Environmental Management Vol 68, pages 591–603
https://doi.org/10.1007/s00267-021-01518-2

From project impacts to strategic decisions: recurring issues and concerns in wind energy environmental assessments

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Environmental Management Vol 68, pages 591–603
https://doi.org/10.1007/s00267-021-01518-2

Abstract

Wind energy is among the fastest growing renewable energy source. Although not as controversial as fossil fuel-based energy projects, wind energy projects can be contested. Understanding common environmental assessment issues surrounding wind energy projects is important for addressing the transaction costs for renewable energy projects. This research examined 16 environmental assessments (EAs) for wind energy projects in Western Canada to identify the recurring issues and concerns raised by government reviewers, project interveners, and other affected interests. Fifty different issues were identified. Although variability existed among the number and diversity of issues by jurisdiction and by project, depending on location and size, concerns about land use, impacts on human well-being, impacts on natural ecosystems, and economic opportunity, represented nearly eighty per cent of all issues and concerns. The majority of issues reflect project-specific impacts and concerns, but many issues including impacts to other land tenure holders or licensees (such as other utilities and industries) are issues that are beyond the scope and scale of what can be resolved at the time wind energy projects are proposed. Understanding and addressing recurrent issues and concerns and shifting the bigger issues to the planning and strategic process, are important conditions for energy transition.

Keywords: wind energy; renewable energy; environmental assessment; energy transition

Funding: This research was funded by the Social Sciences and Humanities Research Council of Canada, grant numbers 435-2018-0008 and 895-2019-1007.

Environmental Management Vol 68, pages 591–603
https://doi.org/10.1007/s00267-021-01518-2

Introduction

Ensuring the security and reliability of energy supply whilst reducing greenhouse gas emissions will necessitate a substantial energy transition (Gielen et al. 2019; IRENA 2018). The shift from a fossil fuel-dominated energy system to a largely renewables-based one will require not only new policy instruments (Potvin et al. 2017), but also the development of new technologies and infrastructure (Batille et al. 2015; Labanca 2017). Globally, wind power is one of the fastest growing energy technologies, and installed wind power generating capacity has increased steadily over the past decade (IRENA 2018; NRCan 2020). Although a clean energy source, the development of wind energy infrastructure is not without adverse impacts and controversies (Geißler et al. 2013; Hanna et al. 2019; Fischer et al. 2020).

Previous research has examined the potential impacts of wind turbines, from bird strikes and loss of wildlife habitat to implications for human health and well-being (Dai et al. 2015; Enevoldsen and Sovacool 2016; Fast et al. 2016; Geißler et al. 2013). Wind energy development has generated considerable land use conflicts, many of which emerge at the project assessment and permitting stage (Jones and Eiser, 2010; Mulvihill et al. 2013; Normann 2020; Phylip-Jones and Fischer 2013; Smart et al. 2014). Despite having the potential to reduce emissions and meet growing energy demands, the development of wind energy infrastructure can also generate resistance due to real or perceived impacts and conflicts (Hirsh and Sovacool 2013; Jami and Walsh 2017).

Environmental assessment (EA) is a tool for identifying, assessing, and finding ways to manage the impacts of energy development – including wind energy projects. It is widely used globally and, indeed, a regulatory requirement in many jurisdictions. EA can provide an opportunity for the public and other interests to participate in the review of energy projects, identify potential issues and concerns, and propose management solutions. That said, only recently have discussions begun to emerge about the role of EA in supporting renewable energy transitions (McMaster et al. 2020). Various procedural and administrative challenges to EA for renewable energy have been identified, including concerns that EA may be a source not only of delay and obstruction for individual renewable energy projects (Jay 2010; Scott et al. 2014) but also of risk to general renewable energy transitions (Fischer et al. 2020; Geißler et al. 2013; Schumacher 2017; Ryan et al. 2019). Although often attributed to regulatory complexity (Bond et al. 2014; Hunsberger et al. 2020), inefficiencies also emerge due to public and actor concerns about energy development raised during the EA process – from concerns about typical project impacts with known mitigation solutions, to more comprehensive issues such as climate change and national energy policy (Chetkiewicz and Linther 2014; Gibson et al. 2010). The associated transaction costs emerging when energy projects are proposed include increased conflict, delayed decisions, and lost economic opportunities (Noble 2017; Udofia et al. 2017).

Renewable energy projects are no different, but the transaction costs are much higher – delayed or abandoned renewable energy projects (Schumacher 2017; Smart et al. 2014) can have significant implications for energy transition and meeting climate change mitigation commitments.

Several researchers have examined the issues and conflicts associated with particular wind energy case studies (Scott et al. 2014; Devine-Wright 2005), but knowledge about the impacts of renewables remains thematically dispersed (Hanna et al. 2019; Walker et al. 2015). Many of the issues and concerns raised when wind energy projects are proposed are neither new or unique (Doelle and Critchley 2015); however, there has been limited attention to defining recurring issues so that developers and decision makers can be better informed about what the public and other actors expect EA to address when wind energy projects are proposed. There has been even less work on whether recurring concerns are suitable to project-level solutions versus much earlier and proactive policy and planning level resolution. For the fossil fuel sectors, research has shown that many of the issues raised when projects are proposed tend to be larger, more complex, and of a more strategic (policy or economics) nature (Eyeford 2013; Gibson et al. 2010; Noble 2017). These are important issues in energy development, but they are difficult to address in project level EA (Expert Panel 2017; Udofia et al. 2017).

This paper examines the issues that typically emerge during EA applications for onshore wind energy projects, and asks the following question: Are these issues amenable to project-level solutions, or should these issues be "off-ramped" to more strategic policy and land use planning processes? The analysis is based on EA processes in Western Canada, though the lessons emerging are broadly applicable to improving the role of EA and wind energy transition in other jurisdictions.

2. Study area and methods

Wind energy capacity in Canada has risen dramatically over the past fifteen years, from 44 megawatts in 2004 to 13,414 megawatts in 2019 (CANWEA 2020). The Canada Energy Regular (CER 2019) forecasts a 14% increase in total electricity generation by 2040, including an increase in wind energy to 23,800 megawatts. The Pan-Canadian Wind Integration Study (GE Energy Consulting 2016) also suggests that Canada can efficiently generate more than one-third of its total electricity from wind. However, installed wind energy capacity is variable, with the province of Ontario having the most at over 5,000 megawatts and Nunavut territory (in the Arctic) with no wind power installed (CANWEA 2020). For Canada's Western provinces, installed wind capacity ranges from 241 megawatts in Saskatchewan to 1,685 megawatts in Alberta. Western Canada is well-poised for growth in its wind energy sector, owing to both

favourable wind resources and policy environments, including the *Climate Change Accountability Act* of British Columbia. British Columbia started commercial wind energy in 2009 and now has 713 megawatts of installed capacity, meeting 4% of provincial electricity demand (CANEWA 2020). Wind energy in Alberta experienced significant growth between 2005 and 2016, from 1.1% to 6.9% of total generation (CER 2018). Under its *Climate Leadership Plan* (Government of Alberta 2018), the province committed to phase-out coal-fired electricity generation by 2030, replacing it with renewables. In 2017, wind energy was the lowest-cost option for new electricity generation in Alberta (Government of Alberta 2018b). Wind power in Saskatchewan increased from 0.5% in 2005 to near 5% of provincial electricity generation (CER 2020). Saskatchewan is committed to increase its renewables capacity to 50% by 2030, with a substantial increase in wind power generation to 30% of the energy mix (Harper et al. 2016). Over 99% of electricity in Manitoba is generated from renewables, mostly large-scale hydroelectricity (CER 2018). The province has 258 megawatts of installed wind energy capacity (CANWEA 2020) and is positioned to develop its wind energy sector for provincial use and electricity export (Government of Manitoba 2018).

