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The Nuclear Information & Resource Service (NIRS) was founded in the same year and is based in the U.S. WISE and NIRS joined forces in the year 2000 to produce Nuclear Monitor.

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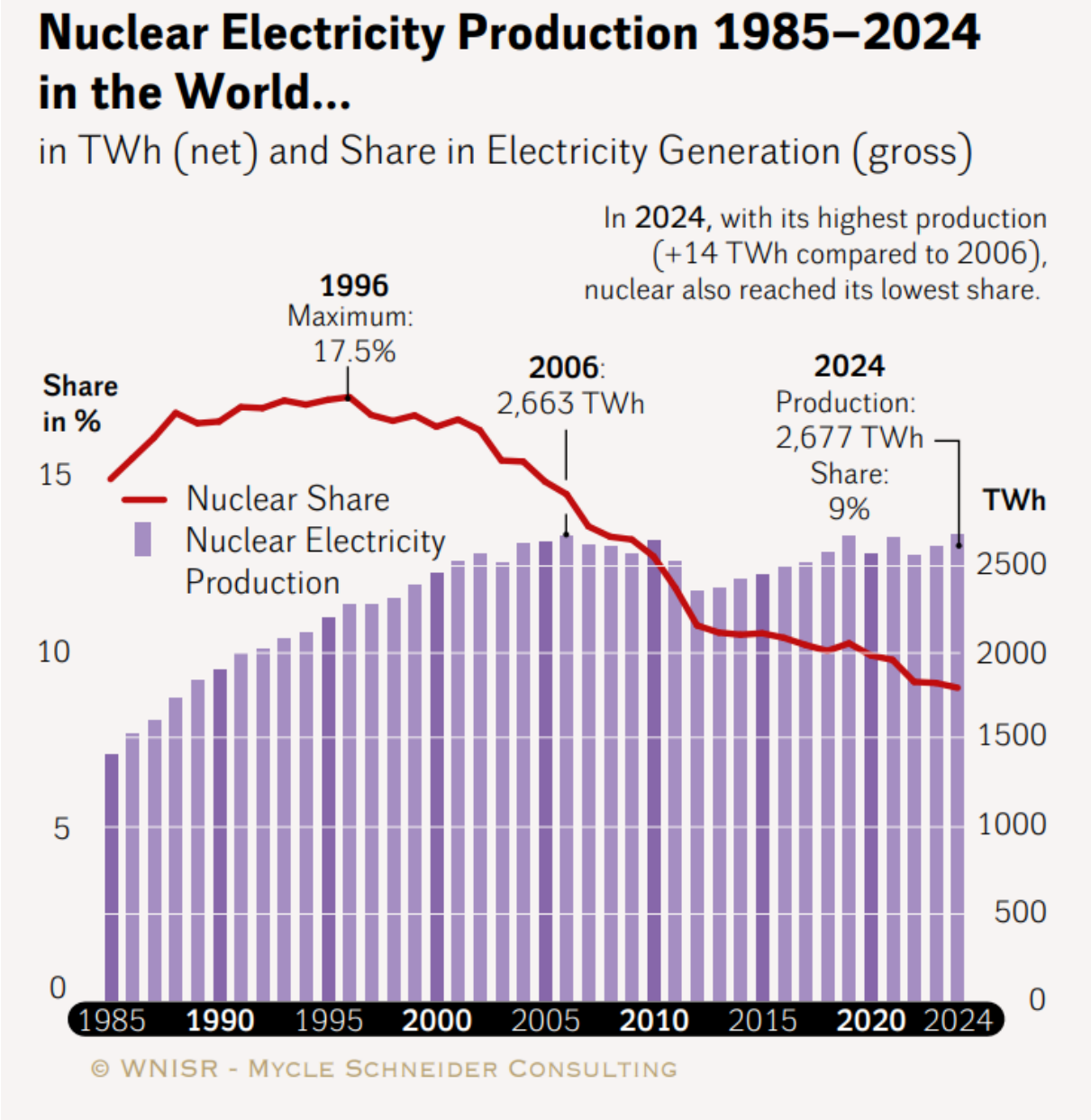
Monitored this issue:

World Nuclear Industry Status Report 2025
Nuclear energy worldwide in decline

Gerard Brinkman, WISE-Netherlands

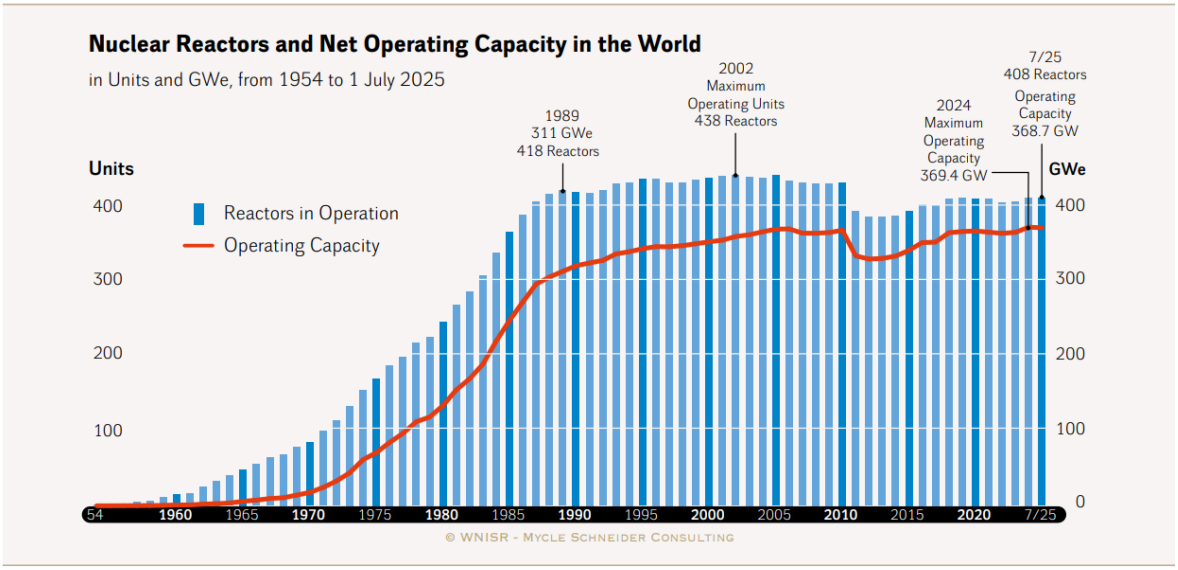
Last week, the annual World Nuclear Industry Status Report was published. This report lists the most important nuclear developments. As in previous editions, the main conclusion of this 2025 edition is that nuclear energy is further declining in global electricity production. Its share has fallen to 9.0%. Solar and wind are much cheaper and are taking off.

In 1996, nuclear power plants produced at their maximum. The share of nuclear power was at its highest worldwide in that year, at 17.5%.



In the last year, nuclear energy's share in the global electricity mix declined from 9,1 to 9,0 %. The question is of course what is causing the decline. The most important issue is that the number of operating nuclear power plants is quite stable in the last years, while more and more electricity is gradually being used in the world.

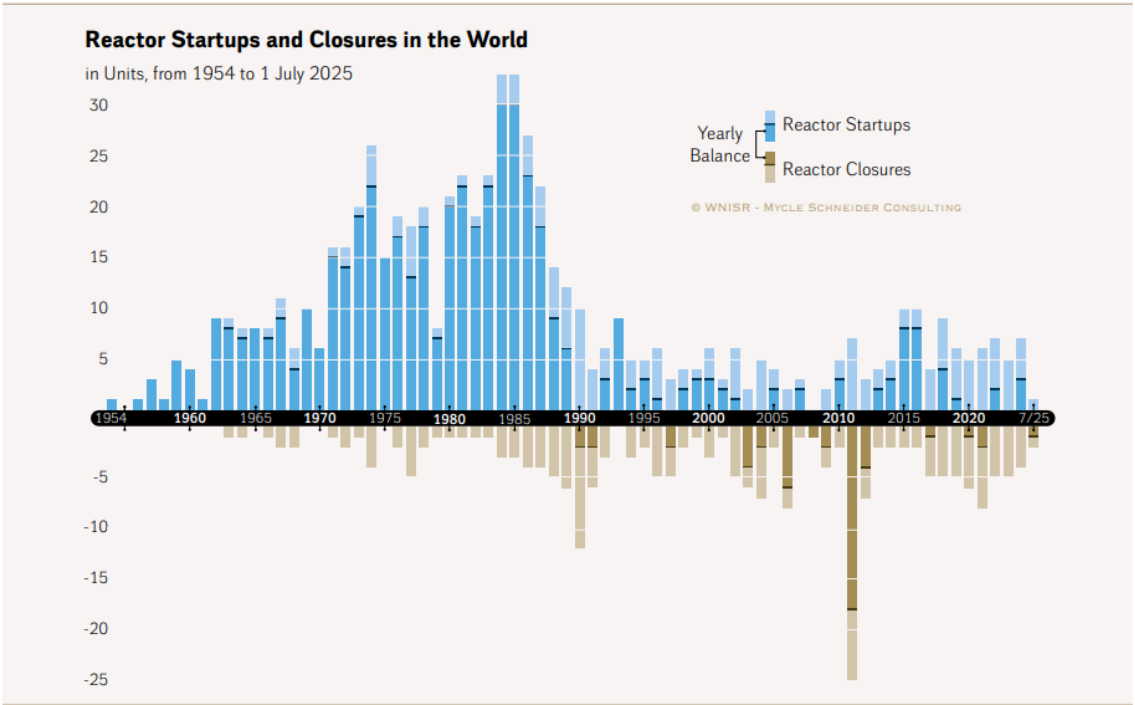
408 Reactors were operating in 31 countries, the same as the number of reactors reported in the previous WNISR-2024, but they are operating in one less country.



Sources: WNISR with IAEA-PRIS, 2025

Since 1990, the number of nuclear power plants has fluctuated at just over 400. Although new nuclear power plants are being connected, approximately the same number are being shut down. This is clearly visible in the balance below.

Figure 4 · Nuclear Power Reactor Grid Connections and Closures in the World



Sources: WNISR with IAEA-PRIS, 2025

Since around 1990, the blue line (new nuclear power plants) and the brown line (closures) have been in balance. The only exception is 2012, when Japan closed its nuclear power plants as a precaution after the Fukushima disaster. In the first half of 2025 (the rightmost column), more nuclear power plants will have been closed than added. According to the IAEA, the current figure (September 2025) is 1 new and 2 closed. The so-called “nuclear renaissance” is still very much questionable.

