

Russian Conflict, Gazprom Cut-Offs, Climate Concerns Raise Prospects for Long-Shunned Nuclear Energy

Blog post by Stephanie Grumet, 05 May 2022

The current stress on fossil fuels created by Russia's invasion of Ukraine, combined with deep decarbonisation efforts is reigniting interest in nuclear power - which has heretofore been de-emphasised by some policymakers and companies in recent years due to safety concerns and a greater emphasis on renewable energy deployment.

Nuclear power has the attribute of producing carbon-free electricity round the clock, referred to as 'baseload power'. Of renewable generators, only offshore wind can deliver power close to matching such consistency. Next-generation technologies, known as small modular reactors (SMRs), are being designed to be smaller, cheaper, safer, and more versatile than their larger brethren. Announcements by the US, UK, and EU on SMR developments are proliferating as all three work to eliminate and taper crude and natural gas imports from Russia. On April 27th Gazprom, the state-owned Russian natural gas distributor announced it had shut supply off to Poland and Bulgaria, insisting on payment in rubles. It is noteworthy that Poland recently inked contracts for SMRs.

This interest is also manifesting itself in the US where nuclear power currently delivers 52% of carbon-free electricity capacity. Nuclear reactors in New York, New Jersey, Illinois, and Connecticut have received state funds to pull units back from the brink of retirement for their carbon-free electricity and local employment attributes. On April 19th, the US launched a \$6bn federal program to ensure existing uneconomic nuclear power plants do not close prematurely to retain the carbon-free generation (progress on this program is discussed below). This funding was authorised by Congress in the 2021 Infrastructure, Investment and Jobs Act along with \$2.5bn for an Advanced Reactor Demonstration Program.

Nuclear Makeover

The lustre of carbon-free nuclear energy was tarnished after the highly publicised and impactful human-error-related accident at Ukraine's Chernobyl No. 4 reactor in 1986 and more recently in Japan after a tsunami cut power from critical backup generators at the Fukushima Daiichi plant in 2011. In Europe, the current dependence on Russian oil and natural gas exports is forcing alternative energy policies at an accelerated rate, leading to a rethink on nuclear energy. Rekindled interest in fission could even include reversing the decision to remove the three remaining German nuclear reactors from service - though absent a dramatic escalation in Russia's aggression and Gazprom depriving natural gas to more European countries it is unlikely. Though in the US, States with net-zero greenhouse

gas policies, like New York, New Jersey and Illinois have used public funds to retain nuclear plants.

SMR Market Heating Up

SMRs hold great promise to safely produce baseload electricity. Importantly, innovations with some SMR prototypes include steam bypass engineering. Bypassing steam from the generator would enable these plants to ramp electricity output up and down. Ramping is an important grid function needed to balance intermittent renewable generation which comes online sporadically. Balancing functions are increasingly well-compensated in wholesale markets and will continue to be critical as even more renewables are added to the grid. Modular technology is a scalable product: a small reactor of less than 80 MW could be deployed, and several modules grouped together can create the same output as a traditional nuclear power plant, typically over 1,000 MW. While SMR technology is not yet commercially available, there are numerous SMRs under development in the US and Europe. NuScale Power was the first company to receive design approval for an SMR technology by the US Nuclear Regulatory Commission (NRC) in 2020. NuScale has a pilot contract with DOE's Idaho National Laboratory and neighbouring rural electric cooperatives for a series of modular SMRs with a projected start date of 2029. NuScale also reported contracts for SMR purchases in Poland with an aim to have those modules operational by 2029. We view this as notable given Poland's border with Ukraine and its vulnerability to Russian gas, highlighted by Gazprom's recent delivery cut-off.

In Wyoming, a coal-to-nuclear project was announced by Pacificorp to embed an SMR (under development by TerraPower) into the structure of a retiring coal plant. The plans even include the retention of existing turbines. This kind of renewal is likely to be politically popular across many states because the plant would retain a fair amount of permanent jobs - unlike solar power installments on decommissioned coal plant properties, which confer only temporary construction jobs. Coal-to-nuclear plants also solve the very real problem of finding interconnections to the electric grid and utilising existing transmission lines. Siting and paying for transmission for new renewables is notoriously litigated, protracted and expensive.

SMR news around the world is picking up. A few recent announcements include:

- Ontario Power Generation (OPG) announced the selection of GE's Hitachi Nuclear Energy BWRX-300 SMR for a 300 MW commercial grid-scale application in Darlington which, according to reports, could be completed by 2028 and in service by 2034. Additionally, four Canadian Provinces - Ontario, Saskatchewan, New Brunswick and Alberta - released a joint strategic plan in March to deploy SMRs to advance a clean energy future.
- The Tennessee Valley Authority (TVA) has secured an Early Site Permit for an SMR to be located at its Clinch River site, though it has not yet announced its SMR

technology plans.

