DAYMARK ENERGY ADVISORS

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INDEPENDENT EXPERT CONSULTANT REPORT: EXPORT PRICING AND REVENUES REVIEW

NOVEMBER 16, 2017

PREPARED FOR
Manitoba Public Utilities Board

PREPARED BY
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AEO	Annual Energy Outlook
CT	combustion turbine
EEPF	Electricity Export Price Forecast
EIA	U.S. Energy Information Administration
EPF	Energy Price Forecast
FRAP	Fixed Resource Adequacy Plan
GRA	General Rate Application (2017/18 & 2018/19)
GW	gigawatts
IRP	Integrated Resource Planning
ISO	Independent System Operator
LMPs	Locational Market Prices
LRZ	Load Resource Zones
LTRA	Long-Term Reliability Assessment
MATS	Mercury and Air Toxics Standards
MEC I	Mankato Energy Center Combined Cycle
MH	Manitoba Hydro
MINN HUB	MISO's Minnesota Hub
MISO	Midcontinent Independent System Operator
MPUC	Minnesota Public Utilities Commission
MTEP	MISO Transmission Expansion Planning
MWh	megawatt-hours
NERC	North American Electric Reliability Corporation
NFAT	Needs For and Alternatives To
NSP	Northern States Power
PRA	MISO's Planning Resource Auction
PUB	Manitoba Public Utilities Board
RPS	Renewable Portfolio Standard
RTO	Regional Transmission Organization
SMEs	subject matter experts
SPLASH	Simulation Program for Long-term Analysis of System Hydraulics

EXECUTIVE SUMMARY

Manitoba Hydro's (MH) 2017/18 and 2018/19 General Rate Application (GRA) seeks approval from the Public Utilities Board (PUB) for an increase in its rates. MH has developed the rates proposal with a goal of restoring its Equity Ratio to 25 percent within 10 years, 5 years earlier than the previous plan. The need for rate increases on sales to its domestic customers is driven, in part, by a decline in MH's expectations for revenues. MH's integrated financial forecast includes a long-term forecast (20 years) of export revenues as a key input.

The PUB retained a team of Daymark employees as Independent Expert Consultants (Daymark IEC Team) to conduct an Export Pricing and Revenues Review. The objective of the review was to determine the accuracy and reasonableness of the export revenues forecast and assumptions included in MH's request for rate increases and its long-term financial forecasts. This report contains our analysis and findings resulting from that review.

We conclude that MH's export revenue forecast is conservative/low relative to a value that is consistent with MH's stated goal that it will have a 50 percent chance of achieving the equity ratio target within 10 years. The key issues we identify here are:

- The reference case energy market price forecast and the resultant energy revenues are susceptible to be biased low.
- MH assumes that no revenue will be received for capacity or any other premium values from the substantial surplus dependable energy in the forecast.
- The uncertainty analysis that MH has conducted demonstrates the asymmetrical nature of the risk, with energy price risk skewed toward higher values, where the expected value of the forecast will be higher than the reference case value.

The components of the export revenue forecast that we reviewed and found to be reasonable include the forecast of surplus dependable energy and opportunity sale energy and MH's forecast of revenues to be derived from existing firm contracts.

The vast majority of MH's export sales are made to U.S. entities operating in the markets administered by the Midcontinent Independent System Operator (MISO). Our review of the characteristics of the MISO marketplace found the following.

- 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. About 88 percent of the existing coal capacity is over 50 years old today. A number of planned coal retirements have been announced in MISO plans or in utility resource plans.
- MISO needs assessments indicate that the current system surplus capacity is expected to erode within 5 years based on current assumptions and information on existing, committed, and planned changes in capacity resources, with the need for new resources of about 24 GW occurring by 2031. This need is driven primarily by expected retirements of aging coal generation. The replacement resources will be determined by the generating companies in the region, with natural gas generation and renewable generation featured as prominent options considered in the resource plans we reviewed.
- State polices have significant influence on resource choices. In Minnesota, policies governing utility resource planning are placing increased importance on greenhouse gas emission reductions and renewable resources. As examples, Northern States Power and Minnesota Power each show coal retirements and increasing natural gas and renewables in their plans for the coming decade. Wisconsin state policy shows some similarities to Minnesota, while North Dakota requires planning to consider least cost.

Our report contains our review and findings on the components of our scope of work:

1. A discussion of factors influencing the MISO market
2. A review of MH's electricity export price forecasts
3. A review of MH's forecast of exportable surplus energy
4. A review of changes in MH's methodology regarding premiums
5. A review of MH's forecast of revenues from existing contracts
6. A review of MH's 20-year forecast of net extraprovincial revenue

I. INTRODUCTION

A. Scope of the Report

Daymark Energy Advisors (Daymark)[1] offers this independent expert report to describe our export pricing and revenues review and provide our expert opinion regarding the treatment of those topics by Manitoba Hydro (MH) in its 2017/18 & 2018/19 General Rate Application (GRA).

On August 21, 2017, the Manitoba Public Utilities Board (PUB) retained a team of Daymark employees as Independent Expert Consultants (Daymark IEC Team)[2] to conduct an Export Pricing and Revenues Review and a Load Forecast Review. This Export Pricing and Revenues Report (Export Report), and the companion Load Forecast Report, are now provided to present the results of the work requested by the PUB.[3] The full text of the scope of work for the Export Report is included in Appendix A, which includes:

1. A review of MH's electricity export price forecasts;
2. A review of MH's forecast of exportable surplus energy;
3. A review of MH's 20-year forecast of net extraprovincial revenues;
4. A review of changes in MH's methodology regarding premiums; and
5. A discussion of factors influencing the MISO market.

The objective of this scope of work is to determine the accuracy and reasonableness of the export revenues assumptions included in MH's request for rate increases for consideration by the PUB. MH's export revenues projections rely on information that is highly sensitive and confidential and rely on MH's proprietary models and third party forecast information, including confidential information shared directly with the Daymark IEC team. For this reason, the Daymark IEC Team is charged with preparing a

[1] Daymark Energy Advisors is the new name of the firm formerly known as La Capra Associates.The name change occurred on November 9, 2015.

[2] The Daymark IEC Team includes specific individuals within Daymark Energy Advisors. A separate set of Daymark employees have been retained by the PUB as Advisors. The Daymark IEC Team conducted its work and maintained documents separate from all other Daymark employees in accordance with the terms of a non-disclosure agreement executed with Manitoba Hydro.

[3] On October 25, the PUB added a third task to the Daymark IEC Team scope of work. That task will be a review of the economic case for the Manitoba-Saskatchewan Transmission Line and export sale to Saskatchewan Power. A report on that review will be submitted separately on or before December 15, 2017.

full, confidential report on our findings to the PUB, and providing a report suitable for the public record that does not disclose any confidential information.

B. Daymark Approach

The Daymark IEC Team conducted the scope of work considering:

- MH's GRA filing, minimum filing requirements, and interrogatory responses;
- Certain information on export revenue projections from prior rate proceedings and the NFAT proceeding;
- Information provided directly and confidentially to the Daymark IEC Team by MH resulting from direct discussion with the MH subject matter experts (SMEs); and
- Publicly available documents obtained by the Daymark IEC Team from research on the export markets.

MH provided direct access to its SMEs for the Daymark IEC Team to conduct our review, including:

- Meetings in MH's offices in Winnipeg with the MH SMEs and staff on September 13 and 14, 2017;
- Weekly coordination calls with the SMEs;
- Frequent conference calls with certain SME's on each of the sub-topics included in the reviews; and
- Transfer of documents identified over the course of these meetings.

In working with MH's SMEs, the Daymark IEC Team solicited certain documentation necessary to complete our scope of work and reviewed those materials with the SMEs that developed them to understand how each analysis was conducted. MH established a secure file transfer mechanism to provide electronic copies of documents identified in this process to the Daymark IEC Team, with those documents held in a secure file server location with access limited to the members of the Daymark IEC Team.

Throughout this report we footnote all materials sourced from a specific document. At the end of this report, Appendix B provides a full annotated listing of all documents relied upon by Daymark in the production of this report.

This report is structured to provide a clear discussion of the work performed by the Daymark IEC Team and to clearly identify the inputs used to reach the expert opinions related to each scope item. We have modified the order of the scope items discussed in this report to better sequence the information, such that the initial sections provide foundation for the later sections. The following report sections correspond to the scope of work as follows.

Table 1: Mapping of Report Sections to Scope Items

REPORT CHAPTER	SCOPE ITEM
Section II: Factors Influencing the MISO Market	5
Section III: Export Prices	1
Section IV: Export Energy and Capacity	2
Section V: Changes in Forecasting Methodology	4
Section VI: Firm Contracts	3
Section VII: Revenue Forecast	3

II. FACTORS INFLUENCING THE MISO MARKET

A. Overview

The most significant wholesale market neighboring the MH system is the Midcontinent Independent System Operator (MISO). MISO and the utilities in MISO's footprint provide a significant opportunity to buy and sell energy, including in firm bilateral deals, shorter-term opportunity sales, and direct participation in the MISO day-ahead energy market. In a typical year, MH exports close to 25 percent of its production to the US through MISO.[4] Over 90 percent of all energy exports included in MH's export revenue forecast are through MISO.[5]

MISO is one of the largest Independent System Operators (ISOs) in North America with primary functions that include the operation of the transmission grid, administration of the wholesale markets, coordination of regional planning activities, and the enforcement of regional and federal reliability standards.

In this section of our report, we discuss the market fundamentals in the MISO region and how they may influence MH's participation in the various MISO markets.

The material presented in this section provides background and context for the subsequent sections of our report regarding MH's export revenue forecast.

B. Scope of Investigation

This section of the report discusses the factors influencing the MISO market and trends that are affecting market prices. This section also serves to provide background information supporting other elements of our work. MH's export sales include several longer-term contracts and the GRA filing includes a longer-term forecast of export sales and revenues. Accordingly, several elements of the scope of work call for information regarding longer-term trends and forecasts, as well as information on near-term market conditions. The information we provide here relies principally on publicly available information on near-term conditions and longer-term trends. Our scope of work does not include preparation of an independent forecast or consideration of confidential forecast information available to MH.

[4] Manitoba Hydropower's website, accessed November 2017, available at: http://www.manitobahydropower.com/who-we-are.shtml

[5] Derived from confidential SPLASH results

We have modified the order of the topics discussed in this section to better sequence the information, such that the initial sections provide foundation for the later sections. The following report sections correspond to the scope of work as follows.

Table 2: Mapping of Report Subsections to Scope Item #5

SUBSECTIONS		SCOPE ITEM
II. C.1	Existing Generation Mix	5 (b)
II. C.2	Forecasted Retirements for the Next 20 Years	5 (d)
II. C.3	Expected New Generation to be Installed in the Next 20 Years	5 (c)
II. C.4	Supply and Demand Balance in the Northern MISO Region	5 (e)
II. C.5	State and Federal Policies on Electricity Generation and Emissions	5 (a)
II. C.6	Factors that may Affect Manitoba Hydro's Ability to Export Energy and Capacity into the MISO Market	5 (f)

To perform this scope of work, Daymark reviewed publicly available documents including reports from MISO, for the North American Electric Reliability Corporation (NERC), and data from SNL Financial, an entity that provides electric industry-specific market data obtained from public and private companies worldwide.[6] A specific list of these documents is provided in Appendix B.

C. Analysis

MISO administers the U.S. wholesale market neighboring the MH system. MISO coordinates the movement of electricity across all or parts of 15 U.S. states, largely in the corridor between Minnesota and Louisiana. MISO operates its wholesale markets only within its market footprint and coordinates reliability under a larger reliability footprint.

MH's relationship with MISO differs from other entities that serve load and/or own generation within the MISO market footprint. MH's load is not served under the MISO's Open Access Transmission, Energy and Operating Reserve Markets Tariff, and its generation is not directly dispatched by MISO. Under MH's governing legislation, the delegation of authority of MH's assets to a third party is not authorized except only to limited instances and subject to Lieutenant-Governor in Council approval. As a result, MH participates as a coordinating member in the MISO market via three agreements.

[6] http://www.snl.com/

Two of the agreements pertain to transmission coordination between MISO and MH and the third is a MISO market participation agreement required by MISO for all market participants.[7]

The table below provides a brief overview of the MISO's characteristics.[8]

Table 3: MISO at a Glance

Generating Capacity	174,724 MW
Peak Demand	127,125 MW (Summer) 109,336 MW (Winter)
Transmission Lines	65,800
Annual Billings	$25.3 Billion
States Served	15
Generator Units	6,567

The figure below depicts MH's transmission interface limits to three neighboring regions including the U.S. MH is connected via one 500-kV transmission line and one 230-kV transmission line with Minnesota and two 230-kV transmission lines with North Dakota. The figure also provides the transfer capability of the three different interconnections under the best-case scenario.[9]

[7] NFAT Chapter 5 – page 41-61
http://www.pubmanitoba.ca/v1/nfat/pdf/hydro_application/nfat_business_case_chapter_05_the_manitoba_hydro_system_interconnection_and_export_markets.pdf

[8] https://www.ferc.gov/market-oversight/mkt-electric/midwest.asp

[9] http://www.manitobahydropower.com/who-we-are.shtml

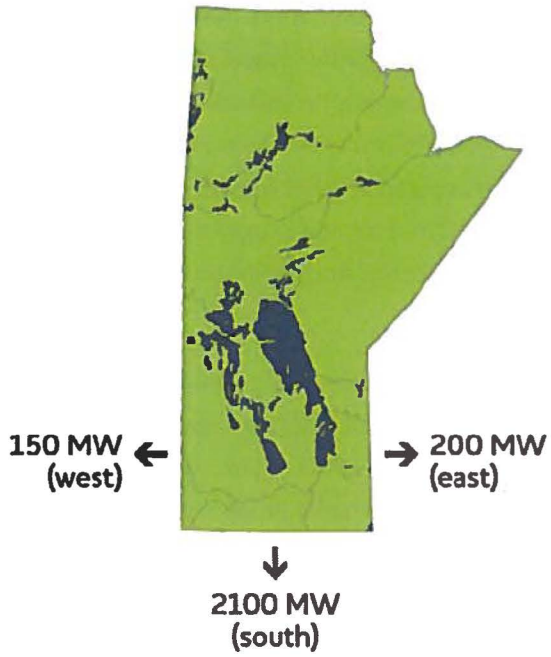


Figure 1: MH's Transmission Interconnections to Neighboring Regions

1. Existing Generation Mix

The MISO system is comprised of a variety of generating resources such as coal, natural gas, nuclear, renewables, and others. Natural gas and coal resources are the predominant sources of capacity, each providing approximately one-third of the total, with a mix of other sources providing the remainder as depicted in the table below[10]:

Table 4: Percentage of Total MISO Capacity by Fuel Type

Fuel Type	2017 Market Capacity Share	2017 Market Capacity (MW)
Gas	41%	71,637
Coal	35%	61,153
Nuclear	8%	13,978
Renewables	13%	22,714
Other	3%	5,242
Total	**100%**	**174,724**

[10] MISO website, accessed in November 2017, available at : https://www.misoenergy.org/AboutUs/Pages/FactSheet.aspx

As recently as 2012, the MISO region was one of the most coal-dependent regions in the U.S. with close to 66 GW of coal-fired generating capacity. Over 5 GW of coal generators have retired since 2012, reducing the amount of available coal resource capacity to 61 GW.[11] According to the 2016 MISO Transmission Expansion Planning (MTEP), MTEP16, 4,847 MW of generation capacity retired in 2016 with an additional 67 MW slated to retire in 2017. The report indicated that the data suggested that the majority of retirements in 2016 were related to compliance with the Mercury and Air Toxics Standards.[12]

These economic factors and tighter environmental regulations, described in the *State and Federal Policies on Electricity Generation and Emissions* section below, have stimulated several unit retirements in the MISO region. The retirement of resources has been slower than other regions[13] due to smaller amounts of economic natural gas resources compared with other regions. However, based on the MTEP16 report retirements have accelerated over the past year.[14]

[11] SNL Financial

[12] MTEP16 Full report – page 75

[13] Electric System Reliability and EPA's Clean Power Plan: The Case of MISO Page 12 and figure 4, Analysis Group

[14] MTEP Full report – page 76

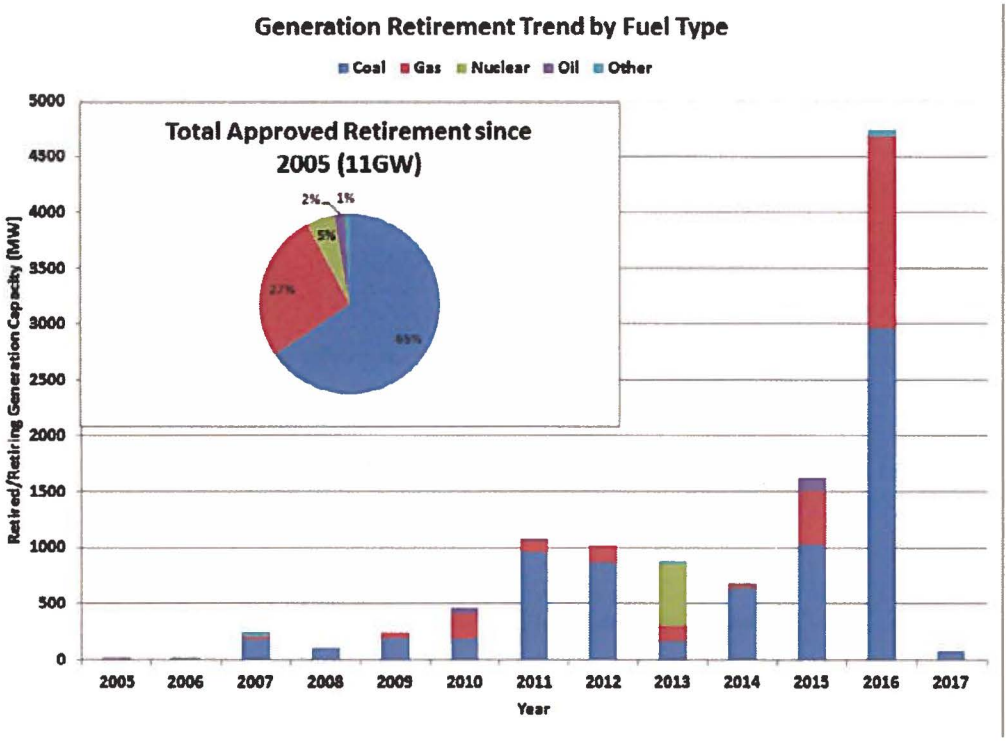


Figure 2: Generation Retirement Trend by Fuel Type, 2005-2017

The reduction in available coal capacity and the less advantageous economics for the coal resources reduced the amount of energy production from coal as depicted below.[15] The shale gas revolution and the resulting lower natural gas prices influenced all Regional Transmission Organizations (RTOs) and ISOs, including MISO's generation, and stimulated a transition to a fuel mix with increasing dependence on natural gas-fired generation compared to coal.

