March 2014 Redacted
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La Capra Associates

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

Initial Expert Analysis Report

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This report contains information that has been deemed Commercially Sensitive Information and is, therefore, subject to a protective order.

PREPARED FOR

The Manitoba Public Utilities Board

January 24, 2014

PREPARED BY

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(No Redactions)

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Acronyms

Initial Report

CCGT	Combined Cycle Gas Turbines
DSM	Demand Side Management
GS	Generating Station
HVdc	High Voltage Direct Current
IFPS	Interactive Financial Planning System
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
NCS	Northern Collector System
NFAT	Needs For and Alternatives To
NVP	Net Present Value
PDP	Preferred Development Plan
SCGT	Simple Cycle Gas Turbines
SOW	Scope of Work
SPLASH	Simulation for Long-Term Analysis of System Hydraulics
US	United States
WPS	Wisconsin Public Service Corporation

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La Capra Associates' Initial 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 Manitoba Hydro ratepayers. The PDP included the development of the Keeyask and Conawapa hydropower generation stations totaling 2,180 MW and associated transmission to connect these project to the MH systems, 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 Initial Report on our findings. This Initial Report and the technical appendices contain the results of our analysis to date and our observations and findings on the questions posed to us in our NFAT Scope of Work.

MH's proposal, by its own analysis, asks the Public Utilities Board to take a very long-term view, basing all of its economic analysis on a 78-year perspective and a single economic metric, lowest cost on a net present value (NPV) basis. Using that same analysis, we find that the economic advantage is very limited over the alternatives considered and that the internal rate of return (IRR = 6.15% over 78 years) and the payback period (break-even year of 2054) indicate a plan that is very dependent on estimated benefits that only accrue to the PDP in years 2055 and beyond. Further, using the IRR metric, the PDP does not perform as well as plans that exclude Conawapa. MH's own reference scenario analysis shows a plan that offers limited, at best, advantages over other alternatives.

MH's uncertainty analysis further reduces the benefits of the PDP. MH's assessment of uncertainty in discount rates, capital costs, and energy prices and probability assignments show the reference scenario result to be an overstatement of the benefits derived from a weighted average (expected value) of the uncertainty scenarios.

LCA concludes that the MH analysis, as presented, makes clear that the economic case for the PDP is marginal and requiring a very long-term perspective.

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Beyond MH's published results, our review identified a number of limitations and concerns with MH's planning methods, resource options assessments, alternatives considered, and sensitivity testing. Some of the concerns we discuss in our report and appendices include the following:

- MH's assessment of the year of need is very conservative.
- MH's assumptions regarding alternative generating options tend to overstate costs and ignore industry expectations on improvements over time.
- MH's economic modelling did not test the plan with standard metrics other than 78-year NPV, such as IRR, break-even, or interim period NPV.
- MH's selection of alternative development plans did not consider a sufficiently broad spectrum of alternative. (LCA is working with two additional alternatives that MH has since prepared.)
- MH's uncertainty analysis uses an unconventional comparison method that does not convey the relative performance of alternatives on comparable assumptions.
- MH has not established the need for expanded transmission to the US, particularly in cases without Conowapa.
- MH assumes very little uncertainly in the cost of Conawapa and the associated transmission facilities.

LCA is continuing its review of the MH analysis of the alternative development cases with data recently received from MH and will supplement this assessment when that review is complete. The balance of this report and the technical appendices and work papers provided in support of this report contain further discussion and analysis of the issues raised here and others that are responsive to elements of our NFAT SOW.

This report contains information that parties to this litigation may deem to be confidential and is, therefore, subject to the protective order in this case.

I. Introduction

A. Scope of Report

La Capra Associates (LCA) has prepared this Initial Expert Report (Initial Report) to provide the analysis and findings that we have reached, thus far, regarding our Need For and Alternatives to (NFAT) Scope of Work (LCA SOW) in accordance with Public Utilities Board amended schedule that calls for LCA to file its report on this date.

At this writing, progress on our scope is very much a work-in-process. LCA has only recently received information from Manitoba Hydro (MH) that is necessary for the completion of key elements of our SOW. This Initial Report provides the results of our work to-date and summarizes our preliminary findings from the work that has been completed.

The LCA SOW includes a number of tasks in five areas of investigation. Our full SOW is included as Attachment A to this Initial Report. 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 Modelling

Due to the interrelated nature of these areas of work, this 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 Modelling. 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.

Along with this Initial Report, we are submitting nine technical appendices. Like this Initial Report, many of these technical appendices are reports that are still works-in-progress. However, these technical reports contain substantial additional information and analysis on the observations and findings that are summarized in this report.

LCA will be continuing our progress on the remaining elements of our SOW of work and will provide a supplemental report as soon as it is practical. We appreciate the time that has been afforded us to complete this work and appreciate the time constraints of

this NFAT process. We have included a summary of our planned work activities and our plans for supplementing this filing and providing our final report.

B. La Capra Associates Approach

LCA organized its work into ten categories of work and have or will be submitting technical appendices and supplements in each of these areas:

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

All tasks specified in our SOW of work are addressed within these ten technical appendices. At this time, we are submitting nine of these reports, with several of those being issued as an initial report with a supplement to be provided upon completion of the balance of our SOW. We are not providing a report on Hydrological Risk at this time as much of the scope of that effort is 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 Information Requests 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.

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. We have attached a complete listing of the materials provided to us in this fashion, along with a numbering system that we have assigned to these documents for ease of reference. Throughout our technical appendices, we have citations to these documents where they are the source material for our work.

Lastly, a component to our SOW is to prepare economic and financial models for use in this proceeding. We have developed models in Excel spreadsheet format for our economic and financial analysis work and are providing copies of those models on disk as part of this submission.

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 this section of the report, we provide a summary of the key findings, issues, and concerns that we have identified in the planning methods and processes that are germane to the NFAT Application.

A. Planning Criteria

The following is a summary of our findings regarding MH's planning criteria as it was applied in its NFAT Application. These criteria pertain to the determination of need for new capacity and dependable energy supply.

- MH's criteria for energy and capacity are, in most respects, consistent with practices in the industry.
- We did find that MH's planning criteria to be very conservative with respect to the consideration of energy imports. MH recently revised its policy on energy imports in its planning criterion, limiting this source to the amount that can be imported during off-peak hours.
- MH's planning criteria inherently creates a system that produces surplus energy for export, given the dominant role of hydropower in MH's supply mix and its limited allowance for reliance on imported energy in planning. A surplus will exist in all but the driest of years and will be greater in years immediately following the additional of a large scale hydro power installation.

Additional discussion of the planning criteria can be found in LCA Technical Appendix 1: Resource Planning.

B. Resource Needs Analysis

Our review of these data shows that MH's conclusion regarding the year of energy need in 2022/23 and capacity in 2025/26 are very conservative. Using MH's forecasts and assumptions, there is low probability that the year of need for Manitoba load is earlier than those dates, there is a material probability that the year of need is several years later, and there are near-term options that could mitigate that need for several years. Our findings include the following:

- Considering only the impact of MH's lower 2013 load forecast and its load forecast sensitivity assessment, the year of need ranges from as early as 2020/2021 to 2032/33.
- MH's need analysis uses conservative assumptions on the availability of resources that could mitigate the need for new capacity. These include the assumed retirement of Brandon Unit #5, no renewal of diversity contracts, minimal assumption on DSM, and low reliance on imports in the analysis.

MH Preferred Development Plan (PDP) proposes to add energy and capacity in advance of the year of need (Keeyask GS in-service date of 2019). This addition is in advance of the year of need by MH calculation and could be in advance of the year of need by a decade.

In this context, the role of export market opportunities plays an important role in determining the need for the proposed facilities. MH's plan also includes the marketing of the surplus power that would result from the addition of Keeyask GS, including the proposed MP 250 MW export contract and marketing of other surplus firm supply that may be available. MH also discusses a "window of opportunity" in the export markets for the PDP that exists at the moment. Based on our assessment of the needs analysis for the domestic loads, these export market issues are central to the question the timing for the proposed plan.

Additional discussion of the year of need analysis can be found in LCA Technical Appendix 1: Resource Planning.

