NEEDS FOR AND ALTERNATIVES TO (NFAT)

REVIEW OF MANITOBA HYDRO'S

PREFERRED DEVELOPMENT PLAN

REPORT PREPARED FOR

THE CONSUMERS ASSOCIATION OF CANADA (MANITOBA) INC.

BY

ECONALYSIS CONSULTING SERVICES

FEBRUARY 4, 2014

Table of Contents

1. Introduction 1
2. Purpose of Report 2
3. Preferred Development Plan 4
4. Need and Alternatives 5
   - 4.1 Manitoba Hydro's Approach 5
   - 4.2 Comments 9
     - 4.2.1 Need 9
     - 4.2.2 Plans with No New Intertie 10
     - 4.2.3 Plans with a New 250 MW Intertie 12
     - 4.2.4 Plans with a New 750 MW Intertie 13
5. Economic Evaluation – Reference Cases 15
   - 5.1 Manitoba Hydro's NFAT 16
     - 5.1.1 Manitoba Hydro's Approach 16
     - 5.1.2 Manitoba Hydro's Results and Conclusion 17
   - 5.2 Comments 19
     - 5.2.1 Analytical Approach 19
     - 5.2.2 Results and Conclusions 27
6. Economic Uncertainty Analysis 29
   - 6.1 Manitoba Hydro's NFAT 29
     - 6.1.1 Manitoba Hydro's Approach 29
     - 6.1.2 Manitoba Hydro's Results and Conclusions 30
   - 6.2 Comments 39
     - 6.2.1 Analytical Approach 39
     - 6.2.2 Results and Conclusions 42
7. 2013 Update 56
   - 7.1 Manitoba Hydro's Update 56
   - 7.2 Comments 57
8. Multiple Account Analysis 58
   - 8.1 Manitoba Hydro's Approach 58
   - 8.2 Comments 59
9. Conclusions 60

1. Introduction

Manitoba Hydro is a Crown Corporation created by the *Manitoba Hydro Act*. Under the *Act*, the purposes and objectives of Manitoba Hydro are to:

"provide for the continuance of a supply of power adequate for the needs of the province, and to engage in and to promote economy and efficiency in the development, generation, transmission, distribution, supply and end-use of power and, in addition, are

> (a) to provide and market products, services and expertise related to the development, generation, transmission, distribution, supply and end-use of power, within and outside the province; and
>
> (b) to market and supply power to persons outside the province on terms and conditions acceptable to the board." [1]

In accordance with this purpose, Manitoba Hydro regularly assesses the outlook for future electricity requirements[2] and the extent to which its current supply resources are sufficient to reliably meet these forecast needs[3].

Since at least 2008 Manitoba Hydro's Power Resource Plans have identified a need date for new resources[4] sometime between 2019/20 and 2022/23. The timing varied from Plan to Plan due to changes in the load forecast, DSM and base resource assumptions. However, in each case the preferred plan for meeting this need called for a major new 500 kV interconnect with the U.S., a new sale agreement with Minnesota Power, and the (early – either 2018/19 or 2019/20) construction of Keeyask followed by Conawapa.

On January 13, 2011, the Government of Manitoba advised Manitoba Hydro of its intention to carry out a public Need For and Alternatives To (NFAT) Review and assessment of the Manitoba Hydro's proposed Preferred Development Plan ("PDP") for major new hydro-electric generation and Canada-USA interconnection facilities using an

[1] *Manitoba Hydro Act*, Section 2.
[2] Manitoba Hydro typically produces a 20-year load forecast each year – see Corporate Documents Appendices C and D.
[3] Manitoba Hydro typically produces a Power Resource Plan in the fall of each year which determines the timing of the need for new supply resources and sets out Manitoba Hydro's plans for addressing the need – see Corporate Documents, Appendix B.
[4] Wuskwatim Generating Station which commenced construction in 2006 and became commercially operational in 2012/13 was Manitoba Hydro's last major commitment to new supply resources.

independent body. Subsequently, the Minister of Innovation, Energy and Mines announced that the Government of Manitoba had asked the Manitoba Public Utilities Board ("PUB") to conduct the NFAT Review.

The Terms of Reference for the NFAT Review called for a wide ranging assessment of the PDP[5] and for the Review to consider not only Manitoba Hydro's evidence but also input from independent expert consultants retained by the PUB and as well as from the public and formal intervenors[6].

2. Purpose of Report

PUB Order 67/13 granted intervenor status to the Consumers Association of Canada (Manitoba) Inc. ("CAC MB"). Subsequently CAC MB retained Econalysis Consulting Services ("ECS"), and specifically Mr. William Harper, to assist it with its participation in the NFAT Review.

ECS is a consulting firm offering regulatory and economic consulting services to clients in the electricity, natural gas and telecommunications sectors since 1980. Its areas of expertise encompass the development and assessment of regulatory applications and regulatory structure, strategic planning, industry intelligence and educational seminars. Mr. Harper has over 25 years' experience in the electricity industry gained through positions held with the Ontario Ministry of Energy and Ontario Hydro (and one of its successor companies Hydro One Networks). While at Ontario Hydro, his responsibilities included Ontario Hydro's wholesale rates and Ontario Hydro's regulation of the province's municipal electric utilities; as well as the coordination of the Company's overall participation in public review processes. He has testified frequently before the OEB on rates and regulatory matters. He also testified before the Ontario Environmental Assessment Board with respect to Ontario Hydro's Demand/Supply Plan. Since joining ECS in 2000, he has provided support to intervenors in energy proceedings in British Columbia, Manitoba, Ontario and Quebec on rates, revenue requirements, industry restructuring and resource planning. He has testified as an

[5] See Formal Terms of Reference issued.
[6] PUB Orders 67/13 and 91/13 addressed requests by various parties for intervenor status.

expert witness before the Manitoba Public Utilities Board and the Quebec Régie de l'énergie.

With specific regards to resource planning, Mr. Harper has appeared as an expert witness before the Régie with respect to Hydro Quebec Distribution's 2001 and 2004 Supply Plans and before Manitoba Clean Environment Commission with respect to its Needs For and Alternatives Review of Manitoba Hydro's proposed Wuskwatim Project. Mr. Harper has also assisted clients in British Columbia with their participation in public reviews undertaken by the BCUC of integrated resource plans prepared by BC Hydro and FortisBC Inc. and, similarly assisted clients in Ontario with their participation in an OEB review of the Ontario Power Authority's 2007 Integrated Resource Plan for Ontario's electricity sector.

Given the wide scope of the terms of reference for the NFAT Review and the issues being addressed by the other consultants retained by CAC[7] and other intervenors[8], the ECS evidence addresses Manitoba Hydro's economic evaluation of the PDP. The focus of the evidence is on the approach taken by Manitoba Hydro in performing its economic evaluation and the interpretation of the results and, for purposes of the report it has been assumed that the underlying planning assumptions are appropriate. Various Independent Expert Consultants have been retained by the PUB to examine the reasonableness of Manitoba Hydro's planning assumptions (e.g. project capital costs, export price forecasts, scenario probabilities, etc.) and have been granted special access to commercially sensitive information in order to do so. Their findings will need to be considered in conjunction with the observations made in this report.

Overall, the report is organized as follows:

- Section 1 – Introduction
- Section 2 – Purpose of Report
- Section 3 – Preferred Development Plan
- Section 4 – Need and Alternatives (Subject to Economic Evaluation)
- Section 5 – Economic Evaluation – Reference Cases

[7] For example other consultants retained by the Consumers Association of Canada (Manitoba) Inc. are focusing on issues such as load forecasting and demand-side management.
[8] For example, InterGroup Consultants, retained by MIPUG, are looking at the financial evaluation.

- Section 6 – Economic Uncertainty Analysis
- Section 7 – 2013 Update
- Section 8 – Multiple Account Analysis
- Section 9 - Conclusions

3. Preferred Development Plan

In the NFAT Application[9] Manitoba Hydro indicated it was seeking government approval for its Preferred Development Plan which calls for[10]:

- Construction of the 695 MW Keeyask Project with an in-service date of 2019.
- Construction of the 1,485 MW Conawapa Project with an (updated) in-service date of 2026.
- Construction of a 185 MW North-South Transmission Project with an in-service date to coincide with Conawapa.
- Construction of a 750 MW Manitoba-Minnesota Transmission Project with an in-service date of 2020.
- Construction of simple-cycle gas thermal units towards the end of Manitoba Hydro's planning period to meet forecast domestic load growth,

The PDP also calls for the satisfactory completion and approval of export agreements with Minnesota Power and Wisconsin Public Service. While the agreement with Minnesota Power has been signed, one of the two agreements with Wisconsin Power is still under negotiation[11].

In order to implement the Plan, Manitoba Hydro requires[12] the following commitments by June 2014:

- Start construction of the Keeyask generating station for a 2019 in-service date,
- Proceed with a (signed) 250 MW export agreement with Minnesota Power,
- Proceed with a (signed) 100 MW export agreement with Wisconsin Public Service,

[9] Unless otherwise noted details regarding the various Plans and planning assumptions are based on main NFAT Application and have not been revised to reflect the 2013 Update discussed in Chapter 12 of the NFAT Application.
[10] NFAT Application, Chapter 2, page 1
[11] NFAT Application, Chapter 6, page 28
[12] NFAT Application, Executive Summary, page 1

- Proceed with a 300 MW export agreement with Wisconsin Public Service, subject to satisfactory conclusions of negotiations currently still underway, and
- Proceed with a 500 kV/750 MW U.S. interconnection.

Manitoba Hydro notes that while the Plan includes the Conawapa generating station decisions on whether or not to construct Conawapa and its specific timing are not required now. However, activities (and spending) would continue to protect an in-service date for Conawapa as early as 2026[13].

4. Need and Alternatives

4.1 Manitoba Hydro's Approach

In its NFAT Application[14], Manitoba Hydro has provided an assessment of the capability of its existing and currently planned resources (including savings from its planned DSM programs) that will be available to meet future electricity requirements. It has also provided its most recent load forecast for domestic needs and its current firm export commitments. Based on this information and its planning criteria with respect to both capacity and energy, the NAFT Application identifies 2025/26 as the need date for new capacity resources and 2022/23 as the need date for new energy resources[15].

Manitoba Hydro then identifies a number of resource options that could be used to meet the future need for additional capacity and energy. Its initial list of options is fairly extensive and an initial "screening" process is undertaken to create a shorter list of options that could be incorporated into alternative development plans. The "short-listed" options include:

- Additional DSM
- Hydro –with storage or run-of-river
- Wind – on-shore
- Natural Gas-Fired Generation – simple cycle and combined cycle
- Imports.

[13] NFAT Application, Executive Summary, page 1
[14] Chapter 4
[15] NFAT Application, Chapter 4, pages 46 and 49

Using this information, Manitoba Hydro has created seven development plans that have new resources starting in 2022/23 (i.e. Manitoba Hydro's identified need date)[16]. The plans are designed to specifically consider which option should be pursued to meet this "need" date (i.e. wind, Keeyask or Natural Gas[17]). The plans also incorporate Conawapa or natural gas-fired generation as alternatives for the next major resource (likely required in the mid to late 2020's) in order to help assess whether Conawapa is a viable option. The Plans that include Keeyask in 2022 provide sufficient energy to serve a 100 MW contract with WPS starting in that year[18]. However, as the Plans are generally designed to meet Manitoba load and current firm export contracts there is insufficient surplus dependable energy and transmission capability to the U.S. to support other potential power contracts.

In this regard, Manitoba Hydro has identified new export opportunities based on negotiations it has completed or that are still ongoing with various parties. These specifically include potential power contracts with[19]:

- Minnesota Power (MP) – including a firm power contract for 250 MW and an Energy Exchange contract, both of which have been signed and cover the period June 1, 2020 to May 31, 2035.
- Northern States Power (NSP) – for a 125 MW firm power contract for the period May 1, 2021 to April 30, 2025 which has been signed.
- Wisconsin Public Service (WPS) – including contracts from June 1, 2021 to May 2025 for 100 MW of firm power and from June 2025 to May 2029 for surplus energy both of which have been signed along with a further contract for up to 300 MW of firm power and surplus energy sales for the period June 2014 to May 2040 which is still under negotiation.

As a result, Manitoba Hydro has also created a further three development plans[20] that provide for the advancement of Keeyask to 2019 and a new 230 kV U.S.

[16] NFAT Application, Chapter 8, pages 17
[17] Conawapa cannot be constructed to meet an in-service date earlier than 2025 (now 2026 with the 2013 Update)
[18] NFAT Application, Chapter 9, page 22
[19] NFAT Application, Chapter 6, page 28
[20] NFAT Application, Chapter 8, pages 12-14

interconnection with 250 MW of export and 50 MW of import capability. These development plans can accommodate not only the 100 MW WPS contract (starting in June 2021) but also the 250 MW firm power contract with Minnesota Power and the 125 MW contract with NSP. The purpose of these plans is to determine whether the value from the export contracts in terms of additional export net revenues offsets the added costs associated with advancing Keeyask and constructing the additional intertie facilities. The three alternatives can also help identify whether, in this context, Conawapa is a viable option to consider after Keeyask and, if so, when.

Finally, Manitoba Hydro has created five development plans[21] that include a 500 kV U.S. interconnection with 750 MW of import and export capability. Two of these plans include the export contracts associated with the 250 MW intertie as well as an export contract with WPS for 300 MW starting in June 2026: one where Conawapa is in-service by 2025[22] and second where a natural-gas fired station is in-service by 2025/26. The third assumes that Conawapa is in-service for 2025 but there is no 300 MW contract with WPS. The last two assume that there is no 300 MW WPS contract; that additional resources (after Keeyask and the 750 MW intertie are constructed) are put in place only when needed for domestic load (i.e. 2031/32) - either Conawapa or natural gas-fired generation.

It is these 15 Plans that are subject to economic evaluation by Manitoba Hydro. A summary of the individual plans can be found in Table 9.3 of the NFAT Application and is provided below.

[21] NFAT Application, Chapter 8, pages 8-12
[22] Now 2026 as of the 2013 Update

ECS Table #1 – Summary of Manitoba Hydro's Alternative Development Plans

Table 9.3 LIST OF FIFTEEN DEVELOPMENT PLANS

Order of Capital Investment (Plan Number)	Development Plan Short Name	Description of Development Plan
1	All Gas	Natural Gas-Fired Generation starting in 2022/23
2	K22/Gas	Keeyask 2022/23, Natural Gas-Fired Generation starting in 2029/30
3	Wind/Gas	Wind Generation starting in 2022/23 supported by Natural Gas-Fired Generation starting in 2025/26
4	K19/Gas24/250MW	Keeyask 2019/20, Natural Gas-Fired Generation starting in 2024/25, 250 MW Export/50 MW Import U.S. Interconnection 2020/21, 250 MW MP Sale
5	K19/Gas25/750MW (WPS Sale & Inv)[2]	Keeyask 2019/20, Natural Gas-Fired Generation starting in 2025/26, 750 MW Import/Export U.S. Interconnection 2020/21, 250 MW MP Sale, Proposed 300 MW WPS Sale
6	K19/Gas31/750MW	Keeyask 2019/20, Imports, Natural Gas-Fired Generation starting in 2031/32, 750 MW Import/Export U.S. Interconnection 2020/21, 250 MW MP Sale
7	SCGT/C26	Simple Cycle Gas Turbine in 2022/23, Conawapa 2026/27, Natural Gas-Fired Generation starting in 2038/39
8	CCGT/C26	Combined Cycle Gas Turbine in 2022/23, Conawapa 2026/27, Natural Gas-Fired Generation starting in 2039/40
9	Wind/C26	Wind in 2022/23, Conawapa 2026/27, Natural Gas-Fired Generation starting in 2036/37
10	K22/C29	Keeyask 2022/23, Conawapa 2029/30, Natural Gas-Fired Generation starting in 2040/41
11	K19/C31/250MW	Keeyask 2019/20, Natural Gas-Fired Generation starting in 2024/25, Conawapa 2031/32, 250 MW Export/50 MW Import U.S. Interconnection 2020/21, 250 MW MP Sale
12	K19/C31/750MW	Keeyask 2019/20, Imports, Conawapa 2031/32, Natural Gas-Fired Generation starting in 2041/42, 750 MW Import/Export U.S. Interconnection 2020/21, 250 MW MP Sale
13	K19/C25/250MW	Keeyask 2019/20, Conawapa 2025/26, Natural Gas-Fired Generation starting in 2040/41, 250 MW Export/50 MW Import U.S. Interconnection 2020/21, 250 MW MP Sale
14	K19/C25/750MW (WPS Sale & Inv)[2] Preferred Development Plan	Keeyask 2019/20, Conawapa 2025/26, Natural Gas-Fired Generation starting in 2041/42, 750 MW Import/Export U.S. Interconnection 2020/21, 250 MW MP Sale, Proposed 300 MW WPS Sale
15	K19/C25/750MW	Keeyask 2019/20, Conawapa 2025/26, Natural Gas-Fired Generation starting in 2041/42, 750 MW Import/Export U.S. Interconnection 2020/21, 250 MW MP Sale

[2] Inv refers to WPS investment in the U.S. portion of the 750 MW interconnection facilities.

4.2 Comments

4.2.1 Need

In order to ensure that proposed projects are based on good planning and informed decision making, regulatory reviews (whether they have an environmental or an economic focus) generally start by establishing the need underlying the project. This is an essential step as it provides a basis for identifying viable alternatives to the proposed project and serves to focus the assessment of the project's justification.

In its September 2004 Report[23] on the Wuskwatim Generation and Transmission Projects the Manitoba Clean Environment Commission ("CEC") noted that "the *CEAA* defines "need for" as the problem or opportunity the project is intended to solve or satisfy".

Manitoba Hydro has presented the "need" for its Proposed Development Plan as both: a) a problem to be solved, i.e. shortfall in existing resources to meet projected domestic electricity needs and b) a response to an opportunity, i.e., increase export sales. Since Manitoba Hydro is the proponent of the PDP it is important to determine whether these "needs" are in accordance with Manitoba Hydro's objectives and therefore legitimate for it to be addressing.

Given that the statutory purpose of Manitoba Hydro starts with a requirement for it "to provide for the continuance of a supply of power adequate for the needs of the province" it seems clear that addressing the "problem" of a projected shortfall in resources to meet Manitoba electricity requirements is a legitimate "need" for Manitoba Hydro to be responding to.

With respect to the export opportunity that would be capitalized on by advancing the in-service of new generation prior to domestic need dates and by constructing new interconnection to the U.S., this too appears to be a legitimate "need" provided it "promotes the economy and efficiency" in the supply of electricity to Manitoba. This

[23] Page 31

perspective is also consistent with the Terms of Reference of the Manitoba Hydro Board of Directors[24] which states that:

> "The corporation is charged with responsibilities which include, to ensure a safe, reliable, economical and environmentally responsible supply of energy for Manitoba, and to earn revenues to keep rates low for Manitobans through the export of power and the provision of energy-related services (emphasis added)."