Data collection and analysis

Assessments and permitting for onshore wind energy are the responsibilities of each of the provinces and territories (**Table 1**). Canada's federal *Impact Assessment Act* applies only to offshore wind energy projects or if a project is proposed in a national park or federal protected area. Legislated and regulatory provisions for EA thus vary considerably across Western Canada in terms of EA triggers, assessment roles and responsibilities, and EA procedural requirements. The reader is referred to the respective EA jurisdictions for details on provincial assessment processes (Table 1) and to McMaster et al. (2020) for an overview of EA requirements for wind energy. In general, the information required during an EA process includes the proponent's EA application or impact statement. Requirements for public participation in the EA process vary, but in all jurisdictions formal opportunities exist for written comments and submissions (McMaster et al. 2020). Written comments and submissions are typically received from government, including provincial or federal government agencies and regulators; environmental non-government organizations, such as lobby or special interest groups; Indigenous groups, which may include First Nations organizations, councils, community members or legal representatives; and all other interests, ranging from individuals not representing any organization or entity to those commenting on behalf of private sector enterprise. These written comments form part of the formal, public record of the project's EA.

Table 1: Western Canada's EA provisions and triggers for onshore wind energy projects.

Province	British Columbia	Alberta	Saskatchewan	Manitoba
EA legislation	*Environmental Assessment Act* (SBC 2002 c.43)[1]	*Environmental Protection and Enhancement Act* (RSA E-12, 2000)	*The Environmental Assessment Act* (S.S. 1979-80 c.E-10.1)	*The Environment Act* (SM 1987-88 c.26)
Applicable regulations	Review Projects Regulations (B.C. Reg. 370/2002)	Environmental Assessment Regulation (112/93; 89/2013) Activities Designation Regulation 276/2003; 125/2017)	--	Classes of Development Regulation (E125 – M.R. 164/88) Licensing Procedures Regulation (E125 – M.R. 163/88)
EA trigger	≥ 50 MW	≥1 MW (discretionary)	Case by case consideration	>10 MW
Further reference on EA procedures	https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/environmental-assessments	https://www.alberta.ca/environmental-assessment-process.aspx	https://www.saskatchewan.ca/business/environmental-protection-and-sustainability/environmental-assessment	https://www.gov.mb.ca/sd/permits_licenses_approvals/eal/index.html

[1]British Columbia updated its EA legislation and review projects regulations in 2018 (SBC 2018, c. 51). Under the current act and regulations, EA is required for wind energy projects with 15 or more turbines, or with at least one turbine located in water and total of 10 or more turbines. Projects included in this study were assessed under the 2002 act and regulations.

To identify key and recurrent issues raised during the EA process, we conducted a document analysis of comments and submissions for wind energy projects in Western Canada post-2005. Scott et al. (2014) used a similar approach to assess public concerns about small-scale wind energy projects in the UK. The online EA public registry of each province was searched to identify wind energy projects. EA registries serve as a documentation system to provide public access to EA information (Hanna and Noble 2013), including a record of public comments and written submissions about projects under review. A total of 16 wind energy EAs were identified (**Table 2**). In some cases, access to information requests were filed with the respective EA authority to obtain complete documentation.

Three stages of coding were conducted, with each stage coding-up to more aggregate output. First, all written submissions and comments were reviewed to identify and extract the specific concern(s) raised. Inductive coding (Chandra and Shang 2019) was used to categorize comments and concerns based on: *i)* the specific concern raised (e.g., impact on a specific bird species, a particular health concern); *ii)* who submitted the comment (i.e., government agency, environmental non-government organization, Indigenous organization, other public and private sector); and *iii)* frequency (i.e., how many times the concern was raised). Second, specific concerns were coded into core issues, with issue comprised of multiple but related concerns, thus capturing the most important and recurring issues across all projects (e.g., impacts on terrestrial environments, noise, setback distances, loss of property value, etc.). These issues were then coded to each project, by province, concerned group, and assessed based on frequency raised.

Table 1: Wind energy projects reviewed in this research.

Project	EA decision	Capacity (MW)	Number of turbines	EA registry
British Columbia				
Bear Mountain	2007	102	34	*www.projects.eao.gov.bc.ca/*
Thunder Mountain	2009	320	159	
Dokie Wind Energy	2009	144	48	
Quality Wind	2010	142	79	
Cape Scott	2012	99	55	
Meikle	2014	179	61	
Alberta				
Ghost Pine	2010	81	51	www.alberta.ca/environmental-impact-assessments-current-projects.aspx
Wintering Hills	2010	88	55	
Halkirk Wind	2010	149	83	
Oldman 2	2010	50	22	
Blackspring Ridge	2011	299	166	
Bull Creek	2015	29	17	
Saskatchewan				
Chaplin	2016	177	59-118	www.saskatchewan.ca/business/environmental-protection-and-sustainability/environmental-assessment
Blue Hill	2018	177	56	
Manitoba				
St. Leon I and II	2007, 2010	120	73	www.gov.mb.ca/sd/eal/registries/
St. Joseph	2009	138	60	

In the final stage of coding, issues raised were summarized in a hierarchical coding frame to identify broad themes that capture the overall nature and scale of the issues raised. Literature focused on the scope and expectations of EA was used to gauge which issues are typically discussed within the context of project-level assessments and which are the focus of more regional, policy, planning, or strategic-level assessments. For example, impacts of a proposed project on local water resources or wildlife and human health are issues typically assessed at the project level (Keith et al. 2008; Larsen et al. 2018; Madders and Whitfield 2006; Smart et al. 2014), and thus within the scope of what project proponents might be expected to assess – usually as identified in their EA terms of reference. In contrast, other literature (Doelle and Critchley 2015; Geißler et al. 2013; Gibson et al. 2010; Noble 2017; Phylip-Jones and Fischer 2013) indicates that many issues raised in project reviews are beyond the scope of a single-project assessment, such as land use planning, climate change, energy policy, and more appropriate to policy or strategic-level assessments.

