

# KEY INSIGHTS FOR VALUING AND PRESERVING THE BENEFITS OF NUCLEAR ENERGY



C2ES held a Solutions Forum in July 2017 in Carmel, Indiana, focusing on challenges facing nuclear energy and various approaches to preserving the existing fleet of generation. Three panels comprising business, government, power market, think tank, and other experts shared their first-hand experiences around the existential crisis facing the U.S. nuclear fleet. Discussions focused on state approaches, federal actions, and overcoming operational and market challenges to nuclear energy. Nearly 50 participants were involved in the event at Midcontinent Independent System Operator (MISO) headquarters.

## EXISTENTIAL CRISIS

Experts at the forum suggested that *one-half to as many as two-thirds of nuclear plants are economically challenged* – far beyond the numbers that are generally reported. Also, the issue now extends beyond the merchant generation fleet to plants in vertically integrated states. Currently, there are 99 operational reactors in the United States. However, since late 2012, six nuclear reactors have retired, and seven more are scheduled to close by 2025. If this trend continues or accelerates, there could be serious climate implications. Nuclear supplies 20 percent of total U.S. electricity production, but 57 percent of zero-carbon electricity. As all recent U.S. nuclear retirements have led to increased fossil fuel-fired generation, any additional loss of nuclear generating capacity could be expected to increase carbon dioxide emissions. For example, according to emissions data from the Air Resources Board, California’s in-state electric power sector emissions rose by 10 million metric tons the year after San Onofre Nuclear Generating Station (2,250 MW) retired; as of 2015 California was still 9 million metric tons (21 percent) above its 2011 low. The entire U.S. nuclear fleet avoids the emissions of 290 million to 408 million metric tons of carbon dioxide per year, depending on whether you assume it will be replaced entirely by natural gas combined cycle generation or by the resources of the

average grid. In addition to its climate benefit, workshop participants noted other positive attributes of nuclear power, including: reliability, no sulfur or nitrogen oxides, rural jobs, national security, and the benefits of a well-functioning nuclear supply chain/workforce.<sup>1</sup>

U.S. nuclear plants are being prematurely retired with respect to their operating licenses, primarily due to low wholesale electricity prices caused by excess power generation capacity, low natural gas prices, declining renewable energy costs, and low growth in electricity demand. Industry representatives also cited *pressure from Wall Street to quickly retire money-losing assets*, as a driver of early retirements. Wholesale power markets do not explicitly reward power sources for being reliable or zero-emitting (or penalize sources that emit pollution). Additionally, life-extending capital investments, mandated post-Fukushima safety enhancements, and other maintenance activities are adding to plant costs. Though this issue has been prominent for several years, and nuclear energy enjoys bipartisan support in Congress, a national response has so far failed to emerge.

## STATE ACTION

In the absence of a federal remedy, some states are taking steps to try to preserve the existing nuclear fleet.

Panelists discussed actions that states are taking, summarized here:

- New York, which gets nearly a third of its electricity from nuclear, enacted a clean energy standard (CES) that includes compensating nuclear specifically for its value as a zero-emission energy source.
- Illinois passed a law in December 2016 to support two (i.e., Quad Cities and Clinton) of its six nuclear power plants with zero-emission credit (ZEC) payments in a similar fashion to New York.
- Connecticut is close to approving a measure that would allow nearly three-quarters of the power generated by its Millstone Nuclear Power Station to be eligible in a state Department of Energy and Environment zero-emission electricity procurement, if it is determined that it is in the best interest of the state and ratepayers.
- New Jersey, Ohio, and Pennsylvania are exploring options to support their nuclear reactors.

In addition to increasing its commitment to renewable generation, New York's CES established a transparent, workable model for valuing and compensating nuclear energy's environmental attributes that can be replicated by other states – a priority for New York, but something its wholesale market was not designed to do. However, some power market participants argue that “around-market” or “out-of-market” subsidies (e.g., ZECs, renewable energy credits) are creating unfair market and price distortions.<sup>2</sup> Nevertheless, the CES with its estimated range of costs and clearly defined targets can also serve as a benchmark that others can use to devise alternative approaches.

There are important lessons to be learned from Illinois' approach to preserving its nuclear fleet. What started out as a narrow and negative debate, grew over more than three years into a larger discussion involving more stakeholders and a broader-based solution. Ultimately, the resulting legislation, the Future Energy Jobs Act, will support jobs in nuclear, jobs and new investment in energy efficiency and renewables, and support for low-income communities. Workshop participants felt the broad set of stakeholders involved was key to passing the legislation.

California, on the other hand, has chosen to phase out its last remaining nuclear power plant. Some

workshop participants were skeptical that California's approach to phase out 18,000 GWh of zero-emission nuclear generation could be reliably replaced by renewables and energy efficiency by 2030 without leaning on fossil fuel generation – for several years at least. California has managed to grow its solar PV generation from virtually zero in 2008 to more than 17,200 GWh in 2016. Though, much of this capacity is in the southern part of the state, there are signs that the growth rate is slowing, and, of course, the sun isn't always shining. If California is successful, it may not actually reduce emissions, but rather, as one workshop observer remarked, will be merely “running to stand still.”

## FEDERAL ACTION

Federal actions that could help existing nuclear power plants were also raised at the workshop, and much of the discussion pointed to the role of the Federal Energy Regulatory Commission (FERC). FERC's work on wholesale electricity price formation to more accurately compensate generators for the services they provide is a potential pathway to helping existing reactors. For example, nuclear generation could be compensated specifically for its reliability because, among other things, its fuel is stored on-site. Some participants felt that FERC could play a larger role in integrating carbon pricing in wholesale power markets, which could provide another avenue for states to achieve their low-carbon policies and potentially preserve existing nuclear plants. However, others were doubtful that FERC had the legal authority to act in that capacity.

