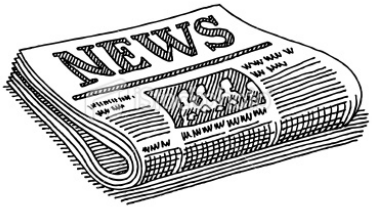

- Congressional Legislative Action:
  - July 2018:
    - During the week of July 8, the U.S. House of Representatives Energy and Commerce Committee advanced two bills related to nuclear energy to the full House for further consideration.
      - The Advanced Nuclear Fuel Availability Act (HR 6140) would ensure that adequate supplies of domestically produced high-assay low-enriched uranium (enriched above 5 percent and below 20 percent) are available.
      - The Nuclear Utilization of Keynote Energy Act (HR 1320) would (1) update the U.S. Nuclear Regulatory Commission's (NRC) fee collection mechanism so that industry-paid fees are collected more efficiently; (2) direct studies to analyze possible outdated procedures at the NRC to identify efficiencies; and (3) create a review of timelines for license applications.
  - June 2018:
    - On June 8, the U.S. House of Representatives voted 235-179 to pass H.R. 5895, "Energy and Water, Legislative Branch, and Military Construction and Veterans Affairs Appropriations Act, 2019" which includes $267.7 million in funding to support the Yucca Mountain nuclear waste repository. The Senate version of the bill approved in May does not include funding, leaving open the prospect that differences could be ironed out in a House-Senate conference committee. Efforts in 2017 and 2018 to renew licensing both failed when the House and Senate failed to agree on funding.

- August 29, 2018: The U.S. Nuclear Regulatory Commission (NRC) accepted for review a subsequent license renewal application to extend Peach Bottom Units 2 and 3, for an additional 20 years. Peach Bottom, located near Lancaster, PA, is owned and operated by Exelon Generation Company, LLC. The NRC approved the initial license 20-year renewal application in 2003, which is currently licensed to operate through 2033 (Unit 2) and 2034 (Unit 3).

- August 24, 2018: NRC staff declared that small modular reactors (SMRs) would not need large emergency planning zones (EPZs), stating instead that EPZs can feasibly be scaled down for SMRs. The staff made the preliminary finding public in its advanced safety evaluation of a Tennessee Valley Authority (TVA) 2016 early site permit application (ESPA) for a potential nuclear plant at the TVA's Clinch River Nuclear Site. In its ESPA, TVA requested an exemption to the 10-mile EPZ requirement for large light water reactors. TVA used information from four SMR designs to provide the technical basis for the request and provided an analysis of the safety and performance attributes of SMRs. A staff audit report concluded that an SMR plant at the Clinch River site based on the NuScale SMR design would meet the conditions for a site boundary-sized EPZ. The Commissioners will make the final decision regarding this exemption request following the mandatory hearing later this year – the date for final decision is unknown at this time.

- August 17, 2018: Two major milestones were met in the commissioning of two AP1000s under construction in China. Unit 2 of the Sanmen nuclear power plant attained first criticality - a sustained chain reaction, the China National Nuclear Corporation and State Nuclear Power Technology Corporation announced. Meanwhile, unit 1 at the Haiyang plant was connected to the electricity grid and began power generation.

- August 10, 2018: The cost projections for the completion of the Vogtle plant have increased by an estimated $2.2 billion, to more than $27 billion total costs, more than double its original estimate. Co-owner Georgia Power's (45.7%) increase is $1.1 billion; another co-owner, Oglethorpe Power (30%), will see an increase of $450 million. The project is two-thirds complete. All four owners will vote to continue the project later this year.
    - A third co-owner MEAG (22.7%) is facing pressure from JEA, a Florida utility contracted to buy the power from Vogtle. JEA agreed in the power purchase agreement to pay MEAG even if the new Vogtle reactors never generate power; there is no cap on how high their obligations to construction costs could go. MEAG may choose to vote "no", leaving the other co-owners a choice to buy MEAG's share or cancel the project.

- August 16, 2018: FirstEnergy Solutions filed plans related to decommissioning three nuclear power plants with the NRC. The plants, Davis-Besse, Perry, and Beaver Valley, are scheduled to close during the next 3 years unless legislative actions are taken to keep them operating.

