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# Thinking Thematically

## Fukushima sushi – and the future of nuclear energy?

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**Overview**

- Japan's decision to dump wastewater from Fukushima served as a reminder of how complicated the politics of nuclear have become
- Still, after a decade of "running in place", nuclear could be seeing changes
- While carbon-free baseload energy is clearly needed to combat climate change, new technologies could also play a role

Smiling for the camera in front of a table full of food this August, Japanese Prime Minister, Fumio Kishida, dug into a plate of sashimi. Sampling the delectable slices of flounder, octopus, and sea bass, he described the fish as "safe and delicious." While most sushi fans at least *hope* their fish is safe, this was not just any catch. Harvested from the waters of Fukushima, this feast was Kishida's stamp of approval on Japan's decision to begin releasing wastewater from the 2011 nuclear disaster into the ocean[1].

After the tragic earthquake and tsunami, many remember the tense emergency that followed at the Fukushima Daiichi nuclear plant. As the disaster triggered meltdowns in multiple reactors, valiant workers braved high levels of radiation to control the cores. However, doing so also contaminated millions of gallons of water – with ongoing cooling required even once the reactors were under control. Stored on site, Fukushima Daiichi has gradually run out of storage space with upwards of 350 million gallons of contaminated water stored in more than a thousand tanks[2].

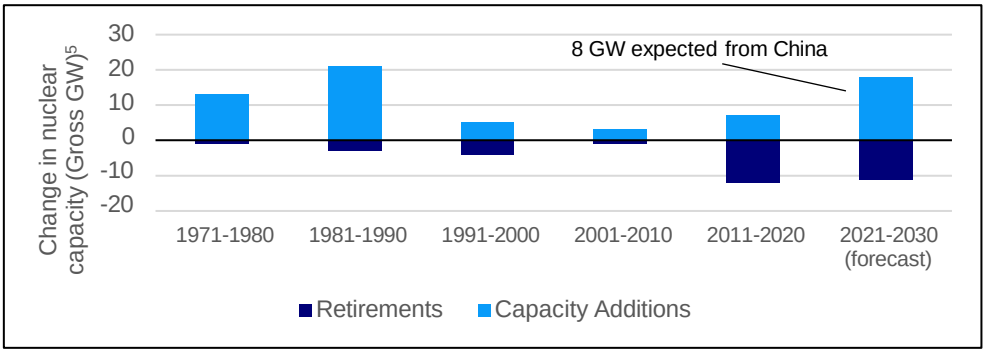
As they begin to clear the facility – a process that will take years – there is the obvious concern of radioactive waste going into the ocean, and the process to prevent issues is laborious. Contaminated with cesium, strontium, and tritium, the water must first be filtered. However, filtering can't remove tritium since it's an isotope of hydrogen (which is part of water, of course). The water is thus diluted with millions of gallons more of clean water and pumped through long underground pipes, though it still ultimately ends up in the ocean[2].

Experts are divided on the risks. With dilution, the radioactivity *should* be manageable for the ecosystem. Still, other scientists are concerned about transparency, and think any contamination of the ocean should be a last resort. However the science breaks down, though, the geopolitical ramifications are clear. China has moved to bar seafood imports from Japan, there have been protests in South Korea, and tensions are higher than ever[1]. Across the globe, Fukushima dramatically changed the politics of nuclear energy even as energy access and climate change loom large. So today, we talk about the state of nuclear and what the future might look like for the technology.

1. Japan Times, August 2023
2. NPR, August 2023
3. International Atomic Energy Agency, March 2021
4. Bloomberg New Energy Finance (BNEF), August 2023
5. International Energy Agency, September 2023

### What's changed since Fukushima?

In the wake of the disaster in 2011, many countries changed their stance on nuclear. Germany decided to phase out the technology, while Spain and Switzerland decided to not build new reactors[3]. More recently, Germany's PM, Olaf Scholz, described nuclear as a "dead horse," and Europe's largest nuclear reactor remains at risk in Ukraine due to the Russian invasion[4]. This has led to Bloomberg to describe nuclear as "running in place" over the past decade. As seen in the chart below, over the past thirteen years, the world has roughly balanced new reactors with permanent closures in the existing fleet, amounting to around 76 gigawatts (GW) of new capacity and 60 GW of closures[4]. However, this could now be changing as some closures are being put off (especially due to the energy crisis in Europe), and China has announced new builds[5]. The real question is if new technologies and the need for carbon-free baseload power will offset these hard political calculations.




### Why nuclear is still in play

As noted above, one of the most pressing concerns for operating a power grid is baseload power. While that has traditionally been provided by coal and natural gas (and nuclear, of course, depending on your locale), climate change demands a different fuel landscape. While we're rapidly building more utility-scale solar and wind, matching these more intermittent and distributed resources will require either battery storage or other alternatives for baseload power that don't emit carbon. Battery storage has grown by leaps and bounds, seeing a 68% increase in capacity in 2022, though we continue to need to make inroads on cost and technology[6]. Meanwhile, the invasion of Ukraine – and subsequent sanctions on Russia and tight supply – have shown the need to keep existing baseload power online, including reactors whose shutdowns have been postponed.

### New technologies

While the world remains enthralled by the prospects (and breakthroughs) surrounding fusion and the potential for waste-free nuclear energy, those remain a long way off, which requires innovation surrounding the fission technology we already have. One of the more promising technologies seems to be small modular reactors (SMRs), or nuclear reactors that have a smaller footprint than the sprawling facilities many are familiar with. Ranging in size from tens to hundreds of megawatts, SMRs are an attempt to build nuclear reactors on a much smaller scale – with hopes for better control and security due to their relative size[7]. Building smaller reactors could provide greater siting flexibility (including some proposals to put them in abandoned mines), lower-waste cooling options, and "security by design" including pre-fueling and sealing of reactors to reduce the risk of terrorism, theft, and leaks[7].

While SMRs certainly *seem* promising – including attracting the attention of angel investors like Bill Gates – there are also more regulatory and political issues to work out. Here in Illinois, for example, the governor, JB Pritzker, recently vetoed a law that would open the door to more nuclear builds and SMR technology. Opposed in part by environmental activists, there are very real concerns that need to be addressed, including disclosure (one vivid example brought up by opponents included whether you could build an SMR in a warehouse in a school zone without telling anyone)[8].

### What happens next?

The world desperately needs new sources of carbon-free energy. However, as we've shown here, nuclear remains a controversial option. The heated political environment and the legacy of Fukushima show just how complicated the path forward is. Still, in spite of this, we continue to see new builds announced and new technologies that could help pave the way. We're certainly keeping our eye on nuclear, even if that means sampling a bit of atomic ahi tuna…

6. BNEF, March 2023
7. Department of Energy, September 2023
8. Chicago Sun-Times, August 2023

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