There are limitations to the approach. The sample of EAs does not include all wind energy projects in the study area, as not all wind energy projects trigger an EA review. Further, the analysis focused only on those written comments and submissions to the formal EA process. Not all individuals or actors with a concern

about wind energy necessarily engage in the EA process. Our analysis may not capture all issues and concerns about wind energy projects, but it does capture those included in the formal decision-making record for projects subject to EA review.

3. Results

3.1 Issues raised in EA submissions

A total of 848 comments were identified in EA submissions across the sample of projects reviewed, from which 50 different issues were extracted that capture public and actor concerns about proposed wind energy development (**Table 3**). Approximately 50% of all comments coded to only 7 issues. Impacts to the terrestrial environment was the most frequently raised (n = 141) and was identified across all 16 projects. Impacts to wildlife (n = 63), birds and bats (n = 45), and habitat (n = 38) were the primary concerns raised within this category, typically in relation to site clearing, increased back country road access, bird and bat collision, and the introduction of invasive flora. Noise from turbine construction and operation; impacts to other land tenure holders; turbine setback distances; visual impacts; light pollution and flicker effect; and loss of property value comprised the balance of the top 50% of frequently raised issues and were found in EA submissions for least half of the projects reviewed.

Concerns about impacts to other land tenure holders were raised 55 times and across all 16 projects. These concerns were twofold: first, concerns about restricted or no access to lands within or adjacent to the project site for other licensees, such as electricity utilities, energy pipeline rights-of-way and maintenance, and community woodlot licenses; second, impacts to, or interference with, other industrial land uses. For example, a mining tenure holder expressed concern that the Cape Scott project, located on Vancouver Island, would affect access to mineral title in the project area; and an aerial pesticide application business expressed concern that the Wintering Hills project in east-central Alberta would restrict aerial service to certain areas, resulting in adverse economic impact.

Concerns about noise, setback distances from residential areas, flicker effect, and visual impact were often raised in relation to health concerns and property values. For example, comments about project lighting and noise levels from blade rotation were often discussed in relation to individual and community health and well-being. A comment on the St. Joseph project, southern Manitoba, for example, characterized the wind farm as an “industry area”, noting that “the area will be a disaster …[and] fewer people want to live in an industry area." Many other issues, such as road and traffic safety, were also commonly raised across projects but were raised less frequently – suggesting that it may be a *typical* concern but not a frequently raised one

by multiple interests (**Table 3**). Concerns about government policies for renewable energy, technology related hazards, and social cumulative impacts appear both *less typical* and *less frequently raised* issues when wind energy projects are proposed. Some issues were unique to a particular project. For example, a specific concern regarding the Bear Mountain project, Northeast British Columbia, was whether the project would make a substantial enough energy contribution to decrease uptime of coal or oil and gas fired power plants.

Table 3: Frequency of specific issues raised in EA submissions by all actors across the sample of 16 wind energy projects, showing top 50%, next 25%, and bottom 25%, and number of projects for which issues were raised.

Issue	Frequency[i]	Issue	Frequency[i]
Top 50%			
1. Impact on terrestrial environment	141 [16]	5. Visual impact	46 [9]
2. Noise	76 [10]	6. Light flicker/strobe light effects, and light pollution	45 [7]
3. Impact on other tenure holders	55 [11]		
4. Setback distances	55 [8]	7. Loss of property value	39 [6]
Next 25%			
8. Impact to aquatic environment	39 [6]	12. Employment opportunities	27 [8]
9. Adequacy of consultation process	35 [10]	13. Health impacts (other than noise)	20 [6]
10. Selection of project location	31 [10]	14. Biophysical cumulative impacts	13 [7]
11. Impact on recreational use	31 [5]	15. Community benefit (other than jobs)	13 [3]
Bottom 25%			
16. Impact on roads and traffic safety	12 [8]	34. Impact on protected/sensitive areas	4 [2]
17. Technology hazards (e.g. ice throw)	12 [2]	35. Benefit agreements negotiation	4 [2]
18. Compensation for impacts	11 [5]	36. Increased natural hazards	4 [3]
19. Social cumulative impact	11 [2]	37. Concern with tax and revenue[ii]	3 [3]
20. Need for traditional use assessment[iii]	8 [5]	38. Impact on microwave and radar	3 [3]
21. Impact on agriculture lands	8 [5]	39. Impact on air traffic navigation	3 [3]
22. Access to traditional use areas[iii]	8 [3]	40. Timeliness of EA process	3 [2]
23. Chemical hazards/ contamination	8 [2]	41. Concerns about rules or laws[ii]	3 [2]
24. Concerns about different policies[ii]	8 [1]	42. Concern with export/import of power	3 [1]
25. Cumulative impacts (other) [ii]	7 [6]	43. Placement of meteorological towers	2 [1]
26. Archaeological site disturbance	7 [5]	44. Concern related with competition[ii]	2 [1]
27. Preference for different energy form	7 [3]	45. Social effects (unspecified) [ii]	2 [1]
28. Impact on GHG reduction goals	7 [1]	46. Impact of ground disturbance[ii]	1 [1]
29. Impact on Treaty rights[ii]	6 [2]	47. Impacts to land use (unspecified) [ii]	1 [1]
30. Credibility of EA process	6 [1]	48. Adverse impacts to local busines[ii]	1 [1]
31. Air quality impacts (dust, emissions)	5 [4]	49. Climate change (unspecified) [ii]	1 [1]
32. Disturbance of traditional use areas[iii]	5 [2]	50. Supply source for site construction aggregate materials[ii]	1 [1]
33. Viability (cost, stability)	5 [1]		

[i] total number of times an issue was raised across all projects [total number of projects in which the issue was raised]
[ii] general issue or concern was raised but no further details provided.
[iii] referring to Indigenous lands and resources and traditional use areas (e.g., hunting, fishing, cultural practices)

3.2 Issues raised by EA actors

Of the 848 concerns identified, 603 (71%) were public comments or submissions; 127 (15%) from environmental non-government organizations (NGOs); 100 (12%) from government agencies, and 18 (2%) from Indigenous organizations or their legal representatives. Public comments contained the greatest *diversity* of issues – 41 different issues across the sample of projects; Indigenous groups raised 28 different issues, government 20, and NGOs raised the least number of issues – six, focused primarily on terrestrial impacts and recreation (**Table 4**). The issue most frequently raised by government agencies, NGOs and Indigenous organizations concerned *project specific impacts* on *local terrestrial* and *aquatic environments*. However, public comments were most frequently related to noise, followed by impacts on terrestrial environments. Public 'participants' also frequently raised concerns related to setback distances from residences and property and impacts on other land uses; and Indigenous groups were often concerned with cumulative impacts and employment opportunities. With only three exceptions, namely the Halkirk, Blackspring, and Ghost Pine projects in Alberta, all concerns identified in project submissions from Indigenous groups were for projects in British Columbia.

