NEED FOR AND ALTERNATIVES TO (NFAT) REVIEW

NFAT review for Manitoba Hydro's proposed preferred development plan for the Keeyask and Conawapa Generating Stations, their associated domestic AC transmission facilities and a new Canada-USA transmission interconnection

EVALUATING THE MACRO ENVIRONMENTAL AND SOCIO-ECONOMIC IMPLICATIONS OF ADDITIONAL WIND RESOURCES IN MANITOBA

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Submitted to the Manitoba Public Utilities Board

On behalf of the Manitoba Métis Federation

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1 INTRODUCTION

1.1 BACKGROUND

The *Manitoba Hydro Act* requires approval from the Lieutenant-Governor in Council for the development of new electricity generating stations, interconnections, and contracts for power exports and imports. In January 2011, the Government of Manitoba notified Manitoba Hydro (Hydro) of its intention to carry out a Needs For and Alternatives To (NFAT) review of Hydro's Preferred Development Plan (PDP). In November 2012, the Minister of Innovation, Energy and Mines announced that the Government of Manitoba had requested the Manitoba Public Utilities Board (PUB) to conduct the NFAT.

On August 16, 2013, Manitoba Hydro filed its NFAT documentation with the PUB for approval of its PDP. This Plan includes:

- Development of the Keeyask Project, a 695-megawatt (MW) hydroelectric generation project on the Nelson River with a proposed in-service date (ISD) of 2019;
- Development of the Conawapa Project, a 1,485-MW hydroelectric generation project on the Nelson River with an earliest ISD of 2026;
- Development of the North-South Transmission Project, a proposed 185-MW transmission line with an in-service date coinciding with the Conawapa Project;
- Development of the Manitoba-Minnesota Transmission Upgrade Project, a proposed 750-MW transmission intertie between Manitoba, Minnesota and Wisconsin with an in-service date of 2020;
- Development of natural gas generation facilities later in the planning period; and
- Six long-term export commitments, with Minnesota Power (MP), Wisconsin Public Service (WPS) and Northern States Power (NSP).

Manitoba Hydro notes that while the PDP includes the Conawapa Project, decisions on whether or not to construct Conawapa and its specific timing are not required now. However, activities (and spending) would continue to protect an in-service date for Conawapa as early as 2026, but conditions will be continually monitored to determine if such continued investments are worthwhile and, ultimately, to determine if Conawapa should be constructed and for what ISD.

The PUB is to submit a report to the Minister responsible for the administration of *The Public Utilities Board Act* by June 20, 2014. The report is to include recommendations to the Government of Manitoba on the need for the PDP and whether the Plan is in the best long-term interest of the Province compared to other options and alternatives.

1.2 QUALIFICATIONS

Rick Hendriks is Director of Camerado Energy Consulting, an Ontario-based consulting firm providing management consulting, strategic planning, research, and negotiation services to Aboriginal communities, community energy cooperatives, municipalities and non-governmental organizations with respect to energy planning, assessment, development and conservation. Mr. Hendriks' work with Aboriginal communities has focused on the environmental assessment of proposed hydroelectric, transmission and mining developments on or adjacent to some of the largest rivers in Canada, including the Mishta-shipu (Churchill) River in Nitassinan (Labrador), the Attawapiskat River in Treaty 9 (northern Ontario), the Slave River in Treaty 8 (Alberta and the Northwest Territories), and the Peace River in Treaty 8 (BC) in the traditional territory of the Dane-zaa.

Mr. Hendriks works closely and collaboratively with community and organizational leadership to envision, implement and achieve strategic objectives. Trained in engineering, science and social science, he brings an analytical, structured and comprehensive approach to understanding and explaining the opportunities and risks of development proposals.

Rick has provided testimony in several proceedings evaluating the environmental and socio-economic risks and benefits of hydroelectric development in Alberta, British Columbia, and Newfoundland and Labrador. At the recent environmental assessment hearings for BC Hydro's proposed Site C Clean Energy Project on the Peace River, he prepared written submissions and provided oral testimony concerning: the socio-economic benefits of wind resources; effectiveness of mitigation measures related to fish, fish habitat and fishing; and the development of site alternatives to the proposed Site C Project as a means to provide for potential reconciliation of the rights of the Crown with the rights of the affected First Nations.

Prior to founding Camerado Energy in 2009, Rick worked for six years with Chignecto Consulting Group, supporting natural resource negotiations between Aboriginal groups, government and industry with respect to mining and hydroelectric developments across Canada. Previous to that, Rick worked for the Innu Nation in Labrador as their environmental and engineering analyst for the proposed Lower Churchill Project.

Mr. Hendriks is a founding member of the Hamilton Association for Renewable Energy, and a member of the Ontario Waterpower Association, the Ontario Sustainable Energy Association and the Ontario Association for Impact Assessment.

1.3 MANDATE

The Terms of Reference for the NFAT Review of Manitoba Hydro's PDP require "an assessment as to whether the Plan is justified as superior to potential alternatives that could fulfill the need."[1] This assessment requires consideration of:

- "The macro environmental impact of the Plan compared to alternatives", [2] which involves "a critical analysis of the macro environmental impacts and benefits of Manitoba Hydro's Preferred Development Plan (PDP) and alternative Plans"[3]; and
- "The socio-economic impacts and benefits of the Plan and alternatives to northern and aboriginal communities" [4]; and
- "If the Plan has been justified to provide the highest level of overall socio-economic benefit to Manitobans, and is justified to be the preferable long-term electricity development option for Manitoba when compared to alternatives". [5]

I was requested by the Manitoba Métis Federation (MMF) to review the available evidence concerning the macro environmental impact and socio-economic impacts and benefits of the PDP and the alternative Plans, focusing on the potential for development of additional wind resources in Manitoba as part of an alternative plan to the PDP or as part of an optimized plan to delay a decision to proceed with the PDP. Secondly, I was asked to identify additional relevant information that would assist the Board in fulfilling its mandate with respect to the consideration of alternative plans containing wind resources, and of development of additional wind resources in Manitoba more generally.

[1] Terms of Reference – Needs For and Alternatives To (NFAT) Review ("NFAT Terms of Reference") at p.2.

[2] *Ibid.*, at p.3.

[3] Manitoba PUB, Order 92/13, at p.13.

[4] NFAT Terms of Reference, at p.3.

[5] *Ibid.*, at p.3.

2 REQUIREMENTS OF THE TERMS OF REFERENCE

2.1 MACRO ENVIRONMENTAL IMPACT

In Order 92-13, the PUB provided the following definition of "macro environmental impact":

> macro-environmental impact: the collective macro-environmental consequences of changes to air, land, water, flora and fauna, including the potential significance of these changes, their equitable distribution within and between present and future generations.[6]

Further to my previous submission to the PUB,[7] I understand this definition to imply the following with respect to these key terms:

- Collective: a bringing together of the consequences resulting from all components of the PDP or of the alternative plans that maintains their defining features
- Consequences: includes potential and likely, positive and adverse, direct and indirect, individual and cumulative, secondary and synergistic, where likelihood is determined by:
  - Probability of occurrence
  - Scientific uncertainty [8]
- Significance: consideration of the following criteria in relation to the "consequences of the changes":
  - Magnitude
  - Geographic extent
  - Duration and frequency
  - Degree to which the consequences of the changes are reversible or irreversible
  - Ecological context [9]

[6] Manitoba PUB, Order 92/13, at p. 14.

[7] Hendriks, R. February 2014. Need for and Alternatives To (NFAT) Review: Evaluating Macro Environmental Impact, at pp. 6-12.

[8] Federal Environmental Assessment Review Office. November 1994. A Reference Guide for the Canadian Environmental Assessment Act: Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects, at p. 193.

[9] *Ibid*., at p. 192.

2.2 SOCIO-ECONOMIC IMPACTS AND BENEFITS

2.2.1 Scoping the Definition of Socio-economic Impacts and Benefits

Prior to providing clarification with respect to the interpretation of "socio-economic impacts and benefits", the PUB required Manitoba Hydro and any approved intervener intending to address this factor to submit a definition of this term.[10] As was the case for macro environmental impact, the PUB received several responses to its request, and I reviewed these responses in preparing this evidence in order to better understand the intentions and expectations of the Board when defining this factor, as well as the positions of other NFAT participants.

Manitoba Hydro

In its response to the PUB request, Manitoba Hydro provided a definition of socio-economic impacts and benefits as follows:

> Socio-economic: high level summary of potential effects to people in Manitoba, including such things as employment, training and business opportunities; infrastructure and services; personal, family and community life; resource use; and heritage resources. [11]

In its response to the PUB request, Hydro also described the three-step process it used in its consideration of socio-economic impacts and benefits:

1. Screening level analysis
    - Sixteen available resource technologies were screened against over fifteen technical, economic, environmental and socio-economic criteria

The screening process undertaken by Hydro is described in Chapter 7 of the NFAT. Detailed information is summarized in Table 7.1, and further information concerning emerging energy technologies is provided in Appendix 7-1. The relevant findings of the NFAT concerning the macro environmental impact and socio-economic impacts and benefits of wind resources are discussed below in section 3.5 of this submission.

[10] PUB Order 67-13.

[11] Letter of Manitoba Hydro to Mr. H. Singh (PUB) of June 28, 2013 re: Manitoba Hydro NFAT Terms of Reference Meaning of "Macro Environmental" and "Socio-economic", at p. 1.

2. Preferred and alternative development plans

    - Specific resource plans were developed from the "screened in" technologies
    - A qualitative analysis of the potential environmental and socio-economic impacts of the specific resources in the preferred and alternative plans was undertaken
    - For the Keeyask, Conawapa and Manitoba-Minnesota Transmission Projects, Hydro drew on its existing understanding of these components of the PDP
    - For natural gas turbine and wind projects, Hydro drew from past environmental impact statements and licenses (underlining added)

Manitoba Hydro's suggested use of previous environmental impact statements, licenses and other related existing information for other similar projects is important and necessary in the case of wind and natural gas resources, since no detailed environmental assessments have yet been undertaken for specific wind and gas resources that would be developed as part of any alternative plans to the PDP. Environmental impact statements, licenses and related documents for comparable wind projects within and outside Manitoba are considered in section 4 of this submission in terms of both macro environmental and socio-economic considerations.

3. Multiple Account Benefit-Cost Analysis (MA-BCA)

    - The MA-BCA is a disaggregated form of cost-benefit analysis that integrates project specific environmental and socio-economic considerations along with other factors. It was used to assess the full range of economic, environmental and social advantages and disadvantages of the different plans to Manitobans
    - The overall socio-economic benefit of the preferred and alternative plans was assessed by examining the advantages and disadvantages in terms of seven accounts of which "environment" is one and "social" is another
    - The environment account "assesses the consequences of the different plans for the environment. It analyzes impacts on GHG emissions in Manitoba and elsewhere, criteria air contaminant (CAC) emissions in Manitoba, and natural resource and other bio-physical effects associated with the construction and operation of the projects in the different plans, and assesses the externality (net social cost) they represent. For GHGs this is done quantitatively; for other impacts it is done qualitatively."[12]
    - The social account "assesses consequences of the different plans for aboriginal and non-aboriginal communities as well as other social effects not taken into account in the

[12] Letter of Manitoba Hydro to Mr. H. Singh (PUB) of June 28, 2013, at p. 4.

