

**NEEDS FOR AND
ALTERNATIVES TO (NFAT)
REVIEW OF MANITOBA
HYDRO'S PROPOSAL FOR THE
KEYYASK AND CONAWAPA
GENERATING STATIONS**

PUBLIC VERSION

The Commercially Sensitive Information contained within this report has been redacted in accordance with the protective order.

PREPARED FOR

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Supplemental Expert Analysis Report

La Capra Associates

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Technical Appendices:

Initial Technical Appendices:

1. *Resource Planning*
2. *Generation Alternatives*
3. *Alternative Resource Plans - Initial*
4. *Environmental Issues and Policy*
5. *Hydrological Risk – Supplemental Only*
6. *Export Markets*
7. *Export Contracts - Initial*
8. *Transmission*
9. *Economic Analysis - Initial*
10. *Financial Analysis – Initial*

Supplemental Technical Appendices:

3. *Alternative Resource Plans - Supplemental*
5. *Hydrological Risk – Supplemental Only*
7. *Export Contracts - Supplemental*
9. *Economic Analysis - Supplemental*
10. *Financial Analysis – Supplemental*

Attachments:

Initial Report Attachments:

- A. *La Capra Associates' Scope of Work*
- B. *List of Documents Received From Manitoba Hydro*

Supplemental Report Attachments:

- C. *Scope of Work References to LCA Reports*
- D. *List of Additional Documents Received from Manitoba Hydro*

Acronyms

Supplemental Expert Analysis Report

CCGT	Combined Cycle Gas Turbines
DSM	Demand Side Management
HVdc	High Voltage Direct Current
IR	Information Request
IRR	Internal Rate of Return
KP	Knight Piesold
LCA	La Capra Associates
MH	Manitoba Hydro
MISO	Midcontinent Independent System Operator
MP	Minnesota Power
MW	Megawatt
NFAT	Needs For and Alternatives To
NPV	Net Present Value
PDP	Preferred Development Plan
PUB	Public Utilities Board
SCGT	Simple Cycle Gas Turbines
SOW	Scope of Work
SPLASH	Simulation for Long-Term Analysis of System Hydraulics
TOR	Terms of Reference
US	United States
WPS	Wisconsin Public Service Corporation

La Capra Associates' Supplemental Expert Report

Executive Summary

Manitoba Hydro's (MH's) NFAT Application is based on its determination that its Preferred Development Plan (PDP) is economically beneficial to the Province of Manitoba and the MH ratepayers. The PDP included the development of the Keeyask and Conawapa hydropower generation stations totaling 2,180 MW and associated transmission to connect these projects to MH's system, a 500 kV Transmission Line to Minnesota, and firm power sales contracts to the US. Through this NFAT proceeding, MH is seeking governmental approval to implement all of the elements of the PDP except for Conawapa and the associated transmission.

La Capra Associates (LCA) was retained as an Independent Expert to review the planning, economic, and financial case that MH has put forth in support of its Application and provides this Supplemental Report on our findings. This Report includes five Technical Appendices containing the results of further analysis conducted since the issuance of our Initial Report and its associated Appendices. In this Report, LCA updates its observations and findings on the questions posed to us in our NFAT Scope of Work (SOW).

LCA's supplemental analysis centers on two additional alternative development plans, and more detailed examination of the original fifteen development plans. The first additional plan is one that meets all future load growth with natural gas-fired combined cycle gas turbine additions (CCGT plan). The second new plan defers the need for new generation additions with a combination of demand-side management, fuel switching, and added transmission for increased imports (LCA No New Generation plan). These plans test two key variants from the plans that MH considered.

At LCA's request, MH conducted its economic analysis of the two additional cases and produced detailed economic analysis outputs. This new information forms the basis for the further work described herein.

The results of this additional work do not alter the findings we offered in our Initial Report. Our findings in this Supplemental Report extend the initial assessments provided and offer added detail. Our initial conclusion that the MH analysis, as

presented, makes clear that the economic case for the PDP is marginal and requires a very long-term perspective remains our conclusion.

Our key findings and observations deriving from our supplemental analysis include the following:

- Our review of the All Gas and CCGT plans indicates potential for a more beneficial, modified All Gas Plan, featuring a CCGT in 2022, followed by one or two SCGTs, and then a combination of units. The All Gas and CCGT cases are instructive, but may not be the best configuration for a strategy that is exclusively based on natural gas-fired generation.
- From our review of the LCA No New Generation plan, the results demonstrate that even with only moderate adjustments to assumptions on load, the need for new resources can be delayed until at least 2029. Furthermore, the addition of new transmission capacity for import can delay the need for new resources even further.
- The LCA No New Generation plan also shows the potential for new transmission for import to be a consideration in all of the plans. The amount and timing of increased import capability could provide meaningful value to each of the plans, particularly those that do not include any increases in import capability that is associated with transmission built primarily for export.
- Based on the insights gained from the results of the CCGT Plan and the LCA No New Generation Plan, our further review of the Wind/Gas plan identified several potential changes that could have developed a more optimal configuration than the one presented by MH.
- The supplemental analysis confirms our initial assessment that MH evaluated a narrow selection of development plans and in most cases did not perform sufficient analysis to show that the plans were developed to be optimal or near optimal configurations of the development scenarios evaluated.
- The selection of alternative development plans limits the ability to test important alternative configurations, including a 5-10 year delay of Keeyask, the sequencing of transmission additions and the value of transmission in non-hydro plans, and alternative combinations of demand-side management and natural gas-fired generation.