Thus, to the extent the PDP capitalizes on an opportunity to increase export revenues and reduce rates, it also addresses a legitimate need of Manitoba Hydro.

In this regard, it is useful to note that one of the CEC's conclusions underpinning its support for the advancement and an early in-service date of the Wuskwatim Generation and Transmission Project was that it would ameliorate long-term rate increases while the "small increases to MH's debt-to-equity ratio and the impacts to the interest-coverage ratio expected as a result of the Projects will likely have negligible impact on MH's financial stability and will not require any offsetting increase to domestic electricity rates during the start-up of the Projects"[25].

Under the current Proposed Development Plan, the total cost of the stations being advanced prior to their domestic need date and associated interconnection is almost 20 times the capital cost of Wuskwatim[26]. As a result, the impacts on both the Corporation's financial ratios and rates are more significant during the early years of the projects. Thus while the Wuswkatim project was portrayed as offering lower long-term rates at virtually no short-term cost[27], this is not the case for the current PDP and rate impacts on customers at different points over the life of the project will need to be carefully considered.

4.2.2 Plans with No New Intertie

These Plans focus on alternatives for addressing the "problem" of the pending shortfall in supply to meet just existing export contracts and Manitoba's electricity needs. As

[24] http://www.hydro.mb.ca/corporate/terms_of_reference.shtml
[25] CEC Report, page 54
[26] At the time of the CEC proceeding the cost of Wuskwatim was projected to be $900 M as compared to roughly $17 B for Keeyask, Conawapa and the supporting interconnections.
[27] In the form of rate increases or deterioration in financial integrity.

formulated by Manitoba Hydro, Development Plans #1, #2 and #3 will allow for an assessment of whether natural-gas fired generation, wind or Keeyask are the "preferred" option for meeting the identified 2022/23 need date. However, there are no plans that provide for a similar assessment of the other two feasible "options" that Manitoba Hydro identified during its initial screening process: Additional DSM and Imports.

With respect to DSM, the amount to be achieved is held constant across all the Development Plans[28] and, as a result, it is not considered as a "competing option"[29] in the same way wind, Keeyask and natural gas-fired generation are. In part, this approach is the result of a lack of information regarding the "cost" of achieving different levels of DSM[30]. To address this shortcoming, Manitoba Hydro looked[31] at whether the relative ranking of the Plans it did consider would change as a result of increased levels of DSM (referred to as a "DSM Stress Test"). However, such Stress Tests only look at the implications for the set of originally proposed development plans and, as such, they are not a full substitute for including alternative levels of DSM as options in the initial design of the development plans to be assessed. If such an approach had been taken then it would have been practical to consider development plans to meet domestic needs plus current export commitments where with enhanced DSM:

- Conawapa is the first major new generation placed into service (as opposed to Keeyask, wind or natural gas-fired generation).
- New opportunities come into play such as solar (either utility or customer scale) that while not currently cost competitive are expected to become increasingly so with time.

Manitoba Hydro has indicated[32] that it will strive to provide the NFAT process with evaluations of two levels of DSM before the hearings that will consider the DSM load savings and DSM cost in plans with supply side options and export/import benefits. Unfortunately, it appears that the enhanced DSM will simply be combined with one (or

[28] CAC/MH I-235 a)
[29] CAC/MH I-235 a)
[30] LCA/MH I-406
[31] NFAT Application, Chapter 12, pages 16-25
[32] CAC/MH I-235 b)

more) of the existing 15 Plans such that what effectively results is a Stress Test with DSM costs. In contrast, what really needs to be considered is what is the optimum level of DSM and how this enhanced level of DSM could best be combined with other options to meet Manitoba's needs.

With respect to imports, since Manitoba Hydro typically has surplus energy it does not contract for long-term firm blocks of energy imports[33]. However, all of the Development Plans assessed do utilize off-peak imports to the full degree allowed by Manitoba Hydro's energy planning criteria[34]. In terms of capacity needs, the various Plans do not consider alternative levels for long-term capacity imports[35]. While most of the current import capability is already required to support Manitoba Hydro's existing Diversity Agreements[36], there does appear to be some scope for increases. Also, the NFAT alternatives did not consider increased imports due to new interties built expressly for this purpose or increased imports beyond those allowed by its current planning criteria. However, Manitoba Hydro has undertaken to provide the economic analysis of such a plan[37].

Plans #7, #8, #9 and #10 permit an assessment of whether or not Conawapa is a preferable option for the subsequent major generation requirement sometime in the mid to late 2020s based just on Manitoba's needs and existing export commitments.

4.2.3 Plans with a New 250 MW Intertie

The three Plans included in this category all have a new 250 MW intertie and Keeyask with a 2019 in-service date and are meant to address the "problem" of the pending shortfall in resources to meet Manitoba electricity needs and also capitalize on the "opportunity" for increased exports to MP and NSP. What differs across the three plans is whether the subsequent development is: a) all gas-fired (Plan #4), b) Conawapa/followed by all gas-fired generation (Plan #13) or c) a gas-fired station/followed by Conawapa/followed by all gas-fired generation (Plan #11).

[33] NFAT Application, Chapter 7, page 38
[34] CAC/MH I-057 & 059
[35] NFAT Application, Appendix 9.3, pages 18-19
[36] CAC/MH I-058 and NFAT, Appendix 9.3, Table 1.10
[37] LCA/MH I-250

The inclusion and consideration of these plans will assist in the assessment of whether or not the "advancement" of Keeyask and the construction of a 250 MW intertie in order to facilitate the pending export contract with MP (and also NSP) is a preferable approach to meeting the need for new resources in 2022/23 as compared to an approach that focuses strictly on meeting Manitoba's needs and current export commitments. However, in contrasting the results with the seven Plans previously identified, Manitoba Hydro's assessment effectively assumes that one of these Plans would be the preferred choice with no new intertie/new export contracts.

The DSM Stress tests undertaken by Manitoba Hydro[38] provide additional insight but have limitations in that they presume that Keeyask is the best option for meeting any shortfalls not met by enhanced DSM regardless of the new "need date".

The range of Plans included will also help assess current expectations as to whether the next major generation resource to be developed after Keeyask should be Conawapa. Even more importantly for the decisions currently at hand, the range of Plans included will assist in determining whether Conawapa should be actively retained as a future option, if a 250 MW intertie is constructed. Again, this can only be done within the context of and in comparison to Plans where gas-fired generation is the alternative option.

4.2.4 Plans with a New 750 MW Intertie

The Plans with a new 750 MW intertie would allow Manitoba Hydro to exploit even more potential "opportunities" for electricity exports while addressing the "problem" of meeting Manitoba's electricity requirements. The Plans with a new 750 MW intertie all include Keeyask in 2019 to facilitate the 250 MW contract with MP but then consist of:

- Two plans that include the WPS 300 MW export contract – one with gas-fired generation in 2025/26 (Plan #5) and one with Conawapa in 2025/26 (Plan 14 – the Preferred Plan). Each of these Plans also assumes that WPS invests in the U.S. portion of the required 750 MW intertie.
- Three Plans with no WPS export contract – one where gas-fired generation is built in 2031 to meet emerging Manitoba needs (Plan #6), a second where

[38] NFAT Application, Chapter 12, pages 16-21

Conawapa is built in 2031 to meet emerging Manitoba needs (Plan #12) and a third where Conawapa is advanced to 2025/26 in order to facilitate increased exports (Plan#15).

The inclusion of these Plans will assist in the assessment of whether:

- A 750 MW intertie (along with the associated increase in export opportunities and import capabilities) is preferable to a 250 MW intertie,
- With a 750 MW intertie, Conawapa is the next major generation source that should be developed (after Keeyask) and, again more importantly, should Conawapa be actively retained as a potential future option, and
- The findings regarding either of these two issues change if Manitoba Hydro were to successfully conclude a new export contract for 300 MW with WPS.

However, the scope of such assessment is limited to a comparison with the three 250 intertie-related Plans that are also included and the question of whether Conawapa is preferable to natural gas-fired generation as the next option following Keeyask.

Again, the DSM Stress tests undertaken by Manitoba Hydro[39] can provide additional information but presume that the two options for meeting any shortfalls not addressed by enhanced DSM are Conawapa or gas-fired generation.

Finally, since the completion of the NFAT analysis, WPS has indicated that while it is still interested in pursuing negotiations regarding the 300 MW export contract it is no longer interested in investing in the 750 MW intertie. Manitoba Hydro has indicated that it is actively seeking new investors and that, if required to invest up to 2/3 of the funds required for the intertie to facilitate its construction, will seek to subsequently divest itself of any additional investment over 49%. However, for now, Manitoba Hydro's eventual success on these fronts is unknown and a more pragmatic approach would be to assume that those Plans with a WPS export contract require a 2/3 investment by Manitoba Hydro in the U.S. portion of the 750 MW inter-tie.

[39] NFAT Application, Chapter 12, pages 16-21

5. Economic Evaluation – Reference Cases

An economic evaluation involves comparing the costs and consequences (typically benefits) of two or more alternatives. Economic evaluations focus on the differences between alternatives and therefore generally exclude costs and benefits that are common to all alternatives. Similarly economic evaluations exclude sunk costs (i.e. costs that have already been incurred) since they will also be common to all alternatives.

In undertaking an economic evaluation it is important to establish the perspective from which the evaluation is being undertaken (i.e., whose costs and whose consequences) as this will establish what costs and consequence should be included. Also, since the alternatives being compared typically involve different streams of costs and benefits over time economic evaluations discount these streams to a common point in time so as to allow for their comparison on an equivalent basis. In order to do so a “discount rate” is used and a net present value (“NPV”) calculation is performed.

Discount rates represent the rate at which people would willingly trade off present for future costs or benefits. Discounting arises for a number of reasons including the fact that people generally prefer benefits to occur sooner rather than later (and vice versa for costs), benefits achieved sooner (or dollars associated with costs avoided) can be invested and grow to larger amounts in the future and the future is somewhat uncertain. Given these various considerations different parties will have different views as to what is the appropriate discount rate. For economic evaluations the discount rate used typically reflects the perspective from which the evaluation is being done (e.g. if the evaluation is being done from the perspective of a private corporation assessing alternative investment opportunities the discount rate would reflect the corporation’s cost of capital).

At the same time, it must be noted that an economic evaluation has limitations in terms of the information it provides to a decision maker. As noted above, economic evaluations are carried out from a particular perspective or point of view. If there are multiple stakeholders involved with different perspectives then several economic

evaluations may need to be carried out. Another limitation is that if the perspective being taken in the analysis involves more than one party/person, the evaluation does not look at the distribution of the costs and consequences amongst those whom the "perspective" represents. A final limitation is that economic evaluations are generally performed over the life of a project/initiative and focus on the overall costs and consequences. While discount rates can address temporal differences as to when the costs and consequences occur, for projects with long time horizons there may be inter-generational issues in terms of whom the costs and consequences are accruing to.

5.1 Manitoba Hydro's NFAT

5.1.1 Manitoba Hydro's Approach

In Chapter 9 and Appendix 9.3 of the NFAT Application Manitoba Hydro outlines the approach it has taken and the assumptions it has made for purposes of its economic evaluation of the alternative Development Plans it has identified. Key elements of the approach taken are:

- The use of a 78 year study period, to reflect both the long life of the assets included in some of the Plans as well as the fact that some of the investments in such assets are not made until a number of years into the study period.
- All costs incurred prior to June 2014 (the anticipated date by which the Manitoba Government will make decisions regarding the Development Plan) are treated as sunk costs.
- The evaluations are done from Manitoba Hydro's perspective, but without any accounting for any aboriginal income sharing.
- The future streams of costs and benefits are discounted using what Manitoba Hydro has defined as its "real cost of capital" which is based on Manitoba Hydro's forecast long-term interest rate (including the debt guarantee fee); an imputed interest rate associated with equity and weights that reflect Manitoba Hydro's target capital structure of 75% debt and 25% equity, with the result then adjusted based on Manitoba Hydro's forecasted long-term inflation rate.
- The costs used in the Reference Scenario analysis are the "most likely costs".

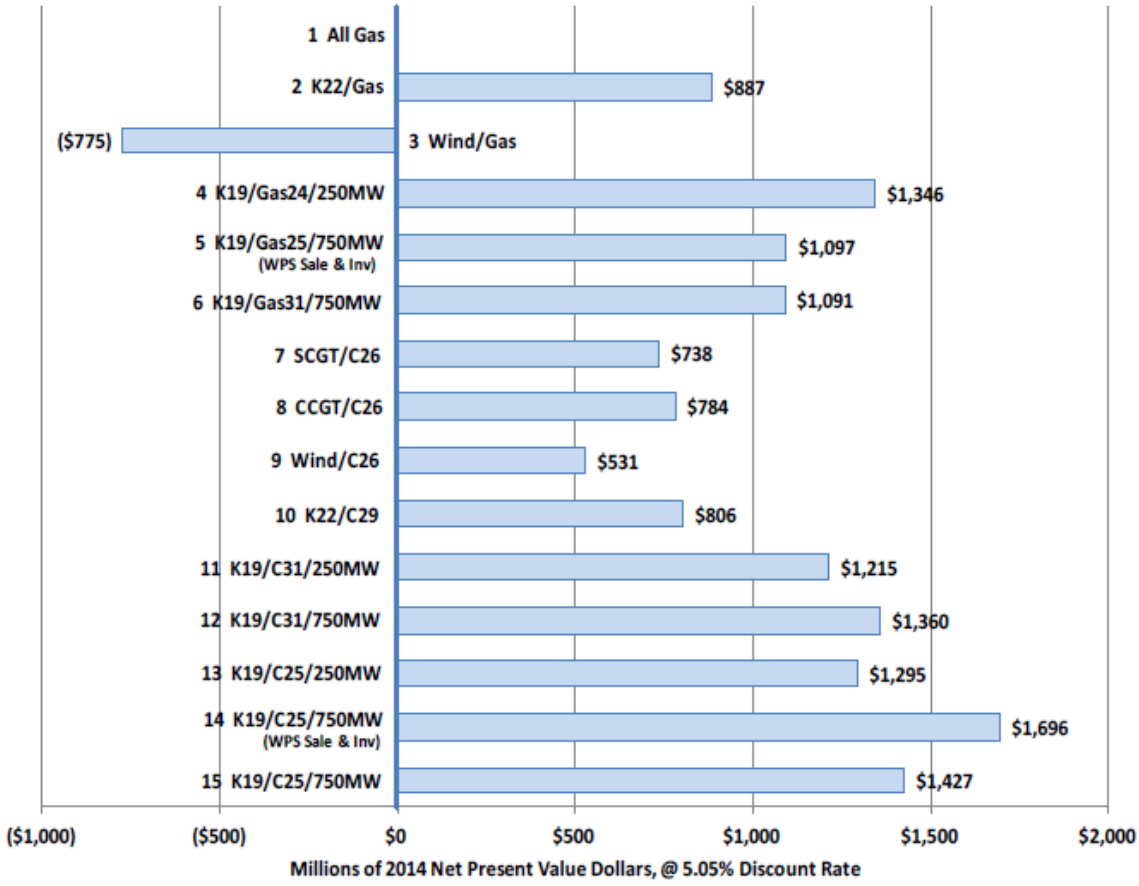
In the same section of the NFAT Application Manitoba Hydro has also included a comparison of the various Development Plans whereby payments to the Province in the form of capital taxes, water rentals and debt guarantee fees (all "costs" to Manitoba Hydro) are include as benefits[40].

5.1.2 Manitoba Hydro's Results and Conclusion

The results of Manitoba Hydro's initial economic evaluations based on the Reference case forecasts of the costs and revenues for each Plan are set out in Figure 9.2 from the NFAT Application and are copied below.

ECS Table #2 – Manitoba Hydro's Economic Evaluation Results

Figure 9.2 DEVELOPMENT PLAN NPVS – BENEFITS TO MANITOBA HYDRO (RELATIVE TO ALL GAS PLAN)



[40] NFAT Application, Chapter 9, pages 23-25

The economic evaluation results indicate that of the seven plans with no new intertie Plan #2 (K22/Gas) has the highest NPV. However, Manitoba Hydro also observes[41] that the net benefit of Plan #2 as compared to Plan #10 (K22/C29) is not large enough to be decisive between the two plans on the basis of NPV. Furthermore, the difference between the Development Plans with a SCGT versus a CCGT where each is followed by Conawapa in 2026 is even smaller. Indeed, in its responses to the information requests Manitoba Hydro has observed that, given the costs and revenues involved, differences of more than $100 M would be required to determine conclusively that one Plan was more attractive than another[42].

All three Plans with a 250 MW intertie have materially higher NPV values than any of the seven Plans with no intertie. This has led Manitoba Hydro to observe that "it would be significantly more beneficial for Manitoba Hydro to invest in one of these three development plans"[43]. When considering between the 250 MW Plans, Manitoba Hydro has concluded that the net benefit between Plan #4 and Plan #13 (where the difference is Gas vs. Conawapa as the next resource developed after Keeyask) is sufficiently small to result in indifference between them. Plan #11, which has a later in-service date for Conawapa, is considered to be marginally less beneficial[44].

Again, all five plans with a 750 MW intertie have materially higher NPV values than any of the seven Plans with no intertie, with the (preferred) Plan #14 having the highest net present value (or net benefit). However, not all the Development Plans with a 750 MW intertie provide more benefits than the Plans with a 250 MW intertie. In particular, the 250 MW intertie provides greater benefits (i.e. has a higher NPV) if natural gas fired generation were to follow Keeyask; whereas the 750 MW intertie provides greater benefit if Conawapa is developed after Keeyask[45]. Overall Plans with a 750 MW intertie and Keeyask followed by Conawapa yield the greatest benefit even without the WPS (or similar) contract and without reducing Manitoba Hydro's initial 2/3 investment in U.S. transmission.

[41] NFAT Application, Chapter 9, page 16
[42] LCA/MH I-349
[43] NFAT Application, Chapter 9, page 19
[44] NFAT Application, Chapter 9, page 19
[45] NFAT Application, Chapter 9, pages 22-23

Based on these results Manitoba Hydro selected twelve of the initial 15 alternative Development Plans for more detailed economic uncertainty analysis[46]. The following three plans were excluded from further consideration:

- Plan #8 (CCGT/C26)[47]
- Plan #9 (Wind/C26)[48]
- Plan #10 (K22/C29)[49].

5.2 Comments

5.2.1 Analytical Approach

Manitoba Hydro's approach to economic evaluation is generally consistent with accepted practice and the results appropriate for comparative purposes subject to comments on the following issues:

- Treatment of Aboriginal Income Sharing,
- Determination of the Discount Rate,
- Treatment of WPS Contract & Investment,
- Aggregation of Manitoba Hydro and Provincial Benefits,
- Ratepayer Perspective, and
- Intergenerational Issues

Treatment of Aboriginal Income Sharing

Ideally, if the economic evaluation is meant to reflect a Manitoba Hydro perspective it should reflect only costs and benefits that accrue to Manitoba Hydro. However, as the investment by KCN is assumed to be small (i.e. $25 M[50] out of a total cost for Keeyask of over $6 B and total capital costs for each Plan that are significantly greater) not accounting for the costs and benefits specifically accruing to KCN is unlikely to have an impact on the conclusions drawn from the evaluation.

