TEAM PENNSYLVANIA

PA Nuclear Energy Roadmap

Important Dynamics and Considerations

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Attributes of Nuclear Energy

Nuclear energy is a key source of carbon-free energy in Pennsylvania and throughout the United States. In Pennsylvania, nuclear energy provides almost one-third of the state's energy while accounting for over 90% of the state's carbon-free energy. Nuclear energy also provides reliable, firm power that can complement renewable energy in an increasingly decarbonized electric grid. With its small land footprint, nuclear energy is the most land-effiencent source of energy. Similarly, nuclear energy's value stems from its energy density, meaning that a small amount of fuel produces an immense amount of electricity. This allows nuclear power plants to operate for long periods without refueling.

Beyond its climate benefits, nuclear energy strengthens grid resilience while protecting ratepayers. Its long operational lifetime and stable fuel costs protect ratepayers from price volatility. Nuclear energy's high capacity factor ensures that a consistent and dependable output of energy is available when demand is highest. For a more detailed look at the benefits of nuclear energy, see section 8.

Capital Alignment in a Competitive Market

➔ Market Structure and Constraints

Pennsylvania operates within PJM's competitive wholesale electricity market. Since the passage of restructuring in 1996, electric distribution companies in Pennsylvania do not own generation assets and instead procure power through competitive mechanisms. Independent power producers bear market risk and depend on energy and capacity market revenues under federal jurisdiction.

This structure differs from vertically integrated states, where utilities can directly own and rate-base new generation. As a result, Pennsylvania cannot simply direct utilities to build new nuclear facilities without fundamentally altering its market design. Any approach to enabling new nuclear capacity must operate within competitive market principles and respect federal authority.

➔ Investment Risk and Revenue Certainty

New nuclear projects are capital intensive and require long development timelines. Investors and lenders typically seek predictable revenue over extended periods to manage construction risk and long-term repayment obligations. Competitive wholesale markets provide price signals but do not guarantee long-duration revenue stability.

For first-of-a-kind or early commercial projects, the absence of predictable long-term revenue can increase financing costs. Addressing this dynamic is less about replacing market structures and more about determining how risk can be managed in a way that preserves competition while enabling private capital participation.

➔ Policy Tools Compatible with Competitive Markets

Within its authority, Pennsylvania retains options to reduce non-market barriers and improve investment conditions without interfering in PJM price formation. These tools may include:

- Coordinated siting and permitting processes that reduce transaction costs
- Predictable tax treatment and fiscal clarity for construction inputs
- Facilitation of voluntary long-term offtake discussions among interested buyers

Financing Mechanisms
IN ACTION

Contracts-for-Differences (CfDs):

The Hinkley Point C nuclear project is financed through a long-term contract for differences with an inflation-indexed strike price. The same model has enabled large-scale offshore wind deployment.

Credit-Base Structures (CBSs):

Illinois and New York have implemented zero-emission credit programs for nuclear generation based on environmental attributes.

Over time, some states have explored revenue stabilization approaches for zero-emission, firm capacity. Mechanisms such as contracts-for-differences or credit-based structures have been implemented in other states while allowing projects to continue selling energy and capacity into competitive wholesale markets. If Pennsylvania were to consider similar tools, careful design would be required to ensure compatibility with PJM rules, cost discipline, and protection for ratepayers.

➔ Durability and Pathways to Scale

Initial deployment is only the first step. Long-term success depends on repeatability. Standardized contract structures, defined authorization windows, and coordinated procurement cycles can provide predictability without committing to open-ended obligations.

Further, regional coordination within PJM may also reduce fragmentation and strengthen legal durability. In addition, durable deployment will depend on community acceptance and transparent benefit structures that align long-term economic development with local priorities.

Community Alignment and Public Trust

Nuclear deployment is most durable when host communities experience sustained economic participation and transparent engagement. Because nuclear facilities operate on multi-decade timelines, long-term community confidence is essential to project stability.

