (3) Long development and construction periods;
- (4) Reputational risk;
- (5) Political commitment; and
- (6) Concerns relating to technology, fuel, and human resources.

4.2.1.1 Regulatory Uncertainty

The regulatory environment within which NPPs must operate is a key factor in the development, financing, and operation of NPPs. There is a series of licensing events that are critical and unique to the nuclear industry. To begin, each country with an NPP has a national regulatory authority that is specifically dedicated to nuclear activities. If structured in accordance with the guidance from the IAEA, such an entity is an independent regulatory body and, therefore, insulated (at least in theory) from political and other influences.

Such regulatory authority has a series of activities which influence the project development cycle. First, the site on which the NPP is to be located must receive a site permit. Second, the nuclear reactor design must have a review and approval of the reactor design.⁵ Third, prior to construction, the regulator must issue a construction license, which allows key construction (beyond site preparation) to commence. Finally, prior to loading nuclear fuel in the reactor, the regulator must issue an operating license, which permits the operation of the facility by the designated operator, who must demonstrate adequate technical and financial capability to operate the NPP.

The nuclear regulator continues to monitor the project through the construction and operation of the facility. Such monitoring includes the ability to halt plant activities and, in extreme cases, shut down the NPP. Lenders look to the regulator to be the “adult in the room,” as lenders have neither the technical capability nor the access to ensure that the NPP is being operated safely. Thus, a capable and independent regulator is a key precondition for financing an NPP, with a knowledgeable and authoritative regulator being a confidence-building measure for project participants.

The safety case is one of the critical issues for NPP development and operation. However, because of its importance and attendant scrutiny in respect thereof, the regulatory process has been a historical source of cost and schedule overruns on NPPs. Moreover, given this history and the lockstep process inherent to the licensing process, regulatory change, as evidenced after the accidents at Three Mile Island (1979), Chernobyl (1986), and

⁵ In the United States, a Design Certification can be obtained.

Fukushima (2011), are key pressure points in the financing process. Lenders need to understand the regulatory process and the risk allocation among project participants in respect thereof.

Finally, with the emergence of both new reactor technologies, the experience and technical capability of the regulator become key risk factors in the financing process. Absent a proven track record for NPPs in general and/or specific reactor technologies, the financiers (and project developers) judge regulatory risk to be a major area of uncertainty in the project development, execution, and financing processes.

4.2.1.2 High Capital Costs

In the large reactor space, current nuclear reactor designs are in excess of 1,000 MWe. Depending on the type of nuclear reactor design, an NPP (of the 1000 MWe+ class) could have a capital cost in the neighborhood of \$10–15B, depending on reactor type and site conditions. However, given the optimization/economies of scale to be achieved by dual unit construction, such projects are often grouped, resulting in a total project cost of around \$15–25B. Current trends toward four-unit projects (Barakah in the UAE; Akkuyu in Türkiye; and El Dabaa in Egypt) result in further upward scaling, necessitating even larger debt and equity commitments.

Such significant project costs are not unique to the nuclear industry, considering the costs of developing large-scale petrochemical facilities, liquefied natural gas facilities, and natural gas fields; however, as measured against the market capitalization of most of the utilities that would undertake such a project, an NPP has the potential to be a “bet the company” project for the utility. At a minimum, rating agencies view NPPs as credit negative undertakings, and a significant ratings downgrade for a utility could have further negative implications for the utility’s ability to raise capital across all its business activities.

This credit negative view from the ratings agencies is based on a historical analysis of the ability (or lack thereof) of developers/owners to deliver NPPs in an on-time/on-budget fashion. Financing, too, is burdened by this history of cost overruns and delays. Examples include Olkiluoto 3 (Finland), Flamanville (France), Hinley Point C (UK), and Vogtle 3&4 (U.S.), all of which have had delays of over 10 years. Given the scale of NPPs, the risk of delays and cost overruns puts significant pressure on financing structures and the need for significant equity support to stand behind the project company and ensure completion of the project.

4.2.1.3 Long Development and Construction Periods

Large-scale facilities like NPPs have lengthy construction periods. From a financing perspective, the construction period represents the greatest risk for NPPs. Because of the industry’s history of significant cost and schedule overruns, debt lenders and equity investors have been reluctant to finance NPPs prior to issuance of the regulator’s construction license. As a result, a project Sponsor is historically the entity responsible for shouldering the responsibility during this vulnerable stage between a Final Investment Decision (“FID”) and Financial Close, or the closing of the primary debt facility.

Several years of project funding, to include development costs (site investigations, regulatory submissions, early engineering, detailed engineering, early purchase of long lead items, early works at the site, etc.) are needed to create a viable, financeable project, so that a Final Investment Decision can occur. Getting to an FID signals to external investors and lenders that the Sponsor intends to expend significant front-end funds to get the project fully developed. After FID, the next key milestone is the Financial Close on the debt facility.

This “valley of death” prior to Financial Close can be fatal to project developers, as well as the reactor technology companies that might lack the balance sheet strength to fund this Development Phase, where costs will typically run in the hundreds of millions of dollars for pre-construction activities including Front-End Engineering Design. Figuring out how to source such funding, especially from government sources, is fundamental to the overall financing plan for the project.

Financial Close on the main debt facility usually occurs shortly after issuance of the construction license, with draws occurring around the time that “first safety concrete” is poured at the site. From the “first safety concrete” through the Commercial Operation Date, the construction period can run, on average, for a minimum of 60 months for a stand-alone unit.⁶

In a best-case scenario for a large reactor, after Financial Close, the commercial operation date (“COD”) is still 60-72 months away, which is very difficult for equity investors to weather. However, once COD has been reached and the unit has come out of its first refueling outage (anywhere from 12 to 18 months after commercial operation), both lenders and investors have historically viewed the attractiveness of a NPP investment more positively.

4.2.1.4 Reputational Risk

“Reputational risk” is a topic that can include a number of concepts and is relevant to lenders involved in all infrastructure projects, whether or not such project is an NPP. However, because of the unique characteristics of and issues facing NPPs, the idea of “reputational risk” encompasses a wider range and more significant set of considerations. Of note, certain ECAs and commercial banks have specific lending guidelines/policies for NPPs.⁷

International standards and practices

Reputational risk encompasses the concept that the project will meet internationally recognized standards. This concept can be covered in financing documentation by the concept of “Prudent Industry Practice,” introduced in [Section 4.1.1.1](#) above. Part of the diligence process will be for the lenders to work with their technical adviser to ensure that the project complies with this requirement, especially given the sensitivities, both perceived and real, involved in an NPP.

⁶ First safety concrete is a relevant measuring point for the construction cycle because of the licensing process that supports the overall construction schedule. Due to the unique nature of an NPP, the licensing process is particularly important. Issuance of the construction license from the nuclear regulator having authority over the NPP is a key milestone in the construction process, and it is also a point prior to which Financial Close for the debt facility is unlikely.

⁷ As an example, see: (1) BNP Paribas’ nuclear policy at: https://cdn-group.bnpparibas.com/uploads/file/csr_sector_policy_nuclear_power.pdf; (2) Société Générale’s nuclear policy at: <https://www.societegenerale.com/sites/default/files/documents/CSR/civil-nuclear-power-sector-policy.pdf>; and (3) see JBIC’s Environmental Guidelines, including for “Sensitive Sectors” like nuclear power: https://www.jbic.go.jp/en/business-areas/image/Environmental_Guidelines_2022.pdf (each last accessed January 14, 2026).

Public acceptance

NPPs are surrounded by a heightened sensitivity by the general public. NPP risks and the safety case are often misunderstood, and it is incumbent upon project developers to work with the public to develop the necessary level of local support for the project. Of note, public opinion surveys of local communities around operating NPPs indicate very high approval rates; however, during project planning and development, NPPs suffer from a particularly high level of “NIMBY” sensitivity. The negative consequences of failing to achieve public acceptance is underscored by the histories at Shoreham (Long Island, USA), Bataan (the Philippines), Zwentendorf (Austria), Kudankulam 1 and 2 (India), the cancellation of Italy’s civilian nuclear power program following Chornobyl (and the referendum in 2011 that blocked an attempt by Enel to restart the program), and, most recently, Germany’s decision in 2023 to shut down its seventeen nuclear power stations following Fukushima.

Sustainability

Sustainability considerations are still prevalent in the financial community, and lenders will want to see, at a minimum, that compliance with federal, state, and local environmental laws and international standards (e.g., the Equator Principles and/or IFC guidelines) is observed. Such matters will necessarily bring project lifecycle considerations to the lenders’ analysis of the project, as lenders will look to see that the NPP planning includes a spent fuel/nuclear waste plan and a decommissioning plan, demonstrating the lenders’ desire to look beyond the tenor of the debt.

Sustainability is a combination of both art and science, where there is often no clear solution that is measurable and quantifiable; instead, the compliance plan can be qualitative, not quantitative, and, thus, much more difficult to resolve. Sustainability considerations can be applied through a number of mechanisms, with each a function of the financial institution and/or the location of the ultimate project.

Sustainability concerns will also be relevant when considering potential offtakers, or the ultimate consumers of any products produced by the plants powered by the nuclear facility’s electricity. Nuclear provides a unique low-carbon baseload power source that is particularly attractive to technology companies with emissions reduction targets, and to energy-intensive materials bound for export to certain markets, such as Europe.

Nuclear liability and insurance

In the event of a nuclear incident at an NPP, where a radiological release occurs from containment, such release has the potential – in the case of a release on the scale of Chornobyl or Fukushima – to cause physical injury or property damage to third parties. As a precursor to this discussion, it is important to understand that an examination of nuclear liability does not involve damage to the asset itself. Such damage to the asset is covered within the contract for construction of the NPP and through facility insurance once nuclear fuel is loaded into the reactor. However, damage to third parties is outside the bounds of the contract and, due to a unique set of conditions, requires special treatment.

Under the nuclear liability conventions listed previously, there are several key principles which govern such conventions:

- (1) Strict liability of the nuclear operator;
- (2) All nuclear liability is channeled to the owner/operator of the facility, regardless of fault (known as “legal channeling” and distinguishable from the U.S. Price–Anderson system of “economic channeling”)⁸;

⁸ A discussion of Price-Anderson is included at the end of this section.

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- (3) All claims are afforded equal standing, regardless of nationality, domicile, or residence;
 - (4) Mandatory financial coverage of the operator's liability;
 - (5) Exclusive jurisdiction (only courts of the member state in which the nuclear accident occurs have jurisdiction, and usually one specific court in such member state will be designated to handle nuclear liability cases);
 - (6) Limitation of liability in amount and in time; and
 - (7) Terrorism does not relieve an owner/operator of liability.⁹

Despite the breadth of such principles, two key concerns remain. *First*, no international nuclear liability convention has ever been tested in a court of law. *Second*, such conventions are only as effective as the membership covered thereunder (in other words, if cross-border damage occurs in a member state that is not a fellow treaty member, then legal channeling does not occur, and the project participants are exposed to claims in such neighboring jurisdictions and without the benefit of the limits of liability specified under the applicable treaty; we refer to this risk as “gap risk”).

Under any nuclear liability framework, insurance provides a means of mitigating risk. From a nuclear-specific perspective, nuclear liability conventions and/or national legal regimes aid in attempting to specify the maximum exposure faced by the nuclear industry in the development and operation of a nuclear power facility. Insurance (carried by the licensed operator as a legal requirement under national law) then provides the means for covering such defined exposure in the event of a nuclear incident.

Unique to the nuclear industry, however, is the limited availability and prohibitive cost of certain types of insurance. While insurance prior to fuel loading is generally readily obtainable (and commercially reasonable) for EPC contractors, their subcontractors, and technology and equipment providers, to include nuclear steam supply system suppliers (the foregoing parties collectively comprising the “**Suppliers**”), the insurance marketplace is limited in its coverage for nuclear damage after fuel loading has occurred. Insurers have limited capacity to provide nuclear damage insurance, recognizing that the amounts required by the nuclear industry to cover both third-party exposure and on-site property damage are commercially significant. The former is driven by national laws and by international conventions; the latter is driven by facility value. Furthermore, even though nuclear insurance premiums favorably reflect the nuclear industry's successful operating track record, insurers still must carry such risk with a view towards the catastrophic potential of a nuclear incident (and, thus, limit their portfolio exposure). The marketplace is, therefore, comprised of nuclear insurance risk-sharing pools,¹⁰ which, effectively, are only available to owners/operators. Recognizing that owners/operators already will need to carry certain amounts of coverage for nuclear damage to the facility, coupled with the high value of such facilities, these insurance pools, in effect, are only able to maintain the capacity to support the owner/operator market.

As a consequence of this limited capacity, there is no meaningful insurance market for nuclear Suppliers for the provision of post fuel load insurance to cover nuclear damage to the project and the facility site. The net effect of this market reality is that the owner/operator is best positioned to assume all liability for nuclear damage after fuel loading. While such responsibility, in respect of third-party claims, is imposed by law under any legal channeling regime, such responsibility in respect of on-site property damage is imposed as an economic reality. Without the ability to insure nuclear-related property damage risks after fuel loading,

⁹ World Nuclear Association, Liability for Nuclear Damage, available at: <https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/liability-for-nuclear-damage>.

¹⁰ Nuclear Energy Agency, available at: <https://www.oecd-nea.org/ndd/workshops/nuclearcomp/presentations/documents/1.SebastiaanReitsma-OECD-NEALiabilityWorkshop-December2013.pdf>.

nuclear Suppliers have historically refused to take responsibility for such risk, recognizing that, without an insurance backstop, pricing such risk into contracts would be prohibitive. With the assumption of such risk by the owner/operator, economic efficiency can be achieved, as risk is allocated to the one party that can insure against it. Furthermore, the owner/operator can spread the cost of such risk over the lifecycle of the project.

Given insurance costs and market limitations, coupled with the fact that, in all countries other than the U.S., the owner/operator is solely liable for third party claims arising out of a nuclear incident, the owner/operator has been traditionally viewed as the party that is in the best position to bear certain nuclear-specific insurance costs. In being the party best positioned to buy the insurance, the natural corollary is that the owner/operator then is in the best position to assume the risks being insured through the coverages obtained. As mentioned previously, third party liability is generally designated as an owner/operator liability; however, other risks covered by insurance (chiefly, nuclear damage to the asset) are subject to a limited marketplace as well.

By taking these “other risks,” the owner/operator can effectively lower the cost of the project through the consolidation and alignment of risks. Without this assumption of risk by the owner/operator, nuclear Suppliers no longer have to price such risks and, correspondingly, purchase insurance (to the extent even available) to cover such risks, thereby lowering the overall cost of the project. Given the high costs of a nuclear power facility, such “deal efficiency” can help make the business case more defensible and achievable. Nevertheless, even the maximum liability coverage available in the marketplace may not cover the full costs of a nuclear accident. Accordingly, to secure their assets and the assets of their corporate family, owners/operators must employ other risk mitigation strategies. Furthermore, all parties involved in the financing and development of a nuclear power plant must consider these issues in cases where gaps exist in liability coverage.

For lenders to an NPP, the foregoing analysis of nuclear liability and insurance translates into several key concerns:

- (1) Is the project company properly protected from third party claims, either by a limitation of liability under national law and international treaty obligations or through project structuring whereby the owner (as project company) and operator (as the licensed entity to which legal liability is channeled) are separate entities? Does any gap risk remain?
- (2) Has the project company properly insured the risk for nuclear incidents, in terms of both third-party exposures and damage to the asset?
- (3) Are the lenders exposed through any “lender liability” (*see below*) jurisprudence in the country and, perhaps, the surrounding jurisdictions (in the event of cross-border damage arising out of a nuclear incident)?

The Price-Anderson Act

The Price-Anderson Act¹¹ (the “PAA”) stands as a cornerstone of U.S. nuclear policy, designed to encourage private commercial development of nuclear power while establishing a robust legal and financial framework for addressing the unique risks associated with nuclear energy. Its primary goals are threefold: (1) to foster industry growth, (2) to provide an exclusive mechanism for handling claims arising from nuclear incidents, and (3) to ensure a ready source of funds for compensating potential injuries or damages.

¹¹ 42 U.S.C. 2210.

At the heart of the PAA is the concept of “public liability,” which covers personal injury or property damage to individuals or property located away from the reactor site—so-called “off-site” damages—resulting from a nuclear incident. Such incidents are defined broadly, encompassing occurrences that cause bodily harm or property damage due to the hazardous properties of radioactive materials. Accordingly, a release of medical radioisotopes in the U.S. would likely be viewed as a nuclear incident under the PAA.

The PAA’s financial protection is comprehensive, extending coverage to anyone who may be liable, including operators, owners, contractors, vendors, suppliers, investors, and even third parties whose actions might cause harm to a facility. All claims related to a nuclear incident are channeled to the facility operator, which is required to maintain minimum insurance coverage and demonstrate financial qualification.¹² This “omnibus” approach ensures universal coverage and makes the PAA the exclusive remedy for nuclear liability claims.

For large commercial nuclear power plants (those exceeding 100 MWe), operators must maintain primary financial protection—insurance coverage for public liability claims. The minimum required coverage is set at the maximum available from private sources at reasonable cost and terms. This minimum is \$500 million per reactor site, periodically adjusted for inflation. Coverage is provided through a pool of commercial insurers, notably the American Nuclear Insurers, under standard policy terms prescribed by NRC regulations.

Beyond primary insurance, every covered reactor operator participates in a secondary layer of protection—an excess insurance plan. If primary coverage is exhausted, all participating reactor operators are required to pay a deferred (“retrospective”) premium, currently \$158 million per reactor, with annual limits and a 5% surcharge for administrative and litigation costs. The total available under this secondary layer is calculated as 105% of the maximum deferred premium multiplied by the number of reactors in the pool, which currently stands at 94 reactors.

The aggregate public liability protection for a single nuclear incident thus combines primary and secondary coverage, exceeding \$16 billion.¹³ Operators must provide evidence to the NRC of their ability to pay retrospective premiums. If available funds are insufficient, the President is required to submit a compensation proposal to Congress, which is authorized to provide further relief.

Other related coverages exist for on-site damage or injury, accidental outage, property damage, workers’ injuries not covered by state compensation laws (Master Workers Policy), and injury arising from contamination by radioactive materials in transit to and from a reactor site. These coverages are typically provided through industry mutual insurers like Nuclear Electric Insurance Limited and others.

¹² The Act creates a “no-fault” system for nuclear accidents, using “economic channeling” to ensure prompt public compensation by consolidating liability with reactor operators, limiting their financial risk through mandatory insurance and government indemnification, and waiving traditional defenses like contributory negligence, providing a federal, unified system for claims against the nuclear industry to encourage development while guaranteeing payments for victims. The U.S. system is distinct from the corresponding Paris and Vienna Conventions, which take a “legal channeling” approach, where all liability is channeled – as a matter of law – to the licensed operator of the nuclear facility.

¹³ Price-Anderson Act: Nuclear Power Industry Liability Limits and Compensation to the Public After Radioactive Releases, Congressional Research Service, Feb. 28, 2025 at Figure 1 (Price Anderson Insurance Layers); available at https://www.congress.gov/crs_external_products/IF/PDF/IF10821/IF10821.6.pdf. For smaller reactors, the coverage requirements are scaled based on reactor size and proximity to population centers. Reactors between 10 MWth and 100 MWe must procure insurance ranging from \$4.5 million to \$74 million, while those between 1 MWth and 10 MWth require a minimum of \$2.5 million. The NRC may also provide indemnification agreements of approximately \$500 million, reduced by the amount that minimum required insurance exceeds \$60 million.

4.2.1.5 Political Commitment

Government support is critical to the successful development of NPPs. This support manifests in several fashions:

- (1) financial support, both from the host jurisdiction and, if applicable, the exporting country of any critical component;
- (2) consistent and sustained support in the legal and regulatory framework within the host jurisdiction; and
- (3) overall leadership in the dialogue with the public regarding the need, benefits, and accountability for nuclear power.

Consistency is critical for both lenders and investors, to ensure that the long-term economics of the project remain stable. This concern might encompass several areas. *First*, financing entities will be concerned with market conditions. With an NPP being a baseload plant with approximately 60 years of operation, it needs to run and remain in operation. Historically, NPPs have not been designed as load-following generation facilities, and have traditionally been price takers, not price setters. Hence, financing entities will want to be confident that NPPs will be able to run and obtain favorable pricing. This can be ensured through a regulated market structure, long-term PPAs, or priority treatment within an electricity market. However, as demonstrated recently in the U.S., NPPs have not fared well in merchant markets overall, where the combination of deregulation and historic subsidies for renewables has put such downward pressure on electricity prices (including negative pricing scenarios) such that older NPPs, requiring significant capital upgrades, are being taken out of service, with potential new NPPs being viewed as not financeable.

Second, unpredictable government action, as evidenced most recently with Germany's post-Fukushima decision in 2011 immediately to shut down permanently multiple older NPPs and to revoke operating license extensions for the remaining NPPs that were allowed to remain in operation, creates uncertainty for financing entities, which are trying to model NPPs and to determine the levelized cost of electricity over a long operating period.

Finally, as discussed earlier in this Report, public acceptance is a key aspect to the long-term success of a nuclear power program. The host government, through a commitment to transparency, engagement, and international best practices (in the areas of safety, security, safeguards, and nuclear liability), can create the necessary alignment between the public and the nuclear power program. As noted previously, changing public attitudes can have dramatic impacts on both individual projects and a country's overall nuclear power program.

4.2.1.6 Concerns Relating to Technology, Fuel and Human Resources

There are a number of areas that are of additional concern to lenders, as they go through the diligence process in respect of a potential NPP. They are highlighted briefly here.

First- of-a-kind risk

One of the challenges for Gen III/III⁺ designs¹⁴ (and now, too, with the development of Small Modular Reactors and other Advanced Reactors) has been FOAK risk. Lenders like certainty and predictability;

¹⁴ The World Nuclear Association explains the Gen III and III⁺ designations as follows: Such reactors have:

- (1) a standardized design for each type to expedite licensing, reduce capital cost, and reduce construction time;
- (2) a simpler and more rugged design, making them easier to operate and less vulnerable to operational upset;
- (3) higher availability and longer operating life—typically 60 years;
- (4) further reduced possibility of core melt accidents;
- (5) substantial grace period, so that following shutdown the plant requires no active intervention for (typically) 72 hours;

however, as reactor designs have matured and evolved, especially with the advent of passive safety features, there has been an inherent tension between a move towards the latest designs and the desire for proven technology.

Furthermore, financiers will be cautious in the move from FOAK to *N*th-of-a-kind. For the first several projects in a series, especially those that have overlap (i.e., FID on the “next” project occurring before the “first” project achieves COD), financiers will remain stuck in an FOAK mentality, especially with regard to cost and schedule metrics.

Operational Success

Regardless of the quality of the technology and the engineering and construction of the NPP, the capability of the operator is critical to the long-term success of the NPP. Nuclear incidents at both Three Mile Island and Chernobyl have been tied to operational errors.¹⁵ In addition, failure to maintain high standards, safety culture, and performance in operation can result in regulatory actions that can then constrain operation and, ultimately, affect the revenue stream for the asset.

Human Resources and Supply Chain

The nuclear industry is highly specialized, requiring specific skill sets on the human resources side and specific fabrication (i.e., nuclear grade/nuclear certified) capabilities on the manufacturing side. Unfortunately, there are a limited number of suitably qualified and experienced personnel in the nuclear industry that can support a “knowledgeable customer” capability within owner, operator, government, and regulatory organizations.

Similarly, there are a limited number of entities that can supply nuclear grade critical components for an NPP, an issue exacerbated when in the FOAK space for SMRs or advanced reactors. As such, lenders will need to be confident that human resources concerns are adequately addressed in the early years of the project and that an achievable succession plan also exists, especially in cases where ex-patriot personnel are heavily relied upon during the early stages of the nuclear power program.

Lenders will also want to work with their technical adviser to be confident that the supply chain can support the project schedule, taking account of long lead time items and supply chain bottlenecks, for example, heavy forgings. Supply chain limitations might force the project company to expend heavy amounts of capital early in the project development process, trading lower cost for project delivery certainty.

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- (6) resistance to serious damage that would allow radiological release from an aircraft impact;
 - (7) higher burn-up to use fuel more fully and efficiently and reduce the amount of waste;
 - (8) greater use of burnable absorbers (“poisons”) to extend fuel life.

The greatest departure from most designs now in operation (and, thus, the III+ designation) is that many incorporate passive or inherent safety features which require no active controls or operational intervention to avoid accidents in the event of malfunction, and may rely on gravity, natural convection, or resistance to high temperatures. See <https://world-nuclear.org/information-library/nuclear-power-reactors/other/advanced-nuclear-power-reactors>.

¹⁵ <https://thebulletin.org/2020/08/critical-underlying-factors-in-three-major-nuclear-accidents/>.

Fuel cycle concerns

While on a global scale, uranium is not in short supply, the ability to fabricate nuclear fuel raises concerns from a non-proliferation perspective. While neither enrichment nor reprocessing are illegal under international conventions, the technology for both is the same technology that can be used to create weapons-grade nuclear material. For political or financial reasons, a country might wish to forego enrichment and/or reprocessing facilities, in which case, the lenders will want to review the overall fuel strategy for the NPP, recognizing that fuel bundles can be purchased far in advance of need and can be safely stored on-site.

In the Advanced Reactor space, the issue of nuclear fuel is a pressure point, given High Assay Low Enriched Uranium (“HALEU”) needs. Currently, commercial supply of HALEU is restricted to Russian sources, which are viewed as no longer tenable due to Russia’s aggression in its full-scale invasion of Ukraine in 2022. HALEU fabrication in North America is currently inadequate to support the ambitions for advanced reactors, and it will need to be resolved to support advanced reactor-specific NPPs.

4.2.2 Can Project Finance Work for Nuclear Power Plants?

As mentioned above, no NPP has ever been developed on a textbook project finance basis. It is important to understand why this has been the case to date.

First, given the unfortunate history of NPPs not being delivered on time and on budget, coupled with the high capital costs for an NPP (perhaps, even a multi-unit NPP), this history of cost and schedule overruns becomes highly challenging to project finance structures. Being one year late on a project of this scale is untenable for the lender community (considering the significance of interest during construction vis-à-vis the size of the debt and the length of the construction period over which such interest accrues), and, based on historical modelling, the probability of such downside risk is high.

Second, regulatory delays and changes have plagued the nuclear industry. Given the primacy of the nuclear regulator, this risk is higher in the nuclear sector, as compared to its power generation peer group and its infrastructure peer group, with heightened exposure in any situation involving a FOAK reactor technology and/or the first NPP in a country.

Third, classic project finance remedies are not suited to NPPs. In infrastructure projects, if the delivery team defaults under the EPC contract, it can be terminated, and a new team can be brought on to finish the job. Given the specificities associated with reactor designs, it would be very difficult, if not impossible, to terminate the contractor/vendor team and replace it with another entity (or entities) to finish the project. Even more significant, in a classic project finance structure, if there is a default under the financing documents, the lenders can always exercise step in rights and take over the project. However, in the context of an NPP, while the lenders could take over the asset, they would have no authority to operate the asset, as the operating license is specific to the operator (most often, the owner). With the lenders in control of the NPP, they would then need to find a new operator, which would then have to be licensed by the nuclear regulatory authority, which would take anywhere from 12 to 24 months to facilitate. Finally, given that nuclear power plants are often considered strategic assets of the host country, there might be legal limitations as to foreign ownership or control of the asset (including in the U.S.), as well as the practical realities of the host government simply not allowing a consortium of lenders to take over such a strategic asset.

Fourth, under project finance structures, lender remedies create the possibility, either directly or indirectly, and at least the perception, that the lenders are exercising some level of control over the project. In the context of an NPP, and, specifically, in the event of a nuclear incident at the NPP, where nuclear damage is suffered by third

parties outside the perimeter fence, it is safe to assume that significant lawsuits will follow. Such lawsuits will, in part, be a search for deep pockets, and the unfortunate reality is that anyone associated with the NPP will be “in the zone” of potential litigation. At a minimum, such litigation will be lengthy and costly. At the extreme, if found liable, the exposure, in the case of a catastrophic nuclear incident (e.g., on the scale of a Chernobyl or Fukushima), is almost unquantifiable. For lenders, a very remote risk (especially considering the safety case of Gen III /III⁺ reactor designs) has an inverse relationship with the financial exposure. Thus, lenders will need to balance the desire to impose project finance-styled controls over the project against the risk that such levers of control can expose the lenders to lender liability claims.

“Lender liability” is not an independent cause of action, but a term that refers to the imposition of traditional contract or tort liability on a bank or other financial institution. Lender liability to the project company or to third parties comes in a variety of forms and may be premised on statutory theories, common law theories, and bankruptcy law doctrines. Although the types of claims asserted against a lender may vary depending upon the unique facts and circumstances of a given case, claims against lenders typically involve allegations of either failure to act in good faith or the exercise by the lender of control over their borrower.

While other types of infrastructure projects that employ classic lender controls within a project finance framework can expose the lenders to lender liability claims, the downside risk for lenders in the context of an NPP is far greater and, therefore, influences lender thinking on the overall structuring of financing for an NPP, especially if a sovereign indemnity is not available (either in fact or in circumstance, due to the poor credit rating of the sovereign or concerns about the enforceability of such indemnity against the sovereign).

4.3 SPECIFIC FINANCING CONSIDERATIONS FOR SMRs

4.3.1 First-of-a-Kind Reactors

SMRs (traditionally defined as below 300 MWe) and Advanced Reactors (traditional defined as involving advanced fuel designs, the most common being HALEU), create new possibilities for project structures, financing structures, and applications, including for hydrogen production, industrial decarbonization, desalination, mining, and AI/data centers, among others.

At present, no U.S. SMR technologies have received a construction license from the U.S. Nuclear Regulatory Commission (“NRC”), placing all such SMR options within the scope of the FOAK risk.

For these new reactor types, regulatory hurdles (licensing a new technology, licensing a new technology with a new regulator, etc.) and FOAK risk in project deployment are the biggest concerns. However, with shorter construction periods, interest during construction is reduced. In addition, if a fleet is built in series, the revenue generated by earlier units can then support the financing needs of later units under a “fleet financing” approach, discussed elsewhere in this Report. Finally, with non-grid applications, newcomers to the nuclear industry are now becoming part of the project development, structuring, and financing process. The viability of the project can now be judged across new factors (not the cost of electricity, but the cost of the end project – like hydrogen).

With certain end users being motivated more by availability and carbon footprint (e.g., hyperscalers), price sensitivity might be of less importance, relatively speaking, and project delivery will rise in prominence, which, in turn, might be able to facilitate early funding of projects to accelerate project delivery.

To the extent that a reference plant for the chosen technology is first developed elsewhere, any efforts in the State of Arkansas have the potential to be de-risked, depending on the period of time between the schedule of the reference plant and the first units to be deployed in Arkansas.

4.3.2 The Fleet Effect

Unlike GW-sized NPPs, where one or sometimes two reactor units are sufficient to provide the necessary economic rationale for investment, the small size of SMRs, in terms of output, only become commercially viable when multiple reactor units are constructed and economies of scale are achieved, referred to as the “Fleet Effect.” The theory behind SMRs is that while FOAK costs are typically high, these costs reduce dramatically the deeper development goes into “next-of-a-kind” production of a particular unit. Lessons learned from the development and advancement in the design of each unit are then applied to subsequent units, leading to greater efficiencies, economies of scale, and, ultimately, lower costs. This practice also holds true for most other manufacturing processes, and the industry expects this practice to hold true for SMRs, given the expected modular factory production that is envisioned for the SMR reactor units.

The Fleet Effect becomes extremely important for the development of the supporting supply chain that needs to be established to deliver multiple SMR units. The creation and expansion of the supply chain will then drive the broader economic value creation for a country or a state / region by adding high-paying skilled jobs during both the construction period and during the operations of a fleet of SMRs.

Thinking in terms of the “Fleet,” certain opportunities arise:

- Designing the site to maximize common facilities;
- Rolling craft labor from one reactor to the next, so that the same work packages are performed by the same team; and
- Purchasing equipment in multiples, which should enable the developer/owner to obtain quantity discounts.

Production of a “fleet” of SMRs will also allow the deployment of SMRs not only for power generation but, potentially, also for desalination or steam and hydrogen production, or directed for single source power purchasers like data centers or industry or technology hubs that are currently seeking clean, reliable base-load power sources (i.e., industrial decarbonization – in sectors such as steel, chemicals, cement, and glass – through the use of low-carbon baseload power, as well as high temperature steam from advanced reactors).

The Fleet Effect can also enhance financing opportunities, recognizing that, once the first unit (and then the earlier units) of the fleet goes into operation, it is generating revenue can then be redeployed to support the financial needs of follow-on units. Furthermore, if a creditworthy and commercially viable offtake structure is implemented for the offtake of the electricity generated from the units in operation, the initial equity stakes in the first units can be refinanced, enabling that capital to be redeployed for future units.

4.4 STATE ENERGY REGULATION

Thus far in the Report we have focused on the difficulties in financing NPPs, but the U.S. has financed in excess of 100 nuclear units.¹⁶ How have those projects been successfully financed and completed?

¹⁶ <https://world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today>.

When the last generation of NPPs was developed, electricity markets were regulated, and the costs of the NPP, regardless of overruns, were simply passed through to the rate base. Whether the owners were regional utilities operating in protected markets or national utilities wholly owned (and financially supported) by the sovereign, the government and/or the rate payer was the ultimate source of recovery, thereby favorably driving the economics for NPPs. However, deregulated markets across the United States have broken these linkages. In addition, even in regulated markets, public utility commissions now often exert prudency reviews over new NPPs, with the likely outcome being that all cost overruns will not be passed through to the rate base (which, in turn, puts negative credit risk on the utilities and, as mentioned previously, negative pressure on the credit rating of such utilities).

We note that regulatory concerns are outside of the scope of this Report, which is focused on financing. However, the following is intended to provide a very brief review of how power is built and distributed in the State of Arkansas to demonstrate the landscape against which future developers would be entering the market.

4.4.1 Regulated Utility Model

Arkansas is a regulated market. The State’s regulatory agency, the Arkansas Public Service Commission (“APSC”)¹⁷ regulates twenty-four electric utilities in the State, including four investor-owned utilities, one generation and transmission cooperative utility, seventeen distribution cooperative utilities, and two Regional Transmission Organizations. APSC approves the rates, riders, rules, and terms and conditions for service in the utility tariffs for the State. By having the established authority to regulate electric utility rates, this provides opportunities for certain State-provided cost offset programs, discussed in more detail in [Section 4.6.5](#) below.

Entergy is an APSC-regulated, investor-owned utility that operates across the South. Entergy owns and operates 5,000 MW of nuclear capacity across five sites, including the only operating nuclear power plant in the State of Arkansas – Nuclear One Units 1 and 2 in Russellville.¹⁸

4.4.2 Independent Power Producer

The APSC does not regulate exempt wholesale generators, also known as Independent Power Producers (“IPPs”). Prior to connecting to the transmission grid, these entities must obtain a Certificate of Public Convenience and Necessity, or a Certificate of Environmental Compatibility and Public Need from APSC. These producers often own and operate their power generation sources, but do not manage the transmission and customer distribution infrastructure.

These IPPs have more recently been focused on the growth of renewable energy capacity in the state, often signing PPAs with well-resourced private corporations in the technology and industrial sectors. See examples of this private energy investment below:

- *Newport Solar*: In August 2024, General Motors signed a 15-year PPA with NorthStar Clean Energy for a 180MW solar project to power General Motor assembly plants.¹⁹

¹⁷ <https://apsc.arkansas.gov/utilities/electric/>

¹⁸ <https://www.entergy.com/nuclear/arkansas-nuclear-one>.

¹⁹ <https://news.gm.com/home.detail.html/Pages/news/us/en/2024/aug/0815-newportsolar.html>.

- *Project Pyramid*: In September 2025, Google confirmed the signing of a deal for a 600 MW solar and 350 MW battery storage project in partnership with Entergy to power a \$4B Google data center campus in West Memphis, Arkansas.²⁰
- *Treaty Oak*: On November 12, 2025, Treaty Oak Clean Energy announced its 15-year PPA with Google for 100 MW from the 1,033-acre Redfield Solar Project located in southeastern Grant County, Arkansas. Google will serve as the sole offtaker, with the clean power supporting data centers across the Midcontinent Independent System Operator region.²¹

For more detail on Power Purchase Agreements, please see [Section 4.7.6](#), as well as strategic partnerships discussed in [Section 4.7](#) of this Report.

4.4.3 Electric Cooperatives and Municipalities

The APSC does not regulate municipally-owned utilities. Twelve communities in the State provide their own electricity: Jonesboro, Benton, Bentonville, Conway, Siloam Springs, Osceola, Clarksville, Prescott, Hope, North Little Rock, West Memphis, and Paragould.²²

Although nuclear projects are inherently expensive and thus difficult to pair with the economic realities of municipalities, creative opportunities may exist for more local-level partnerships with SMRs, including the creation of energy and industrial hubs (see [Section 4.7.10](#)), and direct partnerships with creditworthy offtakers, as demonstrated by the Energy Northwest example described in [Section 4.7.13](#) in this Report.

4.5 FINANCING OPTIONS – HIGH STATE RESOURCE INPUT

The following sections provide a menu of available options for state representatives and developers alike to consider in their evaluation of means of obtaining sufficient financial support for a nuclear project to succeed. These have been categorized into “High,” “Medium,” and “Low” state resource input groups, based on the amount of capital required from state sources to implement each financing option. These options are discussed with full consideration of Arkansas’ financial limitations, and as a result, more detail will be provided on the “Medium” and “Low” categories, which consider the availability of federal and third-party funding sources, as well as tax credits and other “back end” financial support.

We note that no single option is sufficient to independently support a project. Instead, it is likely that a selection of several financing options will be needed both sequentially and in parallel at certain points of the capital-intensive development and construction phases to address unique challenges and costs that arise during such periods. The discussion that follows covers both financing models and financing sources, both of which are relevant for the State of Arkansas as it considers future nuclear energy deployment.

4.5.1 State-Funded Grant Program

²⁰ <https://blog.google/inside-google/company-announcements/google-american-innovation-arkansas/#:~:text=Google%20is%20announcing%20a%20new.and%20affordability%20for%20local%20residents;https://www.entergy.com/news/entergy-arkansas-powers-googles-4b-investment-in-the-state>.

²¹ <https://www.businesswire.com/news/home/20251112919880/en/Treaty-Oak-Clean-Energy-and-Google-Enter-into-a-Long-Term-Power-Purchase-Agreement-of-100-MW-of-Solar-Energy-in-Grant-County-Arkansas>.

²² <https://www.arkansasedc.com/why-arkansas/infrastructure/electric-utilities>.

Grants are a “front end” form of capital support, providing a fixed sum to eligible grant awardees for specified expenditures without the expectation of direct future repayment. The State would indirectly recoup the benefits of its expenditure through satisfaction of other interests met by a completed nuclear power project, including future tax revenue, local high-paying employment, stable baseload power, and a decarbonized power grid, among many others.

The State of Arkansas could establish a grant program to provide funds directly to eligible participants for specific development and/or construction-related costs. To ensure the best chance of project success and the creation of ancillary state benefits, the program could link award eligibility to prior developer experience, use of proven technology, and local employment requirements, among other factors. The State could focus its support on one or more of the most critical activities, for example, safety and engineering studies in the pre-development and development stages, to help support entities through the “valley of death” between FID and Financial Close and increase the likelihood of a completed project. By focusing on supporting an aspect critical to the State’s interest, for example, site and technology safety, the State could help bring legitimacy to the project, and support the developer’s factual basis for responses to constituent inquiries in this important area.

The State may also be interested in conducting a broader economic impact analysis that assesses a more comprehensive set of benefits, many of which are traditionally not properly valued at the project level in a financial model. If these benefits are not factored into the planning decision, the project’s true value is not being captured, and Arkansas may lose out on projects that have immense value when viewed across a state-wide economic lens, in favor of other states who appreciate the bigger picture. For example, Westinghouse Electric Company recently released an independent report from PricewaterhouseCoopers LLC quantifying the substantial job and GDP growth potential that completion of the two AP1000 units would provide in South Carolina.²³

To expedite the implementation of this effort following any budgetary allocation, the State could work with existing agencies and organizations familiar with grants and local employment and safety concerns, for example, the Arkansas Office of Energy and Environment,²⁴ and Arkansas Economic Development Council.²⁵

However, without an expectation of repayment, a grant is the most capital-intensive form of support that could be provided to nuclear developers. While this option could be used for a more limited, targeted scope of costs, Arkansas may be hesitant to provide broad grant support, especially for a FOAK technology in the State.

4.5.2 State-Provided Loan

Similarly, the State of Arkansas could also establish a loan program to provide funds to eligible recipients for key project costs during vulnerable stages of the development and construction phases. In contrast to a grant, a loan is provided with the expectation of repayment, generally with interest (but potentially at favorable rates). This requires “front end” expenditure of state allocated funds, but absent default, such resources would return to the State for repurposing at a later date. In addition to substantive eligibility criteria, the State will need to evaluate

²³ “South Carolina is poised to become a national leader in the deployment of advanced new nuclear generation,” said Dan Sumner, Interim CEO, Westinghouse. “This report highlights that the two AP1000 units at V.C. Summer would generate lasting economic benefits for the state, creating thousands of high-paying, highly skilled jobs while supporting the future expansion of South Carolina’s industrial base.” Westinghouse News Release, December 9, 2025, available at: <https://info.westinghousenuclear.com/news/new-study-finds-restart-of-v.c.-summer-project-will-support-10000-south-carolina-jobs>.

²⁴ <https://ee.arkansas.gov/news-post/ee-announces-energy-efficiency-and-conservation-block-grant-awards-to-small-cities-and-counties/>.

²⁵ The Arkansas Economic Development Council is composed of sixteen (16) members appointed to four-year terms by the governor. These appointments are made with the advice and consent of the Arkansas Senate. At least three members are from each of the four congressional districts, and four members are appointed at large. <https://www.arkansasedc.com/about>.

the recipient's financial condition and ability to repay. The State's comfort with the risk of default would inform the criteria for interest rate and tenor, and other loan terms. As with a grant, the loan could be used for a more limited, targeted scope of design and study-related costs, focusing on elements critical for the State, such as safety, health and environmental impacts, and job creation.

A State-provided loan could be a longer tenor loan, with a longer repayment period to provide greater flexibility to the borrower, or alternatively, the State could consider a shorter-term "bridge" loan. A bridge loan could provide financial support to cover the gap between FID and Financial Close, while a longer tenor loan could be used for a broader set of costs and expenses across the development and construction phases. The longer the tenor, the longer the State-provided funds would be disbursed and unavailable for repayment to the State budget or for redeployment elsewhere. State support could also focus on the financing of long-lead items, which need to be purchased prior to issuance of the construction license (and, thus, prior to Financial Close). The collateral used for such bridge loan would depend on the size of the loan and the creditworthiness of the counterparty.

For both a State-provided grant and loan, the State would need to develop some internal (or contract out for external) expertise on both substantive award eligibility criteria, as well as financial-specific criteria for any State-provided loan. However, there appear to be a limited number of agencies²⁶ familiar with providing State funds to private entities, so additional State resources beyond the loan amount would need to be allocated to establish a program or office within an existing agency and develop or contract out for the expertise for financial due diligence, loan administration and monitoring, and other activities related to the loan issuance and repayment.

4.5.3 State-Provided Contract for Difference

A Contract-for-Difference ("CfD") is a contract entered into between a power producer and typically a government-owned entity, such as a utility, that provides price stability by guaranteeing a fixed price for power generated from a specific project, regardless of market variability. The provision of CfDs was a government-supported structure intended to stabilize revenues for investors in low-carbon electricity generation projects, such as nuclear power, by helping developers secure the large up-front capital costs for low carbon infrastructure.

In practice, the CfD structure is essentially a two-way financial hedge based on an agreed-upon "Strike Price" and the market price. The CfD provides the developer with the protection that, if the market price is lower than the Strike Price, the mechanism allows for recovery of the difference to be paid to the power producer. Conversely, the public is also protected if the market price is higher than the Strike Price, the differential is recovered by the utility, thereby precluding the power producer from gaining an unfair windfall under certain market conditions. In this way, CfDs stabilize returns for generators at a fixed level, over the duration of the contract. This removes the generator's long-term exposure to electricity price volatility that is characteristic of a deregulated electricity market, substantially reducing the commercial risks faced by these projects. However, the CfD does not reduce development risk.