The overall MISO generation mix became larger and more diverse with the integration of Entergy's utilities into MISO in 2013, having considerably more natural gas-fired capacity than the rest of the MISO zones. The graph below indicates the magnitude of the gas resources added to the MISO system by the integration of MISO South, as compared to the rest of MISO, described as MISO North/Central.[16]

[15] SNL Financial

[16] Today's Trends, Tomorrow's Energy Needs - Wisconsin Public Utility Institute – slide 13 – 2016 YTD is depicted as of March 2016

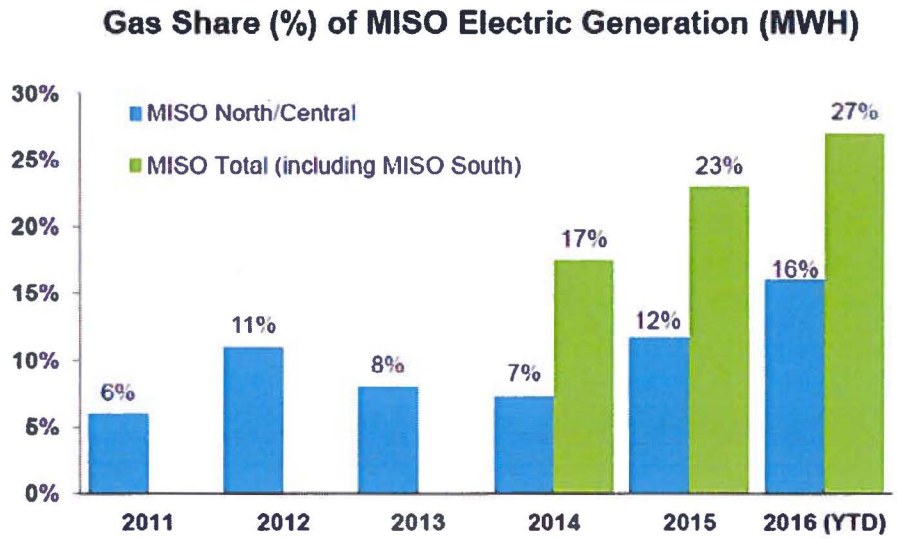


Figure 3: Gas Share (%) of MISO Electric Generation (MWh)

Despite the increase in gas share, the MISO real-time energy market is frequently priced based on coal. Natural gas resources set prices approximately 40 percent of the time, compared to approximately 10 percent of the time in 2012.[17] The 2016 State of the Market Report presents the following graph of monthly price setting by fuel.[18]

[17] 2012 STATE OF THE MARKET REPORT FOR THE MISO ELECTRICITY MARKETS, page A-7

[18] 2016 State of the Market Report for the MISO Electricity Market, Analytic Appendix – Figure A1, page 2.

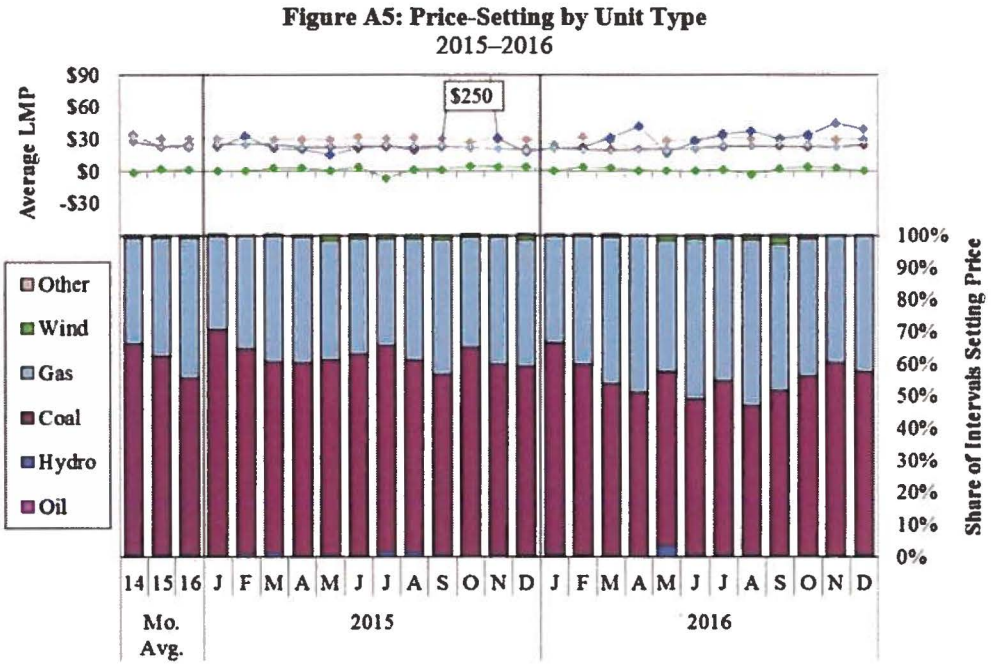


Figure 4: Price Setting by Unit Type, 2015-2016

2. Forecasted Retirements for the Next 20 Years

Even with the recent retirements of coal plants in the MISO markets, coal generation remains a significant part of the MISO mix. Looking forward, there will continue to be pressures that will bear on future coal plant retirements, including the aging of existing units, environmental regulations, and the cost of alternatives.

With respect to alternatives, the shale gas revolution and significant investment in pipelines throughout North America have made low-priced natural gas available and have eliminated the price separation between the regions that had persisted for decades. The U.S. Energy Information Administration (EIA) graph below presents the estimated natural gas production potential in the U.S., indicating a continued expansion of the availability of natural gas over the next 20 years and beyond.[19] High availability of natural gas for the longer term provides a basis for natural gas generation to be a competitive alternative to coal in the MISO market in the longer term.

[19] https://www.eia.gov/outlooks/archive/aeo16/MT_naturalgas.cfm#natgasprod_exp

Figure MT-46. U.S. dry natural gas production by source in the Reference case, 1990–2040

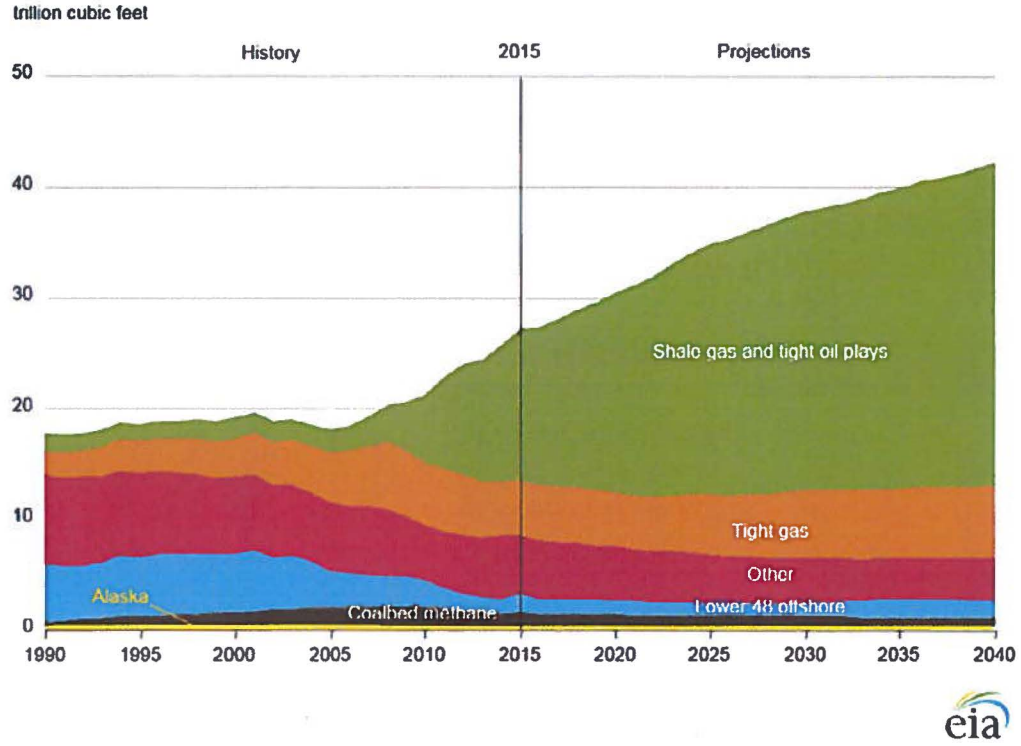


Figure 5: U.S. Dry Natural Gas Production, 1990-2040 (Trillion Cubic Feet)

Another critical factor of the existing MISO fleet that may stimulate retirement is plant age. Nearly 88 percent (55 GW) of the MISO's coal capacity is at least 50 years old and 52 percent (~30 GW) is at least 60 years old, as shown in Figure 6.[20] Coal generating units have traditionally been built with an assumed design and economic life span of about 30 years, with the implicit assumption that the generator engine and critical components would be replaced after that period. Therefore, it is common for coal resources to remain in service much longer than 30 years after critical components are replaced, extending their life span to 50-60 years. As they age, generators face substantial reliability, efficiency, and performance problems, which in turn increase operating costs.

[20] MISO Fleet Changes – slide 9

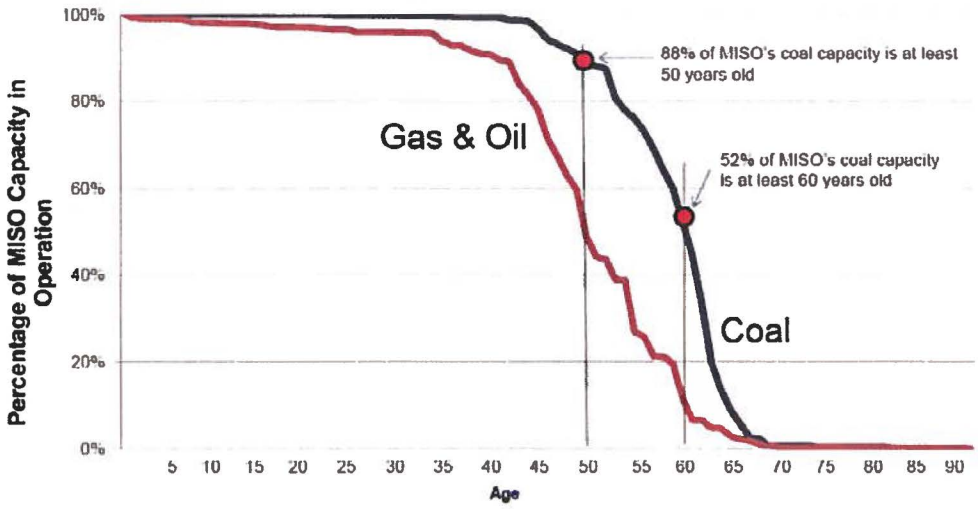


Figure 6: Age Distribution of Operating Coal Capacity and Gas & Oil Capacity in MISO

MISO has determined that 91 percent of the MISO coal capacity that has retired, retired prior to its assumed 65-year useful life and 48 percent retired by age 60. If this trend persists, then close to 50 percent (30 GW) of the coal fleet is at risk for retirement in the next decade and more over the next 20 years.

These changing market conditions and the potential for accelerated retirements have been reflected in various reports from MISO and the NERC. In its 2016 Long-Term Reliability Assessment (LTRA), NERC identified a resource adequacy need by unconfirmed resource retirements over the next few years. The graph below describes the impact of these retirements on the reserve margin in the region.[21]

[21] Reliability Assessments DL_2016 Long-Term Reliability Assessment, p 8

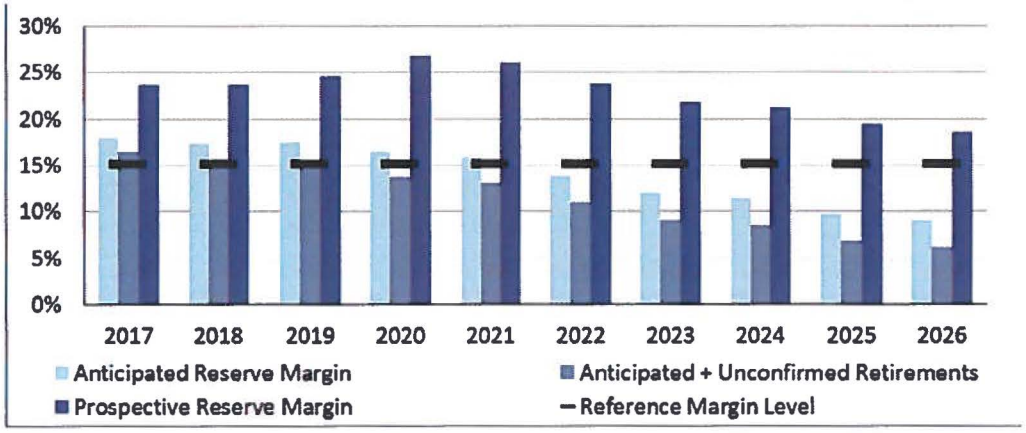


Figure 7: Impact of Retirements on Reserve Margin, MISO

Furthermore, in the draft MTEP17, MISO projects a range of approximately 8 to 24 GW of coal retirements between now and 2031, with 1.7 to 4.8 GW of that amount in MISO zones 1 and 2 (zones neighboring Manitoba). These values are shown in Figure 8.[22]

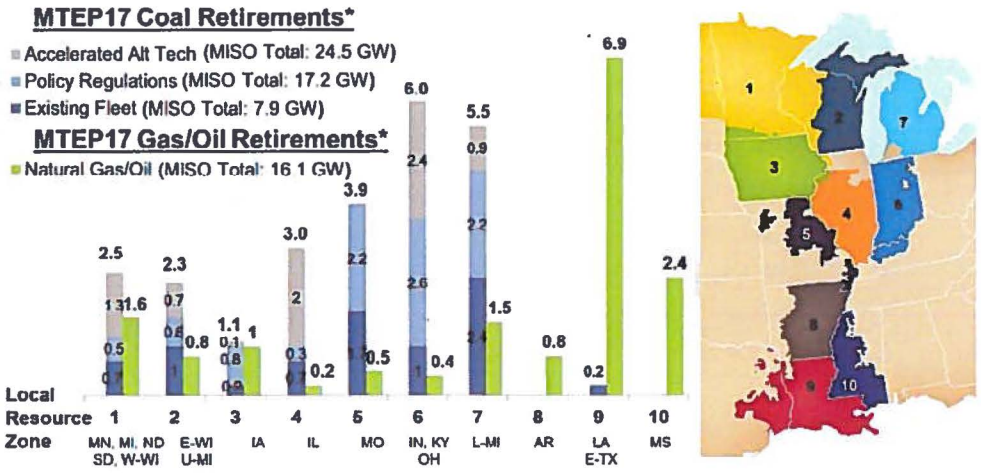


Figure 8: MTEP17 Retirement Assumptions by Zone by 2031

Unit age is the main driver of retirements in MTEP17. The Mercury and Air Toxics Standards (MATS) compliance deadline ended in April 2016 and the MTEP17 assumes no further unit retirements due to environmental compliance assumptions (retirements, retrofits or coal-to-gas conversions).

[22] MTEP 2017 draft, Appendix E2, pp 17

MTEP17 also provides information on the location of most of the older units that are located within the MISO region and what is considered to retire based on age or environmental policy. Figure 9 is a visual depiction of the locational distribution of the retirements assumed in MTEP17.

