INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-001**

SUBJECT: Knight Piésold

QUESTION:

Please file the curriculum vitae for each member of your firm who has participated in the preparation of your report and the curriculum vitae of each third party (if any) retained to assist in preparation of your report. Please specify those individuals who intend to appear to give evidence during the oral portion of the proceeding.

RESPONSE:

Relevant curriculum vitae have been filed through the NFAT Process.

The following members of Knight Piésold have participated in the preparation of the report:

- Sam Mottram P.Eng., Managing Principal – Power Services
- Mike Robertson P.Eng., Specialist Engineer / Project Manager,
- Rob Adams P.Eng., Specialist Engineer - Mechanical
- Boris Fichot P.Eng., Senior Engineer - Civil
- Travis Brown P.Eng., Senior Engineer - Civil
- Michael Pullinger P.Eng, Project Engineer – Mechanical

Engineers Robertson and Fichot intend to appear during the oral portion of the proceeding.

/bxf

INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-002**

SUBJECT: PUB Documents

QUESTION:

Please provide copies of all documents received from the PUB, PUB advisors, or any third party in connection with your retainer and/or in contemplation of preparing your report in this proceeding. Please provide notes of all meetings with PUB, PUB advisors or any third party in connection with your participation in this proceeding (in confidence if necessary).

RESPONSE:

Outside of the documents received from Manitoba Hydro, KP has received only two documents from the PUB (on September 4, 2013):

- A Presentation to Independent Experts dated September 4, 2013 (including KPs scope of work)
- An IEC Briefing slide deck dated September 3, 2013.

Since this question has been asked to all IECs, we will leave it to the PUB to disclose such documents.

/bxf

INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-003**

SUBJECT: Inflation

REFERENCE: Section 2.10.1, Page 25

PREAMBLE: In contrast to the consensus methodology used by Manitoba Hydro and described in Appendix G: Economic Outlook 2013-2034, pages i and 5, KP states that Manitoba Hydro's "…normal practice has been to assume that future costs will increase at a rate generally consistent with the CPI using the future CPI levels targeted by the Bank of Canada."

QUESTION:

Please confirm KP's understanding that MH assumes future cost increases through use of a consensus forecasting methodology and not through future CPI levels targeted by the Bank of Canada. If not confirmed, please explain and provide the basis of your understanding.

RESPONSE:

The In-Service Cost breakdown page 27 of Appendix 2.4 of the submission shows “Escalation at CPI”. KP understands that MH assumes future cost increases through use of future CPI levels targeted by the Bank of Canada.

/bxf

INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-004**

SUBJECT: Project Costs

REFERENCE: KP IEC Report; Executive Summary, Page III of IV

PREAMBLE:

KP states "For the natural gas project costs, appropriate cost estimates have been adopted for the combined cycle and industrial style simple cycle gas turbines (excluding transmission line and pipeline costs).

Similar to wind project costs, the small reported range of natural gas project costs and the relatively lower uncertainty in project definition as compared with hydropower projects at a similar stage of development justifies KP's assessment. Again, the estimates would benefit from some sensitivity analyses.

QUESTION:

Please confirm that the estimates that you are suggesting would benefit from some sensitivity analysis refers only to the O&M costs of natural gas projects.

RESPONSE:

We suggest that sensitivity analysis be performed using both the wider range of possible O&M costs outlined in our report, and the tighter range of capital cost certainty. We agree that the "base case" natural gas project cost is reasonable, so no sensitivity analysis would be required on the capital cost base case.

/mgp1/bxf

INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-005**

SUBJECT: Capital Costs

REFERENCE: KP IEC Report; Section 5.3.2, Pages 47-48

PREAMBLE:

KP states that with respect to the wind projects, the costs are found to be valid for the time period which the independent consultant's study was written (2011) but suggest wind project costs have reduced in the interim and are expected to reduce further in the immediate future.

QUESTION:

Please provide the evidence or analysis upon which you rely to support this position?

