★ Recent Legislative Actions:

- May: The Senate Environment & Public Works Committee on May 30, 2023 approved the Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy (ADVANCE) Act in a bipartisan 16-3 vote. The legislation was introduced on March 30 by a set of bipartisan Senators. The bill, introduced in April, aims to reduce regulatory costs for companies seeking to license advanced nuclear reactor technologies, preserve and support existing nuclear power plants, strengthen the domestic nuclear fuel cycle and supply chain infrastructure, and improve NRC efficiency. The bill also authorizes funds for environmental cleanup programs by sanctioning funding to assist in cleaning up legacy abandoned mining sites on tribal lands.

- May: The House Energy and Commerce (E&C) Committee has advanced a bill to the chamber's floor that, with certain exceptions, would ban the import of low-enriched uranium from Russia into the United States. Introduced in February by the E&C Committee's chair, the Prohibiting Russian Uranium Imports Act (H.R. 1042) was approved in a bipartisan vote on May 24. The legislation would start banning Russian uranium 90 days after its enactment but would also allow the Department of Energy to issue waivers should the DOE determine (1) that there is no alternate source of low-enriched uranium available to keep a U.S. nuclear reactor in operation or (2) that importing Russian uranium is in the national interest.

★ **April 1, 2023**– The Vogtle power plant's Unit 3 reactor was connected for the first time to the electric grid on April 1 and attained 100 percent energy output on May 29 —the first time it has reached its maximum expected output of approximately 1,100 MWe. The unit, one of two Westinghouse-supplied AP1000s at the Waynesboro, Ga., plant's nuclear expansion site, becomes the first new U.S. power reactor to start up in seven years.

★ **April 3, 2023** – The Savannah River Site's H Canyon facility has initiated actions to recycle a small amount of used high-enriched uranium (HEU). SRS is a 310-square-mile DOE site in South Carolina. The HEU, which is currently stored at the site's H Area, will be downblended in a few years into high-assay low-enriched uranium (HALEU), which will help to provide fuel for advanced nuclear reactors in the United States.

★ **April 7, 2023** – Portland, Ore.–based PacifiCorp, the owner of the soon-to-be-retired Wyoming coal plant selected in 2021 as the future site of TerraPower's Natrium reactor demonstration project, released its *2023 Integrated Resource Plan*, which recommends the addition of two more Natrium units to the company's generation resource mix by 2033. The two additional reactors, according to a PacifiCorp news release, are likely to be sited in Utah near currently operating coal-fired facilities. TerraPower's demonstration plant, slated for Kemmerer, Wyo., is intended to validate the design, construction, and operational features of the Natrium technology, developed in collaboration with GE Hitachi. The plant will feature a 345 MW sodium-cooled fast reactor with a molten salt–based energy storage system designed to boost the reactor's output to 500 MW of power when necessary to integrate with variable renewable energy sources.

★ **April 13, 2023** – The National Association of Regulatory Utility Commissioners (NARUC) and National Association of State Energy Officials (NASEO) have announced the launch of the Advanced Nuclear

State Collaborative (ANSC)—an effort to bring together utility regulators and energy officials from across the nation to "enhance collective understanding" of the regulatory and policy issues facing states contemplating the deployment of new nuclear generation. The ANSC is an initiative of the Nuclear Energy Partnership, a multiyear cooperative agreement established in January 2021 between NARUC and the Department of Energy's Office of Nuclear Energy. Thirty-one utility commissions and state energy offices from 23 states have joined the ANSC so far.

- **May 2, 2023** - The Great Lakes Clean Hydrogen Hub coalition (GLCH) has submitted an application for funding from the $8 billion Department of Energy program authorized by the Bipartisan Infrastructure Law to support the creation of regional clean hydrogen hubs. Energy Harbor, owner and operator of the Davis-Besse and Perry nuclear plants in Ohio as well as Beaver Valley in Pennsylvania, announced in September 2022 that it was joining forces with major industrial companies in the region, the University of Toledo, several DOE national laboratories, and others to form the GLCH in hopes of transitioning the Midwest into a leading low-carbon fuel production center.

- **May 9, 2023** - The Department of Energy announced the awarding of $22.1 million to 10 industry-led nuclear projects, including two aimed at expanding clean hydrogen production and one at advancing a microreactor design. Other projects selected for funding are focused on addressing nuclear regulatory hurdles, improving existing reactor operation, and facilitating new advanced reactor developments. The projects are being funded through the Office of Nuclear Energy's industry funding opportunity announcement.

Pre-Application Licensing Activities

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. Vendors and utilities may choose to engage with regulators prior to submitting their applications to pre-empt potential problems with their design and make the review process more efficient.