- August 2, 2018: Brookfield completed its purchase of Westinghouse Electric Company from Japan's Toshiba Corporation, marking Westinghouse's exit from Chapter 11 bankruptcy protection as a restructured company. Westinghouse first filed for bankruptcy in March 2017 to undergo strategic restructuring, affecting the construction of four AP1000 reactors at two sites, Vogtle in Georgia and VC Summer in South Carolina.

- August 1, 2018: Secretary of Energy Rick Perry visited Oswego, New York to tour Exelon Generation's James A. FitzPatrick Nuclear Power Plant. After the tour, Secretary Perry participated in an energy roundtable discussion with U.S. Congressman John Katko, Exelon CEO Chris Crane, industry executives and employees, and community leaders on the importance of nuclear energy. Perry reiterated his support for nuclear energy as a clean and reliable source of baseload energy, and noted that the department is partnering with industry to extend the safe and economic lifespan of the nuclear fleet.

- August 1, 2018: Holtec International agreed to purchase Oyster Creek Nuclear Generating Station in New Jersey from Exelon Generation, and the Pilgrim nuclear plant in Massachusetts and the Palisades nuclear plant in Michigan from Entergy. The plants will operate until their scheduled closure dates (Oyster Creek: 2018, Pilgrim: 2019, and Palisades: 2022), with Holtec seeking to decommission the sites in as few as eight years. Decommissioning will be performed by Comprehensive Decommissioning International, a joint venture between Holtec and SNCLavalin.

- July 30, 2018: Details of a deal to finish the Bellafonte Nuclear Power Plant in Alabama and its two pressurized water reactors were announced at a news conference on July 30. Tennessee Valley Association (TVA) began building the plant in 1974, but construction was halted in 1988 amid a downturn in the U.S. nuclear industry. The site has two partly-built reactors, cooling towers, and other infrastructure still in place. Nuclear Development, LLC bought the TVA site in November 2016 for $111 million. The company said they have pursued production tax credits to help make continued construction financially viable and has hired Canadian construction and design firm SNC-Lavalin to complete the plant for an estimated $12 billion.

- July 29, 2018: NextEra Energy Resources, the wholesale power generating subsidiary of Florida-based NextEra Energy Inc., announced it will close the Duane Arnold Energy Center, a 615-MW nuclear power plant located in Palo, Iowa, before the end of 2020. The Duane Arnold operating license expires in 2034 but was originally planned to retire in 2025 when its power purchase agreement (PPA) with Alliant Energy

was set to expire. However, NextEra Energy Resources and Alliant agreed to a deal to shorten the PPA by 5 years. The Iowa Utilities Board must approve this deal.

- July 27, 2018: Exelon Generation's application to renew licensing for two Pennsylvania nuclear reactor units is now available for public review. This would be the second renewable application in the history of Peach Bottom Units 2 and 3, which were originally placed on-line in 1974. Unit 2 and 3, both GE-Hitachi boiling-water reactors, are currently licensed to operate through August 2033 and July 2034. Approval could push those licenses out to 2053 and 2054, making Peach Bottom Units 2 and 3 about 80 years old on those dates. Exelon filed the application for renewal on July 10. The U.S. is the first nation to consider whether to stretch nuclear power reactor lifespans to 80 years.

- July 10, 2018: U.S. Secretary of Energy Rick Perry announced the DOE has selected nine domestic projects to receive nearly $20 million in funding for cost-shared research and development for advanced nuclear technologies. These awards are through the DOE's Office of Nuclear Energy's funding opportunity announcement for U.S. Industry Opportunities for Advanced Nuclear Technology Development and are the second group selected under this solicitation. The first group was announced on April 27, 2018. Subsequent quarterly application review and selection processes will be conducted over the next five years.

- July 10, 2018, Exelon Corporation filed a second license renewal application for its Peach Bottom Unit 2 and Unit 3 reactors, located in Delta, Pennsylvania. Peach Bottom Unit 2 reactor began commercial operation in July 1974, and its current license will expire in August 2033. Unit 3 reactor began commercial operation in December 1974, and its current license will expire in July 2034. If granted, the license will be renewed until 2053 and 2054 respectively.

