# Report to the Kentucky Legislative Research Commission Pursuant to 2023RS SJR 79

Submitted by: Kentucky Office of Energy Policy

Date: November 17, 2023

## Table of Contents

# Acknowledgement

This report is the result of the formation and collaboration of the Kentucky Nuclear Energy Development Working Group as directed by Senate Joint Resolution 79 of the 2023 General Assembly. The report would not have been possible if not for the funding provided through the State Energy Program and technical assistance via the Nuclear Innovation Alliance.

# Introduction

The following represents the actions stipulated in Senate Joint Resolution 79 (2023RS SJR 79), implementing its objectives while focusing on key aspects of Kentucky's past, present, and future energy landscape. This report is intended to provide final recommendations for the creation of a permanent nuclear energy[1] development organization in Kentucky.

The report begins with Section 1 detailing the objectives set forth by SJR 79, including the organizations and representatives who were tasked with developing these recommendations. The chronological ordering of the report is intended to communicate how the Nuclear Energy Development Working Group (hereby referred to as the "Working Group") developed final recommendations. Section 2 describes the "all of the above" approach perspective of the Working Group.

The report continues with Section 3, which is an introduction to Kentucky's unique energy landscape, highlighting its array of energy sources and their role in fulfilling the state's energy requirements. Only after discussing Kentucky's energy generation history and landscape does the report begin discussing nuclear-specific topics as seen in Section 4 and Section 5. The purpose of these sections is to introduce the potential value of nuclear energy, and the status of different nuclear energy technologies under development in the United States (U.S.).

Using the information from Sections 1 through 5, the essence of the report is presented in the following sections, where the Working Group communicates its consensus statement on Kentucky's approach to nuclear development. Section 6 encompasses the critical activities the Working Group has performed between May 2023 and the submission of this report in December 2023, including evaluating barriers[2] described in SJR 79, and providing recommendations for the potential role a permanent nuclear organization can play in nuclear energy development in Kentucky.

Based on robust discussion and the 2017 "Review of State Administrative Regulations and Regulatory Processes to Assure Costs and Environmental Protection Associated with Construction, Operation, Waste Management, and Decommissioning of Nuclear Power Facilities", the **Working Group concluded that there are no insurmountable barriers to nuclear**

[1] For this report, "nuclear energy" is defined as fission and fusion technology. The focus of this report is on fission technologies due to the nascency of the fusion industry. More attention should be placed on fusion as it continues to grow.

[2] For this report, barrier is defined as an obstacle that prevents movement (too great to overcome). Simply, a barrier is something that impedes or hinders but do not always prevent.

**energy development in Kentucky.** However, the challenges the Working Group have defined are real and require serious attention. Addressing these challenges will improve Kentucky's attractiveness and support for nuclear energy development within the state but will require extensive coordination across local, state, and federal government entities. These opportunities for Kentucky can be viewed in terms of goals for a permanent nuclear organization and categorized as "near-term (0-3 years)" and "intermediate and long-term (3+ years)". In addition, there are certain potential opportunities that are considered "gated opportunities," meaning a preceding event must occur to initiate progress in that area. These opportunities and key initiating events can be found in Section 7 outlining the structure and formation of a permanent nuclear energy development organization.

Section 7 introduces a suggested framework for establishing a permanent nuclear energy development organization. This framework outlines the mission, goals, duties, structure, budgetary considerations, and location. Furthermore, it describes the composition of advisory board members who will provide guidance for this pivotal initiative.

Concluding this report are several appendices, containing additional detailed material that may be useful in reading the report.

## Defining Kentucky's Nuclear Energy Ecosystem

For this report, nuclear energy development refers to the development of the entire nuclear energy ecosystem and is rooted in utility and private sector economic development activities. The "nuclear industry" is not just building nuclear power plants, but involves a wide suite of economic opportunities. In this report, the nuclear energy ecosystem is defined to include the nuclear fuel cycle, which includes fuel conversion, enrichment, and fabrication, as well as potential future spent fuel recycling and reprocessing; reactor design and component manufacturing; component supply chain manufacturing and distribution; facility siting and development; radioisotope production; operation and maintenance; decommissioning waste storage, transport, and waste management; and end uses of nuclear energy and co-products.

The report does include advanced reactor deployment considerations. Advanced nuclear reactors are commonly defined as fission reactors "with significant improvements compared to reactors operating on the date of enactment".[3] These reactors include Light Water Reactor

[3] The term "advanced nuclear reactor" is defined in federal law (42 U.S. Code § 16271) as a fission reactor with "significant improvements compared to reactors operating on December 27, 2020", a fusion reactor, or a radioisotope power system that utilizes heat from radioactive decay to generate energy.

(LWR) designs that are mostly far smaller than existing reactors, as well as concepts that would use different moderators, coolants, and types of fuel.[4] Many of these advanced designs are small modular reactors (SMRs), conveniently defined by the International Atomic Energy Agency (IAEA) as reactors with electric generating capacity of 300 megawatts (MW) and below, although there is no exact definition for what size constitutes an advanced reactor. Some may be slightly larger or significantly smaller.[5] For example, the IAEA classifies reactors with 10 megawatts or less as microreactors. See the "Congressional Research Service's Advanced Nuclear Reactors: Technology Overview and Current Issues" for more information.[6]

Due to the infancy of the commercial fusion industry, the focus of this report will be on fission related technologies. More attention may be required as fusion technology continues to mature.

[4] For more information about the differences between conventional and advanced nuclear, see the Nuclear Innovation Alliance's Primer on Advanced Nuclear Reactor Technology https://nuclearinnovationalliance.org/advanced-nuclear-reactor-technology-primer.
[5] *ibid*
[6] https://crsreports.congress.gov/product/pdf/R/R45706

## Section 1: Overview of Workgroup members and SJR 79 Directives

This report is mandated by SJR 79, which was signed into law in March 2023. A summary of SJR 79 can be found below:

Summary of Original Version: "Establish the Nuclear Energy Development Working Group; attach the working group to the Energy and Environment Cabinet for administrative purposes and staff support; establish the membership of the working group; designate the executive director for the Office of Energy Policy as the chair; require the working group to hold its first meeting no later than September 1, 2023; require the working group to meet at least 3 times before submitting its required report; require the working group to identify the barriers to the deployment of nuclear power generation and related technologies and to consult with stakeholders to develop recommendations for the role of a permanent nuclear energy commission to be established in state government; require the working group to submit a report to the Governor and to the Legislative Research Commission on or before December 1, 2023, detailing all work group activity since its establishment and providing recommendations for the creation of a permanent nuclear energy commission in state government; REPORT MANDATED."[7]

Per SJR 79, the following members made up the Nuclear Energy Development Working Group[8]:

- The Executive Director of the Office of Energy Policy (Chair of the Working Group);
- The Executive Director of the Public Service Commission;
- The Director of the University of Kentucky Center for Applied Energy Research;
- A representative for each of the four investor-owned electric utilities operating in the Commonwealth;[9]
- The Chief Operating Officer of the Kentucky Association of Electric Cooperatives;
- The Chief Nuclear Officer of the Tennessee Valley Authority;[10]
- The Executive Director of the U.S. Nuclear Industry Council;
- The Executive Director of the Kentucky Conservation Committee;
- A representative from a national nuclear educational nonprofit organization;[11]

[7] For more information on SJR 79, please visit https://apps.legislature.ky.gov/record/23RS/sjr79.html.
[8] For a list of the names of each working group member, see Appendix A.
[9] The four investor-owned electric utilities are: Duke Energy Kentucky, Kentucky Power, Louisville Gas and Electric, and Kentucky Utilities.
[10] The Vice President of TVA's New Nuclear Program served this role.
[11] The Director of Nuclear Policy at the Energy Communities Alliance served this role.

- A representative from a U.S. Department of Energy National Laboratory with expertise in nuclear energy policy issues;[12]
- The Director of Business Services for the Four River Nuclear Partnership;
- A representative from each of the two cooperative electric generation and transmission utilities operating in the Commonwealth;[13]
- A representative of the Nuclear Energy Institute;
- Two members of the Kentucky Senate; and
- Two members of the Kentucky House of Representatives.

SJR 79 directed that the Working Group meet at least three times to develop final recommendations. Since May 2023, the Working Group has met a total of three times physically in Frankfort, KY at the Energy and Environment Cabinet and once virtually.[14]

SJR 79 also directed the Working Group to "identify the barriers to the deployment of nuclear power generation and related technologies". Discussion about this activity can be found in Section 6, Working Group Activity. It should be noted that under 2017RS SB11, the Energy and Environment Cabinet (EEC) was required to review regulations required for permitting nuclear facilities and provide a report to the Legislative Research Commission (LRC).[15] The Working Group leveraged the findings of this report in their work. More information about SB 11 and the report to LRC can be found in Appendix C.

Finally, SJR 79 directed the Working Group to consult with stakeholders to develop recommendations for the role of a permanent nuclear energy commission to be established in Kentucky state government. These recommendations can be found in Section 7 of the report.

[12] The Director for the Gateway for Accelerated Innovation in Nuclear (GAIN) at the Idaho National Laboratory served this role.
[13] The cooperative electric generation and transmission utilities are: East Kentucky Power Cooperative and Big Rivers Electric Corporation.
[14] For more information about each meeting, please see Appendix B.
[15] For more information about 2017RS SB11, please see https://apps.legislature.ky.gov/record/17rs/sb11.html or Appendix C.

## Section 2: Working Group Position Statement

In beginning the work, it was important to the Working Group to establish a position moving forward in relation to discussing nuclear energy opportunities. The Working Group acknowledges that various energy generation technologies have made significant contributions to meeting the energy needs of communities, states, and nations. Each of these technologies, ranging from traditional fossil fuels to renewable and nuclear power, has its unique strengths and challenges. Thus, the Working Group approaches nuclear energy with a holistic, technology-neutral approach as it relates to the work conducted and discussions provided in this report.

Therefore, the Working Group recognizes the value of all energy technologies and fuel choices and that the Commonwealth maintains an "all of the above" approach in terms of its energy mix to meet growing energy demands and support economic growth. Nuclear energy development in this context should be viewed as additive and able to compete with other firm, low carbon fossil and renewable resources. Nothing in this document should be viewed as favoring one energy generation technology over another.

## Section 3: Kentucky's Energy Position Now and in the Future

Kentucky has an energy-intensive economy and ranks 11$^{th}$ among U.S. states for energy used per dollar of Gross Domestic Product (GDP). The industrial sector is the state's largest energy consumer, accounting for about 35% of total end-use energy consumption. Kentucky's low electricity prices have helped attract manufacturing to the state. Major contributors to the state's GDP include the manufacture of motor vehicles; food, beverages, and tobacco products; primary and fabricated metal products; fuels and chemicals; and agriculture and forestry. Manufacturing represents the largest sector by total employment. As such, cost-competitive and reliable electricity is a primary driver of Kentucky's economy, but the pathways necessary to ensure continuing affordability, reliability, and sustainability of Kentucky's energy sector are becoming more complex.

At the state level, energy policy is addressed with an "all of the above" approach at the Energy and Environment Cabinet, which ensures the Commonwealth thrives amid rapid changes occurring in the production, delivery and use of energy. The mission of Kentucky's Office of Energy Policy is to support the utilization of all of Kentucky's energy resources for the betterment of the Commonwealth while protecting and improving the environment. However, while taking a fuel-neutral approach to energy policy, Kentucky's current and historical energy portfolio is one that hasn't included nuclear generation.

Kentucky's electric utility landscape represents one of the most diverse utility frameworks nationwide. It is comprised of four investor-owned utilities (IOUs), two generation and transmission member cooperatives, one corporate agency of the US federal government entity (Tennessee Valley Authority), and 30 municipal electric utilities. Duke Energy Kentucky, Kentucky Power, East Kentucky Power Cooperative and Big Rivers Electric Cooperative, along with their member-owners, participate in two regional power markets. The Regional Transmission Organizations (RTO) are the Midcontinent Independent System Operator, Inc. (MISO) and the Pennsylvania-New Jersey-Maryland Interconnection, LLC (PJM).

Kentucky does not have a restructured electric utility industry. The Kentucky Public Service Commission (PSC) governs regulated electric utilities in Kentucky. This includes the investor-owned utilities along with the member owners of Kentucky's two generation and transmission cooperatives as well as the distribution cooperatives themselves. Municipal electric utilities and the TVA with their local power companies are not regulated by the PSC.

Those utilities in Kentucky that are regulated by the PSC have a conditional exclusive franchise to provide electricity to a certified territory, protection from direct competition, the ability to recover costs through rates, and the opportunity to earn a reasonable rate of return. Additionally, the utility accepts the obligation to provide all paying customers with access to safe, adequate, reliable, convenient, and nondiscriminatory service on just and reasonable terms. In doing so, the utility assumes certain business and market risks and subjects itself to comprehensive regulatory review and oversight by the PSC.

The Local Power Companies (LPC) that purchase power from the TVA are governed by the TVA Act of 1933 and the provisions of the wholesale power contract entered between TVA and distributors of TVA power.

