CHARGING AHEAD: CANADA MOVING AHEAD ON SMALL MODULAR REACTORS

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I. Introduction

On April 14, 2021, the Government of Alberta announced that it had officially entered into the memorandum of understanding (MOU)[1] previously signed by the Provinces of Saskatchewan, New Brunswick and Ontario regarding small modular nuclear reactors (SMRs). Concurrently, various Provincial utilities published a feasibility report (Feasibility Report) setting out a time frame for deploying SMRs and measuring their feasibility against other energy sources.[2] This article summarizes what SMRs are, how the Feasibility Report and MOU coincide with Canada's existing plans for SMRs, and what the future of SMRs is in Canada.

II. What Are SMRs?

SMRs are nuclear fission reactors. Their name comes from their small physical size and power output, portable and scalable structure, and function as a power source.[3] SMRs are generally classified as nuclear reactors creating up to 300 megawatts (MW) of electricity.[4] By comparison, Ontario's Bruce Power nuclear power plant has a capacity of about 6,400 MW.[5] SMRs are more affordable to produce through factory construction, relatively portable to ship and easier to install, whether for large or small electricity grids or off-grid locations.

Nuclear power has a long history in Canada dating back over sixty years and accounts for approximately 15% of Canada's electricity needs. The country has established expertise and infrastructure, including SMRs being sold commercially to other countries. Canada also has a strong uranium industry as the second-largest producer in the world, with most mining occurring in Northern Saskatchewan. Approximately 75% of uranium exported is for nuclear purposes.

With a variety of uses, SMRs produce more energy while using a smaller footprint without emitting greenhouse gases during generation. This is especially notable compared to the emissions from diesel fuel, which is currently a popular fuel source in many of Canada's remote communities and industrial sites. Given Canada's recent commitment to reduce its greenhouse gas emissions by 40-45% from 2005 levels by 2030, SMRs may provide one feasible solution to meeting this ambitious goal.

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[1] Collaboration Memorandum of Understanding dated December 1, 2019, between the Provinces of New Brunswick, Ontario and Saskatchewan [MOU].
[2] SaskPower, Ontario Power Generation Bruce Power and NB Power, "Feasibility of a Small Modular Reactor: Development and Deployment in Canada" (March 2021) [Feasibility Report].
[3] Canada's Small Modular Reactor SMR Action Plan [SMR Action Plan].
[4] Press Release, Government of Alberta, "Alberta signs small modular nuclear reactor MOU" (April 14, 2021); See also Canadian Nuclear Safety Commission, "Small modular reactors" (last modified November 19, 2020).
[5] Bruce Power, "The Ontario Energy Report" (2019).

II. Why Are Provinces Getting Involved with SMRs Now?

A. Alberta

Until recently, Alberta has not focused on nuclear power generation. In 2009, the Minister of Energy commissioned a Report on Nuclear Power[6] and undertook a public consultation process.[7] However, following the consultation, the Government announced that no public funding would be provided for nuclear power proposals. Nonetheless, it appears that Alberta has re-assessed the opportunities that nuclear energy may present. In fact, Alberta is now emphasizing its expertise in responsible energy development, bountiful uranium supplies, and potential utilization of SMRs in the oilsands, remote communities and industrial sites, and as a replacement for soon-to-be-decommissioned coal-fired plants.[8]

B. Saskatchewan

Saskatchewan has primarily relied on coal and natural gas for its energy needs. However, given its abundance of uranium, SMRs provide significant potential for growth, and its government is attuned to this opportunity. Saskatchewan's Growth Plan: The Next Decade of Growth 2020-2030,[9] identifies a number of goals, including the advancement of zero-emission technology and expansion of the uranium industry. By all indications, Saskatchewan is committed to developing SMR technology to boost uranium production, enhance nuclear research and expertise, and develop ancillary construction and infrastructure jobs.

C. Other Canadian Provinces

Ontario and New Brunswick rely heavily on nuclear power as the largest and majority sources of power generation, respectively. Other Canadian provinces such as British Columbia and Manitoba have traditionally relied on hydroelectric energy, largely removing the need to consider large-scale nuclear projects.

