

# The Future of Nuclear Power

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2023 Baseline Survey

# Executive Summary

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Nuclear carbon-free energy is essential to a clean, reliable and affordable energy system. Nuclear generation, both existing and new, is critical to decarbonizing not only the electric sector but entire economies. Through Federal policy and State action, demand for and advancements in nuclear technology in the United States has grown exponentially in the last five years. The passage of the Infrastructure Investment and Jobs Act in 2021 and the Inflation Reduction Act in 2022 has put in place policies that create an inflection point for the future of nuclear power in the U.S.

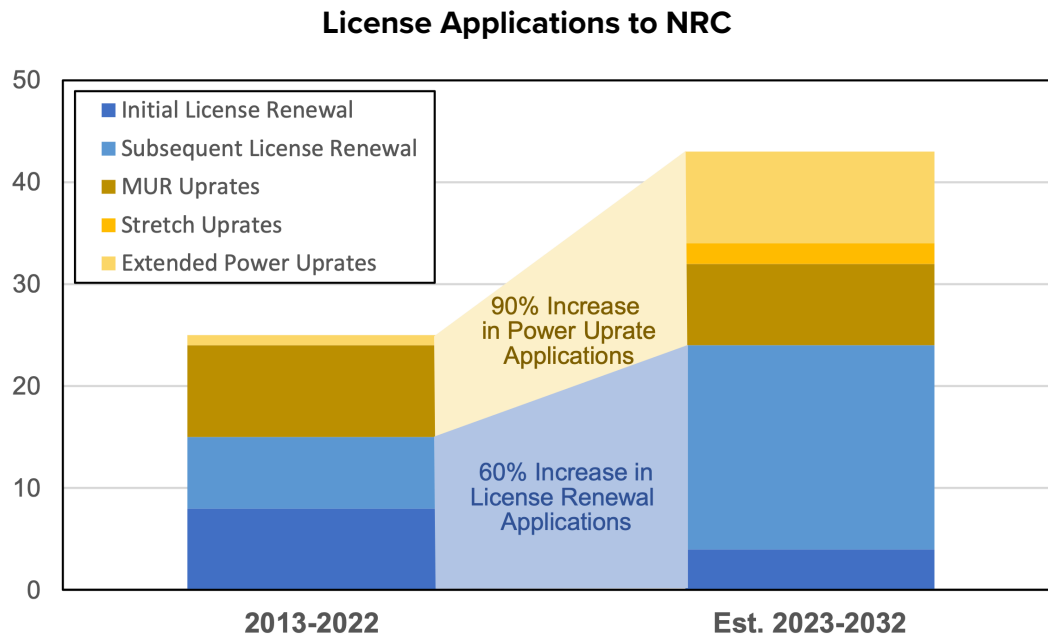
In recognition of this, NEI conducted a survey to obtain a better sense of the impact these federal actions are having on industry activities underway or in planning to extend the life and performance of the current fleet of reactors and to provide insights into plans to extend the U.S. fleet of reactors. The survey was conducted among nineteen NEI member companies that currently operate 80 of the nuclear reactor facilities in the U.S.

While not all the implementing guidance is available for these new federal policies and utility plans are still evolving, this survey was initiated to provide a baseline of the activities currently being considered. The scope of the survey included utility interest/activity in initial and subsequent license renewal, power uprates, extending refueling cycles, using clean, firm nuclear energy for non-grid applications, and new nuclear. It is anticipated that NEI will periodically update this survey as a means to gauge the progress being made.

Key insights for the operating fleet:

- Greater than 90% of the 80 units surveyed anticipate receiving approval to operate for at least 80 years. This means that the vast majority of the current fleet will operate to 2050 or beyond.
- Greater than 50% of sites surveyed have a level of interest/planning for power uprates for their site units. The cumulative total of these uprates could provide over 2GWe of carbon-free nuclear energy in the coming decade.
- Nearly half of sites in the survey have varying levels of interest/planning for one or more of the enabling changes identified in the survey (ATF/LEU+, risk-informed LOCA, extended fuel cycle). As many of these activities will involve regulatory approvals by the NRC, the timing of planned activities is provided, where available.
- Nearly half of sites have interest in “behind-the-meter” applications of nuclear power, with 48% of sites considering data centers and 57% considering generation of carbon-free hydrogen.
- Supporting the planned changes to the current operating fleet described above, the survey identified plans for well over six billion dollars in capital investment.

Many of these activities will require review and approval by the Nuclear Regulatory Commission (NRC). Based on the data received, understanding that these are not firm commitments, it appears that there could be a significant increase in the number of applications being submitted to the NRC, as shown below:



In early 2022, prior to the current survey, NEI conducted a survey specifically focused on member interest in new nuclear. This survey focused primarily on changes since that prior survey.

Key insights on new nuclear include:

- Nearly two-thirds of respondents indicated that the recent federal policy developments have resulted in increased interest in new nuclear within their company. The majority indicated increased interest in light water SMRs, but one-third also indicated increased interest in non-light water reactors.
- An additional 9 GWe of new grid-scale demand was identified beyond the 90 GWe identified in early 2022. This increase occurred over just 8 months and brings the total new nuclear opportunity for these utilities to over 99 GWe.
- Half of the respondents indicated that their company is considering or actively working to include new nuclear in their integrated resource plans (IRPs).
- Nearly half of the respondents indicated that they have interest in pursuing actions to site or license a new reactor, with the first applications expected to occur in the next year. These applications will also require NRC review and approval during the same period that we expect a higher incidence of current fleet regulatory applications.

Overall, the results of this benchmark survey demonstrate the benefits of the recent policy changes and paint a bright future for the U.S. nuclear industry with significant enhancements planned for the current fleet and an increasing level of activity toward the deployment of advanced nuclear.

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## Background

Nuclear energy has seen increased support at the federal level and that has manifested itself in several ways. Congress took advantage of the momentum that we have seen around the country for nuclear energy, and they passed several laws in just the last two years.

On November 15, 2021, President Biden signed the Infrastructure Investment and Jobs Act (IIJA), commonly known as the “bipartisan infrastructure bill.” This legislation included significant investments in nuclear energy. The law directs funding to preserve the operation of nuclear plants facing the prospect of early closure, demonstrate new advanced reactors, and explore the ability of nuclear energy to produce hydrogen for other energy applications.

The Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act of 2022 (the “CHIPS Act”), was signed into law on August 9, 2022. It contains a broad range of advanced nuclear energy technology provisions that promote higher education programs for nuclear science and engineering, invests in human capital for nuclear, provides funding for advanced nuclear activities, and allows for governmental and Native American Tribal entities, universities, and others involved in the nuclear supply chain to be eligible for the provided funding for such programs.

The Inflation Reduction Act, signed into law on August 16, 2022, will have perhaps one of the most significant impacts on the industry of any bill that became a law in many years. It includes a first ever production tax credit for the existing fleet, it includes a production tax credit for clean electricity, or alternatively an investment tax credit for the industry. It includes tax credits for hydrogen production, and all of these are direct payments so they would be benefits available to tax exempt entities, as well, and those are important parts of the industry, as well. In addition, it includes things like loan guarantee expansion and \$700 million for HALEU; so a broad array of benefits to the industry that add up to billions of dollars. And all of this will allow the existing fleet to be preserved, and it will also allow substantial opportunities for the future of the industry, as SMRs and other advanced technologies are deployed in the near future and into the 2030s.

## Introduction

In late 2022, NEI conducted a survey of its utility members to better understand the impact of recent changes in federal policy that have the potential to significantly increase the level of planning and activity for both operating reactors and new advanced reactors. The survey was conducted among nineteen NEI member companies with operating reactors and focused on significant planned plant enhancements being considered or actively planned over the next ten years. The goal is to gain an aggregate sense of industry activities underway or in planning to extend the life and performance of the current fleet of reactors and to provide insights into plans to extend the U.S. fleet of reactors. This aggregate information will be helpful with the NRC and with policymakers to provide a more robust forecast of the industry’s future.

The results of the survey show strong interest and increasing activity in license renewal, power uprates, extending refueling cycles, using clean firm nuclear energy for non-grid applications. It is recognized that this survey is a snapshot in time. NEI intends to conduct a survey annually to provide an enhanced perspective on trending with time.

All plant specific information collected as part of the survey is being maintained confidential by NEI. Only aggregate industry level results are being shared.

## Survey Content

The survey was comprised of two parts: Part A – Significant Plant Enhancements and Part B – Advanced Nuclear Activities.

### Part A – Significant Plant Enhancements

Part A covered and requested levels of interest and planning for plant activities that extend plant operation (License Renewal and Subsequent License Renewal). Part A also covered activities that increase licensed power through uprates (e.g., Measurement Uncertainty Recapture, Stretch Power Uprates, Extended Power Uprates) as well as changes to increase capacity such as fuel cycle extensions.

The survey requested information on interest/planning associated with plant changes that support increases in power or increases in capacity. These changes include transitions to Accident Tolerant Fuel and use of increased enrichment fuel (ATF/LEU+) and utilization of risk-informed methodologies to revise design/accident parameters (Risk-informed LOCA).

One area of interest, spurred by recent federal legislation, is behind-the-meter application of nuclear generated electricity, such as data centers and hydrogen.

Finally, acknowledging that many of the changes being considered will require long-term capital investment, the survey requested information on major capital projects being considered or actively planned over the next 5 to 10 years.

Part B – Advanced Nuclear Activities

This survey follows an advanced nuclear interest survey conducted by NEI in February 2022 and asked how each company’s views have changed since the initial survey. To assess how views have changed, the survey requested information on the level of activity associated with the following activities:

- Whether new nuclear is included in internal assessment
- Whether new nuclear is included in Integrated Resource Planning
- Interest in Early Site Permit(s)
- Interest in Construction Permit(s)
- Interest in Combined Operating License(s)

Survey Demographics

The survey was distributed to nineteen NEI utility member companies. These companies operate eighty units at 46 sites. Of the 80 units, 51 are PWRs and 29 are BWRs. Of the 46 sites, 21 operate in merchant markets and 25 operate in “cost of service” regulated markets.

Survey Results

5.1. License Renewal

The Atomic Energy Act and NRC regulations limit commercial power reactor licenses to an initial 40 years but also permit such licenses to be renewed for an additional 20 years. The NRC has renewed licenses for eighty-four of the ninety-two currently operating reactor units.

Currently only eight reactor units (five sites) are operating under their original 40-year license.

- Comanche Peak Units 1 & 2 (license renewal application currently under review)
- Perry
- Clinton
- Diablo Canyon Units 1 & 2
- Watts Bar Units 1 & 2 (anticipate two separate license renewal applications)

Luminant submitted their application for license renewal of Comanche Peak Units 1 & 2 on October 3, 2022, and is currently under review. By letters of intent, Energy Harbor and Constellation have notified NRC of their plans to submit license renewal applications for Perry and Clinton in 2023 and 2024 respectively. Due to changes in state energy policies, PGE is now expected to submit a license renewal application for Diablo Canyon Units 1 and 2 before the end of 2023. The original licenses for Watts Bar Units 1 and 2 will not expire until 2035 and 2055 respectively. As such there is no immediate need for TVA to declare plans for Watts Bar, however, all indications are that Watts Bar will apply for license renewal at the appropriate times.<sup>2</sup>

| Submittal Schedule      | 2023 | 2024 | 2025 | 2026 | TBD |
|-------------------------|------|------|------|------|-----|
| Initial License Renewal | 2    | 1    |      | 1    | 1   |

**Survey Takeaway**

The survey results confirm that all 80 units included in the survey have either received approval of their original license renewal, submitted their license renewal application or are planning for license renewal.

<sup>2</sup> Due to the time difference between Watts Bar Unit 1 and Watts Bar Unit 2 licenses, they are counted as two separate license renewal applications.