- The Preferred Development Plan shows somewhat greater variance in economic results in drought conditions than the other plans tested.
- The addition of the CCGT units provides economic export opportunities that are not present in the All Gas case.
- The CCGT units are utilized extensively in below-average water years, working in tandem with the reservoir operations to increase on-peak exports in those dryer years.
- LCA confirmed that the pricing terms for firm energy reflect a premium over MH's energy price forecast. On average, for all of its contracts considered together, we found that MH should receive [REDACTED] above forecasted market prices for its firm energy from the contracts and term sheets.
- CCGT capacity can play an important drought risk impact mitigation role without any noticeable increase in costs under average water conditions.
- The use of non-generation resources such as managing demand through sponsorship of energy efficiency and heating fuel switching and increasing imports through strategic transmission expansion to the U.S. can economically delay the need for generation investments whether they be natural gas or hydroelectric facilities.
- Keyask provides half or more of the economic value that would result in comparisons of the Preferred Development Plan to those without hydroelectric additions.
- The economics of the combination of investing in the 250 MW Transmission line with the Minnesota Power Contract has positive robust economics across uncertainties and independent of the other components within the MH system.
- Conawapa and the 750 MW transmission line economics are tightly linked. The comparisons show that there are no benefits to adding either without the other.
- Conawapa economics are not robust given the uncertainties and how the economics deteriorate when tested for various uncertainties.
- The Provincial View serves to increase the marginal economics of the Conawapa investment.

I. Introduction

A. Scope of Report

La Capra Associates (LCA) has prepared this Supplemental Expert Report (Supplemental Report) to provide the additional analysis and findings that we have prepared since we filed our Initial Expert Report in January 2014, regarding our Needs For and Alternatives to (NFAT) Scope of Work (LCA SOW).

At the time of the LCA Initial Report, LCA had only recently received information from MH on two additional alternative development plan analyses that were conducted in response to PUB and LCA requests, as well as detailed output information from MH's analysis of the alternative development plans presented in the MH NFAT Submission. In addition, a number of responses to LCA information requests (IRs) had not been received for consideration in our Initial Report. That information was necessary for the completion of key elements of our SOW. This Supplemental Report provides the results of our work to evaluate that additional information and summarizes our findings based on the entirety of the LCA analysis.

The LCA SOW includes a number of tasks in five areas of investigation. Our full SOW was included as Attachment A to the Initial Report. In this Supplemental Report, LCA has included an Attachment C that provides a guide to the locations within our Technical Appendices where the SOW elements are addressed. The five areas of investigation are:

1. Power Resource Planning and Economic Evaluation
2. Business Case and Risk Assessment
3. Transmission Economics
4. Review of Manitoba Hydro's Export Contracts, and
5. Financial Modeling

Due to the interrelated nature of these areas of work, our Initial Report and this Supplemental Report organizes the observations and findings from our work into the categories of Planning Methods and Process, Resource Options, Economic and Financial Analysis, Business Case for the MH Proposal, and LCA Modeling. We believe the

Public Utilities Board will find this organizational structure a useful way to understand the various component of our work in a form that is focused on the key component of the decisions it will need to make.

At the conclusion of this Supplemental Report, LCA provides a summary of the LCA results and findings that pertain to the items that the Panel's report to the Minister is to address in accordance with the Scope of the NFAT Review set forth in the Terms of Reference. In this section, we summarize the work that LCA has completed within the context of those specific questions to provide the Panel with a guide to the work completed that we believe pertain to each element in that Scope.

Along with this Supplemental Report, we are submitting five additional Technical Appendices. Four of these Appendices supplement the initial Technical Appendices included with our Initial Report. These Technical Appendices contain substantial additional information and analysis on the observations and findings that are summarized in this report.

B. La Capra Associates Approach

LCA organized its supplemental work into five categories of work are submitting technical appendices and supplements in each of these areas:

3. Alternative Resource Plans (Supplemental)
5. Hydrological Risk
7. Export Contracts (Supplemental)
9. Economic Analysis (Supplemental)
10. Financial Analysis (Supplemental)

All tasks specified in our SOW of work are addressed within the nine technical appendices included with our Initial Report and the additional five technical appendices. We did not provide a report on Hydrological Risk with our Initial Report, as that work was dependent on the data recently received from MH.

In preparing our reports, LCA has made substantial efforts, formally and informally, to seek and obtain information, documentation, data, models, and contracts from MH. In addition to the comprehensive IRs we have issued, we have actively engaged with MH

personnel in on-site meetings and in conference calls to understand the elements of its applications that pertain to our SOW. We have continued to receive IR responses from MH in response to our Round I and II IRs during the latter half of January and throughout February with a 138 IR responses still outstanding at the time of this writing.

