SUBJECT: Internal Expert Analysis Report

REFERENCE: LCA - Executive Summary, p. ii

PREAMBLE: LCA is of the view that MH's assessment of the year of need is very conservative. The 2022/23 date for energy need and the 2025/26 date for capacity need apparently relate to domestic load only.

QUESTION:

Confirm that domestic energy sales are forecast to be 25,078 GWh in 2022/23 plus transmission losses which MH estimates at about 3,000 GWh for a total of 28,000± GWh.

RESPONSE:

Appendix 11.3 of the NFAT Submission shows MH forecasts load to be 25,078 GWh in FY 2022/23 and domestic energy losses to be 2,941 GWh.

SUBJECT: Internal Expert Analysis Report

REFERENCE: LCA Executive Summary, pp. 1-16

PREAMBLE: LCA is of the view that MH's assessment of the year of need is very conservative. The 2022/23 date for energy need and the 2025/26 date for capacity need apparently relate to domestic load only.

QUESTION:

Confirm that this load (in 2022/23) can be met from 22,420 GWh of dependable hydraulic energy plus about 5,500 GWh of wind/DSM/natural gas generation and some net imports.

RESPONSE:

Manitoba load in 2022/23 can be met from any number of combinations of resources, including hydro, wind, DSM, natural gas, and imports.

SUBJECT: Internal Expert Analysis Report

REFERENCE: LCA Executive Summary, pp. 1-16

PREAMBLE: In a dependable flow situation, exports volumes may be exceeded by import volumes.

QUESTION:

Is LCA referring to domestic load forecasts as being overstated or is LCA referring to not utilizing the Brandon coal plant and more imports?

RESPONSE:

The preamble to this question is not a statement from LCA's Executive Summary or from page 1-16. We are not clear on the statement to which the question is referring.

SUBJECT: Internal Expert Analysis Report

REFERENCE: LCA Main Report, p. 5

PREAMBLE: LCA suggests that the domestic need range runs from 2020/21 to 2032/33.

QUESTION:

Provide a tabulation of the 2013 load forecast base and sensitivity ranges that support the 2020/21 to 2032/33 range.

RESPONSE:

See LCA Technical Appendix 1: Resource Planning pp. 1-18 to 1-45 and supporting workpapers (TA1 Resource Planning Figures).

SUBJECT: Internal Expert Analysis Report

REFERENCE: LCA Main Report, p. 5

PREAMBLE: MH's domestic load forecasts have been questioned on several points: 1) lower population/customer growth; 2) fuel switching away from electric heat; 3) lower top consumer industry growth; and 4) lower transmission losses assigned to domestic load reflecting incremental use by domestic load and then exports.

QUESTION:

Did LCA adopt a lower base domestic load growth, such as the 10th percentile illustrated in Figure 1-7 and 1-15? Please explain why or why not.

RESPONSE:

A detailed critique of MH's load forecast was not included in the LCA Scope of Work. The values in Figures 1-7 and 1-15 were provided by MH as its view of a reasonable range of possible outcomes of load growth. LCA requested MH run a development plan scenario with lower load growth discussed in Technical Appendix 3B.

SUBJECT: Internal Expert Analysis Report

REFERENCE: LCA Main Report, p. 5

PREAMBLE: MH's domestic load forecasts have been questioned on several points: 1) lower population/customer growth; 2) fuel switching away from electric heat; 3) lower top consumer industry growth; and 4) lower transmission losses assigned to domestic load reflecting incremental use by domestic load and then exports.

QUESTION:

Please confirm that on an aggregated basis, these issues might reduce the base domestic load by 5 or 10%. If not, please explain.

RESPONSE:

LCA cannot confirm or deny the load reduction impacts postulated. LCA Main Report at page 5 does not speak to the questions posed in the Preamble. Further, these issues were not in LCA's scope of work and are not addressed in the LCA evidence.

SUBJECT: Internal Expert Analysis Report

REFERENCE: LCA Main Report, p. 5

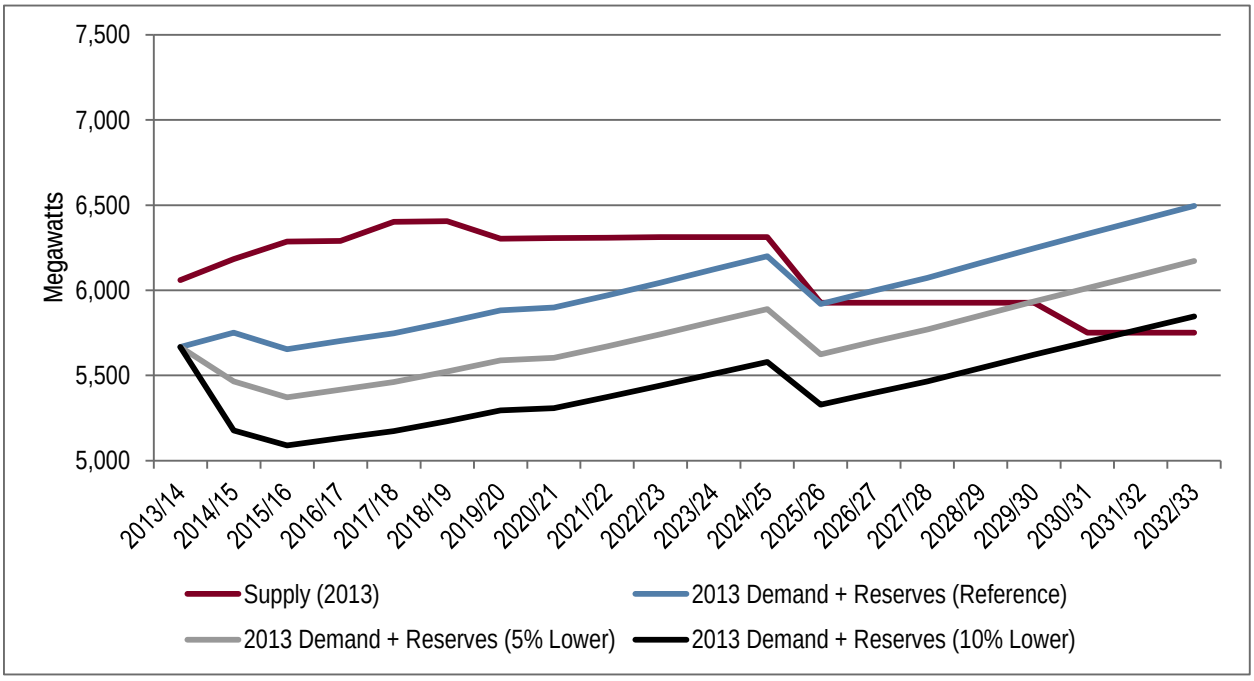
PREAMBLE: MH's domestic load forecasts have been questioned on several points: 1) lower population/customer growth; 2) fuel switching away from electric heat; 3) lower top consumer industry growth; and 4) lower transmission losses assigned to domestic load reflecting incremental use by domestic load and then exports.

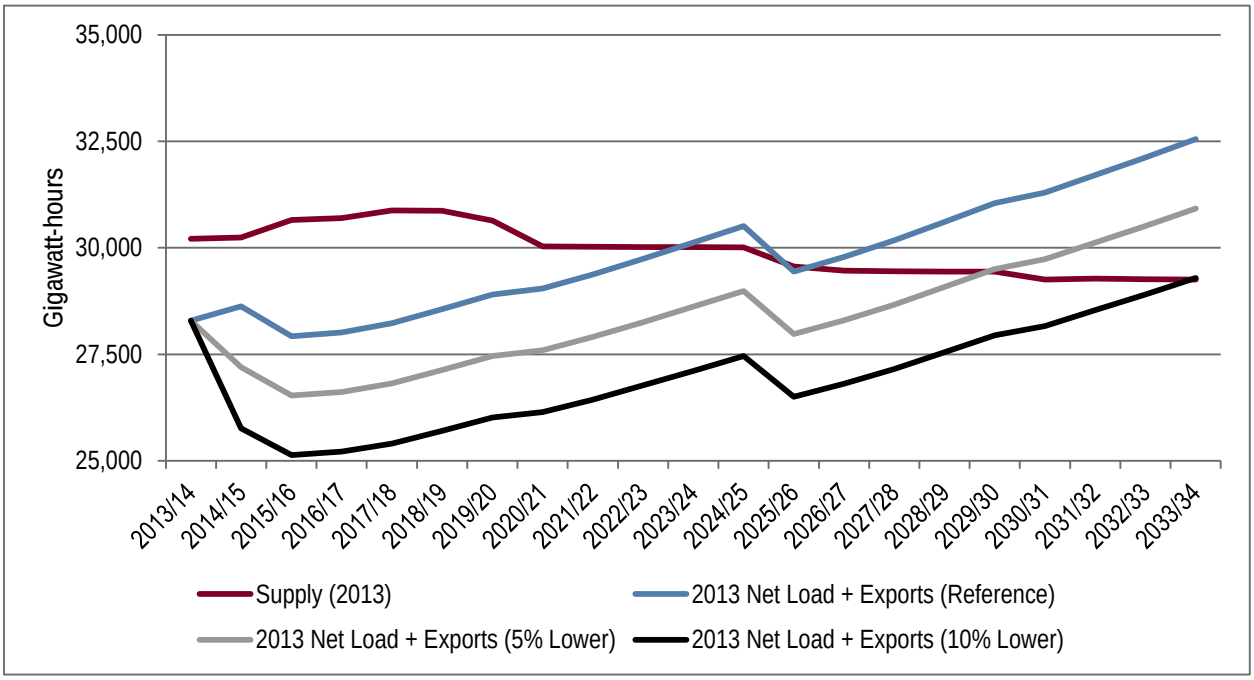
QUESTION:

Please provide a sensitivity analysis of both a 5% and 10% lower domestic load going forward from 2013/14, indicating the potential deferral of new generation.

RESPONSE:

See below for revised versions of Figures 1-7 (capacity) and 1-15 (energy) with lower load forecasts.





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2 See also Technical Appendix 3B for a description of the LCA No New Generation case that MH
3 ran at LCA's request.

SUBJECT: Internal Expert Analysis Report

REFERENCE: LCA Main Report, p. 5

PREAMBLE: Deferral of Keeyask in-service could be achieved by: 1) keeping Brandon unit #5 in-service for brought and capacity services; 2) Renewals of diversity contracts; 3) higher levels of DSM; 4) Reliance on peak as well as off-peak imports; and 5) more non-firm imports.

QUESTION:

Provide LCA's view on the potential deferral of Keeyask if all of these measures were achieved.

RESPONSE:

The energy and capacity need sensitivities provided in LCA Technical Appendix 1 makes clear that the combined effect of the measures cited could defer the year of need for several years on either an energy or capacity basis. However, consideration of deferring Keeyask does not necessarily rest solely on domestic need for energy and capacity. The economic analysis of the plan for Keeyask in conjunction with the MP 250 Contract is also a consideration. Please refer to LCA's response to PUB/LCA-025b for further discussion of the window of opportunity issue.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA 6-71

PREAMBLE: Using SPLASH to perform arbitrage through importing at low-priced hours and exporting during high-priced hours has been MH's strategy but the results in above-average flow years have not been positive. MH has in some years maximized off-peak summer sales only to buy back that energy at higher winter market prices.

QUESTION:

Confirm that MH may decide to maximize exports even when market prices only cover water rentals and added transmission costs.

RESPONSE:

LCA cannot confirm MH's decision criteria for exports for the specific condition specified. LCA understands the question to be asking if MH will export surplus hydropower whenever market prices exceed MH's variable cost of hydropower production. LCA's understanding is that decisions regarding short and medium-term market transactions are based, at least in part on hydraulic conditions, as well as market based criteria. For more on MH's operational planning see Technical Appendix 5: Hydrologic Risk.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA 6-71

PREAMBLE: Using SPLASH to perform arbitrage through importing at low-priced hours and exporting during high-priced hours has been MH's strategy, but the results in above-average flow years have not been positive. MH has in some years maximized off-peak summer sales only to buy back that energy at higher winter market prices.

QUESTION:

Does LCA agree that in low-flow years MH's expansion of summer sales can lead to substantial losses in the subsequent year [e.g. 2003/04 drought was exacerbated by the 2002/03 summer and fall sales]? Please explain your answer.

RESPONSE:

Whether a sell then buy-back transaction is economically beneficial is determined by the prices at the time of sale and purchase. If the price at the time sale is lower than the price at the time of purchase, the transaction will incur a cost. This is true regardless of water conditions. However, water conditions may add additional constraints on MH operations and decisions on any expansion of summer sales that may be made. For more on MH operations, see Technical Appendix 5: Hydrologic Risk.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA - 27

PREAMBLE: Firm price contracts in place in 2023/24 are 375/325MW – NSP and 250 MW – MP. Firm price contracts in 2033/34 are 250MW- MP and 100 MW – WPS.

QUESTION:

Indicate the firm contract prices and energy sales volumes that MH could rely on in 2023/24 and 2033/34

RESPONSE:

Please see Technical Appendix – 7B, Section II, Subsection C – Projecting Energy Revenues and Volumes.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA - 27

PREAMBLE: Firm price contracts in place in 2023/24 are 375/325MW – NSP and 250 MW – MP. Firm price contracts in 2033/34 are 250MW- MP and 100 MW – WPS.

QUESTION:

Did LCA critique MH's average unit export revenues on a scenario by scenario basis? If so, please provide LCA's version of the reference cases?

RESPONSE:

LCA critiqued the All Gas Case and the Preferred Development Plan in Technical Appendix – 7B, Section II, Subsection E - LCA Risk Analysis.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA - 19

PREAMBLE: The levelized cost of energy [LCOE] analysis does not incorporate uncertainties, it does not distinguish different technology offering characteristics, and it does not include financing costs

QUESTION:

Would LCA prefer to rely on revenue requirement analysis or an internal rate of return analysis in evaluating MH's various alternatives?

RESPONSE:

La Capra Associates prefers to use a revenue requirements analysis as an alternative to unleveraged cash flow analyses in evaluating MH's various alternatives. IRR is a metric that can be used with revenue requirements analysis of a plan or unleveraged cash flow.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA - 19

PREAMBLE: The levelized cost of energy [LCOE] analysis does not incorporate uncertainties, it does not distinguish different technology offering characteristics and does not include financing costs

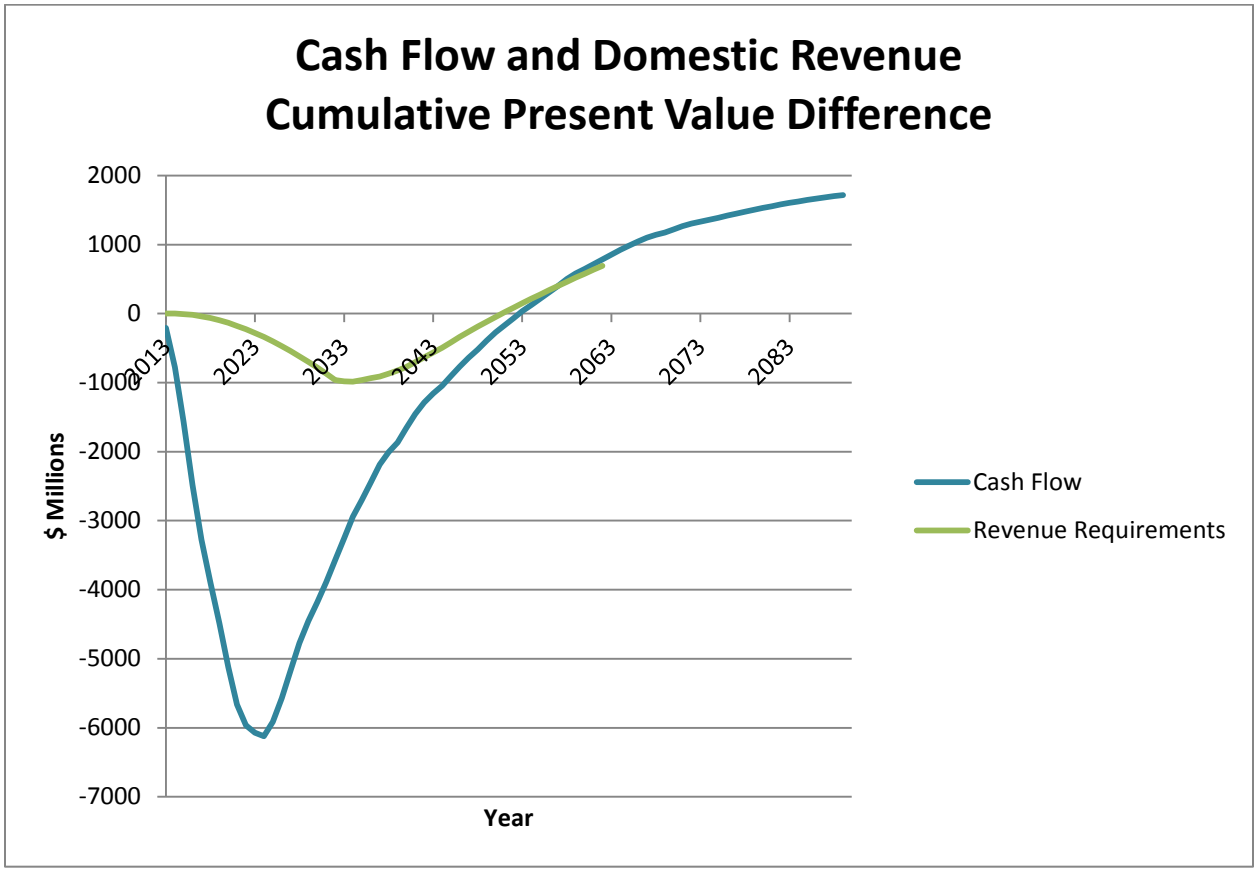
QUESTION:

Did LCA carry out either a revenue requirement analysis or internal rate of return analysis on the preferred development plan, the all gas scenario and other scenarios. If so please provide in summary format.