C. Resource Planning and Alternative Development Plans

Our review of the NFAT Application included consideration of MH's planning process for identifying and defining the alternative development plans featured in the economic evaluation of the PDP.

In our review, we have found the planning process and methods used by MH to have some limitations. MH's overall approach to this resource planning process is generally consistent with practices in the industry. However, due to the relatively unique power system, its planning models and methods require substantial time and effort. As a result, MH has more limited capacity to examine alternatives and conduct optimization that is typical in the industry.

MH considered the forecasted timing of resource need, as well as export opportunities, and manually created the alternative development plans using the resource options that passed the screening process. MH did not perform any optimization during the plan development process, so there is no analytical foundation for determining whether adjusting timing or parameters would produce a more beneficial result.

The various development plans are developed prior to any economic or financial analysis, and the plan configurations are not revised after this analysis. This single-pass process results in plans structured without the benefit of any analytical results. This is another way in which the plans are not optimally structured.

Another limitation of MH's process pertains to the consideration of alternative resource options. With respect to demand side management (DSM) options, none of the alternative development plans considered in the NFAT application considered DSM options. Other options were screened out and not evaluated in the alternative development plans, as well. MH has recently completed cases that pertain to expanded use of combined cycle generation in a plan and a plan that features fuel switching, DSM, and imports. We do note that MH has subsequently received a DSM potential study and is preparing several cases with DSM options, with the expectation that those will be made available in the near future.

The 15 plans evaluated represent a limited spectrum of possibilities. LCA has worked with MH to develop and model the two additional plans mentioned above. MH has recently completed those analyses.

LCA's review of the results of these plans will be submitted in a supplemental filing. Our supplemental filing will also provide further analysis associated with the 15 plans that MH featured in the NFAT application.

Additional discussion of the resource planning and alternative development plan analysis can be found in LCA Technical Appendix 3: 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. These include MH's system operations planning model (SPLASH[1]), its Economic Model, Economic Uncertainty analysis, and Financial Model.

1. SPLASH

SPLASH is integral to MH's planning process, using it to produce forecasts of system production costs and export market revenues for each of the alternative development plans. This analysis also produces forecasts of export market volumes, levels of dependable energy available, and energy production for each MH generating station.

SPLASH is a model developed by MH designed to simulate the unique characteristics of it hydropower system. While this has the advantage of being tailored to the MH system, it has the disadvantage of limited transparency to an outside reviewer. MH and LCA personnel have held a number of meetings and discussions to review the functionality and design of the SPLASH model. Through those discussions, we agreed on a set of output data reports that MH could produce to aide us in conducting the analysis of the SPLASH model results that are part of the LCA SOW. MH has recently provided those data reports and that information is currently under review at LCA. We intend to supplement our filing with additional analysis based on this data when that analysis is complete.

One of the key functions that the SPLASH model must perform to evaluate the MH system and the proposed expansions to its hydropower system is the representation of export market sales and revenue. LCA has evaluated the features of the model in this regard and have discussed that review in some detail in LCA Technical Appendix 6: Export Markets.

[1] Simulation Program for Long-Term Analysis of System Hydraulics.

We explored a number of issues in this review. The representations of the export market interactions are approximations that could impact the results. However, we have not identified any issues in these model functions that are likely to impact the comparison of alternative development plans in any significant way. The biggest concern is that pricing premiums used to model some transactions, especially the sale of surplus dependable hydro energy, are not well documented. Nor has it been proven that MH will be able to sell all of its surplus dependable hydro energy on a long-term basis. Our analysis of these issues requires review of the data received from MH recently and will be addressed further in a supplement to this report.

The biggest uncertainty in modelling export markets is the level of forecasted export market prices. Potomac Economics has performed an analysis of the Midcontinent Independent System Operator (MISO) market and a review of MH's export market price forecast. LCA will address this further in our supplemental analysis, as well.

Lastly, an additional LCA SOW item that will be addressed in a supplemental filing is the hydropower operations and optimization. We are not in a position to provide an analysis at this time as this work relies on the MH SPLASH data recently received by LCA.

2. Economic Model

MH's Economic Model is a spreadsheet model that is used to conduct the economic analysis of the alternative development plans. It is used to compile forecast of future operations costs and market revenues (SPLASH output) and capital spending into a forecast of future costs and market revenues. The model is used to derive the net present value (NPV) of those costs and revenues over the planning period to compare the economics of alternative development plans.

MH provided detailed PDFs or worksheets of Economic Model output in lieu of working versions of the Economic Model. LCA created our own working economic model to conduct our review of MH's work and to conduct the analysis required of us in the LCA SOW. A working version of this model is provided in the work papers accompanying LCA Technical Appendix 9: Economic Analysis. Through the process of building this model, we have been able to replicate MH's results and confirm our understanding of the functionality of the MH Economic Model.

LCA has a number of comments and concerns with MH's Economic Model and the features of the economic analysis structure. Specifically, the key issues we identified with the MH economic analysis approach are as follows:

1) The economic differentials at the end of 78 years between the alternative development plans is relatively small compared to the scale of the investments proposed in the PDP. The relative economic value of the plans considered can be materially affected by relatively small changes in assumptions.
2) A 78-year planning horizon analysis is particularly susceptible to forecast uncertainty.
3) MH's singular focus on the 78-year Net Present Value metric as the basis for comparing alternative development plans is too limited in scope for a decision of this magnitude. MH does not offer any comparative metrics that capture important differences in the plans through the study period that bear on the timing of costs and benefits and the associated risks.
4) MH's use of an unleveraged cash flow analysis for its economic evaluation is a relatively simple approach for economic analysis of alternative plans with investments of the scale that are under consideration in this NFAT proceeding.
5) MH does not feature the annual differences in cash flow between the plans in its application, which is important foundational information for assessing relative ratepayer cost and risk implications between the alternative plans. LCA has prepared those comparisons.
6) MH does not provide a break-even evaluation of the alternative plans. This analysis provides important information on the time required for proposed investments to provide benefits and on assessing implications of forecast risk. LCA has prepared comparisons of the plans using a cumulative NPV analysis.
7) MH does not provide conventional metrics comparing alternative plans over time. LCA has prepared comparisons of the alternative plans for 20-year, 35-year and 50-year NPV analysis and internal rate of return (IRR) analysis.

The MH economic modelling for the 78-year study period includes a 35-year detailed evaluation of the alternative development plans with SPLASH. For the balance of the study period, years 36 to 78, system operations, loads, and market interactions are being

represented with much less detailed evaluation. Overall, there is both simplified modelling and the inherent reliance on very long-term projections to derive the 78-year NPV results that MH has presented.

Further explanation of each of these critiques is provided in LCA Technical Appendix 9: Economic Analysis.

3. Economic Uncertainty Analysis

MH conducted an uncertainty analysis as part of its economic analysis presentation in the NFAT Application. MH evaluated the alternative development plans in its Economic Model treating three variables as uncertain: Discount Rate; Energy Prices; and Capital Costs. For each of these three variables, MH defined the uncertainty with three values (low, reference, and high) and assigned its assessment of the probability of those three values occurring. For each alternative development plan, MH used the Economic Model to evaluate the 27 combinations of inputs to develop a distribution of economic results for those plans.

As with the Economic Model, LCA created our own working uncertainty analysis model to conduct our review of MH's work and to conduct the analysis required of us in the LCA SOW. A working version of this model is provided in the work papers accompanying LCA Technical Appendix 9: Economic Analysis. Through the process of building this model, we have been able to replicate MH's results and confirm our understanding of the functionality of the MH Economic Model. We have also constructed an alternative formulation which we view as a better approach to considering the uncertainty cases MH has evaluated.

Our concerns with the MH uncertainty analysis methodology are several.

First, the uncertainty methodology relies on the Economic Model for all of its analysis. Thus, all of the issues discussed above regarding the Economic Model are resident in the uncertainty analysis.

Secondly, MH's method of comparing cases and presenting the results is unconventional and can be misleading, as a result. MH's method compares all cases to a single case, All Gas using reference case assumptions on discount rate, energy prices, and capital costs. This does not compare the performance of All Gas to the other plans with comparable sets of assumptions. We view such comparison to be more informative and a more conventional practice for this method of analysis. LCA has developed a model that does the comparative analysis of MH's cases. The LCA Methodology provides a comparative analysis across plans on consistent assumptions of uncertain parameters. Using this method with MH's economic analysis results and probability assessments, the comparative assessments of the plans are quite different than depicted in the MH S-Curve analysis.