> other account. Included in this assessment is the net benefits to Manitoba Hydro's partners, the impacts on other affected communities or interests and the long term 'bequest' values that may be affected by the different plans." [13]

The MA-BCA compared the PDP to three plans as follows:

- Plan 1 – Gas Thermal with No New Interconnection (All Gas)
- Plan 2 – Keeyask with No New Interconnection (K22/Gas)
- Plan 4 – The Smaller Interconnection Alternative (K19/Gas24/250MW)

The MA-BCA did not compare the PDP to any of the alternative plans containing wind resources, and is not considered further in this submission.

Consumers Association of Canada

The Consumers Association of Canada (CAC) also submitted an understanding of socio-economic impacts and benefits to the PUB, acknowledging that it did "not possess a clear definition of "socio-economic"". [14] The CAC suggested that the term could encompass:

- Availability and use of infrastructure and services;
- Health and aesthetics;
- Social and cultural well being potentially including issues regarding heritage resources and traditional use by First Nations;
- Public safety.

The CAC also acknowledged that: "there is an overlap with "economic" considerations as both may consider impacts/benefits due to tax revenues (for support services), employment and the economy as they relate to well-being." [15]

Manitoba Métis Federation

In its response to the PUB request, the MMF submitted a proposed definition of socio-economic impacts and benefits to the PUB as follows:

> … the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to

[13] *Ibid*.

[14] Letter of the Public Interest Law Centre (on behalf of CAC Manitoba) to Mr. H. Singh (PUB) of June 28, 2013 re: Commentary on the Definitions of "Macro-Environmental Impact and "Socio-economic Impact", at p.3.

[15] *Ibid*., at p.3.

> meet their needs and generally cope as members of society. The term also includes cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society. [16]

In proposing this definition of socio-economic impacts, the MMF's consultant provided additional rationale in relation to Aboriginal populations and small communities, noting that the analysis must include impacts on the wage and traditional economies, and that socio-economic impacts can be conceptualized as changes to one or more of the following:

- people's way of life
- their culture
- their community
- their political systems
- their environment
- their health and wellbeing
- their personal and property rights
- their fears and aspirations[17]

2.2.2 Applying the Definition of Socio-economic Impacts and Benefits

In Order 92-13, the PUB provided the following definition of "socio-economic" for use by participants in the NFAT:

> …a high level summary of potential effects to people in Manitoba, especially Northern and Aboriginal communities, including such things as employment, training and business opportunities; infrastructure and services; personal family and community life; and resource use.[18]

Based on the contributions of Manitoba Hydro, the CAC, the MMF, and the definition itself, I understand the definition to imply the following:

- That the identified indicators of socio-economic impact are not intended to be exhaustive, but that other indicators are also relevant, particularly with respect to addressing the requirements of the Terms of Reference related to Aboriginal communities, including: way-of-life, culture and cultural heritage, extent of democratic

[16] Letter of MMF to PUB Order 67/13, dated July 2, 2013, at p.2 of Schedule B "Third-party Review of Manitoba Hydro's 2013 Proposed Development Plan".

[17] International Association of Impact Assessment (IAIA), *Social Impact Assessment*, http://www.iaia.org/iaiawiki/sia.ashx#What_are_social_impacts_1

[18] Manitoba PUB, Order 92/13, at p. 14.

control, health and well-being, public safety, and rights, including personal, property and Aboriginal rights

- The term “Aboriginal communities” is inclusive of the identified geographic Aboriginal reserves and residential communities within the Province but also the broader Metis and First Nation communities within the Province.

A broad range of concerns and issues were raised in response to the Keeyask Project during the CEC hearings, and a similar range of issues have been relevant to the assessment of wind resources, as discussed further below. A broad interpretation of socioeconomic impacts and benefits is appropriate in my view in light of the potential implications of expanding the development of these resources in Manitoba.

3 REVIEW OF NFAT INFORMATION

3.1 MANITOBA'S WIND POTENTIAL

Manitoba Hydro generally acknowledges in the NFAT that: "large areas in southern Manitoba are environmentally and technologically suitable for additional wind development."[19] This view is consistent with the Manitoba Clean Energy Strategy goal of 1,000 MW of wind energy,[20] which is equivalent to about 10% of Manitoba Hydro's average annual electricity generation. The Strategy notes the following:

> Continue to develop 1,000 MWs of wind power as economically viable. In total, 1,000 MWs is expected to generate $2 billion in new investment and $400 in lifetime revenues to rural communities.[21]

As noted in the Strategy and in the NFAT, incorporation of these additional potential wind resources hinges largely on their economic viability compared to available alternatives as well as requirements for additional energy. Specifically:

> The location, scale and timing of future utility and community scale wind development in Manitoba will be shaped by circumstances such as exchange rates and export prices, federal support, global turbine prices, rural economic conditions and Manitoba Hydro's evaluation of its supply and demand situation. [22]

Despite the preference in the NFAT for the development of northern hydroelectric resources, the NFAT nonetheless accepts that "other resources not specified as being included [in the PDP] may well be added (e.g. customer self-generation, wind, biomass, solar and additional enhancement of existing Manitoba Hydro generation)".[23] (underlining added)

Moreover, Manitoba Hydro notes that it also includes wind generation as a resource option in the event of significant delays or deferral of large hydro, if large hydro cannot be built due to environmental or regulatory restrictions, or when new supply-side resources are required for dependable energy and not capacity.[24] In my view, this is a very important consideration in

[19] NFAT, Chapter 7, at p. 31.

[20] For the purpose of this report, "wind energy" refers to energy from on-shore wind resources. Manitoba Hydro screened out offshore wind technology based on energy costs, which are significantly higher than land based alternatives, and development challenges, such as winter ice floes. (NFAT, Chapter 7, at pp.17-18).

[21] Manitoba's Clean Energy Strategy, at p.4, in NFAT, Appendix 14.1, at p.23.

[22] Manitoba's Clean Energy Strategy, at p.29, in NFAT, Appendix 14.1, at p.23.

[23] NFAT, Chapter 14, at p.4.

[24] NFAT, Chapter 8, at p.5.

these proceedings. Evidence from other jurisdictions, where development of large hydroelectric resources has resulted in significant surpluses without adequate consideration of the potential evolution of alternatives that could delay a decision on a capital-intensive development,[25] suggests that such a strategy needs to be developed in this instance.

The need to develop an "in-the-event-of-a-delay" or a "wait-and-see-how-things-evolve" strategy reflects the understanding that the PDP and the alternative plans are just that, plans, that the manner in which new demand- and supply-side resources are actually developed will not match any particular plan precisely, and that the eventual development of resources hinges on their evolution over time.

> Of course, in reality there are many other possible plans that could occur in each of these five pathways, resulting, for example, from inclusion of other options such as wind generation more DSM and earlier retirement of existing Manitoba gas generation. As discussed earlier in the submission, it is expected inclusion of these other options would not substantially alter the comparison of these pathways and the associated development plans. (underlining added) (NFAT, Chap. 14, p.36)

As discussed further in section 3.4 below, within the materials filed during this proceeding in relation to the development of further wind resources, several concerns were raised as to whether or not the above claim remains true in the case of wind, or is likely to remain true only a few years into the planning period. The intention of this submission is not to assess the validity of this claim, which is being addressed by others, but to provide the Board with additional information concerning the environmental and socio-economic implications of developing substantial new wind resources. This information will assist the Board in evaluating these resources in light of continuing and expected future improvements in their economic viability, and in the event that the hydroelectric resources are deferred, delayed or otherwise do not or cannot proceed as anticipated.

3.2 NFAT CONSIDERATION OF WIND RESOURCES

In addition to the general consideration of wind resources as an alternative for meeting the energy requirements of Manitoba contingent on energy demand and resource affordability, Hydro also specifically evaluated wind resources as part of two alternative Plans:

[25] Hendriks, R. February 2014. Need for and Alternatives To (NFAT) Review: Evaluating Macro Environmental Impact, at pp. 26-34.

- Plan 3: Wind/Gas – Wind Generation Starting in 2022/23 Supported by Natural Gas-Fired Generation Starting in 2025/26
- Plan 9: Wind/C26 – Wind in 2022/23, Conawapa 2026/27, Natural Gas-Fired Generation Starting in 2036/37

Both of the above plans were selected as combinations that provide the firm winter peaking capacity that wind generation alone does not provide. In reviewing the list of alternative plans, and considering that capacity is not required until at least 2026, it remains unclear as to why a Wind/K26 alternative plan was not also evaluated. As indicated in Table Appendix 7.2-3, the Keeyask Project has a lower levelized unit energy cost ($60) compared to the Conawapa Project ($67), and Keeyask is more likely to proceed in advance of Conawapa given the initiation of the Keeyask Infrastructure Project. Inclusion of a Wind/K26 plan would have allowed it to be evaluated in terms of the most effective means of delaying the large capital expenditure required for additional hydroelectric development at Keeyask. It appears that alternatives were developed for asking a similar question in relation to the necessity of Conawapa following development of Keeyask (e.g. K19/Gas/250, K19/C25/250) but not for the timing or necessity of Keeyask in the short to medium term.

With respect to the two alternative plans containing wind resources, Figure 8.1 provides an indication of the quantity of wind resources contemplated in these plans:

- Plan 3: Wind/Gas – nominal wind capacity of 1755 MW
- Plan 9: Wind/Conawapa – nominal wind capacity of 390 MW

Table 8.1 lists the new resources associated with each of the development plans, including the two plans containing wind resources:

- Plan 3: Wind/Gas
  - Generic 65 MW wind farms, two per year from 2022 through 2024, and one per year from 2027 through 2047 for a total of 1755 MW; and
  - Two GE 7FA Heavy Duty Simple-Cycle Gas Turbine (@209 MW)[26] in 2025, and one GE 7FA Heavy Duty Simple-Cycle Gas Turbine every ~ 3 years beginning in 2028 until 2045, followed by a GE LM6000 PH Aeroderivative Simple-Cycle Gas Turbine (@47 MW)[27] in 2047, for a total capacity of 2,137 MW.

[26] NFAT, Chapter 7, at p.29.

[27] NFAT, Chapter 7, at p.30.

- Plan 9: Wind/Conawapa
  - Generic 65 MW wind farms, two per year from 2022 through 2024 for a total of 390 MW;
  - Conawapa in 2026; and
  - One GE 7FA Heavy Duty Simple-Cycle Gas Turbine every ~ 3 years beginning in 2036 until 2045.

