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U.S. nuclear power still threatened



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Recent history

Three existing nuclear power plants have retired early since 2013 for purely economic reasons. Kewaunee closed in May 2013, Vermont Yankee closed in December 2014, and Fort Calhoun closed in October 2016. Revenues in the electricity markets were not sufficient to cover the costs to operate these nuclear power plants.

Two more existing nuclear power plants retired early because of the high cost of major maintenance. Crystal River closed in February 2013 and San Onofre closed in June 2013. If the value of nuclear-generated electricity had been higher, the owners of these plants might have justified the cost of the major maintenance needed to return the plants to full operation.

Oyster Creek in New Jersey was retired early in 2018. The plant's operating license would have allowed operation until 2029, but Exelon and the state of New Jersey agreed that the plant could operate until 2019 without a requirement to retrofit expensive cooling towers. Exelon then decided to close the plant a year earlier than required.

Some other existing nuclear power plants were scheduled for early retirement for economic reasons, including Nine Mile Point, FitzPatrick, and Ginna in New York and Clinton and Quad Cities in Illinois. In response to the scheduled early retirements, New York and Illinois developed and implemented Zero-Emissions Credit (ZEC) programs. The additional revenue from the New York and Illinois ZEC programs kept these threatened nuclear power plants in operation. These ZEC programs are appropriate actions by government to stop [market failure](#).

This Commentary is an update on what has (and has not) happened over the past year or so to prevent more early retirements.

Federal Actions

Little has happened at the federal level to stop nuclear power plant early retirements. The Supreme Court has been asked to review appeals court decisions upholding the Illinois and New York ZEC programs, DOE's resilience initiative was stopped and additional action is on hold, and the NRC's review of license renewal applications (both initial and subsequent) is going well.

Supreme Court

The New York and Illinois ZEC programs were challenged in court. So far, the courts have rejected filings intended to stop ZEC programs. In January 2019, a coalition of power generation companies asked the [U.S. Supreme Court to review](#) the Seventh Circuit Court of Appeals decision affirming lower court decisions upholding the Illinois ZEC programs. The industry seems to believe that the Supreme Court is unlikely to overturn the Appeals Court decisions



related to the Illinois ZEC program, or the related Second Circuit Court of Appeals decision on the New York ZEC program. Overturning these Appeals Court decisions would overturn the earlier [Hughes v. Talen Supreme Court decision](#) and would likely cause problems with existing renewable energy programs in many U.S. states.

DOE Initiatives

In September 2017, the U.S. Department of Energy (DOE) sent a Notice of Proposed Rulemaking (NOPR) to the Federal Energy Regulatory Commission (FERC) that was aimed at maintaining the resilience of the U.S. power generation system. This NOPR would have provided cost recovery for power plants that have 90 days of fuel at the plant site (i.e., nuclear power plants and most coal-fired power plants). FERC rejected the DOE NOPR and asked regional market/system operators to assess system resilience issues.

In 2018, FirstEnergy asked DOE to issue an emergency order that would provide cost recovery to coal and nuclear power plants in PJM. This request, and a revisit of the DOE NOPR, are [on hold](#) and may not be pursued.

NRC

There is some good news for existing nuclear power plants at the Nuclear Regulatory Commission (NRC). Some existing nuclear power plants see an opportunity to operate for much longer. Most U.S. existing nuclear power plants have applied for and received approval for an initial 20-year license renewal, allowing the nuclear power plant to operate for a total of 60 years.

The initial license renewal application under review for Seabrook was expected to be approved by the NRC during the week of 11 Mar 2019.

Also, the NRC has started a process to review applications for subsequent license renewal (SLR) that would, if approved, allow a nuclear power plant to operate for a total of 80 years. Turkey Point in Florida, Peach Bottom in Pennsylvania, and Surry in Virginia have filed an SLR application and North Anna in Virginia has indicated that it will file an SLR application in 2020.

State Activity

Arizona

In 2018, an Arizona ballot initiative on renewable energy, Proposition 127, was rejected. Proposition 127 would have required Arizona electric utilities to obtain at least 50% of electricity from renewable energy by 2030, with nuclear power not included in the definition of renewable energy. The [defeat of Proposition 127](#) is seen as success for the Palo Verde nuclear power plant, which was projected to retire early if Proposition 127 was approved and implemented.

California

In early 2018, the California Public Utilities Commission (CPUC) approved a plan to allow the Diablo Canyon nuclear power plants units to retire at the end of their original 40-year NRC operating license in 2024 and 2025 with Pacific Gas & Electric (PG&E), the owner of Diablo Canyon, not applying for a 20-year initial license renewal from the NRC for the units.

