



Nuclear Business and Regulatory Survey

Insights from the Nuclear Community

Tennessee Nuclear Energy Advisory Council | Survey Results | August 2024



Executive Summary

This report provides a comprehensive analysis of Tennessee's nuclear industry, drawing from survey responses to identify key trends, challenges, and opportunities. The findings offer valuable insights into the current state of the industry and highlight areas for future focus. Below are the most significant insights drawn from the survey, categorized by key areas of interest.

Key Findings

- **Respondents:** The survey showed that 66.7% of respondents were private companies, with 54% being small businesses with fewer than 100 employees. This highlights the private sector's dominant role and the importance of small enterprises in Tennessee's nuclear industry.
- **Important Sub-Sectors:** While Nuclear Power Generation remains central, there is a growing anticipation of an increase in fusion technology (50% criticality increase in 5-15 years), indicating the need for strategic investments in this emerging area.
- **Critical Resources:** Skilled labor emerged as the most critical resource, with respondents emphasizing the importance of workforce development and targeted incentives to attract and retain talent, alongside significant investments in computing and AI technologies.
- **Siting Considerations:** Proximity to other nuclear organizations is a key factor in site selection, with 72% of respondents expanding in Tennessee considering it important, underscoring the value of industry clustering for collaboration and efficiency.
- **Education and Workforce:** There is a perceived need for improvement in nuclear education programs, particularly among those actively involved in educational pipelines, highlighting the necessity for better alignment with industry needs.
- **Incentives:** The Tennessee Nuclear Fund has mixed perceptions of effectiveness, with 11.7% of respondents unaware of it, indicating a need for improved outreach, and a broader call for financial incentives like tax abatements and grants to attract businesses.

The insights gathered from this survey provide a clear picture of the current strengths and challenges within Tennessee's nuclear industry. The findings emphasize the critical need for workforce development, the anticipated rise of fusion technology, the importance of strategic siting, and the necessity of enhanced educational programs and incentives. Addressing these areas will be crucial for Tennessee to maintain its leadership in the nuclear sector and to capitalize on future growth opportunities.

Nuclear Business and Regulatory Survey

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Introduction

The Tennessee Nuclear Energy Advisory Council was established by Governor Bill Lee under Executive Order 101 with the mission of positioning Tennessee as a national leader in nuclear energy innovation and advancement. Comprising twenty members with extensive experience across various facets of the nuclear sector, the Council is charged with driving investment and creating a thriving nuclear energy ecosystem that will fuel Tennessee's economic growth, energy independence, and environmental stewardship. Governor Lee's vision is clear: "Tennessee can lead America's energy independence and deliver continued economic growth with safe, reliable, and clean nuclear energy for the future. I am confident that these appointees will use their unique industry expertise to ensure that Tennessee is the top state for nuclear energy companies to invest and succeed, creating quality jobs and greater opportunity for Tennesseans."

A dedicated subgroup of the Council, the Business and Regulatory team, played a crucial role in this effort by developing the Business and Regulatory Survey. Composed of three council members, this team focused on analyzing Tennessee's regulatory framework, evaluating business opportunities, and assessing state incentives. Their objective was to make Tennessee the most attractive location for priority nuclear sector companies, both in the near and long term. The survey they developed, consisting of 38 detailed questions, was designed to gather direct input from industry stakeholders on a range of critical topics, including demographics, nuclear subsectors, critical resources, siting considerations, education and workforce, regulatory environment, and incentives.

The survey, which was open from June 20th to August 15th, 2024, was distributed widely with the assistance of the East Tennessee Economic Council (ETEC) and the Tennessee Advanced Energy Business Council (TAEBC). These organizations were instrumental in ensuring that the survey reached a diverse array of respondents, including small businesses, large enterprises, and other stakeholders throughout Tennessee's nuclear sector. The survey aimed to gather data on economic solutions, regulatory challenges, and the broader conditions impacting the nuclear industry in Tennessee.

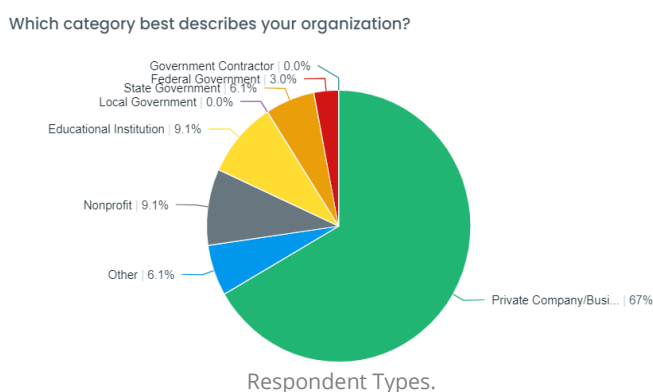
The findings from this survey are crucial to the Council's final report, which will be submitted to Governor Lee by October 31st, 2024. This report will outline a strategic path forward for Tennessee, ensuring energy independence and environmental sustainability.

Respondents: Organizational Insights

This survey had 36 respondents. Understanding their demographics and characteristics provides valuable context for interpreting their responses.

Organizational Categories and Sectors

The survey asked respondents to categorize the organization they represent. The responses revealed a wide range of organizational types, including private companies, government agencies, educational institutions, and nonprofits. Notably, **66.7%** of the respondents were private companies, reflecting the significant presence of the private sector in Tennessee's nuclear industry. In contrast, **6%** of respondents identified as government agencies.



The survey also asked respondents about the sectors of the nuclear industry they work in, such as nuclear fuel processing, higher education, radiological health, nuclear security, and spent fuel. Though nuclear service and fission power were mentioned most, the respondents' diversity highlights the multifaceted nature of the nuclear industry in Tennessee, with many organizations working across multiple sub-sectors to support the state's energy and technological needs.

Physical Presence and Expansion Interest

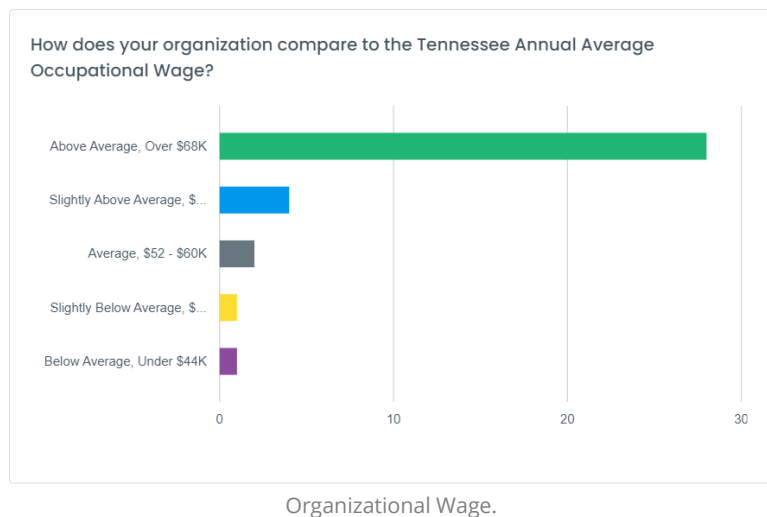
A critical aspect of the survey was understanding the respondents' geographical footprint. The data showed that **64%** of the respondents have an established physical presence in Tennessee, demonstrating the state's strong role in the nuclear industry. Moreover, **55%** of the respondents expressed interest in expanding or relocating their operations to Tennessee. This interest underscores the potential for growth in the state's nuclear sector, driven by its favorable business environment, strategic location, and commitment to supporting the industry. The combination of an existing strong presence and significant interest in expansion suggests that Tennessee is well-positioned to attract further investment in the nuclear field.

