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Wind energy environmental assessment requirements and processes: An uneven landscape

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Abstract

Environmental assessment (EA) is an important entry point to the development of renewable energy projects, yet the role of EA in the renewable energy sector remains poorly understood in comparison to its role in assessing and managing the potential impacts of traditional fossil fuel-based energy developments. This paper examines the requirements and provisions of EA for renewable energy development, specifically wind energy development, across Canada and the implications for renewable energy transition. Results show considerable variability in EA requirements and provisions for wind energy, including such factors as EA timelines, screening approaches, proponent responsibilities for consultation, and whether a proposed wind energy development even triggers an EA review. Differences in EA systems and procedures for wind energy projects may have implications for the predictability of EA and the relative attractiveness of certain jurisdictions for wind energy developers. As countries transition to renewable energy technologies to meet climate change targets and to deliver sustainable energy to remote and developing regions, the role of EA in balancing good environmental reviews with the pressing need to build and operate renewable power production requires further attention. This paper outlines four areas where improvements are needed in EA systems to meet these dual objectives.

Keywords

renewable energy; wind energy; environmental assessment; energy transition

Introduction

Renewable energy technologies are essential to decarbonization of the global electricity sector and meeting growing power demand (Chapman et al. 2018, Potvin et al. 2017). The International Renewable Energy Agency (2020) reports that the share of renewables in global power generation will need to double by 2030 in order to transition energy systems toward sustainable development goals. Canada's electricity industry generated approximately 652 terawatt-hours of electricity in 2017 (NRCan 2019). Non-hydro renewable sources comprised only 7% of Canada's electricity generation by source; approximately 60% was generated by large-scale hydroelectric plants, followed by nuclear (15%), oil and gas (10%) and coal (9%) (NRCan 2019). As party to the Paris Agreement, Canada has committed to climate change mitigation and emissions reduction, including the Pan-Canadian Framework on Clean Growth and Climate Change and Mid-Century Long-Term Low-Greenhouse Gas Development Strategy. The Government of Canada has also committed to an electricity system that is 90% non-emitting by 2030. Commitments are equally ambitious in many of Canada's provinces and territories. Saskatchewan, for example, Canada's largest per capita emitter of greenhouse gases, has committed to increase renewable energy from 25% of its energy mix in 2014 to 50% by 2030, and to an increase in wind-generated energy from 5% to 30% of total generating capacity (SaskPower 2016). Wind is the primary source of new electricity generation in Canada, with an average annual growth rate of 18% over the last five years (CWEA 2020), but still comprises only 5% of national electricity generation (NRCan 2019).

Harnessing renewable energy sources, including wind, will require the development of new energy infrastructure – including new generation projects, uptake of land and, in some regions, new transmission infrastructure (Batille et al. 2015). Renewable energy is essential to a low carbon future, but renewable energy projects are not without adverse impacts, and these need to be acknowledged and mitigated (Hanna et al. 2019). Impacts can include habitat and wildlife, land use and social conflicts, lifecycle impacts, and impacts to Indigenous lands and resources (Geißler et al. 2013). Environmental assessment (EA) plays an important role in renewable energy planning, and thus in facilitating energy transition. EA is not the *only* legislation or mechanism to plan for and manage the impacts of renewable energy projects, including wind energy. Depending on the jurisdiction, various permitting and land use planning regulations may apply, addressing a range of factors from biodiversity conservation to feed-in tariffs. However, EA is often considered to be a universally applicable tool (Smart et al. 2014) and a primary instrument for identifying, assessing, and finding ways to manage the impacts of proposed developments, including renewable energy projects (Hanna et al. 2019).

There is an extensive literature on the impacts of renewable energy, including wind energy (see Langbroek and Vanclay 2012, Dai et al. 2015, Hanna et al. 2019); however, research addressing the role of EA in supporting renewable energy transition is relatively limited (Smart et al. 2014, da Silva et al. 2019). Research that does exist indicates an enduring concern that EA may be inconsistently applied (da Silva et al. 2019), a "source of delay and obstruction" (Jay 2010: 494), and stifling renewable energy growth (Schumacher 2017, Ryan et al. 2019), thus emphasizing the need to identify and resolve potential EA administrative and procedural challenges to renewable energy projects (Geißler et al. 2013, Smart et al. 2014, Schumacher 2017, Fischer et al. 2019). This is especially the case in Canada, where EA has been criticized by some in the energy industry as a cumbersome process characterized by excessive bureaucracy and administrative burden, resulting in project delays and litigation (Hunsberger et al. 2020; Macintosh et al. 2018). However, most research and policy attention has focused on large-scale fossil-fuel projects assessed under the federal EA system, often recommending harmonization of provincial and federal EA (e.g. Powell 2015). The implications of EA procedures for renewable energy projects, including wind development, across Canada's provincial and territorial jurisdictions has not been explored.

In Canada, for onshore wind energy projects, EA is typically the responsibility of each of the provincial and territorial governments. Variability in permitting and authorization requirements, including EA systems and procedures, can cause confusion for new, first-time developers entering the renewable energy market, or favor some jurisdictions over others in terms of attracting renewable energy investors and meeting jurisdictional (and thus national) energy and climate commitments (see Iglesias et al. 2011, Geißler et al. 2013, Smart et al. 2014, Schumacher 2017). Research in Canada has examined variability in electricity regulations on such matters as export, ownership, taxation, and rate structures, and the relationship between political power and renewables deployment (Christian and Shipley 2019; Taylor 2019), but there is a lack of understanding of the requirements and variability of EA processes for renewable energy. Jurisdictional differences can significantly influence the nature and pace at which renewable energy development takes shape (Portman et al. 2009, da Silva et al. 2019).