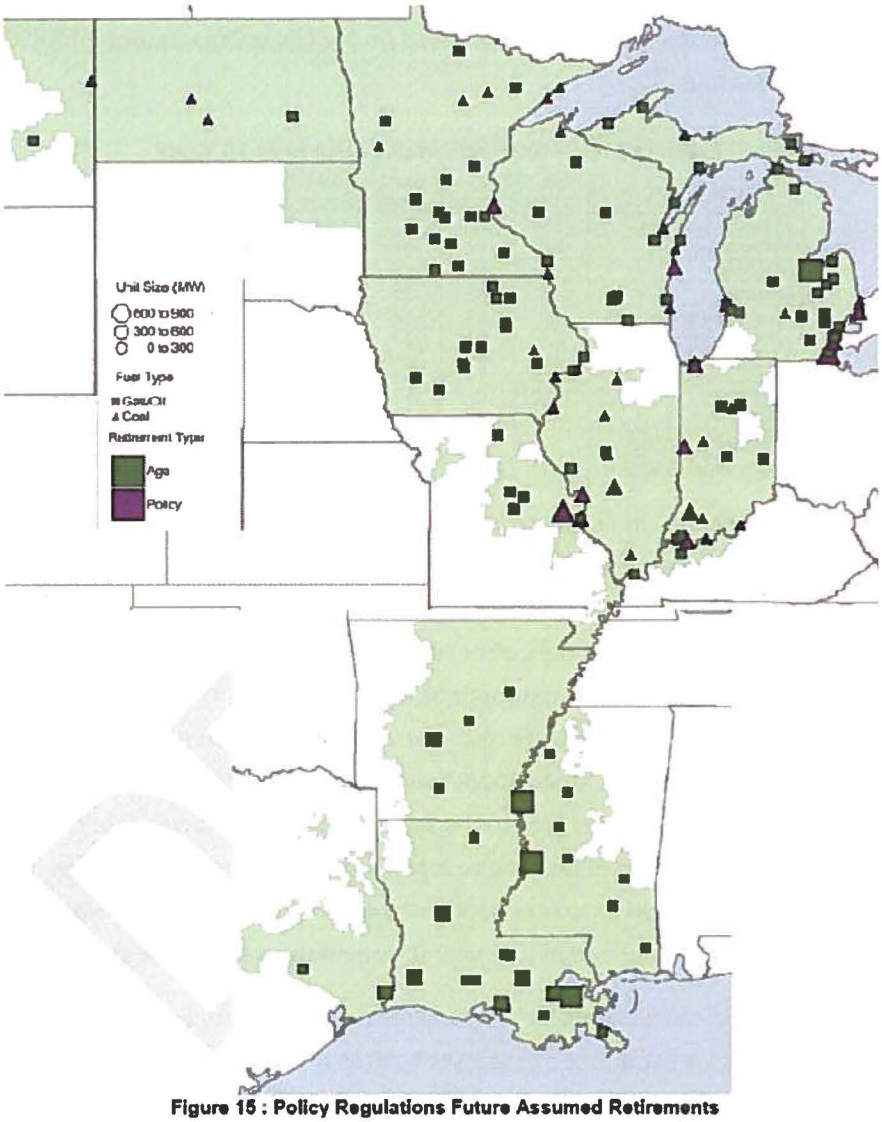


Figure 15 : Policy Regulations Future Assumed Retirements

Figure 9: Assumed Retirements in MTEP17

3. Expected New Generation Over the Next 20 Years

The potential significant amount of generation retiring over the next few years will create a need for new resources in the region. In its draft MTEP17, MISO indicates that in order to maintain resource adequacy within its footprint, close to 4.5 GW of new resources are projected to enter the market as described in the Table 5, below.[23] The table's resource projections are based on the latest Organization of MISO States-MISO survey results.[24]

Table 5: Expected New Generation over the next 10 Years

In GW (ICAP)	PY 2018/19	PY 2019/20	PY 2020/21	PY 2021/22	PY 2022/23	PY 2023/24	PY 2024/25	PY 2025/26	PY 2026/27	PY 2027/28
(+) Existing Resources	150.0	149.3	148.9	148.6	146.7	145.0	144.7	144.2	144.0	144.0
(+) New Resources	2.0	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5
(+) Imports	4.1	4.1	4.1	4.2	4.2	4.2	4.2	4.2	4.2	4.2
(-) Exports	4.1	3.9	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
(-) Low Certainty Resources	1.0	1.1	1.4	1.5	1.5	2.3	2.3	2.4	2.4	2.4
(-) Transfer Limited	2.5	2.3	2.1	1.8	1.1	0.0	0.0	0.0	0.0	0.0
Available Resources	148.5	150.4	150.3	150.4	149.2	147.8	147.5	147.0	146.8	146.8
Demand	125.9	126.5	127.0	127.6	128.3	128.9	129.4	129.1	128.9	128.9
PRMR	145.8	146.5	147.1	147.8	148.5	149.2	149.9	149.5	149.3	149.3
PRMR Surplus / Shortfall	2.7	3.9	3.2	2.6	0.6	-1.4	-2.4	-2.5	-2.5	-2.5
Reserve Margin Percent (%)	17.9%	18.9%	18.3%	17.9%	16.3%	14.7%	14.0%	13.9%	13.8%	13.8%

With respect to the expected new generation over the next 20 years, there is significant need for new capacity resources in years 6 to 20 for which the MISO participants have not yet identified the resources to be developed to meet the need. The MISO MTEP17 analysis indicates that the current system surplus capacity is expected to erode within 5 years based on current assumptions and information on existing, committed, and planned changes in capacity resources. This assessment assumes no reduction in imported capacity through 2028. 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. For example, in MISO's MTEP16 report, it included an assessment that 24 GW of new resources would be needed by 2031 to meet the need in that year (this analysis was not updated in the MTEP17 draft).

The region can accomplish the procurement of needed, but as yet unidentified, resources via established processes both at the state and regional level. Each state's Integrated Resource Planning (IRP) process and the MISO's capacity market ensure that

[23] MTEP17 draft – Table 6.2-1 MISO anticipated PRMR details

[24] PMMR is the Planning Reserve Margin Requirement. Low certainty resources are resources that may be available to serve MISO load but do not have firm commitments to do so. The 2016 OMS- MISO results can be found here: https://www.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/Workshops%20and%20Special%20Meetings/2016/OMS-MISO%20Survey/2016OMS-MISOSurveyResults.pdf

this need will be met in the most cost-efficient way to the consumers. The IRP process is described in more detail in the *State and Federal Policies on Electricity Generation and Emissions* section of this report. In this section, we will provide information related to MISO's capacity market. Under the IRP construct, a utility may forecast a supply adequacy need and propose to build a new plant to fill the need. Utilities that need capacity will weigh the cost of developing new resources relative to the cost and availability of bilaterally-sourced existing supplies from neighboring systems. For instance, it may be more cost-effective to procure excess capacity from neighboring utilities or uncontracted IPPs rather than build new resources. The MISO capacity market provides a measure of the cost and availability of existing surplus capacity as an option to meet the utility's capacity needs.

4. Supply and Demand Balance in the Northern MISO Region

For the purposes of this report, Daymark defines the Northern MISO Region to be comprised of Minnesota, Iowa, Wisconsin and parts of North Dakota, South Dakota, and Montana – the states that are most proximate to MH. MISO defined nine Load Resource Zones (LRZ) in its system, defined by major internal transmission interfaces where transfers may be limited between LRZs. MH connects to MISO LRZ 1, which includes most of Minnesota, North Dakota, and portions of Montana and Wisconsin (see map in Figure 10).

The MISO Northern Zones are currently transfer limited, meaning capacity is surplus in those zones with the surplus capacity exceeding the ability of the transmission system to allow that surplus to be transferred to and used by zones with short supply to the south. Currently, LRZ 1 has an export limit of 600 MW and has surplus capacity in excess of this limit. Figure 10 is an illustration of this current surplus condition in LRZ 1.

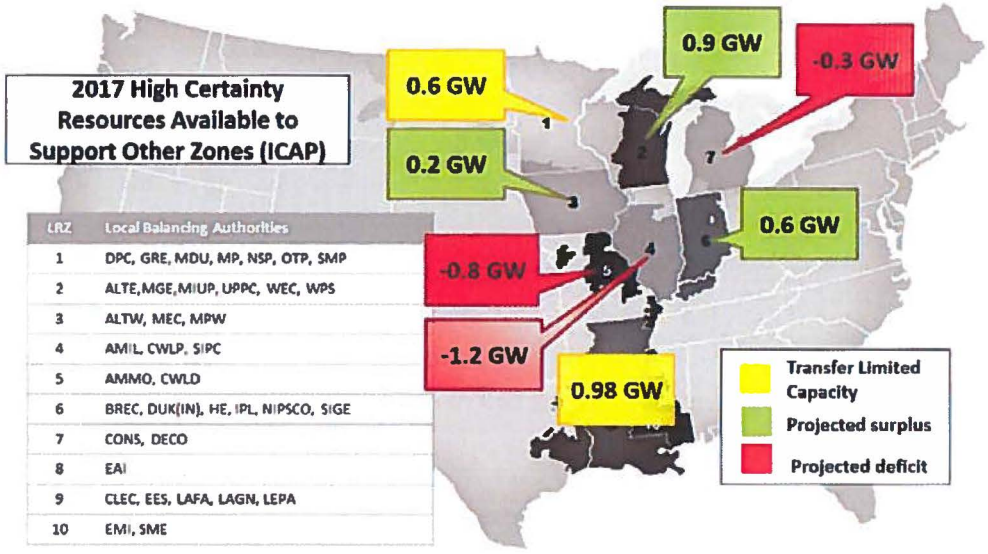


Figure 10: MISO Capacity Zones: Capacity Surplus/Deficit[25]

Table 5, above, included an amount of capacity that is transfer-limited, and therefore unavailable to meet MISO requirements in the 2018-2023 period. That analysis indicates that the system is not expected to be transfer-limited thereafter.

The retirement of capacity in the northern zones, as shown in the figure, eliminate that export-constrained situation by 2023. Figure 9 shows a significant number of retirements in the northern MISO zones.

MISO North's load growth on average is below 1 percent, with LRZ 1, 2, and 3 having slightly higher load growth than most of the other zones.[26]

[25] Source: 2016 OMS MISO Survey Results, June 2016 https://www.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/Workshops%20and%20Special%20Meetings/2016/OMS-MISO%20Survey/2016OMS-MISOSurveyResults.pdf

[26] 2016 MISO Independent Load Forecast - https://www.misoenergy.org/Library/Repository/Study/Load%20Forecasting/2016%20Independent%20Load%20Forecast.pdf

Table 6: Summer Non-Coincident Peak Demand with EE/R/DG/Adjustments, LRZ Peak Demand Forecasts

LRZ PEAK DEMAND FORECASTS

Table 19: Summer Non-Coincident Peak Demand with EE/DR/DG Adjustments (Metered Load in MW)

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2015	16,935	11,604	8,751	9,280	8,361	17,297	19,994	7,486	21,071	4,755
2016	16,807	11,399	8,444	9,622	8,775	17,332	19,800	7,291	18,986	4,765
2017	17,062	11,656	8,507	9,693	8,890	17,581	20,047	7,488	19,548	4,874
2018	17,322	11,918	8,594	9,739	9,006	17,825	20,413	7,635	19,951	4,943
2019	17,589	12,112	8,713	9,807	9,107	18,079	20,681	7,721	20,111	5,030
2020	17,869	12,256	8,829	9,869	9,213	18,320	20,824	7,767	20,237	5,118
2021	18,125	12,380	8,920	9,902	9,306	18,552	20,871	7,804	20,279	5,213
2022	18,390	12,537	9,014	9,931	9,403	18,764	20,973	7,857	20,382	5,302
2023	18,635	12,702	9,114	9,961	9,510	18,967	21,079	7,927	20,552	5,383
2024	18,868	12,862	9,218	10,002	9,623	19,171	21,254	8,004	20,762	5,465
2025	19,110	13,005	9,329	10,039	9,732	19,373	21,413	8,085	20,896	5,550
2026	19,355	13,162	9,444	10,082	9,832	19,578	21,556	8,169	21,070	5,637
Annual Growth Rates (%)										
2015-2016	-0.76	-1.76	-3.51	3.68	4.95	0.20	-0.97	-2.60	-9.89	0.22
2016-2017	1.52	2.25	0.74	0.74	1.31	1.43	1.25	2.70	2.96	2.28
2017-2018	1.52	2.24	1.03	0.47	1.30	1.39	1.82	1.96	2.07	1.41
2018-2019	1.54	1.63	1.38	0.71	1.13	1.42	1.31	1.12	0.80	1.76
2019-2020	1.60	1.19	1.33	0.63	1.16	1.33	0.69	0.60	0.62	1.76
2020-2021	1.43	1.02	1.04	0.33	1.01	1.27	0.22	0.48	0.21	1.85
2021-2022	1.46	1.27	1.05	0.29	1.04	1.15	0.49	0.67	0.51	1.71
2022-2023	1.33	1.32	1.11	0.30	1.13	1.08	0.51	0.89	0.83	1.53
2023-2024	1.25	1.26	1.15	0.42	1.20	1.08	0.83	0.98	1.02	1.51
2024-2025	1.28	1.11	1.19	0.36	1.12	1.05	0.75	1.00	0.65	1.56
2025-2026	1.29	1.21	1.24	0.43	1.03	1.06	0.66	1.04	0.84	1.57
Compound Annual Growth Rates (%)										
2015-2020	1.08	1.10	0.18	1.24	1.96	1.16	0.82	0.74	-0.80	1.48
2015-2026	1.22	1.15	0.69	0.76	1.48	1.13	0.69	0.80	0.00	1.56
2017-2026	1.41	1.36	1.17	0.44	1.12	1.20	0.81	0.97	0.84	1.63

5. State and Federal Policies on Electricity Generation and Emissions

State and federal policies regarding environmental performance of electric systems – particularly with respect to requirements for renewable and clean energy content and with respect to reliability and operational requirements in power markets – can lead to opportunities for premium pricing for MH contract offerings.

Environmental policy associated with U.S. electric systems has shifted to a more state-centric approach. The Obama Administration was actively advancing policies to reduce greenhouse gas emissions in the electric sector, most notably in the form of the Clean Power Plan rules pursued by the Environmental Protection Agency. Following the election, the Trump Administration has acted to withdraw from the Paris Climate

Agreement and has suspended the Clean Power Plan. While the Clean Air Act requirements will remain important to planning for the future of the electric system, the policy initiatives for renewable and clean energy are most active at the state level, with several states recently placing more emphasis on renewables and greenhouse gas emission reduction policies.

In this section, we discuss policy issues in Minnesota, Wisconsin and North Dakota as examples that are most relevant to Manitoba. We also discuss the development of capacity markets in the MISO market, driven by federal policy to ensure resource adequacy (sufficient generation reserves).

State Policy Drivers

Since most new capacity at MISO is procured through IRPs, state policies have a significant impact on what capacity is procured. With respect to MH's potential counterparties, key states to review are:

- Minnesota;
- Wisconsin; and
- North Dakota.

Minnesota

Minnesota is a state with aggressive renewable energy and carbon reduction policies. The state has a renewable portfolio standard (RPS) requiring 25-30 percent renewable energy by 2025 or 2020, depending on the utility.[27] The Minnesota Public Utilities Commission (MPUC) recently acted to increase the range of CO_2 pricing in resource planning assessments.[28]

One of the key counterparties for MH – Minnesota Power – is even more aggressively pursuing renewable power. Minnesota Power recently announced a new plan with a goal of 44 percent of the company's energy supply coming from renewable resources in the near term (2025) and a long-term goal of reducing coal to one-third of its energy mix, with two-thirds being renewable energy and natural gas.[29]

[27] http://programs.dsireusa.org/system/program/detail/2401

[28] *Minnesota agency raises state's CO2 values, rejects federal cost of carbon*, July 28, 2017, S&P Global Market Intelligence.

[29] https://minnesotapower.blob.core.windows.net/content/Content/Documents/Company/PressReleases/2017/201767_NewsRelease.pdf

Northern States Power (NSP), an Xcel Company, is another MH counterparty that serves load in Minnesota as well as in North and South Dakota. According to "*Application for Consideration of a Resource Treatment Framework to Address Jurisdictional Cost Allocation Issues*," pages 14-15,[30] the latest IRP for NSP identified the following "energy resources" as scheduled to retire in the 2020s:

- 2023: Blue Lake Units 1-4 (natural gas combustion turbines (CTs)) cease operation (153 MW);
- 2023: Sherco Unit 2 (682 MW coal) retirement;
- 2025: Manitoba Hydro contracts expire (850 MW);
- 2026: Cottage Grove Combined Cycle Energy Center contract expires (262 MW);
- 2026: Sherco Unit 1 (680 MW coal) retirement; and
- 2027: Mankato Energy Center Combined Cycle (MEC I) contract expires (375MW).

The MPUC has approved NSP's plan. The document states that new baseload will not be needed until 2026 in NSP's service territory, but NSP does indicate that aging of its coal and nuclear facilities will require planning to address the loss of 75 percent of the energy-producing resources on the NSP system in its next IRP.[31]

In addition to the above, Minnesota has been a leader in developing value of solar methodology that assigns externality value to solar.[32]

Finally, Minnesota has the Next Generation Energy Act, which sets goals of reducing carbon emissions by 80% of 2005 levels by 2050, with interim goals.[33]

Wisconsin

The Public Service Commission of Wisconsin produces a Strategic Energy Assessment[34] every 2 years. The purpose of that document is to evaluate, "*the adequacy and reliability of Wisconsin's current and future electrical capacity and supply*." The latest version of that assessment predicts that there will be about 520 MW of retirements in the state by 2020. This includes one 320 MW coal facility. The remainder are natural gas units.

[30] https://puc.sd.gov/commission/dockets/electric/2017/informational/2017infoel1.pdf

[31] *Upper Midwest Resource Plan 2016-2030*, Northern States Power, page 3, available at: http://www.ci.becker.mn.us/DocumentCenter/View/421

[32] http://mn.gov/commerce-stat/pdfs/vos-methodology.pdf

[33] https://www.pca.state.mn.us/air/greenhouse-gas-emissions-minnesota-0

[34] https://psc.wi.gov/Documents/SEA2022.pdf

Additionally, Wisconsin has an RPS that requires LSEs to increase their renewable supply percentages by 2 percent by 2010 and 6 percent by 2015. The Strategic Energy Assessment projects a surplus of renewable energy, as shown in Figure 11.

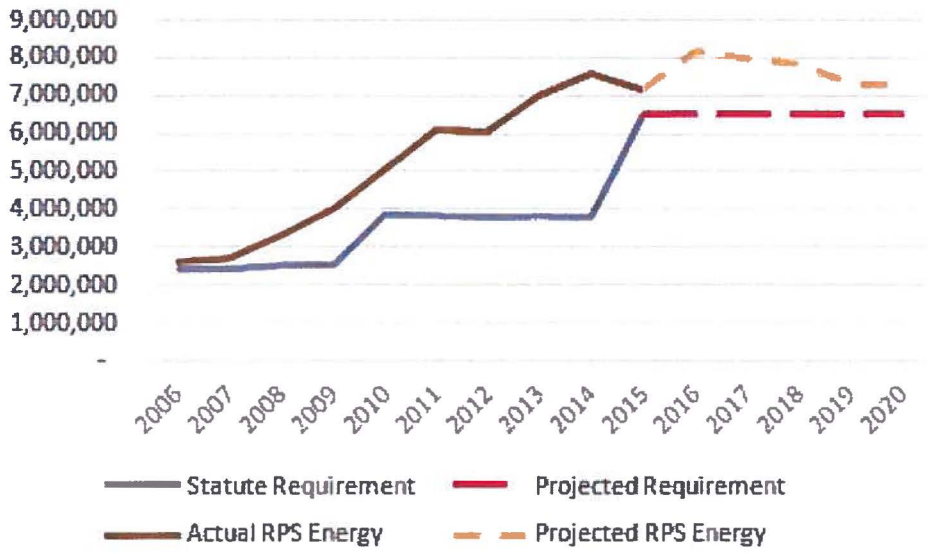


Figure 11: Statewide RPS Renewable Retail Sales (Actual vs. Required, 2006-2020)[35]

[35] Projection out to 2020 based on 0 percent energy growth. Source: Commission Staff 2015 RPS Compliance Memorandum (PSC REF#: 285744).