RESPONSE:

The recent downward cost trend, as described in KP's original report, is due to ongoing turbine cost reductions (as indicated by Figure 5.1 of our report), resulting in an approximately 15% reduction in reported project costs from 2010 to 2012, and continuing cost reductions into 2013. This is best outlined in "*2012 wind technologies market report"* (US DoE, 2013), which indicates that:

> *"The capacity-weighted average project cost stood at roughly $1,940/kW, down almost $200/kW from the reported average cost in 2011 and down almost $300/kW from the apparent peak in average reported costs in 2009 and 2010. Anecdotal indications from a handful of projects currently under construction and anticipating completion in 2013 suggest that average installed costs may decline further in 2013".*

A less comprehensive, but still useful assessment is provided in the US Energy Information Administration reports "*Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants"*, which suggested an approximately 13% cost reduction for a "generic" wind farm between 2009-2012.

While the 2009-2012 time-frames do not line up precisely with the 2011-2013 time frame between the GL GH report and the NFAT submission, it does indicated an approximately 15% cost reduction over the recent 2-3 year period, and cost reductions continuing into 2013. Furthermore, the average reported cost for the region closest to Manitoba ("Interior") reported an average project cost of $1760/kW in 2012 (lower than the country wide average of $1,940/kW). This cost of $1,760/kW corresponds approximately to the project cost obtained by applying a 15% cost reduction (based on the two year time difference) between when the GL GH report was written until the NFAT submission. While projects costs beyond 2014 are uncertain, if the cost reduction trend continues in the immediate term, the $1,800/kW base case is likely to be conservative. Two synthesis reports (IPCC, 2012; REN21, 2013b) summarised findings and opinions from energy market researchers, industry experts and executives and suggested that future cost reductions are possible. Knight Piésold does not suggest that there is consensus of opinion among industry market experts that future cost reductions be included in the

base case estimate. Nevertheless, KP does believe that there is sufficient recent data to suggest that a cost of $1,800/kW is a reasonable (and possibly conservative) estimate for a hypothetical wind project installed in Manitoba in 2014.

/mgp1

Knight Piésold CONSULTING

www.knightpiesold.com

INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-006**

SUBJECT: Capital Costs

REFERENCE: KP IEC Report; Section 2.3.3 and Table 2.3, Pages 9-10

PREAMBLE:

KP states that the classification of estimates determined by Manitoba Hydro should be revised to a higher class of estimate according to AACE International Recommended Practice.

QUESTION:

Please provide the evidence or analysis upon which you rely to support this position?

RESPONSE:

See PUB/KP I-002 e.

/bxf

Knight Piésold CONSULTING

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INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-007**

SUBJECT: Capital Costs

REFERENCE: KP IEC Report; Section 2.11.5, Page 30

PREAMBLE:

KP states "One aspect of the use of Management Reserves is that it is outside of a system that would allow for Performance Measurement."

QUESTION:

Please explain why Management Reserve does not allow for Performance Measurement and what information you relied on to reach this conclusion.

RESPONSE:

The total planned value (PV) at the end of the project serves as a key benchmark for comparison against performance management indicators such as earned value (EV). If a project has a Management Reserve, it is typically not included in the budget at completion and, therefore, in the Performance Measurement.

For example, if the cost of steel skyrocketed overnight and the escalation reserve was called upon to fill the deficit, it would not be included in the comparison between earned value and planned value, and therefore not be included as an indicator of performance.

/bxf

INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-008**

SUBJECT: Project Costs

REFERENCE: KP IEC Report; Table 2.1, Page 8

PREAMBLE:

It would appear the Total Estimated Capital Cost dollars are not directly comparable as they are in different years. For example, Wuskwatim would be In Service Dollars for 2012, while Conawapa would be In Service Dollars for 2025 (Table 2.4 Chapter 2 of the Submittal), which is escalated from a $6.1 billion base cost. Total Estimated Capital Costs for other projects are likely in different years.

QUESTION:

Please provide the reference year for each estimate, and escalate/ de-escalate each Total Estimate Capital Cost to a common year.