[46] NFAT Application, Chapter 9, page 27
[47] CAC/MH I-117
[48] NFAT Application, Chapter 9, page 17
[49] NFAT Application, Chapter 9, page 17
[50] CAC/MH II-006 a)

Determination of Discount Rate

PUB/MH I-156 a) (copied below) sets out Manitoba Hydro's calculation of its real Weighted Average Cost of Capital (WACC) as used in its economic evaluation of the alternative Development Plans.

ECS Table #3 – Manitoba Hydro's Weighted Average Cost of Capital (WACC)

NFAT 2012					
Capital Source	**Target Capital Structure**	**Nominal Rates**		**Real Rates**	
		Rate	***Weighted Rate***	***Rate***	***Weighted Rate***
CDN 10 Year+Bond Yield		4.65%			
10 Year+ Credit Spread		0.65%			
Provincial Guarantee Fee		1.00%			
Long-Term Debt	75%	6.30%	4.73%	4.32%	3.24%
Long Term Debt		6.30%			
Imputed Cost of Equity		3.00%			
Equity	25%	9.30%	2.33%	7.26%	1.82%
Total	100%		7.05%		5.05%

When asked about the rationale for the 300 basis point premium for the cost of equity Manitoba Hydro indicated that it was based on the allowed equity returns for electric utilities regulated on a rate of return basis but did not provide any supporting documentation.

The following table sets out the rates of return on equity approved in recent decisions by Canadian regulators following formal generic cost of capital reviews.

ECS Table #4 – Results of Recent Generic Cost of Capital Proceedings

Jurisdiction	Reference	Allowed Return on Equity	Underlying Long Canada Bond Rate	Differential
BCUC – British Columbia Utilities Commission	Generic Cost of Capital Proceeding (Stage 1), Decision – May 2013	8.75%	3.8%	4.95%
Alberta – Alberta Utilities Commission	2011 Generic Cost of Capital, Decision 2011-474	9.00%	4.32%	4.68%
Ontario – Ontario Energy Board	Report of the Board on Cost of Capital for Ontario's Regulated Utilities (EB-2009-0084)	9.75%	4.25%	5.50%

The range for these findings is 468 – 550 basis points above the yield on long term Canada bonds. In contrast the 300 basis points premium over Manitoba Hydro's debt costs translates into a 465 basis point premium over long–term Canada bond yield forecast utilized by Manitoba Hydro, slightly below this range. Compounding this variance is the fact that Manitoba Hydro's forecast of long-term Canada bond yields is based on the average of 10-year and 30-year yields. In contrast, the long-term Canada bond yield used by the regulators referenced above is the 30 year rate which is typically higher[51].

As a result, the 300 basis point premium used by Manitoba Hydro understates the cost of equity allowed by regulators on rate of return regulated utilities. If one was to use the average of recently approved values noted above (~5.0%) and adjust for the difference in reference point (i.e. the 30 year rate versus the average of the 10 and 30-year rates

[51] PUB/MH I-065, Attachment 1

of ~0.25%) this would increase the equity premium from 300 basis points to 360 basis points. In the overall WACC calculation this would increase the value by 15 basis points to 5.20%.

A more fundamental issue is the fact that Manitoba Hydro is not regulated on "rate of return" basis like privately owned electric utilities and most publicly owned electric utilities. Instead, Manitoba Hydro is regulated on what has been characterized as a "cost of service" basis. Under this approach there is no approved return on equity which is then translated into net income for purposes of setting the revenue requirement underlying the utilities approved rates. Instead, net income requirements are set with a view to balancing year over year rate increases with the need to maintain satisfactory financial ratios for the Corporation[52]. For Manitoba Hydro this has meant achieving (on a timely basis) and maintaining a debt/equity ratio of 75%/25%[53].

It is ultimately the Corporation's Manitoba customers[54] that are responsible for maintaining a satisfactory level of retained earnings. If the equity ratio is below 25% and/or if future capital spending is putting upward pressure on the amount of debt Manitoba Hydro requires this will in turn put upward pressure on customers' rates in order to increase the Corporation's retained earnings through higher levels of annual net income. As a result, the Corporation's retained earnings can be viewed as "customer" dollars and, to the extent the debt/equity ratio is not currently being met, the shortfall is funds that may eventually[55] need to be contributed by customers. Given this context, the appropriate discount rate for Manitoba Hydro to assign to this source of capital would be the discount rate that customers require in order to be neutral as between contributing to the Corporation's retained earnings now (and on gradual basis) as opposed to at some future point in time (and on a more "impactive" basis).

[52] Manitoba Hydro's 2012/13-13/14 GRA, Tab 2, pages 2-5
[53] NFAT Application, Chapter 11, page 4
[54] As opposed to export customers or the Province
[55] It is acknowledged that activities such as export sales can contribute to net income. However, at the end of the day, accountability for maintaining a satisfactory level of retained earnings rests with the domestic customers of Manitoba Hydro.

However, determination of the appropriate discount rate from a customer perspective is difficult by virtue of the fact that Manitoba Hydro's domestic customers consist of both residential consumers as well as commercial/industrial businesses which are likely to have different views as to the time value of money (i.e., different costs for debt, different tax rates and investment opportunities). Furthermore, within in each of these customer segments, individual customers will have varying views on the time value of money.

At best, the allowed return on equity for electrical utilities can be viewed as a proxy for this discount rate, since it reflects the rate of return that is viewed as being fair compensation to investors in utilities similar to Manitoba Hydro.

Treatment of WPS Sale/Investment

The alternative Development Plans consider different utility-scale generation resources that Manitoba Hydro could develop in different timeframes, different interconnections with the U.S., different firm export contracts and different degrees of investment by Manitoba Hydro in U.S. transmission facilities. Subject to regulatory and government approvals, the various generation options are choices that rest primarily with Manitoba Hydro and therefore can be viewed as "alternatives" that are available to Manitoba Hydro.

In the case of interties, construction of the U.S. portion is facilitated by the support of a U.S. utility that is willing to champion the construction[56]. Currently, Minnesota Power has an Application before the Minnesota Public Utilities Commission[57] for a Certificate of Need for the Great Northern Transmission Line. This Application identifies a 230 kV (250 MW) line as being a possible alternative but the 500 kV (750 MW) line is characterized as being considered the "preferable" size by both Minnesota Power and Manitoba Hydro[58] and is the basis for the current application. Thus, while the 250 MW intertie is an "alternative" available to Manitoba Hydro pursuing it would require a "change of plans" on the part of Minnesota Power.

[56] MIPUG/MH I-20
[57] MPUC Docket No. E-015/CN-12-1163
[58] GNTL Certificate of Need Application, page 76

In terms of the various firm export contracts assumed in the Development Plans, they are all "signed" with the exception of the 300 MW contract with WPS[59]. Furthermore the other key contract, the 250 MW contract with Minnesota Power, has been approved by the Minnesota Public Utilities Commission[60]. In the case of the WPS 300 MW contract, negotiations are still ongoing and a "signed" agreement has yet to be achieved although there is a term sheet which provides a framework for the agreement.

Finally, initial discussions with WPS regarding the 300 MW contract also included WPS investing in the required 750 MW intertie required to facilitate the sale. Indeed, this investment is included as an element of Manitoba Hydro's Preferred Plan. However, subsequent to the Manitoba Hydro's completion of the analysis for its NFAT Application WPS notified Manitoba Hydro that an investment in the 750 MW intertie did not match its current business objectives and it would not be investing in the line[61]. Manitoba Hydro has indicated that its intent is to not own more than 49% of the interconnection facilities in the U.S.[62]. However, unless another investor can be found or MP agrees to increase its investment in the interconnection facilities, Manitoba Hydro will be responsible for 2/3 of the capital and ongoing operating cost associated with the U.S. portion of the line.

As a result, neither the WPS contract (particularly one with the precise terms assumed in the Preferred Plan) nor a 750 MW intertie with only 40% investment by Manitoba Hydro can be considered as being "available" to Manitoba Hydro as choices that are its (or the Province's) to make as both are clearly conditional on successful negotiations with counter parties in the U.S.. Furthermore, the recent change of heart by WPS regarding its investment in U.S. intertie facilities demonstrates that such negotiations are fluid and the ultimate results cannot be easily predicted.

The implications are that while a future that looks like Plan #14 is something that may occur if Manitoba Hydro's Preferred Plan is accepted by the Provincial government it is not a given. Indeed, a future that looks like Plan #15 or Plan #14 – but with a 2/3

[59] NFAT Application, Appendix 9.3, page 17
[6060] Approved February 1, 2012, Docket No E-015/M-11-938
[61] NFAT Application, Chapter 14, page 30
[62] NFAT Application, Chapter 8, page 7 and CAC/MH I-089 b)

investment by Manitoba Hydro in the U.S. intertie – could also easily emerge as the eventual outcomes if Manitoba Hydro pursues a 750 MW intertie and Conawapa. The economic evaluation of the alternative Development Plans should take this uncertainty into account.

Treatment of Cash Transfers to Province

Section 9.3.3 of the NFAT Application compares the Net Present Values of the various Development Plans when the cash transfers to the Province, in the form of water rentals, capital tax and the provincial (debt) guarantee fees, are discounted at the same 5.05% (real) rate as used in the initial economic evaluation and also included. The rationale for doing so is that these transfers benefit the provincial government and indirectly Manitobans[63].

The problem with the resulting comparison[64] is the fact that the perspective from which cost and benefits are being viewed has now changed for a portion of the analysis. With the inclusion of "Transfers to the Province" it is no longer purely a "Manitoba Hydro" perspective but is now taking on elements of a broader provincial or societal perspective. This mixing of perspectives raises an immediate issue as to whether or not it is appropriate to continue to apply the 5.05% discount rate to all costs and benefits.

Indeed, when the same government revenues are considered in the Government Account part of the Multiple Account Analysis they are discounted at a rate of 6% that is meant to reflect the social opportunity cost of capital[65] from the point of view of taxpayers[66] and not Manitoba Hydro's WACC. Furthermore, the comparisons do not reflect the fact that when one looks at the Development Plans from a broader provincial perspective it is necessary to take into account not only the benefits arising from the increased in cash transfers to province but also any additional costs. In this regard, the calculation of the Government Account value in Chapter 13 of the NFAT Application appropriately recognizes that the debt guarantee fee serves to reduce Manitoba Hydro's

[63] NFAT Application, Chapter 9, page 24
[64] See NFAT Application, Chapter 9, page 25
[65] NFAT Application, Chapter 13, page 5 and CAC/MH II-53
[66] NFAT Application, Chapter 13, page 8

borrowing costs by transferring risk to the province and can therefore be viewed as compensating the province for the "cost" associated with its increased risk. However, the analysis presented in Section 9.3.3 does not.

Overall, it is inappropriate to combine the costs and benefits accruing to Manitoba Hydro with government transfers in the way Manitoba Hydro has done in Section 9.3.3.

Ratepayer Perspective

While, as described earlier, Manitoba Hydro's domestic customers have a significant stake in the economic/financial performance of the Corporation, rates are not set on a rate of return basis. This fact combined with the fact that rates are based on an accounting cost-based revenue requirement as opposed to cash flow means that customers see (from their perspective) a different flow of costs and benefits than Manitoba Hydro does from its perspective. In order to look at the Preferred Plan and the alternatives from a customer perspective it is necessary to look at how the costs and benefits – in terms of the electricity bills paid by customers – vary over time in each case. Manitoba Hydro did not undertake such an analysis as part of either its economic evaluation or its multiple account analysis. However, it did address the issue in its interrogatory responses[67]. It is understood that InterGroup, the consultants retained by MIPUG, will be examining this issue. As a result, it is not addressed further in this report. However, it is noted that this too is an important perspective from which the PDP (and its alternatives) need to be considered.

Timeframe

Manitoba Hydro's economic evaluation utilizes a 78 year study period. Given this multi-generational time horizon it is important to understand the benefits and costs are distributed over time and whether, from this perspective, there are material differences between the Plans.

[67] PUB/MH I-149 a)

5.2.2 Results and Conclusions

The following table sets out the NPV's (in millions of 2014$ relative to Plan #1- All Gas) for Manitoba Hydro's 15 alternative Development Plans based on the Reference case for each Plan using Manitoba Hydro's 5.05% discount rate and the alternative value of 5.2%. It also includes the results for two additional plans:

- Plan #14 a) – which is Plan #14 but with MH responsible for 2/3 of the cost of the U.S. transmission
- Plan #5 a) – which is Plan #5 but with MH responsible for 2/3 of the cost the U.S. Transmission.

ECS Table #5 – Comparison of Reference Case NPVs (Millions 2014 $)

Plan	Description	NPV (relative to All Gas) @ 5.05%	NPV (relative to All Gas) @ 5.20%
#1	All Gas	0	0
#3	Wind/Gas	($775)	($763)
#7	SCGT/C26	$738	$595
#8	CCGT/C26	$784	$632
#9	Wind/C26	$531	$385
#10	K22/C29	$806	$597
#2	K22/Gas	$887	$774
#4	K19/Gas 24/250 MW	$1,346	$1,210
#13	K19/C25/250 MW	$1,295	$1,037
#11	K19/C31/250 MW	$1,215	$994
#6	K19/Gas 31/750 MW	$1,091	$955
#15	K19/C25/750 MW	$1,427	$1,152
#12	K19/C31/750 MW	$1,360	$1,123
#5	K19/G25/750 MW WPS Inv&Sale	$1,097	$967
#5 a)	K19/G25/750 MW WPS Sale	$914	$785
#14	K19/C25/750 MW WPS Inv&Sale	$1,696	$1,417
#14 a)	K19/C25/750 MW WPS Sale	$1,513	$1,235

Note: NPV values were calculated using the cash flows from CAC/MH I-115 but varying the discount rate and, in the case of Plans 5 a) and 14 a) adjusting the cash flows to reflect a 2/3 investment in U.S. Transmission per Plan #15's cash flows.

It can be seen from the preceding Table that based on the NPV values for the Reference cases:

- Increasing the discount rate to 5.2% does not change the initial overall conclusion that Plan #2 yields the highest economic benefit for Manitoba Hydro from amongst the no-intertie plans.
- Increasing the discount rate to 5.2% does not change the conclusion that a 250 MW intertie (along with the advancement of Keeyask) yields economic benefits relative to any of the no intertie plans and that Plan #4 is the superior choice.
- At 5.2% all of the 750 MW intertie alternatives provide net benefits relative to the no intertie alternative, although for Plan #5 a) – the results are virtually equivalent.
- At 5.2%, Plan #4 provides greater benefit than any of the 750 MW intertie alternatives when there is no WPS contract and no new investor in the U.S. transmission. However, the differences between Plan #4 and Plans #12 or #15 are minimal.
- Without additional investment from other sources that will reduce Manitoba's overall stake in the U.S. transmission facilities to 40% but with the WPS contract (i.e. Plan 14 a)), the outcome still provides more benefit than any of the 250 MW intertie options at Manitoba Hydro's 5.05% discount rate. However, this differential virtually disappears with a 5.2% discount when the results are compared with those of Plan #4.
- With additional investment that reduces Manitoba Hydro's stake in U.S. Transmission to 40% and the WPS contract, Plan #14 is preferred to Plan #4 at both a 5.05% and 5.2% discount rates.
- Also, with a 750 MW intertie and in the circumstance where Conawapa was to follow Keeyask, the higher 5.2% discount rate virtually eliminates any benefit of advancing Conawapa without there being a firm contract for additional sales such as that envisioned with WPS.

Overall, the use of the higher discount rate in conjunction with the Reference cases for each Plan does not change the conclusion reached in Manitoba Hydro's analysis that there are economic benefits (from Manitoba Hydro's perspective) to advancing Keeyask and constructing an intertie. However, with a higher discount rate the choice between

the 250 MW and 750 MW intertie become less clear and dependent on the level of Manitoba Hydro investment in U.S. transmission and the existence of new firm export contracts such as that envisioned with WPS.

6. Economic Uncertainty Analysis

6.1 Manitoba Hydro's NFAT

6.1.1 Manitoba Hydro's Approach

At the time of Manitoba Hydro's last major NFAT Review (i.e. Wuskwatim), Manitoba Hydro's corporate polices with respect to project evaluation[68] called for the use of a risk-adjusted hurdle rate to discount future revenues and costs and determine whether the resulting NPV was positive (i.e. there was an overall net benefit from the project). The hurdle rate was set at Manitoba Hydro's Weight Average Cost of Capital for investments associated with the Corporation's core business (i.e., generation, transmission and distribution). If the project fell outside of its core business areas or involved an unusual degree of risk then a higher hurdle rate was applied. At the time the policy was written the range of potential hurdle rates was from 5.98% (WACC in real terms) to 10% to 15%, where the latter two values were for medium and high risk projects respectively.

This general approach is still in use by Manitoba Hydro today. However it has been refined and the choice of risk category and any resulting inclusion of a "risk premium" now also take into account:

- Whether future anticipated cash flows have already been adjusted to reflect a degree of uncertainty, and
- Whether risk has been accounted for by some other means.

In the case of the current NFAT Application Manitoba Hydro has not adjusted the discount rate in order to account for risk but rather undertaken risk analysis by looking at the sensitivity of the results to key inputs and assigning probabilities to the likely value for these inputs[69].

[68] CAC/MH I-102
[69] PUB/MH I-151 c)

Manitoba Hydro assessed the sensitivity of its NPV calculations and, in particular the impact on the differences between the NPV values of different Plans to various inputs and determined that real discount rates, energy prices (natural gas and electricity exports) and capital costs were the highest impact factors[70]. It then created High and Low alternatives to its Reference Scenario (i.e. the "most likely" outcome) for each of these three factors and assigned probabilities to each of the three outlooks for each of the three factors. This produced 27 scenarios each with an associated probability, based on the product of the probabilities associated with the values used for each of the three factors in the particular scenario.

6.1.2 Manitoba Hydro's Results and Conclusions

Manitoba Hydro has calculated 27 possible NPV values for each of its 15 Development Plans. For comparative purposes, the NPV results for each were presented relative to the NPV value for the All Gas Development Plan's (Plan #1) Reference Case results. The results are summarized below in what Manitoba Hydro has termed a "probabilistic quilt"[71].

From these results Manitoba Hydro is able to calculate cumulative probability distributions and expected values for the NPVs for each Development Plan. These results are summarized below.

