Emerging Clean Energy Choices in Canada's Net-Zero 2050 Transition: The Role of Nuclear in the Low Carbon and Clean Hydrogen Context

by

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CONTENTS

Abstract

The paper argues that nuclear energy could play a significant role in decarbonizing the production of low carbon hydrogen from natural gas feedstock with associated carbon storage, as part of a wider shift towards 'net-zero' in Canada's natural resources value chain. It examines regulatory readiness for small modular reactors in the oil, gas, and low-carbon energy sector of Canada's energy jurisdiction, and calls for the speedy design and development of a single 'go-to' regulatory framework for nuclear energy in Alberta.

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Résumé

L'article soutient que l'énergie nucléaire pourrait jouer un rôle important dans la décarbonisation de la production d'hydrogène décarboné à partir de gaz naturel avec la conservation de carbone souterrain associé, dans le cadre d'une transition plus vaste vers la neutralité carbone dans la chaîne de valeur des ressources naturelles du Canada. Il examine l'état de préparation réglementaire des petits réacteurs modulaires dans le secteur du pétrole, du gaz et de l'énergie peu carbonée de la juridiction énergétique du Canada. Cet article appelle à la conception et au développement rapides d'un cadre réglementaire unique pour l'énergie nucléaire en Alberta.

Key words: regulation and business law; nuclear energy law; coal industry.

JEL: K32, K39

I. Introduction

International and domestic "Net-Zero 2050" climate and sustainability impulses are focusing the attention of the Canadian natural resources value chain of oil, gas, and mining operations on 'decarbonization'. Increasingly stringent calls for lower carbon life-cycle intensities of natural resources production, and the incremental increase of the cost of greenhouse gas pricing, will pose serious constraints to this high-emitting sector of the Canadian economy. For example, in November 2020 the federal government introduced the *Canadian Net-Zero Emissions Accountability Act*, which formalises Canada's commitment to a net-zero greenhouse gas emissions target by 2050. Aligned with this development, Canada's strengthened Climate Plan, released in December 2020, sets out details on an ambitious increase in the cost of the federal carbon price, increasing in annual increments of $15 from 2023 onwards, up to $170 by 2030. Presently it is $65 per tonne.

In 2021, the Supreme Court of Canada ruled that the federal government's greenhouse gas pricing regime was constitutionally valid on grounds of 'national concern', with the court noting that 'the only way to address the threat of climate change is to reduce greenhouse gas emissions'.[1] Most recently, the federal government has announced a new cap on greenhouse gas emissions from the oil and gas sector, which it is in the process of implementing.

Sustainably produced hydrogen is actively being discussed as a low carbon clean energy carrier to reduce reliance on carbon intensive diesel for mining

1 Supreme Court of Canada, *Reference re Greenhouse Gas Pollution Pricing Act*, 2021 SCC 11.

operations and industrial processes (Canadian Hydrogen Strategy, 2020). There are also advanced discussions on producing hydrogen via electrolysis using clean electricity and heat generated from nuclear energy (including small modular reactors (hereinafter: SMRs). As part of a novel nuclear, carbon and hydrogen alignment advanced in this paper, SMR technology could play a significant role in decarbonizing the production of hydrogen from natural gas with associated carbon capture and storage technologies (hereinafter: CCS/CCUS), to produce low carbon hydrogen (also known as 'clean' or 'blue' hydrogen). In light of the opportunities for using nuclear energy in Canada's natural resources sector, the paper identifies the potential for a shift towards SMR deployment in Western Canada, specifically within the oil, gas, and mining sectors. Using Canada's energy jurisdiction of Alberta as a point of reference, the paper explores the role of new nuclear energy within an ongoing shift towards net-zero in the natural resources value chain. It concludes that (given the jurisdictional complexities of Canada's regulation of nuclear energy) the emerging legal and policy framework for SMR technology deployment will not only require an 'energy systems' approach, but a concerted effort at aligning regulatory matters between the federal and provincial jurisdictions. This is due to the constitutional complexities of Canada's regulation of nuclear energy (federal jurisdiction) and the provincial jurisdiction over the natural resources sector and the generation of electricity. Although a thorough exploration of these constitutional complexities is beyond the scope of this paper, they serve as important context to conclude that there is, as yet, no single 'go-to' regulatory regime to expedite the deployment of SMRs in Alberta's energy sector in order to advance the province's low-carbon energy future through the scaling-up of a clean hydrogen economy.