- **May 9, 2023** – Westinghouse Electric Company filed a preapplication regulatory engagement plan for the AP300 SMR with the NRC. The AP300 SMR will be a 300-MWe, 900-MWth single-loop pressurized water reactor based on the company's larger Generation III+ AP1000 unit, which has achieved regulatory approval in the United States, Great Britain, and China, as well as compliance with European Utility Requirements standards for nuclear power plants. According to the announcement, the regulatory engagement plan documents the basic design philosophy of the technology, an overview of the proposed licensing approach, and a timeline for the planned preapplication interactions between the NRC and Westinghouse, with the goal of soliciting agency feedback on noteworthy topics.

- **May 11, 2023** – Dow and X-energy have announced that their Xe-100 SMR demonstration project will be located at Dow's UCC Seadrift Operations manufacturing site in Texas. The SMR plant will provide the Seadrift site with power and heat as the site's existing energy and steam assets near the end of their operational lives. Dow and X-energy anticipate to reduce the Seadrift site's emissions by approximately 440,000 metric tons of CO_2 equivalent per year. Construction on the four-unit project is

expected to begin in 2026 and be completed by the end of this decade. Dow articulated an interest in advanced reactors for its U.S. production sites in April of last year and signed a letter of intent with X-energy to deploy an Xe-100 at one of its Gulf Coast facilities, to be operable by about 2030. In March 2023, the companies signed a joint development agreement (JDA) for the project. As part of the agreement, Dow became a subawardee under X-energy's Advanced Reactor Demonstration Program Cooperative Agreement with the Department of Energy. The JDA included up to $50 million in engineering work, up to half of which is eligible for ARDP funding, with the other half funded by Dow. The JDA work scope also included the preparation and submission of a construction permit application to the Nuclear Regulatory Commission, which the companies say they will now begin to prepare.

★ **May 22, 2023** – Seven sites in southwestern Virginia have been identified as "competitive hosting grounds" for SMRs by a feasibility study that Dominion Engineering, Inc. (DEI) prepared for the LENOWISCO Planning District Commission. DEI chemical engineer and principal investigator Chuck Marks said the review represents the "very early stages of, does this region have what it takes to site one of these reactors, successfully deploy and successfully operate. And the answer is overwhelmingly yes," according to an article in the *Cardinal News*[1].

The DEI study was prompted by Virginia Gov. Glenn Youngkin's October 2022 announcement that he wanted an SMR built on former coal mine land in the southwestern region of the state within 10 years. It was funded by the Virginia Department of Energy and GO Virginia Region One, a southwestern Virginia organization focused on economic and workforce development, and examined technical feasibility, safety considerations, economic viability, and preliminary sites over a period of three months. The review was conducted using DOE's National Reactor Innovation Center Siting Tool for Advanced Nuclear Development (STAND) which aggregates data from multiple governmental sources and ranks the proposed sites with respect to socioeconomic, proximity, and safety suitability.

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)*

As of May 2023, six reactor designs that are being considered for future builds in the U.S. have been certified by the NRC. Two previously submitted designs have been withdrawn from consideration[1].

[1] https://cardinalnews.org/2023/05/22/far-southwest-virginia-is-a-competitive-hosting-ground-for-small-modular-nuclear-reactors-study-finds/?utm_medium=email

	VENDOR	TECHNOLOGY	STATUS
Issued	Westinghouse	AP1000	Issued: 12/30/2011
	Westinghouse	AP600	Issued: 12/1999, expired 01/2015
	General Electric-Hitachi	ESBWR	Issued: 11/14/2014
	NuScale Power	NuScale SMR Power Module	Issued: 02/21/2023
	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

[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.

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.[3]

	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

[3]Victoria County Station, Texas (Exelon) was withdrawn from NRC review October 2012

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 COL application 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 COL applications 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[4] due to utility, economic or other considerations while two applications remain in "suspended" status[5]. After the COL was issued, three applications, totaling six reactors, were subsequently terminated.[6]

	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

[4] 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,

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

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

[7] Denied 1/6/2022: Oklo Power LLC, Idaho National Laboratory, Aurora 1

Construction Permit Applications

A construction permit application for a production or utilization facility submitted to the NRC under Title 10 of the Code of Federal Regulations Part 50, "Domestic Licensing of Production and Utilization Facilities" consists of two parts: an environmental report and a preliminary safety analysis report (PSAR).

After receiving the construction permit application, NRC staff begins its review by making an initial determination on completeness and acceptability of the application. Should the NRC staff determine that the application is incomplete or otherwise unacceptable, the staff will inform the applicant and explain how the application is deficient. The applicant will then have the opportunity to correct the deficiencies. Once the staff determines that it has enough information to continue with a thorough technical review of the submittal, the NRC will formally docket the application.

Following an application's acceptance for docketing, there are several significant review milestones including the following: issuance of a request or requests for additional information, preparation of a safety evaluation report, development of either an environmental assessment or environmental impact statement, independent review of the application and safety evaluation report by the Advisory Committee on Reactor Safeguards (ACRS), potential contested hearing(s), mandatory hearing.

Finally, the Commission will make a decision to either grant or deny the construction permit based on the application, NRC staff's safety evaluation report, the recommendations of the ACRS, and the outcome of any contested hearings and the mandatory hearing. As of May 2023, two applications are under review.

