



A Policy Scan of Cumulative Effects Assessment in Support of Renewable Clean Growth Projects in Canada

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Abstract

In Canada, clean growth has been viewed as an essential strategy for achieving net zero carbon emissions by the year 2050. However, clean growth initiatives can create cumulative effects. Moreover, such initiatives are evolving rapidly and it is unclear if conventional environmental assessments are sufficient. The assessment of cumulative effects of clean growth remains a relatively novel activity, yet is seemingly important given that some of the emerging actions and technologies could themselves yield a variety of unanticipated environment impacts. To support evidence-based policy development for clean growth, we conducted a policy scan at subnational and national levels in Canada supported by targeted scans in other jurisdictions to assess the scope at which cumulative effects are assessed for renewable clean growth projects, and to identify best practices, approaches, and/or methods for assessing the cumulative effects of clean growth. Our policy scan revealed that approaches for assessing cumulative effects of renewable clean growth activities are inadequately developed across Canada. Though we confirmed few existing cumulative effects frameworks in practice, we found a diverse set of cases where cumulative effects have been effectively identified and managed (in Canada and afar) for projects predominately in the natural resource sector. Four policy insights were generated for assessing cumulative effects of renewable clean growth in Canada; (1) adopt a regional approach that considers local context, (2) support the development of valued ecosystem components, (3) conduct rigorous and comprehensive baseline monitoring, and (4) prioritize collaborative governance including with Indigenous governments and communities. Failure to consider cumulative effects during the early phases of renewable clean growth could impede the ability to meet targets and yield the environmental and socio-economic benefits that are promised by the clean growth movement.

Keywords clean growth · cumulative effects · cumulative effects assessment · climate change · policy scan

Introduction

Growing the Canadian economy while protecting Canadian communities and ecosystems requires socio-economic transformation in the face of climate challenges. Given the well-documented link between some forms of economic

growth and environmental degradation (Kahuthu 2006), international governments have agreed that climate change must be limited to a level that would prevent dangerous interference with the climate system, while ensuring sustainable food production and economic development (Knutti et al. 2016; United Nations 1992). To address this goal, Canada along with 194 other countries have committed to limit global average temperature rise to 2 °C with efforts to aim for 1.5 °C (Paris Agreement 2015). Currently, increasing trends in emissions indicate that global emissions must start declining to hold off global warming (Friedlingstein et al. 2014). As one of the most emission-intensive economies in the world, Canada faces unique challenges in mitigating greenhouse gas emissions while maintaining the pace of economic growth (Haider et al. 2023).

In Canada, clean growth has been viewed as an essential strategy for achieving net zero emissions by the year 2050.

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Clean growth (also variously termed green capitalism, the green economy, and green growth) is defined by the United Nations as economic growth that is energy efficient, uses sustainable agricultural practices, and uses renewable energy technologies (Hoffmann, 2010). This definition covers a broad range of activities existing throughout a wide spectrum and can include both physical initiatives and technologies as well as implementation of protocols and mandates. The premise of clean growth is simple; with appropriate application of science and technological innovation and by establishing relevant market incentives that include environmental considerations, environmental degradation can be mitigated, while yielding new opportunities for capital accumulation and economic growth (Dale et al. 2016; Sapinski 2015). This includes fostering and encouraging investment in clean technology solutions that can facilitate economic growth, long-term job creation, and environmental responsibility and sustainability (ECCC, 2016). Clean growth is also anticipated to have direct benefits to the health and well-being of people and communities, ensuring that they are resilient to the anticipated impacts of climate change (Lee 2021).

Now more than ever is the clean growth agenda achievable due to technological advancements and declining costs of adopting clean technologies (Arkoulakis and Walsh 2023). During the last few decades, governments and industry have invested hundreds of billions of dollars in clean technologies while the associated costs like solar photovoltaic installation and onshore wind generation have consistently decreased year over year (International Energy Association 2016). Policy changes are also underway to ensure that various policy instruments and options align with the clean growth agenda (Beck et al. 2023). The Pan-Canadian Framework on Clean Growth was released by the federal government in partnership with several provinces and territories in 2016 and serves as a roadmap for achieving clean growth and reducing GHG emissions (ECCC, 2016). Actions outlined in the framework range from phasing out coal and modernizing electricity systems, to harnessing clean power and building energy capacity in remote and Indigenous communities. These activities presumably have a net benefit for the environment (Olsen and Fenhann 2006); however, there are still potential issues associated with clean growth including environmental consequences such as those arising in the form of cumulative effects—which are the focus of this paper.

The Impact Assessment Agency of Canada's (IAAC) Cumulative Effects Assessment Practitioners Guide defines cumulative effects as “changes to the environment that are caused by an action in combination with other past, present and future human actions” (Hegmann et al. 1999). The concept recognizes not only that multiple, minor stresses (e.g., many wind turbines) can add up to create significant

threats to the environment (i.e., “additive effects”), but also that different activities can combine in complex ways to produce aggregate effects that may differ from the additive effects of individual activities (i.e., “interactive effects”; *Impact Assessment Act*, 2019; Master et al. 2009). It also recognizes that complex human impacts (e.g., climate change, forestry, and urbanization) can affect multiple features of ecosystems via interacting and often indirect processes and complex feedbacks.

The *Impact Assessment Act* (2019) outlines the typical process (acknowledging that there are exceptions) for how the federal government assesses the impacts of designated projects and projects carried out on federal lands or outside of Canada (with the financial support or authority of the federal government), which includes the consideration and mitigation of cumulative effects. In the context of impact assessment, cumulative effects need to be considered to ensure that human activities and developments do not have deleterious impacts on the environment and society. An example of cumulative environmental effects that IAAC assesses would be the destruction of habitat of the same fish population from multiple physical activities or the disturbance of an archeologically significant site due to construction activities associated with multiple physical activities (IAAC 2018). Despite IAAC's existing guidance regarding cumulative environmental effects, major knowledge gaps exist on how practitioners should assess cumulative effects for clean growth projects and whether and how these assessment methods should differ from other types of projects outside of clean growth¹. As the advancement of clean growth projects continues for new and less-understood technologies, considerations of cumulative environmental effects need to be mapped out for all involved in impact assessment processes. This is critical given that emerging actions and less-understood technologies could themselves yield a variety of unanticipated environmental impacts as has been observed with other forms of green technology (Zehner 2011). In other words, just because a technology is touted as “clean growth” does not mean that environmental assessment should be conducted with less rigor than is demanded for other forms of development (Sinclair et al. 2017). Failure to consider these adverse impacts during the early phases of the clean growth “revolution” could slow action on climate change and lessen the environmental and socio-economic benefits that are promised by clean growth.

There is growing consideration of cumulative effects in environmental assessment and useful frameworks for doing so (e.g., Blakley and Franks 2021; Noble 2021; Blakley and

¹ But see the Physical Activities Regulations SOR/2019-285 from the Canadian Government where there is explicit recognition that some clean growth activities related to renewable energy are so designated.

Russell 2022) but few efforts specific to clean growth initiatives. Clean growth initiatives are somewhat unique in the speed at which these initiatives are rolling out and the assumption that they are a net positive. Moreover, some aspects of clean growth infrastructure are distributed (e.g., lots of wind turbines) rather than one larger site (e.g., a mine) for which much of the cumulative effects assessment has previously been focused. There is also limited opportunity to address new technologies given the way that projects are designated (i.e., by regulation) and how federal jurisdiction (in Canada) is often not achieved. That is, the threshold for project-level assessments for these types of developments are quite high so implementation is reliant on sub-regional processes that are highly variable.