Public support for nuclear energy in the United States is currently strong, including among residents who live near existing nuclear plants. At the same time, public confidence remains closely tied to safe operations and responsible environmental stewardship. Concerns raised by members of the public often focus on safety, environmental protection, and the long-term management of used nuclear fuel. Pennsylvania's experience with nuclear energy reflects this dynamic. The accident at Three Mile Island Unit 2 prompted major improvements in safety culture and regulatory oversight across the industry. Although the incident caused no detectable health effects among plant workers or the public, it remains an important moment in the state's energy history and continues to shape public discussion.

Maintaining public trust requires sustained engagement over the life of a facility. Structured community benefit frameworks can clarify expectations around local hiring, workforce pathways, and long-term economic participation. Predictable host revenues and stable tax contributions can provide planning certainty for communities, particularly in rural areas and regions with a legacy of energy production. Additionally, advisory structures that include local leaders, emergency services, and public health professionals can support ongoing dialogue. Clear communication and access to independent technical expertise help communities evaluate nuclear projects with confidence. Together, economic participation, transparency, and strong safety performance form the foundation of long-term public confidence in nuclear energy development.

Competing for Supply Chain Investment and Talent

Nuclear deployment is occurring within a competitive interstate environment. States are pursuing strategies to attract nuclear-related manufacturing, engineering functions, and workforce development activity. Incentive frameworks, regulatory clarity, infrastructure coordination, and executive-level engagement can influence where suppliers site new facilities or expand existing operations.

As discussed in **Policy Considerations**, state-level coordination and financing tools shape long-term investment decisions. For Pennsylvania, the relevant question is not solely where reactors are constructed, but where nuclear-qualified manufacturing capacity and skilled labor ecosystems grow. Given the commonwealth's established operating fleet, research institutions, and industrial base, positioning efforts may influence whether future supply chain expansion and talent development occur in-state or shift to competing jurisdictions.

Demand Signals and Long-Term Procurement

Investment decisions within the nuclear supply chain are shaped by long-term demand signals.

New nuclear projects typically rely on long-duration customer commitments, such as power purchase agreements or other structured procurement arrangements. These commitments influence project timing, vendor selection, and financing conditions. As outlined in **Capital Alignment in a Competitive Market**, revenue visibility is central to reducing financing risk. It is also central to industrial planning.

When large customers signal sustained demand for zero-emission, firm power, suppliers gain greater confidence in expanding capacity, upgrading facilities, and scaling workforce training. In the absence of clear demand signals, suppliers may delay investment and skilled labor pipelines may remain constrained.

For Pennsylvania's industrial base, alignment between customer demand, project development, and supplier readiness is a structural consideration that extends beyond any individual project.

Emergency Preparedness and Local Coordination

Emergency preparedness is an embedded requirement of nuclear facility operations. Federal regulations establish defined emergency planning zones around each plant. Operators coordinate with state agencies, county emergency management offices, and local first responders to maintain readiness. These plans are tested through regular exercises and evaluated by federal regulators.

Preparedness is continuous rather than episodic. Agencies conduct drills, review response protocols, and update procedures as conditions evolve. Communication systems and notification processes are assessed to ensure clarity of roles and responsibilities. For communities, emergency preparedness provides visible evidence of coordination among operators and public institutions. It reinforces that nuclear facilities operate within an established public safety framework.

As Pennsylvania considers future nuclear development or expansion of its industrial base, emergency preparedness remains a structural component of long-term community integration and operational resilience.