Most participants expressed doubt that Congress could act given the current legislative priorities. However, Congressional action, to many, would be the best approach with options ranging from a full market-based price on carbon to more sector-based tax incentives. Continued educational efforts with Congress were discussed.

## OPERATIONAL CHALLENGES

Nuclear power plants in the United States were originally designed to provide baseload power, i.e., the most resilient and reliable electricity sources that run 24 hours a day, seven days a week, to meet the continuous, minimum level of demand. Some argue that this paradigm is

shifting and that the system needs fewer baseload power plants and more flexible power plants, capable of ramping, i.e. dialing output up or down when necessary.

Industry representatives noted that nuclear power companies have been exploring ways to adapt the existing baseload fleet so that power plants are capable of ramping. However, this may be a short-term issue. Longer-term, deep decarbonization strategies suggest that significant electricity demand growth will be necessary by 2050 (i.e., to power electric vehicles, industrial processes, etc.). Creating this low-carbon electricity sector of the future will require more nuclear power, more renewables, fossil-fuel generation with carbon capture technology, and greater deployment of energy efficiency.

Still, operational challenges remain. In some areas of the country, nuclear competes directly with renewable generation in the wholesale power market, at times leading to the curtailment of zero-emission resources. Some observers question whether more careful system planning could help avoid this direct competition. Alternatively, solutions are needed to make nuclear and renewables complementary.

## MARKET CHALLENGES

Wholesale power markets were established to create competition in the electric power sector and deliver affordable, reliable electricity. Largely, these markets have been functioning as designed. Recently, the New England market (ISO-NE) saw its lowest average prices in 13 years due to low natural gas prices and weak demand – a result of mild weather. While low prices are great for consumers, they have been a challenge for nuclear plant operators. Markets are technology-agnostic and do not take environmental benefits (i.e., low-emission sources) into consideration when selecting generation. Nuclear and renewable power sources provide zero-emission electricity to the grid, but receive no compensation from the market for this service. Federal tax credits (i.e., production tax credit and investment tax credit), a policy intervention, provide “around-market” support for renewable generation, but are being phased out.

At the same time, as states have become more concerned about greenhouse gas emissions, they have promulgated policies (i.e., renewable portfolio standards, ZECs) to encourage and preserve lower carbon technologies. These efforts could affect market price formation

as well as regular market participant entrance and exit.<sup>3</sup> FERC held a technical conference in May 2017 to gather information on these around-market payments, focusing on ISO-NE, NY ISO, and PJM. During the conference, Commissioner Cheryl LaFleur said she hoped that FERC would be able to preserve the markets that have functioned well and that a system would emerge that would be able to accommodate states’ aspirations. Workshop participants expressed an interest in further exploring how power market rules could be modified to better value nuclear’s benefits.

As mentioned earlier, market solutions could come from pricing attributes that nuclear is currently providing to the market for free. Independent System Operators (ISOs) and Regional Transmission Operators (RTOs) like MISO, PJM, NY ISO, and ISO-NE have demonstrated the ability to adapt to changing market circumstances (e.g. increasing quantities of intermittent generation and incorporating new technologies like energy storage) and are regulated by FERC; they can help drive market changes from the bottom up. In 2015, FERC approved PJM’s capacity performance proposal, which has helped many nuclear units in subsequent capacity auctions. Solutions Forum participants agreed that there is scope for more pricing ideas (e.g., valuing carbon-free electricity sources) from ISOs and RTOs. ISO stakeholder groups are currently discussing some of these proposals. Notably, the New England Power Pool an advisory group to ISO-NE, has been looking into integrating markets and public policy for more than a year. Workshop participants noted that there are regional differences across the country in terms of available resources for electricity supply and distinct patterns of end-user demand. Therefore, it is unlikely that a one-size-fits-all solution exists; rather, tailored, regionally-based solutions are more likely to emerge.

## NEXT STEPS

Preserving the existing U.S. nuclear reactor fleet for as long as possible is a critical element in the transition to a low-carbon future (along with the development of advanced nuclear designs for future needs). Some states have taken steps to preserve nuclear generation and FERC has begun exploring the situation amidst a range of operational and market challenges.

In the coming months, C2ES will explore the range of available solutions at the federal and state level in more detail. C2ES will continue to work with stakeholders, including Congress, to inform on the value and the large environmental, economic, security and operational benefits provided by the existing nuclear fleet as a key element to a low carbon future.

## ENDNOTES

1 With regard to national security, nuclear power is growing globally and the U.S. is ceding development and leadership to Russia and China. National security is improved by having a robust domestic nuclear industry because it enables technology exports to foreign countries, bringing along the U.S. gold standard of safety and ensuring non-proliferation of nuclear materials.

2 Around-market subsidies are payments received by a generator that participates in an organized electricity market (e.g., PJM, MISO, NY ISO) outside of normal market operations. These include zero-emission credits (ZECs) and the federal production tax credit (PTC), among others.

3 Subsidies for new generation allow new entrants into a market, and subsidies for existing generation allow participants to remain in the market. Without those subsidies, under regular market conditions, the new entrant would not have appeared in the market and the existing participant would have exited the market.



The Center for Climate and Energy Solutions (C2ES) is an independent, nonprofit, nonpartisan organization promoting strong policy and action to address our climate and energy challenges. The C2ES Solutions Forum brings together businesses, states, and cities to expand clean energy, reduce greenhouse gas emissions, and strengthen resilience to climate change.