Organizational Size and Wage Competitiveness

Understanding the size and wage competitiveness of the organizations provides additional insights into their operational capabilities and economic impact. The survey revealed a mix of

both large and small organizations, with **54%** of respondents representing small businesses with fewer than 100 employees, making this the largest group.

Regarding wage competitiveness, an impressive **89%** of the respondents indicated that their wages are above the Tennessee Annual Average Occupational Wage, as per the January 2024 data from the Tennessee Department of Revenue¹. This finding indicates the high skill levels required in the nuclear industry, where specialized knowledge and experience are often compensated with higher-than-average salaries.



Experience in the Nuclear Industry

The survey also explored the longevity of the organizations within the nuclear industry. Responses indicated a wide range of experience, with several organizations having operated for **more than 26 years**. Notably, the majority of these long-established organizations were identified as private companies. This emphasizes the significant role that private businesses play in the nuclear industry, particularly among those with extensive experience.

The demographic profile of the respondents paints a comprehensive picture of Tennessee's nuclear industry. The majority of respondents are well-established private companies with a strong physical presence in the state. However, there is also significant interest from organizations looking to expand or relocate to Tennessee, highlighting the state's attractiveness as a hub for nuclear activities.

With a mix of large and small organizations, competitive wages, and a balance of long-standing experience and new entrants, Tennessee's nuclear industry is both robust and poised for future

¹ Tennessee Annual Average Occupational Wage, <https://www.tn.gov/revenue/taxes/franchise---excise-tax/exemptions/job-tax-credit/annual-average-occupational-wage.html>

growth. The insights gained from these demographic questions provide a solid foundation for understanding the needs, challenges, and opportunities facing the nuclear sector in Tennessee.

Critical Nuclear Industry Sub-Sectors

The Survey has provided key insights into the anticipated growth of critical sub-sectors within the nuclear industry. This analysis isolates the differences between near-term (current or short-term) and long-term (future or expansion) predictions of criticality, highlighting five sub-sectors expected to see significant growth in importance.

Among these, **Fusion Power Generation** emerged as the most promising area, with a 50% increase in predicted criticality from near-term to long-term. One respondent emphasized, *"These sectors are where the industry is heading and in growth mode."* This suggests that fusion energy is seen as a key future technology, particularly by private companies, which were the most likely to foresee its growing importance. The potential of fusion as a clean and abundant energy source drives interest and investment in this area.

Medical Isotopes also saw a substantial 25% increase in importance, particularly highlighted by educational institutions and energy advisors. Respondents noted Tennessee's high potential for growth, with one remarking, *"Highest potential for growth in Tennessee."* This subsector's critical role in medical diagnostics and treatment ensures its growing relevance as the demand for advanced healthcare solutions continues to rise.

The **Back End of the Nuclear Fuel Cycle**, essential for the management and disposal of nuclear waste, showed a 25% increase in predicted criticality. Nonprofit organizations were particularly focused on this area, with one respondent underscoring its importance by stating, *"These are essential to the growth of the nuclear industry."* This highlights the need for sustainable and safe waste management practices as the industry evolves.

Fission Power or Heat Generation remains a cornerstone of the nuclear industry, with a 11% increase in its predicted importance. Private companies, heavily invested in this area, see it as a reliable source of energy crucial to meeting global energy demands. One survey respondent articulated this sentiment by saying, *"Increasing sustainable, net-zero carbon emission electrical power generation is crucial to our customers and stakeholders."*

Lastly, the **Front End of the Nuclear Fuel Cycle**, encompassing uranium mining and fuel fabrication, is expected to see a 27% increase in criticality. This sub-sector was most frequently highlighted by educational institutions, with predictions likely driven by the sheer volume of business and future needs, as noted by one respondent: *"Based on business volume."* This underscores the need for continued research and development to ensure a steady supply chain for the nuclear industry.

Private companies were the primary drivers behind the predicted growth in **Fusion Power Generation** and **Fission Power or Heat Generation**, reflecting their strong commercial interest in these areas. In contrast, **Medical Isotopes** and the **Front End of the Nuclear Fuel Cycle** were largely highlighted by educational institutions, while nonprofits focused on the **Back End of the Nuclear Fuel Cycle**.

Given these findings, it is recommended that the government strategically focus on supporting these five critical sub-sectors. This could involve targeted investments in research and development, incentives for private sector involvement, and the creation of policies that support the sustainable growth of these areas. By concentrating efforts on these emerging and expanding sub-sectors, Tennessee can position itself as a leader in the future of nuclear energy, driving economic growth and technological innovation for the long term.

Critical Resources

In analyzing the responses related to the specialized equipment, resources, or components critical to the nuclear industry over the next 1-15 years, four key categories emerged as the most significant: **Labor or Workforce**, **Funding**, **Computing or Artificial Intelligence (AI)**, and **Radiological Source Material**. These categories represent the core areas where the industry anticipates substantial challenges and needs.

Labor or Workforce

The most frequently mentioned critical resource was the availability and retention of skilled labor. Survey respondents repeatedly emphasized the challenges in finding experienced staff, particularly those with expertise in power generation, transmission, and distribution. One respondent noted that "Finding experienced staff with power generation, transmission, and distribution" is a significant long-term concern, reflecting the broader issue of workforce availability in the nuclear sector. Another respondent highlighted, "Likely the access to capable personnel will remain an issue into the 5-15 year time span," underscoring the ongoing difficulty in securing "Skilled craft workers and staff" as a long-term challenge.

We most need a "quality workforce to meet the new manufacturing challenges"

Funding

Funding emerged as another crucial resource, especially concerning the support needed for education and continuous skill development. In particular, an institute of higher education stated, "Funding is needed for education to support **ongoing educational needs**, albeit less than an initial start-up," emphasizing the need for sustained financial support to maintain the educational pipelines that feed into the industry. This response highlights a broader concern that while initial funding may be in place, the ongoing financial commitment to education is necessary to ensure a steady stream of skilled workers and the development of new technologies.

