

Review of Bipole III, Keeyask and Tie-Line Project

Manitoba Hydro Electricity Board

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Introduction

This report summarizes the results of a review performed by The Boston Consulting Group ("BCG"), on behalf of Manitoba Hydro Electric Board ("MHEB"), to evaluate the prudence and risk associated with Manitoba Hydro's ("Hydro") investments to build the Bipole III transmission project ("Bipole III"), the Keeyask generation station ("Keeyask"), and the MMTP/GNTL¹ projects ("Tie-line") [Exhibit 1]. The work was conducted between June and August 2016, using data provided by Hydro at the request of BCG, and through independent analysis performed by the BCG team based on its experience and expertise in the utility industry and with large capital projects.

The review performed sought to answer three key questions regarding the projects assessed [Exhibit 2]:

- Were the original decisions to invest the right ones to make?
- Is there further downside risk to the projects?
- Can the projects be stopped or paused without undue cost or risk?

Overview of Findings [Exhibit 3]

Through our analysis, we conclude that the decision to build a Bipole III was justified due to the significant and real reliability risks associated with relying solely on Bipole I, Bipole II, and Dorsey, and the societal impacts a catastrophic failure would carry. We also conclude that, while Bipole III East would have been the best option from an economic and execution standpoint, the decision to build along the West route was appropriate given the 2007 direction to the Chair of the Manitoba Hydro Electricity Board (MHEB) by The Minister of Hydro which deemed the East route inconsistent with environmental commitments and initiatives.

Conversely, the decision to build Keeyask and its associated infrastructure was an imprudent one due to a failure to fully assess the risks associated with moving forward. These included

- Financial modelling that did not fully reflect the specific project risks (e.g. construction execution, market prices, domestic demand)
- Discount rates that favored high capital projects over lower upfront cost projects
- The magnitude of the overall level of debt that both Hydro and the Province of Manitoba would ultimately be exposed to. This is especially true given the concurrent build of Bipole III, which is required for reliability purposes.

All three projects - a Bipole III, Keeyask, and the associated tie-line - should have been reviewed on an aggregate basis, instead of individually, to properly assess the collective risks of conducting all projects at once. While a Bipole III could have been pursued as a stand-alone project, the feasibility of Keeyask and the tie-line were both dependent on one another, and on construction of a Bipole III as well. Hence, separate reviews of the projects was not the best choice given their inherently interconnected nature.

¹ Manitoba Minnesota Transmission Project and the Great North Transmission Line together form the Tie Line project

Hydro took on undue execution risk by failing to fully obtain all the required approvals (notably the US Presidential and tie-line partner approvals) prior to commencement of construction of Keeyask, whose value is impacted by availability of the tie-line. Moreover, since the time the original analyses that supported proceeding with both projects was conducted, further downside risk associated with capital execution on both Bipole III and Keeyask has materialized.

Risks such as these have adversely impacted the economics of the projects and continued to put Hydro into a more and more difficult financial position, making construction of Keeyask and the tie-line in particular an even more questionable decision.

Despite our finding that the original decision by the Provincial Government and Manitoba Hydro to construct Keeyask and the tie-line was imprudent, given the current state of execution and the estimated incremental costs to cancel or delay the projects at this point, the most prudent decision – from an economic and strategic perspective – is to continue both projects to completion. However, continuing the projects will require a focus on mitigating any further downside impacts on costs and schedule to the extent they can be controlled.

Topic 1: Were the original decisions to invest the right ones to make? [Exhibit 4]

Bipole III

Manitoba Hydro's existing infrastructure of Bipole I & II and Dorsey carry significant reliability risks that have been untenable for a significant amount of time, but which should be immediately addressed upon completion of a Bipole III [Exhibit 5].

