Next-generation nuclear power in the UK: A challenge but not an impossibility

A spate of devastating floods across England last winter stoked fears about climate change in a way that no scientific report could have. The unusual weather, which left thousands of homes without electricity and sank acres of farmland, was for many a visible sign of what the future could look like if the country's reliance on fossil fuels continues. Currently, 35% of electricity in the United Kingdom (UK) comes from coal and 28.5% from gas, with nuclear power consigned to an ever-decreasing share of the pie, at under a fifth.

A briefing document recently released by the UK's Parliamentary Office of Science and Technology (POST), which provides independent policy analysis, states that nuclear power could help the country achieve its policy of cutting greenhouse gases by 80% by 2050. At the same time, it notes, almost all of the country's nuclear power stations are due to close by 2023.

The gap between this reality and the government's ambition—to have a fleet of new-generation nuclear reactors up and running by 2050, as the document explains—is filled with challenges.

One of the biggest barriers is money, according to Paul Dorfman, a senior researcher at the Energy Institute at University College London. Companies have become reluctant to invest in UK nuclear projects. "It's not only construction cost, it's also waste cost and accident liability," he said. As an incentive, the government plans to provide multi-billion-pound subsidies, although these are subject to an investigation by the European Commission, since they may contravene the European Union's competition rules.

Sizewell B nuclear power station, the UK's newest reactor in Suffolk, England, was completed in 1995. It is operated by the French-owned firm, EDF Energy. Courtesy of EDF Energy.

Robin Grimes, a nuclear energy specialist at Imperial College London, agrees that "the issues of financing the new build program still remain a challenge." But he is cautiously optimistic. He believes that as soon as one company begins construction on a new reactor—likely to be at Hinkley, in the southwest of England—others will soon follow.

"We are much further than we were," said Grimes. "We just have the last hurdle." This final barrier, of getting the green light to finance the first new power station, is nevertheless a formidable one.

Although successive governments have supported nuclear power, it has been almost two decades since the last nuclear reactor was connected to the grid in the UK. Since then, advanced third-generation reactors have been developed worldwide, with both active and passive safety systems. Three of these are under review for the UK, all uranium-fueled advanced boiling water reactors or pressurized water reactors, with lifespans each of at least 60 years. The designs hail from French, American, and Japanese firms.

The UK also boasts an enviable health and safety record when it comes to big structural projects. Such attention to detail has other benefits. "If you get it right the first time, it's cheaper," said Grimes.

One potential stumbling block, however, is a skills shortage in the nuclear industry. By 2025, more than half of the current nuclear industry workers in the country will have retired. There have been many measures to meet this shortfall, including the formation of the Nuclear Energy Skills Alliance in 2012. "The universities have stepped up to the mark," said Grimes, "The UK nuclear academic community is thriving."

Jean Llewellyn, Chief Executive of the National Skills Academy for Nuclear, founded in 2008 to represent employers, said that although graduates are keen to enter the industry, a skills shortage exists in the 30- to 40-year-old-age range, mainly because of industry stagnation for the past two decades. She said that workforce capacity issues may emerge if too many reactors are constructed at the same time.

https://doi.org/10.1557/mrs.2014.149 Published online by Cambridge University Press

Another problem, as yet unresolved, is waste. Because of the high cost of reprocessing spent fuel, the government has said that new reactors should be built on the assumption that fuel will be disposed, and that funds for this must be set aside by the operators.

The UK is not alone in pursuing next-generation nuclear power stations. India, Vietnam, and to a smaller extent Czechoslovakia, Poland, and France are all planning new reactors, according to Grimes. However, "China dwarfs everybody," he said. According to the World Nuclear Association's latest figures, 28 reactors are already under construction in China, adding to the 20 already in operation. India is also pouring resources into new thorium-powered reactors—a technology that is gaining worldwide interest.

Across much of Europe, meanwhile, popularity of nuclear has waned. Germany, which once drew a quarter of its electricity from nuclear power, plans to phase it out altogether. Switzerland, Denmark, and Belgium similarly show no signs of building any new reactors.

In the UK, "public opinion is vaguely pro-nuclear. The perception is that nuclear is needed to help with climate change, and to stop the lights going out," said Dorfman, who believes nuclear power is not the solution to the UK's energy problems. "The reality is that they won't really help with either," he said. The time scale for completing the next generation of reactors is so long-term, he argues, that it won't resolve the problem of high electricity prices now, nor the immediate threat of climate change.

Even so, as this latest briefing note shows, the UK government seems committed to pressing ahead with its new nuclear build program, and is demolishing the barriers in its way.

Angela Saini

DOE releases report on hydropower

http://nhaap.ornl.gov/nsd

The US Department of Energy and its Oak Ridge National Laboratory released a renewable energy resource assessment in late April detailing the potential to develop new electric power generation in waterways across the United States. The report estimates over 65 GW of potential new hydropower development across more than 3 million US rivers and streams. According to the report, these findings demonstrate one of the ways the United States can further diversify its energy portfolio with sustainable and clean domestic power generation.

Hydropower makes up 7% of total US electricity generation and continues to be the United States' largest source of renewable electricity, avoiding over 200 million metric tons of carbon emissions each year. Hydropower also provides reliable baseload power day and night—providing greater flexibility and diversity to the electric grid, and allowing utilities to integrate other renewable sources such as wind and solar power.

The report, titled "New Stream-reach Development Assessment," capitalizes on recent advancements in geospatial data sets and represents the most detailed evaluation of US hydropower potential at undeveloped streams and rivers to date. The greatest hydropower potential was found in western US states, including Alaska, California, Colorado, Idaho, Montana, Oregon, and Washington. Meanwhile, Kansas, Missouri, Pennsylvania, and Wyoming led the rest of the country in new stream-reach hydropower potential.

The hydropower resource assessment also analyzed technical, socioeconomic, and environmental characteristics that will help energy developers, policymakers, and local communities identify the most promising locations for sustainable hydropower facilities. The assessment includes stream- and river-specific information on local wildlife habitats, protected lands, water use and quality, and fishing access areas.

The current report builds on a 2012 Department of Energy assessment that found over 12 GW of hydropower potential at the country's existing 80,000 non-powered dams. The results of the resource assessment released this year show that there are still many opportunities to develop new hydropower projects around the country, most of which would likely be smaller, run-of-river facilities that could utilize new low-impact designs and technologies. □

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