Here, we report on a policy scan focused on the assessment of cumulative effects of renewable clean growth activities at subnational and national levels in Canada with additional targeted searches in other international jurisdictions. Although the landscape of clean growth initiatives is diverse, this report focusses solely on the renewable clean growth initiatives such as wind, solar and hydropower which are commonly associated with clean growth, are relatively ubiquitous throughout Canada and within the legislation. Given that in Canada, impact assessments are governed by multiple pieces of legislation, regulations, policies, and frameworks, the policy scan serves as a useful approach for understanding the evolving policy and regulatory landscape as well as supporting the operationalization of the Agency's work assessing cumulative effects in renewable clean growth projects throughout Canada (Cox 2014). Overall, this scan aims to summarize the current policy landscape and assist the development and alignment of policies, regulations, and frameworks in Canada to support a national renewable clean growth transition that reconciles economic growth and environmental protection.

Approach

We used a policy scan approach which is a well-recognized method in political science for understanding the policy and regulatory frameworks and instruments that exist around a given topic or theme (Presley et al. 2015). In this case, a policy scan was conducted in search of Canadian policy documents, regulations, and directives that require and/or consider cumulative effects assessments for renewable clean growth activities. We recognize that other initiatives may occur which are consider part of the “clean growth” umbrella but for the purpose of this policy scan, we chose to focus on renewable energy clean growth initiatives. For example, these include on primary clean growth initiatives, such as hydropower, wind energy (on shore and offshore), solar, and marine hydrokinetic (energy harnessed from the

natural movement of water such as waves, tides, and river and ocean currents) as well as opportunistically on secondary clean growth initiatives which included electricity transmission, green transport, and critical minerals. That said, to identify relevant policy documents we did not search for specific types of infrastructure and instead focused on terms related to clean growth and cumulative effects more holistically (as outlined below). We acknowledge that as a limitation and suggest that sector/infrastructure-specific assessments could be useful. We also recognize that focusing solely on English papers/reports may have led to missing useful exemplars.

Given an overall lack of information due to rapidly emerging domain of clean growth, complementary searches were conducted for frameworks and guidance documents that describe general cumulative effects assessment processes for proponents, practitioners, and the public. In addition, searches were also conducted for general clean growth policies and frameworks. Policies included in these scans were those created by the governments of the 13 Canadian provinces and territories, as well as those created at the national level by the Government of Canada. More rudimentary searches were also conducted at the international scale, including policies developed by the United States (U.S.), the United Kingdom (U.K.), the European Union (E.U.), and Australia. Those countries were identified given reasonably similar governance structures and socio-economic status relative to Canada. The searches were comparatively less structured and intended to identify exemplars from elsewhere in order to identify opportunities to contextualize the Canadian-specific findings—albeit, in a cursory manner (i.e., a comparative analysis was not part of the objective statement—it is simply supportive).

Searches were conducted in English using the Google search engine between October 17th and December 10th, 2023. We used Google's general search engine to ensure that any form of cumulative effects/clean growth documents would be captured, and not just peer reviewed papers that would be generated from searches on Google Scholar. Search terms/phrases were scoped, and a comprehensive list was established. The search terms used were: Clean growth; Green growth; Clean economy; Green economy; Cumulative effects; Cumulative impacts; Clean growth framework; Clean growth policy; Environmental assessment; Clean growth cumulative effects; Cumulative effects policy; Clean growth cumulative effects policy. These searches returned many hits that were then screened manually for Canadian context. This was not a systematic review but rather a policy scan so we did not record the number of documents included/excluded. Each document was searched for text related to the intersection of clean growth and cumulative effects assessment and when such text was located it was flagged for inclusion in our narrative analysis.

Targeted emails were also sent to provincial, territorial, and federal government department/agencies across Canada to capture information that may not be published online. Targeted emails were sent to generic program email addresses that were provided within clean growth plans or in cumulative effects frameworks. Where no generic email address was identified, targeted emails were sent to individuals named in resource management and/or climate change sections at sufficiently high levels, such that the recipient of the email would have awareness of existing documents on cumulative effects assessment for clean growth. All were sent in English aside for those sent to officials with the province of Quebec which were sent in French. At least one email contact was made in each province/territory in Canada as well as within each key federal government agency.

Policy Scan Findings

The searches conducted on the websites of Canadian federal, provincial, and territorial departments and agencies using Google yielded unique documents that mentioned clean growth and cumulative effects assessment. Responses to targeted emails and calls for information did not generate any documents that were not already identified in our Google search.

Clean Growth Policies in Canada

Since the release of the Pan-Canadian Framework in 2016, searches identified clean growth plans developed by each of the ten provinces and three territories (Table 1). Throughout Canada, a central theme in all jurisdictional plans was the reduction of emissions through cleaner economic growth and innovation. For example, Atlantic Canada is pursuing clean growth via offshore wind projects due to world-class wind speeds that rival the North Sea (Dong et al. 2021). In Nova Scotia, specifically, the large continental shelf with vast areas of relatively shallow waters creates ideal conditions for building wind farms at sea (Government of Nova Scotia 2023). The offshore area of Newfoundland and Labrador also has strong potential for wind energy generation. The province's growth plan, the Way Forward on Climate Change in Newfoundland and Labrador, reports that with an already 98% renewable grid, the province is seeking opportunities to develop wind energy for export markets.

Hydropower was also identified in many of the provincial clean growth plans. For instance, Quebec's Electrification and Climate Change Policy Framework stated that the government will be investing in secondary clean growth initiatives by "relying on the electrification of the

economy" to fight climate change while boosting economic growth (Government of Quebec 2020). Likewise, in Manitoba, a keystone of the "Made-in-Manitoba Climate and Green Plan" is harnessing clean energy from the province's rivers (Government of Manitoba 2017). Ontario's plan, "Powering Ontario's Growth", states that the provincial government is "making major investments in refurbishing the province's nuclear fleet". Specifically, Ontario's clean growth plan highlighted the use of cutting-edge technology including Canada and the G7's first grid-scale small modular reactor which will generate enough clean energy to power 300,000 homes (Government of Ontario 2023).

In Northern and Western Canada, provinces and territories identified Indigenous leadership as foundational to achieving emission reduction and clean energy goals. The Alberta emissions reduction and energy development plan (Government of Alberta 2023) states that Indigenous communities will be at the forefront of lowering emissions, responsible energy development and environmental protection. Alberta's plan also mentioned the potential for carbon capture, utilization, and storage, of which some projects are already partly owned by Indigenous communities (Government of Alberta 2023). In the Yukon, supporting reconciliation was listed as a step toward the jurisdiction's collective vision for a cleaner future. Specifically, Yukon's "Our Clean Future" plan committed to protect the unique spiritual relationship that Indigenous people have with the land through strong action on climate change (Government of Yukon 2020).

Cumulative Effects Policies in Canada

Our scan revealed no existing pieces of legislation at the federal or provincial/territorial level that mentioned clean growth. As such, we found no documented overlap between cumulative effects assessment and clean growth in the legislation of Canada's federal and provincial/territorial governments. Our complementary search for legislation on impact assessments for broader designated projects, of which clean growth projects likely apply, was more successful.

For each of the ten Canadian provinces, we found corresponding provincial acts respecting the impact assessments of designated projects (Table 2). In the case of the three territories, our searches revealed three federal acts and one agreement, the *Inuvialuit Final Agreement* (1984), governing the impact assessments of designated projects. All pieces of legislation listed within the acts themselves, or within complementing regulations used assessment factors that were considered during the impact assessment process. However, only five jurisdictions, Quebec, British Columbia, Yukon, the Northwest Territories, and Nunavut were found to mention the term "cumulative effects" within the text of their legislation.

