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December 15, 2017

Mr. D. Christle
Secretary and Executive Director
Public Utilities Board
400-330 Portage Avenue
Winnipeg, Manitoba
R3C 0C4

Dear Mr. Christle:

RE: MANITOBA HYDRO 2017/18 & 2018/19 GENERAL RATE APPLICATION ("GRA") – MANITOBA HYDRO REBUTTAL EVIDENCE OF DAYMARK ENERGY ADVISORS' WRITEEN EVIDENCE

Please find attached Manitoba Hydro's Rebuttal Evidence with respect to the written evidence of:

- Daymark Energy Advisors, Independent Expert Consultant for the Public Utilities Board, on the Load Forecast Review
- Daymark Energy Advisors, Independent Expert Consultant for the Public Utilities Board, on the Export Pricing and Revenues Review

Manitoba Hydro is enclosing, for the public record, copies of its Rebuttal Evidence with confidential information redacted and with redaction codes inserted thereon. Manitoba Hydro is also enclosing copies (on blue paper) of its Rebuttal Evidence with redactions removed, which copies Manitoba Hydro requests be received and held in confidence pursuant to Rule 13 of The Public Utilities Board Rules of Practice and Procedure. We confirm that the redaction codes applied are the same as those applied to redactions in the Daymark reports.

If you have any questions or comments with respect to this submission, please contact the writer at 204-360-3946 or Odette Fernandes at204-360-3633.

Yours truly,

MANITOBA HYDRO LEGAL SERVICES DIVISION
Per:

M Band

for **PATRICIA J. RAMAGE**
Barrister & Solicitor

MANITOBA HYDRO PUBLIC UTILITIES BOARD

IN THE MATTER OF *The Crown Corporation Public Review and Accountability Act*

AND IN THE MATTER OF Manitoba Hydro's 2017/18 & 2018/19 General Rate Application

REBUTTAL EVIDENCE OF MANITOBA HYDRO

WITH RESPECT TO THE WRITTEN EVIDENCE OF:

Daymark Energy Advisors, Independent Expert Consultant for the Public Utilities Board, on the Load Forecast Review

Daymark Energy Advisors, Independent Expert Consultant for the Public Utilities Board, on the Export Pricing and Revenues Review

Manitoba Hydro

December 15, 2017

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1. LOAD FORECAST REVIEW

This section of Manitoba Hydro's Rebuttal Evidence addresses the written evidence of Daymark Energy Advisors ("Daymark") with respect to its Load Forecast Review.

1.1. Impact of Daymark's Recommendations on Base Forecast

As part of Daymark's Executive Summary of its Load Forecast Review report, Daymark provided, on page 5, table ES1 entitled "Key Summary Findings of MH Load Forecast Analysis". This table provides a summary of Daymark's remarks on Manitoba Hydro's methods and general comments on the directional impacts on the load forecast. Although Daymark does not quantify the impacts of various key findings, the summary table includes both topics that could directionally increase the load forecast and topics that could directionally decrease the load forecast.

While Daymark has developed recommendations with respect to Manitoba Hydro's current load forecasting methodology, Manitoba Hydro's Electric Load Forecast has already been reviewed a number of times by several external independent consultants' both as part of regulatory proceedings and at Manitoba Hydro's request. In 2010, Drs. Kubursi and Magee were retained by the Public Utilities Board ("PUB") as part of the 2010/11 & 2011/12 General Rate Application to review the Electric Load Forecast as part of their risk analysis. In 2014, as part of the NFAT proceedings, the PUB retained the services of Elenchus Research Associates to review the 2013 Electric Load Forecast. Following the recommendations resulting from NFAT, Manitoba Hydro refined the econometric models underlying the Load Forecast to incorporate electricity prices. Following the implementation of these models, Manitoba Hydro enlisted Christensen Associates Energy Consultants to review the econometric models and provide recommendations that would enhance the Electric Load Forecast methodologies.

1.2. Manitoba Hydro's Forecast of Potential Large Industrial Loads

Daymark noted the changes in the Potential Large Industrial Loads ("PLIL") econometric model between the 2014 Electric Load Forecast and the 2017 Electric Load Forecast and suggested in their response to Coalition/IEC (Daymark Load) I-6 that the conservative approach places a downward bias on the forecast.

The PLIL methodology utilized in 2017 better represents the expected growth in the Top Consumer sector based upon the changes to the definition of Top Consumers within the 2017 Load Forecast. In comparing the 2014 and 2017 Load Forecasts, Manitoba Hydro changed the threshold definition for designating a customer as a Top Consumer from a load of 6 MW to 25 MW. This change in definition resulted in the move of 7 customers defined as Top Consumers in the 2014 Forecast to the General Service Mass Market sector. Under the current definition for the 2017 Forecast, four of the ten current Top Consumers, who now represent 54% of the energy use in this sector, would have been classified under the General Service Mass Market Sector when they initially started operations in Manitoba. The change in definition suggests a strong possibility of a new non-residential customer entering Manitoba under the General Service Mass Market sector and, only under significant growth and expansion, moving to the Top Consumer sector.

Daymark identifies on page 63 of its Load Forecast Review Report that "*The 2017 PLIL method was conservative because it only considers the total load of the top consumer companies that have been in the MH service territory since 1983/84, thus excluding the historical load of three companies that are currently in the top consumer sector.*" Manitoba Hydro does not exclude the total load of the three customers that have since joined the service territory, but removes only the initial start-up load, allowing for the variations of operating activities to be included in the analysis. Manitoba Hydro's justification for making this change is to recognize the strong possibility that new connecting customers may enter the Manitoba market under the General Service Mass Market sector prior to growing to become a new Top Consumers.

1.3. Fuel Switching in Manitoba Hydro's Load Forecast

At page 1 of its Report Daymark states: "*the company does not address potential fuel substitution during a time of anticipated large electricity price increases*".

<u>Residential</u>

Manitoba Hydro incorporates the fuel substitution in the Residential forecast using the "saturation" variable within the Residential Average Use Model. It is incorporated using the "saturation" variable as follows:

- Manitoba Hydro creates the saturation variable using an econometric equation to forecast the space heating systems in new dwellings based upon the ratio of forecast natural gas to forecast electricity price assuming a natural gas high efficiency furnace.

- The space heating systems existing dwellings is forecasted within the Residential end-use model based upon the findings of the Residential Energy Use Survey.
- The saturation forecast is further adjusted to reflect the anticipated fuel switching by customers to natural gas arising from the Heating Fuel Choice initiative.

<u>General Service Mass Market and General Service Top Consumers</u>

Manitoba Hydro recognizes the potential/opportunity for General Service Mass Market customers and Top Consumers to switch to alternative energies for heating or to self-generate electricity. Although it is not explicitly included within the econometric models, it is taken into consideration as part of alternative energy. Manitoba Hydro is aware that natural gas has had a significant operating cost advantage in Manitoba for a number of years. Commercial and industrial customers within the General Service Mass Market Sector will typically make investment decisions, including those involving their heating systems, based upon their assessment of the potential capital, operating and maintenance costs and savings, along with other factors specific to their operations. Even with the significant operating cost advantage, it is estimated that 22% (15,000 customers) of the approximately 67,700 customers in the General Service Mass Market sector are located in natural gas available areas but currently are not identified as heating with natural gas either directly or from a shared source (as supplied by a landlord or property manager). Excluded are those customer accounts identified as non-buildings. Although some customers are identified as "within natural gas available areas", they may not be economically close to natural gas depending upon how far their specific site is from the nearest natural gas main. In other words, the operating cost advantage of natural gas may not offset the capital cost of extending the natural gas main to their site combined with the cost of converting their existing heating system. Manitoba Hydro's Top Consumers consist of customers that utilize electricity for production purposes which limits the ability to switch to another more economic fuel source such as natural gas or are located a significant distance from natural gas service areas which makes the cost of extending natural gas to their site uneconomic.

As a result of the foregoing considerations, Manitoba Hydro includes projected electricity reductions of 611 GWh by 2030/31 through Load Displacement and Alternative Energy initiatives and a further 139 GWh of projected electricity reductions through Solar PV targeted to these sectors under the 2016/17 Demand Side Management Plan – 15 Year Supplemental Report (Appendix 7.2, Appendix A.2).

1.4. Econometric Models Underpinning Manitoba Hydro's Load Forecast

The following sections address issues identified by Daymark with respect to the econometric models used by Manitoba Hydro in the Load Forecast.

1.4.1 Multicollinearity

In Daymark's Load Forecast Review report, Daymark indicated that the Residential Average Use Model underpinning the Residential Load Forecast exhibited multicollinearity issues.