II. Aligning nuclear, carbon and hydrogen

The discussion of deploying nuclear energy generation in Canada's natural resources sector is not new and Canada's oil and gas province, Alberta, was in advanced stages for a Bruce Power nuclear power plant as recently as 2011. Literature has sporadically linked the potential of nuclear technologies and oil sands production in Alberta.[2] In a 2015 paper, the production of hydrogen

[2] Romney B. Duffey, S. Kuran and A. Miller, 'Application of Nuclear Energy to Oil Sands and Hydrogen Production' in IAEA, Application of Nuclear Energy to Oil Sands and Hydrogen Production (IAEA-CN-164-5S11); Hernan Carvajal-Osorio, 'Nuclear Power in Heavy Oil Extraction and Upgrading: A technical overview of the use of nuclear plants as a heat source in the oil industry' (1989) 3 IAEA Bulletin 50.

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from steam methane reforming of natural gas, based on nuclear energy, was given detailed attention, albeit in a technical context.[3]

The paper sets out to examine the deployment of SMRs in Canada's natural resources sector. To start, the Canadian Minerals and Metals Plan (2019) discusses SMRs in the context of reducing greenhouse gas emissions in mining operations, increasing energy reliability and reducing costs, in particular in remote mining locations where SMRs could reduce dependence on diesel-fuelled electricity and heat generation. Canada's Hydrogen Strategy notes the potential of SMRs in the context of distributed hydrogen production. Low carbon hydrogen that is produced using electricity and heat from SMR generation could, in turn, displace fossil fuels currently used in the exploration, mining, and refining processes of the natural resources value chain, as well as a fuel to decarbonize the transportation of natural resources.

Alberta has been producing hydrogen for purposes of upgrading bitumen from oil sands production processes since the late 1960's.[4] The predominant process of producing hydrogen, using natural gas as a feedstock and steam methane reforming technologies, results in approximately 27 Mt CO_2e/yr, or 4% of Canada's total greenhouse gas emissions.[5] Without the deployment of carbon storage technologies, the resulting CO_2, as a by-product of hydrogen production, is released into the atmosphere. This raises the critical question of how emissions from hydrogen production are managed in the context of Canada's commitment to a Net-Zero 2050 economy. As a result, carbon storage technologies are an integral part of the future of a 'clean' hydrogen economy in Canada.[6] Alberta's 2021 Hydrogen Roadmap notes that to 'realize a clean hydrogen economy, CCUS needs to be in place to facilitate cost-effective, large-scale production'.[7]

One of the key challenges to the scaling-up of blue hydrogen production, as the Alberta Hydrogen Roadmap notes, is the fact that the anticipated rates of CO_2 capture may not yet comply with emerging low carbon hydrogen thresholds, such as the one set by the European-based CertifHy guarantee of origin programme. The rate of CO_2 capture is critical to CCUS development. As Howarth and Jacobson conclude, CO_2 capture is very energy intensive and 'to capture more carbon dioxide takes more energy, and if the energy comes

[3] G.L. Khorasanov, V.V. Kolesov and Korobeynikov, 'Concerning Hydrogen Production Based on Nuclear Technologies' (2015) 1(2) Nuclear Energy and Technology 126.

[4] The Canadian Association of Petroleum Producers (CAPP), A History of Alberta's oil sands, undated.

[5] David B. Layzell, 'Towards Net-Zero Energy Systems in Canada: A Key Role for Hydrogen' (2020) 2(3) Transition Accelerator Reports 16.

[6] Rudiger Tscherning, 'Developing a Canadian Clean Hydrogen Economy: Maximising the Export Potential' (2021) 2 Oil, Gas & Energy Law (OGEL), www.ogel.org/article.asp?key=3965.

[7] Alberta Hydrogen Roadmap, November 2021, 46.

from natural gas, the emissions of both carbon dioxide and fugitive methane emissions from this increase in such proportion as to offset a significant amount of the reduction in carbon dioxide emission due to carbon capture'.[8] This raises the central question of this paper, namely what role can nuclear energy, specifically new-built SMR technology, play in providing a net-zero opportunity to the Canadian natural resources value chain as part of a nuclear, carbon and hydrogen alignment? Alberta is home to one of only two commercial blue hydrogen operations in the world. The paper anticipates an increased attention on SMR's role in Alberta's natural resources value chain based on: recent investment announcements for additional blue hydrogen projects, an ambitious hydrogen strategy centred on the aggressive expansion of CCUS infrastructure, and the announcement of funding by the Alberta government to study the role of SMRs in oil sands-focused steam production.