Thirdly, MH reports only one performance metric in its uncertainly analysis results, 78-year NPV. LCA has developed a broader set of metrics to display, which we believe provides a more complete perspective on the results of the analysis for decision makers.

Lastly, the assessment of probabilities that MH used to develop its probabilities for the uncertainty scenarios begins with opinions of experts at a given point in time as the key inputs. The probabilities are very important input assumptions that can be changed to reflect updated information or differences of opinions. LCA is concerned that the perspective of the experts that was captured in the probabilistic analysis has likely changed in the two years since the analysis was conducted.

Further explanation of each of these critiques is provided in LCA Technical Appendix 9: Economic Analysis.

4. Financial Model

MH's Financial Model involves a Unix-based programming language—interactive financial planning system (IFPS)—to develop its "FINFOR" proprietary financial model. This model is used in conjunction with EXCEL spreadsheet model to calculate a set of metrics that were provided in the analysis of development plans provided in the NFAT filing. It is used to compile forecast of future operations costs and market revenues (SPLASH output) and capital spending (Economic Model output) into a financial analysis of MH operations. The model is used to derive the rate increase and debt/equity metrics for a development plan over a 50-year period to compare the financial performance of alternative development plans.

The financial analysis uses a 35-year time period (coinciding with the period for which SPLASH simulates system operations) with additional extrapolation to extend the analysis to 50 years. All analysis was performed in nominal dollars, which contrasts with the economic evaluation results that were provided in constant dollars.

We have some concerns with the MH financial analysis methodology, as well.

First, the financial modelling process is time consuming, limiting its use in the analysis. MH performed a financial evaluation of a more limited set of development plans than in the economic analysis. The more limited set of plans exclude wind facilities and only examine gas, hydro, and gas/hydro plans. MH has represented that performing additional financial modelling is very time consuming.

Second, MH prepared a limited set of financial metrics for the NFAT Application. In particular, its metrics for rate impacts were annualized averages over the 50-year period to compare plans, but not to provide specific insight into temporal rate impacts that may result from the alternative plans.

Lastly, MH did not provide a working version of its financial model to LCA for this review. As with the Economic Model, LCA developed a spreadsheet model that provided an approximation to MH's framework to test use of alternative financial targets and the subsequent impact on the rate impacts across development plans. In particular, we examined the impact of altering the target year for the D/E ratio while keeping the target value the same. A working version of this model is provided in the work papers accompanying LCA Technical Appendix 10: Financial Analysis.

III. Resource Options

The LCA SOW included a number of items that required the examination of MH's assumptions on resource options considered in developing the alternative development plans considered in the NFAT Application. In this section of the report, we provide a summary of the key findings, issues, and concerns that we have identified with respect to MH's consideration of resource options in the NFAT Application.

A. Generation Options

MH considered a number of generation alternatives in its development of the alterative development plans included in the NFAT Application. Some of these options were considered in screening, others were featured in one or more of the alternative development plans.

With respect to the screening process, LCA found the MH process to have some limitations. The issues we identified include the following:

- Some of MH cost assumptions were out of date;
- MH did not consider any changes in technology costs or characteristics over time;
- MH levelized cost analysis does not incorporate any uncertainties; and
- The comparison of technologies with different operating profiles, characteristics, etc. on an equivalent levelized cost of energy basis can be misleading.

The following is a summary of our review of MH's assessment of these options. More detail on our review is provided in LCA Technical Appendix 2: Generation Alternatives.

1. Hydropower Options

In addition to the Keeyask and Conawapa projects, MH's screening analysis review the other potentially developable sites in Manitoba. Other sites were screened out due to costs and lead time considerations. Independent Expert Knight Piesold (KP) has reviewed the cost estimates and construction management strategies for Keeyask and

Conawapa. Our report relies on KP's review. LCA will be incorporating its findings on costs, contingencies and uncertainties in project costs in our supplemental analysis.

2. Natural Gas-Fired Generation Options

MH evaluated three configurations of natural gas generation: a heavy duty combined cycle gas turbine (CCGT), heavy duty simple cycle gas turbine (SCGT) and an aeroderivative simple cycle gas turbine. The CCGT and SCGT were included in several alternative development plans. KP offers a review of the MH cost estimated for these options in its report. Two issues have been identified with the MH assessment of these options:

- MH's assumed uncertainty bandwidth for the cost of these turbines of -30% to +50% for the capital costs excessive given the experience with these turbines in the industry.
- MH's analysis does not factor in any anticipated improvements in efficiency over time in the future in its planning.

LCA will be incorporating these findings on costs, contingencies and uncertainties in project costs in our supplemental analysis.

3. Wind Power Options

MH included wind in its resource screening and featured wind in two of its 15 alternative development plans. LCA conducted a review of MH assumptions and KP also provided an assessment of MH wind technology costs in its report. The following issues have been identified with respect to the wind resource option:

- MH's capital costs estimates are significantly overstated as they do not recognize recent development in cost, particularly for projects in North Dakota and elsewhere in the region.
- MH estimate of capacity factor for wind turbines is 5% to 10% lower than new projects in the region are able to achieve.
- MH's analysis does not factor in any anticipated improvements in costs or efficiency over time in the future in its planning.

- MH's assumption on project life, 20 years, is on the low end of the range of typical industry estimates.

LCA provides a sensitivity analysis on these issues in LCA Technical Appendix 3: Alternative Development Plans and will be incorporating these findings on costs, contingencies and uncertainties in project costs in our supplemental analysis.

4. Solar PV

MH considered solar PV in its screening process, excluding it from further consideration based on costs. Industry sources show that both solar costs are projected to decline over time. Solar was screened out of consideration for inclusion in the development plans based on its current high cost and MH despite projections that installed costs will be a quarter of their current value by 2030.

5. Other Options

MH considered coal, nuclear, geothermal and biomass and screened each of these options out based on cost and other factors.

B. Demand Side Management

MH provided information on DSM options in the NFAT Application. However, MH did not include DSM in any of the alternative development plans considered. MH has obtained a DSM potential study since the NFAT Application filing was prepared and is currently preparing several alternative development plan cases with varying levels of DSM investments. LCA understands that MH intends to complete those analyses in the coming weeks. We will review those assessments when provided if sufficient time is provided. LCA will also be addressing in our supplemental analysis an additional case that MH recently completed at our requests that includes DSM, fuel switching and imports.

C. Transmission

Transmission development is integral to MH resource planning whether to integrated new, large hydropower facilities into its system, to transmission power from the north

to the south of the province, or to facilitate exports or imports of power. LCA reviewed the transmission projects as it pertains to MH's resource planning analysis, and the economic and risk issues associated with the alternative development plans.

LCA Technical Appendix 8: Transmission Economics provides additional information on our review of the transmission issues considered in several of the alternative development plans. Independent Expert Power Engineers also provides information on those proposed lines in its report.

1. Keeyask Interconnection Project

The Keeyask Interconnection project includes four transmission lines that will transmit the power from the unit to a new switching station and three new 138 kV transmission lines which will be utilized to transfer power from the Keeyask generator to Radisson Converter Station. The Keeyask power will be transferred south through the three-bipole HVdc system. While managed as a separate project, this transmission facility is an integral and essential component of the Keeyask project to enable the project to deliver its output to the Northern Collector System (NCS).

The costs for these transmission facilities, as currently estimated are included in the costs of the Keeyask facility in the economic modelling.

The Interconnection Facilities Study remains to be completed, which will address issues identified in the Interconnection Evaluation Study (2012), including voltage and transient stability. There is potential for the results of that study to require some additional facilities that would add to the current cost estimate.

2. Manitoba to Minnesota Transmission Project (500 kV)

MH is proposing to construct a new 500 kV transmission line between Dorsey and the US border and all the peripheral equipment with a proposed in-service date 2020/2021, timed to coincide with the in-service date of the Keeyask Project. This project is planned to increase the transfer capability between Manitoba and the US by 750 MW. This facility was conceived to accommodate the firm transfers of power contemplated in the PDP, including Keeyask and Conowapa construction and the firm export contracts contemplated.