In these informal exchanges, documents, data, and models were identified as pertinent to our work and MH made those documents available to LCA and the other Independent Experts via a SharePoint link. Much of this material forms the basis for the work we have documented in our Technical Appendices. In our Initial Report, we attached a complete listing of the materials provided to us in this fashion as of the date of that report, along with a numbering system that we have assigned to these documents for ease of reference. In this Supplemental Report, we have included a listing of the additional documents posted to the SharePoint site and a summary of the additional IR materials received in Attachment D. Throughout our Technical Appendices, we have citations to these documents where they are the source material for our work.

II. Planning Methods and Process

The LCA SOW included a number of items that required the examination of MH's planning methods and processes. In our Initial Report, we provided the results of our review of MH's planning process and methods. In this Supplemental Report, we discuss additional analysis that LCA has conducted to examine the issues raised in our Initial Report.

In this section of the report, we provide a summary of the additional analysis conducted and our further observations on MH planning methods and processes that are germane to the NFAT Application.

A. Planning Criteria

LCA did not prepare supplemental information on this topic. Refer to our Initial Report and the discussion of the planning criteria included in LCA Technical Appendix 1: Resource Planning.

B. Resource Needs Analysis

LCA did not prepare supplemental information on this topic. Refer to our Initial Report and the discussion of the year of need analysis can be found in LCA Technical Appendix 1: Resource Planning.

C. Resource Planning and Alternative Development Plans

The Initial Report discussed the limitations of MH's planning process for identifying and defining the alternative development plans, specifically with respect to the limitations regarding the 15 alternative development plans included in the NFAT Application.

LCA's supplemental analysis examines two additional development plans and conducts more detailed analysis of the alternative development plans using data and analysis produced by MH. This additional analysis provides further insight into MH's planning

and modeling methods and the comparative analysis of the Preferred Development Plan to alternatives.

LCA has worked with MH to define two additional plans to address some of the limitations identified. The two additional cases are:

All Combined Cycle Plan (CCGTs): In this alternative development plan, all future needs for energy and capacity are met with the addition of CCGT units. Over the study period, seven CCGTs are added. This plan does not include new export contracts to the US or new transmission to the US. This plan is a variant of MH's All Gas Plan (Plan 1).

LCA No New Generation Development Plan: This plan tests an alternative development strategy to delay new generation build as long as possible. The plan relies on increased DSM (assumed to be 1.5 times the reference DSM), and the promotion of fuel switching to convert existing electric heat to natural gas as well as a reduction in the penetration of electric heating for new dwellings. This plan also includes a 750MW transmission interconnection to the US and a relaxed MH policy constraint on imports, allowing up to 20% of the dependable energy to come from net imports. The timing of the transmission addition coincides with the need for dependable energy, estimated to be 2029 when the load reduction measures are considered. This plan adds SCGTs and CCGTs late in the study period.

MH conducted an economic analysis of these two additional plans and provided those to LCA for review.

In addition, MH provided a detailed set of outputs from its SPLASH model runs for these two new cases and the original 15 plans. These data provide detail on generation production and costs for each of the 99 water regime sequences used within the SPLASH model.

LCA's supplemental analysis utilizes this added information on the SPLASH modeling to test the performance of the plans that MH has evaluated. This testing includes observations on the choice of amounts and timing of resource additions in the plans, export and import interactions with the market, and examination of performance during drought and high water conditions.

LCA Technical Appendix 3B provides further description of the two additional plans and the analysis of the structure of the alternative development plans. LCA Technical Appendix 9B provides an economic analysis of these two additional plans.

Also refer to our Initial Report and the discussion of the resource planning and alternative development plan analysis provided in LCA Technical Appendix 3A: Alternative Development Plans.

D. Economic and Financial Analysis

Our review of the NFAT Application included consideration of MH's economic and financial planning models and methods as they have been used in the evaluation of the alternative development plans. LCA did not conduct any further review of MH's economic or financial models for this Supplemental Report. Refer to our Initial Report and the discussion of these models in LCA Technical Appendices 9A and 10A.

E. Observations on MH's Planning Methods and Process

Our Initial Report included a review of the alternative development plan process. Our supplemental analysis used the added cases and more detailed case data provided by MH to further consider the reasonableness of the alternative development plans used in the NFAT analysis. Based on that further review, we observe that:

- Our review of the All Gas and CCGT plans indicates potential for a more beneficial modified All Gas Plan, featuring a CCGT in 2022, followed by one or two SCGTs, and then a combination of units. The All Gas and CCGT cases are instructive, but may not be the best configuration for a strategy that is exclusively based on natural gas fired generation.
- From our review of the LCA No New Generation plan, we observe that the results demonstrate that even with only moderate adjustments to assumptions on load, the need for new resources can be delayed until at least 2029. Furthermore, the addition of new transmission capacity for import can delay the need for new resources even further.

- The LCA No New Generation plan also shows the potential for new transmission for import to be a consideration in all of the plans. The amount and timing of increased import capability could provide meaningful value to each of the plans, particularly those that do not include any increases in import capability that is associated with transmission built primarily for export.
- Based on the insights gained from the results of the CCGT Plan and the LCA No New Generation Plan, our further review of the Wind/Gas plan identified several potential changes that could have developed a more optimal configuration than the one presented by MH.
- The supplemental analysis confirms our initial assessment that MH evaluated a narrow selection of development plans and in most cases did not perform sufficient analysis to show that the plans were developed to be optimal or near optimal configurations of the development scenarios evaluated.
- The selection of alternative development plans limits the ability to test important alternative configurations, including a 5-10 year delay of Keeyask, the sequencing of transmission additions and the value of transmission in non-hydro plans, and alternative combinations of demand-side management and natural gas fired generation.