RESPONSE:

Muskrat Falls $6.2 billion (2010), see the following for reference.
http://www.gov.nl.ca/lowerchurchillproject/backgrounder_7.htm
http://www.pub.nf.ca/applications/muskratfalls2011/files/rfi/PUB-Nalcor-39-Rev1.pdf

Site C $7.9 billion (2011), see the following for reference.
http://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/projects/site-c/cost-estimate-site-c.pdf

Petit Mecatina not available for review

La Romaine $6.5 billion (2009) see reference article published in 2009.
http://www.newswire.ca/en/story/480159/the-romaine-hydroelectric-complex-premier-charest-launches-largest-construction-project-in-canada

/bxf

INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-009**

SUBJECT: Contingency

REFERENCE: KP IEC Report; Executive Summary, Page I of IV

PREAMBLE:

KP found that the amount of contingency carried forward for the two generation products could be considered insufficient, depending on the use made of the capital cost estimates.

QUESTION:

In the context of this reference, what is meant by the "use of capital cost estimates"? How does such use impact the sufficiency of the contingency carried forward?

RESPONSE:

KP is suggesting that the contingency is based on a decision maker's appreciation for risk and consequences. Manitoba Hydro accepts the risk associated with a P50 value, with an appreciation of the risks to the organization should the required budget exceed the estimate. Other decision makers may be more risk averse and may require more certainty with a budget. For example if a private development company with no active assets was developing the exact same projects with the exact cost estimate they would require more confidence that the project would not go over the estimated budget regardless of the market certainty.

/bxf

INFORMATION REQUEST RESPONSE

To: Manitoba Public Utilities Board Date: February 20, 2014

KP File: VA103-449/1-A.55

Needs For Alternatives To – **MH/KP I-010**

SUBJECT: Contingency

REFERENCE: KP IEC Report; Executive Summary, Page I of IV

PREAMBLE: "Hydro have chosen a P50 estimate for their base cost but there are others who recommend a higher estimate to provide an adequate contingency for such large individual projects."

QUESTION:

Please identify the "others" referenced in this statement and describe the approaches they recommend. Please also outline the positives and negatives associated with those approaches?

RESPONSE:

A few references can be found below; the USACE is the most relevant.

	Recommendation	Positive Side of Approach	Negative Side of Approach
The United States Army Corp of Engineers (USACE) Construction Cost Estimating Guide for Civil Works (ETL 1110-2-573)	Guidance for cost and schedule risk analysis that generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation	Documented and used. Project more likely to be within budget	Risk averse approach requires greater contingency and more likely to be spent
"Monte Carlo Analysis: Ten Years of Experience" (from Cost Engineering, a publication of the American Association of Cost Engineers, Vol 43/No. 6 June 2001)	P50	Appropriate when managing a large portfolio of projects	Is not applied to very large projects or to strategic projects outside the annual capital budget
	P80 or P90	Very large projects or strategic projects outside the annual capital budget	
CAC/MH I-002b	BC Hydro uses P50 as "Expected Cost Estimate".	BC Hydro also uses the difference between the P90 and P50 to calculate a component of the "Project Reserve" for budget authorizing purposes. This could be used in a similar fashion here.	Requires a large authorized budget, but managed separately.
CAC/MH I-002b	Hydro Quebec uses	Same	Larger pool of operating

	P50 (P70 for rehabilitation)		assets.
NASA	Budgets and Schedules P70		
"How to Manage Project Opportunity and Risk: Why Uncertainty Management can be a much better approach than risk management." by Stephen Ward and Chris Chapman	Contingency is defined as the difference between the expected value (P50) and the Commitment Value (chosen between P50 and P90.)	The rationale for a commitment value is that an organization does not want a particular ratio of projects to exceed their budgets.	Must define acceptable success rate. Is it acceptable if the project exceeds the budget?
"Estimating Risk: A Management Approach" by Andy Garlick	P80 for all Capex but also recommends a tiered control where project managers at the lower decision levels have little to no contingency.	Contingency and managed higher up.	
"Project Risk Management: Essential Methods for Project Teams and Decision Makers" by Yuri Raydugin	Project Cost Reserve P80		
"Integrated Cost-Schedule Risk Analysis" by Dr David Hulett	Uses P80 as example but states to be decided by management.		Who is the decision maker? Depend on what risk is acceptable?

/bxf