Table 1 Official Federal, Provincial, And Territorial Clean Growth Plans in Canada

Jurisdiction	Plan	Release Year	Focus
Canada	Pan-Canadian Framework on Clean Growth and Climate Change	2016	Four core pillars include: (1) pricing carbon pollution, (1) complementary actions to reduce emissions, (3) adaptation and climate resilience, and (4) clean technology, innovation, and jobs
Newfoundland and Labrador	The Way Forward on Climate Change in Newfoundland and Labrador	2019	Carbon program, clean economy, transportation, agriculture, forestry, fisheries and natural areas, energy use in buildings and homes, infrastructure, planning and development, health and well-being, education and outreach
Prince Edward Island	2040 Net Zero Framework: Accelerating our Transition to a Clean, Sustainable Economy	2022	Transform the way people and goods move, transition to efficient and cleaner buildings, shape agriculture for PEI's Transition to Net Zero, remove carbon through forestry, technologies, and emerging opportunities, create a clean industry and waste advantage, inspire transformational change through leadership and engagement
Nova Scotia	Our Climate, Our Future: Nova Scotia's Climate Change Plan for Clean Growth	2022	Responding to climate impacts, reducing greenhouse gas emissions, seizing opportunities for a cleaner sustainable economy, reporting and evaluating progress
New Brunswick	Our Pathways Towards Decarbonization and Climate Resilience: New Brunswick's Climate Change Action Plan 2022 – 2027	2022	Government leadership and accountability, reducing GHG emissions, preparing for climate change
Quebec	2030 Plan for a Green Economy: Framework Policy on Electrification and the Fight Against Climate Change	2020	Mitigate climate change, build the economy of tomorrow, adapt to climate change, create a predictable environment that is conducive to the climate transition, accelerate the development of knowledge
Ontario	Powering Ontario's Growth: Ontario's Plan for a Clean Energy Future	2023	Affordable electricity, energy efficiency and innovation, economic growth and electrification, nuclear energy, SMR, natural gas generation
Manitoba	Made-In-Manitoba Climate and Green Plan	2017	Four Pillars: Climate (clean energy, carbon pricing, sector emissions reductions, adaptation), Jobs (innovation and cleantech, financing and investment, skills and training, green infrastructure), Water (wetlands and watersheds, agriculture and land use, flood and drought, water quality), Nature (parks and protected areas, wild species and habitats, forests and natural areas, conservation)
Saskatchewan	Saskatchewan's Growth Plan: The Next Decade of Growth (2020-2030)	2019	Business and investment into strong communities and strong families. Support growth of new industries and new investment in the province. Create new jobs to attract young people and skilled workers, delivering on Saskatchewan's climate change plan to reduce carbon emissions, reducing carbon emissions in electricity production, and advancing the development of zero-emission small modular reactor technology using Saskatchewan uranium.
Alberta	Emissions Reduction and Energy Development Plan	2023	Indigenous leadership, clean technology and innovation, carbon capture and storage, emissions reductions (oil & gas, electricity, geothermal, hydrogen, critical minerals, circular economy, nature-based solutions...), climate adaptation, accountability and reporting
British Columbia	CleanBC: Our nature. Our power. Our future.	2018	Zero-emission vehicles, switch to cleaner fuels, energy efficient buildings, reducing waste and turning it into a resource, cleaner industry, measuring progress, collaboration
Yukon	Our Clean Future: A Yukon strategy for climate change, energy, and a green economy	2020	Partnership with Yukon First Nations, transboundary Indigenous groups and Yukon municipalities to achieve four main goals: reduce Yukon's greenhouse gas emissions, ensure Yukoners have access to reliable, affordable and renewable energy, adapt to the impacts of climate change, build a green economy

Table 1 (continued)

Jurisdiction	Plan	Release Year	Focus
Northwest Territories	2030: NWT Climate Change Strategic Framework	2018	Three main goals: (1) Transition to a strong, healthy economy that uses less fossil fuel, thereby reducing greenhouse gas emissions by 30% below 2005 levels by 2030, (2) Increase understanding of climate change impacts occurring in the NWT, (3) Build resilience and adapt to a changing climate
Nunavut	Ikummatiit: The Government of Nunavut Energy Strategy	2007	Addressing energy use in Nunavut, energy conservation and efficiency, fostering the adoption of alternative energy, better management practices, Uranium and fossil-fuel development

Impact assessment legislation from Quebec, British Columbia, Yukon, and the Northwest Territories mentioned cumulative effects as a consideration in impact assessments of designated projects. For example, the regulation respecting environmental impact assessment and review of Quebec's *Environment Quality Act* (2023) requires project proponents to provide “a list and evaluation of positive, negative and residual impacts of the project on the environment, including indirect, cumulative, latent and irreversible effects on the aspects identified in subparagraph b and a description of the area as it will appear after the project has been carried out and developed”. In subsection 25(2) of British Columbia's *Environmental Assessment Act* (2018), the act listed matters that must be considered in every assessment, which included positive and negative direct and indirect effects of the reviewable project, including environmental, economic, social, cultural and health effects and adverse cumulative effects. In addition, the effects on current and future generations in British Columbia was listed as another matter to be considered for every project assessment in the province (*Environmental Assessment Act*, 2018).

Similarly, in the federal *Yukon Environment and Socio-Economic Assessment Act* (2003), the list of matters that shall be taken into consideration in conducting an assessment of a project or existing project included “the significance of any adverse cumulative environmental or socio-economic effects that have occurred or might occur in connection with the project or existing project in combination with the effects of other projects for which proposals have been submitted under subsection 50(1) or any activities that have been carried out, are being carried out or are likely to be carried out in or outside Yukon.”

In the Northwest Territories, federal legislation for impact assessments in the Mackenzie Valley region was captured in the *Mackenzie Valley Resource Management Act* (1998). This act stated that a cumulative effects assessment is required by the project proponent to consider other activities in the area, what the project's combined effect is with other activities on the environment, and the people (*Mackenzie Valley Resource Management Act*

1998). In addition, the act also stated that responsible authorities shall collect and analyze data for the purpose of monitoring cumulative impacts of development on the environment.

In Nunavut, the *Nunavut Land Claims Agreement* was another enabling piece of federal legislation that alluded to the assessment of cumulative effects within the jurisdiction. Though the terms “cumulative impacts” were not explicitly mentioned in the legislative text, the agreement did stipulate the requirement for general monitoring to collect and analyze information on the long-term state and health of the ecosystemic and socio-economic environment in the Nunavut Settlement Area.

In terms of national and sub-national policies, frameworks, or guidelines for assessing cumulative effects of clean growth projects, our search again returned no results. In a broader search of policy documents providing guidance for cumulative effects assessment of projects in general, we identified one technical guidance document from a federal agency (IAA 2019), and one interim policy, one framework, and two monitoring programs from provincial/territorial departments.

Our search at the national level returned a technical guidance document developed by IAAC under the former *Canadian Environmental Assessment Act* (2012). The purpose of this document was to provide guidance on federal impact assessments commenced under the former act and has been retained for the completion of transitional impact assessments commenced prior to the *Impact Assessment Act* (2019). The technical guidance document provides methodological options and considerations to support the implementation of the former *Canadian Environmental Assessment Act* (2012), such that project impact assessments are of high quality and meeting requirements related to cumulative effects. Guidance in the document informed the assessment of cumulative effects undertaken as part of the impact assessment process, which is typically a project-by-project basis (IAAC 2018; IAAC 2023).

