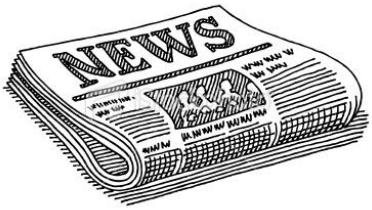
NUCLEAR POWER SUMMARY – **LICENSING ACTIONS** **DEC 2021**



- ★ Recent Developments:
  - December 2021:
    - The Fission for the Future Act of 2021, S.3428, was introduced in the Senate and referred to the Committee on Energy and Natural Resources. The bill includes provision for providing financial assistance for advanced reactor deployment and development of the associated supply chain infrastructure.

- ★ December 13th: As a part of its Subsequent License Renewal (SLR) Program, Dominion Energy's Surry Nuclear Power Station awarded Framatome a contract to upgrade it's in-core instrumentation system. The upgrade will replace the movable in-core detector systems with new fixed in-core detector systems (FIDS).
- ★ December 3rd: The first carbon mitigation credits under recently passed clean energy legislation, SB 2408, in Illinois were awarded to the Braidwood, Byron, and Dresden Nuclear Power Plants.
- ★ December 1st: The application to construct a low power test reactor, submitted to the Nuclear Regulatory Commission (NRC) by Kairos Power, was formally accepted for review. The 35 MW molten salt cooled reactor would be located in Oak Ridge, TN and provide insights to be used for construction of a larger commercial scale version.
- ★ November 23rd: The Humbolt Bay Unit 3 nuclear power plant decommissioning has been completed, and the site where it operated was released for unrestricted use.
- ★ November 19th: The US NRC approved a power uprate application submitted by Dominion Energy for its Millstone 3 Nuclear Power Plant.
- ★ November 18th: The NRC approved the transfer of licenses associated with Exelon Corporation's operating reactors, decommissioning reactors, and associated spent fuel storage facilities. The transfer was necessary due to a restructuring plan that aims to separate Exelon's utility businesses from its competitive power generation and customer-facing energy businesses.
- ★ November 15th: An inspection of the decommissioned Pilgrim Nuclear Power Plant has concluded and found no violations of more than minor significance. Holtec International, the firm conducting the decommissioning activities, anticipates completion of decommissioning work by the end of 2027.
- ★ November 11th: The NRC voted to extend the required Inservice Inspection (ISI) Program and Inservice Testing (IST) Program Code of Record update frequency from 120 months to 240 months.
- ★ November 10th: The NRC issued a draft environmental impact statement for the subsequent license renewal for the Point Beach nuclear power plant in Two Rivers, Wisconsin.
- ★ November 5th: Pueblo County Colorado's Energy Board will consider nuclear energy as it seeks to ensure a reliable supply of power. Pueblo County currently receives power from the Comanche 3 Power Plant which is scheduled to close by 2040.
- ★ November 4th: The NRC approved a rule concerning the decommissioning of reactors that have been permanently shut down and defueled. The rule is meant to provide a regulatory distinction between such reactors and those that are operating.
- ★ November 3rd: Calvert Cliffs has become the first nuclear plant to load a fuel assembly consisting entirely of accident tolerant fuel.

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 NRC, which will then conduct an in-depth review of safety and environmental aspects related to the design and / or site.

Reactor Design Certifications (DC)

By issuing a DC, the NRC approves a nuclear power plant design, independent of an application to construct or operate a plant. A DC is valid for 15 years from the date of issuance but can be renewed for an additional 10 to 15 years. A DC 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)*

Four reactor designs that are being considered for future builds in the U.S. have been certified by the NRC. In addition, one SMR design is currently under NRC review*. One of the four certified designs is under renewal review. Two previously submitted designs have been withdrawn from consideration[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
	Korea Electric Power Corp	APR1400	Issued: 9/19/2019
Renewal	General Electric-Hitachi	ABWR	Originally Issued 5/12/1997: Final Safety Evaluation Report approved in March 2020
Active DCAs	NuScale Power	NuScale SMR Power Module	*Under Review: Standard Design Approval received on 9/30/2020