The [PG&E deal](#) anticipates that the clean electricity from Diablo Canyon will be replaced by other carbon-free resources, but the details and cost of the power to replace Diablo Canyon will not be known until a later Integrated Resource Plan proceeding.

California has aggressive targets for reducing carbon emissions (i.e., [100% zero-carbon electricity by 2045](#)) that will be harder to achieve when the Diablo Canyon nuclear power plant closes early.

Connecticut

Dominion Energy, the owner of Millstone, has indicated that the plant may be retired early. In 2018, a Connecticut program to solicit carbon-free generating capacity selected a 10-year bid from Millstone, after which [state regulators concluded](#) that Millstone was at risk of retiring early.

Negotiations over the prices in the 10-year Millstone power contract continued as this Commentary was final (i.e., on 12 Mar 2019), but Dominion Energy faces a [15 March 2019 deadline](#) to inform ISO New England if the plant will retire early. Millstone has capacity obligations that may limit the option to close before 2023, but a notification by March 2015 that Millstone will not bid in future ISO-NE capacity auctions [would move this to 2022](#).

Illinois

The Illinois ZEC program has been successful in preventing the early retirement of the Quad Cities and Clinton nuclear power plants.

In early 2019, there are [reports](#) that three other Exelon nuclear power plants in Illinois (i.e., Dresden, Braidwood, and Byron) face potential early retirement. All three of these nuclear power plants have capacity contracts that will prevent closure until 2021 for Dresden and until 2022 for Byron and Braidwood.

Negotiations between Exelon and state lawmakers are in progress.

In the meantime, [new Illinois legislation](#) has been proposed that would put aggressive renewable energy targets in place (i.e., 45% by 2030 and 100% by 2050), with nuclear power excluded.

Iowa

Duane Arnold received approval of an initial license renewal that expires in 2034.



A power [contract extension to 2025](#) was approved by the Iowa Utilities Board in 2013. In 2018, a [settlement agreement](#) that would end the power contract in 2020 was approved by the Iowa Utilities Board. The Duane Arnold nuclear power plant will close in 2020.

Massachusetts

Pilgrim received approval of an initial license renewal that expires in 2032.

Pilgrim will close in June 2019 and Entergy has agreed to sell Pilgrim to Holtec International, who will carry out the decommissioning.

Michigan

Palisades received approval for an initial license renewal that expires in 2031.

The Palisades nuclear power plant in Michigan will retire early when the power contract with Consumers Energy ends in 2022. Entergy announced that it has agreed to sell the Palisades nuclear power plant to Holtec International after shutdown, with Holtec taking over decommissioning of the plant.

Minnesota

Prairie Island nuclear power plant in Minnesota is considered as one of the existing nuclear power plants potentially threatened by economic early retirement as a result of relatively high costs (i.e., small, single unit plant) and low power market prices.

In early 2019, Minnesota [proposed a plan](#) for the state's electricity to be carbon free by 2050. Xcel Energy, which owns the Prairie Island and Monticello nuclear power plants in Minnesota, has its own [plan](#) to be carbon free by 2050 and to [reduce carbon emissions by 80%](#) by 2030. Nuclear power appears to be a part of both plans. However, there are several issues:

- Nuclear power plants in Minnesota may not operate much beyond 2050. Prairie Island unit 1 and 2 started operation in 1974 and both have approved initial license renewal applications that extend the operating licenses to 2033/2034. If these units received an SLR (there is no application filed for this), operation might continue to 2053/2054.
- The actual legislation introduced in the Minnesota house to implement the carbon-free goal, HF1956, [excludes existing nuclear power plants](#) in Minnesota from the definition of a "carbon-free resource."
- The proposed legislation appears to allow *new* nuclear power plants in Minnesota as a carbon-free resource. However, new nuclear power is banned in Minnesota and [legislation](#) to end this ban is being discussed.

The carbon-free electricity plans of Minnesota and Xcel Energy offer some hope that existing Minnesota nuclear plants will not retire early, but these plans are not certain.



New Jersey

In 2018, New Jersey passed legislation that required the Board of Public Utilities (NJBPU) to develop and implement a ZEC program. The NJBPU [approved a ZEC program](#) in November 2018 and initiated the ZEC process. Public Service Enterprise Group (PSEG) submitted ZEC applications for three nuclear power plants (i.e., Hope Creek, Salem unit 1, and Salem unit 2).

The NJBPU is scheduled to consider the applications and the analysis conducted by BPU staff and consultants in an April 2019 meeting.

The New Jersey ZEC process has generated some public controversy before any outcomes have been made public. State [Rate Counsel testimony](#) stated that the PSEG nuclear plants should not qualify for ZEC payments and PSEG asserted that the [nuclear plants will close early](#) if there are no ZEC payments.