The only cumulative effects policy we found at the subnational level in Canada was the “Cumulative Effects Framework Interim Policy” developed by the Province of

Table 2 Environmental Legislation Enabling Environmental Impact Assessments for Development Projects (Federal, Provincial, Territorial)

Jurisdiction	Act	Regulation/Section	Environmental Assessment Factors
Canada	<i>Impact Assessment Act (S.C. 2019, c. 28, s. 1)</i>	Section 22(1)	The impact assessment of a designated project, whether it is conducted by the Agency or a review panel, must take into account the following factors: (a) the changes to the environment or to health, social or economic conditions and the positive and negative consequences of these changes that are likely to be caused by the carrying out of the designated project, including (i) the effects of malfunctions or accidents that may occur in connection with the designated project, (ii) any cumulative effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out, (iii) the result of any interaction between those effects; (b) mitigation measures that are technically and economically feasible and that would mitigate any adverse effects of the designated project; (c) the impact that the designated project may have on any Indigenous group and any adverse impact that the designated project may have on the rights of the Indigenous peoples of Canada recognized and affirmed by section 35 of the Constitution Act 1982; (d) the purpose of and need for the designated project; (e) alternative means of carrying out the designated project that are technically and economically feasible, including through the use of best available technologies, and the effects of those means; (f) any alternatives to the designated project that are technically and economically feasible and are directly related to the designated project; (g) Indigenous knowledge provided with respect to the designated project; (h) the extent to which the designated project contributes to sustainability; (i) the extent to which the effects of the designated project hinder or contribute to the Government of Canada's ability to meet its environmental obligations and its commitments in respect of climate change; (j) any change to the designated project that may be caused by the environment; (k) the requirements of the follow-up program in respect of the designated project; (l) considerations related to Indigenous cultures raised with respect to the designated project; (m) community knowledge provided with respect to the designated project; (n) comments received from the public; (o) comments from a jurisdiction that are received in the course of consultations conducted under section 21; (p) any relevant assessment referred to in section 92, 93 or 95; (q) any assessment of the effects of the designated project that is conducted by or on behalf of an Indigenous governing body and that is provided with respect to the designated project; (r) any study or plan that is conducted or prepared by a jurisdiction — or an Indigenous governing body not referred to in paragraph (f) or (g) of the definition jurisdiction in Section 2 — that is in respect of a region related to the designated project and that has been provided with respect to the project; (s) the intersection of sex and gender with other identity factors; and (t) any other matter relevant to the impact assessment that the Agency requires to be taken into account. (1) Where, the minister determines with respect to an undertaking that there (a) may be significant negative environmental effects; or (b) is significant public concern, the minister shall require an environmental impact statement. (2) In making a determination under paragraph (1)(a), the minister may consider (a) whether or not the environmental baseline information provided with respect to the undertaking is sufficient for predicting environmental effects; (b) whether or not original field data collection is required; (c) whether or not the undertaking would be located in an environmentally sensitive area; (d) whether or not hazardous or toxic substances in combination with unknown or experimental technology are intended to be used with respect to the undertaking; (e) whether or not the undertaking emissions, discharges or effluent may exceed limits imposed by law; (f) the environmental effects of the undertaking upon rare or endangered species; and (g) the economic importance of a resource to which the undertaking relates. (3) In making a determination under paragraph (1)(b), the minister may consider whether or not (a) public acceptability of the undertaking is seriously questioned; and (b) government policy has been established to address public concerns. The environmental impact statement should describe the positive and negative effects which the project may have on the environmental features identified in previous sections of the proposal. The level of evaluation on particular subjects will vary according to project complexity and potential for interaction with particular environmental components. Other impacts may relate to animal or plant species. These impacts could include the following issues: · air quality · sewage disposal · sludge and wastewater management · groundwater impacts and servicing · surface water · proximity and impact on environmental features · waste management · noise from construction equipment · noise from infrastructure (i.e., wind turbines, etc.) The report should discuss the proposed methods of evaluating the environmental impacts and the accuracy of the evaluation method. Depending on the nature of the proposed project, the environmental assessment co-ordinator may ask proponents to address additional specific issues related to the project. All of the following information shall be considered by the Minister in formulating a decision under subsection 34(1) of the Act: (a) the location of the proposed undertaking and the nature and sensitivity of the surrounding area; (b) the size, scope and complexity of the proposed undertaking; (c) concerns expressed by the public and aboriginal people about the adverse effects or the environmental effects of the proposed undertaking; (d) steps taken by the proponent to address environmental concerns expressed by the public and aboriginal people; (da) whether environmental baseline information submitted under subclause 9(1 A)(b)(x) for the undertaking is sufficient for predicting adverse effects or
Newfoundland and Labrador	<i>Environmental Protection Act (O.C. 2003-220)</i>	Environmental Assessment Regulations, (NLR Reg 54/03)	
Prince Edward Island	<i>Environmental Protection Act (RSPEI 1998, c E-9)</i>	Environmental Impact Assessment Guidelines	
Nova Scotia	Environment Act (SNS 1994-95 c 1)	Environmental Assessment Regulations (NS Reg 328/2022)	

Table 2 (continued)

Jurisdiction	Act	Regulation/Section	Environmental Assessment Factors
New Brunswick	<i>Clean Environment Act (RSNB 1973, c C-6)</i>	Section 5	environmental effects related to the undertaking; (e) potential and known adverse effects or environmental effects of the proposed undertaking, including identifying any effects on species at risk, species of conservation concern and their habitats; (f) project schedules where applicable; (g) planned or existing land use in the area of the undertaking; (h) other undertakings in the area; (ha) whether compliance with licences, certificates, permits, approvals or other documents of authorization required by law will mitigate the environmental effects; (i) such other information as the Minister may require. (a) to control or reduce the rate of release of any contaminant into or upon the environment or any part of the environment; (b) to eliminate the release of any contaminant into or upon the environment or any part of the environment (i) permanently, (ii) for a specified period, or (iii) in the circumstances set out in the order; (c) to alter the manner of release of any contaminant into or upon the environment or any part of the environment; (d) to alter the procedures to be followed in the control, reduction or elimination of the release of any contaminant into or upon the environment or any part of the environment; (e) to install, replace or alter any equipment or thing designed to control, reduce or eliminate the release of any contaminant into or upon the environment or any part of the environment; (f) to install, replace or alter a wastewater treatment facility or waterworks in order to control, reduce, eliminate or remedy the release of a contaminant into or upon the environment or any part of the environment; (g) to conduct any investigation, make any tests and prepare and submit to the Minister any reports required by the Minister; and (h) if a contaminant has been released into or upon the environment or any part of the environment, to carry out clean-up, site rehabilitation, restoration of land, premises or personal property or other remedial action. 5(2)The Minister may issue an order in relation to a contaminant if the Minister is of the opinion that (a) the contaminant has been, is being or may be released into the environment at a rate exceeding the maximum rate established by this Act or the regulations for the release of that contaminant, (b) the contaminant has been, is being or may be released into the environment in a manner prohibited under this Act or the regulations, (c) the release of the contaminant is prohibited under this Act or the regulations, or (d) it is in the best interests of the public to make the order, in circumstances where the release of the contaminant has caused, is causing or may cause (i) the natural, physical, chemical or biological quality or constitution of the environment to be affected, (ii) the health of human, plant or animal life or the safety or comfort of a human to be adversely affected, (iii) property or plant or animal life to be damaged or rendered unfit for use by persons, or (iv) visibility, the normal conduct of transport or business or the normal enjoyment of life or use or enjoyment of property to be interfered with. a qualitative and quantitative inventory of the aspects of the environment which could be affected by the project, such as fauna, flora, human communities, the cultural, archeological and historical heritage of the area, agricultural resources and the use made of resources of the area; (c) a list and evaluation of positive, negative and residual impacts of the project on the environment, including indirect, cumulative, latent and irreversible effects on the aspects identified in subparagraph b and a description of the area as it will appear after the project has been carried out and developed; a description of the environment that will be affected or that might reasonably be expected to be affected, directly or indirectly, the effects that will be caused or that might reasonably be expected to be caused to the environment, and the actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment, a description of the potential impacts of the development on the environment, including, but not necessarily limited to the following: (i) type, quantity and concentration of pollutants to be released into the air, water or land, (ii) impact on wildlife, (iii) impact on fisheries, (iv) impact on surface water and groundwater, (v) forestry related impacts, (vi) impact on heritage resources, (vii) socio-economic implications resulting from the environmental impacts; a description of the proposed environmental management practices to be employed to prevent or mitigate adverse implications from the impacts identified in clause (j) having regard to, where applicable: containment, handling, monitoring, storage, treatment and final disposal of pollutants; conservation and protection of natural or heritage resources; environmental restoration and rehabilitation of the site upon decommissioning; and protection of environmental health; and any other information requested by the director. Is the proposed project likely to influence any unique, rare or endangered feature of the environment? Is the proposed project likely to substantially utilize any provincial resource and, in so doing, pre-empt the use, or potential use, of that resource for any other purpose? Will the proposed project cause the emission of any pollutants or create by-products, residual or waste products, which will require handling and disposal in a manner that is not regulated under any other Act or regulation? Is the proposed project likely to cause widespread public concern about potential environmental changes? Is the proposed project likely to involve new technology that is concerned with resource utilization and that may induce significant environmental change? Is the proposed project likely to have a significant impact on the environment or necessitate a further development which is likely to have a significant impact on the environment?
Quebec	Environment Quality Act (Q-2)	Regulation respecting environmental impact assessment and review (Q-2, r.23)	
Ontario	Environmental Assessment Act (RSO 1990, c E-18)	Section 6	
Manitoba	The Environment Act (CCSM c E-125)	Licensing Procedures Regulation (Man Reg 163/88)	
Saskatchewan	The Environmental Assessment Act (SS 1979-1980 c E-10.1)	Section 9	