ECS Table #6 – Results of Manitoba Hydro's Probabilistic Analysis

Development Plan	1	3	7	2	4	13	11	6	15	12	5	14
Millions 2014$ - NPV	All Gas	Wind/Gas	SCGT/C26	K22/Gas	K19/Gas24/250MW	K19/C25/250MW	K19/C31/250MW	K19/Gas31/750MW	K19/C25/750MW	K19/C31/750MW	K19/Gas25/750MW (WPS Sale & INV)	K19/C25/750MW (WPS Sale &Inv)
10th Percentile	-3502	-4599	-1217	-1249	-898	-1988	-1363	-1181	-2186	-1594	-828	-1429
25th Percentile	-560	-2200	-297	-248	115	-650	-363	-183	-904	-361	139	-204
75th Percentile	1481	383	1363	1636	2092	1854	2074	1832	2008	2009	1726	2255
90th Percentile	1905	1209	1956	2007	2479	3180	2953	2215	3360	3220	2256	3377
Expected Value	-70	-1084	455	564	971	712	736	706	760	821	772	1085
Ref-Ref-Ref NPV	0	-775	738	887	1346	1295	1215	1091	1427	1360	1097	1696
50th Percentile	115	-641	661	849	1266	941	1040	1007	1003	1016	1053	1266

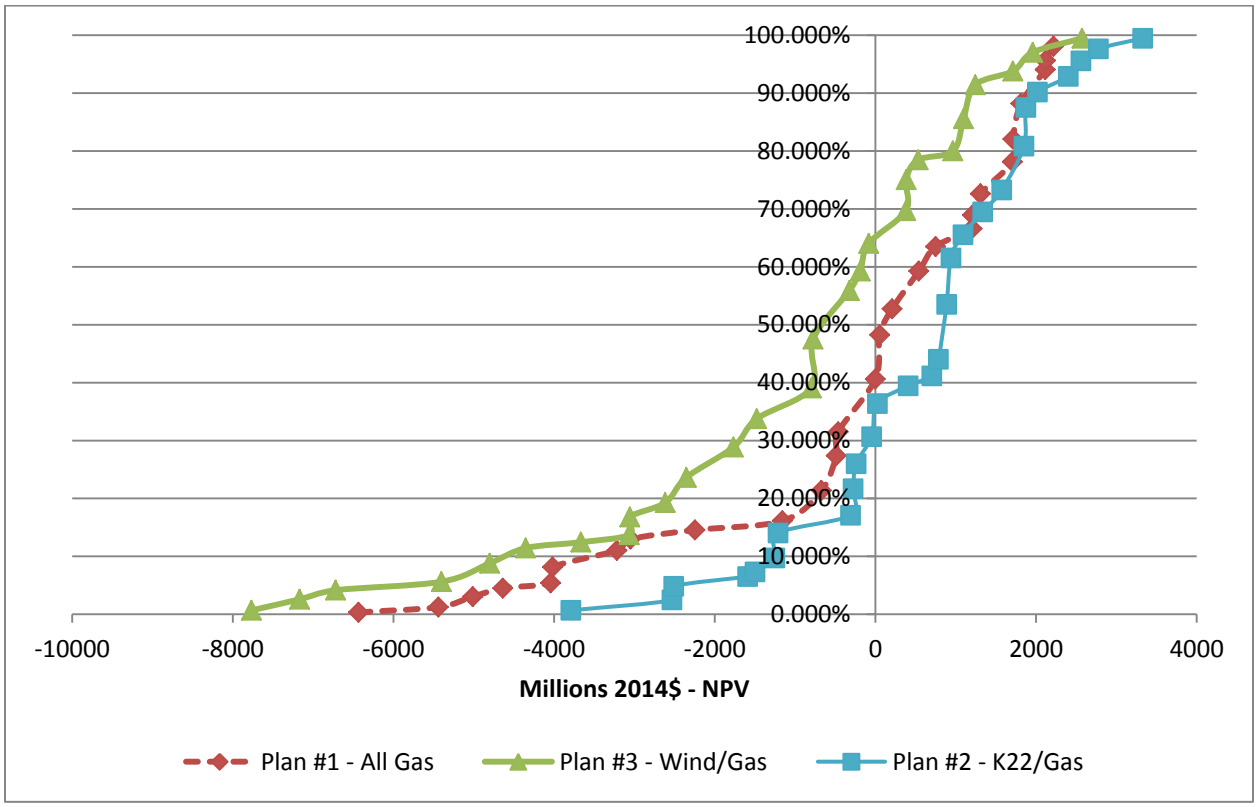
[70] NFAT Application, Chapter 10, pages 2-5
[71] NFAT Application, Chapter 10, page 14

Manitoba Hydro has also calculated cumulative probability curves (also referred to in the Application as S-curves) that allow for a comparison of the risk profiles of the alternative Development Plans.

No Intertie

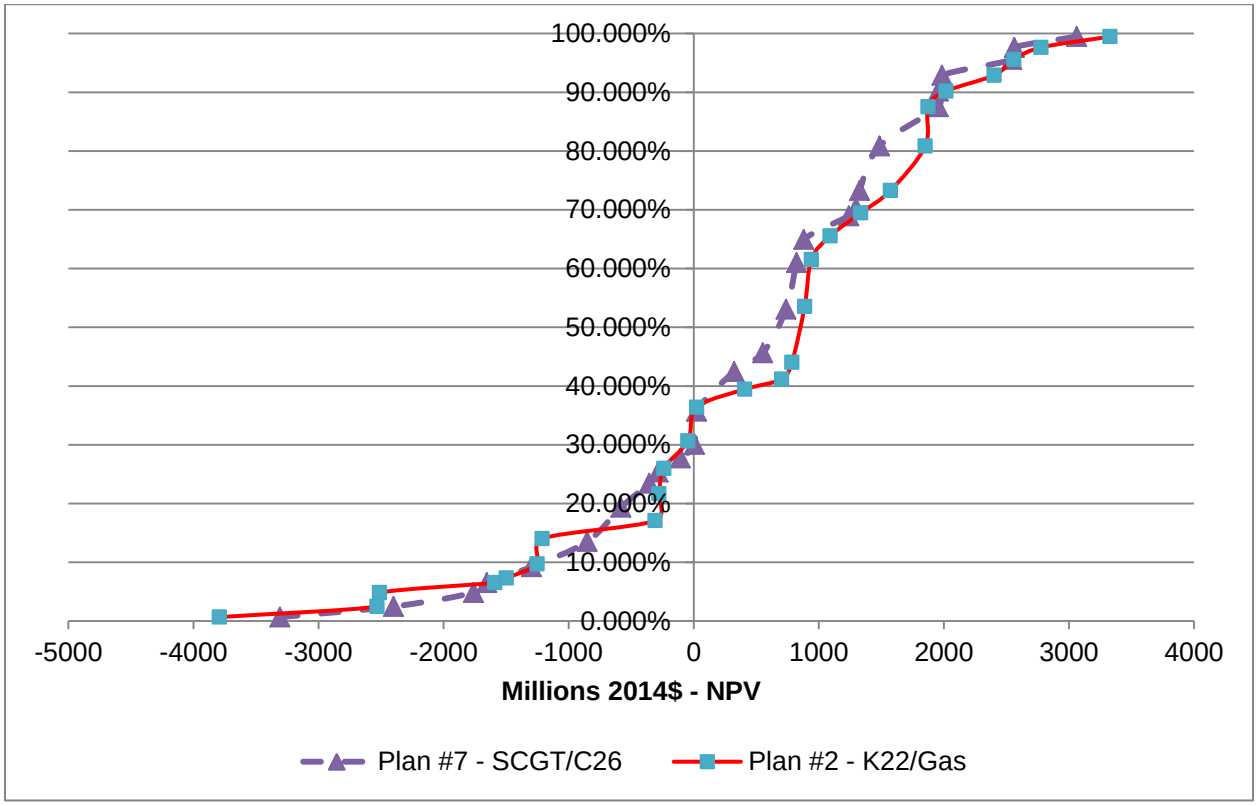
Manitoba Hydro's S-curves indicate that not only is Plan #2's(K22/Gas) Reference case NPV value higher than that for Plan #1 (All Gas) and Plan #3 (Wind/Gas) but it also dominates these two Plans from a risk profile perspective.

ECS Figure #1 – Manitoba Hydro's S-Curves: No Intertie Plans #1, #2 and #3



In contrast the risk profiles for Plan #2 and Plan #7 (SCGT/C29) are reasonably close to each other, although Plan #2, while having a marginally greater downside risk, does appear to dominate most of the time.

ECS Figure #2 – Manitoba Hydro's S-Curves: No Intertie Plans #2 and #7



Overall, Manitoba Hydro concludes[72] that for plans with no interconnection:

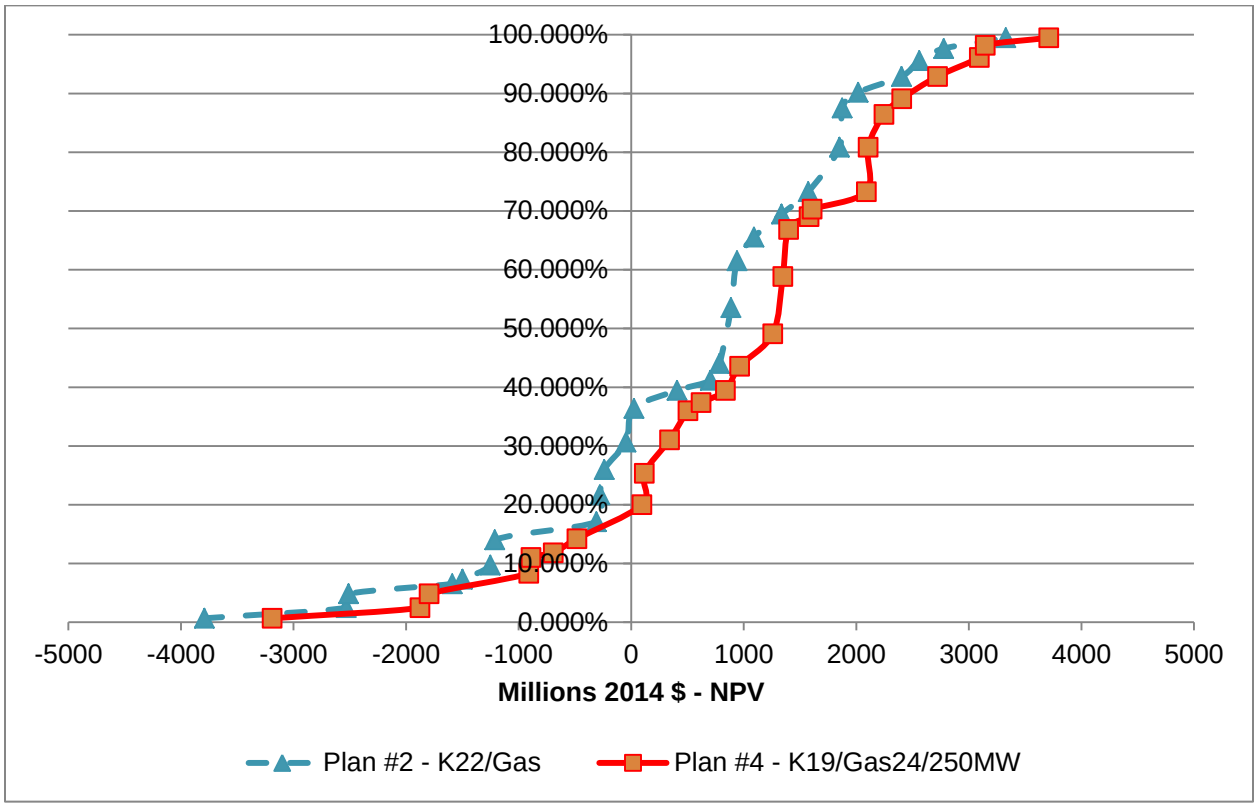
- Plans with hydro (Keeyask) next are clearly more economic than the All Gas Plan.
- Plans with Keeyask followed by Gas are marginally more economic than plans with Gas followed by Conawapa next.

[72] NFAT Application, Chapter 14, page 16

250 MW Intertie

A comparison of Manitoba Hydro's S-curves also demonstrates that not only does Plan #4 (K19/Gas) have a higher NPV value under the Reference case but that it dominates Plan #2 (K22/Gas). This has led Manitoba Hydro to conclude that "it is more beneficial to advance Keeyask G.S. and invest in a small interconnection than to consider any of the development plans without a new U.S. interconnection"[73].

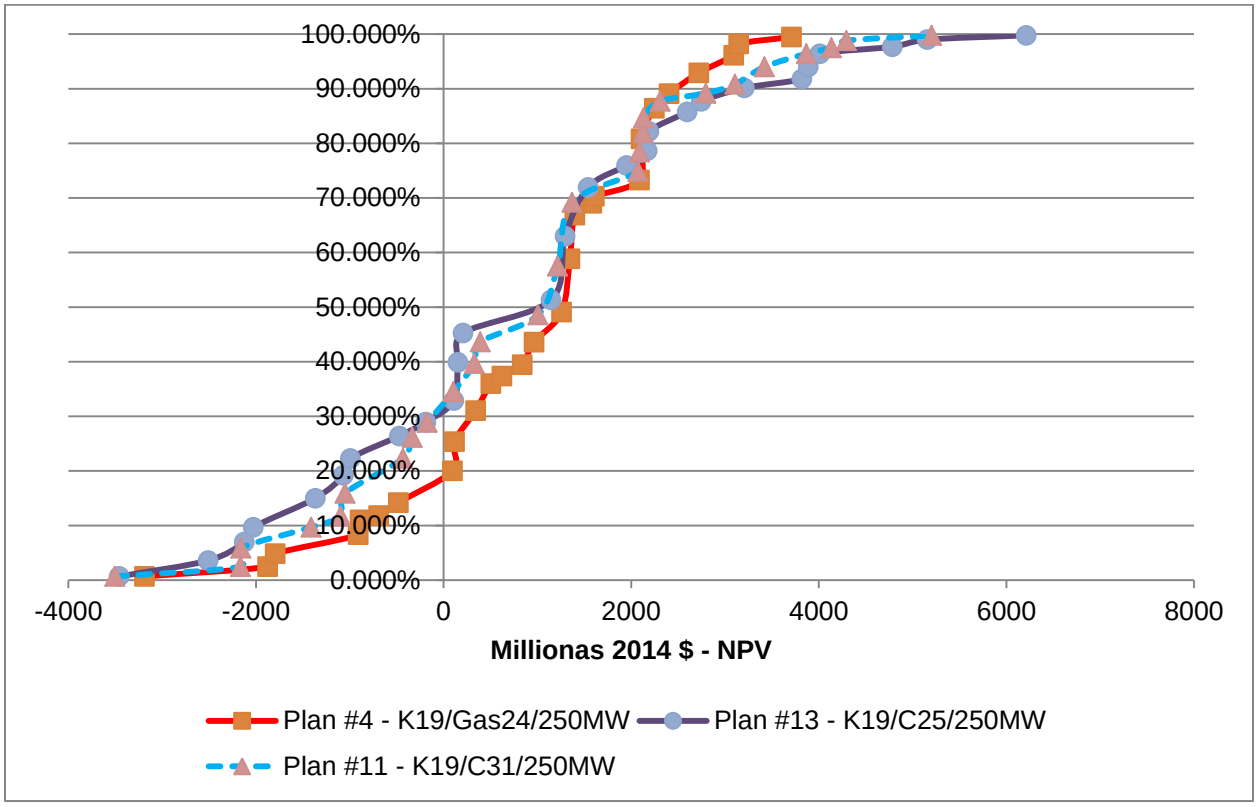
ECS Figure #3 – Manitoba Hydro's S-Curves: Plans #2 and #4



[73] NFAT Application, Chapter 10, page 31. See also Chapter 14, page 16.

Manitoba Hydro also notes that not only is Plan #4 the most economic plan of the three with a 250 MW intertie, but it has a notably different risk profile[74] as illustrated in the following figure.

ECS Figure #4 – Manitoba Hydro's S-Curves: 250 MW Intertie Plans #4. #11 & #13



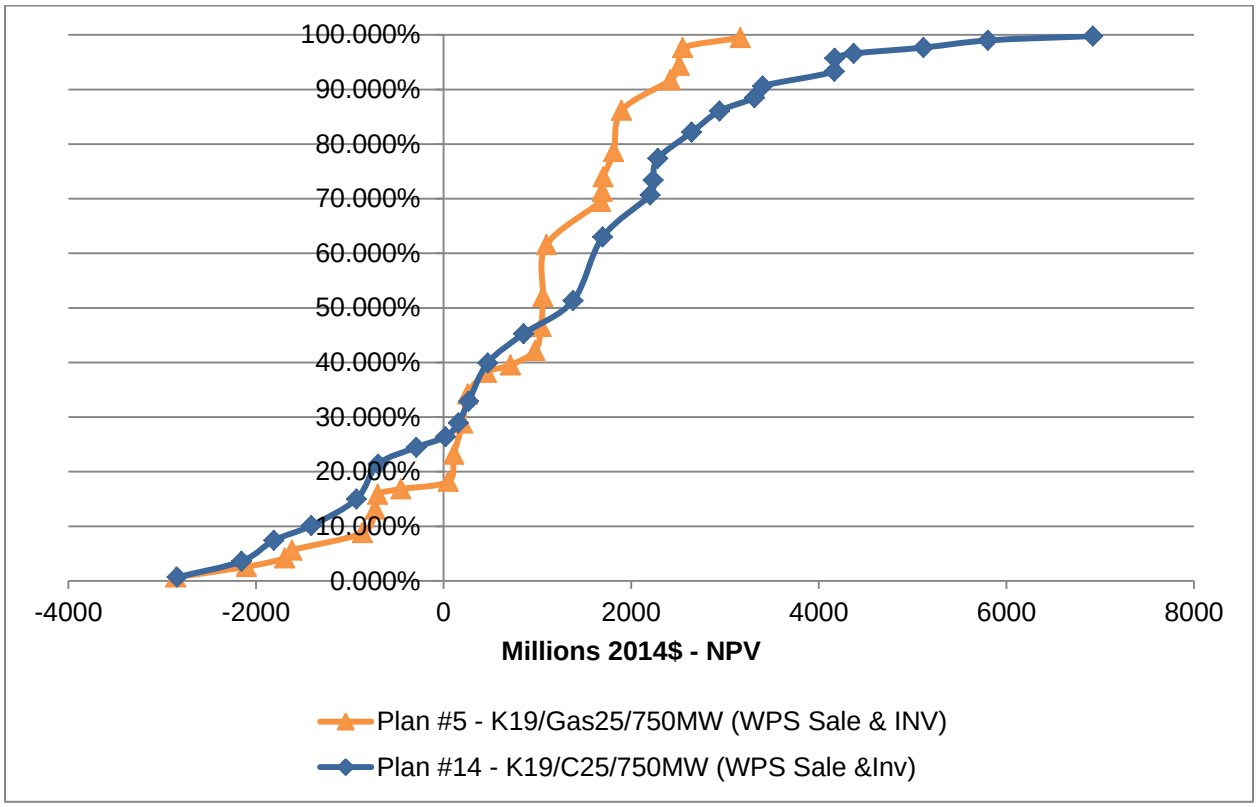
[74] NFST Application, Chapter 10, page 37

750 MW Intertie

When the five plans with a 750 MW intertie are compared there is a noticeable distinction in the risk profiles between those with and those without Conawapa G.S. While plans with natural gas generation have lower downside risk, overall the plans with Conawapa have higher expected NPV values as well as higher Reference NPV values[75].