This framework is more common in the UK and has been reviewed and approved by the European Commission. It is typically used by governments to provide revenue certainty for a project to attract a specific kind of power to a region. The project Developer would retain several risks (siting, licensing, construction, cost overruns) and the

²⁶ It does appear that the Department of Transformation & Shared Services, Division of Building Authority oversees and administers a revolving loan for renovations of state-owned buildings under the Sustainable [Building Design Revolving Loan Fund](#). Certain loan administration skills could be brought over from these existing offices, however, sector-specific skills would also be needed and therefore this program could not be wholesale replicated for a nuclear energy-focused loan.

responsibility for delivering a fully constructed NPP in return for receiving an inflation-adjusted Strike Price for a substantial period of time (for example, 35 years for the Hinkley Point CfD in the UK).

Depending on the ultimate risk of the wholesale market price falling below the Strike Price, this could be characterized as “High” or “Medium” with respect to the State’s necessary resource expenditures.

4.5.4 State-Provided Cost Overrun Facility

Given the history of nuclear power projects running over budget and schedule (and significantly so), financiers will expect that a financing plan for the project will likely have a cost overrun, or project completion) facility. This financial instrument serves to answer the question, “*Where does the money come from to finish the project, if it exceeds the base case cost projections?*”

Three considerations are important in this discussion:

- *First*, cost and schedule overruns are not unique to nuclear power projects. If one were to study megaprojects (complicated projects in excess of \$1B), the scholarship is clear that megaprojects experience similar problems.
- *Second*, there is no correct answer as to what the amount of a cost overrun facility should be. Cost overruns can be modeled, or a suitable creditworthy counterparty can provide a completion guarantee, but the goal is for a reasonable approach to be put in place as a risk mitigation strategy.
- *Third*, the structure of the EPC Contract will impact the cost overrun facility. Currently, market trends demonstrate that non-state-owned enterprises are not offering lump sum turnkey contracts. The degree to which the EPC Contract deviates from a turnkey contract will drive the discussion the structure and sizing of the cost overrun facility.

Because of the possibility of developing a FOAK reactor in the State of Arkansas, which would be at a higher risk of cost and schedule overruns, we consider this to be a “High State Resource Input” form of financial support for the project. The scope and size of such facility, and the State’s ability to provide such support, would depend on the economic conditions in the State at the time, and the characteristics of the specific project under consideration. In addition, to the extent that the State selects a more proven, de-risked technology, with a project schedule that allows for the transfer of lessons learned from a U.S.-based reference plant, the amount of the cost overrun facility could, in theory, be reduced.

4.5.5 Case Study: California Infrastructure and Economic Development Bank

If the State of Arkansas is considering putting significant state resources into developing a nuclear program, one option is to follow the model provided by the state of California. California established the Infrastructure and Economic Development Bank in 1994 to “to finance public infrastructure and private development that promote a healthy climate for jobs, contribute to a strong economy and improve the quality of life in California communities.”²⁷

The Development Bank has the authority to provide numerous financial products to qualifying projects, including the ability to issue tax-exempt and taxable revenue bonds, direct financing, credit enhancement, and real estate acquisitions and leases. Specifically, the Development Bank has developed “Climate Incentive Bridge Loans,” which provide bridge financing to private borrowers who have qualified for certain other incentives, such as utility

²⁷ <https://www.ibank.ca.gov/about/about-ibank/>.

and state agency rebates, federal clean energy tax credits, and/or reimbursable grant funds, but which are incurring immediate costs prior to receipt of such incentives. The bridge loans can be used for pre-development, land acquisition, construction, working capital, equipment, materials, facilities, startup costs, and inventory, and typically are provided for a 24-month term, extendable at the Development Bank’s discretion. These bridge loans range from range from \$1 million to \$30 million, with maximums up to \$100 million for particularly high-impact, creditworthy opportunities. Loans are subject to a 1% origination fee and a repayment date will be no more than three months following the anticipated receipt of the incentive payment by the borrower.²⁸

The State of Arkansas could consider establishing a fund from which limited, targeted bridge financing could be provided for qualified projects to cover certain engineering or pre-construction costs. This would help project Sponsors to weather the “valley of death” between FID and Financial Close when development costs are high, but project debt is not yet available.

We recognize that California’s economy is much larger than that of Arkansas; consequently, the State of Arkansas would not have similar resources available to support nuclear initiatives in the State. However, the California example is included for reference purposes.

4.5.6 Case Study: Texas Advanced Nuclear Energy Office

If the State of Arkansas wishes to allocate significant financial resources towards a front-end capital support model for the nuclear industry’s development in the State, it could follow the model established by the state of Texas. In mid-2025, Texas state legislature²⁹ enacted a multi-prong initiative to signal its broad support for the nuclear industry, including a state-based coordinating agency and a dedicated fund to finance reactor development, in addition to workforce training initiatives and a streamlined permitting regime.

First, Governor Abbott signed House Bill 14 into law in June 2025, establishing the Texas Advanced Nuclear Energy Office (“TANEO”) within the Office of the Governor and the Texas Advanced Nuclear Development Fund (“TANDF”). TANEO is tasked with advising on opportunities to eliminate regulatory and financial barriers for the industry in the state, including bi-annual reporting.³⁰ TANDF was initially funded with \$350M, with potential increases up to \$2B, with grants, loans, and other financial support for eligible project costs including:³¹

1. *Project Development and Supply Chain Reimbursement Program*: For initial development costs for companies that have submitted an early site permit, construction permit or combined license (including technology development, feasibility and environmental studies, site planning and infrastructure expansion);
 - a. Any grant may not exceed more than 50% of the project’s qualifying expenses, or \$12.5 million.
2. *Advanced Nuclear Construction Reimbursement Program*: Construction-related expenses such as fabrication, installation, inspection and testing for projects already under review by the NRC); and
 - a. Any grant may not exceed more than 50% of qualifying expenses or \$120 million. If an application is accepted, the money would be disbursed on a rolling basis for expenses as they arise.
3. *Interconnected Reactors*: For operations expenses.

²⁸ <https://www.ibank.ca.gov/climate-financing/climate-incentive-bridge-loans/>.

²⁹ Governor Abbott signed HB 14, SB 1535 and SB 1061 into law in June 2025 and each took effect on September 1, 2025.

³⁰ <https://www.pillsburylaw.com/en/news-and-insights/texas-america-nuclear-energy.html>,

³¹ <https://texasscorecard.com/state/texas-to-launch-advanced-nuclear-energy-office/>; <https://gov.texas.gov/news/post/governor-abbott-taneo-boost-advanced-nuclear-construction>.

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- a. Any grant is given based on a per-MW basis according to the generation capacity for the nuclear plant in question.

Other funding is earmarked for broader research and development programs, as well as secondary school and higher education programs to support the development of a workforce for specialized welding, radiological control, reactor operators, and nuclear, electrical, chemical, civil, and environmental engineering.³² Applications for funding under the TNADF were due by May 14, 2026,³³ so more details on the application process, criteria, and the ultimately selected entities will become available in the coming months.

Similar to California, Texas is an example of a well-resourced state providing tremendous support behind the nuclear industry. However, given the pragmatic realities of budgetary constraints, the other areas needing State support in Arkansas, and the availability of other financing options mentioned in this Report, we understand that the State of Arkansas may not dedicate such significant resources towards these capital intensive-means listed above. Other options are presented in more detail in the sections below.

4.6 FINANCING OPTIONS – MEDIUM STATE RESOURCE INPUT

In addition to the “High State Resource Input” options provided above, there are numerous financial support products that are available from State, Federal, and third-party sources that require fewer front-end state resources. As noted above, the following descriptions are high-level summaries of a select few of the numerous potentially available sources of financial support for nuclear projects, many of which can be used in combination to provide a comprehensive financial foundation for a successful nuclear-powered facility in the State of Arkansas.

4.6.1 Supply Chain: Involvement of Foreign Export Credit Agencies

Given the aforementioned challenges for NPP financing, Export Credit Agencies (“ECAs”) have been viewed as an important, viable option for NPP financing.³⁴ ECAs are sovereign or quasi-sovereign entities, tasked with promoting exports from the ECA’s country. ECA financing is tied to the amount of national content that originates from the exporting country. Depending on the ECA, they can provide direct loans, loan guarantees, insurance, and equity loans. Because of the sovereign quality of the ECAs, ECA debt is generally considered to be cheaper than commercial bank debt, in terms of the interest rate on the loans.

Often, ECAs have a stabilizing effect on the overall financing structure of the project. This “halo effect” encourages additional participation by other financing entities, who take comfort from the presence of the ECAs. This comfort comes from the belief that, if problems under the financing were to occur, such disputes would be resolved substantively at a sovereign-to-sovereign level (recognizing that ECA debt most often requires a sovereign guarantee from the borrowing country for large, complex financing, as would be the case with an NPP). This comfort also comes from the level of diligence (i.e., rigor) that ECAs undertake in support of the financing, prior to Financial Close – again, facilitated by the sovereign engagement involved.

Also, because of this sovereign quality and export promotion mission, ECAs might be willing to undertake riskier projects than what the commercial bank debt market might otherwise support. Whether the ECAs take a “go it

³² <https://texasscorecard.com/state/texas-to-launch-advanced-nuclear-energy-office/>.

³³ <https://gov.texas.gov/news/post/governor-abbott-taneo-boost-advanced-nuclear-construction>.

³⁴ Demonstrated most recently for the Barakah NPP. <https://www.world-nuclear-news.org/Articles/Refinancing-of-Barakah-classed-as-green-loan>.

alone” approach or a leadership role that then attracts commercial bank and other multilateral debt, ECA financing can have a determinative impact on the viability of the project in question.

With regard to ECA financing, the Organization for Economic Cooperation and Development (“OECD”) has established the Arrangement on Guidelines for Officially Supported Export Credits (the “Rules”) for OECD Member States, which includes the United States.

As stated by the OECD:

The main purpose of the Arrangement on Guidelines for Officially Supported Export Credits is to provide the institutional framework for an orderly market for officially supported export credits. The Arrangement, therefore, seeks to prevent an export credit race in which exporters compete on the basis of which are granted the favorable financing terms or "subsidy" from their respective governments; instead, it seeks to encourage competition on the basis of which exporter provides the highest quality and the best service at a competitive price.

Official support can take the form of direct credits/financing, refinancing, interest rate support, aid financing (credits and grants), export credit insurance and guarantees.

Minimum interest rates for official financing support (direct credits/financing, refinancing or interest rate support) by the Participants are Commercial Interest Reference Rates (CIRRs); CIRRs have been established for 13 currencies, the majority of which are based on either the 5-year Government bond yields or on 3, 5 and 7 year bond yields, according to the length of the repayment period. The Arrangement provides for a choice for Participants to select the basis for their own CIRR.

Annex 2 of the Rules is the Sector Understanding for Nuclear Power Plants, which includes the application Special Commercial Interest Reference Rates. Recent updates to the Rules now allow for a loan repayment period for NPPs of 22 years (from COD, plus a 6-month grace period after COD, if requested) and the financing of local costs of 50% of the national content amount.

Examples of relevant ECAs include the following:

- The Export-Import Bank of the United States (“EXIM”). EXIM has numerous initiatives designed to support American jobs by facilitating the export of U.S. goods and services, including the Engineering Multiplier Program.³⁵ Although EXIM is focused on investment in foreign projects that use U.S. materials, other ECAs may have similar programs that can be tapped for investment in the U.S. and in Arkansas specifically. EXIM also has a “Make More in America” initiative, which extends the bank’s existing medium- and long-term loans, loan guarantees, and insurance to export-oriented domestic manufacturing projects.³⁶ This could be a significant source of federal support that fills the gap in a

³⁵ The EMP will finance feasibility studies, pre-construction design, engineering, architectural and environmental services undertaken prior to commencement of the implementation phase of a physical project, supporting the award of major equipment supply and construction contracts and development of technical and environmental and social information that required to facilitate EXIM’s future consideration of requests to support the implementation of foreign projects. <https://www.exim.gov/solutions/loan-guarantee/emp>. See also <https://www.exim.gov/policies/exim-support-for-nuclear-sector-transactions>.

³⁶ Transaction eligibility will be determined by the “export nexus” – the percentage of production or shipments tied to exports (requiring 25% of output exported or expected to be exported) – and U.S. job support (as a substitute for the traditional U.S. content requirement for transactions to foreign buyers), among other factors. <https://www.exim.gov/about/special-initiatives/make-more-in-america-initiative>.

potential energy-intensive industrial hub with manufacturing facilities co-located with low-carbon baseload nuclear power.

- The Japan Bank for International Cooperation (“**JBIC**”). JBIC provides debt financing, equity investment, and guarantees to support Japanese companies’ development abroad, including for companies like Toshiba, Mitsubishi Heavy Industries, and Hitachi with nuclear industry involvement. See [Section 4.7.9](#) for more discussion of potential Japanese partnerships.
- The government of South Korea-supported Korea Trade Insurance Corporation (“**K-Sure**”) and the Export-Import Bank of Korea (“**KEXIM**”). These entities provide a range of products, including insurance, debt, equity investments, and guarantees. These entities signed agreements with Holtec International, an American supplier of equipment and systems for the energy industry, and Hyundai Engineering & Construction, a South Korean engineering and construction company, to provide support for Holtec’s Small Modular Reactor projects globally.³⁷

Note that ECA debt most often requires a sovereign guarantee from the borrowing country for large, complex financing, as would be the case with an NPP.

4.6.2 Capital Markets: Issuance of Green/Revenue Bonds for Specific Project

A “revenue bond” is a bond issued by a government, financial institution, or project sponsor for purchase in the capital markets, to fund a specific project or portfolio of projects, with repayment of such bonds occurring at a certain time period with the revenues generated from the relevant project. A “green bond” follows the same mechanics, but is focused on specific types of projects with certain environmental or decarbonization attributes. A bond is designed as “green” if it complies with certain principles, for example, the Green Bond Principles, which are voluntary guidelines created by the International Capital Market Association (“**ICMA**”)³⁸ to promote transparency and integrity in the green bond market.

To date, corporate issuances of green bonds with a nuclear focus have not been used to finance new reactors, although more recent issuances (e.g., new rounds by Bruce Power, discussed below) have identified nuclear newbuild as a possible use case for bond proceeds. However, given investor appetite in these issuances, it is worth considering how such techniques could be applied to new NPPs, especially under a targeted refinancing after COD.

A bond issuance could be led by a private third party, such as a financial institution interested in partnering with the State and a Sponsor to add a nuclear project in the region to its portfolio, or by a Sponsor who would use the funds for expenses during the development and construction phases.

³⁷ <https://holtecinternational.com/holtec-and-hyundai-engineering-construction-company-sign-agreements/>.

³⁸ ICMA is a self-regulatory organization and trade association for participants in capital markets. ICMA offers four types of sustainability-related bonds that allow issuers to raise capital for qualifying projects:

(1) Green Bonds: any type of bond instrument where the proceeds will be exclusively applied to finance new and/or existing eligible Green Bonds.

(2) Social Bonds: any type of bond instrument applied to finance new and/or existing eligible Social Projects.

(3) Sustainability Bonds: any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance a combination of both Green and Social Projects.

(4) Sustainability-Linked Bonds: any type of bond instrument for which the characteristics can vary depending on whether the issuer achieved predefined sustainability or ESG objectives.

<https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/green-bond-principles-gbp/>.

The State of Arkansas could also consider issuing bonds directly to provide the capital needed to support development and construction costs for one or more NPPs.³⁹ Funds raised from such bond issuance could then be used to provide the capital for a state-issued bridge loan, or other support. The State of Arkansas' current credit rating⁴⁰ could support favorable pricing on a normal bond issuance.

Several examples are provided below that detail how certain entities have used funds from the capital markets to finance their nuclear projects. Critical aspects of this approach are: (a) compliance with an external standard and/or validation by an external rating agency; and (b) the creditworthiness of the issuer.

4.6.2.1 Constellation Energy (United States)

On March 18, 2024, Constellation Energy, a publicly traded company, issued the first green bond in the U.S. specifically designated for use with expenses related to nuclear energy projects. Constellation will use proceeds from the \$900M, 30-year term offering for investments such as maintenance, expansion and life extensions of certain units of its nuclear fleet, which currently stands at 21 reactors.

Crédit Agricole CIB, the corporate and investment banking arm of Crédit Agricole Group, served as Green Structuring agent in Constellation's nuclear green bond offering. The firm Sustainalytics verified the environmental benefits of Constellation's framework and its alignment with the Green Bond Principles. Compliance with these voluntary guidelines for issuing or borrowing green financing instruments supported a "green" label for Constellation's bond issuance.

4.6.2.2 Bruce Power (Canada)

In 2021, Bruce Power, Canada's only private sector nuclear power generator, issued C\$500M in green bonds, marking a global first for nuclear power. BMO Capital Markets and TD Securities acted as co-lead green structuring agents for the bonds. The seven-year bonds were offered on a private placement basis to certain credited investors in each of the provinces of Canada. The offering was done through a syndicate of agents, co-led by BMO Capital Markets, HSBC, and TD Securities.⁴¹

The issued Green Bonds were in alignment with the ICMA Green Bond Principles.⁴² The bonds qualified under the Green Bond Principles because the use of proceeds was to finance investments associated with life extensions and increasing the outputs of Bruce Power's existing six (of eight) nuclear units. Investments include component replacement, refurbishment and maintenance aimed at increasing the units' operational life span and improving/maintaining operational safety. Beyond qualifying as a "green bond", which is itself significant for

³⁹ A bond issuance of the size needed would likely occur at the state level, not the municipality level. There are twelve community utilities in the State of Arkansas – Jonesboro, Benton, Bentonville, Conway, Siloam Springs, Osceola, Clarksville, Prescott, Hope, North Little Rock, West Memphis, and Paragould. The likelihood of a municipality-issued bond issuance would depend on the specific municipality, their credit rating, and the scope of their legally permitted financial commitments.

⁴⁰ As of Summer 2025, S&P raised its long-term rating on state general obligation bonds to AA+ and affirmed the state's stable outlook. Moody's affirmed Arkansas' Aa1 issuer rating. https://governor.arkansas.gov/news_post/arkansas-credit-rating-rises-under-gov-sanders-leadership/#:~:text=S&P%20raises%20to%20AA+%2C%20highest,the%20State%20to%20issue%20bonds.

⁴¹ <https://www.globenewswire.com/news-release/2021/11/22/2339115/0/en/Bruce-Power-announces-500-million-issuance-of-first-Green-Bond-globally-for-nuclear-power.html>.

⁴² <https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/green-bond-principles-gbp/>.

the nuclear industry, other items are particularly noteworthy, including that market demand for the bond exceeded supply by a factor of about six.⁴³

Bruce Power announced an additional C\$950M in green bonds in December 2025, bringing its total issuance to C\$3.3B through five offerings.⁴⁴

4.6.2.3 Ontario Power Generation (Canada)

Ontario is home to the first grid-scale SMR under construction in the G7, as well as three nuclear generating stations, with a track record of delivering multiple large-scale refurbishments on time and on budget.⁴⁵ Ontario Power Generation (“OPG”) is the largest Canadian corporate issuer of green bonds, with more than \$5.6B in bonds issued as of March 2025.⁴⁶ Their bespoke [Sustainable Finance Framework](#), last updated in June 2024, permits funding of a broad range of clean energy technologies, including new nuclear projects, both SMRs and large-scale reactors, in addition to maintenance or refurbishment of existing facilities.⁴⁷

In 2022 OPG issued a C\$300M green bond, its first specially focused on nuclear power, with proceeds dedicated to the refurbishment of the Darlington reactor.⁴⁸ The bonds were offered as part of OPG’s medium term notes series in each of the provinces of Canada, through a syndicate of agents co-led by BMO Capital Markets and CIBC World Markets as Lead Agents and Joint Bookrunners. It was well received by the market despite Bank of Canada rate hike of 100bps and was oversubscribed 5.8x.⁴⁹

In June 2024, OPG issued C\$1B of bonds under its Sustainable Finance Framework, which permitted proceeds allocation to a broad scope of energy-related projects, including new nuclear, as well as existing fleet maintenance.⁵⁰

Other jurisdictions with successful green bond programs for nuclear projects include Canada (federally⁵¹), EDF (France),⁵² and TVO (Finland).⁵³

4.6.3 State Dispatch Strategies: State Removal of Unfavorable Market Dispatch Adjustments

⁴³ <https://www.reutersevents.com/nuclear/bruce-power-bond-success-good-news-nuclear>. Approximately 60 Canadian investors purchased the bonds across multiple provinces. Demand for the debt call prompted an increase in interest from different banks and other stakeholders, says Co-Founder and Managing Partner of Cicero Shades of Green, Christa Clapp.

“The fact that it was six times subscribed tells you that there is money floating around capital markets that needs a direction, and a green label helps provide that direction,” Clapp says.

⁴⁴ <https://www.brucepower.com/2025/12/09/bruce-power-announces-the-issue-of-an-additional-950-million-in-green-bonds-as-it-powers-ontarios-clean-energy-future/>.

⁴⁵ <https://news.ontario.ca/en/release/1006888/ontario-and-new-york-sign-agreement-to-build-nuclear-energy-and-grow-economies>.

⁴⁶ <https://www.opg.com/news-resources/newsroom/release/opg-issues-1-billion-in-green-bonds-and-welcomes-cedar-leaf-capital-to-its-dealer-syndicate/>.

⁴⁷ <https://www.opg.com/releases/opg-releases-sustainable-finance-framework/>.

⁴⁸ <https://www.opg.com/releases/opg-issues-inaugural-nuclear-green-bond/>.

⁴⁹ <https://www.opg.com/releases/opg-issues-inaugural-nuclear-green-bond/>.

⁵⁰ <https://www.opg.com/news-resources/newsroom/release/opg-issues-first-bonds-under-sustainable-finance-framework/>.

⁵¹ <https://www.canada.ca/en/departement-finance/programmes/financial-sector-policy/securities/debt-program/canadas-green-bond-program.html>.

⁵² <https://markets.ft.com/data/announce/detail?dockey=1330-1000901623en-5OVLSIJPS6B61HJC36FKNO6EK4>

⁵³ <https://www.bloomberg.com/news/articles/2025-09-08/finnish-nuclear-firm-tests-eu-green-bond-gold-standard-with-sale?embedded-checkout=true>.

Certain financial support mechanisms are not capital-intensive. The reduction or removal of industry and market barriers to revenue sources is also a bankability element. Simply put, investors do not want to be exposed to market or merchant risk. Considering (i) the lengthy development and construction period before a NPP begins generating revenue, and (ii) that a nuclear power plant is baseload asset that should not be turned on and off, investors want to know that, if the plant is running, it is running at full output, and all the electricity is being sold at a favorable price, to reach the target rate of return established in the financial model.

Market risk is problematic for investors, recognizing that renewable energy platforms are often subsidized and receive dispatch preferences, which, in turn, destroy the economics for the nuclear power plants. These lessons learned are demonstrated in the U.S., where every NPP ever built was built in a regulated market. As certain markets were deregulated, nuclear plants struggled to survive, with the combination of renewables (subsidies, dispatch preferences) and cheap natural gas.

To the extent that the APSC has or plans to issue rates or rules regarding pricing or dispatch based on power generation source that negatively impacts nuclear power, such rates and rules should be reevaluated and ideally removed to ensure that there is an even market for power generation in the State.

4.6.4 Tax: Approval of Ratepayer Fees for Cost Recovery Prior to Commercial Operation

Another option for the State of Arkansas to consider is the pass through of certain costs and expenses for a nuclear project on to the ultimate consumer – the ratepayer. Traditionally, vertically integrated utilities in regulated markets both build and operate power plants and distribute electricity to their consumers. They make their profits based on collecting a return on their investments at a specified rate that is fixed by the state’s commission and paid by the ratepayers in their monthly utility bills. As of March 2026, the State of Arkansas has the advantage of a fairly low existing electricity price (9.74 cents/kWh) compared to its peers⁵⁴ and the national average (14.18 cents/kWh),⁵⁵ potentially creating an opportunity for modest increases to support nuclear infrastructure expansion.

The federal government has specifically endorsed this approach for energy infrastructure such as transmission lines. In 2006, Federal Energy Regulatory Commission (“FERC”) issued Order No. 679, which allowed utilities to apply for and include 100% of construction-work-in-progress (“CWIP”) in their rate base for transmission projects that meet certain criteria.⁵⁶ This “CWIP Incentive” was designed to promote cost-effective transmission development by reducing cash flow challenges caused by long lead times and large capital commitments. Per traditional electric ratemaking principles, project costs, including financing, are usually only recoverable through rates once an asset enters service and is “used and useful.” However, given the specific characteristics of electric transmission, FERC tailored the CWIP Incentive as an exception to this principle to benefit both customers and transmission developers by improving cash flows, stabilizing rates, and ultimately lowering costs to customers.

The State of Arkansas can, and likely should, use some form of cost recovery from ratepayers to offset the costs of the expensive development and construction phases, and indeed the State legislature has begun these steps. In 2025, Senate Bill 307, the “Generating Arkansas Jobs Act” was signed into law in Arkansas, seeking to increase electricity production by allowing power companies to charge customers higher rates to cover their costs of capital

⁵⁴ Oklahoma – 8.93 cents/kWh; Tennessee – 12.76 cents/kWh; Alabama – 12.62 cents/kWh; Louisiana – 10.55 cents/kWh; Mississippi – 12.46 cents/kWh. EIA Electric Power Monthly; Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector, by State, March 2026 and 2025 (Cents per Kilowatthour).

⁵⁵ https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

⁵⁶ https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

⁵⁶ <https://www.ferc.gov/incentives/transmission-incentives>.

improvements.⁵⁷ This facilitates a utility's ability to pass through costs to ratepayers, and lessened the administrative burden previously imposed by the APSC to approve such rate hikes.⁵⁸

However, the State would be wise to consider the reputational and affordability lessons learned from Georgia's Vogtle Units 3 & 4 discussed in more detail in [Section 4.6.6](#) below to temper the scope and duration of rate hikes associated with any specific project, especially in communities that are least able to absorb price increases.

In addition to cost and schedule overruns, ratepayer-supported nuclear projects have been subject to mismanagement concerns due to fraud and waste, as seen in South Carolina and Florida. In South Carolina, the former SCANA Corporation's CEO and Board Chairman was sentenced to two years in federal prison for intentionally defrauding ratepayers while overseeing and managing SCANA's operations, including the construction of two reactors at the V.C. Summer Nuclear Station in South Carolina, so the company could obtain and retain rate increases imposed on its rate-paying customers and qualify for up to \$2.2 billion in tax credits.⁵⁹

In Florida, the North Carolina-based utility Duke Energy proposed to construct two 1,100 MW nuclear units in Levy County, at an expected cost of \$14B.⁶⁰ In 2008, Duke Energy began collecting recovery fees permitted under Florida's law, and accumulated more than \$1.2B in ratepayer-funded cost recovery.⁶¹ Due to various delays and regulatory uncertainty, Duke scrapped the project and terminated the EPC Agreement in August 2013. Duke Energy continued to file for cost recovery through 2017 for the costs incurred at the terminated plant,⁶² but ultimately absorbed \$150M in fees before confirming that the project would be fully terminated.⁶³

While fraud, waste, and other mismanagement risks are not industry-specific, ratepayers may be understandably sensitive to significant cost burdens due to these scandals and fiscal responsibility sentiment, and receptive officials may push for greater regulatory oversight and caps on a utility's ability to pass through costs.

4.6.5 Capacity Payments

When nuclear power plants operate in formal electricity markets, the primary source of revenue is from sales into the day-ahead spot market. In some of these markets, the annual average price in the market is too low to support some generating assets, such as NPPs. To resolve this situation, one approach has been to add capacity markets that operate side-by-side with the electricity spot markets. The capacity markets set a level of reliable capacity required in the market/system, then undertake a procurement auction to purchase that capacity. The winning

⁵⁷ https://arktimes.com/arkansas-blog/2025/03/18/house-passes-bill-to-give-windfall-to-utilities-raise-consumer-rates#:~:text=The%20bill%20will:%20*%20Allow%20power%20companies,their%20investments%20offer%20customers%20nothing%20of%20value.

⁵⁸ Finding that "The bill gives the Public Service Commission almost no way to reject a request to pass these costs to consumers unless there was outright fraud or other illegal activity on the part of the utility." https://arktimes.com/arkansas-blog/2025/03/18/house-passes-bill-to-give-windfall-to-utilities-raise-consumer-rates#:~:text=The%20bill%20will:%20*%20Allow%20power%20companies,their%20investments%20offer%20customers%20nothing%20of%20value.

⁵⁹ See U.S. Attorney's Office, District of South Carolina, *Former SCANA CEO Sentenced to Two Years for Defrauding Ratepayers in Connection with Failed Nuclear Construction Project*, 2021, available at: <https://www.justice.gov/usao-sc/pr/former-scana-ceo-sentenced-two-years-defrauding-ratepayers-connection-failed-nuclear>.

⁶⁰ <https://www.enr.com/articles/11999-duke-energy-cancels-24-7b-florida-nuke-plant-project>.

⁶¹ <https://apnews.com/general-news-1aafbb61fb4d43479e56a2309c413f31>.

⁶² In May 2017, Duke Energy submitted a filing with the Florida Public Service Commission to recover \$82M for investments at the proposed nuclear plant in Levy County, which is estimated to be \$2.51 per 1,000 kWh for residential customers. At the time, the company was not actively building, but officials continue to regard the site in Levy County as a viable option for future nuclear generation. <https://news.duke-energy.com/releases/releases-20170501>.

⁶³ <https://news.duke-energy.com/releases/duke-energy-florida-files-settlement-agreement-for-building-a-smarter-energy-future>.

participants in these capacity auctions will receive a separate stream of payments for providing capacity, separate from, and in addition to, the revenue earned the capacity market participants in the electricity spot market.

The details of these auctions vary, but they offer a way to provide additional revenue to support nuclear power plant financial viability. To the extent that these capacity markets have a history of robust prices and some certainty that the capacity markets will continue into the future, capacity market payments will help support the development of new private nuclear power projects.

4.6.6 Case Study: Georgia Nuclear Construction Cost Recovery Tariff for Financing Construction of Vogtle 3/4

The construction of the Vogtle Units 3 & 4 in Burke County, Georgia is a well-studied example for more recent nuclear power plant development in the United States. There are many lessons that can be learned from its example. The reactors were originally projected to cost \$14B and be completed by 2017. Ultimately, Vogtle Units 3 & 4 took fifteen years to build and cost \$36.8B, more than twice the projected timeline and cost.⁶⁴

In 2009, the Georgia Nuclear Energy Financing Act provided that a utility “shall recover from its customers . . . the costs of financing associated with the construction of a nuclear generating plant which has been certified by the commission . . . [which] financing costs shall be recovered from each customer through a separate rate tariff.”⁶⁵ The Georgia Public Service Commission (the “GPSC”) approved the Nuclear Construction Cost Recovery tariff, which allowed utilities to recover certain costs of the plant construction. The intent of the tariff was to allow the company collect costs upfront from ratepayers to finance construction and avoid a “rate shock” by phasing in costs over time as the plants were built; however, with increased costs spanning a longer timeline, Georgia Power ratepayers faced increasingly larger utility bills for a longer period.

More than \$1.2B was collected in advance from residential and small business customers to pay for the financing costs and taxes.⁶⁶ Rate increases were authorized as late as 2023, when the GPSC unanimously approving an additional 6% rate increase to pay for \$7.56B in remaining costs at the facility.⁶⁷ These resulted in a rate increase of approximately 25% overall, the largest in Georgia’s history.⁶⁸ Nearly 190,000 Georgia Power customers were disconnected from service in 2024, allegedly due to the inability to pay their utility bills.⁶⁹

Time and budget overruns are extremely common at all megaprojects, and traditional large-scale nuclear reactors are no different. Although construction timelines and associated costs are expected to be significantly lower for any SMR deployment, the Vogtle plant still remains a cautionary tale for any utility repeatedly increasing their cost overrun burdens on a population with limited ability to absorb such expenditures. The project was ultimately successfully constructed; however, the affordability impact on ratepayers was significant, and it impacted the public’s perception of the industry, the participating corporations, and state regulators.

⁶⁴ https://www.oregonpsr.org/plant_vogtle_the_true_cost_of_nuclear_power_in_the_u_s.

⁶⁵ <https://www.legis.ga.gov/api/legislation/document/20092010/87038>.

⁶⁶ [https://cleanenergy.org/news/consumers-deserve-protections-from-the-rising-costs-of-the-vogtle-nuclear-expansion/#:~:text=Due%20to%20the%20controversial%2C%20anti.of%20just%20over%20\\$6.1%20billion](https://cleanenergy.org/news/consumers-deserve-protections-from-the-rising-costs-of-the-vogtle-nuclear-expansion/#:~:text=Due%20to%20the%20controversial%2C%20anti.of%20just%20over%20$6.1%20billion).

⁶⁷ <https://www.businessinsider.com/georgia-nuclear-reactors-billions-over-budget-years-behind-schedule-2023-12#:~:text=The%20Georgia%20Public%20Service%20Commission%20unanimously%20approved.operation%2C%20projected%20to%20be%20sometime%20in%20March>.

⁶⁸ <https://www.powermag.com/blog/ratepayers-first-the-economic-case-against-nuclears-data-center-dreams/>.

⁶⁹ We note that the report referenced in the article credits the rate-hikes, and therefore the disconnections, to Plant Vogtle construction costs. However, Georgia Power said the disconnections had no correlation to the construction of Vogtle, and that the average number of residential disconnections had not changed significantly in recent years.

<https://www.macon.com/news/environment/article301776774.html#storylink=cpy>.

4.7 FINANCING OPTIONS – LOW STATE RESOURCE INPUT

In addition to the “High-” and “Medium State Resource Input” options provided above, there are additional support sources and financial products that require few, if any, front-end State resources. These largely come from federal direct “front-end” support, federal “back-end” tax incentives, opportunities created by strategic partnerships, and more traditional private sector commercial sources. The following discussion areas may be of particular interest to the State of Arkansas, as they would facilitate the financing of a nuclear project in the State without the expenditure of significant State financial resources, allowing State budgets to be allocated towards other areas of need.

As noted above, the following descriptions are summaries of a select few of the potentially available sources of financial support for nuclear projects, which can be used in tandem with other “High,” “Medium,” and/or “Low” State Resource Input options, which can be used in combination to provide a comprehensive financial foundation for a successful nuclear-powered facility in the State of Arkansas.

4.7.1 Federal Support: Department of Energy

The U.S. Department of Energy (“DOE”) is the primary federal agency with opportunities for direct financial support for individual nuclear projects. The agency has multiple offices with specific mandates, including the \$240M Advanced Reactor Demonstration Program (“ARDP”) launched in May 2020,⁷⁰ with a goal of speeding the demonstration of advanced reactors through cost-shared partnerships with U.S. industry, and the \$13M Advanced Nuclear Energy Licensing Cost-Share Grant Program launched in January 2025 to help industry offset certain licensing costs.⁷¹ Two projects have already been selected to each receive \$80M in ARDP funding – the X-energy Xe-100 reactor at the Dow facility in Seadrift, Texas, and the TerraPower Natrium Reactor in Kemmerer, Wyoming,⁷² which began construction in April 2026 following issuance of a construction permit from the NRC in March.⁷³ DOE has also supported State Energy Financing Institution projects, including advanced nuclear projects, under Title 17 Clean Energy Projects, by providing additional financial support to projects that align federal energy priorities with those of U.S. states.⁷⁴

Perhaps most importantly, as part of the Energy Policy Act of 2005, the U.S. government set aside \$18B for new NPPs, and special tax credit treatment and standby support for regulatory delays. Such loans were to be provided by the Federal Financing Bank, a U.S. Government instrumentality, and guaranteed by DOE. A credit subsidy was to be assessed on each project, factoring in the default risk on the loan. The purpose of the U.S. Loan Guarantee Program was to provide liquidity, with the hope that a new round of NPPs, successfully financed and delivered, would encourage lenders to finance further rounds of NPP development. It was not about risk transfer, as the U.S. Government approached potential projects with a lender mentality, looking at the full commercial risks associated with new NPP development in the United States.

In fact, DOE’s extensive technological due diligence for proposed projects is generally more rigorous than what lending institutions, private equity firms, and infrastructure funds typically commit, due to both technical expertise

⁷⁰ <https://www.energy.gov/ne/articles/us-department-energy-launches-230-million-advanced-reactor-demonstration-program>.

⁷¹ <https://www.energy.gov/ne/articles/us-department-energy-announces-13-million-support-advanced-nuclear-reactor-licensing>.

⁷² <https://www.energy.gov/ne/advanced-reactor-demonstration-projects>.

⁷³ <https://www.terrapower.com/TerraPower-Commences-Construction-on-Americas-First-Utility-Scale-Advanced-Nuclear-Power-Plant>; <https://wyofile.com/wyoming-nuclear-power-plant-receives-federal-approval-for-reactor-construction/>.

⁷⁴ <https://www.energy.gov/lpo/state-energy-financing-institutions-sefi-supported-projects>.

and the resource commitment that the U.S. Government can make to new technologies.⁷⁵ Like with ECAs, loan commitments from DOE are viewed positively by many in the financial community because DOE involvement signals the agency's endorsement by their technical experts, thus reducing perceived technological risk in funding projects. Thus, DOE plays a catalytic role in various industries, jumpstarting selected projects and technologies, supporting projects through vulnerable phases, and later "crowding in" commercial capital.

DOE's nuclear energy projects are generally funded out of the Title 17, Clean Energy Financing program under one of its four categories: innovative energy, innovative supply chain, State Energy Financing Institution, or Energy Infrastructure Reinvestment. From 2005 until recently, as discussed below, DOE implemented the Loan Guarantee Program through the Loan Programs Office ("LPO"), which provided (1) direct loans from U.S. Treasury, backed by a 100% DOE guarantee, or (2) DOE partial guarantees of commercial debt. LPO-guaranteed loans could share a first lien position with other debt on a *pari passu* basis. Most guarantees have been for loans over \$100 million.⁷⁶

In June 2010, DOE awarded Georgia Power (a subsidiary of the Southern Company) conditional loan guarantees of \$3.4B, to cover up to 70% of the then estimated \$5B each for the construction of Vogtle 3 and 4 NPPs in the state of Georgia. At the time, the DOE funding guarantees were to catalyze private sector financing and enable the project to be completed at no cost to the U.S. taxpayer. But with each announcement of delays and cost overruns, the DOE award amount, even with the subsequent increase to \$8.0B (and increased again several years later to ~\$10.0B), dwarfed in comparison to the overall financing to complete the project, which ballooned to over \$30B.⁷⁷ Incidentally, Vogtle is the only NPP newbuild that has proceeded and the only one that procured Loan Guarantees because of the heavily negotiated and conservative terms that were being proposed by DOE for a regulated utility (the other being VC Sumner 2&3 NPP that was abandoned in 2017 following Westinghouse declaring bankruptcy).

4.7.1.1 DOE under the Trump Administration

The current Administration has been supportive of nuclear energy. President Trump signed an executive order in May 2025 that called for the U.S. to "to expedite and promote to the fullest possible extent the production and operation of nuclear energy to provide affordable, reliable, safe, and secure energy to the American people".⁷⁸ This Executive Order encouraged the DOE and the Small Business Administration to prioritize funding of grants, loans, and investment capital.

⁷⁵ [https://nuclearinnovationalliance.org/sites/default/files/2025-01/DOE LPO role in US Nuclear Energy Leadership - January 2025.pdf](https://nuclearinnovationalliance.org/sites/default/files/2025-01/DOE%20LPO%20role%20in%20US%20Nuclear%20Energy%20Leadership%20-%20January%202025.pdf) - :~:text=The LPO's extensive technological due diligence is,helped reduce technological risk in funding projects.

⁷⁶ <https://www.energy.gov/lpo/articles/t17-downloadable-handout-overview>.

⁷⁷ <https://www.powermag.com/wp-content/uploads/2022/01/southern-companys-troubled-vogtle-nuclear-project-january-2022.pdf>

⁷⁸ https://www.whitehouse.gov/presidential-actions/2025/05/reinvigorating-the-nuclear-industrial-base/?utm_source=chatgpt.com.

More recently, DOE has undergone a reorganization, with the former LPO evolving into the Office of Energy Dominance Financing (“OEDF”), with a clear focus on enhancing energy security, maintaining technological leadership (particularly with respect to artificial intelligence), and ensuring an affordable, reliable, and secure domestic energy supply.⁷⁹ The Secretary of Energy Chris Wright has said that the office has significant lending authority, and “by far the biggest use of those dollars will be for nuclear power plants.”⁸⁰ Nuclear is specifically included within the scope of OEDF’s financing project areas, both for new generation facilities and for repowering, or repurposing retired facilities.⁸¹

The One Big Beautiful Bill Act (“OBBBA”), signed into law by President Trump in July 2025, added to the loan guarantee program from the Inflation Reduction Act of 2022 (the “IRA”), and proposed to modify the newly formed OEDF’s scope. An interim final rule went into effect on October 28, 2025, amending DOE’s loan guarantee regulations to expand the definition, criteria, and requirements of certain eligible projects under the loan guarantee program, and included language to implement the OEDF provisions of the OBBBA.⁸² The Interim Final Rule authorizes DOE to guarantee loans of up to \$250B in total principal amount through September 30, 2028.⁸³ OBBBA also provided an additional \$1B in credit subsidy funds for the Energy Dominance Financing Program.⁸⁴ Only 17 comments were submitted to the rulemaking docket by the December 29, 2025 deadline; a final rule has not yet been issued and is not expected for several months after agency review of the submitted comments.⁸⁵

The former LPO and current OEDF program accepts invitations on a rolling basis, beginning with pre-application meetings and discussions, a formal application and review, due diligence consistent with private commercial diligence, then conditional commitment, or term sheet signing, followed by financial close, or execution of the definitive financing documents and conditions precedent to disbursement. The period between application submission through conditional commitment often takes a year or more, based on applicant sophistication and project readiness.⁸⁶

Applicants are encouraged to submit a “Consultation Request” through the [agency website](#).

4.7.1.2 Recent DOE Support of the Nuclear Industry

⁷⁹ <https://www.energy.gov/EDF>.

⁸⁰ <https://www.cnbc.com/2025/11/10/nuclear-power-energy-department-chris-wright-loan-westinghouse-ai-data-center.html>.

⁸¹ <https://www.energy.gov/edf/energy-dominance-financing-program>.

⁸² <https://www.regulations.gov/document/DOE-HQ-2025-0174-0001>.

⁸³ <https://www.govinfo.gov/content/pkg/FR-2025-10-28/pdf/2025-19675.pdf>.

⁸⁴ In addition to the legislative authority to issue loans or loan guarantees within a specified authorization cap, the 1990 Federal Credit Reform Act requires that the credit subsidy of the loan or loan guarantee agreement be recorded in the budget as an obligation and outlay. The credit subsidy is the net present value of the probability of a future default on repayment of the loan (adjusted for any estimated recovery value from the disposition of the project). The credit subsidy is paid at the time of the closing of the loan agreement, either with a federal appropriation earmarked for this purpose or as a fee paid by the borrower. OBBBA rescinded the unused balances of credit subsidy appropriations for a number of OEDF programs, with a new appropriation of \$1 billion of credit subsidy for the restructured Energy Dominance loan guarantee program: https://bipartisanpolicy.org/issue-brief/three-big-ideas-for-modernizing-does-loan-program/#_ftn6. See also <https://www.hklaw.com/en/insights/publications/2025/12/senate-appropriators-release-fiscal-year-2026-energy-funding-bill>.

⁸⁵ <https://www.govinfo.gov/app/details/FR-2025-10-28/2025-19675>.

⁸⁶ <https://www.energy.gov/lpo/application-process>.

Prior to the agency restructuring, nuclear- specific applications to the LPO totaled over \$64B worth of loans by the end of the FY2024.⁸⁷ DOE is continuing to increase its expertise in nuclear financing and is beginning deployment of its nuclear-focused mandate under the Trump Administration.