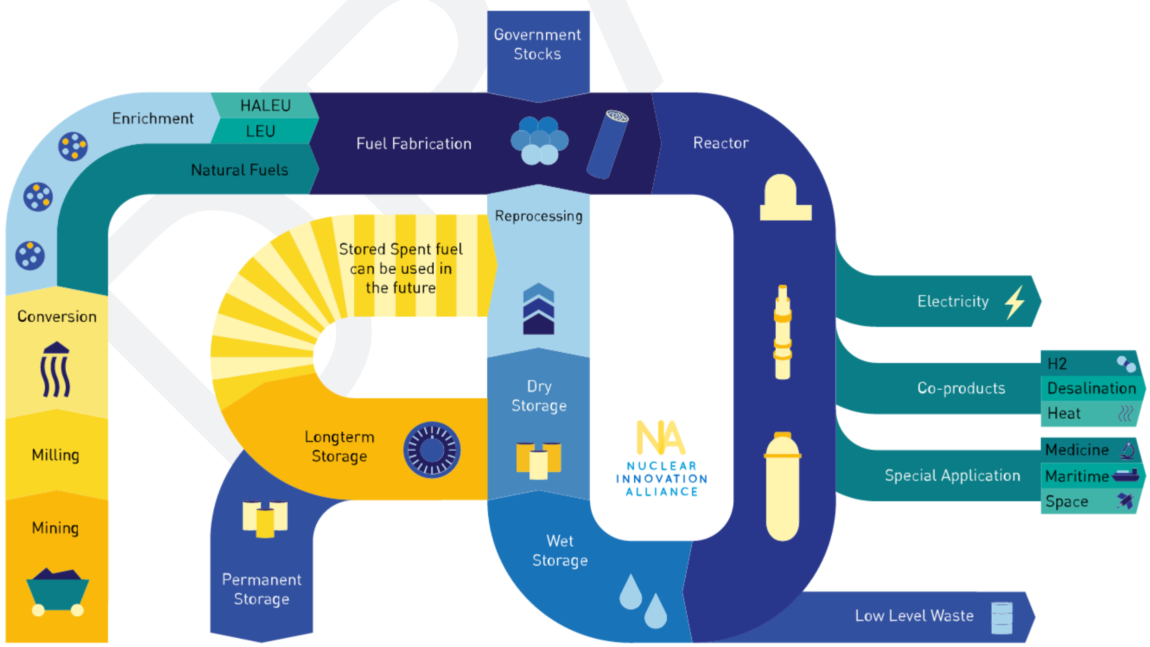
Fuel Cycles and Waste Management

→ Fuel Supply and Advanced Fuel Cycles

Fuel availability and fuel cycle infrastructure are central considerations in long-term nuclear deployment. Traditional light-water reactors rely on uranium that is mined, converted, enriched, fabricated into fuel assemblies, and ultimately stored after use. Much of this infrastructure operates globally, and fuel supply relationships often persist for decades once a reactor technology is selected.

Advanced reactor designs introduce new fuel forms and, in some cases, higher enrichment levels or alternative materials. These innovations can improve performance, increase fuel efficiency, and extend operating cycles between refueling outages. Fuel choices also influence safety systems, waste characteristics, and supply chain requirements.

Fuel strategy carries economic and geopolitical implications. Long-term fuel supply contracts can strengthen trade relationships, while domestic fuel capability can enhance energy security. Federal initiatives aimed at rebuilding enrichment and advanced fuel capacity within the United States are intended to reduce reliance on foreign sources and support next-generation reactor deployment. For Pennsylvania, participation in the broader fuel ecosystem may involve research partnerships, manufacturing capability, or alignment with federal supply chain efforts rather than direct fuel production.