LCA Supplemental Technical Appendix 3B provides further discussion of these concerns. LCA Supplemental Technical Appendix 9B, Section V also addresses these issues.

III. Resource Options

The LCA supplemental analysis provides additional information on three resource options: MH hydropower system, CCGT, and imports. In the Initial Report and in Technical Appendix 2, we reviewed the cross-section of resource options considered in MH's analysis.

In this section of the Supplemental Report, we discuss the findings on the performance characteristics that the subject resources exhibit in MH's modelling.

A. Generation Options

1. Hydropower Options

LCA conducted a review of the performance of MH's Preferred Development Plan and several alternative plans in drought conditions. The additional modeling data provided by MH was used to examine the collection of water year sequences that were simulated in the SPLASH model and examine those sequences that had the most influence on the overall net benefits of the plans and identify the sequences that are most adverse to the economic value of the plans. LCA also reviewed MH's materials on its reservoir operations. LCA Technical Appendix 5: Hydrologic Risk contains the details of the analysis conducted. The following is a summary of our findings from that work.

LCA's findings from our analysis on drought risk include the following:

- LCA conducted a comparative analysis of the Preferred Development Plan (PDP), the All Gas Plan, the CCGT Plan, and the No Generation Plan. Each of the plans are sensitive to drought conditions due the common reliance on the MH existing hydropower system. The PDP results show somewhat greater variance in economic results in drought conditions that the other plans.
- The greatest impact on the PDP comes with inserting the 1929-1942 drought starting in 2025 in MH's economic model with an impact of approximately \$1.5 billion on an NPV basis.
- Modeling the 1929-1942 drought in the economic analysis narrows the difference between the overall NPV of benefits of the PDP relative to the other

plans and extends the date where the PDP breaks even with the LCA No New Generation and the All Gas Development Plans. In the most severe drought scenario modeled, the LCA No New Generation Development Plan analysis showed a higher NPV of benefits than the PDP.

- Transmission can serve as a hedge against drought risk. Both the PDP and the LCA No New Generation Plan contain an expanded interconnection with the MISO market, which serves to reduce the impact of drought on the plan economics. In low water years, the PDP uses the new transmission to import energy, mitigating the impact of drought in all years when the new line is in service.
- There is not one optimal value for reservoir operations; the optimal value differs by development plan. MH's simulation of reservoir operations in cases with a CCGT in service indicates dispatch coordination between the CCGT, reservoir operations, and market imports and exports.

2. Natural Gas-Fired Generation Options

LCA conducted a review of the performance of the CCGT and SCGT natural gas-fired units in the All Gas Plan and the new CCGT plan. The additional modeling data provided by MH was used to examine the collection of water year sequences that were simulated in the SPLASH model and examine those sequences that had the most influence on the operations of each unit type and the collection of units featured in each plan. LCA Technical Appendix 3B contains the details of the analysis conducted. The following is a summary of our findings from that work.

- The operation of the CCGT units interacts with the import levels and the hydro generation differently than the SCGT units. This is evident by the increase in hydro generation and increase in net exports when CCGT units are added instead of SCGT units.
- The addition of the CCGT units provides economic export opportunities that are not present in the All Gas case.

plans and extends the date where the PDP breaks even with the LCA No New Generation and the All Gas Development Plans. In the most severe drought scenario modeled, the LCA No New Generation Development Plan analysis showed a higher NPV of benefits than the PDP.

- Transmission can serve as a hedge against drought risk. Both the PDP and the LCA No New Generation Plan contain an expanded interconnection with the MISO market, which serves to reduce the impact of drought on the plan economics. In low water years, the PDP uses the new transmission to import energy, mitigating the impact of drought in all years when the new line is in service.
- There is not one optimal value for reservoir operations; the optimal value differs by development plan. MH's simulation of reservoir operations in cases with a CCGT in service indicates dispatch coordination between the CCGT, reservoir operations, and market imports and exports.

2. Natural Gas-Fired Generation Options

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- The operation of the CCGT units interacts with the import levels and the hydro generation differently than the SCGT units. This is evident by the increase in hydro generation and increase in net exports when CCGT units are added instead of SCGT units.
- The addition of the CCGT units provides economic export opportunities that are not present in the All Gas case.

- The CCGT units are utilized extensively in below-average water years, working in tandem with the reservoir operations to increase on-peak exports in those dryer years.
- At the reference market price levels used in the analysis, CCGTs operate to support exports and operate in lieu of on-peak imports in dry year conditions. SCGTs do not operate for export or in lieu of imports, operating only when import limits are reached.

B. Transmission

The LCA No New Generation alternative development plan features a transmission addition (modeled as the 750 MW line to Minnesota) as an import option. As noted in the discussion of the drought issues and the CCGT operation issues above, the transmission option in the LCA No New Generation Plan shows the potential value for transmission as an import option. In addition, the analysis of the PDP detailed model results show that the transmission addition in that case also serves to expand the use of the line for imports in below-average water years, providing drought hedge value to the MH system.