EA helps "guide decisions as to where renewable devices should be best placed and under what circumstances consent for building or operating these devices should be refused" (Maclean et al. 2014), but concerns raised by the energy sector about certainty, timeliness, and complexity of EA systems (Hunsberger et al. 2020) have received only limited research attention in the context of renewable energy. Although EA is theorized as a tool to broker knowledge for achieving sustainable outcomes (Partidario and Sheate 2013), its role in energy transition remains poorly understood. This paper examines the requirements and variability of EA for *onshore* wind energy development across Canada and the

implications for renewable energy transition. The focus is on the EA procedural requirements of proponents when applying to develop wind energy projects. This study identifies opportunities for improved clarity and coordination of EA procedures as a means to enhance the effectiveness of EA in energy transition. Although focused on the Canadian context, the results and recommendations are likely to be of relevance to other countries with diverse EA systems and requirements.

Context and method

Hydro, wind, tidal, geothermal, solar, and biomass are Canada's renewable energy sources that contribute to the current electrical generation mix, with geothermal (heat pump), solar (thermal) and biomass also contributing to space heating and industrial processes. Although hydro dominates Canada's primary sources of renewable energy, wind energy is the nation's fastest growing energy source in terms of installed capacity (CWEA 2020). In 2004, total installed wind power capacity was 444 megawatts; by the end of 2019 this had increased to 13,414 megawatts (Table 1) (CWEA 2020).

Table 1: Renewable energy (electrical generation) and wind energy capacity, 2018.

Jurisdiction[1]	GHG per capita tCO_2e[2]	Total electric generation (MWh) by source (%)[3]							Wind energy[6]	
		MWh	*fossil fuels*	*hydro*	*nuclear*	*wind*	*solar*	*all other*	*# projects*	*Installed capacity (MW)*
Canada	19.6	640,087,117	19.9%	59.8%	14.8%	5.1%	0.3%	≤0.1%	301	13,413
AB	62.4	77,161,279	91.8%	2.6%	--	5.3%	≤0.1%	0.3%	38	1,685
BC	12.3	69,080,321	8.1%	89.4%	--	2.5%	≤0.1%	--	9	713
MB	15.9	31,712,590	0.3%	97.0%	--	2.7%	--	--	4	258
NB	20.0	13,531,316	39.2%	18.7%	36.0%	6.1%	--	--	6	314
NL	20.3	43,633,614	3.7%	95.8%	--	0.5%	--	--	4	55
NS	16.5	10,171,478	79.4%	9.1%	--	11.3%	--	0.2%	78	616
NT	36.2	758,875[4]	64.2%	33.3%	--	2.4%	≤0.1%	--	1	9
NU	18.9	194,366	100%	--	--	--	--	--	0	--
ON	11.5	156,110,747	8.7%	24.5%	57.7%	7.7%	1.4%	--	94	5,436
PE	12.2	648,300	1.3%	--	--	98.6%	≤0.1%	--	10	204
QC	9.5	212,780,155	1.1%	93.8%	--	5.0%	≤0.1%	--	47	3,822
SK	66.9	23,826,226	82.0%	15.1%	--	2.9%	--	--	8	241
YT	11.8	477,850	12.4%	87.6%	--	--[5]	--	--	2	0.8

[1]Alberta (AB); British Columbia (BC); Manitoba (MB); New Brunswick (NB); Newfoundland and Labrador (NL); Nova Scotia (NS); Northwest Territories (NT); Nunavut (NU); Ontario (ON); Prince Edward Island (PE); Quebec (QC); Saskatchewan (SK); Yukon Territory (YT).

[2]Canada Energy Regulator, Provincial and Territorial Energy Profiles https://www.cer-rec.gc.ca/nrg/ntgrtd/mrkt/nrgsstmprfls/ab-eng.html.

[3]Includes electric producer utilities and other industries producing power that are not part of the electric power generation, transmission, and distribution industry. Statistics Canada Table 25-10-0020-01 https://www.statcan.gc.ca/eng/start.

[4]Over 45% of electric generation in NT is by industries other than electric producer utilities.

[5]Yukon generated electricity from wind in each of 2014 to 2017, averaging less than 1.0% of total generation. No generation is reported for 2019.

[6]Canadian Wind Energy Association, Installed Capacity https://canwea.ca/wind-energy/installed-capacity/.

Installed wind energy capacity is variable across Canada. There are currently 301 onshore wind farms, the largest of which is the 300-megawatt Lac Alfred project in Quebec (NRCan 2020). Ontario has the most installed wind energy capacity (5,076 megawatts), the most wind farms, and experienced the biggest growth in installed capacity (360 megawatts) in 2019 (CWEA 2020). Wind dominates electric generation (> 98%) in Prince Edward Island. Nunavut is currently the only jurisdiction without installed wind generation capacity. The only wind energy project in the Northwest Territories is owned by the Diavik Diamond Mine, deployed on a diesel microgrid to support the mine's operations. The Canada Energy Regulator's futures outlook indicates an increase of 14% in total electricity generation by 2040, under a "business-as-usual" scenario, with hydro, other renewable sources, and natural gas comprising the bulk of this growth (CER 2019). Wind generation is expected to increase in most all jurisdictions under this scenario, with wind capacity increasing from 13,413 megawatts in 2019 to 23,800 megawatts by 2040.

Across Canada, EA is the primary instrument for identifying and managing the potential impacts of wind energy developments. Proponents applying to develop wind energy must do so through one of two application procedures, depending on jurisdiction: a competitive bid process, whereby government, typically a crown energy corporation, issues a call for project proposals; or an open application process, where proponents identify market or resource potential for wind energy and submit applications for development on a case by case basis. Whether a wind energy project application is part of a competitive bid or open application process has no bearing on EA requirements.

