NATIONAL GOVERNORS ASSOCIATION

Policy Update: State Policy Support for Nuclear Generation

Summary

Nuclear power plays an important role in the U.S. energy and environmental landscape. The 98 nuclear reactors operating across 30 states generate almost 20 percent of all electricity used in the United States and nearly 60 percent of the zero-emissions electricity produced.[1] In addition, the nuclear industry supports economic development across multiple states, including in many rural parts of the country.[1] However, due to increasing market competition from natural gas and renewable energy, existing U.S. nuclear power plants have faced economic challenges in recent years that threaten their ability to remain in operation. Since 2013, seven nuclear units across the nation have closed prematurely and 12 more have announced early retirement, representing more than 15 percent of the nation's nuclear capacity.[2]

Recognizing the role nuclear power plants have in meeting various policy goals (e.g., decarbonization, economic development, energy security and diversity, or others), several states have developed policy mechanisms to support exiting or new nuclear generation. **Connecticut**, **Illinois**, **New Jersey** and **New York** have recently adopted substantial policies to support *existing* nuclear plants. **Pennsylvania** and **Ohio** are considering similar support. Others, including **California**, **Indiana**, **Ohio** and **Utah**, have included, or at least not excluded, *new* nuclear generation in broader energy policies.

Background

The U.S. Energy Information Administration (EIA) cites natural gas prices and renewable policies as the two greatest factors impacting the future of the U.S. nuclear power fleet.3 Most significantly, low natural gas prices mean natural gas-fired generation is more cost competitive than existing nuclear generation.4 State carbon policies that exempt nuclear power from financial incentives available to technologies like solar and wind power also contribute to the inability of some nuclear plants to remain economically viable (e.g., state renewable portfolio standards (RPSs) and other financial incentives for clean energy). In addition, uncertainty over nuclear waste disposal and other political and regulatory changes (e.g., the reversal of the EPA's Clean Power Plan) also impact the nuclear industry.

The cost of *new* nuclear generation also is higher than certain other generation options and the total generating costs for *existing* nuclear resources is routinely lower than market prices. For example, the total generating cost for *existing* nuclear resources was $33.50/MWh in 2017. These plants are operating in markets that routinely have prices of lower than $30.00/MWh.

Current prices do not reflect the value for zero carbon emissions or other attributes provided by nuclear power plants such as reliability, resilience, grid and price stability, or the economic benefits provided to local communities. Thus, policy makers have sought to develop incentives to account for those benefits.

THE FUTURE OF NUCLEAR ENERGY

If this future [of achieving least-cost deep decarbonization] is to be realized, government officials must create new decarbonization policies that put all low-carbon energy technologies (i.e. renewables, nuclear, fossil fuels with carbon capture) on an equal footing, while also exploring options that spur private investment in nuclear advancement (MIT, The Future of Nuclear Energy in a Carbon-Constrained World, 2018).

State Policy Updates: 2016-2019

States have taken a leadership role in supporting existing and new nuclear power generation. From 2016 through December 2018, Illinois, New Jersey and New York adopted policies to support existing

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nuclear generation. In March 2019, Connecticut moved forward on efforts to support including nuclear energy as part of its clean energy strategy.

Ohio and Pennsylvania have been considering financial support for existing plants.

In addition, Ohio and Indiana allow for new nuclear generation to qualify under their RPS guidelines. These policies were adopted in Indiana in 2011 and in Ohio in 2008; however, to date, they have not been successful at incentivizing the building of new plants.

This paper provides examples of three areas of recent state policy activity:

- Nuclear Procurement Targets and Zero Emissions Credits (ZEC) Programs
- State mandated power purchase agreements (PPAs).
- Inclusion of nuclear in state energy plans.

Together, these three types of policies are helping encourage use of nuclear generation and monetize value not currently being captured in electricity markets.

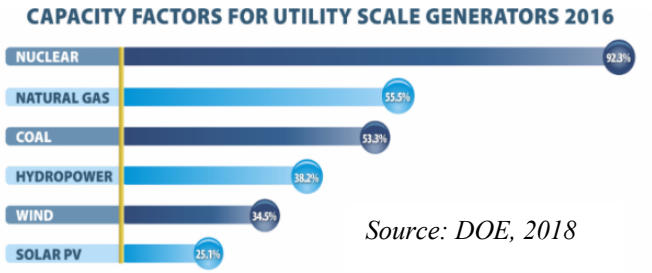
Nuclear Power Snapshot

U.S. nuclear power plants directly employ nearly 100,000 people and 475,000 with secondary jobs.[5]

