FACT SHEET

Going Nuclear in the Neighborhood: The Dangers of Small Nuclear Reactors

The need to transition from fossil fuels has sparked interest in emerging technologies, including small modular reactors (SMRs). SMRs are championed as sustainable, flexible nuclear power. However, under that veil of innovation lie significant concerns about safety, economic viability, and environmental injustice. Nuclear at any scale is not the solution to the climate crisis. Rather than chasing unproven and dangerous technologies, governments must invest in affordable, ready-to-deploy renewables like wind and solar.

What Are Small Modular Reactors (SMRs)?

Small modular reactors are smaller in size and capacity than conventional nuclear power plants. They are designed as factory-built units to be transported and installed on-site.[1] SMRs can be cooled with water or other substances (including liquid metal and gas) and typically produce up to 300 megawatts of electrical power (MWe) per unit — about 30 percent of the generation of traditional nuclear plants in the U.S.[2]

According to the International Atomic Energy Agency (IAEA), current SMR project designs range from microreactors (10 or fewer MWe) to a 470 MWe reactor.[3] Small is also relative: some designs include multiple large buildings and would cover dozens of acres of land.[4] As of October 2024, the IAEA identified nearly 100 SMR designs, noting that many are "proofs of concept" that may never be completed. Only a handful of SMR projects catalogued by the IAEA are under construction, and just three are operational (in Russia, Japan, and China).[5]

Smaller Size, Same Large Problems

Proponents claim that compared to conventional nuclear reactors, SMRs are safer, cost-effective, require less initial capital investment, and have smaller footprints.[6] However, with no working example of SMRs currently in the U.S. — and very few global examples[7] — these claims are speculative at best. Moreover, what we do know about SMRs suggests otherwise.

SMRs are not necessarily safer

Nuclear safety is incredibly complex and has evolved beyond technical factors (such as design defects) to include emerging social risks like cyber security vulnerability and terrorist threats. Adding SMRs into the mix raises additional safety challenges. First, it takes multiple SMRs to meet the power output of a single conventional reactor, bringing risks of nuclear incidents to more communities — especially given plans to build SMRs near population centers.[8] Additionally, many SMR designs deviate from conventional reactors in terms of fuel and coolants, necessitating new expertise by agencies reviewing their safety.[9]

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Generally, SMR safety can be evaluated by examining whether the technology reduces both the frequency of severe incidents from nuclear reactors as well as their radiological impacts on nearby communities.[10] SMRs' smaller size may lend itself to more passive safety systems, such as utilizing surface area to transfer heat. This, however, may cut into the supposed cost savings attributed to small reactors.[11]

To the second point, nuclear reactors — like other hazardous facilities — calculate emergency planning zones (EPZs), the area surrounding the plant that could be impacted by major incidents. An SMR could have a smaller EPZ compared to a conventional reactor, but this is not necessarily proportional. According to one model, reducing the power of a 1,000 MW reactor by 95 percent would reduce the EPZ by 92 percent.[12] Doing so would also necessitate building 20 SMRs, each with its own EPZ, to meet the power output of a 1,000 MW reactor.

This is assuming that SMRs follow through with creating EPZs. In 2023, the U.S. Nuclear Regulatory Commission (NRC) finalized amendments to its emergency preparedness rules that carve out alternative pathways for SMRs. Broadly, SMR developers can approach safety through a "performance-based" framework, meaning that they focus on the end goal (nuclear safety) rather than proscribing steps to achieve that goal. Notably, some SMRs may be exempt from offsite emergency planning under the assumption that they do not pose a risk outside of the site boundary — a decision that has been slammed by advocacy groups such as the Union of Concerned Scientists.[13]

This performance-based approach may have implications for other aspects of SMR safety, such as physical or cyber-attacks. SMRs may be built to power industrial or military facilities, meaning that incidents or attacks at adjacent facilities could compromise SMR safety.[14] However, hiring security personnel can significantly raise operation costs, threatening the economic viability of SMRs. This may push SMR developers toward cutting back on personnel in favor of more structural and automated safety features such as underground or remotely operated facilities and weapons.[15]

Even if SMRs could theoretically have reduced incidents compared to conventional reactors (an unproven scenario), it is still a risk that many communities may oppose. Past nuclear meltdowns such as those occurring in Fukushima (Japan) and Chernobyl (former USSR, now Ukraine) caused health impacts ranging from acute radiation syndrome to increased incidents of cancer in children — along with adverse mental health effects from the disaster and related displacement.[16]

SMRs exacerbate the nuclear waste storage crisis

Disposal and storage of radioactive waste already raises a major red flag for conventional reactors. This includes waste produced through the mining and enriching of uranium as well as spent nuclear fuel, which is highly radioactive.[17] The U.S. — like most countries with nuclear reactors — lacks the deep geological storage facilities necessary for long-term storage of spent nuclear fuel. This is due in part to opposition from fenceline communities and state governments that, understandably, do not want to be burdened with the nuclear industry's waste.