Method

Most wind energy projects in Canada are assessed at a provincial or territorial level – exceptions would include offshore projects or projects located in a national park or protected wildlife area (e.g. migratory bird sanctuary, marine protected area), under the federal *Impact Assessment Act*. Previous research has examined different aspects of the effectiveness of Canadian EA, though primarily at the federal level (Doelle and Sinclair 2019; Noble et al. 2019). Our analysis of provincial and territorial EA for onshore wind energy projects focused on six attributes of key relevance to wind energy developers:

i) what triggers an EA screening or review for a proposed wind energy development,
ii) classes or level(s) of assessment required for wind energy developments,
iii) EA documentation requirements of proponents,
iv) scope of EA and responsibility for setting terms of reference for assessment, including obligations for public review,

v) requirements of the proponent to engage in pre-EA public consultation, and
vi) EA timelines, including timeline for screening determinations and to issue an EA decision.

These attributes are critical to the scope, complexity, and timeline for project approvals and reflect aspects of EA often criticized by the energy sector (Hunsberger et al. 2020) and topics of national EA importance identified in the recent Expert Panel's (2017) report on EA reform in Canada. Analysis consisted of a review of EA legislation, regulations, and guidelines for each jurisdiction (Table 2), and the EA process information described on the jurisdictions' website. To examine EA timelines, we identified a sample of 48 wind energy EAs completed within the last 15 years, from public registries across all jurisdictions, and examined the applications, timelines, and decision statements to determine the median number of days from the time a proponent submitted an environmental impact statement (EIS) until the final EA approval was issued. These are not the only wind energy projects in Canada, but they are the only ones that were subject to EA *and* available in public registries. Although EA is a public process, accessing project documentation was not always easy and, in some cases, required submissions of *access to information* requests to the responsible minister. Our sample is comprehensive of available EAs for wind energy projects, but not necessarily the total number of EAs completed or wind energy projects permitted.

Table 2: EA jurisdictions and documents reviewed.[1]

Jurisdiction	Legislation	Regulations and guidance
AB	Environmental Protection and Enhancement Act (RSA E-12, 2000)	Environmental Assessment Regulation (112/93; 89/2013) Activities Designation Regulation 276/2003; 125/2017) Guide to Preparing Environmental Impact Assessment Reports (AESRD 2013)
BC	Environmental Assessment Act (SBC 2018 c.51)	Reviewable Projects Regulation (67/2020) Early Engagement Policy (BCEAO 2019a) Readiness Decision Policy (BCEAO 2019b) Environmental Assessment User Guide (BCEAO 2019c)
MB	The Environmental Act (SM 1987-88 c.26)	Classes of Development Regulation (E125 – M.R. 164/88) Licensing Procedures Regulation (E125 – M.R. 163/88) Environmental Assessment and Licensing (Government of Manitoba 2018) Environmental Act Proposal Guidelines (Manitoba Sustainable Development 2018)
NB	Clean Environment Act (RSNB 1973 c.C-6)	Environmental Impact Assessment Regulation 87-83 (O.C. 87-558) Guide to Environmental Assessment (Environment and Local Government 2018) Information Requirements for Wind Turbines (Environment and Local Government 2019)
NL	Environmental Protection Act (SNL 2002 cE-14.2)	Environmental Assessment Regulations (54/03) Environmental Assessment Process Guide (Municipal Affairs and Environment 2017)
NS	Environment Act (SNS 1994-95 c.1)	Environmental Assessment Regulations (sec, 1994-95) Developments that Require Assessment (Department of Environment 2017) Regulatory Time Frames for Assessment (Department of Environment 2018) A Proponent's Guide to Environmental Assessment (Department of Environment 2019)

NT	Mackenzie Valley Resource Management Act (SC 1998 c.25)	Environmental Impact Assessment Guidelines (MVEIRB 2004); Engagement and Consultation Policy (MVLWB 2013) Ten-Day Pause Period for Preliminary Screenings (MVEIRB 2019)
NU	Nunavut Planning and Project Assessment Act (S.C. 2013 c.14 s.2)	Proponent's Guide (NIRB 2020) Illustrative Process Guide (NIRB 2018)
ON	Environmental Protection Act (R.S.O. 1990 c.E.19)	Renewable Energy Approvals (O. Reg. 359/09) Technical Guide to Renewable Energy Approvals (Ministry of the Environment, Conservation and Parks 2019)
PE	Environmental Protection Act (R.S.P.E.I 1988 c.E-9)	Environmental Assessment Fees Regulations (Ec244/05, 2011) Environmental Assessment Guidelines (Environment, Labour and Justice 2010)
QC[2]	Environmental Quality Act (SQ 2017 cQ-2)	Regulation Repecting the Environmental Impact Assessment and Review of Certain Projects (CQLR c.Q-2 r.23.1) Directive pour la réalisation d'une étude d'impact sur l'environnement (MELCC 2018a); L'information et la consultation du public dans le cadre de la procédure d'évaluation et d'examen des impacts sur l'environnement: Guide à l'intention de l'initiateur de projet (MELCC 2018b)
SK	The Environmental Assessment Act (S.S. 1979-80 c.E-10.1)	Technical Proposal Guidelines (Saskatchewan Ministry of Environment 2012a) Environmental Assessment in Saskatchewan (Saskatchewan Ministry of Environment 2012b)
YT	Yukon Environmental and Socio-Economic Assessment Act (SC 2007 c.7)	Assessable Activities, Exceptions and Executive Committee Projects Regulations (SOR/2005-379) Decision Body Time Periods and Consultation Regulations (SOR/2005-380) Filing Requirements for Project Proposals (YESAB 2019) Project Proponents and Proposals (YESAB n.d.)

[1]Review focused on the most recent version of EA legislation, regulations, and procedural guidelines. All documents are publicly accessible on the EA website of each jurisdiction.

[2]Quebec has two EA systems: southern Quebec and the James Bay Northern Quebec Aboriginal land claim settlement. The focus was on southern Quebec, under the Environmental Quality Act.

Results

What triggers the EA process?