- July 9, 2018: Exelon Corporation informed the U.S. Securities and Exchange Commission that the commission it has entered into an agreement to purchase the power business of FirstEnergy Solutions for $140 million. If the sale is completed, it would give Exelon the accounts of the commercial, industrial, government and nonprofit customers that selected FirstEnergy Solutions as their electricity provider, and those for whom FirstEnergy was a provider of last resort. The majority of the company's clients are in Pennsylvania and Ohio. The sale also does not include any of FirstEnergy's bankrupt power plants, such as Beaver Valley nuclear station and the coal-fired Bruce Mansfield plant. The transaction is expected to close in the fourth quarter of 2018 but is conditional on Exelon being the winning bidder after a bankruptcy auction and the subsequent approval of the purchase agreement by the U.S. Bankruptcy Court for the Northern District of Ohio.

- July 6, 2018: Dominion is considering retiring its Millstone Power Station in Waterford, Connecticut after state regulators proposed delaying the company's ability to bid on zero carbon projects until 2023. Connecticut passed a bill last year authorizing regulators to allow nuclear plants to compete in a zero-carbon auction for fixed-price contracts with utilities. The intent of this bill is to encourage development of clean energy producers, and reward them with higher prices for their electricity. Millstone, although emitting zero carbon, still generates radioactive waste; however, it was granted an exception to enter the auction through an "at risk" designation signaling economic hardship. Under this proposal, Millstone will not be eligible to receive incentives for being at-risk for closure until at least 2023. Regulators will weigh factors beyond price only in cases where zero-carbon energy producers face potential shutdown due to economic duress. Dominion claims that while Millstone is profitable, it is still at risk now due to rising expenses and competition from cheaper natural gas that have weakened its financial position. Millstone produces 2,100 MW of from two operating reactors.

- July 2, 2018: Unit 1 of the Sanmen nuclear power plant in China has been connected to the grid, becoming the world's first Westinghouse AP1000 to achieve grid connection and power generation. Hot testing of Sanmen 1 was completed in June 2017. The loading of fuel assemblies into its core began on April 25th following the issuance of a permit by the Chinese National Nuclear Security Administration. The unit achieved first criticality on June 21st, and on June 27th nuclear-generated steam was used for the first time to successfully rotate the turbine at rated speed. The unit will now undergo gradual power ascension testing until all testing is safely and successfully completed at 100% power. Sanmen 1 is scheduled to enter commercial operation by the end of 2018.

- June 28, 2018: Robert Powelson, nominated to the Federal Energy Regulatory Commission (FERC) by President Trump in May of 2017, recently announced that he will retire from the five-member body to lead the National Association of Water Companies, a group that lobbies for private water companies. An advocate for competitive power markets, Powelson opposed the coal and nuclear bailouts pushed by energy secretary Rick Perry in 2017. President Trump now has the authority to nominate a new commissioner, who would then have a hearing before the Senate Energy Committee. FERC members serve three-year terms.

- June 26, 2018: U.S. District Judge J. Michelle Childs rejected the DOE's request to stay a preliminary injunction for the Mixed Oxide Fabrication Facility (MOX), which was handed down earlier this month, and allowed the MOX project to move forward. The injunction ultimately vacated an earlier partial stop work order and halted termination efforts until the case is heard in the U.S. 4th Circuit Court of Appeals.
    - June 7, 2018: The State of South Carolina was granted a preliminary injunction, preventing the US Department of Energy's shutdown of the MOX project at Savannah River Site. The injunction maintains ongoing work and construction at MOX while the state of South Carolina continues its lawsuit against the DOE. South Carolina Attorney General Alan Wilson argued that the shutdown would leave the state a permanent repository for plutonium, as no other disposal method has been approved by Congress. The DOE has identified a "dilute and dispose" alternative for dealing with the plutonium, but faces resistance from the State of New Mexico, where the plutonium would be shipped after dilution.
    - May 11, 2018: Construction of the mixed-oxide fuel fabrication facility (MOX) was formally ended by Secretary of Energy Rick Perry. The facility was designed to reprocess weapons-grade plutonium and uranium into fuel for reactors, but ballooning costs and missed construction milestones, along with the unraveling of a nuclear non-proliferation agreement between the U.S. and Russia, eventually caused the project to be discontinued. At the time of cancellation, the estimated cost of the project exceeded $18 billion with over $7 billion already spent. With the cancellation of the MOX plant, the National Nuclear Security Administration proposed installing pits to store plutonium waste at both the Savannah River Site and Los Alamos National Laboratory.