Computing or Artificial Intelligence (AI)

The growing importance of computing resources and AI was another key theme. As one respondent pointed out, "Artificial Intelligence...has recently become a new and significantly important tool useful towards effectively coordinating the flow of such information." The anticipated expansion of AI's role in the industry suggests that AI will become increasingly critical in optimizing operations, managing complex data, and potentially advancing nuclear

fusion feasibility. Another respondent simply stated, "**Computational resources**," indicating the foundational role that computing technology plays in both current and future operations.

Radiological Source Material

Lastly, radiological source materials, including uranium, neutrons, gamma-rays, and other radiation sources, were highlighted as essential for both current and future operations. The statement, "**Sources** of neutrons, gamma-rays, and other radiation" points to the ongoing need for reliable access to these materials, which are crucial for a wide range of nuclear applications. Additionally, respondents noted the need for "Pressure vessels, graphite, uranium conversion, and enrichment," indicating the specific materials and processes vital for maintaining and advancing nuclear technologies.

Expected Energy Consumption

While most survey respondents indicated that they **do not anticipate a significant increase** in their energy consumption, there were notable exceptions. One respondent, who is currently located out of state but **plans to relocate to Tennessee, highlighted the need for a significant increase in energy** consumption due to their future operations or expansion plans. This indicates that while many organizations may have stable or slightly increasing energy needs, key players are planning to move into the state who will require substantial energy resources to support their growth. This highlights the importance of ensuring that Tennessee's energy infrastructure can support such expansions, particularly for new entrants to the state.

In conclusion, the nuclear industry faces critical challenges in securing labor, funding, advanced computing resources, and radiological materials to support its operations and future growth. While most organizations expect stable energy consumption, new entrants' potential for significant increases underscores the need for careful planning in Tennessee's energy infrastructure. Addressing these critical resources will ensure that the state can attract and support the growth of nuclear organizations, ultimately contributing to the industry's long-term success.

Siting Considerations

When organizations in the nuclear industry consider where to site their operations, a range of factors come into play. This section summarizes the key siting considerations identified by respondents, from the need for additional space to the importance of logistics and transportation.

A clear majority 72% of those planning to expand or relocate to Tennessee consider proximity to other nuclear entities as "Important" or "Very Important."

Additional Space Requirements

The majority of organizations indicated that additional space, land, or property is not critical to their current or future operations. Specifically, 34 respondents stated that additional space is "Not critical" for their short-term (1-3 years) operations, and 29 respondents felt the same about their long-term (5-15 years) needs. However, a small number of organizations do require additional space, with a few indicating needs ranging from 1 to 100 acres, particularly for long-term expansion.

Interestingly, **71%** of the respondents who indicated a critical need for additional acreage are based in Tennessee. This suggests that local organizations are likely to be the primary drivers of future growth in the state's nuclear industry.

Proximity to Other Nuclear Organizations

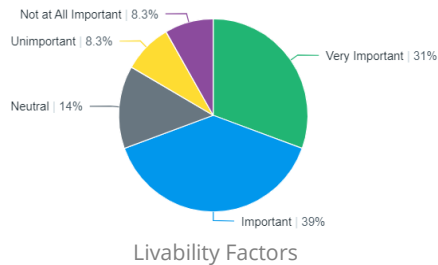
Proximity to other nuclear organizations is another significant consideration for many respondents. A clear majority—**72%** of those planning to expand or relocate to Tennessee—consider proximity to other nuclear entities as "Important" or "Very Important." This suggests that for most expanding organizations, being close to industry peers is a key factor in their siting decisions.

Connection with the Surrounding Community

Most organizations highly value maintaining a strong connection with the surrounding community. A total of 30 respondents rated this as either "Very Important" or "Important," emphasizing the significance of community engagement in their operations. None of the organizations planning to expand or relocate to Tennessee considered community connection "Unimportant," highlighting the priority placed on positive community relations for those businesses ready to grow.

Workers' Livability Factors

How important are workers livability factors, such as housing, daycare, or public transportation, affecting your siting decisions?



Workers' livability factors, such as housing, daycare, and public transportation, also play a critical role in siting decisions for many organizations. The majority of respondents—**70%**—consider these factors as "Important" or "Very Important." This indicates that organizations are keenly aware of the need to support the well-being of their employees to attract and retain a skilled workforce.

Other Important Siting Considerations

When asked about other considerations in siting efforts, respondents highlighted a variety of factors. Three dominant themes emerged:

1. **Proximity (to Clients and Other Industry):** Many organizations emphasized the importance of being close to their client base and other industry players.
2. **Taxes and Financial Considerations:** Tax incentives, such as abatements and subsidies, are significant factors in site selection.
3. **Proximity to Workforce:** Access to a skilled labor force is essential, with organizations recognizing the need to be near labor markets that can support their operational needs.

Logistics and Transportation

Special logistical concerns appear to be largely irrelevant for most organizations. The majority of respondents indicated that they do not have unique requirements for logistics and transportation.

In summary, as Tennessee continues to develop its nuclear industry, understanding and addressing these diverse siting considerations will be crucial for supporting the growth and success of organizations within the state.

Education and Workforce

Tennessee's nuclear industry's success hinges on its educational pipelines' effectiveness and the ability to attract, retain, and develop skilled talent. The following section synthesizes responses from key industry stakeholders, providing insights into current perceptions and recommendations for improvement.

Effectiveness of Tennessee's Nuclear Education Programs

When asked about the effectiveness of Tennessee's nuclear education programs in cultivating a skilled workforce, responses were mixed. The largest group of respondents rated the programs as **"Slightly Effective,"** reflecting a recognition that, while beneficial, the programs have room for improvement. A significant number of participants were "Neutral" or "Unsure," indicating a lack of strong endorsement or possibly insufficient engagement with these programs.

Organizations more involved in educational pipelines were more critical, suggesting that those with closer ties to these programs see gaps that need to be addressed. These involved entities could be invaluable in guiding future improvements, as they are likely to have a clear understanding of where current programs fall short.

Critical Careers: Short-Term and Long-Term Needs

Tennessee's nuclear industry identifies several key roles as critical for both the short-term (1-3 years) and long-term (5-15 years). **Nuclear Engineers** emerged as the most crucial occupation, mentioned 33 times across both time frames. This highlights the consistent demand for this role, vital for the industry's ongoing operations and expansion.

Other significant roles include **Health Physicists, Radiation Protection Technicians, Construction Tradesmen,** and **Maintenance Tradesmen.** These occupations are critical for maintaining safety standards, constructing and maintaining facilities, and ensuring operational efficiency. Interestingly, private companies within the industry highlighted these roles as particularly vital. The consistency of these mentions underscores the importance of developing specialized skills in these areas to meet both current and future demands.

Involvement in Educational Pipelines

Despite the recognition of critical roles, there is a notable gap in involvement with educational programs. Among those who did rate Tennessee's education programs as effective, none were highly involved in the educational pipelines. This suggests that those who see the value in these programs might not be directly engaged in shaping them, potentially limiting the impact of their

insights. Conversely, those who are more engaged with these pipelines expressed a need for improvement. Their feedback indicates that closer collaboration between industry and education providers could lead to more tailored and effective programs.