At page 33 of its Report, Daymark states the following:

> *Although multicollinearity doesn't affect the overall fit of the model, or result in bad forecasts of the dependent variable, it does produce unreliable coefficient estimates. As a result of the multicollinearity in MH's residential average usage model, the coefficients associated with electricity price and income, which are interpreted as price elasticity and income elasticity may be incorrectly estimated.*

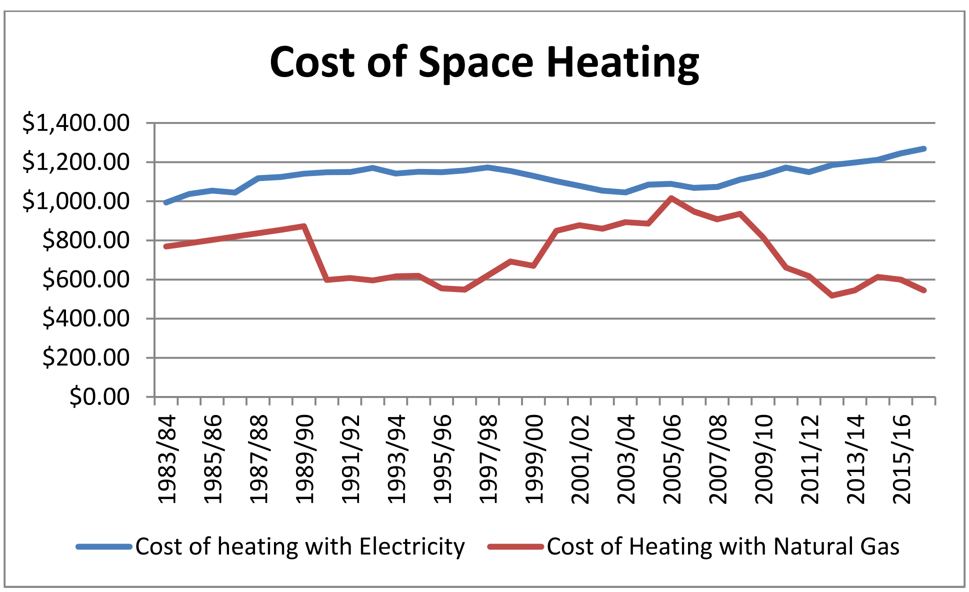
The primary impact of multicollinearity is that coefficients may react unpredictably in response to small changes in the model or the data. This, however, does not result in a reduction to the reliability of the model as a whole. The presence of multicollinearity increases the statistical variance of the estimates which in turn greatly increases the chances that an independent variable exhibiting multicollinearity with another independent variable will become insignificant as part of the regression analysis. The t-statistics included in the 2017 Electric Rate Forecast indicate that all independent variables within the residential average use model are statistically significant. In the residential average use model, the electric price independent variable does not exhibit any multicollinearity and therefore does not have the concern as it relates to multicollinearity when utilizing the individual predictor.

Daymark acknowledges on page 1 of their report that "*The independent variables, or predictors, used in the regression models that MH developed are similar to the variables used in load forecasts in the industry.* " and also suggest on page 4 that "*MH should consider economic reasoning before introducing any new predictor variables into its regression models*".

The selection of the independent variables in the Residential Average Use Model were based on the ability to gain explanatory power of key economic variables, primarily electric price, and also capture the impacts of customers utilizing electricity for space heating. Manitoba currently has 188,440 (39.2%) residential customers heating their homes with electricity of which over 110,000 customers are situated in areas where natural gas is available. Utilizing the 2014 Residential End Use Survey provided in response to PUB/MH I-125a), page 38, a single detached home using Electric Heat consumes 17,500 kWh more electricity annually than a customer utilizing natural gas space heating. With the significant amount of electricity consumption required to heat a home in Manitoba, Manitoba Hydro includes the “saturation” independent variable as the representation of the forecast percentage of electric heat residential customers over total residential basic customers.

As depicted in **Figure 1.1** below, cost of heating in real terms (2016/17 base) with natural gas relative to electricity has fallen since 2009 showing a significant operating cost advantage for heating a home with natural gas in comparison to electricity.

Figure 1.1



However, even with the operating cost advantage of heating with natural gas, Manitoba has continued to see a growth of electric heat customers from 160,561 (36.3%) in 2009/10 to 188,440 (39.2%) in 2016/17. The capital cost advantage of installing an electric furnace over a natural gas furnace has led to customers and contractors installing electric furnaces to reduce upfront purchase costs, particularly in gas available areas outside of Winnipeg.

The "Saturation" independent variable was included to provide insight and future guidance to the impact of both the Heating Fuel choice initiative and the selection choice of new customers related to the current operational cost advantage of natural gas over electricity.

However, inclusion of the Saturation independent variable, led to the Income independent variable no longer being statistically significant. This was not a desirable outcome as there is evidence that customers with higher income have higher energy use (page 38 of the 2014 Residential Energy Use Survey). It was not hypothesized that income and the fuel choice (Saturation independent variable) were related; for example, a customer having a higher income was not anticipated to be more likely to have installed electric heat, nor was an electric heated customer anticipated to have a higher income. However, it continued to be logical that both income and the saturation of electric heat customers would influence the average use of Manitoba Hydro's residential customers. A Trend variable was introduced to address the spurious regression outcomes.

The Trend variable plays a role of controlling the exogenous increases in the dependent variable (electricity usage per residential customer) which is not explained by other variables. When dealing with economic situations, ignoring the fact that several series are trending over time can lead to false conclusions that changes in one variable actually cause changes in the other variables. Therefore, the inclusion of a trend variable has both theoretical and economic reasoning behind it.

Manitoba Hydro has also evaluated the robustness of the Residential Average Use Model by looking at several time series data including the impact of simulating future year values to better evaluate the underlying model consistency. The outcome of this analysis shows the elasticities of Manitoba Hydro's key economic variables continue to lie within industry ranges and to produce relatively similar elasticity values with the electric price elasticity ranging from -0.23 to -0.28, and the income elasticity values ranging from 0.26 to 0.31, as summarized in the **Figure 1.2** below. The saturation and trend variable estimates also remain statistically significant.

Figure 1.2

Residential Average Use Model				
Year	**Price Elasticity**	**Income Elasticity**	**Trend**	**Saturation**
2016/17	-0.28 (t=-4.43)	0.30 (t=3.19)	0.01 (t=4.53)	1.31 (t=2.11)
2015/16	-0.26 (t=-4.12)	0.28 (t=3.00)	0.01 (t=4.59)	1.46 (t=2.37)
2014/15	-0.23 (t=-3.69)	0.26 (t=2.87)	0.01 (t=4.74)	1.63 (t=2.73)
2013/14	-0.26 (t=-4.43)	0.31 (t=3.62)	0.01 (t=5.35)	1.23 (t=2.13)
2012/13	-0.24 (t=-3.78)	0.30 (t=3.42)	0.01 (t=5.28)	1.36 (t=2.27)
2011/12	-0.26 (t=-3.49)	0.30 (t=3.34)	0.01 (t=5.16)	1.30 (t=2.10)

1.4.2 GDP Interpretability Issues

In Daymark's Load Forecast Review report, Daymark raised concerns with the interpretability of the geometric blended GDP used in General Service Mass Market and Potential Large Industrial Loads econometric models.

Daymark states the following on page 29 of its Report:

> *There are a couple of issues with the way the blended GDP is created and used in the analysis. First, the GDP units used for creating a combined GDP for the three sectors are not consistent. MH used Manitoba's GDP in millions of dollars ($), whereas Canada and U.S. GDP are considered in billions of ($). Even though the results (regression coefficients) would not have changed using the same units for three different GDP, the use of a blended GDP also has an interpretability issue, especially with the real GDP elasticity. For instance, the real GDP elasticity estimated for large customers within the GSMM sector is 0.29 and interpreting this number is challenging until the geometric combination is used to track back to the individual GDP relationship.*

Manitoba Hydro utilizes a geometric average in order to incorporate the GDP of relevant markets that influence the overall economic growth of Manitoba Hydro customers. The GDPs of Manitoba, Canada, and U.S. were utilized in the development of Manitoba Hydro's econometric models forecasting future energy requirements. When individual GDPs are included as separate independent variables, statistical issues arise due to the correlation between the individual GDP projections. Because of the co-relationships, using a geometric average to calculate a blended GDP is a more appropriate method for incorporating the influence of economic growth within each sector. The geometric average provides a method to ensure weightings between economic regions are not dominated by the largest market.

As indicated by Daymark, the utilization of different denominations does not impact the coefficients and Manitoba Hydro utilizes the typical reporting denomination for each market. After a thorough evaluation of the specific customers in each of the sector, Manitoba Hydro assigns the portion of Manitoba, Canada and U.S. GDPs that best represents local, national and global economic conditions. While the blended GDP is not as straight forward to interpret as a single GDP variable, the impacts of a specific GDP change can be calculated accordingly. The following **Figure 1.3** illustrates the impact to the geometric average if the average growth rate of Canadian GDP were to increase by 0.2% annually.

Figure 1.3

GS Large	GDP Weighting			
	30%	35%	35%	
Fiscal Year	MB RGDP chained 2007m$	Cdn RGDP chained 2007b$	US RGDP chained 2009b$	Geometric Blended RGDP
2016/17	60,533	1,798	16,708	11,267
2017/18	61,748	1,835	17,089	11,506
2018/19	62,954	1,871	17,479	11,743
2019/20	64,208	1,904	17,847	11,973
2020/21	65,392	1,935	18,200	12,191
2021/22	66,651	1,970	18,579	12,426
2022/23	67,811	2,006	18,980	12,665
2023/24	68,801	2,042	19,379	12,893
2024/25	69,805	2,079	19,788	13,126
2025/26	70,823	2,116	20,205	13,362
2026/27	71,857	2,154	20,630	13,603
growth rate	1.7%	1.8%	2.1%	1.9%

GS Large	GDP Weighting			
	30%	35%	35%	
Fiscal Year	MB RGDP chained 2007m$	Cdn RGDP chained 2007b$	US RGDP chained 2009b$	Geometric Blended RGDP
2016/17	60,533	1,798	16,708	11,267
2017/18	61,748	1,872	17,089	11,586
2018/19	62,954	1,908	17,479	11,825
2019/20	64,208	1,942	17,847	12,057
2020/21	65,392	1,974	18,200	12,276
2021/22	66,651	2,009	18,579	12,513
2022/23	67,811	2,046	18,980	12,753
2023/24	68,801	2,083	19,379	12,983
2024/25	69,805	2,120	19,788	13,217
2025/26	70,823	2,158	20,205	13,455
2026/27	71,857	2,197	20,630	13,698
growth rate	1.7%	2.0%	2.1%	2.0%

Over the next 10 years, should an analysis of the impact to the General Service Mass Market Large customer class under a scenario where the real Canadian GDP values increase 0.2% per year from 1.8% to 2.0% be required, the average annual growth in the Geometric Blended GDP would increase 0.1%.