The impact of this risk is increasing [Exhibit 6] given several factors

- Approximately 70% of the Province's system's energy moves through this infrastructure
- The risks of significant incidence to these facilities are not negligible. For example, freezing rain and wind is estimated to impact Bipole I & II approximately once every 20 years, and fire risks at Dorsey are estimated to lead to reliability issues once every 29 years.
- Either of these types of events, or other significant events such as ground ice build-up or tornados, could lead to prolonged outages lasting weeks to months [Exhibit 7].
- Such events, while extremely rare, would result in an estimated \$4 – 20B in negative societal impact, and hence must be planned for to avoid a catastrophic event at significant cost for multiple Hydro stakeholders [Exhibit 8].

While the decision to proceed with a Bipole III was a prudent action on the part of Hydro due to the reliability concerns of not building the asset, it should be noted that a Bipole III East route was deemed the most economic design, with funding requirements \$900m² lower than alternatives. However, the East route option was not pursued following 2007 guidance from the Minister for Hydro to MHEB's Chair that the route would not be considered consistent with stated environmental commitments and initiatives [Exhibit 9]. The communication also stated the Corporation should

² As per 2007 Hydro Management West Route submission review presentation to the MHEB

move ahead with required consultations and planning for alternative routes. Of the options excluding Bipole III East, Bipole III West is the most cost effective [Exhibit 10].

Keeyask and tie-line

Unlike Bipole III, our analysis determined the accelerated commencement of construction of Keeyask with the tie-line to be an imprudent decision on the part of the provincial Government and Hydro leadership at the time of its initiation [Exhibit 4].

While new generation capacity will be needed for the region and system to ensure the ability to meet domestic load and capacity needs, this need does not consistently arise until 2027 [Exhibit 11]. Our analysis looked at the reasonability and soundness of several aspects of Manitoba Hydro's net demand and supply availability forecasts, in addition to various scenarios for Demand Side Management ("DSM") programs to identify the need for new generation [Exhibits 12, 13]. The earliest consistent need for new generation is 2027, and it is possible the need may not arise until as late as 2034 depending on actual gross demand and DSM impacts observed. This placed the originally planned 2019 Keeyask in-service date well in advance of the domestic need.

The decision to accelerate Keeyask to 2019 and build the tie-line, as opposed to building and completing construction by 2025/26 or pursuing alternative options such as gas generation, was based on an expected NPV analysis that measured the expected value versus alternatives [Exhibit 14]. Acceleration and the tie-line were of high value as they were projected to allow Hydro to meet a portion of the renewable energy needs of US customers, and hence earn attractively priced, contracted export revenues that would improve project NPV. The perception of a limited window of time to capture the benefits of the tie-line and export revenues significantly drove the decision to build on the originally planned schedule [Exhibit 15].

While this approach to offset capital costs was logical, the assumption that the window of opportunity for export to the US was closing should have been more closely scrutinized and tested. Specifically, the potential for additional future waves of renewable energy needs allowing for future export, driven not only by RPS³, but also the US CPP⁴ or other regulatory requirements, should have been more deeply assessed and considered as part of the analysis. In addition, the fact that acceleration of Keeyask led to commencement of construction prior to the tie-line receiving the required external approvals (US Presidential and the tie line partners), neither of which have been received to date, underscores the failure to perform all the important risk analyses associated with accelerating Keeyask to 2019.

Furthermore, while the expected NPV for Keeyask and the tie-line was estimated as being higher, the range of uncertainty around the expected NPV was also significantly larger than for alternatives [Exhibit 16]. This is due to larger project execution risks, industrial account electric load (i.e. demand) risks, export price and underlying hydrological risks.

³ Renewable Portfolio Standards

⁴ Clean Power Plan

Most importantly, given the financial outlook of the company (Hydro's equity ratio was expected to fall to 9% in a base case scenario) put forth during NFAT, consideration of the magnitude of project risks and their impact on the company's financial health should have been provided more weight and consideration in the evaluation [Exhibits 17]. This is particularly true as Hydro already has less equity than most of its peers [Exhibit 18] and must be sufficiently capitalised to withstand the natural volatility of hydrological conditions and the impact on available energy. Further analysis of the risks related to the additional debt required to construct Keeyask and the tie-line in concurrence with a Bipole III should have also been performed prior to project initiation. In fact the level of debt being taken as part of Hydro's expansion program will dramatically increase the total level of debt taken on by and/or guaranteed by the Province [Exhibits 19].