Table 4: Most frequently raised issues (top 50% based on frequency) by concerned group in comments and submissions to the EA process for the sample of 16 wind energy projects

Concerned Group	Issues	Frequency
Public	Noise impact	66
	Impact on terrestrial environment	63
	Setback distances	48
	Impact on other tenure holders/licensees/land uses	47
	Flickering/strobe light effects/shadow/light pollution	43
	Visual impacts	40
	Loss of property value	39
Governments	Impact on terrestrial environment	37
	Impact to aquatic environment	15
NGOs	Impact on terrestrial environment	10
Indigenous groups	Impact on terrestrial environment	31
	Impact to aquatic environment	10
	Social cumulative impact	9
	Employment opportunity	9
	Traditional land use (TLU) assessments	8
	Access to TLU areas	8

3.3 Issues raised by EA jurisdiction

The main issues raised by jurisdiction are identified in **Table 5.** This is based on the top 50% of issues noted across projects in the respective jurisdiction. The number and diversity of issues raised within each jurisdiction also varied considerably from project to project. For example, the most frequently raised issues

for wind energy projects in British Columbia concerned project impacts on the terrestrial environment, raised for all projects and raised more than twice as often as the next issue of concern. Concerns about impacts to aquatic environments, identified 39 times, was the only other issue raised in all projects. Concerns about the *flicker effect* and *light pollution* were also in the top 50% of issues raised in British Columbia, but they were all raised in relation to one project – Bear Mountain. More than 80% of all issues across all projects in British Columbia concerning impacts on recreation, noise (88%), setback distances (91%), and flicker effect (100%), were raised for the Bear Mountain project. Bear Mountain was the province's first fully operational wind park, located only 16 km southwest of the city of Dawson Creek. The project with the next most frequently raised and diverse issues was the Meikle project, the most recent wind project in the province. The fewest issues were raised for the Dokie project, located on Crown land in the northeast region of the province, and far away from the nearest community, and Thunder Mountain, also in the northeast and located far from the nearest community - but also the project with the largest generating capacity.

Table 5: Most frequently raised issues (top 50% based on frequency) by jurisdiction in comments and submissions to the EA process for the sample of 16 wind energy projects

Jurisdiction	Issues	Frequency	Projects
British Columbia [6 projects]	Impact on terrestrial environment	99	6
	Setback distances	46	3
	Noise	42	3
	Impact to aquatic environment	39	6
	Light flicker/pollution	37	1
	Impact on recreation	31	5
Alberta [6 projects]	Noise	23	6
	Impact on terrestrial environment	24	6
	Impact on other tenure holder/license/land users	17	4
	Impact of project (other than noise and light) on health	17	4
	Visual impact	11	5
	Loss of property value	10	3
Saskatchewan [6 projects]	Impact on terrestrial environment	15	2
Manitoba [2 projects]	Noise	11	1
	Impact on other tenure holder/license/land users	8	2
	Potential technology related hazard	7	1
	Visual impact	6	2

In Alberta, concerns about noise and project specific impacts on terrestrial environments were the most frequently identified issues and appeared in all EAs. The Oldman 2 project, southwest Alberta, and Ghost Pine project, central Alberta, both located closer to communities than the Halkirk project in east-central Alberta, recorded the greatest frequency of issues and concerns, while Halkirk had the lowest. Relatively few issues were also raised Blackspring, the largest wind farm in Alberta, but located on privately owned land in the south central region and 30 km from the nearest urban settlement.

Impacts to terrestrial environments were the most frequently raised issue for Saskatchewan projects, and comprised more than 50% of issues raised. The frequency of issues for the most recently proposed wind project in Saskatchewan, Blue Hill, was higher than the previous Chaplin project. Both proposals are for developments in southwest Saskatchewan. Blue Hill is located closer to a community than the proposed Chaplin project; however, the EA for Chaplin was rejected due to concerns about the project's proximity to a designated migratory bird corridor.

For Manitoba projects, noise-related issues were the most frequently raised. Concerns about noise impacts were raised 11 times in EA comments and submissions, but notably only in relation to *one* project – St. Joseph. Most issues raised in the St. Josef EA were double those raised for the earlier St. Leon project. Both projects are located in southern Manitoba in the vicinity of communities and on privately owned agricultural land.

3.4 Key themes

The 50 different issues, raised 848 times across all EA submissions and comments, indicate what people are generally concerned about, and what they want EA to resolve when wind projects are proposed. Based on the submissions and comments, several broad themes can be seen (**Table 6**). The majority of themes comprise project-specific concerns, such as project impacts on the local environment (e.g., habitat disturbance), implications for health and community well-being (e.g., light flicker), and economic impact (e.g., employment), or to concerns about the administration of EA process (e.g., assessment timelines, adequacy of consultation). However, results also indicate that many issues extend beyond the typical scope of a project-specific review.

In each of the four jurisdictions, as is the case across all Canadian EA jurisdictions, the legislative focus of EA is on the impacts of a project itself (McMaster et al. 2020). However, more than one-third of all issues raised across the sample of EAs mapped to the theme *land use planning* (**Table 6**), reflecting issues and concerns much broader than the wind energy project under review such as land use conflicts and implications for other land uses and land tenure- and rights-holders. For the Cape Scott project, for example, a mining company raised concerns about issuing a "license of occupation," noting that the proposed wind energy project was within the company's mineral claim area and would restrict mineral exploration and development opportunity. Similarly, a major hydrocarbon exploration and production company expressed concerns about the Halkirk project because it conflicted with their existing resource claim area; and an electricity distribution company identified potential conflicts with the proposed Blackspring project's electricity collector system and the company's existing power corridors. Private agricultural landowners

and associations also expressed concerns about limited access to productive lands (St. Leon), and disruptions to seasonal cattle grazing and range corridors (Bear Mountain).

A second, but less prominent non-project-focused theme concerned provincial or national *energy policy and renewables options* (**Table 6**). Although this was only 4% of issues across the sample of projects, public and other actors raised comments and concerns about the adequacy of provincial energy policies to support growth in the renewables sector, the viability of wind energy to meet climate targets, and energy import-export regulations. Similar to land use planning, such issues are beyond the scope of project-focused EA and require a policy or planning response (e.g., Geißler et al., 2013; Phylip-Jones and Fischer, 2015).

Table 6: Broad themes of issues and frequency they were raised across the sample of projects.