1.4.3 Price Elasticity

Daymark states at page 36 of its Report: "*While the inclusion of both the trend and dummy variables in MH's average usage models may be justified, Manitoba Hydro's analysis shows that the price elasticities reported by MH are underestimated*".

The electricity price elasticity assumptions included within the Electric Load Forecast are within the acceptable range and as acknowledged by Daymark in response to MH/Daymark (Load) I-6 "*… elasticities proposed by Manitoba Hydro are not unreasonable*". Meta-analysis is a statistical procedure that combines results from multiple studies, and is used to qualitatively summarize previous published literatures. There are two meta-analysis studies of electricity demand elasticities that Dr. Yatchew references in section C of his report which incorporates a number of econometric studies of electricity demand conducted over the years with a broad range of elasticities.

Figure 1.4 below contains a summary of listed price elasticity studies, including studies which are referenced by Dr. Yatchew in his Report of November 15, 2017.

Figure 1.4

Electricity Price Elasticities							
Report	Jurisdiction	Residential		Commercial		Industrial	
		short-run	long-run	short-run	long-run	short-run	long-run
RAND Study	National	-0.24	-0.32	-0.21	-0.97	N/A	N/A
	Regional	-0.13 to -0.32	-0.17 to -0.62	-0.18 to -0.31	-0.37 to -1.4	N/A	N/A
EIA	National	-0.12 to -0.24	-0.4	-0.12 to -0.25	-0.82	N/A	N/A
Espey Study	previous studies	-2.01 to -0.004 (mean of -0.35)	-2.25 to -0.04 (mean of -0.85)	N/A	N/A	N/A	N/A
AEP's 2016 Study	AEP customers	-0.08	-0.14	-0.1	-0.27	-0.23	-1.26
Gillingham, Newell and Palmer	literature	-0.14 to -0.44	-0.32 to -1.89	0 to -0.46	-0.24 to -1.36	-0.11 to -0.28	-0.22 to -3.26
AEO2003	National	-0.20 to -0.34	-0.49	-0.10 to -0.20	-0.45	N/A	N/A
AEO99	National	-0.23	-0.31	-0.23	-0.24	N/A	N/A
Labandeira, Labeaga and Lopez-Otero	literature	-0.216	-0.620	-0.230	-0.721	-0.166	-0.508
Garen, Jepsen and Saunoris	United States	-0.137	-0.607	-0.205	-0.559	-0.22	-0.832
Fell, Li and Paul	United States	-0.385 to -1.020		N/A		N/A	
Ryan and Razek	Manitoba	-0.57		-0.44		0.02	

As can be seen by **Figure 1.4** above, every jurisdiction is different and will have electricity price elasticity effects that reflect the unique combination of different characteristics including the existing price of electricity of each jurisdiction. The customer response to price may increase in jurisdictions with higher starting electric prices, which result in a greater absolute expense to a consumer. Jurisdictions with lower starting electricity prices may experience lower price responses. In comparison to the information from U.S. jurisdictions, BC Hydro in 2008 adopted a price elasticity of -0.05 in their load forecast which has been reviewed and accepted by their regulator.

1.5. Load Variability and Scenario Analysis

1.5.1 Daymark is Not Recommending Base Load Forecast Address 90% of Potential Futures

Daymark originally stated in its report at page 1 that "*a key shortcoming of the approach taken by MH is the reliance on a forecast that has a probability of being accurate 50% of the time*" and that "*a forecast that is expected to address 90% of the* *potential futures is typically preferred*". This led to a conclusion that Daymark was recommending that a base forecast that addressed 90% of potential futures was being recommended. Manitoba Hydro was questioned during cross examination by PUB counsel on whether it had considered developing a forecast with a higher probability as suggested by Daymark (Transcript page 1132, lines 13 – 16). While Manitoba Hydro attempted to respond on the record, Manitoba Hydro indicated that it would briefly address this issue in rebuttal.

Daymark's response to MH/DAYMARK (LOAD) I-1(a), corrects their representation of Manitoba Hydro's approach by stating that "*the reference to 50% accuracy was an inappropriate characterization*". In response to MH/DAYMARK (LOAD) I-1(b) of Daymark further clarifies that:

> *Addressing 90% of the uncertainties is not the intent, Daymark is not suggesting overbuilding to address potential loads; instead, we are recommending that Manitoba Hydro perform the analysis that identifies key uncertainties and the magnitude impact should they occur, … so that stakeholders can understand and better reflect on the implications of uncertainty on planning and consumers.*"

There is therefore no suggestion from Daymark that a base forecast with a higher probability should be developed by Manitoba Hydro.

1.5.2 Determining Load Uncertainty

Daymark recommends at page 3 of its Report that "*the load forecast should consider scenario analysis by developing alternative load forecasts in addition to the base load forecast.*"

Prior to 2009, Manitoba Hydro did produce scenario based medium high and medium low forecast based on various economic and demographic assumptions. In 2009, Manitoba Hydro adopted its probabilistic analysis as it allows quantifiable risk-analysis to be completed while understanding the probability of any selected load profile of occurring, where the desired likelihood of the case can be selected for the study. During Manitoba Hydro's 2010/11 & 2011/12 GRA, the PUB set forth an independent review of Manitoba Hydro Risks conducted by Drs. Kubursi and Magee. The Electric

Load Forecast was part of their review and Drs. Kubursi and Magee stated the following with regards to Manitoba Hydro's use of probabilistic analysis:

> *A probabilistic framework is worked out to identify the load given the probability of the actual load will be less than the forecast load. … This is an improvement on using arbitrary pessimistic or optimistic forecasting to bracket the forecast.*

Drs. Kubursi and Magee recommended that the probabilistic methodology be continued and this methodology was used in setting the ranges to assess the sensitivity to high and low load growth within the 2017 Electric Load Forecast.

Manitoba Hydro has provided in the Load Forecast the data needed to understand the potential impact of possible future events and their respective impact on Manitoba energy and peak. Combined with the probabilistic analysis that is provided on pages 44 to 46 of the 2017 Electric Load Forecast document, this information allows planners the ability to derive any number of scenarios they wish to analyze and understand the probability of occurrence.

1.6. Weather Normalization

On the issue of weather normalization, at page 47 of its Report, Daymark states that "*MH may get better estimates of weather-dependent load by relying on more than two-years of monthly energy and degree days to estimate the weather-dependent relationship.*" In addition, on page 48, Daymark asserts that "*MH could also improve its weather normalization by using a shorter-period to calculate the "normal" year weather variables.*" and that "*With the climate change debate, it may make sense to use a shorter time-frame if in fact electricity use is becoming more weather dependent. However, MH has not provided evidence to demonstrate why one approach is superior to the other.*"

While in this proceeding the issue of weather adjustment methodologies have not been discussed in detail, this issue has in fact been presented and reviewed to varying degrees by the PUB during the Centra Gas Manitoba Inc. 2011/12 Cost of Gas Application, the 2012/13 & 2013/14 Electric GRA, and the 2014 Needs For and Alternatives To (NFAT) Review as discussed further in the sections below.

1.6.1 Defining a "Normal" Weather Year

In 2007, Manitoba Hydro communicated to the PUB that it would be adjusting its definition of weather normal and degree day in order to align approaches between forecasting for future electricity and natural gas needs and improve the overall approach. Year to year variation in the revenue forecast, most notably for natural gas, due only to a change in the estimation of normal weather was not desired. Manitoba Hydro undertook a review of alternative normalization methods that would serve primarily to reduce the year-to-year variability, while minimizing the impact on forecast accuracy.

The following **Figure 1.5** presents a summary of the findings of the impact of changes to the definition of "normal" on Manitoba Hydro's weather adjustment calculation, as originally presented in the 2011/12 Centra Gas Manitoba Inc. Cost of Gas Application and subsequently approved in PUB Order 65/11:

Figure 1.5

Normal HDD Calculation Methodology
Impact on Normal HDD

Methodology	**Average Change**	**Maximum Change**	**Years between Changes**	**Avg 1 Yr Forecast to Actual**	**Worst Case 1 Yr Forecast to Actual**
25 Year Average	21	54	1	325	989
Olympic Average	32	100	1	300	998
10 Year Average	43	146	1	301	1057
Environment Canada	86	251	10	332	944
Five Year Fixed	104	160	5	306	1050
Statistical Significance Method	364	485	37	315	970

The result of moving from ten year to 25 year averages was a significant improvement in year-to-year stability with only a small reduction in accuracy. In response to PUB/Daymark-28, Daymark commented that an Itron survey[1] of utilities comparing survey responses from 2006 to 2013 indicated a slight increase in utilities moving from long term to short term weather normal in 2013 as compared to 2006. . In the survey, 7% more utilities have moved to a weather normal that is 10 years or shorter, which as of 2013 represented 30% of all utilities. It should be noted however, that the Itron survey shows that normal weather calculations are still dominated by 30 year averages with 58% of all utilities surveyed continuing to rely upon weather normal that is based upon 20 years or greater.