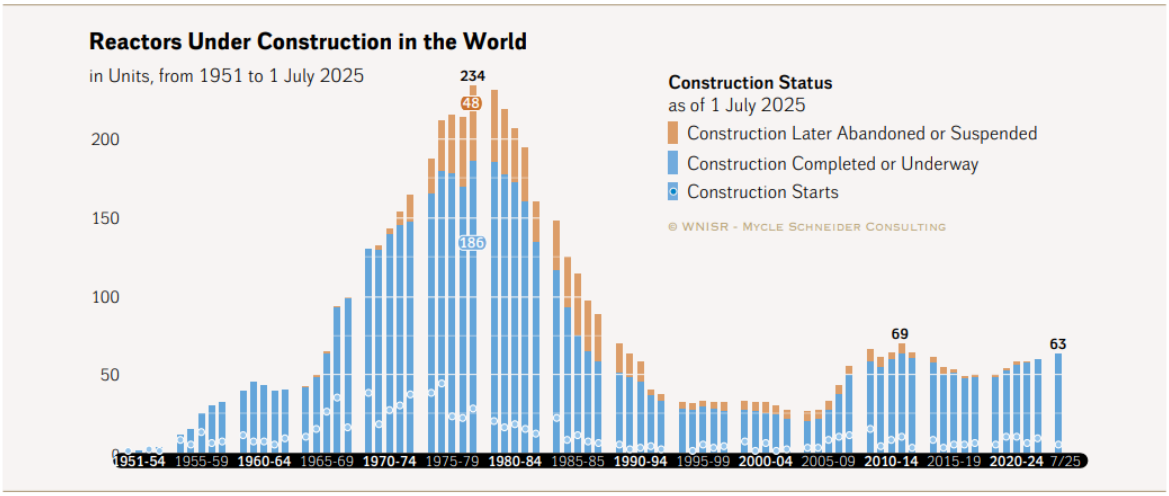
Year: 2025

New connections to the grid	
RAJASTHAN-7	(630 MW(e), PHWR, INDIA) on 17 March
Permanent shutdowns	
DOEL-1	(445 MW(e), PWR, BELGIUM) on 14 February
MAANSHAN-2	(938 MW(e), PWR, TAIWAN,CHINA) on 18 May
Construction starts	
LENINGRAD 2-4	(1150 MW(e), PWR, RUSSIA) on 20 March
TAIPINGLING-3	(1209 MW(e), PWR, CHINA) on 10 June

Under construction

That many new nuclear power plants are being built is a myth. Since 2010, the number of nuclear power plants under construction has fluctuated around 60.

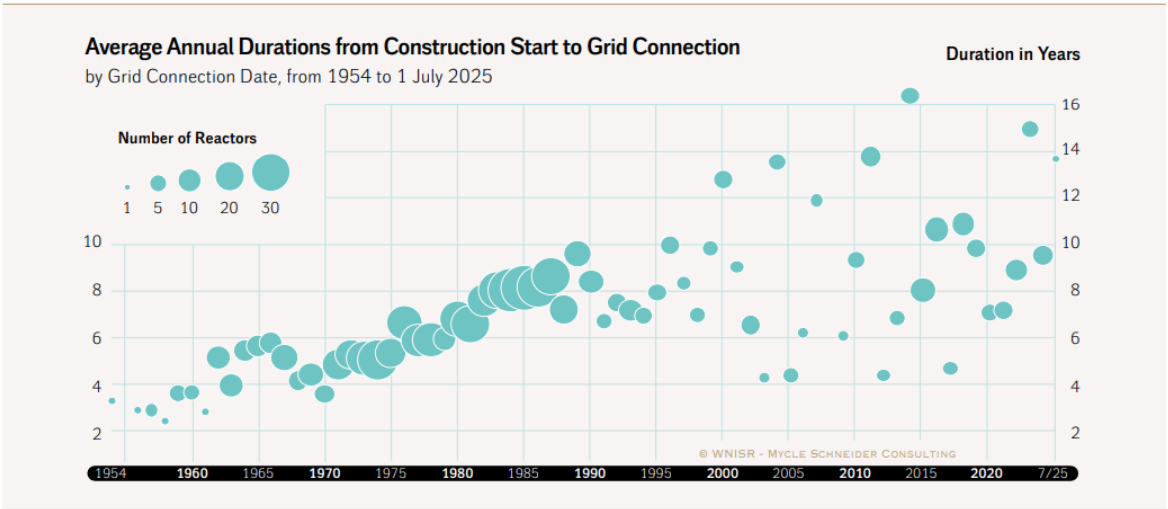
Figure 8 · Nuclear Reactors “Under Construction” in the World



Sources: WNISR, with IAEA-PRIS, 2025

The long construction time of nuclear reactors remains problematic. The average time from start of construction to grid connection for the seven reactors started up in 2024 was 9,6 years.