- Even more opportunities could be available for the micronuclear reactors underdevelopment - under 10 MW - that could pair well with industrial electricity needs and microgrids.

DOE's Civil Nuclear Credit Program Up and Running

The US Department of Energy (DOE) is wasting no time in making the IIJA funds available, creating a program to assist existing nuclear reactors facing uneconomic conditions in wholesale markets. DOE's Civil Nuclear Credit Program (CNC) issued guidance on April 19th: applications are accepted for this initial funding cycle through May 19th. Nuclear units appealing to DOE for funds in this tranche must have "publicly announced their intention to cease operations" to ensure funds are directed towards most at-risk plants facing deactivation. Only units in competitive wholesale markets are eligible; these units must demonstrate they would operate at an average annual operating loss during the award period and that air pollution would increase should the reactor cease operation. Applications must also include information on the source of uranium, its enrichment, fabrication and domestic content. The domestic fuel content is a material factor in DOE's award process. This second round of funding is likely where most of the support awards will be granted.

There is also an existing production tax credit (PTC) which would award new nuclear generation 1.8 cents per kilowatt-hour for its output during the first eight years of operation. The PTC is limited to 6,000MW of capacity and the new AP1000 pressurized water reactors (total capacity of 2234MW) being built in Georgia are likely to consume over a third of these credits.

The most obvious reactors fitting the deactivation criteria of announcing a cease of operations before September 2026 are Entergy's Palisades Power Plant (777 MW) in Michigan and PG&E's Diablo Canyon in California. It is unclear if these plants will request DOE's assistance given long-standing deactivation plans and, in the case of Diablo Canyon, significant local opposition. It is possible that the Perry (1,100 MW) and Davis Besse (894 MW) units owned by Energy Harbour in Ohio could also apply - having lost \$11 megawatt-hour (MWhr) of state subsidies in a scandalous conflagration over First Energy's lobbying practices, which incited a federal investigation and resulted in the repeal of the nuclear subsidies in March 2021. Deactivation notices for the Ohio plants were rescinded in 2019, when the state initially passed legislation to support the plants. Plant owners could try to argue these facilities remain in peril since the loss of the state subsidies. It is unclear if they will apply or whether DOE would view their applications as meeting the deactivation criteria.

Final awards for the initial funding period will be announced by October 1st. DOE is capping this initial award at US\$1.2 bn and will provide annual support on a per megawatt-

hour (MWhr) basis based on the unit's submission from 2023 to 2026. Applicants must submit a bid including the number of per MWhr requested, committed generation and average credit price per MWhr it is seeking. DOE will update its guidance for the second award cycle - which we believe will be more impactful - starting in 2023, which will issue credits from 2024-2027.

Might Germany Re-Think on Nuclear?

Germany went the farthest in rejecting nuclear energy post-Fukushima. Germany passed legislation in 2011 to close its nuclear fleet of eight plants after the Fukushima incident. Germany is not alone in abandoning its nukes, as Spain and Belgium also embraced policies to close nuclear power plants. Even France, which generates over 70% of its electric output from its nuclear fleet, at one point planned to shave its nuclear generation to 50% of its generation portfolio by 2025 - a deadline that has already been extended by a decade. We believe those anti-nuclear power sentiments are bound to be re-thought as Europe and the UK address the twin goals of decarbonisation and weaning reliance off Russian petrochemicals. In 2021, Europe imported over 40% of the natural gas it consumed from Russia - thus finding new sources of electric generation in addition to renewables will be paramount.

Eight nuclear plants were operational in Germany in 2011 when it made the decision to shutter its entire fleet. The last remaining nuclear plants - Isar unit 2 (1,410-MW), Emsland (1,335-MW) and Neckarwestheim 2 (1,310-MW) - are slated for decommissioning by December 31, 2022. Reversing these facilities' fate would require either legislative action or action by the electric network regulator to deem the plants critical to the grid. Operators have been planning for decommissioning for years, thus, staffing and fuel levels may also pose a challenge for an extension. Untangling the decommissioning trust plans also presents an obstacle to extending the life of the plants. While some prominent voices, including Vice-Chancellor of Germany, Federal Minister for Economic Affairs and Climate Action, Robert Habeck, have raised rethinking the remaining plants' shut down dates, for now, there is broad political consensus there should be no reversal. Only dramatic increases in Russian aggression, decreases in the availability of Russia's natural gas, and significant instability over the next eight months could move the needle.