1.6.2 Necessary Changes to Weather Adjustment Methods

While Daymark indicates that Manitoba Hydro could improve its weather normalization by using a shorter-period to calculate the "normal" year weather variables, utilization of differing weather adjustment methodologies will have little if any effect on the load forecast. The weather adjustment is used to normalize the historical annual usage such that the historical usage can be viewed assuming a "normal" year as defined by Manitoba Hydro's 25 year average. Any change in weather adjustment methodology will only affect the starting point of the forecast. The growth rate forecast will not be affected by a change in weather adjustment methodologies since both Residential growth rates and General Service growth rates are based on the customer forecast which are then added to the weather adjusted starting point. Any variance produced by differing methodologies will cause all years of the forecast to change up or down by a minimal amount per year, resulting in not more than +/- 50 GWh overall compared to Manitoba's 2016/17 gross firm energy of 25,896 GWh (weather adjusted).

As alluded to by Daymark in its Report, prior to 2009, Manitoba Hydro had utilized a stepwise regression-based method incorporating many years of data to determine the weather effect. The regression model was as follows:

Monthly GWh = basey + basem + hddy*(HDD – normal HDD) + cddy*(CDD – normal CDD)

[1] http://capabilities.itron.com/efg/2014/10_WeatherNormSurvey.pdf

Where

basey = the baseload in year y
basem = the baseload in month m of any year
hddy = the Heating Degree Day coefficient in year y
HDD = the actual HDD in the month
normal HDD = the long term normal HDD for the month
cddy = the Cooling Degree Day coefficient in year y
CDD = the actual CDD in the month
normal CDD = the long term normal CDD for the month

As can be seen by the model, the base, hdd and cdd coefficients are all dependent upon the year chosen, since the coefficients all change over time. As part of the stepwise model, changes in coefficient values for any given year would be determined for only the years in which the cumulative change of the coefficient was significant. This resulted in each coefficient changing approximately every four or five years, not necessarily in the same years as the other coefficients.

These stepwise regression coefficients had fewer fluctuations, but with that, were less accurate. In addition, the stepwise regression coefficients remained constant for several years and then changed sharply, and therefore a smooth growth of the parameters was not being modeled. As such, all the values of the coefficients and the years that reflected the rise in coefficients would change whenever another year of data was added.

The stepwise linear regression model incorporates many years of data, which is similar to the model being advocated by Daymark, but prevented the best weather adjustment from being made within every year.

In order to effect the best possible weather adjustment in the current year, weather coefficients needed to be determined from the most recent data, ideally, the previous year. However, 12 monthly data points were found to be insufficient to produce good estimates of the base, HDD and CDD coefficients. Using more years of data produced more stable coefficients, but each additional year added resulted in less accuracy due to the coefficients changing over time. Manitoba Hydro analyzed different time periods to calculate the coefficients and found with using two previous years of data to best represent the current year's coefficients.

The primary purpose of weather adjustment at Manitoba Hydro is to explain monthly revenue variance between forecast revenue and actual. As the majority of variance is due to weather, reliable methods are needed to estimate the variance in GWh due to weather which can then be converted into a dollar value.

Manitoba Hydro found that by determining the coefficients in advance, the weather adjustments for each month of the then current year could be determined and reported as they happened. The coefficients would be set and not change at the end of the year, and all weather adjustment reporting at Manitoba Hydro would be consistent.

Beginning in 2009, Manitoba Hydro determined that a new model would be used which resulted in a simplified equation:

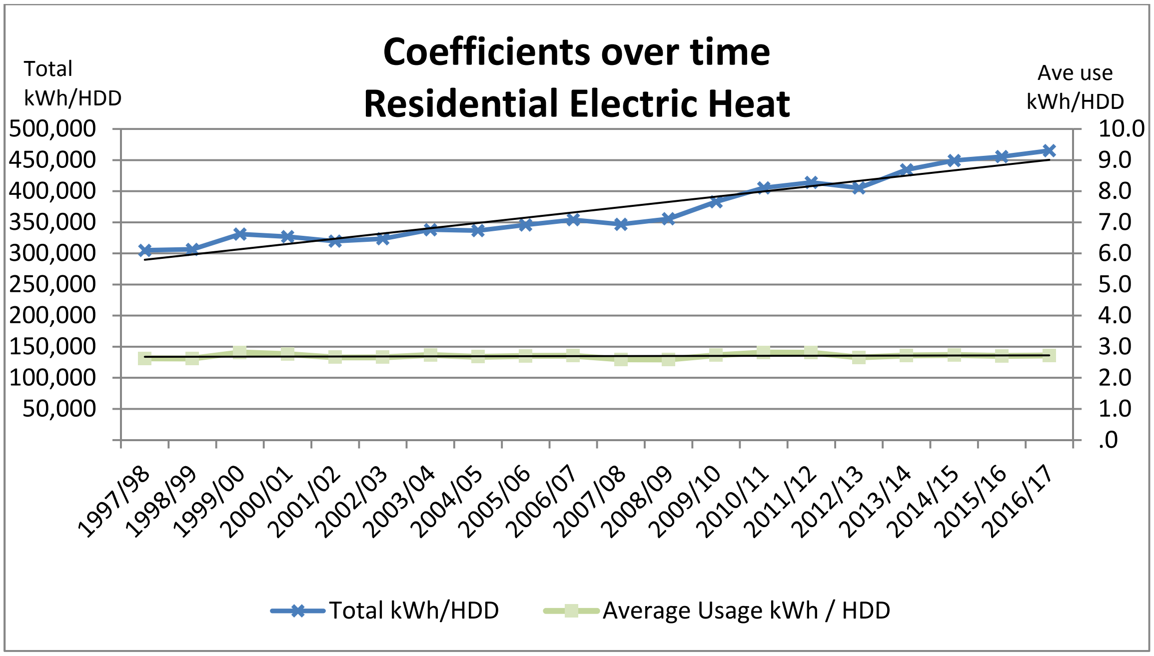
Monthly GWh = base + hdd*(HDD – normal HDD) + cdd*(CDD – normal CDD)

The base, hdd and cdd coefficients for each year are determined using the previous 24 months of data.

Unlike the regression models being proposed by Daymark, the current model does not result in a change in historic coefficients as new data is added and the coefficients calculated for each sectors are additive and equal the coefficients of the total of the sectors. In addition, the methodology can be used down to the individual customer, and the resulting change in coefficients over time provides insight to customer heating and cooling usage pattern over time.

At page 48 of the report, Daymark stated that Manitoba Hydro's weather coefficients may be overstated as their analysis using 10 years of history produced lower coefficients than the coefficients estimated by Manitoba Hydro when only utilizing two years of information. Over the 10 years of historical data used by Daymark in their analysis the coefficients that were rising are directly correlated with the growth of Electric Heat Customers. Depicted in **Figure 1.6** below are the two year coefficients calculated for every historical year since 1997/98 for the Residential Basic All Electric customers. The Total kWh/HDD represents the Residential Basic All Electric coefficients which grow from 300,000 kWh/HDD to 450,000 kWh/HDD overall as a sector, while the Average Usage kWh/HDD represent the per customer usage (kWh per HDD) which has remained around 2.7 kWh/HDD.

Figure 1.6



The chart depiction of the total kWh/HDD confirms Daymark's conclusion on p.48 that using 10 years of historical information will produce lower HDD coefficients, however the lower HDD coefficients would under represent the impacts of weather as more customers have chosen to heat their homes with electricity.

As noted above, the methodology chosen for weather adjustment has minimal effect on the overall Load Forecast with only a potential variation of +/- 50 GWh throughout the forecast due to a change in the weather adjusted starting point. This represents up to a 0.2% variation in Manitoba Hydro's forecast overall at any point and is insignificant in that context.

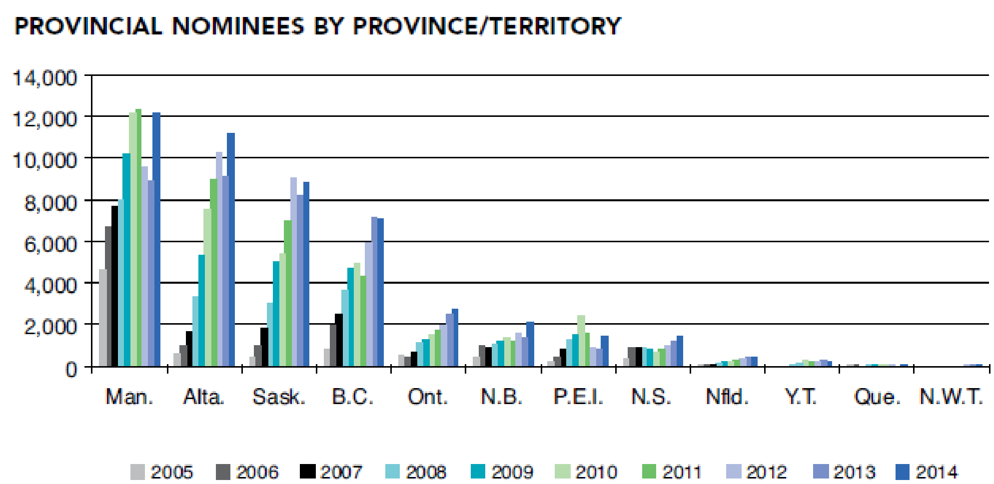
1.7. Population Forecast Accuracy

In its Report, Daymark states at page 30 that "*MH's evaluation of population and residential customer forecast shows that MH has typically under-forecasted the population values*". The underlying population data within Figure 10, which is displayed on page 31 of Daymark's report, consists of Manitoba Population as reported by Statistics Canada along with the Population forecasts from each Economic Outlook from 1989 to 2016. In the analysis of past forecasts, the impacts of the Manitoba Provincial Nominee Program ("MPNP") must be considered. In 1998, the Government of

Manitoba set out the goal to develop the first provincial nominee program that was designed to attract and retain immigrants with skills, education and work experience to make an immediate economic contribution to Manitoba[2]. The province of Manitoba has attracted the most immigrants as part of the MPNP and the impacts since the inception of the program have exceeded over 103,000 people by 2014. Industry forecasters preparing long term population projections for the Province of Manitoba leading up to the introduction of this program would not have anticipated or forecast the impacts of a provincial program specifically designed to increase the number of immigrants to Manitoba.