Instead, U.S. spent nuclear fuel is typically stored at reactor sites, presumably until geological facilities are built — a prospect that increasingly appears out of reach.[18] This on-site storage can lead to the release of radioactive materials. A 2011 *Associated Press* investigation that reviewed NRC records found that radioactive materials have leaked from at least 48 out of 65 reactor sites, with some materials even contaminating drinking water wells.[19] Spent nuclear fuel can also ignite in an incident at the nuclear reactor, magnifying the release of radioactive plumes.[20]

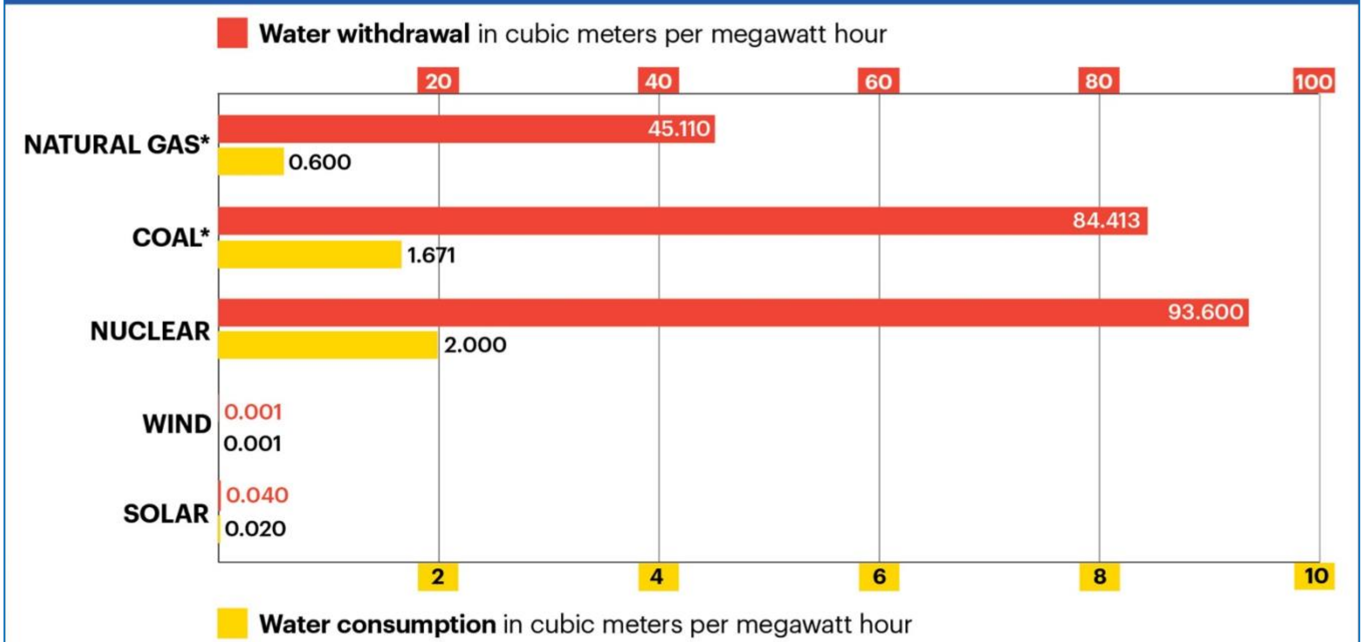
SMRs do not lower this flag. SMR deployment would create more nuclear waste with an already troubling legacy, and potentially add new waste disposal complexities with their use of novel fuels.[21] One recent study suggests that SMRs would significantly increase the volume of spent nuclear fuel compared to conventional pressurized water reactors.[22]

