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December 17, 2013

Mr. H. Singh
The Public Utilities Board
400 - 330 Portage Avenue
WINNIPEG, Manitoba R3C 0C4

Dear Mr. Singh:

RE: MANITOBA HYDRO NFAT SUBMISSION -

Manitoba Hydro is responding to the request for further explanation of development plans that include large amounts of wind supported by natural gas-fired generation as requested by the PUB in Order 67/13.

Section 4.5.0 of Order 67/13 states that, "it appears that a development plan that is premised on natural gas and wind, in various combinations, did not make the final cut as to a plan to be vigorously tested by Manitoba Hydro and included in the alternatives". The Board goes on to say that, "the Board expects Manitoba Hydro to include an alternative plan that is premised on incorporating more wind energy in conjunction with a combined cycle gas turbine" and that "this scenario should examine various options including the option of up to 1000MW of wind in conjunction with an efficient combined cycle gas turbine that uses the best available technology for optimization of intermittent generation resources".

In response to Board Order 67/13, on June 19, 2013, Manitoba Hydro advised that, "Manitoba Hydro can provide an additional Plan which will include over 1000MW of wind in conjunction with natural gas generation" and that "the most cost effective gas turbine type will be used and the filing will contain an explanation of how this determination was made." Manitoba Hydro further explained that the basis for limiting the analysis to reference case assumptions was "because the economics of the wind plan were so significantly unfavourable that it was clear that evaluating this Plan with the full 27 Scenarios would also result in a negative economic indication." Nonetheless, in response to the PUB request, the full 27 Scenarios for the Plan were included in the submission of the NFAT Business Case.

In the study of large amounts of wind generation as a resource option, wind generation can be relied upon to supply energy and when capacity is required natural gas-fired resources will be used to provide such capacity. In general, as explained below, SCGTs are more economic for providing capacity while CCGTs are more economic when energy is required as well. Manitoba Hydro therefore continued its analysis using SCGTs rather than CCGTs in order to

avoid penalizing the Wind/Gas Plan by using generation resources that would yield a lower incremental NPV.

Wind generation is not assigned a winter peak capacity value in the Manitoba Hydro system due to the intermittent nature and physical limitations associated with wind generation¹; as such it can only be relied upon as an energy resource. In this context, natural gas-fired generation is expected to operate at a low capacity factor, a role for which SCGTs are better suited.

Through analysis of the Wind/Gas development plan it can be seen that by the fiscal year 2047/48 (at the end of the detailed planning horizon), in the order of 30% of the available energy from the new SCGTs capacity is required in a dependable flow year². Additionally for the average of all flow cases in each load year, the capacity factor of the new SCGT units, as demonstrated in the table below, is less than 10% over the detailed 35 year study period.

Fiscal Year	New SCGT Capacity (MW)	Maximum Annual Energy (GWh)	Average of all Flow Cases Energy (GWh)	Capacity Factor (%)
2025/26	490	3714	192	5%
2035/36	1225	9285	835	9%
2047/48	2505	18996	1761	9%

Where wind generation is the predominant energy resource, replacing SCGT resources with CCGT resources is expected to be uneconomic because of the low expected operating capacity factor of thermal resources in the development plans as all plans incorporate the effect of the average of all flow conditions. Through Manitoba Hydro's optimization process for natural gas-fired resources³ it has been shown that capacity factors in excess of 40% are required from a CCGT, in any development plan, to justify economically the additional capital cost of the resource.

The Wind/Gas development plan, as described in Chapter 8, Section 8.2.3.3 of the NFAT Business Case is based on SCGT resources as the capacity support. The replacement of the SCGTs with CCGTs would make this plan less economic.

¹ See Manitoba Hydro's NFAT Business Case, Chapter 7 Section 7.2.4 Wind Resource Option Screening, and Appendix 7.4 Capacity Value of Wind Resources for additional information.

² See Appendix 4.2, page 59

³ See Manitoba Hydro's response to PUB/MH I-171.

Mr. Hollis Singh
December 17, 2013
Page 3

We trust that this is the information you require. If you have any questions regarding this submission, please contact the writer.

Yours truly,

MANITOBA HYDRO LAW DIVISION

Per:

A handwritten signature in black ink, appearing to read "M. Boyd", written over the printed name Marla D. Boyd.

MARLA D. BOYD

Barrister and Solicitor

cc. R.F. Peters, Fillmore Riley LLP
C.L. Monnin, Hill Sokalski Walsh Trippier LLP