Table 2 (continued)

Jurisdiction	Act	Regulation/Section	Environmental Assessment Factors
Alberta	<i>Environmental Protection and Enhancement Act (RSA 2000, c E-12)</i>	Environmental Assessment Regulation (AR 112/93)	potential positive and negative environmental impacts of the proposed activity; (c) plans for mitigating potential negative environmental impacts; (d) all public consultation and participation that is, has been or will be occurring with respect to the environmental assessment of the proposed activity.
British Columbia	Environmental Assessment Act (SBC 2018, c 51)	Section 25(2)	The following matters must be considered in every assessment: (a) positive and negative direct and indirect effects of the reviewable project, including environmental, economic, social, cultural and health effects and adverse cumulative effects; (b) risks and uncertainties associated with those effects, including the results of any interaction between effects; (c) risks of malfunctions or accidents; (d) disproportionate effects on distinct human populations, including populations identified by gender; (e) effects on biophysical factors that support ecosystem function; (f) effects on current and future generations; (g) consistency with any land-use plan of the government or an Indigenous nation if the plan is relevant to the assessment and to any assessment conducted under section 35 or 73; (h) greenhouse gas emissions, including the potential effects on the province being able to meet its targets under the Greenhouse Gas Reduction Targets Act; (i) alternative means of carrying out the project that are technically and economically feasible, including through the use of the best available technologies, and the potential effects, risks and uncertainties of those alternatives; (j) potential changes to the reviewable project that may be caused by the environment; (k) other prescribed matters.
Yukon	Yukon Environment and Socio-economic Assessment Act (S.C. 2003, c. 7)	Section 42	In conducting an assessment of a project or existing project, a designated office, the executive committee or a panel of the Board shall take the following matters into consideration: (a) the purpose of the project or existing project; (b) all stages of the project or existing project; (c) the significance of any environmental or socio-economic effects of the project or existing project that have occurred or might occur in or outside Yukon, including the effects of malfunctions or accidents; (d) the significance of any adverse cumulative environmental or socio-economic effects that have occurred or might occur in connection with the project or existing project in combination with the effects of other projects for which proposals have been submitted under subsection 50(1) or any activities that have been carried out, are being carried out or are likely to be carried out in or outside Yukon; (e) alternatives to the project or existing project, or alternative ways of undertaking or operating it, that would avoid or minimize any significant adverse environmental or socio-economic effects; (f) mitigative measures and measures to compensate for any significant adverse environmental or socio-economic effects; (g) the need to protect the rights of Yukon Indian persons under final agreements, the special relationship between Yukon Indian persons and the wilderness environment of Yukon, and the cultures, traditions, health and lifestyles of Yukon Indian persons and other residents of Yukon; (h) the interests of residents of Yukon and of Canadian residents outside Yukon; (i) any matter that a decision body has asked it to take into consideration; and (j) any matter specified by the regulations.
Northwest Territories	Mackenzie Valley Resource Management Act (S.C. 1998, c. 25)	Part 5 – Mackenzie Valley Environmental Impact Review Board	Impacts predictions: The impacts that could happen to the biophysical, social, economic, and cultural environment are described in the Developer's Assessment Report. The developer also cites any traditional knowledge research, scientific studies and literature reviews. Significance: The developer will state its opinion on the significance of the impacts. However, keep in mind the Review Board makes the final decision on significance at the end of the environmental assessment. Mitigation measures: The developer will explain the methods it will use to reduce or avoid the impacts predicted. • Cumulative effects assessment: The developer will identify other activities in the area, what the project's combined effect is with other activities on the environment, and the people. The developer must also include ways to manage these cumulative effects.
Northwest Territories	Inuvialuit Final Agreement (1984)	Sections 11, 12, 13	Scope of issues: What VCs are most likely to be subject to interactions with the proposed Development, and how can changes to the VCs be measured through identification of indicators and measurable parameters; b. Geographic scope: How big of an area may be subject to direct and indirect impacts from the proposed Development, for each VC; and c. Temporal scope: How far back in time do we need to look to establish baseline conditions against which to assess change over time to date, and how far in the future should the assessment be required to predict Development-related impacts.
Nunavut	Nunavut Planning and Project Assessment Act (S.C. 2013, c. 14, s. 2)	Nunavut Impact Review Board Guidelines	Using both traditional knowledge and recognized scientific methods, the NIRB assesses the potential biophysical and socio-economic impacts of proposals and makes recommendations and decisions about which projects may proceed. The Board may also establish monitoring programs for projects that have been assessed and approved to proceed.

British Columbia (2016) Consisting of a policy, procedures, and decision-support tools, the framework was created to complement current land management legislation, land use plans, and best practices in the natural resource sector. The policy itself provided details that outlined the systematic steps involved in conducting a cumulative effects assessment. Steps included selecting values to assess (e.g., wild-life species of particular concern that are identified as priority species or in First Nations agreements), defining a standard assessment protocol for each value (involving a summary of best available knowledge and data to support assessment, including supporting rationale for selected benchmarks), and assessing the condition and trend of each value. The policy emphasized the importance of reporting on value conditions annually and periodically, at both provincial-wide and area-specific scales.

Another cumulative effects document we found at the sub-national level was the Land-use Framework (2008) developed by the Government of Alberta. The Land-use Framework stated that it “sets out an approach to manage public and private lands and natural resources to achieve Alberta’s long-term economic, environmental and social goals.” Using said approach, the province was delineated into seven distinct regions, and seven corresponding regional plans were created to ensure current and future planning for land use, water and air quality are aligned with each other. The framework highlighted that within each region, a cumulative effects management approach would be used in regional plans to manage the combined impacts of existing and new activities within the region. This regional perspective denotes a shift from the traditional assessment system in the province that considered environmental effects on a project-by-project basis.