The first application is for a low-power test reactor to support development of Kairos Power's fluoride salt-cooled, high-temperature reactor technology (KP-FHR). As of May 17, 2023, the safety review process is complete, and the environmental review is approximately 90% complete.

The most recently accepted application, for a Molten Salt Research Reactor (MSRR) at Abilene Christian University (ACU) in Abilene, Texas, is the first ever application for an advanced university research reactor. ACU submitted the application for the Nuclear Energy eXperimental Testing Lab (NEXT), which includes the 1MW, non-power MSRR, in August 2022. ACU is the lead university in the NEXT Research Alliance (NEXTRA), which includes Georgia Institute of Technology, Texas A&M University, and the University of Texas at Austin. The alliance has a $30.5 million research grant agreement with Natura Resources to design and build a university based MSRR. The NRC estimates a review schedule of 18 months, and expects that environmental and safety reviews will be complete by May 2024. As of May 17, 2023, the safety review process is approximately 20% complete and the environmental review is approximately 23% complete.

	SITE/LOCATION		VENDOR	REACTOR TECHNOLOGY/ NO. of REACTORS		STATUS
Under Review	Abilene Christian University	Abilene, TX	NEXTRA	MSRR	1	Under Review
	East Tennessee Technology Park, ORNL	Oak Ridge, TN	Kairos Power, LLC	KP-FHR	1	Under Review

Fuel Facility License Applications

Fuel cycle facilities must comply with the regulatory requirements established by the NRC. The regulations contain the basic safety standards that the fuel cycle facilities need to meet. Each facility also has an NRC license which contains site-specific requirements that the facility is required to comply with. Each license is unique and is specific to the nuclear material and hazards present at the fuel cycle facility.

A total of five facilities have been docketed by the NRC. Two licensed facilities were terminated[7], and one other facility was issued a construction authorization before it was terminated at the request of the company[8]. One facility has been licensed; however, construction is not currently proceeding[9].

	SITE/LOCATION		VENDOR	FACILITY and FUEL TYPE		STATUS
Issued	American Centrifuge Plant	Piketon, OH	Centrus Energy Corp.	Centrifuge Enrichment	HALEU	Approved
Under Review	TF3	Oak Ridge, TN	TRISO-X, LLC	Fuel Fabrication	HALEU TRISO	Under Review

[7,8] Terminated: Eagle Rock Enrichment Facility, GLE Uranium Enrichment Facility, Mixed-Oxide Fuel Fabrication Facility

[9] Suspended: Fluorine Extraction Process and Depleted Uranium Deconversion (FEP/DUP) Plant

- ★ In late December 2022, the NRC accepted an application from X-energy's fuel subsidiary, TRISO-X, LLC, for a proposed TRISO-X fuel fabrication facility (TF3). A 30-month review schedule was presented in early February 2023 by the NRC that should be completed by June 2025, assuming no delays. TRISO-X, a subsidiary of X-energy, has requested as 40-year license to possess and use special nuclear material to manufacture advanced fuel. The facility would be the first-ever commercial-scale fuel fabrication plant focused on using HALEU. Additionally, Kairos Power is still in pre-application discussions with the NRC for its Atlas fuel fabrication facility. Both facilities would be located in Oak Ridge, TN, and would manufacture HALEU TRISO particles and pebbles.

- ★ In June 2021, the NRC approved a license amendment authorizing Centrus Energy Corp to demonstrate commercial production of HALEU at the American Centrifuge Plant. In September, installation of the HALEU demonstration centrifuges in cascade form was halted temporarily until a contract could be competitively awarded for the HALEU demonstration project. In November 2022, the DOE announced an approximately $150 million cost-shared award with American Centrifuge Operating, LLC, a subsidiary of Centrus Energy Corp, to demonstrate the ability to produce HALEU. Advancing domestic capability to produce HALEU will set the stage for larger, commercial-scale HALEU production in the US, providing important fuel stability for advanced reactors to achieve smaller designs, longer operating cycles, and increased efficiencies over existing technologies.

During the first year, some $30 million of the cost-share will be used to start up and operate 16 advanced centrifuges in a cascade at a Department of Energy facility in Piketon, Ohio. The facility represents the only U.S. plant licensed to produce HALEU at present. The cascade is expected to meet the demonstration requirements by enriching uranium hexafluoride gas to produce 20 kilograms of 19.75% enriched HALEU by December 31, 2023. They will then continue production in 2024 at an annual rate of 900 kilograms of HALEU per year, subject to appropriations, with additional options to produce more material under the contract in future years.

In February 2023, Centrus announced that it had finished assembling the cascade of uranium enrichment centrifuges and most of the associated support systems ahead of its contracted demonstration of HALEU production by the end of 2023. When the 16-machine cascade begins operating inside the Piketon, OH, American Centrifuge plant, which has room for 11,520 machines, it will be the first new US-technology based enrichment plant to begin production in 70 years.