RESPONSE:

La Capra Associates did not carry out a revenue requirements analysis per se. However, we did extract and compare the revenue that would be collected from domestic customers for several plans from the MH provided in their Financial Analysis in Appendix 10.4. MH has emphasized that its modeling is not a revenue requirements analysis.

The chart below shows the cash flow and total domestic revenue comparison for the Preferred Development Plan on a cumulative present value basis relative to the All Gas plan.



Although the cash flow analysis extends to year 2090 while the Revenue Requirements analysis only provides data for the first 50 years, the two curves exhibit similar behavior. Both break even with the All Gas Plan around 2054. They also both demonstrate a cash outflow initially and a steep trend towards the Preferred Development Plan case having lower costs and revenue requirements than the All Gas Case. A similar analysis was conducted for the other thirteen plans and as a result, LCA concluded that relying on a complete cash flow analysis for our review of the MH economic analysis was sufficient. The analysis is described in further detail in the attached electronic work papers.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA - 6-64 Figure 6.39, 6-52 Figure 6-32

PREAMBLE: LCA has taken issue with MH's scenario evaluation, specifically the following points:

- conservative load forecast
- limiting import resources
- too optimistic export prices and revenue forecasts

QUESTION:

If possible, please re-analyze MH's scenario analysis out to 2033/34 with the following changes:

- 10% lower domestic load forecast from 2012
- 20% limit on imports in peak and off-peak periods
- firm existing contract price coupled with low case dependable energy price for peak opportunity sales and off-peak opportunity sales at adjusted reference

RESPONSE:

La Capra Associates is unable to produce the analysis requested without support from MH. LCA had requested an additional plan be evaluated where load growth is lower through additional DSM programs (1.5 times what was in the forecast) and by the fuel switching of electric heat to natural gas heating for primarily new residential dwellings and some retrofits of existing residential dwellings. In addition LCA requested that this plan would have a transmission project of 750 MW built enabling the increasing of the amount of imports and more

1 importantly increasing the amount of dependable energy imports can provide to a maximum of
2 20%. This Plan is discussed and results provided in Technical Appendix 9B and Technical
3 Appendix 3B. The plan was to add natural gas fired generation after the transmission
4 increase/imports when there is a need for additional dependable energy. This is the closest
5 analysis to what is requested in this IR.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA - 6-64 Figure 6.39, 6-52 Figure 6-32

PREAMBLE: LCA has taken issue with MH's scenario evaluation, specifically the following points:

- conservative load forecast
- limiting import resources
- too optimistic export prices and revenue forecasts

QUESTION:

Please confirm whether in LCA's view, Manitoba Hydro's export revenue forecasts are achievable with current contracts and market energy sales.

RESPONSE:

Confirmed. Please see Technical Appendix - 7B for detailed analysis.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA 1-57 NFAT Appendix 11.3 Page 271

PREAMBLE: In all scenarios, MH projects linear domestic load growth to 2047. Thereafter MH assumes zero domestic low growth that export sales will remain constant. Moreover, export prices are forecast to increase at a higher rate than domestic rates, resulting in higher revenue after 2047 than if domestic load continued to grow.

QUESTION:

Does LCA agree with the 1.5%/year linear growth projection of domestic load to 2047, no growth thereafter? On what basis?

RESPONSE:

LCA's Scope of Work did not include a review of MH's load forecast. As a result, LCA does not have a basis to offer an opinion on MH's load growth projections or assumptions.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA 1-57 NFAT Appendix 11.3 Page 271

PREAMBLE: In all scenarios, MH projects linear domestic load growth to 2047. Thereafter MH assumes zero domestic low growth that export sales will remain constant. Moreover, export prices are forecast to increase at a higher rate than domestic rates, resulting in higher revenue after 2047 than if domestic load continued to grow.

QUESTION:

Did LCA examine any modified domestic load growth curves that would have lower nonlinear growth rates after 2032 /33?

RESPONSE:

LCA did not examine any alternative load growth curves in its Initial Expert Analysis Report. However, LCA did recognize this issue in Technical Appendix 9A and has addressed it further in our Supplemental Report.

In Technical Appendix 9A, the concern regarding the extrapolation of the economic analysis beyond 2047 (see Pages 9A-16 and 9A-21). Our review of the economic analysis contained in Technical Appendix 9A focused on the extent to which the economic results are dependent upon the assumptions beyond 2047 by providing views of the cumulative impacts over the planning horizon and interim metrics of net present value.

LCA did request alternative development plan analysis from MH through the IR process and in meetings with the Company. MH has recently produced one alternative development plan, based on our request, which examines a lower domestic load and increased reliance on

imports. That case is evaluated in the LCA supplemental analysis. See our Supplemental Report, Technical Appendices 3B and 9B.

LCA also understands that MH is preparing additional case analyses which address the sensitivity of the results to varying levels of Demand Side Management investments. LCA has not received or reviewed those results.

LCA does not have access to the SPLASH model. SPLASH model runs would be required to test alternative load forecast cases.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA 1-57 NFAT Appendix 11.3 Page 271

PREAMBLE: In all scenarios, MH projects linear domestic load growth to 2047. Thereafter MH assumes zero domestic low growth that export sales will remain constant. Moreover, export prices are forecast to increase at a higher rate than domestic rates, resulting in higher revenue after 2047 than if domestic load continued to grow.

QUESTION:

If the answer to (b) is yes, please provide LCA's sensitivity analysis of such modified curves.

RESPONSE:

Please refer to LCA response to PUB/LCA-012b for information on analysis contained in the LCA Initial and Supplemental Reports.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Elenchus Report

PREAMBLE: Elenchus indicated that some of MH's forecasts were too high. These included:

- Population/customer numbers
- Shift to electric heat
- Focus on population rather than GDP
- Top consumers after 2015/16
- Potential large industrial load (PLIL)

Another aspect that may overstate domestic load is the allocation of a component of incremental export transmission losses to domestic load.

QUESTION:

What is LCA's view on the potential overestimation of domestic load from each of the items identified by Elenchus?

RESPONSE:

Please refer to LCA's response to PUB/LCA-012a.

SUBJECT: Internal Expert Analysis Report

REFERENCE: Initial Export Analysis Report, LCA

PREAMBLE: Elenchus indicated that some of MH's forecasts were too high. These included:

- Population/customer numbers
- Shift to electric heat
- Focus on population rather than GDP
- Top consumers after 2015/16
- Potential large industrial load (PLIL)

Another aspect that may overstate domestic load is the allocation of a component of incremental export transmission losses to domestic load.

QUESTION:

What is LCA's view as to the overall likely magnitude of the overestimate? Please comment on the implications to the Preferred Development Plan.

RESPONSE:

Please refer to LCA response to PUB/LCA-012a.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-15

PREAMBLE: LCA states that MH's other recent changes to the energy criterion have not been fully supported and have a qualifiable impact on resulting year of need for new energy resources.

QUESTION:

What process should MH employ to review the energy criterion to be used for dependable energy?

RESPONSE:

The first step in the assessment would be to conduct economic analyses of the potential value to MH of changes in is criteria. Conducting SPLASH runs testing a range of criteria would provide information on the potential economic value of alternative approaches. If the economic potential is significant, additional reliability and operational assessments may be appropriate.

See also LCA's response to PUB/LCA-016.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-14

PREAMBLE: LCA states the US transfer capability between the systems has expanded greatly over the past 40 years, MH's planning criterion has not adequately incorporated these changes.

QUESTION:

Please describe the available transmission interconnection that should be considered in determining the level of dependable energy

RESPONSE:

The available transmission interconnection capability is described in section II-A of LCA's Technical Appendix 08 – Transmission, beginning on page 8-2. Figure 8.3 provided the current firm transfer limits for imports into Manitoba.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-14

PREAMBLE: LCA states the US transfer capability between the systems has expanded greatly over the past 40 years, MH's planning criterion has not adequately incorporated these changes.

QUESTION:

Please describe how additional transmission in the new and/or contemplated export contracts impacts the level of dependable energy that could be measured, and discuss how that will impact the timing for new generation.

RESPONSE:

Under MH's criteria, increasing the interconnection transfer capability between MH and the US would allow MH to increase its dependence on off-peak imports to meet dependable energy needs. As stated on page 1-11 of Technical Appendix 1: Resource Planning, at current import limits of 700 MW, the criterion allows for 3,068 GWh of imported dependable energy. If that were increased by 750 MW to 1,450 MW, the amount of energy allowed from imports would be 6,355 GWh, and the off-peak import limitation would no longer be binding. This amount of 6,355 GWh is very similar to the 6,443 GWh limit that would result by relaxing the import constraint to include all hours instead of off-peak hours. The 6,443 GWh limit is shown in Figure 1-3 on page 1-13 of Technical Appendix 1: Resource Planning. The impact on the year of resource need of relaxing the import limit to include all hours is shown in Figure 1-20 on page 1-41 of Technical Appendix 1: Resource Planning. The impact of the additional 750 MW of new import capacity would have virtually the same impact.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-16

PREAMBLE: BC Hydro's self-sufficiency standard requires it to have to domestic resources to fulfill load during an average flow year. Figure 1-5 demonstrates the significance of that standard versus one based on the minimum flow condition.

QUESTION:

Please discuss whether MH should adopt BC Hydro's approach for measuring dependable energy and, if so, indicate the implications to MH related to additional generation development and supply considerations during low water flow years.

RESPONSE:

LCA does not have sufficient information to make that determination. MH's planning analysis did not test alternative policies to their dependable energy approach.

LCA requested MH run a case with lower load, additional DSM, renewal of diversity contracts and more imports, including relaxing MH's policy limiting the extent of reliance on imports. See Technical Appendix 3B for more details on this case and the potential for deferral of new generation.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-17

PREAMBLE: LCA states limiting the amounts of imports to 10% of Manitoba load plus export obligations has not been supported by any analysis. This threshold does not appropriately incorporate changes in the transmission system or market since the policy was first established in 1977.

Limiting amount of dependable energy to the quantity that can be imported during the off-peak period similarly is not supported by any analysis and is very conservative.

QUESTION:

Please indicate whether MH provided any analysis in support of the criteria and explain its use in LCA's work.

RESPONSE:

MH did not provide any analysis in support of the criteria.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-17

PREAMBLE: LCA states limiting the amounts of imports to 10% of Manitoba load plus export obligations has not been supported by any analysis. This threshold does not appropriately incorporate changes in the transmission system or market since the policy was first established in 1977.

Limiting amount of dependable energy to the quantity that can be imported during the off-peak period similarly is not supported by any analysis and is very conservative.

QUESTION:

In light of these observations, please indicate what level of dependable energy should be set for determining when there is a need for new generation investments.

RESPONSE:

Please refer to LCA's response to PUB/LCA-016.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-17, 1-41

PREAMBLE: LCA states limiting the amounts of imports to 10% of Manitoba load plus export obligations has not been supported by any analysis. This threshold does not appropriately incorporate changes in the transmission system or market since the policy was first established in 1977.

Limiting amount of dependable energy to the quantity that can be imported during the off-peak period similarly is not supported by any analysis and is very conservative.

QUESTION:

Please describe the criteria that LCA recommends MH adopt for measuring the level of dependable energy.

RESPONSE:

Please refer to LCA's response to PUB/LCA-016.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-14

PREAMBLE: LCA states limiting the amounts of imports to 10% of Manitoba load plus export obligations has not been supported by any analysis. This threshold does not appropriately incorporate changes in the transmission system or market since the policy was first established in 1977.

Limiting amount of dependable energy to the quantity that can be imported during the off-peak period similarly is not supported by any analysis and is very conservative.

QUESTION:

What are the best practices in other jurisdictions related to import limits?

RESPONSE:

There are a broad range of experiences in the industry on the determination on limitations on reliance on imports and the extent to which utilities or regions allow for imports. The formation of capacity market in several U.S. systems, including the MISO market, include a determination of transfer limits and minimum requirements for local generation to assure reliability in a particular region or zone. Within the reliability constraints, the reliance on imports is principally an economic choice.

Also, please see the discussion of BC Hydro's criteria on pages 1-9 and 1-15 to 1-16 of Technical Appendix 1: Resource Planning.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-57

PREAMBLE: The determination of resource supply and demand performed by MH is very conservative. Combined with restrictive planning criteria, MH has identified a resource need that is likely well in advance of the year that it will actually face an energy or capacity supply deficiency.

QUESTION:

Please indicate the range of years for which MH could defer new generation.

RESPONSE:

See Technical Appendix 3B for a description of the LCA No New Generation case, which defers the need for new resources for many years.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page I-39

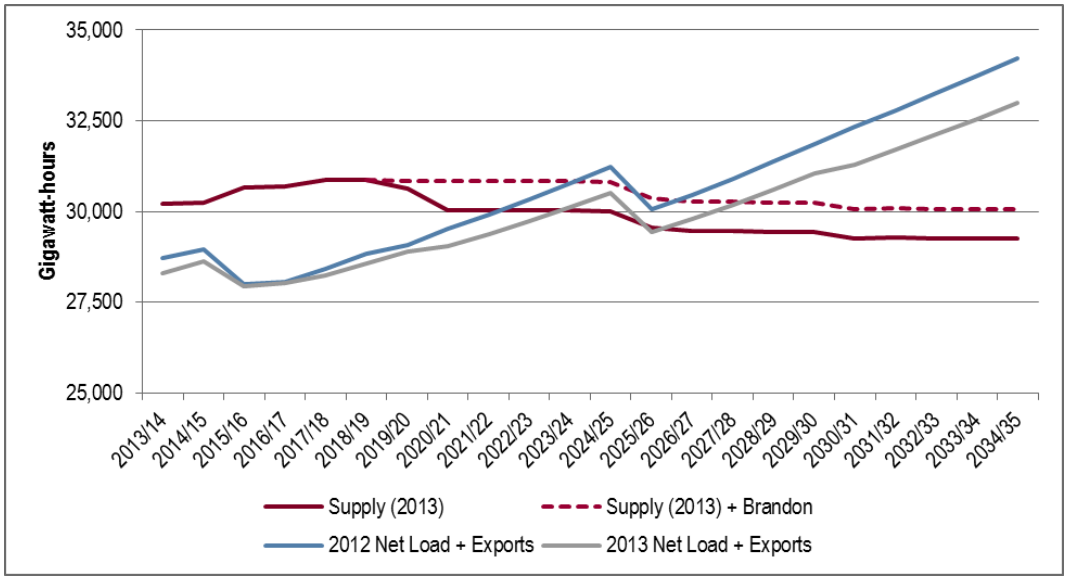
PREAMBLE: Brandon Coal unit # 5 produces up to 810 GWH at 105 MW, which is equivalent to two years of domestic load growth.

QUESTION:

Explain the five year deferral on new G&T from 2023 to 2028/29

RESPONSE:

Due to the expiration of export contracts after 2024/2025, there is a steep drop in the level of net load plus exports. Using the 2013 supply and demand data, this expiration of the export contracts occurs before demand exceeds supply. Figure 1-19 is reproduced below. If the grey "2013 Net Load + Exports" line continued to increase with load growth, the continued service of Brandon Unit 5 would only delay resource need by two years. However, the dependable energy provided by Brandon Unit 5 delays resource need until after load growth replaces the demand reduction caused by the expiring contracts.



SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page I-45

PREAMBLE: LCA has a identified various scenarios for Keeyask and or Conawapa deferrals related to;

- on-peak imports
- average flow versus lowest flow scenarios
- diversity Hydro adjustment
- demand-side management
- lower load growth
- Brandon Coal extension

QUESTION:

Provide a summary matrix which illustrates LCA's various potential Keeyask and or Conawapa deferrals and indicated whether any of the measures are additive, correlated, or not.

RESPONSE:

This response speaks to the analysis of need for new capacity or energy supplies to service domestic load requirements based on MH criteria and load forecast assumptions. Changes in the year of need may or may not change MH's view on whether they consider a deferral of Keeyask or Conawapa. Please refer to LCA's response to PUB/LCA-25b regarding the window of opportunity issues that have bearing on that determination.

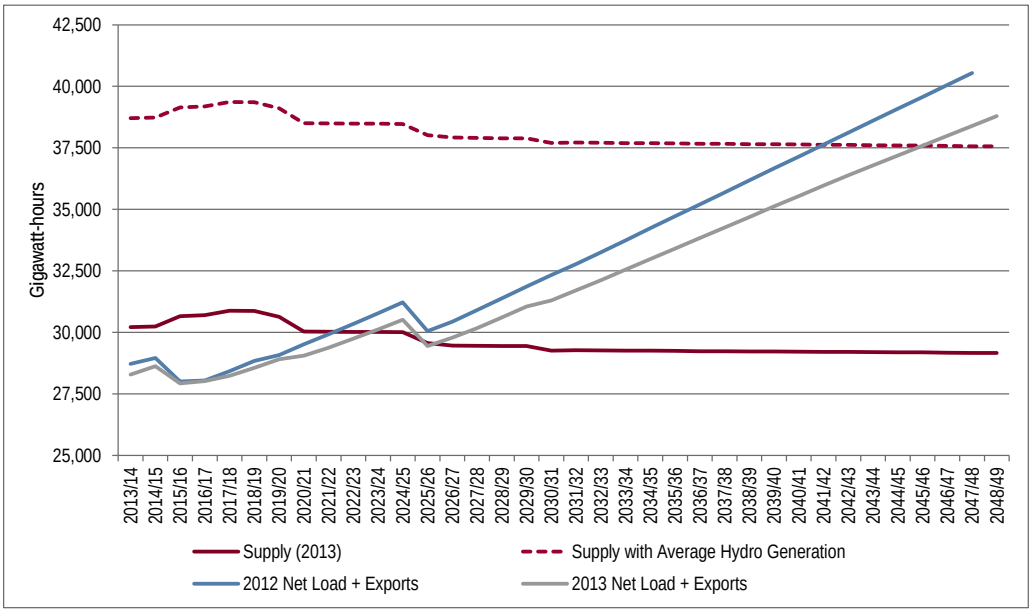
The following matrix summarizes the impacts each item has on the year of capacity or dependable energy need under 2013 Update assumptions. The impact of each item is shown separately, i.e. none are added together. A case with multiple factors was modeled as the LCA No New Generation case, which is described in Technical Appendix 3B. The references refer to

figure and page numbers in Technical Appendix 1: Resource Planning. The Diversity Contract extension and Hydro Adjustment do correlate as the Hydro Adjustment is a byproduct of the diversity contract.