Early Site Permits (ESP)

By issuing an early site permit (ESP), the U.S. Nuclear Regulatory Commission (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)*

Six ESPs have been issued 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
	Clinch River	TN	TVA	PPE	Issued: 12/19/2019

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. A COLA may reference a certified design and/or an ESP, or neither. *(From NRC website)*

A COL is valid indefinitely. If a licensee chooses not to construct a plant immediately following the issuance of 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. Alternatively, a licensee can choose to withdrawal their COL if they no longer wish to proceed with the plants.

A total of nineteen COLAs have been docketed by the NRC. Eight applications, totaling 14 reactors, have been issued COLs and one is under review. Eight applications were suspended and later withdrawn[3] due to utility, economic or other considerations while two applications remain in "suspended" status[4]. After the COL was issued, three applications, totaling six reactors, were subsequently terminated.[5]

[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

[5]Terminated: Levy 1&2, South Texas Project 3&4, V.C. Summer 2&3

	SITE/LOCATION		UTILITY	REACTOR TECHNOLOGY/ NO. of REACTORS		STATUS
Issued	Vogtle	GA	Southern Nuclear	AP1000	2	Issued: 2/10/2012
	Fermi	MI	DTE Energy	ESBWR	1	Issued: 5/1/2015
	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
Under Review	Idaho National Laboratory	ID	Oklo Power LLC	Aurora	1	Denied: 1/6/2022

NEW PLANT CONSTRUCTION

Vogtle

In October, Georgia Power announced a revised schedule for the completion of Unit 3 and 4 at Plant Vogtle. The revised schedule projects an in-service date of the third quarter of 2022 and the second quarter of 2023 for Unit 3 and 4, respectively. The revised schedule is expected to cost Southern Company an additional $460 million in capital costs for the project.

Vogtle Unit 3 (Courtesy of Georgia Power/ Southern Company, April 2021)

Remediation work at Vogtle Unit 3 is underway on the electrical cable raceway system, which supports cables needed to power safety related equipment. The NRC recently completed a special inspection of the system and concluded that safety related cables were inadequately separated from non-safety related cables. While the remediation work caused an initial delay in hot functional testing, plant systems achieved normal operating pressure and temperature during tests. In addition, work to repair the leaking spent fuel pool was completed after seven months, which consisted of a complete rebuild of the pool. Direct construction for Units 3 & 4 is now 99% complete.

In its fourth quarter earnings statement, Georgia power estimated the total cost for completion of the plant at $28.5 billion, more than double the original estimate. Since the release of the most recent cost estimate, Southern Company announced an additional increase in costs of $300 million related to construction and an additional delay due to “construction quality issues”.

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 2018 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 2018 alleging the PSC’s decision benefits Georgia Power’s shareholders over ratepayers. The Fulton County Superior Court dismissed the cases in December 2018 and, again, in April 2020 on the basis that the commission’s decision was not “final” and appealable until the project is complete.

VC Summer

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 were being installed, while two of the four reactor coolant pumps for Unit 2 reactor are on site. Units 2 and 3 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, the United States is the world's largest producer of nuclear power, accounting for approximately 25% of worldwide nuclear generation of electricity. Currently, there are 93 reactors operating in the United States. In 2020, they produced approximately 790 thousand Megawatt-hours (MWh), approximately 20% of America's total electrical output and nearly 55% 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 2019 of over 94%.

In deregulated electricity markets, nuclear power plants are facing financial challenges from solar and wind power sources.

License Renewal and Uprate Status

License Renewal

Sixty-one reactors have received 20-year extensions of their operating licenses from the NRC, including Kewaunee, Vermont Yankee, Fort Calhoun, Oyster Creek, and Pilgrim which are now permanently closed.