Kentucky has historically been an energy generation hub powered by the Commonwealth's coal resources. In 2021, coal-fired power plants supplied 71% of Kentucky's electricity generation, the fourth-largest share among the states after West Virginia, Missouri, and Wyoming. For many years, Kentucky was the third-largest coal-producing state, after Wyoming and West Virginia, and typically accounted for about one-tenth of total U.S. coal production. However, Kentucky's coal production declined as coal-fired electricity generating plants that were consumers of Kentucky coal retired or converted to natural gas. Natural gas is now providing an increasing amount of Kentucky's net generation. In 2021, natural gas-fired power plants generated 21% of the state's electricity, double the share from five years earlier. The remaining 8% is powered by renewable generation, dominated by Kentucky's hydroelectric assets.

In 2020, Kentucky's coal production decreased to its lowest level since 1915 and accounted for slightly less than 5% of total U.S. production. Coal mining employment peaked in 2009 at approximately 19,000 jobs statewide. As of the second quarter of 2023, coal-mining jobs account for approximately 4,600 jobs statewide. Many of the families impacted by the transition away from the use of thermal coal for electricity generation have not been able to replace the level of income lost, resulting in more families being classified as low income and living in newly disadvantaged communities.

However, retiring fossil generation assets at the end of their useful life may also provide a unique opportunity for re-powering, redevelopment and re-industrialization given the infrastructure already present at these locations. In addition, the trade and skilled workforce in these formerly coal-fired power plant communities presents a unique opportunity for re-employment within the power sector.

## Energy and Economic Development

In 2021, Kentucky reported the 12th-lowest average electricity price of any state and the second-lowest price east of the Mississippi River. Slightly more than half of Kentucky households use electricity as their primary heating source.[16] This competitive advantage has resulted in significant economic development across Kentucky over the past several years.[17] Manufacturers continue to be a driving force behind Kentucky's economic growth, contributing to over 8,900 of the announced jobs in 2022 with $8.27 billion in new investments by the Cabinet for Economic Development. Kentucky is home to approximately 5,000 manufacturing facilities that employ around 250,000 residents.

Another major driver of the Commonwealth's continued economic momentum is the quickly expanding electric vehicle sector. In April of 2022, Envision AESC announced the state's second largest economic development project in state history, a $2 billion investment in electric vehicle manufacturing that will create 2,000 jobs in Warren County. With Ford Motor Co. and SK Innovation celebrating the largest economic development project in state history in 2021, these announcements solidify Kentucky as a national leader in EV battery production.

[16] For more information, see the U.S. Energy Information Administration website at https://www.eia.gov/state/analysis.php?sid=KY#
[17] For more information, see https://www.kentucky.gov/Pages/Activity-stream.aspx?n=GovernorBeshear&prId=1618

In addition to the above milestones, in the past two years, Kentucky's automotive industry saw an additional 37 announcements totaling $4.21 billion in new investments and 4,200 newly created full-time positions, as companies prepare for a future that will rely more heavily on electric power and, increasingly, lower carbon sources of power.

Logistics and distribution played a significant role in bringing varied industries to the Commonwealth, which touts an ideal geographic location within a day's drive of two-thirds of the U.S. population and three key international shipping hubs operated by Amazon, DHL and UPS. The sector announced 42 new-location and expansion projects this year, totaling $1.66 billion in new investments and the creation of 4,200 full-time positions.

Health care-related projects also contributed to economic development growth in 2022, with companies like UPS, which announced more than $330 million in investments to boost the health care supply chain, and Catalent Pharma locating or expanding in Kentucky. The Commonwealth saw 19 announcements for the health care industry totaling $761 million in new investments and 1,550 new jobs created.

Other key industry growth across the state includes the food, beverage and agri-tech sector, with more than $2.55 billion in new investments across 56 projects that will create 1,750 full-time jobs, many in Kentucky's signature bourbon industry.

Metals-related operations announced 20 new-location or expansion projects in 2022 that will create over 900 jobs with $996 million in announced investments. The growth is not just limited to U.S.-based business; in 2022, internationally owned facilities announced a total investment of $3.91 billion and nearly 3,400 new jobs for Kentuckians.

In terms of attracting investments, both S&P Global Ratings and Fitch Ratings upgraded the state's financial outlook to positive in recognition of the Commonwealth's surging economy. In addition, Site Selection magazine placed Kentucky 6th in its annual Prosperity Cup rankings for 2022, which recognizes state-level economic success based on capital investments.

However, this economic growth is reliant on cost-competitive, resilient, and reliable power, regardless of time of day or weather impacts. Increasingly, the power demands of new businesses include the need for reliable, decarbonized power options.

## Importance of Reliability and Increasing Threats to the Grid

Kentucky's energy landscape is not without its challenges. Recently, historic natural disasters in the state have significantly challenged the state's electrical generation and delivery capacity. On December 10, 2021, a potent storm system moving across the central U.S. resulted in devastating damage and community destruction. A violent EF-4 tornado began in far northwest Tennessee and moved across 11 western Kentucky counties. Its 165.7-mile-long path was the longest of any tornado in U.S. history. During the same time, another long-track EF-3 tornado with estimated peak winds of 160 mph traveled 122.7 miles through northwest Tennessee and into Christian and Todd Counties in western Kentucky. At least 1,000 homes were damaged or destroyed and 80 lives were lost, with communities like Mayfield, KY being devastated. Severe weather events like these and the expected increase in similar threats in the future reinforce the need for a more resilient and reliable power grid.

Less than a year later, July 25- 30, 2022, severe weather caused devastating flooding to eastern Kentucky and central Appalachia. The overwhelming amounts of rain and flooding led to 45 deaths and widespread catastrophic damage within a 13-county area. Entire homes and parts of some communities were swept away by floodwaters, leading to costly damage of infrastructure in the region.

During Christmas week 2022, Winter Storm Elliott caused widespread infrastructure disruption including power outages and, for the first time in Kentucky's history, rolling power outages were initiated in select areas. Both coal and natural gas resources were compromised during the extreme event and regional power markets were unable to provide necessary reserves in some instances; however, they were able to maintain sufficient energy for member utilities.

Again, on March 3, 2023, an intense low-pressure system produced severe weather and historic gradient winds in the Lower Ohio Valley. Wind gusts of 60-80 mph produced widespread damage and power outages. The storm broke all-time low-pressure records in Louisville and Bowling Green. Kentucky power outages surged to approximately 300,000 statewide.

These historic events have highlighted the need for resilient, reliable, fuel-secure, and firm resources.

## Other Notable Infrastructure Assets

In addition to Kentucky's unique energy landscape, the state's infrastructure assets extend to notable energy communities and defense operations.

The Paducah Gaseous Diffusion Plant (PGDP) was constructed in 1952 to produce enriched uranium, initially for the nation's nuclear weapons program and later for nuclear fuel for commercial power plants. The plant is owned by the U.S. Department of Energy (DOE), which oversees environmental cleanup activities at the site, including environmental remediation, waste management, depleted uranium conversion, and decontamination and decommissioning. Commercial enrichment was conducted under lease from 1993 until 2013 when operations ceased, and the gaseous diffusion facilities were returned to the DOE Environmental Management (EM) program. EM has conducted extensive cleanup activities at the site since the late 1980s and is currently deactivating the returned plant facilities while continuing the aggressive remediation program being managed by its Portsmouth/Paducah Project Office.
In June of 2023, the Paducah Area Chamber of Commerce was awarded a non-competitive financial assistance grant to lead a study for the future of the Paducah Gaseous Diffusion Plant Site. The $2 million award from the U.S. Department of Energy Office of Environmental Management will focus on the development of a reindustrialization plan for the site.

However, Kentucky's nuclear legacy is not limited to Paducah. The Maxey Flats Nuclear Disposal Superfund site is an inactive, low-level radioactive waste disposal site located in eastern Kentucky about 10 miles northwest of Morehead. The property encompasses approximately 770 acres, including a buffer zone of 230 acres of adjacent land. In 1963, the Commonwealth issued a license to Nuclear Engineering Company, Inc., (NECO) to bury low-level radioactive waste at Maxey Flats. The site accepted radioactive waste from 1963 to 1977. The EPA placed the site on the Superfund program's National Priorities List (NPL) in 1986 because of contaminated soil, surface water and groundwater resulting from facility operations. The EPA and several potentially responsible parties (PRPs), including the Kentucky Department for Environmental Protection (KDEP), have investigated conditions, and taken steps to implement remediation measures that protect human health and limit further environmental impacts. Maxey Flats provides an important reminder of the negative influence that such sites have on local perception, impacts, and future development.

The U.S. Army's Bluegrass Army Depot in Richmond, KY provides America's Joint Warfighters reliable, timely and cost-effective munitions and chemical defense equipment in support of full spectrum military operations. The Depot also serves to safeguard the remainder of the National Chemical Weapons Stockpile until demilitarization. The Army released results of the Blue Grass Army Depot Feasibility Study to members of Congress on Aug. 31, 2023. The study assessed the feasibility and potential for reuse of the Blue Grass Chemical Agent-Destruction Pilot Plant, located at the Depot. The 15,000-acre site presents significant economic development opportunities for central Kentucky and for a skilled workforce in the surrounding communities. Other notable Department of Defense sites in Kentucky include Ft. Knox, home to Kentucky's

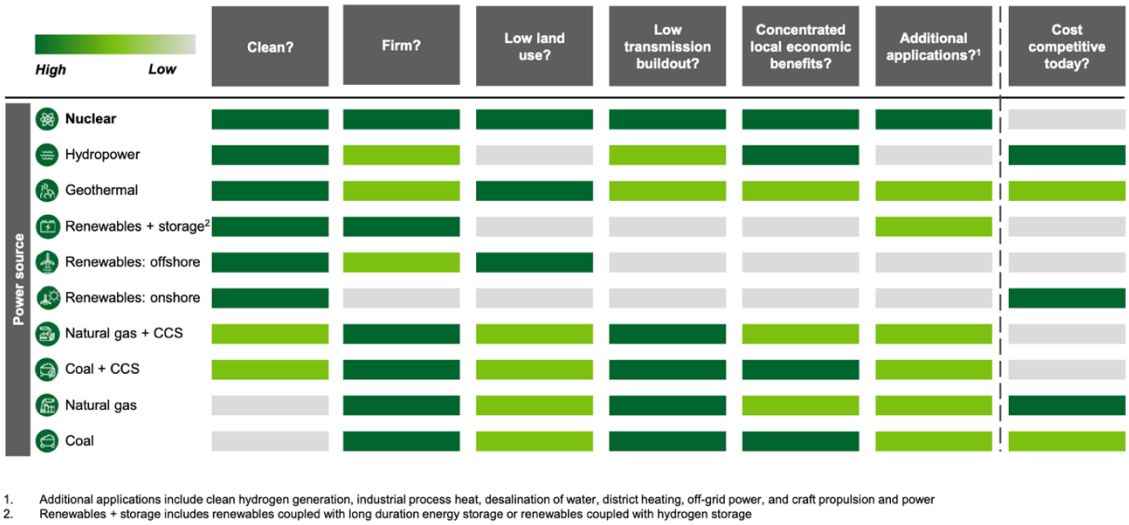
first emergency microgrid installation, and Ft. Campbell, home to Kentucky's first large-scale solar array developed on a landfill. DoD facilities like Ft. Knox have exhibited leadership in decarbonization solutions that offer community benefits and resilience. A positive relationship with the DOD remains important because the DOD is leading nuclear microreactor deployment through programs like Project Pele[18], to meet their own clean energy demands.

## Section 4: Nuclear Energy's Value Proposition

Given Kentucky's energy landscape and economic development momentum, developing a nuclear energy ecosystem in Kentucky provides a unique value proposition. Nuclear energy generates carbon-free electricity, provides firm, energy-secure power that can integrate intermittent generation resources, has low land-use requirements, and has relatively low transmission requirements among generation sources (see Figure 1). It also offers significant regional economic benefits, can aid in the transition to the electric grid of the future, and has a wide variety of use cases that enable grid flexibility and decarbonization beyond the grid (e.g., process steam and hydrogen production) especially within the advanced manufacturing and industrial sectors. In addition to reliable, low carbon electricity and heat, nuclear energy has the potential to create high-paying jobs with concentrated economic benefits for communities most impacted by the energy transition away from conventional fossil resources.[19] Advanced nuclear plants typically have a design life of 60 years or more, while other generation sources are much less. However, this value does come at a cost, is not a perfect solution, and requires long-term commitments utilizing significant institutional capacity and collaboration among local, state, and federal stakeholders, including policymakers, regulators, technology providers, utilities, economic development professionals, and community members.

Many of these considerations relevant to nuclear energy's value to Kentucky will be reviewed in Section 6.

[18] See more at https://www.cto.mil/pele_eis/.
[19] For more information about the potential of nuclear energy, see the U.S. Department of Energy's Liftoff Report for Advanced Nuclear Energy at https://liftoff.energy.gov/wp-content/uploads/2023/03/20230320-Liftoff-Advanced-Nuclear-vPUB.pdf




1. Additional applications include clean hydrogen generation, industrial process heat, desalination of water, district heating, off-grid power, and craft propulsion and power
2. Renewables + storage includes renewables coupled with long duration energy storage or renewables coupled with hydrogen storage

*Figure 1: Advanced Nuclear Energy's Value Proposition, Source: DOE Advanced Nuclear Liftoff Report*

## Section 5: The Current Status of Nuclear Energy Development in the U.S. and Globally

The U.S. is in the midst of a resurgent interest in nuclear energy with the development of advanced reactors, particularly small modular reactors. This offers a window of opportunity for Kentucky to engage and benefit from this new nuclear energy ecosystem. Advanced nuclear reactors are primed for deployment, and developers are moving forward with agreements to demonstrate and build full-sized commercial reactors in multiple states.[20] As of September 2023, fourteen different advanced reactor companies have publicly announced demonstration and/or deployment agreements with a variety of stakeholders including public and private universities, the Department of Defense, major chemical companies, and many more.[21] These nuclear reactors will provide the licensing, construction, and operational basis for rapid commercial expansion of advanced nuclear energy in the late 2020s and 2030s. Technology, business, and regulatory lessons learned from these first-of-a-kind (FOAK) projects will facilitate lower costs and shorter construction timelines for subsequent nth-of-a-kind (NOAK) reactors due to wide-scale deployment and technological learning. Utilities and other customers that gain early experience with FOAK or early NOAK projects will be in competitive positions to become technology leaders.