LCA has review the information submitted in the NFAT Application, as well as more recent transmission system studies conducted by MH and MISO to examine the requirements for the facility and associated system upgrades. LCA Technical Appendix 8: Transmission Economics includes our assessment of the issues and concerns and refer you to that for details, as much of the information reviewed is confidential. The nature of the issues we considered includes:

- Basis of the need for the requested transfer capability;
- The project costs and potential for any added costs;
- The reasonableness of the study assumptions; and
- The cost risks to MH in the event that absent WPS participation in the project.

3. Manitoba to US Transmission Alternative (230 kV)

MH has included a 230kV transmission alternative to the Manitoba to Minnesota Transmission Project which is featured in some of the alternative development plans. This project is planned to increase the export transfer capability between Manitoba and the US by 250 MW, with options to increase import transfer capacity by 50 or 250 MW. This facility was conceived to accommodate the firm transfers of power contemplated in some alternative development plans with lower levels of required firm exports.

MH has not developed this project in as much detail as the 500 kV option. However, it is has been studied in the transmission system studies mentioned above for some conditions, although not for all of alternative development plan configurations which include this option. LCA addresses this option in LCA Technical Appendix 8: Transmission Economics, as well.

3. Conawapa Interconnection

The transmission requirements associated with the development of the Conawapa generation station will differ in plans where Keeyask is built and plans where it is not. MH has prepared an *Integrated Transmission Plan for Keeyask and Conawapa Generation* that focuses on the case where both projects are constructed.

Assuming Keeyask is constructed; MH's North-South Project is contemplated for integration of Conawapa generation into the NCS and providing sufficient transmission capacity to move all firm power to southern Manitoba. The combined generation in the north with both Keeyask and Conawapa in-service exceeds the transfer capability of the three-bipole HVdc line. Thus, the interconnection includes a 230 kV AC transmission line to provide added transfer capacity from the north to the south. In addition to this 230 kV transmission line and any associated system upgrades needed, a set of transmission facilities will be constructed to connect the facility to MH's NCS and the NCS is to be split into two systems to manage the transfer of the power to the south. These facilities are all integral and essential components of the Conawapa project to enable the project to deliver its output to the NCS and to southern Manitoba.

The need for transmission facilities in southern Manitoba and into the US is also dependent upon whether Keeyask is developed, and if so, the nature of the transmission facilities developed for export to the US. The 500 kV Manitoba to Minnesota Transmission Project has been planned assuming both Keeyask and Conowapa. If Keeyask and that facility are constructed, the added requirements for Conawapa should be limited. However, should those facilities not be developed or if Keeyask is developed without US transmission or with the smaller 230 kV alternative, the requirements for Conawapa may change.

LCA Technical Appendix 8: Transmission Economics includes our assessment of the issues and concerns regarding Conawapa transmission and we refer you to that for details, as much of the information reviewed is confidential. The nature of the issues we considered includes the following:

- The project costs and potential for any added costs; and
- The reasonableness of the study assumptions.

D. Imported Power

Related to the prior discussion on transmission, MH identified imports as a feasible resource option in its screening analysis. Yet only a few plans feature additional import development, and none of the plans are specifically formulated to take advantage of excess capacity in MISO in lieu of constructing new domestic resources. Also, as noted earlier in the discussion of Planning Criteria, MH has adopted a policy to limit the reliance on imports.

MH has considered two transmission options associated with the export marketing attendant with the Keeyask GS and Conawapa GS developments: a 500kV (750 MW) and a 230 kV (250 MW). However, MH's planning does not consider an option to construct transmission for imports.

At LCA's request, MH has recently completed a new development plan case that postulates construction of the 500 kV line for imports, along with assumption for DSM and fuel switching within Manitoba. LCA will be evaluating that plan and addressing the results in our supplemental analysis.

IV. Export Markets and Contracts

The LCA SOW included a number of items that required the examination of MH's proposed export contracts and export markets. In this section of the report, we discuss our work on these topics.

A. Export Markets

MH's PDP proposal relies on exports of surplus power through firm long-term contracts, shorter-term firm sales, and opportunity sales of surplus energy. LCA Technical Appendix 6: Export Markets reviews the export market opportunities and MH's representation of them. In addition, LCA Technical Appendix 4 includes a discussion of renewable energy policies in the US and the market opportunities for MH to participate in those markets. The following is a summary of our findings on export markets.

In general, MH has presented a reasonable portrayal of its export market opportunities in the NFAT Submission. MH's primary export market is likely to continue to be the US, specifically the MISO region. The MISO region provides export opportunities through both bilateral contracts with utilities in the region and through formal markets administered by MISO. Historically, bilateral contracts have been MH's primary method for exporting power to the US, and this is likely to remain the case for the foreseeable future. However, starting in 2005, the MISO-administered markets have created new opportunities for spot market trading and have created increased price transparency. These market benefits are likely to continue to increase as the MISO-administered markets evolve over time.

MH's primary export market opportunity to other Canadian provinces is Saskatchewan, which has a purely bilateral market. It appears MH is making reasonable efforts to expand exports to this region through negotiations with SaskPower, which is the largest utility in the province.

Significant expansion of exports to Ontario or Alberta would require substantial changes to the market. MH participates in the Independent Electricity System Operator-administered energy spot market in Ontario, but this market has lower average prices

than other market regions, including MISO, making it generally less attractive for spot market sales. A bilateral agreement for power export to Northwest Ontario is currently hindered by Northwest Ontario's policy to diversify its portfolio and reduce reliance on hydro power, as well as policies favoring in-province generation throughout Ontario. Ontario's policies favoring in-province generation also hinder MH's ability to make a new major bilateral agreement to sell power to Southern Ontario. Such a sale would also require greater transmission access to the Toronto area, which is a long distance from Manitoba. Alberta Electric System Operator operates a spot market in Alberta, which currently has prices that indicate Alberta would be an attractive market for MH.

However, new transmission investment would be required to expand MH's access to Alberta, which is also a long distance from Manitoba.

B. Export Contracts

MH's PDP features long-term firm export contracts to US utilities. The contracts are linked with MH's development of new hydropower facilities. Due to the size of the Keeyask and Conawapa projects relative to load growth in the province, the export contracts mitigate the surpluses that occur when the proposed facilities would come into service and to mitigate the cost impacts on MH domestic ratepayers.

LCA has conducted a review of the proposed export contracts. We offer a summary of the contracts that are featured in the alternative development plans here. Our assessment is contained on LCA Technical Appendix 7: Export Contracts. Given that the entirety of the contracts and much of the related materials reviewed for that report is Commercially Sensitive Information, we refer you to that report directly for our assessment.

1. Minnesota Power 250 MW Agreement (MP 250)

MH has entered an agreement with Minnesota Power (MP) to sell 250 MW of firm system power to MP for 15 years, starting on June 1, 2020. This contract is contingent on Keeyask start of construction by 2016 and a joint initiative to develop the transmission capacity necessary to deliver this power to MP. MH has the option to exit this agreement in the event that Keeyask is not constructed and affords MH some flexibility on the dates for start of construction and start of operations.

MH has indicated that it is seeking government approval of this agreement in this NFAT application along with its request for approval of the Keeyask facility and the Manitoba to Minnesota Transmission Project (500kV).

The MP 250 Agreement is integral to the economics of the proposal to develop the Keeyask facility and the basis for the joint effort to develop the Transmission Project.

2. Wisconsin Public Service 100 MW Agreement (WPS 100)

MH has entered into an agreement with Wisconsin Public Service (WPS) to sell 100 MW of firm system power to WPS for eight years, starting on June 1, 2021. This agreement is an extension of an existing agreement for 108 MW.

MH has indicated that it is seeking government approval of this agreement in this NFAT application along with its request for approval of the Keeyask facility and the Manitoba to Minnesota Transmission Project (500kV).

3. Wisconsin Public Service 300 MW Negotiations

MH is in negotiations with WPS for up to 300 MW of System Participation and Surplus Energy Sales. MH is unable to offer further description on these negotiations since they are ongoing. WPS had, initially, also expressed interest in funding the proposed new 500 kV Transmission Project. However, WPS recently notified MH it was no longer interested in funding new transmission.