The following **Figure 1.7** from the 2014 Statistical Report on Manitoba Immigration Facts[2] displays the number of immigrants arriving in each province as part of the Provincial Nominee Program and in 2014, 75.1% of immigrants to Manitoba came as part of the program.

Figure 1.7



Similar to the evaluation of accuracy of the Electric Load Forecast, which do not include the future load impacts of Program-based Demand Side Management activities; the preparation of population forecasts prior to the creation of the MPNP would not have anticipated or forecast a provincial program designed to increase the number of immigrants to Manitoba. **Figure 1.8** below displays the number of immigrants to

[2] http://www.immigratemanitoba.com/wp-content/uploads/2015/09/MIF-2014_E_Web_Programmed.pdf

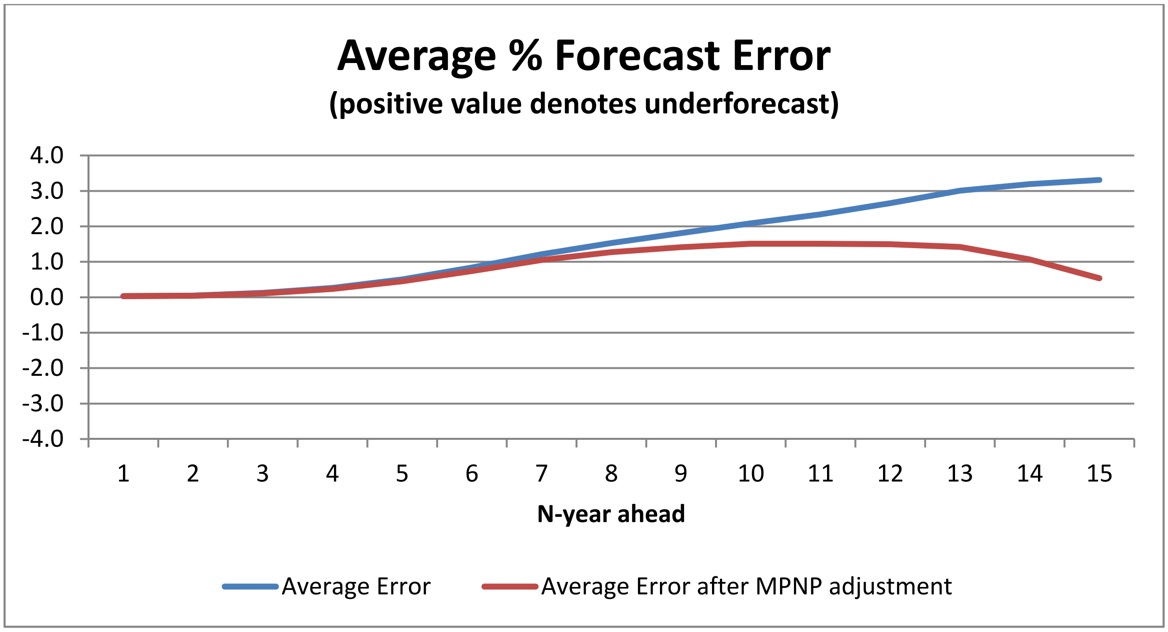
Manitoba from the MPNP and the cumulative growth within Manitoba from the inception of the Provincial Nominee Program in 1998 through 2014.

Figure 1.8

Year	No. of Immigrants to MB through the MPNP	Cumulative Growth
1999	418	418
2000	1,097	1,515
2001	972	2,487
2002	1,527	4,014
2003	3,106	7,120
2004	4,048	11,168
2005	4,619	15,787
2006	6,661	22,448
2007	7,689	30,137
2008	7,968	38,105
2009	10,151	48,256
2010	12,178	60,434
2011	12,342	72,776
2012	9,531	82,307
2013	8,854	91,161
2014	12,187	103,348
Total:	103,348	103,348

The following **Figure 1.9** displays the average percentage population forecast accuracy as displayed in the Daymark report at page 31 and updated to include the average percentage population forecast accuracy when the forecasts prior to 2000 are adjusted for the MPNP program.

Figure 1.9



Manitoba Hydro acknowledges that in previous forecasts, it may be difficult to capture the impact of a program such as the MPNP and that the external forecasters may not have been able to quantify the potential impact of the MPNP given the significant positive impact to the immigration within Manitoba. As displayed in the chart above, the average of all population forecasts shows a slight under-forecasting but individually, the population forecasts within any given N-year ahead have realized both under and over forecasting. Daymark also indicated in the response to Coalition/IEC (Daymark Load) I-7(a) regarding the population forecast that *"there is no consistent trend in the historical annual forecast errors estimated by MH that show under-forecasting or over-forecasting".*

Manitoba Hydro is confident in the approach of utilizing a consensus forecast and annually updates and reviews the external population forecasts received.

2. EXPORT PRICING AND REVENUES REVIEW

This section of Manitoba Hydro's Rebuttal Evidence addresses the written evidence of Daymark with respect to the Export Pricing and Revenues Review.

2.1. Review of Long-Term Reference Case Energy Market Price Forecast – Manitoba Hydro's Forecast is Not Biased Low

At page 39 of its Export Pricing and Revenues Review Report, Daymark states: *"To review the reasonableness of the consensus methodology and the resulting energy price forecast, Daymark reviewed the key inputs: natural gas prices, carbon prices and capacity retirements."*

At page 50 of its Report, Daymark further states:

> *MH's resultant reference case forecast has the following characteristics:*
>
> - [redacted]
> - [redacted] 3b
> - [redacted]"

Manitoba Hydro addresses the above in the following sections.

2.1.1 Consensus Forecasting Methodology

Daymark agreed with Manitoba Hydro's consensus forecasting methodology in general and flagged no concerns. Manitoba Hydro agrees with Daymark that not all forecasters explicitly refer to their products as "reference" in the documentation reviewed; however, based on discussions Manitoba Hydro has had with forecasters in prior years regarding their nomenclature [redacted] 3b [redacted]), Manitoba Hydro is confident in its selection of forecasts that make up the reference forecast.

2.1.2 Natural Gas

On page 40, Daymark compares the consensus natural gas forecast to that of the 2017 Annual Energy Outlook ("2017 AEO") from the U.S. Energy Information Administration ("EIA"). Manitoba Hydro agrees the EIA is a good benchmark but it is not an unassailable standard. The EIA forecast is simply that, another forecast with its own set of assumptions and methodology, and its own strengths and weaknesses. It is noteworthy that the EIA forecast (December 2016) [redacted] by Manitoba Hydro in its consensus forecast. Daymark highlights that the strength of the EIA forecast is that it is publicly available and *"contains descriptions of the underlying fundamentals that drive their forecasts"* (Daymark Report, page 40). Simply because a forecast is free and has detailed assumptions does not attribute any special value or standing. The third-party consultants that make up the consensus forecast rely on their forecasts as their business model and these "blue chip" forecasters function in an extremely competitive industry and deliver forecasts equal to those the EIA provides. The EIA itself recognizes that while it may have nearly unlimited data, any forecast by its very nature is subject to uncertainty: 3b

- *Projections in the Annual Energy Outlook 2017 (AEO2017) are not predictions of what will happen, but rather modeled projections of what may happen given certain assumptions and methodologies.*

  ...

- *Energy market projections are subject to much uncertainty, as many of the events that shape energy markets and future developments in technologies, demographics, and resources cannot be foreseen with certainty.*[3]

In short, comparing Manitoba Hydro's consensus natural gas price forecast to the EIA's forecast is simply an additional piece of information, no more or less accurate than other forecasts, and less current than those used by Manitoba Hydro.

[3] U.S. Energy Information Administration, *Annual Energy Outlook 2017*, page 4. Available at: https://www.eia.gov/outlooks/aeo/

2.1.3 Carbon Price

Daymark on Page 51 of its report states: "[redacted]". 3b

Any view of CO_2 pricing in the United States is based upon primarily policy assumptions. Unlike a fundamental supply and demand product like oil, the value of CO_2 is based on regulatory policy. Current and future governments may place an explicit or implicit price on GHG emissions. Given the current Trump administration's pending plans to terminate or fundamentally alter the Clean Power Plan[4] along with long standing opposition to carbon legislation by US Republican law makers who currently control all three branches of the U.S. government, the long term carbon outlook is understandably lower than in years past. Based on current information available to Manitoba Hydro, the consensus value of carbon from the four electricity export price forecasters remains the best estimate of future carbon values at the time MH16 Update with Interim was filed. The subsequent Trump administration actions highlight the further downside risk associated with carbon values.