- June 18, 2018: Accident tolerant fuels developed by Framatome are being loaded into the DOE's Advanced Test Reactor at Idaho National Laboratory for testing. The fuel company is testing two different concepts. The first is a chromium-coated cladding, which is designed to protect the fuel cladding from damage and oxidation at higher temperatures. The second concept is chromia-doped fuel pellets, which are expected to last longer and perform better under accident conditions. The tests are scheduled through January 2021, after which the fuels will be loaded into the Transient Test Reactor to determine safe operating limits.

- June 14, 2018: Researchers at Pacific Northwest National Laboratory (PNNL) have successfully completed a trial to use acrylic fibers to extract uranium from seawater. The material was developed by Idaho-based LCW Supercritical Technologies with support from PNNL. Three separate month-long tests were carried out where seawater was pumped through about a kilogram of fiber in conditions mimicking the open ocean, producing about five grams of uranium. LCW is planning to conduct further testing in the Gulf of Mexico, which could produce three to five times the extraction rate due to the material's increased performance in warm water.

- June 12, 2018: The Federal Energy Regulatory Commission (FERC) testified during an oversight hearing before the Senate Energy and Natural Resources Committee. FERC Chairman Kevin McIntyre said, "there is no immediate calamity or threat to our ongoing ability to have our bulk power system operate and satisfy the energy needs," before adding that the long-term issue needed to be studied. McIntyre also said the commission is reviewing feedback from grid operators to determine whether action by FERC is required. Commissioner Neil Chatterjee voiced support for grid resilience measures, while Commissioner Robert Powelson was resistant to the directive's possible impacts to wholesale competitive markets.

- June 4, 2018: The U.S. Department of Energy announced up to $24 million in funding for ten projects as part of a new Advanced Research Projects Agency – Energy (ARPA-E) program called "Modeling-Enhanced Innovations Trailblazing Nuclear Energy Reinvigoration, or MEITNER. The MEITNER teams will identify and develop technologies that enable lower operating costs and safer designs for nuclear reactors. The MEITNER awards include private companies and universities, which will have access to DOE modeling and simulation resources and support from national laboratories.

- June 1, 2018: President Trump has directed Secretary of Energy Rick Perry to prepare immediate steps to stop the loss of "fuel-secure" power facilities, including nuclear and coal power plants. The directive cites "rapid depletion of a critical part of our Nation's energy mix," and impacts to "the resilience of our power grid." This represents the administration's second attempt to prevent early retirement of coal and nuclear plants. In 2017, Secretary Perry proposed a rule that would require regional markets to compensate coal and nuclear plants based upon the reliability they provide, but the rule was rejected by the Federal Energy Regulatory Commission in January.

LICENSING ACTIONS

Vendors and utilities that wish to certify a new reactor design or a potential site, or construct and operate a new nuclear power plant must submit an application to the U.S. Nuclear Regulatory Commission (NRC), which will conduct an in-depth review of safety and environmental aspects related to the design and / or site.

Reactor Design Certifications (DC)

By issuing a design certification, the NRC approves a nuclear power plant design, independent of an application to construct or operate a plant. A design certification is valid for 15 years from the date of issuance, but can be renewed for an additional 10 to 15 years. A Design Certification application (DCA) must include enough information to show the design meets NRC's safety standards and that the design resolves any existing generic safety issues and issues that arose after specific events in the nuclear industry such as the Three Mile Island accident. Applications must closely analyze the design's appropriate response to accidents or natural events, including lessons learned from the Fukushima accident. Applications must also lay out the inspections, tests, analyses and acceptance criteria that will verify the construction of key design features. Certification reviews identify key information to consider in site-specific reviews for operating licenses. *(From NRC website)*

Three reactor designs that are being considered for future builds in the United States are certified. Two additional designs, (including a small modular reactor design), are under NRC review. One is under renewal review and two have been withdrawn[1].

[1]AREVA US-EPR – Submitted December 12, 2007, and docketed February 25, 2008; review suspended at the request of the applicant.
Mitsubishi Heavy Industries US-APWR – Submitted December 31, 2007 and docketed February 29, 2008; MHI has requested a deferral of the review due to their work on reactor restarts in Japan.