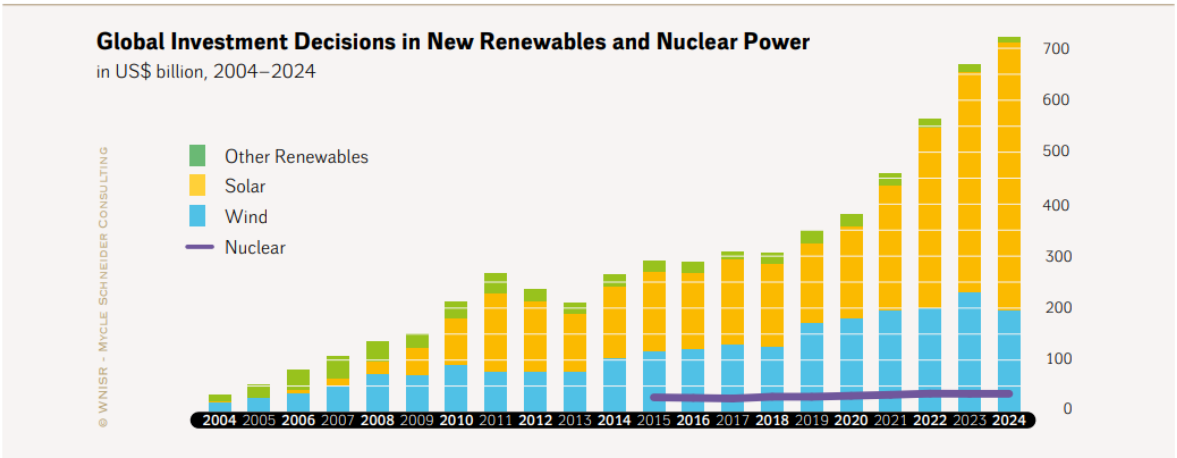
Figure 11 · Average Annual Construction Times in the World



Sources: WNISR with IAEA-PRIS, 2025

The nuclear renaissance is also not yet visible in the investments in nuclear energy. While there is growing investment in new solar and wind parks, nuclear energy remains a marginal phenomenon.

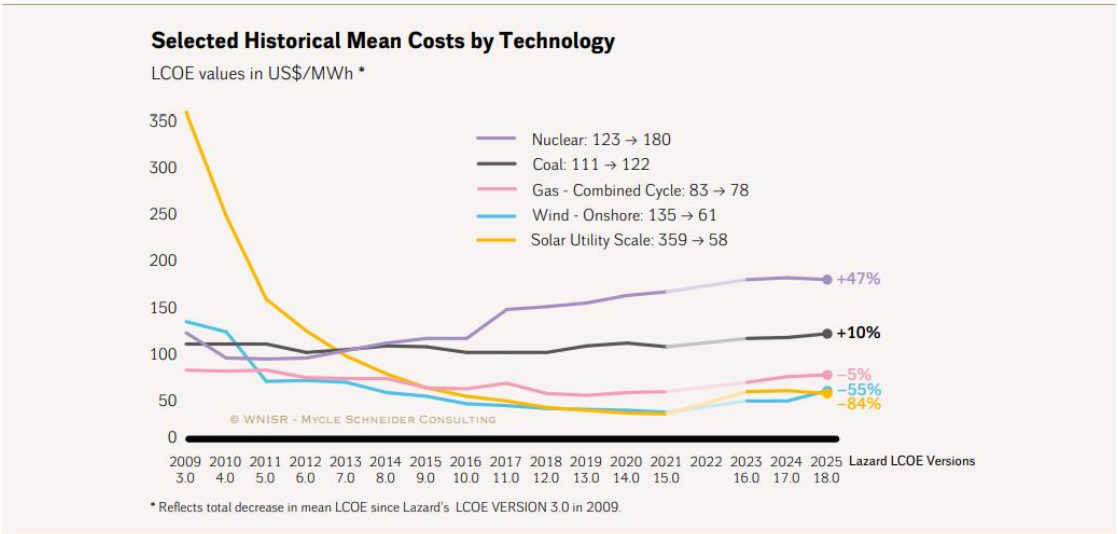
Figure 61 · Global Investment in Renewables and Nuclear Power, 2004–2024



Source: BloombergNEF, 2025

An important aspect lies in the cost development. Lazard, a renowned agency that analyses and advises investors, calculates the costs per MWh each year and determines that solar power has become 84% cheaper compared to 2009, wind on land 55% cheaper and nuclear energy has become 47% more expensive. Investors simply do not like higher costs. The graph shows that due to higher costs and inflation, solar and wind have also increased in price in recent years.

Figure 64 · The Declining Costs of Renewables vs. Traditional Power Sources



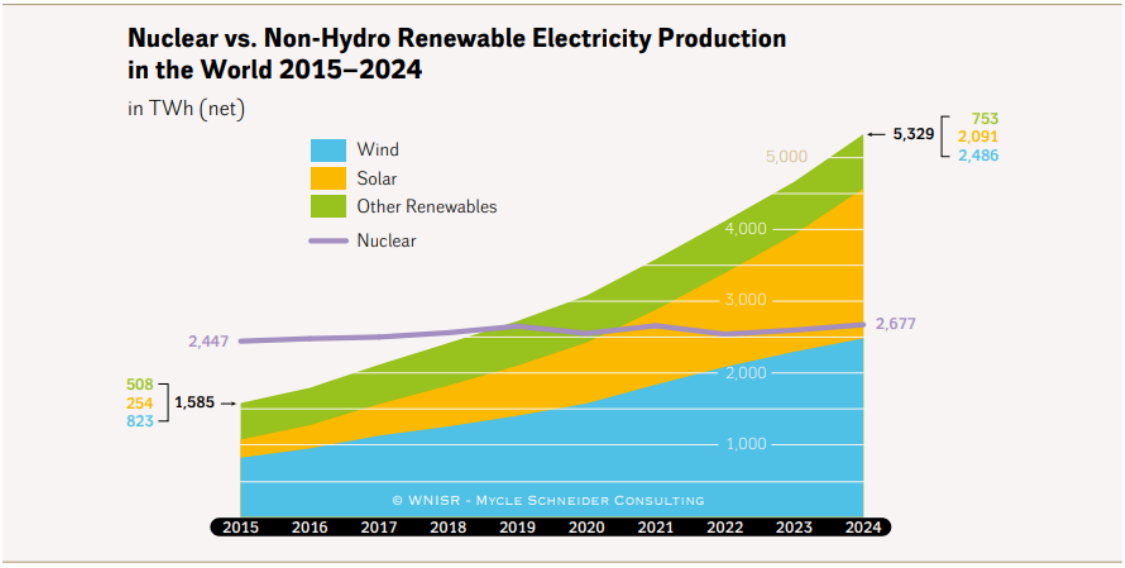
Source: Lazard Estimates, 2025

Notes: **LCOE**: Levelized Cost of Energy

*This graph reflects the average unsubsidized LCOE values in current dollars (not adjusted for inflation) for a given version of LCOE study. It primarily relates to the North American energy landscape but reflects broader, global cost developments.