North Dakota

North Dakota's policy environment differs from Minnesota and Wisconsin. By law, utilities cannot consider environmental externalities in their resource planning decisions. This difference is punctuated by a recent Northern States Power filing with the MPUC and the North Dakota Public Service Commission, seeking a process to separate the IRP processes in those states due to the differences in policy.[36] From a policy perspective, utilities in North Dakota would not apply any premium on renewable or clean energy attributes.

With respect to the need for power in North Dakota, the discussion of system needs in the NSP system would apply in North Dakota, as well, because NSP's system planning is currently completed for its multi-state service territory.

MISO Resource Adequacy

MISO has established a uniform resource adequacy standard that requires an aggregate quantity of installed capacity to meet peak demand plus a determined minimum reserve margin. The capacity requirement is estimated at a level expected to produce a loss-of-load event no more than once every ten years. Each utility or load serving entity in the region is obligated to procure enough capacity resources to meet their own coincident peak plus a reserve margin. The aggregate requirement is comprised of all the LSE and utility requirements. The resource adequacy process includes a location-specific aspect to account for transmission limitations on moving capacity between specific areas of the system. The figure below depicts the current planning resource zones at MISO.[37]

[36] Application for Consideration of a Resource Treatment Framework to Address Jurisdictional Cost Allocation Issues, Northern States Power, December 31, 2016. MPUC Docket No. E-002/M-16-223 and NDPSC Case Nos. PU-12-813, et. al.

[37] https://www.misoenergy.org/Library/Repository/Report/Resource%20Adequacy/Planning%20Year%2017-18/2017-2018%20Planning%20Resource%20Adequacy%20Results.pdf, slide 6.

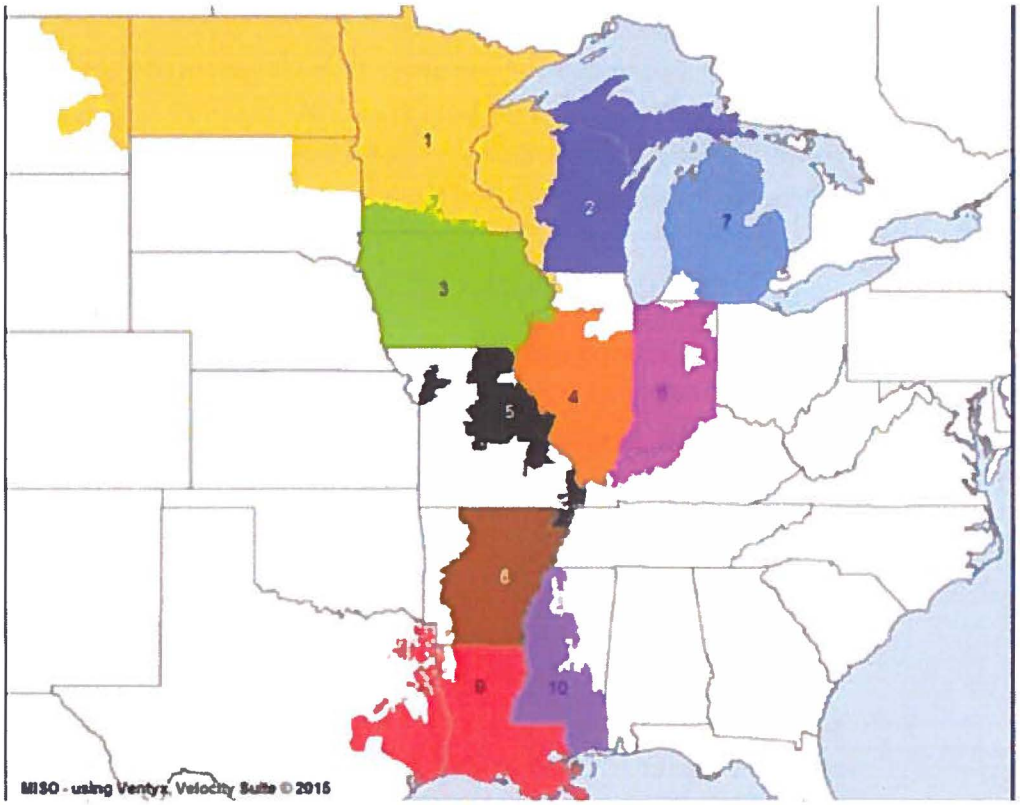


Figure 12: MISO Planning Resource Zones

Each LSE or utility can meet their requirement using a combination of self-supply, bilateral contracts, and procurements through MISO's Planning Resource Auction (PRA). MISO's hybrid model is necessary because most of the LSEs are regulated utilities with resource commitments selected within integrated resource plans well in advance of the delivery year. MISO's capacity maket can be considered as the last opportunity for LSEs to fill any deficiency in their capacity obligations. This auction is the only opportunity for market participants and the MISO to view the aggregate impacts of locational supply and demand balance and to ensure that local obligations are met.

An LSE seeking to pre-plan for its resource adequacy requirement can obtain resources by either self-scheduling resources or by submitting a Fixed Resource Adequacy Plan (FRAP). In the MISO PRA auctions, the majority of the capacity that clears is either self-supply or FRAP. In the 2017/2018 Planning Auction Resource Results report[38], out of

[38] https://www.misoenergy.org/Library/Repository/Report/Resource%20Adequacy/Planning%20Year%2017-18/2017-2018%20Planning%20Resource%20Adequacy%20Results.pdf

134,753 MW of total committed capacity, 129,017 MW of it was either FRAP (49,463 MW) or self-scheduled (79,554 MW). Thus, 96 percent of the cleared capacity was identified by LSEs prior to the balancing auction. This indicates the critical part that IRPs and bilateral transactions play in meeting MISO's resource adequacy needs.

The capacity market at MISO has produced low prices since its inception, mainly due to the significant amount of surplus capacity. The recent retirements of various resources have reduced the amount of surplus, changing the market dynamics and potentially resulting in higher prices to incentivize new investment. The table below indicates how prices in the region have fared over the last few periods and the MISO's estimate on the amount of resources exiting and entering the market. Historically, the entities MH has transacted with are in zones 1 and 2.

Table 7: Capacity Market Prices, by Zone, 2014/15-2017/18

	$/MW-day			
Zone	2014/15	2015/16	2016/17	2017/18
LRZ 1	$ 3.29	$ 3.48	$ 19.72	$ 1.50
LRZ 2	$ 16.75	$ 3.48	$ 72.00	$ 1.50
LRZ 3	$ 16.75	$ 3.48	$ 72.00	$ 1.50
LRZ 4	$ 16.75	$ 150.00	$ 72.00	$ 1.50
LRZ 5	$ 16.75	$ 3.48	$ 72.00	$ 1.50
LRZ 6	$ 16.75	$ 3.48	$ 72.00	$ 1.50
LRZ 7	$ 16.75	$ 3.48	$ 72.00	$ 1.50
LRZ 8	$ 16.44	$ 3.29	$ 2.99	$ 1.50
LRZ 9	$ 16.44	$ 3.29	$ 2.99	$ 1.50
LRZ 10		.	$ 2.99	$ 1.50

For a resource to enter the market, it will have to be economically feasible. In theory, merchant generation will not enter unless average future prices are expected to be at least the Net Cost of New Entry (Net CONE), which is the gross cost of new entry, less the variable profit the resource is expected to earn from energy, ancillary service, and other market services. While most capacity does not enter the market through this mechanism, it is still an important indicator of the total revenue requirement of new capacity.

MISO calculates the CONE[39] and for the 2016/2017 planning year has produced the following expectations.

Table 8: Cost of New Entry, by Zone, Planning Year 2017/17

Zone	PY 2016/17 CONE ($/MW-yr)	Zone	PY 2016/17 CONE ($/MW-yr)
LRZ 1	$94,170	LRZ 6	$94,340
LRZ 2	$95,110	LRZ 7	$94,830
LRZ 3	$93,130	LRZ 8	$90,360
LRZ 4	$94,630	LRZ 9	$91,690
LRZ 5	$96,430	LRZ10	$89,810

Even though most new capacity at MISO is procured through the established IRP processes, the MISO capacity market provides an indication of the value of capacity in the region. Utilities that seek to build new resources to meet their resource adequacy requirement assess – among other things – the capacity market environment at the time and whether it is sensible to procure the required capacity through the market, build it on their own, or enter into a bilateral contract. Failure to procure enough capacity to meet capacity requirement results in deficiency charges.[40]

The expectations that MISO will be moving from the current capacity surplus position to one of potential shortages and need for capacity and energy additions will increase the importance of the capacity market structure in MISO. Other regions have seen material changes in capacity market design to better align the market to the need for resources.

6. Factors That May Affect Manitoba Hydro's Ability to Export Energy and Capacity into the MISO Market

MH interconnects with MISO via multiple transmission lines. This interconnection provides reliability and economic benefits to both Manitoba and MISO. In a study conducted in 2013, MISO evaluated the benefits from MH's large and flexible system in terms of its ability to reliably and economically integrate wind.[41]

[39] MISO does not calculate net CONE

[40] An LSE that is capacity deficient will be assessed a Capacity Deficiency Charge in accordance with Section 69A.10 of the MISO Tariff – Module E

[41] https://www.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/Planning%20Materials/Manitoba%20Hydro%20Wind%20Synergy%20TRG/Manitoba%20Hydro%20Wind%20Synergy%20Study%20Final%20Report.pdf

In brief, the study identified that there are significant benefits derived from integrating an incremental amount of MH resources, which are realized as:

- **Production cost savings** after less-economic resources are displaced by inexpensive MH resources;
- **Load cost savings** after the region experiences lower energy prices;
- **Reserve cost savings**, due to an added ability to share reserves, enabled by the increased transmission capacity between the two regions; and,
- **Wind curtailment reduction**, since MH resources are easily dispatchable and able to mitigate wind intermittency over the long term.

As the region continues to invest in wind resources, the benefits articulated in the MISO wind-hydro synergy study should continue to provide strong incentive for MH and their U.S. counterparties to continue to derive benefits from bilateral contracts for power and capacity.

D. Daymark Findings

Based on our analysis, we make the following observations:

- MISO's existing generation mix is becoming more diversified. Over 5 GW of coal retirements and increases in natural gas and renewable production in recent years leaves coal as the leading energy source in the MISO market, but with natural gas and renewables having increasing market shares. Natural gas is the fuel setting market prices about 40 percent of the year.
- 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. About 88 percent of the existing coal capacity is over 50 years old today. A number of planned coal retirements have been announced in MISO plans or in utility resource plans.
- MISO needs assessments indicate that the current system surplus capacity is expected to erode within 5 years based on current assumptions and information on existing, committed, and planned changes in capacity resources, with the need for new resources of about 24 GW by 2031. This need is driven primarily by expected retirements of aging coal generation. The replacement resources will be determined by the generating companies in the region, with natural gas generation and renewables being prominent options under consideration in resource plans we reviewed.

- State polices have significant influence on resource choices. In Minnesota, policies governing utility resource planning are placing increase importance on greenhouse gas emission reductions and renewable resources. As examples, Northern States Power and Minnesota Power each show coal retirements and increasing natural gas and renewables in their plans for the coming decade. Wisconsin state policy show some similarities to Minnesota's priorities, while North Dakota requires that utility planning primarily consider least-cost resource options.
- Federal policies that will be important in the coming decade will likely center on market mechanisms. With MISO expecting an end to its historical capacity surplus conditions by 2025, the MISO capacity market will become increasingly important. FERC has been very active in capacity market design policy across the U.S. and in MISO.
- The continuous and rapid integration of renewables will add significant value to the energy and capacity provided by MH due to its reliability and dispatchability characteristics. The MISO wind-hydro synergy report identified several market and reliability benefits. We expect these to increase over time upon the potential creation of new ramping and/or other market products.

III. EXPORT PRICES

A. Overview

The Export Prices section of this report provides a more detailed assessment of MH's electricity export price forecast with an emphasis on the primary export market in the U.S., which is administered by MISO.

MISO administers a complex competitive wholesale market for energy, reserves, and capacity. The energy markets are day-ahead and real-time exchanges that establish market clearing prices by location on 5-minute intervals (Locational Market Prices or LMPs). The capacity market is a voluntary auction process allowing entities with load serving obligations to buy or sell capacity entitlements for the coming year, a market that is locational by zone across the MISO system.

Market participants can buy or sell energy and capacity directly into the organized MISO markets or they can enter into bilateral contracts directly with other market participants. In either case, market participants will consider historical market prices and estimates of future market prices when making decisions about energy and capacity transactions. It is common practice for market participants to develop or obtain a forecast of market prices to forecast costs and revenues from transactions in the markets as well as to provide a price benchmark in evaluating bilateral transactions.

In this section, we describe our review of MH's market price forecasts used as inputs to the export revenues forecast included it its GRA application. We describe, (i) the scope of our investigation, (ii) the analysis we conducted, including detailed findings, and (iii) a summary of our findings.

B. Scope of Investigation

Daymark has prepared this section of the report to address the first part of the Scope of Work and support other elements of our work that rely on the materials in this section. The specific section of the Daymark Scope of Work addressed in this section is:

> *"Review Manitoba Hydro's electricity export price forecast and third party consultant forecasts, including the low and high case forecasts, in the context of current MISO market conditions and factors influencing future MISO prices. The third party consultant forecasts are to be taken as a "given" and are to be assumed to be reasonable and accurate with respect to the other tasks in this*

Scope of Work. Notwithstanding that the third party consultant forecasts are to be accepted for the purposes of this review, if the IEC identifies significant issues or inconsistencies with the third party consultant forecasts in the course of its general review, those issues or inconsistencies are to be identified in the IEC's reports."

To perform this scope of work, Daymark interviewed MH personnel responsible for the MISO energy forecasts and reviewed public and confidential MH documents, including the actual third-party forecasts and the contracts between MH and the third-party vendors. A specific list of these documents is provided in Appendix B.

C. Analysis

The Daymark IEC Team investigated both the reasonableness of the process used by MH in obtaining and vetting the price forecasts received from the third-party consultants and the reasonableness of the price forecast derived by MH based on those forecasts. We also reviewed MH's development of the price inputs used in its various processes and planning applications used to develop the export revenue forecast.

1. Background

Fundamentally, there are four services or commodities that MH may export:

1. **Energy:** Actual electrical energy generated, as measured in MWhs.
2. **Capacity:** Ability of generation units to generate energy, as measured in MWs.
3. **Ancillary Services:** Services necessary to support the transmission of capacity and energy from generation resources to consumers while maintaining reliable power grid operation. These services include Regulation, Operating Reserve, and Black Start services.
4. **Environmental Attributes:** Additional value of energy from certain types of generators, generally either renewable or low-emission, as defined by environmental policies and regulations.

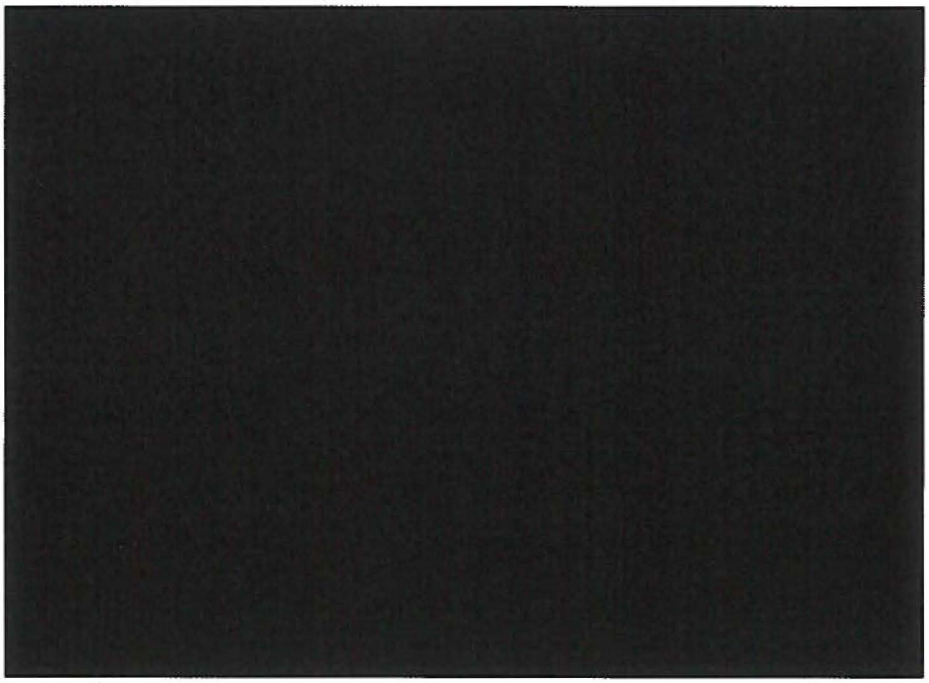
These components of power can be sold either in a direct contractual arrangement with another utility, often referred to as a bilateral transaction, or be sold in an organized market where multiple sellers can offer these components to multiple buyers through a competitive market structure. The primary export market for Manitoba is the MISO market to the south of the province.

One can view the price forecast in two horizons that align with energy resource decisions: (i) the short-term or operating horizon and (ii) the long-term planning horizon.