Two types of EA triggers for wind energy projects were identified: EA is triggered based on project size (e.g. generation capacity), which is specified in regulations; or EA is triggered on a case-by-case basis, using indicative guidance and with no specified thresholds (Table 3). Under the first type of trigger, two sub-models were identified: jurisdictions where wind energy projects are listed in EA regulations and generation thresholds for wind energy projects are specified; and jurisdictions where energy projects and generation thresholds are identified in regulations, but not specifically wind energy projects. In six jurisdictions (Table 3) wind energy projects are specified either under EA regulations or class assessment regulations (see below) along with the thresholds that would trigger EA review; however, the thresholds vary by jurisdiction. In British Columbia, for example, EA is triggered for most energy projects based on generation capacity; however, for wind energy projects the threshold is based on the number of turbines and their location. Facilities with 15 or more turbines are subject to review, as are wind facilities with at least one turbine located in water and a total of 10 or more turbines. In Prince Edward Island, EA is triggered for wind energy projects based on generation capacity of only one megawatt, whereas in Quebec

the trigger is significantly higher at 10 megawatts. In Yukon, most *all* projects are subject to at least an EA screening unless specifically exempt. For wind energy, the threshold for exemption is 0.05 megawatts.

Ontario also uses thresholds to determine whether a wind energy project requires assessment, but wind energy projects in Ontario are not subject to the usual EA process. Renewable energy projects (onshore wind, solar, bioenergy) are subject to an alternate, streamlined review and approval process referred to as a Renewable Energy Approval (REA) under the *Environmental Protection Act*. The REA functions similar to EA in terms of triggers, with thresholds based on a combination of generation capacity and sound power level. Wind energy projects with generation capacities greater than 3 kilowatts are subject to assessment – usually a routine application and permitting. Projects above 50 kilowatts and of a specified turbine height, blade length, and sound generation levels are subject to more comprehensive assessments.

Table 3: EA trigger and terms of reference responsibilities for wind energy projects.

Jurisdiction	EA trigger				EA Terms of Reference			
	Case-by-case[1]	*Threshold-based*			*Primary responsibility*		*Public comment*	
		Wind energy projects[2]	*Energy projects*[3]	*Thresholds*	*EA Authority*	*Proponent*	*Mandatory*	*Discretionary*
AB			✓	> 1 MW		✓	✓	
BC		✓		15 or more turbines; or with at least 1 turbine located in water and a total of 10 or more turbines	✓		✓	
MB			✓	> 10 MW	✓			✓
NB			✓	≥ 2 MW	✓		✓	
NL	✓				✓		✓	
NS		✓		≥ 2 MW	✓		✓	
NT	✓				✓		✓	
NU	✓							
ON		✓[5]		> 3 kW		✓	✓	
PE		✓		≥ 1 MW	✓			✓
QC		✓		> 10 MW	✓		✓	
SK	✓					✓		
YT		✓[4]		> 0.05 MW	✓		✓	

[1]Wind energy projects trigger EA on a project-by-project basis (i.e. no specified thresholds)

[2]Wind energy projects trigger EA if the project meets certain thresholds that are specific to wind energy.

[3]Energy projects trigger EA regulations if the project meets certain thresholds, but thresholds are not specific to wind energy projects.

[4]In YT, most all activities are subject to EA screening unless otherwise exempt. For wind energy projects, the exemption applies to projects < 0.05 MW.

[5]ON requires a 'renewable energy approval' versus EA, with a class-based approach whereby projects of different capacities and sound levels require different classes or levels of assessment (see below – classes or levels of EA).

Regulations in three other jurisdictions also contain generation thresholds that trigger EA, but they are not specific to wind energy (Table 3); rather, they apply to most all electricity generation project types including renewable and non-renewable. In New Brunswick and Manitoba, the triggers are 2 and 10 megawatts, respectively. In Alberta, projects smaller than 1 megawatt are exempt from the regulatory process, while those greater than 1 megawatt trigger an EA screening; whether the project will be subject to full EA review is at the discretion of the regulatory authority.

The remaining jurisdictions neither directly list wind energy projects in EA regulations nor include specific thresholds. For example, in Saskatchewan, the need for assessment is determined on a case-by-case basis using a set of loosely defined screening criteria. A wind energy project might require an EA if it is determined that the project is likely to have a significant impact on the environment, create widespread public concern, have an effect on a unique feature of the environment, or substantially utilize a provincial resource. Two identical projects but in different locations may result in different EA screening decisions, at the discretion of the respective EA authority. The generic nature of the screening criteria provide flexibility for decision makers to consider local context, but at the same time introduce a lack of predictability and perceived inconsistency across projects of the same type, size, and design for project proponents. Similarly, in Newfoundland and Labrador, developments that have potentially significant environmental impacts may be required to undergo assessment. Whilst some energy projects are specified as requiring assessment, wind energy projects are not listed. The Mackenzie Valley and Nunavut processes are similar in that the need for and scope of EA are determined by regional boards or agencies on a case-by-case basis, considering such factors as public concern and impact potential.

Classes or levels of EA

Because a wind energy project is subject to an EA act or regulations does not mean that it will undergo a full EA review. Wind energy projects undergo a preliminary screening whereby a decision is made as to whether the project can proceed subject to standard permitting conditions, or whether a comprehensive review is required. In Saskatchewan, for example, these determinations are based on the proponent's project description and the potential for significant adverse impacts, widespread public concern, or conflict with existing laws, regulations, or land use plans. This is similar to Alberta and also Yukon, Mackenzie Valley, and Nunavut – with the exception that in Yukon, Mackenzie Valley, and Nunavut routine screening assessments are undertaken by regionally-designated EA offices or co-management boards. In Yukon, for example, most assessments are conducted by a locally designated office. More complex projects are assessed by a central EA authority; and projects with potential to cause significant impacts may be assessed by an independent panel – with determinations made on a case by case basis.