Daymark makes oblique references to higher carbon values in other "market assessments." [redacted] 3b Manitoba Hydro agrees that forecasts with higher values for CO_2 may be available, however, the goal to have an unbiased consensus forecast is achieved by accepting other experts' views of the future and not imposing its biases by choosing forecasts to produce a predetermined result.

With regards to Daymark's sources of "market assessments", Daymark stated at page 22 of its Report that *"The Minnesota Public Utilities Commission (MPUC) recently acted to increase the range of CO_2 pricing in resource planning assessments* [emphasis added]" and references this again in its response to PUB/DAYMARK CSI-1. It is important to understand that this range of CO_2 values is not a forecast of carbon values. What Daymark has described in PUB/DAYMARK CSI-1 is in fact a "social cost of carbon" designed to be a penalty factor used only in the Minnesota resource planning process

[4] Please refer to the following news release: https://www.theglobeandmail.com/report-on-business/international-business/us-epa-chief-to-sign-proposed-rule-on-clean-power-plan-withdrawal/article36525281/

and applied to the projected emissions from thermal units for modeling purposes. This value is not a carbon tax or any other pricing mechanism. It only exists for planning purposes and is not applied in operations. The value of carbon in Minnesota will tend to encourage resource planning decisions by Minnesota utilities away from thermal fuels towards renewable alternatives. The value of carbon provided by Manitoba Hydro's consensus price forecasters applies to the U.S. as a whole in actual dispatch (i.e. market clearing prices) and increases electricity market prices across the entire region, and is not in any way comparable to a variable imposed by regulatory order in the resource planning process of a single state in the MISO region.

2.1.4 Capacity

On page 73 of its Report, Daymark states *"We believe there is clearly a range of plausible market values for capacity that MH does not consider in its Reference Case, particularly for MISO planning years 2023/24 and later."*

Manitoba Hydro has developed a consensus forecast of capacity value in connection with its Long-Term Energy Market Price Forecast. In determining the export revenue forecast, and having regard for the uncertainty associated with capacity values, a policy decision has been made by Manitoba Hydro to remove the potential capacity revenue that is as yet uncontracted from its revenue forecast, as further discussed in Section 2.3.

2.2. A Long-Term Premium No Longer Exists

At page 61 of its Report Daymark states*:*

> *The elimination of the premium in the longer term is not consistent with the longer-term outlook for energy, capacity and clean energy requirements in the Northern MISO region. Based on Daymark's MISO market assessment provided in Section II and the independent consultants view on capacity needs in the near future, an opportunity for premiums in long-term contracts is a distinct possibility, as was observed by MH when it initiated the premium in 2013.*

To reiterate what Manitoba Hydro indicated to LaCapra Associates[5] (now known as Daymark) during the NFAT, Manitoba Hydro has been applying the Long Term Dependable Premium for planning purposes since 2008. The Long Term Dependable Product Premium was appropriate for planning purposes in an era when Manitoba Hydro was the only regional supplier capable of supplying a larger volume of renewable and carbon free energy at a long term fixed price. Such a product was attractive to customers who were concerned about carbon emissions and future carbon pricing, and also those concerned about natural gas price volatility. The premium was a function of Manitoba Hydro's ability to leverage its unique position in the market at the time of the NFAT[6] review. Notwithstanding this information, LaCapra Associates was skeptical of the inclusion of a premium during the NFAT, noting that *"In addition, MH provides little justification for the amount of the premium"*[7].

History also demonstrates that Manitoba Hydro has been consistent in its application of the premium for planning purposes. LaCapra Associates evidence during the NFAT noted, *"However, for the low case, the long-term dependable 2012 Adjusted price forecast does not include a premium"*[8]. The current outlook for export prices has deteriorated significantly since the NFAT was filed in August 2013 and is near the low price forecast used in the 2012 price forecast that underpinned the business case. Manitoba Hydro's decision in the 2016 Electricity Export Price Forecast ("EEPF"") to remove the Long Term Dependable Product Premium is consistent with the assumption to exclude the premium in the low export price case included in the NFAT analysis.

Manitoba Hydro agrees with Daymark that market conditions in the next 5-7 years do not support any premium. However, the information Manitoba Hydro relies upon to guide its planning assumptions[9] does not support Daymark's assertion that the premium will return possibly as soon as 2025 (Daymark Report, Page 72). Manitoba Hydro's best information suggests that inclusion of a premium is not supported by market conditions.

[5] Please see La Capra's response to CSI IR LCA/MH I-432 from the NFAT.
[6] Please see Manitoba Hydro's response to CSI IR PUB/MH II-301 which provided evidence of the premium.
[7] LaCapra Associates, NFAT Review Technical Appendix 6: Export Markets, January 24, 2014, Page 6-61.
[8] LaCapra Associates, NFAT Review Technical Appendix 6: Export Markets, January 24, 2014, Page 6-58.
[9] For example, IRPs, Staff Report of the DOE, and forecaster portal documents.

2.2.1 Lower Price and Volatility Expectations for Natural Gas Prices

Since the 2014 EEPF, the forecast natural gas price has fallen by 35% on average. Manitoba Hydro offered stable, predictable prices at a time when the market was exposed to fuel price risk; customers were prepared to pay a premium to avoid this risk. Natural gas prices are now low and all indications from the independent forecasters are that prices will remain low for the foreseeable future. The shale gas revolution and the resulting surplus supply of North American natural gas significantly reduce concerns regarding price volatility. The Department of Energy ("DOE") Staff Report on Electricity Markets and Reliability (MH/DAYMARK (EXPORTS) I-1 Attachment 4) highlighted the importance of gas to markets on page 36 stating:

> *Wholesale electricity prices generally tracked natural gas prices for the study period, as shown in Figure 3.18. This is likely because gas-fired mid-merit and peaker power plants have been the marginal generators following load in many hours of the day, and their short-run marginal costs are driven by natural gas prices. Thus, natural gas plants and gas prices have been the largest single driver of spot electricity prices.*

While wind and solar technologies are currently attracting most of the headlines, what remains the most significant change in the markets since the NFAT and the 2013/14 & 2014/15 GRA has been sustained lower natural gas prices with a "new reality" of lower long term electricity prices.

2.2.2 Uncertainty on Greenhouse Gas Emissions Policy

The Trump administration's rollback of environmental regulations[10], the lack of pending carbon legislation, and the pending plans to terminate the Clean Power Plan have significantly deferred a national carbon value in the U.S. Dr. Yatchew raises similar concerns in his Expert Testimony in this proceeding, on page vii, stating:

> *The U.S. administration has also altered direction on its decarbonization policies, disengaging from the Paris Agreement and making efforts to*

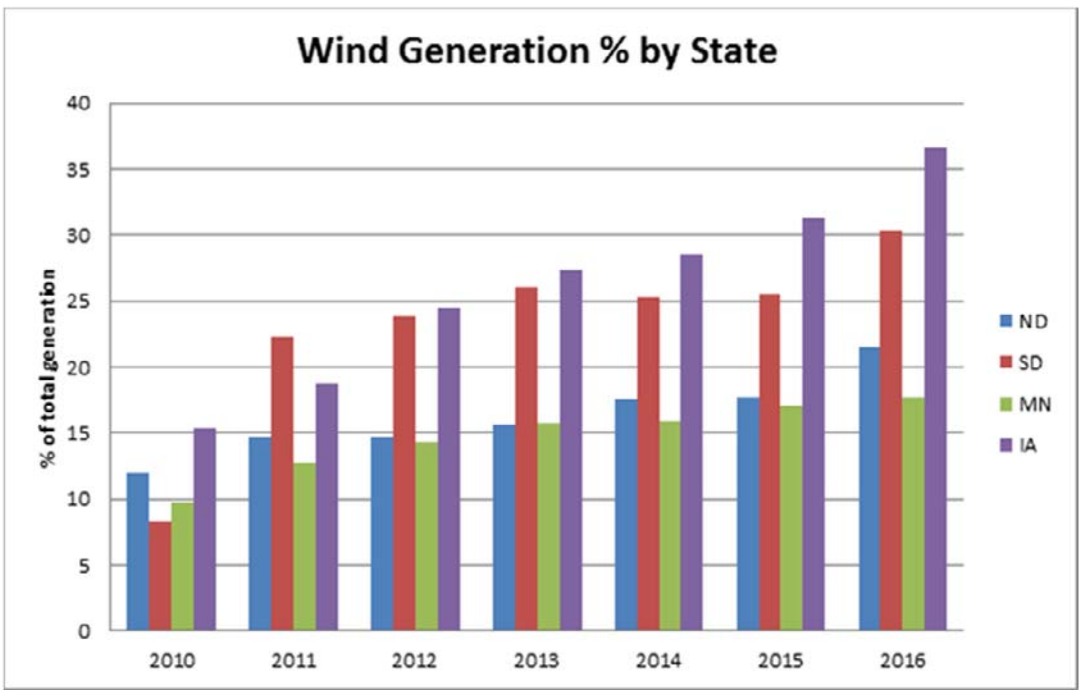
[10] Please refer to the following news release: https://www.theglobeandmail.com/report-on-business/international-business/us-epa-chief-to-sign-proposed-rule-on-clean-power-plan-withdrawal/article36525281/

> *revive the coal industry. Together, these factors are likely to have a dampening effect on investment, and* ***weaken prospects for long-term power sales agreements that are premised on clean hydro-electric power.****" [emphasis added]*

2.2.3 Competition from Wind and Solar Resources

Wind generation and more recently solar generation have increased significantly in the MISO market. **Figure 2.1** below shows how wind as a percentage of total generation has increased in the MISO North footprint since 2010.