Theme	Frequency of issues captured [%]
Land use planning: competing land uses, land use conflicts, land rights, and related project siting concerns. *Examples:* impacts to other land tenure holders (e.g. mining, energy pipelines, agriculture); setback distances from designated uses or features; visual impacts and property values; interference with access to Indigenous traditional land use and infringement of land rights	35%
Impacts on the local environment: impacts to the biophysical environment at, or near the project site. *Examples:* project impacts to wildlife habitat; risk to migratory birds; sedimentation and water quality impacts; wetland disturbance; air quality (i.e., dust)	22%
Health and community well-being: impacts to individual and community well-being. *Examples:* noise and light pollution; light flicker; road and traffic safety; community sense of place/identify	18%
Economic opportunity and impact: income, employment and business costs and benefits. *Examples:* new employment opportunities; compensation for impacts; local business opportunities and costs; benefit agreements	7%
Concerns about EA process: procedural concerns about the assessment processes for the project. *Examples:* adequacy of consultation; regulatory timelines; credibility and trust	5%
Energy policy and renewables options: government policy regarding renewable energy development and suitability of wind energy to meet policy goals. *Examples:* adequacy of policies to support renewable energy; effectiveness of wind to meet energy demands and GHG reduction targets; energy import-export policies	4%
Cumulative impacts: interactions of project impacts with impacts of other land uses and disturbances in the project's environment. *Examples:* habitat loss; disturbance of Indigenous traditional use lands; change in community identity	4%
Project risks and hazards: associated with project operations or natural hazards and events. *Examples:* ice-throw and public safety; chemical hazards on construction site; fire and flood hazards to project	3%
Cultural and social implications: impacts to cultural and archaeological resources. *Examples:* disturbance to archaeological and spiritual sites; need for comprehensive Indigenous traditional land use assessments; other (unspecified) concerns about impacts to 'way of life'	2%
Other: issues vaguely identified or raised in comments and submission for which specific meaning or categorization could not be discerned.	< 1%

Environmental Management Vol 68, pages 591–603
https://doi.org/10.1007/s00267-021-01518-2

4. Discussion

4.1 Diversity of issues raised and project characteristics

Although the sample of projects reviewed spanned 14 years, there was no apparent relationship between the number or diversity of issues raised in the EA process for more recent versus older projects. We also observed no relationship between the number or diversity of issues raised and the size of the project - i.e., generation capacity, number of turbines. However, results suggest that more issues are raised during the EA process for projects located closer to settlements. This is not unexpected and is consistent and well document in the literature on facility citing (e.g., Baxter et al. 2013; Devine-Wright 2009; Swofford and Slattery 2010). There is considerable research showing public support for wind energy (Hamilton et al. 2018), but communities often prefer that turbines are out-of-sight (Jones and Eiser 2010).

Multiple factors affect the nature and extent of concerns raised when wind energy projects are proposed. While this study did not set out to test NIMBYism (not-in-my-back-yard), it does suggest that proponents pursuing wind energy projects might expect a larger number and greater diversity of issues to be raised during the EA process when the proposed development is close to communities – regardless of project size (i.e., number of turbines) or whether wind energy projects already exist in the area. Local issues and concerns about wind energy emerging during the EA process should not be surprising, if such concerns have not been addressed earlier in the project planning cycle (Khan 2003). This has implications for both project proponents and decision makers, in that early consultation for wind energy projects may need to be enhanced if EA is not to delay renewable energy initiatives. Proponents and decision makers often take public support for granted for wind energy projects (Toke et al. 2008), but we cannot assume that such projects do not cause concern simply because they are a ‘green’ energy source.

4.2 Proactively addressing recurrent project issues

The local impacts often identified during EAs for wind energy, and the strategies for addressing them, are not always new or unique (Doelle and Critchley 2015). The results indicate several recurring issues similar to those reported in other research on local concerns about wind energy (e.g., Baxter et al. 2013; Devine-Wright 2005; Geiβler et al. 2013; Langbroek and Vanclay 2012). Concerns such as impacts to habitat, wildlife, soils, and human health are typical and frequently raised, regardless of project size, location, or jurisdiction, and fall within the scope of what a project-based EA process can manage or mitigate (e.g., Fast et al. 2016; Jami and Walsh 2017; Knopper et al. 2014; Kørnøv et al. 2005). However, these issues are repeatedly raised over time and across projects, which indicates that communities need better information about the typical impacts and risks of wind energy developments and how proponents and governments plan to manage them (McMaster et al. 2020; Schuster et al. 2015).

Pre-empting common project-related concerns requires that proponents and decision makers are aware that such issues and concerns exist, and that potentially affected communities are provided with the information in advance of wind energy proposals so that they understand what to expect. The absence of such information, and not knowing what to expect when wind energy projects are proposed, can lead to misunderstandings about the impacts of wind energy, delayed projects, and in worst-case scenarios the abandonment of otherwise viable renewable energy projects (Schumacher 2017; Wright 2014). Limited experience with wind energy EA is not the problem, but rather limited mobilization and sharing of knowledge (McMaster et al. 2020; Sánchez and Mitchell 2017). By building on previous assessments, there is an opportunity to not only better understand impacts and improve management strategies for future projects (Greig and Duinker 2011), but also to minimize the EA transaction costs for renewable energy projects (McMaster et al. 2020; Schumacher 2017). Unfortunately, such open knowledge transfer is less common in EA that it should be (Expert Panel 2017), and a more formalized knowledge broker may be required to fill this role (McMaster et al., 2020) – such as Canada's Wind Energy Association, a non-profit organization representing energy owners, operators, manufacturers, project developers, consultants, and service providers (see https://canwea.ca/).

4.3 Recurring strategic issues and solutions

Some issues extended beyond project-specific impacts. Land use planning and competing land uses, including conflicts between project siting and other industrial or commercial land tenure holders (e.g., mining, energy, agriculture), infringements on traditional rights-holders (i.e., Indigenous land uses), and community concerns about property values and viewscapes, comprised one-third of all issues raised. Landscape and land use concerns can dominate the conversation when wind energy projects are proposed

(Mulvihill et al. 2013; Fast et al. 2016; Langbroek and Vanclay 2012; Larsen et al., 2018; Tabassum-Abbasi et al. 2014) – even more so than for fossil fuel projects (Wüstenhagen et al. 2007). Such concerns, especially those related to conflicting land uses, are not unique to Western Canada. Scott et al. (2014), for example, report on land use conflicts and concerns about cumulative landscape and visual impacts from a sample of small-scale wind energy project applications in Aberdeenshire, UK. In northern Sweden, Szpak (2019) identified significant concern from the Sámi people over wind farms and implications for traditional reindeer herding activity. Similar concerns about land use allocation for wind energy and the disruption of livelihoods and culture have also been raised by the Sámi reindeer herding community in Norway (Norman 2020).

Other strategic issues identified in public comments and submissions were raised less frequently but represent important issues that can either facilitate or constrain projects at the EA stage. Approximately 4% of issues concerned broader energy policy and discussions about the efficacy of renewables, including energy import-export policy and whether wind energy was sufficient to meet provincial or national greenhouse gas reduction targets. Gerrard (2008) reports that questions are often raised about climate change mitigation when renewable energy developments are proposed, in addition to concerns about the ability of wind power to sufficiently contribute to climate change mitigation (Smart et al. 2014).

The types of strategic issues noted above are important in the transition to renewable energy, but they may be beyond the ability of proponents to effectively resolve within the scope of a project EA, or at least difficult to resolve at the time an EA application is submitted (McMaster et al. 2020). Larsen et al. (2018), for example, found that aesthetic issues, property values and cumulative impacts concerning wind energy development in Denmark are poorly addressed in EA applications. Phylip-Jones and Fischer (2013) report that the consideration of alternative locations for wind farms in EA processes in the UK and Germany are limited; while in eastern Canada Mulvihill et al. (2013) conclude that project-level approaches to site selection for wind energy are largely ineffective at resolving land use concerns. The overall lack of strategic planning for wind energy projects, including early engagement in facility siting, can result in conflict and public backlash at the time individual projects are proposed (Smart et al. 2014).