Manitoba Hydro considered a 65-MW capacity development as one that can benefit from economies of scale and that is approximately equal to the estimated provincial annual load growth for energy. Hydro also assumed, for the purposes of simplifying modeling and evaluations that all additional wind facilities would be owned and operated by Manitoba Hydro.[28] As I discuss below in section 4, this assumption may have limited a more thorough exploration of how wind resources could be developed to maximize socioeconomic benefits for Manitobans, including Aboriginal groups.

In assessing the alternative plans, Hydro concluded that the two plans with wind generation were "clearly uneconomic"[29] and thus were not carried through the full set of evaluations, including the macro environmental and socioeconomic evaluations. Observations concerning this determination regarding the current and future economics of wind resources are provided in section 3.4 below.

3.3 DEVELOPING ADDITIONAL WIND RESOURCES

3.3.1 Introduction

The most promising potential locations for additional wind resources in Manitoba are within the southern and south-western regions of the province. This is the result of the relatively high and consistent wind speeds[30] and the anticipation that additional development will be environmentally sustainable and socially desirable within those regions.[31] In addition to these environmental and socio-economic considerations, which are discussed further in section 3.5 below, wind resources also offer a number of development advantages and disadvantages that require consideration.

[28] NFAT, Chapter 7, at p. 33.

[29] NFAT, Executive Summary, at p.18.

[30] Natural Resources Canada. Canadian Wind Energy Atlas. http://www.windatlas.ca/en/maps.php

[31] NFAT, Chapter 7, Table 7.1 Screening Characteristics of Resource Technologies.

3.3.2 Development Advantages

Minimized transmission losses. Located in the southern portion of the Province, wind resources are more proximal to the primary load in Winnipeg, reducing the potential for significant transmission line losses.

> Manitoba load is primarily in the southern portion of the province, and as a result, wind generation would be located in the south as well. Since load and generation occur in close proximity, the transmission loses have been assumed to be negligible. Therefore transmission loses [sic] are not considered in the calculation of LCOE for wind generation.[32]

Modularity. As illustrated in Table 8.1 of the NFAT, wind generation can generally be sized in response to anticipated energy requirements.[33] This minimizes the potential for creating energy surpluses that would otherwise have to be sold on the export markets,[34] or curtailing demand-side management programs[35] that provide energy at prices lower than the levelized cost of production from supply-side resources.

Shorter lead times. Manitoba Hydro anticipates that additional wind resources could be brought into service with relatively short lead times, on the order of 3 to 5 years.[36] This issue is considered further below in sections 4.2 and 4.3, in the context of comparable wind projects recently developed in Manitoba and elsewhere. The shorter lead times for wind and natural gas resources allow greater planning flexibility compared to hydroelectric resources. The potential to discontinue or scale back anticipated wind development is also possible, which contrasts the situation for the PDP: "Once Keeyask construction has fully started, it would not be feasible to cancel construction."[37]

Low operating costs. Similar to hydroelectric resources, wind resources also have upfront capital investment costs and low operating costs.[38]

[32] GAC/MH II-003C.

[33] LCA/MH I-331; NFAT, Chapter 7, at p. 31.

[34] E.g. see Hydro Québec. 2009. Strategic Plan 2009-2013, at p.18.

[35] E.g. see BC Hydro. 2013. Integrated Resource Plan, 4.2.5.2 Delay Planned Ramp-ups in Spending on DSM Activities, at pp.4-19 to 4-23.

[36] NFAT, Chapter 8, at p.5.

[37] NFAT, Chapter 14, at p.37.

[38] LCA/MH I-331.

Contracting. Wind generation projects can be completed under turnkey contracting approaches, which can minimize cost uncertainties.[39] Regardless of the contracting approach, the development of wind resources by third parties has the advantage of transferring risk from Manitoba Hydro (i.e. taxpayers and ratepayers) to developers. These advantages are acknowledged in the assumption that "contracted purchases of wind generation are assumed to be renewed using the same terms and conditions after the expiration of the current contracts and to extend through to the end of the study period".[40]

Renewing or decommissioning. The NFAT assumption that wind energy contracts are automatically renewed overlooks the potential that it may be advantageous in the future not to renew them. With declines in the rate of load growth over the past several decades,[41] it is conceivable that at the end of the existing wind contracts in the late 2030s that the resources may no longer be required. Coupled with the fact that wind facilities are relatively straightforward to decommission, this illustrates one of the advantages of wind resources, namely that they offer considerable system planning flexibility. The risk to ratepayers is reduced as a result of contracting wind resources from third parties when required and not renewing those contracts if and when the need no longer justifies doing so. For example, in its recent Integrated Resource Plan, BC Hydro did not assume that independent power producer energy purchase agreements (EPA) would be necessarily renewed.

> Prior to this IRP, BC Hydro treated EPA renewals as committed resources, and assumed that all EPAs would be renewed with the exception of biomass-related EPAs, which were assumed to not be available after EPA expiry due to fuel risk. BC Hydro reviewed this treatment, and given its LRBs and the price and availability issues, has decided that it is not appropriate to treat EPA renewals as a 'given' and thus a committed resource. In particular, BC Hydro is of the view that potential EPA renewals should be treated as any other viable future resource to meet the energy and capacity LRBs set out in this chapter. EPA renewals must be considered with other alternatives to meet the forecasted load, balancing considerations of cost, risk, uncertainty, supply reliability/deliverability and B.C. Government energy objectives.[42]

[39] La Capra Associates. Needs for and Alternatives To (NFAT) Review of Manitoba Hydro's Proposal for the Keeyask and Conawapa Generating Stations ("La Capra Associates") Appendix 9A Economic Analysis Part1, at p.9A-123.

[40] NFAT, Chapter 4, at p.42.

[41] EIA. 2013. Annual Energy Outlook 2013 with Projections to 2040, at p.71.

[42] BC Hydro. November 2013. Integrated Resource Plan, at p. 2-31.

Dependable energy. As an intermittent resource, wind generation can be relied upon in Manitoba Hydro's system to provide annual dependable energy. Based on the performance of the two existing wind generation facilities in the Province, which produce 777 GWh/year and 914 GWh/year of dependable and average energy respectively,[43] Hydro determined that for future planning purposes, 85% (i.e. 777/914) of the expected average annual energy from wind generation is assumed to be dependable energy.[44] Manitoba Hydro estimates that "each year there is a 5% chance that actual annual generation will be less than the 85% level. The five percentile probability is the industry standard for determining the dependable energy of wind generation." [45]

3.3.3 Development Disadvantages

In addition to the advantages discussed above, wind resources suffer from several disadvantages, the most important of which is a lack of dependable capacity, which requires additional capacity resources.

Lack of Predictability. Wind resources have operational challenges related to the limited ability to forecast wind accurately beyond a few hours. As noted in the NFAT, improving the ability to forecast wind would greatly increase the effective incorporation of the wind resource into the integrated system.[46] Several methods are noted in the NFAT for improving predictability, including wind forecasting, wind ramp-up predictability, and sub-hourly scheduling.[47] However, these methods and their potential implications for the future integration of additional wind resources appear not to have been modeled in the estimated future costs or future value of these resources. This is despite the acknowledgement by Hydro that:

> Efforts to improve the ability to forecast wind more accurately and to reduce the overall per-unit cost of energy cost through innovative designs and efficiency improvements are expected to increase the attractiveness of wind energy technologies over the next two decades.[48]

[43] NFAT, Chapter 5, Table 5.1.
[44] NFAT, Chapter 5, at p.6.
[45] NFAT, Chapter 7, at p. 33.
[46] NFAT, Appendix 7.1, at pp.18-19.
[47] NFAT, Appendix 7.1, at p.24.
[48] NFAT, Appendix 7.1, at p.19.

Operation during winter peak loads. Since Manitoba is a winter peaking system, the analysis of capacity value of wind must consider potential winter performance of available supply-side resources. Manitoba Hydro examined the performance of the existing wind resources and found that "the minimum wind generation, during the peak load hour each month, was zero or near zero [at] least once each month."[49] Whether this assumption would continue to be valid in a future with significant additions of wind resources is unclear in the NFAT.

Low temperature operation is a second consideration for wind turbine operation in Manitoba.

> At the present time, commercially available utility scale wind turbines are shut down at -30°C to avoid mechanical failures as a result of low temperature operation. As Manitoba Hydro is winter peaking, the very extreme cold temperatures that cause low temperature wind turbine shut downs also tend to cause peak load conditions.[50]

The NFAT does not analyze the potential for future improvements in the mechanical performance of wind turbines at low temperatures and the implications this may have for shut down frequency. Secondly, the potential for future winter temperature changes in Manitoba as a result of climate change is also not considered in determining the potential frequency of turbine shutdowns due to low temperatures. The Government of Manitoba has projected a change of +3 to +5 °C with very high confidence,[51] which would appear to mitigate against the potential for cold weather cut-outs currently covering about 1% of the year.[52]

Export Potential. The NFAT notes that export customers "have shown no interest in wind energy from Manitoba and are unwilling to enter into contracts for such energy. It would be uneconomic for Manitoba Hydro to develop additional wind energy in Manitoba for export purposes."[53] In addition, "any natural gas-fired generation located within Manitoba would be at a competitive disadvantage due to the transmission losses between Manitoba and major MISO

[49] NFAT, Appendix 7.4, at p.3.

[50] NFAT, Appendix 7.4, at p.4.

[51] Blair, D. et al. undated. Review of Climate Change Projections for Southern Manitoba and Potential Impacts for Agriculture. http://www.gov.mb.ca/agriculture/environment/climate-change/pubs/climate%20change%20projections%20and%20impacts%20(4).pdf

[52] GAC/MH I-014, Attachment: Manitoba Hydro Wind Integration Sub-Hourly Operational Impacts Assessment, at p.24.

[53] PUB/MH I-026a.

load centers such as Minneapolis,"[54] implying that the prospects for exporting a wind/gas combination are equally unlikely.

Dependable Capacity. As noted by Manitoba Hydro, only the energy portion of wind energy is considered dependable, and no dependable capacity is assumed for wind resources.[55]

> The variations in the output of wind generation can be somewhat absorbed over a large load area but most variations require an equivalent but opposite change in other generation.[56]

With the potential for additional wind resources to be brought onto the system in the future, this assumption may require some modification depending on the geographic diversity and quantity of future wind resources, as well as their expected operation at periods of peak demand. For example, BC Hydro uses a different measure for evaluating the capacity contribution of intermittent or variable generation resources, known as the effective load carrying capacity (ELCC). The ELCC is the maximum peak load (measured in MW) that a generating unit or system of units can reliably supply such that the loss of load expectation will be no greater than one day in 10 years, and is taken as 26 percent of installed wind capacity in the BC Hydro system. [57]

> BC Hydro uses ELCC to represent the capacity contribution from intermittent clean or renewable IPP resources such as wind and run-of-river hydro. This method evaluates wind and run-of-river capability using a probabilistic approach that is sensitive to wind and run-of-river availability, rather than relying on a deterministic value for available dependable capacity. The ELCC contribution to the system is largely drawn from BC Hydro's large and reliable hydroelectric system. The ELCC method may overstate the capacity contribution of these intermittent resources. The incremental ELCC contributions of intermittent clean or renewable resources will decrease as more of these intermittent resources come into service.[58] (underlining added)

BC Hydro uses this measure as a planning tool to evaluate the onshore wind contribution in the Province, in addition to the usual measures of total energy, dependable energy and installed capacity. Relying on intermittent resources to meet peak demand has risks, and the utility of

[54] PUB/MH I-103c.