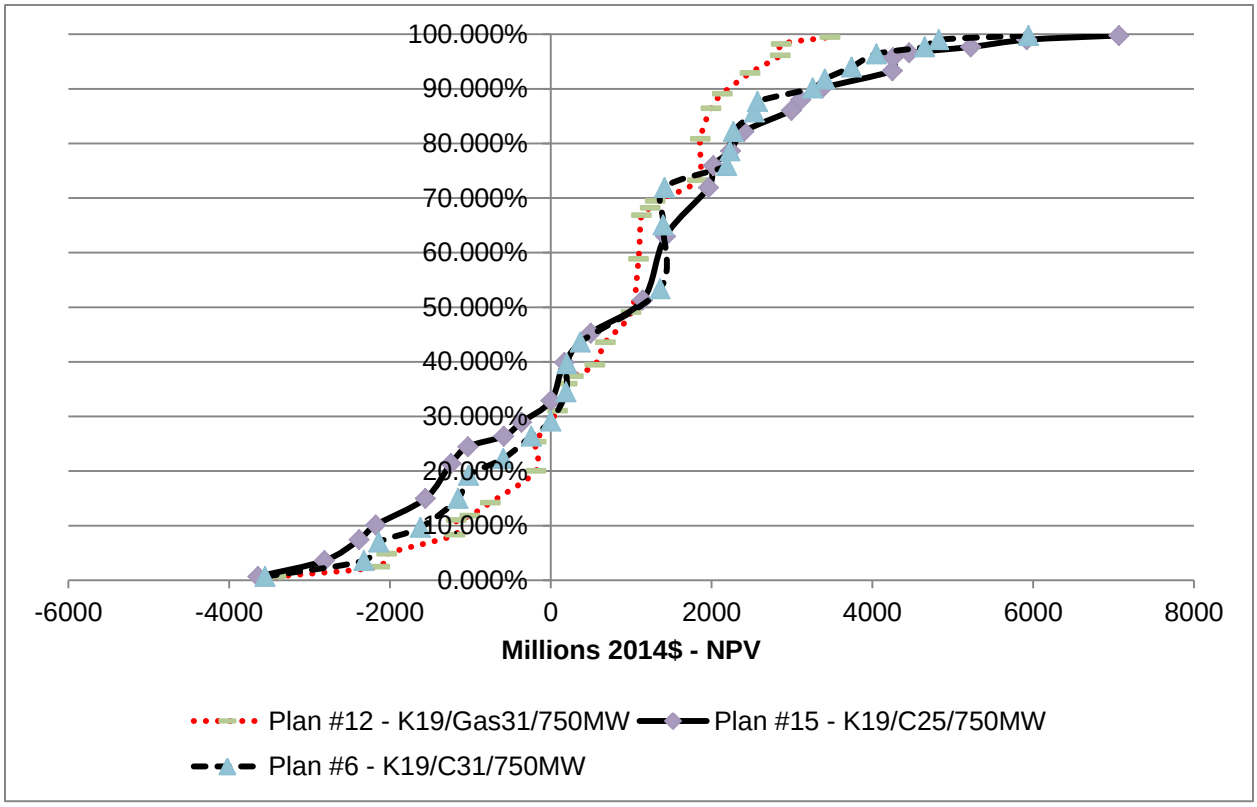
This observation applies regardless of whether one is comparing plans with or without the WPS Sale and Investment.

ECS Figure #5 – Manitoba Hydro's S-Curves: 750 MW Intertie and WPS (Sale/Inv)



[75] NFAT Application, Chapter 10, page 30

ECS Figure #6 – Manitoba Hydro's S-Curves: 750 MW Intertie and No WPS

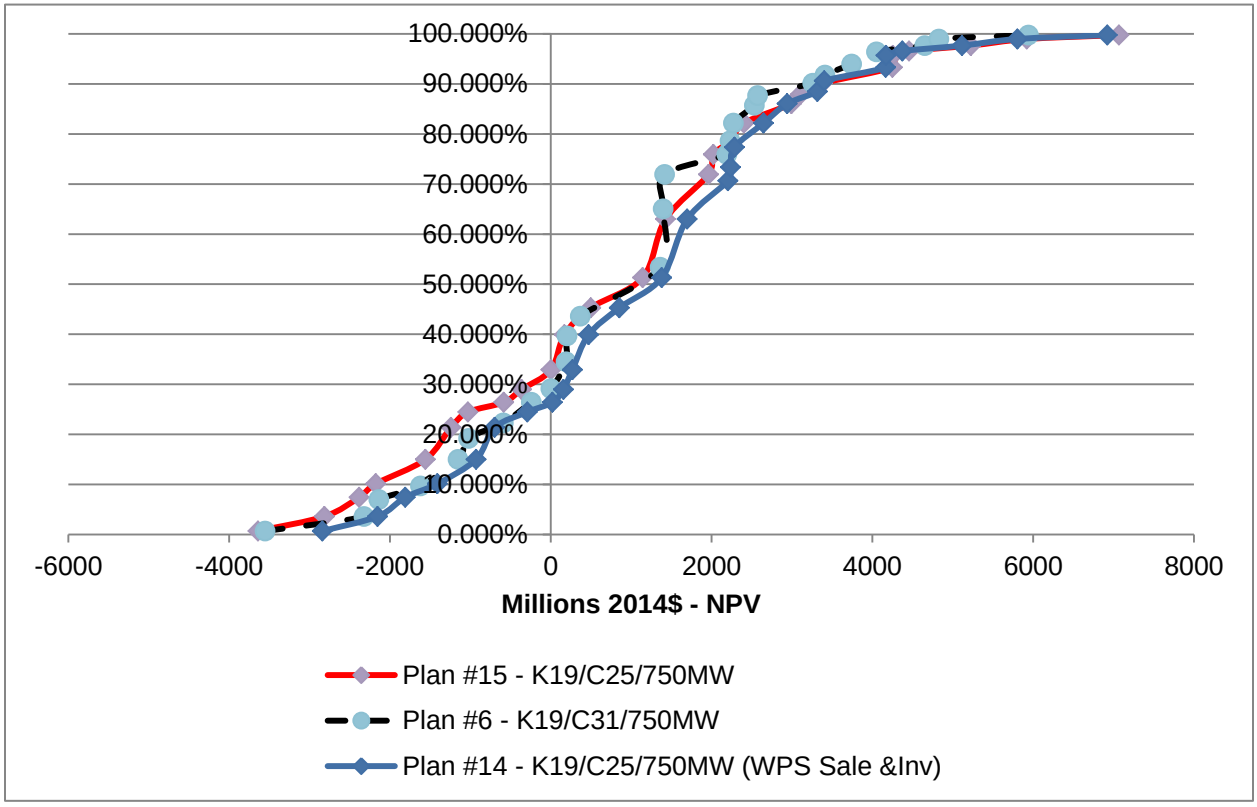


Of the three plans with Conawapa, Plan #14 (the Preferred Plan) has the highest expected value. While Plan #15 (with Conawapa advanced but no WPS contract/investment) has slightly higher upside potential this is offset by significantly higher downside risk[76].

[76] NFAT Application, Chapter 10, page 29

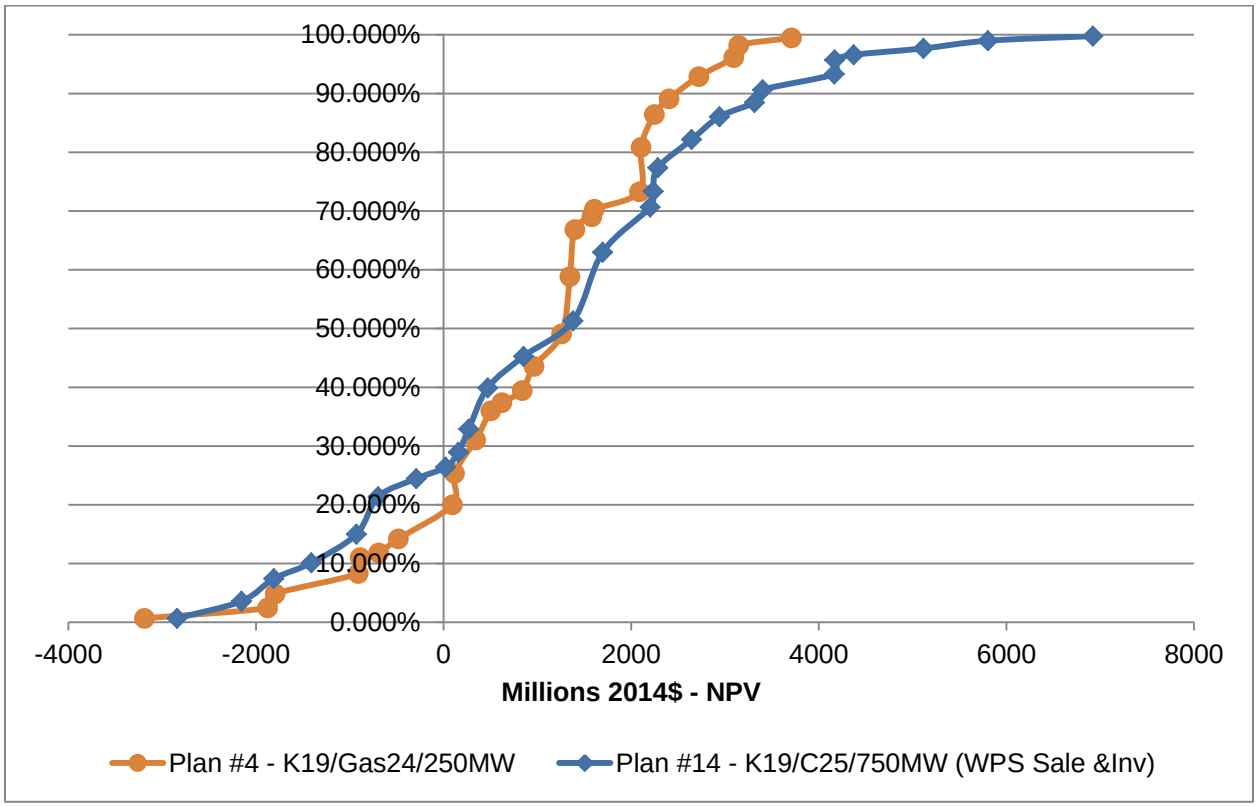
ECS Figure #7 – Manitoba S-Curves: 750MW Intertie and Conawapa

t



Finally, while the Preferred Plan has a significantly greater NPV value under the Reference Scenario than Plan #4 (K19/Gas24/250MW) the expected value is only $114 M higher, as the upside potential is offset somewhat but the greater downside risk.

ECS Figure #8 – Manitoba Hydro's S-Curves: Plan #4 and Plan #14



Overall, Manitoba Hydro concludes that "careful consideration must be given to the trade-offs between the plans given the different characteristics of these plans (Conawapa G.S. versus Gas and 750 MW interconnection versus 250 MW interconnection)"[77].

Protect a Conawapa In-Service Date

Whether Manitoba Hydro proceeds with a 250 MW or a 750 MW interconnection, there is still the remaining question as to whether or not Conawapa will eventually be constructed or not in the period up to the early 2030s. While the decision as to whether

[77] NFAT Application, Chapter 10, page 39

or not to construct Conawapa does not have to be made at this point in time[78] , there must be a commitment to continued spending on Conawapa if the option is to remain open. Manitoba Hydro has examined this issue by considering what it characterizes as different Pathways. At the broadest level there are seven pathways possible[79]:

- Pathway 1 – No interconnection and no Keeyask – must decide whether to protect an in-service date for Conawapa in the mid-2020s.
- Pathway 2 – No interconnection but construction of Keeyask – must decide whether to protect an in-service date for Conawapa in the late 2020s.
- Pathway 3 – A 250 MW interconnection and Keeyask in 2019 – must decide whether to protect an in-service date for Conawapa as early as the mid-2020s (Pathway 3A) or early 2030s (Pathway 3B).
- Pathway 4 – A 750 MW interconnection and Keeyask in 2019 – must decide whether to protect an in-service date for Conawapa are early as the mid-2020s or (Pathway 4A) or early 2030s (Pathway 4B)
- Pathway 5 – A 750 MW interconnection, Keeyask in 2019 and a WPS contract – must decide whether to protect an in-service date for Conawapa in the mid-2020s.

However, given the preceding conclusions, Pathways 3, 4 and 5 are superior to Pathways 1 and 2. Analysis undertaken by Manitoba Hydro[80] suggests that if a 250 MW interconnection is chosen then the cost of protecting Conawapa outweighs the expected benefit. However, if a 750 MW interconnection is chosen then protecting an in-service date in the mid-2020s for Conawapa increases the expected value of the outcome.

6.2 Comments

6.2.1 Analytical Approach

These comments are focused on Manitoba Hydro's approach and not the input values or the probabilities used in the various scenarios. Other parties to the proceeding, with

[78] NFAT Application, Executive Summary, pages 1-2 and Chapter 14, page 2
[79] PUB/MH I-279
[80] PUB/MH I-279

greater accessibility to Manitoba Hydro's planning assumptions and cost estimates, are assessing the input assumptions used.

Overall, Manitoba Hydro's approach to addressing "risk" through uncertainty/probability analysis as opposed to through the application of a hurdle rate is reasonable. Assigning a higher hurdle (i.e., discount) rate effectively attaches less value to future benefits and costs. In cases where investments are being made now for future benefits this effectively discounts (de-values) the future benefits. Such an approach is appropriate where there is a concern regarding the risks/uncertainty that the future benefits will accrue as forecast. However, in doing so it assigns the same risk "discount" to all future benefits regardless of their source or risk profile. Furthermore, use of a higher hurdle rate also increases the discount factor applied to future costs and, in doing so, lessens their impact on the overall NPV calculation. Therefore, in circumstances where future costs are uncertain use of a higher discount rate will have the opposite effect to what one may want if one is concerned about cost uncertainty/risks.

However, Manitoba Hydro's overall probabilistic-based risk assessment is fairly simplistic in that only three factors (albeit the three most significant ones) were utilized in the uncertainty analysis and, in each case, only three possible outcomes assigned. In reality there are virtually an infinite set of outcomes for each of the factors and considerably more factors that could be included in the analysis. While the simplicity of Manitoba Hydro's approach makes it easier for parties to follow the analysis and understand the results (e.g. Manitoba Hydro's probabilistic quilt) the resulting probability distributions for each Plan are not as robust as they could have been.

Also, while risk and uncertainty can affect time preference, time preference (i.e. the fact that people generally prefer benefits to occur sooner rather than later and for costs to be deferred) exists even in instances where costs and benefits are certain. As a result, it is important that one recognizes and clearly distinguishes the role that discount rates play in reflecting time preference and thereby allowing alternatives that have different cost and benefit patterns over time to be compared on a consistent basis (i.e. NPV) from the consideration of risk and uncertainty.

One of the "problems" with Manitoba Hydro's uncertainty analyses is that it has not maintained this separation. As noted in the description of Manitoba Hydro's approach one of the three factors that it has "varied" in its creation of the 27 scenarios is the discount rate used in the economic evaluation from a real value of 3.35% for the Low Discount Rate scenario up to 6.5% for the High Discount Rate Scenario[81]. This use of different discount rates for the different scenarios means that the cash flows are not being assessed using a common view as to the time preference of costs/benefits and that the NPVs calculated are no longer comparable.

The scenarios should all be evaluated using the same discount rate (i.e. time preference). If there are concerns regarding the appropriateness of the time preference value used then this should be addressed through sensitivity analysis whereby all of the scenarios are reassessed using a different discount rate and a determination made as to whether or not this changes the overall conclusions of the economic evaluation.

Compounding this issue is the fact that economic evaluations typically only include costs that vary across the alternatives. However, in Manitoba Hydro's economic evaluations, the benefits for each year include all of the export revenues from all export sales[82], including those associated with surplus energy (i.e. hydro production in excess of dependable energy) from currently existing hydro stations. The evaluation for each case also includes the total expected costs for water rentals, thermal operations and purchases. The inclusion of these revenues and costs does not impact the conclusions reached based on the economic evaluation of the Reference case for each Development Plan. Since the same costs/benefits are involved in each and the same discount rate (5.05%) was used these amounts will "net out" when the differences between the Plans are compared. However, when it comes to the economic uncertainty analysis the inclusion of these (common) costs and benefits will impact on the relative comparisons of the alternatives across the various scenarios where the discount rate is varied.

[81] NFAT Application, Appendix 9.3, page 34
[82] NFAT Application, Chapter 11, page 5 and NFAT Application, Appendix9.3, page 87

Finally, using the probability distributions established for each Plan it is possible to calculate an "expected" NPV value for each Plan. As ECS Table #6 illustrates these values are not the same as the NPV values for each Plan's Reference case. Furthermore, the rank ordering of the Plans (based on NPV) changes if one uses the expected NPV values for each Plan as opposed to NPV values for the Reference cases. This raises the question as to which value should be used in comparing the results of the various Plans. The Reference values for each Plan are characterized as the "most likely outcome"[83]. In contrast, the "expected value" considers the full range of anticipated outcomes for each Plan and the probabilities associated with them. As a result, the "expected value" more appropriately reflects the risk associated with each Plan and therefore is the appropriate value to use when comparing the anticipated outcomes of the various Plans for decision making.

6.2.2 Results and Conclusions

Based on the foregoing comments regarding the discount rate used by Manitoba Hydro and the issues raised regarding the use of different discount rates to assess the different scenarios, Manitoba Hydro's uncertainty analysis was replicated with two changes. First, a 5.2% discount rate was used as the discount rate for the Reference case and, second, this same rate was utilized to discount the cash flows for all the scenarios created for each Plan. Since this discount rate was applied to the cash flows as provided by Manitoba Hydro[84], the uncertainty analysis will reflect the impact variations in the inflation rate have on outcomes of the various scenarios.
The following chart sets out the resulting "probabilistic quilt" and the summary P-values for the same 12 Development Plans that Manitoba Hydro assessed in Chapter 10 of its NFAT Application.