On October 28, 2025, Cameco Corporation and Brookfield Asset Management entered into a binding term sheet with the U.S. Government, including DOE and the Department of Commerce, to establish a strategic partnership to accelerate the deployment of Westinghouse Electric Company’s nuclear reactor technologies and to “reinvigorate supply chains and the nuclear industrial base.”⁸⁸ The U.S. Government has agreed to an aggregate investment value of at least \$80B and to facilitate the permitting and approvals for new Westinghouse nuclear reactors.

In November 2025, the DOE closed on a \$1B interest-bearing loan to support Constellation Energy’s Crane Clean Energy Center.⁸⁹ The loan will help finance the restart of an 835 MW plant located on the Susquehanna River in Londonderry Township, Pennsylvania. It is the first project to receive a concurrent conditional commitment and financial close under the Trump Administration.⁹⁰

On December 2, 2025, DOE announced the selection of the Tennessee Valley Authority and Holtec Government Services to support early deployments of advanced light-water SMRs, with up to \$400M in federal cost-shared grant funding to each entity to deploy a GE Vernova Hitachi BWRX-300 at the Clinch River Nuclear site in Tennessee and two SMR-300 reactors at the Palisades Nuclear Generating Station site in Covert Township, Michigan.⁹¹

In addition, in February 2026, OEDF closed on \$26.5B in loans to support two wholly owned subsidiaries of Southern Company – Alabama Power and Georgia Power. This loan provides broad support for Southern Company’s power generation fleet, but specifically includes funds for upgrading Vogtle Units 1 and 2, and for planning costs for additional future upgrades at Plant Hatch and Plant Farley.⁹²

Given the significant resources and political support behind the industry at the federal level, the State of Arkansas may want to engage contacts at DOE to signal an interest in receiving federal support for a project in the State.

⁸⁷ <https://nuclearinnovationalliance.org/sites/default/files/2025-01/DOE%20LPO%20role%20in%20US%20Nuclear%20Energy%20Leadership%20-%20January%202025.pdf#:~:text=The%20LPO's%20extensive%20technological%20due%20diligence%20is,helped%20reduce%20technological%20risk%20in%20funding%20projects.>

⁸⁸ [https://www.cameco.com/media/news/united-states-government-brookfield-and-cameco-announce-transformational-partnership.](https://www.cameco.com/media/news/united-states-government-brookfield-and-cameco-announce-transformational-partnership)

⁸⁹ [https://www.constellationenergy.com/newsroom/2025/11/us-government-backs-constellations-plan-to-launch-crane-clean-energy-center-adding-835-mws-of-new-baseload-power-to-the-grid.html.](https://www.constellationenergy.com/newsroom/2025/11/us-government-backs-constellations-plan-to-launch-crane-clean-energy-center-adding-835-mws-of-new-baseload-power-to-the-grid.html)

⁹⁰ [https://www.energy.gov/articles/energy-department-closes-loan-restart-nuclear-power-plant-pennsylvania.](https://www.energy.gov/articles/energy-department-closes-loan-restart-nuclear-power-plant-pennsylvania)

⁹¹ <https://www.energy.gov/articles/energy-department-selects-tva-and-holtec-advance-deployment-us-small-modular-reactors>; [https://fleischmann.house.gov/media/press-releases/energy-and-water-chairman-chuck-fleischmann-applauds-funding-to-deploy-us-small-modular-reactors.](https://fleischmann.house.gov/media/press-releases/energy-and-water-chairman-chuck-fleischmann-applauds-funding-to-deploy-us-small-modular-reactors)

⁹² [https://www.energy.gov/edf/southern-company.](https://www.energy.gov/edf/southern-company)

4.7.2 Federal Tax Credit: 48C Qualifying Advanced Energy Project Credit

The 48C Qualifying Advanced Energy Project Credit was established by the American Recovery and Reinvestment Act of 2009 and subsequently renewed and expanded under the IRA. The 48C credit is a tax credit for investments in advanced energy projects, and was intended to build clean energy supply chains, drive investments, and lower costs in energy communities. The IRA provided \$10B in funding for the expanded 48C program. The Internal Revenue Service allocated approximately \$4B towards projects in 2024 and the remaining approximately \$6B in January 2025, thus depleting the currently available allocated funding. Although funding is not currently available, Congress may choose to renew the program by providing additional funds in the future.⁹³

4.7.3 Federal Tax Incentives: Production Tax Credit & Investment Tax Credit

When considering the financing of an NPP, the sourcing of debt and equity is the focus of the financing effort. However, underlying the financeability of the project is the overall economic viability of the project, which is driven by the sale of electricity from the project, taking into account the cost of the project, as well as any other financial enhancements, such as tax treatment. While tax revenue can be a benefit from the project to the country or state, there is a balance needed between maximizing tax revenue to the locality, and creating tax benefits to promote a successful project and the economic vitality of the region powered by such project's electricity.

The U.S. has several tax laws that support the development of NPPs. Despite the name of the IRA, the Act has significant energy security provisions in the legislation, many of which are applicable to the nuclear sector. In addition, the Creating Helpful Incentives to Produce Semiconductors and Science Act (“CHIPS”), also signed into law in August 2022, includes provisions that are expected be beneficial for the nuclear sector.

The OBBBA modified certain elements of these laws, but largely left the nuclear energy industry-related provisions intact. The following provisions remained with respect to federal tax policies and incentives for the nuclear industry:⁹⁴

- The zero-emission nuclear power production credit under Section 45U of the federal tax code (the “**Nuclear PTC**”), was mostly left unchanged by the OBBBA. This provides a provides a tiered credit, adjusted for inflation, per kWh of electricity produced at a qualified nuclear facility and sold to an unrelated party after 2023 and before 2033.
- The technology-neutral clean electricity production and investment tax credits under Sections 45Y and 48E of the federal tax code (the “**Clean Electricity PTC and ITC**”), remain generally available to new nuclear facilities that “begin construction” prior to 2034 before phasing out over three years, with a new 10% “adder” for nuclear facilities that are located in “nuclear energy communities.”⁹⁵
 - Qualification for the nuclear energy community adder increases a facility’s otherwise applicable PTC rate by 10% (or two percentage points if the facility does not satisfy a separate prevailing wage and apprenticeship standard).⁹⁶

⁹³ <https://www.energy.gov/infrastructure/qualifying-advanced-energy-project-credit-48c-program>.

⁹⁴ <https://www.morganlewis.com/pubs/2025/07/the-impact-of-the-one-big-beautiful-bill-act-on-nuclear-tax-incentives>;

<https://www.sidley.com/en/insights/newsupdates/2025/07/the-one-big-beautiful-bill-act-navigating-the-new-energy-landscape>.

⁹⁵ A “nuclear energy community” is any metropolitan statistical area (MSA) that has, or any time since 2010 has had, 0.17% direct employment related to the advancement of nuclear power, including through a number of proscribed industries, such as advanced nuclear facilities, advanced nuclear power research and development (R&D), and the manufacture or assembly of advanced nuclear facility components. It is anticipated that the Internal Revenue Service and the US Department of Energy will release an approved list of nuclear energy communities, as they have done for other “energy community” designations.

⁹⁶ <https://www.sidley.com/en/insights/newsupdates/2025/07/the-one-big-beautiful-bill-act-navigating-the-new-energy-landscape>.

- The Clean Electricity PTC and ITC begin to sunset in 2034.
- These provisions are now subject to broad “foreign entity of concern” (“**FEOC**”) rules. The OBBBA also prohibits transferring credits to “specified foreign entities.”
 - This includes wide range of persons and entities with ties to China, Russia, North Korea, or Iran—are ineligible to claim both to the Nuclear PTC and the Clean Electricity PTC and ITC. Furthermore, taxpayers not compliant with certain ownership or control restrictions with respect to SFEs are deemed “foreign influenced entities” and are also denied such credits.

Project participants hoping to take advantage of the Nuclear PTC or the Clean Electricity PTC and ITC will need to assess eligibility carefully, including detailed consideration of both taxpayer-level and project-level ownership and capitalization, as well as project-level sourcing, contracting, and documentation. However, the overall takeaway is that policy measures at the national level can be implemented to directly incentivize project development and provide support for overall programmatic and project-specific needs. If the State of Arkansas wishes to consider tax credits within an overall financing strategy, special tax advisory support should be engaged.

4.7.4 State Tax Incentives: State Providing Tax Incentives to Developer

In addition to federal tax benefits, state-level tax incentives can help boost the overall economic profile of a proposed nuclear power plant and serve as a signal to developers of the State’s support of the industry. Although these may be categorized as “Low State Input,” the greater the tax relief provided, the lower the state revenue benefit from the project. By providing tax relief to a project or its developer, the State of Arkansas is foregoing the right to future tax revenue from the operating project. The State must therefore reconcile the inherent tension between its loss of future tax revenues for overall State budgetary purposes, with the benefit of supporting the industry without an upfront capital-intensive investment, and potentially leading to greater local or regional economic opportunities.

4.7.4.1 Traditional Tax Incentives & State-Specific Examples

A state typically collects taxes on a commercial business’ property, income, and certain sales and use, or expenditures, among others.⁹⁷ Arkansas does not collect property tax and instead, a property tax is collected by cities and counties to fund certain local needs.⁹⁸ A state has an opportunity to defer collection of, or to reduce the set percentage on the taxed category for one or more taxable years of the project. Arkansas has many existing tax programs that encourage the siting of certain desired businesses and economic opportunities in the State.⁹⁹

While not solely sufficient to facilitate an NPP, these incentives would incrementally boost the attractiveness of a project. Arkansas has many tax exemptions, credits, and deferment programs already in place, which have the benefit of broad industry applicability and existing in-state management expertise, reducing the expenditure of political capital to amend, or the need for additional in-state or contracted expertise to manage such programs.

For example, there are existing income tax credits incentivizing jobs created in certain areas with average wages above a certain threshold.¹⁰⁰ In addition, Arkansas has exemptions from the standard 6.5% sales and use tax,

⁹⁷ <https://www.dfa.arkansas.gov/office/taxes/other-taxes/tax-credits-special-refunds/business-incentives-and-credits/>.

⁹⁸ <https://www.arkansasedc.com/why-arkansas/business-climate/tax-structure/property-tax#:~:text=The%20State%20of%20Arkansas%20does.all%20real%20and%20personal%20property>.

⁹⁹ <https://www.arkansasedc.com/why-arkansas/business-climate/incentives>.

¹⁰⁰ <https://www.arkansasedc.com/why-arkansas/business-climate/incentives/pages/job-creation-incentives>.

including for electricity sold to manufacturers for use directly in the manufacturing process, ideal for partnerships with the energy-intensive metals and manufacturing industries.¹⁰¹

In addition, payments by businesses to local governments in lieu of property taxes (“**PILOT**”) are negotiated between the locality and the company. Currently, a negotiated PILOT cannot be less than 35% of the property taxes that would have been paid by the entity if the property were on the tax rolls, unless a lesser amount is approved by the Executive Director of the Arkansas Economic Development Commission and the Chief Fiscal Officer of the State of Arkansas.¹⁰²

Arkansas also offers an Equity Investment Incentive Program (the “**EIIP**”), which focuses on technology-based businesses that offer employees above-average wages. Such businesses can offer a 33.3% income tax credit to investors for the amount invested by an equity investment in the eligible business. The income tax credit earned may be used to offset 50% of the investor’s Arkansas income tax liability in any one tax year.¹⁰³ Depending on the ultimate eligibility for the credit, an advanced nuclear facility may qualify, or the State may want to consider revising certain programs to clarify the inclusion of desired technologies.

Local entities could seek to attract investment in a specific region in the state by offering a combination of tax incentives, similar to what has been provided to certain large private-sector investments in the State. For example, in 2025, the city council in West Memphis, Arkansas approved a 30-year PILOT arrangement with Groot LLC, a Google affiliate, which covers the construction of an approximately \$1B, 900,000 sq ft data center, with an option to extend up to \$10bn if the right “economic, business, and market conditions exist.” The Google affiliate was granted a 65% real and personal property tax abatement.¹⁰⁴ The State could provide a similarly robust tax incentive package to attract nuclear developers specifically, or additional industrial development that plans to rely on low-carbon baseload power to operate, kickstarting a comprehensive industrial hub discussed in more detail in [Section 4.7.9](#) below.

Arkansas also has numerous economic development incentives aimed at other industries, such as manufacturing, computer processing, and research and development, among others.¹⁰⁵ These programs could be expanded or clarified to apply more directly to a nuclear developer to encourage the siting of an advanced nuclear reactor, or its planned offtakers and their associated high paying jobs, within a particular region in the State.

4.7.4.2 Zero Emissions Credits

Although not present in Arkansas, some states are using their taxing authority to provide Zero Emissions Credits (“**ZECs**”) to merchant nuclear power plants. Merchant nuclear power plants are deregulated and privately-owned nuclear power plants, a result of state-level electric utility industry restructuring that was linked to U.S. regional electricity market reforms. Starting in 2014, some of these merchant nuclear power plants found that they were losing money by selling power into the formal electricity markets. The closure of the Kewaunee and Vermont Yankee nuclear power plants led to concerns that other nuclear power plants would also close.¹⁰⁶

¹⁰¹ <https://www.arkansasedc.com/why-arkansas/business-climate/tax-structure/sales-and-use-tax>.

¹⁰² <https://www.arkansasedc.com/why-arkansas/business-climate/tax-structure/property-tax>.

¹⁰³ <https://www.arkansasedc.com/why-arkansas/business-climate/incentives/pages/equity-investment-tax-credit>.

¹⁰⁴ “We’re thrilled to confirm plans to build a data center campus in West Memphis, Arkansas,” Laurel Brown, Google’s regional head of data center public affairs, said in a statement. “In partnership with Entergy, our electricity utility provider, Google will cover the full energy costs associated with powering this facility.” <https://www.datacenterdynamics.com/en/news/google-confirmed-to-be-behind-west-memphis-data-center-project-in-arkansas/>.

¹⁰⁵ <https://www.arkansasedc.com/why-arkansas/business-climate/incentives>.

¹⁰⁶ 2014 12, NECG Commentary #4 (<https://nuclear-economics.com/4-nuclear-lessons-from-vermont-yankee-closure/>).

In several states, the nuclear power plants were seen as a key part of the state's electricity system, providing reliability and low wholesale market prices that benefited the state's electricity consumers. These NPPs also produced zero-emission electricity, helped improve air quality, supported stakeholder decarbonization efforts, while providing a significant number of high-salary jobs.

Starting with New York state, several states developed and implemented programs to provide extra revenue to these threatened merchant nuclear power plants through Zero-Emissions Credit payments linked to the value of the zero-emissions nuclear energy generated.¹⁰⁷ Under the New York program, as market prices decrease, the ZEC value increased and vice versa. Other states are considering mirroring such programs, including Ohio and Pennsylvania.¹⁰⁸

As both a safeguard against erosion of existing nuclear capacity in the State and a signal for future State support of the industry moving forward, the State of Arkansas could consider implementing an analogous program; however, opponents have questioned the benefits of distorting wholesale energy markets.

4.7.5 Commercial Involvement: Equity from Project Sponsor

As stated above, nuclear projects, like other large infrastructure projects, face particular financing pressure prior to Financial Close after issuance of the construction license. One common way to plug this financing gap is through the injection of equity from a project Sponsor. A project Sponsor is typically the entity providing both financial resources and strategic planning for the project. It is often synonymous with the developer of the project, but may also be an affiliate of the developer entity, or a separate third party.

A project Sponsor could bring its own capital (often "common equity") and/or raise equity from third party investors such as institutional funds, high-net-worth individuals, or large corporations in exchange for partial ownership, or equity, in the company, often in the form of "preferred equity". Different equity categories have unique risk profiles, voting rights, dividends, and growth potential. Preferred equity holders have a more secure, debt-like position, while common equity holders have the greatest risk, but also potential for returns on their investments.

Investors would be encouraged to purchase equity interests through the potential for a return on investment generated by a share of the stable, long-term cash flow from electricity sales of the project, once it is operational. The comparatively lower fuel and operations costs of a NPP would also be seen as a benefit to investment. Strong governmental support for the project, regulatory certainty, and creditworthy offtakers would all help bolster the attractiveness for the initial equity investments and build investor confidence in the project.

A robust equity stream would provide a direct source for coverage of specified development costs, or could be used as an initial cushion for any cost overruns. The more reputable and sophisticated the Sponsor, and the more attractive the individual project is, the more likely that a Sponsor would be able to raise capital for use at the planned project.

¹⁰⁷ 2018 04, NEI, "Zero-Emission Credits" (www.nei.org/getContentAsset/7f2cb174-e4dc-4fc6-b909-adf3028782b8/8d8ff8d6-b2ae-401b-a63c-f6b108e809d2/zero-emission-credits-201804.pdf?language=en-US&disposition=inline).

¹⁰⁸ <https://kleinmanenergy.upenn.edu/commentary/blog/zero-emissions-credits-an-overview/#:~:text=What%20exactly%20is%20a%20ZEC,their%20own%20economically%20troubled%20reactors>.

Equity investments are considered more flexible than a fixed debt that must be repaid on a specific timeline at pre-determined rates, but the more Sponsor equity injected during the development and construction phases, the more such equity investors will expect to recoup their investment during project operations.

4.7.6 Commercial Involvement: Securing a Power Purchase Agreement with Creditworthy Offtaker

A Power Purchase Agreement (“PPA”) is a form of contract between the power producer and the power purchaser under a series of defined terms and conditions over the duration of the contract term. From a financing perspective, the PPA is the primary source of revenue for the project. It helps to drive the financial model and determine the overall commercial viability of the project. In addition, the commercial provisions of a PPA will also require a suitable rate of return over an extended period embedded in the tariff, absent which private actors will be unwilling to invest in the project.

While certain deregulated jurisdictions restrict the use of PPAs (due to the bilateral and, therefore, non-market elements of the contract), PPAs are a key component driving the commercial relationship between power producers and purchasers / users in a state’s electricity market. Key considerations for a PPA include the following:

- the creditworthiness of the offtaker;
- the tenor of the PPA;
- the rate of the PPA (i.e., the price of electricity);
- the percentage of output from the NPP contracted for sale under the PPA; and
- the flexibility of the PPA (i.e., if the project is late, does the owner lose time under the PPA, or does the tenor of the PPA simply shift?).

A project does not begin receiving revenue under a PPA until the project is in operation and power has been transferred. Therefore, this revenue source does not provide support during the “valley of death,” when development costs are high, but project debt is not yet available, but it is nonetheless critical for attracting later stage commercial investment, and for refinancing.

As discussed in [Section 4.7.10](#) below and in other areas of this Report, a PPA is the documented anchor for a project at a specific location. The creation of energy and industrial hubs are based on the guaranteed production of a set amount of power at a specified location, jumpstarting other investments and economic opportunities in the area. Given the number of creditworthy entities that have already signed PPAs in the State (as listed in [Section 4.4.2](#) above), the growing energy-intensive metals and manufacturing industries in the State, and the extreme demand for certain technology-adjacent industries such as data centers, securing a large PPA with a stable, creditworthy offtaker would be an immensely significant piece of a successful NPP in the State.

4.7.7 Commercial Involvement: Main Debt Facility & Other Private Capital

As discussed elsewhere in this Report, significant project preparation must have been completed and financial resources expended prior to Financial Close on the main debt facility. Financial Close typically occurs shortly after issuance of the construction license, with draws occurring around the time that “first safety concrete” is poured at the site. However, the preparation for Financial Close should begin early in the project development process. While the State does not need to personally expend significant financial or human capital for private investment in a project or the loan application and diligence process, the State will be a critical partner to the key actors, signaling continued institutional and regulatory support.

Historically, there has been little private commercial investment in the nuclear projects, from the sheer lack of available investments in the U.S. in the last 50 years. As a result, many commercial banks did not have robust nuclear desks, with little domestic financing expertise in the industry. However, that is beginning to change with the largest U.S. banks publicly signaling their support for the industry in recent years. In 2023, the Declaration to Triple Nuclear Energy launched at COP28 in Dubai, with the goal of tripling nuclear energy capacity globally by 2050 and inviting international financial institutions to include nuclear energy in their energy lending policies.¹⁰⁹ In 2024, 14 financial institutions, including Bank of America, Citi, Goldman Sachs, and Morgan Stanley, expressed support for growing nuclear power generation and recognized the importance of mobilizing finance and investment for the industry.¹¹⁰ Since then, momentum has been building, albeit slowly, with Morgan Stanley and Goldman Sachs issuing numerous statements on their belief in the industry's expansion,¹¹¹ and Citi partnering with Bulgarian ministry to expand their existing nuclear facilities.¹¹² The consequence of this commercial bank interest is that more options are available to project developers; however, it is also important to recognize that commercial lending terms are still "to be determined."

Private investments in the domestic nuclear industry has instead come from outside of traditional commercial debt.¹¹³ Venture capital firms, private equity funds, and institutional investors have recently supported projects in the industry to meet this financing need, seen through Ares Management's support of X-energy and Terra Talent's support of Kairos Power,¹¹⁴ as well as direct end-user support of project development, as seen through the Google, Amazon, Meta, and Microsoft support of specific projects, each discussed in the Case Studies below in this Section 4.7.

More discussion on debt lenders and equity investors' expectations, diligence process, general financing terms, and challenges are included in [Sections 4.1](#) and [4.2](#) above.

4.7.8 Commercial Involvement: Forward Sale Agreement Across a Portfolio

Another structure for consideration is a Forward Sale Agreement, or an arrangement under which parties enter into a contract to purchase a commodity at a fixed price on a specified date in the future. A Forward Sale Agreement helps developers secure offtakers for a specific project, while purchasers benefit from locking in electricity supply and rates, thus reducing price volatility in the spot market. Unlike Power Purchase Agreements, which, as the name suggests, focus on providing power traditionally from a specified source, a Forward Sale Agreement could be used for purchasing a wide variety of commodities. An example of a power purchase across a broader utility portfolio is provided below. We note that this example is from France, but the principles could be applied domestically.

¹⁰⁹ <https://www.energy.gov/articles/cop28-countries-launch-declaration-triple-nuclear-energy-capacity-2050-recognizing-key>.

¹¹⁰ <https://www.prnewswire.co.uk/news-releases/14-major-global-banks-and-financial-institutions-express-their-support-for-effort-to-triple-nuclear-energy-by-2050-302255614.html>; <https://thehill.com/opinion/energy-environment/5721699-nuclear-power-financing-options/>.

¹¹¹ <https://www.morganstanley.com/insights/articles/nuclear-energy-investment-renaissance-2050>; <https://www.goldmansachs.com/insights/articles/new-nuclear-age-why-the-world-is-rethinking-atomic-power>.

¹¹² <https://www.world-nuclear-news.org/articles/bulgaria-says-citi-to-help-financing-of-new-kozloduy-units>.

¹¹³ <https://www.businessinsider.com/amazon-invests-in-nuclear-for-aws-following-google-and-microsoft-2024-10#:~:text=Citadel's%20founder%20and%20CEO%2C%20Ken%20Griffin%2C%20as,investors%20in%20the%20Series%20C%2D1%20financing%20round>.

¹¹⁴ <https://energynow.com/2024/10/private-equitys-next-bet-on-artificial-intelligence-is-nuclear-energy/#:~:text=Nuclear%20Startups,for%20years%20it's%20been%20overlooked.%E2%80%9D>.

4.7.8.1 Exeltium (France)

In this example, a group of over two dozen French energy-intensive industrial companies entered into a pre-agreed, fixed-price, long-term contract with Électricité de France (“EDF”), the multinational utility. The specially formed project company purchaser, Exeltium,¹¹⁵ was obligated to purchase a fixed amount of power from EDF over a 24-year term, with payment for such power provided upfront. However, as electricity is fungible, the contract intentionally did not specify which nuclear-powered (or non-nuclear) assets in EDF’s existing portfolio could supply such power. Exeltium thus did not share in any nuclear new-build project or development risk, because EDF had the flexibility to determine where the supply originated. In addition, there was never any stipulation in the financing agreements that the upfront funds provided by Exeltium to EDF were to be used exclusively for the construction of the Flamanville NPP, which was then under construction in 2010 and finally connected to the French grid in December 2024.¹¹⁶

EDF and Exeltium initially signed the contract on July 31, 2008, which consisted of a €4B upfront payment and an annually indexed variable price proportional to the operating costs of EDF’s nuclear power plants. However, the onset of the Financial Crisis in the autumn of 2008 and subsequent credit crunch proved challenging to procure the €4B upfront payment in a difficult market. As a result, the project and payment structures were split into two phases:

- Phase 1 – 2010: a first phase to deliver 148 TWh over 24 years for an up-front payment of €1.75B;
- Phase 2 – 2011: a second phase to deliver the remaining 163 TWh over the same 24-year term upon payment of the remaining €2.25B.¹¹⁷

On May 1st, 2010, the first deliveries of Phase I’s 148 TWh were sent out to over one hundred sites of the industrial companies that made up Exeltium. Phase II was launched in 2011, once market conditions improved enough and allowed Exeltium to secure the remainder €2.25B in upfront funding from a consortium of French banks.¹¹⁸

Documenting the entire transaction from start to finish lasted almost 5 years, commencing with the start of negotiation with EDF in 2005; signing a MoU in 2007 for delivery of 311 TWh of electricity supply over 24 years (until 2034); securing European Commission approval on the contractual scheme; and, ultimately, procuring financing in 2010, after which the Consortium was able to supply electricity to its shareholders based on the contract negotiated with EDF.¹¹⁹

Given its existing nuclear fleet in the State of Arkansas, this structure may be of particular interest to Entergy, or other utilities in the state, with opportunities for partnership with a consortium of industrial offtakers and pooling of existing nuclear capacity and planned additional capacity, with redundancy provided by non-nuclear sources. While this would not be limited to utilities with existing operational nuclear assets, having a broader fleet of power generation sources would also provide unique opportunities for capital distribution to support development costs for a proposed facility, including using power sales as potential collateral sources for a Sponsor’s bridge loan or other debt.

¹¹⁵ The project company was a representative of a consortium of French electro-intensive industrial companies in the steel, aluminium, chemical, industrial gas and paper sectors, including: Ahlstrom Munksjö; ArcelorMittal; Air Liquide; Arkema; ArjoWiggins; Eni; Ineos; Linde; Solvay; Rio Tinto; TotalEnergies; and others.

¹¹⁶ <https://www.edf.fr/en/the-edf-group/dedicated-sections/journalists/all-press-releases/update-on-the-flamanville-cpr-the-reactor-produces-its-first-electrons-on-the-national-electricity-grid>.

¹¹⁷ The actual price of the power delivered was never disclosed as it was proprietary to EDF.

¹¹⁸ <https://www.kslaw.com/blog-posts/france-hard-times-electricity-intensive-consumers>.

¹¹⁹ <https://www.exeltium.com/le-projet>.

4.7.9 Strategic Partnerships: U.S. – Japan Trade and Investment Deals

The Trump Administration has made significant strategic commitments with both governments and private entities to boost the development of advanced nuclear technology in the United States. The State of Arkansas could seek to capitalize on these large investment pools by serving as the implementation location for specific projects.

For example, in October 2025, the U.S. Government signed a trade framework with Japan to guarantee a \$550B Japanese investment in exchange for a reduction in tariffs on Japanese goods. The agreement includes significant Japanese investment in energy, with \$332B earmarked for critical energy infrastructure, including AP1000 nuclear plants and SMRs.¹²⁰ Specifically, \$100B is expected to be allocated for SMRs constructed in collaboration with GE Vernova and Hitachi, with Japanese companies Mitsubishi Heavy Industries, Toshiba Group and IHI mentioned as potential participants in energy-specific partnerships between the countries.¹²¹ In March 2026, the U.S. Department of Commerce announced a \$40B energy partnership with Japan to deploy GE Vernova Hitachi BWRX-300 SMRs in Tennessee and Alabama.¹²² Significant investments were also promised in AI infrastructure like data centers and fiber optic cables, general manufacturing, supply chain, and logistics support, showing the strategic importance of these sectors and opportunities for further collaboration.

The Trump Administration has brought the promise of tremendous external investment into the U.S., significantly lowering the investment burden of the federal government and individual private companies to create or expand their existing infrastructure. Arkansas may want to seek out opportunities for siting these nuclear-focused investments in the State, thereby reducing the State-sponsored financing burden. In parallel, as the federal government is likely going to be particularly interested in the success of any project tied to its trade and investment agreement, such project may be able to benefit from greater attention to federal permitting and funding needs.

It is important to recognize that, despite significant investment flowing into the nuclear sector, almost all capital has gone into technology investment, not project investment. Moreover, hyperscaler and data center interest has taken the form of PPAs, not direct project investment, with the exceptions being AWS (see the X-energy – Energy Northwest example) and, most recently Meta (with TerraPower’s projects to be determined). See the case studies described in [Section 4.7.13](#) and [Section 4.7.15](#) below for more detail.

4.7.10 Strategic Partnerships: Creation of Energy & Industrial Hubs

Arkansas does not have to look abroad for significant funds to support local infrastructure. There are opportunities for strategic partnerships with entities with deep, existing ties within the State, and opportunities to concentrate local investment to jumpstart regional industry, employment, and other economic benefits.

For example, the State could seek to identify areas of planned or desired industrial growth, or identify areas that would particularly benefit from additional employment opportunities. Overlaid with siting and technical elements, should specific sites emerge as viable, the State may wish to focus its efforts for an energy and industrial “hub,”

¹²⁰ <https://www.whitehouse.gov/fact-sheets/2025/07/fact-sheet-president-donald-j-trump-secures-unprecedented-u-s-japan-strategic-trade-and-investment-agreement/>; <https://www.hunton.com/insights/legal/us-and-japan-agree-to-trade-framework-on-energy-infrastructure-and-critical-mineral-investments#:~:text=What%20Happened?,The%20Full%20Story>.

¹²¹ [https://www.ans.org/news/2025-11-03/article-7512/japan-looks-to-support-us-nuclear-projects/#:~:text=Following%20a%20meeting%20last%20week,%2C%20Toshiba%20Group%2C%20and%20IHI.](https://www.ans.org/news/2025-11-03/article-7512/japan-looks-to-support-us-nuclear-projects/#:~:text=Following%20a%20meeting%20last%20week,%2C%20Toshiba%20Group%2C%20and%20IHI.;); <https://www.spglobal.com/commodity-insights/en/news-research/latest-news/lng/102825-us-japan-sign-agreement-to-implement-550-bil-investment-in-us-energy-lng-critical-mining#:~:text=A%20fact%20sheet%20released%20Oct,with%20GE%20Vernova%20and%20Hitachi>.

¹²² <https://www.energy.gov/ne/articles/one-year-after-executive-orders-us-nuclear-energy-renaissance-full-swing>.

or an intentionally planned, efficient concentration of energy, industrial, transportation, and other infrastructure. This could efficiently build economically active centers or regions where the cost of such infrastructure is spread out over more entities, lowering economic burdens on each individual actor while concentrating a tax base and a skill-specific workforce. This could take the form of co-location of a staged fleet of SMRs with a planned data center campus, healthcare research institutes, or heavy manufacturing or other energy-intensive industry, supported by a State-sponsored industrial strategy with corresponding incentives. Initial momentum could then serve to attract additional industry to the area, further building out the hub.

To the extent that a group of industrial offtakers could be organized under a PPA structure, such revenue – from the bundling of electricity from the existing fleet – could support SMR project costs. The offtakers would need to value the premium they would pay in exchange for clean, baseload energy, which, in turn, could support committed corporate emission reduction goals (in the case of many tech and artificial intelligence firms), or industrial decarbonization goals (including with respect to export competitiveness into the European Union for specific commodities such as machinery and electrical equipment, pharmaceuticals and chemicals, and various timber/pulp and agricultural products).

With the recent growth in Arkansas' data center industry,¹²³ together with existing industries and corporations, such as Walmart, Tyson Chicken, J.B. Hunt Transport, as well as various healthcare and research-related entities, and energy-intensive industries like metals manufacturing and chemicals extraction and refining,¹²⁴ such entities could be approached to align their planned in-state growth with such a hub, with the added benefit of their potential financial investment in the project, and their further goodwill in the State. As discussed above, having a creditworthy entity involved in the project structuring, offtake, and community engagement would jumpstart and boost the attractiveness of other forms of financing discussed above. In addition, a PPA commitment could involve prepayments for electricity under the PPA, which then could be used as equity during the development and construction phases.¹²⁵

Of course, such a project development strategy would need to be orchestrated at multiple levels, to include the possible creation of a “special economic zone” for the hub. That said, the beauty of SMRs is that the scaling of the generation platform can align better with the addition of industrial offtakers, as such offtakers commit new facilities to the location. In this respect, SMRs are far better suited for scalable industrial hubs than large reactors.

4.7.11 Case Study: DOE Support For Nuclear Plant Restarts

In addition to DOE's support for novel technologies, the Vogtle nuclear plant, and other programs discussed in more detail in [Section 4.6.6](#) and [4.7.1](#) above, the agency has provided significant financial and technical resources to restart retired nuclear power plants.

¹²³ *Arkansas is a Data Center Growth Spot*, <https://www.axios.com/local/nw-arkansas/2025/12/19/arkansas-is-a-data-center-growth-spot>; Avaio Digital Partners announced today a major new data center hub near Little Rock in Pulaski County, Arkansas – AVAIO Digital Leo - that will help accelerate the state's rapidly growing tech sector: <https://www.arkansasedc.com/news-events/newsroom/detail/2026/01/12/avaio-digital-announces-new-large-scale-ai-ready-data-center-and-power-campus-in-little-rock--arkansas>.

¹²⁴ https://www.arkansasedc.com/docs/default-source/data-and-reports/largest-employers-report-2023.pdf?sfvrsn=1fb38d96_1; <https://www.instituteeforenergyresearch.org/regulation/enormous-lithium-discovery-in-arkansas/#:~:text=Exxon%20Mobil%20is%20among%20the%20firms%20investing,Arkansas%2C%20Louisiana%2C%20Texas%2C%20Alabama%2C%20Mississippi%2C%20and%20Florida>; <https://armoneyandpolitics.com/small-state-big-industry-arkansas-home-to-emerging-hot-spots/#:~:text=Arkansas%20is%20an%20emerging%20hot,the%20Port%20of%20Little%20Rock>.

¹²⁵ See the upfront payment approach taken in the Exeltium example in [Section 4.7.8](#) of this Report.

In September 2024 under the then-existing LPO, DOE closed on a \$1.52B loan guarantee to Holtec Palisades to help bring the 800-MW Palisades Nuclear Plant in Covert Township, Michigan back online and upgraded to operate until 2051, subject to U.S. NRC licensing approvals.¹²⁶ The Palisades Nuclear Plant had ceased operations in May 2022 and was the first recommissioning of a retired nuclear power plant in U.S. history. DOE funds were intended to be used for inspections and testing costs, as well as restoration and replacement of existing equipment.¹²⁷ The investment spurred local economic development, with the maintenance of up to 600 high-paying jobs, together with more than 1,000 jobs during the facility's regularly scheduled refueling and maintenance periods every 18 months. The plant was originally intended to reopen in early 2026, but the timeline has slipped.¹²⁸

The Holtec Palisades project demonstrated the follow-on investment impact of DOE involvement. Prior to Holtec Palisades, there were no announced projects to restart retired reactors. Recently thereafter, Microsoft and Constellation Energy announced plans to reopen Three Mile Island Unit 1 and establish the Crane Clean Energy Center centered around the facility.¹²⁹ DOE will support this restart as well, with a \$1B loan to Constellation Energy, announced as the first project to receive a concurrent conditional commitment and financial close under the Trump Administration.¹³⁰ Microsoft and Constellation signed a 20-year PPA to secure the carbon-free power from the plant, with the Crane Clean Energy Center expected to power Microsoft data centers, and create 3,400 direct and indirect jobs and deliver more than \$3B in state and federal tax revenue.¹³¹ Constellation has submitted to FERC that the Crane Clean Energy Center's could begin power delivery to the grid as early as 2027, but waivers would be needed for the transmission line upgrades needed to provide full delivery, which may not be complete until December 2030 or early 2031.¹³²

In addition, in January 2026, the Linn County Board of Supervisors approved a Host Community Agreement with NextEra Energy, an important step in the plan to restart the Duane Arnold Nuclear Plant in Iowa, which closed in 2020 following heavy storm-related damage to the cooling towers.¹³³ This plan is supported by Google, which has entered into a 25-year PPA with NextEra to purchase nearly all of the power from the 615-MW plant, Iowa's only nuclear facility.¹³⁴ Since then, work has progressed toward the plant's restart, which is targeted for the first quarter of 2029.¹³⁵ This site was particularly intriguing for reinvestment as two large data center developments in Cedar Rapids are set to bring a heavy new demand for electrical power.¹³⁶

These investments show that DOE is continuing to prioritize nuclear investments, both in the novel and existing technology space, with a particular interest in co-location with data center and other technology-supporting infrastructure.

¹²⁶ <https://www.energy.gov/lpo/holtec-palisades>.

¹²⁷ <https://www.powermag.com/trump-administration-backs-1-52b-loan-for-palisades-nuclear-restart/>.

¹²⁸ <https://www.michiganpublic.org/environment-climate-change/2026-02-09/regulators-asking-for-more-details-on-palisades-repairs-as-restart-timeline-stretches-on>.

¹²⁹ <https://www.world-nuclear-news.org/articles/constellation-to-restart-three-mile-island-unit-powering-microsoft>; <https://apnews.com/article/three-mile-island-nuclear-power-constellation-microsoft-energy-b36d8ce1b68891e18d165063f57e4c5b>.

¹³⁰ <https://www.energy.gov/articles/energy-department-closes-loan-restart-nuclear-power-plant-pennsylvania>.

¹³¹ <https://www.npr.org/2024/09/20/nx-s1-5120581/three-mile-island-nuclear-power-plant-microsoft-ai>.

¹³² https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20260331-5562&optimized=false; <https://www.world-nuclear-news.org/articles/constellation-seeks-regulators-help-for-2027-plant-restart>.

¹³³ <https://www.ans.org/news/2026-01-08/article-7660/restart-progress-and-a-new-task-force-in-iowa/>.

¹³⁴ <https://newsroom.nexteraenergy.com/NextEra-Energy-and-Google-Announce-New-Collaboration-to-Accelerate-Nuclear-Energy-Deployment-in-the-U-S?l=12>; <https://www.iowapublicradio.org/ipr-news/2026-04-29/what-restarting-the-duane-arnold-power-plant-tells-us-about-nuclear-energy-under-the-trump-administration>.

¹³⁵ <https://www.ans.org/news/2026-01-08/article-7660/restart-progress-and-a-new-task-force-in-iowa/>.

¹³⁶ <https://corridorbusiness.com/nextera-president-says-company-is-very-interested-in-restarting-duane-arnold-nuclear-plant/>.

Even without confirmed DOE support, other nuclear plants have announced plans to restart construction. For example, Brookfield Asset Management recently won the bid to restart construction on the Summer-2 and -3 AP1000 power reactors at the V.C. Summer site in Jenkinsville, South Carolina.¹³⁷ This coincides with a study commissioned by Westinghouse Electric Company finding that the construction phase of the V.C. Summer project can create more than \$7.3 billion of GDP for South Carolina while supporting 7,300 high-paying jobs annually. Once operational, the two AP1000 units would create an additional \$1.6 billion of annual GDP and support more than 2,700 jobs in the state annually over an 80-year lifetime.¹³⁸

4.7.12 Case Study: Google-Kairos Power-TVA Partnership

Many tech companies are directly pursuing nuclear power. With emissions-reduction commitments and a need for reliable baseload power, many of these companies see nuclear as a potential solution to long-term technology-driven energy growth needs.¹³⁹ Google has been particularly active in securing carbon-free electricity, signing a corporate agreement to buy a total of 500 MW of power from six to seven SMRs from Kairos Power, a U.S.-based nuclear developer.¹⁴⁰ Google's commitment sent a demand signal to the market that it was making a long-term investment, giving Kairos the financial and strategic certainty to make costly investments.

In August 2025, Google announced the first deployment of Kairos Power's advanced reactors at the Hermes 2 Plant in Oak Ridge, Tennessee, which broke ground in April 2026.¹⁴¹ Kairos Power signed a PPA with the Tennessee Valley Authority ("TVA"), marking the first purchase of electricity from an advanced GEN IV reactor by a U.S. utility, and funneling 50 MW of nuclear energy on TVA's grid to power Google's data centers in Montgomery County, Tennessee and Jackson County, Alabama. Kairos and Google said the companies "will bear the financial risk" associated with building the FOAK project, while TVA will provide revenue during operations through the PPA.¹⁴² This project provides a useful precedent, not only for a FOAK technology deployment, but also for public-private partnerships among well-resourced technology companies, universities, and local utilities, all with state support.

Google plans to be involved in further development at the site with a goal of re-establishing Oak Ridge as a nuclear innovation hub, with programs developed in partnership with the University of Tennessee and other institutions to grow local workforce talent for high-paying jobs as plant operators and engineers.¹⁴³ The state of Tennessee has allocated significant resources to building its nuclear capacity, including \$60M provided by the Tennessee General Assembly to the state's nuclear development fund, with allocations advised by the Nuclear Energy Advisory Council.¹⁴⁴ Locally, Oak Ridge has provided tax breaks for other industry development, including a

¹³⁷ <https://www.ans.org/news/2025-10-24/article-7493/santee-cooper-opts-to-reboot-summer-reactor-project/#:~:text=The%20board%20of%20directors%20of%20South%20Carolina's,bid%20to%20restart%20construction%20on%20the%20Summer%2D2.>

¹³⁸ <https://info.westinghousenuclear.com/news/new-study-finds-restart-of-v.c.-summer-project-will-support-10000-south-carolina-jobs.>

¹³⁹ <https://www.techtarget.com/whatis/feature/Three-tech-companies-eyeing-nuclear-power-for-AI-energy.>

¹⁴⁰ [https://www.reuters.com/technology/artificial-intelligence/google-buy-power-small-modular-nuclear-reactor-company-kairos-ai-needs-2024-10-14/.](https://www.reuters.com/technology/artificial-intelligence/google-buy-power-small-modular-nuclear-reactor-company-kairos-ai-needs-2024-10-14/)

¹⁴¹ <https://www.kairospower.com/updates/kairos-power-breaks-ground-on-hermes-2-demonstration-plant.>

¹⁴² The company did not disclose the financial terms of the deal. <https://www.cnbc.com/2024/10/14/google-inks-deal-with-nuclear-company-as-data-center-power-demand-surges.html>; <https://www.cnbc.com/2025/08/18/google-kairos-nuclear-smr-tennessee-valley-authority-tva-data-center-ai.html>.

¹⁴³ [https://blog.google/outreach-initiatives/sustainability/google-first-advanced-nuclear-reactor-project-with-kairos-power-and-tennessee-valley-authority/.](https://blog.google/outreach-initiatives/sustainability/google-first-advanced-nuclear-reactor-project-with-kairos-power-and-tennessee-valley-authority/)

¹⁴⁴ [https://www.knoxnews.com/story/news/environment/2024/12/26/2024-was-huge-for-east-tennessee-nuclear-industry-in-oak-ridge-beyond/76336168007/.](https://www.knoxnews.com/story/news/environment/2024/12/26/2024-was-huge-for-east-tennessee-nuclear-industry-in-oak-ridge-beyond/76336168007/)

sales and use tax exemption for Orano’s \$4.5B uranium enrichment facility in Oak Ridge, with other PILOT incentives, tax increment financing and industrial revenue bonds available to certain industries.¹⁴⁵

4.7.13 Case Study: Amazon-X-Energy Partnership

In April 2021, X-energy signed an agreement with Energy Northwest, a consortium of state public utilities, to set up the Tri Energy Partnership with a view to building a plant near the Columbia nuclear power plant in Washington state.