Improving Tennessee's Educational Pipelines

Respondents offered several suggestions for enhancing Tennessee's educational pipelines. A common theme was the need to start early, with a stronger focus on STEM (Science, Technology, Engineering, and Mathematics) education at the K-12 level. Additionally, collaboration with community colleges was also highlighted as a critical step. By aligning college programs more closely with industry needs, Tennessee could ensure that graduates are well-prepared to enter the nuclear workforce.

Attracting, Retaining, and Developing Talent

To attract and retain talent, respondents emphasized the need for visible progress and commitment within the nuclear industry. Early exposure to identify students with a passion for nuclear science and guide them through a well-supported educational pathway could help build a strong future workforce. As one respondent said, "Tennessee seems to have impressive pipelines in place, but needs to focus on recruitment of students to fill those pipelines who wish to enter the nuclear industry."

Tennessee...needs to focus on recruitment of students to fill those pipelines.

Incentives, both financial and professional, were frequently mentioned. Addressing cost-of-living concerns and improving the state's overall appeal as a place to live and work were also noted as important factors. Additionally, enhancing Tennessee's image as a progressive and supportive environment for nuclear energy could further attract top talent.

The feedback from industry stakeholders provides a clear roadmap for strengthening Tennessee's educational pipelines and workforce development efforts. By focusing on early education, industry collaboration, and visible progress, Tennessee can position itself as a leader in the nuclear industry and ensure that it has the skilled workforce needed to support future growth.

Regulatory Environment

The regulatory landscape is critical to the success and growth of Tennessee's nuclear industry. Effective regulation ensures safety and quality, but it can also present significant challenges for organizations. This section examines the responses to several key questions about the regulatory environment in Tennessee.

The Cost and Burden of NQA-1 Certification

One aspect of the regulatory environment specifically asked about was the NQA-1 Certification². This certification process, a critical quality assurance standard in the nuclear industry, is perceived by many as both costly and burdensome. According to the survey:

- **70%** of respondents who are subject to the NQA-1 Certification process indicated that it is "Moderately," "Very," or "Extremely Costly or Burdensome."
- The certification involves extensive documentation, time-consuming audits, and significant costs, particularly for smaller organizations.

These figures underscore the substantial impact of the NQA-1 Certification process on companies operating in Tennessee. For many, the burden of certification can divert resources away from other important areas, such as innovation and workforce development. Addressing these challenges could involve streamlining the certification process, providing financial support, or offering technical assistance to help organizations navigate the requirements more efficiently.

Tennessee's Regulatory Environment for Nuclear Technology

The overall regulatory environment in Tennessee received mixed reviews from respondents:

- **75.9%** of respondents found the environment to be either "Very Conducive" or "Conducive" to the establishment and growth of nuclear technology.
- **22%** felt it was only "Slightly Conducive," and **only one** respondent described it as "Not Very Conducive."

² The American Society of Mechanical Engineers, Nuclear Quality Assurance (NQA-1) Certification, <https://www.asme.org/certification-accreditation/nuclear-quality-assurance-nqa1-certification>

These responses suggest that while the majority of organizations view Tennessee's regulatory environment positively, while the one respondent who rated the environment as "Not Very Conducive" was not currently located in Tennessee. This indicates that these concerns may be more pronounced among companies unfamiliar with the state rather than those already established here.

Challenges in Navigating Tennessee's Regulatory Landscape

When asked about specific challenges or obstacles encountered in Tennessee's regulatory landscape, respondents provided a range of insights, which can be grouped into four key categories:

1. Regulatory Complexity and Overlap:

- Respondents noted the involvement of too many agencies and regulatory bodies, which complicates the process of navigating regulations.
- Knowing who the key players are and understanding their roles at different stages in the process were also identified as challenges.

2. Licensing and Funding Challenges:

- Licensing and funding were highlighted as significant obstacles, particularly in terms of obtaining local and state regulatory support during plant expansions or new developments.

3. Access and Infrastructure Issues:

- Access to national laboratories and utilities was cited as a specific challenge, indicating that infrastructure and resource availability are critical considerations for companies operating in Tennessee.

4. No Significant Obstacles or Not Applicable:

- A substantial portion of respondents indicated that they did not face significant obstacles, or that the question was not applicable to their situation, suggesting that for many, the regulatory environment in Tennessee is functioning effectively.

How Tennessee Can Assist with Regulatory Compliance

Respondents offered several suggestions for how Tennessee could better assist organizations in achieving regulatory milestones or compliance. Notable responses include:

1. Communication and Networking:

- Enhancing communication and networking abilities, similar to the E4 Carolinas model, was suggested as a way to improve collaboration and streamline

regulatory processes. By fostering stronger connections between stakeholders, Tennessee could help organizations navigate the regulatory landscape more effectively.

2. Consistent Regulatory Support:

- Providing consistent support and thoroughly evaluating proposed regulatory changes were highlighted as critical needs. By ensuring that regulatory updates are clear and predictable, Tennessee can help companies maintain compliance without facing unexpected challenges.

3. Investment in Education and Talent Development:

- Continuing to invest in education and workforce development was emphasized as a key area where Tennessee can make a difference.

4. Early Engagement with Businesses:

- Early engagement with Tennessee-based businesses was identified as an important strategy for helping organizations navigate regulatory requirements.

These suggestions highlight the importance of proactive support from the state, both in terms of regulatory consistency and in fostering a strong, well-connected industry community.

The regulatory environment in Tennessee is a critical component of the state's nuclear industry, with significant implications for the success and growth of organizations operating in this sector. While many respondents view the environment as conducive to growth, there are clear challenges that need to be addressed. By focusing on these key areas will not only help organizations achieve regulatory compliance more efficiently but will also foster a more innovative and resilient nuclear sector in the state.

Nuclear Industry Incentives

Incentives the State's commitment to supporting the industry and can significantly impact the financial viability of establishing or expanding operations. This section explores responses related to the Tennessee Nuclear Fund, the types of incentives most valued by industry stakeholders, specific federal incentives, and the cost burdens that companies face in both the short and long term.

The Tennessee Nuclear Fund: Signaling State Commitment

The Tennessee Nuclear Fund was established to demonstrate the state's commitment to supporting the nuclear industry. When asked whether the Fund is sufficiently signaling this commitment, responses varied, reflecting different perceptions of the Fund's effectiveness. The responses to the question "Is the Tennessee Nuclear Fund sufficiently signaling the State's commitment to the nuclear industry?" from the survey are as follows:

- **Strongly Agree:** 23.5% of respondents
- **Agree:** 29.4% of respondents
- **Neutral:** 29.4% of respondents
- **Haven't heard of the fund:** 11.7% of respondents
- **Strongly Disagree:** 2.9% of respondents
- **Disagree:** 2.9% of respondents

A notable observation is that all respondents who were unfamiliar with the fund, as well as those who disagreed or strongly disagreed with its effectiveness, were based in Tennessee. This suggests that awareness of the Tennessee Nuclear Fund may need to be enhanced within the state, particularly among local stakeholders who could benefit from its support. Despite this, a significant portion of respondents did express agreement or strong agreement, indicating that the Fund is a positive step forward, although there is room for improvement in outreach and communication.