[20] https://nuclearinnovationalliance.org/advanced-reactor-deployment-timelines
[21] For more information about expected deployments, see NIA Deployment Map: https://nuclearinnovationalliance.org/advanced-nuclear-techology-map-north-america

In 2016, TVA submitted an Early Site Permit (ESP) application the NRC.[22] In 2019, the NRC issued the ESP for the Clinch River Site in Oak Ridge, Tennessee. The ESP application was based on the construction and operation of two or more small modular reactors (SMRs) of combined electricity generating capacity from the site to not exceed 800 megawatts-electric, with a possibility of building additional SMRs. TVA holds the only NRC Early Site Permit for SMRs. The early work performed by TVA has put itself in a position to take advantage of near-term advanced nuclear reactor deployment. As it stands, TVA and GE-Hitachi are exploring potential deployment opportunities at the Clinch River Site, including signing a technology collaboration agreement between them, Ontario Power Generation Inc. (OPG) and Orlen Synthos Green Energy Group to finalize the engineering design of GE-Hitachi's SMR design. In parallel, Tennessee Governor Bill Lee has made two key announcements: 1) an executive order[23] to establish the Tennessee Nuclear Energy Advisory Council and 2) a partnership with the Tennessee General Assembly to create a $50 million Nuclear Fund in the state's Fiscal Year 2023-2024 budget. The fund will establish a nuclear development and manufacturing ecosystem built for the future of Tennessee by providing grants and assistance to support nuclear power-related businesses that choose to relocate or grow in the state.

The federal government is actively involved in supporting and investing in advanced nuclear energy projects. DOE and its national laboratories are at the forefront of research and information dissemination to address the challenges associated with advanced nuclear energy deployment. A wide range of initiatives, including funding opportunities, analysis, tax incentives, and policy frameworks have been established to foster the development and implementation of advanced nuclear technologies. The federal government is also helping deploy advanced nuclear energy technologies to repower coal facilities and communities.[24] Federal organizations like the Energy Communities Interagency Working Group (Energy Communities IWG), and the Gateway for Accelerated Innovation in Nuclear (GAIN) all support advanced nuclear reactor deployment efforts and have funding opportunities for advanced nuclear developers. Of note, the Energy Communities IWG published a report that identified existing federal programs with available funding totaling nearly $38 billion that could potentially be used to provide immediate investments in energy communities.

Additionally, DOE's Loan Program Office (LPO) can offer financial support for new nuclear energy projects, which are loan guarantees for qualified projects that deploy advanced nuclear

[22] For more information about the Clinch River Site Early Site Permit see https://www.nrc.gov/reactors/new-reactors/large-lwr/esp/clinch-river.html
[23] For more information about Governor Lee's announcement, see https://publications.tnsosfiles.com/pub/execorders/exec-orders-lee101.pdf
[24] For more information about coal to nuclear, see https://nuclearinnovationalliance.org/resources-coal-repowering-nuclear-energy.

energy technologies. LPO's Title 17 Clean Energy Financing Program, which has $2.5 billion of loan guarantees available for financing projects that deploy new or significantly improved high-impact clean energy technology, is inclusive of new nuclear energy projects. Since its creation, LPO has received $40 billion in loan authority from the Inflation Reduction Act, all of which can be used to finance clean energy-related projects, including advanced nuclear energy projects. These financing opportunities could be significant for developers looking for loan assistance with advanced nuclear development, provided they can meet LPO's criteria.[25]

Globally, the U.S. is falling behind other countries in nuclear energy development and deployment. Countries like China and Russia already have operating advanced nuclear reactors for electricity production, and other commercial purposes. This has allowed them to take a leadership role in nuclear technology, and help other countries develop their commercial (non-military) nuclear programs. Additionally, the first commercial, grid-scale U.S. advanced nuclear reactor will not be built in the U.S. As of this report, the only contract in place for a grid-scale SMR project is between GE-Hitachi (GEH) and Ontario Power Generation (OPG) to build GEH's BWRX-300 in Canada before the end of the decade. Significant reactor components, like the Reactor Pressure Vessel, will be built by BWXT Canada, and will use Canadian labor, leaving most of the economic benefits in Canada, not the U.S..[26]

## Section 6: Working Group Activity

### Identified Barrier Categories per SJR 79 and Working Group Conclusions

Per SJR 79, the Working Group investigated the following types of potential barriers identified in SJR 79 and whether these potential barriers existed in Kentucky, were unique to nuclear energy, or cross-cutting and common among other energy technologies:

- Regulatory
- Statutory
- Financial
- Social
- Environmental

[25] It should be noted that Title 17 clean energy financing states that DOE's authority to issue this amount of loan guarantees remains available until committed. These funds need to be designated for Conditional Commitment on or before September 30, 2026, after which time the authorization expires.
[26] There are more new nuclear reactor projects underway – to learn more visit https://nuclearinnovationalliance.org/advanced-nuclear-techology-map-north-america.

- Workforce and Education
- Safety
- Security and Weapons Proliferation

The Working Group engaged in significant dialogue around the development of a nuclear energy ecosystem in Kentucky. Barrier identification began with a set of one-on-one interviews with each Working Group organization and these barriers were discussed at the second in-person Working Group meeting to reach group consensus. After discussion, the Working Group found that many of the challenges surrounding nuclear energy development are already well researched, well discussed, are common across many states, and not unique to Kentucky.

Based on this robust discussion and the 2017 "Review of State Administrative Regulations and Regulatory Processes to Assure Costs and Environmental Protection Associated with Construction, Operation, Waste Management, and Decommissioning of Nuclear Power Facilities", the **Working Group concluded that there are no insurmountable barriers to nuclear energy development in Kentucky.**

However, the challenges the Working Group have defined are real and require serious attention. Opportunities exist to improve Kentucky's attractiveness and the availability of support for nuclear energy development within the state, which will require extensive coordination across local, state, and federal government entities. These opportunities for Kentucky can be viewed in terms of goals for the permanent nuclear organization and categorized as "near-term (1-3 years)" and "intermediate and long-term (3+ years)". In addition, there are certain potential opportunities that are considered "gated opportunities," meaning a preceding event must occur to initiate progress in that area.

## Cross-Cutting Issues

Based on discussion, the Working Group realized that the development of the nuclear energy ecosystem in Kentucky faces cross-cutting issues common to other economic development sectors. These issues include education, workforce development, and trust building through robust community engagement.

Energy education, addressing environmental justice issues and concerns, and increasing the level of energy literacy remain cross-cutting issues throughout Kentucky. Energy literacy is an understanding of the nature and role of energy accompanied by the ability to apply this understanding to answer questions and solve problems. Without a basic understanding of energy, energy sources, generation, use, and conservation strategies, individuals and

communities cannot make informed decisions on topics ranging from smart energy use at home and consumer choices, to national and international energy policy. Current national and global issues highlight the need for the development of robust and balanced energy education programs across the Commonwealth. However, as with other types of energy development projects, these conversations are centered around communities with a history of environmental justice impacts and a lack of trust birthed from the lack of participatory voices in the development conversations and decision making. Education is one factor, but trust-building in communities goes beyond education and involves two-way dialogue.

Even though the need for employees will rise and fall depending on the status of the economy and how it reacts to many other variables, Kentucky will require a significant increase in the size of its workforce between 2023 and 2026. An unemployment rate in the Commonwealth of 3.8%, along with a labor force participation rate of 57%[27], tends to indicate that the job market is growing. Statistical state occupational outlooks in Kentucky's Workforce Pipeline show a demand for advanced skilled occupations in advanced manufacturing, transportation, and broadband. The Kentucky Department for Workforce Development recognizes the need for new public-private partnerships and the development and implementation of a worker-centered strategy, including training programs that are inclusive and diverse and that meet the skilled workforce needs of large infrastructure investments. This extends to clean energy manufacturing and supply chain including future nuclear energy development.

Community engagement is another cross-cutting issue not singularly applicable to nuclear energy development but rather to all types of economic development activities. Engaging communities in an authentic and practical way can help develop a shared understanding of local economic development priorities, assets and liabilities, and increase the awareness of potential program effectiveness and impacts over time. Understanding the unique conditions within a community can help identify how diverse community sectors can support short- and long-term economic development priorities in a way that encourages economic competitiveness and improves economic health. Community engagement utilizing trusted voices and partnerships that complements existing regulatory community engagement models, such as those under the National Environmental Policy Act (NEPA) and the U.S. Nuclear Regulatory Commission (NRC), can identify and shape economic development strategies and actions in a way that supports two-way engagement. An example of this in practice is the use of place-based economic development models that encourage collaborative and integrated approaches. Community engagement through regulatory and non-regulatory pathways should be complementary and

[27] The labor force participation rates is calculated as the labor force divided by the total working-age population. The working age population refers to people aged 15 to 64. This indicator is broken down by age group and it is measured as a percentage of each age group.

supportive, especially as it relates to nuclear energy development in communities with no previous nuclear energy activities or those dealing with legacy energy concerns.

In addition, the Federal Justice 40 Initiative has a goal that 40% of the overall benefits of certain federal investments flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution. Federal investments and programming for clean energy projects, including nuclear, are included in these covered programs. Community engagement is a critical component of the Justice 40 Initiative, especially in Kentucky where a significant portion of the Commonwealth is considered "disadvantaged" under the Justice 40 Initiative and eligible for additional resource support and programs.

## Nuclear Energy Development Potential Barriers Discussed per SJR 79

**Regulatory:** The siting, permitting, construction, operation, and decommissioning of an energy project is a complicated process that involves a variety of local, state, and federal organizations. Although the report "Review of State Administrative Regulations and Regulatory Processes to Assure Costs and Environmental Protection Associated with Construction, Operation, Waste Management, and Decommissioning of Nuclear Power Facilities" found no regulatory barriers to nuclear energy development in the Commonwealth, Working Group members expressed concern about the uncertainty associated with licensing and permitting new nuclear power facilities. The Nuclear Regulatory Commission (NRC) is the independent federal agency responsible for the safe use of radioactive material. The NRC is the entity that issues licenses to "applicants" and regulates the construction, operation, and decommissioning of nuclear power plants, research reactors, fuel facilities, and other nuclear facilities.

Additionally, the NRC provides assistance to states expressing interest in establishing programs to assume certain portions of NRC regulatory authority under the Atomic Energy Act of 1954 (as amended). Section 274 of the act provides a statutory basis under which NRC relinquishes to the states portions of its regulatory authority to license and regulate byproduct materials (radioisotopes); source materials (uranium and thorium); and certain quantities of special nuclear materials, but not commercial nuclear fission power generation[28]. The mechanism for the transfer of NRC's authority to a state is an agreement signed by the governor of the state and the chairman of the NRC, in accordance with section 274b of the act. Kentucky is an

[28] At the time of this report, the Nuclear Regulatory Commission has announced that it will regulate commercial fusion energy under the byproduct materials license framework (10 CFR 30) in consultation with Agreement States. The fusion rulemaking process (scheduled for completion by 2027) will develop requirements and guidance on the role of Agreement States in commercial fusion energy regulation.

"Agreement State" and has authority over some nuclear-related functions, but no state has independent authority to permit a new nuclear facility.

At the state level, the Working Group discussed the importance of greater clarity on the regulatory issues that would come before the Public Service Commission (PSC) and other entities. A significant discussion occurred around gaining greater clarity on the following:

- The inclusion of advanced nuclear power generation projects in Integrated Resource Planning,
- Recovery of Construction Work in Progress (CWIP) for utility nuclear power generation projects,
- Greater clarity on the Certificate of Public Convenience and Necessity (CPCN) process for nuclear power generation projects,
- Greater clarity on the process of siting and building a merchant nuclear power generation facility and the oversight of the Generation Transmission and Siting Board,
- Further evaluation and stakeholder engagement around the potential utilization of securitization for advanced nuclear reactor deployment.

With the announcements of Dow, Nucor[29] and 3M regarding nuclear reactor deployment at large industrial operations, the Working Group acknowledges that there would be a need for significant engagement and discussion around the deployment of "behind-the meter" nuclear reactor projects and the regulatory structures needed for those types of projects.

Local ordinances were also discussed, and could limit deployment. Local decision-making remains a top consideration and lessons learned can be utilized from Kentucky's experience with large-scale merchant solar deployment and land use planning at the local level.