2. Short-Term Forecast

The short-term forecast (months to a year out) relies on one independently-produced forecast. [redacted] is the company that provides a monthly price forecast for the upcoming months. Like the long-term forecast, the prices reflect the consulting firm's view of the market based on factors that, in their opinion, will influence the MISO markets over the forecasting period. 3a

The short-term price forecast is provided to the MH staff on a monthly basis and is reviewed internally before it is used as an input to various planning applications. One of the critical components of this review is the MH staff's adjustment to the [redacted]-produced prices. According to MH staff, this adjustment is necessary to account for historical deviations between forecast and actuals. The graph below depicts a 12-month average on-peak price variance between the actual forecast and [redacted] short-term forecast.[42] 3a 3a



3a

Figure 13: 12-Monthly Average On-Peak Price Variance

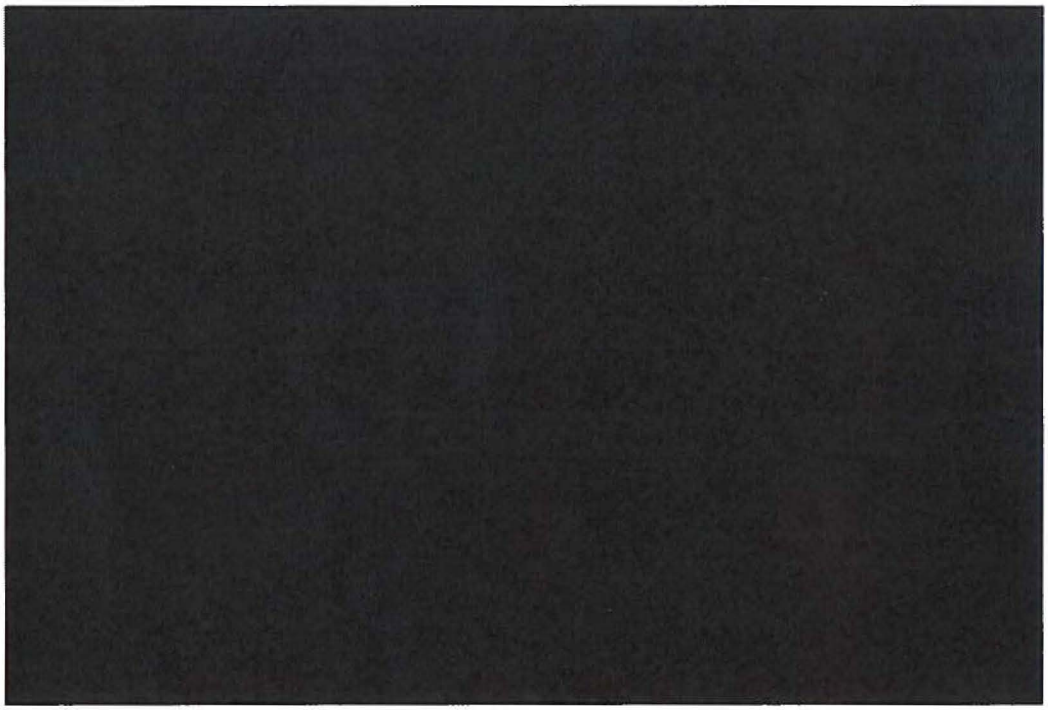
[42] 2[redacted] Performance Review - CHARTS CONF 3a

Based on the information provided by MH, these adjustments:

- Were selected by evaluating differences between [redacted] and other market providers[43], 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. 3a

MH applied their judgement to [redacted] forecasted energy prices in [redacted] months and [redacted] months to reflect what they saw as a systematic [redacted].

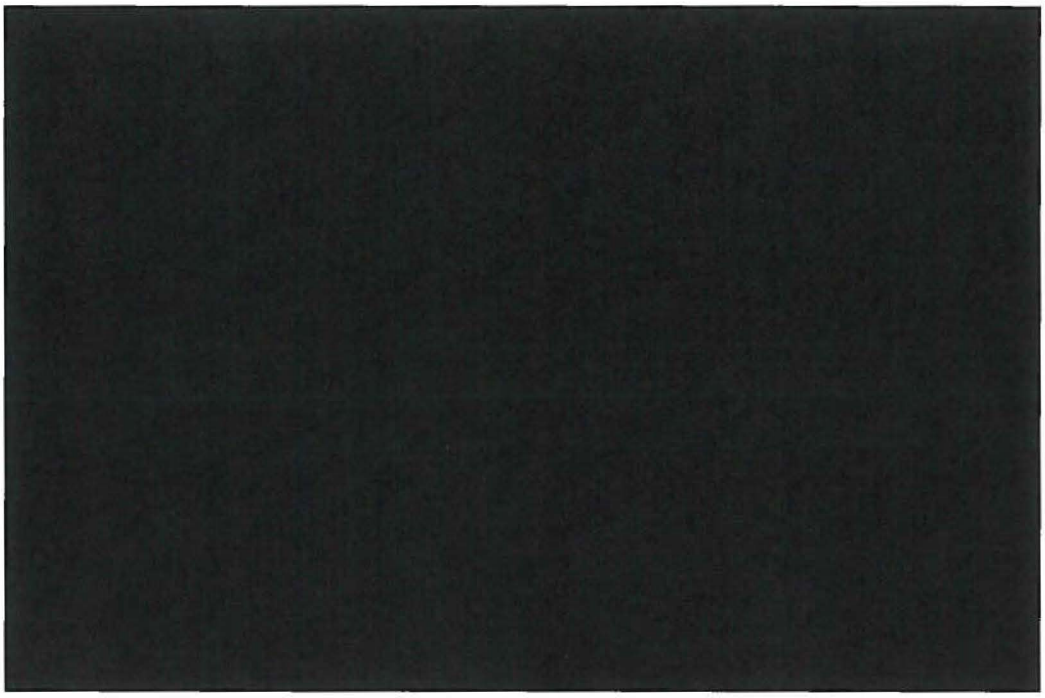
The two graphs below depict the on- and off-peak [redacted] forecast, the adjustment, the actual forecast used in the planning applications, and the average of the 3 independent consultants and ICE forwards. 3a



3a

Figure 14: On-Peak Forecast Comparisons ([redacted], Adjustment, Actual, Average) 3a

[43] Manitoba Hydro uses short term forecasts from 3 independent consultants and ICE forwards to benchmark [redacted] forecast 3a



3a

Figure 15: Off-Peak Forecast Comparisons (, Adjustment, Actual, Average) 3a

For the 2016 forecasts, MH staff incorporated

3b

This practice was also used in 2017. We have reviewed the data and the methodology for this use of historical data and we find it reasonable.

3. Long-Term Forecast

MH uses the long-term forecast to develop price inputs to its long-term planning model called SPLASH. In this context, the long-term period begins in the second future year in the planning period and extends to the end of the planning period.

Under the long-term forecast process, MH acquires four independent market price forecasts from various consulting firms that have established expertise in North American energy markets. Each consulting firm uses an electricity price forecast model. While the contracts between MH and the vendors do not specify what tools will be used to produce the forecasts, these vendors are well known consulting firms in the industry who typically use production cost models capable of simulating the operation of the

power system over a specific period. Each consultant considers their models and market price models to be confidential and proprietary.

While differing in the specifics, the products purchased from the independent consultants all provide MISO-specific outputs and some level of information on the factors that affect pricing outcomes within its region. More specifically, the models used to produce the prices are based on key inputs such as:

- Load characteristics and estimated load growth rate;
- Existing generator characteristics like generator size, fuel, and heat rate;
- Retirements and additions to the generator fleet;
- Thermal fuel forecasts; and,
- Potential changes in the regulatory environment regarding emissions and RPS requirements.

MH received electronic information from each vendor, which represented the entirety of the information available for reviewing and characterizing the forecast received. For all four vendors that information was provided via one or more spreadsheets. All four vendors provided annual energy and capacity prices. Some provided monthly energy prices as well. MH used a consensus approach, taking the average of the annual energy and capacity prices to create a single forecast, which MH called their reference energy price forecast.

The reports provided to MH staff for the 2017 reference energy price forecast are described below.[44]

- [redacted]
- [redacted] 2b
- [redacted]
- [redacted]

[44] Vintage of Consultant Forecasts for MH 16 Update

Details of each vendor contract and the product provided are included in the next four subsections.

[redacted]

2b

[redacted]

2b

[redacted]

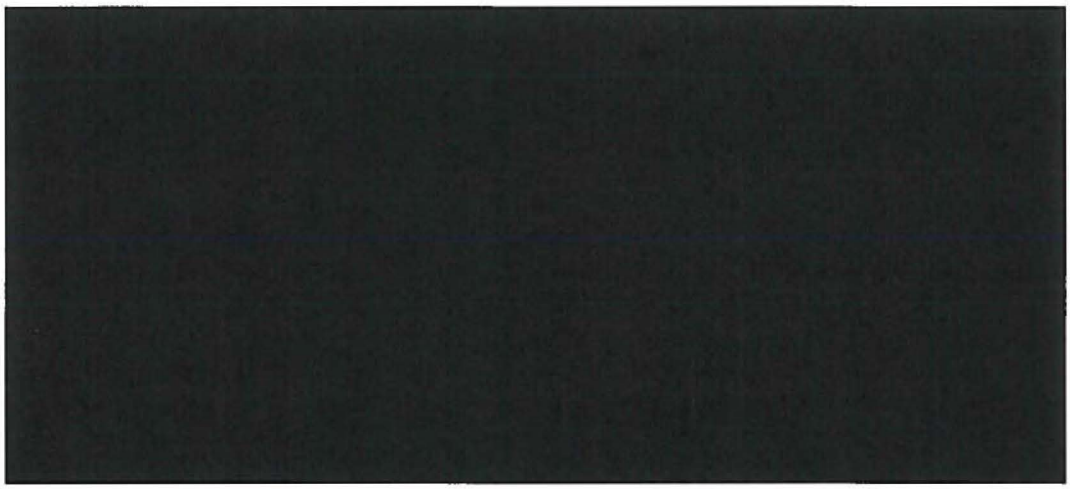
2b

[redacted]

2b

Key Inputs

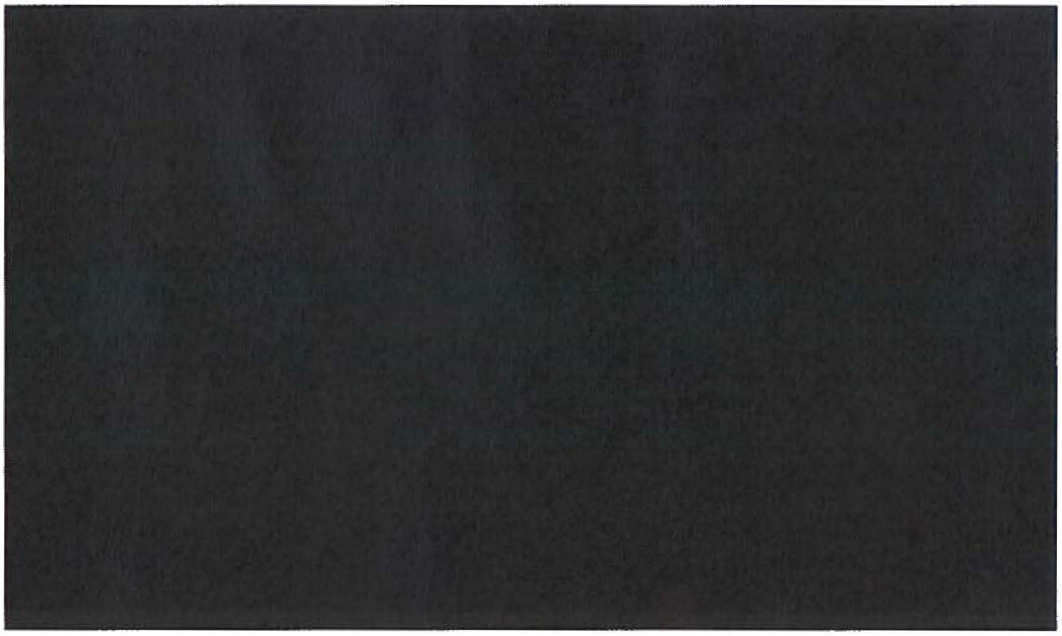
To review the reasonableness of the consensus methodology and the resulting energy price forecast, Daymark reviewed the key inputs: natural gas prices, carbon prices and capacity retirements. Natural gas forecasts varied across the four vendors. Figure 16 provides an MH graph comparing the four natural gas forecasts and the resulting 2017 Reference natural gas forecast based on the MH consensus methodology.



2b

Figure 16: Comparison of Natural Gas Price Forecasts, by Independent Consultant

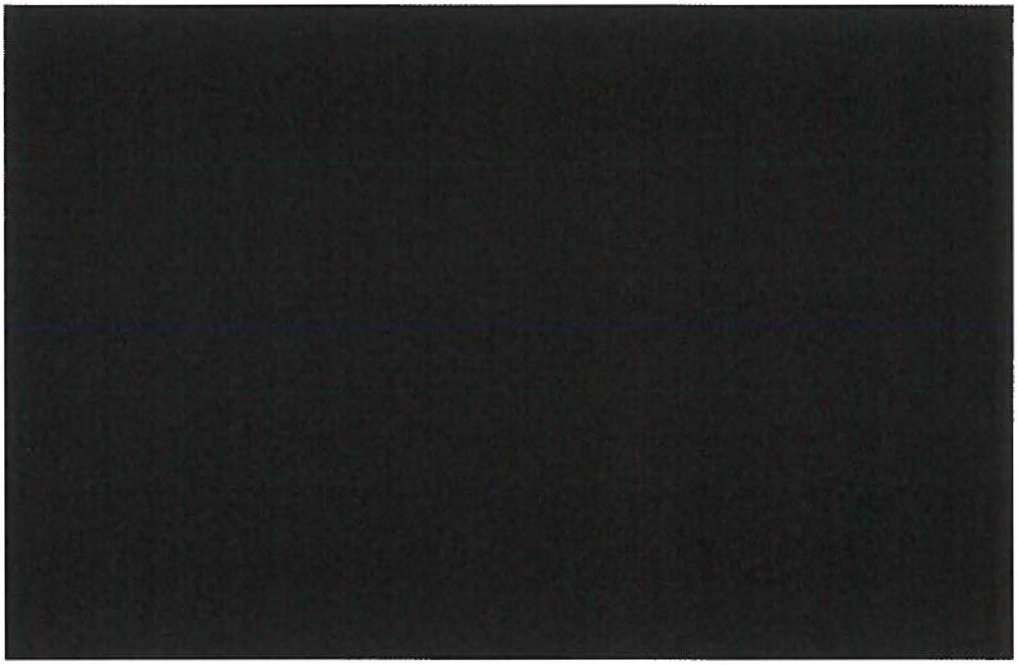
To test the reasonableness of the results, Daymark compared the consensus natural gas forecast to the 2017 Annual Energy Outlook (2017 AEO) from the U.S. EIA. The 2017 AEO is a good benchmark because it is publicly available and contains descriptions of the underlying fundamentals that drive their forecast. Figure 17 shows that comparison with the consensus view being somewhat lower in the short term and close to the AEO in the longer term.



2b

Figure 17: Comparison of MH Consensus Natural Gas Price Forecast to EIA 2017 AEO

In addition to natural gas prices, carbon pricing assumptions are an important assumption used in many energy price forecasts. Figure 18 provides a MH graph comparing the four carbon forecasts and the resulting 2017 Reference Carbon forecast based on the MH consensus methodology.

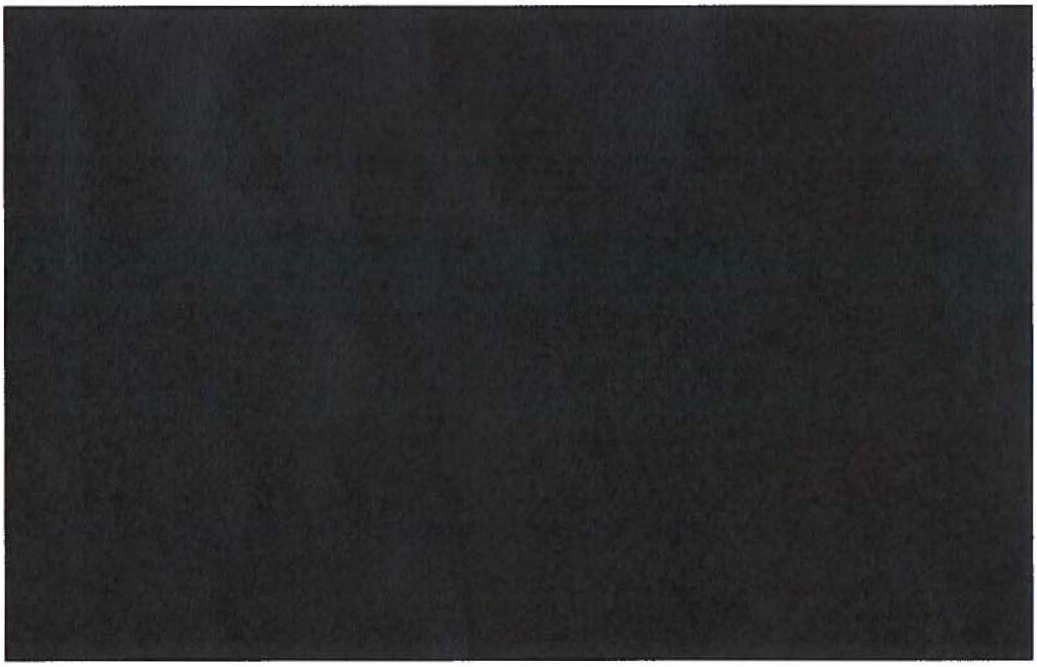


2b

Figure 18: Comparison of CO_2 Price Forecasts, by Independent Consultant

Range of Results

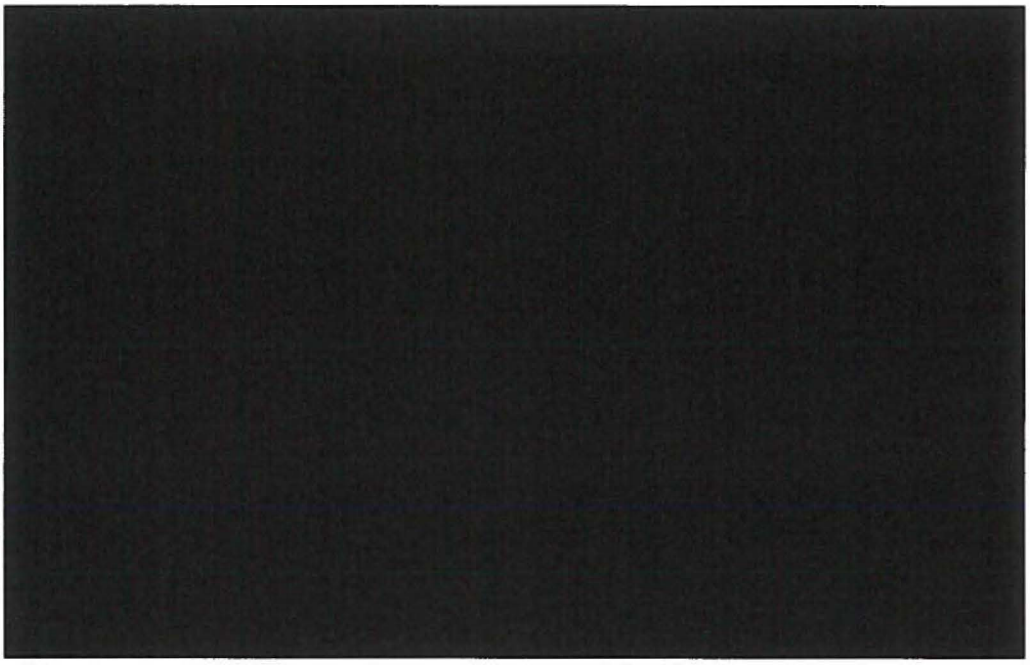
The following charts provide the price at the MHEB energy pricing node and the range of the independent consultant forecasts for on-peak energy, off-peak energy, and capacity.[49] Since the independent consultants provide only 20-year forecasts, MH extrapolated prices for all additional years at a constant real rate. Figures 19 through 21 provide the 2017 reference case prices as a result of the consensus methodology, accompanied by the range of the independent forecasts prices.



