US Nuclear Power, Current Status

By John Benson

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1. Introduction

Although I started my career in the nuclear industry, most of it was spent in the electric utility SCADA, and similar markets. However, it has always apparent to me that we need nuclear power, and more of these base-load generators need to be built in future years. Thus, when I happened upon reference 1 below, I was pretty sure that I would spin a post of this document.[1] However, the document accessed through this reference is very detailed, so this paper will only be a brief summary. Thus, readers that are interested in nuclear power, should probably bookmark the Reference 1 link below.

The USA is the world's largest producer of nuclear power, accounting for about 30% of worldwide generation of nuclear electricity.

The USA's nuclear reactors made 816 million MWh (2024), 18% of total electrical output.

Vogtle 3 was connected to the grid in April 2023, followed by unit 4 in March 2024.

The Inflation Reduction Act was signed into law in August 2022. The Act provides support for existing and new nuclear development through investment and tax incentives for both large existing nuclear plants and newer advanced reactors, as well as high-assay low enriched uranium (HALEU) nuclear fuel.

Targets to quadruple US nuclear capacity (to 400 GWe) by 2050 and to deploy advanced reactors in the near term were set by the administration in 2025.

2. U.S. Nuclear Diversification

Nuclear power plays a major role in electricity provision across the country. The US fleet is operated by 30 different power companies across 30 different states. Since 2001 these plants have achieved an average capacity factor of over 90%. The average capacity factor has risen from 50% in the early 1970s, to 70% in 1991, and it passed 90% in 2002, remaining at around this level since. In 2019 it was a record 94%. The industry invests about $8 billion per year in maintenance and upgrades of the plants.

Nuclear plants generate nearly 20% of the nation's electricity overall and about 55% of its carbon-free electricity.

Author's comment: Although most sources do not consider nuclear power (nor large hydroelectric) "renewables," I do, considering the above "…55% of its carbon-free electricity."

Since about 2010 sustained low natural gas prices dampened plans for new nuclear capacity (see section on "Recent Update" at the end of this paper). However, in August 2022 the Inflation Reduction Act was passed by the US House of Representatives and later that month signed into law by President Joe Biden.

[1] World Nuclear Association, "Nuclear Power in the USA," February 2, 2026, https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-power

The energy provisions in this Act outline support for existing and new nuclear development through investment and tax incentives for both large existing nuclear plants and newer advanced reactors, as well as HALEU (High-Assay Low-Enriched Uranium, enriched between 5% and 20% in U-235) and hydrogen production.

Later, in May 2025 President Donald Trump signed a series of orders designed to stimulate growth in the industry with the aim of quadrupling capacity by 2050.

3. Nuclear Industry History

The USA was a pioneer of nuclear power development. Westinghouse designed the first fully commercial pressurized water reactor (PWR), a unit of 250 MWe capacity, Yankee Rowe Nuclear Power Station was a nuclear power plant in Rowe, Massachusetts. Its 180 MWe pressurized water reactor operated from 1961 to 1991. Meanwhile the boiling water reactor (BWR) was developed by the Argonne National Laboratory, and the first commercial plant, Dresden 1 (250 MWe) designed by General Electric, was started up in 1960. A prototype BWR, Vallecitos, ran from 1957 to 1963.[2]

By the end of the 1960s, orders were being placed for PWR and BWR reactor units of more than 1000 MWe capacity, and a major construction program got under way. These remain practically the only types built commercially in the USA.

Almost all the US nuclear generating capacity comes from reactors built between 1967 and 1990. Until 2013 there had been no new construction starts since 1977, largely because for a number of years gas generation was considered more economically attractive and because construction during the 1970s & 1980s had often been delayed.

Nuclear developments in USA suffered a major setback after the 1979 Three Mile Island accident, though that actually validated the very conservative design principles of Western reactors, and no-one was injured or exposed to harmful radiation. Many orders and projects were cancelled or suspended, and the nuclear construction industry went into the doldrums for two decades. Nevertheless, by 1990 over 100 commercial power reactors had been commissioned.

Another PWR – Watts Bar 2 – started up in 2016 following Tennessee Valley Authority's (TVA's) decision in 2007 to complete the construction of the unit, and two additional units utilizing Westinghouse AP1000 reactors began preliminary construction in 2009, with Unit 3 being completed in July 2023. Unit 4 followed, entering commercial operation on April 29, 2024.

The AP1000 is a pressurized water reactor with improved use of passive nuclear safety and many design features intended to lower its capital cost and improve its economics.[3]

Most reactors were built by regulated utilities, often state-based, which meant that they put the capital cost (whatever it turned out to be after, for example, delays) into their rate base and amortized it against power sales. Their consumers bore the risk and paid the capital cost. With electricity deregulation in some states, the shareholders bear any risk of capital overruns and power is sold into competitive markets.

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[2] Your author worked at GE Vallecitos Nuclear Center (VNC) from 1977 until 1980. Recently VNC's current owner started work to remove all nuclear facilities (including the old Vallecitos BWR) from this site, and take it back to grass.

[3] See https://en.wikipedia.org/wiki/AP1000

Despite a near halt in new construction for more than 30 years, US reliance on nuclear power has grown. In 1980, nuclear plants produced 251 million MWh, accounting for 11% of the country's electricity generation. In 2023 output was 779 million MWh providing about 19% of electricity. Much of the increase came from the 47 reactors, all approved for construction before 1977, that came online in the late 1970s and 1980s, more than doubling US nuclear generation capacity.