Advanced Fission Fuel Cycle, Nuclear Innovation Alliance

➔ Regulatory and Institutional Ecosystem

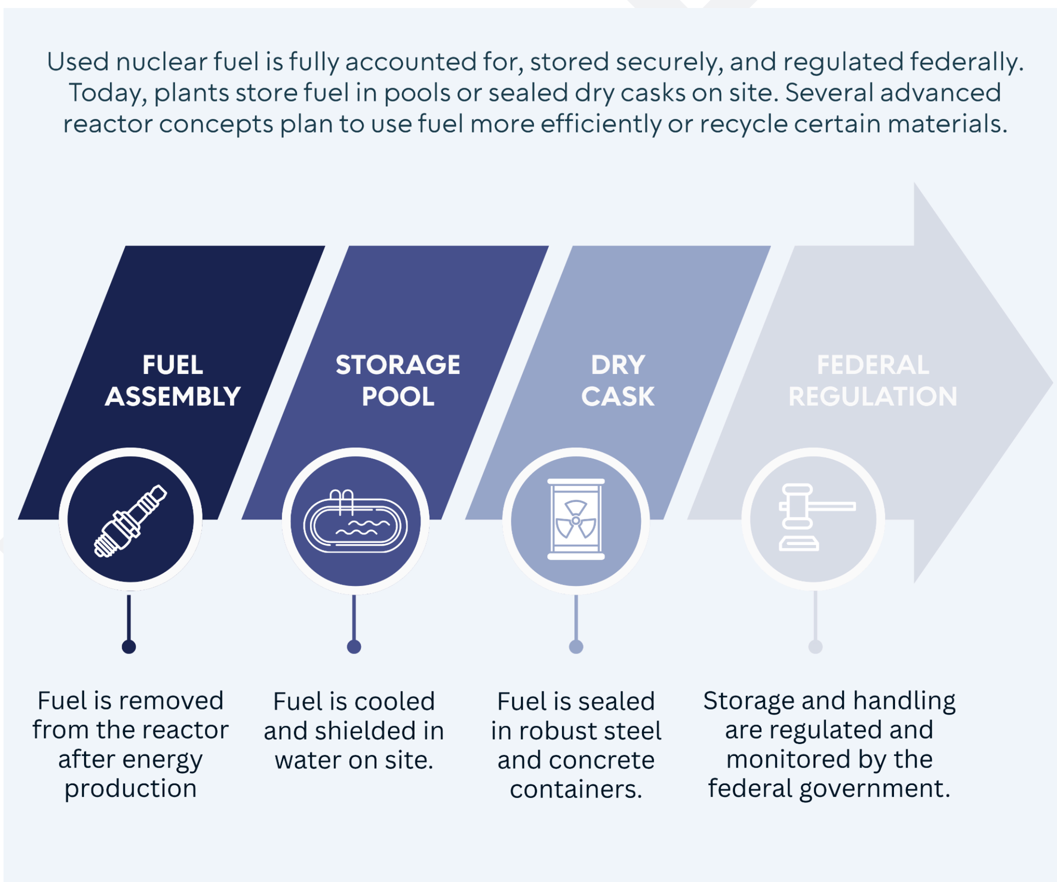
The nuclear fuel cycle operates within a defined federal framework. The Department of Energy and national laboratories support research, fuel qualification, and supply chain development. The Nuclear Regulatory Commission oversees licensing and safety standards and is pursuing modernization efforts to accommodate advanced reactor technologies through risk-informed and performance-based approaches.

Private industry drives most current reactor and fuel innovation. Developers are advancing new designs while financiers explore structures that reduce cost and risk during commercialization. Universities contribute research and talent development, and nonprofit organizations support policy research and stakeholder engagement. For Pennsylvania, alignment with this national ecosystem will influence how quickly new technologies can be deployed and how effectively local industry can participate.

➔ Waste Management and Long-Term Stewardship

All nuclear technologies require responsible waste management. Spent fuel from light-water reactors is currently stored safely at plant sites in dry casks or pools under federal oversight. Technically, long-term geological disposal solutions are well understood, but permanent repositories have faced political and siting challenges in the United States. National discussions have increasingly focused on consent-based siting approaches for consolidated storage or disposal facilities. Other countries, including Finland and Sweden, have advanced permanent repository programs using community consent models.

Advanced reactor designs may influence waste characteristics by improving fuel efficiency or reducing long-lived byproducts. However, long-term storage and disposal requirements will remain part of the nuclear lifecycle. Durable deployment will depend on transparent communication, continued federal leadership, and credible stewardship strategies.