MH has indicated that it is seeking government approval of this proposed agreement in this NFAT application along with its request for approval of the Keeyask facility and the Manitoba to Minnesota Transmission Project (500 kV).

4. Additional Agreements

MH has also entered two additional agreements that are contingent on MH hydropower development.

MP Energy Exchange is a 15 year agreement to exchange energy with MP, up to 250 MW in any hour, starting on June 1, 2020. This agreement is coterminous with the MP 250 System Power Agreement.

NSP 125 is an agreement to sell 125 MW of firm system power to Northern States Power for four years, starting on May 1, 2021. This agreement is contingent on start of construction of at least 1,000 MW of new hydropower facilities by May 1, 2018.

MH has not indicated that it is seeking government approval for either of these agreements in this NFAT application.

V. Economic and Financial Analysis

The LCA SOW included the examination of MH's economic and financial analysis of the alternative development plans and the development of models to allow LCA and others to conduct sensitivity analysis and alternative case analysis. At this juncture, our work has focused on the examination of MH's analysis and sensitivity work, as well as model development. Our economic and financial analysis will be supplemented upon our review of the detailed SPLASH model data only recently made available to us, as well as the two additional alternative development plans.

In Section II of this report, we discuss our observations and concerns regarding MH planning methods, which includes its economic and financial planning methods. In this section, we provide our observations and concerns regarding the economic and financial analyses MH has presented in its NFAT Application and the observations we have made from the additional analysis LCA has conducted.

In this section of the report, we discuss the work we have done to-date on these topics.

A. Economic Analysis

MH conducted economic analysis on 15 alternative development plans presented in the NFAT Application. The economic analysis was conducted to provide a comparative economic assessment of the plans based on reference scenario assumptions, based on a set of uncertainty scenarios, and from the perspective of the Province of Manitoba.

LCA reviewed MH's economic analyses and developed spreadsheet models enabled LCA to replicate and test MH's analysis and to conduct additional uncertainty and sensitivity analysis. Our observations and findings on these issues are summaries in this section.

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1. Reference Scenario

LCA has a number of comments and concerns resulting from our review of the MH Economic Analysis of its Reference Scenario analysis. Specifically, the key issues we identified with the MH reference scenario analysis of the alternative development plans are as follows:

- Based on MH's reference case analysis, it takes at least 30 years, until 2043, before any development plans studied is lower cost than the All Gas Plan, with the PDP requiring 41 years (2054) to break even versus the All Gas Plan.
- When interim period economic analysis results are used to measure economic performance of plans under MH reference scenario assumptions (20-, 35- and 50-year NPV), the PDP is not the lowest cost resource plan alternative. Using a 50-year NPV metric, Plan 4 (Keeyask, Gas24, 250 MW transmission) has higher NPV.
- The IRR of the development plans compared to All Gas Plan are only slightly higher than the discount rate. The Plan with the highest 78-year IRR is Plan 4 and not the PDP.
- The magnitude of the 78-year NPV benefits in MH's reference scenario analysis for each of the plans relative to the All Gas plan after 78 years are small relative to the added capital investment in those plans.
- Based on these last two points, it is apparent that the economic margins between the alternative development plans, using MH's reference scenario analysis, are very small. Small changes in assumptions could alter the ranking of any of these plans.
- Based on a 35-year NPV metric, Plan 4, Plan 5 (Keeyask, Gas 25, 750 MW transmission) and All Gas are the most economic plans using MH Reference scenario assumptions.

2. Economic Uncertainty Analysis

LCA has a number of comments and concerns resulting from our review of the MH Economic Uncertainty Analysis. We provide an uncertainly analysis using LCA's methodology. (See critique of MH methodology in Planning Methods.) Specifically, the key results from our analysis of uncertainty based on MH's resource scenarios and probability assumptions are as follows:

- The reference scenario benefit that each of the alternative developments has when compared to the All Gas Plan (discussed above) is much lower based on the expected value. This indicates that the MH reference scenario assumptions are not a reasonable proxy for the value obtained with all of its scenarios considered. MH's reference case assumptions are more favorable to the plans with hydropower investments than the results of the uncertainty analysis.
- Given this result, the margins and IRRs for the PDP and other alternative plans are even smaller than those computed with the reference scenario.
- The expected benefits 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 requires a long-term view of benefits and comfort with possibilities of upside benefits that accrue in the latter years of the planning horizon.
- The LCA Methodology provides a comparative analysis across plans on consistent assumptions of uncertain parameters. Using this method with MH's economic analysis results and probability assessments, the comparative assessments of the plans are quite different than depicted in the MH S-Curve analysis.
- When interim period economic analysis results are used to develop metrics for 20-, 35- and 50-year study periods, the PDP does not appear to be the lowest cost resource plan alternative even when a probabilistic scenario analysis covering 27 scenarios is included.

- Plans with Keeyask GS but without Conawapa GS have more favorable economic profile in the uncertainty analysis relative to the PDP.
- Based on a 35-year NPV metric, the All Gas plan is the most economic plan using MH uncertainty scenario assumptions.

3. Sensitivity Analysis

LCA performed various sensitivity tests to understand how robust the observations and conclusions are that were made by MH, given that there can be differing opinions on certain core assumptions. The sensitivities chosen by LCA are not intended to be extremes, but are intended to be reflective of more current information, the opinions of IECs in this proceeding, or to reflect a risk factor. The key observation we draw from the sensitivity analyses are the following:

1. A modest increase in discount rates or the elimination from consideration the low discount rate scenarios postulated by MH would make the PDP have the same present values of costs over 78 years as the All Gas Plan on an Expected Value basis. The ranking of the plans is sensitive to discount rate assumptions.
2. Several plans are more economic than the PDP, even over 78 years, when higher discount rates are assumed.
3. Modest increases in Capital cost assumptions for the Keeyask and Conawapa projects would also result in other Development Plans having lower costs than the PDP, even over 78 years.
4. A slightly lower view of export market prices substantially erodes the MH expected economic benefits of the PDP.
5. The economics used by MH to arrive at its preference for the PDP is not robust and, depending upon the perspective of the decision maker, could actually conclude that other development plans are preferred. As noted above, the margins are small on reference scenario assumptions, smaller on an expected value basis, making the comparative results between plans very sensitive to the assumptions tested.

4. Provincial Perspective

LCA reviewed MH's analysis of the economics of the alternative development plans from the perspective of the Province of Manitoba. This analysis considers costs to MH which are payments made to the Province that do not have a cost to the Province (i.e., essentially a tax payment of sort). MH has identified three candidate costs which can be labeled as Provincial Transfer Payments: Water Rental Fees, Capital Tax, and the 1% Provincial Guarantee Fee on Borrowing made on behalf of MH.

Important observations that would we make from the Province of Manitoba Perspective analysis are as follows:

1. La Capra Associates, in consultation with Morrison Park Associates, does not agree with MH's assessment that the 1% interest rate guarantee fee that the Province of Manitoba adds to the borrowing costs is a Provincial Transfer Payment. This fee is believed to be compensation to the Province for it taking on potential costs should the loan guarantee be needed. LCA agrees with the MH assumption that water rental fees and the capital tax collected can be considered Provincial Transfers.
2. The removal of the Provincial Transfers as 'costs' of the Development Plans provides measurable improvement the present value metrics used in the economic analysis for the development plans with Keeyask and/or Conawapa The Provincial Perspective results shows that development of Keeyask and some new transmission to be a common element among the lowest cost plans of the 15 Development Plans studied in the NFAT application by MH.
3. The Provincial Perspective results would not favor developing Conawapa unless there is a willingness to give 78-year NPV metrics more weight than the 50-year NPV metric.
4. The benefits of the PDP over other plans accrue after year 50 of the study, even from the Provincial Perspective.
5. The PDP is not lowest cost through the next 50 years even from the Provincial Perspective.

6. The Provincial Perspective Analysis shows that at least half of the positive benefits of development plans that develop either or both of the hydroelectric stations are captured by the Province and not MH electric ratepayers.
7. In the first 35 years of this study the Province of Manitoba would collect tax benefits from the hydroelectric development, even when the development plan has yet to yield benefits to MH customers on a present value basis.