Figure 2.1



The amount of direct competition for Manitoba Hydro's clean energy in the MISO market has increased significantly over the last eight years. Manitoba Hydro is no longer the only renewable option for potential customers and over the same time period, the levelized cost of energy for wind has declined over 60%, according to Lazard[11]. It is expected that competition will continue to increase in the future. Ben Fowke, chairman,

[11] Please refer to the following news release: https://www.lazard.com/perspective/levelized-cost-of-energy-2017/

president and CEO of Xcel Energy in a news release noted as follows: "*We're investing big in wind because of the tremendous economic value it brings to our customers. With wind energy at historic low prices, we can secure savings that will benefit customers now and for decades to come*"[12].

The U.S. DOE Staff Report explains the market impact of wind and solar which it describes as Variable Renewable Energy (VRE) beginning at page 102:

> *New technologies with very low marginal costs, i.e. VRE, reduce wholesale prices, independent of—and in addition to—the effects of low natural gas prices. To the extent that additional development of such resources is driven by subsidies and mandates, their price suppressive effect might place undue economic pressure on revenues for traditional baseload (as well as non-baseload) resources and could require changes in market design.*

In the MISO market currently, wind penetration is significantly higher in the MISO North in comparison to other MISO hubs. The North Region that includes Manitoba Hydro has recently shown over 35% of generation on a monthly level from wind compared to 4.8% in the next highest region. As such, the price of energy at the Minnesota Hub is consistently lower than all other hubs. Minnesota Hub in 2016 was the lowest price hub in MISO (MH/DAYMARK (EXPORTS) I-1 Attachment 3, page 31). Manitoba Hydro is of the opinion that wind and solar will continue to have a suppressive effect on wholesale market prices throughout the forecast period.

Dr. Patten, as part of Potomac's review of Manitoba Hydro's export prices and revenues during NFAT, summed up the nature of the premium: *"Because I -- I don't know that over time Manitoba really has the ability to increase that premium. That premium is going to be driven by the -- the preferences of the buyers"* [NFAT Transcript Page 4718].

Xcel's public statement supporting wind development in their system and the value to their customers, have clearly articulated an evolution in their preference. Manitoba Hydro is simply in a more competitive market and its planning assumptions must reflect this new reality. By expecting the premium to return in 2025, Daymark is in essence

[12] Please refer to the following news release:
https://www.xcelenergy.com/company/media_room/news_releases/xcel_energy_announces_the_nation%E2%80%99s_largest_multi-state_investment_in_wind_energy

expecting to roll back the clock to a time when Manitoba Hydro did not face an extremely competitive market place with low cost renewable alternatives.

2.3. Elimination of Capacity Revenues in the Long-Term Export Revenue Projection is Reasonable

At page 72 of its Report, Daymark states:

> *As with the discussion of the premium in Section V, we believe the elimination of capacity revenues for surplus dependable energy and opportunity sales in its entirety for the 20-year forecast is not well supported and not consistent with the information available to MH from the independent market consultants (see Section III) or the information from MISO, NERC and utility IRPs (See Section II). With that said, we agree with MH assessment of the softening of the market for exports in the near term over the past several years. The explanations of the market conditions associated with this issue from the 2017 EPF (discussed in Section V) are very focused on the current and near term market conditions. We do not see any consideration of the potential for materially different circumstances to be prevailing beyond the near term, as is evident in the third party forecasts and MISO planning.*

Daymark also states on page 18 that "*Longer term (year 2024 and later), absent any action to add new capacity resources to the system, the MISO market would be short of the capacity needed to meet reserve margin requirements.*" Manitoba disagrees with the degree of certainty that Daymark seems to apply to this conclusion on page 18, and notes the key qualifier "absent any action to add new capacity resources". At page 72, Daymark better recognizes this uncertainty in stating *"that it is likely that MISO will be short capacity within the next ten years, possibly as soon as 2025"*.

2.3.1 Receding Horizon for the Capacity Need Date in MISO

Manitoba Hydro, through ongoing monitoring of a variety of sources[13], remains concerned regarding the uncertainty around capacity values. One of the primary sources that Daymark cites in making its conclusion is the Midwest ISO's MTEP 2017 report which cites the 2023/24 date as a "need date" for new resources to meet capacity requirements. Manitoba Hydro notes that MTEP17 was not the first report to warn of coming shortages[14]. In MTEP16, MISO warned that reserves will drop and new generation would be needed in 2018. One year before, MTEP15 indicated the need date was 2020 and in MTEP14 the need date was 2016. MTEP13 raised the issue in stronger language saying "Recent assessments show the potential for a 3 to 7 GW capacity shortfall as early as 2016". Although there are five annual reports that indicated various "need dates", thus far none of these anticipated "need" dates have borne out in capacity auction values. The need date in MTEP17 is now 6 years in the future (previous reports were 2-5 years out) but that date is clearly subject to significant uncertainty.

Uncertainty regarding the capacity need date can be focused in the areas of declining load forecast and resource additions and retirements, which are discussed below.

[13] Staff Report to the Secretary of Electricity Markets and Reliability, Xcel IRP, Minnesota Power IRP, MISO MTEPs 13-18, OMS study.

[14] Please refer to the following:
MTEP16 Book 2 – Resource Adequacy, 6.2, page 12 - "MISO forecasts the reserve margin will drop below the PRMR of 15.2 percent beginning in 2018, and will remain below the PRMR for the rest of the assessment period". Available at: https://www.misoenergy.org/Library/Repository/Study/MTEP/MTEP16/MTEP16%20Book%202%20Resource%20Adequacy.pdf
MTEP15 Book 2 – Resource Adequacy, 6.2 - "MISO forecasts the reserve margin will drop below the PRMR of 14.3 percent beginning in 2020, and will remain below the PRMR for the rest of the assessment period". Available at: http://www.misomtep.org/long-term-resource-assessment-mtep15/
MTEP14 Book 2 – Resource Adequacy, 6.2 - "MISO forecasts the reserve margin could drop the PRMR of 14.8 percent beginning in 2016, and will remain below the PRMR for the rest of the assessment period". Available at: http://www.misomtep.org/long-term-resource-assessment/
MTEP13 Book 2 – Resource Adequacy - "A changing Resource adequacy environment with the potential impact of current and proposed air regulations. Recent assessments show the potential for a 3 to 7GW capacity shortfall as early as 2016". Available at: http://www.misomtep.org/test-executive-summary/

2.3.1.1 Load Forecast is Declining

As noted in the U.S. DOE Staff Report at page 13 *"Growth of total electricity use has slowed from averaging 2.5 percent annually in the late 1990s, to averaging 1.0 percent annually from 2000 to 2008, to remaining roughly flat since then."*

The above quote highlights that load forecasts are essentially flat (0.3%[15] to 0.5%[16] in MISO long term current expectation). This shifts the emphasis from new resources to managing existing fleets. As the DOE summarizes regarding MISO and similar markets: *"markets were designed when supply curves tilted sharply upward, demand grew over time, and capacity was not explicitly compensated to make up for insufficient revenues from an energy-only market"* (U.S. DOE Staff Report, page 107).

2.3.1.2 Resource Additions and Retirements

Daymark presented a great deal of information on generation retirements, but failed to adequately describe the uncertainty on either the retirements or the potential for resources additions. In MTEP 17, MISO studied the potential levels of resource additions and retirements under three future scenarios. **Figure 2.2** below (reproduced from MISO's Figure 5.2-2 in the MTEP17 Report Book 1, page 85) shows potential Additions and Retirements for the 15 year period 2016-2031. In all three scenarios, projected capacity additions exceed projected retirements.

[15] Please refer to the MTEP17 found in MH/DAYMARK (EXPORTS) I-1 Attachment 1.
[16] Please refer to the 2017 OMS MISO Survey Results. Available at: https://www.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/Workshops%20and%20Special%20Meetings/2017/20170616%20OMS-MISO%20Survey%20Results%20Conference%20Call/2017%20OMS-MISO%20Survey%20Results.pdf