[55] NFAT, Chapter 4, at p. 38.

[56] NFAT, Chapter 6, Table 6.3.

[57] BC Hydro. 2013. Integrated Resource Plan, at p.3-5.

[58] *Ibid*., at p.3-4.

this additional measure and its value in Manitoba depends on future expectations with respect to wind operation in cold temperatures, and the future correlation of peak demand with temperature.

For planning purposes, Manitoba Hydro assumes an average annual capacity factor of 40% for all future wind farm developments in southern Manitoba and 85% of the 40% is assumed to be dependable wind energy. [59] However, "if tower heights continue to rise and turbine efficiencies continue to improve additional sites could also achieve capacity factors above 40% in southern Manitoba."[60] The potential for these increased capacity factors does not appear to have been considered in evaluating the potential future contribution of wind resources.

3.4 ECONOMIC EVALUATION

3.4.1 Introduction

In the NFAT, Manitoba Hydro concludes with respect to wind resources that "while wind farms have successfully been established in Manitoba and will continue to be considered, wind generation as a major generation supply in Manitoba was determined not to be economic at this time."[61] Furthermore, Hydro's conclusion following the evaluation of the four plans in the "Manitoba load" category (All Gas, Wind/Gas, K22/Gas and SCGT/C26) was as follows:

> Based on the expected values, reference scenario NPVs and on risk profiles, the All Gas and Wind/Gas plans are effectively dominated, making both inferior to K22/Gas and SCGT/C26. The K22/Gas plan is preferable to the SCGT/C26 plan with the SCGT/C26 plan being a reasonable second choice.[62]

Considerable evidence presented during the proceeding suggests that this conclusion may be premature or inaccurate, as discussed below.

3.4.2 Declining Wind Costs

The NFAT technology review presents a downward trend in wind turbine pricing as shown in Figure 1.

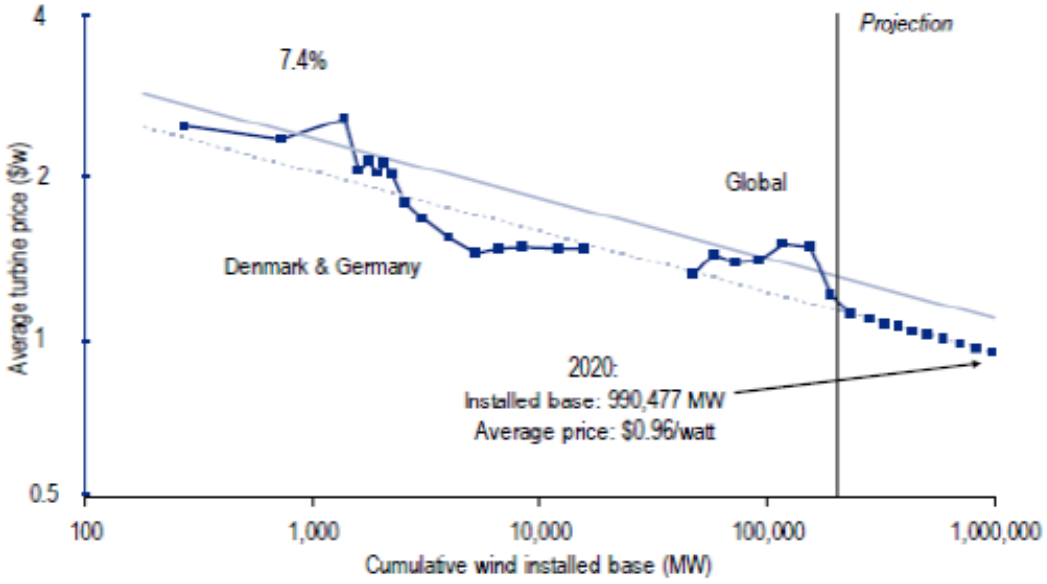
[59] NFAT, Chapter 7, p. 32-33.

[60] NFAT, Appendix 7.2, at p.18.

[61] NFAT, Chapter 14, at pp.3-4.

[62] NFAT, Chapter 10, Figures 10.11 and 10.12.

Figure 1. WIND TURBINE TRENDS PROJECTED FROM 1972[1]



> The trend is driven by [a] combination of factors, including technology improvements, utilities installing significant amounts of wind generation to meet government mandates, and overcapacity in the market largely [due] to increased manufacturing in China. [63]

The NFAT and the submissions of at least two independent expert consultants (IECs) also point to continuing declines in wind costs going forward.

> By 2030, all but one study envisions cost reductions falling below 1% per year. [64]
>
> Hybrid towers are currently under development in which a significant portion of the tower section consists of pre-stressed concrete components. This could potentially reduce tower material costs, as well as the associated transportation costs required to move the tower to site.[65]
>
> A downward cost trend has occurred in recent years after a period of increasing project costs over the previous decade. This downward trend is expected to be due to ongoing wind turbine cost reductions (US DoE, 2013) as turbine costs have fallen approximately 20-25% worldwide from 2008 to 2012 (REN21, 2013a). … On this basis, applying a [redacted] to the cost provided in the GL GH report would

[63] NFAT, Appendix 7.1, p.19.

[64] NFAT, Appendix 7.1, p.20.

[65] NFAT, Appendix 7.1, p.21.

> indicate an approximate "base case" of $1,800/kW (excluding transmission) for the 65 MW wind project in Manitoba.[66]
>
> LCA has performed analysis using MH's economic model to demonstrate that with more current assumptions, development plans featuring wind capacity are much more competitive than MH has concluded.[67]

In addition to declining costs, the use of a generic 65-MW wind facility appears to have undermined the potential for wind resources as part of a competitive strategy to be implemented in the event that the PDP is delayed or otherwise does not proceed. Table Appendix 7.2-2 indicates wind costs ranging from $62/MWh to $99/MWh without transmission or $67/MWh to $108/MWh with transmission in 2012 dollars. The wind resource cost considered in the NFAT appears to be an average of these costs at $83/MWh (2012$ @ 5.05%). If this is the case, then it does not reflect how the wind resource would actually be developed. A competitive process for wind procurement would result in the lowest-cost resources being developed first. With the continued decline in wind costs, it is possible that subsequent wind resources would not be anymore costly than those first developed.

La Capra Associates notes the implications of the approach taken in the NFAT to the declining cost of wind resources:

> By not including any of the expected cost improvement, MH is handicapping technologies with expected improvement.[68]
>
> Their assumptions significantly overstate the costs in today's market and ignore anticipated improvements over time. These assumptions are carried forward into the economic and financial analyses, which handicaps the development plans containing onshore wind.[69]
>
> As a result of the poor economic performance, MH is not planning to develop any wind resources. As discussed above, with a strong domestic wind resource, modular development options, and declining resource costs, <u>it is very likely that at least some wind development should be included in an optimized development strategy</u>.[70] (underlining added)

[66] Knight Piesold Ltd. 2014. Knight Piesold Independent Expert Consultant Report (Redacted), at p.48.

[67] La Capra Associates, Appendix 3A, at p.3A-32.

[68] *Ibid.*, at p.2-18.

[69] *Ibid*., at p.2-20.

[70] *Ibid*., at. p.3A-21.

3.4.3 An optimized development strategy

The MMF does not possess the resources or tools to undertake an analysis of potential development strategies that aim to address the question of the optimal timing to initiate development of the PDP, including beyond 2022, the latest date contemplated in the NFAT. However, consideration of such a strategy is important in terms of determining:

- Whether the expected declines in the cost of wind resources have the potential to avoid the need for the PDP for the foreseeable future (e.g. beyond 2030) in a cost-effective manner; and
- Whether imposing the adverse macro environmental impact of the proposed PDP can be delayed, recognizing the high likelihood of the significance of this impact.

In the NFAT, Hydro does give some consideration to a variety of delay scenarios, which essentially involve a one-year delay or a five-year delay:

> In order to demonstrate the sensitivity of the Preferred Development Plan to delays in the in-service date of Keeyask G.S. and Conawapa G.S., a development plan was studied in which the in-service date of both generating stations is delayed by one-year. Delaying the in-service dates of both plants decreases the NPV of the Preferred Development Plan by $97 million (2014$ @ 5.05% discount rate). A deferral in in-service dates will result in less surplus energy available for export thereby reducing export revenues. These lower revenues will be partially offset by the capital cost savings from the deferral. The decrease in NPV is attributable to lower export revenues being more than offset by the savings of delaying the capital expenditures by one year.[71]
>
> If Keeyask construction does not start in 2014 but is delayed for as long as 5-years (e.g. due to a decision to follow Pathway 1 and develop natural gas generation first), the existing licences and aboriginal arrangements likely would still be applicable as long as some minor investments were undertaken to monitor and update environmental information and to maintain partnership communications.[72]

Considering the current modest differences between the costs of wind resources and the costs of hydroelectric resources, the likely decline in the cost of wind resources, and the imposition of the macro environmental impacts associated with the PDP, there appears to be merit in analyzing the most appropriate strategy for delaying a decision on the PDP to beyond 2030.

[71] NFAT, Chapter 10, at p.53.

[72] NFAT, Chapter 14, at p.36.

3.5 ENVIRONMENTAL AND SOCIO-ECONOMIC EVALUATION

3.5.1 Introduction

As noted in Manitoba Hydro's submission respecting the definitions of macro environmental impact and socio-economic impacts, in addition to the MA-BCA, which did not analyze any plans with wind resources, the NFAT compares resource options through two other approaches:

- A screening level analysis
- Preferred and alternative development plans

In addition to the screening level analysis and alternative development plans, Manitoba Hydro provided additional information concerning the macro environmental and socioeconomic aspects in response to information request CAC/MH I-231a.

Finally, MNP conducted an analysis respecting the preferred and alternative development plans relative to the effects of climate change, GHGs and other air emissions. [73] While this analysis confirms the low life cycle emission intensity of wind resources,[74] the financial analysis of the potential and direct incremental revenue associated with the environmental attributes of exports into the MISO market did not consider any development plans containing wind resources.[75] The analysis determined that the PDP "minimizes the effect of inequitable distribution of macro environmental impacts on future generations as this plan has the lowest overall GHG emissions and air pollutants."[76] However, as noted in our prior submission, "without knowledge of the macro environmental impacts of the alternative plans with respect to the consequences of other (i.e. non-GHG) changes to the environment, it is not possible to determine whether an alternative plan performs better overall than the PDP."[77] The MNP analysis and findings are not considered further in this submission.