**Policy:** In the past two years, approximately 180 bills have been introduced and considered directly related to the deployment and commercialization of new nuclear reactors or the legislation affecting existing nuclear generation, with 34 bills passed in 23 states. Sixteen of these bills relate to the Appalachian states. Given the momentum at the state level, the Working Group discussed including a section on policy issues not specifically addressed in the regulatory or statutory sections of this report. There was consensus from many electric utilities that it is vital that the state put a constructive environment in place for nuclear if Kentucky wants to compete with surrounding states to attract this significant investment. Specifically, discussions centered on policy pathways to lower the risk involved in the construction of nuclear facilities.

[29] For more information about the announcement, see https://www.prnewswire.com/news-releases/nucor-and-helion-to-develop-historic-500-mw-fusion-power-plant-301940341.html.

Additionally, Nebraska[30], Colorado[31], and North Carolina[32], West Virginia[33], Tennessee[34], Alaska[35], and Wyoming[36] have introduced or passed legislation to study siting of nuclear reactors, and to perform transition studies for countries with coal stations that simultaneously require addressing workforce, as well as defining nuclear energy as "clean energy" under a clean energy standard. Other states outside of those mentioned above have announced or established nuclear development programs of their own, and have allocated funds towards development of nuclear energy within their state, including incentives for supply chain. A significant portion of the Working Group discussions focused on the need for Kentucky to create an environment that can match this movement in other states so it doesn't get left behind. Discussions included allocating resources to other state organizations like the PSC to have the appropriate financial and staffing necessary to engage and evaluate potential regulated nuclear energy development projects, as well as more robust financial support and incentives targeting the nuclear energy ecosystem.

**Statutory:** Across the U.S., several states have restrictions in place on new nuclear power facility construction. In 2017, the moratorium on new nuclear construction in Kentucky was removed by "The Leeper Act". The report, "Review of State Administrative Regulations and Regulatory Processes to Assure Costs and Environmental Protection Associated with Construction,

[30] In Nebraska, LB 565 and LB 1014 were passed. LB 565 was an omnibus bill including the Nuclear and Hydrogen Development Act and LB 1014 appropriated funding for a feasibility study to assess advanced reactor siting options and the compatibility of existing electric generation facilities in the state with advanced nuclear reactors. To learn more information about Nebraska's Nuclear Plant Siting Feasibility Study, see https://opportunity.nebraska.gov/nebraska-department-of-economic-development-is-accepting-applications-for-nuclear-plant-siting-feasibility-study-program/.

[31] For more information about 2023 Regular Session Colorado Senate Bill 1247 see https://leg.colorado.gov/bills/hb23-1247.

[32] In North Carolina, HB 951 was passed which provides a technology inclusive target to reduce electric generating facility $CO_2$ emissions by 2030. Additionally, SB 678 included nuclear and fusion energy under the definition of clean energy. For more information about 2023 Regular Session North Carolina Senate Bill 678 see https://ncleg.gov/Sessions/2023/Bills/Senate/PDF/S678v6.pdf.

[33] In West Virginia, HR5 was passed which urges state and federal legislators, state and federal public utility regulators, Independent System Operators, and Retail Transmission Organizations to adopt laws, regulations, protocols and policies that provide market incentives to foster the maintenance of adequate and reliable dispatchable sources of power and encourage the deployment of advanced nuclear reactors.

[34] In Tennessee, HJR 1009 was passed which encourages energy policies that increase domestic energy independence through the production of oil, natural gas, and nuclear energy and HB 946, which establishes permissible sources of clean energy for political subdivisions to include in their requirements or expectations for public utilities (TVA) as permissible sources, including nuclear.

[35] In Alaska, SB 177 was passed which excludes microreactors from a requirement for legislative approval of land designated for nuclear development and defines microreactors.

[36] In Wyoming, HB 131 was passed which amends requirements and conditions for legislative approval of the siting of high-level radioactive waste storage facilities.

Operation, Waste Management, and Decommissioning of Nuclear Power Facilities" found no statutory barriers to nuclear energy development in the Commonwealth.

In 2023, 2023RS SB 04 was signed into law, which prohibits Kentucky from approving a request by a utility to retire a coal-fired electric generator unless the utility demonstrates that the retirement will not have a negative impact on the reliability or the resilience of the electric grid or the affordability of the customer's electric utility rate. The Working Group discussed whether 2023RS SB04 could be considered a barrier to nuclear energy deployment. The consensus from the Working Group is that SB04 is not a barrier to nuclear energy development, but close attention should be paid to the implementation of this new law moving forward.

**Financial:** Nuclear energy projects are capital-intensive endeavors that require a significant amount of money to scope, begin, and complete. Historically, final nuclear plant construction costs are heavily dependent on construction timelines and the interest rate on debt accumulated to build the facility. The local, state, and federal levels of government have potential avenues for financing these types of projects and increasing confidence that a project will be completed on time and on budget. This will involve developing financing mechanisms for new nuclear energy projects that will vary depending on the specific circumstances, project scale, and state regulations in place. Collaboration with industry stakeholders, financial institutions, and federal agencies can provide additional guidance and expertise in structuring the financing plan. Finding an appropriate location to potentially site a nuclear facility is an essential early action. Different types of facilities (e.g., power production, reactor component manufacturing, and fuel production) will have different geographical, seismic, security, and financial characteristics to consider. Again, the Working Group spent a significant amount of time discussing the need for financial solutions relating to early site permitting, the use of cost recovery mechanisms such as construction work in progress (CWIP), and the application of securitization[37] as it relates to nuclear energy development. These issues are not specific to Kentucky as states nationwide face the same challenges.

Given the financial lift required for all types of nuclear energy projects, the Working Group discussed the need for new utility and business models and partnerships but acknowledged the complexities of those partnerships given the utility landscape in Kentucky and the ties to regional transmission organizations. The term" new utility business model" should not be interpreted to suggest a movement toward a de-regulated or restructured utility regulatory

[37] "Securitization is a special form of bond financing to secure the highest possible rating from credit rating agencies, making the bonds attractive to investors and ensuring that the utility can lower its borrowing costs." (NRRI 2019). See more at: https://pubs.naruc.org/pub/34058ED0-1866-DAAC-99FB-B8BC5BCC625C.

environment. The term is intended to emphasize the need for new or expansion of existing utility partnerships and financial models.

The Working Group acknowledged that for development to occur, economic development stakeholders will need to understand and enable projects to take advantage of the technology-neutral tax credits that were created under the Inflation Reduction Act. Several studies have shown that these tax credits can make advanced nuclear energy cost competitive with other nascent, clean-energy technologies, like carbon capture utilization and storage (CCUS), and energy storage systems. The Working Group also acknowledged that projects may be able to leverage hundreds of billions of dollars of lending authority, for nuclear energy projects[38] within the Department of Energy Loan Programs Office to help secure low-interest debt. The institutional capacity of economic development agencies to build relationships and attract private industry within the nuclear energy ecosystem is an early challenge recognized by the Working Group.

A significant amount of the Working Group discussion focused on Early Site Permitting for an advanced reactor. This discussion highlighted the importance of public-private partnerships for nuclear energy ecosystem development. Additionally, the Working Group discussed the topic of a federal and state cost-share program with utilities and co-ops for obtaining an Early Site Permit (ESP) from the NRC that could be used for a future advanced nuclear reactor site. While an ESP would not provide regulatory finality from the NRC about whether a nuclear reactor can be built or operated in Kentucky, it would improve regulatory certainty that it can be done and could be a valuable investment for the Commonwealth. The Working Group acknowledged that the ESP would provide a market signal to potential investors and developers.

**Social:** The Working Group stressed that public acceptance is a key issue for nuclear energy. While it is well regarded by many in the energy industry, policymakers, and independent experts; spent nuclear fuel management and concerns about other environmental impacts of nuclear energy have led to many dismissing nuclear energy as an option. Many may not know the crucial role nuclear plays in generating firm electricity across the U.S. and its ability to produce electricity at near zero-emissions. Many constituents of the Commonwealth may be completely unfamiliar with nuclear energy and its history in Kentucky or may have pre-conceived notions about nuclear energy from different applications (i.e., military).

In addition, many Kentucky communities are faced with historical and complex environmental justice issues where communities have disproportionally been the recipient of environmental

[38] See more about LPO's lending authority at https://www.energy.gov/lpo/inflation-reduction-act-2022.

impacts which require more than basic education to resolve and address. The Working Group also recognized the growth of disadvantaged communities as a result of the transition away from fossil fuels and the importance of focused work in these communities to improve employment opportunities and economic security. Often, these communities also suffer from an imbalance of representation in the decision-making process and the dialogue around energy project development. The Working Group discussions included the importance of not over-relying on simple public outreach and education programs but stressing more focused, intentional work around these justice issues, relying on partners like the Community and Economic Development Initiative of Kentucky, which works to connect communities to people, place and purpose.

Thus, the Working Group stressed that all nuclear energy developers and supporters have a responsibility to engage the public early to educate all stakeholders on the potential opportunities associated with nuclear energy projects, and address any areas of concerns about the technologies, including environmental justice related issues. This includes both traditional regulatory and non-regulatory[39] avenues for two-way[40] public communication.

**Environmental:** The Working Group has acknowledged that every energy project (coal, nuclear, solar, etc.) will have an impact on the environment. Land use, water use, and waste production are examples of some of the metrics that should be considered when evaluating energy projects and that are regulated by different federal agencies as well as state and local bodies. Throughout Working Group discussions, members expressed concerns about past management of nuclear waste, low-level nuclear waste (LLW) production and management, high-level nuclear waste (HLW) production and management, geographical and seismic conditions for nuclear facilities, and water consumption at nuclear facilities.

The Working Group recognizes the concerns about Kentucky's unique geologic characteristics such as seismic hazards and karst geology. However, the Working Group acknowledges that these are factors around site selection and as mentioned previously, seismic hazards are the purview of the NRC, specifically around approval of designs and site permitting that account for the seismic risk and mitigation.

The Working Group stressed the need for continued work from the U.S. Department of Energy (DOE) on interim storage solutions and a permanent waste repository. The need to develop an

[39] At the U.S. Nuclear Regulatory Commission, formal public engagement opportunities for nuclear facility and nuclear power plant siting are required, but this should not be the first opportunity for a constituent to express their thoughts on projects. It should come before.
[40] Two-way conversation means both parties involved exchange information.

interim storage facility, however, is not unique to Kentucky. The DOE has recently made progress in establishing a consent-based siting program[41] that will help with the establishment of a federal interim storage facility.

The DOE's road map for its consent-based siting process includes three broad initiatives spanning the next 15 years: 1) capacity building (2-3 years), 2) site-screening and assessment (4-7 years), and 3) negotiation and implementation (4-5 years). The current phase of work includes the Consent-Based Siting Consortia, which facilitates inclusive community engagement and elicits public feedback on consent-based siting, management of spent nuclear fuel, and federal consolidated interim storage. The 12 awardees are comprised of various organizations to help reach communities across the country and remove barriers to participation in the department's consent-based siting process. Each awardee receives roughly $2 million to carry out community engagement activities and provide direct grants to communities wanting to learn more.[42]

Additionally, private companies like Holtec and Interim Storage Partners are working towards developing an interim storage facility. But the future of an interim storage solution has faced challenges, including a recent decision from the U.S. Court of Appeals for the Fifth Circuit that vacated the U.S. Nuclear Regulatory Commission (NRC) license granted to Interim Storage Partners, LLC (ISP) for its temporary spent nuclear fuel storage facility in Texas—known as a Consolidated Interim Storage Facility (CISF).[43] The Fifth Circuit asserted that the NRC did not have the requisite statutory authority under federal law to issue licenses for private parties to store spent nuclear fuel away from the reactor site.[44] The Working Group agreed that the issue of interim and permanent storage is one that must be resolved at the federal level, which has jurisdiction of this political issue. This issue was regarded by the group as one that is essential for nuclear energy development moving forward.

The Working Group also stressed the importance of ongoing work at the federal level around domestic nuclear fuel manufacturing, the ability to re-process spent nuclear fuel in the future to reduce waste volumes, and the reprocessing, waste reduction, and enrichment of uranium hexafluoride that currently exists at the Paducah Gaseous Diffusion site. While the U.S. DOE is working to catalyze a domestic nuclear fuel supply chain to ensure a reliable fuel source for

[41] To see the latest updates to the U.S. Department Of Energy Consent-Based Siting Process Program, read more at https://www.energy.gov/ne/articles/4-key-updates-us-department-energy-consent-based-siting-process.
[42] For more information on the awardees of the DOE's Consent-Based Siting Program, see https://www.energy.gov/articles/doe-awards-26-million-support-consent-based-siting-spent-nuclear-fuel
[43] To learn more about Holtec International's HI-STORE CISF, see the U.S. Nuclear Regulatory Commission website: https://www.nrc.gov/waste/spent-fuel-storage/cis/holtec-international.html.
[44] For more information, see https://www.engage.hoganlovells.com/knowledgeservices/news/fifth-circuit-rules-against-nrc-vacating-consolidated-interim-storage-facility-license-in-texas?utm_medium=email&utm_source=campaign.

advanced nuclear reactors,[45] more progress is needed to guarantee a reliable supply of nuclear fuel for reactors that relies on unique fuel forms. American Centrifuge Operating (ACO), a subsidiary of Centrus Energy Corp, started enrichment operations for the first time at the U.S. DOE enrichment facility in Piketon, Ohio. ACO is now one step closer to producing the nation's first commercial quantity of high-assay low-enriched uranium (HALEU)—a crucial material needed to develop and deploy advanced reactors in the U.S. The demonstration project is on track to produce 20 kilograms of HALEU by the end of 2023 and continue production in 2024 at an annual production rate of 900 kilograms of HALEU per year, with options to produce more in future years. HALEU domestic capability is needed to support current government commitments and initial cores for advanced reactor demonstrations. Furthermore, while the DOE is working on reprocessing and waste reduction efforts,[46] many challenges remain to achieve these goals.