X-energy’s chosen technology, the Xe-100, consists of four 80 MWe reactors and a total output of 320 MWe of flexible, reliable, carbon-free power. The design includes the ability to scale-up the plant by adding additional units to increase energy output – without the need to build an entirely new facility.¹⁴⁶ The Tri Energy Partnership was also supported by a \$25M grant from Washington State’s Climate Commitment Act to Energy Northwest.¹⁴⁷

In October 2024, X-energy announced a Series C-1 financing round of approximately \$500M, anchored by Amazon. The investment went to several X-energy projects, those that would use X-energy’s Xe-100 advanced SMRs.¹⁴⁸ Amazon committed to funding the initial feasibility phase of the Tri Energy Partnership. Amazon will have the right to purchase electricity from the first project (four modules), which is expected to generate 320 MW of energy capacity. Energy Northwest has the option to further build out the site by adding up to eight additional modules (640 MWs) resulting in a total project generating capacity of up to 960 MWs. This additional power will be available to Amazon and to northwest utilities to power homes and businesses.¹⁴⁹ X-energy has since gone public, raising over \$1B in its initial public offering in April 2026.¹⁵⁰

Although this project is still underway, it shows the opportunities available when diverse stakeholders collaborate to form mutually beneficial partnerships. Although Amazon has been active in energy infrastructure buildouts across the U.S., it is also worth noting that they chose their home state of Washington for their largest nuclear investment to date. The brand loyalty and local goodwill of in-state corporations provide a unique opportunity for public-private-partnerships, especially in the capital-intensive energy infrastructure space.

4.7.14 Case Study: DOE-Dow-X-Energy Partnership

In 2020, DOE launched the Advanced Reactor Demonstration Program (“**ARDP**”) with a goal of identifying a next-generation nuclear reactor capable of becoming operational within 5-7 years. The ARDP provides one-for-one cost matching between DOE and the private entity for eligible costs, with \$160M allocated for the initial funding of two successful applicants. DOE selected X-energy and TerraPower as initial participants for the program.¹⁵¹

¹⁴⁵ <https://oridb.net/incentives/>; <https://wapp.capitol.tn.gov/apps/BillInfo/Default.aspx?BillNumber=SB0885>.

¹⁴⁶ <https://x-energy.com/ardp>.

¹⁴⁷ <https://www.tri-cityherald.com/news/politics-government/election/article293659364.html#:~:text=The Climate Commitment Act has,its new nuclear development efforts>.

¹⁴⁸ <https://x-energy.com/media/news-releases/amazon-invests-in-x-energy-to-support-advanced-small-modular-nuclear-reactors-and-expand-carbon-free-power>.

¹⁴⁹ <https://www.energy-northwest.com/whoweare/news-and-info/Pages/Amazon-and-Energy-Northwest-announce-plans-to-develop--advanced-nuclear-technology-in-Washington.aspx>.

¹⁵⁰ <https://www.wsj.com/finance/investing/x-energy-ipo-xe-stock-6b96c412>; <https://www.cnn.com/2026/04/24/nuclear-reactor-company-x-energy-begins-trading-as-ai-drives-interest-in-the-industry.html>.

¹⁵¹ <https://x-energy.com/media/news-releases/congress-appropriates-1-billion-dollars-to-x-energyvs-ardp-project>.

X-energy selected Dow's UCC Seadrift Operations manufacturing site on the Texas Gulf Coast for the initial deployment of X-energy's Xe-100 advanced reactor.¹⁵² The project is being developed by Dow's wholly-owned subsidiary, Long Mott Energy LLC, and is focused on providing the site with safe, reliable, and clean power and industrial steam for Dow's manufacturing processes. Once complete, Long Mott Generating Station is expected to be the first grid-scale advanced nuclear reactor deployed to serve an industrial site in North America. In May 2026, the site received a "Finding of No Significant Impact" following the NRC's Environmental Assessment for the site.¹⁵³

Initially, X-energy had planned for the Energy Northwest project to be the ARDP-intended project, but it ultimately reordered the projects, such that the Texas project became the ARDP project. ARDP funding provides up to 50% cost sharing with X-energy for their Xe-100 Advanced Reactor Demonstration Project, which includes construction of the TX-1 fuel fabrication facility in Tennessee.¹⁵⁴ Funding beyond the near-term is contingent on additional future appropriations, evaluations of satisfactory progress, and DOE approval of continuation applications.¹⁵⁵

This project is an example of the partnerships that can be formed for novel technology deployments in industrial sectors, especially with federal support. Given the significant energy-intensive manufacturing already occurring in the State, should Arkansas move forward with additional nuclear deployment, it may be able to benefit from the technological certainty potentially created should these DOE-supported FOAK facilities succeed. Regardless, we would strongly encourage Arkansas to seek out DOE involvement in any NPP proposed in the State.

4.7.15 Case Study: Meta-TerraPower Partnership

In January 2026, Meta announced an agreement with TerraPower, the Bill Gates-backed nuclear company, to contribute funding towards the development of two TerraPower Natrium SMRs, generating up to 690 MW with a planned delivery as early as 2032.¹⁵⁶ The companies' agreement provides Meta with rights for energy from up to six other Natrium SMRs capable of producing 2.1 GW and targeted for delivery by 2035.¹⁵⁷ Of interest, the agreement does not specify the location for these facilities, with the companies targeting identification of specific sites, "in the coming months."¹⁵⁸ Power from the TerraPower plant in Kemmerer, Wyoming, which broke ground in April 2026, is dedicated to regional utility providers.¹⁵⁹

As mentioned above in this Report, technology companies have typically participated in project development as a creditworthy offtaker, with limited or no involvement or financial support during the development and construction phase. However, Meta's recent announcement of its investment in TerraPower is another data point in the growing trend by technology companies to directly develop specific projects in partnerships with project Sponsors to shore up their power supply sources, especially in the low-carbon sectors.

¹⁵² <https://x-energy.com/seadrift>.

¹⁵³ <https://x-energy.com/news/nrc-issues-environmental-assessment-with-finding-of-no-significant-impact-for-dow-and-x-energys-proposed-advanced-nuclear-project-in-texas/>.

¹⁵⁴ <https://www.energy.gov/ne/articles/x-energy-starts-building-construction-advanced-nuclear-fuel-facility>.

¹⁵⁵ <https://www.energy.gov/ne/articles/us-department-energy-announces-160-million-first-awards-under-advanced-reactor>.

¹⁵⁶ <https://www.terrapower.com/terrapower-announces-deal-with-meta>.

¹⁵⁷ https://www.terrapower.com/terrapower-announces-deal-with-meta?mkt_tok=NzY2LVdCTC04NzcAAAGfQ4OIPbhmcfUoKvn7fLSlkCamvpbQ6Q4mvgFjiwEC0JFbq43vfOFFOG9BAbqV8QCqL5Qdy93fuh_qrCl7B8TcTfsun8MuTzqxQ4F2D3uAQ.

¹⁵⁸ <https://www.terrapower.com/terrapower-announces-deal-with-meta>.

¹⁵⁹ <https://www.terrapower.com/TerraPower-Commences-Construction-on-Americas-First-Utility-Scale-Advanced-Nuclear-Power-Plant>; <https://wyofile.com/wyoming-nuclear-power-plant-receives-federal-approval-for-reactor-construction/>.

4.8 STATE SUMMARY TABLE

While the U.S. Federal Government has been instrumental in financing advanced nuclear technologies and bridging the funding gap during critical project development phases, there is also significant nuclear industry momentum at the state level.

Not all U.S. states have an existing nuclear program. Many have recently overturned nuclear moratoriums issued after the Three Mile Island accident in 1979.¹⁶⁰ 2025 saw significant state-led momentum for the nuclear industry: 45 states engaged in nuclear policymaking, state legislatures introduced more than 350 bills and enacted more than 60 measures on the topic, and governors in 11 states highlighted nuclear in their recent State of the State addresses.¹⁶¹ These include a variety of actions, from establishing commissions or commissioning third parties to study economic impacts, potential sites, and ratepayer cost impacts, to awarding multi-million dollar grants to sophisticated developers with advanced projects. Some states, such as New York, Tennessee, Texas, and Virginia, have dedicated significant resources to developing a robust nuclear energy industry with programs for workforce development, grant programs, detailed regulations and private sector partnerships.¹⁶² Other states, such as Ohio, Kentucky, and Utah, have formed task forces or commissions to focus on attracting partners for individual projects or specific regions of the state. Yet other states are continuing to lay the groundwork for a nuclear industry expansion, with a current focus on clearing regulatory or legislative hurdles, removing historic moratorium on new nuclear development, and increasing funds for feasibility studies and workforce development.

There are also likely to be additional developments with federal-state partnerships in the near future, as the DOE considers submissions to its Request for Information (“RFI”) for Nuclear Lifecycle Innovation Campuses following the April 1, 2026 deadline.¹⁶³ DOE’s request indicated that certain support mechanisms will be made available toward selected Nuclear Innovation Campuses including, targeted financial assistance, cost-sharing, loan guarantees, and others. These campuses are expected to drive significant investment and job growth in nuclear and advanced manufacturing at the state level, with other high paying support industries.

A brief summary of programs across key states is provided in Appendix 1 attached to this Report. It is important to recognize that state level activities must be viewed within a competitive framework. Developers cannot be everywhere at once, so there is already a competition among states to get the attention of reactor vendors and developers. The State of Arkansas should be aware of this competitive reality as it considers options to promote NPP development within the State.

4.9 OPPORTUNITIES FOR TIME & COST SAVINGS

While nuclear power plants are capital-intensive, requiring lengthy and costly planning and development, there are ways to structure and implement the processes to generate certain time and cost savings at each stage.

¹⁶⁰ [https://www.energy.gov/ne/articles/what-nuclear-moratorium-#:~:text=A nuclear moratorium is a ban or,* Montana \(2021\) * West Virginia \(2022\).](https://www.energy.gov/ne/articles/what-nuclear-moratorium-#:~:text=A nuclear moratorium is a ban or,* Montana (2021) * West Virginia (2022).)

¹⁶¹ [https://www.ans.org/news/2026-01-12/article-7641/where-states-stand-on-nuclear/.](https://www.ans.org/news/2026-01-12/article-7641/where-states-stand-on-nuclear/)

¹⁶² https://virginianuclear.org/virginias-nuclear-industry-unveils-2025-2029-strategic-plan-to-power-the-commonwealths-future/?mkt_tok=NzY2LVdCTC04NzcAAAGeN4ZqjXq0hdCOMOctJ5iHqL8IG4B9EaJ1kY7aN3oOYKxuQnsxx8GDGlzNSyZ_B0Z0U3FgoJqbD-ZpHgBwK4crxeSkSY9IzdHJxuWyL6JZ8g.

¹⁶³ <https://www.energy.gov/articles/departments-energy-seeks-hosts-nuclear-lifecycle-innovation-campuses.>

4.9.1 Fleet Effect

As previewed in [Section 4.3.2](#), the Fleet Effect can enhance financing opportunities, recognizing that once the first unit goes into operation, revenue from its offtake can be redeployed to support the financial needs of follow-on units. Furthermore, if a creditworthy and commercially viable offtake structure is implemented for the offtake of the electricity generated from the initial unit(s) in operation, the initial equity stakes in the first units can be refinanced, freeing up additional capital and lowering borrowing costs. Additional opportunities arise from a “Fleet” approach include:

- Designing the initial site to maximize common facilities and expansion opportunities;
- Rolling craft labor from one reactor to the next, so that the same work packages are performed by the same team, reducing per-unit personnel expenses and boosting local workforce expertise; and
- Purchasing equipment in multiples, which should enable the developer/owner to obtain quantity discounts.

The inherent replicability that occurs by doing the same thing repeatedly creates direct lessons learned and execution efficiencies, if the fleet is planned from the beginning, as opposed to being treated as isolated projects. Such fleet benefits can be designed into both large and small reactor fleets.

4.9.2 Expansion of Existing Nuclear Infrastructure & Expertise

Only 28 states have existing nuclear power plants, with 94 commercial reactors operating across the country today.¹⁶⁴ The fact that Arkansas has an operational nuclear facility at the Entergy Nuclear One site in Russellville, already places Arkansas ahead of many other states seeking to bring nuclear infrastructure to their regions.

Nuclear power plants have unique siting, interconnection, security, and workforce requirements. Arkansas could expand the capacity at the existing Russellville location more quickly than at a greenfield site, as key project costs and risks, including water, grid and transmission connections, emergency planning zones and regulatory familiarity with the site, a skilled workforce and community industry awareness and support, are already in place. By piggybacking on work already conducted and completed infrastructure at existing sites, building onto already-vetted environmental and technical impact assessments, and capitalizing on the available in-state private and public technical expertise, additional capacity could be added more efficiently than starting from scratch at a new site. Indeed, Entergy has signaled that it is already considering expanding its nuclear capacity in the region, including in Arkansas.¹⁶⁵

In an Executive Order issued May 23, 2025, President Trump has specifically called for DOE to “prioritize work with the nuclear energy industry to facilitate 5 GW of power uprates to existing nuclear reactors,” showing the federal support for this avenue for increased nuclear capacity at existing sites across the states.¹⁶⁶

4.9.3 Siting at Existing Energy Infrastructure

¹⁶⁴ <https://www.energy.gov/ne/articles/5-fast-facts-about-nuclear-energy#:~:text=4.,power%20plant%20in%20the%20U.S.>

¹⁶⁵ “Officials continued that Entergy is evaluating new nuclear options beyond its fleet of five reactors at four locations in Arkansas, Louisiana and Mississippi, with roughly 5,000 megawatts of power generation capacity.” https://www.kark.com/news/state-news/entergy-files-to-extend-time-in-service-for-arkansas-nuclear-one/?mkt_tok=NzY2LVdCTC04NzcAAAGep220hflope3kPk-RUxydqB3ZQxbpHocwQzCKFjPocrrxA9S3Cao246VbfBqe8xFkWR43oeOCpK6TwD0rEfa5IS3r8RqpWzNbaPA8tWs6w.

¹⁶⁶ [https://www.whitehouse.gov/presidential-actions/2025/05/reinvigorating-the-nuclear-industrial-base/?utm_source=chatgpt.com.](https://www.whitehouse.gov/presidential-actions/2025/05/reinvigorating-the-nuclear-industrial-base/?utm_source=chatgpt.com)

Similar to siting at existing nuclear facilities, Arkansas can also consider siting new nuclear capacity at existing energy infrastructure that has historically been powered by other fuel sources. These sites have already undergone certain technical and environmental feasibility studies, have existing interconnections and civil infrastructure in place, and have local communities familiar with major power infrastructure. In addition, there may be an impending employment and tax revenue vacuum expected by a plant closure, which could be partially filled with the addition of a new power source at the site.¹⁶⁷ For example, TerraPower plans to build a reactor near a retiring coal plant in Kemmerer, Wyoming, with DOE funding, as discussed in [Section 4.7.1](#) above. In addition to Wyoming, 10 other states have publicly expressed interest in repurposing their coal sites with nuclear energy, including Arizona, Colorado, Kentucky, Maryland, Montana, North Carolina, Pennsylvania, Utah, West Virginia, Wisconsin.¹⁶⁸

In Arkansas, the Flint Creek Coal Plant near Gentry has been facing controversy as it nears the end of its approved lifecycles, with opportunities for retrofits or extensions still pending.¹⁶⁹ In 2028 and 2030, Entergy Arkansas will cease to burn coal at its two coal plants, White Bluff in Redfield and Independence in Newark.¹⁷⁰ Building nuclear capacity at a repurposed facility with a utility already familiar with the industry, such as Entergy, has the potential for particular efficiency savings through site-level existing connections and emergency planning zones, as well as through existing industry-specific workforce and expertise within the company. Indeed, DOE's System Analysis and Integration Campaign conducted a report on potential coal-to-nuclear repurposed sites, and issued a Stakeholder Guidebook for such conversions.¹⁷¹ Other entities have conducted similar studies on coal-to-nuclear repowering, finding that such redevelopment would create additional high paying jobs, allow for retraining of existing workforces, jumpstart local economic activity, and prevent economic backslide in closure communities, although challenges exist.¹⁷²

There is also significant DOE support for the efficient use of existing energy infrastructure to increase nuclear capacity domestically. DOE's Gateway for Accelerated Innovation in Nuclear ("GAIN") provides assistance to communities considering advanced nuclear in their energy transitions, including connecting communities to potential funding opportunities through the Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization or DOE's Communities LEAP program.¹⁷³ In addition, the newly created OEDF (formerly LPO) at DOE has specifically identified replacing a retired power plant with nuclear as a possibly eligible project for the Energy Dominance Financing Program.¹⁷⁴

¹⁶⁷ <https://www.energy.gov/ne/articles/8-things-know-about-converting-coal-plants-nuclear-power#:~:text=Repowering%20coal%20plants%20with%20nuclear,several%20economic%20and%20environmental%20advantages.&text=Nearly%2030%25%20of%20the%20nation's,stations%20to%20nuclear%20power%20plants>.

¹⁶⁸ <https://www.energy.gov/ne/articles/8-things-know-about-converting-coal-plants-nuclear-power#:~:text=A%202022%20DOE%20report%20found,Preserve%20and%20Create%20New%20Jobs>.

¹⁶⁹ <https://www.sierraclub.org/press-releases/2025/09/new-report-arkansas-utilities-failing-deliver-affordable-energy-customers>; <https://arktimes.com/arkansas-blog/2025/12/05/protesters-urge-state-to-reject-swepeco-rate-increases-that-would-extend-life-of-nwa-coal-plant>.

¹⁷⁰ <https://www.entergy.com/blog/entergy-arkansas-well-prepared-power-future>; <https://mhobserver.com/naec-annual-meeting-hears-3-billion-coal-replacement-plan-from-state-power-provider/>.

¹⁷¹ <https://sai.inl.gov/content/uploads/29/2025/02/evaluation-of-npp-and-cpp-sites-aug-16-2024.pdf>; https://sai.inl.gov/content/uploads/29/2024/12/c2n_guidebook_2024.pdf.

¹⁷² See the University of Michigan and DOE: <https://www.sciencedirect.com/science/article/pii/S2352484724002993>; Breakthrough Institute: <https://thebreakthrough.org/issues/energy/proposal-mass-acquisition-of-early-site-permits-for-coal-to-nuclear-repowering>; EPRI: <https://www.epri.com/research/products/000000003002026517>; Nuclear Innovation Alliance: <https://nuclearinnovationalliance.org/resources-coal-repowering-nuclear-energy>; and Terra Praxis: <https://www.terrapraxis.org/news-and-events/coal-to-nuclear-the-promises-and-pitfalls-of-a-potential-energy-revolution>.

¹⁷³ <https://www.energy.gov/ne/coal-nuclear-transitions-#:~:text=GAIN and Coal-to-Nuclear,about the energy transition process.&text=Nuclear energy is clean, safe,for in a good neighbor>.

¹⁷⁴ <https://www.energy.gov/edf/energy-dominance-financing-program>.

4.9.4 Co-Location with Planned Energy Infrastructure & Demand Centers

In addition to, or in parallel with, increased capacity at existing sites discussed in [Section 4.7.1.1](#) and in the sections immediately above, Arkansas may want to consider strategically growing new baseload infrastructure with planned demand centers. The same principles apply, and project partners can capitalize on the efficiencies created by reduced transmission and distribution and civil engineering costs by siting data centers and power source together, even if both are greenfield developments.

Demand centers could be in the form of any energy-intensive industry, ideally with a diverse, long-term, and creditworthy set of potential offtakers. For example, in February 2022, U.S. Steel announced a planned \$3B steel mill to be constructed next door to the Big River Steel complex, which the company had previously acquired.¹⁷⁵ It is the biggest private-sector facility investment in Arkansas history, and its operations are further supplemented by Highbar's announcement of a \$500M investment in the first of two planned rebar steel mini-mills.¹⁷⁶ The booming metals industry in Arkansas could be one of several energy-intensive industries the State could seek to prioritize and facilitate by encouraging low-carbon, reliable baseload power sited near end users.¹⁷⁷ In addition, data center demand is skyrocketing across the country. While Arkansas does not currently have a notable data center market, momentum is growing. Earlier this year, Google confirmed it was the developer behind a construction of a \$1B, 900,000 sq. ft. data center in West Memphis, Arkansas.¹⁷⁸

Co-locating energy infrastructure with demand centers creates industrial hubs with value for money, or benefits beyond what appears in the financial model. "Value for Money" can also be considered as part of a larger industrial and economic growth strategy. SMRs are particularly well-suited to a hub concept, as the smaller size and more rapid deployment can enable the energy side of the hub to grow and scale as more tenants locate at the hub. Further, with respect to data centers, the redundancy that a multi-unit SMR site can provide should be particularly attractive to technology-focused customers.

As noted elsewhere in this Report, the real opportunity for external equity is once construction is completed and the project is in operation. However, it is reasonable to project that hyperscalers will move into more of a development support role, as options for existing clean baseload power, to include life extensions and restarts, are exhausted (see case studies in [Section 4.7](#) for more detail, including for Amazon-X-energy partnership and the Meta-TerraPower partnership). With the projections for growth in data center and artificial intelligence power demand, one would expect that hyperscalers – considering their market capitalizations, decarbonization commitments, and long-term planning – will adjust their strategies to, at a minimum, facilitate dedicated power projects through the provision of development capital, creating opportunities for capital injections at early (and therefore critical) stages of project development.

Arkansas should capitalize on its geographic and economic advantages. Certain regions of the State are in close proximity to railways, heavily-traveled interstates and the Mississippi River. Together with the comparatively low cost of living, Arkansas is a competitive area for concentration of reliable baseload power to further facilitate manufacturing, technological, and other industrial and economic growth.

¹⁷⁵ <https://siteselection.com/arkansas-takes-over-as-the-epicenter-of-american-steelmaking/>.

¹⁷⁶ <https://armoneyandpolitics.com/diamond-in-the-rough-arkansas-emerging-onto-manufacturing-radar/>.

¹⁷⁷ <https://armoneyandpolitics.com/diamond-in-the-rough-arkansas-emerging-onto-manufacturing-radar/>.

¹⁷⁸ <https://www.datacenterdynamics.com/en/news/google-confirmed-to-be-behind-west-memphis-data-center-project-in-arkansas/>.

4.9.5 Standardization Through Adoption of Existing Regulatory Frameworks in Other Jurisdictions

As noted earlier in this Report, regulatory risk is one of the major considerations in nuclear power project development. Such risk is a cost factor and a scheduling factor. One of the lessons learned from the buildout of the existing global reactor fleet, is that plant designs should be standardized. For example, when the Gen II fleet in the U.S. was deployed, each utility wanted different features, which deviated from a “standard plant” approach. As SMRs and Advanced Reactors enter commercial deployment, one of the goals is to deploy a standard design, such that only site-specific changes occur (e.g., for international markets, the 60 Hz vs. 50 Hz configurations). The same philosophy can be equally applied to large reactors to create efficiencies in the project development process, without compromising regulatory independence and the overall prioritization of and commitment to safety.

This move to standardization can also be utilized on the nuclear regulatory front. For newcomer state or local jurisdictions, the move to SMRs and Advanced Reactors allows for aligning the regulatory process among peer jurisdictions, or avoiding duplication or inconsistency with federal requirements. Such alignment can expedite the regulatory approval process, while still preserving regulatory independence of the host regulator, and can also attract expedited investment regionally and encourage greater partnerships across private and governmental entities. The State of Arkansas can save time and resources by evaluating and adopting regulatory language and programs of peer jurisdictions, making state-specific customizations as needed. This would be of particular interest to nuclear developers and/or data center hyperscalers looking to concentrate capacity growth in a particular region or within a grid interconnection system.

4.9.6 Strategic Partnerships & Arkansas-Specific Considerations

SMR developers in the U.S. have sought out strategic partners as they pursue technology development and project delivery. For example, Holtec has a now well-established relationship with Hyundai Engineering & Construction, which has spurred further support from Korean financing institutions.¹⁷⁹ Such strategic partnerships present opportunities for co-financing from both domestic governmental agencies and foreign ECAs. In addition, with the combination of potential FOAK risks (depending on the timing of the project) and the potential for a fleet deployment, it would be reasonable for the parties to view the project beyond the production of electricity. The fleet deployment creates investment impacts in the region by the localization of any fabrication and supply chain development. Bringing operator capabilities to the project could create opportunities for strategic collaboration on further SMR deployments regionally. Such actions help offset FOAK concerns about project-specific risks by creating a broader relationship beyond the financial model for the initial project.

Further, such relationships that extend beyond one reactor could serve to attract additional capital to the project, as a strategic investor looks to catalyze a larger set of activities. By example, KEPCO provided both debt (via K-EXIM) and equity (an 18% interest in the ownership and operations entities) for the Barakah NPP in the United Arab Emirates, even though arguably, the Emiratis did not need foreign debt or equity for the project. It would not be out of the question for Japanese and/or Korean corporate entities to take a broader interest in certain regions in the United States.

As mentioned earlier in this Report, the Trump Administration has been strongly supportive of the nuclear industry and foreign partnerships. On February 21, 2025, President Trump released a National Security Presidential Memorandum that established his “*America First Investment Policy*,” which specifically encourages investment

¹⁷⁹ <https://www.world-nuclear-news.org/Articles/Team-Holtec-signs-agreements-with-Korean-financial>.

from our allies and partners, to “allow cutting-edge businesses to benefit from foreign investment capital.”¹⁸⁰ This is also supported by EXIM’s “*Make More in America*” initiative, which extends the bank’s financial products to export-oriented domestic manufacturing projects to further boost domestic production and encourage greater foreign trade while boosting local economies.¹⁸¹

The State of Arkansas can think broadly for such strategic partnerships, and there are also opportunities closer to home, with well-resourced entities with significant presence already in the state. Arkansas hosts Fortune 500 headquarters, including Walmart, Tyson Foods, J.B. Hunt, and has significant healthcare and metals and machinery manufacturing industries already established in the State.

For example, Walmart has committed to enable 10 GW of new clean energy projects by 2030, and has executed numerous PPAs in Arkansas and in the region to support its emissions reduction targets.¹⁸² In addition, Mississippi County, Arkansas is a top steel producing county in the U.S., with \$624M worth of goods exported in 2024,¹⁸³ and Arkansas has seen hundreds of millions of dollars of investments in the energy-intensive metals industry since 2019.¹⁸⁴ See [Section 4.9.4](#) above for other state-specific opportunities.

These initiatives all support opportunities for creative partnerships, with broad funding opportunities for the right mix of strategic industry with a supporting power supply. By identifying specific industries and/or regions to prioritize, and by looking for potential synergies among key private players and avenues for complementary federal support, Arkansas can begin developing a comprehensive development plan, underpinned by the low-carbon, reliable, baseload power of nuclear energy.

4.9.7 Refinancing

The cost of capital has a direct impact on the total project cost, as the financing costs are factored into the total (or final) project cost (as opposed to the “overnight cost” number that vendors like to use for marketing purposes). The pricing of money in an infrastructure project reflects the risks in the project. With fewer sources of money during development and construction, coupled with the highest risk periods in the project’s lifecycle, money is either not available or more expensive.

Once an NPP is in operation, the project is beyond the riskiest periods of the project’s lifecycle, which are the development and construction phases. Such view is based on a recognition that NPPs are relatively cheap to operate, variability in nuclear fuel pricing has a negligible impact on the overall operating pro forma for the asset, the asset is a baseload form of generation, and the operating life can run for a *minimum* of 60 years. Such qualities make the asset particularly attractive for investors with long investment horizons, such as pension funds and insurance companies.

¹⁸⁰ <https://www.whitehouse.gov/presidential-actions/2025/02/america-first-investment-policy/>.

¹⁸¹ See [Section 4.6.1](#) above.

¹⁸² <https://corporate.walmart.com/news/2024/03/26/walmart-accelerates-clean-energy-purchases-and-investments-with-nearly-1-gm-of-new-projects-across-the-us#:~:text=Renewable%20Energy%20Purchase%20Agreements:%20Expanding,toward%20our%20zero%20emissions%20targets.>

¹⁸³ <https://www.arkansasedc.com/why-arkansas/key-industries/metals.>

¹⁸⁴ <https://siteselection.com/arkansas-takes-over-as-the-epicenter-of-american-steelmaking/>.

If the economics of the offtake structure are strong (in terms of tenor, pricing, amount of electricity to be sold, and creditworthiness), capital that was not available during development and construction now becomes available during the operational phase. These qualities create interesting opportunities for refinancing both debt and equity.

For the initial capital providers to sell down or sell out of the project, someone must want to buy in. For that dynamic to be valid, the project's economics through the offtake structure, including tenor, pricing, volume, and creditworthiness, need to be present, so that the project is viewed as an investable asset. So long as the offtake structure remains in place, this cycling of both debt and equity can occur throughout the operating life of the project. Moreover, refinancing frees up capital to be redeployed to support future units, which addresses other opportunities for cost savings discussed in [Sections 4.9.1](#) and [4.9.4](#) above.

By accessing cheaper money during operations, the overall cost of capital for the project is reduced, as more expensive money is replaced with less expensive money. Such a strategy should be considered during the project's early stages to ensure that the project is structured for refinancing.

4.10 PROJECT ECONOMICS

The focus of this section is to recognize that the holistic valuation of a nuclear power plant involves a combination of those elements that are represented in a financial model, as well as certain additional benefits that are not captured by financial modeling. While positive project economics are necessary for an individual project to be considered, the State should consider a more comprehensive suite of benefits created, which should further justify any financial support provided to an individual project or across the sector more broadly.

4.10.1 General Industry Impacts

Considerable scholarship has been done regarding the economic impact (or economic benefit) of nuclear power plants. Work has been done across different jurisdictions and involving different reactor technologies. When examining such work, several prevailing themes arise:

1. Economic and Employment Benefits: Nuclear energy projects, whether new builds or expansions, are consistently shown to generate significant economic benefits, including substantial contributions to GDP, job creation, and local investments. These benefits extend over long periods and can be crucial in revitalizing regions affected by industrial transitions or energy shifts.
2. Support for Environmental Goals: There is a strong emphasis on the alignment of nuclear energy with broader environmental objectives. Nuclear power is positioned as a critical component in achieving certain energy targets, particularly in the context of reducing emissions and supporting resilience.
3. Strategic Role of Nuclear Technology: The advancement of nuclear technologies, including SMRs and new reactor designs, is highlighted as a key factor in enhancing energy security, supporting local industries, and establishing technological leadership on a global scale.
4. Localized Economic Impacts: Nuclear projects are noted for their positive localized impacts, such as creating high-paying jobs, developing local skills and infrastructure, and supporting domestic supply chains. These effects are crucial for communities impacted by energy transitions, such as the closure of coal plants.

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5. Importance of Comprehensive Modeling and Research: Accurate assessment of nuclear power's economic and employment impacts relies on detailed macroeconomic modeling and collaborative research. Transparent methodologies and regular model updates are necessary for making informed policy and investment decisions.
 6. Integration into Broader Energy Policies: Integrating nuclear energy into national and regional energy plans is advocated, with recommendations for including it in clean energy standards and policy discussions. This ensures that nuclear power's role is fully considered alongside other energy sources in achieving long-term energy and environmental goals.

4.10.2 Impacts of Expanded Nuclear Development

In a 2025 study (Murphy & Rudolph / January 2025)¹⁸⁵ concerning the impact of completing the two AP1000 units at the V.C. Summer project in South Carolina, the main findings were as follows:

1. Construction alone would generate up to \$25B (2025 USD) for the South Carolina economy, increasing total household income by more than \$7B (2025 USD).
2. During the first thirty years of operation, the two units would generate up to 50 billion (2025 USD) with more than \$20B (2025 USD) additional household income.
3. Once in operation, electricity prices would immediately lower by 7%.
4. After the repayment period 30 years later, electricity prices would lower by an additional 5% with the plant operating at 2.66¢/kWh.
5. The expected lifetime economic impact of the two units on the South Carolina economy across 80 years is around \$130B with a comprehensive lifetime multiplier of around 2.5 on all costs and a multiplier of around 7 on initial investments.
6. Carbon dioxide emissions per kWh of electricity generated by the state would decrease from 0.608 to 0.512 pounds.
7. More than \$5.5B in tax revenue would be generated for the state of South Carolina.
8. The impact and multiplier estimates agree with previous literature.

What is striking about these economic impacts is that they do not appear in the project's financial model. Generally speaking, the financial model serves as the basis for the final investment decision; however, there are a series of benefits which are not properly valued at the project level. If these benefits are not factored into the planning decision, the project's true value is not being captured. While the project Sponsor might only be able to think in the short- to mid-term, governments should have the ability to take a broader view, both in terms of time and in terms of other benefits.

An illustrative list follows:

¹⁸⁵ The referenced study is not publicly available; however, it is referenced here because it was produced by one of the authors of this report.

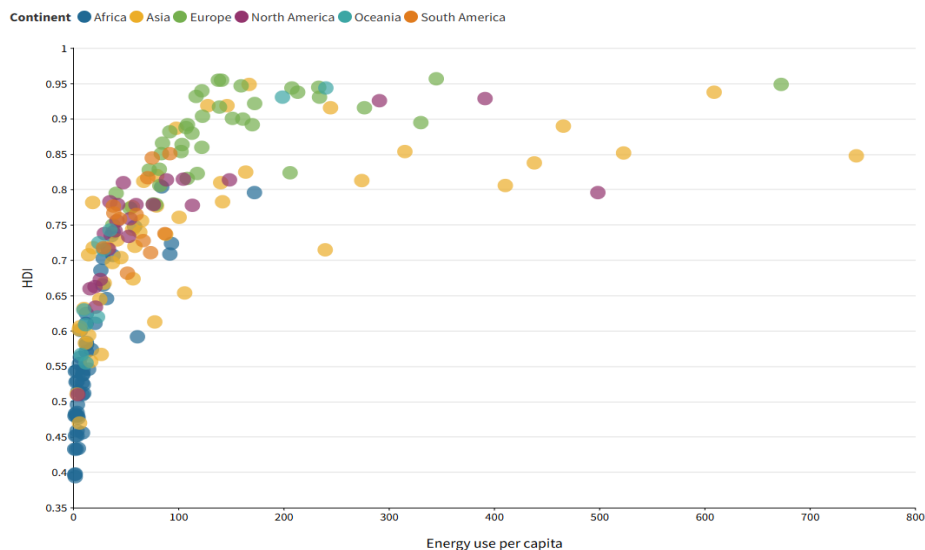
- Useful Life: 60 – 100 years of operations. After 25 to 30 years of operations, financial models discount everything to zero (in present value terms); however, the long asset tail is valuable to the country.
- Energy Security: Reducing exposure to foreign sources of fuel promotes energy independence / security.
- Energy Diversity: A diversified grid isolates the system against shocks to any one form of generation. Nuclear, as a baseload asset, promotes this diversity, especially as certain sources of fuel are deemphasized to meet environmental objectives.
- Sustainability & Air Quality: Not only does nuclear energy promote certain environmental targets (and is a baseload form of generation); it also reduces air pollution, which, in turn, promotes a healthier environment.
- Capacity & Grid Stability / Baseload Generation: Large baseload generation helps to stabilize the grid and provide capacity, especially as renewable energy becomes more prevalent.
 - A system with more reliable dispatchable generation is likely to be more stable.
 - There is a growing concern that low levels of rotational inertia (i.e., as provided by large rotating generators in nuclear and fossil-fueled baseload generators) in a system may lead to instability and potential system blackouts.¹⁸⁶
- Tax Revenue: Regardless of the tax rate chosen, the operation of the plant creates a taxable revenue stream, as does the income received from the workers.
- Job Creation: Both temporary and permanent jobs are created at the plant.
- Secondary Economic Benefits: Suppliers to the plant, during both construction and operation, benefit from the plant. In addition, a secondary economy is created around the facility, as the community is developed (housing, restaurants, schools, etc.)
- Standards of Living: The Human Development Index (HDI) plots energy use per capita against HDI.¹⁸⁷ It demonstrates a significant linkage between the two. By adding clean baseload generation to the grid, standards of living are increased - not just through the benefits of electricity, but also through the job creation, elevation of educational and training standards to support the needs of the plant, health, and climate benefits derived from the nuclear asset.

¹⁸⁶ 2020 07, Energy, Renewables in the European power system and the impact on system rotational inertia (<https://www.sciencedirect.com/science/article/pii/S0360544220308835>).

¹⁸⁷ <https://visualizingenergy.org/does-more-energy-use-increase-the-level-of-human-development/#:~:text=A%20country%20can%20move%20from,South%20America.>

The Human Development Index (HDI) and energy use per capita, 2019

The HDI is a 0 to 1 composite index based on indicators for health, education, and income. Energy per capita is measured in gigajoules (GJ) per person.



So why does any of this matter? As will be discussed in the latter stages of the Report, government support will be critical to the overall success of the project. While individual jurisdictions might choose different methods of government support, the underlying commonality across nuclear programs (and the projects thereunder) is the role of the government in supporting the project. This support is most often demonstrated by financial support. With limited budgets and competing demands, governments need to consider support from a “value for money” perspective. If the project is able to quantify the benefits discussed above, then the rationale for government support is made easier, especially if refinancing approaches are built into the financial planning for the project, resulting in a temporary “lift” from the government.

5.0 Concluding Thoughts

Both the State of Arkansas and the project’s Sponsor will be involved in the development, structuring, delivery, and financing of the project; however, corporate and government perspectives will be different. The corporate focus for an individual project will be on the viability and profitability of the project itself. The State focus will be more on the long-term energy security, decarbonization (relevant for industrial users seeking to export products), workforce, and economic growth and competitiveness of the State. As noted earlier, economic impact discussion can be found elsewhere in the broader EXCEL Services Corporation report.

With different motivations, a public-private partnership approach would seem to be how the two interests best align. Strong overlap between these interest areas and a supportive and constructive working relationship between the two parties is critical for project success. This Report supports this approach, whereby (1) government support is more surgical and targeted, focusing on times and elements where it can be most effective, to include de-risking the project, (2) corporate parties are incentivized by the stability created in the near- and long-term through such government support, and (3) the combination of activities is aligned to then mobilize additional private capital, likely at later stages of the project’s lifecycle.

5.1 RECOMMENDED CONSIDERATIONS & APPROACHES

The following provides a summarized version of the key themes, structures, and perspectives that we recommend the State of Arkansas consider when moving forward on the topic.

1. Public-Private Partnership

Both the State of Arkansas and the project's Sponsor will be involved in the development, structuring, delivery, and financing of the project; however, corporate and government perspectives will be different. The corporate focus for an individual project will be on the viability and profitability of the project itself. The State focus will be more on the long-term energy security, decarbonization (relevant for industrial users seeking to export products), workforce, and economic growth and competitiveness of the State.

With different motivations, a public-private partnership approach would seem to be how the two interests best align. Strong overlap between these interest areas and a supportive and constructive working relationship between the two parties is critical for project success. This Report supports this approach, whereby (1) government support is more surgical and targeted, focusing on times and elements where it can be most effective, to include de-risking the project, (2) corporate parties are incentivized by the stability created in the near- and long-term through such government support, and (3) the combination of activities is aligned to then mobilize additional private capital, likely at later stages of the project's lifecycle.

Strictly speaking, governments are better suited to take the long view / "big picture" view, when compared to corporates, with the latter being more focused on the inputs and outputs of the financial model. Combining these two different viewpoints will enable the project to capture the opportunities that exist at different phases of the project's lifecycle, thereby lowering the overall cost of capital and the financing burden for the project.

2. "Value for Money"

"Value for Money" is a phrase that is often used when considering government support. The South Carolina Economic Impact Analysis discussed in [Section 4.10.2](#) above is one of the main ways to demonstrate empirically and with rigor the benefits created by the project – benefits that do not appear in the financial model and that do not benefit the owners.

Value for Money can also be considered as part of a larger industrial and economic growth strategy, if energy/industrial hub concepts are considered. SMRs are particularly well-suited to a hub concept, as the smaller size and more rapid deployment can enable the energy side of the hub to grow/scale as more tenants locate at the hub. Further, with respect to AI and data center considerations, the redundancy that a multi-unit SMR site can provide should be particularly attractive to technology-focused customers.

Finally, with a creditworthy, long-term, and favorably priced offtake structure, refinancing strategies become a significant option, which could enable the project to return funds provided by the government (as the government's position is refinanced by private capital post-COD).

3. Phasing & Market Conditions / Limitations

The conclusions in this Report are designed to match financing approaches with the three key phases of the project: Development, Construction, and Operation. This Report recognizes that different types of financing are available in different Phases; therefore, the goal is to create the most efficient and economic utilization of financing sources.

In recent years, money has gone into the nuclear sector at significant levels, but that money has been directed into technology development, principally in the SMR, Advanced Reactor, and fusion segments of the nuclear industry. Such investment has not occurred at the project level, with two significant exceptions: Amazon's investment of development capital to support X-energy on the Energy Northwest project and Meta's recent announcement with TerraPower.¹⁸⁸ Money has also gone into nuclear green bonds, as discussed above.

Clearly, these two trends demonstrate the financial sector's appetite for nuclear technology and the nuclear business; however, such appetite is not being demonstrated at the project level. The classic concerns of the length of the development and construction periods, coupled with the nuclear sector's history of not delivering on time or on budget, deter passive equity investors in the sector.

Thus, certain financial support is more likely to be available during specific phases, with certain options to be pursued sequentially, while others may be available in parallel to comprehensively address the large financial needs of a nuclear power project. Our recommendations for a pragmatic financing approach at each phase are described below, followed by suggested next steps to jumpstart the process.

4. Development Phase Funding

Prior to issuance of the construction license and pouring first safety concrete, the project will require several hundred million dollars to cover site work, engineering, and regulatory activities. Depending on the technology chosen and the number of units to be constructed, additional amounts - also in the hundreds of millions of dollars - will need to be sourced for the purchase of long-lead items.

It is unlikely that the main debt (discussed below) will be available, as Financial Close will most likely coincide with receipt of the construction license.

To cover these funding needs during the Development Phase, a combination of funding sources is recommended:

- Equity from the project Sponsor;
- A State-provided bridge loan;
- Possible ECA-sourced early-stage financing for engineering activities (to the extent available and dependent upon the delivery consortium and supply chain sourcing of the reactor technology);
- If the aforementioned sources are not available or are insufficient, a developer could explore other types of private capital through an equity raise, or a developer or a State or regional utility could pursue separate bridge financing, with such bridge financing possibly secured by electricity sales from their existing generation fleet;¹⁸⁹

¹⁸⁸ See discussion in [Section 4.7.13](#) and [Section 4.7.15](#) above.

¹⁸⁹ See the portfolio approach taken in the Exeltium example in [Section 4.7.8](#) above.

- With long-lead items being the biggest concern during the Development Phase, due to the magnitude of the expenditure, particular attention will be needed on this issue (with the aforementioned bridge financing (debt or equity) as a possible solution);
- b. Potential funding from PPA prepayments to support pre-FID (final investment decision) needs, particularly concerning long-lead items.

5. Base Equity

A 60/40 gearing ratio (debt/equity) is a realistic target, with a stretch goal of 70/30. Lenders will take a view on the appropriate gearing ratio, based on their assessment of the overall risk profile of the project, to include sponsor risk, technology risk, and offtake risk.

To the extent that the project corporate sponsor(s) intend to develop, own, and operate the project – but cannot fund the equity component – either (a) the number of units will need to be down-sized; (b) the number of units will need to be staggered to a greater extent (to align better with funding availability); or (c) the State Government will need to cover the equity funding shortfall.

The current and considered view is that passive equity will not support the project during development and construction; however, the ability to source additional equity after COD is discussed below under “Refinancing.”

Entergy is an interesting option, given its existing role in the State, coupled with its existing nuclear fleet (see Exeltium discussion in [Section 4.7.8](#) above), which presents financing opportunities.

6. Base Debt

The most secure pathway for accessing debt is through OEDF and ECA sources. Such debt is both long-term and cheap (relative to commercial debt, which probably is not available to the necessary extent for a nuclear project). Through the financeable export content plus the ability to finance local content, ECAs should be able to cover a portion of the debt not covered by the OEDF tranche, subject to be backstopped by a sovereign guarantee from the State of Arkansas. Note that a sovereign guarantee is a contingent obligation, not a funded amount; however, such a commitment should be examined for budgetary scoring under State law.

7. Cost Overrun Facility

Because nuclear power projects have a long history of going over budget and schedule, lenders will require a cost overrun facility (i.e., a completion facility or completion guarantee). Unfortunately, what is deemed to be an adequate amount for such a facility is highly debatable and is an inexact science. As such, we recommend that the State of Arkansas provide such support to the project.

8. Offtake / Electricity Sales

The considered view is that a dedicated offtake structure is essential for the successful financing of the project. The focus should be on a long-term, creditworthy agreement, with a rate of return that encourages investment in the project, as well as supporting refinancing options.