Effective Financial Incentives and Support Mechanisms

When asked about the types of financial incentives or support mechanisms that would be most effective in encouraging organizations to establish or expand operations in Tennessee, several key themes emerged:

1. Tax Incentives:

- Tax abatements and credits were frequently mentioned as effective incentives.

2. Direct Financial Support:

- Grants and low-interest loans were also highlighted as valuable tools.

3. Support for Workforce Development:

- Incentives aimed at workforce training and development were considered crucial.

4. Infrastructure Investment:

- Respondents also pointed to the importance of state investment in infrastructure, including utilities, transportation networks, and research facilities.

Federal Incentives Supporting the Nuclear Industry

Respondents highlighted several important federal incentives and programs that play a crucial role in supporting the nuclear industry. These include:

1. IRA Production Tax Credits (PTCs):

- The Inflation Reduction Act (IRA) includes extended and expanded Production Tax Credits for nuclear power, providing financial incentives based on the amount of electricity generated by qualifying facilities.

2. Advanced Reactor Demonstration Program (ARDP):

- The ARDP is a U.S. Department of Energy (DOE) initiative that provides funding to accelerate the development and deployment of advanced nuclear reactors. This program supports demonstration projects for new reactor designs, including small modular reactors (SMRs), which are crucial for the future of the nuclear industry.

3. High-Assay Low-Enriched Uranium (HALEU) Incentives:

- HALEU is critical for many advanced nuclear reactors, and the DOE has established programs to ensure a domestic supply chain for this fuel.

These federal incentives provide critical financial support, reduce regulatory barriers, and ensure the availability of necessary resources, such as HALEU. Together, they complement state-level incentives and play a significant role in fostering the growth and innovation of Tennessee's nuclear industry.

Significant Cost Burdens in the Short and Long Term

Understanding the specific cost burdens that organizations face is key to designing effective incentives. Respondents provided examples of significant cost burdens in both the short-term (1-3 years) and long-term (5-15 years):

1. Short-Term Cost Burdens:

- **Regulatory Compliance Costs:** Many respondents highlighted the costs associated with regulatory compliance, particularly the expenses related to meeting stringent safety and quality standards like the NQA-1 Certification. These costs can be a major financial strain, especially for smaller companies.
- **Initial Capital Investment:** The high upfront costs of establishing operations, including purchasing land and equipment and securing permits, were also noted as significant short-term burdens.

2. Long-Term Cost Burdens:

- **Sustained Operational Costs:** In the long term, the ongoing costs of maintaining compliance with evolving regulations, as well as the expenses associated with facility upgrades and expansions, were cited as major financial challenges.
- **Workforce Retention and Training:** The cost of retaining and continually training a skilled workforce was another significant long-term burden.

Leveraging Federal Programs

In addition to state-level incentives, respondents emphasized the importance of leveraging current federal programs that incentivize nuclear energy. Some key points include:

1. Federal Research Grants:

- Several respondents pointed to federal research grants as a critical resource for advancing nuclear technology.

2. Department of Energy (DOE) Support:

- The DOE offers a range of programs that support nuclear energy, including funding for reactor design, safety research, and workforce training. Respondents emphasized the importance of actively pursuing DOE support to complement state-level incentives.

3. Public-Private Partnerships:

- Federal initiatives that promote public-private partnerships were also mentioned as valuable tools. These partnerships can bring together government resources

and private sector expertise to drive innovation and growth in the nuclear industry.

Leveraging these federal programs, in conjunction with state-level incentives, can provide a comprehensive support system for nuclear companies in Tennessee.

The Tennessee Nuclear Fund is a strong signal of the state's commitment, but additional incentives, such as tax abatements, grants, and workforce development support, are needed to fully realize the state's potential as a hub for nuclear innovation. Addressing the significant cost burdens faced by companies, both in the short and long term will be key to attracting and retaining businesses.

Audience Poll from NOW

In addition to the Business and Regulatory Survey, the Business and Regulatory team sought to compare and contrast its findings with those from a separate audience poll conducted by the East Tennessee Economic Committee (ETEC) during their Nuclear Opportunities Workshop (NOW) on July 31st, 2024. The ETEC NOW conference provided a platform for real-time audience engagement, offering immediate feedback to prompt further discussion among attendees.

Poll Overview

The audience poll conducted at the ETEC NOW conference served as an interactive tool, capturing the opinions and priorities of attendees across various sectors within the nuclear industry. The audience, comprising nuclear engineers, policymakers, educators, students, and business professionals, was prompted to respond to several key questions related to economic incentives, workforce development, and the strategic importance of regional clusters and regulatory facilitation.

Key Poll Questions and Findings

1. Economic Incentives for Locating Companies

The first question asked attendees to identify the top three economic incentives most important to them when considering locating their company in a particular state. The options included tax incentives, grants and direct funding, subsidized loans, relocation and training grants, utility incentives, infrastructure support, regulatory flexibility, and land availability.

- Top Responses: Out of 117 respondents, the most frequently selected incentives were Infrastructure Support, Tax Incentives, and Grants and Direct Funding. This aligns with findings from the Business and Regulatory Survey, emphasizing the importance of robust infrastructure and financial support to attract nuclear businesses.

2. Importance of a Nuclear Energy Workforce Center

The second question gauged the importance of establishing a Nuclear Energy Workforce Center in Tennessee, focusing on collaboration, education, training, and career awareness.

- Key Insight: Of the 124 respondents, 94% considered establishing such a center to be moderately to extremely important. This reflects a strong consensus on the need for enhanced

educational and training facilities, mirroring sentiments expressed in the Council's survey about workforce development needs.

3. Interest in Locating Nuclear Business in Tennessee

The third question explored whether attendees considered locating their nuclear business in Tennessee.

- Response Breakdown: Among the 97 respondents, 17% were actively planning or considering relocating to Tennessee, 6% were not considering it, and a significant 76% were already operating within the state. This shared insight from both the poll and the survey emphasizes the importance of focusing on businesses already in Tennessee and supporting their expansion through targeted incentives and a favorable regulatory environment.

4. Priorities for Workforce Development

The fourth question asked respondents to rank their top three priorities for workforce development from a list of areas identified by the Tennessee Nuclear Energy Advisory Council (TNEAC).