	Year of Capacity Need	Year of Energy Need	References
MH Baseline No New Resources Scenario	2026/27	2023/24	Figure 1-6; Figure 1-14
10th Percentile Load Forecast	2032/33	2032/33	Figure 1-7; Figure 1-15
1.5x DSM	2027/28	2024/25	Figure 1-11; Figure 1-17
4x DSM	2030/31	2031/32	Figure 1-11; Figure 1-17
Diversity Contract Extension	2031/32	N/A	Figure 1-13
Hydro Adjustment*	N/A	2023/24	Figure 1-21
Brandon Unit 5 Continued Service	2027/28	2028/29	p. 1-29; Figure 1-19
Relax Import Limitations**	N/A	2034/35	Figure 1-20
Use Average Hydro Supply	N/A	2046/47	See Figure Below

*The Hydro adjustment does not delay the first year of need as it only applies after 2023/24.

**Assumes imports are available all hours instead of only off-peak; no consideration to limitation on imports to 10% of MH load.



SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-19

PREAMBLE: LCA does not mention the Elenchus Report or appear to suggest any changes to MH's 2012 load forecast

QUESTION:

Did LCA explore a lower domestic base load growth than forecast by MH in 2012 and 2013 if so file and explain.

RESPONSE:

LCA evaluated the low load growth sensitivities prepared by Manitoba Hydro (see, e.g. pages 1-19 to 1-21 and pages 1-33 to 1-35). Please refer to LCA response to PUB/LCA-012b for information on LCA analysis of lower domestic load.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-11

PREAMBLE: LCA indicates the off peak import capability of 700 MWh limits imports to 3068 GWH compared to 6,443 GWh . It is not clear whether imports from Sask Power or Ontario Hydro are included.

QUESTION:

Explain the 700 MW thermal limits on imports during off-peak periods. Is the ON-peak capacity greater than 700 MW?

RESPONSE:

The on and off peak import capability is 700 MW.[1]

[1] NFAT Submission Chapter 5, Table 5.8, page 16 of 61.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-11

PREAMBLE: LCA indicates the off peak import capability of 700 MW limits imports to 3,068 GWH compared to 6,443 GWh. It is not clear whether imports from Sask Power or Ontario Hydro are included.

QUESTION:

Please provide the calculations to support the 3,068 GWh of off–peak and 6443 GWh of on-peak imports.

RESPONSE:

3,068 GWH = [700 MW import limit] * [47.62% off-peak hours] * [365.25 days/year] * [24 hours/day] * [1 + 5% loss factor] / [1,000 MWh/GWh]

6,443 GWH = [700 MW import limit] * [100% hours] * [365.25 days/year] * [24 hours/day] * [1 + 5% loss factor] / [1,000 MWh/GWh]

Footnote 32 of Technical Appendix 1: Resource Planning referred to a 0.05% loss factor. This was a typographic error. It should read 5% loss factor.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-21 Figure 1-1, Page 1-34 Figure1-15

PREAMBLE: MH's Demand Forecast drops in 2024/25. The 90th percentile and 10th percentile are respectively:

2014/15	+/- 150 MW	+/- 500 GWh
2024/25	+/- 500 MW	+/- 2,000 GWh
2032/33	+/- 700 MW	+/- 2,500 GWh

QUESTION:

Does LCA agree with the 2024/25 drop in demand forecast? Please explain.

RESPONSE:

While MH's domestic load continues to grow, the system's total energy demand drops due to the expiration of export contracts. This is discussed by LCA in Technical Appendix 1, pages 1-23 to 1-24 and pages 1-30 to 1-32. LCA has verified that this is consistent with the terms of the existing contracts.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-21 Figure 1-1, Page 1-34 Figure1-15

PREAMBLE: MH's Demand Forecast drops in 2024/25. The 90th percentile and 10th percentile are respectively:

2014/15	+/- 150 MW	+/- 500 GWh
2024/25	+/- 500 MW	+/- 2,000 GWh
2032/33	+/- 700 MW	+/- 2,500 GWh

QUESTION:

Provide LCA's rationale for the 2024/25 forecast of +/- 10% Demand and +/- 7% on energy. Wouldn't a 4-5% spread be more realistic?

RESPONSE:

The purpose of LCA's analysis of load sensitivity in the cited figures is to show the sensitivity analysis on the year of need based on MH's data. The spread depicted in those figures are MH's 10th percentile and 90th percentile forecasts. See also PUB/LCA-003a.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page 1-16

PREAMBLE: MH's dependable hydraulic energy circa 2015/16 is at 22,420 GWh; average output is 31,110 GWh with domestic load forecast at 22,781 GWh, not including losses which MH assumes to be about 3216 GWh for a total of 26,000 GWh.

Firm export obligations in 2015/16 are about 2,000 GWh and will bring the firm demand to 28,000 GWh. MH is counting about 5,600 GWh of non-hydraulic resources which is likely to consist of 900 GWh of wind and 4,700 GWh of imports as MH's thermal plants are not competitive with imports. In 2003/04 MH purchased and bought back a total of about 9,000 GWh.

QUESTION:

Is it LCA's recommendation that MH adopt an average flow hydraulic generation for defining resource adequacy presumably permitting 5,000 GW hours of firm exports which would require 10,000 GWh of non-hydraulic energy in a future drought situation.

RESPONSE:

Please refer to LCA's response to PUB/LCA-016.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Pages 1-11

PREAMBLE: MH's dependable hydraulic energy circa 2015/16 is at 22,420 GWh; average output is 31,110 GWh with domestic load forecast at 22,781 GWh, not including losses which MH assumes to be about 3216 GWh for a total of 26,000 GWh.

Firm export obligations in 2015/16 are about 2,000 GWh and will bring the firm demand to 28,000 GWh. MH is counting about 5,600 GWh of non-hydraulic resources which is likely to consist of 900 GWh of wind and 4,700 GWh of imports as MH's thermal plants are not competitive with imports. In 2003/04 MH purchased and bought back a total of about 9,000 GWh.

QUESTION:

Would LCA expect that such a new firm export contracts would require additional import and export capabilities beyond 6,443 GWh?

RESPONSE:

That determination would be contingent on the nature of the contract and the supply resources that were to be committed to supply the exports. Please refer to LCA's response to PUB/LCA-071a.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Pages 1-57, I-58

PREAMBLE: LCA concludes that MH's energy criterion does not include full utilization of import opportunities, imports and DSM have not been appropriately treated and the Preferred Development Plan is structured to build in advance of need in order to maximize potential benefits from exports during the perceived window of opportunity.

QUESTION:

Is it LCA's view that the Preferred Development Plan is being oversold relative to other alternatives? Please explain.

RESPONSE:

Pages 1-57 and 1-58 provide a summary of LCA's observations on MH's resource planning criteria and needs analysis. Please refer to page LCA-32 of LCA's Initial Expert Analysis Report for LCA's view on MH's PDP evaluation.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Pages 1-57, I-58

PREAMBLE: LCA concludes that MH's energy criterion does not include full utilization of import opportunities, imports and DSM have not been appropriately treated and the preferred development plan is structured to build in advance of need in order to maximize potential benefits from exports during the perceived window of opportunity.

QUESTION:

Is it LCA's view that the window of opportunity may not be real if changes in planning criterion identified were made.

RESPONSE:

This response assumes the question refers to the 2nd paragraph on page 1-58.

MH's resource planning criterion or their assessment of need for energy and capacity for domestic supply do not have any bearing on whether the window of opportunity is real. The observation offered by LCA in that passage is that, in LCA's view, the needs for supply to meet domestic loads is not the reason to pursue the Keeyask GS and the 750 MW transmission line in 2019. Rather, that timing is primarily based on MH's assertions that there is a limited window of opportunity for this option.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Page I-49 Table 1-25

PREAMBLE: MH is defined hydraulic generation that would be achieved with the post Limestone Hydro system under the 100-/+ annual historical water flow.

QUESTION:

Confirm that the hydraulic generation plot represents the post 1992 hydro system outputs for historical flows, but it's not been adjusted to reflect Wuskwatim generation.

RESPONSE:

The hydro generation in Figure 1-25 does not represent historical generation. It reflects hydro generation predicted by SPLASH from the All Gas Plan. Each point on the blue curve represents the average hydro generation from all 35 years in the SPLASH analysis period for each of the 99 historical flow years. This includes generation from Wuskwatim and all other existing MH hydropower facilities.

SUBJECT: Resource Planning

REFERENCE: LCA Report Appendix 1 Pages1-49, 2012 GRA PUB/MH II-87(a)

PREAMBLE: It isn't clear what inflow data from MH was used to plot Figure 1 – 25.

QUESTION:

Please explain with the flow data points represent relative to MH's various water sheds in PUB/MH II-87 (a) (2012 GRA).

RESPONSE:

See workpaper "TA1 – Figures 1-23-1-25 (CONFIDENTIAL)." The "Description" tab provides a breakdown of the different inflows. The flow data shown in the chart represents the sum of all the inflows into the MH system.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2-6

PREAMBLE: LCA states "MH should perform a sensitivity analysis to see if higher or lower O&M costs will change the results of the economic evaluation of development plans".

QUESTION:

Please indicate the likely change in the NPV economic analysis for the all-gas plan if the average of the industry range were utilized in the MH analysis rather than the values used by MH.

RESPONSE:

In order to estimate the impact of reducing the O&M assumed for natural gas generation (SCGT and CCGT) LCA estimated from information contained in the NFAT Filing Appendix 7.2 that the use of industry average O&M numbers would mean a reduction in natural gas generation O&M of $6/kw-year in 2012 dollars. LCA used this estimate for both SCCTs and CCGTs in comparing the All Gas Plan, which includes the most natural gas generation and Plan 14 Preferred Development Plan which would be among the plans with the least natural gas generation. The impact on that comparison is about $80 Million on a 78 year NPV basis under the reference scenario assumptions in favor of the All Gas Plan. The impact is less for shorter time periods. LCA would not view this impact as significantly affecting the economic analyses provided in the NFAT filing by MH or in LCA's Technical Appendices 9A & 9B. Comparisons between other plans would be smaller.

Present Value Impact - Millions	20 Year	35 Year	50 Year	78 Year
Preferred Development Plan Reduced Gas Plant O&M	$ -	$ 3.6	$ 11.2	$ 16.5
All Gas Reduced Gas Plant O&M	$ 16.7	$ 55.8	$ 81.6	$ 99.3
Net change to Plan 14 PDP minus All Gas Comparisons	$ (16.7)	$ (52.2)	$ (70.4)	$ (82.8)

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2-6

PREAMBLE: LCA recommends that MH should perform a sensitivity analysis to see if higher or lower O&M costs will change the results of the economic evaluation of development plans.

QUESTION:

Please indicate whether MH has been requested to undertake the recommended sensitivity analysis.

RESPONSE:

LCA is not aware of MH being asked to perform such analysis.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2-20

PREAMBLE: LCA indicates that changes in technology will reduce the costs of Wind and Solar over time and "that combustion turbines will experience improvements in efficiency. MH has not included any of these technology changes in the LCOE analysis or the economic analysis. Solar PV was screened out of consideration for inclusion in the development plans based on its current high cost despite projections that installed cost will be a quarter of their current value by 2030."

QUESTION:

Please indicate what the implications are to the current economic and financial analysis if the Wind and Solar were evaluated based on future cost and efficiency estimates.

RESPONSE:

Please refer to LCA's analysis of the implications for changes in wind costs in LCA Technical Appendix 3A, pages 3A-27 through 3A-32. LCA has not conducted an analysis of changes in solar PV costs.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2-20

PREAMBLE: LCA indicates that changes in technology will reduce the costs of Wind and Solar over time and "that combustion turbines will experience improvements in efficiency. MH has not included any of these technology changes in the LCOE analysis or the economic analysis. Solar PV was screened out of consideration for inclusion in the development plans based on its current high cost despite projections that installed cost will be a quarter of their current value by 2030."

QUESTION:

Should solar energy be reconsidered as a resource option after 2020 and be subject to comparative analysis with other alternatives? If so what characteristics of a facility should be analyzed?

RESPONSE:

Based on MH's own screening process and its own estimates of potential cost declines in solar PV over time, solar energy options after 2020 would pass the screening criteria for further consideration. See LCA discussion of this in LCA Technical Appendix 2, pages 2-13 to 2-15.

With respect to characteristics, MH considered two forms of solar PV installations. Those would be suitable for the purpose of an analysis of the potential for changes in the economics of the Preferred Development Plan in the event that the projections of cost declines in this technology are realized. Due to the uncertainties in the costs, the cost characteristics should be tested over a range of values.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2-12

PREAMBLE: LCA states with respect to wind development that "MH's projected life assumption is on the low end of the range of typical industry estimates and lower than the terms of their current agreements".

QUESTION:

Please provide the range of projected life assumptions and indicate a time frame that should be used for the economic analysis. If such a time frame were utilized, please indicate the impact on the economic analysis of changed assumptions.

RESPONSE:

Please refer to LCA's response to PUB/LCA-032a.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2-20

PREAMBLE: LCA states that MH's range of cost uncertainty is inconsistent across different technologies.

QUESTION:

What range of uncertainties should be applied to the technologies?

RESPONSE:

Please refer to LCA response to PUB/LCA-034b.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2-20

PREAMBLE: LCA states that MH's range of cost uncertainty is inconsistent across different technologies.

QUESTION:

What are the implications to the NPV economic analysis of applying inconsistent probabilities?

RESPONSE:

La Capra Associates performed two uncertainty analyses where the uncertainty surrounding the capital costs for thermal and wind projects were evaluated. These are shown in Technical Appendix 9A Section IV-E (page 9A-122).

In the first sensitivity, the uncertainty for these projects was reduced to +/-20% in the high and low scenarios respectively. In the second sensitivity the assumption was made that there was no uncertainty in capital costs for the thermal and wind projects, using reference capital costs for the high and low scenarios. The results are shown in Figures 9-71 through 9-74 demonstrating that there is little impact when these assumptions are used as replacements for the MH assumptions.

In Section IV-C (page 9A-95), the probability of higher capital costs scenarios were increased by 10% and the probability of lower capital cost scenarios were decreased by 10%. The results showed a decrease in expected value benefits to the plans with Keeyask and/or Conawapa as compared to the All Gas Plan (Figure 9-48). However, this decrease was not significant.

In Section IV-D (page 9A-108), two sensitivities are shown where La Capra Associates varied the capital costs of the Keeyask and Conawapa projects. In the first the capital cost of these projects were increased by 10% over the MH assumed values in the High Capital Cost Scenarios.

In the second sensitivity the MH reference capital costs for Keeyask and Conawapa were applied to the Low Capital Costs Scenarios, the Reference Scenario Capital Cost for Keeyask and Conawapa were increased by 20% and the High Scenario Capital Cost for Keeyask and Conawapa were increased by 20%. The results of these sensitivities are shown in Figure 9-60. In that table we see that increasing the high capital cost scenarios by 10% produced a measurable but small effect on Expected Value benefits of plans with Keeyask and/or Conawapa as compared to the All Gas Plan. However the second sensitivity shows a large reduction in the 78 year NPV of the plans with Keeyask and/or Conawapa in the Reference Scenario, including reducing Plan 14 the Preferred Development Plan benefits from $1.696 Billion to $330 Million. The expected value of the Preferred Development Plan becomes ($102) Million, meaning its costs are on an expected value basis are higher than the All Gas Plan. The probability analysis in the form of S-Curves are shown for these sensitivities in Figures 9-61 through 9-70.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2-20

PREAMBLE: LCA states that MH's range of cost uncertainty is inconsistent across different technologies.

QUESTION:

How would the analysis change if the probabilities were changed as recommended by LCA?

RESPONSE:

Please see response to PUB/LCA-034b.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Pages 2-4

PREAMBLE: KP anticipates reviewing MH's Civil Contract Bids

QUESTION:

Will LCA be looking to adjusting its project costs if warranted relative to KP's review?

RESPONSE:

LCA has prepared sensitivity analysis on the cost of Keeyask and included that in LCA Technical Appendix 9A, Section IV.D. beginning at page 9A-108. Upon completion of KP's review, we expect that sensitivity analysis to provide a basis to determine the implications of any change to Keeyask cost estimates on the economics of each of the alternative development plans including Keeyask.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Pages 2-5

PREAMBLE: Power Engineering stated Conawapa's transmission project estimate as too low.

QUESTION:

Will LCA be adjusting the project capital cost in its analysis based on Power's report?

RESPONSE:

LCA understands this question to pertain to the CTP only, which is $14 M by MH estimation and somewhat higher by Power Engineers estimate (PE report at page 5).

The project capital cost estimates concern identified within Power Engineering's report are within the range of capital cost sensitivities conducted by LCA within Technical Appendix 9A Section III. However, as discussed within LCA Technical Appendix 8 Section V-D discusses some identified exposure to the requirement for an additional transmission upgrades to be required when the Conawapa project is developed. Figure 8-30 on page 8-61 of Technical Appendix 8 shows that the exposure to the additional project would add $100-600 Million to the cost of the Conawapa cases, significantly reducing any 78 year NPV benefits for the Preferred Development Plan as compared to the All Gas Plan.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Pages 2-6

PREAMBLE: MH's range of uncertainty on natural gas generation of -30% to +50% was questioned by KP who suggested a -15% to +20% uncertainty range. Manitoba Hydro noted that the cost of combustion turbines may be expected to decrease and efficiencies may increase but did not adjust for these factors in their analysis.

QUESTION:

Did LCA adjust the combustion turbine cost and efficiency in its analysis to take into account the reduced costs and higher anticipated efficiency, or did it rely on initial Manitoba Hydro numbers?

