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Jan 4, 2021

by Darrell Proctor

Nuclear

Governments Look to Expand Nuclear Power Through SMRs

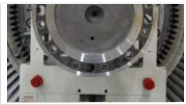
Advancements in small modular reactor (SMR) technology are being supported by government investment within several countries, including the U.S. and the UK, as SMRs are increasingly seen as a way to take advantage of zero-emission nuclear power without the expense of building new, large nuclear power plants. Recent investments have looked at how parts for SMRs could be fabricated and then assembled at their destination, another way to reduce construction and overall project costs.

The International Atomic Energy Agency (IAEA) in a recent report said more than 70 SMR designs and concepts exist worldwide. SMRs also are being touted for their ability to work as a multi-module plant, combining modules for more power output.

A recent report prepared for the Dutch government, part of the Netherlands' effort to explore nuclear power as part of its energy mix, said SMRs carry "a promise for great simplification and related cost reduction while applying industrial manufacturing and construction technologies at factory rather than on site." Eric Wiebes, the Netherlands' Minister of Economic Affairs and Climate, in a letter to that country's parliament wrote, "Various studies show that nuclear energy can be a cost-effective opportunity and is a positive business case. SMRs can become an attractive alternative to larger nuclear reactors. Through serial production in factories, the shorter construction time and the modular design makes financing easier."

SMRs could provide a way for countries to supplement their power generation—nuclear power, from a single-unit pressurized water reactor at Borssele, accounts for about 3% of the Netherlands' electricity production. The unit, which came online in 1973, is currently licensed to operate until 2033. Government officials support expanding the country's nuclear output; Mark Harbers, a member of parliament for the governing People's Party for Freedom and Democracy (VVD), said the country's climate goals for 2050 need nuclear power. He told parliament: "You can focus on solar and wind, but then you need backstop. If you add a few nuclear power stations, you have just a little more stability."

Read about [Rosatom's recently announced SMR project](#) in the Russian Republic of Sakha.



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A 2020 study by the UK's University of Cambridge concluded that a modular concept for nuclear power would reduce project costs by as much as 25%. The study also found that standardization of construction, along with more efficient production of components, would achieve cost-savings of 16% to 17%. UK Prime Minister (PM) Boris Johnson recently announced that the country would invest as much as £250 million (\$332 million) in SMRs. An accompanying policy document from the UK government said that investment would “unlock up to £300 million private-sector match-funding.” SMRs also can help balance power grids, providing electricity during periods of peak demand, and ensuring power continuity in areas that rely on intermittent renewable power without significant storage capacity.

“I’m really optimistic about SMRs,” Leslie Dewan, a nuclear engineer who recently founded Criticality Capital, a venture capital firm focusing on nuclear and other carbon-free energy investments, told *POWER* (see a [POWER Insights video interview](#) with Dewan from earlier this year below). “You have designs like NuScale’s SMR that has already gone through regulatory approval, that should be able to get to market relatively quickly. You can mass manufacture a lot of these, for all of those designs, whether it’s metal-cooled, molten salt, whether it’s traditional LWR [light water reactor].”

NuScale Power, based in Portland, Oregon, is developing a new modular LWR (Figure 1). The company said its design features a fully fabricated NuScale Power Module, capable of generating 77 MW of electricity, “using a safer, smaller, scalable version of pressurized water reactor technology.” NuScale’s SMR technology can be used across several platforms, “including baseload electricity, load-following support for renewables, very high-reliability microgrids, and process heat or steam for district heating, desalination, and other industrial uses.” The company has said its reference power plant “can house up to 12 NuScale Power Modules for a total facility output of 924 MW,” and also can be used in smaller configurations.

1. This is a rendering of a NuScale multi-module small modular reactor (SMR) power plant site. Courtesy: NuScale Power



development, and techno-economic expertise focused on zero-carbon technology options for large-scale, market-based decarbonization of the global economy. Gogan told *POWER*, “Firstly, flexible advanced reactors being rapidly commercialized today can provide economical and clean dispatchable generation that will complement and enable high penetrations of variable renewables into future electricity grids. Secondly, these advanced clean heat sources can re-power coal plants, enabling continued operation of the plant and associated infrastructure, including transmission, without emissions.”

Gogan, who also is a co-founder of Energy for Humanity, an international community of pro-nuclear environmental activists based in the UK and Switzerland, also said, “Thirdly, beyond electricity, new advanced heat sources have potential to supply heat to homes, businesses, and industrial processes; produce hydrogen and synthetic fuels to support cleaner transport, including the hard-to-abate sectors of aviation and shipping; desalinate and purify seawater in regions suffering water scarcity; support access to modern energy services in remote and developing communities; and offer industry an emissions-free source of high-temperature heat, all in support of clean energy transitions that can benefit society and lift up living standards around the world.”

Dewan agreed that the use of SMRs to provide power for a range of applications, as noted by Gogan, is a large part of the technology’s appeal. “You have economies of scale that kick in, and it becomes easier to use SMRs in situations where it’s useful to build additional reactor units, and in the ways that you can improve them,” Dewan said. “You can use [early experience] to potentially tweak the design, in ways you couldn’t with a large reactor unit. In terms of uses for small modular reactors, it’s very scalable, whether you’re powering a data center, or powering a small city. Another use that’s interesting is using the heat, for hydrogen production, or industrial processes like chemical processing, or food processing, [and] food and beverage manufacturing.”

Ontario Power Generation (OPG) in November announced it is resuming planning activities for building new nuclear generating capacity at its Darlington site in Ontario, and is now considering building an SMR rather than the previously discussed large conventional reactor. OPG has applied to the Canadian Nuclear Safety Commission (CNSC) to renew the site preparation license at Darlington; the application will be considered by the CNSC at a public hearing in June 2021. OPG in October announced it was working on engineering and design with three grid-scale SMR developers: X-energy, GE Hitachi, and Terrestrial Energy.

“I can see the SMRs having an easier path to adoption,” Dewan said. “It’s not like they have to be adjacent to a big metropolitan area, so you might eliminate some of the concerns” people would have about living close to a large nuclear power plant. Dewan also noted how SMRs could be used to bring electricity to areas with no access to a traditional power grid. “In Africa, and particularly Congo and Niger, they have borne the effects of the uranium mining industry. But they haven’t really benefited from it, [because] there are no nuclear power plants there. If there’s a safe way to bring nuclear power plants to those areas, that would be a way for them to reap some economic benefits” from their uranium.

approach, after both countries said they would take a lead global role in SMR and advanced modular reactor (AMR) technology with the signing of a Collaboration on Advanced Nuclear Technologies Action Plan in March 2020. “Political support is vital to advance these opportunities,” said Gogan, “so we welcome the recent commitments from PM Boris Johnson, as well as progress in the United States, Canada and many other countries that recognize the important contribution that nuclear technologies could make towards meeting our climate and prosperity goals.”

— **Darrell Proctor** is associate editor for **POWER** (@POWERmagazine).

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