LCA Technical Appendices 3B and 9B provide additional information on our review of the transmission issues considered in several of the alternative development plans.

IV. Export Markets and Contracts

The LCA supplemental analysis provides additional information on the MH export contracts and term sheets. In the Initial Report and in Technical Appendix 7A, we reviewed the contracts regarding a number of the terms and conditions. In our supplemental analysis, LCA analyzed the pricing terms of those agreements and reviewed MH's modeling of those pricing provisions in the economic analysis. The details of this review are contained in LCA Supplemental Technical Appendix 7B. Our findings from that review are summarized below:

- LCA developed models of the pricing terms for each MH contract or term sheet included in the NFAT analysis to verify the representation of revenues in the MH analysis and to test sensitivity of those results to key assumptions.
- LCA's models approximate the aggregate value of the MH export contracts. MH did not provide its contract-by-contract analysis used as input to its NFAT analysis, thus we are unable to verify specific analysis of individual agreements.
- LCA confirmed that the pricing terms for firm energy reflect a premium over MH's energy price forecast. On average, for all of its contracts considered together, we found that MH should receive [REDACTED] above forecasted market prices for its firm energy from the contracts and term sheets.
- Our analysis also shows that the weighted average cost of the firm export contracts on-peak pricing [REDACTED]
[REDACTED] The MP 250 contract, the NSP 375/325 and 125 contracts, the WPS 100 and the WPS 300 Term Sheet pricing are all higher than this firm reference price benchmark.

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- Many of the contract prices are tied to an inflation index. However, they also include contractual price floors, such that there is no significant downside risk to the contract energy revenues due to inflation.
- We also note that the WPS 300 MW transaction is not a completed contract. Any final contract would require regulatory approval in Wisconsin and MH's ability to realize the prices and revenues assumed for this contract is subject to those added uncertainties.

V. Economic and Financial Analysis

The LCA supplemental analysis provides additional economic analysis of the alternative development plans. In the Initial Report and in Technical Appendix 9A, we reviewed MH's economic analysis methodology and results and offered our evaluation of the 15 alternative development plans that MH evaluated for inclusion in its NFAT economic analysis. In our supplemental analysis, LCA conducted additional analysis incorporating new analysis and information provided by MH (discussed above). The details of this review are contained in LCA Supplemental Technical Appendix 9B.

LCA also supplements its financial analysis with analysis of drought-related rate issues and a review of the rates aspects of the new plans. The details of this review are contained in LCA Supplemental Technical Appendix 10B.

Our findings from that review are summarized below.

In Section II of this report, we discuss the two additional alternative development plans that MH has evaluated and LCA has reviewed for this Supplemental Report. LCA conducted its own economic and uncertainty analysis of these two plans and compared those plans to the primary alternative plans included in the NFAT Submission. MH did not conduct financial modeling analysis of these additional plans and, accordingly, the LCA financial analysis on those plans is limited.

In addition, LCA conducted additional economic analysis of the components of the Preferred Development Plan to assess the value each component adds to the overall value. This analysis is offered to provide some information to address the specific requests for government approval to proceed with Keeyask, the MP 250 export agreement, the WPS 100 MW agreement, the 750 MW US transmission interconnection, and the WPS 300 MW export agreement (NFAT Executive Summary, page 1). Our supplemental economic analysis also includes additional sensitivity analysis addressing the export market price risks.

While there are many observations as shown below, there are seven high-level observations that should be considered in the NFAT review.

1. CCGT capacity can play an important drought risk impact mitigation role without any noticeable increase in costs under average water conditions
2. The use of non-generation resources such as managing demand through sponsorship of energy efficiency and heating fuel switching and increasing imports through strategic transmission expansion to the US has the potential to economically delay the need for generation investments whether they be natural gas or hydroelectric facilities.
3. Keeyask provides half or more of the economic value that would result in comparisons of the Preferred Development Plan to those without hydroelectric additions.
4. The economics of the combination of investing in the 250 MW transmission line with the Minnesota Power Contract has positive robust economics across uncertainties and independent of the other components within the MH system.
5. Conawapa and the 750 MW transmission line economics are tightly linked. The comparisons show that there are no benefits to adding either without the other.
6. Conawapa economics are not robust given the uncertainties and how the economics deteriorate when tested for various uncertainties.
7. From the Provincial View, the economics of the Conawapa investment are better than the analysis conducted from the perspective of MH and its ratepayers.

VI. NFAT Review Scope – Summary of LCA Findings

In this section of the report, we summarize the work that we have conducted in our Initial and Supplemental Reports. This summary is organized to align the work that LCA has conducted with the items that the PUB is to address in its report in accordance with the Terms of Reference (TOR).

A. MH's Justification of its Needs

LCA's SOW included analysis that addressed the assessment set forth in TOR Item 1.d:

The reasonableness, thoroughness and soundness of all critical inputs and assumptions Hydro relied upon for its justification of its needs. This should include Hydro's planning load forecast and future load scenarios, its demand and supply analysis, export expectations and commitments, and demand side management and conservation forecasts.