RESPONSE:

La Capra Associates did not perform any sensitivity to test the effect of improvements in combustion turbine efficiency over time and relied upon MH estimates. The analysis of changes in efficiency would require additional SPLASH runs.

LCA performed sensitivities to thermal unit capital costs uncertainty which does include combustion turbines. Please refer to PUB/LCA-34b.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Pages 2-7, 2-12

PREAMBLE: MH's cost for wind turbines was $2,400/KW [2012] which appears to be well above the US Department of Energy's $1750/KW for US interior wind.

MH also assumes a 20 year life for Wind projects while it has contracts for St. Leon (25 years) and St. Joseph (27 years).

QUESTION:

What is LCA's position on the capital cost and estimated life of a wind farm and how would such a view impact the economic and financial analysis in the NFAT?

RESPONSE:

LCA's estimate of the capital cost of a wind farm is $1750 and its estimate of project life is 25 years, as shown in Figure 3-3 in LCA Technical Appendix 3A (page 3A-28). LCA has estimated the impact of these assumptions on economic analysis in the NFAT in LCA Technical Appendix 3A, pages 3A-27 to 3A-32.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Pages 2-19 Summary and Conclusion

PREAMBLE: LCA's summary and conclusions note that MH's wind assumptions overstate costs in today's market, while downward projections in the cost of solar power are not recognized.

QUESTION:

In LCA's view, is this sufficient to make wind or solar power price-competitive?

RESPONSE:

Please refer to LCA's response to PUB/LCA-032a.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2 - 21

PREAMBLE: LCA seems to be critical of MH's cost assumptions and Levelized Cost of Energy (LCOE) analysis.

QUESTION:

Please provide a color coded matrix of MH's alternative resource analysis indicating which items LCA does not agree with.

RESPONSE:

A summary of MH's resource assumptions for technologies screened in can be found in Table 7.6 on page 39 of Chapter 7 of the NFAT Submission. LCA takes issue with the following assumptions regarding resource technologies that were screened in:

Technology	MH Assumption	Issue/Recommendation	Page Ref.
Hydro	P50 value from contingency curve	KP recommends P80 or P90 for large projects	2-3
Natural Gas	Capital cost range of -30% to +50%	KP recommends -15% to +20% given advanced state of technology	2-5 to 2-6
Natural Gas	Constant combustion turbine efficiency	Efficiencies likely to improve over time	2-6
Wind	$2,300/kW Capital Cost	Assumed Cost is higher than costs of recent projects	2-7 to 2-10
Wind	Constant capital cost	Costs are likely to decline	2-10 to 2-11
Wind	20-year lifetime	Lower end of range of typical estimates; current wind PPA terms are 25-27 years	2-12

A summary of LCA's view of MH's resource screening can be found in PUB/LCA-048.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2 - 21

PREAMBLE: LCA seems to be critical of MH's cost assumptions and Levelized Cost of Energy (LCOE) analysis.

QUESTION:

Explain what alternative process would perform better than LCOE.

RESPONSE:

LCOE can be an effective screening metric, provided it is used to compare similar resources. The observation offered on Page 2-21 was simply a caveat indicating that LCOE for a peaking resource would not be comparable to a base load resource for screening purposes.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2 - 21

PREAMBLE: LCA seems to be critical of MH's cost assumptions and Levelized Cost of Energy (LCOE) analysis.

QUESTION:

Would revenue requirement from rates be a better process than LCOE? Why/why not?

RESPONSE:

While there may be circumstances where more detailed analysis may be necessary, LCOE can be used for screening purposes when comparing resources that offer similar characteristics (e.g., choosing among base load supply options). See LCA's response to PUB/LCA-044b.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2 - 21

PREAMBLE: LCA seems to be critical of MH's cost assumptions and Levelized Cost of Energy (LCOE) analysis.

QUESTION:

Would internal rate of return be a better process than LCOE? Why/why not?

RESPONSE:

Internal rate of return analysis requires analysis of costs and benefits, a more detailed analysis. LCOE is used to as a cost comparison of alternative options. The simpler method is generally more appropriate for screening purposes, subject to the limitations of the method as noted in LCA's response to PUB/LCA-044b.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2 -17

PREAMBLE: MH deemed geothermal power suitable for further exploration of that quality of the resource in Manitoba. There is no mention of the electricity usage reduction potential of facilities designed for 50% to 70% of peak heating low / with corresponding overnight costs.

QUESTION:

Please elaborate on MH's evaluation process/ studies that support this conclusion.

RESPONSE:

The Preamble includes “suitable” instead of “unsuitable” as written on Page 2-17.

The geothermal resource referenced on page 2-17 is MH’s assessment of geothermal power generation supply option. We understand the question to be seeking information on geothermal heat pump applications, which MH includes as a demand side resource (See MH’s NFAT Submission Appendix 4.3, Demand Side Management Potential study. MH did not include DSM assumptions in the alternative development plans included in the NFAT Submission.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2 -17

PREAMBLE: MH deemed geothermal power suitable for further exploration du that quality of the resource in Manitoba. The is no mention of the electricity usage reduction potential of facilities designed for 50% to 70% of peak heating low / with corresponding overnight costs.

QUESTION:

Did LCA carry out an independent analysis of the costs?

RESPONSE:

No. Please refer to LCA's response to PUB/LCA-045a.

SUBJECT: Generation Alternatives

REFERENCE: LCA Report Appendix 2 Page 2 -17

PREAMBLE: MH deemed geothermal power suitable for further exploration du that quality of the resource in Manitoba. The is no mention of the electricity usage reduction potential of facilities designed for 50% to 70% of peak heating low / with corresponding overnight costs.

QUESTION:

Would LCA consider geothermal a DSM candidate because of its potential for energy reduction?

RESPONSE:

Assuming the question is referring to geothermal heat pumps, yes. Please see LCA's response to PUB/LCA-045a.

SUBJECT: Generation Alternatives

REFERENCE: LA Report Appendix 2 Page 2 -12

PREAMBLE: It appears that MH, aside from wind energy purchase contracts, does not favour private sector energy supply ventures that reduce MH's energy demand or would contribute energy into MH's system:

Biomass

Solar Photo Voltaic

Geothermal

QUESTION:

Please comment on the potential for private energy projects that would reduce demand and/or provide feed-in power.

RESPONSE:

Biomass, solar PV and geothermal heat pump applications are resources with potential in Manitoba and resources that have been developed by private energy interests in other jurisdictions. LCA has not examined issues pertaining to private development of energy resources as a resource procurement option for MH. The potential for private development of these resources is dependent on MH's policies toward resource procurement, pricing, and DSM program design.

Please refer to LCA's response to PUB/LCA-048 for a summary of our assessment of solar and biomass and LCA's response to PUB/LCA-045a regarding geothermal.

SUBJECT: Resource Plans

REFERENCE: La Capra - App 3A - Alt Plans, page 3A-1, Inappropriate unit metrics

PREAMBLE: La Capra says "MH utilized the US Energy Information Administration estimates of levelized cost, rather than the Manitoba-specific levelized costs it calculated"

QUESTION:

Please provide an example of where a difference between US EIA costs and Manitoba-specific costs might have had a significant impact on screening results - ie something screened in that would have been screen out or vice versa

RESPONSE:

La Capra Associates assumes this question meant to refer to page 3A-15. LCA cannot say with certainty whether MH would have changed its resource screening if it had used Manitoba-specific costs instead of US EIA costs.

The most notable example of this issue is MH's use of EIA information for wind technology costs (See LCA Technical Appendix 2, page 2-8). However, this does not change the screening result for on-shore wind, though it could affect in-lake wind.

SUBJECT: Resource Plans

REFERENCE: LCA 3A-6

PREAMBLE: In Figure 3.1 LCA summarizes MH's resource technology screening, indicating which technologies were not carried forward.

QUESTION:

Please provide a matrix indicating LCA's short-term and long-term view on the potential for each technology, and indicate whether LCA agreed or disagreed with MH's grading.

RESPONSE:

See the matrix below.

Technology	MH Result	LCA Short-term View of Potential	LCA Long-term View of Potential	Reason for Disagreement	Page Ref.
Additional DSM	Passed	High	High		
Hydro with storage	Passed	High	High		
Run of River Hydro	Passed	High	High		
On-Shore wind	Passed	High	High		
In-Lake Wind	Failed	Low	Medium	Better performance and lower development obstacles in certain circumstances	3A-16
Solar PV	Failed	Low	High	Costs likely to decline	3A-16
Solar Thermal	Failed	Low	Low		
Enhanced Geothermal	Failed	Low	Low		
Simple Cycle GT	Passed	High	High		
Combined Cycle GT	Passed	High	High		
Conventional Coal	Failed	Low	Low		
IGCC	Failed	Low	Low		
Nuclear	Failed	Low	Low		
Biomass: Crop Residue and Wood Fuel	Failed	Medium	Medium	630 MW of potential; no analysis of fuel cost provided	3A-18-3A-19
Imports	Passed	High	High		

1

SUBJECT: Resource Plans

REFERENCE: LCA 3A-13

PREAMBLE: In Figure 3.2 LCA lists the resource options that MH deemed worthy of further examination.

QUESTION:

Please provide a matrix indicating LCA's view of MH's potential development plans in terms of export revenue assumptions and capital cost assumptions.

RESPONSE:

Please refer to LCA's Technical Appendix 6: Export Markets. Section IV of that report describes LCA's critique of MH's export market modelling. Please refer to Section II of LCA's Technical Appendix 2: Generation Alternatives for LCA's discussion of capital cost issues. Please refer to LCA's Technical Appendix 9 for our sensitivity analysis.

The attached table provides a brief summary of the export market assumptions and capital cost assumptions issues that are unique to the particular case. Issues that span all cases are not identified in this table (e.g., SPLASH modelling of export sales). Instances where the cases are designed to test certain assumptions (e.g., assuming an export contract with WPS or a certain transmission option) are not flagged as issues. Most of the issues flagged are capital cost assumptions.

Plan Number	Development Plan Short Name	Capital Cost LCA's view on Assumptions
1	All Gas	Capital cost uncertainty range too broad No transmission option tested.
2	K22/Gas	K capital cost level and uncertainty.
3	Wind/Gas	Wind capital costs overstated (see PUB/LCA-041) No transmission option tested.
4	K19/Gas24/250MW	K capital cost level and uncertainty.
5	K19/Gas25/750MW (WPS Sale & Inv)	K capital cost level and uncertainty. Gas Capital cost uncertainty range too broad
6	K19/Gas31/750MW	K capital cost level and uncertainty.
7	SCGT/C26	SCGT Capital cost uncertainty range too broad C capital cost level and uncertainty.
8	CCGT/C26	CCGT Capital cost uncertainty range too broad C capital cost level and uncertainty.
9	Wind/C26	Wind capital costs overstated (see PUB/LCA-041) C capital cost level and uncertainty
10	K22/C29	K & C capital cost level and uncertainty.
11	K19/C31/250MW	K & C capital cost level and uncertainty
12	K19/C31/750MW	K & C capital cost level and uncertainty
13	K19/C25/250MW	K & C capital cost level and uncertainty
14 Preferred Plan	K19/C25/750MW (WPS Sale & Inv)	K & C capital cost level and uncertainty
15	K19/C25/750MW	K & C capital cost level and uncertainty

1

SUBJECT: Resource Plans

REFERENCE: LCA 3A-14

PREAMBLE: LCA concludes that MH's resource needs are overly conservative and that MH's timing of energy and capacity needs are likely earlier than the actual need would suggest.

QUESTION:

Please elaborate on LCA's view of actual need going forward.

RESPONSE:

This response assumes the reference was intended to be to LCA 3A-13.

See Technical Appendix 1: Resource Planning, pages 1-18 to 1-45, where LCA's evaluation of the actual need going forward is presented. LCA's conclusions are summarized on page 1-45.

SUBJECT: Resource Plans

REFERENCE: LCA 3A-17 to LCA 3A-20

PREAMBLE: LCA's critique of MH's resource screening appears to take issue with MH's process and technology-specific screening.

QUESTION:

Please provide a matrix of LCA's view of MH's process limitations indicating whether each limitation is low or high impact.

RESPONSE:

The technology screening process critiques are described on pages 3A-14 and 3A-15. See summary below.

Critique	Description	Impact
"High-level Screening"	Assessment is subjective; lacks specific thresholds to define what warrants screening in or out	Medium – some technologies may have been selected had more rigorous standards been applied
Manual Screening vs. Optimization Process	Technologies screened manually based on scorecard; no formal optimization process to select resources	Medium – some technologies may have been selected in formal optimization process that were otherwise screened out
Inappropriate unit cost metrics	MH used US EIA data and not MH-specific costs	Low – likely not to change screening outcome
Screening ignores future technology trends	MH screens technologies based on current performance characteristics without adequate consideration of future performance potential	High – solar and in-lake wind would likely have been screened in

SUBJECT: Resource Plans

REFERENCE: LCA 3A-17 to LCA 3A-20

PREAMBLE: LCA's critique of MH's resource screening appears to take issue with MH's process and technology-specific screening.

QUESTION:

Please provide a matrix of MH's technology-specific screening, indicating LCA's view of these technologies in terms of short-term and long-term prospects being favourable or unfavourable.

RESPONSE:

Please see PUB/LCA-048.

SUBJECT: Resource Plans

REFERENCE: La Capra - App 3A - Alt Plans, page 3A-16, para 2

PREAMBLE: In respect of in-lake wind, La Capra says "the technology is promising due to higher performance characteristics and lower development obstacles in certain circumstance"

QUESTION:

Please indicate what circumstances lead to higher performance for in-lake wind.

RESPONSE:

In-lake wind has a higher expected capacity factor under average flow conditions compared to on-shore wind.[1] The actual difference in capacity factor between any in-lake wind and on-shore windfarm would depend on the specific wind conditions of the site and the wind turbine technology.

[1] See NFAT Submission, Appendix 7.2, pp. 332 and 340.

SUBJECT: Resource Plans

REFERENCE: La Capra - App 3A - Alt Plans, page 3A-17, 2nd last para

PREAMBLE: With respect to coal (conventional and integrated gasification combined cycle i.e. a clean coal technology) La Capra says "Based on the regulatory restrictions in place"

QUESTION:

Is La Capra familiar with the provisions of the "Climate Change and Emissions Reductions Act" (Manitoba) and "Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations" (Canada)?

RESPONSE:

Yes.

SUBJECT: Resource Plans

REFERENCE: La Capra - App 3A - Alt Plans, page 3A-18, para 3

PREAMBLE: With respect to nuclear, La Capra says "it was reasonable for MH to eliminate nuclear as a potential resource option due to high cost uncertainty, high regulatory risk, and environmental concerns"

QUESTION:

Please indicate how La Capra's dismissal of nuclear differs materially from MH's in being qualitative and without supporting analysis.

RESPONSE:

La Capra Associates did find that MH provided information on nuclear power in Appendix 7.2, including a LCOE analysis and documentation of reference materials reviewed and considered by MH. MH relies on a recent U.S. Energy Information Administration report on nuclear power for its cost analysis.

LCA's conclusion that MH's decision to screen out nuclear power was reasonable was based on our findings that the materials that MH relied upon included information that is consistent with our own understanding of the state of knowledge regarding the future for nuclear power. La Capra Associates did not conduct any specific analysis of the nuclear power option beyond the review of MH's materials.

SUBJECT: Resource Plans

REFERENCE: La Capra - App 3A - Alt Plans, page 3A-20, Plan Optimization, para 3

PREAMBLE: In pointing out that MH has not included an optimization process in its planning La Capra appears to be assuming that the purpose of the plan being developed is to meet incrementally growing needs in Manitoba whereas MH indicates that the timing of the investment is to catch a window of opportunity with respect to the US market (ref NFAT application Chapter 6)

QUESTION:

Is it possible or necessary to formally optimize a supply development plan when the schedule is conditioned on catching a "window of opportunity" that may be closing rather than opening?

RESPONSE:

MH's economic and financial analyses presented in its NFAT Submission are all premised on net benefit to MH and its domestic ratepayers. MH's clear express purpose is to meet the needs in Manitoba at the lowest overall cost, and MH argues that taking advantage of the current opportunity to export power to Minnesota is the best way to accomplish that purpose. La Capra Associates has not assumed a construct any different than MH has proposed.

The comparative analysis of the 15 alternative development plans was constructed to demonstrate that the Preferred Development Plan offers economic benefits to domestic ratepayers (e.g., see NFAT Executive Summary at page 30). While there may be considerations other than net benefits to ratepayers, La Capra Associates' work specifically examines MH's assertion that the proposed plan will be beneficial to ratepayers. As proposed, the domestic ratepayers will benefit if MH is correct in its assertions on economics and will pay the added costs if MH is not correct.

In effect, the window of opportunity proposition is a representation that the combination of Keeyask, the MP 250 MW Contract, and the 750 MW transmission line is an option that is a "limited time only" option that, if exercised, will be better for ratepayers than if it is not exercised. The comparison offered is to alternative development plans that MH would otherwise consider to serve its domestic customers in the absence of the current opportunity.

Even if MH is correct in its representation of the window of opportunity, the timing of all the other components of MH's long-term plan and the other alternative development plans would still require optimization. MH argues that hydro generation's nature, i.e. being surplus by design, would naturally make it benefit from a larger interconnection.[1] However, MH would still have to show that the benefits provided by the interconnection justifies the cost and that the benefits from the export revenues justify the need to build the hydro units to take advantage of the window of opportunity compared to letting the window close and doing something else later on.

[1] See NFAT Submission, Chapter 6, pp. 24-26.

SUBJECT: Resource Plans

REFERENCE: La Capra - App 3A - Alt Plans, page 3A-23, last para

PREAMBLE: In discussing the fact that MH has not included any consideration of relative risk between alternative plans, an example is given of how smaller modular generating resources reduce risk.

QUESTION:

By not incorporating a quantitative analysis of risk is it possible that MH has understated the value of locking in benefits that might accrue from building large long-life projects with known costs?

RESPONSE:

Yes, it is possible. An example of that would be the natural gas price risk mentioned in the third bullet on Page 3A-23.