As noted, there is no single 'go-to' regulatory regime in Alberta dedicated to the deployment of SMRs in the energy sector. Accordingly, this paper argues that as part of a wider focus on the clean energy transition in Alberta, nuclear energy should take a central role in an 'energy systems' regulatory and policy framework, where all available or future energy sources (renewables, nuclear, and fossil fuels) are drawn upon to advance the clean energy transition.[9] By pursuing a systems approach, and advancing the future deployment of nuclear energy as part of it, it may be more feasible to design and develop a regulatory framework for nuclear energy in Alberta. Without taking a whole energy systems approach, any nuclear regulatory regime will have to navigate two key hurdles. One, as noted, the jurisdictional complexities of nuclear energy in Canada, and two, the multiple regulatory frameworks for oil and gas development, electricity generation, the capture and storage of CO_2, which may all see the deployment of new nuclear energy technologies going forward.

Indications of potential SMR deployment in Alberta are further underlined when one considers that the lifecycle emissions of blue hydrogen consist of both external and internal emissions.[10] *External emissions* relate to the production of natural gas and the transport of natural gas feedstock for the initial hydrogen production. *Internal emissions* are generated through the combustion of natural gas that is necessary to supply heat and pressure for the steam methane reforming process. Whilst CO_2 capture from the flue gases for steam/pressure generation

8 Robert W. Howarth and Mark Z. Jacobson, 'How Green Is Blue Hydrogen?' (2021) 9(10) Energy Science & Engineering 1.

9 For a helpful overview of the theory of energy systems and systems thinking in the clean energy policy context, see Fiona Robertson Munro and Paul Cairney, 'A systematic review of energy systems: The role of policymaking in sustainable transitions' (2020) 119 Renewable and Sustainable Energy Reviews 109598.

10 Howarth and Jacobson (n 8). See also generally, Khorasanov (n 3).

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of steam methane reforming is technically possible, it is not presently employed (i.e., there is currently no *secondary* carbon capture and storage). Efforts to reduce greenhouse gas emissions, resulting from the energy cost necessary to run the carbon storage operations to treat this flue gas, may open up a future opportunity for nuclear energy, especially if one considers the energy intensity of capturing and permanently storing carbon underground.

CO_2, released as a by-product of steam methane reforming of natural gas, requires capture (*primary* carbon capture and storage). If the electricity grid, like in Alberta, is predominantly based on natural gas and coal (the latter phased out by 2023), then the electricity generation required to power the primary capture process of compression as well as the transportation of the CO_2 to the site of CCUS injection, generates further CO_2 emissions, which are added to the CO_2 emissions associated with the energy required to inject the CO_2 into underground storage. If the carbon emissions from natural gas at the feedstock, internal emissions, primary carbon capture and storage, (future) secondary carbon capture and storage, and the electricity generation stage of blue hydrogen production are all replaced using zero carbon nuclear energy generated by SMR technology, then the *cumulative* lifecycle carbon intensity of blue hydrogen production could be drastically reduced. The increased focus on hydrogen's role in decarbonizing energy-intensive sectors of the Canadian economy, only serves to underscore the importance of deploying nuclear energy to produce hydrogen for the value chain of natural resources. This is especially relevant given that Canada's recently reformed environmental impact assessment process for energy project approvals (examined further below) is highly sensitive to how a proposed project may affect Canada's ability to meet domestic and international climate change and sustainability commitments.

III. An effective regulatory framework

What role, then, can Canada's regulatory framework for nuclear energy play in order to expedite the deployment of SMR technologies in the provincial natural resources value chain, such as in Alberta? Owing to the history of nuclear (atomic) energy development in Canada, and the federal jurisdiction over nuclear materials and activities in Canada, as enshrined in the constitution, the Canadian Nuclear Safety Commission (hereinafter: CNSC) acts as Canada's sole and dedicated nuclear energy regulator. This is the first reality of nuclear energy development in Canada, in that the CNSC is the federal body with ultimate regulatory oversight over nuclear energy. A second critical context to keep in mind is that the CNSC has extensive experience of regulating large nuclear energy projects in Ontario, New Brunswick and (historically) Quebec for the generation of electricity. The question of designing an effective regulatory framework for SMR deployment, in the context of Alberta's energy sector, thus raises two key issues. One, a regulatory regime in an entirely 'new nuclear' jurisdictions[11], and two, a regime for nuclear energy that must operate within an established and complex regulatory landscape service a multi-faceted energy sector (which may or may not involve the generation of nuclear energy for electricity and/or heat, and steam). Unlike the gradual development of Canada's regulatory regime for nuclear electricity generation in, for example, Ontario, the Alberta scenario is entirely new and without precedent and comes at a time of heightened focus on SMR deployment to achieve Canada's Net-Zero 2050 goals.