In Manitoba, in contrast, there are two classes of EA based on the size of the proposed project. Energy projects with an expected generating capacity between 10 and 100 megawatts are considered a "Class 2 development." Those greater than 100 megawatts are considered a "Class 3 development." The main difference between classes is whether a public hearing is not required (for routine projects), may be required (with determinations made on a case-by-case basis), or always required (for more complex and controversial projects). In Ontario, there are four classes for wind energy projects – only three of which may undergo assessment. Projects between 3 and 50 kilowatts require an application and review, but with limited assessment and rules for setback distances and consultation requirements. Projects equal to or above 50 kilowatts require a more comprehensive assessment with more specific assessment rules for setback distances, determined based on sound power level, turbine height and blade length. British Columbia does not use a class-based process, once it is determined that the project meets the EA trigger thresholds for wind energy projects.

EA documentation requirements

All jurisdictions require an EIS should an EA be required, but there are differences in project application documentation requirements for wind energy projects. A distinguishing factor is whether a project proposal, registration, or application is necessary to begin the assessment process. In the Mackenzie Valley, Prince Edward Island, Quebec, and Saskatchewan the proponent must submit a project application; however, what constitutes a project application varies. In Mackenzie Valley, the project application is submitted by the proponent to gain authorization for a development, which triggers a preliminary screening. In Prince Edward Island, the project application is submitted to participate in the competitive bid to develop; in Quebec, it is an application to advise of the proponent's intent to develop; and in Saskatchewan the project application is the instrument used to determine if the proposed project is considered a development under EA legislation and therefore potentially subject to assessment.

In other jurisdictions, the proponent is required to submit a project proposal or registration document. In Manitoba, New Brunswick, Nova Scotia, Nunavut, and Yukon, the project proposal or registration is a detailed description of the project, including information about construction and operations, baseline conditions, potential impacts, and mitigation strategies. In both Ontario and Newfoundland and Labrador, however, the project proposal or registration are less detailed. In Ontario, only a project description is required when the project is less than the 50 kilowatt threshold. In Newfoundland and Labrador, a summary of expected impacts and mitigations is necessary, after which a further Environmental Preview Report (EPR) may be required if additional information is needed to determine the need for EA. The process is similar in Nova Scotia, where a Focus Report may be required following registration and the

outcome of which may result in a comprehensive EA. Alberta's project proposal or registration is similar to Saskatchewan's project application, in that it consists of the initial details of the project for the purpose of participating in the competitive bid to develop and determining whether a proposed wind energy project is likely subject to assessment.

EA scope and terms of reference

Most jurisdictions provide little or no direction on the scope of an EA for wind energy projects; instead, the scope of assessment and factors to be considered are determined case-by-case depending on the nature or level of EA or the project's impact characteristics. EA guidance in some jurisdictions provides a list of the types of factors that should be considered in EA – though it is not specific to wind energy projects. There are two exceptions: New Brunswick and Ontario. In New Brunswick, sector specific guidelines for wind energy projects indicate that proponents *may* be required to undertake one to two years of pre-construction bird surveys, and two years of pre-construction radar and acoustic monitoring for turbines greater than 150 meters in height (Environment and Local Government 2019). For Ontario, the streamlined REA process identifies the specific factors to be considered by a proponent based on the class of project. In all other jurisdictions, guidance for wind energy EA is provided through project-specific terms of reference (ToR), referred to as assessment guidelines in some jurisdictions. ToRs are normally developed only when a project is subject to a comprehensive EA review – versus more routine screening assessments, which rely on the information provided by the proponent. Project-specific ToRs set out the scope and methodology for EA that a proponent must follow, however the responsibility for ToR development and requirements for public comment on ToR vary (see Table 3).

If a wind energy project in British Columbia requires a full EA review, then a technical working group led by government and comprising representatives of potentially-affected First Nations determines the scope of the EA, and a procedural order is issued to the proponent that sets out the EA procedures and consultation requirements. At this stage, public input is also sought on the issues that should be included in the assessment. But in Alberta, the proponent is responsible for the ToR and for posting the ToR for public comment. Alberta provides standardized ToRs to assist proponents, but only for in-situ, oil sands mining, coal mining, and industrial plant projects (Alberta Environment and Parks 2016).

Across the territories, the EA authority leads ToR development for projects that require a full EA review and either seeks public comment or conducts public scoping sessions in each of the communities affected. ToRs for comprehensive EAs are completed for the minority of projects. Most projects are assessed through screening-level reviews and by local offices of the EA authorities based on the proponent's

project application or description. In all other jurisdictions, the EA authority is responsible for leading ToR development, followed by a mandatory public comment period – the exception is Prince Edward Island, where the public comment period is discretionary.

Proponent's consultation requirements

All jurisdictions require, to some extent, public consultation during EA and encourage project proponents to engage potentially affected publics. One of the purposes of EA is to facilitate public consultation on proposed undertakings – legislation in Nova Scotia, Manitoba, Alberta, Yukon, and Northwest Territories refer specifically to this purpose. Proponents are also required to either make EA documentation publicly available or provide it to an EA authority for that purpose. Most requirements for public consultation are the responsibility of the EA authority. Common to all jurisdictions is that public comment periods have set time limits, thus providing some certainty to the proponent on EA timelines (Table 4). In several jurisdictions there is also a mandatory, set schedule of public meetings throughout the EA process – typically led by the EA authority, with the exception of Ontario and Saskatchewan. In Ontario, the proponent is responsible for notices of public meetings at established steps in the EA process, whereas in Saskatchewan the schedule of public meeting is at the discretion of the minister.

Table 4. Jurisdictional requirements of project proponents to conduct pre-EA public consultation.

