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Small Modular (Nuclear) Reactors in Canada – Small Steps Towards Realization

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Matter Commented On: New Brunswick-Ontario-Saskatchewan Collaboration Memorandum on Small Modular Nuclear Reactors

Introduction

On December 1, 2019, the premiers of New Brunswick, Ontario, and Saskatchewan announced that they are formally collaborating by way of a memorandum of understanding to develop small modular nuclear reactors (SMRs) and that further provinces and territories may join the collaboration. Premier Ford has identified the opportunity as one for Canada "to be a true leader" on an issue of the future. I have followed the international development of small nuclear reactors, and their implications for domestic and international law regimes, since 2010. This post serves as an introduction to SMRs, both within and outside of Canada, and the legal and policy frameworks involved.

Put simply, SMRs are nuclear reactors that are smaller in size and output than traditional nuclear power reactors. According to Canada's *A Call to Action: A Canadian Roadmap for Small Modular Reactors* (the *Roadmap*) published in November 2018, the driver behind the promotion of SMR technology is that the reactors could be used to provide affordable energy for homes, offices, businesses, and industrial processes, especially in remote communities, like those in Canada's Far North. The Roadmap concludes that there are real opportunities for the deployment of SMRs in Canada.

As discussed below, Canada has stated its intention to be at the forefront of a new wave of atomic energy and believes that its current regulatory and governance regimes are capable of safely managing SMRs. However, SMR projects are still in their infancy in Canada, and other countries around the world, notably the United States, seem equally keen to support their development. The recent announcement by the premiers signals a significant step towards the possible development of a domestic SMR industry in Canada.

SMRs in Canada

SMR technology is not entirely new — small-scale reactors have been used in some submarines, aircraft carriers, and icebreakers for more than 60 years. Research and demonstration reactors are also smaller in scale than traditional nuclear reactors. Traditional reactors are those that produce between about 600 and 1,400 megawatts of electricity. The International Atomic Energy Agency (IAEA) considers plants producing less than 300 megawatts to be small. The modular nature of

SMRs allows for a "fleet-based" approach, where plants can add modules as necessary, creating a fleet of reactors that is adaptable and mobile (modules have the potential to be transported from site to site). SMRs are smaller and simpler, and believed to be safer, and cheaper than traditional reactors. They are also increasingly necessary — without nuclear energy, the International Energy Agency (IEA) has said that it will be next to impossible to fulfill the global commitments set out in the United Nations Paris Agreement. In fact, the IEA's World Energy Outlook 2019 noted that nuclear energy needs to "double globally within 20 years to meet [the] two-degree Celsius climate target."

In Canada, as SMR technology is being considered, it is expected that the existing statutory and regulatory regime, which currently regulates large-scale nuclear power plants, will be sufficiently adaptable to accommodate SMRs. In November 2018, the Canadian Small Modular Reactor Roadmap Steering Committee — a group chaired by Natural Resources Canada that included government, utilities, and nuclear and energy stakeholders from across the country — published the *Roadmap*. More than 130 individuals from 40 organizations participated in the document's assessment and determined that "Canada's [existing] enabling framework is sound" (*Roadmap*, page 29). The existing regulatory regime in Canada includes the *Nuclear Energy Act*, RSC 1985, c A-16, the *Nuclear Safety and Control Act*, SC 1997, c 9, the *Nuclear Liability and Compensation Act*, SC 2014, c 4, s 120), and the *Nuclear Fuel Waste Act*, SC 2002, c 23).

Moving forward, the *Roadmap* recommends the provision of federal and provincial funding for SMR projects, the adoption of risk-sharing measures for first-of-a-kind SMRs, alignment of the federal impact assessment process with SMR potential, a review of nuclear liability regulations, adaptation of nuclear security regulations, and engagement with nuclear waste management bodies for proper disposal of used fuel. The *Roadmap* also directs governments and utilities interested in SMRs to engage and consult with Indigenous peoples and to work to develop international partnerships (e.g. see pages 57–59). With regard to the new federal impact assessment regime in Canada, nuclear reactors below 200 megawatts in capacity (and thus most SMRs) are exempted from requiring a federal impact assessment, unless the reactors have a combined capacity exceeding the 200 megawatts threshold.