The limitations of EA in addressing strategic issues are not unique to wind energy. Mulvaney (2017) reports that utility scale solar development is the source of land use conflicts with local communities and Native American tribes in the American southwest. In the Finnish and Canadian Arctic, Strauss (2012) reports that EA procedures are insufficient for properly siting large-scale energy developments and addressing land and resource conflicts. Leaving strategic issues to be addressed at the time projects are proposed may even threaten the viability of some renewable energy projects (Enevoldsen and Sovacool 2016; Geißler et al. 2013; McMaster et al. 2020; Schumacher 2017). Macintosh et al. (2018) and Mclaren and Loring (2007)

report examples of wind energy projects suffering from lengthy delays and a large number of planning applications for wind energy projects failing at the local level. McMaster et al. (2020) report on one wind energy project in Western Canada under EA review for 1,157 days, only to result in a decision to reject the project due to its location near a recognized migratory bird flight path – a location factor known prior to commencement of the EA process.

Findings from this research suggest that a more strategic approach to wind energy development is required before individual projects are tabled for EA approval. This is not a new argument (e.g., Geißler et al. 2013; McMaster et al. 2020; Mulhivill et al. 2013; Thygesen and Agarwal 2014), but progress has been slow. This is especially the case in Canada, where wind energy falls under the jurisdiction of the provinces and territories, but provisions for strategic environmental assessment exist only at the national level. The EA experience in Canada's energy sectors has been marked by conflict, shaped by a number of high profile and controversial fossil fuel-based projects, and highly criticized by both proponents for causing unnecessary project delays and by affected actors for failing to resolve strategic issues associated with land use, energy policy, and climate change (Expert Panel 2017; Hunsberger et al. 2020; Macintosh et al. 2018; Udofia et al. 2017). Mulvihill et al. (2013) argue that the development of renewable energy projects will facing serious questions in absence of prior consideration of historical, recurring, and emerging issues at the strategic level. They suggest that the absence of an effective strategic level planning and assessment regime may result in net delay in the long run to the development of renewable energy projects. This is frustrating not only for developers, but also for meeting nationally and internationally important climate change objectives (Ellis et al. 2009).

5. Conclusion

A global energy transition is well underway and utility scale renewable energy projects will increase significantly over the foreseeable future. EA will continue to be a primary assessment and decision support tool to identify and mitigate potential impacts of renewable energy projects. This is especially true when it comes to wind projects, which, after large scale hydro, tend to generate 429 the most controversy regarding siting decisions. The results of this research show several recurring and enduring concerns in EA when wind energy projects are proposed – many of these are typical project-related impacts, ones that proponents can and should be prepared to address; however, our research also shows that other concerns are more strategic in nature, concerning policy- and planning-related issues. Three types of issues that policy makers and project proponents need to consider regarding wind energy development: 1) specific project-level issues, 2) recurring project-level issues, and 3) recurring strategic-level issues. Importantly, this research provides insights on where we can likely find some efficiencies in EA for renewable energy projects by identifying the recurring issues at both the project- and strategic-

levels, so that policy makers and project proponents can proactively and effectively address these issues before or outside of project EA processes. For instance, it would be more efficient not to load such issues about land use designations, energy export policies, or whether wind energy is the "right" energy source onto the project-level EA process. These are issues that could, and arguably should, be addressed at a strategic level and almost are invariable recurring issues that are fully foreseeable. Addressing these recurring issues in a transparent and systematic way will not only reduce proponent frustrations and needlessly expended financial and human resources, but will strengthen investor confidence, as the recurring parameters are known to all parties before a project EA commences. Nevertheless, some of these issues will always end up in EA no matter what. But if policy makers implement mechanisms to address recurring project- and strategic-level issues, proponents will be better prepared to address them, thus avoiding real, perceived, and unnecessary delays and conflicts in renewable energy development.

6. Acknowledgements

We wish to acknowledge the Social Sciences and Humanities Research Council of Canada and the Community Appropriate Sustainable Energy Security (CASES) partnership for supporting this work. As CASES researchers and scholars, we embrace the special relationship in Canada that we are all treaty people—we reside on, work with, or are members of Indigenous communities from Treaties 5, 6, and 11, and Metis and Inuit homelands.

7. References

Bataille C, Sawyer D, & Melton N (2015) Pathways to deep decarbonization in Canada. Sustainable Development Solution Network (SDSN) and Institute for Sustainable Development and International Relations (IDDRI)

Baxter J, Morzaria R, Hirsch R (2013) A case-control study of support/opposition to wind turbines: Perceptions of health risk, economic benefits, and community conflict. Energy Policy 61:931-943. https://doi.org/10.1016/j.enpol.2013.06.050

Bond A, Pope J, Morrison-Saunders A, Retief F, Gunn J (2014) Impact assessment: eroding benefits through streamlining. Environ Impact Assess Rev 45:46–53. https://doi.org/10.1016/j.eiar.2013.12.002

CANWEA (2020) Wind energy markets – installed capacity. Database of wind farms in Canada. Accessed on Feb-2020. http://canwea.ca/wind-energy/installed-capacity/

Canada Energy Regulator (2018) Canada's Renewable Power Landscape 2016 – Energy Market Analysis. Accessed from https://www.neb-one.gc.ca/nrg/sttstc/lctrct/rprt/2016cndrnwblpwr/prvnc/sk-eng.html

Canada Energy Regulator (2019) Canada's Energy Future 2019. Energy Supply and Demand Projections to 2040. Retrieved from https://www.cer-rec.gc.ca/nrg/ntgrtd/ftr/2019/2019nrgftr-eng.pdf

Canada Energy Regulator (2020) Provincial and Territorial Energy Profiles. Accessed from https://www.cer-rec.gc.ca/nrg/ntgrtd/mrkt/nrgsstmprfls/index-eng.html

Chandra Y, Shang L (2019) Inductive Coding. In: Qualitative Research Using R: A Systematic Approach. Springer, Singapore, pp 91-106. https://doi.org/10.1007/978-981-13-3170-1_8

Chetkiewicz C, Lintner AM (2014) Getting it Right in Ontario's Far North: The need for a regional strategic environmental assessment in the ring of fire (Wawangajing). Thunder Bay, Ontario: Wildlife Conservation Society Canada and Ecojustice

Dai K, Bergot A, Liang C, Xiang WN, Huang Z (2015). Environmental issues associated with wind energy — a review. Renew Energy 75:911–921. http://dx.doi.org/10.1016/j.renene.2014.10.0745

Devine-Wright P (2005) Beyond NIMBYism: Towards an integrated framework for understanding public perceptions of wind energy. Wind Energy 8(2):125-139. https://doi.org/10.1002/we.124