5. Economic Analysis Conclusions

Our review of the NFAT Application's Economic Analysis included consideration of MH's economic and planning models and methods as they have been used in the Economic Model, its Economic Uncertainty analysis and MH's assessment of the Development Plan economics from the Province of Manitoba Perspective. While there are many observations that we draw from this analysis, there are four high level observations that should be considered in the NFAT review.

1) Alternatives metrics, such as IRR and Break-Even Year do not show the PDP to be the lowest cost development plan.
2) The use of Net Present Value (NPV) metrics for different points in time, other than the end of 78 years, show that many other development plans, including the All Gas Plan, are lower cost than the PDP for at least the next 40 years.
3) The conclusion that the plan that includes Keeyask, Conawapa, a 750 MW Transmission Line, the WPS Contract and Investment based upon MH's analysis and observations should be the PDP is not robust to withstand simple sensitivities to changing assumptions, such as capital costs, discount rates and energy prices. In addition, in those cases where the PDP is the most economic, the benefits of that case generally result from the upside value in more than 50 years into the future.
4) While a Provincial Perspective in this study shows improved economics for all the development plans with either or both Keeyask and Conawapa, there are other plans with metrics superior to the PDP even when taking the Provincial Perspective

More detail on the LCA economic analysis review is provided in LCA Technical Appendix 9: Economic Analysis. The LCA economic work papers and models in Excel spreadsheet format is being provided disk as part of this submission.

B. Financial Analysis

MH conducted financial analysis on five of the 15 alternative development plans presented in the NFAT Application. The financial analysis was conducted to provide a comparative assessment of the plans regarding their impact on rates paid by its (domestic) customers and on the financial strength of MH. MH evaluated rates using an "even-annual" rate increase metric and using the level of retained earnings as a financial strength metric.

LCA reviewed MH's financial analyses developed a spreadsheet model that provided an approximation to MH's framework to test use of alternative financial targets and the subsequent impact on the rate impacts across development plans. Our observations and findings on these issues include:

Rate Impacts:

- Using the metric of even-annual and cumulative percentage increases, MH concluded that the All Gas plan had the lowest increases over the shorter term (until 2031/32) but that the Preferred Plan had the lowest rate increases over the entire study period. However, use of the same results to calculate different metrics showed that is not clear that the Preferred plan has the lowest rate increases over the entire study period.
- LCA's analysis estimated the actual rates that would be paid by domestic customers and found the rates could vary over time with significant increases forecasted toward the end of the study period.
- LCA examined the impact of altering the target year for the Debt/Equity ratio while keeping the target value the same. Moving out the target year serves to smooth out (and reduce) the rate increases of the capital intensive plans (and thus reduces their rate impacts on an NPV basis).

- LCA considered a metric of the NPV of the rate increases in the development plans. Using this metric, the Plan 4 (Keeyask 2019, Gas, 250 MW Transmission) performed better than the PDP.
- Over the first 20-year period, the Preferred Plan has the second highest NPV of rate increases, and even over 40 years the Preferred Plan only attains a middling rank when compared to the other development plans.

Financial Strength:

- MH uses the level of retained earnings as a measure of financial strength.
- With the financial plans designed to reach 75/25 Debt/Equity, the capital intensive plans (those with Keeyask and Conawapa) reach the highest level of retained earnings. The All Gas Plan has the lowest level of capital investment and requires the lowest level of retained earnings.

More detail on our financial analysis review is provided in LCA Technical Appendix 10: Financial Analysis. The LCA financial model in Excel spreadsheet format is being provided disk as part of this submission.

VI. Business Case for the MH Proposal

The LCA SOW included a requirement that LCA look for a clear business and value proposition for Manitoba ratepayers as well as MH for each scenario. While we are still conducting evaluations of the alternative development plans, we offer the following observations from our work to-date regarding the value proposition offered to ratepayers:

- Based on its own analysis, MH is offering the PDP as a very long-term value proposition. Over 78 years, MH believes that the PDP will be lower cost to ratepayers than the alternatives consider.
- MH estimates that average rates to domestic load will increase on the order of 4% per year over the planning period, representing a substantial over increase from historical rate levels.
- As the most capital intensive plan considered, the advantages of the PDP to ratepayers are not near term. In fact, using MH's analysis, LCA determined that the PDP only begins to show a net cost advantage over the All Gas Plan in 2054.
- LCA's economic analysis concludes that the total cost difference between the plans considered by MH are relatively small, which also means that the annual average rates over the study period are similar for the alternative development plans MH did consider.
- Given that result, comparison of alternative development plans from the ratepayers' perspective should consider the intertemporal difference among the plans. Under the PDP, MH will be well below target retained earnings and decisions on the level of retained earnings and rates will be an issue for a number of years.
- Results from LCA's economic analysis indicate that the PDP does not have the cost advantage over some other plans that MH asserts, meaning the rate impact issues will be more difficult than MH has described.

VII. La Capra Associates Modelling

The LCA SOW included a requirement to develop a financial model that would have the flexibility to change basic assumptions on factors affecting costs to MH and MISO utility competitive market alternatives. As discussed in the prior section of this report on Economic and Financial Analysis. LCA has developed Excel spreadsheet models to prepare the analysis we have presented in our technical appendices. The models provide capability to conduct analysis similar to MH work in its Economic Model, its S-Curve Model, and its Financial Model, as well as added functionality for LCA's S-Curve Model and LCA's financial analysis.

These spreadsheet models are being provided in electronic form on CD as work papers supporting our work contained in LCA Technical Appendix 9: Economic Analysis and LCA Appendix 10: Financial Analysis. These models should allow Public Utilities Board Staff and Advisors and others to conduct sensitivity analysis on MH's and LCA's analyses.

The spreadsheet models contain some guidance that would allow others to use these models. LCA is amenable to conducting a technical workshop if there is interest in use of the models.

VIII. Supplemental Analysis

Throughout this report, we have referenced our plan to conduct additional work and to provide supplements to this filing when that work is complete. Much of the supplemental work will be more in depth analysis of the alternative development plans with the detailed SPLASH model data only recently made available to us, as well as the two additional alternative development plans. Our work will include economic and financial analysis, drought analysis, and additional work in other areas of our SOW that were limited due to the unavailability of information from late filed Information Request responses.

La Capra Associates

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Attachment A
La Capra Associates
NFAT Scope of Work

Power Resource Planning and Economic Evaluation

1. From a supply perspective, assess the extent to which the Plan addresses the reliability and security requirements of Manitoba's electricity supply.
2. Assess whether MH's approach to comparing generation sequences follows sound industry practice.
3. Review reservoir operations of Lake Winnipeg for optimal value.
4. Review MH'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.
5. Review the potential global warming impacts on water supply/river flows/lake and reservoir evaporation.
6. Develop power resource plans and alternatives, including identifying other scenarios that could potentially compete on an economic basis with MH's PDP.
7. Incorporate exports (bilateral contracts and opportunity market pricing) into power resource planning.
8. Evaluate the accuracy and completeness of MH's export assumptions into MISO and other jurisdictions.
9. Comment on the practical role of merchant trading and energy imports.
10. Examine the No New Generation scenario and the potential for extended use of imports to meet MH's domestic load requirements.
11. For all scenarios addressed, define the lower quartile, median and upper quartile impacts of natural gas supply pricing, coal pricing and wind pricing.
12. Address the relative generation and integration costs of hydro, wind, natural gas turbines (single-cycle and combined-cycle) and Demand-Side Management.

13. Assess the maximum deferral prospects for Keeyask GS and/or Conawapa GS.
14. Comment on climate change impacts on energy supply and demand.
15. Test MH's alternative scenarios and any new scenarios created for drought impacts.
16. Review and assess the reasonableness and completeness of MH's sensitivity analysis of alternative development plans. Perform additional sensitivity analysis as required.
17. Analyze the In-service cost and rate impact on domestic customers of the PDP and alternatives.
18. Analyze the net and gross marginal cost of the Preferred Plan and Alternatives.
19. Analyze the net present value of hydro power and natural gas generation.
20. Assess the reasonableness of the Weighted Average Cost of Capital (WACC) approach, including consideration of different capital structures.
21. Analyze the Internal Rate of Return (IRR), including an evaluation against hurdle rates.
22. Review MH's IRRs against prior IRR values presented in public filings.
23. Upon prior approval by the NFAT Panel, address any other issues that may be identified in reviewing MH's evidence or are requested by the NFAT Panel.