Applications for License Renewal

★ Issued Applications:
- No recently issued applications

★ Application Currently Under Review:
- Currently no applications for license renewal under review

★ Anticipated Future Submittals:
- Clinton Power Station Unit 1
- Comanche Peak Nuclear Power Plant Units 1 & 2
- Perry Nuclear Power Plant Unit 1

Second License Renewal

The NRC staff has defined subsequent license renewal (SLR) to be the period of extended operation from 60 years to 80 years. (per NRC)

Applications for Second License Renewal

★ Issued:
- Turkey Point Units 3 and 4
- Peach Bottom Units 2 and 3
- Surry Units 1 and 2

★ Applications Currently Under Review:
- North Anna Power Station Units 1 and 2
- Point Beach Units 1 and 2
- Oconee Nuclear Station Units 1, 2, and 3
- St. Lucie Units 1 and 2

★ Anticipated Future Submittals:
- None

Operating Fleet Uprate Activities

U.S. nuclear power plants have submitted power uprate applications to the NRC since the 1970s, accounting for an additional 8,010 MWe of output.

- ★ Recently Approved
  - Farley Units 1 and 2
  - Watts Bar 2
  - Oconee Units 1, 2, and 3
  - Millstone 3
- ★ Pending Applications:
  - No pending applications
- ★ Expected Applications
  - As of February 5, 2021, there are 0 expected applications for power uprate in 2020 and 2021. (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, the states of New York, Illinois, New Jersey, Ohio, and Pennsylvania have taken action to level the playing field and include nuclear energy in their clean energy policies and have averted the closure of ten power plants.

- ★ Illinois recently passed the Climate and Equitable Jobs Act, which aims to reduce carbon emissions and sets a goal of achieving a 100% carbon free power sector by 2045. Prior to passage, Exelon announced plans to shut down the Byron and Dresden nuclear plants but have since rescinded those plans due to a provision in the bill to provide $694 million in subsidies to the plants. In addition, Exelon plans to invest $300 million on upgrades to the plants.

Twelve plants (17 reactors) announced they were closing prior to their license expiration date but were saved due to State Actions:

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
2020	Davis-Besse	OH	Energy Harbor	2037 (60)	893
2021	Perry	OH	Energy Harbor	2026 (40)	1,261
	Beaver Valley	PA	Energy Harbor	2036 / 2047 (60)	1,872
	Byron - 1 & 2	IL	Exelon	2044 / 2046 (60)	2,300
	Dresden – 1 & 2	IL	Exelon	2029 / 2031 (60)	1,773
2022	Salem - 1 & 2	NJ	PSEG	2036 / 2040 (60)	2,304
	Hope Creek		PSEG	2046 (60)	1,172
				Total Saved	**17,674**

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.

★ Ten plants (12 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 (60)	566
2014	Vermont Yankee	VT	Entergy	2032 (60)	620
2016	Fort Calhoun	IN	Omaha Power	2033 (60)	479
2018	Oyster Creek	NJ	Exelon	2029 (60)	610
2019	Pilgrim	MA	Entergy	2032 (60)	685
	Three Mile Island 1	PA	Exelon	2034 (60)	803
2020	Indian Point 2	NY	Entergy	2024 (60)	998
	Duane Arnold	IA	NextEra	2034 (60)	615
2021	Indian Point 3	NY	Entergy	2025 (60)	1,030
				Total Closed since 2013:	**9,416**

★ Two plants (3 reactors) have announced plans to retire prior to their license expiration date with many utilities attributing these decisions to market and policy factors:

PENDING CLOSURE YEAR	SITE / LOCATION		UTILITY	LICENSE EXPIRATION (TERM)	POWER (MWe)
2022	Palisades	MI	Entergy	2031 (60)	789
2024-25	Diablo Canyon 1 & 2	CA	PG&E	2024 / 2025 (40)	2,240
				Total Pending Closures:	**3,029**