9. Tax Treatment & Regulatory Action

To enhance the commercial viability of the project, the Report recommends several areas for State action (to include Federal coordination):

- a. Qualification for Federal and State Tax Incentives: To include investment tax credits, production tax credits, and, potentially, zero emissions credits and capacity payments.
 - i. *Qualification for Federal Tax Incentives* (see [Sections 4.7.3](#)): A project would need to be correctly structured, located, and designed to qualify for federal tax incentives, thus this eligibility exercise should occur early in the development process.
 - ii. *Confirmation of State Tax Incentives* (see [Section 4.7.4](#)): We recommend that the State of Arkansas pursue special tax and other incentives to enhance the project's overall economics. Such incentives would include a combination of the existing income tax credits, sales and use tax credits, and EEIP and PILOT programs, among others.

The State could also consider the expansion of modifications of such incentive programs to clarify the eligibility of a desired technology, or to further incentivize a nuclear developer and/or energy-intensive offtakers planning to rely on the low-carbon baseload power provided by a new nuclear facility.

Arkansas could create unique prioritized economic zones, with tax-related incentives in such areas to draw in further industry, allowing for sequential build out of low-carbon baseload electricity to power incremental growth in the area.

- b. Accelerated Depreciation: Accelerated depreciation tax treatment will favorably impact the project's financial model post-COD, enhancing the overall economics of the project.
- c. Removal of Any Unfavorable Market Dispatch Restrictions (see [Section 4.6.3](#)): Although it does not require the expenditure of financial resources, the State's efforts to clear the playing field for the nuclear industry will be important. To the extent there are any subsidies or dispatch restrictions that would reduce the ability for an operating NPP to sell its output, those should be removed during the construction phase, before the plant becomes operational.

Depending on the offtaker, this element may need to be resolved prior to the signing of a PPA, or could be structured as a condition precedent to an initial purchase under the PPA.

- d. Approval of Ratepayer Fees for Cost Recovery (see [Section 4.6.4](#)): Depending on the available coverage for construction related expenses, the State may need to authorize the project to pass through certain CWIP onto the ratepayer through exercise of its rights provided under SB 307.

However, this method should be used prior to COD to allow for more incremental rate increases to offset costs during expensive and capital-intensive construction phase without overburdening a customer base with limited ability to absorb costs.

10. Refinancing

If a robust offtake structure is utilized, then the belief is that that private / external / passive equity can be sourced after COD (and probably after the first fuel reload). A nuclear power generation asset should be attractive to long-term investors, such as pension funds and insurance companies.

By structuring the project with a view to refinancing, the initial equity positions can be reduced, thereby freeing up that money for other uses (especially any funds sourced from the State).

By refinancing during the operating period, debt and equity positions can be restructured to lower the overall cost of capital for the project. For example, if the State of Arkansas provides funding through a cost overrun facility, that capital could be the first to be restructured under a refinancing approach, so that the State's direct financial commitment is temporary.

11. Fleet Considerations

Two recommendations relate to the fleet approach on the deployment of SMRs. *First*, as individual units achieve COD, the revenue from electricity sales should remain in the project, to be redeployed to support the completion of the additional units at the site. *Second*, to stretch available financing capacity, refinancing (discussed above) on a unit basis should create an opportunity to redeploy capital to support the completion of sequential units at the site (or at other sites).

These concepts would need to be discussed with the lenders to the project. Ideally, if the repayment period does not commence until all the units of the project are in operation, then revenues from the earlier units could be recycled into the project (instead of having to be used for debt service).

12. Variation on the Theme: Exeltium Approach

If Entergy were to develop the project on its own, Entergy might consider the bundling of electricity generation from its existing NPPs to sell to high intensity users of electricity, similar to the Exeltium approach discussed in [Section 4.7.8](#) above in this Report. This bundling and resale under a PPA could be advantageous to offtakers seeking price stability and achieving certain environmental targets (for export competitiveness), while generating a premium to Entergy.

13. Variation on the Theme: Nuclear Green Bonds

Similar to the concept of refinancing, we believe that a nuclear green bond structure could be implemented by Entergy (pre-COD) and/or the project company (post-COD).

- Pre-COD: This approach could track the approaches employed by the large utilities referenced in the Report.
- Post-COD: By issuing nuclear green bonds during the operating period, debt and equity positions can be restructured to lower the overall cost of capital for the project. At that point, the bonds can be issued at the project company or holding company level, based on the strength of the asset and the revenue stream (noting, again, the importance of a dedicated and robust offtake structure).

With nuclear green bonds already being rated by external rating agencies, to include for new construction (as discussed above), the necessary precedent exists for a similar issuance for this project.

14. Variations on the Theme: Energy/Industrial Hubs

The project could be the center of an energy and industrial hub, where heavy industry and/or data centers are located under a behind-the-meter or co-location structure. To work, a backup power source would be needed, in case the nuclear plant misses its targeted COD. In addition, special tax rules could further incentivize industries to locate at the hub. Such incentives might encourage investment into Arkansas. Examples of Special Economic Zones developed in other jurisdictions should be examined, if such an approach were to be seriously considered.

15. FOAK Risk

FOAK risk will be a potential element of the SMR project, with the degree of risk having an inverse relationship to the stagger between the timing of the reference plant and the first units in Arkansas. As presently conceived, the Arkansas units could be adequately distanced from the FOAK project; however, supply chain and other prioritization issues will need to be assessed for the project relative to the global fleet.

16. Overall Theme of Government Support

While the Report is mindful of the Arkansas' financial resources, an overarching theme in the financing discussion is the role of government in the overall success of the project. While government support can take a variety of forms, the State's support will be absolutely necessary for the project to succeed.

Thus, even though corporates will serve as the project sponsor (developer, owner, operator), the project Sponsor and the State of Arkansas will need to be aligned regarding the overall objectives of the project (and the State's nuclear program) and will need to work together to create a commercially viable project that, in turn, is financeable.

One of the reasons why refinancing is emphasized in this Report is due to a recognition of the competing demands for government financial support. With that in mind, this Report looks to keep government support targeted and limited in time.

5.2 SUGGESTED NEXT STEPS

Arkansas may want to consider some or all of the following steps to begin advancing their nuclear program and preparing the budgetary conversations, local policies, and building the local, national, and international relationships that may be needed for a successful nuclear project to be built in the State.

These generally focus on building a diverse set of creditworthy electricity offtakers within a prioritized industry and/or region, which will serve as the foundation for the demand for a low-carbon baseload power source such as nuclear. Given the current status of Arkansas' nuclear program, it can benefit from evaluation of other peer states and regions, and more efficiently create a customized plan based on lessons learned from other states' recent ventures.

1. Conduct an accounting of existing State local grant, loan, tax and other programs and incentives in Arkansas that a nuclear project either (1) is eligible for, or (2) could be eligible for depending on the

technology used, and/or minor modifications made to the current scope, and use such record as a baseline from which to revise or expand such programs and incentives.

2. Identify peer states with pragmatic, attainable nuclear programs, regulatory language, and incentive programs. If desirable, engage with their counterparts to benefit from lessons learned. Consider State initiatives, recognizing competitive environment being created to attract reactor vendors and developers.
3. If not already, engage with Entergy and other existing utilities and developers operating in Arkansas to gauge interest, financial capacity, and timeline for a nuclear power project in the State.
4. Identify and begin a working dialogue with corporate and energy-intensive industry leaders in Arkansas and in the region, to signal the State's motivation to power new industry with nuclear power and begin relationship building for aligning potential individual projects and/or industrial hubs with such corporate's planned growth areas.
5. Conduct a survey of creditworthy leaders in targeted industries to identify the key priority areas for business expansion, then work with specific partners in the state to address any incentives or deficiencies, with a goal of obtaining commitments to build additional energy-intensive demand centers.
6. For the relevant committee, build an initial financing and development plan for circulation among other state legislature representatives to build support and financial backing for any State-provided grant, loan, or tax incentive desired to be used to attract developers to the State. Such plan should include more detail on potential sites, estimated cost, timeline, and a shortlist of potential project participants.
7. Explore ways to utilize federal and foreign ECA funds to support partial funding needs for a project. Consider outreach to, or hiring lobbyists to establish dialogue with, both federal agencies and foreign export credit agencies to signal interest in collaborating on siting a nuclear power plant in the State, especially in the case where the project is an integrated effort of SMR deployment and industrial end use, to include AI/data centers or metals manufacturing.
8. Consider joining the Advanced Nuclear First Mover Initiative as a "Participating State" or an "Observer State" to develop greater expertise and access to knowledge-sharing and information.¹⁹⁰
9. Consider participating in the U.S. Conference of Mayors, which recently passed a resolution recognizing workforce and economic benefits of nuclear, or an analogous gathering to benefit from lessons learned at peer states and develop relationships for potential regional partnerships for industrial hubs.
10. Conduct an Economic Impact Assessment for Arkansas, considering different reactor options and fleet sizes.
11. Develop an initial Project Risk Register and initial Project Development Plan, updating both as State planning and project developments progress.
12. Build a preliminary Financial Model for a SMR project and a large reactor project, updating the model as further work progresses.

¹⁹⁰ <https://www.naseo.org/topics/advanced-nuclear-first-mover-initiative>.

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13. Develop a process for reactor technology selection, to include considerations on large versus small reactors. Include Technology Readiness Level assessments for any FOAK reactor designs. Consider “credibility” and “deliverability” in the reactor selection process.
 14. After considering the aforementioned recommendations, develop a legal and regulatory plan that establishes a path forward to make any necessary adjustments to support any approach(es) chosen.

6.0 Appendices

6.1 APPENDIX 1: GLOSSARY OF TERMS

No.	Term or Acronym	Description
1.	AI	Artificial Intelligence.
2.	APSC	Arkansas Public Service Commission; approves, rates, rules, and service terms for utilities in the State and ensures service is safe and adequate.
3.	ARDP	The DOE's Advanced Reactor Demonstration Program.
4.	Clean Electricity PTC and ITC	The technology-neutral clean electricity production and investment tax credits under Sections 45Y and 48E of the federal tax code.
5.	COD	Commercial Operations Date; the date on which the plant reaches commercial operation.
6.	Construction License	A license issued by the nuclear regulator having authority over the NPP, such as the Nuclear Regulatory Commission; permits construction work beyond initial site preparation.
7.	DOE	The U.S. Department of Energy.
8.	ECA	Export Credit Agency; a government-backed institution that promotes national exports and investments abroad by offering financial support to domestic companies.
9.	EIIC	Equity Investment Incentive Program.
10.	EPC	An Engineering, Procurement, and Construction contract.
11.	EXIM	Export-Import Bank of the United States.
12.	FC	Financial Close.
13.	FEOC	Foreign entity of concern.
14.	FERC	Federal Energy Regulatory Commission.

15.	FID	Final Investment Decision; referring to the point at which an entity commits to expending significant front-end funds to develop a project.
16.	Financial Close	The point at which loan documents are signed and any pre-disbursement conditions are met, allowing funds from the main debt facility to be legally disbursed to the borrower.
17.	FOAK	First-of-a-kind; usually referring to a new technology.
18.	GAIN	U.S. DOE's Gateway for Accelerated Innovation in Nuclear.
19.	GPSC	The Georgia Public Service Commission.
20.	HALEU	High Assay Low Enriched Uranium.
21.	IAEA	The International Atomic Energy Agency.
22.	ICMA	International Capital Market Association.
23.	IFC	International Finance Corporation.
24.	IPP	Independent Power Producer.
25.	IRA	The Inflation Reduction Act of 2022.
26.	JBIC	Japan Bank for International Cooperation.
27.	K-Sure	The Korea Trade Insurance Corporation.
28.	KEXIM	The Export-Import bank of Korea.
29.	LPO	The Department of Energy's former Loan Programs Office; this has been superseded by the OEDF (<i>see below</i>).
30.	NPP	A nuclear power plant.
31.	Nuclear PTC	The zero-emission nuclear power production credit under Section 45U of the federal tax code.
32.	O&M	Operations & Maintenance.

33.	OBBBA	The One Big Beautiful Bill Act, signed into law by President Trump in July 2025.
34.	OECD	The Organization for Economic Cooperation and Development.
35.	OEDF	DOE’s Office of Energy Dominance Financing; this largely replaces the former Loan Programs Office.
36.	PAA	The Price-Anderson Act.
37.	PDP	A Project Development Plan; outlines a series of activities that are fundamental to the development of the nuclear power project.
38.	PILOT	Payment in lieu of tax.
39.	PIM	A Project Information Memorandum; presents the financing opportunity to financiers and provides the proper context from which the technical, legal, and financial diligence can then occur.
40.	PPA	A Power Purchase Agreement.
41.	PTC	Production Tax Credit.
42.	PRR	A Project Risk Register; a document that assists the project’s leadership with overall project planning, by identifying, assessing, allocating, managing, and mitigating risks within the project.
43.	RFI	Request for Information; a document issued by a soliciting agency or organization to provide potential bidders an opportunity to showcase their qualifications and interest in a future bid.
44.	Sponsor	A project “Sponsor” is typically the entity providing both financial resources and strategic planning for the project, often with some ownership interest in the project.
45.	Strike Price	A “Strike Price” is a fixed value above or below which the entities to a Contract for Difference will be either entitled to repayment, or obligated to pay the other party. This is discussed in more detail in Section 4.5.3 above.
46.	TANDF	The Texas Advanced Nuclear Development Fund.
47.	TANEO	The Texas Advanced Nuclear Energy Office.

48.	TVA	The Tennessee Valley Authority.
49.	U.S.	The United States of America.
50.	ZEC	A Zero Emission Tax Credit.

6.2 APPENDIX 2: SUMMARY OF STATE ACTIONS

The following table is intended to provide a high-level summary of certain key nuclear industry-related policies or programs that have been implemented in certain jurisdictions across the United States, with a focus on bespoke financial support.

We note that not all 50 states are described, as many states have not yet developed or implemented nuclear-specific plans, policies, or regulations, or are not yet at the stage in their program development that warranted material discussion. Of those included, the states are listed in alphabetical order. The State Summary is provided on the following pages.

State	Brief Summary of Nuclear Industry Activity in the Identified State
California	The state operates approximately 1.8 GW of nuclear power, solely from the Diablo Canyon site, which provides approximately 8% of the state's electricity.¹⁹¹ Between 2022 and 2024, the state has passed legislation and adopted numerous regulations to support the nuclear industry, including authorizing a \$1.4B loan guarantee, a \$400M loan and \$722.6M in ratepayer costs, all to the Diablo Canyon Nuclear Power Plant.¹⁹² Existing state law currently prohibits the California Energy Commission from certifying nuclear power plants outside of specified power plants like Diablo Canyon. It also includes land use permit restrictions. Assembly Bill 2647, introduced in February 2026 and approved and passed to the State Senate in May 2026, would pave the way for modern nuclear development in the state by clarifying that the state's moratorium on nuclear power plants does not include "advanced nuclear reactors," or those that have been licensed by the federal government since 2005. The bill was amended in April to require "a comprehensive assessment of the potential role for advanced nuclear technologies in supporting critical infrastructure in California," without making substantive changes to the permitting laws in place in the state.¹⁹³
Florida	The state operates approximately 3 GW of nuclear power from two plants, which provides nearly 12% of the state's electricity. In 2015, Florida enacted legislation authorizing electric utilities to petition the Florida Public Service Commission ("FPSC") for financing orders that authorize the issuance of nuclear asset recovery bonds. Between 2006 and 2015, the state legislature also enacted several bills to permit certain cost recovery programs for the siting, design, licensing, and construction of nuclear, permitted cost recovery for transmission lines for new nuclear plants, authorizes issuance of nuclear asset recovery bonds, and exempts new nuclear plants from the mandatory competitive bidding process.¹⁹⁴ In March 2025, the FPSC issued a report to evaluate the technical and economic feasibility of using nuclear power.

¹⁹¹ <https://world-nuclear.org/information-library/country-profiles/others/californias-electricity>.

¹⁹² <https://www.latimes.com/business/story/2022-11-21/biden-gives-pge-1-billion-to-keep-diablo-canyon-nuclear-plant-open>; <https://www.nei.org/resources/reports-briefs/state-legislation-and-regulations> (hereinafter referenced as the "NEI Nuclear State Legislation Study").

¹⁹³ https://leginfo.ca.gov/faces/billVersionsCompareClient.xhtml?bill_id=202520260AB2647.

¹⁹⁴ [NEI Nuclear State Legislation Study](#).

	In March 2026, House Bill 1461 was introduced, proposing to delegate authority to regulate advanced nuclear reactor design review, permitting and certification, oversight and construction approval to the FPSC. The Bill passed the house, but ultimately died in the Senate, signaling a need for additional bipartisan support before similar bills could be advanced.
Georgia	The state operates approximately 6.2 GW of nuclear power, which provides approximately 34% of the state’s electricity. Georgia is home to the largest nuclear plant in the U.S., the Vogtle plant.¹⁹⁵ In December 2023, Georgia’s Public Service Commission approved Georgia Power’s application to adjust rates to include reasonable and prudent costs from Plant Vogtle Units 3 and 4. The Commission had previously approved recovery of financing costs from ratepayers in 2009.
Illinois	Illinois generates more electricity from nuclear power than any other state, and accounts for 1/8th of the nation’s total nuclear power. Illinois currently has 11.5 GW of nuclear power generation in the state, which provides just over half of the state’s electricity.¹⁹⁶ The state has used a zero-emissions credit program for specific nuclear facilities in the state. In December 2023, the state General Assembly authorized the Governor to establish a commission to study the potential for development of SMRs in the state.¹⁹⁷ Nuclear energy enjoys strong bipartisan support in Illinois. Governor Pritzker signed the Clean and Reliable Grid Affordability Act in January 2026, which lifted a 30-year moratorium on the construction of new large-scale nuclear reactors.¹⁹⁸ Legislation was passed in late 2023, allowing the construction of small modular reactors of up to 300 MWe capacity.¹⁹⁹ During the February 2026 “State of the State,” Governor Pritzker announced plans to accelerate construction of new nuclear reactors through an executive order.²⁰⁰ Governor Pritzker ordered the Illinois Commerce Commission and the Illinois Power Agency to issue a notice of inquiry to potential new nuclear developers, existing plant owners that want to expand existing facilities, and to communities interested in hosting new sites, all in support of the State’s next Integrated Resource Plan development.²⁰¹ The

¹⁹⁵ <https://www.eia.gov/state/?sid=GA>.

¹⁹⁶ <https://www.eia.gov/state/analysis.php?sid=IL#:~:text=25%2C26-.Electricity,32%2C33>.

¹⁹⁷ [NEI Nuclear State Legislation Study](#).

¹⁹⁸ <https://www.ans.org/news/2026-01-09/article-7664/illinois-lifts-moratorium-on-new-large-nuclear-reactors/>; <https://www.world-nuclear-news.org/articles/illinois-governor-aims-to-speed-up-nuclear-new-build>.

¹⁹⁹ https://world-nuclear-news.org/articles/us-states-take-steps-towards-nuclear-new-build?cid=62842&utm_source=omka&utm_medium=WNN_Daily:4_November_2025&utm_id=446&utm_map=d18a2bdd-e49f-4f7d-8c81-542d987348b8.

²⁰⁰ <https://www.nbcchicago.com/news/local/chicago-politics/pritzker-executive-order-will-aim-to-speed-construction-of-nuclear-power-plants/3895969/>.

²⁰¹ <https://www.illinois.gov/government/executive-orders/executive-order-executive-order-2026-01.2026.html>.

	executive order also directs establishment of an interagency workgroup that will issue a report to the Governor's office with recommendations to enable construction to begin on at least 2 GW of new nuclear capacity by 2033.
Indiana	Indiana does not currently have an operating nuclear power plant in the state. The state signaled its support for nuclear in 2011 when it enacted S.B. 251, providing financial incentives to assist electric companies with nuclear generating facilities to recover costs and expenses incurred during comprehensive life cycle management upgrades. In May 2025, the state general assembly enacted a SMR Manufacturing Expense Tax Credit, available to certain investments made by a taxpayer to manufacture a SMR in the state. The credit considers SMRs to fall under 470 MW, and credits equal to 20% of a taxpayer's qualified investment.²⁰² In November 2025, First American Nuclear announced its commitment to invest over \$4B in the state to establish its headquarters and to build a nuclear energy park, creating nearly 5,000 high-paying jobs in the state. The park will feature the nation's first closed-fuel cycle system, designed to reuse spent nuclear fuel.²⁰³ In addition, S.B. 423 was adopted in May 2025, and establishes a pilot program for SMR partnerships in the state. Under this law, utilities can petition the Indiana Utility Regulatory Commission ("IURC") for approval to participate in the program and to recover project development costs through periodic rate adjustments.²⁰⁴ The bill requires the IURC to review petitions within 180 days, considering factors such as project consistency with program goals, potential compliance with nuclear regulations, and the reasonableness of project timelines. Utilities can recover 80% of approved project development costs through rate schedules and defer the remaining 20% for recovery in their next general rate case. The program includes provisions for cost recovery even if a project is canceled, subject to specific conditions, and is set to expire on July 1, 2035.²⁰⁵ Another bill signed into law in 2025 (SB 425),²⁰⁶ allows SMR projects to bypass local zoning rules if they are developed on the site of an existing power plant or mine. In February 2026, S.B. 258 was signed into law, which repealed prohibitions on constructing, operating, or increasing the capacity of a nuclear power-generating facility or fuel reprocessing plant without a permit.²⁰⁷ Indiana is also a co-chair of the Nuclear First Mover Initiative.

²⁰² <https://www.in.gov/dor/files/ib124.pdf>.

²⁰³ <https://www.21alivenews.com/2025/11/04/nuclear-energy-startup-establish-hq-manufacturing-operations-indiana/>.

²⁰⁴ <https://legiscan.com/IN/bill/SB0423/2025>.

²⁰⁵ <https://www.billtrack50.com/billdetail/1778315>.

²⁰⁶ <https://iga.in.gov/legislative/2025/bills/senate/425/details>.

²⁰⁷ <https://legiscan.com/IN/bill/SB0258/2026>.

Kansas	Kansas has approximately 1.2 GW of nuclear power generation in the state, which provides approximately 20% of the state’s electricity.²⁰⁸ In 2024, the state legislature enacted S.B. 410, which exempts new nuclear facilities from certain property taxes. The state had previously provided financial incentives for nuclear, including allowing power plants to qualify for recovery of Construction Work in Progress and other pre-construction recovery in rates. It also exempts from state property taxes any property purchased, constructed or installed to expand capacity at an existing nuclear plant or to build a new nuclear plant.²⁰⁹ In December 2025, California-based startup Deep Fission broke ground at the Great Plains Industrial Park in Labette County. Evergy, in partnership with Bill Gates-backed TerraPower and the Kansas Department of Commerce, signed a Memorandum of Understanding in late 2025 to evaluate siting a Sodium reactor in Kansas. The Kansas State Corporation Commission was required to conduct a comprehensive legal and technical study on nuclear generation. The final report was due April 1, 2026, and is expected to provide the roadmap for future state-level nuclear policy.
Kentucky	Kentucky does not currently have an operating nuclear power plant in the state. In 2024, the state established the Kentucky Nuclear Energy Development Authority (“KNEDA”) as an extension of the University of Kentucky Center for Applied Energy Research. KNEDA is a non-regulatory state entity tasked with supporting the development of a nuclear “ecosystem” across the state, including economic development opportunities, environmental protection, community outreach and workforce development.²¹⁰ In 2025 and 2024, the state legislature has also passed bills authorizing up to \$2M in grants and other financial assistance for nuclear projects. In 2024, the state also appropriated \$20M to the University of Kentucky to support and facilitate the development of nuclear energy by the Center for Applied Energy Research.²¹¹ In February 2026, State Senator Danny Carroll sponsored S.B. 57, which would establish a Nuclear Reactor Site Readiness Pilot Program and make the state more competitive for future nuclear projects by creating jobs and minimizing upfront costs. The Bill

²⁰⁸ <https://www.evergy.com/landing/wolf-creek-nuclear-generating-station#:~:text=As%20Kansas'%20one%20nuclear%20power,of%20its%20emissions%2Dfree%20electricity.>

²⁰⁹ [NEI Nuclear State Legislation Study.](#)

²¹⁰ [https://ksenaterepublicans.com/press-releases/2025/10/30/sen-funke-frommeyer-highlights-legislative-efforts-to-make-kentucky-leader-in-nuclear-development-during-expert-panel-discussion#:~:text=Senate%20Bill%20179%20\(2025\)%20created,Kentucky%20is%20prepared%20to%20lead.%E2%80%9D.](https://ksenaterepublicans.com/press-releases/2025/10/30/sen-funke-frommeyer-highlights-legislative-efforts-to-make-kentucky-leader-in-nuclear-development-during-expert-panel-discussion#:~:text=Senate%20Bill%20179%20(2025)%20created,Kentucky%20is%20prepared%20to%20lead.%E2%80%9D.)

²¹¹ [NEI Nuclear State Legislation Study.](#)

	would authorize grant funding for eligible applicants for up to 1/3 of the actual costs incurred in applying for and procuring an early site permit (not to exceed \$25M), and allow a regulated utility to apply to the Kentucky Public Service Commission (“KPSC”) for the recovery of costs not covered in its existing rates incurred in applying for and procuring an early site permit, construction permit, or combined operating license. The Bill cleared the legislature and was signed by the Governor in April 2026.²¹² In April 2026, KPSC completed a series of public information meetings across the state, including discussion of nuclear siting guidelines.²¹³ Kentucky is also a co-chair of the Nuclear First Mover Initiative.
Louisiana	Louisiana has approximately 2.2 GW of nuclear power generation in the state.²¹⁴ Entergy owns and operates both nuclear power plants in the state. The state’s draft Louisiana Competitive Edge Framework was filed, including recommendations to the state Public Service Commission to support the deployment of advanced reactors. The state had previously implemented a regulation in 2007 allowing for a phased cost recovery mechanism on construction work in progress for nuclear facilities.²¹⁵ In March 2026, Governor Jeff Landry announced the state’s Nuclear Strategic Framework, and a \$45M federal funding renewal for the Future Use of Energy in Louisiana (“FUEL”) initiative, with a focus on nuclear manufacturing and component production, expansion of generation capacity, fuel conversion and enrichment capabilities. Louisiana is also a participating state in the Nuclear First Mover Initiative.
Mississippi	Mississippi has 1.4 GW of nuclear power generation, sourced entirely from Entergy’s Grand Gulf Nuclear Station near Port Gibson, which provides approximately 15% of the state’s electricity.²¹⁶ In 2024, the Public Service Commission expressed its support of nuclear energy and hosted its first Nuclear Summit to examine developments around the deployment of new reactors. In 2020, the state legislature enacted H.B. 863, which exempts nuclear generating facilities from county, municipal, and district ad valorem taxes, instead requiring the utility pay the state Department of

²¹² <https://www.wbko.com/2026/04/08/gov-beshear-signs-legislation-lower-utility-mortgage-costs/>.

²¹³ <https://kyrc.org/public-comment-opportunities-announced-in-psc-nuclear-investigation/>.

²¹⁴ <https://www.energy.gov/sites/default/files/2021-09/Louisiana%20Energy%20Sector%20Risk%20Profile.pdf>

²¹⁵ [NEI Nuclear State Legislation Study](#).

²¹⁶ <https://magnoliatribune.com/2025/09/19/mississippi-officials-eye-nuclear-energy-to-power-states-economic-development-future/>.

	Revenue a sum based on the assessed value of such nuclear generating plant. The state has also authorized the Public Service Commission to include certain pre-construction, construction, and operations work-in-progress in an electric utility's rates, including for nuclear.²¹⁷ In 2026, Republican legislators proposed two bills that would incentivize nuclear development and growth through the Mississippi Development Authority. S.B. 2185 would provide up to \$10M to defray nuclear development costs in the coming fiscal year. H.B. 697 would create a special fund for nuclear site development grants. Both proposed bills died in committee, signaling the need for additional bipartisan support before further bills can be advanced in the future.
Missouri	Missouri has approximately 1.2 GW of nuclear power generation, entirely from the Callaway Energy Center, which provides approximately 15% of the state's electricity.²¹⁸ In 2024, the state legislature authorized a state and local sales tax exemption for all sales and purchases of tangible personal property, building materials, equipment, fixtures, manufactured goods, machinery, and parts for the purposes of constructing all or any portion of a "nuclear security enterprise."²¹⁹ In January 2026, the Governor issued an Executive Order establishing the Missouri Advanced Nuclear Energy Task Force to promote nuclear development in the state. In early 2026, House Bills 2122 and 1626 were introduced, which each remain in Committee as of May 2026, proposing to allow electric companies to charge customers for the cost of building new nuclear power plants.²²⁰
Nebraska	Nebraska has 770 MW of nuclear power generation, solely from the Cooper Nuclear Station, which provides approximately 17.2% of the state's electricity.²²¹ In 2021, the state legislature passed LB 84, making nuclear energy a qualifying source for the state's business tax credit and sales tax exemptions.²²² In addition, the Nebraska Department of Economic Development was provided \$1M for a feasibility study to consider specific sites for potential nuclear development. Previously, the Department was appropriated \$1M for use by a political

²¹⁷ [NEI Nuclear State Legislation Study.](#)

²¹⁸ <https://dnr.mo.gov/energy/energy-resources/nuclear#:~:text=Nuclear%20in%20Missouri,power%20almost%20800%2C000%20average%20households.>

²¹⁹ [NEI Nuclear State Legislation Study.](#)

²²⁰ <https://legiscan.com/MO/bill/HB1626/2026>; <https://house.mo.gov/bill.aspx?bill=HB2122&year=2026&code=R>.

²²¹ <https://www.nppd.com/power><https://www.nei.org/CorporateSite/media/filefolder/resources/fact-sheets/state-fact-sheets/Nebraska-State-Fact-Sheet.pdf>.

²²² <https://revenue.nebraska.gov/about/2021-nebraska-legislative-changes>.

	subdivision that owns or operates a nuclear plant to conduct an advanced reactor feasibility study. Nuclear also qualifies for a business tax incentive in the state.²²³ In late 2025, The Nebraska and Omaha Public Power Districts, Lincoln Electric System and the Grand River Dam Authority of Oklahoma signed a MOU, agreeing to create the Great Plains New Nuclear Consortium to explore deploying 1,000 to 2,000 MW of new nuclear generation in Nebraska. Nebraska has also submitted information to DOE to consider its participation in the Nuclear Lifecycle Innovation Campus Request for Information.
New Jersey	New Jersey has approximately 3.5 GW of nuclear power generation from three reactors, which provides approximately 40% of the state’s electricity.²²⁴ In 2019, the Board of Public Utilities approved a zero-emission credit program for two nuclear power plants in the state, which was renewed in 2023. This credit program provides up to \$300M annually to support low carbon electricity sources, including nuclear power. The proposed New Jersey Energy Reliability and Affordability Act (S.B. 4876, introduced in November 2025) would require the state’s board of public utilities to issue a solicitation for expressions of interest from developers for qualifying nuclear projects, with such proposals judged on cost, economic and system impacts, feasibility, and ratepayer impacts. An approved project would be entitled to financial support through a nuclear development charge imposed on all electric utility customers. This charge may fund up to 5% of construction costs, payable as construction milestones are met. The proposed legislation also allows for negotiation of limited risk-sharing for cost overruns up to 20% above the approved budget. In addition, this innovative proposal creates an “Advanced Nuclear Energy Certificate program, which obligates electricity suppliers to purchase certificates representing advanced nuclear generation in proportion to their retail load. Revenues from the sale of nuclear output into regional wholesale markets would then generally be credited back to ratepayers, except in specific circumstances involving co-located loads.²²⁵ The bill was ultimately unsuccessful in the 2024-2025 legislative session. New Jersey Governor issued an Executive Order in January 2026 to establish an interagency Nuclear Power Task Force to coordinate efforts of the Executive Branch departments and agencies to formulate and implement a strategy for the development of new nuclear generation in the state.

²²³ [NEI Nuclear State Legislation Study](#).

²²⁴ <https://www.utilitydive.com/news/new-jersey-bpu-nuclear-rfi-pseg/747349/#:~:text=New%20Jersey%20has%20three%20nuclear,generation%2C%20according%20to%20the%20BPU.>

²²⁵ <https://scarincihollenbeck.com/client-alert/new-jersey-energy-security-and-affordability-act-what-senate-bill-s4876-means-for-nuclear-and-grid-development>.

	A.B. 5517, enacted in January 2026, requires the New Jersey Board of Public Utilities to study the feasibility of deploying advanced reactors including recommendations related to a pilot program. The study must be submitted to the Governor and Legislature within 18 months of enactment. In March 2026, Legislative Bill A4528 was introduced, proposing to modify environmental permit review requirements for nuclear facilities. This bill was substituted by S3870, which was approved by the general assembly in April 2026 and signed by the Governor in April 2026, removing a key permitting hurdle that had created a de facto moratorium on new nuclear power for decades.²²⁶
New York	New York currently has 3.4 GW of nuclear power generation in the state, which provides approximately 20% of the state’s electricity.²²⁷ On January 14, 2025, Governor Kathy Hochul announced the start of a process to develop a Master Plan for Responsible Advanced Nuclear Development in New York, to develop recommendations for implementation of advanced nuclear technologies in the state. The Master Plan development process is expected to conclude with publication by the end of 2026.²²⁸ In June 2025, the Governor directed the state’s public electric utility to consider developing at least 1 GW of new nuclear capacity in upstate New York. In November 2025, the state released its first solicitations: (1) a RFI for Upstate New York communities interested in hosting an advanced nuclear project developed by the Power Authority; and (2) a RFI seeking information from potential development partners with experience developing, constructing, operating or servicing nuclear power projects, with a targeted construction start date of 2033.²²⁹ In December 2025, Governor Hochul and Ontario Premier Ford signed a Memorandum of Understanding (“MOU”) to advance the development and deployment of nuclear power, including large-scale reactors and SMRs.²³⁰ The MOU focuses on shared expertise in industry-specific technology, public education efforts, expanded electric trade between jurisdictions, and collaboration on workforce opportunities.

²²⁶ <https://www.nj.gov/governor/news/2026/20260408a.shtml>.

²²⁷ <https://www.nuclearny.org/nuclear-power-generation-in-new-york/>.

²²⁸ <https://www.nyserda.ny.gov/All-Programs/Advanced-Nuclear-Energy#:~:text=The%20development%20of%20the%20Master%20Plan%20will%20provide%20a%20framework,Read%20the%20Blueprint>.

²²⁹ https://world-nuclear-news.org/articles/us-states-take-steps-towards-nuclear-new-build?cid=62842&utm_source=omka&utm_medium=WNN_Daily:4_November_2025&utm_id=446&utm_map=d18a2bdd-e49f-4f7d-8c81-542d987348b8.

²³⁰ “New York and Ontario have a proud tradition of trade, cooperation and a bond that cannot be broken,” said Governor Hochul. “This first-of-its-kind agreement represents a bold step forward in our relationship and New York’s pursuit of a clean energy future. By partnering with Ontario Power Generation and its extensive nuclear experience, New York is positioning itself at the forefront of advanced nuclear technology deployment, ensuring we have safe, reliable, affordable and carbon-free energy that will help power the jobs of tomorrow.” <https://news.ontario.ca/en/release/1006888/ontario-and-new-york-sign-agreement-to-build-nuclear-energy-and-grow-economies>.

	During the 2026 State of the State in January, Governor Hochul expanded her earlier 1 GW target and announced a target of building 5 GW of new nuclear capacity, issued with a Policy Book focusing on reliability and issued through a new Department of Public Service process (see chapter 9 of the Policy Book). However, there are reports that Governor Hochul opposes the reopening of the Indian Point power plant, which closed in 2021. Other state politicians oppose expansion of the industry in the state. The state has a Zero-Emissions Credits program, created by the state Public Service Commission in 2016 to compensate the four Upstate nuclear plants for their zero-emissions power. Under the program, any benefits received from the federal nuclear production tax credit (“PTC”) enacted in 2022 were required to be passed along to ratepayers.²³¹ New York is also a co-lead of the Advanced Nuclear First Mover Initiative, a multi-state initiative on nuclear energy focused on driving down costs and risk-sharing.²³²
North Carolina	North Carolina is one of the top nuclear generation-producing states in the country, with five units operating across three sites, with a total capacity of over 5,000 MW. This accounts for approximately 1/3 of the state’s net generation. In 2024, the state Utilities Commission accepted a proposal for a Consolidated Carbon Plan and Integrated Resources Plan for two utilities, including the approval of \$440 million for continued development work and early site permits for two SMRs, totaling 600MW of new nuclear capacity online by 2035. In 2008, the Utilities Commission allowed Duke Energy to recover certain development costs associated with the construction of the Lee Nuclear Generating Station. Governor John Stein supports the industry and he established the North Carolina Energy Policy Task Force, which published its first Interim Report in February 2026. Nuclear energy facilities qualify as a “clean energy facility” in the state. The North Carolina Utilities Commission is responsible for reviewing and approving utility Integrated Resource Plans. Duke Energy’s updated Carbon Plan and Integrated Resource Plan provides that it will consider large reactors in addition to SMRs at its proposed nuclear sites and targeting a 2037 deployment date. The updated plan is expected to be filed in August 2026.

²³¹ <https://www.governor.ny.gov/news/governor-hochul-announces-151-million-savings-new-york-energy-customers>.

²³² The National Association of State Energy Officials (NASEO) Advanced Nuclear First Mover Initiative is led by the state co-chairs New York, Indiana, Kentucky, Tennessee and Wyoming, and the participating states Louisiana, Maryland, Pennsylvania, Utah, Virginia, and West Virginia – committed to working with the private sector, DOE, and Nuclear Regulatory Commission to accelerate advanced nuclear projects and bring more power to the electric grid for reliability, sustainability, and economic growth. A cornerstone of the Initiative is forming public-private partnerships through the engagement of utilities; nuclear technology companies; hyperscalers; manufacturers and other major end-users; developers; investors; and educational institutions.

Ohio	Ohio currently has approximately 2.1 GW of nuclear power, providing approximately 12% of the state’s electricity. Ohio has two nuclear plants in the state, including the Perry 1 site in Lake County, and the Davis-Besse power plant in Oak Harbor.²³³ In 2023, the state established the Ohio Nuclear Development Authority within the Ohio Department of Development and included \$750,000 to establish an Ohio State Nuclear Technology Research Program that will develop and study advanced nuclear research reactors.²³⁴ In September 2025, Centrus Energy announced a plan to significantly expand its uranium enrichment plant in the town of Piketon, creating hundreds of jobs and boosting Low-Enriched Uranium (LEU) and High-Assay, Low-Enriched Uranium (HALEU) production.²³⁵ In October 2025, Governor Mike DeWine announced a new \$100M Energy Opportunity Initiative to support nuclear and natural gas projects in the state over the next 5 years²³⁶ to attract supply chain companies for small modular reactor manufacturing and for the creation of “nuclear energy center of excellence.” Funds would be used in the form of grants and low-cost loans focusing on: (1) engineering, right-of-way, and construction for new and existing natural gas infrastructure; (2) site preparation for SMR generation; (3) advanced workforce training and the creation of a “nuclear energy center of excellence” around employment; and (4) incentives for attracting supply-chain companies for SMR manufacturing and production. The Governor has encouraged PJM to prioritize the interconnection review queue for nuclear projects to take precedence over renewable projects.²³⁷
South Carolina	South Carolina currently has approximately 6.5 GW of nuclear power generated by seven operating reactors at four plants across the state, providing approximately 55% of the state’s electricity.²³⁸ In 2020, the legislature established the Electricity Market Reform Measures Study Committee to consider whether it should adopt electricity market reform measures and recognized the carbon-free and economic benefits of nuclear power. In 2024, the state legislature appropriated \$10M to the Department of Commerce for “SC Nexus,” a tech hub in South Carolina driving advanced energy and grid resilience technologies for emerging and exportable energy solutions.

²³³ <https://ema.ohio.gov/prepare-respond/emergency-preparedness/radiological-emergency/nuclear-power-plants>.

²³⁴ [NEI Nuclear State Legislation Study](#).

²³⁵ <https://governor.ohio.gov/media/news-and-media/centrus-details-plans-to-add-at-least-300-new-jobs-in-southern-ohio-with-multi-billion-dollar-investment>.

²³⁶ <https://www.cleveland.com/news/2025/10/ohio-launches-100m-energy-fund-to-support-nuclear-other-power-development.html>.

²³⁷ <https://www.ans.org/news/2025-11-06/article-7523/ohio-mike-dewine-jobs-ohio-centrus-bwxt-smr-workforce-development/>.

²³⁸ <https://www.eia.gov/state/analysis.php?sid=SC#:~:text=24,Electricity,27>.

	The Public Service Commission is responsible for regulating utility rates and infrastructure planning, and specifically by the 2025 Energy Security Act (H. 3309), responsible for evaluating new nuclear projects. The Governor established a Nuclear Advisory Council, housed under the Department of Commerce, to advise on nuclear issues and activities in the state. The April 2026 meeting focused on the DOE Nuclear Lifecycle Innovation Campus RFI Response, state funding opportunities, Orano’s reprocessing business, V.C. Summer progress updates, and NRC regulatory support. In early 2026, the state legislature authorized a submission of a notification of interest to host a Nuclear Lifecycle Innovation Campus.²³⁹
Tennessee	Tennessee has approximately 8.2 GW of nuclear capacity, which provides almost half of the state’s electricity.²⁴⁰ The state’s 2023-2024 budget included funds for a Nuclear Energy Fund, with \$50M allocated to expanding nuclear development and manufacturing and workforce training.²⁴¹ In 2025, the Governor secured more than \$90 million in addition to the \$60 million already invested by the state in nuclear, including \$50 million for the Clinch River site (which obtained an early site permit from the NRC in 2019), funds for R&D, and \$10 million for workforce development.²⁴² Tennessee Nuclear Network was established in July 2025 to coordinate between industry and state regulators.²⁴³ Oak Ridge remains a national hub for next-generation nuclear energy. The NRC and U.S. Army Corps of Engineers released a draft environmental impact statement for the Tennessee Valley Authority’s proposed GE Hitachi BWRX-300 SMR in Oak Ridge, Tennessee.²⁴⁴ If approved, this moves the project one step closer to approval, paving the way for the first U.S. utility-scale SMR, and addressing some of the FOAK concerns discussed above in this Report. In addition, TRISO-X received approval to commercially manufacture high-assay low-enriched uranium fuel for advanced reactors, the first new fuel facilities licensed by the NRC in over 50 years.

²³⁹ <https://scdailygazette.com/2026/03/06/sc-considers-joining-federal-effort-to-boost-nuclear-fuel-supply-opponents-say-it-wont-work/>;
https://www.postandcourier.com/aikenstandard/news/local/south-carolina-seeking-nuclear-lifecycle-innovation-campus/article_0435e173-c114-4438-a2b8-424fb3cc9fe0.html.

²⁴⁰ <https://www.tva.com/energy/our-power-system/nuclear>.

²⁴¹ [https://tnced.com/news/governor-lee-commissioner-mcwhorter-announce-new-funding-for-nuclear-education/#:~:text=Tennessee's%20Nuclear%20Energy%20Fund%20is%20a%20\\$50,000,000%20research%20institutions%20Developing%20their%20nuclear%20education%20programs](https://tnced.com/news/governor-lee-commissioner-mcwhorter-announce-new-funding-for-nuclear-education/#:~:text=Tennessee's%20Nuclear%20Energy%20Fund%20is%20a%20$50,000,000%20research%20institutions%20Developing%20their%20nuclear%20education%20programs).

²⁴² [https://www.nei.org/news/2025/where-is-nuclear-energy-policy-in-the-states#:~:text=The%202025%20proposal%20includes%20\\$50%20million%20for%20R&D%2C%20and%20\\$10%20million%20for%20workforce%20development](https://www.nei.org/news/2025/where-is-nuclear-energy-policy-in-the-states#:~:text=The%202025%20proposal%20includes%20$50%20million%20for%20R&D%2C%20and%20$10%20million%20for%20workforce%20development).

²⁴³ <https://www.eteonline.org/tennessee-nuclear-network/about-tn2/>.

²⁴⁴ <https://www.ans.org/news/2025-11-07/article-7528/nrc-finishes-draft-supplemental-eis-for-clinch-river-smr-site/>.

