Nuclear power

All at sea

Researchers find advantages in floating nuclear power stations

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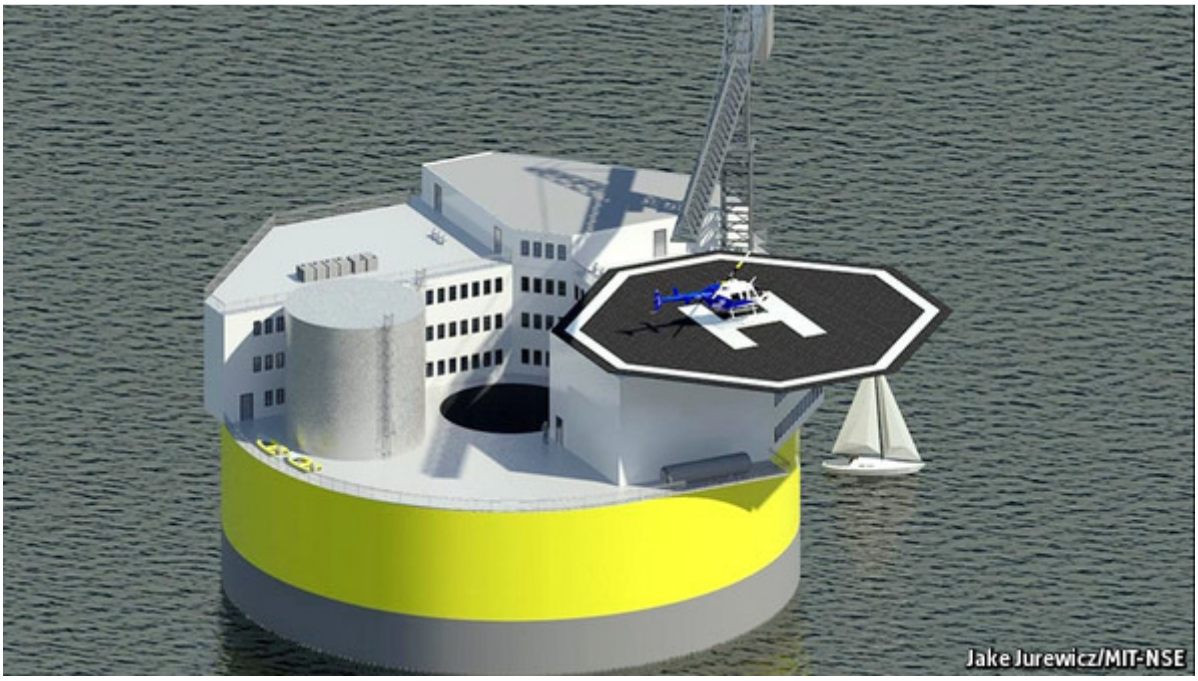

THERE are many things people do not want to be built in their backyard, and nuclear power stations are high on the list. But what if floating reactors could be moored offshore, out of sight? There is plenty of water to keep them cool and the electricity they produce can easily be carried onshore by undersea cables. Moreover, once the nuclear plant has reached the end of its life it can be towed away to be decommissioned. Unusual as it might seem, such an idea is gaining supporters in America and Russia.

The potential benefits of building nuclear power stations on floating platforms, much like those used in the offshore oil-and-gas industry, were recently presented to a symposium hosted by the American Society of Mechanical Engineers by Jacopo Buongiorno, Michael Golay, Neil Todreas and their colleagues at the Massachusetts Institute of Technology, along with others from the University of Wisconsin and Chicago Bridge & Iron, a company involved in both the nuclear and offshore industries.

Floating nuclear power stations (like the one in the illustration above) would have both economic and safety benefits, according to the researchers. For one thing, they could take advantage of two mature and well-understood technologies: light-water nuclear reactors and the construction of offshore platforms, says Dr Buongiorno. The structures would be built in shipyards using tried-and-tested techniques and then towed several miles out to sea and moored to the sea floor.

Keeping cool

Offshore reactors would help overcome the increasing difficulty of finding sites for new nuclear power stations. They need lots of water, so ideally should be sited beside an ocean, lake or river. Unfortunately, those are just the places where people want to live, so any such plans are likely to be fiercely opposed by locals.

Another benefit of being offshore is that the reactor could use the sea as an “infinite heat sink”, says Dr Buongiorno. The core of the reactor, lying below the surface, could be cooled passively without relying on pumps driven by electricity, which could fail. In the

nuclear disaster in Japan in 2011 a powerful earthquake off the coast created a tsunami that inundated the Fukushima Dai-ichi nuclear power plant, wrecking the backup power generators used to keep the cooling pumps going. This set off a meltdown in three of the plant's reactors.

A floating nuclear power station would be protected against earthquakes and tsunamis. The expanse of the ocean would shield the structure from seismic waves in the seabed, says Dr Buongiorno, and, provided the power station was moored in about 100 metres of water, the swell from a tsunami should not be large enough to cause any serious damage.

At the end of its service life, a floating nuclear power station could be towed to a specially equipped yard where it could be more easily dismantled and decommissioned. This is what happens to nuclear-powered ships.

Rosatom, a Russian state-controlled energy company, is already building a floating nuclear power station. This is the *Akademik Lomonosov*, a large barge carrying a pair of nuclear reactors capable of together generating up to 70 megawatts (MW)—enough to power a small town. The vessel is due to be completed in 2016 and is said to be the first of many. Some people believe the project's primary mission is to provide power for the expansion of Russia's oil-and-gas industry in remote areas, including the Arctic.

The American researchers think there is no particular limit to the size of a floating nuclear power station and that even a 1,000MW one—the size of some of today's largest terrestrial nuclear plants—could be built. They believe the floating versions could be designed to meet all regulatory and security requirements, which would include protecting the structure from underwater attack, says Dr Todreas.

The idea is not new. In the late 1960s *Sturgis*, a converted Liberty ship containing a 10MW nuclear reactor, was used to provide electricity to the Panama Canal Zone, which faced a power shortage. In the 1970s there was a plan to build 1,200MW nuclear power stations off America's east coast. These would float on giant concrete barges surrounded by a breakwater. The scheme got as far as constructing a huge manufacturing yard near Jacksonville, Florida. But the idea faced opposition and was scrapped, in part because of technical and regulatory uncertainties. A newer generation of floating nuclear reactors would be safer and cheaper, but they are still unlikely to set sail without a fight.

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