Our scan also identified the 2021–2025 Action Plan for the Northwest Territories Cumulative Impact Monitoring Program (Government of Northwest Territories 2021). The plan funds monitoring and research projects to better understand the impact of large landscape changes to its priority valued components. According to the Cumulative Impact Monitoring Program, the program supports effects-based-and stressor-based approaches to generate needed information for decision-makers. Meaningful partnerships with Indigenous governments and organizations in the design and delivery of the program are a legal requirement and key to the program’s success (Government of Northwest Territories 2021). Similarly, there is the Nunavut General Monitoring Plan, which outlines the approach for cumulative effects environmental monitoring for the state of Nunavut. While the plan did not explicitly refer to the environmental monitoring in question as “cumulative effects monitoring”, the plan stated that it will “serve to weave a tapestry of credible monitoring information that is illustrative of the overall state and health of Nunavut’s

environment.” Data gathering that includes both traditional and scientific knowledge was identified as foundational to Nunavut’s plan. A common theme throughout these sub-national cumulative effects guidance documents is the need for the implementation of long-term monitoring as well as evaluating these effects at a regional scale as oppose to a project scale.

International Legislation and Policies for Cumulative Effects of Clean Growth Initiatives

As for international legislation and policy for cumulative effects assessment of clean growth projects, our search generated multiple hits (See Table 3). First, we came across the U.S. Inflation Reduction Act, which was introduced in 2022. One of the avenues established in the act to curb inflation was to invest in domestic energy production and promote clean energy (*Inflation Reduction Act 2022*). A complementary clean energy guidebook was found that set out the vision and strategy for the U.S. to remain a global leader in clean energy technology, manufacturing, and innovation. Neither the legislation nor the guidebook explicitly discussed the assessment of cumulative effects of clean growth projects.

We did, however, find a published cumulative effects report from the U.S. Environmental Protection Agency (EPA). The report identified gaps and barriers in cumulative impacts research, as well as recommendations for advancing cumulative impact research going forward. Gaps included the identification and characterization of stressors, methods to conduct analyses of cumulative impacts, and a lack of high-resolution data (U.S. EPA 2022). Barriers to overcoming these gaps included a lack of expertise, relationship-building, and resource stability to follow through on results (U.S. EPA 2022). The report laid out five research recommendations for cumulative impacts assessment: (1) establish decision context and partner engagement, (2) address scientific considerations for meeting partner needs, (3) empower local decisions and actions through science, (4) support science translation and delivery, and (5) provide research management support for cumulative impact assessment (U.S. EPA 2022).

In the E.U., our scan highlighted the Renewable Energy Directive (Revised Directive EU/2023/2413), which set the legal framework for clean growth across the E.U. economy. Specifically, the directive aimed to maintain the E.U. as a global leader in renewable energy, with a revised renewable energy target of 42.5% by 2030 (E.U. 2023). However, the Renewable Energy Directive did not make mention of, or provide guidance for, cumulative effects assessment for clean energy projects but does require strategic environmental assessment (SEA) which under the E.U. SEA Directive includes cumulative effects assessment and spans

Table 3 International Examples of Environmental Legislation and/or Policy that Related to Clean Energy and/or Cumulative Effects

Country	Name of Legislation and/or Policy	Link	How clean energy and/or cumulative effects are considered	Direct Legislation and/or Policy related to cumulative effect and clean energy?
United States of America	Inflation Reduction Act (2022)	https://www.congress.gov/117/bills/hr5376/BILLS-117hr5376enr.pdf	Invest in domestic energy production and promote clean energy	No
United States of America	Inflation Reduction Act Guidebook	https://www.whitehouse.gov/cleanenergy/inflation-reduction-act-guidebook/	Sets out the vision and strategy for the U.S. to remain a global leader in clean energy technology, manufacturing, and innovation	No
United States of America	Cumulative Impacts Research - Recommendations for EPA's Office of Research and Development	https://www.epa.gov/system/files/documents/2022-09/Cumulative%20Impacts%20Research%20Final%20Report_FINAL-EPA%20600-R-22-014a.pdf	Identified gaps and barriers in cumulative impacts research, as well as recommendations for advancing cumulative impact research going forward.	Yes
European Union	Renewable Energy Directive (Revised Directive EU/2023/2413)	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023L2413&qid=1699364355105	Set a legal framework for clean growth across E.U. and aimed to maintain the E.U. as a global leader in renewable energy, with a revised renewable energy target of 42.5% by 2030	No
European Union	Environmental Impact Assessment Directive (2011/92/EU as amended by 2014/52/EU)	https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052&from=FR	Requires impact assessments to be conducted before any major project or development in the E.U.	No
United Kingdom	Cumulative Effects Framework for Key Ecological Receptors	https://www.ceh.ac.uk/our-science/projects/cumulative-effects-framework-key-ecological-receptors	A framework to address impacts of all planned and constructed projects of offshore renewable developments on key ecological receptors (e.g., seabirds, marine mammals) across all seasons, over multiple years, at multiple population scales	Yes
Australia	Cumulative Impact Assessment Guidelines for State Significant Projects (NSW)	https://www.planning.nsw.gov.au/sites/default/files/2023-03/cumulative-impact-assessment-guidelines-for-ssp.pdf	Comprehensive framework in place for assessing cumulative impacts and facilitating ecologically sustainable growth	Yes
Australia	Environment Protection and Biodiversity Conservation Act 1999	https://www.legislation.gov.au/C2004A00485/latest/versions	National environmental legislation that protects and manages nationally and internationally important plants, animals, habitats and places which are impacted by an action	No
New Zealand	Aotearoa Cumulative Effects (ACE) framework	https://www.sustainableseaschallenge.co.nz/tools-and-resources/ace-framework/#:~:text=The%20Aotearoa%20Cumulative%20Effects%20(ACE)%20framework%20is%20a%20tool%20that,in%20an%20iterative%2C%20cyclical%20manner	A tool that guides collaborative CE management across a range of scales	No

plans and programs. We also found the Environmental Impact Assessment Directive (2011/92/EU as amended by 2014/52/EU), which required impact assessments to be conducted before any major project or development in the E.U. In that case cumulative effects were not mentioned in the main document but are covered in Annex IV.

The U.K. was the only jurisdiction we found to have policy guidance for cumulative effects assessment of clean

growth projects; specifically, offshore renewable developments. Marine Scotland, the Scottish government directorate for managing Scottish seas, commissioned a project to develop a tool for assessing cumulative effects of energy development on key ecological receptors, like seabirds and other marine mammals. Given the accelerated rate of construction of offshore renewable projects, a framework was identified as needed to address impacts of all planned

and constructed projects on key receptors across all seasons, over multiple years, at multiple population scales (U.K. Centre for Ecology & Hydrology 2022). Key objectives of the proposed framework are to create robust methods for cumulative effects assessment, provide a baseline of current effects, and maintain flexibility to add new projects to update cumulative effects assessments scales (U.K. Centre for Ecology & Hydrology 2022).

Policy guidance regarding cumulative effects assessment was also found in Australia, specifically the state of New South Wales. A document titled “Cumulative Impact Assessment Guidelines for State Significant Projects” described the comprehensive framework in place for assessing cumulative impacts and facilitating ecologically sustainable growth. As stated under the framework, strategic assessments are conducted “to identify and assess impacts, including cumulative impacts and how environmental, social, and economic conditions change over time,” and strategic plans or actions are set out to “mitigate and monitor these impacts and encourage continuous improvement in the mitigation of these impacts over time” (New South Wales Government 2022). On the federal level, *The Environment Protection and Biodiversity Conservation (EPBC) Act* (1999), Australia’s main national environmental legislation which provide protection and management of nationally and internationally important plants, animals, habitats and places, incorporates understanding cumulative effects within their strategic project assessments when projects have the potential to impact matters of national environmental significance (Court et al. 1994). Although there are no explicit guidelines within this document to address clean growth activities, many clean growth activities have the potential to impact matters of national environmental significance, such as protected flora, fauna or communities which are protected under the regulations. The EPBC Act has recently come under scrutiny, in particular during the 2020 Samuel Review which concluded that cumulative impacts are not systematically considered, and decisions are made project by project and only if projects exceed a size (Samuel 2020).