Nuclear power plants provide almost 20 percent of U.S. electricity and nuclear power is the largest source of zero-emissions electricity.[6]

The U.S. fleet of reactors operates more than 92 percent of the time, making it the most reliable energy source on the grid.[7]

The newest nuclear reactor operating in the U.S.,



Source: DOE, 2018

Watts Bar Unit 2, began operation in 2016 in Tennessee, and there are two nuclear reactors under construction in Georgia (the Vogtle plant).[8]

Projected levelized cost of electricity (LCOE) from advanced nuclear beginning operation in 2022 is $90.1/MWh.[9]An advanced natural gas combined cycle power plant is expected to cost $48.1/MWh and solar PV is estimated at $46.5/MWh (including a $12.4/MWh tax credit) in 2022.[10] Advanced reactor designs (e.g., small modular reactors) are targeting LCOE in the $65/MWh range; these designs are expected to be available around 2026.[11]

According to the Nuclear Energy Institute (NEI), by using nuclear energy, the United States avoided more than 14,000 million metric tons of carbon dioxide emissions between 1995 and 2016, the equivalent of removing 3 billion cars from the road.

Most nuclear power plants are located east of the Mississippi River. Illinois has the most nuclear capacity of any state, followed by Pennsylvania, South Carolina, New York and North Carolina.[12]

Policy Area 1: Nuclear Procurement Targets and Zero Emissions Credits (ZEC) Programs

New York was the first state to include existing nuclear generation as an eligible resource under a state RPS, as part of its Clean Energy Standard (CES) issued in 2016. The CES is divided into three tiers; Tiers 1 and 2 constitute the Renewable Energy Standard (RES) component. Nuclear power qualifies as a Tier 3 resource and is recognized as a necessary bridge to help the state meet its 50 percent renewable energy goal by 2030 and goal of reducing greenhouse gas (GHG) emissions 40 percent by 2030. Existing nuclear facilities can receive zero energy credits (ZECs) – load-serving entities in the state must purchase ZECs from the New York State Energy Research and Development Authority (NYSERDA) based on a percentage of their electric load beginning in 2017. NYSERDA offers qualifying nuclear facilities a multi-year contract for the purchase of ZECs through March 21, 2029. The ZEC price is adjusted every two years and has been initially set at $17.48/MWh. Nuclear power is described as an "environmental attributes purchase program" designed to value the environmental and carbon reduction benefits from nuclear plants. Ratepayers will absorb the cost of the ZECs program through charges on their monthly electricity bills.

Through harmonized standards, a coalition of the six **New England** governors, ISO New England, and through the New England States Committee on Electricity (NESCOE) have committed to continue to evaluate market-based mechanisms for nuclear energy to ensure regional reliability and security. The effort to transition to nuclear energy comes in response to recent shortages of natural gas to serve

both heating needs and power plant demands, particularly in the winter months. With approximately 25% of the region's annual electricity demand stemming from nuclear energy, the New England region have stalled talks of wholesale retirement of nuclear generation resources.[13]

Illinois adopted an approach like New York's, under its Zero Emission Credits (ZECs) program. The Future Energy Jobs Act, was signed into law in late 2016.[14] It calls for the procurement of ZECs from zero-emission facilities and sets annual procurement targets for utilities – 16 percent of the electricity delivered in calendar year 2014 for Ameren Illinois and Commonwealth Edison Company (ComEd), and 16 percent of the power and energy procured by the Illinois Power Agency for the 2016-2017 delivery year for MidAmerican Energy Company. This procurement event is held through the Zero Emission Credits RFP. Power plants are evaluated based on air pollutant emissions (CO_2, SO_2, NO_x, PM) and multiplied by an Economic Stress Multiplier (the degree to which a plant is at risk of closure due to economic and market conditions). The first procurement event was held in January 2018. The winning ZEC suppliers were the Quad Cities nuclear power plant and Clinton nuclear power plant. The winning suppliers were paid a ZEC price of $16.50/MWh (the social cost of carbon price set by the state).[15] Ratepayers will cover the cost of the ZECs program through monthly surcharges.