	In his 2026 State of the State address, Governor Bill Lee announced budget allocation of an additional \$25M investment in the Nuclear Energy Fund to attract advanced nuclear technology companies (bringing the total to \$95M). The state is also allocating funds for AI, data center, and quantum computer investments. Tennessee submitted a notification of interest to host a DOE Nuclear Lifecycle Innovation Campus. Tennessee is also a co-chair of the Nuclear First Mover Initiative.
Texas	Texas has approximately 5 GW of nuclear capacity from four reactors at two plants, providing approximately 10% of the state’s electricity in the oil and gas-dominated state.²⁴⁵ The state has long supported the nuclear industry, with legislation enacted in 2007 enabling local taxing authorities to grant property tax abatements for new nuclear plants.²⁴⁶ In June 2025, the Governor established the Texas Advanced Nuclear Energy Office and created a \$350M nuclear development fund, including workforce development initiatives.²⁴⁷ More details on Texas initiatives can be found in Section 4.5.6 above.
Utah	Utah currently does not have any operating nuclear power plants in the state. However, Utah has recently been increasing its support for the industry. In 2024, the state legislature modified the definitions and qualifications applicable to the high-cost infrastructure development tax credit to include nuclear power generation systems. In 2024 the Governor also announced “Operation Gigawatt” to double Utah’s power generation over the next 10 years. This prompted the establishment of a state nuclear commission,²⁴⁸ and the announcement of partnerships with Holtec International and Hi Tech Solutions to build an SMR component manufacturing plant and workforce training center at an energy hub in Brigham City.²⁴⁹

²⁴⁵ [https://comptroller.texas.gov/economy/economic-data/energy/2023/nuclear.php#:~:text=The%20U.S.%20Energy%20Information,of%20electricity%20\(Exhibit%201\).](https://comptroller.texas.gov/economy/economic-data/energy/2023/nuclear.php#:~:text=The%20U.S.%20Energy%20Information,of%20electricity%20(Exhibit%201).)

²⁴⁶ [NEI Nuclear State Legislation Study.](#)

²⁴⁷ <https://gov.texas.gov/news/post/governor-abbott-delivers-remarks-at-2025-texas-nuclear-summit>.

²⁴⁸ <https://energy.utah.gov/homepage/about-us/operation-gigawatt/>.

²⁴⁹ <https://www.sltrib.com/news/environment/2025/11/17/utah-announces-plans-nuclear-power/>.

	In 2025, the Governor signed H.B. 249 to establish a Nuclear Energy Consortium to coordinate nuclear policy among state stakeholders, and H.B. 70, to establish a Utah Energy Council, to establish a process for designating energy development zones, each within the OED. In 2025, the state legislature also passed H.B. 78, sponsored by Representative Carl Albrecht and Senator Derrin Owens, to establish a Nuclear Energy Regulatory Office to streamline licensing for nuclear projects. The new office also has the authority to enter cooperative agreements with federal agencies. Senate Bill 135, signed by the Governor in March 2026, requires the state to assess existing laws to identify factors that could limit the state’s ability to host a nuclear innovation campus in response to DOE’s 2026 request for information on such projects. The state submitted its responses to DOE on March 31, 2026. Utah is a participating state in the Nuclear First Mover Initiative. Utah also has joined Idaho and Wyoming in a tri-state compact focused on regional nuclear energy collaboration and deployment.²⁵⁰
Virginia	Virginia operates approximately 3.7 GW from four reactors at two plants in the state. Nearly 32% of the Commonwealth’s power currently is sourced from nuclear power.²⁵¹ In November 2025, the Virginia unveiled a 2025-2029 Strategic Plan describing the Commonwealth’s goal of establishing the state as a global hub for nuclear innovation, manufacturing, and research. The Strategic Plan included manufacturing, workforce, and financing goals: (1) accelerate the deployment of small modular and advanced reactors, expand the nuclear supply chain, and develop a research and education reactor facility through the Virginia Innovative Nuclear Hub; (2) expand workforce education and hands-on training programs through community colleges and universities; (3) support public-private partnerships for research and technology transfer, attracting new investment in nuclear manufacturing and medicine, and ensuring grid stability for data centers, hospitals, and military installations. The state’s major utilities, Dominion Energy and Appalachian Power Company, are currently bound by VCEA requirements to reach carbon neutrality by 2050.²⁵² As of 2024, the state legislature authorized utilities to petition the state Corporation Commission for

²⁵⁰ <https://governor.utah.gov/press/news-release-governors-of-utah-idaho-and-wyoming-sign-tri-state-agreement-to-strengthen-regional-energy-collaboration/>.

²⁵¹ <https://www.commerce.virginia.gov/initiatives/va-nuclear/>.

²⁵² <https://virginiamercury.com/2025/11/07/energy-policy-tees-up-to-take-focus-in-new-administration/>.

	approval of a rate adjustment clause for the recovery of SMR project development costs. The state legislature also established a Virginia Power Innovation Fund and Program, and a specific Nuclear Innovation Hub.²⁵³ Virginia is also a participating state in the Nuclear First Mover Initiative.
Washington	Washington State has significant nuclear history from the plutonium producing reactor at the federal site²⁵⁴ in Hanford, Washington; however today, the state has approximately 1.2 GW generating capacity provided solely by the Columbia Generating Station, which has been operating since 1984.²⁵⁵ In 2024, the state provided \$25M towards Energy Northwest’s proposal to build 12 small modular reactors capable of generating up to 960 megawatts in central Washington.²⁵⁶ Funds were derived from the auction of air pollution allowances through the Climate Commitment Act’s cap-and-invest program., and were provided to help offset costs related to Energy Northwest’s participation in the DOE LPO’s “Part 2” application, including due diligence and environmental impact reviews.²⁵⁷ In February 2026, Representatives Stephanie Barnard (sponsor of H.B. 1210 discussed below) and Mark Klicker, who have been particularly supportive of the industry, introduced House Joint Memorial 4016 to request the governor submit responses to the federal Nuclear Lifecycle Innovation Campus RFI. Governor Bob Ferguson has generally been supportive of the nuclear industry. In March 2026, he signed H.B. 1210, which updates Washington’s targeted urban property tax exemption for qualifying clean energy transformation business facilities, including those connected to advanced nuclear manufacturing. There were numerous nuclear-related legislative actions in the 2025-2026 legislative session. H.B. 2090 would integrate nuclear energy into the state strategy, H.B. 1249 would create a 13-member advanced nuclear advisory commission, and H.B. 1481 would commission a state study on the benefits and feasibility of expanding nuclear energy in Washington. These bills were not passed by the end of the session, but show the growing focus on the industry in the state.

²⁵³ [NEI Nuclear State Legislation Study.](#)

²⁵⁴ <https://www.hanford.gov/page.cfm/understandPAST>.

²⁵⁵ <https://www.energy-northwest.com/energy-projects/columbia-generating-station/extended-power-uprate/>.

²⁵⁶ <https://www.seattletimes.com/seattle-news/environment/small-nuclear-reactors-could-be-on-their-way-to-central-wa/#:~:text=A%20new%20chapter%20in%20the,the%20U.S.%20Energy%20Information%20Administration.&text=On%20Friday%2C%20local%20officials%2C%20tribes,to%20excessive%20levels%20of%20radiation>.

²⁵⁷ <https://washingtonstatestandard.com/2024/03/27/wa-governor-urged-to-veto-25m-for-nuclear-power-project/>.

Wyoming	Wyoming currently does not have any operating nuclear power plants in the state. However, the state is developing its first nuclear power plant, the TerraPower Natrium plant (discussed in Section 4.7.1 above), which is expected to have a capacity of 345 megawatts and be operational by 2030. In 2024, the state’s Energy Authority awarded Phase Two of the \$20 million cost share program to assess the viability of deploying small-scale nuclear reactors in the state. In 2022, the state legislature removes certain taxes on nuclear electricity generation.²⁵⁸ Wyoming is also a co-chair of the Nuclear First Mover Initiative.
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²⁵⁸ [NEI Nuclear State Legislation Study](#).

6.3 APPENDIX 3: SAMPLE PROJECT RISK REGISTER

Note #1: This document is for illustrative purposes only. It is not intended to identify all risks, nor is it designed to provide a complete solution to the assessment of such risks. Any ultimate user of this document should prepare a state-specific / project-specific risk register that considers all risks relative to the intended project. A final, state-specific project risk register would cover more risks and the “Action / Accommodation” analysis would be much more detailed, to include potential cost (and other) effects of preferred solutions.

Note #2: The “Probability” and “Impact” columns could be done on a high/medium/low basis or converted to numerical values, ultimately combining into a numerical risk weighting.

Note #3: Because this is for illustrative purposes, the Development Phase Risks and Descriptions have been completed. Please note that it has been done as a training aid, not as a specific analysis of the current program in the State of Arkansas. Observe that the list of Risks changes, depending on the Phase of the Project.

Note #5: As the project progresses, the Project Risk Register should be updated periodically. It is intended to be a “living” document.

The Development Phase

	RISK	DESCRIPTION	PROBABILITY	IMPACT	ALLOCATION	ACTION/ACCOMMODATION
1	Licensing (nuclear)	Project delays (and cost impact) due to regulatory uncertainty, given FOAK aspects Deviations from standard practice Changes in regulatory standards (e.g., post-Fukushima adjustments)				
2	Permitting / Licensing (non-nuclear)	Complications and/or delays due to slow permitting process, possibly due to lack of				

	RISK	DESCRIPTION	PROBABILITY	IMPACT	ALLOCATION	ACTION/ACCOMMODATION
		alignment across authorities (both Federal, State, and Local)				
3	Site Characterization	Problematic site conditions; need to do full site investigation				
4	Social	Local resistance to project; national resistance to project; disruption to local population due to construction, etc.				
5	Environmental	Issues impacting Federal, State, third-party standards				
6	Reputational	Commitment to best practices; transparency; sustainability				
7	Long-lead items; specialty materials	Supply-chain bottlenecks; timing of equipment to support project schedule				
8	Political	Sustainability of Federal and State Government's Commitment				
9	Funding	Inadequate funding to engage in proper Program and Project planning				
10	Commercial & Contractual Structure	Delays to schedule due to inability to develop proper contracting and commercial structure				

	RISK	DESCRIPTION	PROBABILITY	IMPACT	ALLOCATION	ACTION/ACCOMMODATION
11	Human Resources Development	Inability to source adequate personnel for owner and regulatory organizations				
12	Public Relations	Opposition to project (citizens, neighboring states, regional organizations, NGOs)				
14	Financing Structure (debt)	Inability to source debt to support financing				
15	Financing Structure (equity)	Inability to source equity to support financing				
16	Total Project Cost	Total Project Cost is too high				
17	Project Company Structure & Management	Poor management of overall Project				
18	Ethics / Fraud	Bribery, Corruption, Counterfeit, Fraudulent, and Suspect Items				
19	Intellectual Property (IP)	Availability of (and rules on) IP				
20	Export Control	Bars to tech transfer				
21	Localization	Desired targets				
22	Technology Transfer	Desired targets				
23	Jurisdiction-specific Risk Factors	TBD				

The Construction Phase

	RISK	DESCRIPTION	PROBABILITY	IMPACT	ALLOCATION	ACTION/ACCOMMODATION
1	Design					
2	Technology					
3	Technical					
4	Cost					
5	Schedule (incl. Execution Plan and Key Personnel)					
6	Financing (both debt & equity)					
7	Completion Support (financing)					
8	Foreign Exchange					
9	Interest Rates					
10	Insurance (non-nuclear)					
11	Insurance (nuclear)					
12	Political					
13	Force Majeure					
14	Social					
15	Environmental					
16	Human Resources Development					
17	Reputational					
18	Nuclear Incident					

	RISK	DESCRIPTION	PROBABILITY	IMPACT	ALLOCATION	ACTION/ACCOMMODATION
19	Site / Sub-surface conditions					
20	Logistics to the Site					
21	Performance of Units					
22	Commissioning					
23	Labor (availability)					
24	Labor (productivity)					
25	Change in Law					
26	Change in Standards					
27	Taxes					
28	Public Relations					
29	Project Oversight (by Owner)					
30	Supply Chain					
31	Safety					
32	Quality					
33	Ethics/Fraud					
34	Export Control					
35	Localization					
36	Technology Transfer					
37	Intellectual Property					
38	Jurisdiction-specific Risk Factors	TBD	TBD	TBD	TBD	TBD

The Operation Phase

	RISK	DESCRIPTION	PROBABILITY	IMPACT	ALLOCATION	ACTION/ACCOMMODATION
1	Regulatory					
2	Operation					
3	Fuel supply					
4	Electricity Sales & Market Risk					
5	Foreign Exchange ²⁵⁹					
6	Interest Rates					
7	Insurance (non- nuclear)					
8	Insurance (nuclear)					
9	Political					
10	Reputational					
11	Environmental					
12	Nuclear Incident					
13	Spent Fuel / Waste Management					
14	Decommissioning					
15	Human Resources					
16	Change in Law					
17	Change in Standards					
18	Taxes					
19	Maintenance					
20	Public Relations					

²⁵⁹ If applicable, for example, based on involvement of foreign Export Credit Agencies.

	RISK	DESCRIPTION	PROBABILITY	IMPACT	ALLOCATION	ACTION/ACCOMMODATION
21	Warranty; Unscheduled Outages					
22	Site Physical Security					
23	Cybersecurity					
24	Debt Service					
25	Refinancing					
26	Intellectual Property					
27	Revenue / Operating Budget Needs					
28	Jurisdiction- specific Risk Factors					

6.4 APPENDIX 4: SAMPLE PROJECT DEVELOPMENT PLAN (OUTLINE)

Note #1: This document is for illustrative purposes only. It is not intended to identify all steps or elements, nor is it designed to provide a complete solution for project delivery. Any ultimate user of this document should prepare a jurisdiction-specific and project-specific Project Development Plan that considers all elements of the intended project.

Note #2: The Project Development Plan does not incorporate all elements of the IAEA's Milestones Approach; however, such omissions are not intended to minimize the importance of these Milestones elements, all of which should continue to be considered. Instead, the focus is on project deliverability within the context of financing. Nevertheless, there are issues that are of tremendous importance to overall programmatic success that will need to be addressed outside of the Project Development Plan (and, if desired, they can be incorporated into the Project Development Plan).

A Project Development Plan (“PDP”) outlines a series of activities that are fundamental to the development of a NPP in any jurisdiction. The PDP is meant to be a flexible tool, not a rigid structure that is applied universally for all project types and situations. Activities are not intended to be performed in series; they can be performed in parallel, as applicable.

A formal PDP would integrate the elements discussed below into an integrated planning schedule, which would establish timelines and reflect linkages and dependencies across activities.

Ultimately, execution of the PDP is a function of three key elements: (1) human resources; (2) budgetary resources; and (3) “planning in reverse”. The final PDP should be reflected in a schedule with key timelines, identifying “critical path” activities as applicable.

1. Project Definition

- a. Why is nuclear power the preferred choice?
 - i. Is the NPP part of the State’s (and country’s) Critical Infrastructure?
 - ii. Is nuclear power part of the State’s energy and industrial policy?
- b. What are the future electricity needs of the State and region?
- c. What other considerations factor in the decision to pursue a nuclear power program?
- d. What is the target date for commercial operation of each NPP?
- e. Commitments vis-à-vis Prudent Industry Practices.
- f. Am I planning for a single unit or a fleet? If the latter, how big could the fleet be?
- g. Is this just about electricity for the grid, or are there other considerations, applications, and ambitions that will influence overall programmatic and project-level decisions?

❖ Above all else, is there clarity of purpose?

2. Management

- a. Creation of:

-
- i. State planning authority
 - ii. Project team with project development experience
 - iii. Operating organization
 - b. Human Resources Development
 - i. Initial hiring for core team
 - ii. Staffing plans
 - iii. Succession planning
 - iv. Educational and technical training programs
 - v. Public sector outreach (to encourage interest in NPP-related careers)
 - vi. Exchange programs / training programs / workforce development
 - vii. Laboratories / research institutes
 - c. Engagement of individual consultants (technical, legal, commercial, financial, regulatory, environmental, public/government relations) to be integrated into “core team”
 - d. Engagement of advisory companies (technical, legal, financial) beyond the core team

3. Project Analytics

- a. What are the “lessons learned” (both positive and negative) from other NPPs?
- b. What are the “lessons learned” (both positive and negative) from non-nuclear megaprojects?
- c. If applicable, what are the “lessons learned” from prior efforts within the State or region to develop an NPP (or other major infrastructure projects)?
- d. State risk analysis
- e. Project Risk Register
- f. How will the project being structured and managed to reflect this analysis?

❖ Never forget the importance of Reputational Risk Analysis²⁶⁰

4. Project Milestones

- a. Identification of key decision points for Government
- b. Identification of key decision points for project team
- c. Consider Government’s “process”

5. Studies

- a. Feasibility Study
 - i. Need for generation; electricity mix and carbon footprint
 - ii. Site surveys (including geotechnical and cooling options)
 - iii. Environmental and social impact
 - iv. Cost estimates (based on national, regional benchmarks)
 - v. Project economics (including current and future projects’ impact on electricity pricing)
 - vi. Grid assessment, including cross-border connectivity

²⁶⁰ Reputational Risk Analysis is a subjective, but important process. Essentially, it tries to address the question, “Is this a ‘good project’?” To that end, it focusses on (among other things): alignment with international best practices, regulatory approach and competences, participation in customary international treaties, sustainability, and nuclear liability.

- vii. Public opinion
- viii. Project benefit (jobs during construction, jobs during operation, benefit to local economy, tax impact, energy security, energy diversity, clean energy benefit, grid stability, energy density, energy intensity, etc.)
- b. Site selection
- c. Nuclear safety and security considerations
- d. Public opinion
- e. Logistics
- f. Labor
- g. Industrial development / localization potential
- h. Federal, State, Local law
- i. Sustainability (environmental & social) benchmarking against applicable lending practices
- j. Technology readiness and suitability relative to national plan

6. Technology Assessment

- a. What size reactor is desired?
- b. What nuclear steam supply system designs are favored/disfavored?
 - i. FOAK considerations
 - ii. Geopolitical considerations
- c. What is the nuclear safety reputation of the reactor supplier?
- d. How are nuclear safety and security prioritized in the reactor design?
- e. How is proliferation resistance prioritized in the reactor design?
- f. What is the deployment timeline for each reactor?
- g. Potential opportunity for host government involvement in global strategy
- h. Query: At what point should the technology (and project delivery team) be chosen?

7. Electricity Market Assessment

- a. Current vs. future desired generation mix
- b. Current vs. future demand growth
- c. Emissions profile (current vs. future desired carbon footprint)
- d. Regulated vs. Deregulated Market structures (current and future; plans on market design)
- e. Current vs. future sustainable electricity price limits
- f. Pros & Cons of various offtake options

8. Funding and Financing Assessment

- a. Budgetary resources for program development
- b. Budgetary resources for project development
- c. Budgetary resources for financing of the project (both debt and equity)
 - i. Resources to support pre-Financial Close (FC) activities
- d. Fund utilization time horizons
- e. External sources of financing
- f. Avoiding predatory lending
- g. Timing of Market Sounding
- h. Timing of Formal Financing Kickoff

-
- i. Timing of Final Investment Decision (FID)
 - j. Timing of Financial Close
 - k. Development of Financial Model
 - i. Total Project Cost assessment (estimated); include both Owner's Costs and EPC / Prime Contract Costs
 - l. Strategies to maximize host government impact, while minimizing length of commitment
 - m. Refinancing strategy

9. Selection

- a. Identification of Key Buying Factors
 - i. Cost
 - ii. Schedule
 - iii. Deliverability (incl. project execution plan)
 - iv. Plant Design
 - v. Plant Performance and Operating Life
 - vi. Key Personnel
 - vii. Major Subcontractors & Supply Chain
 - viii. Bilateral Relationship
 - ix. Localization, Technology Transfer, Knowledge Transfer / Human Resources Development, including:
 - impact on cost & schedule
 - realistic assessment of country capabilities
 - national ambitions
 - x. Balance sheet strength
 - xi. Financing options
- ❖ Remember: While cost is very important, it is only one key building factor. Ultimately, everyone on the project team needs to understand what is most important, as Priority #1 (*whatever that might be*) should drive planning behavior.

- b. Prior history of each consortium (list of reference projects; performance against cost and schedule; plant performance data)
- c. Corporate bandwidth of bidding team (financial strength, supply chain capacity, human resources capacity)
- d. Contracting terms and conditions
- e. Financing terms and conditions
- f. Safety, security, proliferation resistance
- g. Other geopolitical considerations

10. Procurement; Contracting

- a. Will this be a classic government procurement?
- b. If not a classic government procurement, how will options be assessed?
- c. Have you surveyed the market before you start formal proceedings?
- d. What are preferred contracting structures?

-
- i. Pros/Cons of each contracting format
 - ii. Price impact of each contracting format
 - iii. Owner burden re. each contracting format
 - iv. Initial drafting and negotiating timeline for each contracting format
 - v. Benefits of open book approaches
 - vi. Benefits of collaborative approaches
 - e. Negotiating Strategy
 - i. Term sheets
 - ii. Phases
 - *When do I “lock in” my final cost and schedule?*
 - *Would the project benefit from an Early Works period?*
 - *Would the project benefit from a Limited Notice to Proceed and a Final Notice to Proceed?*
 - iii. Requirements or detailed scope of work?
 - iv. Final contracts
 - v. Negotiating positions, including limits of negotiating authority
 - *Remember to empower the deal team*
 - f. Can I properly evaluate the offer?
 - i. *Do I understand what is being offered?*
 - ii. *Do I have the interdisciplinary skills sets and experiential knowledge to evaluate the complexity of the offer?*
 - iii. *What happens if “things” go wrong? Where am I exposed? Where is the project exposed? Where is the country exposed? How strong is the bilateral relationship with the vendor country?*
 - iv. *Do I have the team to manage the prime contractor? Will I be able to be actively involved in project oversight and execution?*
 - v. *Do I understand how all aspects of the deal fit together?*
- ❖ Remember: *You do not get something for nothing. If the deal sounds “too good to be true” ... it probably is. Do not sign up to a deal that you cannot afford. Do not sign a deal that you do not understand.*

11. Execution

- a. Owner’s Scope of Work (including government functions)
- b. Oversight / Project Management

12. Regulatory

- a. Philosophy
- b. Key Licenses
- c. Human Resources Development
- d. External (ex-patriot) hiring
- e. Engagement of technical services organizations
- f. Risk strategy

-
- g. Timing of regulatory development relative to project schedule
 - h. Bilateral / multilateral collaboration

13. Legal

- a. Federal and State Nuclear Law, and local restrictions, if applicable
- b. Harmonization of laws
- c. Permitting and Licensing
- d. Special laws (procurement, selection of advisors, special economic zone, etc.)

14. Stakeholder Engagement

- a. Within federal government
- b. With state and local government
- c. Across political parties
- d. Public acceptance; local communities
- e. With NGOs (both internal and external)

15. Nuclear Liability & Nuclear Insurance

- a. Federal Law
- b. Gap Analysis (and strategy)
- c. Insurance Pool

Final Note: The Important Activities That Are Often Missing But Should Always Be Prioritized From The Outset:

- *Safety, Security, Safeguards, Proliferation Resistance*
- *Legacy Issues: Decommissioning and Interim/Final Disposition of Spent Fuel and Nuclear Waste*
- *Emergency Planning*

6.5 APPENDIX 5: SAMPLE PROJECT INFORMATION MEMORANDUM (OUTLINE)

Preparing the Project Information Memorandum

List of Deliverables to be Prepared Prior to Start of Formal Financing Discussions

1. Jurisdiction Overview
 - a. Economy
 - b. Energy Profile
 - c. Applicable Geopolitics (alliances, strategic significance, current issues, diplomatic history, etc.)
 - d. Local Environmental Requirements and Generation Mix
 - e. State Nuclear Program History
2. Description of Project
 - a. Project history (site; prior efforts)
 - b. Contributions to environmental goals
 - c. Economic benefit / impact of project
 - d. Safety, Security, Safeguards (including cybersecurity)
3. Description of Current Program Status and Project Status
4. Summary of Policies of Government re. project (& nuclear power more generally)
 - a. Including levels of multi-party support for nuclear power
5. Analysis of Electricity Demand in State and region
 - a. Justification for size of project relative to demand
 - b. Future growth projections
 - c. Other future energy projects planned
6. Estimated Total Project Cost
 - a. Include Owner's Costs and EPC Costs
 - b. Include early works activities (pre-FID / pre-FC) and funding source(s)
 - c. Operating Costs (including fuel)
7. Estimated Project Schedule
 - a. Pre-FID/FC activities
 - b. Post-FID/FC activities
8. Electricity Pricing
 - a. Electricity market structure
 - b. Any intended pricing / offtake support mechanism
 - c. Current pricing and future price projections

-
9. Summary of External Approvals or Other Regional Coordination
 10. List of Major Project Participants (including key personnel and relevant corporate histories, as necessary)
 - a. Owner(s) (both direct and indirect)
 - b. Owner's Engineer, Legal Advisor, and Financial Advisor; other advisors
 - c. Operator
 - d. Major Contractors (EPC, major subcontractors, fuel supplier, etc.)
 - e. Regulator
 11. List of Major Project Contracts (including structure & key provisions)
 - a. EPC Contract
 - b. O&M Contract
 - c. Fuel Supply Contract
 - d. Other
 12. Summary of Nuclear Reactor Technology
 - a. Key safety features
 - b. Operating history
 - c. Any special factors or issues
 - d. Prior project performance against cost and schedule (including lessons learned, both positive and negative)
 13. Summary of Operating Structure
 - a. Operating Model
 - b. Staffing (including training and succession planning)
 14. Summary of Regulatory Process
 - a. Regulatory experience and structure
 - b. Key regulatory approvals (and schedule)
 - c. Other permits and licenses (non-nuclear)
 - d. Outline of process for financiers to engage with nuclear regulator
 15. Key Legal Issues
 - a. Nuclear Liability
 - b. Federal and State Laws and any applicable local restrictions
 16. Summary of Key Studies
 - a. Environment & Social
 - i. Including gap analysis of local law vs. ECA policies (IFC guidelines, Equator Principles, ECA-specific policies – both nuclear and non-nuclear), to include further comparisons of project design to such policies
 - ii. Environmental Impact Assessment

-
- b. Soil / Site Conditions
 - c. Cooling source
 - d. Labor
 - e. Logistics
 - f. Public Opinion

17. Federal Nuclear Policies re. Legacy Issues

- a. Decommissioning
- b. Interim and final disposition of spent fuel and nuclear waste
- c. Funding of legacy matters

18. Project Risk Assessment

- a. Conclusions from Feasibility Study(ies)
- b. Identification and mitigation of key project risks

19. Proposed Financing Structure

- a. Elements
 - i. Schedule to Financial Close
 - ii. Drawdown Schedule
 - iii. Debt
 - 1. ECA national content breakdowns plus local content adders
 - 2. Host Government support
 - 3. Any additional debt sources
 - iv. Equity
 - 1. In-kind contributions (and valuation of the same)
 - 2. Host Government
 - 3. Other Government-related equity
 - a. Analysis of borrower options under loan-to-equity structure (to include plans for investor outreach; market sounding)
 - 4. Third Party equity
 - a. Status of / plans for investor outreach (market sounding; level of investor interest)
 - 5. Timing of equity
 - v. Funding sources prior to Financial Close
 - vi. Refinancing Strategy (if any)
- b. Financial Model

20. Data Room

- a. Description of Contents
- b. Access & Confidentiality Procedures



Chapter 6:

Arkansas Nuclear Energy Law

STATUTORY, REGULATORY, AND LEGAL ANALYSIS

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Acronyms

Acronym	Definition
AEA	Atomic Energy Act
ANO	Arkansas Nuclear One
APSC	Arkansas Public Service Commission
CECPN	certificate of environmental compatibility and public need
CPCN	certificate of public convenience and necessity
IRP	Integrated Resource Plan
LLRW	low-level radioactive waste
NRC	Nuclear Regulatory Commission
UFEPA	Utility Facility Environmental and Economic Protection Act
U.S.	United States

1 Overview of the Arkansas Statutory Framework for Nuclear Energy

Introduction

Arkansas's nuclear energy law spans multiple statutory frameworks: federal-state jurisdictional boundaries under the Atomic Energy Act, radiation control, emergency planning, and waste management.

Under the Atomic Energy Act (AEA) of 1954, the United States Nuclear Regulatory Commission (NRC) has authority to regulate uses of nuclear power and nuclear material. The NRC allows “Agreement States,” like Arkansas, to regulate certain non-power uses of nuclear technology (e.g., medical uses). Agreement States may not regulate power uses of nuclear technology, like the reactors at Russellville; that is the NRC’s jurisdiction.

The four subchapters below form the foundational legal architecture governing nuclear activity in the state. Together, they define what Arkansas can and cannot regulate, and where gaps or updates may be needed to support new nuclear development.

Nuclear Power Generally (§ 15-10-301)

State policy endorses the Atomic Energy Act; authorizes a Governor-appointed Coordinator of Atomic Development Activities; standing mandate to study needed legal changes.

Radiation Control Program (§ 20-21-201)

Arkansas regulates byproduct/source material via the Dept. of Health. NRC retains exclusive jurisdiction over commercial reactor licensing.

Nuclear Planning & Response (§ 20-21-401)

Program centered on ANO; transferred to the Division of Emergency Management (July 2025). New reactors may require updates to emergency plans and zones.

Low-Level Radioactive Waste (§ 8-8-201)

Arkansas is a member of the Central Interstate Compact. No regional disposal facility exists; ANO ships Class A waste to EnergySolutions in Clive, Utah.

1.1 Nuclear Power Generally Subchapter: Ark. Code Ann. § 15-10-301 et seq.

Arkansas’s nuclear enabling statute is at Title 15, Chapter 10, Subchapter 3 of the Arkansas Code, “Nuclear Power Generally.” This subchapter was originally enacted to harmonize state law with the federal Atomic Energy Act of 1954 and has received limited substantive amendment since its initial passage.

Section 15-10-301 (Declaration of Policy) endorses the Atomic Energy Act of 1954, which provides for peaceful purposes of nuclear power consistent with the common defense and security and with the health and safety of the public. Section 15-10-301 is an affirmative statement of support for nuclear

power as a matter of state policy. It is a good start. It does not provide any formal agencies or mechanisms to actively encourage new nuclear in the state.

Arkansas Code §§ 15-10-301 and 15-10-304 set a state policy of continually reviewing whether Arkansas laws and rules should be updated as nuclear materials and facilities come into use. Section 15-10-304 directs designated state agencies, and any others the Governor names, to run continuing studies and recommend changes to the laws and rules they administer.

Section 15-10-305 authorizes the Governor to appoint a Coordinator of Atomic Development Activities (“Atomic Coordinator”) to serve as the state’s liaison with federal nuclear agencies. We are not aware of a coordinator appointed recently. This study recommends appointment, and that is discussed below in the Structural Legal Gaps and Barriers section.

1.2 The Arkansas Radiation Control Program: Ark. Code Ann. § 20-21-201 et seq.

Arkansas is an Agreement State under Section 274 of the AEA and is delegated the authority to regulate:

- + by-product material (radioactive materials produced as a byproduct of nuclear reactions, including most radioisotopes used in medicine and industry);
- + source material (uranium and thorium ores); and
- + certain quantities of special nuclear material that are not sufficient to form a critical mass.

This authority is exercised by the Arkansas Department of Health’s Radiation Control Section under the authority of Ark. Code Ann. § 20-21-201 et seq. (the Radiation Control Act). The Department of Health promulgates “Rules for Control of Sources of Ionizing Radiation” (the Radiation Control Rules), which are periodically updated to remain compatible with NRC regulations.

The Agreement State Agreement does not extend to production facilities or utilization facilities (i.e., nuclear power reactors). Under the AEA and its implementing regulations, commercial reactor licensing, including any future SMR or advanced reactor, remains exclusively under NRC jurisdiction. Therefore, the Arkansas Department of Health has no jurisdiction over reactor licensing.

1.3 Nuclear Planning and Response: Ark. Code Ann. § 20-21-401 et seq.

The current Arkansas Nuclear Planning and Response Program is operationally centered on Arkansas Nuclear One (ANO), the state’s existing commercial nuclear power facility. Act 583 of 2025 transferred the program to the Division of Emergency Management effective July 1, 2025, but it did not limit the program to ANO. The statute uses broader language covering nuclear-powered electricity-generating facilities in Arkansas, including surveillance in the area of any such facility, emergency planning zones identified by the Division, and fees assessed to utilities operating one or more nuclear-powered electricity-generating facilities.

A new reactor in Arkansas may require updates to state and local emergency plans, emergency planning zone determinations, funding allocations, exercises, and possibly implementing rules. A statutory amendment may later be needed if Arkansas seeks to cover facilities or deployment models not fairly captured by the existing “nuclear-powered electricity generating facility” framework, such as non-electric microreactors or fuel-cycle facilities.

1.4 Low-Level Radioactive Waste: Ark. Code Ann. § 8-8-201 et seq.

Arkansas is a member of the Central Interstate Low-Level Radioactive Waste Compact, codified at Ark. Code Ann. § 8-8-202. The Compact received congressional consent for membership by Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, North Dakota, and Oklahoma. The current active members are Arkansas, Kansas, Louisiana, and Oklahoma. No regional disposal facility has been sited under this Compact, and Arkansas currently has no low-level radioactive waste (LLRW) disposal facility within its borders.

Any commercial reactor operating in Arkansas would generate LLRW that requires licensed disposal. Typical practice, seen in ANO's arrangements with EnergySolutions in Clive, Utah, is shipping Class A waste out of state. The absence of a regional disposal solution represents both a cost and a regulatory challenge for any new Arkansas nuclear project.

2 Utility Regulation and the APSC Framework

2.1 APSC General Jurisdiction: Ark. Code Ann. § 23-1-101 et seq.

The Arkansas Public Service Commission (APSC) is the state's primary regulator of investor-owned electric and gas utilities. The APSC consists of three commissioners appointed by the Governor for staggered six-year terms. Its general jurisdiction is established in Title 23 of the Arkansas Code.

The APSC exercises quasi-legislative and quasi-judicial authority over utility rates, tariffs, service territories, plant construction siting certificates, bond issuance, and resource planning. The Commission's authority over electric utilities encompasses all investor-owned utilities operating in Arkansas, including Entergy Arkansas, the owner and operator of ANO. Electric cooperatives are subject to APSC jurisdiction, but rural electric distribution cooperatives operate under a cooperative-specific, lighter-touch rate framework for many rate changes. They remain subject to APSC certification requirements for covered major utility facilities and transmission facilities, unless a statutory exemption applies.

2.2 APSC Certification Requirements.

Arkansas law requires APSC approval before construction or operation of covered utility facilities, but the applicable approval path depends on the type of facility.

For ordinary utility construction, operation of equipment or facilities for supplying public service, or extension of public service, Ark. Code Ann. § 23-3-201 generally requires a certificate of public convenience and necessity ("CPCN") from the APSC before the work begins. The statute includes exemptions, including certain replacements, expansions, extensions in the ordinary course of business, and certain short transmission or distribution connections where the utility already has the necessary property rights.

Major utility facilities are addressed separately under the Utility Facility Environmental and Economic Protection Act ("UFEPA"), Ark. Code Ann. § 23-18-501 et seq. Except where an exemption applies, a person may not begin construction of a major utility facility in Arkansas without first obtaining a certificate of environmental compatibility and public need ("CECPN") from the APSC. Ark. Code Ann. § 23-18-

510(a)(1). "Major utility facility" is defined at § 23-18-503(6) and includes, among other facilities, an electric generating plant capable of operating at a capacity of fifty megawatts (50 MW) or more, together with associated facilities.

This distinction matters for large electric generation projects, including covered nuclear generation facilities. For a nuclear project that qualifies as a major utility facility, the CECPN is the principal pre-construction certification, subject to statutory exemptions and any project-specific facts that affect jurisdiction, ownership, facility type, and interconnection. The § 23-3-201 CPCN framework may also apply to related service operations of the underlying utility, such as service-territory or service-extension matters. The application of UFEPA's major utility facility threshold to advanced nuclear designs, including microreactors below 50 MW, is addressed in Section 2.3.

Arkansas also recently enacted Act 373 of 2025, the Generating Arkansas Jobs Act of 2025. As relevant to certification, Act 373 added Ark. Code Ann. § 23-3-207, which establishes a default six-month deadline for APSC action on a CPCN application when the Commission determines that approval is consistent with the public interest.

More broadly, Act 373 creates a statutory framework for certain "strategic investments" by public utilities, including investments approved in CPCN or CECPN proceedings and investments related to adequate dispatchable generation, nuclear license extension, and other covered utility infrastructure. The Act does not eliminate the need for otherwise applicable APSC certification. Rather, it provides a related mechanism for approval and recovery of covered strategic investments, including through a rider process when statutory conditions are met. The operational mechanics of the strategic investment framework are addressed in Section 2.4.

2.3 The UFEPA's Substantive Framework and Application to Advanced Reactors.

The UFEPA can accommodate a two-step certification pathway. Under § 23-18-507(f), the APSC may determine the need for additional energy supply and transmission resources in an energy-resource declaration-of-need proceeding. If the Commission makes that determination, it "shall be deemed the basis for the need" for construction of a major utility facility to be sited and constructed under UFEPA.

UFEPA was enacted in 1973 and calibrated to the conventional thermal generating plants then dominant in utility-scale generation. The "major utility facility" definition at § 23-18-503(6) sets the trigger threshold at fifty megawatts or more of electric generating capacity. The statute contains no nuclear-specific provisions. The threshold's interaction with advanced nuclear designs produces three application questions.

For utility-scale advanced reactors, the facility clearly exceeds the threshold, and the CECPN process governs. For single-unit microreactors below 50 MW (designs in the 1.5 to 20 MW range targeted at industrial host sites, university campuses, or remote applications), the generating plant may fall below UFEPA's electric-generating-plant threshold and may not require a CECPN on that basis. A CPCN under § 23-3-201 may still be required for related utility construction or service operations if the project is undertaken by an APSC-jurisdictional utility, and no statutory exemption applies.

For multi-unit microreactor installations, the application of the 50 MW threshold is unclear: a site hosting four 20 MW microreactors aggregating to 80 MW would arguably trigger UFEPA, but the statute does not expressly address aggregation across co-located units.

This ambiguity needs a legislative answer. The threshold should state plainly whether the capacity of co-located generating units is added together for the 50 MW test. Without that, a developer siting several microreactors on one site cannot know in advance whether the certificate of environmental compatibility and public need applies, which adds risk and delay to the projects Arkansas most wants to attract. The attached bill does not yet resolve this.

2.4 Cost Recovery and Ratemaking: The Generating Arkansas Jobs Act

The Generating Arkansas Jobs Act (Act 373 of 2025) is the most significant recent change to Arkansas utility law with direct implications for nuclear development.

The Act also declares a state policy of generation adequacy: “It is the policy of this state to maintain adequate capacity of available, reliable, dispatchable, affordable, and resilient electric generation to provide for the existing and reasonably projected future energy consumption needs of all consumers of electricity in Arkansas.” Ark. Code Ann. § 23-4-1302(14). The Act pairs that policy with an in-state preference. For rider recovery, a utility must give priority to strategic investments in new generation and transmission facilities located in Arkansas unless an out-of-state facility provides greater benefits to its Arkansas customers, a comparable in-state facility is not available, or a customer contracts to pay the cost. Ark. Code Ann. §§ 23-4-1305(h), 23-4-1307(j). A new nuclear generating facility in Arkansas is dispatchable, resilient generation located in state, squarely within both provisions.

The Act establishes three principal financial and contractual mechanisms applicable to new nuclear development. First, it authorizes investor-owned utilities to recover strategic investments through a rider that provides a return on construction work in progress (CWIP). Second, it authorizes special rate contracts between investor-owned utilities and individual customers, including provisions by which a customer may pay all or part of the cost of strategic investments through a contribution in aid of construction, a customer prepayment, a minimum bill provision, or another agreed cost-recovery method. Third, it authorizes alternative methods of financing for strategic investments, including sale-leaseback agreements, third-party financing, and customer financing.

The Act imposes specific limitations on rider eligibility. Wind resources located in Arkansas are not eligible for rider recovery under § 23-4-1303(10)(D). Renewable resources may be eligible only on a Commission finding, based on substantial evidence, that the renewable strategic investment will result in benefits to customers and that the utility would continue to have adequate dispatchable resources consistent with the load balancing authority's resource adequacy requirements. § 23-4-1303(10)(C)(i). Nuclear is not subject to those conditions; the Act identifies nuclear affirmatively as an area for strategic investment and treats nuclear within the dispatchable-generation framework that the Act's findings and definitions are designed to support.

For abandoned or indefinitely suspended projects, § 23-4-1305(e) requires the utility to remove the costs from the rider unless the Commission determines, on substantial evidence, that the costs were:

- + reasonable and prudently incurred at the time,
- + continued recovery through the rider remains reasonable,
- + the circumstance of the abandonment or suspension is reasonable, and
- + recovery is in the public interest.

This four-factor abandonment provision is the primary consumer-protection backstop within the Act,

supplemented by the general refund authority at § 23-4-1304(h) (rider amounts collected subject to refund pending completion of Commission review) and a parallel set of cooperative provisions at § 23-4-1306(h) and § 23-4-1307(e).

2.5 Energy Resource Planning: 23 Code of Ark. Rules § 459-101 et seq.

The APSC requires regulated utilities to file resource plans that project load growth and assess resource options to meet future demand. The IRP process is the vehicle through which a utility would formally identify and evaluate advanced nuclear generation as a resource option.

The Clean Energy Development Act (Ark. Code Ann. § 23-18-701 et seq.) requires utilities under APSC jurisdiction to consider clean energy and renewable resources in their resource plans. The Clean Energy Development Act does not define “clean energy” or “clean energy resource.” Nuclear generation is a clean technology compared to many prevalent power-generation resources, but current Arkansas law does not expressly classify it as such. A statutory amendment declaring nuclear energy to be a clean energy resource would remove that ambiguity and place nuclear generation clearly within Arkansas’s clean-energy framework. See Appendix A, Sec. 1 (adding § 23-18-707).

Arkansas Act 373 of 2025 directs public utilities to monitor and evaluate modular nuclear reactors and other new nuclear-generation technologies and, once those technologies are determined to be in the public interest based on their technical, commercial, and financial viability and benefits to Arkansas customers, to evaluate them as part of resource planning. This nuclear-specific directive is separate from, although complementary to, the Clean Energy Development Act.

Generating Arkansas Jobs Act (Act 373 of 2025)

Act 373 of 2025 is the most significant recent change to Arkansas utility law. It authorizes CWIP rider recovery, special rate contracts, and alternative financing (sale-leaseback, third-party, customer financing) for nuclear strategic investments. Nuclear is treated as dispatchable generation and is not subject to the conditions imposed on renewables.

3 Structural Legal Gaps and Barriers

The analysis above shows a handful of changes to Arkansas law that could encourage new nuclear development. A proposed bill to effect the suggested changes is attached as an appendix, the Arkansas Nuclear Competitiveness Act (Appendix A).

3.1 The State Needs an Atomic Coordinator

Arkansas Code § 15-10-305 lets the Governor appoint Coordinator of Atomic Development Activities (Atomic Coordinator). The role has existed on paper for decades but has gone unused. Section 15-10-305 makes the Coordinator a Governor-appointed, cross-agency official: advisor to the Governor on atomic industrial development and coordinator of the state’s atomic-energy activities. No state office now owns

the nuclear development agenda, runs the continuing-study duty in § 15-10-304, or drives the site, workforce, and supply-chain work a new reactor program needs.

The study recommends the Governor appoint the Atomic Coordinator, and that the General Assembly give the position funding. The role is one of economic development, coordination, and public engagement, not technical or safety regulation, which stays with the Nuclear Regulatory Commission. Activating it uses authority the state already has rather than building a new agency. Texas, New Hampshire, Virginia, and New York have created nuclear-development offices or coordinator roles.

The attached bill would expand the role to identifying sites for new nuclear generation, promoting workforce and supply-chain investment, administering the nuclear energy development fund, updating the state low-level radioactive waste plan, serving as a central point of contact for utilities, reactor vendors, and industrial customers evaluating nuclear projects. The role would also track federal nuclear programs, financing options, and report each year to the Governor and legislative leaders. See Appendix A, Secs. 2 and 3 (amending § 15-10-305).