As part of a general shift towards new nuclear energy, the CNSC has undertaken extensive steps so that it is ready 'to accept and evaluate' licensing applications of SMR technologies.[12] For example, Canada's Small Modular Reactor Action Plan (December 2020) identifies actions on developing policies and standards in support of the deployment of SMRs as a priority. Ongoing regulatory changes have focused on increasing 'regulatory efficiency', in particular on nuclear safety, increasing engagement with communities and Indigenous peoples, and fostering international collaboration (especially with the USA and UK regulators).

At a high level, the CNSC regulates in a 'risk-informed' manner and permits, where possible, the use of a 'graded approach' pursuant to Section 24 of the *Nuclear Safety and Control Act* for nuclear licences applications. The graded approach is 'a method in which the stringency of the design measures and analyses applied are commensurate with the level of risk posed by the reactor facility. Designs using the graded approach shall demonstrate that the safety objectives and the requirements... are met'.[13] The CNSC applies its technology neutral requirements in a risk-informed manner, placing primary responsibility for nuclear safety on the licensee.[14]

[11] Feasibility of Small Modular Reactor Development and Deployment in Canada, Ontario Power Generation (OPG), Bruce Power, NB Power and SaskPower for the governments of Ontario, New Brunswick and Saskatchewan (2021).

[12] Kevin W. Lee, 'The Canadian Nuclear Safety Commission's Readiness to Regulate Small Modular Reactors' (2020) 9(1) CNL Nuclear Review 99, 99.

[13] Canadian Nuclear Safety Commission, Design of Small Reactor Facilities, RD-367, June 2011, Graded Approach, 3.

[14] Canadian Nuclear Safety Commission, 'Information Session on Regulatory Readiness: Enhancing Efficiency and Effectiveness in the Regulation of Small Modular Reactor Projects,' CMD 21-M5, January 2021, Slide 18, available at https://www.nuclearsafety.gc.ca/eng/the-commission/meetings/cmd/pdf/CMD21/CMD21-M5.pdf (accessed 18 July 2023).

In 2014, the CNSC issued a specific regulatory document on SMR technology, RD-367, which sets out that SMRs 'shall be designed and operated in a manner that will protect the health, safety, and security of persons and the environment from unreasonable risk'.[15] As part of the CNSC's radiation protection safety objective, the SMR facility 'shall be designed to ensure that...radiation exposures within the reactor facility are kept below the limits prescribed in the *Radiation Protection Regulations* and as low as reasonably achievable (ALARA)'.[16]

In response to increased interest in SMR technologies, in 2016, the CNSC published a discussion paper on Small Modular Reactors: Regulatory Strategy, Approaches and Challenges (DIS-16-04). This document, together with extensive stakeholder consultations undertaken by the CNSC (What We Heard Report), observed a general consensus that 'SMRs do not pose an insurmountable challenge to existing regulatory requirements in Canada'.[17] The consultation did, however, identify a number of regulatory modifications that the industry urged the CNSC to undertake so as to address the novel nature of SMRs. This included amendments to regulations, particularly to the *Nuclear Security Regulation* on site security provisions by design measures.[18] The need for further clarity on the application of the graded approach as well as the risk-informed approach to SMR designs was also identified by the industry, as was a clarification on the SMR licensing process for 'first of a kind' (hereinafter: FOAK) reactors.[19]

Consultations on the CNSC's proposal to amend the *Nuclear Security Regulation* closed in June 2021 and remain under consideration by the CNSC. In the context of SMR technologies, the proposed amendments would remove current prescriptive requirements on nuclear security requirements, and would replace these with provisions for 'performance-based regulatory approaches' designed 'to provide flexibility for licensees to introduce new technologies, processes and procedures'.[20] Concerns on how the graded approach would apply to novel SMR technologies, and how the CNSC may consider FOAK licensing applications, were considered by the CNSC, which noted that 'additional discussions are necessary to further reinforce how the graded approach may be

[15] Canadian Nuclear Safety Commission (n 13) 3.