Fusion Energy and Emerging Fuel Cycles

Fusion energy remains in development and differs fundamentally from conventional nuclear fission. Most commercial fusion concepts rely on reactions between the hydrogen isotopes deuterium and tritium. Deuterium is widely available in water. Tritium does not occur naturally in significant quantities and must be produced within the reactor system through breeding processes that use lithium.

Fusion produces a different waste profile than fission. Conventional fission reactors generate spent fuel that contains long-lived radioactive materials and requires long-term management. Fusion reactions do not produce the same transuranic waste streams. Instead, fusion systems primarily generate activated structural materials created when reactor components are exposed to high-energy neutrons. These materials typically require management for shorter periods, depending on reactor design and material selection.

Waste volumes and management requirements for fusion depend heavily on engineering choices and the maturity of reactor technologies. Advances in materials science are expected to further reduce long-term waste generation.

Fusion is not expected to play a near-term role in Pennsylvania's energy system. However, continued progress in fusion technology, fuel production, and regulatory frameworks could create future opportunities. Monitoring these developments may position Pennsylvania's energy sector, including its research institutions and manufacturers, to participate in long-term commercialization pathways.

Jurisdictional and Market Complexity

Nuclear deployment in Pennsylvania occurs within overlapping regulatory and market systems. Federal authority governs reactor safety and licensing through the Nuclear Regulatory Commission and oversees wholesale electricity markets through the Federal Energy Regulatory Commission. State policy influences retail electricity structure, environmental oversight, and economic development incentives. Local governments play an important role in land use decisions and community engagement.

Participation in the PJM regional grid adds another layer. PJM manages energy and capacity markets across multiple states and conducts regional transmission planning. As a result, generation development in Pennsylvania interacts with market rules, transmission planning processes, and reliability standards that extend beyond state borders.

This structure can introduce complexity when responsibilities are not clearly aligned. At the same time, it reflects the integrated nature of the regional power system. Projects that coordinate state permitting processes with federal licensing and regional grid planning are more likely to move forward efficiently. For Pennsylvania, the central challenge is coordination rather than jurisdictional change. Predictable sequencing across agencies, clear communication with federal regulators, and early engagement with regional grid planning processes often determine whether projects advance smoothly.

Load Growth

Nuclear deployment is most durable when aligned with identifiable and growing sources of electricity demand. In Pennsylvania, large load customers such as data centers, advanced manufacturing facilities, and other energy-intensive industries are shaping the future of grid expansion. Pairing new nuclear capacity with new load can reduce stranded asset risk, improve financing prospects, and link energy investment directly to economic development outcomes.

Intentional alignment may take several forms. Co-locating nuclear facilities with data centers or advanced manufacturing can reduce transmission congestion and anchor long-term demand. Smaller-scale nuclear technologies may also serve medium-sized industrial campuses or specialized facilities that require highly reliable power. By aligning generation development with credible load growth, Pennsylvania can strengthen project economics while reinforcing the connection between nuclear energy and industrial competitiveness.

Market and Policy Shifts Influencing Investment

Investment conditions for nuclear energy are changing. Private sector demand is increasing while federal policy and state participation are shaping how projects move forward. Large technology companies are beginning to view nuclear power as a source of dependable electricity for energy-intensive digital infrastructure. Long-term power agreements and strategic partnerships between technology firms and nuclear developers are emerging across the United States. Microsoft's 20 year agreement to purchase power from the Crane Clean Energy Center in Pennsylvania illustrates how large electricity buyers can support reactor restarts or future deployment.

Investor activity is also growing. Several nuclear technology companies have recently entered public markets and venture funding for nuclear innovation has expanded. These developments suggest increasing confidence that nuclear energy will play a larger role in the future power system. Federal policy reinforces these market signals. Congress preserved tax incentives that support both operating nuclear plants and new clean electricity investment. Many of these incentives require projects to begin construction before the mid-2030s. Federal financing programs administered through the Department of Energy also provide capital support for nuclear projects.