LCA reviewed MH's planning criteria for dependable energy and capacity. Our conclusions on this evaluation are summarized in our Initial Report at pages LCA-4 to LCA-5. Our detailed assessment of those aspects of MH's justification of the need is included in LCA Technical Appendices 1 and 3.

B. MH's Analysis of Preferred and Alternative Resources

LCA's SOW included analysis that addressed the assessment set forth in TOR Item 2.a:

If preferred and alternative resource and conservation evaluations are complete, accurate, thorough, reasonable and sound.

LCA reviewed MH's consideration of its Preferred Development Plan and alternative development plans throughout materials. LCA Technical Appendices 3A and B address the planning process and the reasonableness of the alternatives considered. Technical Appendix 2 reviewed the technology alternatives considered by MH. Technical Appendices 9A and 9B provide our evaluation of the economic analysis of the alternative development plans.

C. MH's Modeling of Export Contracts

LCA's SOW included analysis that addressed the assessment set forth in TOR Item 2.c:

The accuracy and reasonableness of the modeling of export contract sale prices, terms, conditions, scheduling provisions, export transmission costs, and the reasonableness of projected revenues.

LCA Technical Appendices 7A and 7B provide our review of the export contracts, with 7A addressing the terms and conditions and 7B addressing the pricing and revenue issues. LCA Technical Appendix 8 includes our assessment of the transmission issues associated with the export agreements and Technical Appendix 6 provides information on the export markets. LCA Technical Appendices 9A and 9B include economic analysis of the plans that include export contract assumptions.

D. MH's Forecasts of Inputs to Its Economic Analysis

LCA's SOW included analysis that addressed the assessment set forth in TOR Item 2.d:

The reasonableness of forecasted critical inputs including construction costs, opportunity export revenues, future fuel prices, electricity market price forecasts, the determinants of those values, and export volumes.

LCA Technical Appendix 2 addresses the assumptions on construction costs, relying on the work of Knight Piesold.

LCA Technical Appendices 6 and 9B address the opportunity export markets and revenue assumptions. LCA Technical Appendix 9B includes economic analysis of the opportunity export revenues, including an uncertainty analysis.

LCA Technical Appendices 9A and 9B include an economic analysis of all of the listed factors, relying in part on analysis of inputs on market prices from Potomac Economics.

E. MH's Evaluation of Risks and Benefits

LCA's SOW included analysis that addressed the assessment set forth in TOR Item 2.e:

The reasonableness of the scope and evaluation of risks and the benefits proposed to arise from the development and the reasonableness and the reliability of Hydro's interpretation of the most likely future outcomes as a result of climate changes, interest rate fluctuations, export market prices, domestic load fluctuations, droughts, competing technologies, fuel prices, carbon pricing, technology developments, economic conditions, Hydro's transmission positions and other relevant factors

LCA Technical appendices 9A and 9B include analysis of the set of factors listed.

F. Impact on Domestic Electricity Rates

LCA's SOW included analysis that addressed the assessment set forth in TOR Item 2.f:

The impact on domestic electricity rates over time with and without the Plan and with alternatives.

LCA Technical Appendices 10A and 10B address the issues regarding domestic electric rates. Also, Technical Appendices 9A and 9B show the economic analysis from the perspective of the domestic electric ratepayers, as well as an assessment from the perspective of the Province of Manitoba.

G. Financial and Economic Risks

LCA's SOW included analysis that addressed the assessment set forth in TOR Item 2.g:

The financial and economic risks of the Plan and export contracts and export opportunity revenues in relation to alternative development strategies.

LCA Technical Appendices 9A and 9B contain our economic analysis comparing alternative development strategies and economic risk factors. LCA Technical Appendices 5 and 10B include analysis of drought risk considerations.

Attachment C

Guide to La Capra Associates NFAT Scope of Work

Power Resource Planning and Economic Evaluation

Scope of Work Description	Associated Technical Appendix
1 From a supply perspective, assess the extent to which the Plan addresses the reliability and security requirements of Manitoba's electricity supply.	Technical Appendix 1: Resource Planning
2 Assess whether Manitoba Hydro's approach to comparing generation sequences follows sound industry practice.	Technical Appendix 3A: Alternative Resource Plans
3 Review reservoir operations of Lake Winnipeg for optimal value.	Technical Appendix 5: Hydrologic Risk
4 Review Manitoba Hydro's NFAT filings with respect to the Lake Winnipeg and Upper Nelson River Water Regime change and the potential mitigation costs to the NFAT projects.	Technical Appendix 4: Environmental Issues and Policy
5 Review the potential global warming impacts on water supply/river flows/lake and reservoir evaporation.	Technical Appendix 4: Environmental Issues and Policy
6 Develop power resource plans and alternatives, including identifying other scenarios that could potentially compete on an economic basis with Manitoba Hydro's Preferred Development Plan.	Technical Appendix 3B: Alternative Resource Plans
7 Incorporate exports (bilateral contracts and opportunity market pricing) into power resource planning.	Technical Appendix 1: Resource Planning
8 Evaluate the accuracy and completeness of Manitoba Hydro's export assumptions into MISO and other jurisdictions.	Technical Appendix 6: Export Markets
9 Comment on the practical role of merchant trading and energy imports.	Technical Appendix 3B: Alternative Resource Plans
10 Examine the No New Generation scenario and the potential for extended use of imports to meet Manitoba Hydro's domestic load requirements.	Technical Appendix 3B: Alternative Resource Plans
11 For all scenarios addressed, define the lower quartile, median and upper quartile impacts of natural gas supply pricing, coal pricing and wind pricing.	Technical Appendix 9B: Economic Analysis