5.2. Subsequent License Renewal

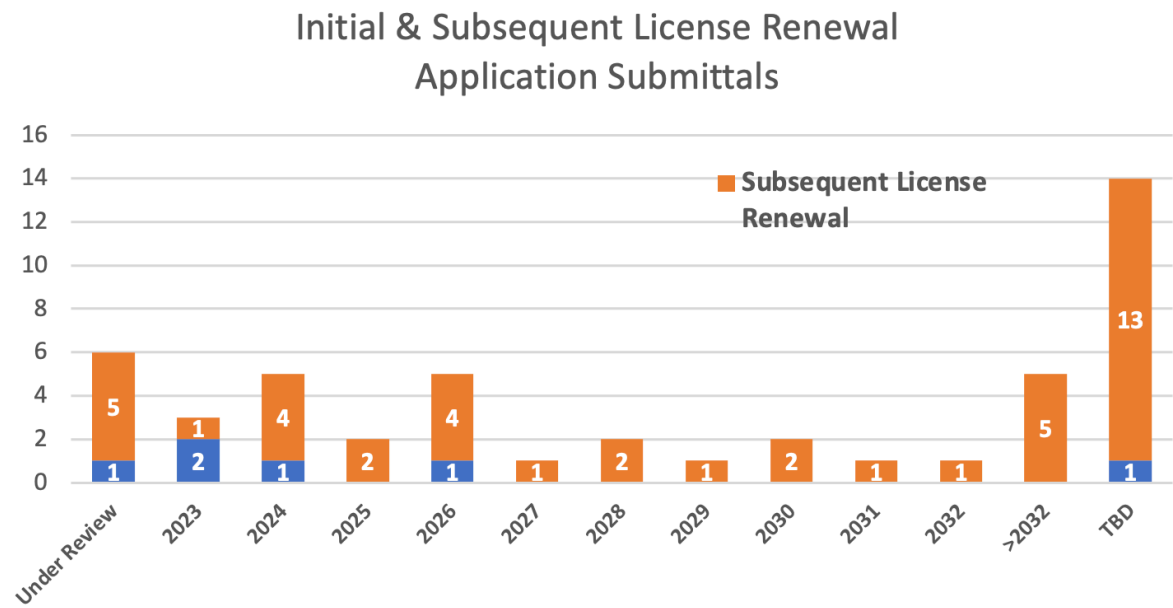
Subsequent license renewal (SLR) is defined as an extension of the license to operate from 60 years to 80 years. As of the end of 2022, SLR licenses have been issued for three sites (6 units) – Turkey Point 3&4, Peach Bottom 2&3 and Surry 1&2. Applications have been received and are currently under review for five sites (10 units) - St. Lucie 1&2, Oconee 1,2&3, Point Beach 1&2, North Anna 1&2 and Monticello.

Three companies have announced, through letters of intent to NRC, their plans and schedules for submittal of SLR applications.

- TVA – Browns Ferry Units 1, 2 and 3 (2023)
- Dominion – Summer (2024)
- Southern Nuclear – Hatch Units 1 & 2 (2025)

In response to the survey, three additional SLR applications are anticipated in 2024 and one additional SLR application is anticipated in 2025. An additional four applications are anticipated in 2026. In total, 42 of 46 sites responding to the survey expressed a level of planning for SLR.

| Submittal Schedule         | Under Review   | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | >2032 | TBD |
|----------------------------|----------------|------|------|------|------|------|------|------|------|------|------|-------|-----|
| Subsequent License Renewal | 5 <sup>3</sup> | 1    | 4    | 2    | 4    | 1    | 2    | 1    | 2    | 1    | 1    | 5     | 13  |



Survey Takeaway

Greater than 90% of the 80 units surveyed anticipate receiving approval to operate to at least 80 years.

<sup>3</sup> Monticello SLR application submitted in 2023 and is currently under review

### 5.3. Power Upgrades

Power upgrades are generally classified in three categories:

- measurement uncertainty recapture
- stretch power
- extended power

Measurement uncertainty recapture (MUR) power upgrades are less than 2 percent and are achieved through the implementation of improved techniques for calculating reactor power. This involves the use of measurement devices to measure feedwater flow more precisely, which is then used to calculate reactor power. More precise measurements reduce the degree of uncertainty in the power level.

Stretch power upgrades are typically up to 7 percent. Stretch power upgrades usually involve changes to instrumentation set-points but can also include plant modifications as well as changes to plant tests and procedures.

Extended power upgrades (EPU) are significant increases in power and have been approved for increases as high as 20 percent. These upgrades require significant modifications to major balance-of-plant equipment such as the high-pressure turbines, condensate pumps and motors, main generators, and/or transformers.

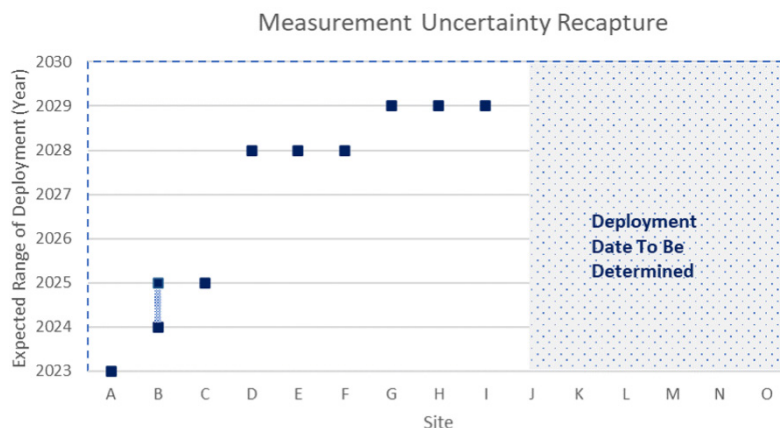
#### 5.3.1. Measurement Uncertainty Recapture

Nuclear power plants are licensed to operate at a specified maximum core thermal power often called rated thermal power (RTP). Regulations formerly required licensees to assume that the reactor has been operating continuously at a power level at least 1.02 times the licensed power level when conducting design basis analyses. This requirement was included to ensure that instrumentation uncertainties were adequately accounted for in the safety analyses. In 2000, the regulations were changed to allow licensees to use a power level less than 1.02 times the RTP for safety analyses based on the use of state-of-the art feedwater (FW) flow measurement devices that provide a more accurate calculation of power. Licensees can use a lower uncertainty in the safety analyses, provided that the licensee has demonstrated that the proposed value adequately accounts for instrumentation uncertainties.

Since this regulation change became effective in 2000, the NRC has issued 50 safety evaluations reports approving plants to implement MUR power upgrades for a total increase in power across the fleet of 3400 MWth. Improvements in methods and equipment have allowed some plants to receive approval for multiple MUR power upgrades.