2b

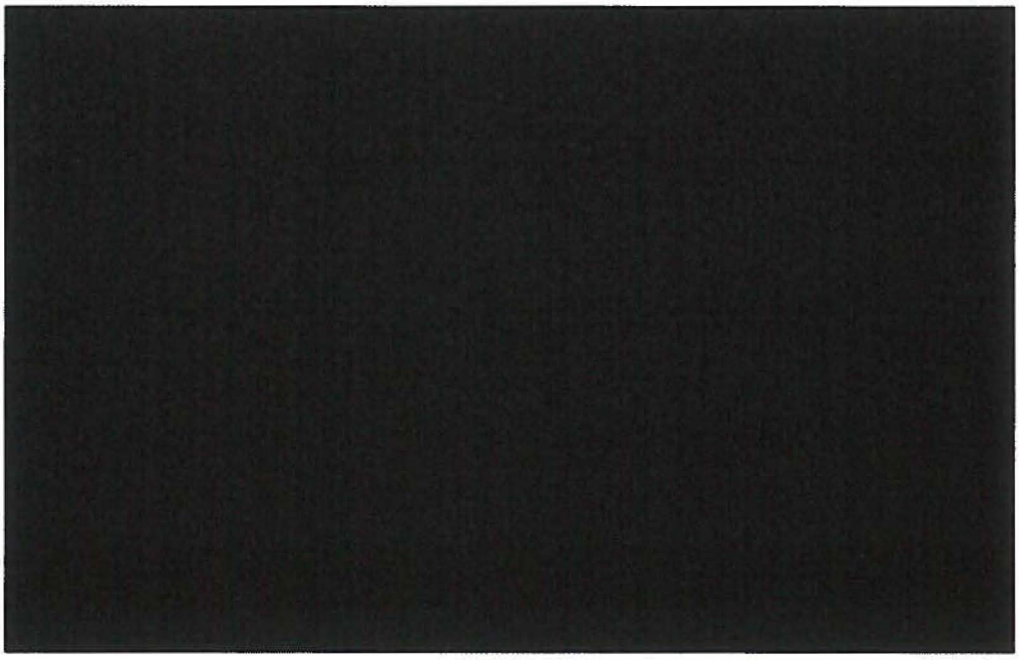
Figure 19: On-Peak Energy Price Forecast at Pricing Node MHEB

[49] Information provided by Manitoba Hydro in 2017 Energy Price Forecast



2b

Figure 20: Off-Peak Energy Price Forecast at Pricing Node MHEB



2b

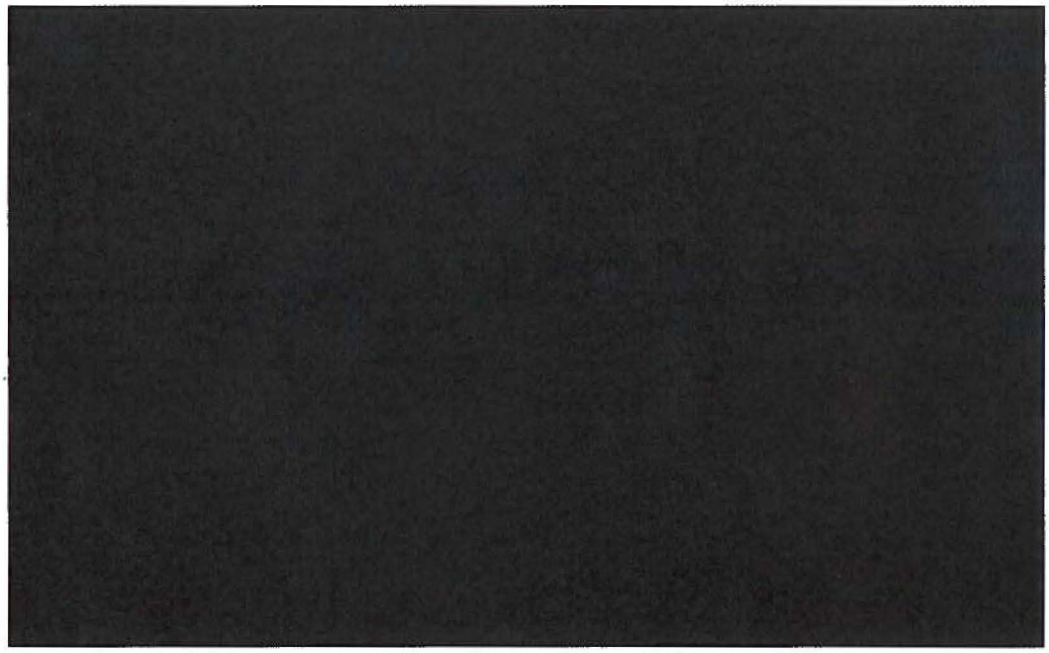
Figure 21: Capacity Price Forecast at Minnesota

Forecast Variance

As discussed in the section results above, the energy and capacity price forecasts show significant variance between the four independent consultants. Given that one of the forecasts was three months older than the others, Daymark investigated the impact of the oldest forecast to understand the impact of its inclusion.

Market price forecasts rely on information that is knowable about future market conditions at the time the forecast is prepared. Forecasts prepared at different points in time will vary, even from the same forecaster, if new information becomes available (e.g., updated forecasts of fuel prices, retirements, or market designs). We reviewed the vintage of the four forecasts to assess whether they were reasonably contemporaneous and, if not, if any change in market conditions were evident in the differences in the forecasts.

MH's On Peak Consultant Comparison graph provides an example of the range of forecasts. [redacted] 2b

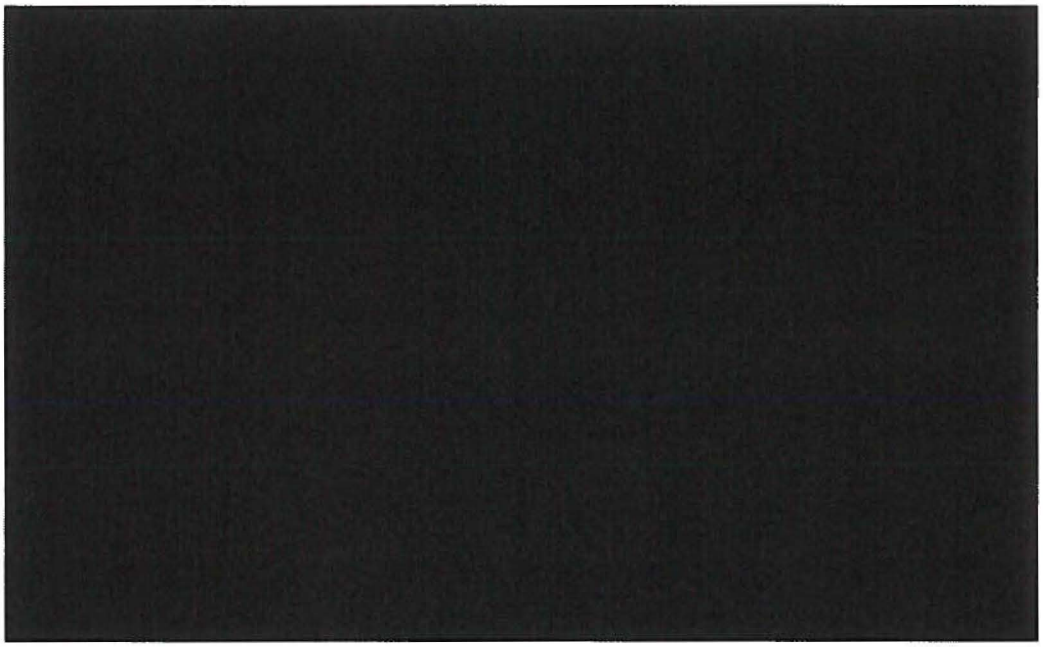


2b

Figure 22: Comparison of On-Peak Energy Price Forecasts, by Consultant

[50] [redacted] 2b

A look at the capacity price forecast graph from MH shows another view of the difference in the [redacted] forecast (See Figure 32). 3a



2b

Figure 23: Comparison of Capacity Price Forecasts, by Independent Consultant

[redacted] 2b

Lack of Detailed Input Review

The issue of report variance is exacerbated by the lack of detailed review that was done with regards to the forecasts themselves. As was discussed above, the four forecasts provided different levels of insight into what input assumptions were used. The documentation provided by the vendors did not provide the level of information a price forecaster would need to be able to assess the forecasts to determine if they each represented their company's reference forecast. Nor do the documents define how MH should view these forecasts within a range of possible outcomes. Only one of the four,

[redacted] even uses the term "reference" when referring to the product being provided to MH. 2b

Furthermore, there is no evidence that MH attempted to perform a deeper review of the forecasts, or assess the possibility that one or all of the forecasts might not qualify as "reference". The four forecasts provided price strips for energy and capacity and, after performing some basic due diligence on the natural gas and carbon prices, MH used the average of the four forecasts.

Neither the information available in the contractual arrangements with each vendor, nor the forecast materials provided by each vender contain any information on the vendors' views on the probability that prices will be higher or lower than the forecast provided. In each case, a single forecast was provided; there were no high or low alternative cases delivered that might serve to provide some context on their view of how the delivered forecast fits within the range of uncertainties.

As a result, we found no means to determine if the four forecasts are prepared on a consistent basis or if they were prepared with a specific objective to be a "50/50 reference forecast".

Apparent Inconsistencies between MH and Third-Party Forecasts

After looking in more detail at the data provided by the independent consultants we identified inconsistencies between MH's market view and the consultants' views. More specifically, one of the primary reasons for MH to remove the capacity premium from a subset of modeled products in its planning applications (See Section VII) was that the capacity prices will remain low "as coal closures have been delayed under the Trump administration, increasing capacity supply."[51] [redacted] 2b

[redacted]

[51] PUB MFR 79 Updated - CONFIDENTIAL

Adjustments for Congestion and Losses

The consulting firms provide a forecast for MISO's Minnesota Hub (MINN HUB), which is an aggregation of generation and load pricing nodes in the Minneapolis area. Since MH delivers its power at the border between Manitoba and the U.S. represented by a pricing node called MHEB or Manitoba interface, MH calculated an adjustment and applied it to account for the historical transmission congestion and marginal transmission line losses.

[redacted] 3b

4. High and Low Cases Methodology

Following reduced interest by its stakeholders and to minimize cost, MH began in 2017 to produce the high- and low-price cases in-house. MH considered a variety of methodologies with the goal of producing a forecast that used publicly available information, had scientific accuracy, and provided a reasonable deviation from the reference case.

The methodology chosen included information provided by the U.S. EIA on an annual basis via its AEO process. The AEO outlook includes projections of energy production, consumption, fuel oil prices, and other prices through 2050. The data is provided in a reference case that describes the EIA's view of the future[52] and seven sensitivities around the base case that capture fundamental economic drivers such as growth, oil prices, resource and technology changes, and others. In brief, the seven sensitivities capture the industry changes as mentioned above based on variances in oil and natural gas prices, technology differences, and economic growth.

[52] "The Reference case projection assumes trend improvement in known technologies, along with a view of economic and demographic trends reflecting the current central views of leading economic forecasters and demographers. It also assumes current laws and regulations will remain unchanged" Annual Energy Outlook 2017 with projections to 2050.

As an example, the total energy production is represented in Figure 24.

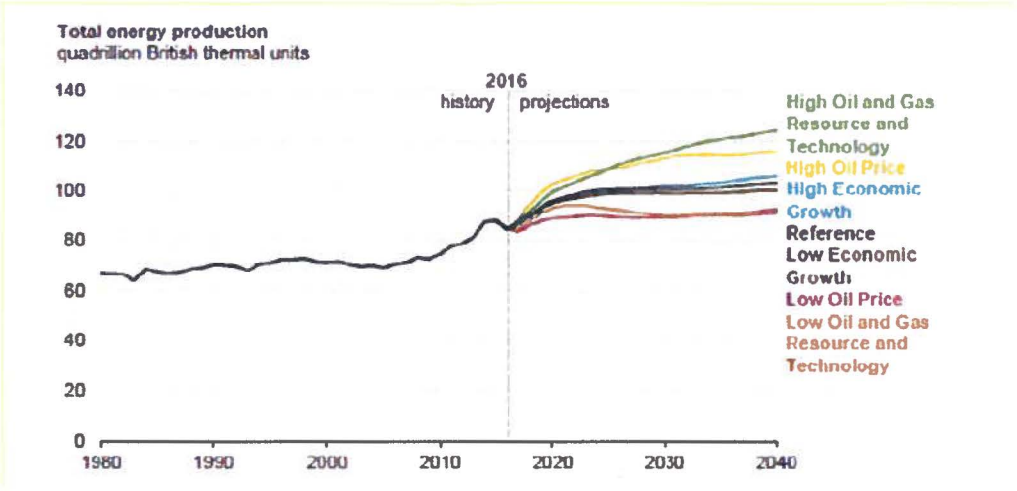


Figure 24: Total Energy Production, Annual Energy Outlook

MH chose two of the seven sensitivities to represent the high and low cases [redacted] 3b
[redacted] A natural gas price deviation was then calculated between the reference AEO case and the two chosen boundary cases. [redacted] 3b

After estimating the prices, MH staff used the following formula to derive a heat rate:

Heat Rate = Power Price ÷ Natural Gas Price

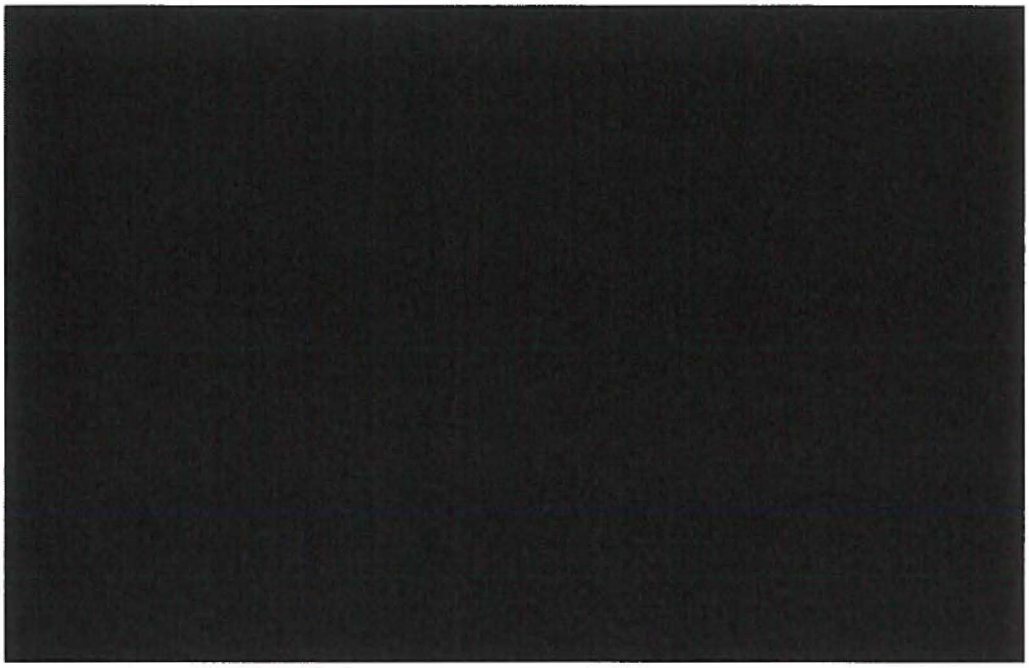
Finally, the high- and low-price cases were developed by changing the natural gas price in the above calculation and keeping the heat rate consistent.[53] The resulting high and low cases for 2017 – for both on-peak energy and off-peak energy[54] - are presented in Figure 25 and Figure 26, respectively.