The result of all these investments is that the production of sustainable energy is growing strongly worldwide and nuclear energy is stagnating.

Figure 68 · Nuclear vs. Non-Hydro Renewable Electricity Production in the World

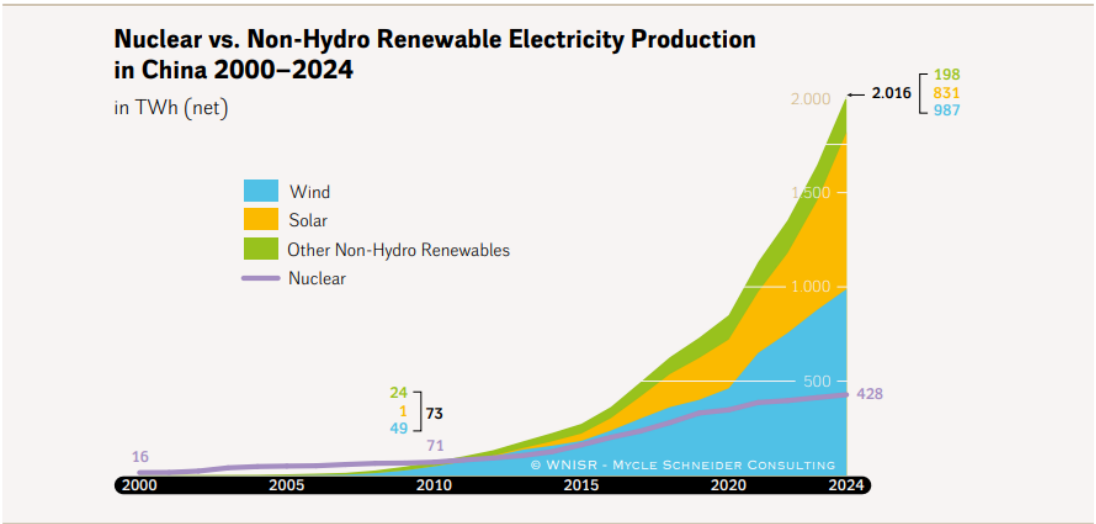


Source: Energy Institute, 2025

China

There is still a major misconception about China. The image that persists is that nuclear power plants in China are being connected to the grid on a regular basis. But what actually is happening there is that the share of renewable energy is increasing dramatically.

Figure 74 · Nuclear vs. Non-Hydro Renewables in China, 2000–2024



Source: Energy Institute, 2025

Nuclear power generation is increasing steadily, but the growth of solar and wind is particularly spectacular.

Small Modular Reactors

While a number of countries see SMRs as the future of nuclear power, experience so far suggests otherwise. The few existing cost estimates all show that SMRs will be more expensive per unit of installed capacity than large reactors.

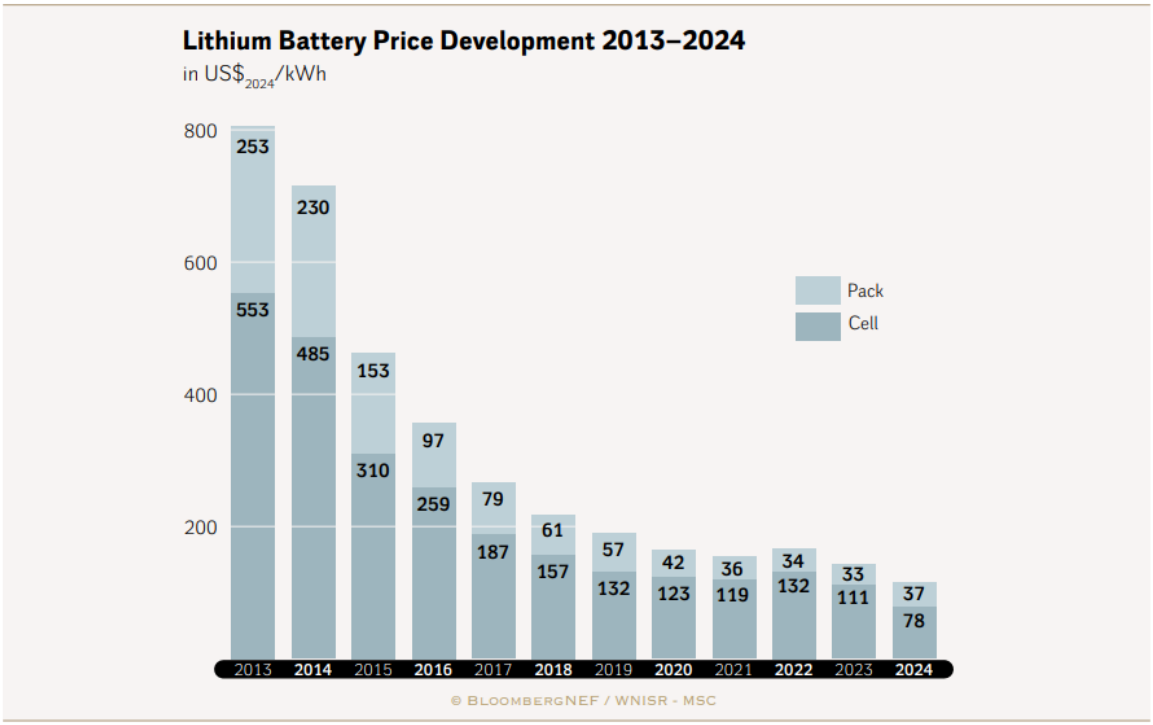
The WNISR concludes that so far, there is only one Design Certification and one Standard Design Approval (both NuScale, U.S.) but no constructions of SMR's in the West. Two of the largest European nuclear startups Newcleo (cash shortage) and Naarea (insolvent) are in serious financial trouble.

