



## Nuclear power in 2023: the ‘nuclear renaissance’ resurrected?

Twenty years ago, there was a lot of talk among supporters of civil nuclear power of a ‘nuclear renaissance’. Their argument was that nuclear power provided energy security combined with low carbon dioxide emissions. The strength of nuclear’s case steadily declined as the costs of new plants rose and their commercial viability in competitive markets declined. The 2011 Fukushima Daiichi nuclear accident in Japan appeared, at the time, to then provide the death knell for civil nuclear power.

However, the last few years have seen this form of energy gradually return to favour as the challenge of climate change mitigation increases in severity. Emblematic of this was the vote in the European Parliament in July 2022 to support the Commission’s proposal to classify nuclear power as green energy. Finally, the conflict in Ukraine and its effect on international energy markets has highlighted the importance of energy security. Thus, in 2022 we saw a number of countries reversing or at least postponing decisions to phase out nuclear power and, in some cases, to construct new reactors. Meanwhile, several nations have been embarking on their first nuclear power programmes, mostly to address energy supply shortages. The years 2022 and 2023 may be viewed in later years as marking a critical turning point in the history of nuclear power.

The effect of the war in Ukraine has been particularly striking. In Europe, both Germany and Belgium have postponed the phase-out of their nuclear fleet, so these plants will still be operating in 2023. Of greater consequence have been the decisions of countries that are heavily reliant on nuclear power. France’s President Macron has announced an ambition to build 6 (possibly 14) new reactors in the coming years. The UK continues to seek investors in reactors at two sites and is supporting the development of small modular reactors (SMRs).

In northeast Asia, the Japanese government decided in December 2022 that nuclear energy should remain at the heart of its power supply for the foreseeable future through a combination of life extensions and new reactors. Likewise, the new government in Korea has reversed the decision of its predecessor to phase out nuclear power. Instead, work will continue on those reactors currently under construction, others will start construction in 2023, and 4 new reactors are planned. Both Japan and Korea hope to deploy new types of reactor, both SMRs and those using advanced technologies, so-called Generation IV reactors. With 11 reactors under construction, India’s government gave financial sanction for 10 new reactors in December 2022. Meanwhile, China with the world’s third largest fleet of reactors continues with its ambitious programme, having 22 reactors under construction and another 47 planned. Russia is also expanding its large fleet.

Aside from these larger actors, numerous countries are adding, planning to add or considering adding to their existing small fleets of reactors.

**Table 2: Nuclear reactor plans, by country**

Country	Recently completed reactors	Reactors under construction	Plans for reactors	New reactors under consideration
<i>Europe</i>				
Finland	Olkiluoto 3			
Slovakia		1		
Czechia			Yes	
Bulgaria			Yes	
Hungary			Yes	
Romania			Yes	
Netherlands				2
<i>Latin America</i>				
Brazil		1	Yes	
Argentina		1	Yes	
<i>South Asia</i>				
Pakistan	2		1	

Behind these established nuclear power nations is a long queue of so-called ‘newcomers’. These are countries in which the governments are at various stages of considering, planning or building their first commercial nuclear reactors. Five of these newcomers have reactors recently completed or under construction. The UAE has three reactors of Korean design in commercial operation and a fourth under construction. The four other countries are reliant on Russian design and support, namely Belarus, Turkey, Bangladesh, and Egypt. Poland and the Philippines, in 2021 and 2022 respectively, declared firm decisions to embark on a nuclear power programme, while most of the remaining newcomers are still to make a firm decision. Southeast Asia is a region where nuclear power is under serious consideration. Indonesia, Malaysia, Vietnam, and Thailand have built expertise in the field over many years and could launch a nuclear power programme at any time. Vietnam is the country most likely to make a firm commitment in the near future as political conditions in the three other countries are less favourable for such a far-reaching decision. In 2022 Singapore stated publicly, for the first time, that nuclear power was an option for the city state, depending on technological developments.

A key unknown is the future of new technologies. Two types can be distinguished: SMRs based on conventional technologies, and those based on advanced technologies. Several long-established nuclear power countries are pursuing both options. Russia was the first to put SMRs into commercial operation, the barge transportable Akademik Lomonosov 1 and 2 reactors in 2022. In China, two high-temperature, gas-cooled reactors have undergone tests and will be ready for commercial operation in 2023. The next year or so will start to reveal which, if any, of the many designs becoming available will be attractive to buyers.

Regardless of which technologies, conventional or new, are deployed, these ambitions and plans will face two main hurdles. The first is the longstanding challenge of cost. Russia has been generous in its financial support to those purchasing its reactors. The extent to which this can continue is unclear. Most other vendors are less generous. SMRs are intended to provide the solution to the cost problem, but this has yet to be demonstrated. One thing to watch for is the approval of SMR designs by national nuclear regulators. In 2022, the US Nuclear Regulatory Commission (NRC) formally certified the design of NuScale’s SMR for use in the country, the first SMR to receive NRC certification. Also last year, Rolls Royce submitted its SMR design for approval by the UK’s Office for Nuclear Regulation. In addition, companies in Canada, Japan, South Korea, India, China, and Russia are all working on SMR designs. A second challenge may arise from supply chain failures. Recent years have demonstrated the vulnerabilities of supply chains for technologies and raw materials. The nuclear power sector has a particular problem with a shortage of skilled manpower.

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