MH also eliminated the production of the high and low capacity forecasts, since they were not used by the stakeholders.[55]

[redacted] 3b

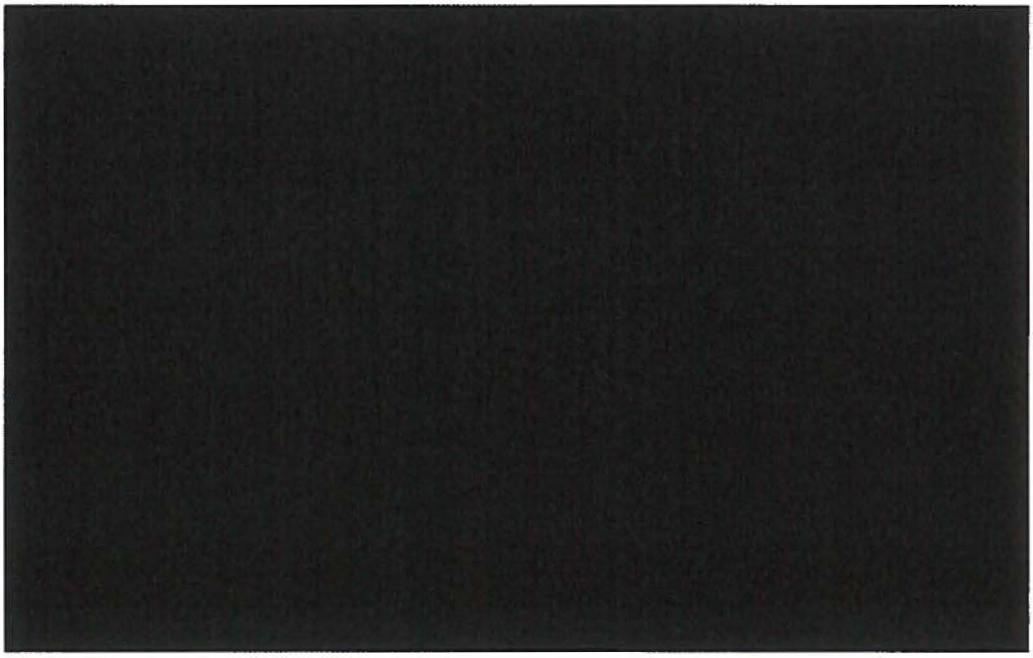
[54] 2017 Energy Price Forecast v3 – tab charts

[55] PUB MFR 79U-CONF



3b

Figure 25: On-Peak Energy Price Forecasts (Reference, High, Low) at MHEB



3b

Figure 26: Off-Peak Energy Price Forecasts (Reference, High, Low) at MHEB

D. Summary of Findings

We offer the following observations regarding the third party consultant forecasts and MH's reference case forecast:

- MH's purchased off-the-shelf energy and capacity price forecasts from four third-party consultants that offer these services to the industry broadly on a subscription basis.
- In each case, MH purchased a single case or scenario and did not purchase high or low case alternatives. The single case forecasts and associated documents did not include any characterization of the design objectives of the case with respect to the likelihood that values could be higher or lower than the case presented.
- MH used the average of the four forecasts as its reference case.
- MH's resultant reference case forecast has the following characteristics:
  - [redacted]
  - [redacted] 3b
  - [redacted]

We offer the following observations regarding the low and high case forecasts:

- MH elected to develop high and low case forecasts in-house, rather than purchase such forecasts from third-party consultants as it had done in prior years.
- MH defined those cases by calibrating its reference case to its high and low cases using EIA AEO low, reference, and high cases.
- [redacted] 3b
- MH did not provide a low or high capacity price forecast.
- [redacted] 3b

As we discuss further in Section VII, we understand that "reasonableness" in this context is whether the forecast is a balanced, with the values being used representing assumptions that fall in the middle of the range of plausible values (i.e., a P50 value). In that context, our observations on the reasonableness of the market price forecasts are:

- Assuming the four third-party forecasts reflect each vendors' view of a P50 forecast, MH's reference case method of weighting the four equally is a reasonable basis for a forecast.
- [redacted]
  - [redacted]
  - [redacted] 3b
  - [redacted]
- [redacted]

IV. EXPORT ENERGY AND CAPACITY

A. Overview

This section describes the work undertaken to understand the forecasting methodology used by MH to determine the exportable energy and capacity, considering the flow and inflow conditions, reservoir levels, as well as other hydrologic inputs that are applied to the Emma/Splash modeling. Additionally, we discuss changes in forecasting methodology between the NFAT and today.

B. Scope of Investigation

The MH16-Update projections were classified as short-term (2017/18 and 2018/19) and long-term (2019/20 to 2051/52). Our analysis in this section is sub-divided into *Short-Term Hydrology* and *Long-Term Hydrology.* Due to the differences in calculation of water inflows between Year 1 (2017/18) and Year 2 (2018/19), the *Short-Term Hydrology* subsection is further organized into *Year 1 Inflow Calculations* and *Year 2 Inflow Calculations*, before combining the outputs of the two into the short-term forecasting model, as explained below.

For this assessment, Daymark used all confidential documents in relation to hydrology provided by MH, as well as publicly available sources of information on historical hydrologic trends. Documents relied upon in the performance of this work are listed in Appendix B.

C. Analysis

The assessment by Daymark showed that the methodology used by MH for both the short-term and the long-term periods appeared to be reasonable. The short-term hydrology methodology has changed from previous years and it is dependent on initial storage condition assumptions that result from that change. However, the change in methodology and the resulting energy and capacity values appear reasonable. The long-term hydrology methodology is consistent with the approach used in previous rate filings and Daymark did not identify any concerns with respect to the hydrologic calculations.

Details of the work performed are organized into the following subsections:

- Short-Term Hydrology Analysis
- Long-Term Hydrology Analysis

1. Short-Term Hydrology Analysis

Based on information provided by MH, the hydraulic generation values and net export revenues are dependent on the following two important factors:

- Inflow conditions; and
- Starting reservoir/lake storage level elevations.

From IFF16, Tab 3.1,[56] the short-term forecast methods used in IFF16 and MH16-Update can be summarized as follows:

- For Year 1 (2017/18):
  - Actual inflow conditions until May 2017
  - 'Expected' inflow conditions[57] determined through statistical (regression) analysis for June 2017 through March 2018
  - Actual reservoir and lake level elevations
- For Year 2 (2018/19):
  - Inflow conditions calculated based on an average of 104 water flow cases[58] – referred to as the 'multiflow' method
  - Expected starting reservoir and lake level elevations assumed to be carried forward from Year 1

Year 1 – 2017/18 Inflow Calculation Overview

The Year 1 methodology and calculations were reviewed in detail. Year 1 hydrology is based on the state of actual hydrology as of the date the analysis is done plus an expected rest-of-year hydrology using regression analysis designed to predict balance-of-year hydrology from the previous month's results.

No issues were found with the Year 1 methodology or results.

Year 2 – 2018/19 Inflow Calculation Overview and Inputs

MH used the 'multiflow' technique for the Year 2 forecast of inflow conditions in preparation for the MH16-Update. This methodology differs conceptually with the previously-used 'median flow year method'. Daymark analyzed the two methods, including the rationale for the change and the supporting documents articulating the results.

[56] GRA Submission, Appendix 3.1, pp. 16.

[57] PUB-MH II-37a-b, pp. 2.

[58] Correction from 102 flow cases to 104 flow cases by the Company as indicated in MH PUB 1.19a, pp. 1.

Multiflow Method

For Year 2 (2018/19)[59], using MH's operational modeling capability, the average of 104 river flow cases (1912/13 to 2015/16) was considered for inflow conditions. The resulting hydrology for the IFF was the average of all flow cases.

Median Water Flow Year Method

From the documentation provided by MH[60], the 'median water flow year' method can be summarized as a calculation technique for inflow conditions based on a single flow year, where the single flow year would be the median water flow year among 80 years.

Comparison between the Two Methods using Starting Storage Conditions

An important factor to understand is the asymmetrical relationship between water flow conditions and hydro generation. The river flow conditions might not directly depict an impact on the hydro generation due to the limitations in storage conditions. If the median water flow year is determined to be a high-flow year, this could result in more water than the capability of hydro generating units, resulting in capped generation. This could consequentially result in lesser downstream energy production.

Given the uncertainty surrounding future hydrology, an average of all flow years is more likely to capture the asymmetry than a single flow case, even the median one. Based on that, Daymark determined that the analysis using the 'Multiflow Method' in MH16-Update was reasonable.

2. Long-Term Hydrology Analysis

From IFF16, Tab3.1[61], the long-term forecast method used in IFF16 and MH16-Update can be summarized as follows:

- It applies to years 3 and beyond (2019/20 and beyond); and
- The forecast is determined by averaging revenues across inflow conditions for the past 102 years.

This approach is consistent with methods used in the NFAT and previous GRAs. The principle tool used in this approach continues to be Simulation Program for Long-term

[59] PUB-MH I-19d, pp. 1-2.

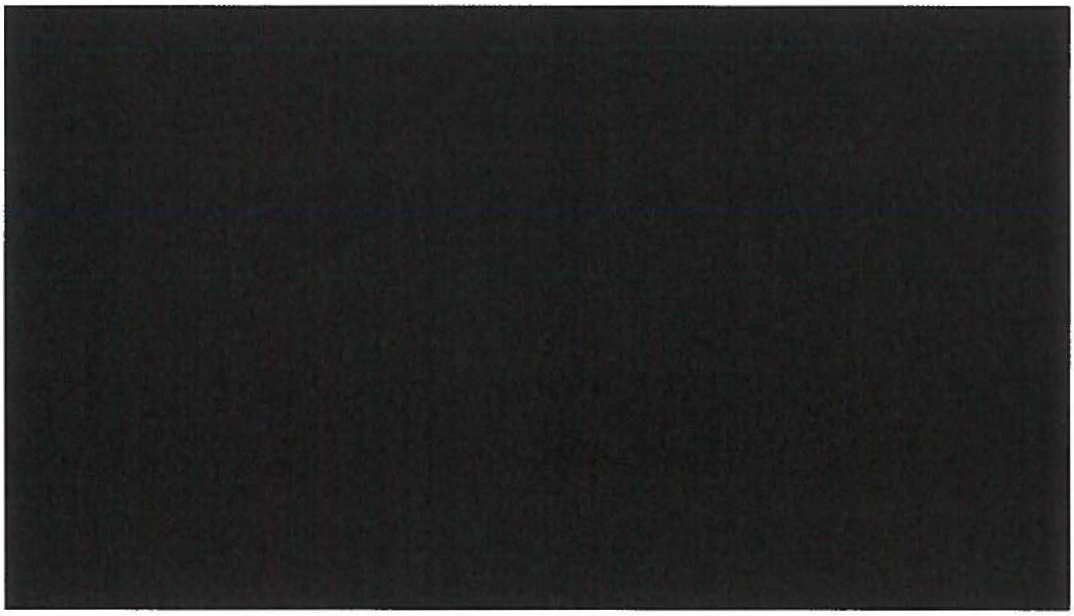
[60] COALITION-MH I-62a-e, pp. 2., PUB-MH I-19d, pp. 1-2.

[61] GRA Submission, Appendix 3.1, pp. 16.

Analysis of System Hydraulics (SPLASH). SPLASH has been thoroughly tested over many years and remains a reasonable tool for modeling the specific MH system.[62]

Dependable Energy Results

One of the key outputs of the modeling efforts is the available dependable energy. Figure 27 shows the opportunity sales, firm (contract) sales and available dependable energy, all in GWh.[63]



5b, 5c

Figure 27: Annual Firm and Opportunity Exports and Dependable Surplus

Long-term Hydrology Observations

The methodology used in determining the hydrology for the long-term period appears to be reasonable and consistent with the previously-reviewed and approved methodology. Furthermore, the post-processing calculations of the SPLASH output data have been appropriately represented to be the average of 102 flow cases for each load year and are properly being used in the export revenue forecast. To the extent that proper price and firm energy assumptions are assumed, the results are reasonable.

[62] Manitoba Hydro, "Peer Review of Manitoba Hydro's Splash Model", May, 2005, https://www.hydro.mb.ca/regulatory_affairs/electric/gra_2010_2012/Appendix_74-Attachment_2.pdf.

[63] The dependable energy numbers are from Appendix 7.3, pp 22 and 23. Because 7.3 assumed Keeyask in service in 2019/20, the dependable energy values for 2020/21 and 2021/22 were adjusted to estimate the impact of the delay of Keeyask. Firm and Opportunity Sales come from confidential SPLASH documents provided to Daymark via MH's SharePoint site.

D. Summary of Findings

Daymark concludes that the hydrology used by MH for the MH16-Update appears reasonable and consistent with previously-used methodology. Calculations of dependable and total energy are reasonable.

V. CHANGES IN FORECASTING METHODOLOGY

A. Overview

MH regularly conducts forecasts of export revenues for its annual financial planning for resource planning studies. The export revenues are generated from the sale of surplus energy including sale of surplus dependable energy via existing long-term contracts (as discussed in Section VI) and through the sale of additional surplus energy. The additional surplus energy can include surplus dependable energy (surplus energy in dry year conditions) and additional surplus opportunity sales (additional energy available in average year conditions). In this GRA, MH's methodology and assumptions for forecasting the revenues from the surplus energy that is not committed via long term contracts – surplus dependable and surplus opportunity –differs from those used by MH in the NFAT proceedings and prior financial projections.

B. Scope of Investigation

Scope item #4 requires Daymark to "*assess the reasonableness of changes in MH's forecasting methodology that eliminates the assumed premiums for surplus dependable energy and capacity sales.*"

Our approach to this work centers on MH's response to PUB MFR 79 (Updated), in which MH offers it explanations of the changes in methodology, along with the 2016 Electricity Export Price Forecast (2016 EEPF).[64] We discussed the response and the methodology changes with MH SMEs and reviewed associated analysis of export revenue sales. We also rely on our work on presented in Sections II, III, and IV of this report to assess the reasonableness of the methodology.

C. Analysis

MH included a Long Term Dependable Product forecast in its EEFP in 2013, 2014 and 2015, as well as in the analysis MH provided in the NFAT proceeding. MH removed the assumption of a premium for that product in its 2016 EEFP and has continued the assumption of no premium in the export revenue projections provided in the GRA proceeding. In more recent analyses, MH made additional changes to its method of forecasting prices for that product.[65] In this Section V, we discuss the change in the assumption regarding the premium, which is the subject of our

[64] The 2016 EEPF is an internal MH document, dated August 9, 2016 provide as a confidential document to the Daymark IEC Team via SharePoint. The 2016 EEFP is identified in the response to PUB MFR 79 (Updated).

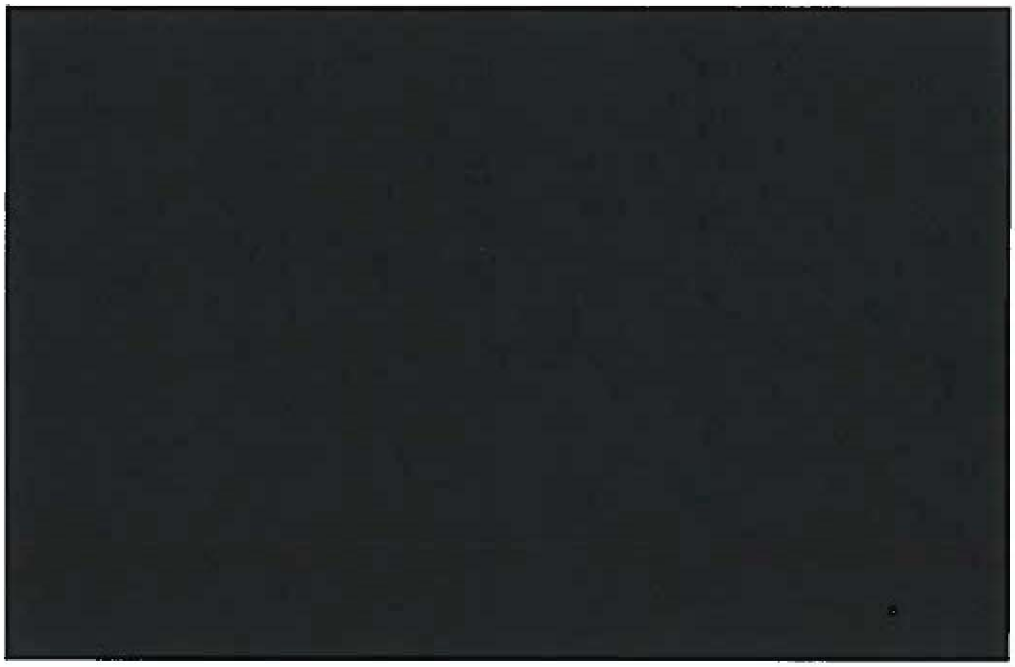
Scope Item #4. In Section VII, we discuss the full set of changes to the forecasting methods that have been implemented in the current export revenues forecast.

In the NFAT proceeding, and in the 2013 to 2015 EEPFs, the long-term forecast was used for both spot/opportunity sales and non-committed firm sales. The non-committed sales – an important component of MH's Preferred Development Plan during the NFAT – were defined as firm sales not yet under contract that were priced at premium prices.

In this period, MH defined a Long Term Dependable Product to be On-Peak Energy (5x16) and associated capacity sold in a long-term contract of 5 years or more. The price premium [redacted] was used to represent the additional amount that buyers would pay for price and volume certainty over the long term and for the environmental advantages of hydropower.[66] The value of the premium was [redacted] 7b

Figure 28 illustrated the forecast results of the reference case for the Long Term Dependable product, broken out by component, at MHEB in 2015 US$/MWh.[67]

[65] PUB MFR 79U, page 1.
[66] 2015 EEPF, page 14.
[67] 2015 EEPF, page 15.



3b, 3c

Figure 28: Reference Case Forecast, Long Term Dependable Product, by component

In MH's 2016 EEPF, the [redacted] premium for the Long Term Dependable Product was removed due to MH's assessment of then-current market conditions. MH removed the premium based on the following concerns:[68] 3b, 7b

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

3a

With respect to the 2017 Energy Price Forecast (2017 EPF), MH's observation on the current market conditions [redacted] The premium was not used in the 2017 EPF. 3a

The primary question we have been asked to address is the reasonableness of the assumptions regarding the premium for the surplus dependable energy and capacity.

[68] 2016 EEPF, pages 12-13.

[69] PUB MFR-79U-CONF, page 4.

We have been asked to consider the 20-year forecast of export revenues and consider the entirety of that term in this assessment. As we discuss further in Section VII, we understand that "reasonableness" in this context is whether the forecast is a balanced view, with the values being used representing assumptions that fall in the middle of the range of plausible values (i.e., a P50 value).

We also observe that the forecast of surplus available energy is significant for most of the 20-year forecast period. The values are shown in Figure 27 in Section IV, with roughly 2,000 GWh/yr in the near term and over 4,000 GWh/yr for a ten-year period and remaining above the 2,000 GWh/yr level thereafter. These values make the longer term pricing assumptions important to the reasonableness of the forecast.

Upon review of the reasons for first instituting a premium and then removing the premium, we believe the elimination of the premium 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's 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 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.

Based on our review of the information on the longer-term trends in MISO (as documented in Sections II and III), the near-term market conditions that are adversely affecting the ability to sell firm power at a premium are not expected to persist for more than a few years. Our observation that the 20-year plus long-term outlook prepared by MH, assuming no premium at any point in time, is inconsistent with the rationale for instituting the premium in the first instance for years 6 to 20 of the forecast.