When considering repurposing activities for Paducah, the Working Group highlighted the need for a better understanding of the Southern Ohio Diversification Initiative (SODI) in Portsmouth, Ohio. This project studied characterization, permitting, and decontamination and decommissioning (D&D) to support the deployment of advanced reactor technology at the Portsmouth site in the 2028 to 2033 timeframe. One example of success included the DOE redesignating land to SODI and which was then transferred to Oklo.[47]

**Workforce and Education:** Nuclear development in Kentucky will require timely, accurate, and precise coordination with educational systems and existing workforces. This will allow the next generation to learn, practice their trade, and gain the experience necessary in a variety of skills and at a pace that will match the deployment of different energy projects across Kentucky.

The Working Group expressed concern for the lack of accredited nuclear engineering or nuclear technician programs within Kentucky, but also expressed concerns about the viability, cost and timing of any programming for these career paths. The Working Group also recognized the importance of K-12 education in helping expose young students to different career pathways that could lead them to a career in energy, and potentially nuclear energy. However, the Working Group was resolute in the importance of timing and pacing of workforce development activities. This is classified as an area where an initiating event would require the development of any workforce development activity. The workgroup expressed concerns over premature

[45] https://www.energy.gov/ne/haleu-availability-program#:~:text=The%20HALEU%20enrichment%2Facquisition%20RFP,Why%20are%20there%20two%20RFPs%3F
[46] https://arpa-e.energy.gov/technologies/programs/onwards
[47] For more information, see https://www.energy.gov/pppo/portsmouth-future-use.

workforce development activities relating to nuclear energy development that would result in trained workers having to look for employment outside the state.

Additional areas of concern include the need for a trained workforce across the entire spectrum of electricity generation. Not only will nuclear engineers and technicians be needed, but many other engineering disciplines (e.g., mechanical, electrical, civil, and environmental) will be needed to plan, build and operate the infrastructure necessary to move Kentucky forward. All existing and new electricity generation will require transmission and distribution, regardless of the energy source it comes from, implying that Kentucky will also need to be responsible for educating the next generation of low- and high-voltage transmission electricians, construction workers, builders, architects, chemists, etc. This is no small task and will require coordination with the appropriate state-level cabinets, training programs, and higher education.

The Working Group discussions, however, did speak to the need to continue to invest in skilled trades programs that can serve a variety of energy workforce sectors including nuclear.

**Safety, Security, and Weapons Proliferation:** The Nuclear Regulatory Commission is the entity that issues licenses and regulates the construction, operation, and decommissioning of nuclear power plants, research reactors, fuel facilities, and other nuclear facilities. The NRC will only issue a license for the construction and operation of a nuclear facility if it meets their stringent standard for safety. The Working Group raised concerns about the safety and worker protection standards surrounding new nuclear energy operations within the Commonwealth and understands that the construction of a new nuclear power production facility, fuel facility, or manufacturing facility would meet the appropriate stringent requirements of safety and security.

## External Factors Affecting Nuclear Energy Deployment in Kentucky

### Emerging technologies and the race to compete

As the Commonwealth looks toward the future, a range of promising technologies are emerging and impacting the energy landscape. While nuclear energy remains an important leading technology, the Working Group discussed that there is competition between a suite of emerging innovative alternatives, each of which have an impact on the overall system and customers. These technologies offer diversity and expand the landscape by which nuclear must compete, but it remains uncertain how and when these technologies will be incorporated.

- **Solar Energy:** Solar energy has made remarkable strides over the past few decades. Beyond traditional photovoltaic panels, we're seeing innovations like transparent solar windows, flexible solar films, and perovskite solar cells. These technologies could transform the way we power our homes and buildings, making them more energy-efficient and sustainable.
- **Wind Energy:** Wind power is rapidly evolving, with taller and more efficient wind turbines capturing energy from higher altitudes. Additionally, advanced materials and designs are making wind turbines more cost-effective and environmentally friendly.
- **Energy Storage:** Energy storage is a crucial component of a clean energy future. Current energy storage technologies are primarily Lithium-ion batteries, but new energy storage technologies like solid-state batteries, flow batteries, and supercapacitors are under development. New pumped storage opportunities are emerging and being revisited as a long duration storage option. These innovations promise longer lifespans, faster charging, and higher energy densities, potentially revolutionizing electric vehicles and grid energy storage.
- **Clean Hydrogen:** Hydrogen is being explored as a clean energy carrier. Clean hydrogen, primarily produced through electrolysis powered by renewable or nuclear energy, is gaining traction as a versatile and low-carbon fuel for various applications, from transportation to industrial processes. Fuel cell technology is improving, making hydrogen a more viable alternative to traditional fossil fuels.
- **Geothermal Energy:** Geothermal power taps into the Earth's natural heat reservoirs. Advanced drilling techniques and enhanced geothermal systems are making it possible to harness geothermal energy in regions previously considered nonviable. Geothermal energy is a reliable and consistent source of power with a minimal carbon footprint.
- **Carbon Capture and Utilization:** Innovative carbon capture, utilization, and sequestration (CCUS) technologies are being developed to reduce greenhouse gas emissions from fossil fuel plants. These methods not only capture CO2 from industrial processes but also convert it into valuable products, such as synthetic fuels, chemicals, and building materials.

**Natural gas and renewable market characteristics:**

Natural gas and renewable market characteristics can make it challenging to deploy new energy projects in the U.S. A brief explanation of how these market behaviors affect the nuclear energy sector follows:

- **Price Competitiveness:** Natural gas, due to the shale gas revolution and hydraulic fracturing (fracking), has become abundant and relatively inexpensive in the U.S. This

has led to lower electricity prices for consumers and made natural gas-fired power plants economically attractive for utilities. In contrast, the construction and operation of a nuclear power production facility involves high upfront capital costs and lengthy construction periods, which can make nuclear energy less cost-competitive in the short term compared to gas-fired plants. As a result, utilities may opt for natural gas over nuclear when considering new energy projects. This is especially true for electric utilities which are subject to PUC oversight and jurisdiction.

- **Renewable Energy Subsidies and Prioritization:** In terms of price competitiveness, renewables are also very attractive to utilities. The growth of renewable energy sources like wind and solar has been supported by federal and state subsidies, tax credits, and mandates for renewable energy generation. These incentives have created a competitive advantage for renewables over other new energy projects, as they have made it more financially attractive for utilities to invest in wind and solar projects. This has allowed wind and solar projects to lower their costs by "learning by doing",[48] essentially maturing their technology. This prioritization of renewables has limited the opportunities for new, expensive projects that are a first of a kind, like advanced nuclear energy, to secure a share of the market. However, nuclear energy is now eligible for new federal tax credits enacted in the Inflation Reduction Act last year, leveling some of the federal playing field going forward.

- **Intermittent Power vs. Firm Power:** Existing nuclear power production facilities are designed to provide a stable and constant supply of electricity, serving what is traditionally described as "baseload power". In contrast, renewables like wind and solar are variable, depending on weather conditions. Natural gas power plants are considered more flexible and can quickly ramp up or down to complement renewables' intermittency. As a result, natural gas-fired plants are seen as more adaptable and compatible with the variable nature of renewables than other energy projects, though the new advanced nuclear energy plants being designed can operate more flexibly, with the ability to load-follow more efficiently than traditional nuclear plants. This synergy between natural gas and renewables can reduce the need for new types of energy projects, as gas can fill the gaps when renewable energy production is low.

- **Investment Uncertainty:** The uncertainty associated with long-term energy investments in new technology is heightened due to the dynamic nature of the energy market. Rapid shifts in natural gas prices, state and federal policy, and technological advancements (like

[48] See more at: https://resources.environment.yale.edu/gillingham/BollingerGillingham_SolarLBD.pdf

carbon capture**,** utilization and storage) can create uncertainty about the future competitiveness of any new technology. Investors and utilities may hesitate to commit to nuclear energy projects when they fear that changing market conditions could render them less economically viable.

**Geopolitical events:**

Geopolitical events can complicate the deployment of new energy projects, including nuclear energy, in several ways:

- **Supply Chain Disruptions:** Geopolitical conflicts or tensions in key regions of the world can disrupt the supply chains for critical components needed for energy projects. This can affect the availability and cost of materials, equipment, and technologies necessary for the construction and maintenance of nuclear power plants, renewable energy installations, and other energy infrastructure. For example, the only existing supplier of High-Assay, Low-Enriched Uranium (HALEU), a fuel type that many advanced reactor designs will use, is a state-owned enterprise in Russia. The current geopolitical situation with respect to Russia has made the procurement of HALEU difficult and has delayed the deployment of advanced nuclear energy projects already.[49] Discussions about how to create the domestic infrastructure necessary for critical energy supply chain, including HALEU fuel, are underway.[50]

- **Energy Resource Availability:** Geopolitical instability in regions that are significant suppliers of energy resources, such as oil, natural gas, or uranium, can impact the availability and price of these resources. This can affect the economic viability of energy projects, especially those that rely on imported resources. Nuclear energy projects depend on a stable supply of uranium, which can be influenced by international trade agreements, export controls, or geopolitical tensions in uranium-producing countries. Other energy projects like solar with battery storage similarly depend on other critical minerals sourced globally, like lithium for batteries.

- **Energy Security Concerns:** Geopolitical events and conflicts can raise concerns about energy security. Governments may prioritize domestic energy sources, diversification of supply, or the development of energy technologies that are less susceptible to

[49] For more information, see: https://www.reuters.com/business/energy/new-nuclear-may-be-delayed-by-uncertain-fuel-supplies-2023-09-21/.
[50] For more information about HALEU, see https://nuclearinnovationalliance.org/index.php/catalyzing-domestic-commercial-market-haleu.

international disruptions. This could lead to shifts in energy policy that impact the deployment of specific energy projects, favoring those that align with national security goals. Advanced nuclear energy, paired with a domestic manufacturing and supply chain market, could help reduce U.S. reliance on foreign governments.

**Carbon and environmental regulations:**

Current carbon and environmental regulations in the U.S. play a significant role in shaping the energy landscape and can both facilitate and hinder the deployment of new energy projects.

- **Carbon regulations**. The U.S. Environmental Protection Agency recently proposed greenhouse gas emissions standards for powerplants under Section 111(d) of the Clean Air Act. These standards will add new requirements to coal and natural gas power plants, potentially making them less competitive than zero-emitting electricity generators like nuclear power plants.

- **Uncertainty in Permitting, including Transmission Permitting:** Environmental regulations can introduce uncertainty into the permitting process for energy projects. The potential for legal challenges, changes in regulations, or public opposition can create delays and add risk to project timelines. This also includes the siting and construction of transmission for any energy project. Nuclear energy's relatively small need for transmission relative to the struggle of transmission for renewable integration is an advantage in the context.[51]

- **Evolving Regulations:** Environmental and carbon regulations can change over time as governments seek to address evolving environmental challenges. Whereas clean energy standards that include nuclear energy can encourage advanced nuclear investment, renewable energy standards that exclude nuclear energy can be a barrier. This introduces uncertainty for long-term nuclear projects, as regulatory requirements and standards may shift, potentially impacting project viability and costs. It is noted that Kentucky does not have a clean energy standard or renewable energy standard and nothing in this section should be construed as the Working Group's support or opposition to these requirements. This is information regarding actions that other states have taken that can impact nuclear energy development and level the field of competition with renewable technologies.

[51] See Figure 1 for a comparison of transmission needs of different energy sources.

**Policies of Regional Transmission Organizations:**

Regional transmission organizations (RTOs) play a crucial role in managing and overseeing the transmission of electricity in specific regions of the U.S. While RTOs aim to ensure the reliability and efficiency of the grid, their policies and practices can pose challenges to the deployment of new energy projects, including nuclear energy projects.

- **Complexity of Grid Integration:** RTOs are responsible for coordinating the operation and planning of the transmission grid within their regions. It can be challenging to integrate new energy projects, especially larger and complex ones like nuclear power production facilities, into the grid. RTOs must evaluate the impact of these projects on grid stability, capacity, and reliability, which can involve extensive studies and modifications to existing infrastructure.

- **Access to Transmission Infrastructure:** RTOs manage access to transmission infrastructure, including the allocation of transmission capacity to various energy generators. New energy projects, particularly those in remote or rural areas, may face challenges in obtaining sufficient transmission capacity to deliver electricity to demand centers. This can hinder the economic viability of these projects. As noted in this report, the federal government is also helping deploy advanced nuclear energy technologies to repower coal facilities and communities, which can leverage existing transmission infrastructure.

- **Market Design and Rules:** RTOs often have market structures and rules that prioritize certain types of generation, such as those that offer flexibility and fast response times. Nuclear power production facilities, which historically have operated continuously as firm energy sources, may not align with these market structures, although new nuclear technologies are expected to be able to operate more flexibly. RTO rules may not adequately compensate nuclear generators for their unique attributes, potentially making it less financially attractive to invest in nuclear energy.