States influence investment conditions as well. Nuclear licensing remains a federal responsibility, but state policy can affect project timelines and investment risk. State actions related to site readiness, talent development, and revenue stability can signal confidence to investors and help projects move forward. These shifts in private capital, federal policy, and state participation are creating a new investment environment for nuclear energy. States that align these elements effectively are more likely to attract projects and capture long-term economic value.

Hyperscaler Interest in Nuclear

- **Microsoft demand driving Crane Clean Energy Center**
- **Amazon Web Services acquiring Talen data center campus in Pennsylvania**
- **Meta working with Vistra, Oklo, Terrapower**
- **Amazon working with X-Energy**
- **Google working with Kairos, TVA**

Orderbooks, Standardization, and Industrial Scale-Up

The scale and predictability of national nuclear deployment directly influence the strength of Pennsylvania's industrial base. Nuclear manufacturing and skilled labor expand most efficiently when there is visibility into sustained, multi-unit demand. A clear orderbook allows suppliers to justify investments in nuclear-grade upgrades, certification, tooling, and workforce expansion. In contrast, sporadic or single-project deployment cycles can limit capital investment and constrain hiring.

Standardization further shapes industrial performance. Repetition of reactor designs and component specifications reduces qualification costs, shortens production timelines, and improves schedule reliability. For manufacturers and service providers, consistent technical requirements lower transaction costs and improve long-term competitiveness.

As discussed in **Skilled Labor and Long-Term Employment**, talent pipelines depend on predictable demand. Absent that predictability, suppliers may defer expansion and skilled workers may migrate to other sectors. For Pennsylvania, national deployment trends therefore affect not only reactor siting decisions but also the depth and durability of in-state manufacturing and employment.

Why Nuclear Order Books Matter

Nuclear supply chains expand only when manufacturers see a **predictable pipeline of projects**

A single reactor rarely justifies new production lines or new talent training programs

Multiple projects over time create the confidence suppliers need to invest in nuclear certification and specialized equipment while building skilled labor capacity

For Pennsylvania the implication is clear.

Regional deployment matters even when reactors are built in other states. A steady flow of projects across surrounding states can sustain manufacturing demand while strengthening engineering expertise and skilled labor based in the commonwealth.

Permitting and Licensing Framework

Nuclear development operates within a layered approval structure. The Nuclear Regulatory Commission governs reactor safety and licensing. Federal programs may support research or financing. Pennsylvania agencies oversee environmental and water-related approvals. Local governments control land use decisions. Each authority plays a legitimate role, yet the interaction among them shapes project risk.

The federal licensing pathway is well established. The greater challenge lies in coordination. When environmental reviews, interconnection studies, and site approvals move at different speeds or lack early alignment, uncertainty grows. For capital-intensive projects with long development timelines, uncertainty translates directly into higher financing costs and reduced investor confidence.

Clarity and sequencing therefore become economic tools. When state and local processes are predictable and aligned with federal timelines, Pennsylvania becomes a more competitive destination for investment. When responsibilities are clearly defined, communities gain transparency and developers can plan responsibly.

In a capital-intensive industry where timelines span decades, permitting discipline is not merely administrative. It is foundational to attracting investment, protecting ratepayers, and ensuring that deployment decisions reflect deliberate strategy rather than avoidable delay.

Safety and Risk Perception

Safety is a foundational consideration in any discussion of nuclear energy in Pennsylvania. Commercial nuclear facilities operate under a comprehensive federal regulatory framework. The Nuclear Regulatory Commission maintains continuous oversight through inspections and performance evaluations. Plants are designed with multiple safety systems and conservative engineering standards. Operators are subject to ongoing training and certification requirements.

Pennsylvania's nuclear history includes the 1979 accident at Three Mile Island Unit 2. The accident had no detectable health effects on plant workers or the public and resulted in significant changes to safety culture and regulatory oversight nationwide. Even so, it remains a reference point in public dialogue. For some communities, that event continues to shape perceptions of nuclear risk.