[73] MNP. January 2014. NFAT Review: A Review of Manitoba Hydro's Macro Environmental Considerations, at pp.12-36.
[74] *Ibid*., at p.27.
[75] *Ibid*., at p.34.
[76] *Ibid*., at p.75.
[77] Hendriks, R. February 2014. Need for and Alternatives To (NFAT) Review: Evaluating Macro Environmental Impact, at p. 17.

3.5.2 Screening Level Analysis

Table 7.1 and 7.6, as well as Appendix 7.2 present screening characteristics for various resources. Several of the technical and economic characteristics of wind resources are addressed previously in sections 3.3 and 3.4, respectively. Environmental and socio-economic observations made in the NFAT concerning wind resources include the following:

- Environmental
  - Water quality impacts – none
  - Hazardous air pollutants – none
  - Greenhouse gas emissions – virtually none
  - Land use impacts
    - set backs and land use limitations
    - generating station footprint – 10 to 20 hectares
    - additional impacted area – 990 to 2980 hectares
    - additional linear development – average 29 km
  - Wildlife species of interest – birds and bats
  - Vegetation – restoration of native plant communities after service life
- Socio-economic
  - Aboriginal participation interest – neutral
  - Independent power producer interest – positive
  - Proximity to load center – southern generation potential
  - Regulatory constraints – land use setbacks
  - Social acceptability – strongly support
  - Health concerns – Low
  - Safety concerns – Very low
  - Employment
    - direct construction – 35 to 80 person years
    - permanent operations & maintenance – 4 to 8 full-time equivalent
    - combined 120 to 240 person years
  - Manitoba business opportunities
    - % capital spent in MB – 18%
    - less relative to Wuskwatim
  - Royalties / taxes – Land rentals, grants-in-lieu of taxes

The general concern with the observations made in the NFAT is that much has changed in the previous few years with respect to: industry and government knowledge of the environmental

effects of wind resources, including their potential significance; public expectations concerning economic benefits; and public awareness regarding potential effects.

I also note the view of Manitoba Hydro that Aboriginal interest in developing wind resources is "neutral". This may be the case for northern Aboriginal groups, where the prospects for wind development are modest, but the experience in other jurisdictions where wind is being developed (e.g. British Columbia and Ontario) indicate that Aboriginal interest is very high. As discussed below in section 4.4, provided the appropriate opportunities, Aboriginal groups will participate actively in the development of renewable energy, including wind.

3.5.3 Development Plan Comparison

Appendix 9.1 of the NFAT presents a high level comparison of the development plans, including the Wind/Gas and Wind/Conawapa plans. In addition to the information provided in the screening analysis, this appendix indicates the following with respect to these plans and the PDP:

- Dispatchability: both plans address the dispatchability concerns of wind resources
- Asset Life (years): Wind/Gas – 20 and 30; Wind/Conawapa – 20 and 67; PDP – 67
- Transmission length (km): Wind/Gas – 943; Wind/Conawapa – 263; PDP – 738
- Additional impacted area (ha): Wind/Gas – 53,595; Wind/Conawapa – 13,291; PDP – 10683
- Employment
    - Direct Construction (P-Y): Wind/Gas – 3100; Wind/Conawapa – 8300; PDP – 12500
    - Permanent O&M (P-Y): Wind/Gas – 4700; Wind/Conawapa – 4200; PDP – 2000

The asset life of the Wind/Gas plan provides the flexibility to reconsider the development in 30 years time on the basis of need and in light of the alternatives available at that time. It also potentially allows for incremental changes to future development in the form of additional or fewer wind turbines, additional or fewer gas turbines (either CCGT or SCGT), or relocating some wind turbines as a mitigation or enhancement measure in the event monitoring shows unanticipated environmental or socio-economic impacts or opportunities for enhancing socioeconomic benefits.

The transmission length for the Wind/Gas plan is based on the assumption that the best wind resource locations will be developed first and that the required transmission would be

developed in coordinated stages.[78] This seems reasonable. What is less clear is whether the transmission length for the PDP includes the transmission lines located outside of Manitoba that are necessary to deliver the electricity to the export markets. Since the table presents the regional GHG displacement potential, it would be appropriate to include the environmental impacts of the plans to jurisdictions outside of Manitoba as well as the environmental benefits.

With respect to additional impacted land area, the values do not convey the nature of the impact, and its potential significance. Transmission infrastructure to interconnect wind resources in southern Manitoba could potentially be located along existing corridors or through areas that are already developed for agriculture. In the latter case, agriculture could continue unaffected below the transmission lines or near the wind turbines, other than in the immediate infrastructure footprint area. The criterion of "impacted land area" also does not consider the potential for remediating the affected area following the end of the useful service life of the particular resource option. In the case of wind and gas, sites are readily decommissioned and remediated, while there is much less potential to decommission large dams and reservoirs without considerable cost to future generations.

With respect to employment, I am concerned that the use of only "direct" employment as a measure of employment potential of the various resources may be misleading, and that indirect and induced employment also need to be considered. Secondly, it appears that the estimates for employment from wind resources may be low based on similar experience elsewhere.

[78] GAC/MH I-019a

Table 3-1: British Columbia Wind Energy Construction and Operations Employment[79]

Wind	Energy	Capacity	Construction Employment (P-Y total)				Operations Employment (P-Y annual)			
#	GWh	MW	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
PC28	591	153	219	1210	230	1659	24	27	12	63
PC21	371	99	139	773	147	1059	15	17	8	40
PC13	541	135	245	1137	225	1607	23	25	12	60
PC19	441	117	168	928	176	1272	18	20	9	47
PC16	377	99	170	820	161	1151	16	17	8	41
PC14	527	144	226	1162	224	1612	22	24	11	57
PC15	382	108	162	867	166	1195	16	17	8	41
PC20	609	159	251	1378	262	1891	25	28	13	66
TOTAL	**3839**	**1014**	**1580**	**8275**	**1591**	**11446**	**159**	**175**	**81**	**415**
Prorated to NFAT		**1755**	**2735**	**14322**	**2754**	**19810**	**275**	**303**	**140**	**718**
Wind/Gas (Both)		**3892**	**3100**				**70**			
All Gas (Gas)		**2115**	**2000**				**58**			
Wind/Gas (Wind)		**1755**	**1100**				**12**			

The above table provides information on wind resources in British Columbia that formed part of BC Hydro's alternatives to the Site C Clean Energy Project, a proposed 1100 MW hydro facility on the Peace River. On the left are listed the wind resources (actual proposed projects, not generic projects) selected as part of the "Clean + Thermal" alternative to Site C. Since BC Hydro used a shorter planning period than that used by Manitoba Hydro in the NFAT, the operations employment is presented in person-years on an annual basis.

The information below the green shaded region prorates the findings of BC Hydro by multiplying by a ratio of the installed megawatts of wind in the Wind/Gas plan (i.e. 1755) divided by the number of megawatts of wind in BC Hydro's plan (i.e. 1014). The following line presents the information for the Wind/Gas plan contained in Appendix 9.1 of the NFAT. The value for the operations employment is obtained by dividing the total number of person-years of operations employment (i.e. 4700) by the number of operating years (i.e. 67). The next line presents employment information for the All Gas plan while the final line subtracts the All Gas information from the Wind/Gas information to arrive at totals for wind only. It is possible that

[79] BC Hydro. 2013 Resource Options Report Update. Appendix 3 – Resource Options Database (RODAT) Summary Sheets. http://www.bchydro.com/energy-in-bc/meeting_demand_growth/irp/document_centre/reports/2013-ror-update.html

gas-related employment for the All Gas plan may be somewhat higher than gas-related employment for the Wind/Gas plan, but the differences would relate only to the greater use of gas and would have minimal effects on operations staffing.

Based on these numbers, it appears that the wind component of employment for the Wind/Gas plan in the NFAT is substantially lower than for wind developments in BC. While some construction employment differences could be the result of more difficult terrain in BC, the operations employment differences are more difficult to explain away, especially considering the magnitude of the differences. Appendix 7.2 of the NFAT suggests that direct operations employment for a generic 65 MW wind facility is 4-8 full-time equivalent positions. Based on 1755 MW, this would amount to 108 to 216 full-time equivalents (i.e. person-years annually). The upper range of this estimate for operations employment for wind resources compares somewhat more favourably to the findings of BC Hydro than do the numbers in Appendix 9.1. In my view, the numbers for operations employment for the plans containing wind resources in Appendix 9.1 require explanation.

If the numbers in the NFAT were adjusted to include indirect and induced employment and corrected for what appear to be underestimates of employment related to wind resources, I suspect that a picture would emerge that is similar to that for the proposed Site C Project.

Table 3-2 Site C Economic Development Attribute Comparisons[80]

Attribute	Units	Wind + Pumped Storage Generation	Wind + Natural Gas Generation	Site C Hydro Generation
Construction Jobs	Total Jobs	33,200	28,500	44,200
Operations Jobs	Jobs per Year	1,175	1,025	75
Total (Year 10 Operations)	Person-years	44,950	38,750	44,950
Total (Year 15 Operations)	Person-years	50,825	43,875	45,325
Total (Year 30 Operations)	Person-years	68,450	59,250	46,450
Total (Year 67 Operations)	Person-years	111,925	97,175	49,225

The above table presents the total construction and operations employment for the two main alternatives to Site C as well as for Site C, as determined by BC Hydro. For the purposes of comparison, the two alternatives develop the same 1100 MW of capacity and 5100 GWh of

[80] BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement Volume 1, Section 5, at p.5-71.

energy as Site C. What is clear from the table is that large hydroelectric projects tend to create higher levels of construction employment than do wind-based alternatives, regardless of the capacity used to supplement the wind resource. However, in the longer term, a wind + natural gas alternative provides much higher levels of operations employment and within a 15 year period makes up the difference in construction employment and provides double the employment overall in the long-term.

3.5.4 Information Requests

In response to CAC/MH I-231a, Manitoba Hydro provided a more detailed high-level summary of macro environmental and socioeconomic impacts in relation to each of the components of the PDP as well as for natural gas and wind resources. As noted in the response, the information respecting wind resources is drawn from environmental impact statements and monitoring reports for Manitoba wind farms. Other than some details concerning the extent of bird and bat mortality at the existing wind turbines in Manitoba, the environmental information concerning wind resources is essentially contained in the NFAT and its appendices.

As was the case for the information presented on those plans containing hydroelectric resources, the NFAT presents and considers the effects of wind developments individually and not collectively. As noted in our prior submission, some insignificant effects may be significant when considering multiple impacts, multiple project components, or multiple developments interacting cumulatively or synergistically.[81] In the case of wind resources, I consider the potential for cumulative effects based on the experience of other jurisdictions in section 4.3 below.

The response to the information request does provide some further insights into the socioeconomic effects of wind resources, including the following:

- Employment (construction):
  - Employment of Aboriginal persons is not estimated
- Employment (operations):

[81] Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling, and D. Stalker. 1999. Cumulative effects assessment practitioners guide. Prepared by AXYS Environmental Consulting Ltd. and the CEA Working Group for the Canadian Environmental Assessment Agency. Hull, Québec, at p.30.