Devine-Wright P (2009) Rethinking NIMBYism: The role of place attachment and place identity in explaining place-protective action. J of Community & Appl Soc Psychology 19(6): 426-441. https://doi.org/10.1002/casp.1004

Doelle M, Critchley R (2015) The role of strategic environmental assessments in improving Scotia. McGill International J of Sustainable Development Law and Policy 11(1):87-114

Ellis G, Cowell R, Warren C, Strachan P, Szarka J, Hadwin R, Miner P, Wolsink M & NadaÏ A (2009) Wind Power: Is There A "Planning Problem"? Expanding Wind Power: A Problem of Planning, or of Perception? The Problems Of Planning—A Developer's Perspective Wind Farms: More Respectful and Open Debate Needed, Not Less Planning: Problem "Carrier" or Problem "Source"? "Innovative" Wind Power Planning. Planning Theory & Practice 10(4):521-547. https://doi.org/10.1080/14649350903441555

Enevoldsen P, Sovacool B (2016) Examining the social acceptance of wind energy: Practical guidelines for onshore wind project development in France. Renew & Sustainable Energy Rev 53:178-184. https://doi.org/10.1016/j.rser.2015.08.041

Expert Panel (2017) Building common ground: A new vision for impact assessment in Canada. Environment and Climate Change Canada, Ottawa ON: CEAA

Eyford DR (2013) Forging partnerships building relationships: Aboriginal Canadians and energy development. Report to the Prime Minister. Ottawa ON: Natural Resources Canada

Fast S, Mabee W, Baxter J, Christidis T, Driver L, Hill S, Tomkow M (2016) Lessons learned from Ontario wind energy disputes. Nature Energy 1(2):15028. https://doi.org/10.1038/nenergy.2015.28

Fischer D, Lochner P, Annegarn H (2020) Evaluating the effectiveness of strategic environmental assessment to facilitate renewable energy planning and improved decision-making: A South African case study. Impact Assess Proj Apprais 38(1):28–38. https://doi.org/10.1080/14615517.2019.1619389

GE Energy Consulting (2016). Pan-Canadian Wind Integration Study (PCWIS). Prepared for Canadian Wind Energy Association (CanWEA). Revision 3. Retrieved from https://canwea.ca/wp-content/uploads/2016/07/pcwis-fullreport.pdf

Geißler G, Köppel J, Gunther P (2013). Wind energy and environmental assessments - a hard look at forerunners' approaches: Germany and the United States. Renew Energy 51:71-78. https://doi.org/10.1016/j.renene.2012.08.083

Gerrard M (2008). Climate Change and the Environmental Impact Review Process. Nat Resour & Environ, 22(3):20-24

Gibson RB, Benevides H, Doelle M, Kirchhoff D (2010) Strengthening strategic environmental assessment in Canada: An evaluation of three basic options. J of Environ Law and Practice, 20(3):175-211

Gielen D, Boshell F, Saygin D, Bazilian M, Wagner N, Gorini R (2019) The role of renewable energy in the global energy transformation. Energy Strategy Rev, 24:38-50. https://doi.org/10.1016/j.esr.2019.01.006

Government of Alberta (2018, September) Transitioning Alberta to a Greener Grid. https://open.alberta.ca/dataset/6d1a4c64-e18a-40db-8348-be0f33ccc871/resource/2ef8c42d-84ce-46b9-abc9-2598ac3c799f/download/ppca-energyprofile-final.pdf

Government of Alberta (2018b, Dec 17) Wind projects create jobs, Indigenous partnerships. https://www.alberta.ca/release.cfm?xID=6225465E583D7-C8A6-0844-D9754D497BA00D68

Government of Manitoba (2018) Sustainable development-Wind energy. https://www.gov.mb.ca/sd/environment_and_biodiversity/energy/wind/index.html

Greig LA, Duinker PN (2011) A proposal for further strengthening science in environmental impact assessment in Canada. Impact Assess and Proj Apprais, 29(2):159–165. https://doi.org/10.3152/146155111X1291367973055

Hamilton L, Bell E, Hartter J, Salerno J (2018) A change in the wind? US public views on renewable energy and climate compared. Energy, Sustainability and Society 8(11): 1-13. https://doi.org/10.1186/s13705-018-0152-5

Hanna K, Noble BF (2011) The Canadian environmental assessment registry: Promise and reality. UVP Rep 25(4): 222-225

Hanna K, Noble BF (2015) Using a Delphi study to identify effectiveness criteria for impact assessment. Impact Assess and Proj Apprais 33(2): 116-125. https://doi.org/10.1080/14615517.2014.992672

Hanna K, McGuigan E, Noble B, Parkins J (2019) An analysis of the state of impact assessment research for low carbon power production: Building a better understanding of information and knowledge gaps. Energy Res and Soc Sci 50:116-128. https://doi.org/10.1016/j.erss.2018.10.017

Harper D, Wong S, Drost A, Crossman T, Taylor D, Bakker N, Chernawsky N, Nolin M (2016) An overview of various provincial climate change policies across Canada and their impact on renewable energy generation. Energy Regulation Quarterly 4(4)

Hirsh R, Sovacool B (2013) Wind turbines and invisible technology: Unarticulated reasons for local opposition to Wind Energy. Technology and Culture 54(4):705-734

Hunsberger C, Froese S, Hoberg G (2020) Toward 'good process' in regulatory reviews: is Canada's new system any better than the old? Environ Impact Assess Rev 82:106379. https://doi.org/10.1016/j.eiar.2020.106379

IRENA [International Renewable Energy Agency] (2018) Renewable energy statistics 2018. International Renewable Energy Agency. https://irena.org/publications/2018/Jul/Renewable-Energy-Statistics-2018

IRENA (2020) 10 years progress to action. Accessed on 18 Apr 2021. https://www.irena.org/publications/2020/Jan/10-Years-Progress-to-Action

Jami A, Walsh P (2017) From consultation to collaboration: A participatory framework for positive community engagement with wind energy projects in Ontario, Canada. Energy Res & Soc Science 27:14-24. https://doi.org/10.1016/j.erss.2017.02.007

Jay S (2010) Strategic environmental assessment for energy production. Energy Policy 38(7):3489-3497. https://doi.org/10.1016/j.enpol.2010.02.022

Jones C, Eiser R (2010) Understanding 'local' opposition to wind development in the UK: How big is a backyard. Energy Policy 38:3106–3117. https://doi.org/10.1016/j.enpol.2010.01.051

Keith S, Michaud D, Bly S (2008) A proposal for evaluating the potential health effects of wind turbine noise for projects under the Canadian Environmental Assessment Act. J Of Low Frequency Noise Vib And Active Control 27(4):253-265. https://doi.org/10.1260%2F026309208786926796

Khan J (2003) Wind power planning in three Swedish municipalities. J of Environl Planning and Management 46 (4): 563-581. https://doi.org/10.1080/0964056032000133161