Additionally, water-cooled SMRs are less efficient than their larger counterparts, meaning that they use more uranium to produce the same amount of energy.[23] This results in more uranium to be mined, refined, and transported (each of which carries its own risk; see below) — before becoming waste that needs to be safely stored indefinitely. A 2023 National Academies of Science report on advanced nuclear reactors emphasizes these risks, stating: "*The 40-year history of delay, rising costs, and finally failure to deal with highly radioactive waste is a legacy that this generation should not pass on to future generations*" (emphasis in original).[24]

SMRs do not eliminate other impacts from nuclear energy

Like conventional reactors, SMRs may require significant water withdrawals over their lifetimes. A Food & Water Watch analysis found that electricity produced from nuclear energy requires 93.6 cubic meters of water per megawatt hour produced — twice as much as electricity produced by natural gas, and thousands of times as much as electricity produced by wind or solar (see Fig. 1).[25]

FIG. 1: Lifecycle Water Consumption and Withdrawal Intensities by Energy Technology



*Average of once-through and recirculation cooling systems

DATA SOURCE: Kondash, Andrew J. et al. "Quantification of the water-use reduction associated with the transition from coal to natural gas in the US electricity sector." *Environmental Research Letters*. Vol. 14. December 4, 2019 at 8.

Nuclear energy is also fully dependent on uranium, a heavy metal with a legacy of environmental contamination. Studies have linked uranium mining to lung cancer in mine workers, and mining can contaminate nearby water sources with the radioactive metal. Uranium can also bind to agricultural soils and be taken up into crops, creating additional exposure routes that remain poorly studied.[26] A 2025 analysis estimated that, at current consumption levels, the world has just over 150 years' worth of uranium remaining for nuclear fuel[27] — which could be more quickly depleted if SMRs were widely deployed.

SMRs are not necessarily cheaper than conventional reactors

Generally, smaller modular reactors are cheaper to build than larger reactors, but they are more expensive per MW of electricity produced, thanks to economies of scale. That is, reducing a plant's energy capacity reduces its construction cost, but by a smaller margin. Therefore, the "modular" aspect of SMRs — mass production of modular components that are transported and assembled on-site — is essential to making them economically viable.[28]

However, even with SMRs, there is always some construction to be done on-site. Furthermore, many large conventional reactors already implement modular aspects, so whether SMRs can in fact reduce construction costs and overcome the issues around economies of scale remains unproven.[29] Finally, modularity is only achievable and cost-saving when a design reaches mass production scales — meaning that just a handful of current designs could realistically be widely marketed across the globe.[30]

Nothing demonstrates these challenges better than the collapse of NuScale's SMR project in the U.S. In 2020, the U.S. Department of Energy (DOE) approved a cost-share award worth up to $1.4 billion for the Utah Associated Municipal Power Systems (UAMPS) to build a 12-module NuScale plant at the Idaho National Laboratory.[31] The NRC officially certified NuScale's design in January 2023, making it the first SMR design certified in the U.S. By this time, the NuScale project aimed to roll out just six modules.[32] And by October 2023, projected costs for produced electricity surged 53 percent compared to initial estimates, which already surpassed the average costs of utility-based solar and wind energy in the U.S. This was despite generous government funding and tax breaks that likely prevented projected energy costs from rising even higher.[33]

UAMPS ended the project in November 2023, since it could not attract enough subscriptions, as the project's electricity prices continued to rise.[34] By this time, the project had reportedly received $232 million in DOE funding.[35] This outcome mirrors historical trends in the nuclear industry. In a study that examined cost and time overruns of 401 electrical projects spanning five energy sources, nuclear had the highest rate of projects with cost overruns (92 percent, or 175 out of 180 projects considered). It also had the highest cost escalation at 117%, compared to just 7.7 percent for wind projects and 1.3 percent for solar projects.[36]

Scaling Up SMRs Puts More Communities at Risk

If realized, the modular design of SMRs means that they could be readily replicated and have flexible placement[37] — thereby bringing their safety risks to more communities. SMRs are one proposed solution to help meet rising demands for energy from tech companies to power artificial intelligence (AI) and data storage.[38] Concerningly, data center growth is expected to occur in several heavily populated communities such as Las Vegas, Nevada and Dallas, Texas.[39]

Historically, undesirable facilities like nuclear reactors are more likely to be built in marginalized communities that lack political power. [40] A 2015 study found that communities within the injection EPZ (50-mile radius) of a nuclear power plant had higher percentages of people of color compared to those living outside of them. (In total, nearly one-third of people in the U.S. were living within these EPZs.[41]) Time will tell whether SMR placement would follow similar patterns.