	VENDOR	TECHNOLOGY	STATUS
Issued	Westinghouse	AP1000	Issued: 12/30/2011
	General Electric-Hitachi	ESBWR	Issued: 11/14/2014
Renewal	General Electric-Hitachi	ABWR	Originally Issued 5/12/1997: DC Renewal Application is under review
Active DCAs	Korea Electric Power Corp	APR1400	Under Review: Final SER expected 9/2018
	NuScale Power	NuScale SMR Power Module	Under Review: Final SER expected 9/2020

Early Site Permits (ESP)

By issuing an ESP, the NRC approves one or more sites for a nuclear power facility, independent of an application for a construction permit or combined license. An ESP is valid for 10 to 20 years from the date of issuance, and can be renewed for an additional 10 to 20 years. In reviewing an ESP application, the NRC staff will address site safety issues, environmental protection issues, and plans for coping with emergencies, independent of the review of a specific nuclear plant design. During this process, the NRC notifies all stakeholders (including the public) as to how and when they may participate in the regulatory process, which may include participating in public meetings and opportunities to request a hearing on the issuance of an ESP. *(From NRC website)*

Five ESPs have been issued. One is currently under review and one was withdrawn[2]

[2]Victoria County Station, Texas (Exelon) was withdrawn from NRC review 10/2012

	SITE/LOCATION		UTILITY	TECHNOLOGY REFERENCED	STATUS
Issued	Clinton	IL	Exelon	Plant Parameter Envelope (PPE)	Issued: 3/15/2007
	Grand Gulf	MS	Entergy	PPE	Issued: 4/5/2007
	North Anna	VA	Dominion Power	PPE	Issued: 11/27/2007 Amended 1/30/2013
	Vogtle	GA	Southern	AP1000/ Westinghouse	Issued: 8/26/2009
	Salem County	NJ	PSEG	PPE	Issued: 5/5/2016
Active ESPs	Clinch River	TN	TVA	PPE	Under Review: Final Environmental Impact Statement expected 6/2019 Final SER expected 9/2019

Combined Construction and Operating Licenses (COL)

By issuing a COL, the NRC authorizes the licensee to construct and (with specified conditions) operate a nuclear power plant at a specific site, in accordance with established laws and regulations. In a COL application (COLA), NRC staff reviews the applicant's qualifications, design safety, environmental impacts, operational programs, site safety, and verification of construction with inspections, testing, analyses, and acceptance criteria. The staff conducts its review in accordance with the Atomic Energy Act, NRC regulations, and the National Environmental Policy Act. All stakeholders (including the public) are given notice as to how and when they may participate in the regulatory process, which may include participating in public meetings and opportunities to request a hearing on the issuance of a COL. Once issued, a COL is good for 40 years and can be renewed for an additional 20. *(From NRC website).* A COLA may reference a certified design and/or an early site permit, or neither.

Eighteen COLAs have been docketed by the NRC: Eight, totaling 14 reactors, have received COLs; one, totaling two nuclear reactors, remains under active NRC review; 10 were suspended and later withdrawn3 due to utility, economic or other considerations while four remain in "suspended" status4. A Reference COL (R-COL) application has been submitted for five reactor designs (in addition to the designs for which a COL has been issued listed in the table below, COL applications were submitted for a USEPR and an US-APWR but were later withdrawn); subsequent COLs (S-COLs) incorporate the corresponding R-COL application by reference, noting any site-specific departures.

[3]Suspended and Withdrawn: Bell Bend; Bellefonte 3&4 Callaway 2, Calvert Cliffs 3 , Grand Gulf 3 , Nine Mile Point 3, River Bend 3 , Victoria County 1&2 ,

[4]Remains Suspended: Shearon Harris 2&3, Comanche Peak 3&4

	SITE/LOCATION		UTILITY	REACTOR TECHNOLOGY/ NO. of REACTORS		STATUS
Issued	Vogtle	GA	Southern Nuclear	AP1000	2	Issued: 2/10/2012
	V.C. Summer	SC	SCE&G	AP1000	2	Issued: 3/30/2012
	Fermi	MI	DTE Energy	ESBWR	1	Issued: 5/1/2015
	South Texas Project	TX	STPNOC	ABWR	2	Issued: 2/12/2016
	Levy	FL	Duke Energy	AP1000	2	Issued: 10/26/2016
	William States Lee	SC	Duke Energy	AP1000	2	Issued: 12/19/2016
	North Anna	VA	Dominion Energy	ESBWR	1	Issued: 6/2/2017
	Turkey Point	FL	Florida Power and Light	AP1000	2	Issued: 4/12/2018

A COL is valid indefinitely. If a licensee chooses not to construct a plant immediately following being granted a COL, it must submit a COL update annually to the NRC to reflect the most recent regulatory requirements and any new or different environmental or design information, or it can request an exemption. To begin construction, the COL must be fully updated.