Thirty-one of the forty-six sites included in the survey have received approval for one or more MUR upgrades. Fifteen sites identified varying levels of interest or planning to implement an MUR power upgrade in the future. Of these 15 sites (26 units), nine are merchant sites and 6 are regulated. Several of the 15 sites have already received an initial MUR upgrade and are considering a second by taking advantage of improvements in methods (e.g., Data Validation and Reconciliation). Very few of the surveyed sites that have not previously implemented a MUR indicated no interest in MUR power upgrades.

| Topic | Completed or No Current Interest | Varying Levels of Interest/Planning |
|-------|----------------------------------|-------------------------------------|
| MUR   | 31 sites (67%)                   | 15 sites (33%)                      |





### 5.3.2. Stretch Power Uprate

Since 1977 stretch power uprate (SPU) approvals have been issued to 65 units (39 sites). With some of these plants receiving multiple SPU approvals and several sites having stopped operation and transitioned to decommissioning. Thirty of the forty-six sites included in the survey have received approval for a SPU power increase.

The survey identified two sites that are planning stretch power uprates (one 4-6%, one 5%). Stretch power uprates are typically up to 7 percent and are within the design capacity of the plant. The actual value for percentage increase in power a plant can achieve and stay within the stretch power uprate category is plant-specific and depends on the operating margins included in the design of a particular plant. Stretch power uprates usually involve changes to instrumentation setpoints but do not involve major plant modifications. The timeframe for deployment of the SPU at the two sites is 2029.

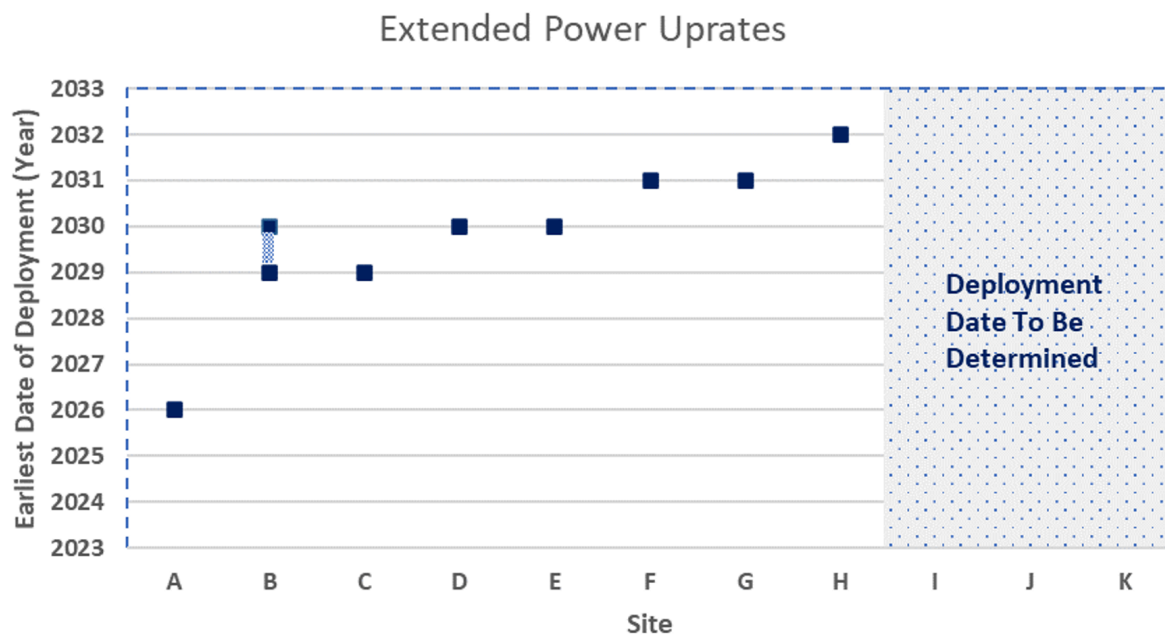
| Topic | Completed or No Current Interest | Varying Levels of Interest/Planning |
|-------|----------------------------------|-------------------------------------|
| SPU   | 44 sites (96%)                   | 2 sites (4%)                        |

### 5.3.3. Extended Power Uprate

Extended Power Uprates range from 6% to 20% increase in power and generally involve major modifications to plant equipment. These changes include modification or replacement of the main turbine, condensate pumps, feedwater pumps and main generator. Since 1998, 21 sites (34 units) have received approval for an Extended Power Uprate. Thirteen of the forty-six sites included in the survey, covering 23 units, have received EPU approval.

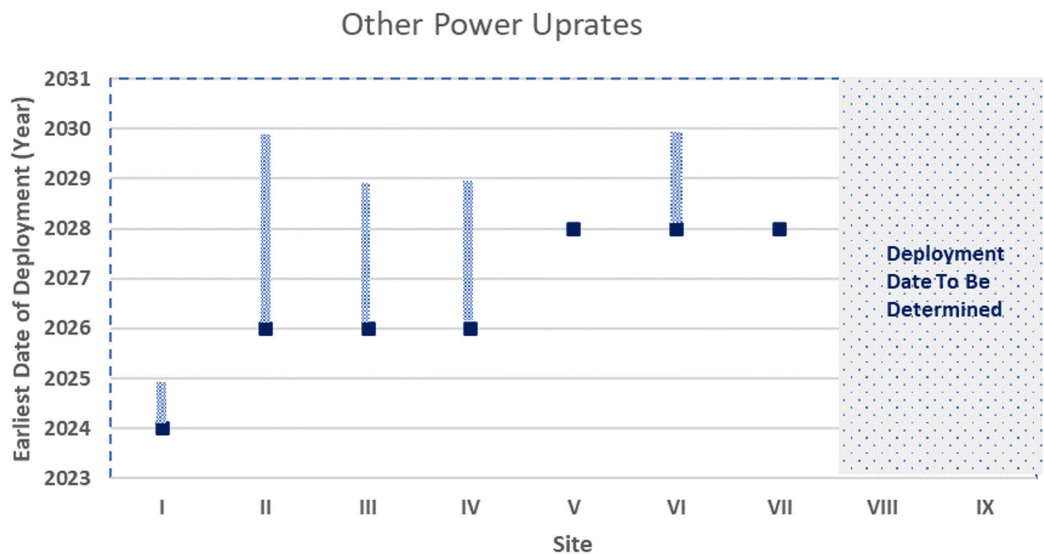
In response to the survey, eleven sites (24%) indicated a level of interest/planning for an extended power uprate. The targeted deployment of these uprates ranged 2025 to 2032.