Jurisdiction	Requirements of the proponent to conduct pre-EA public consultation *before* submitting a project application
AB	Terms of reference for the EA are to be made available by the proponent for public comment.
BC	Proponents are required to submit an engagement plan and initial project description as part of early engagement.
MB	Proponents are encouraged to consult to identify issues and concerns prior to finalizing the project proposal.
NB	Upon project registration, EA guidelines require that the proponent submit a public involvement report.
NL	None – public consultation requirements commence post project application screening
NS	EA regulations require that project registration includes a list of public concerns and steps taken to address those concerns.
NT	Proponents are required by regional IA authority to consult communities before submitting a project application.
NU	Proponents are asked to provide information regarding public engagement and consultation efforts undertaken when submitting a project application.
ON	Proponents are required to submit a project notice to affected communities and organize public meetings.
PE	No pre-EA public consultation required of project proponent.
QC	Public notice of the project must provide a description of the plans to involve the public
SK	When submitting a project proposal, proponents are expected to solicit public input within the project area and from other individuals or groups that may have an interest in the project.
YT	Proponents are encouraged to meet with affected First Nations prior to project application, to improve the efficiency of the IA authority's evaluation, but there is no specified requirement

Most jurisdictions also require that proponents engage in early consultation with potentially affected publics; however, the extent to which this is required or encouraged, and how early in the pre-project planning process, varies (Table 4). In Northwest Territories, for example, proponents must consult before submitting an application to the EA authority, and EA authorities may provide proponents with a list of potentially affected parties in the area of the proposed development. For a proponent's application to be considered complete, it must include an engagement record that details the outcomes of engagement, changes to the proposed project as a result of engagement, and identification of any unresolved issues.

In Yukon, proponents are encouraged, but not required, to consult with First Nations when preparing a project application for the sake of improving the efficiency of the EA authority's evaluation (YESAB 2020). This is similar to Saskatchewan, where there is an expectation that proponents seek public input before submitting a technical project description, but there is no requirement for such in EA legislation or regulations. Alberta does not specify that pre-application engagement is required, rather the earliest stage of engagement required of the proponent is consultation on the EA ToR. Regulations in Prince Edward Island detail a proponent's responsibilities for engagement only at the time an EIS is submitted.

EA timelines

Most jurisdictions identify procedural timelines for EA, but not for all phases of the EA process. Legislated timelines are normally indicated only for those aspects of the EA process that involve government review and public comment periods. EA systems vary, with some systems having different classes of projects (e.g. Manitoba), some with separate streamlined processes for renewable energy (i.e. Ontario), and others where almost all proposals are subject to at least a screening-level assessment (e.g. Yukon), making it difficult to compare EA timelines for wind energy projects from proposal to approval. Much of the variability in EA timelines depends on the complexity of the project, level of public concern, and the efficiency of the project proponent in either preparing their assessment or responding to information requests. However, despite context differences, it is possible to compare two critical components of EA timelines: the length of time required to determine whether a proposed wind energy development requires an EA, and the length of time to reaching a decision on a project after the proponent's EIS is submitted.

Table 5 shows the number of days to reach a screening determination as to whether an EA is required, as specified in legislation or guidelines; the median number of days to project approval after a wind energy EIS has been submitted; and the actual number of days to project approval following EIS submission for an example project from each jurisdiction. Results show that the timeline, when specified, for determining

whether an EA is required for a wind energy project or the level of assessment required, varies from 30 days in New Brunswick to up to 60 days in British Columbia and Manitoba – this can be up to 120 days in Manitoba depending on the size or complexity of the project. Not all jurisdictions specify the timeline for screening determinations in EA legislation or guidelines, and in Ontario all projects above the screening threshold (see Table 3) are subject to the REA process. In Yukon, most all undertakings are subject to a screening-level assessment. The normal timeline is within 60 days for a determination that a project can proceed or that a more comprehensive EA is required, although this timeline can be extended up to an additional 83 days depending on the complexity of the project. Similarly, in Northwest Territories (Mackenzie Valley), regional land and water boards undertake preliminary screenings and determine whether an EA is required – but there is a mandatory "ten-day pause period" following screening decisions that do not result in an EA referral, to allow the Mackenzie Valley board or other government bodies an opportunity to order that an EA still be completed after the screening decision is made but before permits are issued (MVEIRB 2019).

Based on our sample of 48 wind energy projects subject to EA over the last 15 years, the median time from when a project proponent submits an EIS and the project receives final approval is 203 days. However, this varies considerably by jurisdiction and project (Table 5). The median number of days to approval in Alberta is 419, but only 58 days in Nova Scotia. In Saskatchewan, only one wind energy project has received EA approval (160 days); a second project was subject to EA but ultimately rejected (1,157 days). The largest project selected from our sample (Niagara) required 584 days to approval under Ontario's streamlined REA process. However, the next longest approval time was the Mesgi'g Ugju's'n in Quebec; its approval timeline was more than three times longer than the Blue Hill project, Saskatchewan—which was a larger project by generating capacity and number of turbines. The shortest timeline was 35 days, for a 51-megawatt (34 turbines) project in Nova Scotia; while the much smaller Fermeuse, Haeckel Hill, and Hermanville approval timelines were more than twice as long.

Table 5. Timelines for EA screening determinations and approvals for wind energy projects, by jurisdiction.

Jurisdiction	Required # days to screening determination[1]	# days to project approval after EIS submission		Example project and EA timeline			
		median	# EISs in sample	Example project[8]	Capacity (megawatts)	Application (EIS) filed	# days to approval
AB	*Not specified*	419	7	Oldman 2	46 MW 20 turbines	26 Aug 2009	407
BC	60	210	6	Bear Mountain	102 MW 34 turbines	28 Nov 2006	227
MB	60 to 120[2]	275	2	St. Joseph	138 MW	14 July 2008	450

					60 turbines		
NB	30	170	4	Lameque	45 MW 33 turbines	15 Aug 2008	210
NL	45	65	2	Fermeuse	27 MW 9 turbines	7 July 2006	78
NS	50	58	6	Dalhousie	51 MW 34 turbines	30 July 2008	35
NT[6]	45	--	--	--	--	--	--
NU[7]	Not specified	--	--	--	--	--	--
ON	*N/A*[3]	245	7	Niagra	230 77 turbines	2 April 2013	584
PEI	35[5]	63	5	Hermanville Clearspring	30 MM 10 turbines	30 Jan 2013	77
QC		354	6	Mesgi'g Ugju's'n	150 MW 47 turbines	2 July 2013	483
SK	45	160	1	Blue Hill	177 MW 56 turbines	27 Feb 2018	160
YT	60[4]	155	2	Haeckel Hill	27 MW 3 turbines	2 April 2017	89

[1]Specified in EA legislation, regulations, or guidelines.