Supporters suggest that SMRs could be built on the site of retired coal plants[42] or in remote rural communities and at existing mining operations,[43] exacerbating environmental justice disparities by placing already marginalized communities at risk from nuclear incidents. Despite its novelty as a technology, SMR still relies on uranium, which has a dark legacy of harming disempowered communities that work in and live near uranium mining operations.[44]

Big Tech and the U.S. Government's Push for SMR Development

The Biden administration called for a tripling of U.S. nuclear capacity to meet growing energy demand, driven in part by Big Tech's AI and cloud computing technologies.[45] The administration approved a loan of up to $1.5 billion dollars to restart Holtec's Palisades reactor in Michigan and to expand it with two SMRs. The plant also received $300 million in state grants.[46]

Additionally, Microsoft signed a 20-year deal with Constellation Energy to revive a shuttered unit at its Three Mile Island plant in Pennsylvania. The unit shut down in 2019 when it could no longer compete on prices with natural gas and renewables, but it now is being viewed as a reliable source of energy needed to power Microsoft's data centers. The site will be rebranded as the Crane Clean Energy Center.[47] Both Amazon and Google have also announced agreements with SMR developers to fuel their growing energy needs.[48]

Relying on nuclear energy, including SMR, is one tactic for Big Tech companies to avoid reneging on their net zero carbon goals as they simultaneously scale up power-hungry AI.[49] In March 2024, *Utility Dive* estimated that the U.S. had nearly 4 gigawatts (GW) of publicly announced SMR projects, as well as nearly 3 GW of projects in early development[50] — energy that could be generated[51] more safely and affordably by 53 million bifacial solar panels or more than 5,700 wind turbines.[52]

Nuclear in New York Neighborhoods Is Not the Solution

New York State is actively seeking to develop advanced nuclear energy. In January 2025, the New York State Energy Research and Development Authority (NYSERDA) released an informative brief, or "Blueprint," on advanced nuclear technologies. It identifies nuclear as having the potential to help New York reach its goals of a zero-emission electrical grid and carbon-neutral economy, while cataloging several issues related to nuclear development — from cost to environmental justice issues. NYSERDA intends to address these issues and involve public input, culminating in a Master Plan for Responsible Advanced Nuclear Development expected by the end of 2026.[53]

NYSERDA signaled its desire to develop partnerships and projects surrounding advanced nuclear through a request for information in November 2024.[54] For example, in January 2025, NYSERDA announced that it would be joining Constellation's grant proposal to the DOE to fund a site permit for an advanced nuclear reactor at Constellation's Nine Mile Point nuclear facility.[55]

New York Governor Kathy Hochul is driving interest in advanced nuclear technology and small reactors, purportedly to meet the state's 2030 climate goals, which are getting further out of reach thanks in part to growing demand from power-hungry tech industries.[56] At the same time, Governor Hochul's administration is courting energy-intensive manufacturing industries, seeking to make New York a leader in semiconductor manufacturing. The governor helped bring in Micron, a semiconductor manufacturer that secured an up to

$6.1 billion investment from the Biden administration to build a manufacturing facility in Onondaga County.[57] Such energy-intensive projects will only contribute to New York's increase in electricity demand, which is expected to surge 50 to 90 percent by 2042.[58]

Nuclear power is neither a climate solution nor clean energy, as shown by its costly and damaging history.[59] In 1965, the Long Island Lighting Company estimated that construction costs for its proposed Shoreham nuclear plant were $65 million to $75 million; by 1983, the project reported costing $5.6 billion (more than $10 billion in 2025 dollars), one-third of which was the cost of carrying debt. Even so, the project was decommissioned without ever producing power, leaving ratepayers on the hook for the $4.2 billion remaining debt.[60]

Similarly, in 2016, former New York Governor Andrew Cuomo approved an $8 billion bailout for three aging nuclear power plants (including Nine Mile Point), forcing New Yorkers to cover the cost through utility bills across 12 years — even residents who do not receive any of this energy.[61]

Conclusion

SMRs are just smaller nuclear plants that could come with the same impacts as large nuclear power plants, only multiplied and spread across our neighborhoods. Government officials are paving the way for Big Tech companies to move into our communities and use our taxpayer dollars and utility bills to pay for the SMRs that would power their big data technology. Expanding nuclear energy diverts from efforts to build truly renewable sources like wind and solar, which have become increasingly cost-effective and reliable.

Endnotes

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