III. Canada – A Future Global Leader in SMRs?

Together with various stakeholders, Natural Resources Canada committed in 2018 to develop a Roadmap for the future of SMRs in Canada.[10] Following feedback based off of the Roadmap, a wide array of government, academia and industry parties helped develop an SMR Action Plan.[11]

The SMR Action Plan recognizes several principles in developing nuclear technology, including supporting reconciliation with Indigenous and Northern communities as essential partners, developing safer and more affordable clean energy, and building on existing energy expertise. With a goal of support for domestic and international markets within fifteen years, the

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[6] Nuclear Power Expert Panel: Report on Nuclear Power and Alberta
[7] Alberta Nuclear Consultation
[8] Premier Kenney announces an agreement in small-scale nuclear technology (August 8, 2020)
[9] Saskatchewan's Growth Plan: The Next Decade of Growth 2020-2030
[10] A Call to Action: A Canadian Roadmap for Small Modular Reactors.
[11] SMR Action Plan.

SMR Action Plan envisions integration of nuclear energy alongside Canada's existing energy sources, thereby accelerating Canada's plans for a low-carbon future.

On December 18, 2020, the Governments of Alberta and Saskatchewan (amongst other provinces) formally endorsed the SMR Action Plan's Statement of Principles. Both provinces also committed to several action items, including project funding for new technologies; mineral strategies to develop and promote mining of uranium, lithium, vanadium, and rare earth elements; and fostering holistic participation by partnering with Indigenous communities and developing diversity initiatives to support women in the industry. In addition, Saskatchewan committed to developing climate change and clean energy policies to allow for SMR deployment and to developing an SMR Unit within the Ministry of Environment to coordinate SMR policies and programs.

IV. What Does the Feasibility Report Propose?

The Feasibility Report builds on the Roadmap and SMR Action Plan. It is broken down into three streams of SMR project proposals, with the aim to deploy SMRs in Alberta and Saskatchewan as soon as 2030.

The three streams focus on different themes, being to (1) create growth opportunities for communities connected to the grid; (2) support advancement in technologies to reduce nuclear by-products; and (3) bring new energy solutions to rural communities and industrial sites.

Stream 1 concerns a grid-scale SMR of roughly 300 MW at the already-licensed Darlington, Ontario site, with the goal of generating power by 2028, plus four units in Saskatchewan, targeting an in-service date of 2032. Stream 2 comprises two 4th generation[12] SMR designs being developed in New Brunswick, with demonstration units located at the Point Lepreau facility. New Brunswick aims to have the ARC Clean Energy demonstration unit operational by 2030 and Moltex Energy's waste recycling facility and reactor operational by the early 2030s.[13] Stream 3 involves a set of micro SMRs. Ultra Safe Nuclear Corporation is designing a 5 MW gas-cooled reactor demonstration unit at Chalk River, Ontario, which aims to be operational by 2026. This unit may offer a road map for future 10 MW plants for deployment in remote locations.

V. What is the Future of SMRs?

It is clear that the MOU's signatory provinces see SMRs as an opportunity, both as a potential fuel source to meet Canada's energy needs and as an export product to meet expanding international markets.

As Canada works to strengthen its position as an energy and geopolitical leader, interested readers should watch for the MOU's next deliverable, which is a joint strategic plan developed by the Provinces. This has a targeted completion date of later this spring and promises

[12] 4th generation refers to the stage of development of SMRs, as the cutting edge design in this field, developed through the Generation IV International Forum, which includes Canada, see "Gen IV Reactor Design" (last updated September 16, 2013).
[13] Feasibility Report, at 5.

to set out the specific steps required within each Stream of the Feasibility Report to achieve project milestones. Alongside the project commitments, the Federal and Provincial Governments need to ensure that their legislative and policy measures align so that expanded deployment of SMR technology is realistic by the ambitious ten-year plan. Moreover, Canada's Federal regulator, the Canadian Nuclear Safety Commission, currently regulates SMRs by applying the same criteria as those used to regulate traditional nuclear facilities. At this time, it is unclear what adjustments, if any, may be forthcoming to allow for an efficient certification process for SMRs, while ensuring the health and safety of Canadians and the environment.

In conclusion, this is a favorable time for project proponents to get involved in the next phase of SMR development. Canada is working towards leveraging its existing strengths and resources, and is well-positioned to deploy SMRs for a safe, reliable and affordable energy future, all while contributing to a strong economy and working towards meeting its greenhouse gas emission reduction targets.