- **Grid Planning and Expansion:** RTOs engage in long-term grid planning and expansion to meet future electricity demands. The planning process may not always prioritize nuclear projects due to their high upfront costs and long construction timelines. This can result in a bias toward quicker-deploying energy sources, such as natural gas and renewables, which affects the deployment of new energy technologies.

- **Interconnection Challenges:** Connecting new energy projects, including nuclear plants, to the grid requires coordination with RTOs. Delays or difficulties in obtaining grid interconnection agreements can lead to project delays and increased costs, affecting the overall feasibility of new energy ventures.

**National financing environment and state of the economy:**

The financing environment and state of the economy can significantly influence the deployment of new energy projects in the U.S.

- **Capital Intensity:** Energy projects, particularly nuclear power plants, are capital-intensive endeavors. They require substantial upfront investments in design, construction, and regulatory approvals before they can generate revenue. In a challenging financial environment or during economic downturns, securing the necessary capital can be more difficult and costly. Lenders and investors may be more risk-averse, leading to higher interest rates and stricter lending conditions, which can negatively impact the financial feasibility of energy projects.

- **Access to Funding:** Economic conditions, including interest rates, inflation rates, and the overall availability of funding, can affect a project's ability to secure loans, bonds, or equity investments. In a tight financial environment, finding willing investors or creditors can be challenging, particularly for projects that require large-scale financing.

- **Economic Uncertainty:** Uncertainty in the broader economy can influence investment decisions. Economic downturns or periods of economic instability can make investors and lenders more cautious, leading to delays or cancellations of new energy projects. Energy projects often have long payback periods, and uncertain economic conditions can affect the project's financial viability over its lifetime.

- **Market Price Volatility:** Economic conditions can lead to fluctuations in energy market prices. This volatility can impact the revenue streams and profitability of energy projects. For nuclear projects with long-term financial commitments, such as power purchase agreements (PPAs), changes in market prices can affect the project's financial viability.

- **Investor Risk Aversion:** During economic uncertainty, investors may become more risk-averse, preferring safer and more liquid assets over long-term infrastructure investments. Energy projects with long lead times can be perceived as higher-risk due to their capital requirements and regulatory complexities. This risk aversion, which varies

from company to company, can limit the pool of potential investors and financing options. Also, the same risks apply to the great investor pool of investor-owned utilities as a whole, and is not simply limited to individual investors of a single project.

## Working Group Conclusion on Potential Barriers

The following represents the Working Group's consensus statement as it relates to nuclear energy development across the Commonwealth after review.

Kentucky's economic position globally and the wellbeing of its citizens is dependent upon safe, reliable, sustainable, and resilient power that provides price stability and cost competitiveness while protecting Kentucky's environmental and natural resources. The decision of whether to pursue nuclear economic development in Kentucky is a complex one. There are many external factors affecting nuclear economic development; however, Kentucky should remain the primary decision-maker of its energy future rather than be dictated choices from outside stakeholders.

There are several well-documented factors that the state will need to consider, including but not limited to the costs and benefits, external influences such as energy markets and geopolitical events, safety, regulatory requirements and processes, education and workforce development, public perception and environmental impacts, characteristics, and concerns.

While none of these factors are exclusionary from a statewide perspective to the development of nuclear energy in Kentucky, they could affect the attractiveness of project opportunities and the ability to successfully site projects. Therefore, Kentucky's ability to build institutional capacity and capabilities to move in a coordinated manner with all stakeholders through the processes of attracting and developing a nuclear energy ecosystem is critical to success. This success is dependent on having the institutional capacity and capabilities and sending the appropriate market signals that Kentucky is open and ready for project development.

# Section 7: Framework for the Creation of the Permanent Nuclear Energy Development Group

As detailed in the previous section, the factors affecting nuclear energy development offer many potential opportunities for a permanent nuclear energy development organization in Kentucky. This is the first step to building institutional capacity and establishing dedicated resources for nuclear energy ecosystem advancement.

In this section, the report will explore the suggested framework for the creation of the Kentucky Nuclear Energy Development Authority (known hereafter as the "Authority"), and the Working Group's recommendations around the necessary resources, where it will be located or housed, how much financial support should be appropriated to stand up the program, and what organizations should help guide the organization. These recommendations reflect the opinion of the Working Group after consulting with two separate state-level organizations[52] with a focus on nuclear development.

## The Role of the Kentucky Nuclear Energy Development Authority

The Working Group discussed the importance of the Authority being a trusted voice on nuclear energy issues as well as being able to act somewhat autonomously to leverage and engage outside resources to bolster its work.

While the Working Group recognizes the importance of economic development, the Authority should not be a primary economic development entity, but should coordinate with the Kentucky Cabinet for Economic Development and foster relationships with developers, industrial customers, offtakers, and local governments.

The Working Group emphasized the importance of the Authority being non-regulatory as well as a resource for relationship building with nuclear industry private sector businesses and developers.

Similarly, the Working Group emphasized the need for the Authority to not duplicate existing research and development activities but act as a valued stakeholder in the development of

[52] In July 2023, the Nuclear Energy Development Working Group invited the Virginia Nuclear Energy Consortium and the Idaho Line Commission to present on the structure of their organization and lessons learned. For more information about each organization, see Appendix D

these activities and coordinate with the University of Kentucky and National Laboratories on opportunities for industrial engagement and development activities.

With respect to community engagement, the Working Group was specific that the Authority should engage in complementary community engagement processes that do not duplicate existing engagement pathways established via regulatory agencies and that the Authority should be an active stakeholder with utility and developer engagement processes. Transparency and two-way engagement within communities, especially those with environmental justice considerations, were identified as priority areas by the Working Group. This further strengthened the Working Group's consensus on the need for robust education and outreach efforts relating to nuclear energy in Kentucky as well as the deployment of two-way communication engagement models, giving voice to those previously under-represented to establish essential pathways to build trust within communities.

The Working Group stressed the importance of working across the Commonwealth with the acknowledgement that not all parts of the state will benefit from every type of nuclear energy project development, but the entire state can benefit from the creation of a nuclear energy ecosystem in Kentucky.

Finally, the Working Group acknowledges that at some future point, an evaluation of the Authority's accomplishment and successes is required. Achievement of the Authority's mission and Kentucky's establishment of a nuclear energy ecosystem could indicate the need to re-evaluate the need for the Authority.

## Mission

The Working Group recommends the following mission statement for the Authority.

"The mission of the Kentucky Nuclear Energy Development Authority is to be the non-regulatory, trusted agency on nuclear energy issues and development in the Commonwealth. In doing so, the Authority will support and facilitate the development of the nuclear energy ecosystem across the Commonwealth in a collaborative manner that enhances Kentucky's economy, offers opportunities that are safe, protects the environment across the Commonwealth, supports community voices especially in under-represented or historically impacted areas, increases energy education, and prepares a future workforce."

## Proposed Structure, Location, and Duration

The Authority shall be administratively attached to the University of Kentucky within the Center for Applied Energy Research (CAER).[53] This will allow for the Authority to hire personnel more quickly than it would if the Authority were a newly created organization within the University of Kentucky system.

The Authority shall consist of a director, technical staff, students, and administrative support as well an Advisory Board (see below for more information about the Advisory Board).

The director of the Kentucky Nuclear Energy Authority should possess a range of qualifications to effectively lead the organization in achieving its mission. Below are some qualifications that should be considered for someone of this position:

- **Experience in Energy Development and Deployment**: Substantial experience in the field of energy development and deployment, including research, development, and operational aspects, to provide expert guidance.
- **Leadership Skills**: Demonstrated leadership skills and experience in leading multidisciplinary teams and managing complex projects in the energy sector.
- **Collaborative and Diplomatic Skills**: Strong collaborative and diplomatic abilities to foster cooperation among various stakeholders, including government agencies, industry partners, and community representatives.
- **Regulatory Understanding**: A comprehensive understanding of nuclear energy regulations, safety protocols, and compliance requirements, even though the Kentucky Nuclear Energy Authority is a non-regulatory entity.
- **Economic Development Expertise**: A background in economic development, business, or related fields to promote the growth of the nuclear energy ecosystem while enhancing Kentucky's economy.
- **Environmental Stewardship**: A commitment to environmental sustainability and the ability to ensure that nuclear energy development is conducted in an environmentally responsible manner.
- **Community Engagement**: Experience in engaging with and addressing the concerns of local communities affected by nuclear energy projects, demonstrating a commitment to community voices.
- **Workforce Development**: A focus on workforce development, including strategies to train and prepare the future workforce for the nuclear energy industry.
- **Financial Management**: Proficiency in financial management and budgeting to efficiently allocate resources for various programs and initiatives.

[53] For more information about the Center for Applied Energy Research at the University of Kentucky, see https://caer.uky.edu/about-caer/

- **Public Relations and Media Relations**: Skill in managing public relations and media interactions to ensure a positive public perception of the organization's efforts.

The director should possess a diverse skill set that allows them to lead the Kentucky Nuclear Energy Authority effectively, promote the safe and responsible development of nuclear energy, and achieve the organization's mission.

The Authority shall be governed by a 21-member Advisory Board, 15 of which will be voting members and 6 that will be non-voting members.

Advisory Board Makeup (Voting and Non-Voting):

- State Government Representatives[54]
- Local Government[55]
- Manufacturing and Business Advocacy Groups
- Utilities[56]
- Environmental Non-Governmental Organization
- Private Citizen[57]
- Energy Community Representative[58]
- Kentucky Nuclear Industrial Company Representative[59]
- Labor Representation
- Academia[60]
- Non-voting members
    - Department of Energy Office of Nuclear Energy Representative
    - National Laboratories
    - Nuclear Energy Developers
    - Nuclear Industry Leaders
    - National Nuclear Energy Non-profits or Associations

## Budget Appropriation

[54] This includes State Senators and State Representatives, Commissioners of Cabinets, etc.
[55] A local government representative is an appointed official, including a mayor, or chamber of commerce member.
[56] Utilities include Duke, TVA, etc.
[57] A private citizen is a constituent of the Community who does not live in an energy community.
[58] An energy community representative is defined as a community member that represents the interest of an "energy community" as defined by the Internal Revenue Service.
[59] Industrial Company representatives include those (individual groups and industry associations) that may benefit directly or indirectly from electricity or heat produced from nuclear power stations. Ex) Dow Chemical has a Joint Development Agreement (JDA) with X-energy to power their Seadrift Chemical Plant in Texas.
[60] This includes university, community college, and K-12 programs.

The Authority will require an initial state budget appropriation of ~$750,000 and increasing to $900,000 in subsequent years to support personnel, contracts, overhead, and benefits.

## Authority Required Duties

The following duties were recommended by the Working Group for the Authority.

- Adopt bylaws and regulations for the management and operation of the Authority in order to carry out the mission of the Authority,
- Develop and adopt a strategic plan for carrying out the purposes of the Authority,
- Develop and update biennially a Nuclear Energy Economic impact analysis for the Commonwealth,
- Develop an annual summary of the Authority activities and achievements,
- Annually develop and report to the Governor, the Chairmen of the House and Senate Committees on Appropriations and Revenue, and the Chairmen of the House and Senate Committees on Natural Resources and Energy and on Economic Development and Workforce recommendations for the support and expansion of the nuclear energy ecosystem in Kentucky.

## Advisory Board Member Terms and Board Operations

The report will not make final recommendations about limits, terms, rotation, vacancies, etc. This will be the purview of the Kentucky state legislature.

## Goals of the Kentucky Nuclear Energy Development Authority

### Near-Term Goals (0-3 years)

The purpose of providing the Authority short-term goal recommendations is to create an environment in which the Authority can quickly become a trusted, proactive organization within the Commonwealth on nuclear energy and community engagement and to aid in positioning Kentucky proactively with the various nuclear project development areas of the ecosystem.

**Growing the public acceptance of nuclear energy opportunities**

While not every community will be open to or suitable for nuclear energy projects, every community should have access to accurate information for informed decision-making. A goal for

the Authority should be that every interested community understand basic information relating to advanced nuclear opportunities within the nuclear energy ecosystem, the importance of secure, firm, cost-competitive power for facilities and economic development, and the potential for direct and in-direct economic benefits associated with the employment and tax revenue generated from nuclear energy projects. The Authority is positioned to leverage the capacity and resources of the University of Kentucky and other energy education stakeholders to engage in public outreach and education opportunities ranging from technical seminars, forums, and regional two-way community engagement including evaluating regional assets and how they can inform project development.

**Becoming a Trusted Voice**

One key to achieving this goal is the ability of the Authority to gather the information necessary to help the public understand the history of nuclear technologies within the Commonwealth, the status of existing nuclear projects within the Commonwealth (including the Paducah facility), and the potential benefits of nuclear energy technologies. Additionally, the Authority should build the knowledge necessary to answer any concerns associated with each technology (power production, manufacturing, or the fuel cycle) or direct concerns and questions to an appropriate party. It is important that the Authority build this capacity in a way that establishes two-way communication channels with the public to build trust. The Authority should also proactively engage communities that have expressed interest in hosting nuclear energy technologies and appropriately develop relationships with community leaders in communities that may be undecided about their interest in nuclear energy.

One key to public acceptance is understanding the potential “sites” across the Commonwealth that screen or are feasible for all types of nuclear energy development. The Authority is positioned to lead the understanding of site development potential and engage communities with this understanding.