| Topic | Completed or No Current Interest | Varying Levels of Interest/Planning |
|-------|----------------------------------|-------------------------------------|
| EPU   | 35 sites (76%)                   | 11 sites (24%)                      |



5.3.4. Other Power Upgrades

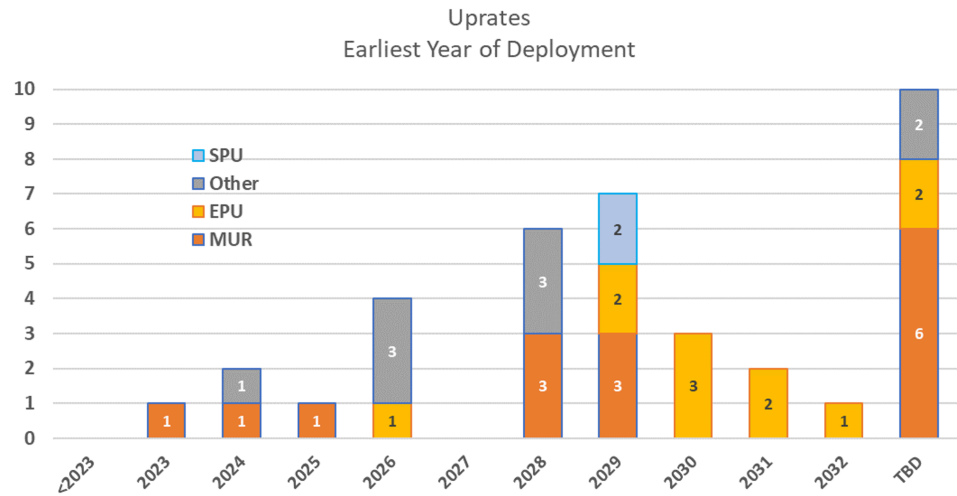
The survey provided an opportunity for companies to identify other power uprate plans. In response, nine sites identified plans for unspecified power upgrades in the 1 to 3% range.



5.3.5. Timeline for Power Upgrades

The table and figure below identify the earliest year of deployment for upgrades identified in the survey. While additional capacity was not identified for all planned upgrades, for those that did the combined capacity from upgrades identified in the survey is over 6700 MWth which equates to roughly 2,000 MWe, or the equivalent to two large light water reactors.

| Earliest Year of Deployment | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | TBD |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|-----|
| MUR                         | 1    | 1    | 1    |      |      | 3    | 3    |      |      |      | 6   |
| SPU                         |      |      |      |      |      |      | 2    |      |      |      |     |
| EPU                         |      |      |      | 1    |      |      | 2    | 3    | 2    | 1    | 2   |
| Other                       |      | 1    |      | 3    |      | 3    |      |      |      |      | 2   |



Survey Takeaway

Greater than 50% of sites surveyed have a level of interest/planning for one or more power upgrades for their site units with a combined capacity equivalent to 2 large light water reactors.

## 5.4. Enabling Changes

The survey requested information on several types of changes that have the potential to support increases in plant power or capacity. These changes are:

- ATF/LEU+
- Risk-informed LOCA
- Extended Fuel Cycle

The first two changes do not directly result in an increase in power production or capacity, but are instead changes that enable power uprates and longer fuel cycles by enabling changes to operational and accident analysis design limits.

### 5.4.1. ATF/LEU+ Enabled

Accident tolerant fuels (ATF) have the potential to enhance safety at U.S. nuclear power plants by offering better performance during normal operation, transient conditions, and accident scenarios. Use of these advanced fuel designs in combination with increased fuel enrichments up to 10% (LEU+) has the potential to increase operational flexibility, achieve longer fuel cycles, and support power uprates.

The survey results demonstrate a high level of interest in ATF/LEU+, with 20 of the 46 sites (44%) expressing a level of interest.

| Topic | No Current Interest | Varying Levels of Interest/Planning |
|-------|---------------------|-------------------------------------|
| ATF   | 26 sites (56%)      | 20 sites (44%)                      |

### 5.4.2. Risk-Informed LOCA Enabled

Accident tolerant fuels (ATF) have the potential to enhance safety at U.S. nuclear power plants by offering better performance during normal operation, transient conditions, and accident scenarios. Use of these advanced fuel designs in combination with increased fuel enrichments up to 10% (LEU+) has the potential to increase operational flexibility, achieve longer fuel cycles, and support power uprates.

The survey results demonstrate a high level of interest in ATF/LEU+, with 20 of the 46 sites (44%) expressing a level of interest.

| Topic   | No Current Interest | Varying Levels of Interest/Planning |
|---------|---------------------|-------------------------------------|
| RI-LOCA | 25 sites (55%)      | 21 sites (45%)                      |