DOE is pursuing multiple pathways to produce HALEU through its HALEU Availability Program authorized by the Energy Act of 2020 to meet this pressing need. Following the HALEU demonstration, the centrifuge technology used at the facility will be available for commercial deployment.

NEW PLANT CONSTRUCTION

Vogtle

Following authorization from the NRC that fuel loading and operation may commence at Unit 3, Southern Company loaded fuel in the fall of 2022, with the intent to begin operating in the first quarter of 2023. However, during preoperational testing for the unit, plant operator Southern Nuclear identified 'vibrations associated with certain piping within the cooling system', according to a January 11th filing by Southern Company and Georgia Power with the Securities and Exchange Commission. The issue was remediated in coordination with the NRC and Vogtle-3 achieved initial criticality in the first week in March 2023.

Vogtle Unit 3 (Courtesy of Georgia Power/ Southern Company, October 2022)

On April 1, 2023, Vogtle-3 successfully synchronized and connected to the electric grid, becoming the first new US power reactor to start up in seven years. On May 29, 2023 Georgia Power announced that Unit 3 had attained 100 percent energy output of 1,100 MWe. Testing at the 100 percent power level is focused on the operation of the reactor, plant control system for the reactor and support systems, and integrated plant operations. The reactor is slated to enter commercial operation in June 2023.

Georgia Power announced on May 3, 2023, that hot functional testing had been completed at Vogtle-4. The achievement marks another significant step toward commercial operation for the Generation III+ AP1000 reactor. The site team will be focusing on completing the remaining work necessary to submit documentation to the NRC that all inspections, tests, and analyses for the unit have been performed and that all acceptance criteria (collectively known as ITAACS) have been met. Each ITAAS closure notice must be verified by the NRC before fuel can be loaded into the reactor.

In its first-quarter 2023 earnings call, Southern Company told investors it expects to commence fuel loading at some point between July and October 2023. This follows the announcement of a possible pushback of Vogtle-4's expected start from the end of 2023 to the end of the first quarter of 2024. Funding these extensions, the Southern chairman has said, will increase Georgia Power's share of the project total capital cost by $201 million. Georgia Power owns 45.7% of Vogtle; other owners include Oglethorpe Power Corporation (30%), Municipal Electric Authority of Georgia (22.7%), and Dalton Utilities (1.6%).

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.

NUCLEAR POWER SUMMARY – **OPERATING FLEET STATUS** **MAY 2023**

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, the fleet 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 zero marginal cost variable power sources and a reduction in the price of natural gas. While increased focus on nuclear energy as a critical part of a clean-energy future for the country, significant collaboration will be necessary from government and industry to maintain and grow the U.S.'s nuclear power generating capabilities.

Nation-Wide Status Updates

On March 3, 2023, the NRC issued the 2022 assessment letters to operators of the nation's commercial nuclear reactors, noting that of the 93 units in the agency's Reactor Oversight Process, 87 "reached the highest performance category in safety and security," known as Licensee Response. Those reactors, including Vogtle-3, which achieved initial criticality in early March, remain in Licensee Response at this writing.

Six reactors, however, have slipped into the second, more highly scrutinized performance category, "Regulatory Response," and continue to reside there. Units under additional NRC oversight include the following:

- Calvert Cliffs-1, for failing to implement foreign material exclusion practices in accordance with site procedures. Specifically, the licensee failed to prevent the introduction of foreign material into the 1A emergency diesel generator (EDG), which led to an EDG automatic trip and consequential failure on February 20, 2022, during routine testing.
- Davis-Besse, for a security-related finding originating in the third quarter of 2021. (Details of security findings are not divulged to the public.)
- Peach Bottom-2, for the performance of a procedure inappropriate to the circumstances, causing a reactor scram, primary containment isolation system Group I isolation, safety-relief valve actuation, and loss of the normal heat sink, which required emergency core cooling systems to maintain level and pressure.
- Quad Cities-2, for the failure of one of the four electromatic relief valves associated with the automatic depressurization subsystem to actuate during surveillance testing. As a result, the valve was inoperable from April 7, 2020, until March 21, 2022.
- V.C. Summer, for failing to identify and correct a condition adverse to quality that resulted in the inoperability of the B emergency diesel generator.
- Waterford, for errors associated with the main condenser wide range gas monitor (WRGM), which introduced the potential to overclassify radiological emergencies and made the results of dose assessment using the main condenser WRGM inaccurate.

Individual Status Updates

- Holtec International is continuing with its unprecedented effort to restart the Palisades power plant, located in Covert, Michigan. The plant is a single-unit facility and was shuttered in May 2022 by its previous owner, Entergy. In November 2022, Holtec was not selected for first-round funding from the DOE's Civil Nuclear Credit Program, and in February 2023, it filed an application with the DOE's Loan Programs Office for financial assistance in reviving Palisades. In April 2023, Holtec officials met with Nuclear Regulatory Commission staff to discuss the proposed regulatory path to reauthorization of plant operations. Holtec Decommissioning International, the owners of the Palisades nuclear power plant, met with the NRC on March 20, 2023, to discuss the proposed regulatory path to reauthorize operations at Palisades and restart the shuttered plant. Holtec is also attempting to secure funding from the state of Michigan, an estimated $300 million to resurrect the plant, and acknowledges that there are multiple hurdles to reopening the plant, including financial commitment from the state, procuring a power purchasing agreement, upgrading the switchyard, partnering with a licensed operator, rehiring qualified staff, and maintenance and delayed capital investments of the facility. If it were restarted, Palisades would return 800 megawatts of power back to the Michigan electricity grid. Holtec's effort has received strong backing from Michigan Gov. Gretchen Whitmer.