**Developing capacity for nuclear economic development**

One key to achieving this goal is gathering literature on the types of jobs created from nuclear energy development within the Commonwealth. This literature can be curated and shared with universities, community college programs, trade schools, and K-12 programs throughout the Commonwealth to introduce students and young professionals to careers in nuclear energy. Additionally, the Authority can contract with professional services to perform an analysis of the different type of jobs expected from an energy future that deploys a significant amount of nuclear, and the requirements to build the necessary workforce in-state.

Another key element for the Authority is the development of a strong relationship with economic development professionals to build the knowledge necessary for engagement. This relationship should include building networks with the private sector involved in the nuclear energy ecosystem, proactively engaging with developers, attracting new business prospects, and understanding and increasing awareness of state and federal incentives available to nuclear industry locating in Kentucky.

A key deliverable for the Authority is the understanding and promotion of existing economic development incentives applicable to nuclear energy development and creating a shared understanding with economic development professionals and the Cabinet for Economic Development.

**Supporting Early Site Permitting Processes**

A key short-term goal is being a trusted stakeholder in analyzing and monitoring any newly introduced legislation related to nuclear energy development within the Commonwealth. The Authority should have the capacity and tools necessary to engage stakeholders and policymakers on the potential opportunities and consequences associated with any proposed legislation. This is applicable to potential legislation around early site permitting, securitization, and changes to Kentucky merchant electric generation and siting board processes.

An additional key goal for the Authority will be seeking greater clarity and certainty with stakeholders on financial support for early site permitting, the process for a nuclear power facility Certificate of Public Convenience and Necessity (CPCN), and the recovery of Construction Work in Progress (CWIP) for nuclear projects. This increased certainty around implementation of existing processes will give utilities and co-ops the confidence necessary to move forward with high capital cost projects, like nuclear energy.

**Community engagement in existing energy and coal communities on project opportunities**

A priority in Kentucky is working with those communities that have previously served the U.S. nuclear mission and those communities facing a transition away from fossil fuels left with an uncertain financial future. The Authority is positioned to empower local entities with the resources and information around community infrastructure assets necessary to engage with regulators, developers, and decisionmakers on new nuclear power facilities, nuclear component manufacturing facilities, and fuel cycle facilities.

Another key goal includes the ability of the Authority to support Paducah, Kentucky in the re-industrialization of the Paducah Gaseous Diffusion Plant and efforts to reduce existing uranium hexafluoride volumes via re-processing and re-enrichment.

Finally, working collaboratively with Kentucky's electric utility sector to better understand integrated resource planning decisions around nuclear and transition timelines and technology assessments relating to existing fossil fuel power stations would be a significant area of work for the Authority.

### Intermediate to Long-Term Goals (3+ years)

After building knowledge and trust through short term activities, the intermediate long-term goals of the Authority should be focused on further reducing the risks, uncertainties, and concerns associated with nuclear energy development to place the Authority in a position to help Kentucky move forward with nuclear energy technology deployment in the years to come.

**Strengthening Engagement with the Nuclear Regulatory Commission**

Because the Nuclear Regulatory Commission (NRC) plays such a pivotal role in nuclear energy development, it is imperative that a goal be strengthening and gaining greater understanding of NRC processes and changes. Specifically, the Authority should focus the current safety and security practices implemented at different types of nuclear facilities under their purview, streamlining of permitting efforts, and the ability to site interim and permanent nuclear storage facilities via the continued use of consent-based siting.

**Becoming a Valued Stakeholder with Environmental Regulatory Agencies**

Building capacity to better understand environmental and safety impacts is essential long term. The Authority is positioned to gather general information on the potential environmental impacts of conventional and advanced nuclear energy projects within the Commonwealth. This includes identifying key areas of public concern, including water protection, land use, potential impact on endangered species, etc., for different type of nuclear facilities. The Authority could become involved with NRC processes because the Nuclear Regulatory Commission (NRC) complies with the National Environmental Policy Act by performing a full Environmental Impact Statement (EIS) for nuclear power production facilities. In the EIS, the NRC estimates the full environmental impacts of building a nuclear energy facility.

In April 2023, the Department of Energy released their latest version of its consent-based siting process as it explores the possibility of siting one or more federal consolidated interim storage facilities for commercial nuclear fuel. An interim storage facility would allow for communities around the country to be relieved of their obligation to maintain used nuclear fuel at an operating or decommissioned site. As discussed earlier in this report, the U.S. Court of Appeals for the Fifth Circuit vacated the U.S. Nuclear Regulatory Commission (NRC) license granted to Interim Storage Partners, LLC (ISP) for its temporary spent nuclear fuel storage facility in Texas—known as a Consolidated Interim Storage Facility (CISF)—asserting that the NRC did not have the requisite statutory authority under federal law to issue licenses for private parties to store spent nuclear fuel away from the reactor site.

While the safety and stability of dry-cask storage has not been undermined or questioned, the federal authorities' movement forward on interim storage solutions remains an issue with uncertainty. Therefore, continued relationship building with Kentucky's federal legislative delegation and government partners is essential.

**Understanding the Needs of Industrial Customers and Engaging Consortia**

As discussed previously, the Authority should continue to build the organizational capacity to engage and potentially convene stakeholders interested in nuclear energy technologies on certain issues. A goal to consider would be helping to form a consortium of potential nuclear offtakers that would consist of utilities, environmental advocates, co-ops, and major industrial companies. This consortium could be used to share best practices, including how to share risk associated with developing and constructing new nuclear power plants within the Commonwealth.

In addition, a long-term goal of the Authority is building relationships with industrial customers and manufacturers to understand the implications of sustainability goals, how advanced nuclear technology can provide solutions at the site level, and the benefits of utility and potential merchant projects. Fostering a greater understanding of PSC processes, utility and RTO tariffs and interconnection processes will help inform long term decision making relating to small to micro nuclear reactor deployment.

**Engaging on Efforts to Allow Spent Nuclear Fuel Re-Processing or Recycling**

There is a renewed (and growing) interest in developing and deploying spent nuclear fuel re-processing[61] or recycling technology. Historically, the high cost of re-processing and recycling spent nuclear fuel combined with the low cost of mined uranium have deterred private commercialization of re-processing and recycling technology in the U.S. Increased interest in minimizing the uranium mining impacts of nuclear energy, deployment of advanced nuclear reactors and fuels forms that can more economically use re-processed or recycled nuclear fuels, and advancements in re-processing or recycling technology may support future public and private investment in new spent nuclear fuel re-processing or recycling facilities.

Studies and research by the National Academy of Science[62], DOE[63], National Laboratories[64], and others have highlighted the economic and environmental challenges associated with commercial spent nuclear fuel re-processing or recycling. The technology is not commercially mature to facilitate deployment today, but efforts are underway with advanced nuclear energy companies like Oklo, Curio, and SHINE attempting to reprocess used nuclear fuel. The Authority should engage the DOE, National Laboratories, and private companies on these efforts and ensure the Commonwealth can take advantage of these technologies if they are deployable and commercially attractive.

### Gated Opportunities

The U.S. will need ~550–770 GW of additional clean, firm capacity to reach net-zero carbon emissions while maintaining energy security. The Authority's work can help Kentucky play a major role in helping the country reach this ambitious goal. Nuclear energy is one of the few proven options that could deliver at scale, while creating high-paying jobs with concentrated economic benefits for communities most impacted by the energy transition. However, nuclear energy projects are plagued with so-called "chicken and egg" problems. Power producers can't move forward with advanced nuclear projects unless they are certain they can be built on time and on budget under the existing least-cost model that is widespread across the United States. Cost and schedule estimates won't be considered predictable until multiple reactors have been deployed. Advanced nuclear technology developers cannot move forward with technology development without customers. Advanced nuclear fuel suppliers and component

[61] See more about reprocessing at https://world-nuclear.org/information-library/nuclear-fuel-cycle/fuel-recycling/processing-of-used-nuclear-fuel.aspx#:~:text=In%20Belgium%2C%20France%2C%20Germany%20and,has%20been%20recycled%20into%20PHWRs.

[62] Merits and Viability of Different Nuclear Fuel Cycles and Technology Options and the Waste Aspects of Advanced Nuclear Reactors | National Academies

[63] DOE ARPA-E CURIE Program | arpa-e.energy.gov

[64] Radioactive Iodine and Krypton Control for Nuclear Fuel Reprocessing Facilities | Journal Article | PNNL

manufacturers cannot scale production unless an order book of multiple nuclear reactors is built. A workforce to help build the next generation of nuclear reactors cannot be trained until there is concrete evidence that these workers will have jobs.

This implies that the Commonwealth, and the Authority, should be aware of potential events that could initiate and accelerate the pace and timing towards developing new nuclear technologies within the Commonwealth to allow the public to benefit from these projects. These potential opportunities are considered "gated opportunities," meaning a preceding event must occur to initiate progress in that area.

Key Initiating Events to Unlock Gated Opportunities

- The realization of public confidence in nuclear energy throughout the Commonwealth
- Development of business, financial or legislative solutions to support the deployment of capital-intensive energy projects.
- Federal regulatory confidence in licensing new nuclear facilities under the Nuclear Regulatory Commission (power production, facility, and fuel manufacturing).
- Federal regulatory support and siting of a permanent nuclear waste repository and the ability to re-process or recycle spent nuclear fuel.
- Promulgation of environmental regulations contributing to the loss of firm reliable generation sources.
- Destabilization of the electric grid through increased threats or disasters.
- Increased state-level confidence in federal licensing and permitting new nuclear facilities.

**Regulatory:**

At the time of this report, the NRC is reviewing several new nuclear license applications that have been submitted within the last two years. In the next several years, many new application submissions are expected. Although the sample size will be small, different nuclear designs receiving a positive regulatory finality decision (like a standard design approval, a design certification, a construction permit, or a combined construction and operating license) should be considered a major initiating event for stakeholders, including the Authority, to take a closer look at advanced nuclear energy technology projects.

Additionally, efforts to provide the NRC the resources necessary to license and permit the next generation of nuclear technologies is well underway. This involves requiring the NRC to update existing regulations and create new rulemakings that reflect the additional safety designs

incorporated in advanced nuclear reactor technology. An example of this is creating a new regulatory framework to license new nuclear reactors, dubbed the "Part 53" process. Another example is the recent announcement related to the Emergency Planning Zone (EPZ) requirement for new nuclear reactors. The NRC will issue a final rule for emergency preparedness that will allow for a scalable method to determine the size of the offsite emergency planning zone around a facility (the current rule required is a 10-mile radius). The final rule announcement comes after the NRC validated NuScale's methodology[65] for a reduced EPZs. Many advanced reactor developers are expecting to have similar, reduced EPZs.

**Financial:**

Development of consortia of offtakers would allow stakeholders to look at advanced nuclear energy projects more closely. Initiating events for nuclear energy development could involve additional federal incentives from government, including concepts like early mover premium cost insurance that could give power producers with limited balance sheets the ability to take on nuclear projects. DOE financial support for early site permitting would also be helpful.

At the state level, Integrated Resource Plan modeling to include advanced nuclear generation projects, recovery of CWIP, and greater certainty around CPCN processes could incentivize utilities to move forward with nuclear projects at an accelerated pace. In addition, any state level work around the use of securitization could alter the pacing and timing of nuclear energy development.

The realization of new regional utility models, private sector funding of nuclear solution sets or financial partnership around nuclear energy project development in RTO markets could significantly change the pacing of project development.

**Workforce and Education:**

As Kentucky and the rest of the country deals with the rapid energy transition, it is vital to keep the current and next generation of workers employed within local communities. This will require the timely development of several different types of educational programs to help train, educate, or retrain the workforce that will be able to help design, build, and construct new nuclear facilities. A natural initiating event for developing education and training programs would be taking advantage of existing re-training programs in-state and with partner states, as many workers are already being displaced. Additional initiating events could include the

[65] For more information, see https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML22287A155.

Authority proactively engaging with utilities and paying close attention to their expected needs, either through public meetings, or their public Integrated Resource Plans (or equivalent). This will allow K-12 educators, universities, and community college programs to graduate nuclear technicians, high-voltage electricians, and construction engineers at a pace that can match a potential ramp-up in nuclear power production facility deployment while taking advantage of federal programs and incentives to retrain workers.

## Section 8: Conclusion

In conclusion, the Working Group presents a comprehensive and strategic document that stems from the objectives set forth by SJR 79 (2023). It offers a detailed exploration of Kentucky's energy landscape, with a specific focus on nuclear energy. This report lays the groundwork for the establishment of a permanent nuclear energy organization within state government.
In its entirety, this report serves as a vital resource for policymakers and stakeholders, offering a comprehensive overview of Kentucky's path towards nuclear energy development and providing a solid foundation for building the state's capacity to engage in the nuclear energy ecosystem.

As stated in the report, developing the nuclear energy ecosystem in Kentucky presents a strong value proposition considering the state's energy history and existing assets. However, that comes with the need to collaborate and commit to sustained work in its development and does not suggest there are not challenges that must be mitigated. As concluded by the Working Group, there are no insurmountable barriers to nuclear energy development in Kentucky. As illustrated by the Working Group's deliberations, this alone is not enough to increase Kentucky's attractiveness for development opportunities and send the appropriate market signals.

The challenges the Working Group have defined are real and require serious attention, allowing for opportunities to improve Kentucky's attractiveness and the availability of support for nuclear energy development within the state. This will require extensive coordination across local, state, and federal government entities. If the goals outlined in this report are achieved, Kentucky will secure its place as an economic and energy development leader nationwide and globally.