NEW PLANT CONSTRUCTION

Until recently there were four Westinghouse AP1000 reactors under construction at the Vogtle (Georgia) and V.C. Summer (South Carolina) sites. Their construction has been impacted when Westinghouse declared bankruptcy last year.

Vogtle Unit 3 containment building under construction. (Courtesy of Georgia Power/ Southern Company, July 2018)

Vogtle

On August 8, 2018 Georgia Power announced that Southern Nuclear has made significant progress on construction of Vogtle Units 3 & 4 since assuming project management on behalf of the project co-owners from Westinghouse. Milestones over the past 60 days alone, have included a major concrete placement lasting more than eight continuous hours inside the Unit 3 shield building and the placement of a 52,000-pound Q233 piping module for Unit 4, a critical piece of the overall passive core cooling system, inside the containment vessel allowing large quantities of specialized piping to now be installed.

The cost projections for the completion of the Vogtle plant have increased by an estimated $2.2 billion, to more than $27 billion total costs, more than double its original estimate. Drivers for the increase include providing craft labor incentives to attract and retain staffing levels and increased field supervision and engineering oversight.

In late July, 2018, Bechtel announced it was making a push to attract and hire skilled workers to meet the peak construction labor requirements beginning at the end of 2018 and continuing into 2019. On July 9, 2018, Georgia Power announced it was providing a second of three $25 credits to its customers in response to an order by the Georgia Public Service Commission (PSC) to shoulder some of the cost overruns when the PSC agreed to let the utility finish the delayed, over-budget Plant Vogtle nuclear expansion. The total credit provided sums to $188 million.

Two groups filed legal challenges to the Georgia Public Service Commission's (PSC) decision to allow Georgia Power and partners to complete two unfinished nuclear reactors at Plant Vogtle in early 2018. Southern Environmental Law Center, Partnership for Southern Equity, and Georgia Interfaith Power and Light filed a lawsuit in February arguing PSC violated state laws and the commission's own rules by approving spending that would nearly double the estimated cost of the project. Consumer group Georgia Watch filed a legal challenge in March alleging the PSC's decision benefits Georgia Power's shareholders over ratepayers. No hearing dates have been set for these filings. In April, Georgia Power filed motions to dismiss the cases.

VC Summer

In January 2018, Dominion Energy proposed to buy SCANA Corporation for $14.6 billion and agreed to make up for customers being charged for the failed V.C. Summer nuclear construction project with $1.3 billion in rebates and no rate increases for three years. In March, the Georgia Public Service Commission unanimously approved the merger. In July, SCANA received the Federal Energy Regulatory Commission and its stockholders' approval of the proposed sale to Dominion and shareholders voted in favor of the merger. The

acquisition now requires approval from North and South Carolina state regulators where SCANA operates, in addition to the Nuclear Regulatory Commission.

SCANA is being sued by its shareholders and customers after it and its minority partner, the state-owned Santee Cooper utility, pulled the plug last July on the $9 billion, decade-long construction of two nuclear reactors in Fairfield County. The lawsuits allege SCANA leaders were aware of critical problems dooming the nuclear project and covered them up. SCANA announced in July 2018, it would open its own investigation in mismanagement of the Summer project.

At the time of its August 2017 cancellation, the V.C. Summer project was about 65% complete. All four steam generators for Units 2 and 3 reactors were being installed, while two of the four reactor coolant pumps for Unit 2 reactor are on site. Units 2 and 3 reactors were planned to come online in April 2020 and December 2020, respectively.

OPERATING FLEET STATUS

Nation-Wide Status

As the pioneer of nuclear power development, America is the world's largest producer of nuclear power, accounting for more than 30% of worldwide nuclear generation of electricity. Our 99 reactors produced approximately 805 billion kilowatt-hours (kWh) in 2017, 20% of America's total electrical output and nearly 60% of our emissions-free electricity. Since the early 1970s, the U.S. nuclear industry has significantly improved its safety and operational performance. By the turn of the century, it was among world leaders with a record-breaking capacity factor in 2017 of over 92% and all safety indicators exceeding targets.

In deregulated electricity markets, nuclear power plants are facing financial challenges from low cost electrical power sources.