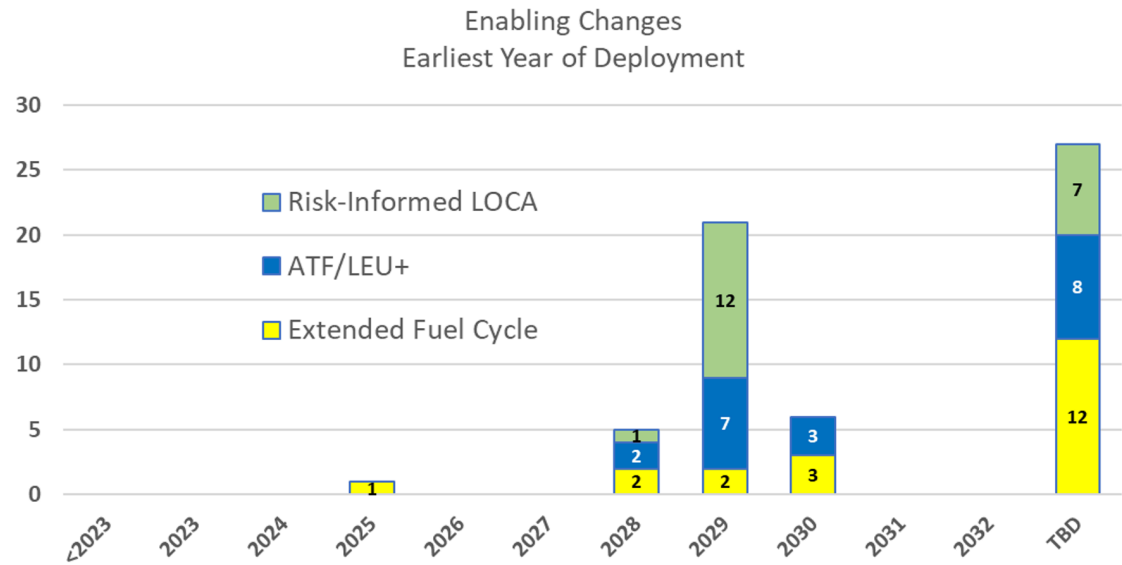
### 5.4.3. Extended Fuel Cycle

An interest in extended fuel cycles (generally extending from 18-month to 24-month) was expressed by 20 of the 46 sites (44%). This interest was expressed primarily by PWR sites, the majority of which are currently operating on 18-month fuel cycles.

| Topic | Completed or No Current Interest | Varying Levels of Interest/Planning |
|-------|----------------------------------|-------------------------------------|
| EFC   | 26 sites (56%)                   | 20 sites (44%)                      |

5.4.4. Timeline for Enabling Changes

| Earliest Year of Deployment | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | TBD |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|-----|
| Extended Fuel Cycle         |      |      | 1    |      |      | 2    | 2    | 3    |      |      | 12  |
| Risk-Informed LOCA          |      |      |      |      |      | 1    | 12   |      |      |      | 7   |
| ATF/LEU+                    |      |      |      |      |      | 2    | 7    | 3    |      |      | 8   |



# Survey Takeaway

Approximately 45% of sites in the survey have varying levels of interest/planning for one or more of the enabling changes identified in the survey. Deployment of these changes is generally targeted in the 2028 – 2030 timeframe.

## 5.5. Licensing Application Timeline

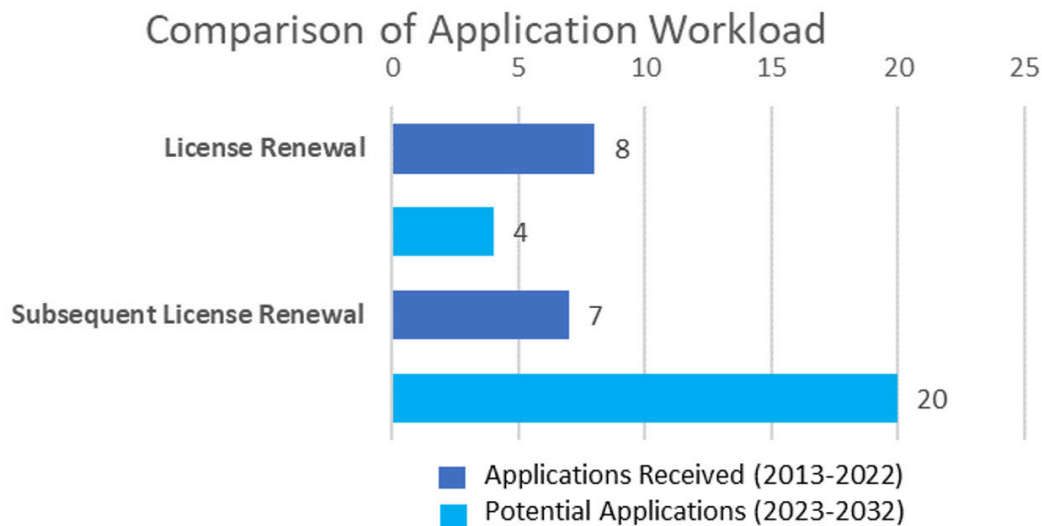
Using the data from the survey, an evaluation was performed to estimate the number of license applications that are possible over the next 10 years. A comparison was then made to the number of license applications that were submitted over the previous 10 years.

### 5.5.1. License Renewal Applications

As presented previously, there are approximately 24 license renewal applications projected to be submitted over the next 10 years. This total includes four original license renewal applications and twenty<sup>4</sup> Subsequent License Renewal applications.

| Application                | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | >2032 | TBD |
|----------------------------|------|------|------|------|------|------|------|------|------|------|-------|-----|
| License Renewal            | 2    | 1    |      | 1    |      |      |      |      |      |      |       | 1   |
| Subsequent License Renewal | 2    | 4    | 2    | 4    | 1    | 2    | 1    | 2    | 1    | 1    | 5     | 13  |

In the prior 10 years (2013-2022) there were fifteen license renewal applications, eight original license renewals and seven subsequent license renewals.



### 5.5.2. Power Uprate Applications

For power uprates the survey responses identified the planned year of deployment. To give a sense of the timeline for licensing applications the following assumptions were made:

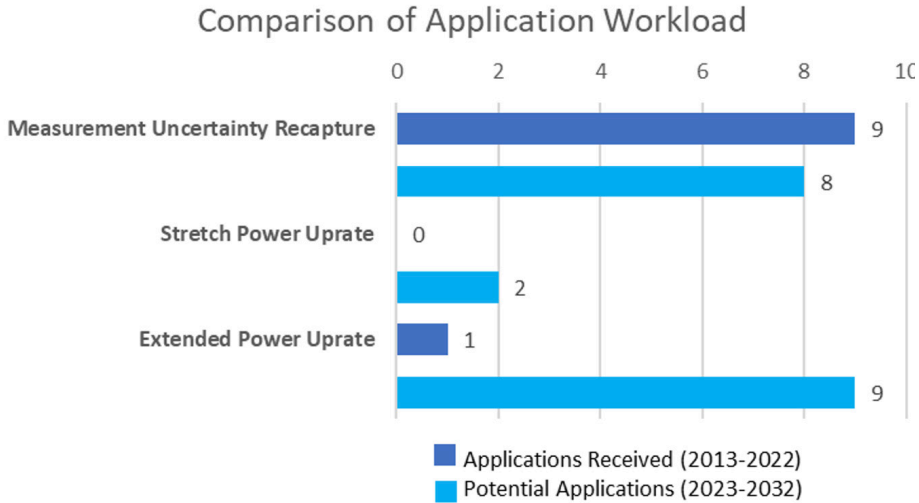
| Uprate Type                       | Application Year           |
|-----------------------------------|----------------------------|
| Measurement Uncertainty Recapture | Deployment minus one year  |
| Stretch Power Uprate              | Deployment minus one year  |
| Extended Power Uprate             | Deployment minus two years |
| Other (unspecified)               |                            |

<sup>4</sup> Total includes Monticello application submitted in 2023.