[2]60 days for Class 1 projects, up to 120 days for Class 2 projects, based on the complexity of the project.

[3]No screening process under REA, all projects above 3 megawatts are subject to some type of assessment.

[4]Applies to regional offices of the EA authority for initial project submissions.

[5]Stated as the minimum number of days for technical review or proposal and ministerial decision.

[6]Applies to regional Land and Water Boards. No EAs have been completed for wind energy projects in NWT. The exception is a wind facility at a diamond mine, which was assessed under the mine EA.

[7]The EA authority provides informal timelines for its review process in its *Guide to the NIRB Review Process* (NIRB 2007), noting that actual timelines depend on the nature of a project. No wind energy projects are identified in the NU EA registry within the timeframe of our search.

[8]One case from each jurisdiction was selected as an illustrative example by assigning a value to the cases and using a random number generator. The intent was to avoid bias based on project size, year, or author familiarity when selecting the case.

Discussion

Results show substantial variability in EA provisions and requirements for wind energy projects across Canada. Variability is not surprising given Canada's constitutional division of powers that establish EA under the authority of each of province and territory. EA is an important entry point to renewable energy development and this variability may have implications for meeting regional and national renewable energy targets and climate commitments (Geißler et al. 2013). As Macintosh et al. (2018) explain, in some cases EA delays can "reduce the private and social returns from development and, in the worst cases, lead to the abandonment of projects that enhance social wellbeing." This is not to say that EA should offer a free-ride to renewable energy developers, since renewable energy projects do generate potentially adverse impacts that need to be mitigated, but neither should EA deter renewable energy investment or stifle renewable energy in any one jurisdiction. Comparing EA provisions for wind energy development in Germany and the United States, Geißler et al. (2013) argue that EA must support an appropriate level of consideration of environmental and social impacts in decision making, but it must

also ensure a process that does not impose unnecessary burden for developers and neglect climate benefits. Based on our results, there are four areas where improvements are needed in EA systems to meet these dual objectives.

First, results show variability across jurisdictions based on when an EA is required for a wind energy development (see Table 3). This includes EA systems that require some form of assessment for all wind energy projects, determinations on a project-by-project basis considering impact potential, and threshold-based determinations – with thresholds of varying generation capacities, turbine height (or blade length), setback distances, sound generation, or number of turbines. Variability in EA requirements for wind energy projects is not unique to Canada (e.g. Geißler et al. 2013; Phylip-Jones and Fischer 2013; Iglesias et al. 2011). Under the European Union EIA Directive, for example, member states also determine their own criteria or thresholds for triggering a project review, and EA triggers for wind energy differ between member states. In Denmark, wind energy turbines higher than 80 metres or wind farms comprised of three or more turbines require a full EA review; moreover, who is responsible for EA also varies, with municipalities responsible for turbines less than 150 metres and the Danish Ministry of Environment responsible for those above 150 metres (Clausen 2013). In the United Kingdom, EA screening determinations for onshore wind energy projects are based on a combination of output and the number of turbines, whereby facilities with five or more turbines or with a total output of 5 megawatts or more are subject to EA screening, and projects of 50 megawatts or more are subject to mandatory assessment (Jones et al. 2011) .

Schumacher (2017) reports that diversity and divergence in EA screening requirements is often met with criticism from stakeholders, including industry. Reflecting on wind energy investments in Europe, for example, WPD AG, a Germany-based wind energy developer and operator, reports that "insight into, and interpretation of the rules must be available and transparent" to be attractive to wind energy investors, and the conditions for development must be equal for all (Jovanovic 2019). Reducing jurisdictional variation in EA triggers among provinces and territories may provide a more consistent and transparent national landscape for potential renewable energy developers. Similar recommendations have been presented by Iglesias et al. (2011) in the Spanish context, as an attempt to support wind energy growth and reduce costs for developers. Discussions about EA harmonization in Canada are hardly new; however, they have traditionally been approached in the context of transboundary projects and reducing EA duplication for projects that are regulated by two or more jurisdictions (Kennett 1997; Powell 2015), and based on the notion that without cooperation "effective public policy in areas that cross borders is not possible" (Roach 2003). We argue that meeting national commitments to climate change and renewable energy transition require similar efforts. This does not mean EA legislative uniformity (Powell 2015), but rather greater

consistency in standards and thresholds that trigger EA requirements for certain classes or types of renewable energy projects that may be designated as projects of common interest.

Europe's TEN-E Regulation (EU no. 347/2013), for example, defines a "project of common interest" as energy infrastructure development that is deemed to be of priority for building energy networks in Europe and meeting various energy and climate strategies. The TEN-E regulations establish guidelines for reducing regulatory complexity and ensuring timely implementation of such projects, supporting lower project administrative costs and streamlining of EA determination procedures (Schumacher 2017). Although TEN-E Regulations are designed for transboundary projects, the notion of designating classes of renewable energy projects as projects of common interest and implementing more uniform EA screening procedures for those projects may have merit in achieving national renewable energy targets. However, given that provinces and territories maintain control over their EA systems, this might be best achieved through the articulation of "best practices", led by the collaborative efforts of the Canadian Council of Ministers of the Environment (CCME), the primary minister-led intergovernmental forum for collective action on environmental issues of national and international concern (CCME 2014), rather than imposed federal legislation.

