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4 March 2025

TESTIMONY REGARDING NUCLEAR POWER APROPOS BILL SB 216

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I am a Professor at the School of Public Policy and Global Affairs, University of British Columbia in Vancouver, Canada. I carry out research on the technical and policy challenges of nuclear energy and small modular nuclear reactors (SMRs). I have published extensively on SMRs, including peer-reviewed academic papers, reports, and articles in popular media. Many of these are available on my profile page: https://sppga.ubc.ca/profile/m-v-ramana/

I am taking the liberty of providing this testimony explaining why I think Oregon should not repeal the requirement that there be a licensed repository for the disposal of high-level radioactive waste before a site certificate for a nuclear-fueled thermal power plant may be issued.

As I understand it, the purpose of the moratorium was to ensure that Oregon would not be saddled with new nuclear plants until there is a permanent disposal facility for radioactive spent fuel. Despite decades of effort and billions spent on trying to establish such a facility in the United States for the permanent disposal of radioactive waste, there is none in operation; nor is there any prospect of one for decades at the very least, if ever.

Small modular reactors are not going to help with this challenge. The physical process underlying the operation of an SMR, i.e., nuclear fission, will always result in radioactive substances being produced. Thus, radioactive waste generation is inextricably linked to the production of nuclear energy, no matter what kind of reactor is used. Some SMR designs, molten salt reactors or sodium cooled fast neutron reactors, for example, would produce waste streams that require extensive processing and would face disposal related challenges.[i]

Neither will SMRs help solve the problems of nuclear energy, which, as a source of electricity, is fading in importance globally. Nuclear power's share of global electricity generation peaked in 1996 at 17.5 percent. Since then, this fraction has steadily declined reaching barely over 9 percent in 2023 (the data for 2024 has not yet been published).[ii] The downward trend is expected to continue. Below, I explain why SMRs will not alter this trend, and why hope in these technologies is misplaced.

1. The most important reason for the decline in the share of nuclear energy in global electricity production is economics. Building new nuclear plants is extremely expensive. The Vogtle nuclear plant in the state of Georgia involving two AP1000 reactors designed to generate around 1,100 megawatts of electricity each was expected to cost $14 billion, and "in-service dates of 2016 and 2017" for the two units.[iii] The project is yet to feed electricity into the grid and is currently estimated to cost over $36 billion. In addition, just operating one has ceased to make economic sense in many electricity markets.[iv]

2. Alternatives to nuclear energy, in particular renewable low carbon sources of electricity like wind and solar energy, have become far cheaper. In the most recent edition of its cost report, Lazard, the Wall Street firm, estimated that the levelized cost of electricity from new nuclear plants will be between $142 and $222 per megawatt hour; in contrast, newly constructed utility-scale solar and wind plants produce electricity at somewhere between $29 and $92 (solar) or $27 and $73 (wind) per megawatt hour according to Lazard.[v] Adding battery storage capable of extending service for up to 4 hours increases these estimates to $60 to $210 per megawatt hour (solar PV + storage) and $45 to $133 per megawatt hour (wind + storage)—still significantly cheaper than electricity from new nuclear plants.

3. The gap between nuclear power and renewables is large, and is growing larger. While nuclear costs have increased with time, the levelized cost of electricity for solar and wind have declined rapidly, and this trend is expected to continue over the coming decades.

4. Small modular nuclear reactors will not help this picture, because these lose out on economies of scale, and therefore start off with an economic disadvantage. Even if their absolute cost is lower than that of a large nuclear reactor, they are more expensive for each unit of generation capacity that they provide (i.e., on a per kW basis).[vi]

5. Cost estimates of SMRs under development offer evidence of higher per kW costs. The now-cancelled UAMPS project involving six NuScale units that was proposed for Idaho ended up costing an estimated $9.3 billion for just 462 megawatts of power capacity.[vii] In comparison to the Vogtle project in Georgia, the estimate for the UAMPS project is greater than the final cost of Vogtle on a per megawatt basis, and around 250% more than the initial per megawatt cost of the Vogtle project, which is a more appropriate comparison because of the likely cost increases that would have been incurred while building NuScale reactors.

6. Historically, too, small reactors were more expensive than large ones. In the 1950s, the U.S. Atomic Energy Commission funded the construction of several small power reactors that were declared to be "suitable both for use in rural areas and for foreign export". But all these reactors ended up shutting down early because they were not economically competitive.[viii] Likewise, India has constructed 16 small pressurized heavy water reactors with a capacity of 220 MWe, which fit the definition of small reactors, but eventually its nuclear establishment decided that the only way to reduce costs was to increase the output and is now constructing 700 MWe PHWRs.[ix]

7. SMR proponents hope that the loss of economies of scale can be compensated through mass manufacture and learning, but even under optimistic assumptions about the rates of learning, hundreds if not thousands of SMRs would have to be constructed before they break even in costs with large reactors, which are themselves not economical.[x]

Historically, in both the United States and France, the countries with the most nuclear plants, costs of building reactors rose as more power plants were built.[xi]

8. SMRs have also suffered construction delays. In Russia, the first SMR that has been deployed is the KLT-40S, based on the design of reactors used in the small fleet of nuclear-powered icebreakers that Russia has operated for decades. When construction started in 2007, the KLT-40S reactor was projected to start operations in October 2010. It was actually commissioned only in May 2020.[xii] Even in the case of designs being developed, there are significant delays. NuScale, the design that is furthest along the regulatory process in the United States, initially claimed that it would be generating electricity in 2015-16.[xiii] That has clearly not happened.

9. These economic challenges add to the other well-known problems associated with nuclear energy, in particular, the absence of any demonstrated solutions to managing radioactive waste in the long run and the potential for catastrophic accidents.[xiv] No reactor design, small or large, is completely immune to these problems. Efforts to ameliorate one of these problems typically makes other problems worse.[xv]

For these reasons, small modular reactors will not solve the challenges confronting nuclear power. In particular, they are not economical and thus will fail commercially. Other claims about safety and helping reduce waste generation are also often unfounded. Repealing the moratorium on nuclear power construction is unwise. It would be better for public investment to focus on proven low-carbon sources of energy such as wind and solar, and technologies that enable these to provide a much larger fraction of our energy needs.

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