  - Employment of Aboriginal persons in the case of both wind and natural gas development is presumed to be "nil"
- Local business opportunities:
  - Business opportunities for Aboriginal persons in the case of both with and natural gas development is presumed to be "nil"

The basis for the assumptions respecting potential benefits of wind development for Aboriginal groups or persons appears to be based on the following:

> Since wind farms would likely be developed on private land in southern Manitoba, northern and Aboriginal people would not be expected to receive training and employment preferences. Preferences for southern Aboriginal people may be more likely if towers were placed on reserve or Crown lands. As well, the environmental impact statements for wind projects developed in Manitoba did not indicate any preference for southern Aboriginal people.[82]
>
> Wind: Since new wind farms would be developed on privately-owned land in southern Manitoba, northern and Aboriginal businesses would not be expected to receive business preferences. Southern Aboriginal business may negotiate preferences, particularly if wind farms are located on reserve or Crown lands in southern Manitoba. No preferences were identified in the EISs of the two existing wind farms in Manitoba. [83]
>
> Wind: Wind development in Manitoba to date has not affected Treaty and Aboriginal rights. If wind farms were developed on reserve or Crown land, appropriate measures could be required. Since wind farms are more likely to occur on private agricultural land, traditional resource use is not expected to be affected. [84]

The development of wind resources on private land does not preclude partnerships with Aboriginal groups, nor does it rule out the possibility that Aboriginal groups may choose to develop private property that they own either as part of a larger commercial wind operation or as a community-based development consisting of only a small number of turbines.

If the environmental impact statements for the existing wind developments did not indicate any preferences or engagement of Aboriginal groups in relation to employment and business opportunities, this suggests that the industry needs to do more to engage Aboriginal people. A review of the environmental assessment documents for the St. Joseph's Wind Energy Project in

[82] CAC/MH I-231a, at p.22.

[83] CAC/MH I-231a, at p.24.

[84] CAC/MH I-231a, at p.29.

section 4.2. below, indicates that the proponent did provide employment advantages to local and Aboriginal persons. In any case, a failure to engage or to adequately engage Aboriginal groups in the past is not a reason for continuing to do so in the future.

With respect to the Manitoba Métis Community, the existing wind farms at St. Joseph and St. Leon are in close proximity to Métis communities at Carman, Morris and St. Agathe. The southern and southwestern regions of Manitoba where wind development is more likely are also located entirely within recognized Métis Harvesting Zones.[85] Future development of wind resources in these regions will need to engage the Métis in a meaningful way.

3.6 SUMMARY

In summary, my review of the existing information provided during the NFAT process concerning macro environmental impact and socio-economic impacts and benefits of wind resources indicates the following:

- Wind resources offer a high degree of system planning flexibility as a result of shorter lead times for development, modularity, and ease of decommissioning.
- The cost of wind resources continues to decline and is anticipated to continue to do so in the coming years and these future cost declines are not adequately captured in the NFAT analysis.
- Considering the current relatively modest unit energy cost differences between wind and hydroelectric resources, the likely decline in the cost of wind resources, and the imposition of the macro environmental impact associated with the PDP, there is merit in analyzing the most appropriate strategy for delaying a decision on the PDP to beyond 2030.
- In analyzing the implications of additional wind resource development, the NFAT assumption that Manitoba Hydro would develop these resources appears to have limited a more thorough exploration of how wind resources could be developed to maximize socioeconomic benefits for Manitobans, including Aboriginal groups.
- The employment benefits of wind resources, particularly the long-term benefits, appear to be underestimated in assessing the socioeconomic benefits of wind resources.
- Finally, the view of Manitoba Hydro that Aboriginal interest in developing wind resources is “neutral” is not supported by experience in other jurisdictions where wind is being developed (e.g. British Columbia and Ontario).

[85] https://www.gov.mb.ca/conservation/pdf/conserv_recognized_areas_for_harvesting_map.pdf

4 INFORMATION TO ASSIST THE PUB

4.1 POTENTIALLY RELEVANT INFORMATION

In the event that the PDP does not proceed, it is very likely that supply-side resources will be required in Manitoba within the next twenty years, even with more aggressive demand side management. Some of this new supply will very likely be additional wind resources. If the Wind/Gas alternative were to be pursued, it would see the development of an additional 1755 MW of wind resources in southern Manitoba. Wind development followed by Conawapa in 2025 would see the development of 390 MW of additional wind resources. A different level of wind development could occur depending on timing of the hydro resources, the decline in costs of wind resources, and other factors.

It is generally assumed in the NFAT and in the Manitoba Clean Energy Strategy that development of new wind resources could occur in southern Manitoba without substantial adverse environmental impacts and with strong community support. However, experience in other jurisdictions[86] suggests that the potential for this to occur should not be taken for granted, and that taking specific actions to properly plan, develop, monitor and decommission these facilities can support a reduction in environmental effects, more robust socio-economic benefits and, ultimately, acceptance by local communities and Manitobans.

In light of the summary of concerns identified above with respect to the existing information available to the Board to conduct “an assessment as to whether the Plan is justified as superior to potential alternatives that could fulfill the need” in terms of macro environmental impact and socioeconomic impacts and benefits, I have considered the following additional information.

1. Existing Wind Resources in Manitoba

In order to assess the potential implications of additional wind development, I reviewed relevant information pertaining to the existing wind facilities in the province. Manitoba has two wind facilities located south of Winnipeg in the rural communities of St. Joseph and St. Leon, having a total installed capacity of approximately 250 MW. I focused my review on the St. Joseph Wind Energy Project for which I had a more complete set of information.

2. Wind resources in other jurisdictions

[86] See http://ontario-wind-resistance.org

Manitoba is not the first jurisdiction in Canada to develop wind resources or the first to consider developing over 1000 MW of wind as part of a preferred or alternative development plan. Other Canadian jurisdictions, including British Columbia, Alberta, Ontario and Québec, as well as several American states, including several states within MISO, have developed substantial wind resources. This experience provides insights into how additional wind development could proceed in Manitoba in a manner that minimizes the potential for adverse environmental effects and to demonstrate how wind resources compare favourably as part of a development alternative to the PDP.

In general, the PDP has the advantage of being scoped in greater detail with respect to socioeconomic benefits, whereas the alternative plans are largely conceptual and do not necessarily reflect the socioeconomic potential of the alternative plans. In reviewing the approaches in some of these other jurisdictions, my intent is to demonstrate to the Board that the socioeconomic benefits of additional wind resources could be greater under a different set of assumptions than those made in the NFAT.

4.2 EXISTING WIND RESOURCES IN MANITOBA

4.2.1 St. Joseph Wind Energy Project

The St. Joseph Wind Energy Project is one of two commercial-scale wind energy projects in Manitoba, the other being the St. Leon Wind Energy Project. Located in the vicinity of the town of St. Joseph, the Project overlaps the rural municipalities of Rhineland and Montcalm. The 60 turbines (138 MW) are distributed over an area of 215 km^2 of primarily agricultural lands. The Project operates under a 27-year power purchase agreement between Manitoba Hydro and Pattern Energy Group LP.

The St. Joseph (as well as the St. Leon) Wind Energy Project is Ecologo certified and Green-e certifiable.[87] Renewable energy from the facility qualifies as renewable energy in Minnesota,[88] but Manitoba Hydro does not realize any Class I REC value for the energy from either of its wind projects.[89]

[87] NFAT, Chapter 5, at p.54.
[88] CAC/MH II-087.
[89] GAC/MH I-018c.

4.2.2 Scope of Available Information

As suggested by Hydro and by the CAC, there is a need to rely on previous environmental impact statements, licences, analyses and related follow-up and monitoring information for wind resources. The information reviewed for this submission included the following in relation to the St. Joseph Wind Energy Project:

- Environmental impact statement[90]
- Post-construction monitoring reports[91] [92]
- Environmental Protection Plan[93]
- Environmental Act Licence No. 2902[94]
- Miscellaneous correspondence filed during and following the environmental assessment

The information provided during the environmental assessment of this wind project is predictive information. That is, it is based on the collection of baseline data and information, analysis and professional judgment about potential changes in the future. Information respecting the actual environmental effects of the existing wind facilities in southern Manitoba provided in the monitoring reports is also valuable to understanding the likely macro environmental impact and socio-economic impacts and benefits of potential future wind development in the Province, as well as for understanding potential cumulative effects.

4.2.3 Relevant Information and Observations

Considering the volume of material obtained in relation to the St. Joseph's Wind Energy Project, potentially relevant information was identified based on:

- the definitions of macro environmental impact and socioeconomic impacts and benefits provided by the PUB;
- avoiding duplication of the information already provided by Manitoba Hydro and by other participants in this proceeding; and
- professional experience with the kinds of information that are important to considering development of energy resources in rural and Aboriginal communities

[90] St. Joseph Wind Farm Inc. July 2008. St. Joseph Wind Energy Project: Environmental Impact Statement (Volumes 1-5).

[91] Natural Resource Solutions Inc. March 2012. St. Joseph Wind Farm (Phase I): 2011 Post-construction Monitoring Report.

[92] Natural Resource Solutions Inc. March 2013. St. Joseph Wind Farm: 2011-2012 Post-construction Monitoring Report.

[93] St. Joseph Wind Farm Inc. November 2009. St. Joseph Wind Energy Project: Environmental Projection Plan.

[94] Manitoba Conservation. October 6, 2009. Environment Act Licence No. 2902.

For simplicity, the information is organized based on the categories used by Manitoba Hydro in its high-level development comparison table in Appendix 9.1.

Technical

- Excluding three years of wind resource assessment that began in 2005 and the avifauna studies that commenced in 2007, the proposed development and construction schedule was three years, commencing in early 2008 and concluding with project commissioning on schedule in March 2011[95]

The assumption that wind resources in the Province can be developed within the 3-5 year timeframe contemplated in the NFAT is conditionally accurate. Based on the experience with the St. Joseph wind farm, development within this timeframe would only likely occur if wind resource assessments, wildlife studies and community engagement began 2-3 years prior to the commencement of the regulatory process.

Environmental

- There were no predicted significant adverse residual environmental effects for any environmental valued components, and follow-up monitoring to date confirms this prediction

Land Impacts

- Though the Project Area was over 215 km^2, with the inclusion of buffer zones, only 42% of the Project Area was suitable for turbine installation[96]
- Setbacks from dwellings were initially established at 550 metres, but the effective Project Area was further reduced during the environmental assessment to accommodate larger setbacks for towns within the Project Area
- Right-of-way compensation agreements based on the capacity of the wind development were negotiated with more than 250 landowners (meaning that the total compensation paid did not change with the number of turbines so long as the total capacity remained unchanged)[97]

[95] St. Joseph Wind Farm Inc. July 2008. St. Joseph Wind Energy Project: Environmental Impact Statement (Volumes 1-5), Volume 1, Table 2-11.