The New York ZEC program and Illinois program have been challenged in court, with opponents arguing that they interfere with wholesale electricity markets that are regulated by the Federal Energy Regulatory Commission (FERC).[16] In April 2019, the Supreme Court denied requests to review the two federal appeals court decisions that upheld the New York and Illinois ZEC programs. This affirms that states can legally enact programs that pay for zero emissions electricity.[17]

In May 2018, **New Jersey** Governor Phil Murphy signed into law a bill supporting the state's three existing nuclear plants – the Salem plant, Hope Creek nuclear plant and the Oyster Creek plant. The new nuclear law is expected to cost $300 million

annually and establishes a Zero Emissions Certificate (ZEC) program. To be eligible under this program, nuclear plants must demonstrate that they

benefit New Jersey air quality and are at risk of closing within three years. The New Jersey Board of Public Utilities (BPU) launched a proceeding to create the ZEC program in August 2018[18] and finalized the ZEC program and application process in November 2018.[19] The ZEC application window closed on Dec. 19, 2018. The BPU also approved tariff modifications setting a rate for the ZEC program set at $4.00 MWh. In April 2019, the BPU awarded three ZECs to the Salem One and Two and Hope Creek nuclear power plants.[20]

Indiana and Ohio also include *new* nuclear generation as eligible under their Renewable Portfolio Standards (RPS) to incentivize deployment. Indiana adopted its Clean Energy Portfolio Standard (CEPS) in 2011, which sets a voluntary goal of 10 percent clean energy by 2025 based on the amount of electricity supplied in 2010. Up to 30 percent of this goal can be met with nuclear energy; "clean coal" technology; combined heat and power (CHP) systems; natural gas-fired systems that displace coal; and net-metered distributed generation (DG) systems.[21] To qualify, new facilities must have been placed into service on or after July 1, 2011.

Ohio has an Alternative Energy Portfolio Standard (AEPS) that was established in 2008. By 2025, 25 percent of retail electricity sold by Ohio's electric distribution utilities must be generated from alternative energy sources, including both renewable and advanced energy technology sources. Qualifying "advanced energy resources" include nuclear generation and other technologies.[22] To qualify, facilities must have been placed in service starting on or after Jan. 1, 1998.

No new nuclear plants have been built in either state since these policies became effective.

Policy Area 2: State Mandated Power Purchase Agreements (PPAs)

In **Connecticut**, the continued operation of the Millstone nuclear plant is expected to move forward based on a March 2019 10-year PPA between Dominion Power and Connecticut utilities Eversource and United Illuminating that allowed Dominion to continue to operate the plant. The plant was at risk of shutting down due to competition from low-cost natural gas. The deal must still be approved by Connecticut's Public Utilities Regulatory Authority, which had 180 days to act. The contract is for 10 years and calls for Millstone to produce 9 million megawatt hours per year for UI and Eversource customers. The office of Governor Ned Lamont and the state Department of Energy and Environmental Protection facilitated the effort to find a workable solution and established a commitment from all New England governors to evaluate regional mechanisms to help maintain critical nuclear and clean energy facilities as part of a new memorandum of understanding. That regional commitment will likely have bearing on the continued operation of the Seabrook nuclear plant in **New Hampshire** whose operating license was recently extended to 2050 by the Nuclear Regulatory Commission (NRC)[23].

Millstone is Connecticut's only operating nuclear power plant. It generates about 45 percent of the state's electricity (and 19 percent of the region's electricity) and 98 percent of the state's emissions-free electricity.[24] In 2017, lawmakers authorized the state's Department of Environmental Protection (DEEP) to conduct a request for proposals (RFP) for zero-carbon resources, including nuclear, if the agency deems bids to be in ratepayers' best interests. Then-Governor Dannel Malloy signed Executive Order No. 59 in October 2017, requiring the state to study the economic viability of the Millstone nuclear generating facility.[25]

The final Millstone resource assessment report was released in February 2018, finding that the units are profitable through 2035; however, also concluding that Millstone is critical to the state and New England region in terms of fuel security and meeting GHG reduction targets.[26] DEEP released a draft version of the RFP for zero-carbon resources in June 2018; however Millstone owner Dominion Energy voiced concerns that language in the RFP may delay the plant from receiving "at risk" status necessary to qualify for support until 2023. The Public Utilities Regulatory Authority (PURA) issued a draft decision in late November 2018, categorizing Millstone at risk for retirement without ratepayer support; this allows the plant to qualify for special consideration in the state's RFP for up to 12 million MWh of zero-carbon generation.[27]

It's important to note that PPA arrangements have been considered at the state level to support plants threatened with closure. In some cases, existing PPA arrangements have been renegotiated to allow for the continued operation of nuclear power plants. The Ohio PUC approved a PPA for existing nuclear and coal generation in 2016. FERC later rejected this Ohio PPA due to contract-related concerns and FirstEnergy retooled its proposal to get around FERC jurisdiction, receiving lesser support, and has recently sought federal support to avoid bankruptcy. The U.S. Supreme Court ruled in 2016 regarding a similar case in Maryland that FERC has oversight authority in restructured markets. This ruling overturned some state approved PPAs.[28]