- Top Priorities: Out of 96 respondents, the highest-ranked priorities were Skilled Craft Workforce, Project Controls, and STEM Certifications. These priorities closely reflect the survey results, which also identified a strong need for skilled labor and specialized training programs. The consistent focus on workforce development across both the poll and the survey highlights a critical area for state intervention, particularly in expanding educational and training pipelines to meet industry demands.

5. Attractiveness of Regional Clusters and Innovation Sites

The fifth question examined the attractiveness of regional clusters of nuclear technology and mixed-use nuclear innovation sites for business operations.

- Attractiveness Ratings: Out of 96 respondents, 80% found regional clusters and innovation sites to be somewhat to highly attractive for their business. This aligns with the survey findings that emphasize the importance of proximity to other nuclear organizations for collaboration and operational efficiency.

6. Establishment of a Regulatory and Business Development Facilitation Team

The final question explored the potential benefits of a state-level regulatory and business development facilitation team.

- Perceived Benefits: Of the 96 respondents, 72% indicated that such a team would be somewhat or highly beneficial to their operations. This response suggests a need for streamlined regulatory processes, a theme also prominent in the Council's survey.

In conclusion, the audience poll conducted at the ETEC NOW conference provides valuable complementary insights to the Business and Regulatory Survey. Both the poll and the survey highlight common themes, such as the importance of economic incentives, workforce development, regulatory facilitation, and strategic site selection. These findings will help inform the final report and recommendations to Governor Lee as the Council continues to position Tennessee as a leader in the nuclear energy sector.

Survey Limitations

In any survey-based study, understanding the limitations of the data collection process is crucial for contextualizing the results. While the responses gathered provide valuable insights into Tennessee's nuclear industry, several limitations should be acknowledged.

Low Number of Respondents

One significant limitation of this survey is the relatively low number of respondents. Thirty-six individuals participated in this survey. Although the responses gathered offer important insights, the small sample size suggests that these insights may not fully capture the diversity of opinions and experiences within Tennessee's nuclear sector.

Missed Question Opportunities

Feedback from the survey highlighted some areas where the questions could have been deeper or more comprehensive. Two key themes emerged from this feedback:

1. **Funding Awareness and Accessibility:** Respondents suggested that the survey should have included more detailed questions about funding opportunities and the accessibility of these funds. Specifically, there was interest in understanding how businesses can better access federal and state funding, such as the Tennessee Nuclear Fund or federal grants.
2. **Nuclear Safety Culture:** Another significant area of feedback was the absence of questions related to nuclear safety culture. Given the importance of maintaining a strong safety culture within the nuclear industry, questions in this area could have helped assess how Tennessee's nuclear enterprises are addressing safety concerns and adhering to industry norms.

These missed opportunities suggest that future surveys could benefit from a broader scope and more targeted questions, particularly in areas critical to the nuclear industry's long-term success and regulatory compliance.

Conclusion

The Tennessee Nuclear Energy Advisory Council, established by Governor Bill Lee, embarked on a comprehensive mission to position Tennessee as a national leader in nuclear energy innovation and advancement. A critical element of this mission was the Business and Regulatory Survey, designed to gather essential insights from stakeholders across the nuclear industry. This survey was undertaken to explore economic opportunities, identify regulatory challenges, and assess the effectiveness of current incentives, all with the goal of ensuring that Tennessee remains an attractive destination for nuclear energy companies.

The survey, consisting of 38 detailed questions, was conducted between June 20th and August 15th, 2024. It covered a wide range of topics, including demographics, nuclear subsectors, critical resources, siting considerations, education and workforce, regulatory environment, and incentives. With the support of the East Tennessee Economic Council (ETEC) and the Tennessee Advanced Energy Business Council (TAEBC), the survey reached a diverse array of respondents, providing a comprehensive overview of the current state of Tennessee's nuclear industry. Key findings from the survey highlighted the critical role of the private sector in Tennessee's nuclear industry, the importance of workforce development, the anticipated rise of fusion technology, and the need for enhanced educational programs and incentives. Additionally, the survey revealed mixed perceptions about the effectiveness of the Tennessee Nuclear Fund, underscoring the need for improved outreach and communication.

Respondents: The survey showed that 66.7% of respondents were private companies, with 54% being small businesses with fewer than 100 employees. This highlights the private sector's dominant role and the importance of small enterprises in Tennessee's nuclear industry.

Important Sub-Sectors: While Nuclear Power Generation remains central, there is a growing anticipation of an increase in fusion technology (50% criticality increase in 5-15 years), indicating the need for strategic investments in this emerging area.

Critical Resources: Skilled labor emerged as the most critical resource, with respondents emphasizing the importance of workforce development and targeted incentives to attract and retain talent, alongside significant investments in computing and AI technologies.

Siting Considerations: Proximity to other nuclear organizations is a key factor in site selection, with 72% of respondents considering it important, underscoring the value of industry clustering for collaboration and efficiency.

Education and Workforce: There is a perceived need for improvement in nuclear education programs, particularly among those actively involved in educational pipelines, highlighting the necessity for better alignment with industry needs.

Incentives: The Tennessee Nuclear Fund has mixed perceptions of effectiveness, with 11.7% of respondents unaware of it, indicating a need for improved outreach and a broader call for financial incentives like tax abatements and grants to attract businesses.

These findings are consistent with the audience poll from ETEC's NOW conference and provide valuable insight into the industry's needs. They are also vital in informing the Council's final report to Governor Lee. Due to be submitted by October 31st, 2024, this report will provide strategic recommendations to foster Tennessee's leadership in the nuclear energy sector. The recommendations will address the industry's current needs while anticipating future developments, ensuring that Tennessee remains at the forefront of nuclear energy innovation, economic growth, and energy independence.

The Business and Regulatory Survey has provided invaluable insights that will guide the Council in shaping policies and strategies to support and expand Tennessee's nuclear industry. By leveraging these findings, Tennessee can continue to build a robust nuclear energy ecosystem that benefits the state and contributes to the nation's energy future.

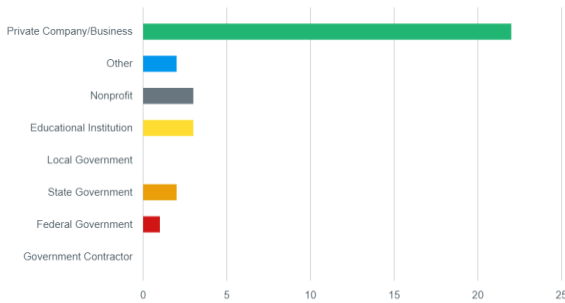
Appendix 1: List of Survey Questions.