- On May 9, 2023, Westinghouse Electric Company signed a contract with Dominion Energy to design, manufacture, and deliver replacement steam generators for Virginia's Surry plant. The generators will be fabricated at the Westinghouse facility in Monfalcone, Italy, and are based on the company's original F-Series units, "with multiple enhancements to maintain an industry-leading best-in-service performance," according to the announcement. Delivery of the new components is scheduled to begin in 2028, with installation commencing in 2029. The deal supports Dominion's goal of extending the operational life of the two-unit Surry facility to 2053 through the utility's subsequent license renewal program. The renewed licenses authorize the plant to continue providing carbon-free energy to some 419,000 homes through January 29, 2053 (The NRC is currently reviewing an SLR application for the two reactors at Dominion's other Virginia nuclear plant, North Anna). In July 2021, the two companies also signed a major instrumentation-and-control upgrade for Surry, which houses two 874-MWe three-loop pressurized water reactors supplied by Westinghouse.

- The Nuclear Regulatory Commission announced on April 25, 2023 that an agency licensing board will hold oral arguments in a challenge to Pacific Gas and Electric's (PG&E) application to renew its license for the Diablo Canyon independent spent fuel storage installation (ISFSI) in California. The arguments, which will be open to the public, will be heard by an NRC Atomic Safety and Licensing Board on May 24. In March 2022, PG&E applied for a 40-year renewal of its site-specific ISFSI license for Diablo Canyon. The current license expires March 22, 2024. San Luis Obispo Mothers for Peace and other groups have also petitioned the NRC to deny PG&E's request to file a new license renewal application for the two-unit nuclear power plant. In March 2023, the NRC announced that that it would grant a timely renewal exemption to California's Diablo Canyon nuclear plant to allow the plant to continue operating while its new license renewal application was under review. The exemption came after the NRC denied in January plant owner PG&E's request for the agency to resume review of its original license renewal application. The NRC's "Effect of timely renewal application" rule (10 CFR 2.109[b]), requires license renewal applications to be submitted at least five years prior to a reactor's closing date. Because of the exemption, PG&E now has until December 31, 2023, to submit the application to extend the plant's two units past their current closure dates of 2024 and 2025.
- The Tennessee Valley Authority's Browns Ferry Unit 2 successfully synced back to the grid in early April 2023 following a refueling and maintenance outage after a nearly two-year, breaker-to-breaker run– the

first in the Alabama nuclear plant's history. According to the utility, the unit established a new record for itself with 665 days of continuous operation, producing more than 20 billion KWh of electricity.

License Renewal and Uprate Status

★ The NRC submitted a proposed rule to update its license renewal generic environmental impact statement (GEIS) to the Federal Register for comment on March 3, 2023. Four hybrid meetings were held in March and April 2023 around the US for the public to ask questions and to seek comment on the rule. The proposed rule is in response to a 2022 NRC order, CLI-22-02, that concluded that the license renewal GEIS did not analyze the environmental impacts of a subsequent license renewal term (from 60 to 80 years of operation). The proposed rule amends the relevant rule language to account for initial license renewal and one term of subsequent license renewal, redefines the number and scope of the environmental issues that must be addressed during the review of each application for license renewal, and updates related guidance to fully address subsequent renewal. Comments were required to be submitted by May 2, 2023, in order to be considered.

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.

On December 8, 2022, the NRC docketed the license renewal application for Comanche Peak Units 1 and 2.

Applications for License Renewal

★ Issued Renewals:
- No recently issued applications.

★ Applications Currently Under Review:
- Comanche Peak Units 1 & 2

★ Anticipated Future Renewal Submittals:
- Clinton Power Station Unit 1
- Perry Unit 1
- Diablo Canyon Units 1 & 2

Subsequent (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.

Applications for Subsequent License Renewal

★ Issued Subsequent Renewals[10]:
- Surry Units 1 & 2 (Issued: 12/04/19)
- Turkey Point Units 3 & 4 (Issued: 03/05/20)
- Peach Bottom Units 2 & 3 (Issued: 05/04/21)

[10] On February 24th, 2022, the NRC revised the requirements for environmental reviews of SLR applications. The Generic Environmental Impact Statements used on SLRs were deemed invalid beyond 60 years of operation, and applicants will be required to complete an "adequate NEPA review for each application."