Business Case and Risk Assessment

1. Analyze the financial and economic risks of the PDP and export contracts and export opportunity revenues in relationship to alternative development strategies.
2. Assess whether the high-level summaries filed by MH of net present value and internal rates of return reflect sound assumptions and calculations.
3. Enumerate any special consideration with respect to Crown-owned utility operations.
4. Address estimate uncertainties involving large complex hydro projects.
5. Examine and evaluate the treatment of risk in MH's development of Power Resource Plans and resource scenario models. Incorporate expert opinions on flood and drought risks and optimal strategy.

6. Analyze the market value of clean energy from hydro power during various seasonal and peak or off-peak periods.

7. Address the future US versus Canadian export opportunities.

8. Review MH's filings and assess the accuracy, reasonableness and completeness of the relative values that MH places on capital costs/energy supply.

9. Review the accuracy ,reasonableness and completeness of presented alternative scenarios including an assessment of key variables such as:

   (a) Time Frames [80 years];

   (b) Alternative Time Frames of 20/40 years;

   (c) Interest rates;

   (d) Inflation;

   (e) Discount rates;

   (f) Present value calculations; and

   (g) Internal rate of return calculations.

10. Review and compare the discount rate applied in the current analysis with prior discount rates used by MH to assess consistency and reasonableness of the approach.

11. Review all significant scenarios employing other methodologies, including:

   (a) in-service rate impacts; and

   (b) The net present value of costs.

12. Within each scenario look for a clear business and value proposition for Manitoba ratepayers as well as MH.

13. Test each scenario for potential risks, including:

   (a) Lower export market prices;

   (b) Higher interest rates;

   (c) Lower or higher domestic load growth;

   (d) Droughts;

   (e) Competing technologies;

(f) Fuel price changes;

(g) Carbon pricing;

(h) Government and regulatory policy change;

(i) Construction cost escalator;

(j) Economic conditions;

(k) Infrastructure failure; and

(l) Any other major risks identified.

14. Upon prior approval by the NFAT Panel, address any other issues that may be identified in reviewing MH's evidence or are requested by the NFAT Panel.

Transmission Economics

1. Review and assess the impact of MH's transmission positions on Manitoba Hydro's assumptions as to export revenue.
2. Review and assess Manitoba Hydro's contemplated plan to partially fund US transmission infrastructure and the financial benefits to be derived from such plan.
3. Upon prior approval by the NFAT Panel, address any other issues that may be identified in reviewing MH's evidence or are requested by the NFAT Panel.

Review of Manitoba Hydro's Export Contracts

1. Review and assess MH's export contracts with US counterparties for:
   (a) Firm energy commitments;
   (b) Firm energy pricing;
   (c) Peak demand opportunity market sales;
   (d) Off-peak period opportunity market sales;
   (e) Adverse water clauses;
   (f) Drought relief;

(g) Clean energy guarantees;

(h) Treatment of environmental attributes;

(i) Any other commercial obligations in the contracts and the implications on MH and its counterparties; and

2. Upon prior approval by the NFAT Panel, address any other issues that may be identified in reviewing MH's evidence or are requested by the NFAT Panel.

Financial Modelling

1. Development a financial model that would have the flexibility to change basic assumptions on factors affecting costs to MH 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 MH Development Plan, and should meet the following requirements:

   (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 LCA 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.

2. Upon prior approval by the NFAT Panel, address any other issues that may be identified in reviewing MH's evidence or are requested by the NFAT Panel.

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Attachment B

Documents Received from Manitoba Hydro via SharePoint Site

Document number	Title/Description	Confidential Status
SP-001	Manitoba Hydro- Natural Gas Fired Power Generation Technologies Study Report	Confidential
SP-002	Alternative Resources Portfolio Capital Cost Risk Analysis and Contingency Estimate	Confidential
SP-003	Contingency Estimating Tool - Combined Cycle Gas Turbine	Confidential
SP-004	Contingency Estimating Tool - Simple Gas Turbine 7FA	Confidential
SP-005	Contingency Estimating Tool - Simple Cycle Gas Turbine -LM6000	Confidential
SP-006	Contingency Estimating Tool - Transmission -For Gas Generation	Confidential
SP-007	Contingency Estimating Tool - Transmission - For Wind Generation	Confidential
SP-008	Contingency Estimating Took - Wind Farm	Confidential
SP-009	Portfolio Capital Cost Risk Analysis Methodology For Manitoba Hydro	Confidential
SP-010	2012 Adjusted Electricity Export Price Forecast	Confidential
SP-011	Economic Cash Flows	Confidential
SP-012	Integrated Financial Forecast - Major Components	Confidential
SP-013	2013 All-in Price rev1	Confidential
SP-014	2013 Capacity rev1	Confidential
SP-015	2013 Off Peak Energy rev1	Confidential
SP-016	On Peak Energy rev1	Confidential
SP-017	Power Market Assessment of MISO 2013	Confidential
SP-018	Optimization of Natural Gas-Fired Generation into the Manitoba Hydro System	Confidential
SP-019	Wind Capital Cost Estimate Basis	Confidential
SP-020	Solar Capital Costs Basis	Non-Confidential
SP-021	NREL Study Feasibility Study of Economics and Performance of Solar Photovoltaic at the Kerr McGee Site in Columbus, Mississippi	Non-Confidential
SP-022	Appendix 11_3 Average	Non-

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	Unit Revenue Cost	Confidential
SP-023	All Gas Development Plan Builder	Confidential
SP-024	Economic Cash Flows	Confidential
SP-025	SPLASH Model Market Price Coefficient Market Price-Volume Overview	Confidential
SP-026	2012 02 08 G190 Approval Authority Table-Wholesale Export Power Policy	Confidential
SP-027	Wholesale Export Policy	Confidential
SP-028	Export Power Credit Risk Management Policy Approved by EPRMC	Confidential
SP-029	ICF Final Report - Independent review of Manitoba Hydro Export Power Sales and Associated Risks	Confidential
SP-030	Planning Criteria Review Final Signed September 2013	Confidential
SP-031	DC Collector System -202 Summer peak case with 2175 exports to US -existing tie liens	Non-Confidential
SP-032	DC Collector System - 2020 summer peak case with 2925 MW (750 MW Increase) export to US - new 500 kv tie line	Non-Confidential
SP-033	DC Collector System - 2020 summer peak case with no exports to US - existing tie lines	Non-Confidential
SP-034	Keeyask Transmission Scope and Construction Estimate	Non-Confidential
SP-035	Long Term Plan 2013	Non-Confidential
SP-036	Manitoba Hydro Major AC-DC Transmission - 2020 summer peak case with 2175 exports to US - existing tie lines-	Non-Confidential
SP-037	Manitoba Hydro Major AC-DC Transmission - 2020 summer peak case with 2925 MW export to US - new 500 kv tie line	Non-Confidential
SP-038	Manitoba Hydro Major AC-DC Transmission - 2020 summer peak case with no exports to US - existing tie lines-	Non-Confidential
SP-039	MMTP Scope and Construction Estimate	Non-Confidential
SP-040	2012 Manitoba Hydro System Performance Assessment - Final November 2012	Confidential
SP-041	NFAT Confidential - Keeyask-IES_Final	Confidential
SP-042	NFAT Confidential - MHEB-1100 MW -V6-Preliminary	Confidential
SP-043	NFAT Confidential - Planning Criteria Review Final Signed September 2013	Confidential
SP-044	Economic, Load and Environmental Impacts of Fuel Switching in Manitoba	Non-Confidential
SP-045	Manitoba Hydro responses to Power Engineers	Non-Confidential
SP-046	NFAT Confidential - Appendix 4.2_Section 3_NFAT 2012 Reference	Confidential