SUBJECT: Resource Plans

REFERENCE: La Capra Report, 3A-21 to 3A-26

PREAMBLE: LCA's critique of MH's alternative developmnet plans covers an array of subjects, namely:

- Omission of DSM/Lack of Imports
- No evidence of plan optimization
- Single pass analysis / no revisits
- SCGT/CCGT optimization / weighting
- Lack of risk analysis
- Focus on portfolio analysis instead of resource option evaluation

QUESTION:

Is LCA's view that MH's alternative development plans lack credibility in the comparison of alternatives? If so, please elaborate on which alternatives, if any, may be skewed.

RESPONSE:

LCA is reviewing MH's detailed model output data provided for our supplemental report. Please refer to LCA supplemental report 3B for our further analysis on this question.

SUBJECT: Resource Plans

REFERENCE: La Capra report, 3A-27 to 3A-32

PREAMBLE: LCA has indicated that supplemental resource plans using CCGT or No-Build + Imports reliance will address some shortcomings in MH's development plans, but has taken issue with MH's cost assumptions for wind scenarios, particularly wind/gas or wind/Conawapa, and concludes that wind should form part of a competitive development plan.

QUESTION:

What level of wind generation did LCA's analysis assume for NPV gains of $1.23B in wind/gas or for NPV gains of $0.43B in wind/Conawapa 2026?

RESPONSE:

The total amount of additional wind capacity is the same as MH assumed for its wind/gas and wind/Conawapa cases. See NFAT Submission, Chapter 8, pp. 20-21 for the assumed additions.

SUBJECT: Resource Plans

REFERENCE: La Capra report, 3A-27 to 3A-32

PREAMBLE: LCA has indicated that supplemental resource plans using CCGT or No-Build + Imports reliance will address some shortcomings in MH's development plans, but has taken issue with MH's cost assumptions for wind scenarios, particularly wind/gas or wind/Conawapa, and concludes that wind should form part of a competitive development plan.

QUESTION:

How would MH's MP wind energy exchange at a 250 MW or 383 MW level impact LCA's analysis?

RESPONSE:

LCA will be addressing supplemental resource plans in Technical Appendix 3B. LCA has taken issue with MH's wind cost assumptions and has provided an analysis of the sensitivity to the MH results to those costs in the cited pages of Technical Appendix 3A. LCA did not offer any conclusion that wind should form a part of a competitive development plan.

LCA has not conducted a sensitivity analysis on the size of a wind energy exchange option, as that would require a SPLASH analysis by MH.

SUBJECT: Resource Plans

REFERENCE: La Capra report, 3A-27 to 3A-32

PREAMBLE: LCA has indicated that supplemental resource plans using CCGT or No-Build + Imports reliance will address some shortcomings in MH's development plans, but has taken issue with MH's cost assumptions for wind scenarios, particularly wind/gas or wind/Conawapa, and concludes that wind should form part of a competitive development plan.

QUESTION:

Did LCA consider a wind/Keeyask 2026 as an alternative to Wind/Conawapa 2026? Why/why not?

RESPONSE:

LCA did not do any analysis on a wind/Keeyask 2026 case due to the fact that MH did not provide that as one of its alternative development plans. Evaluation of that option would require additional SPLASH and economic model runs by MH. A 2026 Keeyask case would need to consider the cost implications for a delay in the construction plan and the implications for the MP 250 contract and the U.S. transmission line project.

SUBJECT: Resource Plans

REFERENCE: LCA 3A-33 to 3A-34

PREAMBLE: LCA's critiqued the following:

- "Needs" were too conservative
- No DSM resource plan
- No optimization of plan
- Wind costs skewed

QUESTION:

Does LCA see any other options that MH could have included in the evaluations?

RESPONSE:

Yes. Please refer to LCA response to PUB/LCA-012b and LCA Supplemental Report Technical Appendix 3B.

SUBJECT: Environment

REFERENCE: La Capra Report, App 4, page 4-4 last para (to top of page 4-5)

PREAMBLE: La Capra states that "The maximum generation at Kettle requires the level of Stephens Lake be at a level that would raise the tailrace level at Keeyask and would reduce the generating capacity of Keeyask. For this reason, Keeyask has asked that Kettle reduce its capacity."

QUESTION:

Does the capacity reduction at Kettle result in a reduction in value of the Kettle generating station and if so by how much?

RESPONSE:

LCA has not performed a valuation analysis of Kettle generating station. According to MH the effect of the Keeyask G.S. rating on the Kettle G.S. is factored into the SPLASH runs and economic analysis in the NFAT Submission. See LCA/MH II-496 Revised.

SUBJECT: Environment

REFERENCE: LaCapra Report, App 4 , page 4-12, 1st para

PREAMBLE: LaCapra says "The GCM results relied upon in MR's analysis reflect only changes to long-term averages rather than specific annual flows, so the streamflows during the more severe droughts in the LTFD are "hard-wired" into this analysis without change.[17] The impact of climate change on drought risk is essentially assumed away in the MH analysis framework."

QUESTION:

Please provide an example of using long term Global Climate Model (GCM) to forecast the extent and frequency of short term extremes (i.e. floods and droughts) with granularity, accuracy and confidence levels consistent with the NFAT planning process.

RESPONSE:

Manitoba Hydro's work on more detailed modelling is ongoing (See NFAT Chapter 10, page 43, footnote 3). LCA described this analysis in Technical Appendix 4, on page 4-12. Examples of these methods are discussed in MH's Attachment K at page 10, pages 13-14, and 14-15.

SUBJECT: Environmental

REFERENCE: LCA Report Appendix 4 Page 4-12

PREAMBLE: LCA indicated that MH's modelling of climate change focuses only on long term average flows and ignores climate change potential impact on drought risk.

QUESTION:

Please describe how MH should incorporate the potential impact of changes in drought risks.

RESPONSE:

Manitoba Hydro's work on more detailed modelling is ongoing. See also PUB/LCA-061. To date, MH's analysis does indicate the potential for more adverse drought conditions, as noted on Page 4-11 and in MNP's Independent Expert Report at page 9.

Absent the results of the more detailed modelling work that MH intends to do in the future, La Capra Associates concurs with MNP's recommendation (MNP Report, page 9) that sensitivity analysis associated to test the impact of more adverse drought conditions would be warranted for analysis in this proceeding.

SUBJECT: Environmental

REFERENCE: LCA Report Appendix 4 Page 4-12

PREAMBLE: LCA indicated that MH's modelling of climate change focuses only on long term average flows and ignores climate change potential impact on drought risk.

QUESTION:

Please discuss the implications on the analysis if the drought risk was analyzed.

RESPONSE:

The economic analysis could be affected by the potential for drought events worse than those in the historical record by:

- cost exposure for replacement energy during such events relative to the drought conditions tested by MH; and
- changes in the water conditions used to define dependable energy levels available from the MH hydro system.

MH has not provided sensitivity analysis of these factors in its analysis.

SUBJECT: Environmental

REFERENCE: LCA Report Appendix 4 Page 4-12

PREAMBLE: LCA indicated that MH's modelling of climate change focuses only on long term average flows and ignores climate change potential impact on drought risk.

QUESTION:

Please comment on whether the current modelling is sufficient given the deficiencies noted.

RESPONSE:

The current modelling is not sufficient to be used as evidence that potential impacts of climate change favor MH's Preferred Development Plan. LCA concluded in Technical Appendix 4 on page 4-27 that "the total impact of the increase [in runoff] is not expected to create a meaningful benefit to the overall economics of the Preferred Development Plan." The exposure to increased drought risk has not been evaluated. MH has indicated that further work to evaluate the impact of climate change is needed, and has described that work in Appendix K of the NFAT Submission. The modelling to date is preliminary in nature.

See also PUB/LCA-061, PUB/LCA-063a, and PUB/LCA-063b.

SUBJECT: Environmental

REFERENCE: LCA Report Appendix 4 Pages 4-4 & 4-5, 2012 GRA PUB/MH II-87 (c)

PREAMBLE: LCA concludes that water regime impacts from Keeyask and Conawapa will be minimal, with no significant changes in reservoir operations anticipated. This may well be correct for Keeyask. However MH's PDP K19/C25/ WPS Sale/750MW looks to increase total hydraulic generation after Conawapa is in-service by 600 GWh relative to K19/C25/250 MW. The K19/ C25/250 MW scenario adds 6,000 GWH to average hydraulic generation output. The addition of K19/C25 WPS Sale/750MW adds 6,600 to the average hydraulic output.

QUESTION:

Please provide a tabulation of the number of months of each year since 1976 that Lake Winnipeg levels exceeded the upper license limit of 715 feet.

RESPONSE:

See http://www.hydro.mb.ca/corporate/water_regimes/lake_winnipeg_means.pdf.

SUBJECT: Environmental

REFERENCE: LCA Report Appendix 4 Pages 4-4 & 4-5, 2012 GRA PUB/MH II-87(a)

PREAMBLE: LCA concludes water regime impacts from Keeyask and Conawapa will be minimal, with no significant changes in reservoir operations anticipated. This may well be correct for Keeyask however MH's PDP K19/C25/ WPS Sale/750MW looks to increase total hydraulic generation after Conawapa is in-service by 600 GWh relative to K19/C25/250 MW. The K19/ C25/250 MW scenario adds 6,000 GWH to average hydraulic generation output. The addition of K19/C25 WPS Sale/750MW adds 6,600 to the average hydraulic output.

QUESTION:

Please provide a parallel tabulation of the months when lower Nelson flows were in excess of the maximum Kettle power house full capacity of 160,000 CFS [4,400 m3/s].

RESPONSE:

LCA does not have the requested information.

SUBJECT: Environmental

REFERENCE: LCA Report Appendix 4 Pages 4-4 & 4-5,

PREAMBLE: LCA concludes water regime impacts from Keeyask and Conawapa will be minimal, with no significant changes in reservoir operations anticipated. This may well be correct for Keeyask however MH's PDP K19/C25/ WPS Sale/750MW looks to increase total hydraulic generation after Conawapa is in-service by 600 GWh relative to K19/C25/250 MW. The K19/ C25/250 MW scenario adds 6,000 GWH to average hydraulic generation output. The addition of K19/C25 WPS Sale/750MW adds 6,600 to the average hydraulic output.

QUESTION:

Please confirm that the increased generation can only be achieved by reducing spillage via increased Lake Winnipeg Storage. If not, please explain.

RESPONSE:

LCA cannot confirm the amounts of increase in generation cited in the preamble. However, LCA does confirm that there is a production difference between these cases. The increased production is discussed in LCA's response to PUB/LCA-065d.

SUBJECT: Environmental

REFERENCE: LCA Report Appendix 4 Page 4-6

PREAMBLE: Net evaporation losses on Lake Winnipeg have the potential for remove several feet of water from storage. Cedar Lake reservoir might be similarly affected.

Net evaporation losses are at their highest in drought years.

QUESTION:

Please explain MH's modelling of PIAO (Partial Inflow Available for Outflow) and, in particular, how it handles the net evaporation issue in drought years.

RESPONSE:

Please see PUB/LCA-064.

SUBJECT: Environmental

REFERENCE: LCA Report Appendix 4 Pages 4-7

PREAMBLE: MH has about 100 years of inflow records but the Global Climate Models focuses on two 29 year periods, namely 1971- 2000 and 1940 – 1969.

QUESTION:

Please explain LCA's understanding of why MH elected the 1971-2000 and 1940-2069 periods for the Global Climate Model (GCM) scenarios.

RESPONSE:

The periods examined from the GCM models were 1971-2000 and 2040-2069, not 1940-1969. Also, the periods are 30 years. Our understanding, based on our reading of the NFAT Submission, Chapter 10.2.2 and a November 1, 2013 presentation by MH, was that the two periods were chosen to represent a "baseline" point and a mid-21st century "future" point to capture long-term impacts of climate change. Our understanding is that a 30-year average was taken to avoid skewing long-term trends with annual variability. See NFAT Confidential – Runoff Methodology Presentation for LCA (SP-079), November 1, 2013, p. 6.

SUBJECT: Environmental

REFERENCE: LCA Report Appendix 4 Pages 4-7

PREAMBLE: MH has about 100 years of inflow records but the Global Climate Models focuses on two 29 year periods, namely 1971- 2000 and 1940 – 1969.

QUESTION:

Please explain why the low-flow periods prior to 1940 and high flow periods post 2000 are excluded from the analysis.

RESPONSE:

The section of the LCA report referenced does not refer to the period 1940-1969, rather 2040-2069. See PUB/LCA-067a. Note that MH's flow records are not (in our understanding) an input to GCMs.

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-26

PREAMBLE: LCA states that the MISO region would benefit from production cost savings from thermal generation not being dispatched, since wind and Hydro have lower variable costs.

QUESTION:

Please confirm that the production cost savings flow only to MISO customers and not to MH customers.

RESPONSE:

LCA cannot confirm this statement.

The statement "*MISO region would benefit from production cost savings from thermal generation not being dispatched, since wind and Hydro have lower variable costs*" included in LCA's report is one of the conclusion of the Wind Synergy Study. While the primary focus of the study was to assess benefits to the MISO region, the report also mentions benefits to MH. For example, see pages 17 and 23 of the Manitoba Hydro Wind Synergy Study Final Report.

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-26

PREAMBLE: LCA states that the MISO region would benefit from production cost savings from thermal generation not being dispatched, since wind and Hydro have lower variable costs.

QUESTION:

Please confirm that this situation may not provide any revenues to Manitoba Hydro in support of fixed costs related to MH's new generation and transmission facilities.

RESPONSE:

LCA cannot confirm. Please see LCA response to PUB/LCA-072a.

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-27,30

PREAMBLE: LCA notes that there is a strong inverse correlation between MH is interchange activity and MISO wind generation.

The Wind Synergy Study found that after Keeyask and Conawapa are operational and new transmission is completed, the interface flow from MH to MISO only increases by 358 MW.

QUESTION:

Is it LCA's view that increasing MISO wind generation displaces MH export sales and lowers the market prices in Peak and Off Peak hours? If not, please explain.

RESPONSE:

Please refer to the Manitoba Hydro Wind Synergy Study page 53, which states "… when the wind picks up and adds downward pressure on prices, Manitoba Hydro reduces its generation. Conversely, when the wind dies down, Manitoba Hydro increases its generation." See also page 34-35 of that report for further illustration of this effect.

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-27,30

PREAMBLE: LCA notes that there is a strong inverse correlation between MH is interchange activity and MISO wind generation.

The Wind Synergy Study found that after Keeyask and Conawapa are operational and new transmission is completed, the interface flow from MH to MISO only increases by 358 MW.

QUESTION:

Provide LCA's view on the net benefits or costs to MH of the wind synergies

RESPONSE:

LCA cannot offer a view on the net benefits or costs to MH of the wind synergies. While the Manitoba Hydro Wind Synergy Study Final Report refers to areas of benefit to MH, it does not present MH system results. Please refer to LCA response to PUB/LCA-072a.

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-27,30

PREAMBLE: LCA notes that there is a strong inverse correlation between MH is interchange activity and MISO wind generation.

The Wind Synergy Study found that after Keeyask and Conawapa are operational and new transmission is completed, the interface flow from MH to MISO only increases by 358 MW.

QUESTION:

Explain the significance of the 358 MW interface flow relative to MH's 250 MW and 750 MW new transmission scenarios.

RESPONSE:

MISO's Manitoba Hydro Wind Synergy study evaluated three transmission routing alternatives, the East option which is similar to the proposed transmission line included in the Preferred Development Plan, a West option that included a 500 kV line from Winnipeg to Fargo/Moorhead area and a 345kV line from Fargo/Moorhead area to Monticello, and a Central option that included a 500 kV line to Grand Rapids MN and 355 kV ties to Fargo ND and Duluth MN.

MISO produced a report and a number of presentations that included the results of the transmission alternatives and their potential benefits to the MISO footprint. A November 5, 2012 presentation included a comparison of the average flow data for both the East and West options during planning year 2027 after Keeyask and Conawapa are in service. The East option increased the MH-US interface flow by 358 MW on average while the West option increased

the MH-US interface flow by 648 MW on average. Therefore, according to this comparison, the West option seems to increase the MH-US flow more than the East option, which is included in the Preferred Development Plan, making it the optimal solution between the two. The importance of this finding relates to the route of the new transmission line and not on whether it will be beneficial to MH and its customers, since both transmission alternatives increase the flow from MH to the US. See Figure 8-14 in LCA Technical Appendix 8 for the companion depiction of the West option.

The Wind Synergy Study did not examine a 230 kV option, thus there is no comparable information on the 250 MW transmission option available from this study.