Figure 2.2

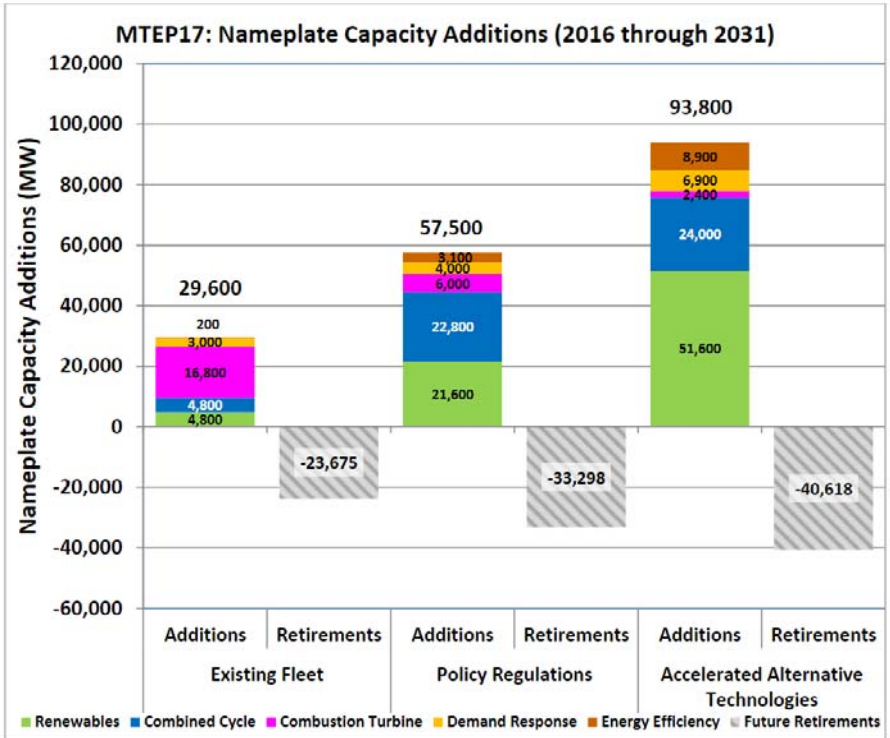


Figure 5.2-2: MISO nameplate capacity additions by future (2015-2030 EGEAS Model)[22]

Wind additions are being added on top of a low natural gas environment causing additional price suppression by pushing more low cost energy into an already over supplied market. Xcel Energy's "Steel for fuel strategy" contemplates building large amounts of wind generation to reduce exposure to fuel risk. When this additional wind generation is installed for energy purposes, additional capacity is inherently added. Wind contributes approximately 15% of the total installation (a 100MW wind farm would have 15MW of capacity accredited) in the form of capacity used for regional resource adequacy/reliability purposes. The proposed wind farms, when developed will have a measurable impact on capacity. Xcel Energy in its recent IRP[17] has announced 1,800 MW of additional wind and Minnesota Power is assuming 250 MW of additional wind.

Furthermore, according to data compiled by the Commerce Department, Minnesota added 203 MW of new solar capacity in the first quarter of 2017, compared to 207 MW

[17] Please refer to PUB/DAYMARK - 3 Attachment 1.

during all of 2016. Overall solar capacity in Minnesota capacity now stands at 447 MW – growing from just 1MW in 2009. More than 800 MW of solar generation is projected in Minnesota by the end of 2017[18]. The capacity credit for solar is even higher than wind and is currently valued by MISO at 50% of the total installation.

Notwithstanding that wind and solar projects are developed for energy and environmental reasons, the associated capacity additions are an additional benefit to the developing utilities. The inclusion of the capacity related to renewable resources further adds to the uncertainty around the potential future MISO need date. MTEP17 highlighted in the executive summary that wind additions make up a large portion of potential additions to MISO and especially in Manitoba Hydro's region:

> *MISO's Generator Interconnection Queue has grown to more than 350 projects totaling 58 GW. This is an unprecedented amount of requested generation driven by phase-outs of wind production tax credits and investment tax credits for solar, expected coal retirements and state renewable portfolio standards. MISO's West Region alone faces more than 22 GW of generation additional incidental capacity may end up dwarfing potential need.*

Daymark states at page 2 of its Report as follows: "*The 61 GW of coal generation in the MISO market is likely to decline significantly over the next decade with the age of the fleet and the economic pressure of low natural gas prices being primary drivers.*" The changes in environmental regulation in the U.S. market are well-noted for the effect on CO_2 pricing but it also has an important and unmentioned effect on coal retirements. The U.S. administration's effort to revive the coal industry and allow coal plants to retire based on economics alone has the potential to slow the rate of coal plant closures over the next decade. The EIA as part of the 2017 AEO showed a nearly 500 TWh difference in coal generation by 2030 between a regulated (CPP) and non-regulated framework[19]. It can be argued that the "no clean power plan" future could become the base planning assumption making coal retirements far from certain.

[18] Please see the news release at: https://www.pv-tech.org/news/dramatic-growth-in-minnesota-solar-power
[19] U.S. Energy Information Administration, *Annual Energy Outlook 2017*, page 70. Available at: https://www.eia.gov/outlooks/aeo/

Manitoba Hydro notes that, in Appendix B of its Report, Daymark references the 2016 Organization of MISO States – MISO report. This document is out of date and a 2017 Organization of MISO States – MISO report dated June 2017 was available and showed 5400 MW of committed and potential capacity additions for 2022.

2.4. Total Revenue Impact of Excluding the Premium and Capacity Revenue from the IFF 10-year Forecast

Manitoba Hydro considers there to be ample support for the decision to exclude the premium and capacity revenue for planning purposes. Even if one were to include the premium and capacity revenue for planning purposes after 2024/25 as suggested by Daymark, the impact on net export revenues for the three year period (2024/25 to 2026/27) would be in the order of $200 million to $300 million[20]. This planning decision has no impact on the immediate and pressing need to address the continued deterioration in Manitoba Hydro's financial condition during the next 5-6 years.

2.5. Clarification on Other Matters Addressed in Daymark's Review

Manitoba Hydro provides the following clarification with respect to other matters addressed in Daymark's report, namely the sources used for Manitoba Hydro's short-term export price forecast, water conditions assumed and the treatment of hydrology in the forecast.

2.5.1 Manitoba Hydro Used Multiple Sources in Deriving its Short Term Export Price Forecast

At page 33 of its Report, Daymark states:

> *The short-term forecast (months to a year out) relies on <u>one independently-produced forecast.</u>* [redacted] [Vendor A] *is the company that provides a monthly price forecast for the upcoming months."* [emphasis added] 3a

[20] Aggregated information derived from Manitoba Hydro's response to PUB-MH I-50a-c CONFIDENTIAL.

As explained by Daymark on page 34 of its Report, Manitoba Hydro applies adjustments to Vendor A's forecast:

> *"Based on the information provided by MH, these adjustments:*
>
> - *Were selected by evaluating differences between* [redacted] [Vendor A] *and other* 3a
> *market providers, and considering the past 12-month historical values; and,*
> - *Were based on approximate comparisons to other forecasts, forward prices, and historic prices for same time of year."*

Daymark also states on page 34 of its Report, footnote 43: *"Manitoba Hydro uses short term forecasts from 3 independent consultants and ICE forwards to benchmark* [redacted] 3a
[Vendor A's] *forecast."*

Manitoba Hydro notes that prior to IFF16, Manitoba Hydro's short term export price forecasts were generally only based on Vendor A's forecast due to the frequency of forecasts from other vendors, however recently other vendor's short term price forecasts have become available at a similar frequency to the original vendor forecast, and have been used in Manitoba Hydro's short term export revenue forecast projections. The additional vendor forecasts, along with other information, were used to determine adjustments to the Vendor A forecast. The adjustment process blended information from the Vendor A forecast, three other vendor forecasts, Intercontinental Exchange (ICE) forwards, and historic prices to arrive at Manitoba Hydro's price forecast. The use of this information was not limited to benchmarking Vendor A's forecast as Daymark asserts. For MH16 and later forecasts, MH has been using multiple forecast sources for its short term export market price projections.

2.5.2 Daymark's Summary of Water Supply Conditions Assumed for Year 1 of the Forecasts

At page 53, Daymark attempts to summarize the dates for actual inflow conditions and reservoir storage for MH16 and MH16 Update. This information is incomplete and incorrectly represents that the dates where actual storage and actual inflows were used in MH16 and MH16 Update. **Figure 2.3** below provides the correct dates.

Figure 2.3

forecast	actual reservoir storage up to	actual inflows flows up to
MH16[21]	February 1, 2017	February 22, 2017
MH16-Update[22]	June 1, 2017	June 14, 2017

2.5.3 Daymark's Summary of Water Supply Conditions Assumed for Year 1 of the Forecasts

At page 53 Daymark states:

For Year 2 (2018/19):

- *Inflow conditions calculated based on an <u>average</u> of 104 water flow cases*[58] *referred to as the 'multiflow' method."* [emphasis added]

Manitoba Hydro notes as follows with respect to year two of the forecast in its response to PUB/MH I-19b:

> *The second year of IFF16 reflects the average of all revenues and average of all costs for each of the water flow years on record from 1912/13 through 2015/16. It is not a reflection of the financial outcome from a single flow case such as median water flow year or an average water flow year.* [emphasis added]

Daymark found Manitoba Hydro's treatment of hydrology in year two of the IFF (i.e. the use of the 'multi-flow method') to be reasonable (Daymark Report, page 54); however, it appears as though Daymark misunderstood the approach used in year two. In spite of this, Daymark found that Manitoba Hydro's treatment of hydrology for years three and later was reasonable. Given Manitoba Hydro's treatment of hydrology in year two was similar to that of years three and later[23], Manitoba Hydro asserts that Daymark's overall finding with respect treatment of hydrology is still valid; as stated by in page 56 of its

[21] Manitoba Hydro's report on 2016 Forecast of Generation Costs and Interchange Revenues, March 1, 2017, p. 11 (submitted to Daymark as CSI).
[22] Manitoba Hydro's response to PUB/MH II-37a-b, page 2.
[23] Tab 7, p. 29: "The year two forecast is now produced in a similar manner as years three and later and reflects the possibility of the full range of historic inflow conditions. This change better reflects expected revenues and costs that are affected by water supply."

Report: "*Daymark concludes that the hydrology used by MH for the MH16-Update appears reasonable and consistent with previously-used methodology.*"