Scope of Work Description	Associated Technical Appendix
12 Address the relative generation and integration costs of hydro, wind, natural gas turbines (single-cycle and combined-cycle) and Demand-Side Management.	Technical Appendix 2: Generation Alternatives
13 Assess the maximum deferral prospects for Keeyask G.S. and/or Conawapa G.S.	Technical Appendix 3B: Alternative Resource Plans
14 Comment on climate change impacts on energy supply and demand.	Technical Appendix 4: Environmental Issues and Policy
15 Test Manitoba Hydro's alternative scenarios and any new scenarios created for drought impacts.	Technical Appendix 5: Hydrologic Risk
16 Review and assess the reasonableness and completeness of Manitoba Hydro's sensitivity analysis of alternative development plans. Perform additional sensitivity analysis as required.	Technical Appendices 9A and 9B: Economic Analysis
17 Analyze the In-service cost and rate impact on domestic customers of the Preferred Development Plan and alternatives.	Technical Appendix 10A: Financial Analysis
18 Analyze the net and gross marginal cost of the Preferred Plan and Alternatives;	Technical Appendices 9A and 9B: Economic Analysis
19 Analyze the net present value of hydro power and natural gas generation;	Technical Appendices 9A and 9B: Economic Analysis
20 Assess the reasonableness of the Weighted Average Cost of Capital (WACC) approach, including consideration of different capital structures.	Technical Appendices 9A and 9B: Economic Analysis
21 Analyze the Internal Rate of Return (IRR), including an evaluation against hurdle rates.	Technical Appendices 9A and 9B: Economic Analysis
22 Review Manitoba Hydro's IRRs against prior IRR values presented in public filings.	Technical Appendices 9A and 9B: Economic Analysis

Business Case and Risk Assessment

Scope of Work Description	Associated Technical Appendix
1 Analyze the financial and economic risks of the Preferred Development Plan and export contracts and export opportunity revenues in relationship to alternative development strategies.	Technical Appendix 3A: Alternative Resource Plans
2 Assess whether the high-level summaries filed by Manitoba Hydro of net present value and internal rates of return reflect sound assumptions and calculations.	Technical Appendices 9A and 9B: Economic Analysis

	Scope of Work Description	Associated Technical Appendix
3	Enumerate any special consideration with respect to Crown-owned utility operations.	Technical Appendices 9A and 9B: Economic Analysis
4	Address estimate uncertainties involving large complex hydro projects.	Technical Appendix 2: Generation Alternatives & Technical Appendices 9A and 9B: Economic Analysis
5	Examine and evaluate the treatment of risk in Manitoba Hydro's development of Power Resource Plans and resource scenario models. Incorporate expert opinions on flood and drought risks and optimal strategy.	Technical Appendix 3A: Alternative Resource Plans & Technical Appendix 9A: Economic Analysis
6	Analyze the market value of clean energy from hydro power during various seasonal and peak or off-peak periods.	Technical Appendix 4: Environmental Issues and Policy
7	Address the future U.S. versus Canadian export opportunities.	Technical Appendix 6: Export Markets
8	Review Manitoba Hydro's filings and assess the accuracy, reasonableness and completeness of the relative values that Manitoba Hydro places on capital costs/energy supply.	Technical Appendices 9A and 9B: Economic Analysis; See also Technical Appendices 3A and 3B: Alternative Resource Plans
9	a Review the accuracy, reasonableness and completeness of presented alternative scenarios including an assessment of key variables such as: Time Frames [80 years]	Technical Appendices 9A and 9B: Economic Analysis & Technical Appendix 10A: Financial Analysis
9	b Alternative Time Frames of 20/40 years;	Technical Appendices 9A and 9B: Economic Analysis & Technical Appendix 10A: Financial Analysis
9	c Interest rates;	Technical Appendix 10A: Financial Analysis
9	d Inflation;	Technical Appendix 10A: Financial Analysis
9	e Discount rates;	Technical Appendices 9A and 9B: Economic Analysis & Technical Appendix 10A: Financial Analysis
9	f Present value calculations; and	Technical Appendices 9A and 9B: Economic Analysis
9	g Internal rate of return calculations.	Technical Appendices 9A and 9B: Economic Analysis
10	Review and compare the discount rate applied in the current analysis with prior discount rates used by Manitoba Hydro to assess consistency and reasonableness of the approach.	Technical Appendices 9A and 9B: Economic Analysis

The Commercially Sensitive Information contained within this report has been redacted in accordance with the protective order.