The Palisades nuclear plant in Michigan is an example of an existing PPA that was renegotiated to keep a plant open. Entergy, the plant owner, planned to terminate its PPA with Consumers Energy in October 2018, citing market conditions that have changed substantially. However, the two utilities later agreed to extend the PPA through 2022. Entergy then plans to permanently close and decommission the plant.[29] A similar PPA extension was agreed to for Entergy's Pilgrim plant in Massachusetts. It was expected to close in 2026; that was recently updated to June 2019.[30] The PPA for the Point Beach facility in Wisconsin has been extended, while the Duane Arnold Energy Center in Iowa has announced plans to close in 2020.[31]

Policy Area 3: Inclusion of Nuclear in State Energy Plans

ZEC programs and PPAs provide a direct financial incentive to nuclear power plants. Another, less direct form of support is including nuclear generation in state energy-planning processes or creating an organization to support the state's nuclear industry. Connecticut[32], **New Hampshire**[33], **South Carolina**[34], **New Mexico**[35], and **Vermont**[36] have characterized the importance of nuclear capacity in recent energy plans. In **Idaho**, the governor issued an Executive Order created the Leadership in Nuclear Energy (LINE) Commission to make recommendations on policies and actions that can support the proliferating nuclear industry in the state. The EO builds on the continued work of the Idaho National Lab which continues to be the lead Department of Energy Nuclear Lab in the United States.[37]

Looking Ahead: States Considering Policy Support

Two states with significant nuclear capacity, Pennsylvania and Ohio, are considering various policy support.

Pennsylvania is currently considering state support for its nuclear power plants. State legislators formed a Nuclear Energy Caucus in 2017 and have held numerous hearings on the value of nuclear generation in the state. The caucus issued a report in November 2018 on the impact of the state's nuclear energy industry on communities and possible solutions to prevent premature plant closures.[38] Pennsylvania Governor Tom Wolf was re-elected in November 2018. While he did not take a stance on nuclear power in his campaign, his office released the statement: "Governor Wolf believes we need a robust conversation about our energy economy and looks forward to engaging with the

General Assembly about what direction Pennsylvania will go in regards to its energy sector, including the future of nuclear power and the value of lower emission energy for Pennsylvania's economy and environment."[39] The Commonwealth's Department of Environmental Protection issued a November 2018 Climate Action Plan that recommended "Implement(ing) policy to maintain nuclear generation at current levels."[40] Currently, Senate Bill 510 is being considered that would allow for nuclear energy to qualify under the state's Alternative Energy Portfolio Standard (AEPS). A similar bill for nuclear energy is being considered in the House, House Bill 11.[41]

Legislation has been proposed in Ohio in the past two years to support the state's nuclear plants but has failed to pass. In early April 2019, a bill was proposed, House Bill 6, that would provide subsidies for two Ohio nuclear power plants owned by First Energy. The proposed legislation would create the Ohio Clean Air Program that would provide an annual incentive payment to any power plant producing zero carbon dioxide emissions at a rate of $9.25/MWh of electricity produced.[42] The two nuclear plants in the state, Davis-Besse and Perry, have announced plans to close by 2021. Ohio Governor Mike DeWine, elected in November 2018, stated during his campaign that he wants to find a solution for the planned nuclear plant retirements and has recently voiced his support of nuclear power highlighting its reliability and environmental benefits[43]

Other states that rely on nuclear generation have also considered policy support models in the past couple of years. For example, nuclear proposals have been considered in **Arizona, Delaware, Georgia, Idaho, Maryland, Michigan, Minnesota, Missouri, Nevada,** New Hampshire, **New Mexico, Oregon, Tennessee, Virginia,** Vermont and **Washington**.[44]

These legislative proposals varied widely in the type of support they offered. They included tax incentives, ZEC programs, inclusion in state portfolio standards and mandatory electricity procurement requirements for state facilities.

NUCLEAR BENEFITS IN PA AND OH

The importance of nuclear generation in these two states is shown in an analysis by the Brattle Group that found that if the plants in Ohio and Pennsylvania keep running, more than 21 million metric tons of carbon will be avoided each year as compared with using natural gas and coal plants in lieu of nuclear. This study found that amount is comparable to the emissions reduction benefits over the last quarter century from renewable generation in the 13-state PJM Interconnection that includes Ohio and Pennsylvania.

Conclusion

Nuclear generation is important to many states to help achieve their policy goals, such as the ability to meet baseload power needs, meet decarbonization goals and provide high-paying jobs along with other benefits. States that have not yet begun to implement nuclear energy support policies can look at the successes and policy paths other states have chosen to assess their next steps.

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