The Atomic Coordinator should have substantial knowledge of Arkansas's nuclear landscape, state policy, utility regulation, and the economic-development implications of new nuclear generation. The ideal candidate should understand federal nuclear law and policy, NRC and DOE programs, advanced reactors, federal financing, and spent nuclear fuel management. Relevant legal, regulatory, legislative, or policy training is preferred.

Because position would be primarily a coordination, policy, and public outreach role, the candidate should bring strong relationships with Arkansas officials, utilities, economic-development organizations, community leaders, and other energy stakeholders, together with national contacts across industry, academia, finance, law, regulation, and public policy. Experience in public education, stakeholder engagement, conferences, and trust-building is important.

The role also requires credibility, sound judgment, bipartisan leadership, statewide reach, and—importantly—the ability to explain complex nuclear issues clearly and accurately.

3.2 Nuclear Should be Defined as Clean Energy

Arkansas's Clean Energy Development Act, Ark. Code Ann. § 23-18-701 et seq., requires utilities to consider clean energy resources in resource planning but does not define “clean energy.” As a practical matter, this has no immediate consequence, as Arkansas has no binding clean energy mandate. An amendment is nonetheless worth enacting for federal-program alignment; proposal is in Appendix A.

3.3 There Should be a State Tax Incentive Framework for Nuclear

Arkansas's general economic development incentive framework, including tax credit programs administered through the Arkansas Economic Development Commission, could apply to nuclear supply chain manufacturers or related businesses, but there is no specific program calibrated to nuclear project development costs, site preparation, or early-stage reactor development.

Other states have established nuclear development as a policy priority. Tennessee created the Nuclear Energy Fund (\$70M appropriated), Kentucky created the Nuclear Energy Development Grant Program

(\$10M appropriated), and Texas established the Texas Advanced Nuclear Energy Office (2025) and the \$350M Texas Advanced Nuclear Development Fund (grant program opened 2026).

Change needed: Creation of a nuclear energy development fund or nuclear investment program. See Chapter 5 (Financing) of this study for more detail. For the proposed legislative change, see Appendix A, Sec. 4 (adding § 15-10-307).

3.4 Low-Level Radioactive Waste Disposal Restrictions Should Be Lifted

Arkansas is a member of the Central Interstate Low-Level Radioactive Waste Compact (Ark. Code Ann. § 8-8-202), but the Compact has not produced a licensed disposal facility. ANO ships its low-level waste to EnergySolutions in Clive, Utah.

Arkansas's dependence on out-of-state disposal capacity, which may become limited, more expensive, or blocked, creates regulatory uncertainty for new nuclear development in the state. Arkansas law also constrains the in-state contingency response: Ark. Code Ann. § 20-21-207 prohibits the State Radiation Control Agency from licensing any facility to receive radioactive waste from other persons for disposal on land not owned by the state or the federal government. A private commercial LLRW disposal facility in Arkansas is, as a practical matter, foreclosed without a statutory change. The proposed change is at

Relevant existing law:

Ark. Code Ann. § 8-8-201 et seq. (Central Interstate Compact); Ark. Code Ann. § 20-21-207 (State Radiation Control Agency licensing restriction).

Change needed:

Legislative direction to ADEE to develop a state LLRW management plan, including in-state interim storage options and a pathway to Class B/C disposal access, and an amendment to § 20-21-207 to permit licensing of a private in-state disposal facility.

Appendix A, Sec. 5 (amending § 20-21-207(b)), and Sec. 6 (State Low-Level Radioactive Waste Management Plan).

4 Conclusion

The Generating Arkansas Jobs Act (2025) includes important provisions that encourage new nuclear development. Its declared policy of maintaining adequate dispatchable generation for Arkansas consumers, paired with rider priority for in-state facilities, gives new nuclear a statutory anchor. Additional legislation would also help encourage new nuclear development, including defining nuclear power as “clean energy,” establishing a nuclear financing incentive program (see Chapter 5, Financing, for more detail), and modifying state law to make LLRW disposal less uncertain.

Stricken language would be deleted from and underlined language would be added to present law.

State of Arkansas

96th General Assembly

Regular Session, 2027

A Bill

HOUSE BILL _____

By: Representative _____

By: Senator _____

For An Act To Be Entitled

ARKANSAS NUCLEAR COMPETITIVENESS ACT

Subtitle

TO ADVANCE NUCLEAR ENERGY DEVELOPMENT IN ARKANSAS BY DEFINING NUCLEAR ENERGY AS A CLEAN ENERGY RESOURCE, BY EXPANDING THE POWERS AND DUTIES OF THE COORDINATOR OF ATOMIC DEVELOPMENT ACTIVITIES, BY CREATING A NUCLEAR ENERGY DEVELOPMENT FUND, BY DIRECTING THE PREPARATION OF A STATE LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT PLAN, AND BY AUTHORIZING THE LICENSING OF LOW-LEVEL RADIOACTIVE WASTE DISPOSAL FACILITIES ON CERTAIN LANDS.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF ARKANSAS:

SECTION 1. Arkansas Code Title 23, Chapter 18, Subchapter 7, is amended to add an additional section to read as follows:

23-18-707. Nuclear energy as clean energy.

(a) As used in this subchapter:

(1) "Clean energy" means electricity that is generated by a clean energy resource.

(2) "Clean energy resource" means a generation resource that produces electricity with zero direct emissions of greenhouse gases at the point of generation, and includes without limitation:

(A) Nuclear energy generation from a nuclear reactor technology or other nuclear technology for which a license,

permit, certification, or other approval may be issued by the United States Nuclear Regulatory Commission, including without limitation conventional light-water reactors, advanced nuclear reactors, small modular nuclear reactors, and microreactors.

(B) Solar energy generation.

(C) Wind energy generation, subject to the limitations established in § 23-4-1303(10)(D).

(D) Hydroelectric energy generation.

(E) Geothermal energy generation.

(3) "Nuclear energy" means energy released by a fission or fusion reaction occurring within a facility licensed, permitted, certified, or otherwise authorized by the United States Nuclear Regulatory Commission.

(b) Nuclear energy is declared to be a clean energy resource for all purposes of this subchapter.

SECTION 2. Arkansas Code Title 15, Chapter 10, Subchapter 3, section 305(b) is amended to add additional subsections to read as follows:

(4) Assist in the identification of potential sites for new nuclear energy generation facilities in this state, including without limitation sites located at or adjacent to existing energy facilities, military installations, industrial sites requiring process heat, data center campuses, and other locations suitable for new nuclear generation.

(5) Promote workforce education, training, and supply chain investment in support of nuclear energy development in this state.

(6) Administer the Arkansas Nuclear Energy Development Fund created under § 15-10-307.

(7) Update the State Low-Level Radioactive Waste Management Plan no less frequently than every five (5) years following the initial preparation of the plan by the Department of Energy and Environment.

(8) Submit an annual report to the Governor, the President Pro Tempore of the Senate, the Speaker of the House of Representatives, and the chairs of the Joint Committee on

Energy summarizing the activities of the Coordinator of Atomic Development Activities during the preceding fiscal year.

(9) Serve as a central point of contact for utilities, electric cooperatives, reactor vendors, industrial customers, and other public and private parties evaluating new nuclear energy generation in this state.

(10) Track federal nuclear energy programs and financing opportunities available to this state and to nuclear energy generation projects in this state.

SECTION 3. Arkansas Code Title 15, Chapter 10, Subchapter 3, section 305 is amended to add an additional subsection to read as follows:

(e) The Secretary of the Department of Energy and Environment may appoint any additional staff necessary to carry out the duties of the coordinator, subject to the availability of appropriated funds.

SECTION 4. Arkansas Code Title 15, Chapter 10, Subchapter 3, is amended to add an additional section to read as follows:

15-10-307. Arkansas Nuclear Energy Development Fund.

(a) There is established on the books of the Treasurer of State, the Auditor of State, and the Chief Fiscal Officer of the State a special revenue fund to be known as the "Arkansas Nuclear Energy Development Fund".

(b) The Arkansas Nuclear Energy Development Fund shall consist of:

(1) Money appropriated to the fund by the General Assembly.

(2) Federal funds received by this state for nuclear energy development purposes.

(3) Gifts, grants, donations, and other contributions made to the fund.

(4) Interest earned on money in the fund.

(c) Money in the Arkansas Nuclear Energy Development Fund shall be used by the Coordinator of Atomic Development Activities to:

(1) Provide grants and other financial assistance to public utilities, electric cooperatives, qualified industrial customers, institutions of higher education, and other entities engaged in the development, demonstration,

2 deployment, or licensing of new nuclear energy generation in
3 this state.

4 (2) Support site characterization studies, early site permit
5 applications, combined license applications, and other
6 licensing activities relating to new nuclear energy generation
7 facilities to be sited in this state.

8 (3) Support nuclear workforce education, training, and
9 development programs at institutions of higher education and
10 career and technical education institutions in this state.

11 (4) Support nuclear supply chain development, including
12 without limitation domestic manufacturing of nuclear
13 components, fuel fabrication, and related industrial
14 activities to be located in this state.

15 (5) Pay the reasonable and necessary costs of administering
16 the fund and the office of the Coordinator of Atomic
17 Development Activities.

18 (d) The Department of Energy and Environment shall promulgate
19 rules establishing the criteria and procedures for the award of
20 grants and other financial assistance from the Arkansas Nuclear
21 Energy Development Fund.

22 (e) Money in the Arkansas Nuclear Energy Development Fund shall
23 not be transferred to the State General Revenue Fund Account of
24 the State Apportionment Fund and shall not lapse or be reverted
25 to the General Revenue Fund Account at the end of any fiscal
26 year. The money in the Arkansas Nuclear Energy Development Fund
27 shall remain in the fund and be available for the purposes set
28 forth in this section.

29
30 SECTION 5. Arkansas Code § 20-21-207(b), concerning the powers and
31 duties of the State Radiation Control Agency, is amended to add an
32 additional subdivision to read as follows:

33
34 (4) (A) Notwithstanding subdivision (b) (3) of this section, the
35 State Radiation Control Agency may approve an application for a
36 license to receive low-level radioactive waste from other persons
37 for disposal on land not owned by the state or the United States
38 Government if the State Radiation Control Agency makes each of
39 the following findings:

(i) The licensing of the facility is consistent with the public health, safety, and welfare of the residents of this state.

(ii) The operator of the facility will be financially and technically qualified to construct, operate, and close the facility in accordance with applicable federal and state requirements.

(iii) The licensing of the facility is consistent with the obligations of this state under the Central Interstate Low-Level Radioactive Waste Compact, § 8-8-202.

(iv) Adequate financial assurance has been established for the long-term care, closure, and post-closure observation and maintenance of the facility.

(B) A license issued under subdivision (b) (4) (A) of this section is subject to the rules promulgated by the State Board of Health for the control of sources of ionizing radiation and to any additional terms and conditions established by the State Radiation Control Agency.

(C) A licensee under subdivision (b) (4) (A) of this section shall comply with all applicable federal and state requirements for low-level radioactive waste disposal facilities, including requirements under the Atomic Energy Act of 1954, 42 U.S.C. § 2011 et seq., implementing regulations compatible with United States Nuclear Regulatory Commission requirements, and applicable requirements of the United States Environmental Protection Agency.

(D) As used in this subdivision (b) (4), "low-level radioactive waste" means radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act of 1954, 42 U.S.C. § 2014(e)(2), and that is classified as low-level radioactive waste under applicable federal law or the Central Interstate Low-Level Radioactive Waste Compact, § 8-8-202.

SECTION 6. DO NOT CODIFY. TEMPORARY LANGUAGE.

STATE LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT PLAN.

2 (a) No later than eighteen (18) months after the effective date
3 of this act, the Department of Energy and Environment shall
4 develop and publish a State Low-Level Radioactive Waste
5 Management Plan.

6 (b) The State Low-Level Radioactive Waste Management Plan shall
7 address each of the following:

8 (1) The current and projected quantities of low-level
9 radioactive waste generated in this state, including without
10 limitation waste generated by Arkansas Nuclear One, waste
11 generated by medical and industrial users, and waste generated
12 by any new nuclear energy generation facility reasonably
13 anticipated to operate in this state.

14 (2) The available out-of-state disposal capacity for Class A,
15 Class B, and Class C low-level radioactive waste, and any
16 limitations on the access of Arkansas generators to that
17 capacity.

18 (3) The feasibility and projected cost of in-state interim
19 storage of low-level radioactive waste pending shipment to a
20 licensed disposal facility.

21 (4) Pathways for reliable, long-term access by Arkansas
22 generators to Class B and Class C disposal capacity, including
23 without limitation continued participation in regional
24 disposal compacts and contractual arrangements with operators
25 of licensed disposal facilities in other states.

26 (5) Recommendations for legislative, regulatory, or
27 administrative action to ensure adequate, reliable, and cost-
28 effective management of low-level radioactive waste generated
29 in this state.

30 (c) In preparing the State Low-Level Radioactive Waste Management
31 Plan, the Department of Energy and Environment shall consult with
32 the State Radiation Control Agency, the Arkansas Department of
33 Health, the Arkansas Public Service Commission, the operator of
34 Arkansas Nuclear One, the investor-owned electric utilities of
35 this state, the electric generation and transmission cooperatives
36 of this state, and other generators of low-level radioactive
37 waste in this state.

38 (d) The Department of Energy and Environment shall submit the
39 State Low-Level Radioactive Waste Management Plan to the:

- 2 (1) Governor.
- 3 (2) President Pro Tempore of the Senate.
- 4 (3) Majority Leader of the Senate.
- 5 (4) Minority Leader of the Senate.
- 6 (5) Speaker of the House of Representatives.
- 7 (6) Majority Leader of the House of Representatives.
- 8 (7) Minority Leader of the House of Representatives.
- 9 (8) Chairs of the Joint Committee on Energy.

10
11
12 /s/ _____



Chapter 7:

Literature Review

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Acronyms

Acronym	Definition
ACRS	Advisory Committee on Reactor Safeguards
ADVANCE	Accelerating Deployment of Versatile Advanced Nuclear for Clean Energy
AGR	advanced gas reactor
ARDP	Advanced Reactor Demonstration Program
ASME	American Society of Mechanical Engineers
BIS	Bid Invitation Specification
BWR	boiling water reactor
CFR	<i>Code of Federal Regulations</i>
COL	combined license
CWIP	Construction Work in Progress
DC	Design Certification
DOD	Department of Defense (Department of War)
DOE	Department of Energy
EI	energy island
EIA	Energy Information Administration
EPC	engineering, procurement, and construction
EPRI	Electric Power Research Institute
ESP	early site permit
ETU	Engineering Test Unit
FHR	fluoride salt-cooled high-temperature reactor
FLiBe	lithium fluoride-beryllium fluoride
FOAK	first-of-a-kind
FPIC	Free Prior Informed Consent
FS	feasibility study
GAIN	Gateway for Accelerated Innovation in Nuclear
GE	General Electric
GEN III+	Generation III+ (water-cooled reactors improved from existing plants)

Acronym	Definition
Gen IV	Generation IV (these are new nuclear plants not using water as a coolant)
HALEU	high-assay low-enriched uranium
IAEA	International Atomic Energy Agency
IEEFA	Institute for Energy Economics and Financial Analysis
INL	Idaho National Laboratory
IRA	Inflation Reduction Act
ITAAC	Inspections, Tests, Analyses, and Acceptance Criteria
ITIF	Information Technology and Innovation Foundation
KP-FHR	Kairos Power - fluoride salt-cooled high-temperature reactor
LCOE	levelized cost of electricity
LWR	light-water reactor
MIT	Massachusetts Institute of Technology
MWe	megawatt electric
MWth	megawatt thermal
NEI	Nuclear Energy Institute
NEIMA	Nuclear Energy Innovation and Modernization Act
NEPA	National Environmental Policy Act
NI	Nuclear Island
NOAK	nth-of-a-kind
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Commission technical report series
ORNL	Oak Ridge National Laboratory
PRISM	Power Reactor Innovative Small Module
PTC	Production Tax Credit
PUC	public utility commissions
REP	Regulatory Engagement Plan
RIPB	risk-informed, performance-based
RG	Regulatory Guide
RPV	reactor pressure vessel

Acronym	Definition
SFR	sodium fast reactor
SMR	small modular reactor
TI	technology-inclusive
TRISO	tristructural isotropic (fuel particle)
U.S.	United States

Introduction

A feasibility study is the decision-support document a state or utility relies on before committing to a new nuclear plant. This study serves that purpose. It also does the homework for prospective developers weighing new nuclear in Arkansas.

Industry Feasibility Study Guidance

According to the International Atomic Energy Agency Nuclear Energy (IAEA) Series, No. NG-T-3.3, “*Preparation of a Feasibility Study for New Nuclear Power Projects*” ([International Atomic Energy Agency, 2014](#)), the Feasibility Study (FS) must assess energy demand in context; analyze industrial infrastructure, human resources, financing capability, and social and environmental conditions; provide the technical, economic, financial, regulatory, social, and environmental information needed for informed decisions; serve as the authoritative record of reasoning and methodology; and form the basis for the Bid Invitation Specification (BIS) and the financial package required by lenders. The FS sits in Phase 2 of the IAEA Milestones Approach, following initial government interest and preceding construction.

In the IAEA Milestones Approach, nuclear infrastructure development is commonly organized into three broad phases. Phase 1 establishes the country’s readiness and commitment: government policy is clarified, institutions are formed, and the basic rationale for nuclear power is examined. Phase 2 is the detailed preparatory phase, in which the feasibility study is performed, sites and technologies are screened, legal and regulatory readiness is refined, and the project is shaped into a contractable procurement package. Phase 3 is implementation and construction, when the project moves from planning into execution, oversight, and delivery.

This feasibility study is positioned in Phase 2 because this is the stage at which a government or utility must decide whether the project can be responsibly advanced to a contracting decision. “Milestone 2” generally refers to the decision to contract for the first nuclear power plant: by that point, the country should have enough technical, economic, regulatory, and institutional clarity to proceed with vendor engagement and financing arrangements. In practice, the FS is the bridge between strategic intent and executable project delivery, translating broad policy goals into specific requirements, assumptions, risks, and conditions precedent.

More broadly, the feasibility study is part of the overall nuclear infrastructure development process, as it connects long-range energy planning to licensing, financing, siting, workforce development, grid planning, public acceptance, and procurement. Its purpose is not only to answer “should we build?” but also to define “under what conditions, with what technology, on what schedule, and with what institutional support?”

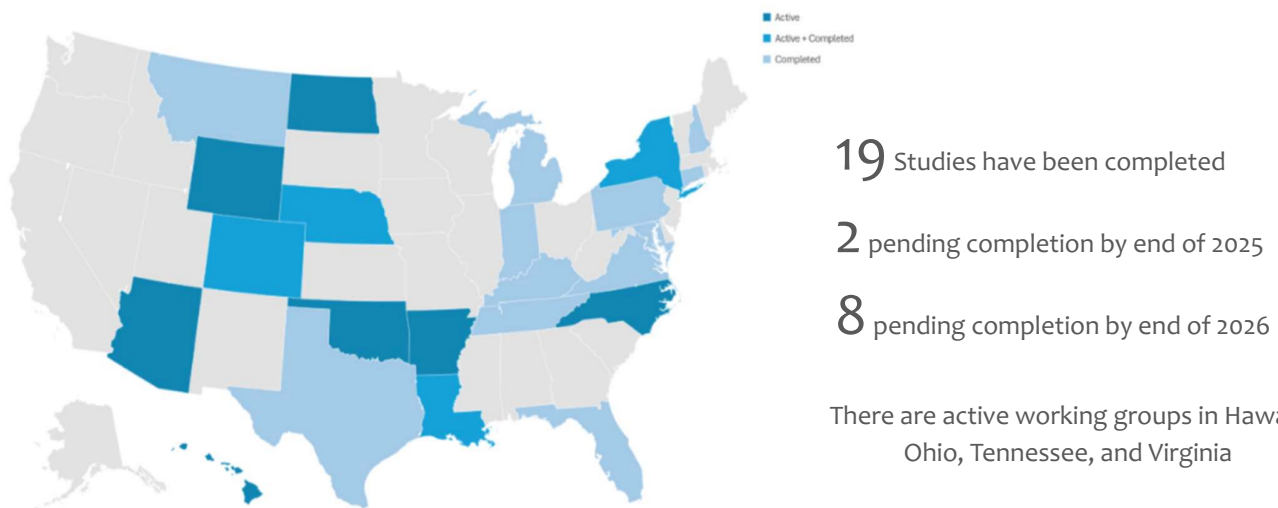
Although IAEA NG-T-3.3 was written for newcomer countries, the same framework is relevant to U.S. state-level feasibility studies.

State-Level Nuclear Feasibility Studies

At the time of this study, nearly 30 state-level feasibility studies and working groups of varying depth have been initiated or completed ([U.S. Department of Energy, 2025](#)). These studies typically:

- + Evaluate the technical and economic viability of advanced nuclear technologies (Gen III+, SMRs, microreactors) for state-specific energy needs
- + Identify regulatory, financial, workforce, and siting barriers to deployment
- + Assess coal-to-nuclear transition opportunities at retiring fossil fuel sites
- + Develop policy and legislative recommendations to attract nuclear investment and supply chain development

29 Feasibility studies covering a range of topics including policy, technical, and economic analyses ([U.S. Department of Energy](#))



State studies vary in type and scope:

Legislatively Mandated Studies

Commissioned by state legislatures via joint resolutions or bills. These studies are typically broad in scope, covering technology, economics, regulation, workforce, and policy recommendations.

Utility & Agency Siting Studies

Focused on identifying specific sites for SMR deployment. These studies, some public, some not, are more technical in nature, e.g. GIS screening and engineering feasibility assessments.

Strategic Framework & Blueprint Studies

High-level policy documents designed to initiate a longer planning process. They identify opportunities and issues without committing to specific sites or technologies.

Common Themes & Findings

Why States Are Studying Nuclear

- Rising electricity demand
- Interest in firm, clean power
- Coal plant transition and economic development

Common Barriers

- High upfront capital cost and financing risk
- Fuel, supply chain, and workforce constraints
- Licensing, permitting, and schedule uncertainty

What the Studies Usually Find

- Nuclear can be viable, but it is highly site-specific
- Strongest opportunities are often near existing energy infrastructure
- Advanced reactors are generally viewed as a medium- to long-term option

Common Recommendations

- Build work-force and supply chain capacity
- Use state and deferral incentives for cost-sharing
- Plan early for siting, permitting, and community engagement

SOURCE: State feasibility studies compiled by GAIN/INL (2025)

Coal-to-Nuclear Transitions. Most of the studies reviewed here identify retiring coal plants as prime candidates for nuclear repowering. Shared infrastructure, such as grid connections, cooling water, skilled workforce, and rail access, reduce siting costs and timelines. States such as Colorado, Pennsylvania, Virginia, and Maryland have conducted site-specific analyses at coal-fired power plants. ([Pueblo Innovative Energy Solutions Advisory Committee, 2024](#)) ([Joint State Government Commission of Pennsylvania, 2024](#)) ([Dominion Engineering, Inc., 2023](#)) ([X Energy, LLC, 2022](#))

FOAK vs NOAK Cost Uncertainty. First-of-a-kind (FOAK) costs for SMRs and advanced reactors remain highly uncertain and may be roughly double eventual nth-of-a-kind (NOAK) costs. Pennsylvania, Florida, and Tennessee flag this as a primary risk. Competitive economics are generally not expected until the 2040–2050 timeframe, after 10–15 units of a given design are built.¹ ([Joint State Government Commission of Pennsylvania, 2024](#)) ([Florida Public Service Commission, 2025](#)) ([Tennessee Nuclear Energy Advisory Council, 2024](#))

Workforce Development as a Prerequisite. Nearly every study reviewed identifies workforce as critical. Common recommendations include nuclear engineering programs at state universities, apprenticeship pipelines for skilled trades, and regional training centers. States with existing nuclear infrastructure, including Tennessee, Pennsylvania, and New Hampshire, have a head start.² ([Tennessee Nuclear Energy Advisory Council, 2024](#)) ([Joint State Government Commission of Pennsylvania, 2024](#)) ([New Hampshire Commission to Investigate the Implementation of Next-Generation Nuclear Reactor Technology, 2023](#))

Military Applications - Microreactors for military base energy resilience are featured in studies in Florida, Texas, Virginia, and Hawaii. The DOD's interest in energy-as-a-service models and mobile microreactor technology, including systems such as Radiant Kaleidos, is a recurring theme for bases in remote

¹ The much-reduced NOAK costs could be realized at 5-10 predecessor builds, extrapolating from the fact that Vogtle 4, the second of a kind, was cheaper to build than Vogtle 3, a FOAK — by 15–20% per the September 2024 DOE Liftoff Report (INL/MIT/ORNL, 2025) and by roughly 30% in trade-press accounts of Southern Company statements. (Power Engineering, 2024)

² Arkansas Tech University is the only university in Arkansas to have a program dedicated to nuclear (power) technology.

or high-risk locations. ([Florida Public Service Commission, 2025](#)) ([Texas Advanced Nuclear Reactor Working Group, 2024](#)) ([Dominion Engineering, Inc., 2023](#)) ([Hawaii State Energy Office, 2025](#))

Regulatory Modernization - The studies reviewed consistently call for streamlined NRC licensing pathways, particularly for Gen IV and SMR designs. Several states, including Texas, New Hampshire, and Montana, recommend state-level permitting officers or nuclear authorities to serve as single points of contact for developers navigating federal and state requirements. ([Texas Advanced Nuclear Reactor Working Group, 2024](#)) ([New Hampshire Commission to Investigate the Implementation of Next-Generation Nuclear Reactor Technology, 2023](#)) ([Montana Energy and Telecommunications Interim Committee, 2022](#)). The Trump Administration has made tremendous progress on this front not only in the executive orders promoting nuclear, but also the NRC moving to enact new, modern regulations, such as 10 CFR Part 57. ([The White House, 2025](#)) ([U.S. Nuclear Regulatory Commission, 2026](#))

Public Engagement & Waste Management - Public acceptance and spent fuel management are significant barriers in nearly every study. States with a history of nuclear incidents or waste-disposal controversies face heightened scrutiny. Effective communication strategies, community engagement, and progress on recycling and reprocessing are seen as essential to building public trust.

High-Level Summary of Available Reports (as of May 31, 2026)

State	Summary
Colorado – Pueblo (PIESAC)	Evaluating replacement for 750 MW Comanche 3 coal plant (closing 2031). Concluded nuclear is the only option providing a one-for-one replacement in jobs and economic impact, with roughly 10 times the jobs of a gas-with-carbon-capture plant and far higher annual tax revenue (about \$95 million versus about \$1.7 million for solar). 66% of Pueblo residents support advanced nuclear. (Pueblo Innovative Energy Solutions Advisory Committee, 2024)
Florida (FPSC, March 2025)	An informational, technology-neutral feasibility report. Reviews large Gen III+ LWRs (AP1000), SMRs, and microreactors without endorsing a preferred technology or site, and notes microreactors as suited to DOD and military applications. Developed with technical input from GAIN, EPRI, and INL. (Florida Public Service Commission, 2025)
Hawaii (HSEO, 2025–2026)	Report to the Hawaii State Legislature per SCR 136. Covers technology overview, nuclear waste, health/environmental impacts, safety, costs, and community considerations. The working group included utilities, the Navy, environmental groups, and nuclear experts. HSEO and most of the working group recommend against pursuing nuclear energy at this time and propose no legislation, suggesting the state revisit the question in about five years. (Hawaii State Energy Office, 2025)
Indiana (Purdue University / IOED, 2023)	Commissioned by the Indiana Office of Energy Development. Identified at least 8 viable coal plant sites for SMR deployment. Senate Bill 271 enables SMR construction at retired coal sites. Highlights 24/7 dispatchable power, job creation, and tax base growth as key benefits. Emphasizes workforce development and stakeholder engagement as prerequisites. (Purdue University, Institute for Energy and the Environment, 2023)
Kentucky (Nuclear Energy Development Working Group)	No insurmountable barriers identified. Recommends establishing the Kentucky Nuclear Energy Development Authority (KNDA) at about \$750,000 in the first year, increasing to \$900,000 in later years. Highlights high-temperature process heat, process steam, and hydrogen potential for advanced manufacturing and industrial users. Strong interest in spent fuel recycling/reprocessing. (Kentucky Office of Energy Policy, 2023)

State	Summary
Louisiana (LPSC LANCE Framework, 2025)	Strategic framework built around three pillars: Generation, Supply Chain, and Value Chain. Positions Louisiana as a potential advanced nuclear hub leveraging its industrial base, port infrastructure, and energy sector expertise. Identifies differentiated market opportunities and outlines statutory considerations for investment and partnerships. (Louisiana Public Service Commission, 2025)
Maryland (X-energy / MEA, 2022–2023)	Site-specific feasibility for Xe-100 SMR at a coal plant. Engineering feasibility confirmed; grid interconnection upgrades needed. Recommends a 2-module configuration to reduce siting risk. Emphasizes communication strategy and community engagement as critical success factors. (X Energy, LLC, 2022)
Michigan (MPSC / ENERCON, 2024)	Comprehensive feasibility study covering existing fleet, advanced reactor options, coal-to-nuclear transitions, and economic impacts. Prepared for the Michigan Public Service Commission in a legislative direction. (ENERCON Services East, P.C. and Veritas Economics, 2024)
Montana (SJ3 / ETIC, 2021)	Broad overview study; no committee bill issued. Concluded advanced nuclear offers significant benefits (carbon-free baseload) tempered by high startup costs and waste concerns. HB 273 (2021) placed nuclear on equal regulatory footing with coal and gas. (Montana Energy and Telecommunications Interim Committee, 2022)
Nebraska (NPPD / 1898 & Co., Phase 1)	The SMR siting screening study identified 17 top-candidate communities across 6 state regions. Phase 2 site reconnaissance and Phase 3 detailed evaluations are recommended. Criteria included transmission access, water supply, health/safety, environmental, and permitting factors. (1898 & Co. and Nebraska Public Power District, 2024)
New Hampshire (Legislative Commission, 2022–2023)	Concluded that advanced nuclear is essential for net-zero. Seabrook, the state's only reactor, provides about 58% of NH generation (2022). Recommends designating nuclear as "clean," providing financial incentives, and developing the workforce. Targets commercial deployment by late 2020s–early 2030s. Prefers regulated markets for FOAK projects. (New Hampshire Commission to Investigate the Implementation of Next-Generation Nuclear Reactor Technology, 2023)
New York (NYSERDA Blueprint, January 2025)	Introductory blueprint for a full Master Plan for Responsible Advanced Nuclear Development, to be completed by the end of 2026. Covers Gen III+, Gen IV, and fusion. Working groups were formed early in 2025, with community engagement to follow. (New York State Energy Research and Development Authority (NYSERDA), 2025)

State	Summary
North Carolina (NC State / General Assembly, 2025)	Feasibility study for an advanced Research and Test Reactor (RTR) at NC State. Recommends a sodium-cooled mixed/coupled spectrum design. Potential to generate \$1–2B in annual state revenue. Targets CHIPS Act funding (\$390M for up to 4 university advanced reactors nationally). (NC State University Department of Nuclear Engineering, 2025)
Oklahoma (OCC, March 2026)	Concluded nuclear energy generation in Oklahoma is technically feasible with no insurmountable barriers. Identified oil & gas, aerospace, and precision manufacturing workforces as transferable to nuclear. Noted cost and public acceptance as key challenges. Involved 20+ organizations, including the University of Oklahoma, Hamm Institute, AEP, and OG&E. Ordered by SB 130 (Gov. Stitt, June 2025). (Oklahoma Corporation Commission, Public Utilities Division, 2026)
Pennsylvania (Joint State Government Commission, February 2024)	Pragmatic assessment: SMR competitive costs are not expected until 2040–2050, after 10–15 units are built. Six operating coal sites are identified as potential SMR sites, and ten retired sites have few or no siting barriers. Key message: Maximize the longevity of the existing 8 reactors at 4 plants first. Cost is the ultimate driver. (Joint State Government Commission of Pennsylvania, 2024)
Tennessee (T-NEAC, 2023)	Recommends TVA pursuing Gen III+ SMR at Clinch River site as the lowest-risk path. Concludes Gen IV technology is not yet mature. Calls for the Tennessee Nuclear Energy Workforce Center (T-NEWC) and stronger supply chain incentives. Target: new nuclear online by 2040. (Tennessee Nuclear Energy Advisory Council, 2024)
Texas (ANRWG, November 2024)	Recommends 7 legislative actions, including a Texas Advanced Nuclear Authority, Nuclear Permitting Officer, workforce development program, Advanced Manufacturing Institute, public outreach program, and two nuclear energy funds. Texas is positioned as a flagship state, with several advanced reactor projects already underway. (Texas Advanced Nuclear Reactor Working Group, 2024)
Virginia – LENOWISCO (DEI, April 2023)	SMR siting study for the LENOWISCO Planning District in Southwest Virginia. Evaluated technologies from microreactors to large SMRs. Assessed potential for dedicated industrial use and grid sales. Identified economic development benefits for a coal-dependent region. (Dominion Engineering, Inc., 2023)

State	Summary
Virginia – LENOWISCO Supply Chain (Dominion Engineering, March 2024)	Companion study to the 2023 siting feasibility report. Analyzes the LENOWISCO region's readiness to participate in the advanced nuclear supply chain. Finds strong regional attributes for supply chain hub development regardless of whether an SMR is sited locally. Emphasizes the national imperative to expand domestic nuclear supply chains. (Dominion Engineering, Inc., 2024)

Lessons Learned from Vogtle 3 & 4

Construction

Plant Vogtle Units 3 & 4 in Georgia are the only new commercial reactors licensed, constructed, and completed in the U.S. in the modern era. Originally budgeted at approximately \$14 billion USD with a 2016–2017 completion target, the project was completed in 2023–2024 at a final cost exceeding \$30 billion, more than double the original estimate and nearly seven years late ([Don Grace, 2025](#)). V.C. Summer Units 2 & 3 (South Carolina) were abandoned in 2017 after \$9 billion USD was spent, following Westinghouse's Chapter 11 bankruptcy. Together, these projects produced the most comprehensive body of lessons learned for U.S. nuclear construction in a generation ([What America's Largest Nuclear Project Can Teach the Energy Sector, 2025](#)). The NRC published a formal 10 CFR Part 52 Construction Lessons-Learned Report in January 2024 ([U.S. Nuclear Regulatory Commission, 2024](#)). A June 2025 INL/MIT/ORNL study (INL/RPT-25-84701) quantified potential cost reductions for future AP1000 builds, showing that, against a first-of-a-kind anchor of about \$15,000/kWe (2024 USD), overnight costs could fall to roughly \$6,200/kWe by the fourth two-unit plant, on a path toward an nth-of-a-kind level near \$4,700/kWe ([INL/MIT/ORNL, 2025](#)).

Key Lessons Learned

1. FOAK Cost & Schedule Risk Is Underestimated

Original estimates for Vogtle were based on optimistic vendor projections and lacked a U.S. reference build. FOAK nuclear projects can exceed initial budgets by up to 2 to 3x in U.S. experience. INL/MIT (2025) shows that overnight costs could fall from a first-of-a-kind anchor of about \$15,000/kWe (2024 USD) to roughly \$6,200/kWe by the fourth two-unit plant, trending toward an nth-of-a-kind level near \$4,700/kWe, but only if those projects are actually built.³

2. Contractor & Vendor Bankruptcy Risk Is Real

Westinghouse Electric filed for Chapter 11 bankruptcy in 2017, during mid-construction, triggering a crisis at both Vogtle and V.C. Summer. The EPC contract structures that seemed to protect owners became a liability when the contractor failed to perform. The original 2008 Vogtle EPC was a hybrid purchase price with fixed escalation amounts and index-based adjustments that became substantially fixed for the owners only through the 2015 settlement restructuring; a clean fixed-price arrangement more closely describes V.C. Summer's 2016 amendment. EPC contract structures, vendor financial health, and contingency planning must be stress-tested during the feasibility study.

3. Workforce & Craft Labor Shortages Were a Primary Driver of Delays

The 30+ year gap in U.S. nuclear construction meant the skilled craft labor base, nuclear-qualified welders, pipefitters, ironworkers, and QA inspectors, had largely retired or dispersed. Rebuilding this

³ Note that the ~59% drop in price here is estimated after about three additional builds. Compare this to the studies discussed on page 7-9 and note 1. In short, there is a wide range of estimates as to how many plants must be built before the FOAK costs are reduced to the point that NOAK is economical. Those estimates run from a low of 3 to up to 15 predecessor plants. The authors believe the number to be about five plants, ten at the most.

workforce mid-project was both costly and slow. Future projects must invest in workforce development years before construction begins.

4. Supply Chain Atrophy Created Critical Bottlenecks

The U.S. nuclear-grade manufacturing base has atrophied significantly since the 1980s. Long-lead components (reactor pressure vessels, steam generators, large forgings) require international sourcing, adding cost, schedule risk, and geopolitical exposure. Domestic supply chain investment is a prerequisite for future builds.

5. Modularization Helped, But Requires a Frozen Design

Vogtle used modular construction techniques (pre-fabricating large structural modules off-site) to improve schedule performance in later phases. However, module design changes and rework were costly when the design was not fully frozen before fabrication began. The design must be complete and stable before modular fabrication begins.

6. NRC Part 52 Licensing Worked, But Was Slower Than Expected

Vogtle was the first project to use the NRC's 10 CFR Part 52 Combined License (COL) process. Although it ultimately worked, it was slower and more resource-intensive than anticipated. The NRC's 2024 lessons-learned report identified improvements needed in inspection hold points, design-change processing, and pre-application engagement. Future projects should begin NRC pre-application engagement five to seven years before planned construction start.

7. Owner Oversight & Independent Monitoring Are Essential

Georgia Power's active owner oversight, including an Independent Construction Monitor reporting to the Georgia PSC, was credited with keeping the project alive following Westinghouse's bankruptcy. Strong owner's engineer capability and independent monitoring are essential, not optional.

8. Chinese AP1000 Experience Offers a Roadmap for Cost Reduction

China built four AP1000 units at SanMen and HaiYang around the same time as Vogtle. By the second pair, construction schedules dropped dramatically. The INL/MIT/ORNL report's optimistic scenario applies Chinese AP1000 learning-curve experience to U.S. conditions and, combined with design standardization, modularization, and supply chain investment, projects that future AP1000s could become substantially cheaper to build. Separately, Shirvan's 2024 analysis projects a subsidized LCOE of \$78–\$97/MWh (in 2024 USD) for the next U.S. two-unit AP1000 plant, reflecting IRA tax credits. ([Shirvan, 2024](#))

9. Public & Ratepayer Acceptance Requires Transparency from Day One

Vogtle ratepayers faced significant bill increases and legal disputes. Neighboring utilities that contracted to buy Vogtle power sought to alter their agreements. Transparent communication about cost ranges, risk allocation, and ratepayer protections must begin before project approval, not after overruns occur.

Implications for Arkansas

Use Realistic FOAK Cost Ranges, if a FOAK is Being Built

State studies should use an \$8,000–\$12,000/kW overnight cost for large light-water-reactor (LWR) FOAK builds, rather than vendor estimates. NOAK projections (~\$4,600/kW) are only achievable after multiple builds.

Assess Contractor Financial Health

Subsequent feasibility studies must evaluate EPC contractors and reactor vendor financial stability, bonding capacity, insurance, and bankruptcy risk as part of project risk analysis. Fixed-price EPC contracts shift risk on paper, but they do not eliminate risk. They convert some project risks into counterparty-credit risk.

Plan Workforce Development Now

States should inventory nuclear-qualified craft labor, identify training gaps, and begin developing the workforce pipeline years before construction. Community college and apprenticeship partnerships are critical.

Secure State Regulatory Framework Early

Identify whether CWIP, Construction Cost Recovery, or other rate mechanisms are available under state law. With the passage of Act 373 (2025), this framework exists for regulated utilities. CWIP and similar mechanisms are important, usually vital, tools to support a new nuclear build.

Engage NRC in Pre-Application and Site Preparation

Developers and their technology vendor must begin NRC pre-application meetings and site characterization work as early as possible to avoid licensing delays.

Leverage Federal Incentives in the Base Case

The IRA Investment Tax Credit,⁴ the Production Tax Credit, and DOE loan guarantees should be modeled in the base-case economics rather than as upside scenarios. These incentives materially change project economics.

Prefer Designs with Reference Builds

Reactor designs with existing U.S. or international reference builds (AP1000, BWRX-300, etc.) significantly reduce FOAK risk compared to first-ever deployments. Design maturity and licensing status should be weighed heavily in the technology selection process.

Regulatory Landscape

The U.S. has three (and soon to be a fourth) licensing pathways for commercial nuclear reactors, all administered by the Nuclear Regulatory Commission (NRC).

⁴ Recent federal legislation narrowed parts of the IRA credit regime and added restrictions, but it did not eliminate the potential role of federal tax-credit monetization for nuclear.

Each pathway reflects a different era of nuclear regulation. As of April 29, 2026, developers may choose among 10 CFR Part 50, Part 52, or the newly effective Part 53, the first technology-inclusive framework designed for advanced reactors. The NRC recently proposed a Part 57, which would govern microreactors.

Historically, Part 50 ([U.S. Nuclear Regulatory Commission](#)) was built for the first wave of commercial reactors that came online in the 1960s and 1970s. The NRC issued Part 52 ([U.S. Nuclear Regulatory Commission, 2024](#)) in 1989 and, most recently, Part 53, “Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors” ([U.S. Nuclear Regulatory Commission](#)).

The proposed Part 57 rule published May 1, 2026 uses the NRC's EO 14300 implementation schedule targets finalization within the order's 18-month rulemaking window.

Table 7-1. Summary of U.S. NRC Licensing Pathways for New Nuclear

	Intended Applicants	Description
Part 50 (1956)	Designed for first-generation LWRs	Prescriptive and technology-specific; still in use today for LWRs. Non-LWR designs use NRC approved guidance for their applications.
Part 52 (1989)	Added design certification and combined licenses	Improved predictability but remained largely LWR-focused and still retained many prescriptive elements from the earlier framework.
Part 53 (2026)	Technology-inclusive and risk-informed	An optional pathway for all reactor types with staged licensing and common design support, built to fit advanced reactors rather than force them into legacy assumptions.
Part 57 (2026, draft)	Microreactors and low-consequence reactors	A narrower, performance-based pathway for factory-fabricated, repeatable reactors with very low offsite consequences, intended to support faster licensing, standardized deployments, and regulatory requirements scaled to the facility's actual risk.

Executive Order 14300: Reforming the NRC

Signed by President Trump on May 23, 2025, EO 14300, “Ordering the Reform of the Nuclear Regulatory Commission,” directed the most comprehensive redesign of U.S. nuclear regulation in nearly 50 years ([The White House, 2025](#)). It accelerated the final stages of reforms already in motion, most tracing to NEIMA (2019) and the ADVANCE Act (2024), and initiated a further wave of NRC actions, including the wholesale revision of the licensing regulations, fixed decision deadlines, and the proposed Part 57 microreactor framework. The order emerged after decades of regulatory stagnation, when the NRC's processes had become widely viewed as too slow, too expensive, and tailored to the large light-water reactors of the past.

Meanwhile, the broader energy policy landscape was shifting toward reindustrialization, grid reliability, and the need to support AI, data centers, and other power-intensive sectors. Rather than wait for Congress to move at the pace of a divided legislative process, the President used executive action to force rapid institutional change, as part of a broader energy dominance agenda centered on abundant domestic power, industrial competitiveness, and strategic independence.

Key Directives

Rewrite NRC regulations

Complete the redesign within 18 months

Align the mission

Focus the NRC on efficiently promoting safe, abundant nuclear energy.

Reduce delays

Cut fee-driven delays and remove unnecessary regulatory red tape.

Set fixed deadlines

Issue licensing decisions within 18 months for new reactor construction permit

Revisit Radiation Standards

Direct the NRC to evaluate whether the LNT model should be replaced with a threshold-based model more consistent with current science.

Expand Workforce and Capacity

Increase NRC staffing and resources to handle the anticipated surge in license applications from advanced reactor developers.