Overall, a decision to further assess alternative options requiring less capital and lower risk profiles would have been more prudent than moving forward with Keeyask and the tie-line at the time the decision was made.

To the credit of Hydro, several aspects of the planning and decision process were conducted well. For example, the construction of Keeyask is an extremely complicated endeavor from technical, operational, and commercial perspectives. That the project was successfully designed and agreed to by multiple parties, stakeholders, and contract holders is a significant achievement that should not be overlooked in assessment of the project. Moreover, the fact that multiple highly favorable US export term contracts were negotiated prior to initiation demonstrates the attempts by project leadership to mitigate at least a portion of the financial and export risk associated with the project [Exhibit 20]. Further, Hydro conducted several analyses regarding potential risks to the project, including low water flows and changes to gas and CO₂ prices [Exhibit 21]. Although the ultimate acceptance of some of the risks identified is questionable, in particular with relation to acceptance of low equity ratios in future years, it is clear Hydro and the Province attempted to weigh several important risks related to the project.

Underlying Factors to Address

To help avoid similar situations in the future, our analysis has sought to trace back the underlying factors leading to the decisions to proceed with Keeyask and the tie-line. The decision can be traced back to systemic decision governance issues that must be addressed by Hydro and the Province of Manitoba. More specifically:

The Province, Hydro and the Regulator lack clear objective functions and criteria / constraints

- For example, it is unclear if the primary role of Hydro, on behalf of the Province (its owner), is to drive economic growth or serve domestic energy needs, which at times may come into conflict as a result of normal operations. In times of adverse operating conditions or capital expansion, this may leave the business with an insufficient or high risk equity base.
- With respect to the Regulator, there is a clear track record of favouring low rates, in accordance with AURAA⁵, but less clear is the role they play in balancing responsible asset

⁵ Affordable Utility Rate Accountability Act

stewardship by Hydro and setting reasonable reliability targets to manage both costs and system performance [Exhibit 22]. Clarification of the objective functions, specific criteria, and constraints on such criteria for both Manitoba Hydro and the Regulator would be of great importance in helping build transparency for planning and operation of the system.

Current rate-setting mechanisms do not link rates to an allowable return, disconnecting revenue recovery from the system investment plan [Exhibit 23].

- This in turn drives increased financial uncertainty at Hydro, which results in more precarious financial conditions (e.g., acceptance of a projected equity ratio that reaches as low as 9% in the near future).
- A revenue model more directly linked with Manitoba Hydro's cost to serve, the maintenance of its financial health, and its future investment needs to serve customers would be an important change in regulation that would more appropriately adjust to the ever changing needs of the system in order to provide reliable electric service.

The current project planning approach is iterative, instead of being consolidated in an upfront manner [Exhibit 24].

- This limits insight into the compounded execution and financial risks from running several major, simultaneous projects concurrently, even when they have clear interdependencies as is the case with Bipole III, Keeyask and the tie-line
- A more consolidated planning approach with respect to major projects – one that takes into account the combined opportunities and risks for the company and its stakeholders – would be more appropriate to implement.

Topic 2: Is there further downside risk to the projects? [Exhibit 25]

Our analysis identified six key factors that have a significant impact on overall economics of the projects and financial health of the business. Each of these was reviewed regarding the assumptions used, to define the probability of further downside risk to the projects. [Exhibit 26].

- **Water flows:** Remains the largest variable, for both the Keeyask and the existing generation assets. No change in the underlying risk range
- **Capital execution** The capital execution costs have already shifted in an unfavorable direction for Hydro
- **Export prices:** Expected opportunity sales (i.e. those sales exclusive of the favorably priced contracted volumes) have already trended toward the low end of MISO sales price range
- **Interest rates:** Short and long term rate expectations have moved favorably since the original assessment of the projects
- **Domestic electricity rates:** While still within the original risk range, the Provincial Utility Board (PUB) granted only a 3.36% domestic rate increase for one year vs. the requested 3.95% for multiple years in Manitoba Hydro's last filing, reducing revenue versus the baseline.