★ Applications Currently Under Review:
- North Anna Power Station Units 1 & 2 (Received: 08/24/20)

- Point Beach Units 1 & 2 (Received: 11/16/20)
- Oconee Nuclear Station Units 1, 2, & 3 (Received: 06/07/21)
- St. Lucie Units 1 & 2 (Received: 08/03/21)
- Monticello Unit 1 (Received 01/09/2023)

★ Applications Received and Under Acceptance Review:
- No pending applications

★ Anticipated Future Subsequent Renewal Submittals:
- Browns Ferry Units 1, 2, & 3 (Estimated: January 2024)
- Virgil C. Summer Unit 1 (Estimated: Oct-Dec 2023)
- Edwin I. Hatch Units 1 & 2 (Estimated: Oct-Dec 2025)
- Dresden Units 2 & 3 (Estimated: Apr-June 2024)
- H.B. Robinson Steam Electric Plant, Unit 2 (Estimated: Apr 2025-June 2025)

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
- No recently approved uprates

★ Pending Applications
- No pending applications

★ Expected Applications
- As of March 18, 2022, there are 0 expected applications for power uprates (per NRC). However, several plants have announced their intentions to submit an application.

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, Colorado, Ohio, Pennsylvania, and California 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.

★ On May 19, 2023, the Illinois Senate approved S.B. 0076. Under the bill, public utilities and energy companies would be granted the option of investing in new nuclear build projects. Introduced January 20, 2023, S.B. 0076 would delete language in the Illinois Public Utilities Act that forbids nuclear plant construction in the state until the Illinois Environmental Protection Agency determines that the federal government "has identified and approved a demonstrable technology or means for the disposal of high-level nuclear waste, or until such construction has been specifically approved by a statute enacted by the General Assembly." The bill now moves to Gov. J. B. Pritzker's desk for consideration. At this writing, the Illinois governor has not commented publicly on the passage of S.B. 0076. In early April, however, following the bill's endorsement by the Senate, Pritzker did suggest that he was not categorically opposed to lifting the ban, and added some kind words for small modular reactors.

★ In September 2022, California legislature voted to provide funds to ensure the continued operation of the Diablo Canyon nuclear plant. The Bill reversed the State's 2016 decision to retire the plant by 2025 and

approved a $1.4 billion government loan to extend its operation to 2030. In addition to this funding, in November 2022, the plant was formally selected as a beneficiary of the CNC program and will receive additional federal funding to ensure it continues to operate.

Thirteen plants (19 reactors) had previously announced they intended to close prior to their license expiration date but have been saved due to Federal and 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
2024-2025	Diablo Canyon 1 & 2	CA	PG&E	2024/2025(40)	2,240
				Total Saved	**19,914**

Premature Closure

Some of the nuclear plants now closing are doing so because of state policy pressure (as with 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.

★ Twelve plants (14 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
2022	Palisades[7]	MI	Entergy	2031 (60)	789
			Total Closed since 2013:		**10,205**

[7]On May 20, 2022 The Palisades Nuclear Power Plant shut down operations and ownership was transferred to Holtec International, with plans to decommission the plant. However, on June 28, 2022, Holtec applied for funds under the CNC Program, with the intention to eventually reopen the plant.

★ Currently, no reactors have announced plans to retire prior to their license expiration date.

PENDING CLOSURE YEAR	SITE / LOCATION	UTILITY	LICENSE EXPIRATION (TERM)	POWER (MWe)
		Total Pending Closures:		**0**

INTERNATIONAL NUCLEAR ACTIVITIES

- **April 3, 2023 –** Westinghouse has signed an agreement with ČEZ, owner and operator of the Czech Republic's nuclear power plants, to supply VVER-440 fuel assemblies to the Dukovany facility. Fuel deliveries will commence in 2024, replacing Russia's TVEL fuel, with an anticipated term of seven years. One of the Czech Republic's two nuclear power plants, Dukovany houses four Russian-supplied VVER-440/V213 reactors. The new contract follows the companies' agreement in June of last year for the provision of modified Robust Westinghouse Fuel Assemblies (RWFA) for the Czech Republic's other nuclear plant, Temelín, home to two VVER-1000/V320 units.

- **April 6, 2023 –** The United Kingdom's nuclear regulators, the Office for Nuclear Regulation (ONR), the Environment Agency, and Natural Resources Wales (NRW), announced the completion of step one of their generic design assessment (GDA) for Rolls-Royce SMR's 470-MWe small modular reactor design and the start of step two, which is expected to last 16 months. The regulators were asked by the Department of Business, Energy and Industrial Strategy (now the Department of Energy Security and Net-Zero, and the Department of Science, Innovation, and Technology) in March of last year to begin the assessment, after a readiness review found the company's GDA application, submitted in November 2021, to be acceptable. A GDA is a three-step process (initiation, fundamental assessment, and detailed assessment) performed to gauge the safety, security, and environmental protection aspects of a nuclear plant design. ONR examines the safety and security of the technology, while the other regulatory bodies focus on the environment and radioactive waste. Successful completion of a GDA culminates in a design acceptance confirmation from ONR and a statement of design acceptability from the Environment Agency.