The EO addresses four legacy licensing issues:

Licensing Paralysis

Between 1954 and 1978, the U.S. authorized 133 civilian reactors. Since 1978, only three new reactors have been brought online, Vogtle Units 3 & 4 and Watts Bar 2. The last commercial power reactor to receive a construction permit before Kemmerer (2026) received it in the late 1970s; the intervening permits (SHINE, 2016; Abilene Christian's research reactor, 2024; Hermes, 2023) were non-power facilities. While the U.S. slowed to a crawl, countries like China and South Korea were building reactors at scale ([Table 2: Nuclear Reactors Under Construction](#)), expanding industrial capacity and strengthening supply chains. The EO argues the NRC prioritized minimizing trivial risks over enabling safe, abundant energy. In practice, NRC reviews often stretched for years and added substantial cost and financing risk before a project ever reached construction ([Ponangi, 2024](#)).

Fee-by-the-Hour Model

The NRC charges applicants by the hour. The full-cost professional rate is \$318 per hour (FY2025) per reviewer, and complex applications consume thousands of reviewer-hours across legal, technical, and administrative staff. The longer a review lasts, the more the applicant pays, and every additional round of questions adds cost and financing risk. As of October 1, 2025, advanced reactor applicants and pre-applicants receive a reduced rate of \$148 per hour for certain activities under Section 201 of the ADVANCE Act. ([U.S. Nuclear Regulatory Commission, 2025](#)) The FY2026 final fee rule (91 FR 36470, June 16, 2026) raises these to \$337 and \$154, effective in August 2026.

Flawed Radiation Model

The NRC's Linear No-Threshold (LNT) model, which assumes no safe threshold of radiation exposure, is criticized in the EO as lacking scientific basis and producing irrational regulatory requirements ([The White House, 2025](#)). Adopted in the 1950s ([Calabrese, 2019](#)) LNT assumes that any dose of radiation, no matter how small, carries a proportional cancer risk. Critics argue the model overstates risk at very low doses and dose rates, and that it has encouraged over-engineered safety requirements that add cost without meaningful additional protection. Treating extremely small exposures as linearly comparable to much larger ones, in this view, distorts regulatory priorities ([Marcus, Miller, & Doss, 2015](#)). LNT remains the NRC's regulatory basis, and the Commission denied petitions to abandon it as recently as 2021 so the EO reopens rather than resolves that dispute.

National Security Cost

The EO frames nuclear energy as a vital national and economic security interest, capable of powering AI, quantum computing, and reducing dependence on geopolitical rivals ([The White House, 2025](#)). Russia and China have been aggressively exporting reactor technology to developing nations ([Table 2: Nuclear Reactors Under Construction](#)) often using these deals to build long-term influence. The U.S. ceding nuclear leadership therefore has strategic consequences beyond energy supply alone: it weakens industrial competitiveness, constrains allied technology exports, and leaves competitors with a larger role in setting the future of global nuclear norms.

Why This Matters for Advanced Reactors

The old LWR-centric framework could not efficiently license SMRs and microreactors as written. Congress directed the NRC to build a technology-inclusive pathway through NEIMA in 2019, and the Part 53 rulemaking was drafted, proposed, and through public comment before EO 14300 was signed. The order's contribution was to compress the final rule schedule and to launch companion actions, Part 57 among them, that extend the modernization beyond what NEIMA required.

Part 53 was finalized in March 2026 (91 FR 15696; effective April 29, 2026). The rule codifies in regulation the risk-informed, technology-inclusive approach that developers previously accessed through guidance endorsement under legacy Parts 50 and 52. Its alignment with EO 14300's objectives reflects common descent from the same critique of the legacy framework rather than the order shaping the rule's content with the technology-inclusive scope and risk-informed, performance-based structure were fixed in the proposed rule published in October 2024, seven months before the order was signed. The order's influence is visible at the margins of the final rule, such as reduced mandatory ACRS referrals, and in the schedule, with final Commission action arriving well ahead of the December 2027 statutory deadline. The EO's 18-month licensing deadline is being implemented through the NRC's separate wholesale-revision rulemaking rather than through Part 53 itself.

Traditional Reactor Licensing under 10 CFR Part 50 and Part 52

10 CFR Part 50 — The Original Framework (1956)

The original licensing framework, 10 CFR Part 50 ([U.S. Nuclear Regulatory Commission](#)) was originally issued by the Atomic Energy Commission. It requires two separate licenses: a Construction Permit (CP)

and an Operating License (OL), issued sequentially. Safety review occurs at both stages, creating uncertainty for investors since final operating approval is not guaranteed at the time construction begins. Recent advanced reactors have used Part 50 because, unlike Part 52 (discussed below), construction could begin before the plant design is final.

10 CFR Part 52 — Combined License Era (1989)

10 CFR Part 52 ([U.S. Nuclear Regulatory Commission](#)) introduced the Combined License (COL), which merges the construction permit and operating license into a single approval. Allows early site permits (ESPs) and design certifications (DCs) to be obtained independently and referenced in a COL application. Part 52 reduces investor risk by resolving most safety questions before construction begins. Southern Company used Part 52 for the most recent U.S. builds, Vogtle Units 3 & 4 in Georgia. That experience showed that Part 52 is best when a design is fully complete. The emerging industry pattern, seen in the Natrium, Hermes, and Xe-100 filings, favors Part 50 for first-of-a-kind builds and Part 52 for replication of a settled design, with Part 53 now available as a third option for either.

10 CFR Part 53 — Risk Informed, Performance Based (2026)

Part 53 is the first new reactor licensing framework since Part 52 in 1989 and the first major update to licensing standards since Part 50 in 1956. The NRC finalized Part 53 in 2026. 10 CFR Part 53 ([U.S. Nuclear Regulatory Commission](#)) originated from the NEIMA-directed rulemaking that began in 2020, years before Executive Order 14300 ([The White House, 2025](#)). The order accelerated the work. It builds on NEIMA 2019, the Nuclear Energy Innovation and Modernization Act, which directed the NRC to develop a technology-inclusive licensing framework for advanced reactors ([U.S. Congress, 2019](#)).

Part 53 does not replace Part 50 or 52. It is an optional pathway to reactor licensing developed with the advent of new reactor technology safety features as they fundamentally differ from water cooled reactor designs. Robust risk-informed analyses with careful assessment of potential public risk now define the basis for regulation with these designs. The NRC continues to update and draft new guidance documents alongside the final rule to help applicants implement the new framework.

Key Features

Technology-Neutral Safety Standards

Removes LWR-specific assumptions; any reactor type can be licensed without seeking exemptions. This places in regulation what applicants previously established through guidance endorsement and case-by-case staff review, reducing dependence on guidance documents that can be revised outside the rulemaking process.

Flexible Risk Analysis

Allows probabilistic risk assessment (PRA) or broader systematic risk evaluations. This is especially important for technologies that do not yet have the operating history needed for a full-scope PRA, so the rule explicitly permits broader methods when they are more appropriate.

Graded Security Requirements

Security tied to actual risk rather than fixed staffing models. This is a major departure from legacy approaches built around large conventional plants, where staffing assumptions often did not fit modular, smaller, or more autonomous designs.

Staged Licensing

Developers can complete licensing in stages and submit staggered applications. That lowers upfront burden, supports iterative design refinement, and avoids forcing applicants to commit to a complete final package before the design has matured.

Common Design Support

Supports repeated deployment across multiple sites using shared designs. This is essential for commercialization, because advanced reactors need to be deployable repeatedly in a consistent way if they are going to achieve scale and economic viability.

Generally Licensed Reactor Operators

Reduces prescriptive operator requirements for smaller or autonomous systems. For these designs, operator rules created for large plants can become a major driver of cost and complexity, so this provision addresses that mismatch.

Key Advantages

Faster Approvals

NRC officials expect design approvals under Part 53 in 18 months or less, consistent with EO 14300's mandate of a maximum 18 months for final licensing decisions.

Major Cost Savings

Application costs could be reduced by 50% or more, with NRC estimated net averted costs of \$50M+ per applicant. The NRC's 2023 draft regulatory analysis also noted that the ADVANCE Act provides an award to help cover licensing costs for the first Part 53 applicant.

Eliminates Regulatory Friction

Creates a centralized framework around the licensing modernization program and codifies the implementation of new reactor applications independent of the reactor technologies.

Ahead of Schedule

Completed nearly two years ahead of the NEIMA 2027 deadline. That is especially notable because the start-to-finish rulemaking timeline stretched more than five years, yet the NRC still finished early, and several advanced reactor developers have already said they are interested in using Part 53.

“This final rule is a major NRC action that provides a clear risk-informed, technology-inclusive licensing framework to enable new nuclear to safely move faster from concept to construction.”
NRC Chairman Ho K. Nieh

10 CFR Part 57 — Microreactors (2026)

10 CFR Part 57 ([U.S. Nuclear Regulatory Commission, 2026](#)) is anticipated to create a new NRC licensing framework for factory-fabricated microreactors and other low-consequence reactors, allowing these

technologies to move through a more flexible, streamlined regulatory path while maintaining safety, security, and environmental protections.

- + Establishes a new NRC licensing pathway for factory-fabricated microreactors and low-consequence reactors
- + Covers the full lifecycle: design approval, manufacturing, construction, operation, and decommissioning
- + Introduces flexible, technology-inclusive frameworks for physical security, cybersecurity, operator licensing, and environmental review
- + Provides multiple licensing pathways: Construction Permits/Operating Licenses (Subpart C), Manufacturing Licenses (Subpart D), and Standard Design Approvals (Subpart E)
- + Eligibility limited to reactors with accident dose consequences ≤ 1 rem TEDE at the site boundary
- + Streamlines NEPA review via categorical exclusion, reduces continuous inspection requirements, and modernizes fitness-for-duty and financial protection rules

DOE to NRC licensing

DOE-authorized reactors create a bridge between demonstration and commercial deployment. DOE can authorize reactor demonstrations under its own nuclear safety framework. That process is not an NRC license, and it does not automatically authorize commercial operation outside DOE jurisdiction. But it can generate a reviewed safety record, operating data, design controls, and authorization-basis material that may later support an NRC application.

In April 2026, the NRC proposed revisions to allow commercial applicants to directly reference prior DOE or Department of War reactor authorizations when seeking NRC licenses for the same or similar designs. The goal is not to substitute DOE approval for NRC approval, but rather avoid relitigating issues already reviewed by a federal nuclear safety authority.

This pathway allows first movers to demonstrate their reactor under DOE authority, collect safety and operating evidence, then use that evidence to support a commercial NRC application. It may reduce duplication, and shorten review schedules. The limitation is that the pathway is still developing. NRC will still decide what it can credit, how much additional information is needed, and whether the DOE-authorized configuration is close enough to the commercial design to support reliance.

Key DOE Programs for Nuclear Development

GAIN Program and R&D Voucher System

The Gateway for Accelerated Innovation in Nuclear (GAIN) is a DOE-sponsored framework that bridges the gap between private-sector nuclear innovators and the world-class research capabilities of the DOE national laboratory complex. Administered through Idaho National Laboratory (INL), GAIN provides a single point of access to nuclear expertise, facilities, and data across the entire national lab system ([U.S. Department of Energy](#)).

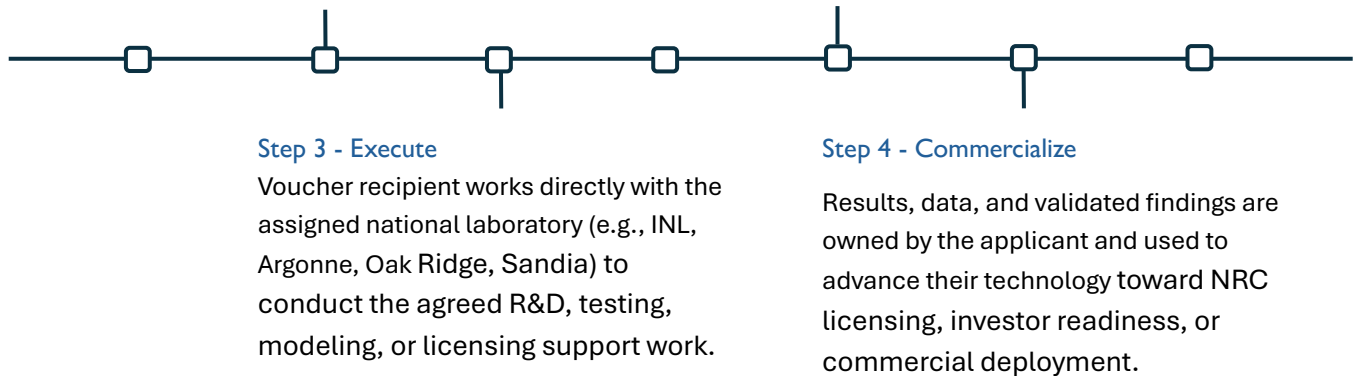
How it Works

Step 1 - Apply

Companies, utilities, universities, or state entities submit a Request for Assistance describing their technical need and proposed scope of work. GAIN staff assist applicants in scoping and costing proposals before submission.

Step 2 — Review & Award

Applications are evaluated on technical merit and market impact. Approved applicants receive a Nuclear Energy (NE) Voucher — a funded work authorization that covers DOE national lab costs.



What GAIN Provides

Access to Experts

Nuclear scientists, engineers, materials specialists, licensing experts, and financial advisors across 17+ national laboratories

Unique Facilities

Test reactors, hot cells, irradiation facilities, computational modeling tools, and state-of-the-art simulation platforms unavailable in the private sector.

Prior Research Data

Access to decades of classified and unclassified nuclear R&D data, sample materials, and experimental results to inform new projects.

Arkansas Relevance

A utility or developer pursuing a new reactor in Arkansas could use GAIN to access NRC pre-licensing support, fuel qualification testing, site characterization modeling, or safety analysis, reducing both cost and timeline for early-stage development.

DOE Loan Programs Office

The DOE Loan Programs Office provides debt financing for large-scale energy projects deploying innovative technologies or reinvest in existing energy infrastructure. For nuclear energy, LPO operates primarily through the Title 17 Innovative Clean Energy Loan Guarantee Program, which can provide federal loan guarantees for advanced nuclear projects that cannot access conventional commercial financing due to technology risk ([U.S. Department of Energy, Loans Program Office](#)).

How it Works

Loan Products

LPO offers two financing structures: (1) a direct loan from the U.S. Treasury's Federal Financing Bank (FFB) backed by a 100% DOE guarantee, or (2) a DOE partial guarantee (up to 90%) of commercial debt. Most guarantees are for loans over \$100 million.

Eligibility

Projects must employ new or significantly improved technology compared to commercial technology in service in the U.S., avoid or reduce greenhouse gas emissions, be located in the U.S., and demonstrate a reasonable prospect of repayment.

Eligible Nuclear Project Types

Advanced reactors, SMRs, uprates and upgrades at existing facilities, front-end nuclear fuel cycle projects (uranium conversion, enrichment, fuel fabrication), and innovative supply chain manufacturing.

Application Process

Projects engage LPO early in development through a Part I (eligibility) and Part II (full application) process. LPO provides in-house technical, financial, legal, and environmental due diligence support throughout the loan term.

Scale & Track Record

LPO has issued more than \$130 billion in loans and loan guarantees across nearly 100 project locations, including the guarantees that financed Vogtle 3 & 4 and recent loans supporting the Palisades and Three Mile Island restarts. The Infrastructure Investment and Jobs Act (2021) and Inflation Reduction Act (2022) expanded LPO's authority and tools. In 2025, Congress expanded the Section 1706 Energy Infrastructure Reinvestment authority into the Energy Dominance Financing Program, and DOE renamed the office the Office of Energy Dominance Financing (EDF), with more than \$300 billion in loan authority across its programs. In June 2026, EDF issued a \$17.5 billion conditional loan commitment to finance long-lead components for ten new AP1000 reactors at up to five sites.

A new nuclear project in Arkansas, whether a utility-scale advanced reactor or an SMR, would likely require hundreds of millions to billions of dollars in debt financing. LPO loan guarantees reduce the cost of capital by substituting federal credit for private credit risk, making projects financeable that would otherwise be too risky for commercial lenders. Arkansas's Generating Arkansas Jobs Act (Act 373 of 2025) creates a complementary state-level cost recovery framework that, combined with LPO financing, could form a complete public-private capital stack for a new Arkansas nuclear project ([Arkansas General Assembly, 2025](#)).

DOE Office of Nuclear Energy Priorities

The DOE Office of Nuclear Energy is the primary federal office responsible for nuclear energy R&D, demonstration, and policy. The Office administers the nation's most significant nuclear technology investment programs, from advanced reactor demonstrations to fuel supply chain development and university research infrastructure ([U.S. Department of Energy, 2024](#)).

Key Priority Programs

Advanced Reactor Demonstration Program (ARDP)

Funds cost-shared demonstration of advanced reactor designs at commercial scale. Current awardees include TerraPower (Sodium sodium fast reactor, Wyoming) and X-energy (Xe-100 high-temperature gas reactor, Seadrift, Texas). Designed to prove out first-of-a-kind designs and establish the commercial template for subsequent fleet deployment

1 HALEU Availability Program

Secures near-term supply of High-Assay Low-Enriched Uranium (HALEU) — the fuel required by most advanced reactor designs. Under the FY2024 NDAA, Congress directed DOE to make 21 metric tons available by June 30, 2026. Includes recovery and downblending of government-owned legacy uranium and ramp-up of enrichment operations at Piketon, Ohio. DOE issued its first allocations to five developers (TRISO-X, TerraPower, Kairos Power, Radiant, and Westinghouse) in April 2025, with a second round in August 2025, and has since awarded \$900 million task orders each to Centrus and General Matter to expand domestic enrichment capacity.

2 Reactor Pilot Program (2025)

Created following President Trump's May 2025 executive orders on nuclear energy, this new DOE pathway fast-tracks advanced reactor demonstration to accelerate commercial licensing and unlock private investment.

3 Light Water Reactor Sustainability (LWRS)

Supports license renewal and long-term operation of existing reactors beyond 60 years. Directly relevant to ANO Units 1 and 2, whose licenses have been extended and may be candidates for subsequent license renewal (SLR) to 80 years.

4 Nuclear Energy University Program (NEUP)

Funds nuclear science and engineering research at U.S. universities, including the University of Arkansas. Supports the next generation of nuclear workforce and provides research infrastructure grants.

Recent Federal Nuclear Policy

The initiatives below form the core of the current federal nuclear policy framework.



Federal Nuclear Energy Legislative Initiatives

Nuclear Energy Innovation and Modernization Act (NEIMA)

Enacted January 14, 2019 | Public Law 115-439. Modernizes NRC regulation to enable advanced reactor licensing and reform the agency's fee structure ([U.S. Congress, 2019](#)).

- + Directs the NRC to develop a technology-inclusive licensing framework for advanced reactors, with a fully operational framework required by the end of 2027
- + Establishes performance metrics and milestones for NRC licensing and regulatory actions
- + Reforms the NRC's fee recovery structure to reduce the burden on advanced reactor applicants
- + Creates a DOE cost-sharing program to assist industry in applying for advanced reactor licenses
- + Establishes a pilot program for predictable uranium recovery fees

Infrastructure Investment and Jobs Acts of 2021

Enacted November 15, 2021 | Public Law 117-58. Provides \$8.5 billion in nuclear energy funding, including a \$6 billion Civil Nuclear Credit Program to preserve at-risk existing reactors ([U.S. Congress, 2021](#)).

- + Establishes the Civil Nuclear Credit (CNC) Program: \$6 billion over four years (\$1.5B/yr) to support economically at-risk nuclear plants through a competitive credit auction
- + Appropriates \$2.5 billion for advanced reactor demonstration, fuel infrastructure (HALEU), and nuclear R&D
- + Extends and expands DOE loan guarantee authority for nuclear projects
- + Supports grid reliability by preventing premature closure of carbon-free nuclear plants

The Inflation Reduction Act of 2022 (IRA)

Enacted August 16, 2022 | Public Law 117-169

Provides the most significant nuclear tax incentive package in U.S. history, supporting both existing plants and new advanced reactor deployment ([U.S. Congress, 2022](#)).

- + Creates the Zero-Emission Nuclear Power Production Credit (45U): \$15/MWh for existing nuclear plants (effective 2024–2032), scaling down as power prices rise above \$25/MWh
- + Establishes a technology-neutral Clean Electricity Production Tax Credit (45Y): at least \$25/MWh for new zero-carbon facilities placed in service after 2025, including advanced nuclear
- + Provides a Clean Electricity Investment Tax Credit (48E): 30% investment credit as an alternative to the PTC for new zero-carbon facilities
- + Expands DOE Loan Programs Office authority by \$40 billion in additional Section 1703 loan guarantee authority
- + Includes 10-percentage-point bonus credits for facilities sited in energy communities (former coal plant sites)

CHIPS and Science Act of 2022

Enacted August 9, 2022 | Public Law 117-167

Authorizes \$11.2 billion for DOE energy R&D, including significant funding for advanced nuclear reactor development and university nuclear infrastructure ([U.S. Congress, 2022](#)).

- + Authorizes \$400 million (FY2023–FY2026) for DOE Office of Nuclear Energy advanced materials R&D
- + Includes the National Nuclear University Research Infrastructure Reinvestment Act, boosting investment in university nuclear science and engineering programs
- + Funds isotope production programs to ensure long-term availability of medical and industrial radioisotopes
- + Authorizes \$1.2 billion for ARPA-E, supporting high-risk, high-reward nuclear and energy innovation
- + Broadly supports the 10 DOE applied energy technology areas, including advanced nuclear

International Nuclear Energy Act of 2023 (INEA)

Introduced 2023 | S. 826 / H.R. 2938

Establishes a whole-of-government U.S. strategy for civil nuclear exports to counter Russia and China's dominance of the global nuclear market ([U.S. Senate, 2023](#)).

- + Creates an Executive Office of Nuclear Energy Policy to coordinate civil nuclear export strategy across federal agencies
- + Directs strategic engagement with ally and partner nations to standardize financing, project management, licensing, and liability frameworks
- + Promotes U.S. nuclear safety, security, and safeguards standards as the global benchmark
- + Establishes competitive financing mechanisms to offset Russia and China's state-backed nuclear export programs
- + Targets countries building their first nuclear plants as priority partners for U.S. technology and expertise

Nuclear Fuel Security Act of 2023 (S. 452 / H.R. 1086)

Introduced 2023.

Strengthens domestic nuclear fuel cycle infrastructure and supply chain resilience to reduce U.S. dependence on Russian and Chinese nuclear materials ([U.S. Senate, 2023](#)).

- + Directs DOE to develop a strategic plan for rebuilding domestic uranium enrichment and conversion capacity
- + Supports investment in HALEU (High-Assay Low-Enriched Uranium) production infrastructure needed for advanced reactor fuels
- + Addresses critical bottlenecks in the nuclear fuel supply chain identified following Russia's invasion of Ukraine

- + Coordinates with allied nations to develop resilient international fuel supply alternative

Recoup American Nuclear Global Leadership Act

Introduced May 18, 2023 | H.R. 3486.

Asserts U.S. nuclear leadership by establishing global relationships and facilitating civil nuclear trade strategies with emerging nuclear nations ([U.S. House of Representatives, 2023](#)).

- + Establishes a White House focal point for civil nuclear coordination, potentially reporting to the National Security Council
- + Directs development of a cohesive U.S. policy for international civil nuclear energy efforts across executive branch agencies
- + Facilitates civil nuclear trade strategies with embarking nuclear nations seeking to build their first reactors
- + Positions U.S. advanced reactor technology — including SMRs and microreactors — as the preferred alternative to Russian and Chinese offerings

Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy (ADVANCE) Act

Enacted July 9, 2024 | Public Law 118-67.

The most comprehensive nuclear regulatory reform in decades — streamlines NRC licensing, reduces costs for advanced reactor applicants, and expands U.S. nuclear export leadership ([U.S. Congress, 2024](#)).

- + Reduces NRC licensing fees for advanced reactor applicants and pre-applicants by excluding mission-indirect costs; authorizes prize incentives for first-mover advanced nuclear projects
- + Establishes an expedited licensing review procedure for qualifying new reactor applications
- + Directs NRC to develop a regulatory framework for fusion technology and microreactors
- + Authorizes NRC to establish an International Nuclear Export and Innovation Branch to improve global nuclear cooperation
- + Removes certain limitations on foreign ownership of licensed facilities to attract international investment
- + Directs NRC to assess licensing pathways for reactors sited at former fossil fuel plant sites and brownfields
- + Passed with overwhelming bipartisan support: 393–13 in the House, 88–2 in the Senate

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Appendix A: U.S. Case Studies

Vogtle Units 3 & 4 (Burke County, Georgia) is the only completed U.S. new-build of the modern era. ([U.S. Nuclear Regulatory Commission, 2012](#)) Southern Nuclear Operating Company filed its combined license (COL) application under 10 CFR Part 52 on March 28, 2008, the NRC issued the combined licenses on February 10, 2012, and the two Westinghouse AP1000 units entered commercial operation on July 31, 2023 (Unit 3) and April 29, 2024 (Unit 4). ([U.S. Nuclear Regulatory Commission, 2012](#)) The project was first projected at roughly \$14 billion with 2016–2017 in-service dates; reported cost rose past \$30 billion and the schedule slipped by approximately seven years.

The Kemmerer Sodium Project (Lincoln County, Wyoming), developed by TerraPower through subsidiary US SFR Owner, LLC, demonstrates a different regulatory strategy: a fully risk-informed, performance-based 10 CFR Part 50 construction permit application for a sodium-cooled fast reactor, with the nuclear island licensed separately from the energy-storage and generation islands. ([The Breakthrough Institute, 2026](#)) The NRC docketed the application on May 14, 2024, and issued the construction permit on March 4, 2026; nuclear-related construction began April 23, 2026. ([The Breakthrough Institute, 2026](#)) ([U.S. Department of Energy, Office of Nuclear Energy, 2026](#)) ([Terrapower, 2026](#))

The Kairos KP-FHR Project (Oak Ridge, Tennessee) is a smaller, fluoride salt-cooled high-temperature reactor advanced through U.S. Department of Energy (DOE) Advanced Reactor Demonstration Program (ARDP) support. The Hermes low-power demonstration reactor received the first NRC construction permit for a non-light-water reactor in over 50 years in December 2023. A follow-on two-unit plant, Hermes 2, received construction permits in November 2024. Both proceed as Part 50 facilities, and safety-related nuclear construction began in May 2025. ([World Nuclear News, 2026](#))

Read together, the three projects show:

- (a) a proven but cost- and schedule-challenged large light-water build (Vogtle);
- (b) a first-of-a-kind commercial non-light-water build using a modernized licensing basis (Kemmerer); and
- (c) a DOE-supported, iterative, smaller-scale pathway (Kairos).

The sections that follow document each project against six milestones: announcement, site selection, site surveying, design/application approval to proceed, initiation of construction, and current status.

Case Study A — Vogtle Units 3 & 4 (Georgia): A First-of-a-Kind

Vogtle 3 & 4 are the only modern U.S. new-build to have completed construction and reached commercial operation. [Note: lessons learned from the Vogtle build are in Chapter 7, pp. 7-12 to 7-13.]

Milestones

Announcement / application. Southern Nuclear Operating Company submitted its COL application for two AP1000 units (called Vogtle 3 and Vogtle 4) on March 28, 2008. ([U.S. Nuclear Regulatory Commission, 2012](#))

Site selection. The new units were sited at the existing Vogtle plant near Waynesboro in Burke County, Georgia, which already hosted two operating reactors. Southern Company filed for an Early Site Permit (ESP) with the NRC in August 2006, and the NRC issued the ESP and a limited work authorization in August 2009. ([U.S. Nuclear Regulatory Commission, 2012](#))

Site surveying / early works. On October 22, 2009, Southern Nuclear supplemented its COL application with a limited work authorization request covering selected construction activities, including reinforcing steel and placement of concrete for the nuclear island foundation base slab; site preparation was under way by August 2011.

Approval of design to proceed. The NRC issued the combined licenses and limited work authorizations on February 10, 2012; this was the first construction approval for U.S. reactors in roughly three decades.

Initiation of construction. First nuclear concrete for Unit 3 was placed in March 2013; Unit 4 nuclear construction began in November 2013.

Current status. Unit 3 entered commercial operation in July 2023 and Unit 4 in April 2024. The Vogtle site (made up of units 1, 2, 3, and 4) is now the largest U.S. nuclear station by capacity.

Heavy ASME Section III Components, by Unit

The AP1000 reactor pressure vessel and steam generators are nuclear-grade components fabricated to ASME Boiler and Pressure Vessel Code Section III. For Vogtle 3 & 4, the reactor pressure vessels and steam generators were fabricated by Doosan Heavy Industries in South Korea and delivered to the site via the Port of Savannah and rail.

Reactor pressure vessels. The Unit 3 reactor pressure vessel lifted into its permanent location inside the Unit 3 nuclear island in November 2016. The Unit 4 reactor pressure vessel was placed inside Unit 4 containment in March 2018.

Steam generators. Each AP1000 unit requires two steam generators (each roughly 80 feet long and about 1.4 million pounds). The first Unit 3 steam generator was placed in August 2017 and the second by October 2017. Unit 4's two steam generators were placed in 2018.

Construction and Operational Milestones, by Unit

Vogtle's late-stage construction and startup sequence is set out below per unit. Under the AP1000 startup sequence, completion of the containment vessel and pre-operational testing precedes hot functional testing (running plant systems at normal operating temperature and pressure without fuel), which in turn precedes ITAAC closure, the NRC 103(g) finding, fuel load, initial criticality, grid synchronization, and commercial operation.⁵

Containment completion and pre-operational testing. For Unit 3, the containment vessel structural integrity test (first pressurization with weld inspection) and placement of the final containment module

⁵ Under 10 CFR Part 52, which is the licensing path taken by Vogtle 3 & 4, Southern Company received permission to both construct and operate prior to construction, rather than the separate construction and operation permissions required under Part 50. Because Part 52 does not have a separate operating license, the NRC instead ensures that an operation checklist (called ITAAC) is complete, and when it is complete, the NRC issues a "103(g)" finding, referring to the relevant section in the nuclear regulations.

(CB-20, the passive containment cooling water tank holding roughly 750,000 gallons) were completed by mid-2020, followed by closed vessel testing in July 2020 and cold hydro testing by October 2020. For Unit 4, the containment integrated leak rate test was completed by spring 2022 and cold hydro testing in early December 2022; the final crane lift (Unit 4's CB-20 water tank) was placed in April 2021.

Hot functional testing. Hot functional testing on Unit 3 began in April 2021, the last major test series before fuel load. For Unit 4, hot functional testing began in late March 2023 and was completed in May 2023. Southern Company reported that it had completed Unit 4's testing in significantly less time than on Unit 3, attributed to lessons learned.⁶

ITAAC closure and NRC 103(g) finding. For Unit 3, Southern Nuclear submitted all Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) to the NRC on July 29, 2022; the NRC published its 10 CFR 52.103(g) finding in August 2022, confirming the unit was constructed and would be operated in conformance with the combined license and NRC regulations, satisfying 398 ITAAC. For Unit 4, the NRC issued the 103(g) finding in July 2023, following satisfaction of 364 ITAAC; no further NRC findings were required before fuel load or startup.

Fuel load. Unit 3 fuel load was completed in October 2022. Unit 4 fuel load began in August 2023.

Initial criticality and grid synchronization. Unit 3 reached initial criticality on March 6, 2023, and connected to the grid, generating electricity for the first time, on April 1, 2023. Unit 4 reached initial criticality on February 14, 2024, and connected to the grid on March 1, 2024.

Commercial operation. Unit 3 entered commercial operation on July 31, 2023 and Unit 4 on April 29, 2024, completing the expansion. A reactor coolant pump motor fault identified in 2023 contributed to moving Unit 4's in-service date from late 2023 into 2024.

Milestone	Unit 3	Unit 4
First nuclear concrete / construction start	Mar 2013	Nov 2013
Containment / pre-operational testing complete	Closed-vessel Jul 2020; cold hydro by Oct 2020	Cold hydro early Dec 2022
Hot functional testing	Began Apr 2021	Mar 2023 – completed May 1, 2023
NRC 103(g) finding (ITAAC closure)	Aug 3, 2022 (398 ITAAC)	Jul 28, 2023 (364 ITAAC)
Fuel load	Completed Oct 17, 2022	Began Aug 17, 2023 (157 assemblies)
Initial criticality	Mar 6, 2023	Feb 14, 2024
Grid synchronization	Apr 1, 2023	Mar 1, 2024

⁶ The progress of Vogtle 4, as compared to Vogtle 3, is illustrative of the improved efficiency from a first-of-a-kind (FOAK) build and an Nth (subsequent) of a kind (NOAK) build. A good take-away lesson from Vogtle is that if the reactor type is a FOAK, stakeholders should be prepared for a longer schedule and cost than if the build is a NOAK.

Milestone	Unit 3	Unit 4
Commercial operation	Jul 31, 2023	Apr 29, 2024

Strengths

- **Completion and proven operation.** Vogtle delivered the first newly constructed U.S. nuclear units in roughly three decades and the first Part 52 construction and operation.
- **Second-unit learning effect.** Unit 4 completed hot functional testing in significantly less time than Unit 3 by applying lessons from the first unit, evidence of an intra-project learning effect between identical units.
- **Replicable contractor base.** Bechtel, brought in as the Vogtle construction contractor in 2017 after the Westinghouse bankruptcy, has used lessons in later advanced projects, including serving as TerraPower’s engineering, procurement, and construction partner.

Weaknesses

- **Budget overruns.** The project, originally estimated near \$14 billion, rose to a reported total exceeding \$30 billion.
- **Schedule overruns.** In-service dates moved from a projected 2016–2017 to 2023–2024, a slip of roughly seven years.
- **Construction uncertainty as an inherent feature.** EIA characterized the expansion as an 11-year effort beset by significant construction delay relative to original expectations, underscoring that first-of-a-kind execution risk is difficult to eliminate.
- **Additional Lessons Learned** are in Chapter 7, pp. 7-12 to 7-13.

Case Study B — Terrapower: Natrium Project

TerraPower's Kemmerer Power Station Unit 1 is the first commercial non-light-water reactor to obtain an NRC construction permit, using a fully risk-informed, performance-based Part 50 licensing basis and a separation of the nuclear island from the energy-storage and generation islands.

Pre-Application Engagement (NRC)

TerraPower's regulatory strategy centered on extended pre-application engagement before any construction permit application was filed. The NRC opened pre-application activities for the Natrium reactor under a dedicated pre-application docket. TerraPower described its design as a 345-MWe base output pool-type sodium fast reactor with a dedicated thermal storage system for up to 500-MWe output using high-assay low-enriched uranium (HALEU) metal fuel that combines features of the earlier GE Hitachi PRISM and TerraPower Traveling Wave designs. ([U.S. Nuclear Regulatory Commission, n.d.](#))

In June 2021, TerraPower submitted a Regulatory Engagement Plan (REP) for the Natrium reactor, which set out anticipated dates for interactions and submittals and stated that feedback from preliminary NRC staff discussions had been incorporated. The plan contemplated working with NRC staff to establish a mutually agreeable review scope and schedule. ([TerraPower, 2021](#))

From 2021 to 2024 the company submitted white papers and topical reports for NRC review covering technical and programmatic areas. These included a topical report addressing the regulatory treatment of the interface between the nuclear island (NI) and the energy island (EI) — the basis for separating the licensed nuclear scope from the energy-storage and generation scope; a Principal Design Criteria topical report for the Natrium advanced reactor (developed using NRC Regulatory Guides 1.232 and 1.233); and a Fuel and Control Assembly Qualification topical report reviewed by the NRC's Advisory Committee on Reactor Safeguards in 2024.

In October 2023, TerraPower requested that the NRC staff conduct a readiness assessment of its forthcoming construction permit application, giving the staff an opportunity to become familiar with the application and its anticipated level of detail before formal submission. At permit issuance, TerraPower characterized the effort as over four years of work with NRC staff, including extensive pre-application and application-phase engagement. ([TerraPower, 2026](#))

Milestones

Announcement. DOE selected the TerraPower/GE Hitachi Natrium design under the DOE's Advanced Reactor Demonstration Program (ARDP) in October 2020 (with \$80 million in initial funding and up to \$2 billion in authorized cost-shared federal support). In June 2021, TerraPower and PacifiCorp announced plans to site the demonstration at a retiring Wyoming coal plant. ([U.S. Department of Energy, 2020](#))

Site selection. In November 2021, the company selected Kemmerer, near the retiring Naughton coal plant in Lincoln County, as its preferred site. ([U.S. Department of Energy, Office of Nuclear Energy, 2024](#)) ([American Nuclear Society, 2026](#))

Site surveying / non-nuclear early works. TerraPower broke ground on non-nuclear site-preparation in June 2024. ([U.S. Department of Energy, Office of Nuclear Energy, 2026](#))

Approval of design / application to proceed. TerraPower submitted its Part 50 construction permit application in March 2024. The NRC docketed it on May 14, 2024, under an initial 27-month review schedule. The NRC completed its final environmental impact statement (NUREG-2268) in October 2025, and the final safety evaluation in December 2025. The NRC Commissioners voted to issue the construction permit in March 2026. ([The Breakthrough Institute, 2026](#)) ([U.S. Department of Energy, Office of Nuclear Energy, 2026](#))

Initiation of construction. TerraPower announced the official start of nuclear-related construction on Kemmerer Unit 1 on April 23, 2026, following permit issuance.

Current status. The unit is under construction. An operating license application under Part 50 remains required before fuel load and operation. TerraPower's goal is to be operational in the 2030-2031 time frame. ([U.S. Department of Energy, Office of Nuclear Energy, 2026](#))

Strengths

- + **First commercial non-LWR construction permit.** TerraPower's Sodium reactor is the first approval for a commercial non-light-water reactor in more than 40 years and the first power-reactor application on a fully risk-informed, performance-based licensing basis. ([The Breakthrough Institute, 2026](#))
- + **Scope separation reduced licensing burden.** Separating the nuclear island from the energy-storage and generation islands exempted the storage and generation portions from NRC licensing, reducing regulatory burden. ([The Breakthrough Institute, 2026](#))
- + **Schedule performance at the permit stage.** The NRC completed its safety review ahead of the original schedule. DOE reported the safety review was completed about 11 percent under budget. ([U.S. Department of Energy, Office of Nuclear Energy, 2026](#)) ([A Historic First: NRC Clears TerraPower's Sodium Nuclear Reactor for Construction, 2026](#))

Weaknesses

- + **Commercialization delay versus original DOE target.** The trade press reported that a 2030–2031 operational target is roughly a three-to-four-year delay from the original goal of about 2027.
- + **First-of-a-kind construction risk remains.** Construction has only just begun (April 2026). Looking only at the Vogtle experience, possible schedule and budget overruns are a concern. ([The Breakthrough Institute, 2026](#))
- + **Operating authorization not yet certain.** The construction permit does not authorize operation; a separate Part 50 operating license application is still required. ([U.S. Department of Energy, Office of Nuclear Energy, 2026](#)) ([The Breakthrough Institute, 2026](#))

Case Study C — Kairos: KP-FHR

Kairos Power pursued a smaller fluoride salt-cooled high-temperature reactor (KP-FHR) using TRISO pebble fuel. Kairos has an iterative strategy. It started with a non-power demonstration reactor (Hermes) followed by an electricity-producing two-unit plant (Hermes 2), with DOE ARDP support.

Pre-Application Engagement (NRC)

Kairos Power's iterative model began with a long pre-application phase. Pre-application activities began in November 2018. In the pre-application phase, Kairos pursued NRC approval of a series of generic topical reports that would be referenced by future KP-FHR license applicants. The topical reports establish reusable regulatory approvals that can be used in future plant-specific applications. The topical reports include a regulatory-applicability review mapping which 10 CFR provisions apply, do not apply, or require exemption for the KP-FHR; principal design criteria; fuel qualification methodology; reactor coolant (FLiBe) specifications; and metallic-materials qualification in high-temperature salt. The fuel qualification methodology used irradiated-TRISO data from DOE's Advanced Gas Reactor Fuel Development and Qualification Program at Idaho National Laboratory.

By the application stage the NRC had reviewed and approved multiple Kairos topical reports supporting KP-FHR licensing. The company and the NRC attributed the accelerated Hermes review to this extensive pre-application engagement dating to 2018.

Technology Demonstrators and Hardware Milestones

Distinct from the NRC licensing track, Kairos advanced a parallel program of non-nuclear hardware demonstrators, the Engineering Test Unit (ETU) series and supporting facilities, to reduce technology, supply-chain, and construction risk.

- + **ETU 1.0 (Albuquerque, New Mexico).** A full-scale, electrically heated, non-nuclear prototype of the Hermes reactor. The system was the largest FLiBe molten-salt system ever built. It began operations in December 2023. The prototype used approximately 12 metric tons of FLiBe coolant. It reached about 675°C. Before decommissioning began in mid-2024, it completed more than 2,000 hours of pumped-salt operations and generated over 10 terabytes of data.
- + **ETU 2.0 (Albuquerque, New Mexico).** The second iteration focused on demonstrating modular construction methods. It incorporated the first reactor vessel fabricated in-house at Kairos's Manufacturing Development Campus, including production of ASME U-stamped pressure vessels and specialized components.
- + **ETU 3.0 (Oak Ridge, Tennessee).** A further iteration planned on Kairos-owned land adjacent to the Hermes reactor site, intended to build local civil-construction experience that transfers to the Hermes project.
- + **Molten Salt Purification Plant (Elmore, Ohio).** This facility produced the high-purity FLiBe coolant for the ETU program, supporting the company's vertical-integration strategy for critical materials.

Milestones — Hermes 1 (Low-Power Demonstration Reactor)

Announcement / DOE support. Kairos was selected for a DOE ARDP risk-reduction award in December 2020; the cost-shared award has a total value of \$629 million with DOE contributing up to \$303 million.

Site selection. Hermes is sited at the Heritage Center Industrial Park (former East Tennessee Technology Park) in Oak Ridge, Tennessee, a remediated former gaseous-diffusion enrichment site.

Application / surveying. Pre-application engagement with the NRC began in 2018; the construction permit application was submitted in September 2021 and the NRC formally accepted (docketed) it on November 30, 2021 with a 21-month review schedule.

Approval to proceed. In December 2023, the NRC issued the Hermes construction permit. This was the first construction permit for a non-light-water reactor in the U.S. in more than 50 years.

Initiation of construction. Kairos began site work and excavation in July 2024 (construction start announced July 30, 2024), with NRC-overseen safety-related nuclear construction formally beginning in May 2025.

Current status. In 2026, the NRC approved a 28-month extension of the Hermes 1's originally projected construction completion date (December 31, 2026). The new date is in 2029.

Milestones — Hermes 2 (Two-Unit Demonstration Plant)

Application. Kairos submitted the Hermes 2 construction permit application in July 2023 for a facility with two 35-megawatt-thermal reactors using TRISO fuel.

Approval to proceed. In November 2024, the NRC issued the Hermes 2 construction permits, sixteen months after receiving the application. The Hermes 2 is the first electricity-producing Gen IV plant approved for construction in the United States.

Initiation of construction. Kairos broke ground for Hermes 2, co-located with Hermes at the Oak Ridge campus, in April 2026.⁷

Strengths

- **Accelerated, precedent-setting reviews.** The Hermes review was completed ahead of an aggressive schedule following extensive pre-application engagement dating to 2018; the Hermes 2 review then ran on a faster timeline of roughly sixteen months.
- **DOE leverage and iterative scope.** DOE ARDP support (up to \$303 million via a performance-based, fixed-price milestone agreement) allows Kairos a path from a non-power demonstrator to an electricity-producing plant.
- **Risk reduction through hardware before reactor operation.** The non-nuclear ETU program allowed Kairos to mature its supply chain and build FLiBe, fuel-handling, and component-manufacturing capabilities ahead of licensed operation.

⁷ For clarification: Hermes 1 is a low power demonstration reactor. Hermes 2 is the project name for two reactors that will produce power, about 35 MWth.

Weaknesses

- **Schedule extension during construction.** The NRC granted a 28-month extension of the Hermes 1 completion deadline, indicating that construction-phase schedule pressure is present even at demonstration scale.
- **Demonstration, not commercial, scale.** Hermes 1 is a non-power reactor and Hermes 2, a two-unit demonstration. Kairos targets commercial deployment in the early 2030s.
- **Operating authorization pending.** As with Kemmerer, a separate operating license application is required before operation.