Using these assumptions, a total of nineteen power uprate applications over the next ten years is determined. Because applications can incorporate multiple aspects of power uprates (e.g., combined MUR and EPU), the number of separate applications may be lower.

| Estimated Year of Application | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | >2032 | TBD |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|-------|-----|
| EPU                           |      | 1    |      |      | 2    | 3    | 2    | 1    |      |      |       | 2   |
| MUR                           | 1    | 1    |      |      | 3    | 3    |      |      |      |      |       | 6   |
| SPU                           |      |      |      |      |      | 2    |      |      |      |      |       |     |
| Other                         | 1    |      | 3    |      | 3    |      |      |      |      |      |       | 2   |

In the prior 10 years (2013-2022) there were ten power uprate applications (9 MUR, 1 EPU).



5.6. Behind the Meter

The survey requested information on interest in behind-the-meter applications, including Hydrogen and data centers. There is increasing interest in behind-the-meter applications of nuclear generated electricity. Nuclear power is recognized as a clean and highly reliable source of electricity, prized as a power source for data centers. Hydrogen generation has also received increased interest, due in part to the Inflation Reduction Act, which provides support for clean hydrogen production via tax credits that will award up to \$3/kg for low carbon hydrogen.

5.6.1. Data Centers

Modern data centers involve a building or facility that houses IT infrastructure for building, running, and delivering applications and services, and for storing and managing the data associated with those applications and services. Data Centers require a highly reliable power source. Nuclear Power meets this need by providing a clean, reliable source of power for data centers.

Efforts are well underway at two nuclear sites. Cumulus Susquehanna, a subsidiary of Talen Energy, is commencing commercial operation of its first 48 MW data center stage at the Susquehanna plant this year. Two additional 48 MW stages are in advanced development, with an eventual aggregate capacity for the campus of 475 MW. A 200 to 300 MW data center is planned to begin operation at Beaver Valley in 2023 with a potential for up to 900 MW in future phases.

In response to the survey, twenty-two sites expressed interest/planning in data centers, with power requirements ranging from 200 to 900 MW.

| Topic       | No Current Interest | Varying Levels of Interest/Planning |
|-------------|---------------------|-------------------------------------|
| Data Center | 24 sites            | 22 sites, 200-900 MW range          |

### 5.6.2. Hydrogen

Nuclear power plants can supply the required heat and electricity to produce hydrogen without generating any carbon emissions. The Department of Energy has already begun teaming up with utilities to support four hydrogen demonstration projects at nuclear power plants. The four projects are:

- Nine Mile Point Nuclear Power Station, involving the construction and installation of a low-temperature electrolysis system at the Nine Mile Point nuclear power plant.
- Davis-Besse Nuclear Power Station is working to demonstrate a low-temperature electrolysis system.
- Prairie Island Nuclear Generating Plant is working on a first-of-a-kind project to demonstrate high-temperature electrolysis.
- Palo Verde Generating Station is negotiating with DOE on a low-temperature electrolysis system.

In response to the survey, twenty-six sites expressed interest/planning in data centers, with power requirements ranging from 50 to 300 MW.

| Topic    | No Current Interest | Varying Levels of Interest/Planning |
|----------|---------------------|-------------------------------------|
| Hydrogen | 20 sites            | 26 sites<br>50-300 MW range         |

### 5.6.3. Other

One site expressed interest in Coin mining and a second site expressed interest in reverse osmosis.

## Survey Takeaway

The survey demonstrated significant interest/planning for behind-the-meter applications of nuclear power with 48% of sites considering data centers and 57% considering Hydrogen.

### 5.7 Major Capital Projects

Major capital projects involving the refurbishment or replacement of equipment are critical to plans for life extensions and large power uprates. Eleven companies provided details on major capital projects identifying over 100 capital projects totaling over \$6 billion. Some of the most significant projects are listed below.

| Significant Capital Projects planned for multiple sites | Sites |
|---------------------------------------------------------|-------|
| Main Turbine (Upgrades/Replacements)                    | 14    |
| Main Generator (Upgrade/Rewind/Replacement)             | 15    |
| Transformers (Modification/Replacement)                 | 10    |
| Digital Upgrades (Feedwater, Turbine Controls, I&C)     | 6     |
| Feedwater Heaters (Replacements)                        | 5     |
| Reactor Coolant Pump Motors                             | 5     |
| Physical Security Modifications                         | 4     |
| Cooling Towers (Upgrades/Refurbishments)                | 3     |
| Steam Generator (Replacement)                           | 2     |

## 5.8. New Nuclear

In the Spring of 2022, NEI conducted a survey of our member utilities that operate nuclear plants, and they identified that they believe they could use up to 90 gigawatts of new nuclear to support their companies' decarbonization goals. This survey was conducted before the Inflation Reduction Act was passed. Because of the nuclear incentives included in the Inflation Reduction Act, we believe that utility plans will be accelerated in response to the incentives in the Inflation Reduction Act that support not just the current fleet but the future fleet.

### 5.8.1. Change in Attitude toward New Nuclear

To assess how utility attitudes toward new nuclear have changed since passage of the Inflation Reduction Act, the survey asked simply, "How has your company's view changed since February 2022?" on four areas of interest:

- Overall attitude toward advanced nuclear
- Light water SMRs
- Non-light water SMs
- Advanced nuclear for non-electricity applications

For each area, the survey asked companies to identify if they had more interest, less interest or if their interest was unchanged.