- **April 15, 2023 –** Despite recent polls showing pronuclear sentiment among a majority of its population, Germany shut down its last three operating nuclear power plants, ending 60-plus years of electricity generation from fission. The last three operating facilities—RWE's Emsland, PreussenElektra's Isar, and EnBW Kernkraft's Neckarwestheim—were previously scheduled to close at the end of 2022, in keeping with Germany's nuclear phaseout policy. In October 2022, however, chancellor Olaf Schloz announced his decision, later approved by the German cabinet, to allow the plants to operate until April 15, 2023, to ensure sufficient power generation for the coming winter.

- **Apil 16, 2023 -** A joint declaration urging G7 governments to support life extensions for today's power reactor fleet, restart operable units, and accelerate the deployment of advanced reactors was made at the Nuclear Energy Forum (NEF). The NEF, a first-of-its-kind colloquy, was held on the margins of the G7 Ministers' Meeting on Climate, Energy, and Environment in Sapporo, Japan. Signatories to the declaration included officials from Canada, Japan, the United States, NucearEurope, the Nuclear Industry Association, and the World Nuclear Association
  Other recommendations in the declaration include:

  - Supporting international cooperation and the nuclear supply chain
  - Developing a financial environment that promotes investment in nuclear power.
  - Harmonizing and modernizing highly efficient international regulatory standards.
  - Supporting innovative nuclear technology development.
  - Promoting public understanding of nuclear energy.
  - Collaborating internationally to share best practices, including working toward the realization of final nuclear waste disposal.
  - Supporting countries that have newly introduced, or are considering, nuclear energy.

- **April 21, 2023 –** The Canadian Nuclear Safety Commission (CNSC) has completed phase two of its prelicensing vendor design review for Terrestrial Energy's Integral Molten Salt Reactor (IMSR). Phase one of the VDR commenced in April 2016 and was completed in November 2017. The IMSR is molten salt–cooled and –fueled and can supply heat at 585°C via a tertiary molten salt loop for direct use in on-site electric power generation and energy-intensive processes, including desalination, hydrogen production, petrochemical refining, and clean synthetic transport fuels production. The reactor is designed to use standard-assay low-enriched uranium, avoiding the need for the high-assay form known as HALEU. According to Terrestrial, the VDR involved a comprehensive examination of the IMSR design covering 19 "focus areas" defined by the CNSC and required preparation of hundreds of technical submissions. Its scope included a systematic review of Terrestrial's engineering management processes; confirmatory testing program for IMSR components and systems; reactor controls and safety systems; defense-in-depth strategy; safety analysis; and the requirements for safeguards, security, fire protection, and radiation protection. Following an extensive multiyear review, CNSC staff concluded that there are no fundamental barriers to licensing the IMSR plant, the company said.

- **April 25, 2023 –** Small modular reactor developer Holtec International and Energoatom, Ukraine's nuclear plant operator, signed a cooperation agreement that envisions the construction of up to 20 of the American firm's SMR-160 units in Ukraine, with grid connection for the pilot project achieved by March 2029. In addition, the agreement calls for building a Ukrainian manufacturing facility to localize the production of equipment required for SMR-160 construction. On February 28, 2018, Holtec and Energoatom signed a memorandum of understanding that envisaged Ukraine's adoption of Holtec's SMR-160 technology to meet the country's projected power demand in the latter half of the 2020s. Under the MOU, Ukraine would also become the home of a manufacturing hub for SMR-160 components and systems, mirroring the capabilities of Holtec's advanced manufacturing plant in Camden.

- **April 25, 2023 –** NuScale signed a memorandum of understanding with Doosan Enerbility and the Export-Import Bank of Korea (KEXIM) that outlines areas of cooperation—such as marketing, technical support, and further development of a global supply chain—and commits NuScale and Doosan to bolstering an already-existing partnership to deploy NuScale's VOYGR SMR plants globally. Specifically, Doosan has committed to helping establish a U.S.-based supply chain for NuScale Power Module production through capacity expansion and manufacturing technology advancement, according to NuScale. The company's flagship VOYGR-12 plant would consist of 12 77-MWe modules, for a total capacity of 924 MWe. Other VOYGR facilities in development at NuScale include the VOYGR-6 and VOYGR-4, rated at 462 MWe and 308 MWe, respectively. Late last year, NuScale placed the first upper reactor pressure vessel long-lead material production order with Doosan for the NuScale Power Module.

- **April 25, 2023 –** TerraPower executives joined corporate leaders from SK and Korea Hydro & Nuclear Power (KHNP) to sign a collaboration agreement supporting the demonstration and commercialization of the Natrium reactor and integrated energy system. TerraPower's demonstration plant, slated for Kemmerer, Wyo., is intended to validate the design, construction, and operational features of its Natrium technology, developed in collaboration with GE Hitachi Nuclear Energy. The plant will feature a 345-MW sodium-cooled fast reactor with a molten salt–based energy storage system designed to boost the unit's output to 500 MW of power when necessary to integrate with variable renewable energy sources.