SP-047	NFAT Confidential - Appendix 4.2_Section 4_NFAT 2012 Sensitivities	Confidential
SP-048	NFAT Confidential - Appendix 4.2_Section 5_NFAT 2013 Update	Confidential
SP-049	NFAT Confidential - Appendix 4.2_Section 6_NFAT 2013 Update DSM Sensitivities	Confidential
SP-050	NFAT Confidential - Incremental IRRs Combinations of Energy Price and Capital Cost	Confidential
SP-051	NFAT Confidential - Manitoba Hydro External Quality Review by KPMG - Appendices	Confidential
SP-052	NFAT Confidential - Manitoba Hydro External Quality Review by KPMG - Main Report	Confidential
SP-053	NFAT Confidential - ProbabilityPlots	Confidential
SP-054	NFAT Confidential - SPD2011_11_Keeyask_Conawapa_Transmission_Plan_final	Confidential
SP-055	NFAT Confidential Potomac Dependable Sales October 24 presentation	Confidential
SP-056	Instructions for export price forecast data sheets	Confidential
SP-057	LCA0050	Non-Confidential
SP-058	NFAT Confidential - Export Power Credit Risk Management Procedures Approved by EPRMC _12 09 14	Confidential
SP-059	NFAT Confidential - LCA0044-45	Confidential
SP-060	NFAT Confidential - Monthly Credit Report - Sept	Confidential
SP-061	2013 Transmission Interface Capability Report OASIS Version	Non-Confidential
SP-062	FAC-012-1 Manitoba Hydro Transfer Capability Methodology_V4	Non-Confidential
SP-063	MH Special Protection Systems_nfat	Non-Confidential
SP-064	MH Transfer Limits in the Planning Horizon_version 3	Non-Confidential
SP-065	MIPUG-MH I-36a-IFF12	Non-Confidential
SP-066	MIPUG-MH I-36b-IFF12pdf	Non-Confidential
SP-067	NFAT Confidential - Drought_References_from_the_KPMG_report	Confidential
SP-068	NFAT Confidential - FS-Report-SP-MH_TSR_76617145-76617148-Mar-2010-final	Confidential
SP-069	NFAT Confidential - LCA I-0369	Confidential

This report contains information that parties to this litigation may deem to be confidential and is, therefore, subject to the protective order in this case.

SP-070	NFAT Confidential - LCA MH I-0134-0135-0136-0137	Confidential
SP-071	NFAT Confidential - Ontario_Facility_Study_Report_TSR_No_76703418-76703400-76703459	Confidential
SP-072	PUB-MH II-91a-IFF12	Non-Confidential
SP-073	TAS 2013 01	Non-Confidential
SP-074	Import Chart from Planning Criteria Review	Non-Confidential
SP-075	LCA-0265_and_LCA-0266	Non-Confidential
SP-076	MH Risks Report Independent Review Redacted	Non-Confidential
SP-077	Import Criteria Calculation Example	Non-Confidential
SP-078	Limiting Import Criteria by Plan	Non-Confidential
SP-079	NFAT Confidential - Runoff_Methodology_Presentation_for_LCA	Confidential
SP-080	Debt Ratio Calc for La Capra	
SP-081	NFAT Confidential - 2012 Adjusted Electricity Export Price Forecast	Confidential
SP-082	NFAT CONFIDENTIAL - 2013-14 GRE Diversity Sales Analysis	Confidential
SP-083	NFAT Confidential - All CCGT Supply and Demand Tables	Confidential
SP-084	NFAT CONFIDENTIAL - Description of MH Contract Risk Analysis	Confidential
SP-085	NFAT CONFIDENTIAL - Evaluation of the 2010 MH-NSP Sale	Confidential
SP-086	NFAT Confidential - Moment Matching and Probability Distribution Explanation	Confidential
SP-087	NFAT CONFIDENTIAL - MP 250 MW Sales Evaluation Report	Confidential
SP-088	NFAT Confidential - Gas Turbine Operating Cost Inputs	Confidential
SP-089	NFAT Confidential - Additional On-Shore Wind Projects Capital Cost Assumptions	Confidential
SP-090	NFAT Confidential - Checklist for 2013-11-07 Teleconference	Confidential
SP-091	NFAT Confidential - Discussion Points for Knight Piesold from RPMA	Confidential

This report contains information that parties to this litigation may deem to be confidential and is, therefore, subject to the protective order in this case.

SP-092	NFAT Confidential - Keeyask and Conawapa OandM Summary for KP	Confidential
SP-093	NFAT Confidential - NREL 57251 Extract	Confidential
SP-094	NFAT Confidential - On Shore Wind OandM	Confidential
SP-095	NFAT Confidential - Solar PV Projects O and M Costs	Confidential
SP-096	NFAT Confidential - 2012-13 and 2013-14 Consultant Natural Gas Price Forecasts	Confidential
SP-097	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN3 - Low Gas Price	Confidential
SP-098	NFAT Confidential - Brattle 2013 - Model Input and Outputs - AEO Reference Case	Confidential
SP-099	NFAT Confidential - Brattle 2013 - Model Input and Outputs - BASE CASE	Confidential
SP-100	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN1 - Low CO2 Price	Confidential
SP-101	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN2 - High CO2 Price	Confidential
SP-102	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN4 - High Gas Price	Confidential
SP-103	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN5 - Strict Climate	Confidential
SP-104	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN6 - Non-Price Climate Policy	Confidential
SP-105	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN6 - Non-Price Climate Policy	Confidential
SP-106	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN8 - Smart Grid-Load Shifting.xls	Confidential
SP-107	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN9 - Energy Efficiency- Conservation	Confidential
SP-108	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN10 - HiGas Low CO2 Price	Confidential
SP-109	NFAT Confidential - Brattle 2013 - Model Input and Outputs - SCN11 - Extreme Low	Confidential
SP-110	System Planning information related to LCA Questions	
SP-111	All CCGT Development Plan	Confidential
SP-112	Economic Cash Flows Energy Exports V4 energy and revenue only	Confidential
SP-113	NFAT Confidential - 2013 All Gas Level 1 DSM	Confidential
SP-114	NFAT Confidential - 2013 Import Development Plan	Confidential

SP-115	NFAT Confidential - 2013 No New Resources Level 1 DSM extended Diversity	Confidential
SP-116	NFAT Confidential - 2013 Preferred Plan Level 1 DSM	Confidential
SP-117	NFAT Confidential - Load Comparisons	Confidential
SP-118	Misc PE responses - Nov 19 2013	Non-Confidential
SP-119	LCA-Oct25-1	Non-Confidential
SP-120	NFAT Confidential - GCM Data related to LCA-0121(CONFIDENTIAL)	Confidential
SP-121	NFAT Confidential - LTFD_DATA_1912-2010(CONFIDENTIAL)	Confidential
SP-122	NFAT Confidential - Criteria Ref 1 Walker Report 1979	Confidential
SP-123	NFAT Confidential - Criteria Ref 4 Planning Criteria for Firm Energy Supply 1977	Confidential
SP-124	NFAT Confidential - Criteria Ref 6 850109 Derry Memo	Confidential
SP-125	Dec 3 Call Notes	?
SP-126	LCA -I-0230	Non-Confidential
SP-127	NFAT Confidential - GL Garrad Hassan 2011 - CAPEX and OPEX Est for a Generic Wind Farm in MB	Confidential
SP-128	NFAT Confidential - LCA-MH-I-0225 Attachment (NFAT CONFIDENTIAL)	Confidential
SP-129	NFAT Confidential - Climate Change sensitivity revenue calc	Confidential
SP-130	NFAT Confidential - Figure 4.1 and 4.3 Manitoba energy consumption	Confidential
SP-131	NFAT Confidential - REVISED Economic Cash Flows Energy Exports V4 energy and revenue only	Confidential
SP-132	NFAT Confidential - Economic Cash Flows Energy Exports V4 energy and revenue only	Confidential
SP-133	NFAT Confidential - REVISED ALL CCGT Development Plan	Confidential
SP-134	NFAT Confidential - ALL CCGT Development Plan	Confidential
SPS-001	Reference Case Economics; NFAT Presentation to Independent Consultants	Confidential

SPS-002	Climate Change Sensitivities in the NFAT Business Case	Confidential
SPS-003	Financial Forecasting Model Overview (PowerPoint presentation)	Confidential
SPS-004	Overview of Manitoba Hydro System (PowerPoint presentation)	Confidential
SPS-005	SPLASH Model NFAT Presentation to Independent Consultants (PowerPoint presentation)	Confidential
SPS-006	Manitoba Hydro System Overview, Operations (PowerPoint presentation)	Confidential
SPS-007	Electricity Export Price Forecast Process	Confidential