Safety therefore operates on two levels. It is a matter of engineering performance and regulatory compliance. It is also a matter of public confidence. Technical standards alone do not fully address community concern. Transparent communication and visible accountability influence how safety is understood at the local level. For policymakers and business leaders, safety considerations extend beyond plant design. They include institutional credibility, oversight clarity, and sustained engagement with host communities.

Skilled Trades and Long-Term Employment

Nuclear energy projects are uniquely labor-intensive during both construction and long-term operation. Large reactor construction typically requires several thousand skilled craft professionals over multi-year build periods. Once operational, facilities employ hundreds of permanent professionals across operations, maintenance, engineering, and security roles. These positions are sustained over asset lifetimes that can extend 60 to 80 years.

In addition to permanent staffing, routine refueling outages and major maintenance activities support recurring talent demand throughout the life of the facility. This structure creates a combination of short-term construction activity and long-term career stability. Nuclear construction depends on a highly trained building trades talent base. Electricians, pipefitters, ironworkers, carpenters, operating engineers, and other skilled professionals are essential to meeting the industry's rigorous safety and quality standards. Because nuclear projects require specialized procedures and inspection protocols, they rely on apprenticeship systems and training institutions capable of sustaining consistent talent pipelines.

During peak on-site activity, craft staffing may include estimated ranges such as:

- **1,000** Electricians
- **400** Ironworkers
- **900** Pipefitters
- **300** Laborers
- **500** Carpenters
- **200** Operating Engineers

Pennsylvania's established apprenticeship infrastructure and coordinated training networks position the commonwealth to support both in-state projects and national deployment efforts. Projects typically prioritize local and regional talent where available, supplemented by national craft resources when necessary to maintain schedule discipline and safety compliance. Yet, beyond direct site employment, nuclear facilities support a broader ecosystem of manufacturers, technical service providers, transportation firms, and long-term operational partners. This extended activity reinforces talent demand across multiple regions of the commonwealth.

The scale and longevity of nuclear assets also translate into durable fiscal contributions. As major capital investments operating over multiple decades, nuclear facilities contribute to stable local tax bases that support schools, infrastructure, and municipal services. For Pennsylvania, the opportunity extends beyond hosting new facilities. The commonwealth's skilled trades base and industrial talent position it to support nuclear construction and modernization projects across the country. Aligning talent readiness with projected deployment timelines will be central to capturing both in-state and national economic opportunity.

Plant Vogtle Units 3 & 4 (Georgia) represent the first new commercial nuclear reactors completed in the United States in more than three decades and provide a useful reference for understanding the scale of modern nuclear construction.

PEAK CONSTRUCTION EMPLOYMENT
More than 9,000 workers onsite during peak activity

PERMANENT OPERATIONS EMPLOYMENT
Approximately 800 long-term jobs once both units are in service

Throughout construction and operation, the project engaged a wide range of skilled craft professionals—including electricians, pipefitters, welders, ironworkers, carpenters, and operating engineers—and will continue to support highly skilled roles over a multi-decade lifespan.

These figures highlight the labor intensity of large nuclear projects and the long-term employment stability they provide.

Social License and Environmental Responsibility

The decision to deploy nuclear energy is ultimately one that rests with the general public. Communities and constituents influence their elected leaders and decision makers who determine our energy mix.

Favorability to nuclear energy is currently high, with 60% of U.S. adults saying they favor more nuclear power plants to generate electricity[1]. Neighbors of nuclear power plants – those who live within a 10 mile radius – report even higher favorability, with 78% approving of a new reactor at the site near them[2].

A look at historical favorability reveals how closely public support and social license are tied to the safe performance of nuclear reactors, as support for nuclear dropped following the Fukushima accident in 2011[3]. Those who oppose nuclear cite safety concerns, environmental concerns and waste as reasons for their opposition[4].