[96] *Ibid*., Volume 1, p.9.

[97] *Ibid*., Volume 1, p.9.

- The use of larger turbines resulted in fewer turbines reducing the footprint from 186 ha to 150 ha, which represents about 0.7% of the Project Area, and essentially all of which is lost agricultural land

One of the potential challenges in moving forward with a considerable expansion of the wind resources in the Province may be the availability of suitable lands in areas with the highest wind potential.

> The towers required for a 100 MW wind farm would have a 15 to 30 ha footprint but would be spread over a much larger area to maintain turbine performance (e.g. to manage 'downstream' effects from one tower to the next) and allow for setbacks from residences and other buildings – in the neighbourhood of 15 to 45 km or more for a 100 MW wind farm.[98]

The St. Joseph Wind Energy Project is a 138 MW facility developed in a 215 km^2 project area, with authorization for up to 300 MW.[99] The St. Leon facility is a 99 MW project in a 90 km^2 project area.[100] If the St. Joseph site is fully developed, this suggests 80 km^2 for a 100 MW facility, or about 1,600 km^2 for the development of 2000 MW, which would be the total contemplated under Plan 3: Wind/Gas.

Manitoba Hydro indicated that future wind turbines would be located in southern Manitoba, but that their exact locations are not known at this time.[101] I reviewed the Canadian Wind Atlas[102] and land use maps for the Province and estimated that the area of highest wind energy potential south and west of the Winnipeg urban area while still located on relatively cleared lands totaled on the order of 15,000 to 20,000 km^2 after estimating for lands that would clearly be precluded from wind development. Presuming similar densities as for the existing wind facilities, this would mean that about 8-10% of the landscape within the region of highest energy potential would be developed with wind turbines. This remains less than in other regions, such as parts of Iowa and southern Minnesota, but is more than the Gaspésie region of Québec which already has over 1000 MW with additional wind development under construction.[103] However, as noted below in section 4.3, the cumulative landscape and visual

[98] CAC/MH I-231a, p.8.

[99] Manitoba Conservation. October 6, 2009. Environment Act Licence No. 2902.

[100] Harvesting the Wind in St. Leon, Manitoba: A new opportunity for renewable energy in Manitoba. http://www.manitoba.ca/iem/energy/wind/files/stleons_wind_brochure.en.pdf

[101] MMF/MH I-053a.

[102] http://www.windatlas.ca/en/index.php

[103] http://www.hydroquebec.com/distribution/en/marchequebecois/parc_eoliens.html

effects of wind turbines is a key consideration in the assessment of additional development in the Gaspésie.

Wildlife Species of Interest

- The primary wildlife species of interest during the environmental assessment, and the only species for which operations monitoring was required were monarch butterflies, avifauna, and bats
- Butterflies[104]
  - Post-construction monitoring was conducted for one year
  - During the 2011 surveys, only 1% (a total of 5) of the observed butterflies were monarchs
  - No abnormal behaviour, high mortality, or high migratory movements of monarchs were observed during the field surveys conducted. As a result, these surveys were discontinued for the monitoring period of 2012.
- Avifauna[105]
  - Post-construction monitoring was conducted over a two-year period
  - The 2011 corrected mortality rate was 2.15 birds/turbine/annual monitoring period or 0.93 birds/MW/annual monitoring period (2012 Report, page 25)
  - The 2012 corrected mortality rate was 1.62 birds/turbine/annual monitoring period or 0.71 birds/MW/annual monitoring period (2012 Report, page 30)
  - The mortality rates for both years are expected to represent a low potential impact on avian populations, and are well below federal thresholds established by Environment Canada.
  - It is expected that bird mortality at the St. Joseph Wind Farm will continue to remain consistently low throughout the life of the project.
- Bats[106]
  - Post-construction monitoring was conducted over a two-year period
  - The 2011 corrected mortality rate was 14.15 bats/turbine/annual monitoring period, or 6.16 bats/MW/annual monitoring period
  - The 2012 corrected mortality rate was 39.50 bats/turbine/annual monitoring period, or 17.18 bats/MW/annual monitoring period

[104] Natural Resource Solutions Inc. March 2013. St. Joseph Wind Farm: 2011-2012 Post-construction Monitoring Report, at p.11.
[105] *Ibid*., at pp.21-30.
[106] *Ibid*., at pp.31-43.

- The mortality rate for the first year represents a low bat mortality rate while that for the second year represents a moderate bat mortality rate for modern wind energy facilities in North America.
- It is possible that proximity to the Red River may have an influence on mortality rates at turbines along the eastern edge of the project area. [107]

The findings for the St. Joseph Wind Energy Project generally support the expectation that the development of new wind resources could occur in southern Manitoba without substantial adverse environmental effects. However, the development of 15-20 more projects similar to those already in operation may pose a cumulative burden on some species that is not captured in the assessment of individual projects.

In the event that the PDP does not proceed or more wind development is contemplated, the Province would benefit from developing a cumulative effects management framework aimed at identifying – prior to any additional wind development – not only those locations most economically suitable but also those most ecologically suitable and socially acceptable for future wind energy development. This would have the effect of minimizing the potential for macro environmental and socioeconomic impacts related to more intensive wind development as part of any future alternative plan to the PDP.

Socioeconomic

- The main concerns raised by potentially affected communities were economics, noise, visual, crop spraying, shadow flicker and impact on agriculture
- The population was generally supportive of the Project, but there was noted opposition "from a small groups of residents living near St. Joseph" who "remained unconvinced"[108] about the potential noise levels (and possibly other issues, but the nature of the opposition is not described in the EIS)
- Both rural municipalities supported the Project
- The proponent committed to donating $20,000 annually to the local museum

While every jurisdiction differs somewhat regarding the expectations of local economic benefits from energy development, the approach taken in the case of the St. Joseph Wind Energy

[107] *Ibid*., at p.48.

[108] St. Joseph Wind Farm Inc. July 2008. St. Joseph Wind Energy Project: Environmental Impact Statement (Volumes 1-5), Volume 1, pp. 61-62.

Project would, in my view, be unlikely to be successful in the future and is not designed to "provide the highest level of overall socio-economic benefit to Manitobans".

Since the St. Joseph Wind Energy Project was first contemplated nearly a decade ago, the public knowledge of wind energy has evolved and the examples of communities participating as owners in the development of wind resources and other smaller-scale renewables are now commonplace. In the case of the projects in Manitoba, economic participation appears to have been limited to payment of compensation to directly-affected land owners, payment of compensation to those along the transmission corridor in accordance with Manitoba Hydro policy, provision of a $20,000 annual grant to the local museum, and priority hiring of local residents.

It is my experience in working with both Aboriginal and non-Aboriginal communities that there is a general expectation that there will be an opportunity to own the energy resource, either through a co-operative or some other form of ownership share. This level of participation also tends to permit those whose lands may not be suitable for wind turbines, but who may experience adverse visual or other effects or who may want to otherwise benefit from the project and support its development, to participate meaningfully. It may also "bring on-side" those who might otherwise oppose the Project on the basis that its environmental impacts are not appropriately balanced with suitable benefits. Models used in other jurisdictions to improve the overall socio-economic benefits of wind resources are discussed below in sections 4.3 and 4.4.

Employment Opportunities

- Creation of 200 to 300 direct jobs during the construction phase and 15 direct jobs during the operating and maintenance phase
- Local populations, including members of the Roseau River First Nation, were given priority in employment and training opportunities

The provision of 15 direct jobs during construction of a 138 MW Project suggests 190 jobs for 1755 MW, the quantity of wind development considered in the Wind/Gas plan. This is reasonably consistent with findings for similar projects in British Columbia as discussed above in section 3.5. As note previously, it appears there were some preferences given to Aboriginal peoples but primarily based on their residential location and not their status.

4.3 WIND RESOURCES ELSEWHERE IN CANADA

4.3.1 Wind Energy in Canada

Wind energy is now commonplace across Canada, with total installations numbering in excess of 7800 MW.[109] So there are numerous examples from which to obtain additional perspective on how the development of additional wind resources in Manitoba could occur so as to minimize environmental effects while maximizing socio-economic benefits for Manitobans generally, and also for Aboriginal groups.

Considering the available time and resources, I focused my review on the observations, conclusions and recommendations of regulatory decisions in the same jurisdictions as those I considered for hydroelectric resources in my previous submission, namely Newfoundland and Labrador, British Columbia and Québec. As before, my preoccupation was not so much with the particularities or idiosyncrasies of the specific cases since these may be different as a result of project design or environmental context, but on the findings that would have more general application to consideration of the macro environmental impact and socioeconomic benefits of wind resources as an alternative to the PDP – the task before the PUB.

I was able to locate environmental assessment decision statements and related documents for nearly all of the wind resources developed in the three jurisdictions in question, in addition to those in Manitoba, as summarized below.

[109] http://www.canwea.ca/farms/index_e.php

Table 4-1 Wind Resources in Four Provinces

Name	COD	MW	District	Province	Owner
Bear Mountain	2009	102	Dawson Creek	BC	AltaGas
Dokie Ridge	2011	144	Chetwynd	BC	Alterra
Quality	2012	142	Tumbler Ridge	BC	Capital Power
St. Joseph	2011	138	St. Joseph	Manitoba	Pattern Energy
St. Leon	2005	99	St. Leon	Manitoba	Algonquin
Fermeuse	2009	27	Fermeuse	NL	SkyPower
St. Lawrence	2008	27	St. Lawrence	NL	NeWind
Baie-des-Sables	2006	110	Bas-Saint-Laurent	Québec	TransCanada/Innergex
Carleton	2008	110	Gaspesie	Québec	TransCanada/Innergex
Des Moulins	2013	135	Chaudière-Appalaches	Québec	Invenergy
Gros-Morne	2012	211	Gaspésie	Québec	TransCanada/Innergex
Jardin d'Eole	2009	127	Bas-Saint-Laurent	Québec	Northland Power
L'Anse-à-Valleau	2007	100	Gaspésie	Québec	TransCanada/Innergex
L'Erable	2013	100	Centre du Québec	Québec	Enerfin/Elecnor
Lac Alfred	2013	300	Bas-Saint-Laurent	Québec	EDF EN Canada
Le Plateau	2012	139	Gaspésie	Québec	Invenergy
Massif du Sud	2013	150	Chaudière-Appalaches	Québec	EDF EN Canada
Mont Copper	2004	54	Gaspésie	Québec	FPL Energy
Mont Miller	2005	54	Gaspésie	Québec	Northland Power
Mont-Louis	2011	100	Gaspésie	Québec	Northland Power
Montagne Seche	2010	58	Gaspésie	Québec	TransCanada/Innergex
Monteregie	2012	101	Monteregie	Québec	Kruger Energy
New Richmond	2013	68	Gaspésie	Québec	TransAlta
Saint-Robert-Bellamin	2012	80	Estrie	Québec	EDF EN Canada
Seigneurie de Beaupré	2013	272	Capitale-Nationale	Québec	Boralex

4.3.2 Relevant Information and Observations

Technical

- The time to commercial operation date from the date of a request for proposals by the purchasing utility until the date of commercial operation was on average about 4 years
- The size of projects developed in these jurisdictions has risen over time to an average of nearly 150 MW for project commissioned since 2010
- Approval of wind projects in Québec now requires that the proponents develop a plan for decommissioning, including a plan for setting aside appropriate funds to ensure that decommissioning occurs

The finding of 4 years to commercial operation from date of request for proposals supports the observations in the NFAT regarding lead times for wind development. However, the trend towards larger developments (in terms of capacity) may suggest that economies of scale are not actually captured with the 65-MW project contemplated by Manitoba Hydro and that larger facilities are more competitive.