Second, in most all jurisdictions the scope of wind energy project EAs is determined on a case-by-case basis. Across Canada, there is no common good-practice framework for wind energy EA. Developers, communities and regulators need better information about the impacts and risks of wind energy, and guidance on how best to assess and manage them (Doelle and Critchley 2015; Schuster et al. 2015). It is not that Canada has no experience with wind energy, but there is limited EA guidance for wind energy projects and limited knowledge mobilization about the impacts of renewable energy systems and proven impact management strategies (Doelle and Critchley 2015; SSHRC 2017; Hanna et al. 2019). National EA good-practice standards and guidance are required for renewable energy projects, including information on the *typical* impacts of different types of renewable energy projects, such as wind energy, the mitigation strategies known to be effective, and the impacts for which mitigation is highly uncertain (for example, see Gartman et al. 2016). The development and implementation of good-practice standards and guidance for wind energy into Canadian provincial and territorial EA systems may be led by the CCME, similar to existing national standards and guidance for such matters as contaminated sites (CCME 2016) or groundwater sustainability assessment (CCME 2017). Such national-level standards and guidance would not interfere with the ability of jurisdictions to scope EAs, but it would provide developers, decision makers, and the public with improved expectations for EAs for wind developments and may help reduce the uncertainties around impacts and mitigation.

Third, not all jurisdictions require the same level of pre-EA consultation with communities potentially impacted by a wind energy project. In some jurisdictions, proponents are required to report on their public consultation actions at the time of project registration; in other jurisdictions there is no requirement for consultation until the EA ToR is established or EIS submitted (see Table 4). The importance of early consultation is well-established in EA scholarship, but the late stage of consultation in some jurisdictions, and the lack of regulatory requirements for pre-EA consultation in others, is problematic in terms of ensuring that EA processes do not unnecessarily undermine energy transition. Smart et al. (2014) report that many individuals potentially impacted by wind energy development have already made up their mind about wind energy by the time consultation occurs, and rarely shift their views following the EA process. Strengthened requirements for pre-EA consultation for wind energy projects is thus necessary in most jurisdictions. Notwithstanding pressures for more streamlined EA (Bond et al. 2014), many project proponents see pre-EA engagement as an opportunity to strengthen their EA application and to minimize EA transaction costs by ensuring a timely review process (Udofia et al. 2017). In Yukon territory, project proponents are encouraged by the EA authority to consult prior to submitting their project application as a means to improve the efficiency of the screening process – but there is no requirement to do so. Although pre-EA consultation may be viewed by some as adding to the approval timeline (Nesbitt 2016), it is less likely to result in project delays later on due to conflict, protests, and court challenges (CCA 2019).

Finally, the length of time EAs typically take for projects, including wind farms, can be a significant factor influencing the attractiveness of a jurisdiction to prospective developers. Schumacher (2017) reports on research in the Japanese context, where wind energy developers have cited lengthy (and costly) EA processes as one of the main factors contributing to project abandonment prior to a permit being issued. Arguably, however, it is not always the length of the EA process per se that is most important, but rather the predictability of timeline. All jurisdictions in our study establish set time limits for public comments on EA documentation (see Table 4). Most, but not all, jurisdictions also provide specific timelines for screening determinations, typically ranging from 30 to 60 days, thus providing reasonable certainty to developers on whether their project requires an assessment (see Table 5). However, we observed significant variability in the median duration of the EA process, from the time the proponent submits an EIS until final approval is issued, ranging from 58 to 419 days. Our analysis did not focus on the reasons for the variability, from our sample we observed no clear pattern in EA duration based on application year, generation capacity, or the number of turbines.

The recent Expert Panel commissioned to review federal EA in Canada emphasized the need for predictable timelines to deliver cost and time certainty to proponents, to “ensure that projects providing a net benefit to the country are approved and built” (Expert Panel 2017, p. 6). Uncertainties in EA timelines

have been a major criticism in Canada's fossil fuel energy sector (Expert Panel 2017) and arguably even more important in the context of renewable energy developments. We are not suggesting that renewable energy projects be *fast-tracked* for approval at the cost of sound EA, but additional research is required to understand the factors that contribute to the significant variability in EA processes for wind energy to ensure that EA timelines, and the respective costs incurred, are not compromising energy transition. We agree with Hunsberger et al. (2020, p. 3) in that "given the urgency of the decarbonization imperative, timeliness takes on new importance even among those unlikely to share the values of the business community."

Conclusions

Renewable energy technologies will play a critical role in the global energy transition, and EA is an important entry point to the development of renewable energy projects. Our results show considerable variability in EA requirements across Canadian jurisdictions, including the scope of assessment, EA timelines, roles and responsibilities of developers, and whether EA even applies to a proposed wind energy development. Consistency and transparency in EA processes, and timely and less cumbersome reviews, are important for potential wind energy investors. Although a single EA requirement for renewable energy projects in Canada is unlikely, given the limited role of federal EA in the renewable energy sector, there is an opportunity for sector-specific good-practice EA guidance for wind energy developments at the national level, including identification of the typical impacts, issues of concern, and known mitigation solutions. In doing so, potential wind energy developers and those impacted by projects will be better informed about what to expect, thus adding a degree of predictability, consistency, and certainty to the EA process. Most importantly, as suggested previously by scholars examining EA in the renewable energy sector in other jurisdictions (e.g. Geißler et al. 2013; Phylip-Jones and Fischer 2013), greater attention must be given to the role of strategic EA in the energy sector and to the transition to renewable energy in particular. As shown in France and Norway, for example, opposition to new transmission corridors risks decelerating energy transmission (Späth and Scolobig 2016; Ceglarz et al. 2017). Yet, across Canada, and in many other jurisdictions, the focus of EA for wind energy projects is on the site-specific impacts of turbines, with limited scope for consideration of broader infrastructure requirements for power transmission. EA has a long history of dealing with large-scale fossil-fuel energy projects, but its role in facilitating renewable energy transition has received relatively less attention. With increasing commitments to climate change mitigation and energy security, there is a need to revisit the role of EA and identify how EA can better balance good environmental reviews with the real imperative to build and operate renewable power production.

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