Nuclear energy safety is very familiar to Pennsylvania. An accident at Three Mile Island Unit 2 resulted in the release of radioactive gasses. No radiation-related injuries occurred, but the stress of the incident had real impacts on the surrounding public[5]. The nuclear industry applied lessons learned from the event, including strengthening the U.S. Nuclear Regulatory Commission as a government safety regulator, and placing NRC resident inspectors at each nuclear site, and the industry created its own safety and operational excellence organization in response, the Institute of Nuclear Power Operations.

The response of the industry underscores the need for nuclear power operators to maintain a continued focus on safety in order to expand the current and future fleets. In addition, the industry must continue to work with the federal government to pursue a long-term solution for spent nuclear fuel – other countries have devised solutions, and the barriers in the U.S. are political, not technical.

Returning to the community, social license can only be maintained through ongoing interaction and communication. A strong program creates the conditions for the community to participate in decision-making, oversight and discussion on nuclear plants.

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[1] https://www.pewresearch.org/short-reads/2025/10/16/support-for-expanding-nuclear-power-is-up-in-both-parties-since-2020/

[2] https://www.bisconti.com/blog/9th-national-survey-of-nuclear-power-plant-neighbors

[3] https://news.gallup.com/poll/659180/nuclear-energy-support-near-record-high.aspx

[4]
https://www.pewresearch.org/short-reads/2025/10/16/support-for-expanding-nuclear-power-is-up-in-both-parties-since-2020/

[5]
https://libraries.psu.edu/about/collections/three-mile-island-2-recovery-and-decontamination/three-mile-island-2-tmi-2-reactor

Standardization, Qualification, and Cost Reduction Pathways

Cost trajectories in nuclear energy are closely tied to manufacturing discipline and regulatory qualification processes. Suppliers entering or expanding within the nuclear sector must meet rigorous quality assurance and certification standards. Achieving and maintaining these standards requires sustained investment in documentation systems, inspection protocols, and workforce training. As outlined in **Skilled Labor and Long-Term Employment**, maintaining a nuclear-qualified skilled labor base is central to sustaining these capabilities.

Standardized component designs and repeat production runs reduce per-unit costs and improve delivery timelines. Conversely, inconsistent specifications or fragmented qualification pathways can increase complexity and expense.

For Pennsylvania's industrial base, cost reduction is linked not only to financial mechanisms but also to manufacturing repeatability, certification capacity, and workforce continuity. These structural factors influence whether Pennsylvania firms remain competitive in regional, national, and global nuclear markets.

Supply Chain Readiness

The pace of nuclear deployment increasingly depends on the readiness of the industrial supply chain. Reactors require specialized manufacturing capability and nuclear-qualified components. They also depend on a deep base of technical talent to design and fabricate those systems. While many of these capabilities exist today, they remain limited in scale. Supply chain readiness has therefore become a key factor influencing project timelines and investment decisions.

Several segments of the nuclear supply chain face national constraints. Production of large nuclear components requires specialized facilities and nuclear certification. Only a small number of manufacturers currently have this capability. Expanding production often requires new equipment and significant lead time. Firms must also recruit and retain highly skilled talent. Without confidence that future projects will follow, suppliers are often hesitant to invest in expanded capacity.

Pennsylvania enters this environment with notable advantages. The commonwealth has a long history of heavy manufacturing and industrial production. Many companies already support nuclear operations through component fabrication and engineering services. Some industrial facilities also possess the physical space and equipment needed for nuclear component manufacturing. With modernization or reactivation, these facilities could help address national supply chain constraints as nuclear deployment expands.

Supply chain readiness is also shaped by the availability of skilled talent. Engineers, machinists, welders, and construction specialists support both manufacturing and plant operations. Pennsylvania's training institutions and experienced labor base provide a strong foundation for these roles while creating pathways for new talent to enter the sector. Industrial capacity and technical expertise together determine how quickly the nuclear supply chain can expand. Regions that align manufacturing capability with strong talent pipelines are better positioned to capture investment and support nuclear deployment over the long term.