[83] NFAT Application, Appendix 9.3, page 2
[84] CAC/MH I-115

ECS Table #7 – Probabilistic Analysis Results @ Common 5.2% Discount Rate

Development Plan Millions 2014 $ - NPV	Plan #1 - All Gas	Plan #3 - Wind/Gas	Plan #7 - SCGT/C26	Plan #2 - K22/Gas	Plan #4 - K19/Gas24/250MW	Plan #13 - K19/C25/250MW	Plan #11 - K19/C31/250MW	Plan #12 - K19/Gas31/750MW	Plan #15 - K19/C25/750MW	Plan #6 - K19/C31/750MW	Plan #5 - K19/Gas25/750MW (WPS Sale & INV)	Plan #14 - K19/C25/750MW (WPS Sale &Inv)
10th Percentile	-732	-2549	-1035	-800	-477	-2092	-1708	-767	-2341	-1847	-403	-1706
25th Percentile	-514	-1898	-244	-253	112	-807	-487	-159	-933	-564	14	-326
75th Percentile	159	-391	1014	880	1318	1690	1630	1054	1869	1789	1078	2117
90th Percentile	531	280	1548	1623	2128	3035	2647	1862	3323	2919	1646	3257
Expected Value	-124	-1136	272	419	832	459	484	564	496	557	642	821
Ref-Ref-Ref NPV	0	-763	595	774	1210	1037	994	955	1152	1123	967	1417
50th Percentile	-11	-927	398	610	1044	755	721	779	848	839	839	1123

ECS Figure #9 – Probabilistic Analysis Quilt @ Common 5.2% Discount Rate

Development Plan Millions 2014$ - NPV			Plan #1 - All Gas	Plan #3 - Wind/Gas	Plan #7 - SCGT/C26	Plan #2 - K22/Gas	Plan #4 - K19/Gas24/250MW	Plan #13 - K19/C25/250MW	Plan #11 - K19/C31/250MW	Plan #12 - K19/Gas31/750MW	Plan #15 - K19/C25/750MW	Plan #6 - K19/C31/750MW	Plan #5 - K19/Gas25/750MW (WPS Sale &	Plan #14 - K19/C25/750MW (WPS Sale	Probability
Energy Prices	Inflation Rates	Capital Costs													
Low	Low	High	-307	-2587	-1249	-1112	-823	-2499	-2071	-1120	-2794	-2238	-650	-2155	1.350%
		Ref	303	-1167	-574	-241	116	-1406	-1019	-172	-1592	-1129	274	-984	2.250%
		Low	796	-126	-19	396	806	-552	-196	516	-662	-269	943	-79	0.900%
	Ref	High	-482	-2989	-1405	-1288	-1010	-2682	-2301	-1293	-2993	-2469	-840	-2344	4.500%
		Ref	166	-1467	-705	-379	-28	-1555	-1209	-308	-1754	-1319	128	-1135	7.500%
		Low	688	-353	-129	289	697	-674	-351	409	-793	-426	829	-200	3.000%
	High	High	-613	-3225	-1546	-1432	-1153	-2852	-2478	-1437	-3174	-2650	-982	-2510	3.150%
		Ref	56	-1649	-827	-497	-142	-1697	-1356	-425	-1903	-1469	15	-1270	5.250%
		Low	597	-496	-236	190	604	-793	-474	312	-917	-551	738	-311	2.100%
Ref	Low	High	-470	-1895	28	21	393	48	94	122	62	162	175	352	2.475%
		Ref	141	-475	703	891	1332	1142	1145	1069	1263	1271	1099	1524	4.125%
		Low	633	566	1258	1529	2022	1996	1969	1757	2193	2131	1767	2428	1.650%
	Ref	High	-648	-2285	-105	-135	228	-90	-98	-30	-88	-27	-1	208	8.250%
		Ref	0	-763	595	774	1210	1037	994	955	1152	1123	967	1417	13.750%
		Low	523	351	1170	1441	1934	1918	1852	1672	2112	2017	1669	2352	5.500%
	High	High	-782	-2505	-218	-255	111	-204	-227	-146	-205	-154	-124	97	5.775%
		Ref	-113	-929	501	680	1122	951	895	866	1066	1027	873	1337	9.625%
		Low	427	223	1092	1367	1868	1855	1777	1603	2052	1945	1596	2296	3.850%
High	Low	High	-895	-1315	1207	983	1423	2527	2198	1141	2759	2434	775	2709	0.675%
		Ref	-285	106	1882	1854	2362	3620	3250	2088	3960	3543	1699	3880	1.125%
		Low	207	1147	2436	2492	3052	4474	4073	2777	4890	4402	2368	4785	0.450%
	Ref	High	-1081	-1694	1094	845	1276	2433	2043	1007	2657	2285	610	2607	2.250%
		Ref	-433	-172	1794	1754	2258	3559	3136	1992	3896	3435	1578	3815	3.750%
		Low	89	942	2370	2421	2982	4441	3994	2709	4857	4328	2280	4750	1.500%
	High	High	-1225	-1902	1008	746	1182	2374	1961	913	2599	2208	500	2548	1.575%
		Ref	-556	-326	1727	1681	2193	3528	3083	1925	3870	3389	1497	3788	2.625%
		Low	-16	827	2318	2368	2939	4433	3965	2662	4856	4307	2220	4747	1.050%

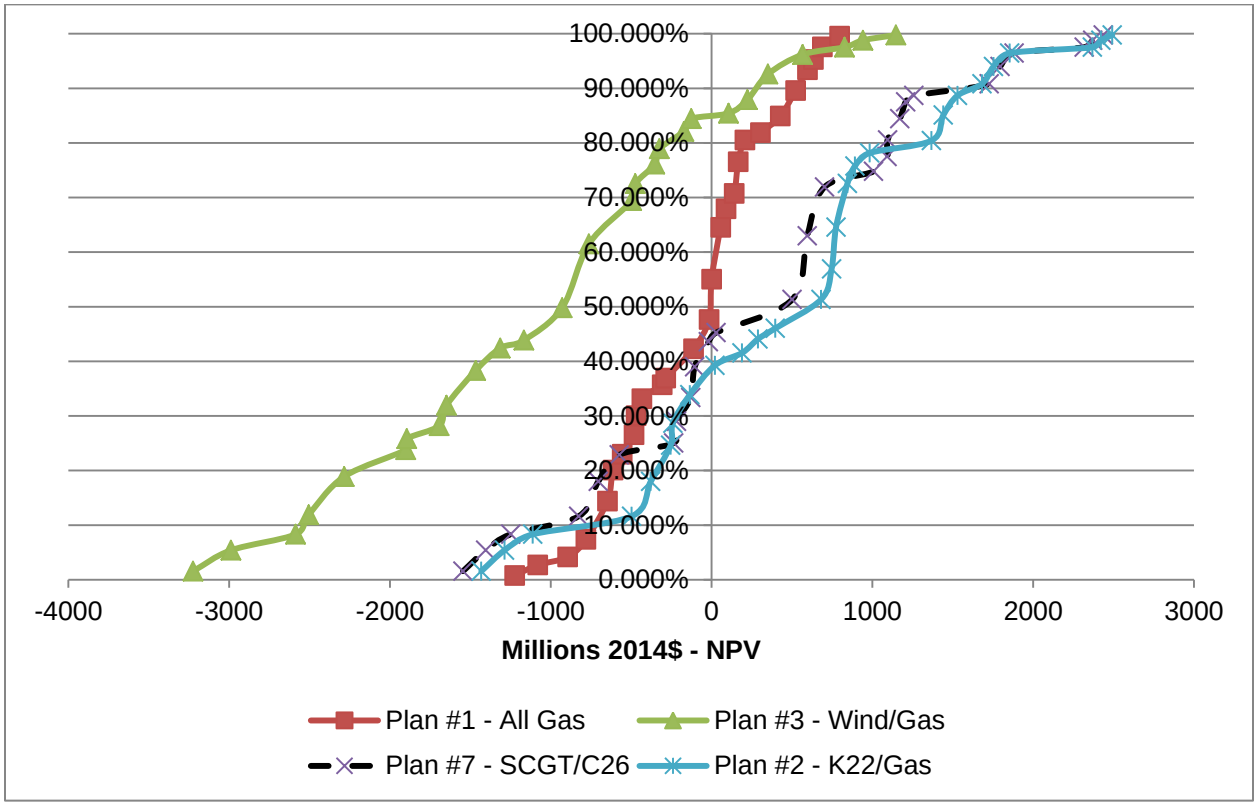
No Intertie

With the use of a common 5.2% discount rate, Plan #3 (Wind/Gas) is still dominated by the other no intertie plans, as in Manitoba Hydro's NFAT analysis. At the same time, the relative economics of the All Gas Plan (Plan 1) improves relative to that of Plans #2 and #7, such that its extreme downside risk is now less than that for either of the two.

However, this soon changes and for most of the probability distribution, Plans #2 and #7 dominate Plan #1. Finally, Plan #2 (K22/Gas) now appears to be nominally more beneficial than Plan #7 as compared to the analysis undertaken by Manitoba Hydro.

Overall, the change in the approach and assumptions does not alter the conclusion in Manitoba Hydro's NFAT Application that Plan #2 appears to offer the best overall value in terms of expected value and risk avoidance from those alternatives with no intertie.

ECS Figure #10 – Revised S-Curves (@5.2%) – No Intertie Plans #1, #2, #3 and #7



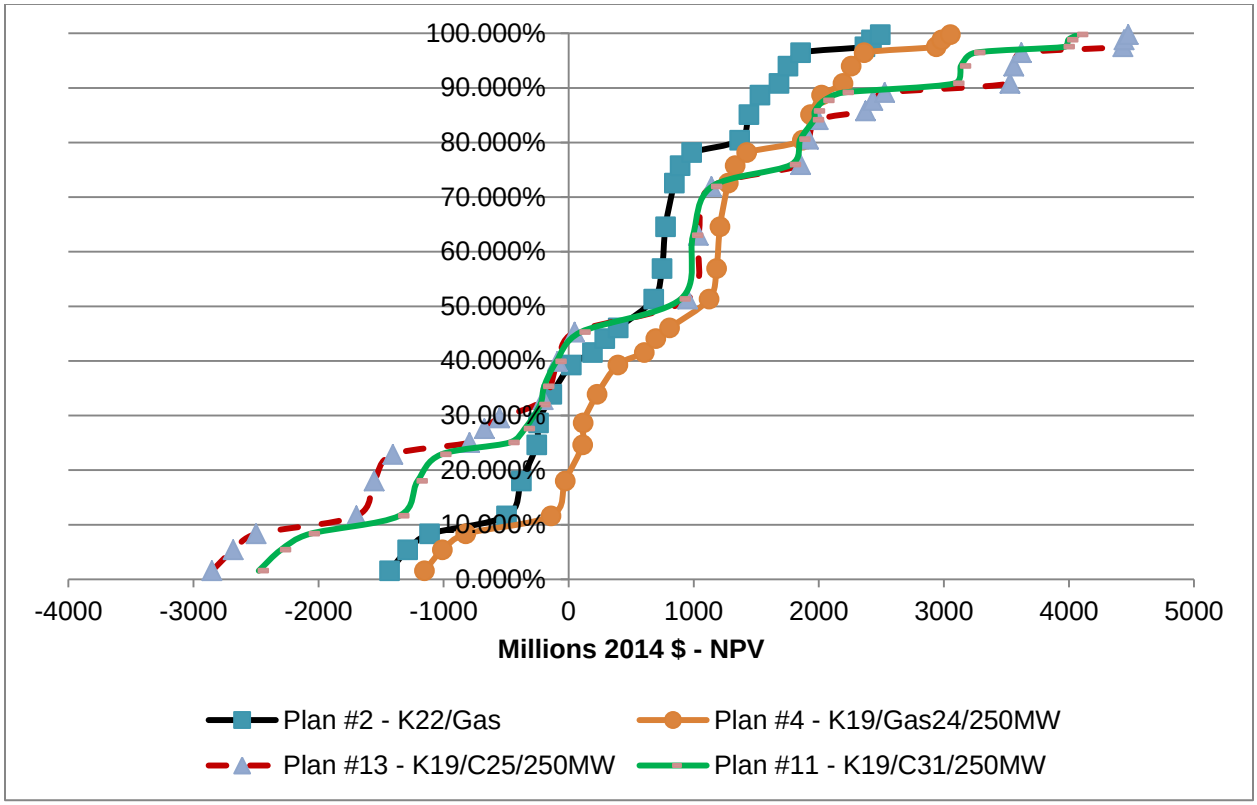
250 MW Intertie

The following table and graph compare the summary results and the S-curves for the various plans with a 250 MW intertie with that for Plan #2 (K22/Gas) using a common 5.2% discount rate. While all of the Plans with the 250 Intertie have Reference and Expected Values greater than Plan #2, the risk profiles of the various 250 MW intertie plans are markedly different.

ECS Table #8 – Probabilistic Analysis (@5.2%): Plan #2 vs. 250 MW Intertie Plans

Development Plan Millions 2014$ - NPV			Plan #2 - K22/Gas	Plan #4 - K19/Gas24/250MW	Plan #13 - K19/C25/250MW	Plan #11 - K19/C31/250MW
10th Percentile			-800	-477	-2092	-1708
25th Percentile			-253	112	-807	-487
75th Percentile			880	1318	1690	1630
90th Percentile			1623	2128	3035	2647
Expected Value			419	832	459	484
Ref-Ref-Ref NPV			774	1210	1037	994
50th Percentile			610	1044	755	721

ECS Figure #11 – Revised S-Curves (@5.2%) – Plan #2 vs. 250 MW Intertie Plans



Using a 5.2% common discount rate Plan #4 dominates Plan #2, indicating it is more beneficial to advance Keeyask and invest in a small interconnection than to consider any of the options without a new U.S. interconnection. This conclusion is consistent with Manitoba Hydro's NFAT evaluation[85].

Looking more closely at just the three Plans with the 250 MW intertie, the use of a common 5.2% discount rate leads to the same conclusion as in Manitoba Hydro's NFAT that Plan #4 is the most economic plan with the highest expected value. Indeed, use of the higher and common 5.2% discount rate tends to accentuate the differences in both the downside and the upside risks as between Plan #4 and the other two plans with a 250 MW intertie and increase the difference in the expected values.

750 MW Intertie

When the five plans with a 750 MW intertie are compared using a common 5.2% discount rate, all the 750 MW Plans have expected values less than Plan #4. However, the expected value for the Preferred Plan is virtually the same as that for Plan #4.

ECS Table #9 – Probabilistic Analysis (@5.2%) – 750 MW Intertie Plans

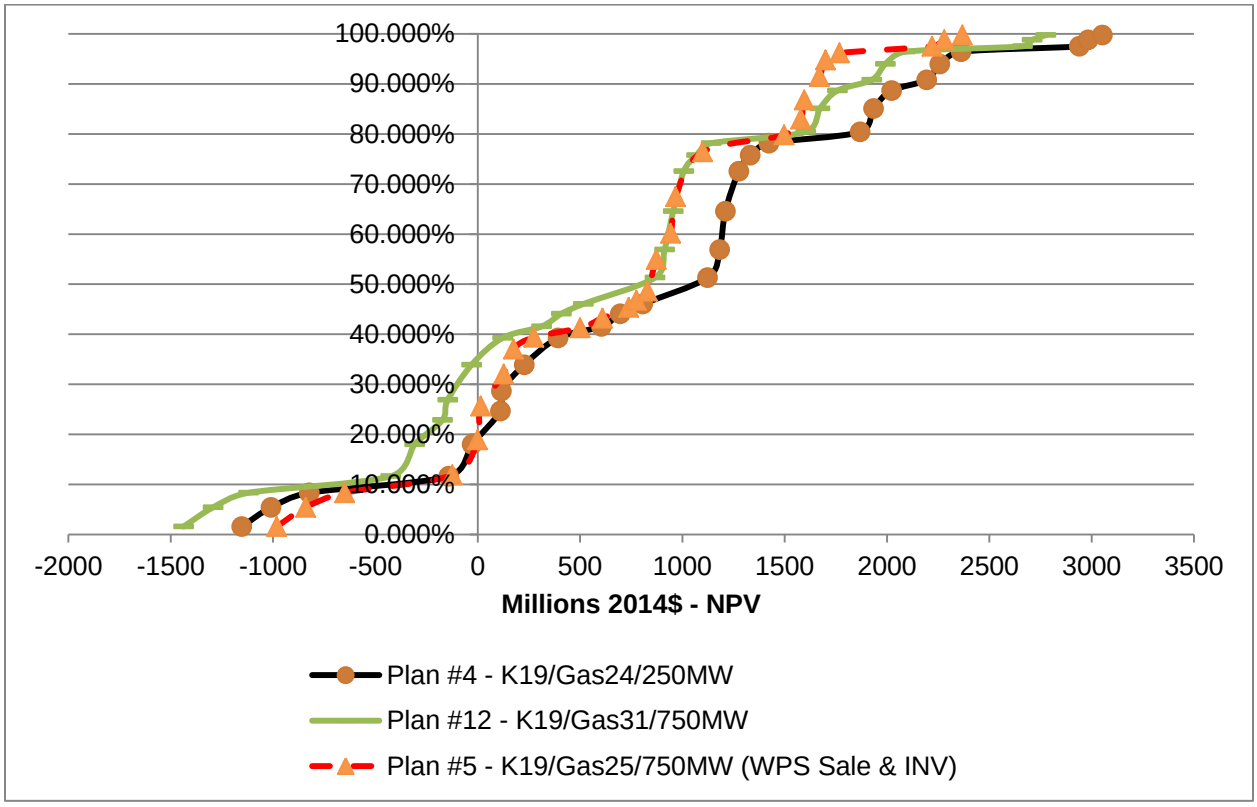
Development Plan Millions 2014$ - NPV		Plan #4 - K19/Gas2 4/250MW		Plan #12 - K19/Gas3 1/750MW	Plan #15 - K19/C25/ 750MW	Plan #6 - K19/C31/ 750MW	Plan #5 - K19/Gas2 5/750MW (WPS Sale & INV)	Plan #14 - K19/C25/ 750MW (WPS Sale &Inv)
10th Percentile		-477		-767	-2341	-1847	-403	-1706
25th Percentile		112		-159	-933	-564	14	-326
75th Percentile		1318		1054	1869	1789	1078	2117
90th Percentile		2128		1862	3323	2919	1646	3257
Expected Value		832		564	496	557	642	821
Ref-Ref-Ref NPV		1210		955	1152	1123	967	1417
50th Percentile		1044		779	848	839	839	1123

Looking at the risk profiles of the 750 MW plans, those plans that have gas following Keeyask have risk profiles similar to Plan #4. However, the risk profile for Plan #4