Scope of Work Description		Associated Technical Appendix
11 a	Review all significant scenarios employing other methodologies, including: in-service rate impacts	Technical Appendix 10A: Financial Analysis
11 b	the net present value of costs	Technical Appendix 10A: Financial Analysis
12	Within each scenario look for a clear business and value proposition for Manitoba ratepayers as well as Manitoba Hydro.	Technical Appendix 10A: Financial Analysis
13 a	Test each scenario for potential risks, including: Lower export market prices	Technical Appendices 9A and 9B: Economic Analysis
13 b	Higher interest rates	Technical Appendices 9A and 9B: Economic Analysis
13 c	Lower or higher domestic load growth	Technical Appendix 9B: Economic Analysis
13 d	Droughts	Technical Appendix 5: Hydrologic Risk & Technical Appendix 10B: Financial Analysis
13 e	Competing technologies	Technical Appendix 9B: Economic Analysis
13 f	Fuel price changes	Technical Appendices 9A and 9B: Economic Analysis
13 g	Carbon pricing	Technical Appendix 9B: Economic Analysis
13 h	Government and regulatory policy change	Technical Appendix 9B: Economic Analysis
13 i	Construction cost escalator	Technical Appendices 9A and 9B: Economic Analysis
13 j	Economic conditions	Technical Appendices 9A and 9B: Economic Analysis
13 k	Infrastructure failure	Technical Appendix 9B: Economic Analysis
13 l	Any other major risks identified	Technical Appendix 9B: Economic Analysis

Transmission Economics

Scope of Work Description	Associated Technical Appendix
1 Review and assess the impact of Manitoba Hydro's transmission positions on Manitoba Hydro's assumptions as to export revenue.	Technical Appendix 8: Transmission
2 Review and assess Manitoba Hydro's contemplated plan to partially fund U.S. transmission infrastructure and the financial benefits to be derived from such plan.	Technical Appendix 8: Transmission

Review of Manitoba Hydro Export Contracts

Scope of Work Description	Associated Technical Appendix
1 a Review and assess Manitoba Hydro's export contracts with U.S. counterparties for: Firm energy commitments;	Technical Appendix 7B: Export Contracts
1 b Firm energy pricing;	Technical Appendix 7B: Export Contracts
1 c Peak demand opportunity market sales;	Technical Appendix 7B: Export Contracts
1 d Off-peak period opportunity market sales;	Technical Appendix 7B: Export Contracts
1 e Adverse water clauses;	Technical Appendix 7A: Export Contracts
1 f Drought relief;	Technical Appendix 7A: Export Contracts
1 g Clean energy guarantees;	Technical Appendix 7A: Export Contracts
1 h Treatment of environmental attributes;	Technical Appendix 7A: Export Contracts
1 i Any other commercial obligations in the contracts and the implications on Manitoba Hydro and its counterparties	Technical Appendix 7B: Export Contracts

Financial Modeling

Scope of Work Description	List of Models Provided
<p>Development a financial model that would have the flexibility to change basic assumptions on factors affecting costs to Manitoba Hydro and MISO utility competitive market alternatives. The model should be able to quickly determine the metrics evaluating the timing and type of resources that could be in the Manitoba Hydro Development Plan, and should meet the following requirements:</p> <p>1 a-d (a) The model is expected to be set up within excel spreadsheets. (b) The model will not require detailed market simulation software to be used with each alternative business cases. (c) The model is expected to be used by La Capra Associates staff to support its independent analysis and report as well as examine cases desired by the NFAT and Interveners. (d) Model documentation will be prepared.</p>	<p>Probability Distributions Dynamic Rates Model - Ref Case POE Quilt Model Rate Inc Quilt Model Revenue LCOE Quilt Model</p>

Expanded Scope of Work

Scope of Work Description	Associated Technical Appendix
1 Economic Analysis sensitivity to alternative Discount Rates	Technical Appendices 9A and 9B: Economic Analysis
2 Economic Analysis sensitivity to changes in Export Revenue	Technical Appendices 9A and 9B: Economic Analysis
3 Economic Analysis sensitivity to CO2 Regulation	Technical Appendix 9B: Economic Analysis
4 Economic Analysis sensitivity to Alternative Drought Scenarios	Technical Appendix 5: Hydrologic Risk & Technical Appendix 10B:
5 Economic Analysis sensitivity to changes in Export Pricing	Technical Appendices 9A and 9B: Economic Analysis
6 Economic Analysis of Combined Cycle Resource Plans	Technical Appendix 9B: Economic Analysis

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Attachment D

Documents Received from Manitoba Hydro via SharePoint Site

January 15, 2014 through February 15, 2014

Document #	Title/Description	Date	Confidential Status
SP-134	NFAT Confidential - ALL CCGT Development Plan		Confidential
SP-135	NFAT Confidential -PlotData_2021_1987 for Lacapra	1/20/2014	Confidential
SP-136	NFAT Confidential PlotData_2032_1987_forLacapra	1/20/2014	Confidential
SP-137	NFAT Confidential -Ch10Drought_AllCCGT	1/20/2014	Confidential
SP-138	NFAT Confidential - New Import Line for Lacapra	1/20/2014	Confidential
SP-139	NFAT Confidential - for LCA 2013 Summary Cash Flows - justkeyaskdelayUpdated	2/14/2002	Confidential

Documents SP-001 through SP-133 are listed in Attachment B of the LCA Initial Expert Analysis Report.