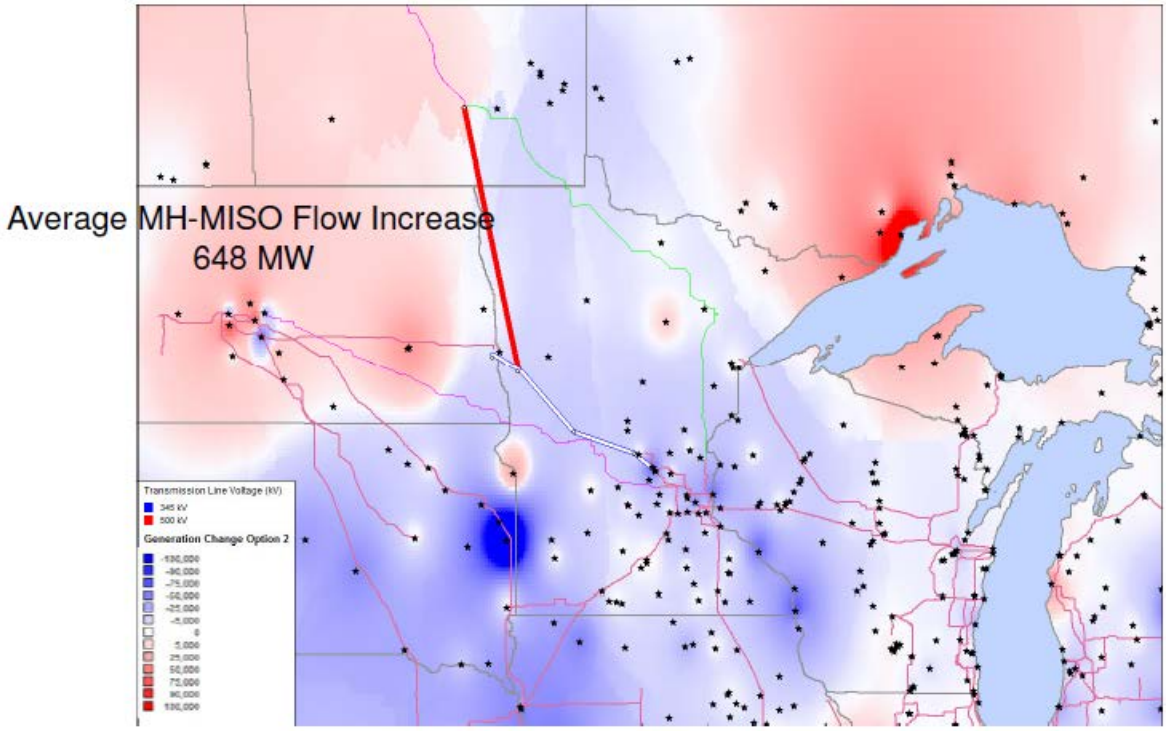


Figure 1 Average flow increase for West Option[1]

[1] Manitoba Hydro Wind Synergy Study 5th TRG 11/05/2012 Updated 11/13/2012, slide 11.

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-68, Figure 8-34

PREAMBLE: Figure 8-34 illustrates the increased revenues achieved from 2014 to 2050 by the PDP compared to the K19/C25/250MW, K22/Gas and All Gas scenarios.

The export sales value appears to differ for each scenario. It also appears that the $m revenues for each scenario are consistent with Appendix 11.3 prices and do not reflect price adjustments from Potomac's work.

QUESTION:

Please confirm that Figure 8-34 employs MH's export prices as shown in Appendix 11.3.

RESPONSE:

Figure 8-34 utilized data provided by MH from SP-131 "NFAT Confidential – Revised Economic cash flows Energy Exports V4 energy and revenue only" available from MH's SharePoint site.

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-68, Figure 8-34

PREAMBLE: Figure 8-34 illustrates the increased revenues achieved from 2014 to 2050 by the PDP compared to the K19/C25/250MW, K22/Gas and All Gas scenarios.

The export sales value appears to differ for each scenario. It also appears that the $m revenues for each scenario are consistent with Appendix 11.3 prices and do not reflect price adjustments from Potomac's work.

QUESTION:

Please provide a chart similar to Figure 8-34 showing the GWh of total exports achieved by the PDP relative to K19/C25/250MW.

RESPONSE:

Figure 1 shows the total export sales (GWH) achieved by the PDP relative to K19/C25/250 MW, which is a summation of the following export products included in the cases:

- Non-Committed Firm Exports – The sales of excess dependable hydro-electric energy assumed to be sold through long-term contracts, but for which no contract or term sheet exists.
- Existing Firm Exports – The sales under existing and planned contractual agreements.
- Term Sheet Firm Exports- The sales resulting from the pending WPS contract.
- On Peak and Off peak Opportunity Sales – The exports that are not long term firm sales of dependable energy.

The data included in this graph were extracted from the SP-131 "NFAT Confidential – Revised Economic Cash Flows Energy Exports V4 energy and revenue only" file.

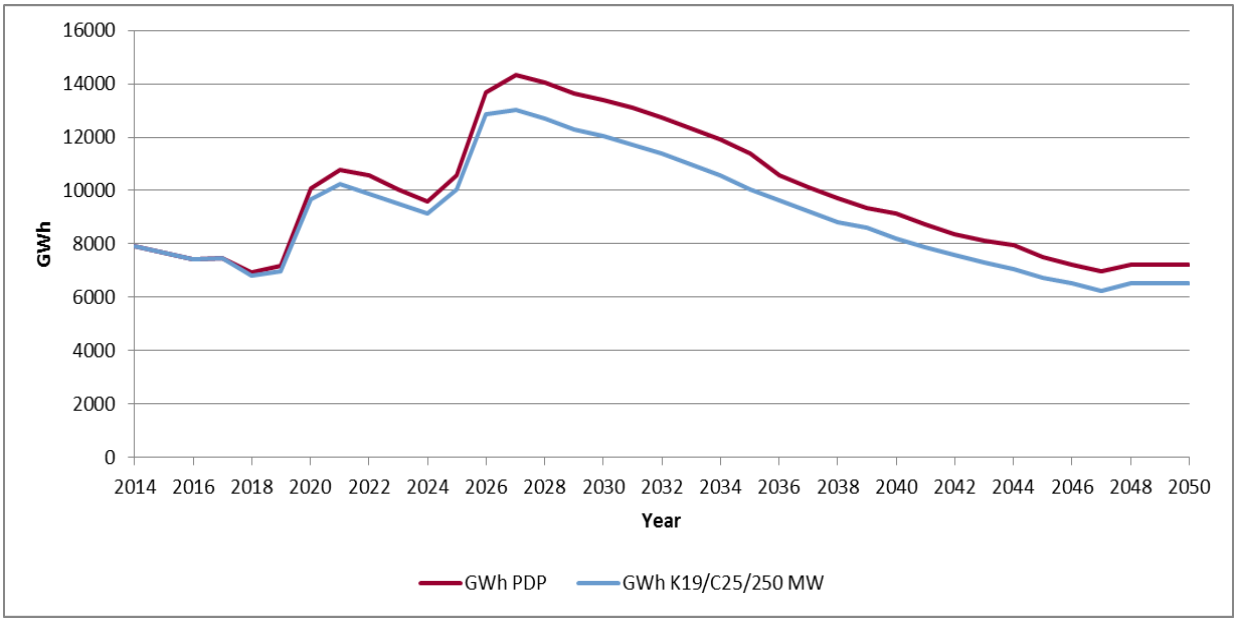


Figure 1 GWh comparison between PDP and K19/C25/250MW

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-68, Figure 8-34

PREAMBLE: Figure 8-34 illustrates the increased revenues achieved from 2014 to 2050 by the PDP compared to the K19/C25/250MW, K22/Gas and All Gas scenarios.

The export sales value appears to differ for each scenario. It also appears that the $m revenues for each scenario are consistent with Appendix 11.3 prices and do not reflect price adjustments from Potomac's work.

QUESTION:

Please provide on the same graph the GWh of Firm exports achieved by the PDP relative to K19/C25/250MW, K22/Gas and All Gas scenarios.

RESPONSE:

Please see the graph below:

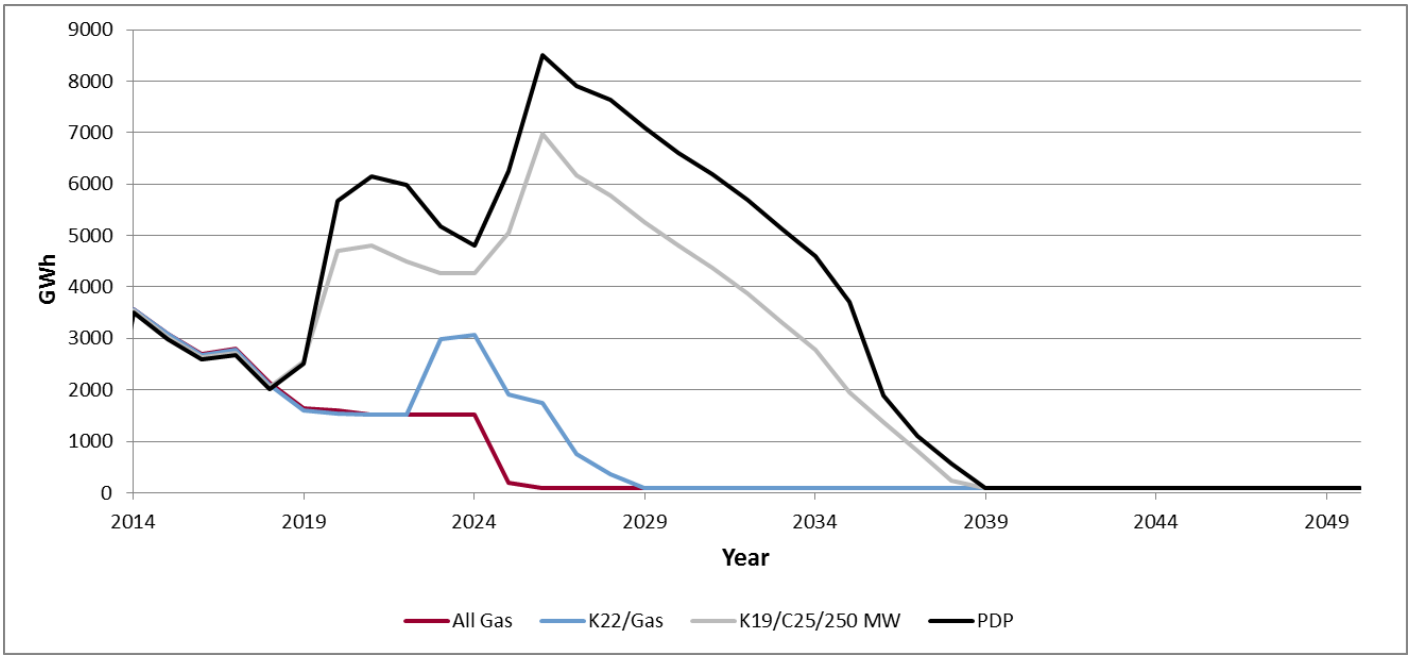


Figure 1 Firm Export comparison between All Gas, K22/Gas, K19/C25/250 MW and PDP

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-83

PREAMBLE: LCA's summary and conclusions flag possible additional transmission costs for the Keeyask interconnnection, the MH U.S. interconnection, and the future Conawapa upgrades that may or may not be included in MH's PDP and alternatives.

The 300 MW pending WPS contract may require network upgrades to achieve Wisconsin market penetration. It is not clear whether these are included in the total costs.

QUESTION:

Please provide a matrix summary of these transmission components and their potential cost implications.

RESPONSE:

Please refer to Figure 8-19 for a matrix of potential upgrades needed in the U.S. for the MH-US line. Please refer to Page 8-19 for a description of the study work needed to identify upgrades associated with the Keeyask Interconnection. No studies have been completed for the Conawapa projects. The transmission components and potential costs have not been identified at this time.

SUBJECT: Transmission

REFERENCE: LCA Appendix 8 Pages 8-83

PREAMBLE: LCA's summary and conclusions flag possible additional transmission costs for the Keeyask interconnnection, the MH U.S. interconnection, and the future Conawapa upgrades that may or may not be included in MH's PDP and alternatives.

The 300 MW pending WPS contract may require network upgrades to achieve Wisconsin market penetration. It is not clear whether these are included in the total costs.

QUESTION:

Please clarify the lost revenues / added transmission risk costs that relate to the WPS contract.

RESPONSE:

Please refer to Figure 8-16 that depicts all the TSRs evaluated in the Preliminary Group Facility Study, including a TSR related to the WPS contract. The results of the study included potential transmission upgrades denoted in Figure 8-19. It is unclear whether these transmission costs were included in the PDP.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report, LCA Appendix 9A -15
NFAT APP. 9.3 Page 56

PREAMBLE: LCA notes that after the initial 35 years, no additional growth in energy or peak loads is estimated; therefore there is no need to add additional resources after 2037. Manitoba Hydro's appendix 9.3 shows that load growth ends in 2047.

QUESTION:

Confirm that the K22/Gas scenario adds thermal generation in 2037, again in 2042 and again in 2046.

RESPONSE:

Page 20 of Chapter 8 of the NFAT Submission shows that the K22/Gas scenario adds SCGT resources in 2029 and 2032 and CCGT resources in 2034, 2038, 2041, and 2045.

LCA Technical Appendix 9A at page 15 reference to 2037 (cited in the preamble to this question) should refer to 2047. The 2037 is a typographic error.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report, LCA Appendix 9A -15
NFAT APP. 9.3 Page 110

PREAMBLE: LCA notes that after the initial 35 years, no additional growth in energy or peak loads is estimated; therefore there is no need to add additional resources after 2037. Manitoba Hydro's appendix 9.3 shows that load growth ends in 2047.

QUESTION:

Confirm that Gas/C26 adds thermal generation in 2042 and in 2046.

RESPONSE:

Page 21 of Chapter 8 of the NFAT Submission shows that the SCGT/C26 scenario adds SCGT resources in 2022, 2038, 2041, 2043, 2045 and that the CCGT/C26 scenario adds SCGT resources in 2039, 2042, 2044, and 2047 and CCGT resources in 2022.

LCA Technical Appendix 9A at page 15 reference to 2037 (cited in the preamble to this question) should refer to 2047. The 2037 is a typographic error.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report, LCA Appendix 9A -15
NFAT APP. 9.3 Pages 218, 272

PREAMBLE: LCA notes that after the initial 35 years, no additional growth in energy or peak loads is estimated; therefore there is no need to add additional resources after 2037. Manitoba Hydro's appendix 9.3 shows that load growth ends in 2047.

QUESTION:

Confirm that K19/C26/250 MW and K19/C26/750 MW also add smaller amounts of thermal generation after 2042.

RESPONSE:

Page 19 of Chapter 8 of the NFAT Submission shows that the K19/C25/250 MW scenario adds SCGT resources in 2040, 2044, and 2046 and that the K19/C25/750 MW scenarios add SCGT resources in 2041, 2044, and 2046.

LCA Technical Appendix 9A at page 15 reference to 2037 (cited in the preamble to this question) should refer to 2047. The 2037 is a typographic error.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report , LCA Appendix 9A -15
Appendix 9.3

PREAMBLE: MH indicated that net production costs and revenues are held constant at the 35 year [2047] value on a real dollar basis.

QUESTION:

Can LCA confirm whether this projection did or did not favor the Preferred Development Plan

RESPONSE:

La Capra Associates cannot confirm as to whether MH's extrapolation methodology used for the years 36 through 78 of the study does or does not favor the Preferred Development Plan.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report , LCA Appendix 9A -15
Appendix 9.3

PREAMBLE: MH indicated that net production costs and revenues are held constant at the 35 year [2047] value on a real dollar basis.

QUESTION:

In LCA's view, would rate impacts have changed?

RESPONSE:

LCA agrees that the rate impact analysis used this assumption. LCA did an alternative rate analysis in Technical Appendix 10a that focuses on 2047 and the prior years. Different assumptions from the constant real dollar basis assumption used by MH will have an effect on the rates calculate in the NFAT review as MH used an even annual increase approach over 50 years, which includes values after 2047 in that calculation (See LCA Technical Appendix 10A at page 10A-15).

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report , LCA Appendix 9A -21-24

PREAMBLE: LCA indicates that MH used simplifying assumptions to capture costs and benefits of each of the alternative development plans over the last 43 years of the 78 year study. LCA has further stated that an analysis based upon forecast of 78 years is even more susceptible to forecast error.

QUESTION:

Given the uncertainty of looking out over a long time frame, is it more appropriate to review the projects over a shorter time frame?

RESPONSE:

Project evaluation should consider the full economic life the investment, often termed life-cycle analysis. In the case of hydropower facilities, which typically have economic lives of more than 50 years, life-cycle analysis does require consideration of costs and benefits over a long time frame. In this NFAT proceeding, the economic life considerations extend even further in time to consider the combined economics of staged investments in two large hydropower projects.

The difficulties in considering the life-cycle economics of the investments proposed in the Preferred Development Plan do derive from the challenges of considering large, near term investments that depend on long-term benefits that are inherently uncertain. Alternatives to such investments are typically less capital intensive or shorter-lived investments (e.g., natural gas fired generation, wind energy).

LCA believes it is appropriate for the PUB to consider the full life-cycle perspective in its review along with additional consideration shorter-term perspectives to allow for a balancing of

near-term and long term costs and benefits and interests. LCA does recommend that the project review consider the extent to which the decision to make these investments relies on benefits that are decades into the future, the reasonableness of the estimates of those long term benefits, and the risk inherent in making large investments when the uncertainty in the estimated benefits is significant. We also expect that the PUB will weigh other factors that have not been included in LCA economic analysis scope of work, such as socio-economic considerations, that may offer additional long-term benefits to be considered.

La Capra Associates in this referenced statement and much of Technical Appendix 9A is presenting the interim impacts of the different plans by providing results through 20, 35 and 50 years in addition to the 78-year results presented by MH. It is our experience that decision makers often consider the shorter-term economic metrics to obtain perspective on the tradeoffs between near-term and long-term impacts, recognizing that the long-term analysis in inherently more uncertain.

In this context, LCA believes it is appropriate for consideration of the proposed investments that the PUB consider both the shorter-term and the longer-term perspectives and determine the weight that should be placed on the tradeoffs and uncertainties inherent in that information.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report , LCA Appendix 9A -21-24

PREAMBLE: LCA also states that MH's use of an unleveraged cash flows analysis for its economic analysis is a relatively simple approach for economic analysis of alternative plans with investments of the scale that are under consideration in this NFAT filing.

QUESTION:

Please comment on whether MH's simplifying assumptions were appropriate, or whether it is inappropriate to prepare an analysis over such a long time frame given the inherent uncertainty of forecasting that far into the future.

RESPONSE:

La Capra Associates in most instances would rely upon a revenue requirements analysis where the costs of financing are considered for long lived investments. While we would not deem the unleveraged cash flow analysis as inappropriate, we do consider it less informative. In the review of the economic analysis provided by MH in the NFAT application, LCA chose to provide information using the unleveraged cash flow analysis provided by MH and LCA selected sensitivities. This choice was made in order to maintain a direct comparison for the PUB Panel members between the LCA analyses and the MH analyses.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report, LCA Appendix 9A -8
Figure 9.1

PREAMBLE: MH's List of 15 development plans include five plans with no Keeyask G.S of which two plans have no Conawapa either.