Building SMR's for data centers appears incoherent. Time horizons do not match: data centers need power in the short term, SMR's need many years to develop, plan, and build.

Batteries

In an energy system based on solar and wind, storage is necessary. Short-term storage can be provided by batteries. The cost of battery systems has fallen dramatically in recent years.

Figure 57 · Lithium Battery Price Development, 2013–2024



Source: BloombergNEF, 2024[1648]

Conclusion

The report shows that the nuclear renaissance is not happening: the big change is in the increase of solar & wind, while the share of nuclear energy is actually decreasing.

www.worldnuclearreport.org

United States plans to restart mothballed nuclear power plant

Jan van Evert

The Palisades nuclear power plant is located on the shores of Lake Michigan, not far from Chicago. It started production at full power (800 MW) in 1973 and was shut down in June 2022. Previous owner Entergy sold Pallisades in June 2022 to Holtec International for decommissioning as part of its strategy to exit the nuclear power sector. In September 2022,Holtec applied for funds from the Civil Nuclear Credit to reopen the plant. The Biden administration committed a $1.5 billion loan guarantee to the Palisades restart, and the Trump administration has since continued those disbursements.

Last May, Holtec cleared a major hurdle when the NRC's (Nuclear Regulatory Commission) environmental assessment concluded there were no significant environmental impacts associated with resuming the plant's operations. The plant transitioned from a decommissioned to an online status on August 27th. The move allows the plant to receive nuclear fuel and begin producing electricity. This would make Palisades the first nuclear power plant to restart

operations in the USA. And it might very well not be the last. There are plans to restart even more reactors in the USA, including the notorious one near Harrisburg.

But at an August 21st subcommittee meeting of the NRC on Reactor Safety, engineer Arnold Gundersen, who has worked in the nuclear sector for more than fifty years, said steam generators at the Palisades plant have degraded to the point that they are unsafe, unreliable and need to be replaced, not remediated.

"Holtec wants to put a Band-Aid fix on the Palisades steam generators to hold them together. But Band-Aids are useless since the steam generators are gangrenous. A complete steam generator replacement is necessary," he said. Never have I been more concerned about the safety of a nuclear plant than I am about the planned 'resurrection' of Palisades."

Kevin Kamps, a spokesman of watchdog group Beyond Nuclear said in an interview: "We fear (…) steam generator tube failure that can lead to catastrophic core meltdown." Beyond Nuclear contested the plan at virtually every step of the vetting process and now "fully intends to appeal to the federal courts", Kamps said. In December 2023, Holtec International announced that it intended to build the first two of its SMR-300 small modular reactors at Palisades by mid-2030.

sources:
https://www.eenews.net/articles/mothballed-nuclear-plant-on-brink-of-revival
https://www.enr.com/articles/61243-palisades-nuclear-plant-moves-closer-to-restart-by-end-of-2025
Wikipedia

The British experience with nuclear-powered submarines: lessons for Australia

Tim Deere-Jones

The British experience with nuclear submarines reveals a litany of public health risks as well as delays and cost blowouts, and it can confidently be predicted that problems will beset the AUKUS submarine programme – the joint development of nuclear-powered submarines by the UK, the US and Australia.

My new report prepared for Friends of the Earth Australia demonstrates that the development of a nuclear-powered, conventionally-armed nuclear submarine (SSN) fleet entails multiple public health risks and would inevitably suffer from delays and cost-blowouts.

The British experience with SSNs reveals a litany of problems and it can confidently be predicted that problems will beset the AUKUS submarine programme – the joint development of nuclear-powered submarines by the UK, the US and Australia.

Operational risks of SSN deployment include radiological pollution of marine and coastal environments and wildlife; risks of radioactivity doses to coastal populations; and the serious risk of dangerous collisions between civilian vessels and SSNs, especially in the approaches to busy naval and civilian sea ways and fishing grounds.

Worsening problems

Ominously, the problems seem to be worsening. In May 2025, it was revealed that the number of 'incidents' at the Faslane naval base has been on the rise in recent years. The UK Ministry of Defence acknowledged that 12 incidents since 2023 had "actual or high potential for radioactive release to the environment" – but

refused to say what actually happened in any of the incidents, or exactly when they occurred.

Navy Lookout reported on a major fire in October 2024 at the BAE system's yard where nuclear submarines are built. After initial claims of no damage or delay to construction of Astute class attack subs, damage was later confirmed and delays are certain.