This section covers information on operating plant uprates, supportive initiatives, and challenges impacting specific plants.

License Renewal and Uprate Status

License Renewal

Eighty-nine reactors have received 20-year extensions of their operating licenses from the U.S. Nuclear Regulatory Commission (NRC), including Kewaunee, Vermont Yankee and Fort Calhoun, which are now permanently closed. Applications for an additional four renewals (five reactors total) are currently under NRC review.

Applications for License Renewal

- Pending Applications:
  - Indian Point 2 & 3
  - Seabrook 1
  - Waterford 3
  - River Bend
- Anticipated Future Submittals:
  - Clinton Power Station 1
  - Comanche Peak Nuclear Power Plant 1 & 2

Applications for Second License Renewal

- In 2018:
  - On August 29, 2018, NRC accepted Exelon Corporation's second license renewal application for its Peach Bottom Unit 2 and Unit 3 reactors, located in Delta, Pennsylvania. Peach Bottom Unit 2 reactor began commercial operation in July 1974, and its current license will expire in August 2033. Unit 3 reactor began commercial operation in December 1974, and its current license will expire in July 2034. If granted, the license will be renewed until 2053 and 2054 respectively.
  - In late January, Florida Power & Light (FP&L) filed an application for a second license renewal of its Turkey Point 3 and 4 reactors with NRC. This was the first application for a second renewal

period to be filed and, if granted, will allow the reactors to operate to 2052 and 2053-a total of 80 years.

- By 2020:
  - Dominion will file will a second license renewal application for its Surry Power Station Unit 1 and 2 reactors in Surry, Virginia. Surry Power Station Unit 1 reactor began commercial operation in December 1972, and its current license will expire in May 2032. Unit 2 reactor began commercial operation in May 1973, and its current license will expire in January 2033.
  - Dominion will file a second license renewal for North Anna Unit 1 and 2 reactors near Mineral, Virginia. Unit 1 reactor's license was granted April 1978 and expires April 2038. Unit 2 reactor's license was granted August 1980 and expires August 2040.

Operating Fleet Uprate Activities

U.S. nuclear power plants have submitted power uprate applications to the NRC since the 1970s, accounting for an additional 7,923 MWe of output.

- Approved Applications
  - Hope Creek Unit 1 reactor – The NRC approved PSEG's 1.6% uprate request on April 24, 2018, increasing the reactor's output from approximately 3,840 to 3,902 megawatts thermal.
  - Browns Ferry Units 1, 2, and 3 – The NRC approved Tennessee Valley Authority's (TVA) 14.3% uprate request on August 14, 2017, increasing the reactors' output from the currently licensed thermal power level of 3,293 to 3,952 megawatts thermal. TVA just completed an upgrade to Browns Ferry Unit 3 for an additional 155 MW and have plans to upgrade Units 1 and 2 in the near future.
  - Peach Bottom Units 2 and 3 – The NRC approved Exelon's 1.66% uprate request on November 15, 2017, increasing the reactors' output from approximately 3,951 to 4,016 megawatts thermal.
- Expected Applications, 2018 & beyond
  - As of July 31, 2018, the NRC reports there are zero pending or expected applications for power uprate.
  - As of July 31, 2018, there are four expected applications for power uprate in 2019 (per NRC)

Operating Fleet Status: Supportive Federal and State Action

Initiatives are taking place at the national and state level to ensure a more competitive market for nuclear power. For example, state action in New York and Illinois to level the playing field and include nuclear energy in their clean energy policies has averted the closure of five power plants.

- Secretary of Energy Rick Perry told the U.S. House of Representatives committee on Science, Space, and Technology on May 9th that the department is looking at using the Defense Production Act to keep coal and nuclear plants from closing.
- In May, New Jersey Governor Phil Murphy directed the state to issue zero emissions credits to eligible nuclear power plants. These credits are expected to apply to Hope Creek and Salem reactors but will not prevent the closure of Exelon's Oyster Creek reactor, which is scheduled to close in October 2018.
- Based on action initiated by the U.S. Department of Energy, the U.S. Federal Energy Regulatory Commission (FERC) is currently collecting resilience preparedness information from the regional transmission organizations/ independent system operators to ensure the resilience of the bulk power system.