[16] Ibid., Radiation protection safety objective, at 4. See also Lee (n 12) 100.

[17] Canadian Nuclear Safety Commission, DIS-16-04, Small Modular Reactors: Regulatory Strategy, Approaches and Challenges, What We Heard Report, September 2017, at 2. See also Lee (n 12) 102.

[18] Ibid., Site security provisions, 9.

[19] Ibid., Greater clarity on licensing of SMRs 11.

[20] Canadian Nuclear Safety Commission, Proposal to Amend the Nuclear Security Regulation, Discussion Paper DIS-21-02, April 2021, a3.

applied in the development of safety cases for SMR projects'.[21] A new regulatory document, REGDOC-1.1.5 (August 2019) sets out additional guidance on how to apply the graded approach. A licensing application 'is to address CNSC requirements in a manner that is commensurate with the novelty, complexity and potential for harm that the activity represents'.[22]

In order to expedite the deployment of SMR technologies in Canada, and to make the regulatory process more attractive to novel SMR vendors, the CNSC offers an optional 'vendor design review process' (hereinafter; VDR). The primary objective of the VDR is to provide feedback and to inform a vendor of the design's acceptability under Canada's regulatory requirements. Strictly separated from the CNSC licensing process, the review offers an 'early identification and resolution of potential regulatory and technical issues in the design process' before the formal licensing process commences.[23] The VDR process also acts as an important 'measure of early assurance'[24] to the public that new nuclear technology will meet Canadian regulatory requirements.

Canada's SMR Roadmap 2018 noted that the modernization of Canada's federal (environmental) impact assessment regime should be aligned with initiatives to expedite the deployment of SMRs. Recent reforms on how environmental impacts of energy projects are assessed, pursuant to the new *Impact Assessment Act* regime, make an important contribution to regulatory preparations for future SMR applications that are classified as 'designated' facilities pursuant to Section 27 of the *Physical Activities Regulation* (that is, for example in the context of SMR development in Alberta, the proposed activity is not located within a currently licensed facility, and the reactors have a combined thermal capacity of more than 200 MWth). The new regime has made a number of changes to the regulatory environment for nuclear energy projects. From a practical perspective, the most significant change to note is a re-allocation of regulatory powers away from the CNSC. Under the previous regime, the CNSC acted as the sole regulator to determine environmental impacts of nuclear facilities. This power is now with a new agency called the Impact Assessment Agency of Canada (hereinafter: IAAC). In addition, final project approval (based on the recommendation report of the Agency) is now a political one, with the federal government issuing the relevant decision. Conditions of the decision may be formulated by the Minister as conditions

21 Canadian Nuclear Safety Commission (n 17) 2.

22 Canadian Nuclear Safety Commission, Supplemental Information for Small Modular Reactor Proponents, REGDOC-1.1.5, August 2019, Development of the Licence Basis for an SMR Facility, at 17.

23 Ibid., The role of the VDR process, 20.

24 Canadian Nuclear Safety Commission, Pre-Licensing Review of a Vendor's Reactor Design, REGDOC-3.5.4, November 2018, Benefit to the public, 4.

that are to be included in the Section 24 licensing decision.[25] The goal of the new regime is to offer a single process that follows the assessment requirements of both the IAAC and the CNSC, on the basis of 'one project, one review'.[26] As part of this, the CNSC and the IAAC share important roles and responsibilities (e.g. powers related to information, notification, public engagement, participation, and Crown and Indigenous consultation), and representatives of the CNSC are appointed as members of an IAAC review panel.

The CNSC plays an important role at the five stages of the IAAC process. One, commencing with a planning phase, the CNSC participates in the engagement with both public and Indigenous groups through respective participation, engagement and partnership plans. Two, the CNSC also plays a critical role in developing the terms of reference for the integrated review panel, in particular in defining the Section 24 licence application which the review panel (as the CNSC) will make. Three, the formal impact assessment phase consists of the appointment of review panel members (with a cross-appointment of a minimum of one CNSC member to the IAA panel). The panel holds public hearings on both the impact assessment and on the applicable nuclear licence consideration. Four, the integrated review panel then prepares an impact assessment report, which is then referred to the federal cabinet for a 'public interest' determination. Five, if the Minister issues an approval decision, the review panel (as the CNSC) makes the licensing decision and any conditions specified by the Minister form part of the nuclear licence.