Meanwhile, radioactive air emissions have been increasing year-on-year at Coulport, a nuclear submarine bases in Scotland. Emissions of radioactive tritiated water vapour doubled between 2018 and 2023.

Case studies of the first generation of British SSNs, fitted with PWR-1 reactors, reveal an inconsistent performance history of reactor cores. All had to undergo extensive planned maintenance periods consisting of updating military equipment (sonar etc.) and repair, refuelling and back refit of new reactor cores. A surprising number of boats required "unplanned maintenance".

PWR-1 reactors were characterised by a marked tendency to develop "serious cracking in the primary cooling circuits" of the reactors leading to leaks of cooling water. In some cases, these problems were recurrent despite repair and were the cause of premature retirement of some boats.

Vanguard class SSNs

Vanguard class SSNs fitted with PWR-2 reactors had to undergo extensive planned maintenance periods consisting of updating of military equipment (sonar etc.) and repair, refuelling and expensive back refit of new reactor cores. "Unplanned" maintenance outages disrupted the programme of "planned" maintenance and increased the wear-and-tear pressure on boats waiting for their planned maintenance.

The seven-year long maintenance outage of the ballistic missile submarine HMS Vanguard from 2015-22 occurred in the wake of a series of reports of observed reactor malfunctions from the Naval Reactor Test Establishment (NRTE).

In 2009 the NRTE reported that such malfunctions posed a risk of "potential failure of the reactor primary coolant circuit", leak of "highly radioactive fission products" and "significant risk to life in close proximity and a public safety hazard out to 1.5 km from the submarine."

In 2011, the NRTE discovered unexpected increases in radioactivity concentrations in the reactor cooling water attributed to microscopic cracking defects in the cladding of the nuclear fuel elements.

In 2015, in the aftermath of the NRTE reports of reactor and nuclear fuel malfunction, the UK Government and the Ministry of Defence decided to close down the NRTE and to abandon empirical "lead" research on naval reactors in favour of computer modelling analysis of the performance of all new reactors and cores.

AUKUS SSNs

This also applies to AUKUS SSNs, which will be the first UK designed and built nuclear powered submarines to be run without the benefit of the NRTE input.

All previous UK nuclear submarine reactors and core types have been built and put into operation at the NRTE at least two years before their deployment in nuclear submarines under operational conditions, thus enabling potential flaws in reactor, core and fuel performance to be identified in advance of at-sea operation and also informing core and fuel designers working towards the development of improved reactors, cores and fuels.

In November 2009, the UK House of Commons Defence Select Committee found that delays due to technical and programme issues meant that the Astute class SSN programme was 57 months late and 53 percent over-budget.

By March 2021, Astute SSNs were delivered between 3–5 years behind the original schedule.

This necessitated the extension in service of HMS Trenchant, Talent and Triumph with the attendant costs of keeping ageing boats running.

There are now growing indications from sources close to the UK Government and Ministry of Defence that the AUKUS successor to the Astute class may be delayed due to financial and technical issues. "It's early days … but the first boat is unlikely to arrive before the mid-2040s," *Navy Lookout* reported in 2023.

Decommissioning and dismantling nuclear-powered submarines

The UK experience is that the decommissioning, defueling, deradiation and scrapping of nuclear submarines is fraught with technical problems and delays arising from those problems. It is also clear that these issues give rise to ever increasing costs.

In 2019 the National Audit Office (NAO) published its report of an investigation, by the Public Accounts Committee of the UK House of Commons, into submarine defueling and dismantling. The investigation took place between 2017 and 2019.

The NAO report noted that since 1980, the Ministry of Defence (MoD) had decommissioned 20 submarines from service and replaced them with updated boats and that the MoD had committed to handling the arising nuclear liabilities responsibly and disposing of submarines "as soon as reasonably practicable".

The NAO reported that despite the 20-year-old MoD commitment to dispose of the 20 submarines it had decommissioned since 1980, none had been completely dismantled by 2019 and that as a result the MoD now stored twice as many nuclear submarines as it operated, with seven of them having been in storage for longer than they were in service. At the time of the NAO report in 2019, nine of the 20 decommissioned boats still contained irradiated (spent) nuclear fuel.

The long-term management, storage and disposal of radioactive waste streams from nuclear submarines remains unsolved in the UK after many decades. And radioactive waste management remains unsolved in Australia, which does not even have a national repository for low-level waste let alone a disposal option for long-lived intermediate-level waste and high-level waste.

Sinking of civilian vessels, collisions, near misses, groundings

Between 1982 and 2015, UK civilian sources collated a dossier of information on 170 "interactions" between civilian vessels and nuclear submarines including net "snaggings", collisions, near misses and at least 30 suspicious unexplained sinkings in UK waters. These incidents have led to loss of life, total loss of vessels and loss of fishing gear.

In the UK it is evident that, despite not firing a shot in anger, UK nuclear submarines have been responsible for the death of a number of UK citizens as a result of such interactions. Wider research has uncovered a number of other incidents involving nuclear submarines across the world's oceans.

A summary review of interactions between nuclear submarines and civilian vessels illustrates that submarine patrol routes, exercise and training areas, followed by maritime choke points and port approaches, present the greatest risks to the safety and operation of civilian vessels and their crew, ranging from small inshore commercial fishing boats up to super tankers.

Despite the best attempts of both civilian and Defence authorities, the secrecy surrounding nuclear submarine operations makes risk avoidance that much more complex, with notification of nuclear submarine movements not publicised and the details of patrol and training strategies not divulged to judicial or government agency inquiries.