Net domestic demand: There is no further change in the expected range of domestic demand

Despite the favourable movement in interest rates the adverse movements in capital execution versus the expected schedule and in export prices in MISO have negatively impacted the project economics.

With respect to capital execution, if mitigation initiatives are implemented to limit further slippage to cost and schedule, ~\$1.0B in additional capital⁶ [Exhibit 27] is expected to be required due to an expected 12 month delay in Bipole III [Exhibit 28], and 21 month delay in Keeyask [Exhibit 29]. Should the mitigation initiatives either not be implemented or prove to be less effective than expected, schedules could further slip by an additional 3 months for Bipole III and 11 months for Keeyask, requiring an additional ~\$0.7B in capital [Exhibits 30, 31].

Regarding export prices, while contracted prices remain unchanged (at favourable levels), the 2016 "reference" scenario now includes opportunity sales at export price forecasts that are below the prior IFF '15 estimates (13-17%). For the non-contracted portion of export revenues, these adjustments will shift the risk range of the project NPV down [Exhibit 32].

Some of the risks above have materialized and impacted Manitoba Hydro's financial metrics [Exhibit 33]. The ultimate impacts could be even worse should additional downside risks – both controllable and uncontrollable by Manitoba Hydro – be experienced [Exhibit 34].

Topic 3: Can the projects be stopped or paused without undue cost or risk? [Exhibit 35]

Despite the finding that the Keeyask project was undertaken without sufficient review and consideration of the risks – some of which have materialized leading to cost overruns and lower revenue expectations upon project completion – on a 'go-forward' basis continuing the projects remains the lowest risk, lowest cost, highest value option.

An added consideration is the interdependent nature of the projects. Transmitting and exporting power from Keeyask will depend on the new transmission capacity provided by Bipole III and the tie-line. Cancelling the current Bipole III project would effectively strand much of the capacity of Keeyask and make it financially implausible that the project could be continued in its current form.

If the projects were stopped today, it is estimated that, in addition to the costs already incurred (~\$5B across the projects), an additional ~\$1B would be incurred for each of Bipole III and Keeyask, bringing the total project costs to ~\$7B [Exhibit 36].

Stopping the projects would also result in no functioning assets being available to the system for the amount spent, continued significant and real reliability risks associated with Bipole I & II and the Dorsey station, the requirement to procure additional generation to meet Manitoba Hydro's load in the coming years (e.g., by 2027), and other undesired impacts to Manitoba stakeholders [Exhibit 37].

⁶ Includes interest and escalation costs

Cancelling Keeyask would require near immediate commencement to build alternative generation options to avoid the risk of Hydro being unable to meet its domestic reserve capacity needs by 2027 when current generation capacity may prove insufficient⁷.

Completing the projects is still expected to yield a net present value more favourable than rerouting to Bipole III East or switching to gas generation, by an estimated ~\$4 - \$6B [Exhibits 38,39].

Final Conclusions and Recommendations

Based on our analysis we believe building a Bipole III line was a reasonable undertaking for reliability purposes, despite the fact that the most cost-effective design to the East was not pursued. However, construction of Keeyask was an imprudent project to undertake in parallel without further consideration of the risks and impacts of concurrently executing the projects with a Bipole III. Some of these risks have begun to materialize, in particular those related to capital execution, creating further strain on the projects and underscoring the original need for enhanced review and analysis before the projects began construction. Notwithstanding these findings, it is our recommendation the projects continue, as, given the estimated costs to complete, the non-economic impacts, and the expected NPV versus alternatives at this point, continuation remains the best path forward for Hydro, the Province, and their stakeholders.

⁷ In addition cancellation of Keeyask would cause Hydro to be unable to fulfill its existing interim contracted volumes, which are at favorable pricing. And it could make Hydro a less credible counterparty for longer term contracts in the future