Knopper L, Ollson C, Mccallum L, Whitfield Aslund M, Berger R, Souweine K, Mcdaniel M (2014) Wind turbines and human health. Frontiers in Public Health 2:63. https://doi.org/10.3389/fpubh.2014.00063

Kørnøv L, Christensen P, Nielsen E (2005) Mission impossible: Does environmental impact assessment in Denmark secure a holistic approach to the environment? Impact Assess and Proj Apprais, 23(4):303-314. https://doi.org/10.3152/147154605781765427

Labanca N (2017) Complex Systems and Social Practices in Energy Transitions: Framing Energy Sustainability in the Time of Renewables. Springer

Langbroek M, Vanclay F (2012) Learning from the social impacts associated with initiating a windfarm near the former island of Urk, The Netherlands. Impact Assess and Proj Apprais 30*(3)*:167-178. https://doi.org/10.1080/14615517.2012.706943

Larsen S, Hansen A, Nielsen H (2018) The role of EIA and weak assessments of social impacts in conflicts over implementation of renewable energy policies. Energy Policy, 115:43-53. https://doi.org/10.1016/j.enpol.2018.01.002

Macintosh A, Gibbons P, Jones J, Constable A, Wilkinson D (2018) Delays, stoppages and appeals: An empirical evaluation of the adverse impacts of environmental citizen suits in the New South Wales land and environment court. Environmental Impact Assess Rev 69:94-103. https://doi.org/10.1016/j.eiar.2018.01.001

Madders M, Whitfield D (2006) Upland raptors and the assessment of wind farm impacts. Ibis, 148(S1), 43-56. https://doi.org/10.1111/j.1474-919X.2006.00506.x

Mclaren Loring J (2007) Wind energy planning in England, Wales and Denmark: Factors influencing project success. Energy Policy*, 35*(4):2648-2660. https://doi.org/10.1016/j.enpol.2006.10.008McMaster R, Noble BF, Poelzer G, Hanna K (2020) Wind energy environmental assessment requirements and processes: an uneven landscape. Impact Assess and Proj Apprais, https://doi.org/10.1080/14615517.2020.1815271

Mulvaney D (2017) Identifying the roots of Green Civil War over utility-scale solar energy projects on public lands across the American Southwest. J of Land Use Science 12(6):493-515. https://doi.org/10.1080/1747423X.2017.1379566

Mulvihill P, Winfield M, Etcheverry J (2013) Strategic environmental assessment and advanced renewable energy in ONTARIO: Moving forward or blowing in the wind? *J of Environ Assess Policy and Management, 15*(2), 1-19. https://doi.org/10.1142/S1464333213400061

Noble B (2017) Getting the big picture: How regional assessment can pave the way for more inclusive and effective environmental assessments. Ottawa, ON: MacDonald Laurier Institute

Normann S (2020) Green colonialism in the Nordic context: Exploring Southern Saami representations of wind energy development. J of Community Psychology 1-18. https://doi.org/10.1002/jcop.22422

Natural Resources Canada [NRCan] (2020) Renewable energy facts. Accessed 26 April 2021. https://www.nrcan.gc.ca/science-and-data/data-and-analysis/energy-data-and-analysis/energy-facts/renewable-energy-facts/20069

Phylip-Jones J, Fischer T (2015) Strategic environmental assessment (SEA) for wind energy planning: Lessons from the United Kingdom and Germany. Environ Impact Assess Rev 50:203-212. https://doi.org/10.1016/j.eiar.2014.09.013

Potvin C, Burch S, Layzell D, Meadowcroft J, Mousseau N, Dale A, Henriques I, Margolis L, Matthews D, Paquin D, Ramos H, Sharma D, Sheppard S, Slawinski N (2017) Re-energizing Canada: Pathways to a Low Carbon Future. Sustainable Canada Dialogues. Retrieved from http://sustainablecanadadialogues.ca/pdf_2017/ReEnergizing_Final.pdf

Ryan K, Danylchuk A, Jordan A (2019) Consideration of scales in offshore wind environmental impact assessments. Environ Impact Assess Rev. 75:59–66. https://doi.org/10.1016/j.eiar.2018.12.004

Sánchez L, Mitchell R (2017) Conceptualizing impact assessment as a learning process. Environ Impact Assess Rev, 62:195-204. https://doi.org/10.1016/j.eiar.2016.06.001

Schumacher K (2017) Large scale renewable energy project barriers: environmental impact assessment streamlining efforts in Japan and the EU. Environ Impact Assess Rev. 65:100–110. https://doi.org/10.1016/j.eiar.2017.05.001

Scott A, Shannon P, Hardman M, Miller D (2014) Evaluating the cumulative impact problem in spatial planning: A case study of wind turbines in Aberdeenshire, UK. The Town Plan Rev 85(4):457-487. https://doi.org/10.3828/tpr.2014.27

Smart D, Stojanovic T, Warren C (2014) Is EIA part of the wind power planning problem? Environ Impact Assess Rev 49:13-23. https://doi.org/10.1016/j.eiar.2014.05.004

Strauss H (2012) Procedures for large-scale energy projects: Local communities and siting processes in the Arctic. The Polar J: Politics, Science and Environ in the Polar Reg 2(1):93-112. https://doi.org/10.1080/2154896X.2012.679562

Swofford J, Slattery M (2010) Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making. Energy Policy 38(5):2508-2519. https://doi.org/10.1016/j.enpol.2009.12.046

Szpak A (2019) Relocation of Kiruna and construction of the Markbygden wind farm and the Saami rights. Polar Science 22:100479. https://doi.org/10.1016/j.polar.2019.09.001

Tabassum-Abbasi PM, Abbasi T, Abbasi, SA (2014) Wind energy: Increasing deployment, rising environmental concerns. Renew and Sustainable Energy Rev 31:270- 288. https://doi.org/10.1016/j.rser.2013.11.019

Thygesen J, Agarwal A (2014) Key criteria for sustainable wind energy planning—lessons from an institutional perspective on the impact assessment literature. Renew and Sustainable Energy Rev 39(C):1012-1023. https://doi.org/10.1016/j.rser.2014.07.173

Toke D, Breukers S, Wolsink M (2008) Wind power deployment outcomes: How can we account for the differences? Renew and Sustainable Energy Rev, 12(4):1129-1147. https://doi.org/10.1016/j.rser.2006.10.021

Udofia A, Noble BF, Poelzer G (2017) Meaningful and efficient? Enduring the challenges to Aboriginal participation in environmental impact assessment. Environ Impact Assess Rev 65:164-174. https://doi.org/10.1016/j.eiar.2016.04.008

Walker C, Baxter J, Ouellette D (2015) Adding insult to injury: The development of psychosocial stress in Ontario wind turbine communities. Soc Science & Med 133:358-365. https://doi.org/10.1016/j.socscimed.2014.07.067

Wüstenhagen R, Wolsink M, Bürer M (2007) Social acceptance of renewable energy innovation: An introduction to the concept. Energy Policy 35(5):2683-2691. https://doi.org/10.1016/j.enpol.2006.12.001