- **May 2, 2023** - Two South Korean financial institutions—the Korea Trade Insurance Corporation (K-Sure) and KEXIM—have signed pacts with Holtec International and Hyundai Engineering & Construction (a Hyundai Motor Group subsidiary) to provide support to Holtec's SMR-160 projects internationally. Holtec participated in the Korea-US Advanced Industry and Clean Energy Partnership event, hosted by South

Commented [HA(1]: Is this South Korea?

Korea's Ministry of Trade, Industry and Energy on April 25 in Washington, D.C., where the company signed a collaboration agreement with Hyundai E&C and K-Sure. Immediately following the event, Holtec signed a financial support agreement with Hyundai E&C and KEXIM to facilitate the adoption of SMR-160 units.

★ **May 8, 2023** - The main construction phase for Unit 3 at Egypt's El Dabaa nuclear power plant project has begun, Russia's state-owned nuclear energy corporation Rosatom announced last week. A construction permit for the reactor had been issued by the Egyptian Nuclear and Radiological Regulatory Authority (ENRRA) on March 29. The project's notice-to-proceed contracts were signed in December 2017 by Mohamed Shaker, Egypt's minister of electricity and renewable energy, and Alexei Likhachev, Rosatom's director general. Under the contracts, Rosatom would build four Generation III+ VVER-1200 units and supply nuclear fuel throughout the plant's operational lifetime, as well as assist its Egyptian partners in plant operation and maintenance for the first decade of operation. In March 2019, ENRRA issued a site approval permit for the project. In June 2021, NPPA submitted a construction permit for the first El Dabaa unit. ENRRA issued the permit the following June. First concrete for El Dabaa-1 was poured in July of 2022. ENRRA issued a permit for Unit 2 construction last October, greenlighting work that commenced in November.

★ **May 18, 2023 –** Atomic Energy of Canada Limited (AECL), Canadian Nuclear Laboratories (CNL), and Global First Power (GFP) have announced a plan to site a gas-cooled microreactor where a staff parking lot now sits on the campus of Chalk River Laboratories in Ontario. The 15-MWt (about 5-MWe) microreactor would serve as a model for future reactor deployments to support remote and industrial applications. The chosen demonstration reactor technology, developed by Ultra Safe Nuclear (USNC), is a gas-cooled, TRISO-fueled microreactor trademarked as a "Micro-Modular" Reactor (MMR). The plan is subject to a CNL review and evaluation process as well as independent Canadian Nuclear Safety Commission regulatory processes and requirements. GFP has submitted a licensing application to the CNSC, and an environmental assessment for the project is underway.

★ **May 18, 2023 –** As part of their collaboration to develop a next generation nuclear power plant based on Lead-cooled Fast Reactor (LFR) technology, Ansaldo Nucleare and Westinghouse have completed the first testing campaign at the Passive Heat Removal Facility (PHRF) at Ansaldo's facility in Wolverhampton, UK. The testing campaign at Ansaldo's PHRF was performed under a contract within Phase 2 of the Advanced Modular Reactor (AMR) program, partially funded by the UK's Department of Business, Energy, and Industrial Strategy. As part of the contract, Ansaldo Nucleare led the design, purchase, installation, and commissioning of the two state-of-the-art experimental facilities to support Westinghouse's Lead Fast Reactor Technology

★ **May 24, 2023 –** On the sidelines of the G7 summit in Hiroshima, Japan, the Biden administration and partners Japan, South Korea, and the United Arab Emirates announced a public-private commitment of up to $275 million to support the advancement of NuScale Power's SMR project in Romania. Funding for the NuScale project will support procurement of long lead materials, phase two of front-end engineering and design (FEED) work, provision of project management expertise, site characterization and regulatory analyses, and the development of site-specific schedule and budget estimates for project execution, according to a May 22 NuScale press release. In addition, the U.S Export-Import Bank (EXIM) and U.S. International Development Finance Corporation (DFC) issued letters of interest for potential support of up to $3 billion and $1 billion, respectively, for project deployment. According to a State Department release, involvement in the Romanian project represents the first nuclear energy–focused activity undertaken within the U.S.-UAE Partnership for Accelerating Clean Energy (PACE) platform. PACE was launched in

November 2022 to catalyze $100 billion in financing, investment, and other support to deploy 100 new gigawatts of clean energy capacity by 2035.

★ **May 25, 2023 –** Westinghouse Electric Company, Bechtel, and Polish utility Polskie Elektrownie Jądrowe (PEJ) announced the signing of a new agreement that defines the main principles of cooperation on the project's design and construction and confirms the implementation of its next major stage. The Polish government chose the Westinghouse AP1000 reactor technology for its initial nuclear energy program in October of last year. Significant licensing and engineering work is already underway on the project, with this latest pact laying the foundation for the design activity scheduled to start later this year, and the construction contract in 2025.