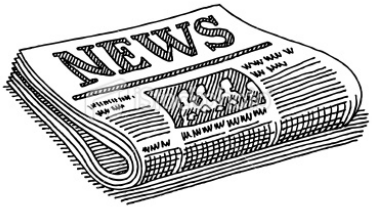
NUCLEAR POWER SUMMARY – **LICENSING ACTIONS** FEB 2022



★ Recent Developments:
  - January: H.R. 4819, The National Nuclear University Research Infrastructure Reinvestment Act of 2021, was introduced in the U.S. House of Representatives. The legislation provides funding to universities for investment in nuclear science and engineering infrastructure.
  - February: Senate Bill 421, the Georgia Utility Rate Reduction Act, was introduced in the Georgia State Senate. The bill amends Title 46 of the Official Code of Georgia Annotated, and would enable Georgia Power to finance the expansion of Plant Vogtle with rate payer backed bonds. Rate payer backed bonds carry a lower interest rate than the bonds currently financing the expansion, and the change would reduce the cost to consumers.
  - February: Senate Bill 271 was passed by the Indiana General Assembly. The legislation directs the Indiana Utility Regulatory Commission to adopt rules by July 1, 2023, governing the permitting of small modular nuclear reactors for electricity production in the state.
  - February: Governor Jim Justice of West Virginia signed Senate Bill 4 into law, removing West Virginia's ban on nuclear power plant construction. The ban on nuclear power in West Virginia had been in place since 1996.
  - February: H.B. 5589 was introduced in the Illinois General Assembly and was assigned to the House Energy and Environment Committee. The bill would repeal Illinois' current ban on nuclear power plant construction.

★ February 25th: The final environmental impact statement (EIS) is now available for Project Pele. The demonstration project, planned to be located at the Idaho National Lab, consists of a mobile microreactor designed to reduce the reliance of military installations on local electric grids and diesel fuel generators.

★ February 25th: The Nuclear Regulatory Commission (NRC) agreed with a legal challenge which argued that a full National Environmental Policy Act review be conducted before approving any Subsequent License Renewal (SLR) applications. Requiring a full National Environmental Policy Act review deviates from the previous policy of requiring a generic environmental impact statement.

★ February 23rd: Through April 19th, members of the public are invited to submit comments regarding the scope of the EIS for the Hermes low-power demonstration reactor. The Hermes reactor demonstration is funded by the US Department of Energy's (DOE) Advanced Reactor Demonstration Program and is expected to be operational in 2026.

★ February 17th: In a recent letter sent to California Governor Gavin Newsome, the San Luis Obispo County Board of Supervisors requested that the State work with PG&E to ensure the Diablo Canyon Nuclear Power Plant has access to all permits necessary to keep the plant operational. The board cited a recent study by MIT and Stanford that highlights the potential to use the plant for hydrogen production and desalination, in addition to the production of zero-carbon electricity.

★ February 16th: As a part of the Bipartisan Infrastructure Legislation, the US DOE will allocate $8 billion for the development of clean hydrogen hubs. The hubs will be geographically concentrated industrial centers where production and consumption of clean hydrogen will be co-located. Funding will be allocated across four hubs, and the energy to produce hydrogen will come from nuclear generation for at least one of them.

★ February 11th: The US DOE has launched the Civil Nuclear Credit Program, a $6 billion program that will allocate production credits to the existing fleet of US commercial reactors.

★ January 6th: The license application submitted by Oklo Power for its Aurora compact fast reactor was denied by the NRC. The application was denied due to failure of Oklo Power to provide information on several issues involving the Aurora design. Oklo Power will be able to resubmit their license application at a future date.

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

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

As a part of its fourth quarter earnings statement, Georgia Power announced a revised completion date for Plant Vogtle Unit 3 and 4. The revised schedule projects an in-service date of the first quarter of 2023 and the fourth quarter of 2023 for Unit 3 and 4, respectively. The revised schedule is expected to increase Georgia Power's share of total capital costs for the project by $920 million, of which $480 million are associated with the utility's share of cost and schedule changes and $440 million with incremental cost increases. In its fourth quarter earnings statement, Georgia power estimated the total cost for completion of the plant at close to $30 billion. The most recent schedule increase triggered a vote among stakeholders as to whether to discontinue the project. Georgia Power Co., Oglethorpe Power Corp., the Municipal Electric Authority of Georgia, and Dalton Utilities voted unanimously to continue the project.

The most recent delay is due to missing inspection records associated with materials and equipment that were installed at Unit 3 and remediation work on the electrical cable raceway system and spent fuel pool, which was recently completed. The missing records are needed to file the inspections, tests, analyses, and acceptance criteria (ITAAC), a necessary step in the regulatory process prior to loading fuel into the core. The ITAACs are currently 69% complete, and Southern Company expects to receive notice from the NRC in September of 2022 indicating that all acceptance criteria have been met. Completing the ITAACs will pave the way to start the fuel loading process in October of 2022.

Unit 4 began open vessel testing in December 2021, a process that demonstrates that the flow of water from the plant's safety systems into the reactor vessel is not blocked or constricted. In addition, in February 2022, both the structural integrity and integrated leak rate test were completed, which demonstrates the integrity and robustness of the plant structure and its ability to perform under normal and extraordinary circumstances. Direct construction for Units 3 & 4 is now 99% 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:
- Surry Units 1 and 2

★ Applications Currently Under Review:
- Turkey Point Units 3 and 4
- Peach Bottom Units 2 and 3
- 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 November 19, 2021, there are 0 expected applications for power uprate in 2021 and 2022. (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**