[85] NFAT Application, Chapter 10, page 31

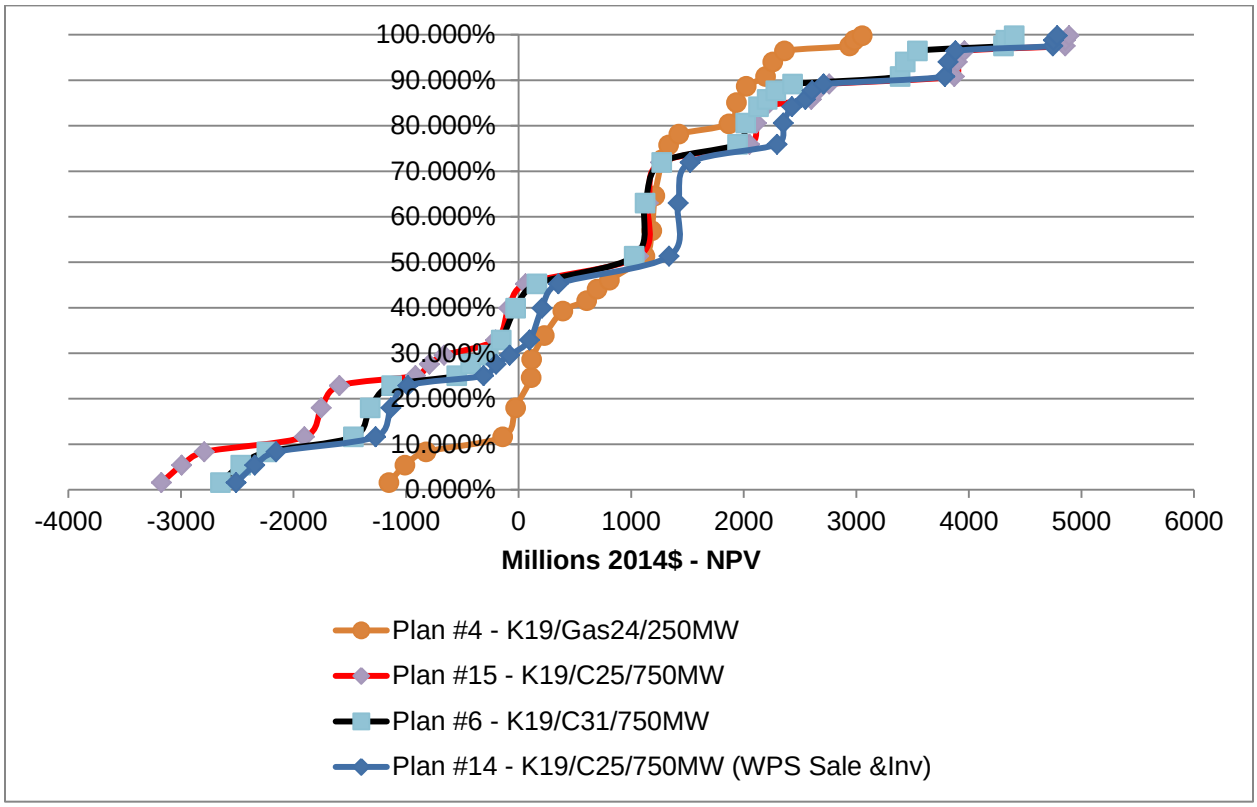
generally dominates that of the other two plans, even the one with the WPS sale and additional outside investment in the U.S. transmission (Plan #5).

ECS Figure #12 – Revised S Curves (@5.2%): Plan #4 vs. 750 MW Plans with Gas



In contrast, as the next Figure shows, the 750 MW plans with Conawapa following Keeyask have markedly different risk profiles than Plan #4 with both higher downside risk and higher upside benefits. Thus while the Preferred Plan and Plan #4 have close to the same expected value, the choice between the two will (from an economic evaluation perspective) depend heavily on risk tolerances/preferences.

ECS Figure #13 – Revised S-Curves (@5.2%): Plan #4 vs. 750 MW Plans with Conawapa



It must be noted that the Preferred Plan assumes both the WPS 300 MW sale and success on Manitoba Hydro's part in finding additional investors for the U.S. portion of the transmission intertie. Without this additional investment, the expected value of the Preferred Plan will decline making it even less attractive.

Overall, with a 5.2% common discount rate:

- The benefits noted by Manitoba Hydro from Plan #4 with a small interconnection relative to Plans with a 750 MW interconnection but with natural gas-fired generation following Keeyask increase reinforcing Manitoba Hydro's conclusions regarding the benefits of a small intertie in such situations[86],
- The benefits noted by Manitoba Hydro from Plan #4 relative to Plans with Conawapa following Keeyask but no WPS (or similar) firm power contract (i.e.,

[86] NFAT Application, Chapter 10, page 38

Plans #12 and #15) also increase such that Plan #4's risk profile dominates that of the other two plans,

- With the WPS contract and additional (outside) investment in the U.S. transmission the expected value of a 750 MW intertie with Conawapa is almost equivalent to that of Plan #4. The result is that under Plan #14 there is now roughly the same expected gain with substantially more risk on the downside but more potential gain on the upside. This is a materially different finding than that of Manitoba Hydro's NFAT analysis where the expected value of Plan #14 is higher than that of Plan #4 and there is a clear risk/reward trade-off. At the 5.2% discount rate, Plan #14 now offers at best the same (expected) reward as Plan #4 but with greater risk.

Choosing Between the 250 MW vs. 750 MW Intertie Alternative

The forgoing discussion appears to suggest that a 250 MW intertie is more beneficial than a 750 MW intertie. This presupposes that Manitoba Hydro, in choosing a particular plan, must commit "now" to the entire resource sequence associated with the Plan. However, in reality what Manitoba Hydro must commit to is whether to construct Keeyask with a view to 2019 in-service date and whether to construct a 250 MW or 750 MW intertie to support the sale to Minnesota Power. Manitoba Hydro does not have to commit "now" to what the next station(s) to be built after Keeyask will be (e.g. Conawapa or natural gas-fired generation).

This flexibility increases the value of the various 250 MW and the 750 MW intertie options since the Corporation is not necessarily committed to a specific Plan if the future appears to be unfolding in way that makes the Plan undesirable relative to other options that are at the time available. It is for this reason that Manitoba Hydro has introduced the concept of Pathways in Chapter 14 of the NFAT Application. Choosing a particular pathway will limit the choices one has in the future but it does not necessarily restrict one to a specific Plan.

An example is that if Manitoba Hydro chooses to proceed with Keeyask and build a 250 MW line, then it has precluded any Plan that includes additional firm contracts (beyond

those envisioned with MP, NSP and WPS) such as the WPS 300 MW contract and has also committed itself to requiring new supply starting in 2024/25 but it has not committed itself as to whether that new supply will be Conawapa or natural-gas fired generation[87]. Furthermore, if natural gas-fired generation was to be pursued for 2024/25 the option would still remain open to construct Conawapa to meet a future "need" date in the early 2030's (e.g. per Plan #11). Clearly these choices will be influenced by factors such as improved information on the capital costs of different types of generation and an improved understanding as to how natural gas and electricity export prices are likely to evolve in the future both of which will be available when these future decisions need to be made.

Similarly, if Manitoba Hydro builds the 750 MW line and there is no contract with WPS, future choices are still available as to whether or not to build natural gas-fired generation or Conawapa to meet the next anticipated need date (early 2030s) and also whether to advance the in-service date for Conawapa in order to support increased exports. Again these decisions will be influenced by the availability of improved information on the capital costs for different types of generation and an improved understanding as to how natural gas and electricity export prices are likely to evolve in the future.

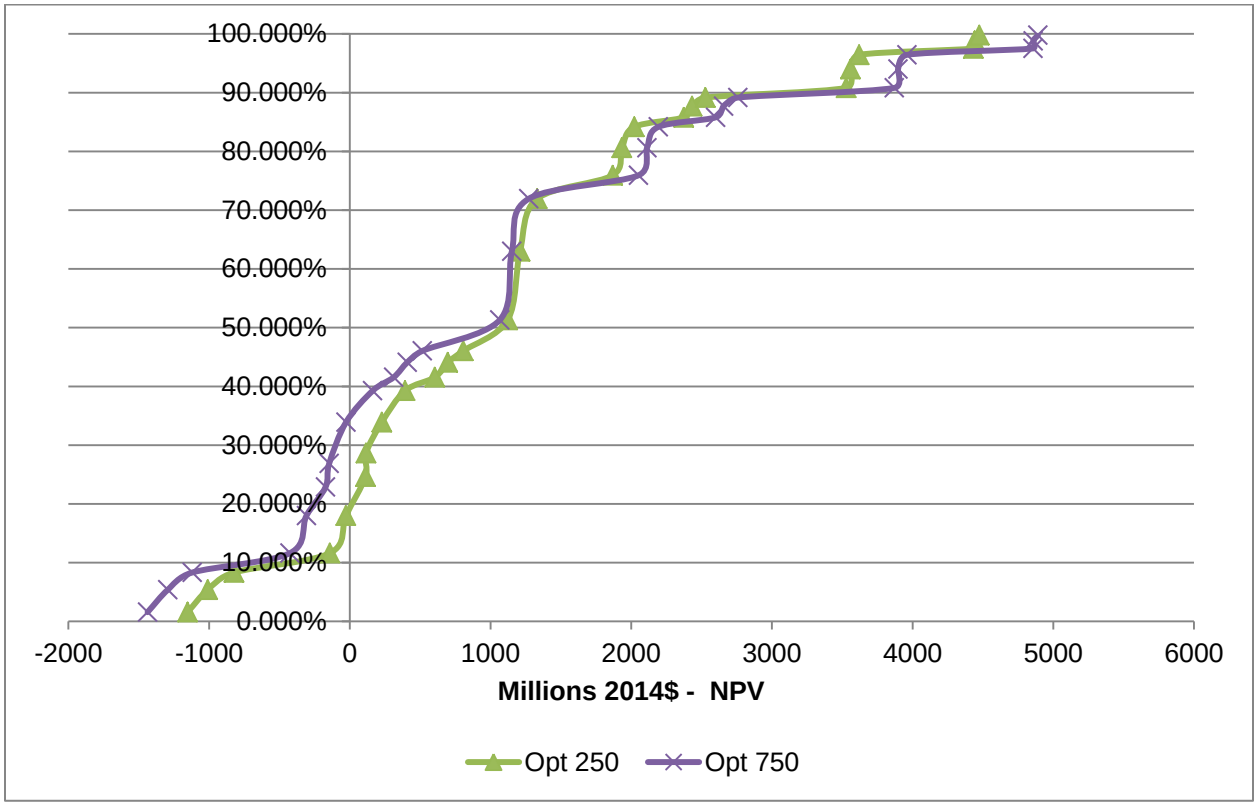
Manitoba Hydro's response to PUB/MH I-279 uses this concept of pathway optionality to explore the question of whether or not protecting Conawapa for a potential in-service date of 2031 or earlier is warranted. Applying a similar approach the following summarizes the NPV results associated with the "best" path forward assuming: i) a 250 MW interconnect is initially built to support Keeyask in 2019 versus ii) a 750 MW intertie to support Keeyask in 2019 assuming no WPS contract. The best or optimum plans (Opt 250 and Opt 750) were constructed by assuming that when the decision needs to be made on the next resource after Keeyask sufficient information is available to permit the Plan with the highest NPV to be identified and chosen.

[87] The need date could also be addressed by additional DSM although this was not included in any of the Development Plans assessed.

ECS Table #10 – Probabilistic Analysis: 250 MW vs. 750 MW Intertie Pathway (No WPS)

Development Plan Millions 2014$ - NPV	Opt 250	Opt 750	4 K19/Gas2 4/250MW	13 K19/C25/ 250MW	11 K19/C31/ 250MW	6 K19/Gas3 1/750MW	15 K19/C25/ 750MW	12 K19/C31/ 750MW
10th Percentile	-477	-767	-477	-2092	-1708	-767	-2341	-1847
25th Percentile	112	-159	112	-807	-487	-159	-933	-564
75th Percentile	1744	1871	1318	1690	1630	1054	1869	1789
90th Percentile	3035	3323	2128	3035	2647	1862	3323	2919
Expected Value	1026	951	832	459	484	564	496	557
Ref-Ref-Ref NPV	1210	1152	1210	1037	994	955	1152	1123
50th Percentile	1044	929	1044	755	721	779	848	839

ECS Figure #14 – S-Curve (@5.2%): 250 MW vs. 750 MW Intertie Pathway (No WPS)



Without the WPS contract and investment, the expected value for the 250 MW intertie is only marginally higher than that for the 750 MW intertie. However, the 750 MW intertie involves more risk on the downside and more potential gain on the upside. The choice between the two would depend on risk tolerances/preferences.

In contrast, when the 250 MW intertie is compared with 750 MW options that include the WPS contract/investment the expected value of the 750 MW option is higher and the risk profile is such that the 750 MW intertie dominates the 250 MW intertie. This suggests that the 750 MW intertie is more beneficial from an economic perspective than a 250 MW intertie when it is accompanied by a firm power contract similar to that under negotiation with WPS and that additional investors can be found for the U.S. portion of the intertie and provided there is flexibility for the Development Plan to adapt to changing circumstances (e.g. no firm commitment to the type or timing of new generation following Keeyask).

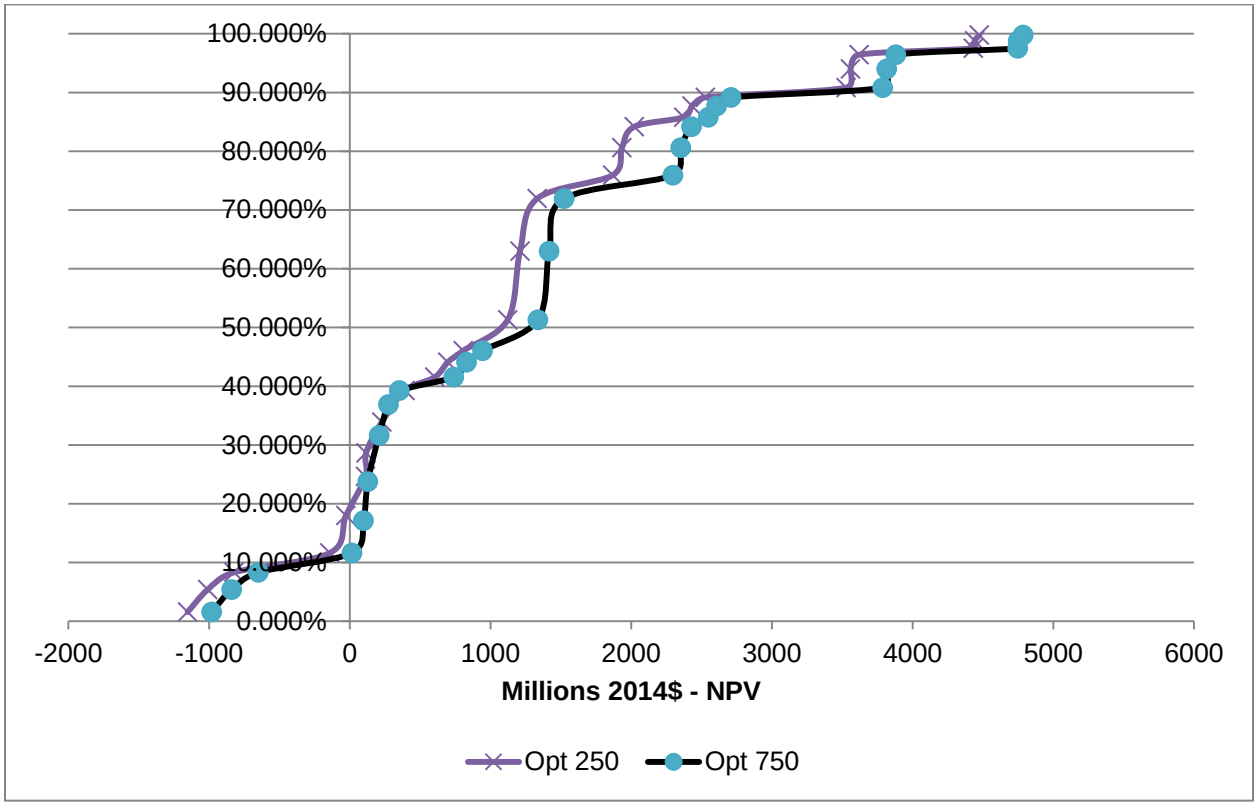
Given that the Reference case NPV value for the required incremental investment in the U.S. transmission should additional investors not be found is roughly $200 M[88], it is likely that there would be negligible difference between the expected values and the risk profiles of the 250 MW intertie option and a 750 MW option with the WPS 300 MW contract but no additional outside investment.

ECS Table #11– Probabilistic Analysis: 250 MW vs. 750 MW Intertie Pathways (with WPS)

Development Plan Millions 2014$ - NPV		Opt 250	Opt 750		4 K19/Gas2 4/250M W	13 K19/C25/ 250MW	11 K19/C31/ 250MW		5 K19/Gas2 5/750M W (WPS Sale & INV)	14 K19/C25/ 750MW (WPS Sale &Inv)
10th Percentile		-477	-312		-477	-2092	-1708		-403	-1706
25th Percentile		112	140		112	-807	-487		14	-326
75th Percentile		1744	2117		1318	1690	1630		1078	2117
90th Percentile		3035	3257		2128	3035	2647		1646	3257
Expected Value		1026	1209		832	459	484		642	821
Ref-Ref-Ref NPV		1210	1417		1210	1037	994		967	1417
50th Percentile		1044	1239		1044	755	721		839	1123

[88] See ECS Table #5

ECS Figure #15 – S-Curves (@5.2%) – 250 vs. 750 MW Intertie Pathways (with WPS)



Choosing to Protect a Conawapa In-Service Date

As noted earlier, Manitoba Hydro has undertaken an analysis[89] of the cost-benefit of protecting various in-service dates for Conawapa. It was not possible (due in part to data limitations) to replicate this analysis using the revised economic evaluation results for the various Development Plans. However, a simpler analysis similar to that performed above for a 250 MW vs. a 750 MW intertie was undertaken to assess whether the incremental value from having the flexibility to choose Conawapa offset the cost of maintaining the option.

The results are set out below for the 750 MW intertie based on those plans that entailed a 2025 or a 2031 in-service date for Conawapa. In each case the cost of maintaining

[89] PUB/MH I-279

the flexibility[90] was subtracted from those Plans with Conawapa to allow for proper comparison of the differences with the "cost of optionality" of being able to choose.