Guidance regarding cumulative effects is also present in New Zealand regarding the cumulative effects at a national level. The Aotearoa Cumulative Effects (ACE) framework is used to guide the management of various cumulative effects over a range of scales. The aim is to support practitioners to take a “systems approach” to managing cumulative effects and allow practitioners to make more informed decisions using existing legislation. Similar to other national guidance documents, there are no explicit mentioned to clean growth cumulative effects, but many clean growth activities are likely to be evaluated using this guidance document.

Synthesis and Policy Insights

Our policy scan identified very few documents that explicitly inform cumulative effects assessment for clean growth projects in Canada. There was an overall lack of overlap between the topics of clean growth and cumulative effects, and the two policy landscapes seemed rather mutually exclusive in the Canadian context. In general, we found the topic of clean growth to be of strong interest across Canada, especially as clean growth plans have already been developed by all provinces and territories. While clean growth plans are defined and moving forward across the country, progress towards understanding how to identify and manage associated cumulative effects is underdeveloped in many if not all jurisdictions.

Scans across Canada revealed that the Arctic and Pacific regions are provincial/territorial leaders in cumulative effects policy, particularly in the natural resource sector. For instance, both British Columbia and Alberta have established frameworks that use regional assessments to monitor and predict impacts on valued ecosystem components. In the territories, cumulative effects considerations have been integrated into enabling federal environmental legislation since the late 1990s, and cumulative effects monitoring programs are already established. Even though governments in Arctic and Pacific Canada are likely more familiar with best practices for cumulative effects assessment compared to other regions, there is still limited guidance available respecting how to tailor current approaches for clean growth projects that use newer and lesser-understood technologies. In Central and Atlantic Canada, the policy landscape for cumulative effects assessment appears to still be evolving while the deployment of clean growth projects has been rapid. This is especially true for Newfoundland and Labrador and Nova Scotia offshore area, where the continental shelf has gained global reputation for being a suitable area for wind energy projects (Government of Nova Scotia 2023).

It is difficult to know why there are so few established policies for cumulative effects assessment of clean growth projects in Canada. Since the release of the Pan-Canadian Framework in 2016, we speculate that whole-of-government energy at all levels was dedicated to developing provincial and territorial clean growth plans to keep up with global competition. While energy was spent developing the clean growth agenda, perhaps cumulative effects considerations were less prioritized, or identified by governments as a consideration to be tackled after clean growth projects break ground. This may explain why targeted emails did not produce any results that were not already identified by our scan. Furthermore, the reality that policies and associated regulations can be established on many different jurisdictional levels (e.g., Federal, Provincial/

Territorial, Regional) throughout Canada may also be a factor in few established policies for cumulative effects assessment of clean growth projects in Canada. In many cases there is often overlap between jurisdictions and understanding the responsible bodies for establishing policy for cumulative effects of clean growth may be challenging and confusing.

We came across a number of published documents from coast to coast to coast demonstrating the use of cumulative effects assessment in practice for various types of projects. In considering the variety of examples across distinct geographical regions of the country, we generated four policy insights to assist the development of nationally consistent cumulative effects assessments in Canada for clean growth. These include; (1) adopt a regional approach that considers local context, (2) support the development of valued ecosystem components, (3) conduct rigorous and comprehensive baseline monitoring, and (4) prioritize collaborative governance including with Indigenous governments and communities. These insights are particularly salient to clean growth but are also broadly relevant to cumulative effects assessments spanning other forms of development. We recommend that these four policy insights be incorporated into future policies regarding cumulative effects assessment of clean growth projects.

Regional Perspectives

A common theme found in scanned policy documents was an overall shift from project-specific to region-specific cumulative effects assessments. According to the IAAC technical guidance document (IAAC 2018), cumulative effects should be assessed relative to a goal in which the effects are managed on a regional basis. It is generally agreed that cumulative effects assessment should go beyond the evaluation of site-specific, direct, and indirect project impacts to encompass broader regional understandings and considerations of the sources of cumulative environmental change (Harriman and Noble 2008; Davey et al. 2000). The premise of a regional perspective is that the boundaries of an area subject to cumulative effects from numerous development projects do not align with political boundaries (e.g., provincial jurisdiction, regional municipalities, cities, or townships).

An exemplary case of a regional perspective put into action is Alberta's Land-Use Framework. Under the *Alberta Land Stewardship Act* (2009), regional plans are established that inform land-use decisions, guide the region toward publicly desired outcomes, direct strategies, and actions to achieve regional vision, and enable the achievement of strategies and actions. Land-use regions were created to be congruent with the province's major watersheds and municipal boundaries. Being that different regions (and

their peoples) have different needs and desired outcomes, regional plans consider how cumulative effects of a specific project type may differ across regions (Government of Alberta 2012). For instance, a proposed clean growth project would be projected to have different cumulative effects in the South Saskatchewan Region, which is home to 44% of the Alberta's population, as compared to the Lower Peace Region, which includes Wood Buffalo National Park and stretches north to the Alberta-Northwest Territories border. Similarly, the British Columbia Cumulative Effects Framework was also rooted in a regional vision. British Columbia has been delineated into eight regions for which assessments are conducted and reported upon regularly (Province of British Columbia, 2016).

What does this mean for clean growth projects? In jurisdictions like Alberta with a regional vision already in place, it can be assumed that cumulative effects assessment for clean growth projects will fit relatively easily into established frameworks. In jurisdictions without regional visions and desired outcomes set in place, the path forward for cumulative effects mitigation and management is less clear. In the absence of regional planning, project-specific cumulative effects assessments may become the fallback since the processes for completing and submitting single project applications to an administrative agency are already developed in impact assessment policy.

Valued Components

Selecting valued components is a core component of cumulative effects assessment. According to technical guidance from IAAC, practitioners should consider effects of proposed projects (including clean growth projects) on valued components due to interactions with other actions, and not just the effects of the single action under review (IAAC 2018). In British Columbia's Cumulative Effects Framework, valued components "provide the foundation for the entire assessment, including the assessment of potential effects, and so appropriate valued component selection is one of the most important steps in ensuring high quality environmental assessment" Province of British Columbia 2016.

When considering cumulative effects of clean growth projects, valued components should be identified so that changes to their baseline condition due to proposed clean growth projects can be estimated and mitigated. Valued components should matter to people and government, and be seen as important for the wellbeing of communities, economies, and ecosystems (Province of British Columbia 2016). In British Columbia, valued components in the Cumulative Effects Framework include forest biodiversity, old growth forest, aquatic ecosystems, grizzly bear, and moose. For every valued component, standard assessment

protocols for assessing their condition have been developed, and “Current Condition Reports” report on the condition of each valued components in relation to state indicators (Province of British Columbia 2016). In the Northwest Territories Cumulative Impact Monitoring Program, valued components include caribou, water, and fish. Valued components are used internationally, too, as Marine Scotland considers the effects of offshore wind production to seabird and other mammal populations (U.K. Centre for Ecology & Hydrology 2022).

Literature reinforces that selecting valued components is not a well-documented and standardized practice (Olagunju and Gunn 2015). In fact, while the central role of valued components in both project-based impact assessment and cumulative effects assessment has long been established (Canter and Ross 2010; Johnson et al. 2011), there has been little research done to examine the principles, processes and rationales applied to valued component selection (Olagunju and Gunn 2015). As such, the guidance document from IAAC provides information on the identification of valued components for cumulative effects assessment to support a consistent national approach. According to IAAC’s policy guidance, “the cumulative environmental effects assessment must consider other physical activities that have been carried out up to the time of the analysis or will be carried out in the future, provided that these physical activities are likely to have an environmental effect on the same valued components that would be affected by residual environmental effects of the designated project.” (IAAC 2018). In the context of clean growth projects, it remains unclear if selected valued components would be the same, or if they would differ from those of natural-resource-sector-based projects, but due to the nature of clean growth projects and the reliance on many natural resources, it is likely there will be some overlap between the two sectors. A good example of overlap is in the CEA methods/analysis of impacts on bird life that was developed for the offshore oil and gas industry in Scotland (Ronconi et al. 2015) which is now one of the most important CEA issues for offshore wind. For clean growth projects, valued components should remain central to cumulative effects assessment, and jurisdictions should begin to consider what their valued components are as the clean growth agenda pushes on.