The US nuclear industry has achieved remarkable gains in power plant utilization through improved refuelling, maintenance and safety systems at existing plants. Average nuclear generation costs have come down from $52.83/MWh (in 2023 dollars) in 2012 to $31.76/MWh in 2023. This 40% reduction in nuclear generating costs since 2012 has been driven by a 41% decrease in fuel costs; a 51% decrease in capital expenditures; and a 33% decrease in operating costs.

Operationally, from the 1970s the US nuclear industry dramatically improved its safety and operational performance, and by the turn of the century it was among world leaders, with average net capacity factor over 90%.

This performance was achieved as the US industry continued deregulation, begun with passage of the Energy Policy Act in 1992. Changes accelerated after 1998, including mergers and acquisitions affecting the ownership and management of nuclear power plants.

3.1. Regulation

The Nuclear Regulatory Commission (NRC) is the government agency established in 1974 to be responsible for regulation of the nuclear industry, notably reactors, fuel cycle facilities, materials and waste (as well as other civil uses of nuclear material).

In an historic move, the NRC in March 2000 renewed the operating licenses of the two-unit Calvert Cliffs nuclear power plant for an additional 20 years. In March 2019 the NRC renewed the license for Seabrook, extending the unit's operation by 20 years to 2050. This took the number of US power reactors that have renewed their licenses to 94, several of which have since shut down. Hence, almost all of the US power reactors are likely to be licensed to operate for 60 years, with owners undertaking major capital works to upgrade them at around 30-40 years. The license renewal process typically costs $16-25 million, and the procedures for such renewals, with public meetings and thorough safety review, are exhaustive.

The original 40-year licenses were always intended to be renewed in 20-year increments, as the 40-year period was more to do with amortization of capital rather than implying that reactors were designed for only that operational lifespan. It was also a conservative measure, and experience since has identified life-limiting factors and addressed them. The NRC is now considering applications for the extension of operating licenses beyond 60 out to 80 years, with its subsequent license renewal (SLR) program.

As of January 2026:

Reactors approved (to 80 years): *Turkey Point 3&4, Peach Bottom 2&3, Surry 1&2, North Anna 1&2, Monticello, Oconee 1-3, Virgil C. Summer 1, Point Beach 1&2, Browns Ferry 1-3, Dresden 2&3.*

Reactors under review: *St. Lucie 1&2, H.B. Robinson 2, Edwin I. Hatch 1&2.*

The license extensions to 60 years and beyond meant that major mid-life refurbishment, such as replacement of steam generators and upgrades of instrument and control systems, could be justified. While active plant components such as pumps and valves are under continuous scrutiny for operability, passive components need to be assessed for ageing which may have weakened them. There are R&D programs focusing on this run by the Department of Energy (DOE), Electric Power Research Institute (EPRI), and American Society of Mechanical Engineers (ASME).

The NRC's reactor oversight and assessment process yields publicly-accessible information on the performance of plants in 19 key areas (14 indicators on plant safety, two on radiation safety and three on security). Performance against each indicator is reported quarterly on the NRC website according to whether it is normal, attracting regulatory oversight, provoking regulatory action, or unacceptable (in which case the plant would probably be shut down).

On the industry side, the Institute of Nuclear Power Operations (INPO) was formed after the Three Mile Island accident in 1979, to establish standards of performance against which individual plants could be regularly measured. An inspection of each member plant is typically performed every 18 to 24 months.

Following the accident at Japan's Fukushima nuclear plant in March 2011, which was exacerbated by inadequate outside assistance to the flooded reactors, the US nuclear industry set up the 'FLEX' accident response strategy. It has 61 centers across the country and two national centers which together provide the capacity to respond to nuclear power plant accidents anywhere in the country within 24 hours.

In September 2025 the USA and UK signed the Technology Prosperity Deal that deepens collaboration between the NRC and the UK's Office for Nuclear Regulation (ONR) and Environment Agency to support the completion of reactor design reviews within two years and site approvals within one year.

3.2. Recent Update

From 1992 to 2005, some 270,000 MWe of new gas-fired plants were built, and only 14,000 MWe of new nuclear and coal-fired capacity came online. But coal and nuclear supplied almost 70% of US electricity at the time and provided price stability. When investment in these two technologies almost disappeared, unsustainable demands were placed on gas supplies and prices quadrupled, forcing large industrial users of it offshore and pushing gas-fired electricity costs towards 10 ¢/kWh. However, due to technological advances (in particular, horizontal drilling techniques) in shale gas fracking in the 2000s, costs have become much lower.

The reason for investment being predominantly in gas-fired plant was that it offered the lowest investment risk. Several uncertainties inhibited investment in capital-intensive new coal and nuclear technologies. The average age of US nuclear plants is over 40 years, and major investment is also required in transmission infrastructure. This creates an energy investment crisis which is recognized in Washington, along with an increasing bipartisan consensus on the strategic importance and clean air benefits of nuclear power in the energy mix.

In 2002, the Department of Energy (DOE) launched its Nuclear Power 2010 (NP2010) program to reinvigorate the US nuclear power industry through identifying sites, demonstrating untested regulatory processes and developing advanced nuclear technologies.[4]

As part of the NP2010 initiative, in 2003, the Department of Energy (DOE) called for combined construction and operating license (COL) proposals on the basis that it would fund up to half the cost of any accepted.

Several industry consortia were created for the purpose of preparing COL applications for new reactors. Although few of these projects went ahead, the secured COLs have a validity spanning 40 years from the date of issue, with the possibility of extension for a further 20 years.

Diablo Canyon Nuclear Power Plant is on the California Coast, Photo by Lionel Hahn, Reuters

[4] See https://www.energy.gov/sites/prod/files/Presentation%20-%202010%20Program%20Overview%20-%20Presentation%20to%20the%20NEAC.pdf