The New Jersey ZEC legislation, and the NJBPU process to implement that legislation, provides a path to preventing the early retirement of the PSEG nuclear power plants, but this process is not completed yet.

New York

Entergy has announced that the Indian Point units will retire early in 2020 and 2021.

Entergy, filed an application for license renewal in 2007 for the Indian Point units, more than 5 years before the original licenses were due to expire in 2013 and 2015. The units continued to operate after the original license expired because the license renewal applications were under review by the NRC.

In 2018, Entergy reached an agreement with the state of New York and environmental groups that had opposed the license renewal that involved Entergy amending the license renewal applications to cover a shorter period. The NRC approved a truncated license renewal that allowed the units to operate until 2024 and 2025.

Entergy is expected to sell the Indian Point Energy Center, after units 2 and 3 are closed, to a firm that would carry out decommissioning.

Ohio

FirstEnergy has announced plans to close two Ohio nuclear power plants early. Unless the plants receive more revenue from state or federal sources, Davis Besse will close in 2020 and Perry will close in 2021.

These nuclear power plants have been under threat for some time. A [2016 state plan](#) to re-regulate the units was not successful. [FirstEnergy asked DOE to issue an emergency order](#) that would provide additional revenue to its nuclear power (and coal) power plants in early 2018. Not long after the DOE emergency order request, the FirstEnergy competitive generation



subsidiary (FirstEnergy Solutions) that owns the company's nuclear power plants [filed for Chapter 11](#) bankruptcy protection.

In 2018, [legislation is expected](#) to be considered that would provide additional revenue to the Ohio nuclear power plants. Past state efforts to stop the early retirement of the Ohio nuclear power plants have been defeated and this new plan is expected to face strong opposition. The potential to include renewable energy in the bill may help gain support.

Pennsylvania

FirstEnergy has also announced plans to close its Beaver Valley nuclear power plant in Pennsylvania in 2021 unless it receives additional revenue.

Exelon has announced plans to close Three Mile Island unit 1 (TMI-1) in 2019 unless it receives additional revenue, with a closure decision coming as soon as [June 2019](#) (i.e., when Exelon needs to order nuclear fuel) for a September 2019 closure.

In March 2019, Pennsylvania PUC [Commissioner Andrew Place](#) sent a [report](#) on policy options for nuclear power to legislators. On 10 March 2019, [legislation was introduced](#) that could save the threatened Pennsylvania nuclear plants by requiring that nuclear power plants receive the same preferential treatment and subsidies that renewables get under a 2004 law.

Earlier efforts to pass legislation to help avoid early retirement of Pennsylvania nuclear power plants have failed and this new legislation faces strong opposition.

Wisconsin

Wisconsin has proposed a [plan](#) to require electric utilities to be carbon-free by 2050. The plan would include nuclear power as a source of carbon-free electricity. This may help the Point Beach nuclear power plants remain viable, depending on the details of the state plan. However, Point Beach may not operate past 2030, as the plant received NRC approval of an initial license renewal and has a current license expiring in May 2030. Even if Point Beach applied for and received an approval for Subsequent License Renewal, that would only last until 2050.

Summary

There are some positive trends for U.S. existing nuclear power, but some near-term decisions may mean that multiple units are likely to retire early. Federal initiatives to limit the early retirement of existing nuclear power plants have not moved forward. This means that states must take action.

The following table provides a summary of the existing nuclear power plants that are scheduled to retire early and some key units that are threatened by early retirement.



Plant	State	NRC license expiry	Early retirement
Scheduled early retirement			
Pilgrim	Massachusetts	2032	2019
Duane Arnold	Iowa	2034	2020
Indian Point 2	New York	2024 (11-year license renewal)	2020
Indian Point 3	New York	2025 (10-year license renewal)	2021
Palisades	Michigan	2031	2022
Diablo Canyon 1	California	2024 (initial 40-year license)	2024
Diablo Canyon 2	California	2025 (initial 40-year license)	2025
Potential early retirement			
TMI-1	Pennsylvania	2034	2019
Davis Besse	Ohio	2037	2020
Perry	Ohio	2026 (initial 40-year license)	2021
Beaver Valley 1	Pennsylvania	2036	2021
Beaver Valley 2	Pennsylvania	2047	2021
Braidwood 1	Illinois	2026 (initial 40-year license)	No earlier than 2022
Braidwood 2	Illinois	2027 (initial 40-year license)	
Byron 1	Illinois	2024 (initial 40-year license)	No earlier than 2022
Byron 2	Illinois	2026 (initial 40-year license)	
Dresden 2	Illinois	2029	No earlier than 2021
Dresden 3	Illinois	2031	
Millstone	Connecticut	2045	No earlier than 2022/3

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