Of the 10 plans with Keeyask all start with Keeyask.
Three plans have Conawapa preceded by natural gas or wind.
There are no plans involving a higher level of DSM.

QUESTION:
In LCA's view should there be a plan where Keeyask was preceded by natural gas or wind?

RESPONSE:

LCA understands this question to be asking whether MH should have prepared a case demonstrating the effects of a material delay in the construction of Keeyask (a similar question was posed in PUB/LCA-058c). Eight of MH's alternative development plans included Keeyask with a 2019 in-service date, two with a 2022 in-service date, and five with no Keeyask development. There are no plans with Keeyask in-service at a later time (such as 2026 as postulated in PUB/LCA-058c).

LCA does believe there would be value in having an analysis of the implications of a deferral of the investment. Based on the analysis MH has conducted, the concept of delay has the some potential. For example, refer to Figure 9-21 on page 9A-48 of LCA Technical Appendix 9A which provides LCA's interim metrics on the alternative development plans using MH's reference case

analysis. Plan 2 includes Keeyask in 2022 with gas filling out the balance of that plan. When compared to the All Gas Plan (as shown in the first row of Figure 9-21), it is clear that the All Gas Plan performs better in the early years, with Plan 2 reaching break even with All Gas in 2051. These results indicate advantages to gas options in the near term and Keeyask in the longer term.

Such a plan would have to address the costs of suspending the project and resuming construction at a later point, and further, it would have to consider the complex partnership and other agreements that may end if Keeyask is delayed, it would have to consider MH's arguments on the "window of opportunity" and consider the prospects for transmission and alternative export contracts to the one currently in place with MP.

See also LCA's response to PUB/LCA-058c.

SUBJECT: Economic Analysis

REFERENCE: 2004/05 Power Resource Plan

PREAMBLE: MH's List of 15 development plans include five plans with no Keeyask G.S of which two plans have no Conawapa either.

Of the 10 plans with Keeyask all start with Keeyask.

Three plans have Conawapa preceded by natural gas or wind.

There are no plans involving a higher level of DSM.

QUESTION:

In LCA's view, should MH have considered a smaller [5 or 6 unit version] of Conawapa instead of Keeyask?

RESPONSE:

La Capra Associates did not evaluate a smaller version of Conawapa instead of Keeyask and thus does not have a view as to whether it would have been beneficial for MH to study such a project. Factors that would need to be considered in such an assessment would be any loss of economy of scale at the Conawapa site with fewer units installed, the transmission configuration needed to integrate a smaller Conawapa configuration into the MH Northern Control System, and the lead time necessary for development of that facility.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report , LCA Appendix 9A -8
Figure 9.1

PREAMBLE: MH's List of 15 development plans include five plans with no Keeyask G.S of which two plans have no Conawapa either.

Of the 10 plans with Keeyask all start with Keeyask.
Three plans have Conawapa preceded by natural gas or wind.
There are no plans involving a higher level of DSM.

QUESTION:
In LCA's view, which plans would have benefited from higher levels of DSM?

RESPONSE:
It is the view of La Capra Associates that it is likely that all plans could have benefited from some higher level of DSM. MH did not prepare alternative development plans with DSM in its application. However, MH prepared one alternative plan at LCA's request which includes a level of DSM and we understand that MH is currently preparing such evaluations. Please refer to LCA's response to PUB/LCA-012b and LCA's Supplemental Report, Technical Appendices 3B and 9B.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report , LCA Appendix 9A -8, 9A-12 Figure 9.3

PREAMBLE: MH's evaluations all disregard accounting for any aboriginal income sharing.

QUESTION:

Did LCA deduct the revenue transfers to the Keeyask partnership from the project revenue stream?

RESPONSE:

No.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report , LCA Appendix 9A -8, 9A-12
Figure 9.3

PREAMBLE: MH's evaluations all disregard accounting for any aboriginal income sharing.

QUESTION:

Please quantify the impact of revenue sharing on project economics.

RESPONSE:

La Capra Associates has not modeled the revenue sharing in its economic analysis review. We estimate the NPV impact for reference assumptions to be less than $100 Million through 78 years, about $50 Million through 50 years and near zero through 35 years. These payments increase if export revenues are high and can be lower if export revenue is low. This analysis utilized the expense item “Non-Controlling Interests” within the income statements in MH’s Appendix 11.4 to develop this estimate.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report , LCA Appendix 9A -37
Figure 9-15

PREAMBLE: The All Gas plan reflects reinvestment at the end of the service life with no assumed change in capital cost or efficiency.

QUESTION:

How would Figure 9-15 change if there was a reduction in the capital costs on reinvestment with a higher level of efficiency? Please illustrate and explain.

RESPONSE:

Figure 9-15 would change after the year 2047, where all the plans illustrated in this figure would exhibit lower NPV of benefits in 2090 than those shown on the figure. The All Gas Plan, having the most reinvestment, would improve in that timeframe relative to Plans 4, 5, and 6. The Break Even Year for the Preferred Plan may be a bit later than shown in that Figure.

SUBJECT: Economic Analysis

REFERENCE: Initial Export Analysis Report, LCA Appendix 9A -24,40-43
Figure 9-17

PREAMBLE: LCA states that it is common for decision-makers to place much less weight on long-term forecasts of long-term benefits in conjunction with plans with high front end costs. LCA also states that the analysis used by MH beyond 35 years is merely an extrapolation and.... "the economic implications of the results in this period are generally viewed as more suspect, given the uncertainty of any assumptions and in this my case the simplistic estimation of annual effects after year 35."

QUESTION:

LCA has provided alternative time frames to those evaluated the PDP. Which of the three time frames should be the primary focus for the analysis and why?

RESPONSE:

The choice of which time frame should be given primary focus is very much a choice of the decision makers and their views on three issues;

1. Their comfort with accepting the risk that the economic benefits determined in the later years will materialize.
2. Their view as to how appropriate extremely long term periods such as 50 years and more are for utility investment.
3. The weight they place on inter-generational equity since a sole view on the longer term views on the economics ignores the negative impacts on customers,

residential, commercial, and industrial, that will pay higher costs in the early years and not experience the forecasted annual benefits of the latter years.

It is for these reasons that LCA provided as much visibility as practical as to the interim economics of the various plans, including the PDP, by providing 20, 35 and 50 year views of the economics in Technical Appendix 9A, review of the economic analysis.

Also refer to LCA's response to PUB/LCA-081.

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Page 9A-49

PREAMBLE: LCA is filing electronic worksheets which have incorporated the MH modeling results.

QUESTION:

If LCA has performed this the analysis, please provide the IRR of each plan over 35 and 50 year time frames.

RESPONSE:

Please find below a table with the requested IRR of each plan compared to the All Gas Plan over 35 and 50 years.

Plan	35 Year IRR	50 Year IRR
2 K22/Gas	4.43%	6.11%
3 Wind/Gas	N/A	N/A
4 K19/Gas24/250MW	5.68%	6.74%
5 K19/Gas25/750MW (WPS)	5.42%	6.30%
6 K19/Gas31/750MW	5.00%	6.20%
7 SCGT/C26	3.45%	5.33%
8 CCGT/C26	3.46%	5.31%
9 Wind/C26	2.74%	4.96%
10 K22/C29	2.61%	4.93%
11 K19/C31/250MW	3.31%	5.33%
12 K19/C31/750MW	3.35%	5.41%
13 K19/C25/250MW	3.84%	5.37%
14 K19/C25/750 (WPS)	4.19%	5.63%
15 K19/C25/750MW	3.90%	5.41%

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Page 9A-61

PREAMBLE: Decision makers do not look at economic analysis for study periods that are this long. The concern about The validity of assumptions, the uncertainties in technology development and the intergenerational equity concerns are just a few reasons why shorter study period metrics are significant factors affecting utility resource plan selections.

QUESTION:

Please indicate, using the example of other development projects or agencies if necessary, the time frame generally used to conduct an economic evaluation.

RESPONSE:

The Preamble is a quote from the LCA Technical Appendix 9A that is preceded by "LCA's experience is that most…" This response further explains LCA's experience with most other decision makers.

La Capra Associates has been involved in conducting or reviewing utility planning analysis in nearly 30 states in the US. None of the plans with which we are familiar has been conducted as 78 year planning study. La Capra Associates is involved in many states where integrates resource planning legislation requires utilities to provide plans for periods ranging from 10 to 30 years. Planning analyses of more than 20 years typically involve considerable scenario and uncertainty analysis. One particular example would be the work that was conducted within the State of Connecticut regarding the development of an Integrated Resource Plan. That planning process typically looks at the impacts on the State's energy costs over 15 years and in 2010 it was extended to a 30 year time horizon. Several options are being given particular

consideration in the Connecticut, including adding additional electric transmission within the region and to increase interconnection to neighboring regions and the potential import of large amounts of Canadian hydroelectric generated energy.

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Page 9A-61

PREAMBLE: Decision makers do not look at economic analysis for study periods that are this long. The concern about The validity of assumptions, the uncertainties in technology development and the intergenerational equity concerns are just a few reasons why shorter study period metrics are significant factors affecting utility resource plan selections.

QUESTION:

In the context of a long-lived asset such as a hydraulic facility, how should any long term benefit/ cost be incorporated in an economic analysis?

RESPONSE:

Please see LCA's responses to PUB/LCA-081 and PUB/LCA-086.

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Page 9A-71 to 73, Figures 9-30,9-31, 9-32

PREAMBLE: LCA observes that the magnitude of the regret in the Preferred Development Plan at the end of 35 years of the study is often four times the amount of Plan 5.

QUESTION:

Please elaborate on the magnitude of regret looking at 20, 35, 50 and 78 years between Plan 14 and Plan 5 and compare with the comparative range of reward between the two plans over the time horizons.

RESPONSE:

Referring to the table in Figure 9-30, the 10th percentile and 90th percentile of the 78-year NPV for Plan 14, ($1.913) Billion and $5.862 Billion respectively, define a much greater range than Plan 5, ($416) Million, $2.999 Billion respectively. Thus for both plans, when compared to All Gas Plan, the expected value benefit over 78 years is $1.155 Billion (Plan 14) and $842 Million (Plan 5). Looking at the risk profiles on Figure 9-30, we see that between the 20% and 80% probabilities the two plans are relatively close. This is driving the expected values of the NPV for the plans to be closer. than the extremes. Plan 14 has much greater regret potential of about $1.5 Billion more than Plan 5. This means that a decision maker would have to make the trade-off between an expected value gain of $313 Million ($1155-$842) if Plan 14 is chosen and the possible regret of $1.5 Billion more if the scenarios with bad outcomes actually occur in the future. LCA would suggest that consideration be given to the other time periods to put these differences in perspective in conjunction with this trade-off that is faced.

Figure 9-31 shows us that over 50 years the 10th percentile and 90th percentile of the NPV for Plan 14 range of outcomes is smaller but still quite wide, ($2.366 Billion) and $3.216 Billion

respectively, have a much greater range than Plan 5, ($576) Million, $1.878 Billion respectively. Thus for both plans when compared to All Gas the expected value benefit over 50 years is $174 Million (Plan 14) and $438 Million (Plan 5). Plan 5 over 50 years has a smaller risk and greater expected value the Plan 14. Looking at the risk profiles on Figure 9-31, we see that Plan 14 still has a much greater regret potential of about $1.8 Billion more than Plan 5. Thus, at the 50 year point, the magnitude of the regret if Plan 14 is chosen is larger than the expected value for Plan 5.

Figure 9-32 shows us that over 35 years Plan 14 still has a much greater regret potential of about $2.3 Billion more than Plan 5. Thus at the 35 year point the magnitude of the regret if Plan 14 is chosen is very large when the expected value and the full risk profile favor Plan 5.

Figure 9-33 shows that at the 20 year point the regret is Plan 14 is chosen is large and there is 100% probability that Plan 5 has lower costs over that period.

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Page 9A-76

PREAMBLE: LCA states that the Reference case results are not a good proxy for the expected value results and that the use of the reference case results as a metric overstates the value of each of the plans relative to the All Gas plan based on MH's analysis and probability assignments.

QUESTION:

Is LCA suggesting the key metric to be review is the probability weighted expected value versus the reference case. Does this suggest that the reference case values should be changed? Please explain.

RESPONSE:

LCA believes that the expected value metric is an important metric in understanding the implications of MH's uncertainty analysis. MH's application prominently features the reference case results in describing the relative economics of the alternative development plans. As a result of our testing the expected value of the plans to the reference case results, it became apparent that the reference case results differed from the expected value. If the comparison of the plans is to be done on a single value, LCA believes the expected value result is a better representation of MH's analysis than the reference case results.

There is no need to change the reference case. The reference case is simply a point of reference. There are many reasons why a reference case will differ from the expected value, including non-linear relationships in the simulation of reference case inputs in the modelling and skewness in the probability assignments to uncertain parameters. However, LCA does recommend that the reference case results be considered in the context of the expected values

resulting from MH's uncertainty values, which is part of the added analysis of MH's work that LCA included in Appendix 9A.

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Pages 9A-24, 80

PREAMBLE: LCA states that the expected benefit from the PDP, relative to the alternative plans, are largely derived from upside opportunities after the first 50 years of the study period. Based on MH's economic analysis and probability assessments, the PDP recommendation or as a long-term view of benefits. LCA also states it is common for decision-makers to place much less weight on long-term forecasts of long-term benefits in conjunction with plans with high front end costs.

QUESTION:

Given the greater degree of uncertainty related to forecasting over longer periods how should planners assess the achievement of benefits for the PDP beyond year 50.

RESPONSE:

Please see LCA responses to PUB/LCA-081 and PUB/LCA-086.

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Pages 9A-89, 94
Figures 9-42 , 9-46

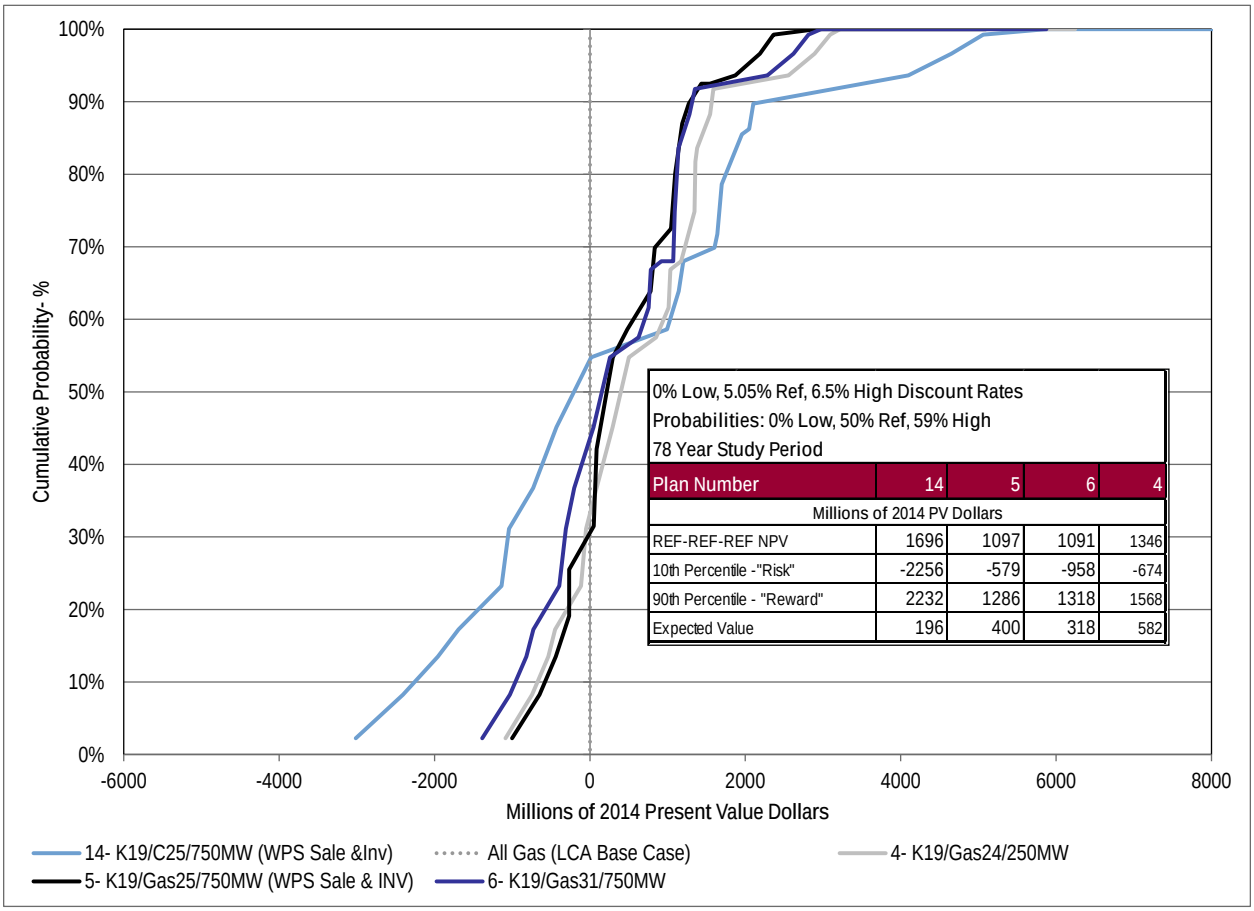
PREAMBLE: LCA states that "As seen in the Figure 9-46 comparison, the Preferred Development Plan without low discount rates is approximately 10% less likely to yield a better economic value (CPV) than the All Gas plan in 78 years. Even though both scenarios exhibit the about the same range of potential outcomes their expected values vary widely. This simple change in opinion, i.e., the elimination of considering the low discount rate scenario, can eliminate nearly all the benefits of the Preferred Development Plan under the expected value metric."

QUESTION:

Please provide modified Figures 9-42, 9-43 and 9-44, reflecting the elimination of the low discount rate probability based on MPA's low discount rate view and provide commentary on the comparative results.