On a number of occasions civilian stakeholder groups (fishers etc.), local authorities and citizens campaigns have attempted to initiate improved protocols for submarine activity by interacting with the International Maritime Authority. However, the Authority does not have the power to mandate a set of standard procedures to prevent damaging interactions between civilian vessels and nuclear submarines.

Radioactivity discharged from nuclear submarine bases

A detailed review of the behaviour and fate of radioactivity discharged from UK nuclear submarine bases during repair, maintenance and refit operations on SSNs and ballistic missile submarines reveals discrepancies between the traditional official monitoring, analytical and dosimetry programmes deployed by UK nuclear regulatory agencies and the conclusions of recent scientific reviews and studies which identify flaws in the official programmes leading to inadequate understanding of the dose pathways by which coastal populations may be exposed to doses of radioactivity from nuclear submarine bases.

A number of case studies are reviewed including a study which demonstrated that a coastal population living approx. 20 miles (32 km) downstream of a UK nuclear submarine base received a higher dietary dose of man-made radioactivity from locally grown terrestrial food stuffs, than did a population living next to a four-reactor civilian nuclear power station.

An unchallenged independent interpretation of this study showed that the radionuclide implicated in the higher dose was Cobalt-60, a radionuclide characteristic of naval PWR discharges and indicated the likelihood that the Cobalt-60 and other nuclear submarine derived radioactivity had transferred from the sea to the land by way of a number of mechanisms.

Information from a number of countries indicates that Belgium, Canada, the Czech Republic, Finland, France, Germany, Luxembourg, Sweden and Switzerland have pre-distributed iodine in the vicinity of nuclear reactors – the area covered has ranged from 4 km to 20 km radius of the nuclear reactors. In the UK, the decision to pre-distribute rests with the local authority and it has only occurred in a limited number of cases and a 3 km radius has tended to be used. As of yet, no decisions on these issues have been made within Australia.

The report, 'The British experience with nuclear-powered submarines: lessons for Australia', is online at https://nuclear.foe.org.au/nuclear-subs/

Tim Deere-Jones has a B.Sc. degree in Maritime Studies and has operated a Marine Pollution Research Consultancy since the 1980s focusing on the behaviour and fate of marine anthropogenic radioactivity, causes/outcomes of hazardous cargos and shipping accidents, marine hydrocarbon, radioactivity and chemical spills.

EDF reprimanded for Flamanville safety problems

Jan van Evert

The French Nuclear Safety Authority (ASNR) has severely criticized crisis management at the Flamanville 3 nuclear power plant which has been shut down since June 19th due to several technical problems (see Nuclear Monitor 924 and 926). On August 20th, inspectors subjected EDF teams to an unannounced “local crisis response” (MLC) exercise which involved the replacement of one electrical panel component with another to recharge batteries in the event of a total power loss. The result was that the operator was unable to complete this operation, which was essential to prevent an accident.

In its follow-up letter, the ASNR points to an "insufficiently precise range of operations", staff "forced to question themselves on numerous occasions", and a training program deemed "perfectible". Worse still, some of the crisis equipment requested by the inspectors could not be presented. "The organization of the Flamanville EPR with regard to crisis management and resources appears insufficient", concludes the nuclear watchdog, a rare assessment in its usually measured vocabulary.

“I don't recall such an observation," Guy Vastel, of the Association pour le contrôle de la radioactivité dans l'Ouest (Acro), told Ouest-France. Yannick Rousselet, from Greenpeace, believes that "nothing is right" in this report. EDF, has announced an ‘action plan’ and asserts that the findings "do not call into question the availability of crisis resources or the site's capacity to manage an emergency

Source: reporterre.net

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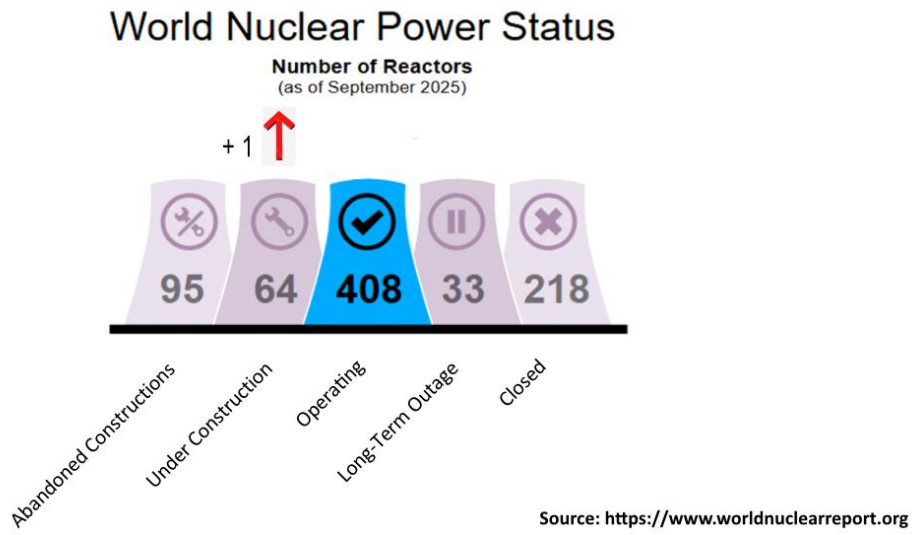

Source: https://www.worldnuclearreport.org

Compared to the last edition of the Nuclear Monitor (929);

- ✓ Construction of Jinqimen-1 has started in China.