ECS Table #12 – Probabilistic Analysis: Protect Conawapa In-Service with 750 MW Intertie

			6	15	12				6	12				5	14
Development Plan Millions 2014$ - NPV	Path 4A - No WPS Conawapa 2025 I/S		K19/Gas31/750MW	K19/C25/750MW	K19/C31/750MW		Path 4B - No WPS Conawapa 2031 I/S		K19/Gas31/750MW	K19/C31/750MW		Path 5		K19/Gas25/750MW (WPS Sale & INV)	K19/C25/750MW (WPS Sale &Inv)
10th Percentile	-854		-767	-2341	-1847		-854		-767	-1847		-312		-403	-1706
25th Percentile	-246		-159	-933	-564		-246		-159	-564		140		14	-326
75th Percentile	1702		1054	1869	1789		1702		1054	1789		2117		1078	2117
90th Percentile	3015		1862	3323	2919		2832		1862	2919		3257		1646	3257
Expected Value	813		564	496	557		779		564	557		1209		642	821
Ref-Ref-Ref NPV	1036		955	1152	1123		1036		955	1123		1417		967	1417
50th Percentile	813		779	848	839		813		779	839		1239		839	1123

In the circumstance where there is no WPS contract the expected outcome (if one chooses the best Plan for the next generation after Keeyask under each scenario and Conawapa is maintained as an option) is $813 M for those Plans that require additional generation in 2025[91]. In contrast, if one is limited to natural gas-fired generation, the expected value is $564M for a difference of $249 M. However, since the cost of maintaining this optionality is $308 M[92], from an economic perspective, the cost nominally outweighs the expected benefit.

In circumstances where there is no WPS contract the expected outcome (again if one chooses the best Plan under each scenario and Conawapa is maintained as an option for a 2031 in-service date) is $779 M. In contrast, if one were limited to natural gas-fired generation, the expected value is $564 M for a difference of $215 M. As the cost of maintaining this option over the next five years is only $87 M this suggests that maintaining the option of a 2031 in-service date for Conawapa would be beneficial.

Finally, in the case where there is a WPS contract (and additional outside investment in U.S. transmission) maintaining the flexibility to choose Conawapa for a 2025 in-service

[90] The costs used were taken from PUB/MH I-279. It is acknowledged that these 2014$ costs were likely developed using a 5.05% as opposed to 5.2% discount rate. However, there was insufficient information to revise the values. This discrepancy needs to be taken into account when interpreting the results
[91] Now 2026 with the 2013 Update
[92] MH/PUB I-279

date has a benefit of $567 M which far exceeds the $308 M costs of maintaining such flexibility.

Overall, the results suggest that maintaining the flexibility for a 2025 in-service date for Conawapa is beneficial if there is WPS (or similar) contract in place and additional outside investment in U.S. transmission. Otherwise, while maintaining flexibility for a 2031 in-service date is beneficial doing so for 2025 may not be[93].

In the case of the 250 MW intertie, the results (see below) suggest there is no benefit to maintaining flexibility for a 2025 in-service date (i.e., expected benefit is $148 M versus a cost of $308 M) but that there could well be benefit to maintaining a 2031 in-service date (i.e. the expected benefit is $121 M versus a cost of $87 M).

ECS Table #13 – Probabilistic Analysis: Protect Conawapa In-Service with a 250 MW Intertie

				4	**13**	**11**				**4**	**11**
Development Plan Millions 2014$ - NPV		Path 3A		K19/Gas24/250MW	K19/C25/250MW	K19/C31/250MW		Path 3B		K19/Gas24/250MW	K19/C31/250MW
10th Percentile		-477		-477	-2400	-1795		-477		-477	-1795
25th Percentile		112		112	-1115	-574		112		112	-574
75th Percentile		1744		1318	1382	1543		1744		1318	1543
90th Percentile		2727		2128	2727	2560		2560		2128	2560
Expected Value		980		832	151	397		951		832	397
Ref-Ref-Ref NPV		1210		1210	729	907		1210		1210	907
50th Percentile		1044		1044	447	634		1044		1044	634

[93] While the cost exceeds the expected benefit, the difference is small.

7. 2013 Update

7.1 Manitoba Hydro's Update

Manitoba Hydro's NFAT analysis was undertaken using its 2012 planning assumptions[94]. However, the economic evaluation results for selected Plans were updated for the 2013 planning assumptions. Key aspects of the update were[95]:

- Revised (downwards) load forecast
- Deferred next generation in-service date requirement based on need
- New/revised export contracts
- New (higher) electricity export prices
- Revised (later) possible in-service date for Conawapa and
- Revised real discount rate of 5.40% (as compared to 5.05%)

Based on these updates the incremental NPV values for the Plans changed as follows:

ECS Table #14: Manitoba Hydro's 2013 Update Impact Assessment

Table 12.5 IMPACT OF 2013 UPDATES TO FORECASTS AND RELATED ASSUMPTIONS

Development Plan	Incremental NPV Relative to All Gas, millions of 2014 Dollars		
	2012 Assumptions 5.05% Discount Rate	2013 Assumptions 5.05% Discount Rate	2013 Assumptions 5.40% Discount Rate
2 K23/Gas	$887	$960	$728
4 K19/Gas30/250MW MP Sale	$1,346	$1,437	$1,133
12 K19/C33/750MW MP Sale	$1,360	$1,763	$1,204
14 K19/C26/750MW MP Sale, WPS Sale & Inv Preferred Development Plan	$1,696	$2,125	$1,462

[94] NFAT Application, Chapter 13, page 1
[95] NFAT Application, Chapter 12, pages 1-2

Based on these results Manitoba Hydro concludes[96] that the economic ranking of the alternative Development Plans remains the same as the ranking under the 2012 planning assumptions.

7.2 Comments

The following table shows the impact on the incremental NPV values of using a 5.55% discount rate[97] instead of 5.40%.

ECS Table #14 – Impact of 2013 Update with Revised Discount Rate (5.55%)

			Millions 2014$ - NPV			
Plan	Description		2012 Assumptions @ 5.05%	2013 Assumptions @ 5.05%	2013 Assumptions @ 5.40%	2013 Assumptions @ 5.55%
2	K23/Gas		$887	$960	$728	$638.38
4	K19/Gas 30/250 MW		$1,346	$1,347	$1,133	$1,014.81
12	K19/C33/750 MW		$1,360	$1,763	$1,204	$991.33
14	K19/C26/750 MW WPS Sale&Inv		$1,696	$2,125	$1,462	$1,206.22

The use of the higher (5.55%) discount rate does not change the ranking of the Plans but it does decrease the differences between their values. This only serves to emphasize the need to carefully consider the reasonableness of the economic and project specific assumptions underlying the Plans. In this regard the reports of the Independent Experts Consultants and intervenors are critically important.

One clear example of this is the assumptions regarding electricity export prices. In its 2013 Update Manitoba Hydro's planning assumptions include higher future export prices than were included in the NFAT analysis and Manitoba Hydro has noted that this is a contributing factor to the increase in the NPV for plans with a new U.S. interconnect[98]. However, in their Report[99] on electricity export prices Potomac Economics "generally forecasts lower prices than Manitoba Hydro".

[96] NFAT Application, Chapter 12, page 14
[97] 5.40% adjusted for the same increase in cost of equity as discussed in Section 5.2.2 above
[98] NFAT Application, Chapter 12, page 13

8. Multiple Account Analysis

8.1 Manitoba Hydro's Approach

In its Multiple Account analysis Manitoba Hydro examines the consequences of the alternative Development Plans from a number of different perspectives. In some cases it has quantified the impacts and presented the resulting NPV values whereas in other cases it has not been able to do so[100].

Market Valuation Account

In its Multiple Account Analysis, Manitoba Hydro revisits the economic evaluation undertaken earlier from a Manitoba Hydro perspective and, using the same cost and benefits, employs a social opportunity cost capital of 6% as the discount rate in order to compare the Plans from a broader "societal" perspective[101].

Government Account

The Government Account measures the net benefit from the point of view of taxpayers and, again, the NPV is calculated using 6%[102].

Customer Account

Manitoba Hydro also includes a Customer Account in its Multiple Account analysis. The measures for this account include both the rate impacts and reliability impacts of the various plans. Rate impacts are not expressed in NPV terms but rather in cumulative % rate increases at different points in time throughout the study period. In contrast, reliability impacts (in the form of incremental expected unsupplied energy costs) are provided for select Plans on an NPV basis.

Environment Account

Selected environmental metrics (e.g. GHG emissions) are monetized and expressed in NPV terms, whereas others are not.

---

[99] Page 5
[100] NFAT Application, Chapter 13,page 3
[101] NFAT Application, Chapter 13, page 5
[102] CAC/MH II-52 c)

8.2 Comments

According to the description provided, the Market Valuation account only discounts the capital and system operating costs and revenue over the 2014-2047 planning period using the 6% discount rate[103]. Cost and benefits in years after 2047 are translated into a residual asset value and also present valued to 2014 using the 6% discount rate. However, as described on page 63 of Chapter 13, this residual value was calculated using Manitoba Hydro's 5.05% WACC[104] as opposed to the 6% discount rate deemed applicable to the Market Valuation account. The following table sets out the comparative NPV values for the Market Valuation account as reported by Manitoba Hydro and the values that would result if one applied a 6% discount rate to the entire study period using the values from the Reference case. Using 6% throughout the entire study period reduces the spread of results across the four Plans and also materially increases the benefit of Plan #4 relative to the Preferred Plan.

ECS Table #15 – Revised Market Valuation Results

Market Valuation Relative to Preferred Plan (Millions 2014$ - NPV)				
	Preferred Plan	**K19/G24/250 MW**	**K22/Gas**	**All Gas**
Manitoba Hydro's Market Valuation	-	$17	($270.5)	($654.1)
Valuation Based on 6% for Entire Planning Period	-	$214	($105)	($214)

[103] NFAT Application, Chapter 13, page 22
[104] NFAT Application, Chapter 13, page 63

It is not at all clear to what extent this hybrid use of discount rates was employed in evaluating the other Multiple Accounts. As a result, the overall monetized net benefits presented in Chapter 13 must be viewed with caution.

It is not at all clear why customer rate/bill impacts were not expressed in NPV terms, particularly since this was the approach used in Manitoba Hydro's NFAT Application regarding the Wuskwatim Project[105]. It is understood that this issue will be examined further by InterGroup, the consultants retained by MIPUG.

9. Conclusions

A summary of the key comments and conclusions from ECS's review of Manitoba Hydro's economic evaluation analysis of its Preferred Development Plan and alternatives is set out below.

Need and Alternatives

- For Manitoba Hydro "need" should be directly related to the Corporation's statutory purposes and objectives. Within this context, addressing anticipated shortfalls in resources to meet Manitoba's electricity need is a legitimate "need".
- Exploiting new export opportunities can also be view as a legitimate "need" provided the purpose for doing so is clearly linked to improving the economy and efficiency of Manitoba Hydro and, specifically, to lowering rates for domestic customers. However, for large projects such as envisioned in the Preferred Development Plan there are likely to be short-term versus long-term trade-offs that must be considered.
- The resource options utilized by Manitoba Hydro in formulating the alternative plans subjected to economic evaluation did not include the full range of options short-listed through its initial screening process – specifically DSM and Imports. It is not clear if the additional analysis Manitoba Hydro is currently undertaking will fully address this deficiency.
- Consideration of these options may have made it practical to construct development plans where the need for new utility-based generation has been deferred such that:

[105] Manitoba Hydro, Submission to Manitoba CEC, NFAT the Wuskwatim Project, Chapter 7, page 11

- Conawapa (as opposed to Keeyask) is the first major new generation placed in-service, or
- New opportunities/technologies currently not cost-competitive could come into play.

Economic Evaluation - Approach

- Manitoba Hydro's approach to economic evaluation is generally consistent with accepted practice.
- Economic evaluations are performed from a specific perspective which will impact both the costs and benefits included in the analysis as well as the discount rate used in the evaluation of alternatives. Manitoba Hydro's economic evaluation is carried out from its perspective as the entity undertaking the proposed plan. This is a valid perspective but differs from that of either its rate payers or the Provincial government.
- A true Manitoba Hydro perspective would have separated out the costs/benefits accruing to KCN which Manitoba Hydro did not. However, the impacts on the results are likely minimal.
- In reporting the results of its economic evaluation Manitoba Hydro has inappropriately combined the benefits attributable to itself and the Provincial government. In the case of ratepayers, Manitoba Hydro did not include in its NFAT Application an economic evaluation based on this perspective.
- Manitoba Hydro's uses its Weighted Average Cost of Capital as the discount rate in its evaluations. This discount rate includes a "cost of equity" rate for the portion of spending deemed to be financed through customer rates (i.e. net income/retained earnings) which Manitoba Hydro has based on what utilities regulated on a cost of capital basis are allowed. However, the 300 basis points (over Manitoba Hydro's debt costs) used to calculate this rate understates the return on equity as recently approved by Canadian regulators. Taking into account these recent regulatory decisions would increase the WACC from 5.05% to 5.20%.
- Furthermore, since Manitoba Hydro is not regulated on a cost of capital basis, the use of allowed returns on equity to determine the appropriate time value for funds

raised through customers' rates is, at best, an approximation of customers' views as to the time value of money.

- Finally, given the long study period used (78 years) considerations of intergenerational equity become important. However, this is an issue that Manitoba Hydro did not explore in its economic evaluation analysis.

Economic Evaluation – Reference Case Results

- Utilizing a discount rate of 5.2% (as opposed to 5.05%) does not change the Manitoba Hydro's conclusion that, based on Reference case costs for each alternative Plan:
    - Plan #2 (K22/Gas) yields the highest economic benefit for Manitoba Hydro from amongst all the no intertie plans considered.
    - Advancing the in-service date for Keeyask and building an intertie yields economic benefits relative to the no intertie alternatives.
- However, with the higher 5.2% discount rate, the decision between a 250 MW and a 750 MW intertie is more nuanced:
    - All of the 750 MW intertie Plans with Conawapa following Keeyask are no longer more economic than the 250 MW intertie Plans. Indeed only the Preferred Plan which includes both the WPS 300 MW contract and additional outside investment in U.S. transmission is more economic than Plan #4 (K19/Gas 24/250 MW).
    - Without the additional investment in U.S. transmission the overall economic benefits from both Plans are roughly the same and without the WPS 300 MW contract or the additional investment the economic benefits of Plan #4 are higher.

Economic Uncertainty Analysis – Approach

- Manitoba Hydro's approach of accounting for risk through probability analysis is preferable to the use of hurdle (discount) rates. However, the probability-based risk analysis in the NFAT Application is relatively unsophisticated as it considers the risk associated with only three factors and considers only three possible outcomes for

each. On the other hand, a limited number of factors and outcomes make the outcomes more transparent.

- Manitoba Hydro's inclusion of the "discount rate" as a factor subjected to uncertainty and therefore variation in the analysis distorts the comparisons of the results of the various scenarios as it means there is no longer a common discount rate (i.e. time value of money) applied to all the possible outcomes for all the Plans analyzed. A preferable approach would be to use a common discount rate across all Plans and underlying scenarios. Concern about the appropriateness of the discount rate used should be addressed through sensitivity analysis.

- The economic uncertainty analysis produces "expected" NPV values for each Plan that differ from the Reference case NPV values for each Plan. The expected NPV values are the appropriate ones to use for comparative and decision making purposes.

Economic Uncertainty Analysis – Results

- Utilizing a common discount rate of 5.2% for all scenarios does not change Manitoba Hydro's conclusions that:
    - Plan #2 (K22/Gas) is the preferred no intertie Plan from an economic benefit perspective.
    - It is more beneficial to advance Keeyask and invest in small intertie than to proceed with any of the no intertie plans.
    - It is more beneficial to invest in a smaller intertie when Keeyask is followed by natural gas-fired generation.

- However, with the use of a higher (5.2%) common discount rate the expected NPV value for the Preferred Plan no longer exceeds that of Plan #4 with the 250 MW intertie, instead the two values are now virtually equivalent. As a result, the risk/reward trade-off between the two plans identified in the NFAT Application no longer exists. At the 5.2% discount rate, the preferred plan offers, at best, the same expected reward but with greater risk. Furthermore, the Preferred Plan is premised on completion of a WPS 300 MW contract and additional outside investment in U.S.

transmission. If Manitoba Hydro is not successful in achieving either of these two elements then the expected value of the plan will decrease.

Multiple Account Analysis

- For the Market Valuation account an economic evaluation is done of the cash flows to Manitoba Hydro but using a 6% discount rate in order to reflect a broader societal perspective as to the social opportunity cost of capital. However, it appears that 6% was not used consistently throughout the study period and, as a result, the net benefit calculations must be viewed with caution.
- Customer rate impacts would have been better expressed in term of the NPV value of forecast customer revenues, as was done for the Wuskwatim Project NFAT.

Key Decisions

- The economic evaluation analyses compared various development plans each of which had specific and different assumptions about the types of resources that would be used to meet Manitoba's future electricity requirements and when they would come into service through to the early 2030s. However, neither Manitoba Hydro nor the Provincial Government need to choose a particular "plan" at this point in time. Rather the key decisions that need to be made are:
    - Should Keeyask be advanced to 2019 and a new intertie with the U.S. constructed to facilitate new export contracts? If not, then what should Manitoba Hydro's plan be for meeting domestic load requirements and existing export contracts?
    - If Keeyask is advanced to 2019 to facilitate new export contracts, should the required new intertie be 230 kV (250 MW capability) or 500 kV (750 MW capability).
    - Should Manitoba Hydro continue to spend funds to support a possible in-service date for Conawapa in the mid-2020s, by the early 2030s or not at all?
- Both Manitoba Hydro's and this Report's economic evaluation analysis support advancing Keeyask to 2019 and the construction of new intertie facilities. However, it will be important for the PUB to revisit these conclusions taking into account the

advice it receives from its Independent Consultants and intervenors regarding the input assumptions used in the analysis.

- The analysis in this Report also indicates that, if there is flexibility for the Development Plan to adapt to changing circumstances (i.e., no firm commitment at this point to type or timing of new generation following Keeyask), a 750 MW intertie is more beneficial from an economic perspective than a 250 MW intertie, provided a firm power contract similar to that under negotiation with WPS is in place and additional investors can be found for the U.S. portion of the intertie. Otherwise the 250 MW intertie is likely to be more beneficial, although only marginally.
- With respect to protecting an in-service date for Conawapa, the analysis indicates that there is benefit to protecting an in-service date in the early 2030s regardless of whether a 230 kV or 750 kV intertie is built and, in the latter case, regardless of whether or not there is WPS contract. The analysis also suggests that, with a 750 kV intertie, there is economic benefit to protecting a mid 2020's in-service date but only if there is a contract with WPS.
- Manitoba Hydro is requesting government approval of its Preferred Development Plan which includes construction of the Conawapa G.S. with an in-service date in the mid-2020s. While the economic evaluations indicate that, with a WPS 300 MW contract, there is benefit to keeping open the options for such an in-service date, it has not been clearly demonstrated that the construction of Conawapa in this timeframe is superior to the potential alternatives. Indeed, depending upon how the future unfolds, it may well not be. Given that no "commitment" to actually construct Conawapa is required at this time, the PUB should recommend that there be no actual approval of Conawapa as part of Manitoba Hydro's future development plan at this time. Rather, the recommendation should be that planning for a future that could possibly include Conawapa should continue but that any formal approval for actual construction be subject to future review shortly prior to when an actual commitment is required. The interim passage of time would hopefully reduce many of the uncertainties that currently exist and allow Manitoba Hydro to address deficiencies in the way it has approached and completed its current NFAT Application.