#### Overall Attitude Toward Advanced Nuclear

Of the nineteen companies addressed in the survey, eleven responded that they had more interest in advanced nuclear energy since February 2022.

| <b><i>How has your company's view changed since February 2022?</i></b> | <b>No Response</b> | <b>Less Interest</b> | <b>Interest Unchanged</b> | <b>More Interest</b> |
|------------------------------------------------------------------------|--------------------|----------------------|---------------------------|----------------------|
| Overall attitude toward advanced nuclear                               | 1                  | 0                    | 7                         | 11                   |

#### Attitude Toward Light Water SMRs

Of the nineteen companies addressed in the survey, eleven (58%) responded that they had more interest in light water SMRs since February 2022.

| <b><i>How has your company's view changed since February 2022?</i></b> | <b>No Response</b> | <b>Less Interest</b> | <b>Interest Unchanged</b> | <b>More Interest</b> |
|------------------------------------------------------------------------|--------------------|----------------------|---------------------------|----------------------|
| Light water SMRs                                                       | 2                  | 0                    | 6                         | 11                   |

#### Attitude Toward Non-Light Water SMRs

Of the nineteen companies addressed in the survey, six (32%) expressed more interest in non-light water SMRs since February 2022.

| <b><i>How has your company's view changed since February 2022?</i></b> | <b>No Response</b> | <b>Less Interest</b> | <b>Interest Unchanged</b> | <b>More Interest</b> |
|------------------------------------------------------------------------|--------------------|----------------------|---------------------------|----------------------|
| Non-light water SMRs                                                   | 4                  | 0                    | 9                         | 6                    |

#### Attitude Toward Advanced Nuclear for Non-electricity Applications

Of the nineteen companies addressed in the survey, two (11%) expressed more interest in non-electricity applications for advanced nuclear since February 2022.

| <b><i>How has your company's view changed since February 2022?</i></b> | <b>No Response</b> | <b>Less Interest</b> | <b>Interest Unchanged</b> | <b>More Interest</b> |
|------------------------------------------------------------------------|--------------------|----------------------|---------------------------|----------------------|
| Advanced nuclear for non-electricity applications                      | 5                  | 3                    | 9                         | 2                    |



### 5.8.2. Activities Related to New Nuclear

To obtain a better sense of company activity associated with new nuclear, companies were asked of their activity level for a series of topics. These were:

- Internal Assessment of New Nuclear
- Inclusion of new nuclear in company Integrated Resource Planning
- Update of Previously Approved ESP(s)
- New Early Site Permit(s) (ESP)
- Construction Permit(s)
- Combined Operating License(s) (COLs)

For each topic, companies were asked the following three questions:

Is there current activity?

Is the topic currently under consideration?

Is the company already working toward topic?

#### Internal Assessment of New Nuclear

In response to the question on whether there was an internal assessment of new nuclear the response was split relatively evenly between No Current Activity (37%), Under Consideration (32%) and Already Working Toward (32%)

| Type                               | No Response | No Current Activity | Under Consideration | Already Working Toward |
|------------------------------------|-------------|---------------------|---------------------|------------------------|
| Internal Assessment of New Nuclear | 0           | 7                   | 6                   | 6                      |

#### Including in Integrated Resource Planning

For this question, the response shows that new nuclear is being included in Integrated Resource Planning for 21% of companies, with 26% responding Under Consideration.

| Type                                      | No Response | No Current Activity | Under Consideration | Already Working Toward |
|-------------------------------------------|-------------|---------------------|---------------------|------------------------|
| Including in Integrated Resource Planning | 1           | 9                   | 5                   | 4                      |

#### Update of Previously Approved ESP(s)

NRC has approved Early Site Permits (ESP) for six sites:

- System Energy Resources, Inc., for the Grand Gulf site in Mississippi
- Exelon Generation Co., LLC, for the Clinton site in Illinois
- Dominion Nuclear North Anna, LLC, for the North Anna site in Virginia
- Southern Nuclear Operating Co., for the Vogtle site in Georgia
- PSEG Power, LLC, and PSEG Nuclear, LLC, for a site in New Jersey
- Tennessee Valley Authority for two or more small modular reactor modules at the Clinch River Nuclear Site in Tennessee

One company identified that they were considering an update to their previously approved ESP.

| Type                                 | No Response | No Current Activity | Under Consideration | Already Working Toward |
|--------------------------------------|-------------|---------------------|---------------------|------------------------|
| Update of Previously Approved ESP(s) | 2           | 16                  | 1                   | 0                      |

### New Early Site Permit(s) (ESP)

In response to the question on whether the company was working on a new ESP, five companies replied that this was under consideration. One company replied that they were already working on an ESP with submittal targeted for 2025.

| Type                           | No Response | No Current Activity | Under Consideration | Already Working Toward |
|--------------------------------|-------------|---------------------|---------------------|------------------------|
| New Early Site Permit(s) (ESP) | 2           | 11                  | 5                   | 1                      |

### Construction Permit(s)

In response to the question on whether the company was working on a Construction Permit (CP), two companies replied that this was under consideration. One company replied that they were already working on a CP with submittal targeted for 2024.

| Type                   | No Response | No Current Activity | Under Consideration | Already Working Toward |
|------------------------|-------------|---------------------|---------------------|------------------------|
| Construction Permit(s) | 2           | 15                  | 1                   | 1                      |

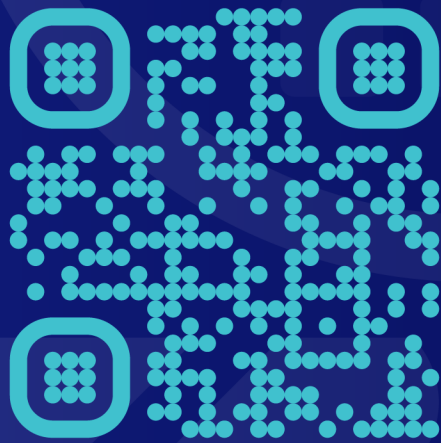
### Combined Operating License(s) (COLs)

In response to the question on whether the company was working on a Combined Operating License (COL), three companies replied that this was under consideration. One company replied that they were already working on a COL. Targeted submittals were provided by two companies as 2027 and 2032.

| Type                                 | No Response | No Current Activity | Under Consideration | Already Working Toward |
|--------------------------------------|-------------|---------------------|---------------------|------------------------|
| Combined Operating License(s) (COLs) | 1           | 15                  | 2                   | 1                      |

## Survey Takeaway

There is an increased level of interest in new nuclear at ~60% of utilities with ~50% of utilities expressing interest or action on one or more regulatory pathways (e.g., ESP, CP, COL).



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