RESPONSE:

The figures below represent an extension of the sensitivity analysis that begins in Technical Appendix 9A Section IV B.2 on page 9A-92. As a result of the elimination of the low discount rate scenarios, the low, reference and high discount rates are 0%, 5.05% and 6.5% respectively. The discount rate probabilities are 0% low, 50% reference and 50% high.



0% Low, 5.05% Ref, 6.5% High Discount Rates
Probabilities: 0% Low, 50% Ref, 59% High
78 Year Study Period

Plan Number	14	5	6	4
Millions of 2014 PV Dollars				
REF-REF-REF NPV	1696	1097	1091	1346
10th Percentile -"Risk"	-2256	-579	-958	-674
90th Percentile - "Reward"	2232	1286	1318	1568
Expected Value	196	400	318	582

Figure PUB/LCA-092-1

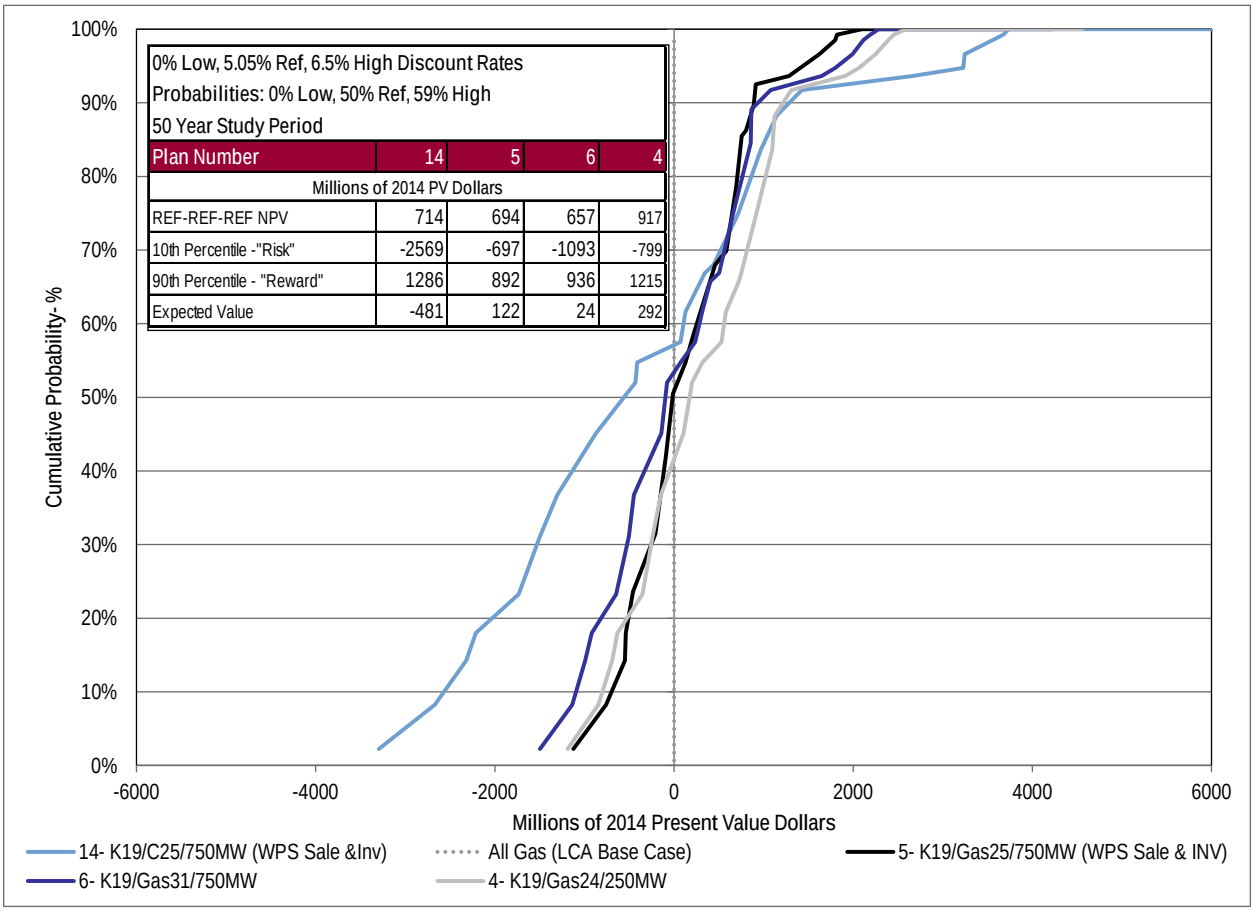


Figure PUB/LCA-092-2

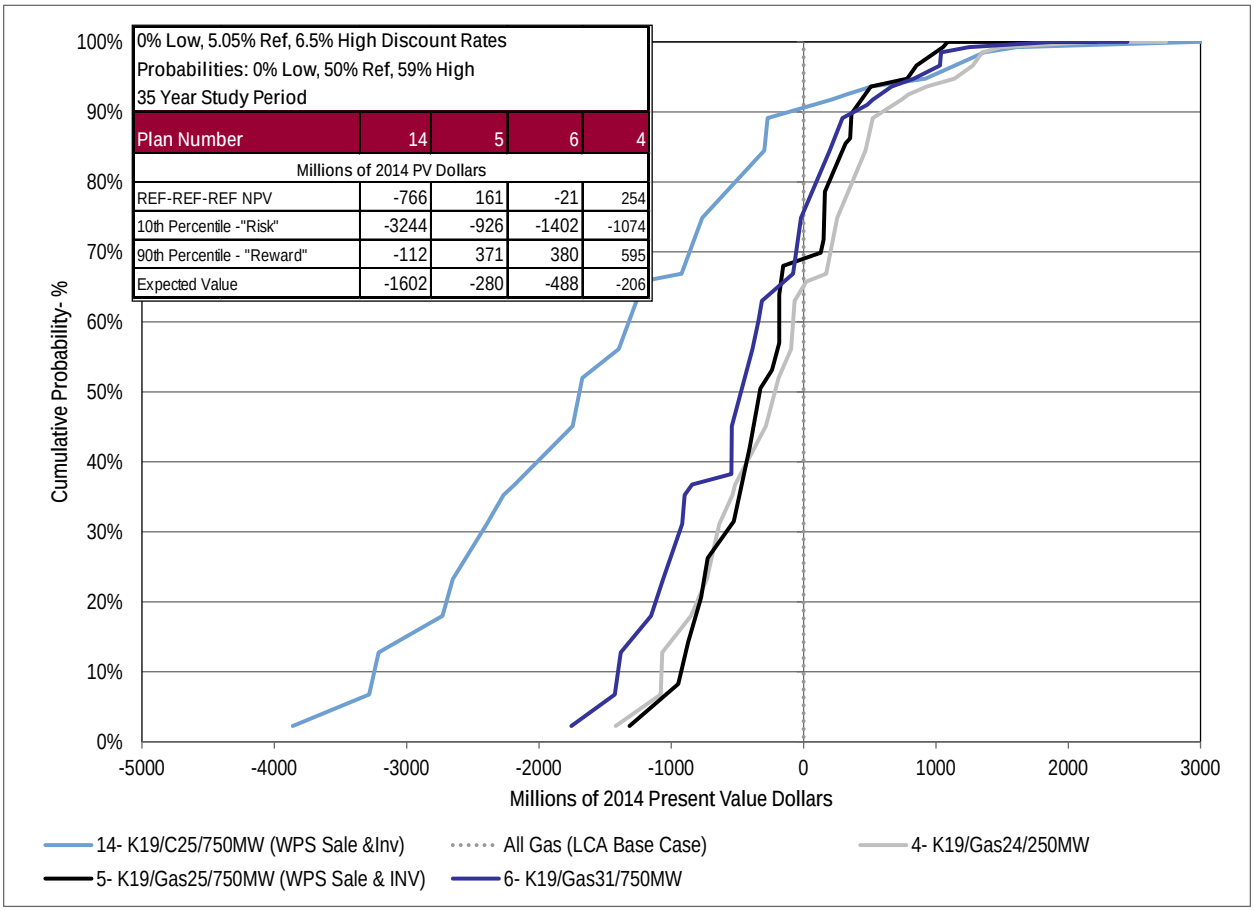


Figure PUB/LCA-092-3

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Pages 9A-109,117, Figures 9-66 to 9-70

PREAMBLE: LCA states that "In this sensitivity section we have two different ways of modeling the concern that capital costs for Keeyask and Conawapa may be higher than the high cost estimates developed by MH and used in MH's economic uncertainty analysis. One situation would be a modest increase in the high cost scenario's capital costs. The other would represent a very pessimistic view on the realities of the MH estimates. This was modeled by LCA assigning the MH estimate for reference capital cost for Keeyask and Conawapa to the low scenario. The reference and high scenario estimates for capital cost were each increased by 20%. We have analyzed the results of the NPV metrics utilizing each of these methods independently in this section."

QUESTION:

Please provide the range of capital cost estimates used in the sensitivity analysis and the % range from reference and compare this to the capital cost estimates used by MH.

RESPONSE:

The table below shows the variations in capital cost used for Keeyask and Conawapa in all the LCA analyses in Technical Appendix 9A. These figures are the cash flow values that would be spent after June 2014, in real 2012 dollars.

Capital Cost to Complete $2012		Reference			High			Low		
Scenario/Sensitivity	Year	$Millions	% of MH Ref	% of MH Base Case	$Millions	% of MH Ref	% of MH Base Case	$Millions	% of MH Ref	% of MH Base Case
MH Base										
Keeyask	2019	$ 3,289	100%	N/A	$ 3,722	113%	N/A	$ 3,007	91%	N/A
	2022	$ 3,391	100%	N/A	$ 3,868	114%	N/A	$ 3,081	91%	N/A
Conwapa	2025	$ 5,691	100%	N/A	$ 6,359	112%	N/A	$ 5,134	90%	N/A
	2026	$ 5,761	100%	N/A	$ 6,454	112%	N/A	$ 5,186	90%	N/A
	2029	$ 5,855	100%	N/A	$ 6,595	113%	N/A	$ 5,225	89%	N/A
	2031	$ 5,937	100%	N/A	$ 6,711	113%	N/A	$ 5,270	89%	N/A
High Capital Cost is 10% increase from MH Base Assumptions, Reference /Low unchanged from MH Base Assumptions										
Keeyask	2019	$ 3,289	100%	100%	$ 4,095	124%	110%	$ 3,007	91%	100%
	2022	$ 3,391	100%	100%	$ 4,255	125%	110%	$ 3,081	91%	100%
Conwapa	2025	$ 5,691	100%	100%	$ 6,995	123%	110%	$ 5,134	90%	100%
	2026	$ 5,761	100%	100%	$ 7,099	123%	110%	$ 5,186	90%	100%
	2029	$ 5,855	100%	100%	$ 7,255	124%	110%	$ 5,225	89%	100%
	2031	$ 5,937	100%	100%	$ 7,382	124%	110%	$ 5,270	89%	100%
Reference Capital Cost is +20% from MH Base Assumptions, High is + 20% from this Reference, Low is Reference from MH Base Assumptions										
Keeyask	2019	$ 3,947	120%	120%	$ 4,467	136%	120%	$ 3,289	100%	109%
	2022	$ 4,069	120%	120%	$ 4,642	137%	120%	$ 3,391	100%	110%
Conwapa	2025	$ 6,830	120%	120%	$ 7,631	134%	120%	$ 5,691	100%	111%
	2026	$ 6,914	120%	120%	$ 7,744	134%	120%	$ 5,761	100%	111%
	2029	$ 7,026	120%	120%	$ 7,914	135%	120%	$ 5,855	100%	112%
	2031	$ 7,125	120%	120%	$ 8,053	136%	120%	$ 5,937	100%	113%

1

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Pages 9A-109,117, Figures 9-66 to 9-70

PREAMBLE: LCA states that "In this sensitivity section we have two different ways of modeling the concern that capital costs for Keeyask and Conawapa may be higher than the high cost estimates developed by MH and used in MH's economic uncertainty analysis. One situation would be a modest increase in the high cost scenario's capital costs. The other would represent a very pessimistic view on the realities of the MH estimates. This was modeled by LCA assigning the MH estimate for reference capital cost for Keeyask and Conawapa to the low scenario. The reference and high scenario estimates for capital cost were each increased by 20%. We have analyzed the results of the NPV metrics utilizing each of these methods independently in this section."

QUESTION:

Please indicate what the relative in-service cost is related to the range used by MH and that settled upon by LCA.

RESPONSE:

Please see the table in response to PUB/LCA-093a.

SUBJECT: Economic Analysis

REFERENCE: LCA Report Appendix 9A Pages 9A-137, Figures 9-77 to 9-79

PREAMBLE: LCA states that in Figure 9-77, from the MH perspective, the plans have negative CPV, meaning they have higher costs than the All Gas plan. However the majority of the development plans' benefits from the proposed Keeyask G.S and Conawapa GS are taken by the Province through the Provincial tax revenue, Capital Tax and Water rental fees.

QUESTION:

Confirm and elaborate on how the negative CPV is in most cases based on a 20 and 35 year time frame, during which the Provincial benefit on most plans outstrips the benefit to MH and its ratepayers.

RESPONSE:

LCA confirms that the 20 year and 35 year CPV in most plans shows positive benefits to the Province and negative benefits to MH and its ratepayers. In the 20 year CVP, all plans show this result. In the 35 year CVP, eleven of fifteen plans show this result. Figure 9-78 and Figure 9-79 show the 35 year and 20 year views, respectively.

The Province receives the benefits shown through water rental and capital tax receipts. The water rental and capital taxes are expenses to MH and its ratepayers in this analysis. Those expenses, combined with the other costs of the plans to MH, are not fully offset by benefits (relative to the All Gas Plan) by year 20 or year 35.

REFERENCE: LCA Report Appendix 6 Pages 6-16

PREAMBLE: MH specifically excludes consideration of the potential to export natural gas fired generation as firm sales in its economic or financial analysis.

QUESTION:

What is LCA's view on the exclusion of natural gas generation from the total dependable energy resource mix for exports?

RESPONSE:

This response assumes the reference was intended to be page 6-65.

See Technical Appendix 6, pages 6-65 to 6-68 under the heading "Exports of Natural Gas Generation." Also refer to Technical Appendix 3B, which examines the detailed SPLASH model output to demonstrate how a combined cycle unit would work in tandem storage with the reservoir operations in years with below average water to produce opportunity sales for export during MISO on-peak periods.

It is LCA's view that the market opportunity for long term firm sales of dependable energy structured in an annual product (such as is assumed by MH for hydropower exports) is very limited due to the fact that market prices in MISO are expected to be below the variable cost of combined cycle natural gas facilities for the majority of the hours in each year. Economic exports of natural gas fired generation from Manitoba to MISO would be limited to times of high peak prices.

REFERENCE: LCA Report Appendix 6 Pages 6-16

PREAMBLE: MH specifically excludes consideration of the potential to export natural gas fired generation as firm sales in its economic or financial analysis.

QUESTION:

Did LCA perform any scenario analysis that met the current export contract obligations with natural gas [CCGT] backup of existing average hydraulic resource? Explain.

RESPONSE:

This response assumes the reference was intended to be page 6-65.

LCA requested MH run an all-gas scenario that included more CCGT resources. MH ran an all-gas case with only additional CCGT resources and no additional SCGT resources. See Technical Appendices 3B, 5, and 9B.

SUBJECT:

REFERENCE: LCA Report Appendix 9A Page 9A-129

PREAMBLE: The economic analysis sensitivity tests indicate that the relative NPV benefit of the Preferred Development Plan disappears after 78 years disappears with:

– a modest increase in discount rates

– a modest increase in capital costs of Keeyask and Conawapa

– slightly lower view of export market prices

There was also no specific conclusion on the impact of the lower variability of thermal and wind generation costs.

QUESTION:

Please explain and quantify the likely range of changes that would reflect:

– a modest increase in discount rates;

– a modest increase in capital costs; and

– slightly lower export market prices

RESPONSE:

These statements refer directly to the sensitivities provided in Section IV of Technical Appendix 9A. With respect to discount rates, please refer to page 9A-83. With respect to capital costs, please refer to page 9A-97 and 9A-109. With respect to export market prices, please refer to page 9A-103.

SUBJECT:

REFERENCE: LCA Report Appendix 9A Page 9A - 124 -128, 129

PREAMBLE: The economic analysis sensitivity tests indicate that the relative NPV benefit of the Preferred Development Plan disappears after 78 years disappears with:

– a modest increase in discount rates

– a modest increase in capital costs of Keeyask and Conawapa

– slightly lower view of export market prices

There was also no specific conclusion on the impact of the lower variability of thermal and wind generation costs.

QUESTION:

Please explain the impact of the cost variability of thermal and wind on the All Gas and other scenarios.

RESPONSE:

As discussed in response to PUB/LCA-034b, La Capra Associates performed two uncertainty analyses where the uncertainty surrounding the capital costs for thermal and wind projects were evaluated. These are shown in Technical Appendix 9A Section IV-E (page 9A-122). In the first sensitivity the uncertainty was reduced for these projects to +/-20% in the High and low scenarios respectively. In the second sensitivity, the assumption was made that there was no uncertainty in capital costs for the thermal and wind projects, using reference capital costs for the high and low scenarios. The results are shown on 9-71 through 9-74 demonstrating that

there is little impact when these assumptions are used as replacements for the MH assumptions.

SUBJECT:

REFERENCE: LCA Report Appendix 9A Page 9A - 150

PREAMBLE: The benefit gains of the PDP over the other plans accrue after 50 years.

These reflect projections for 42 years of system operation, loads and market interactions, the analysis of which only extends 35 years,

In particular: the load forecast continues to grow at 1.5%/year until 2047 and then remain constant at 35,330 GWh; rates increase by $11/MWh over 15 years; export volumes are held constant at 6,144 GWh [538+5806]; average export prices increase by $45/MWh over 15 years.

QUESTION:

Please comment on the reliability of Manitoba Hydro's projections, particularly as to how they reflect domestic load revenues and export revenues after 2047.

RESPONSE:

Please refer to our discussion of this issue in LCA Technical Appendix 9, page 9a-24 and 9A-25.