1. Which category best describes your organization?
2. Which sectors of the nuclear industry does your organization work in (choose all that apply)?
3. Does your organization have a physical presence in Tennessee?
4. Is your organization interested in expanding or relocating to Tennessee?
5. How many employees does your organization have?
6. How does your organization compare to the Tennessee Annual Average Occupational Wage?
7. How long has your organization operated in the nuclear field?
8. What is the most critical nuclear sub-sectors to your current or short-term (1-3yr) operations? (choose up to three)
9. What is the most critical nuclear sub-sectors to your future operations or expansion (5-15yr)? (choose up to three)
10. Why are these sectors important to your operations?
11. What specialized equipment, resources, or components are most critical to your current or short-term (1-3yr) operations, and why?
12. What specialized equipment, resources, or components are most critical to your future operations or expansion (5-15yr), and why?
13. Please name a resource, or resources, your organization relies on that is difficult to acquire, hard to access, or susceptible to very volatile markets.
14. How much do you anticipate your energy consumption will need to increase due to your future operations or expansion (5-15yr)?
15. Is additional space, land or property, critical to your current or short-term (1-3yr) operations, and if so, how much?
16. Is additional space, land or property, critical to your future operations or expansion (5-15yr), and if so, how much?
17. How important is the physical proximity to other nuclear organizations factor into your siting decisions?
18. How important is it for your organization to have a strong connection with its surrounding community?
19. How important are workers' livability factors, such as housing, daycare, or public transportation, affecting your siting decisions?
20. What other considerations are important in your organization's siting efforts?

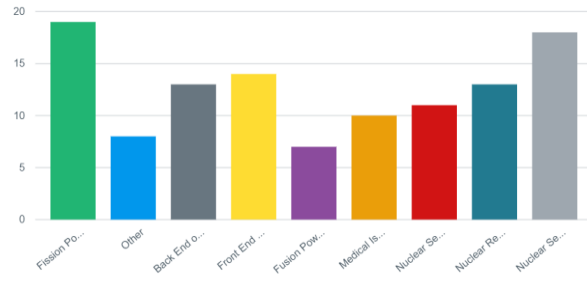
21. Does your organization have unique requirements for logistics and transportation, and if so, what are they?
22. How effective are Tennessee's nuclear education programs at cultivating a skilled workforce and meeting your organization's labor needs?
23. What skills, vocations, or careers are most critical to your current or short-term (1-3yr) operations? (choose up to three)
24. What skills, vocations, or careers are most critical to your future operations or expansion (5-15yr)? (choose up to three)
25. How involved is your organization in the current education pipelines that feed the skills and careers your organization depends on?
26. How can Tennessee improve its educational pipelines to train the workforce to meet labor demands?
27. In what ways do you think Tennessee can improve its efforts to attract, retain, and develop talent relevant to the nuclear industry?
28. How costly or burdensome do you find the NQA-1 Certification process for your company?
29. If you selected "Moderately," "Very," or "Extremely Costly or Burdensome," please indicate which aspects of the NQA-1 Certification process you find most burdensome.
30. To what extent do you believe the current regulatory environment in Tennessee is conducive to the establishment and growth of nuclear technology?
31. What specific challenges or obstacles do you encounter when navigating the regulatory landscape for nuclear technologies in Tennessee?
32. How can Tennessee assist your organization in achieving regulatory milestones or compliance?
33. Is the Tennessee Nuclear Fund sufficiently signaling the State's commitment to the nuclear industry?
34. What types of financial incentives or support mechanisms would be most effective in encouraging your organization to establish or expand operations in our state?
35. Please give an example of a significant cost burden that affects your current or short-term (1-3yr) operations.
36. Please give an example of a significant cost burden that affects your future operations or expansion (5-15yr).
37. Are there current, former, or proposed incentive programs outside of Tennessee that could be replicated or adopted in our state, and if so, which?
38. Are there current programs, such as federal grants, that incentivize nuclear energy that the State and/or organizations can actively take advantage of, and if so, which?

Appendix 2: Survey Result Graphs.

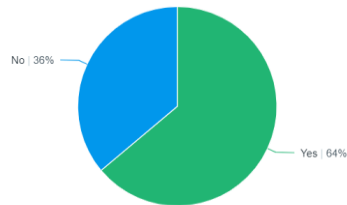
Which category best describes your organization?



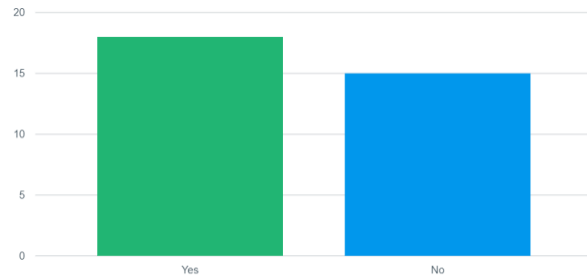
Which sectors of the nuclear industry does your organization work in (choose all that apply)?



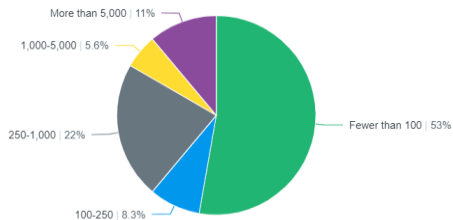
Does your organization have a physical presence in Tennessee?



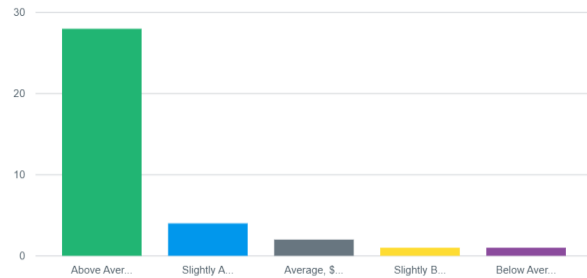
Is your organization interested in expanding or relocating to Tennessee?



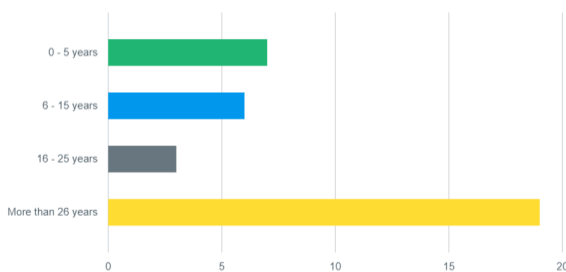
How many employees does your organization have?



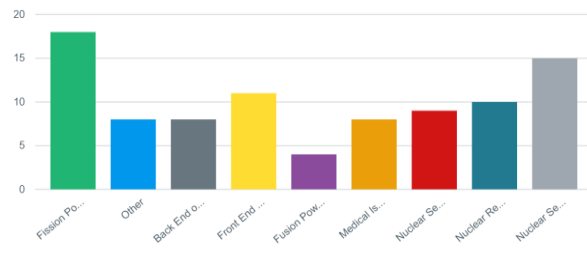
How does your organization compare to the Tennessee Annual Average Occupational Wage?



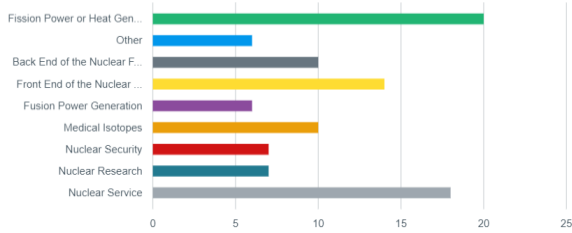
How long has your organization operated in the nuclear field?