SMRs, like traditional nuclear reactors, are currently categorized as Class I nuclear facilities and, as such, are subject to the *Class I Nuclear Facilities Regulations*, SOR/2000-204. The Canadian Nuclear Safety Commission (CNSC) is responsible for regulating the use of nuclear energy in Canada, including approving licences for a company seeking to conduct nuclear operations. In April 2019, the Commission stated that it was ready to regulate SMR technology in Canada and would respond to SMR deployment with "a robust and flexible regulatory framework; risk-informed processes; and a knowledgeable and capable workforce with sufficient capacity and technical expertise".

Those interested in further details on the regulatory implications of SMRs in Canada may wish to consult the Canadian Nuclear Safety Commission's discussion paper DIS-16-04, *Small Modular Reactors: Regulatory Strategy Approaches and Challenges* and its accompanying public feedback report, the *What We Heard Report*.

The CNSC has received its first application for a license to prepare a site for an SMR on March 20, 2019, a proposal that would see Global First Power build an SMR for Atomic Energy of Canada Limited's Chalk River Labs. A further 12 projects are currently engaged in the Pre-licensing Vendor Design Review Process with the CNSC, an optional service that allows the Commission to provide feedback to proponents early in the design process, with an eye toward eventual project licensing.

It can be anticipated that the landscape for SMRs and their regulation in Canada will almost certainly change prior to the first reactor actually becoming operational. While Canadian Nuclear Laboratories, in partnership with Atomic Energy of Canada Limited, has stated its objective to become a "hub for small modular reactor research and technology", media outlets have noted that the first demonstration plant, the Global First Power demonstration plant at Chalk River, is not expected to be operational until 2026.

International Developments

In the United States, on July 23, 2019, the Senate Energy and Natural Resources Committee approved the *Nuclear Energy Leadership Act*, a key piece of legislation aimed at supporting the development and deployment of "advanced nuclear reactors" in the United States. Advanced nuclear reactors include SMRs and the Act seeks to establish incentives and programs aimed at developing this new wave of nuclear energy use and technology. The Act directs the Secretary of Energy to ensure that at least two advanced nuclear reactors are in operation in the United States by 2025, and between four and seven by 2035.

Elsewhere, according to the International Atomic Energy Agency, there are currently at least four SMRs in advanced stages of development and construction in Argentina, China, and Russia. In addition, in *September 2019*, the world's most advanced floating nuclear power plant, the *Akademik Lomonosov*, arrived at its site of operation in Russia's north-eastern Chukotka region. The project will supply electricity and heat and will also be deployed to generate electricity for desalination operations. In previous research, I have considered the international environmental, nuclear security, and nuclear proliferation implications of the deployment of nuclear technology, including with respect of the deployment of SMRs in the Arctic region (see, "Transportable Nuclear Power Plants – An Update on Regulatory Responses in International Nuclear Law", in Proceedings of the International Nuclear Law Association Conference 2013, Nomos Verlag, Baden Baden/Germany, 2014; see also, "Transportable Nuclear Power Plants for Natural Resources Extraction in the Arctic – International Environmental, Proliferation and Security Concerns", Oil, Gas and Energy Law Intelligence – OGEL Journal, Special Issue on the Arctic Region, Vol. 10(2), 2012).

Looking Forward

Canada has declared its intention to be at the forefront of a new age of nuclear energy, embracing the potential of SMR technology. Yet it is clear, both from the next steps required by the *Roadmap* and given the rate of SMR development in other countries, that much work remains to be done before that intention can be fully realized and commercialized. Nonetheless, the recent announcement by the premiers of New Brunswick, Ontario, and Saskatchewan of their intention

to collaborate on the development of SMRs is significant. One cannot but wonder if this collaboration may (re)start a discussion elsewhere in Canada, including in Alberta, regarding the deployment of nuclear energy, this time using SMR technology.

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