- PJM Interconnection LLC, a regional transmission organization, is considering enhancements to energy price formation to allow all resources selected for dispatch to set price (i.e., baseload plants that are currently "price takers") which would more accurately reflect true costs to serve load.
- Two states (New York and Illinois) approved the creation of "zero emissions credit" (ZEC) to provide additional revenue to at-risk nuclear power plants.
- Ohio has considered ZEC legislation similar to New York and Illinois in response to the forecast closure of the Perry and Davis-Besse plants, but progress stalled in late 2017.
- The New Jersey Senate and Assembly passed bills to issue ZECs to eligible nuclear power plants in May 2018. These credits are expected to apply to Hope Creek and Salem reactors but will not prevent the closure of Exelon's Oyster Creek reactor, which is scheduled to close in October 2018.
- Pennsylvania's state legislature created a nuclear caucus, and there is growing interest in potential state action. Community and union leaders asked the caucus in April to award zero emissions tax credits to Exelon-owned Three Mile Island and FirstEnergy's Beaver Valley. Three Mile Island is currently scheduled to close in 2019, and FirstEnergy recently announced plans to close Beaver Valley in 2021.

Five plants (7 reactors) announced they were closing prior to their license expiration date but were saved due to State Action:

ORIGINALLY PROPOSED CLOSURE YEAR	SITE / LOCATION		UTILITY	LICENSE EXPIRATION (TERM)	POWER (MWe)
2017	FitzPatrick	NY	Entergy	2034 (60)	852
	Ginna	NY	Exelon	2029 (60)	582
	Clinton	IL	Exelon	2026 (40)	1,065
2017-18	Nine Mile Point-1 & 2	NY	Exelon	2029 / 2046 (60)	1,780
2018	Quad Cities 1 & 2	IL	Exelon	2032 (60)	1,820
				Total Saved	6,099

Operating Fleet Status: Premature Closure

Some of the nuclear plants now closing are doing so because of state policy pressure (as with California's Diablo Canyon, New Jersey's Oyster Creek, and New York's Indian Point), and some have had maintenance issues that were too costly to fix. However, most plants are closing or threatening closure because–given the economics in some regions—they have become unable to compete against primarily low-cost, gas-fired generation and, to a lesser extent, subsidized and mandated "variable renewable energy," such as wind- and solar-power, in a low electricity demand environment.

- Five plants (6 reactors) have closed prior to their license expiration date:

CLOSURE YEAR	SITE / LOCATION		UTILITY	LICENSE EXPIRATION (TERM)	POWER (MWe)
2013	Crystal River 3	FL	Duke	2016 (40)	860
	San Onofre 2 & 3	CA	SoCal Edison	2023 / 2024 (40)	2,150
	Kewaunee	WI	Dominion	2033	566
2014	Vermont Yankee	VT	Entergy	2032	620
2016	Fort Calhoun	IN	Omaha Power	2033 (60)	479
				Total Closed since 2013:	4,675

★ Ten plants (12 reactors) have announced plans to retire prior to their license expiration date:

PENDING CLOSURE YEAR	SITE / LOCATION		UTILITY	LICENSE EXPIRATION (TERM)	POWER (MWe)
2018	Oyster Creek	NJ	Exelon	2029 (60)	610
2019	Pilgrim 1	MA	Entergy	2032 (60)	678
	Three Mile Island 1	PA	Exelon	2034 (60)	803
2020	Davis-Besse	OH	FirstEnergy Nuclear	2037 (60)	908
	Duane Arnold	IA	NextEra	2034 (60)	615
2020-21	Indian Point 2 & 3	NY	Entergy	2013 / 2015 (40) * renewal application under review	2061
2021	Perry	OH	FirstEnergy Nuclear	2026 (40)	1,268
	Beaver Valley	PA	FirstEnergy Nuclear	2036 / 2047 (60)	1872
2022	Palisades	MI	Entergy	2031 (60)	789
2024-25	Diablo Canyon 1 & 2	CA	PG&E	2024 / 2025 (40)	2240
				Total Pending Closures:	11,844

*NRC webpage: Per 10 CFR 2.109, if a licensee submits a sufficient application for renewal at least five years before expiration of its current license, the request is considered "timely" and the facility is allowed to continue to operate under its existing license until the NRC completes its review and reaches a decision on the license renewal request. Because the license renewal application remains under consideration, the utility will be allowed to continue to operate IP2 and IP3 under its existing licenses, with certain modifications to its procedures and safety analyses that the utility is making to assure continued safe operation during the timely renewal period.