Another change is that the recent reforms have significantly expanded the concept of the 'effect' of a proposed project beyond its narrow environmental impacts.[27] The regime now considers both the positive and negative social, health and economic impacts of a proposed SMR project, and takes into account a number of prescribed factors. In the discussion of a closer alignment of nuclear, carbon and hydrogen, the most pertinent factors relate to mitigation measures, which are technically and economically feasible, to address the effects of malfunctions and accidents that may occur in connection with a project. The impact of the project on climate change is also essential, as is the extent to which the project may contribute to sustainability. Further pertinent issues are economic considerations and considerations of 'alternatives to' the proposed SMR project.

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[25] Canadian Nuclear Safety Commission, Impact Assessment Act, September 2020, Slide 9. available at: https://www.nuclearsafety.gc.ca/eng/pdfs/impact_assessment_act_presentation_2020_en.pdf (Accessed 18 July 2023).

[26] Ibid., Slide 14.

[27] David V. Wright, 'The New Federal Impact Assessment Act: Implications for Canadian Energy Projects' (2021) 59(1) Alberta Law Review 67.

IV. Future incentives and conclusions

The production of blue hydrogen will drastically have to be scaled-up in order to support future demand for low carbon hydrogen, ammonia, liquefied natural gas (hereinafter: LNG), marine fuel or mining exports from Canada. To achieve this objective, a concerted nuclear, carbon and hydrogen alignment, as proposed in this paper, will play a critical role towards achieving Canada's Net-Zero 2050 commitments. Already there are indications that Canada's focus on producing goods using low carbon hydrogen may improve the access of its exports to 'carbon conscious' markets such as the European Union. This discussion is driven by a renewed focus on 'carbon border adjustment mechanisms', which may be imposed at the point of import to take account of the carbon-intensity of goods produced in jurisdictions with lower climate regulation. Presently, there are no uniform methods for calculating the carbon intensity of produced goods, but as international standards on low carbon intensity are implemented, it can be expected that Canadian exports will increasingly be focused on low carbon natural resources exports. In turn, this will increase reliance on hydrogen, and with it the potential for nuclear energy in hydrogen production. Such a development will further cement the nuclear option, within the context of low carbon and clean hydrogen, and act as a strong incentive to investors.

To this extent, the December 2021 announcement by Ontario Power Generation (OPG) stating that it will work with GE Hitachi Nuclear Energy to deploy one SMR at Darlington, and most recently, the Ontario provincial government's announcement that OPG will build three additional SMRs at Darlington (for a total of four SMRs), sends very encouraging 'SMR impulses' in the direction of Western Canada.[28] For example, a March 2021 Feasibility Study on SMR Development and Deployment in Canada noted that the federal government, together with provincial governments, should provide funding to cost-share with the industry on SMR demonstration projects, and to implement risk-sharing measures to incentivize commercial deployment of SMRs. The study also noted that considerations should be given to how an engagement with Indigenous peoples and communities on nuclear energy can be advanced. If SMR deployment in Alberta is indeed to become a reality, additional policies and consultation practices must be developed as part of a 'front-loaded' engagement pursuant to the new impact assessment regime.

[28] Ontario Power Generation, Darlington New Nuclear, Ontario is Leading North America's Clean Energy Future, 7 July 2023 available at: https://www.opg.com/powering-ontario/our-generation/nuclear/darlington-nuclear/darlington-new-nuclear/ (accessed 8 July 2023).

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Given the importance of the natural resources sector to the Canadian economy, deploying SMRs in a low carbon and clean hydrogen economy will make sizable contributions to achieving Canada's net-zero commitments. Bringing SMRs to Western Canada, and the future lessons and experiences gained from such a step, will also play an important role in ongoing efforts to decarbonize the global natural resources sector. Through the responsible deployment of SMRs in a future clean energy 'system' in Alberta, the natural resources sector could make a significant contribution to achieving Canada's Net-Zero 2050 goals. At the same time, there is (as yet) no single 'go-to' regulatory regime to expedite the deployment of SMRs in support of Alberta's low-carbon energy future. Much can be gained from the expertise and credibility of the CNSC on nuclear regulation in Canada. At the same time, important work lies ahead on the swift design and development of a regulatory framework for nuclear energy in Alberta's energy sector, which will require a collaborative effort by all levels of government.

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