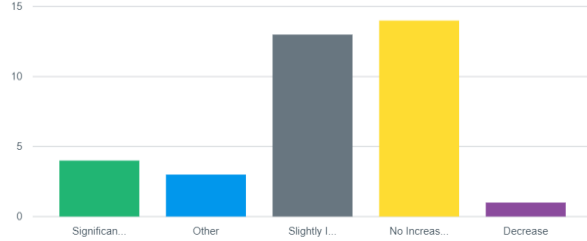
What is the most critical nuclear sub-sectors to your current or short-term (1-3yr) operations? (choose up to three)



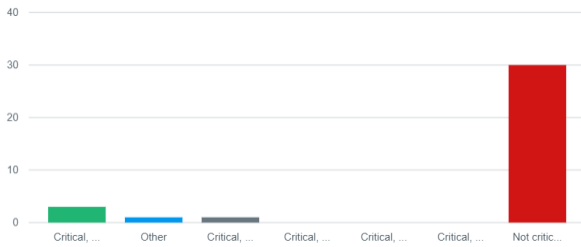
What is the most critical nuclear sub-sectors to your future operations or expansion (5-15yr)? (choose up to three)



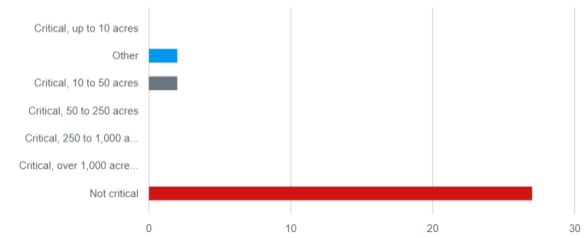
How much do you anticipate your energy consumption will need to increase due to your future operations or expansion (5-15yr)?



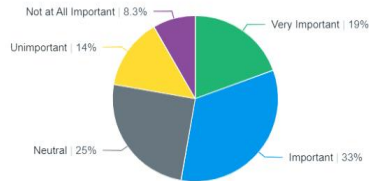
Is additional space, land or property, critical to your current or short-term (1-3yr) operations, and if so, how much?



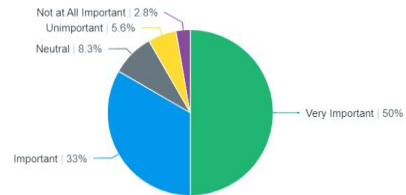
Is additional space, land or property, critical to your future operations or expansion (5-15yr), and if so, how much?



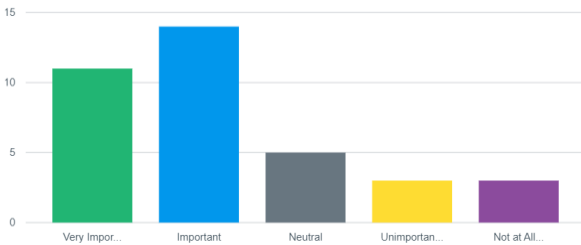
How important is the physical proximity to other nuclear organizations factor into your siting decisions?



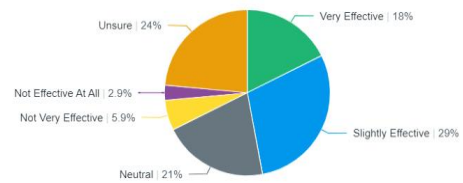
How important is it for your organization to have a strong connection with its surrounding community?



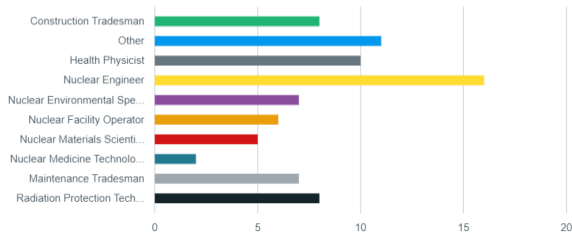
How important are workers' livability factors, such as housing, daycare, or public transportation, affecting your siting decisions?



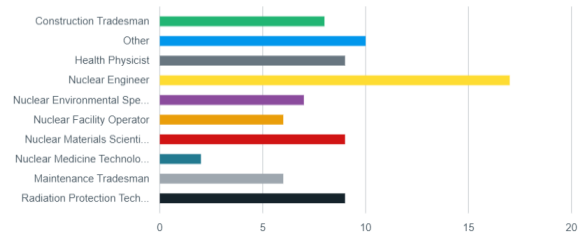
How effective are Tennessee's nuclear education programs at cultivating a skilled workforce and meeting your organization's labor needs?



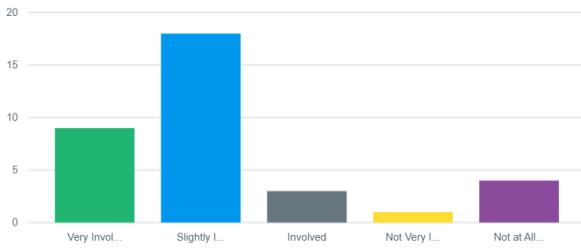
What skills, vocations, or careers are most critical to your current or short-term (1-3yr) operations? (choose up to three)



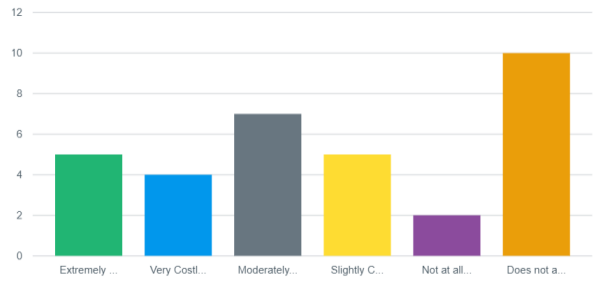
What skills, vocations, or careers are most critical to your future operations or expansion (5-15yr)? (choose up to three)



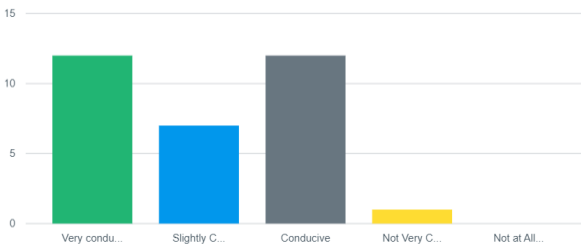
How involved is your organization in the current education pipelines that feed the skills and careers your organization depends on?



How costly or burdensome do you find the NQA-1 Certification process for your company?



To what extent do you believe the current regulatory environment in Tennessee is conducive to the establishment and growth of nuclear technology?



Is the Tennessee Nuclear Fund sufficiently signaling the State's commitment to the nuclear industry?