# Appendix

## Appendix A: Working Group Member List

| Title and Organization | Primary Contact | Alternate Contact |
|---|---|---|
| Chief Nuclear Officer for TVA | Scott W. Hunnewell | Matt Rasmussen |
| Nuclear Energy Institute | Christine Csizmadia | Marc Nichol |
| Kentucky Conservation Committee | Lane Boldman | Randy Strobo |
| U.S. Nuclear Industry Council | Todd Abrajano | David Jones |
| LGE\KU | John Crockett | Aron L Patrick |
| Energy Communities Alliance (Nuclear Development Nonprofit) | Kara Colton | n/a |
| UK Center for Applied Energy Research | Dr. Rodney Andrews | Shiela Medina |
| Duke Energy Kentucky | Chris Nolan | Amy Spiller |
| AEP Kentucky Power | Joe Yeagler | Randy Keefer |
| Kentucky Industrial Utility Customers | Michael L. Kurtz | Carl Kurtz |
| Four Rivers Nuclear Partnership | Cory Hicks | n/a |
| Public Service Commission | Linda Bridwell | n/a |
| Kentucky Association of Electric Cooperatives | Chris Perry | Kelli Gibson |
| Kentucky Municipal Electric Association | Annette C. DuPont-Ewing | Dave Carroll |
| U.S. DOE National Laboratory | Christine King | n/a |
| East Kentucky Power Cooperative | Don Mosier | David Crews |
| Big Rivers Electric Corporation | Nathan Berry | Bob Berry |
| Senate Member | Senator Carroll | Nicole Cusic |
| Senate Member | Senator Webb | n/a |
| House Member | Rep. Rudy | n/a |
| House Member | Rep. Gordon | n/a |

*Table 1: Working Group Member List*

## Appendix B: Working Group Meetings

| Meeting # | Date | Location | Video Recording |
|---|---|---|---|
| Meeting 1 | May 24th, 2023 | Frankfort, KY | Video 1 |
| Meeting 2 | July 26th, 2023 | Frankfort, KY | Video 2 |
| Meeting 3 | September 6th, 2023 | Frankfort, KY | Video 3 |
| Meeting 4 | October 24th, 2023 | Virtual - Microsoft Teams | Video 4 |

*Table 2: Nuclear Energy Development Working Group Meetings*

## Appendix C: Nuclear-related legislation in Kentucky leading up to SJR 79 (2023)

### 2017RS SB11 (“Leeper Act”)

**Summary:** Amend KRS 278.600 to require that nuclear power facilities have a plan for the storage of nuclear waste rather than a means of permanent disposal and to add definitions of "storage," "low- level nuclear waste," and "mixed nuclear waste"; amend KRS 278.610 to allow certification if the facility and its plans for waste storage are approved by the Nuclear Regulatory Commission; eliminate the requirement that the facility have a plan for disposal of high-level nuclear waste; eliminate the requirement that cost of waste disposal be known; eliminate the requirement that the facility have adequate capacity to contain waste; give the Public Service Commission authority to hire a consultant to perform duties relating to nuclear facility certification; prohibit construction of low-level nuclear waste disposal sites in Kentucky except as provided in KRS 211.852; direct the Energy and Environment Cabinet to review regulations required for permitting nuclear facilities and report to LRC; repeal KRS 278.605, relating to construction of nuclear power facilities.

**Significance:** 2017RS SB11 eliminated the nuclear construction moratorium in Kentucky and also directed the Energy and Environment Cabinet (EEC) to perform a review of existing state administrative regulations and regulatory processes to identify whether any changes were necessary. After the review of existing state administrative regulations and regulatory processes, EEC did not identify any regulations or processes that require a revision or modification. As written, the PSC shall enforce KRS 278.610 and no KAR changes are recommended.

### 2023RS SB04

**Summary:** Create new sections of KRS Chapter 278 to define terms; prohibit the Public Service Commission from approving a request by a utility to retire a coal-fired electric generator unless the utility demonstrates that the retirement will not have a negative impact on the reliability or the resilience of the electric grid or the affordability of the customer's electric utility rate; require the Public Service Commission to submit an annual report on retirements of electric generating units by December 1 to the Legislative Research Commission.

**Significance:** SB04 was signed into law in 2023. The extent to which this bill will have an impact on the feasibility to deploy nuclear power production facilities is to be fully determined but The Workgroup consensus is that it will have none.

## Appendix D: Examples of Other State Level Nuclear Development Organizations

### Virginia Nuclear Energy Consortium

In 2013, the Governor and General Assembly created the Virginia Nuclear Energy Consortium Authority. In accordance with the founding statute, VNEC was created to represent stakeholders invested in the development of nuclear energy. These stakeholders include the state of Virginia, institutions of higher education, nuclear energy companies, suppliers, and local organizations who support the advancement of the nuclear industry.

A link for more information about VNEC can be found here: https://virginianuclear.org/.

### Idaho LINE Commission

The LINE Commission makes recommendations to the Governor on policies and actions of the State of Idaho to support and enhance the long-term viability and mission of the Idaho National Laboratory and other nuclear industries in Idaho. It is currently comprised of a Research Development, Demonstration, and Deployment Subcommittee, as well as a Safety, Environment, and Risks and a Workforce and Education Subcommittee.

A link for more information about VNEC can be found here: https://line.idaho.gov/.

## Appendix E: Examples of Nuclear Policies, Orders, and Legislation in Other States

### North Carolina Senate Bill 678 (2023)

**Summary:** In October 2023, the North Carolina Legislature overrode a veto from Governor Roy Cooper to include nuclear energy and fusion energy under the definition of clean energy through SB 678.

**Significance:** This is significant because in 2021, the North Carolina Legislature passed a Clean Energy Standard mandate.

### Colorado House Bill 1247 (2023)

**Summary:** In May 2023, the Colorado Legislature passed a requirement that the Colorado energy office conduct studies to assess advanced energy solutions (including nuclear energy) in rural Colorado. This law included an appropriation and will study key considerations including transmission, labor and the impacts the retirement of coal-fired power plants.

**Significance:** This is an example of legislation that will attempt to focus on key issues of consideration when studying advanced nuclear, including RTO considerations, and labor capital implications (jobs, etc.)

### Nebraska (2022)

**Summary:** The State of Nebraska allocated $1 million (USD) of funding under the American Rescue Plan Act - a wide-ranging economic stimulus package signed into law in 2021 to support the USA's recovery from the effects of the COVID pandemic and the ongoing recession - to complete a siting study for SMRs. It is estimated that this second phase of the study will take about a year to complete. Engineering firm Burns & McDonnell will be assisting NPPD with the study.

**Significance:** The first part of the two-phase study will involve a state-wide assessment to determine 15 "best locations" for siting SMRs based on geographic data and preliminary licensing criteria. An in-depth evaluation including detailed field environmental and constructability evaluations based on US Nuclear Regulatory Commission plant licensing criteria will then aim to reduce the 15 sites to 4. This is an example of a state trying to identify early locations for potential SMR deployment.

### Tennessee Executive Order 101 (2023)

In May 2023, Tennessee Governor Bill Lee signed an executive order to advance Tennessee's

position as a national leader in nuclear energy. Executive Order 101 creates the Tennessee Nuclear Energy Advisory Council, which will seek to build upon the state's legacy in nuclear innovation and drive continued investment to create a nuclear energy ecosystem for the future of Tennessee. The Tennessee Nuclear Energy Advisory Council will consist of 15 members, including members of the Lee administration, the Tennessee General Assembly, Tennessee's Congressional Delegation and key nuclear industry stakeholders.
The advisory council will recommend the following actions to advance Tennessee's ability to lead the nation in nuclear energy:

- Legislative, policy and budgetary changes to address regulatory, workforce or education barriers that exist to the creation and expansion of nuclear energy facilities in Tennessee
- Funding opportunities for state government, local governments and the private sector
- Storage and waste practices that continue the state's long history of conserving Tennessee's natural resources
- Federal actions that Tennessee should pursue with federal partners and agencies

Note: This year, Gov. Lee partnered with the Tennessee General Assembly to create a $50 million Nuclear Fund in the state's Fiscal Year 2023-2024 budget. The fund, proposed by Gov. Lee at his 2023 State of the State address in February, will establish a nuclear development and manufacturing ecosystem built for the future of Tennessee by providing grants and assistance to support nuclear power-related businesses that choose to relocate or grow in the state. A link for more information about TN Executive Order 101 can be found here: https://sos.tn.gov/publications/services/executive-orders-governor-bill-lee.

### Texas Governor Greg Abbott Announcement to Study Advanced Nuclear (2023)

Texas Governor Greg Abbott announced a directive to the Public Utilities Commission of Texas to formulate a working group to study and provide recommendations on advanced nuclear energy. To maximize power grid reliability, the newly formed group will work to understand Texas' role in deploying and using advanced nuclear reactors, consider all potential financial incentives available, determine nuclear-specific changes needed in the Electric Reliability Council of Texas (ERCOT) market, identify any federal or state regulatory hurdles to development, and analyze how Texas can streamline and accelerate permitting for building advanced nuclear reactors. Governor Abbott directed the working group to also coordinate with ERCOT to begin addressing the technical challenges of incorporating advanced nuclear technology into the ERCOT grid. For additional context, Texas is already a leader in nuclear energy, with four nuclear commercial nuclear plants operating, nuclear engineering programs at public state universities, and plans to deploy an advanced nuclear power plant in Texas by the late 2020's at one of Dow Chemical's chemical sites. A link for more information on the Texas

Governor's announcement can be found here: https://gov.texas.gov/uploads/files/press/Jackson,_Kathleen_08.16.23.pdf.

### Arkansas HB1142 (2023)

The bill, titled "AN ACT TO CREATE THE ARKANSAS NUCLEAR RECYCLING PROGRAM," seeks to establish the Arkansas Nuclear Recycling Program with several specific objectives, including:

1. Developing a fiscal model for commercial application: The program aims to create a financial framework for the commercial utilization of nuclear recycling in the state.
2. Developing an interim and long-term storage plan for residual materials: This involves creating plans for the temporary and permanent storage of materials generated through nuclear recycling.
3. Developing a fiscal model for current and future market demand: The bill aims to establish financial models to address the present and future market demand for nuclear recycling products and services.
4. Developing engineering documents for the recycling process: This involves the creation of technical documentation related to the nuclear recycling process.
5. Performing site analysis for prospective recycling facility locations: The bill seeks to evaluate potential locations for nuclear recycling facilities and develop reports related to construction costs and schedules for such facilities.
6. Establishing Arkansas as the only state interested in pursuing a final solution for spent nuclear fuel through recycling: The bill aims to position Arkansas as a leading state in exploring long-term solutions for managing spent nuclear fuel through recycling.

The bill appears to focus on the development and promotion of nuclear recycling within the state of Arkansas, with the goal of addressing various aspects of this process, from financial models and storage plans to facility locations and construction details.

A link for more information about the bill can be found here: https://www.arkleg.state.ar.us/Bills/Detail?id=HB1142&ddBienniumSession=2023%2F2023R.

## Appendix F: List of Educational Nuclear Material

| Type of Resource | Title | Author | Link |
|---|---|---|---|
| Briefings on Nuclear Waste | Commercial Nuclear Fuel | U.S. Nuclear Waste Technical Review | Link |
| | 5 Fast Fact on Nuclear Waste | Department of Energy | Link |
| Briefings on Hydrogen-Nuclear Projects | Three Nuclear Power Plants Gearing Up for Clean Hydrogen Production | Department of Energy | Link |
| Key News in Nuclear | Milestones in Advanced Nuclear Energy | Gateway for Accelerated Innovation in Nuclear | Link |
| Briefings on Nuclear Technology and Its Potential | Advanced Nuclear Reactors: Technology Overview and Current Issues | Congressional Research Service | Link |
| | Advanced Reactors for State Policymakers, In Brief | Nuclear Innovation Alliance | Link |
| | Advanced Nuclear Reactor Technology, A Company Compendium | Nuclear Innovation Alliance | Link |
| | Advanced Nuclear Reactor Technology, A Primer | Nuclear Innovation Alliance | Link |
| | Advanced Nuclear 101 | Nuclear Innovation Alliance | Link |
| | Opportunities for a Coal to Nuclear Transition | Nuclear Innovation Alliance | Link |
| Siting of New Nuclear Energy Projects | Siting Tool for Advanced Nuclear | National Reactor Innovation Center | Link |

| | | | |
|---|---|---|---|
| Strategy for Nuclear Energy Deployment | Advanced Reactor Roadmap | EPRI and NEI | Link |
| | Pathways to Commercial Liftoff | Department of Energy | Link |
| Zero Emitting Resources Study | Pacific Northwest Zero-Emitting Resources Study | E3 | Link |
| Public Private Partnerships | Advanced Reactor Demonstration Projects | Department of Energy | Link |
| Nuclear Regulatory Commission | NRC New Nuclear Reactor Program | NRC | Link |

*Table 3: Nuclear Energy Resources*

## Appendix G: Brief List of NGOs working on Nuclear Development

| **Organization Name** | **Webpage** |
|---|---|
| Energy Communities Alliance | Link |
| ClearPath | Link |
| Clean Air Task Force | Link |
| Good Energy Collective | Link |

*Table 4: List of NGOs working on Nuclear Development*