As an observation, the inclusion of decommissioning funding as an approval condition is something that Manitoba also requires in relation to wind resource development in the Province to protect Manitobans from incurring any legacy costs in relation to the additional wind resources.

> Wind farms have a life expectancy of approximately 25 years, when major refurbishing or decommissioning may be required. The developer and/or owner of the wind farm will be responsible for all decommissioning costs which will be a condition of the Crown land lease and *Environment Act* licence.[110]

However, in reviewing the Environment Act licences for the two facilities,[111] the decommissioning funding requirement appears to have been waived. In the event of expansion of the wind industry in Manitoba it will be important that the decommissioning responsibility is enforced by the Province rather than left to the landowner to address through the right-of-way agreement with the developer.

Environment

- Of the 25 environmental assessment decisions reviewed, none required the justification of significant residual adverse environmental effects in order to approve the project
- Post-construction monitoring of birds and bats was required in essentially every instance, and uncertainty about the potential effects on these species was acknowledged on several occasions as the justification for this monitoring

The fact that so many wind projects have been approved in Canada, including the development of many projects in the Gaspésie region of Québec, without concerns respecting significant

[110] Manitoba Conservation. Windfarms – Manitoba. http://www.gov.mb.ca/conservation/wind-farms/

[111] Manitoba Conservation. October 6, 2009. Environment Act Licence No. 2902.; Manitoba Conservation. May 14, 2010. Environment Act Licence No. 2922.

residual adverse environmental effects contrasts with the findings of environmental assessment reviews of large-scale hydroelectric projects in the same jurisdictions. [112]

Given the experience in other jurisdictions, the need for post-construction bat and avifauna monitoring should be assumed for all future wind development in Manitoba. This monitoring could be incorporated into the cumulative effects management framework recommended in section 4.2.

Socioeconomic

- The need for meaningful long-term economic benefits to locally-affected communities was identified as a key concern for three-quarters of the projects, and is operationalized in Québec through compensation agreements between the developers and affected municipalities as well as the affected landowners, and in BC through agreements with local municipalities and Aboriginal groups since projects to date have been exclusively on Crown lands
- Aboriginal consultation and, in some cases, accommodation was a feature of about half of the projects in Québec and all of the projects in BC, which included consultation with both First Nation and Métis groups, as appropriate
- Cumulative effects, particularly on the visual and rural landscape, have become an issue of increasingly frequent concern over time with the development of more projects in Québec
- Socio-economic information was not available for the Newfoundland and Labrador projects

The approach taken in Québec recognizes the need to ensure that communities as a whole benefit from the development of the wind resources, and not only those who host the actual turbines on their property. The amounts made available to these municipalities were typically on the order of $1000/MW per year. The use of this kind of approach in Manitoba would improve the socio-economic benefits of wind resources.

[112] Hendriks, R. February 2014. Need for and Alternatives To (NFAT) Review: Evaluating Macro Environmental Impact, at pp. 24-48.

4.4 PROMOTING SOCIOECONOMIC BENEFITS IN ONTARIO

4.4.1 Introduction

To illustrate what can be accomplished beyond the existing model used in Manitoba where wind projects are developed solely by Hydro or the wind industry, I investigated the approaches used in Ontario in that province's attempt to realize the highest level of socio-economic benefits from renewable energy resources. While not all of these approaches may be suitable for use in Manitoba, they provide insight into the possibilities for improving the socio-economic benefits of wind resources.

4.4.2 Renewable Energy Programs

The Ontario Power Authority (OPA) coordinates conservation, electricity system planning, and contracting for renewable electricity resources in Ontario. The OPA delivers several programs[113] to support the development of renewable energy, including wind resources, across Ontario.

Aboriginal Partnership Program. This program includes three components:

- an energy fund designed to provide financial support for initial project development costs associated with First Nation and Métis community renewable energy projects;
- a resource network designed to improve knowledge of conservation and renewable energy opportunities for First Nations and Métis; and
- a community energy planning process that assists Aboriginal communities in developing and implementing plans for conservation and renewable energy development

Community Energy Partnership Program. This program provides financial grants to energy co-operatives that are developing renewable energy projects in Ontario to assist with the "soft" or developmental costs associated with new renewable energy projects.

Large Renewable Project Procurement Program. The Large Renewable Project Procurement (LRPP) Program is a new program still under development by the OPA and is designed for renewable energy projects (other than hydroelectric) larger than 500 kW. The program is being designed to improve upon prior processes and to attempt to address some of the challenges identified in developing additional wind resources in Ontario.

[113] http://www.powerauthority.on.ca/opa-programs

Feed-in-tariff Program. The Feed-In Tariff (FIT) Program is designed to encourage and promote greater use of renewable energy sources (between 10 kW and 500 kW) including on-shore wind, waterpower, renewable biomass, biogas, landfill gas and solar photovoltaic (PV) for electricity generating projects in Ontario. The Program pays a guaranteed amount over a set contract period for energy delivered by approved renewable energy projects.

MicroFIT Program. Similar to the FIT Program, the MicroFIT Program is designed for renewable energy projects less than 10 kW, and tends to support mostly solar PV development.

Price Adders

Regardless of whether or not Manitoba chooses to adopt a feed-in-tariff to support greater socio-economic benefits from the development of additional wind resources, one element of the program deserves particular mention as it could be implemented as part of a different procurement process. Both the FIT and MicroFIT contain price adders designed to support involvement of Aboriginal groups and organizations, community-based cooperatives, and municipal governments and public sector organizations in owning and developing renewable energy projects. I expect that the LRPP Program will also contain a similar financial incentive to support the maximization of socio-economic benefits. The price adders are shown in the following table.

Table 4-2 FIT Price Adders

	Aboriginal Participation Project		Community Participation Project		Municipal or Public Sector Entity Participation Project	
Participation Level (Equity)	> 50%	15% - 50%	> 50%	15% - 50%	> 50%	15% - 50%
Price Adder (¢/kWh)	1.5	0.75	1.0	0.5	1.0	0.5

While the price adders are not substantial, they provide groups, communities and organizations that stand to be affected by or to benefit from renewable energy development with a modest competitive advantage in developing renewable energy projects. They also incent developers to work cooperatively with community-based organizations to bring renewable energy projects into development.

4.4.3 Case Studies

Several case studies illustrate the range of renewable energy projects, including wind resources, supported by the OPA programs that are being developed by Aboriginal and non-Aboriginal communities. Similar benefits and opportunities could be realized through development of

wind resources in Manitoba using a different development model than the industry-focused one used to date in Manitoba or the Hydro-focused one considered in the NFAT.

Métis Nation of Ontario. The MNO is developing 8 MW of solar PV as a majority owner with its partner Bright Roof Solar LP through a series of 36 FIT projects, and an additional 7 MW of solar PV through a number of projects in which the MNO is a minority partner.

> "One of the Métis Nation's long-term goals is to be able to generate enough green energy for Ontario's electric system to meet the needs of every Métis household in the province," said MNO President Gary Lipinski. "This announcement puts us on the path to achieving this goal, while also creating training opportunities, jobs and wealth for Métis communities in the province."[114]

Henvey Inlet First Nation. Henvey Inlet incorporated a Nigig Power Corporation in June 2010 to develop a 300-MW wind generation facility on its reserve lands with its partners General Electric Canada and BluEarth Renewables Inc. through the FIT Program. The project is currently in the design stage with environmental baseline, engineering design and transmission system integration studies ongoing.[115]

> The project will produce enough electricity each year to produce power for about 70,000 homes. Henvey Inlet First Nation Chief Wayne McQuabbie says, "Our project team has worked diligently for the past two years for the project to arrive at this point. It's a monumental moment for our First Nation to be awarded such a large scale project."[116]

Kapuskasing River Waterpower Project. In partnership with Hydromega,[117] Brunswick House First Nation, Chapleau Ojibwe First Nation, Chapleau Cree First Nation and the town of Kapuskasing are working collaboratively to develop four hydroelectric sites (total 22 MW) on the Kapuskasing River in northeastern Ontario.[118]

[114] http://www.metisnation.org/news--media/news/mno-wins-major-green-energy-contracts

[115] http://www.aboriginalenergy.ca/aref/case-studies

[116] http://www.hifn.ca/?p=13

[117] http://www.hydromega.com/news/kapuskasing-and-dokis-projects-websites-are-now-on.aspx

[118] http://wpwg.org/initiatives/; http://www.kapuskasing.ca/Businesses/TargetSectors/RenewableEnergy/default.aspx

5 CONCLUSIONS

This review of the available evidence concerning the macro environmental impact and socio-economic impacts and benefits of additional wind resources in Manitoba supports several conclusions respecting the suitability of additional wind resources as part of an alternative plan to the PDP or as part of an optimized plan to delay a decision to proceed with the PDP.

Considering the current relatively modest differences between the costs of wind resources and the costs of hydroelectric resources, the likely decline in the cost of wind resources, and the imposition of the macro environmental impacts associated with the PDP, there appears to be merit in analyzing the most appropriate strategy for delaying a decision on the PDP to beyond 2030.

The fact that so many wind projects have been approved in Canada, including the development of many projects in the Gaspésie region of Québec, without concerns respecting significant residual adverse environmental effects, contrasts with the findings of environmental assessment reviews of large-scale hydroelectric projects in the same jurisdictions.

To best achieve this potential, development of additional wind resources should be preceded by development of a cumulative effects management framework aimed at identifying those locations most economically, ecologically and socially suitable for future wind energy development. This would have the effect of minimizing the potential for macro environmental and socioeconomic impacts related to more intensive wind development as part of any future alternative plan to the PDP.

The development of many wind projects in other jurisdictions supports the characterization of wind resources as a flexible system planning option that can be developed on short time frames, in a sequence that avoids costly surpluses, and in a manner that supports the maximization of socio-economic benefits for Manitobans, including Aboriginal groups.

Finally, as a result of evolution of public knowledge of wind energy and the many examples of communities participating as owners in the development of wind resources and other smaller-scale renewables, a different approach to that used previously in Manitoba will be necessary in order to achieve the highest levels of socioeconomic benefits for Aboriginal communities and for Manitobans in general.