Baseline Monitoring

Adequate baseline monitoring is also a core component that is needed before the cumulative effects of clean growth can be assessed. Insight from our scan indicated that the collection of high-resolution and high-quality data is essential to support data-driven decision making, which will ultimately help achieve promised outcomes for clean growth initiatives. The IAAC guidance document (2018)

underscores the importance of data collection in cumulative environmental effects assessment, yet it also acknowledges that it may be challenging to obtain or generate data to support analyses (IAAC 2018). In the U.S. cumulative effects report, high-resolution data collected was listed as one of the major barriers to broader cumulative effects research (U.S. EPA 2022).

While there are indeed difficulties involved in generating the type of data needed to effectively assess cumulative effects of clean growth projects, the province of Alberta has shown that effective monitoring regimes can be realistically achieved. Alberta has taken the approach of developing a common set of indicators that represent the broad economic, environmental, and social outcomes desired for the region. The provincial government is responsible for collecting data for these indicators across regions, and for monitoring trends in the data that show changes occurring in the region (Land-Use Framework 2008). For instance, each region reports on broad economic, environmental, and social indicators through a variety of data that are presented on a dashboard reporting interface (<https://lufereporting-esrd.hub.arcgis.com/>). Using the dashboard, the public can learn about year-over-year trends for various sub-indicators, including the daily oil sands production rate (i.e., economic sub-indicator), percentage of conserved land in the province (i.e., environmental sub-indicator), or rental affordability (i.e., social sub-indicator).

In jurisdictions where monitoring data is scarce, as is the case in the Northwest Territories, cumulative effects cannot adequately be assessed in high-industry and exploration areas. The Northwest Territories Cumulative Impact Monitoring Program has addressed this scarcity through prioritizing areas with inadequate baseline data and providing support for baseline monitoring in these areas. As exploration activities continue to occur in the Canadian Arctic for the purposes of primary clean growth initiatives pertaining to critical minerals, obtaining adequate baseline data for valued components across regions is imperative to identify and mitigate cumulative effects prior to their negative impacts or even prior to implementation.

Collaborative Governance

Through the lens of collaborative governance, one of the most important factors affecting the success of regional monitoring programs in identifying cumulative effects in clean growth activities is related to trust and credibility (Cronmiller and Noble 2018; Hegmann and Yarranton 2011). When trust and credibility are lacking, key partners may choose not to participate in the governance process, resulting in unbalanced decision making (Cronmiller and Noble 2018; Emerson et al. 2012). According to Emerson and Nabatchi (2015), one or more of the following drivers

are essential for collaboration between partners to unfold: leadership, consequential incentives, interdependence, and uncertainty. Lessons can be learned from the Canadian Arctic, where collaborative governance and shared decision-making are built into the foundation of regional monitoring programs that track cumulative effects.

The Nunavut General Monitoring Plan and the Northwest Territories Cumulative Impact Monitoring Program are two successful examples of collaborative governance in cumulative effects assessment. Under the *Nunavut Land Claims Agreement* (1993), the Government of Canada is required to work with its Nunavut partners to collect and analyze information relating to the ecosystemic and socio-economic health of the territory. As such, the Nunavut General Monitoring Plan is an “ecosystemic and socio-economic environmental monitoring initiative that aims to support, facilitate and coordinate the collection, analysis, management and dissemination of information regarding the long-term state and health of the environment in Nunavut” (Weaving our Tapestry 2012). Within the three types of environmental monitoring in the program (baseline, effect, and compliance monitoring), there are opportunities to build collective monitoring capacity in Nunavut through meaningful and lasting partnerships (Weaving our Tapestry 2012).

In the Northwest Territories, cumulative impact monitoring is an explicit legal requirement. In their Cumulative Impact Monitoring Program, the use of traditional knowledge in cumulative impact monitoring is a program priority. The program states, “the Steering Committee defines traditional knowledge as facts, information, skills, values, and beliefs which have been acquired through experience, observations or by oral means from the land or from the spiritual teachings handed down through generations” (Government of Northwest Territories 2021). In this way, the goal of the program is to apply what is learned from traditional knowledge to inform decision making in the north. The same theme is used in the Alberta Emissions Reduction and Energy Development Plan, where traditional knowledge is considered in development decisions. In the plan, Indigenous communities are at the forefront of lowering emissions, responsible energy development and protection of wildlife, forests, land, and water (Government of Alberta 2023).

There is no doubt that the pathway to achieving clean growth goals in a sustainable manner must include trusted partnerships with Indigenous governments and communities. This may entail increasing supports for Indigenous participation and investment in clean technology and energy projects, as was seen in Alberta’s Emissions Reduction and Energy Development Plan (Government of Alberta 2023). In this way, the economic benefits achieved through the clean growth transition are enabled to flow to Indigenous communities, too. There are various avenues to develop

trusted partnerships, one of which may include negotiating agreements, such as Memorandums of Understanding, with key decision-makers and information providers (Nunavut General Monitoring Plan 2012).

Conclusion

Our policy scan highlights the current lack of overlap in the topics of clean growth and cumulative effects in Canada. However, based on our more limited scan in other jurisdictions, this seems to be somewhat of a global pattern although there are notable exceptions. For example, there is an excellent sector-specific example related to offshore wind farms in The Netherlands (Ministry of Economic Affairs and Climate, Netherlands 2015). Moreover, the International Association for Impact Assessment (IAIA) has recently released (Version 1 in July of 2024) guidance for renewable energy development which includes content specific to cumulative effects (see <https://www.iaia.org/improving-decision-making-for-the-energy-transition.php>). That document provides useful guidance for those working on clean growth and wishing to include cumulative effects in environmental effects assessments. As the implementation of clean growth projects in Canada and around the globe rolls out, it is apparent that policy guidance for cumulative effects management of these projects is lagging somewhat relative to the development of clean growth projects themselves (notwithstanding the recent IAIA guidance). Policy documents outlining approaches and best practices from sub-national and national levels as well as selected other jurisdictions provided insight for the development of a nationally consistent approach for cumulative effects assessment of clean growth in Canada. We conclude that cumulative effects assessments for Canadian clean growth projects should embrace a regional perspective, develop valued components that are relevant to clean growth projects, conduct baseline monitoring for valued components, and exercise collaborative governance so that all communities can realize the positive outcomes promised by clean growth. It is worth noting that these suggestions/principles could also be argued to be somewhat germane to projects and programs beyond those specific to clean growth (Noble et al. 2017). We make that observation recognizing that perhaps existing frameworks will be sufficient but that remains to be seen. What is clear is that there is no reason to think that the same principles identified here would not apply to other jurisdictions around the globe interested in using a cumulative effects lens for considering and managing clean growth. Furthermore, despite the best intentions of creating policies, throughout Canada and the globe, to address cumulative effects in clean growth, policies are only effective if implemented

properly and continuously by both users and managers. Although strong policies exist, without proper implementation and the capacity to implement these mandates, such as monitoring of cumulative effects over time, the strength of the policy is irrelevant. Therefore, development of policies must work alongside managers and user groups to understand the realistic and achievable nature at implementing clean growth cumulative effect policies in the “real world”.

Data Availability

Data is provided within the tables in the manuscript.

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Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

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