D. Summary of Findings

Based on our analysis, we make the following observations:

- The changes to the forecast methodology over the testing period indicate a more conservative approach than was previously used.
- The primary reason for the premium is to reflect the added value to buyers, beyond the commodity energy and capacity value, for attributes such as long term price certainty and stability and the environmental attributes of hydropower.

- The primary reason for the change in methodology is a view that lower natural gas and capacity market prices, along with surplus capacity conditions have made the market soft in recent years.
- The elimination of the premium appears reasonable for the near term.
- 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.

VI. FIRM CONTRACTS

A. Overview

Firm energy and/or capacity export contracts represent a significant portion of MH's forecasted revenues. The Daymark IEC Team reviewed the accuracy and reasonableness of the revenue forecasts associated with these firm export contracts.[70]

MH currently has a substantial portfolio of contracts exporting firm energy and/or capacity to extraprovincial counterparties. The volumes of committed energy and capacity over time from existing executed contracts are summarized in Figures 29 and 30.

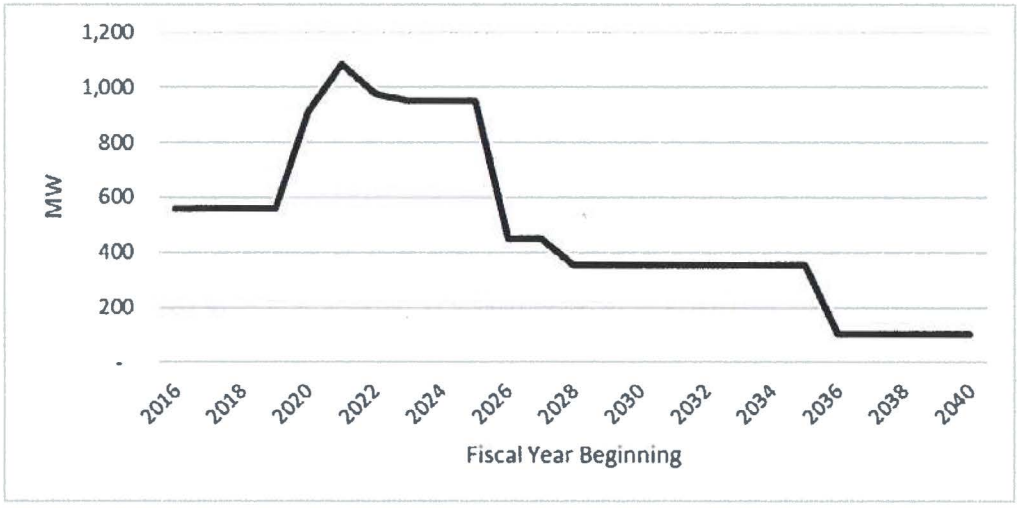
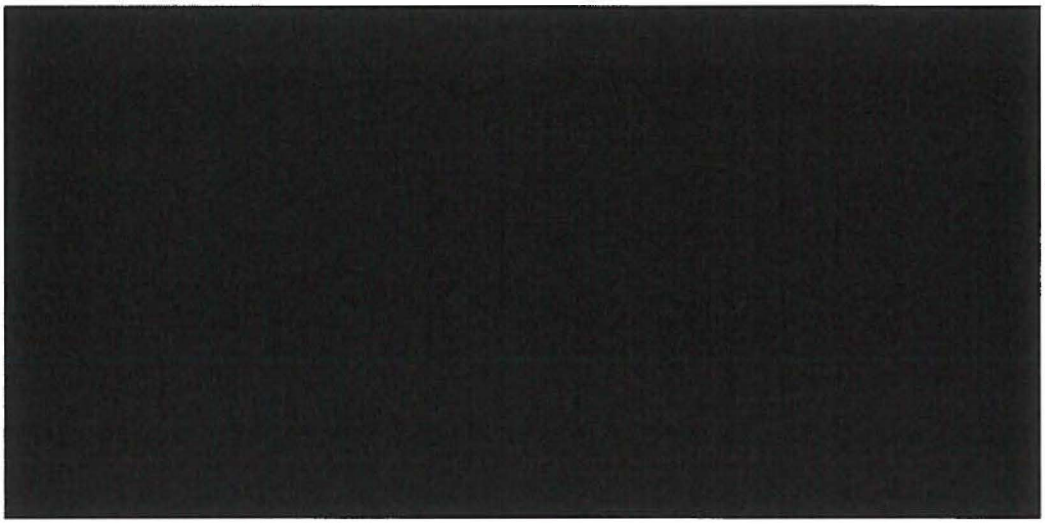


Figure 29: Firm Export Capacity under Contract[71]

[70] Unless otherwise specified, all references to calculations of contract revenues refers to calculations done for the updated MH16 analysis that is part of the presentation in Tab 3.6

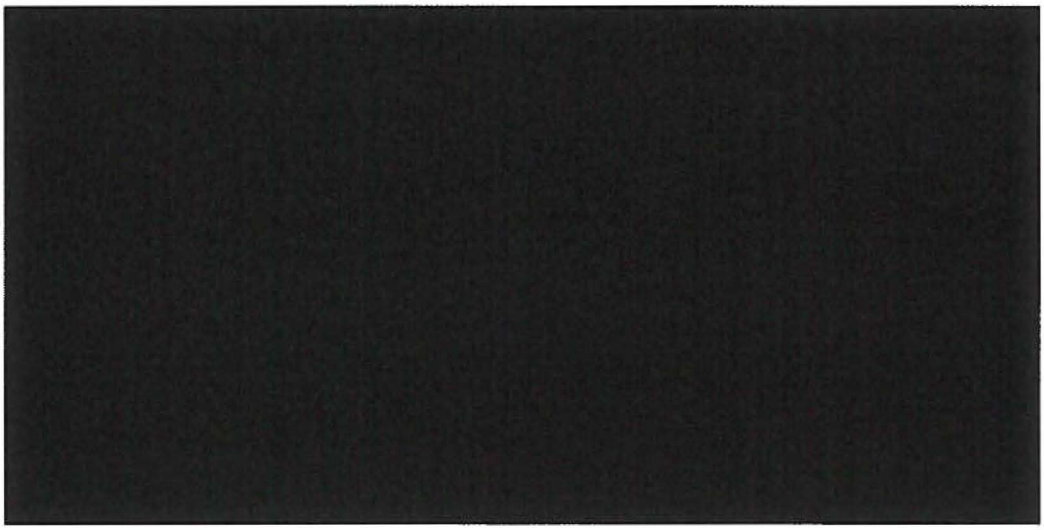
[71] Compiled from export contracts provided by MH. Note that the value for each FY includes the sum of maximum monthly value for each contract for that FY. For example, if a contract exporting 100 MW expires midway through FYB 2020, the total will include 100 MW from that contract.



1d, 3a, 7b

Figure 30: Firm Export Energy under Contract[72]

Forecasted revenues from these contracts reach a peak of [redacted] (see Figure 31 below). 1d, 3a, 7b



1d, 3a, 7b

Figure 31: Firm Export Energy and Capacity Revenue[73]

The Daymark IEC Team reviewed the reasonableness of MH's forecasted revenue from these firm export contracts.

[72] MFR 84, Annual export contract volumes and revenues.

[73] Ibid.

B. Scope of Investigation

This section covers the work done to complete the review of revenues sourced from contracted energy and capacity sales, as contemplated in Scope Item #3. The review of the remainder of the components of the 20-year forecast of export revenues, as contemplated in Scope Item #3, is addressed in Section VII below.

Our investigation of firm contracts included both those contracts that were executed prior to the NFAT filing (referred to here as "carryover contracts") as well as new contracts that were executed since the completion of the NFAT proceeding.

The scope of our investigation varied slightly for carryover and new contracts. For carryover contracts, the revenue forecasts were reviewed in detail during the NFAT proceeding. The Daymark IEC Team was asked to take as a given that the forecasts of the carryover contracts are correct, so long as MH's revenue forecast aligned with the evaluation conducted for the NFAT proceeding, subject to changes in escalation and exchange rates.

For new contracts, the Daymark IEC Team reviewed the contract terms to create an independent forecast of firm energy and capacity revenues, and compared this analysis to MH's forecast.

The documents used in this evaluation are listed in Appendix B.

C. Analysis and Detailed Findings

The Daymark IEC Team conducted analysis on each of the contracts included in the revenue forecasts for both the NFAT and GRA analyses. As discussed above, there are two primary categories of export contracts: carryover contracts consisting of those predating the NFAT proceeding, and new contracts that have been executed since the NFAT proceeding concluded. There are four contracts that were listed in MH-CSI #36[74] that were not included in the GRA analysis; these contracts are considered "excluded" because they are not included in MH's forecast of firm extraprovincial export revenues in the current analysis. The table below lists the carryover, excluded, and new contracts, and identifies the products transacted in each contract.

[74] "LCA-CSI-34-Supp Att-LCA Comparison to MH CSI 36.xlsx", tab "MH CSI 36". This document contains the analysis of extraprovincial energy and capacity export contract revenue from the NFAT proceeding. This document was provided by MH and was used by the Daymark IEC Team to assess forecast consistency.

Table 9: List of Contracts (Carryover, Excluded, and New)

	CONTRACT ID	ENERGY	CAPACITY
Carryover	MP 250	X	X
	MP 50	X	X
	NSP 125	X	X
	NSP 375/325	X	X
	WPS 100	X	X
	WPS 108	X	X
Excluded	MPEE	X	
	NSP 350 Div Exch	X	
	GRE Div Exch	X	
	WPS 308	X	X
New	SP 2020-2040	X	X
	SP 25	X	X
	NextEra 100 ZRC		X
	NextEra 30 ZRC		X
	AEP 79/50 ZRC		X
	Basin 50 ZRC 2018-2020		X
	Basin 50 ZRC 2020-2021		X
	MP 50 ZRC		X

Carryover Contracts

The Daymark IEC Team evaluated the carryover contracts to confirm that the revenues included in MH's forecast are reasonable given the contract terms and the analysis was structured to confirm that the methods used by MH to forecast the energy and capacity revenues are consistent with the methods used during the NFAT proceeding. The terms of individual contracts vary, so the specific analysis conducted was structured specifically for the contract. For example, [redacted] 1d, 3a, 7b

The Daymark IEC Team reviewed the revenue forecasts that were evaluated and approved during the NFAT proceeding and updated the key assumptions to those forecasts that impact pricing terms – [redacted] 1d, 3a, 7b

[redacted] The Daymark IEC Team 1d, 3a, 7b compared these updated forecasts to the export contract revenue assumptions used by MH in the GRA, provided in MFR 84.[75]

Through the review of documentation provided by MH, discussions with MH staff, and independent analysis of the contracts, the Daymark IEC Team has concluded that the revenue forecasts assumed by MH for carryover contracts are reasonable.

The Daymark IEC Team also found that there were four contracts listed in the MH-CSI #36 documents that were not listed as firm contracts in the GRA materials.[76] These excluded carryover contracts are addressed below.

Excluded Carryover Contracts

Four contracts were included in the MH-CSI #36 accounting of firm energy and capacity revenue that were excluded from MFR 84. The Daymark IEC Team investigated these contracts by reviewing documentation provided and through conversations with MH.

The MPEE contract is an energy exchange contract with Minnesota Power [redacted] 1d, 3a [redacted] Through discussions with MH, the Daymark IEC Team determined that while it is not listed in MFR 84, the MPEE contract is included in the Company's financial forecasts. The accounting associated with the MPEE contract is consistent with the treatment in the NFAT proceeding, despite the difference in categorization.

NSP 350 Div Exch and GRE Div Exch are diversity exchange agreements with Northern States Power and Great River Energy, respectively. Diversity exchange agreements allow MH to essentially trade energy with these counterparties across seasons. As a winter-peaking system, MH would receive energy in the winter and deliver energy in the summer. The contracts are structured such that MH has a specified amount of energy it must offer into the counterparty's market during specified hours. [redacted] 1d, 3a [redacted] but that the revenue is still accounted for in the financial forecasts used in the

[75] MFR 84 contains the Company's forecast of extraprovincial energy and capacity export contract volumes and revenue.

[76] MFR #84

GRA. Despite the difference in labeling and classification, the forecast of revenue from the sale of the diversity exchange energy is calculated in the same manner as it was in the NFAT forecasts.

The WPS 308 contract was an agreement with Wisconsin Public Service that was contingent on the approval and construction of the Conawapa project. The MH-CSI #36 forecast included energy and capacity revenue from that contract beginning in 2026. As that project is no longer proceeding as anticipated in the NFAT filing, the WPS 308 contract is no longer included in MH's revenue forecast.

Based on the review of documentation and conversations with MH, the Daymark IEC Team has determined that the exclusion of these contracts from the firm energy and capacity revenue forecast is reasonable.

New Contracts

To evaluate MH's forecasts of energy and capacity revenue from new contracts executed since the NFAT proceeding, the Daymark IEC Team reviewed the executed contracts, as provided by MH, and calculated an independent forecast of revenues based on contract terms. These independent forecasts were compared to the contract-by-contract forecasts developed by MH.[77]

The eight new contracts are categorized into two groups. Six of the contracts are capacity-only contracts, [redacted] 1d, 3a

The remaining two contracts (SP 2020-2040 and SP 25) are firm energy and capacity contracts, with specified quantities of annual energy and capacity that remain constant throughout the term. [redacted] 1d, 3a

For the capacity-only contracts, the calculations performed by the Daymark IEC Team matched the revenue forecasts provided by MH in MFR 84.

In comparing annual forecasts for energy and capacity under the SP 2020-2040 and the SP 25 contracts, there were some very slight discrepancies in MH's forecast and the calculations conducted by the Daymark IEC Team. In total, these discrepancies amounted to less than 0.5 percent of total revenue forecasted from these contracts.

[77] MFR #84

Based on the evaluation of the energy and capacity contracts, as well as the capacity-only contracts, the Daymark IEC Team concluded that MH's forecasted revenue for new contracts is reasonable.

D. Summary of Findings

Based on our review of the export contract revenue forecasts for capacity and energy provided by MH, the Daymark IEC Team makes the following findings:

- With some exceptions (detailed next), MH's treatment of carryover contracts included in both the NFAT and the GRA is consistent. The energy and capacity revenue forecasts used in the GRA analysis reflects a reasonable estimate of firm extraprovincial revenues from these contracts.
- The exception to this conclusion on carryover contracts relates to four specific contracts that were included in the summary of NFAT contracts (MH-CSI #36), but were not included in the GRA summary (MFR 84). The Daymark IEC Team investigated the discrepancy and concludes that for three of the contracts, the actual treatment of these contracts by MH and the method of forecasting revenue from these contracts has not changed, only the classification of the contracts has changed. The final contract was removed due to MH's failure to gain approval for the Conawapa project. The Daymark IEC Team does not recommend any adjustment be made for these contracts.
- The new export contracts executed since the NFAT proceeding were treated in a manner consistent with the carryover contracts. The forecast of energy and capacity revenue included in the Company's extraprovincial revenue forecast reflects reasonable treatment of these contracts, and the Daymark IEC Team has no concerns with these forecasts.

Based on the foregoing findings, the Daymark IEC Team has verified the reasonableness of the extraprovincial revenue forecast.

VII. REVENUE FORECAST

A. Overview

MH's forecast for export revenues and fuel and power purchases (net export revenues) for the next 20 years is a key input to its determination of the need for revenues from domestic ratepayers within the GRA rate period and its longer-term assessment of the attainment of a 25 percent equity ratio target within ten years. MH's forecast of net export revenues for the first 20 years is provided in Figure 32 below.

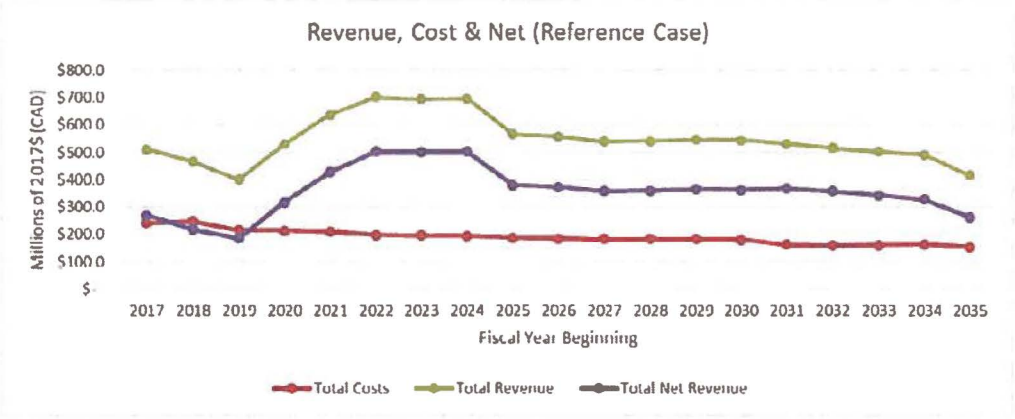


Figure 32: Forecast of Net Export Revenues, 2017-2035

B. Scope of Investigation

This section presents our assessment of the reasonableness of MH's net export revenue forecast, the primary objective included in Scope Item #3. This section builds on the work from Sections II through VI, which contain assessments of key inputs to the forecast: the market context, market prices, forecast of surplus energy and capacity, and revenues from existing export contracts. Our reasonableness review focuses on MH's forecast of overall export revenues used to define its requested rate increase proposal, which we refer to as the Reference Case export revenue forecast. We also include a discussion of the implications of the uncertainty analysis MH provided in Tab 4 to provide information on the uncertainty and risk inherent in the forecast.

Our review tests the reasonableness of the forecast in two ways.

First, we review each of the key inputs and the analysis used to assemble the forecast to verify the soundness of the methodologies and the accuracy of the results.

Second, we consider whether the forecast is a reasonable balance of risk between MH and its domestic ratepayers. In Tab 4, MH observes that "*By the end of the 10-year forecast period, there is a 50% chance that Manitoba Hydro will achieve the minimum 25% equity ratio target.*"[78] Figure 4-10 from Tab 4 of MH's filing (See Figure 33 below) provides the context for MH's presentation of the uncertain impact those revenues would have on the company's financial performance.

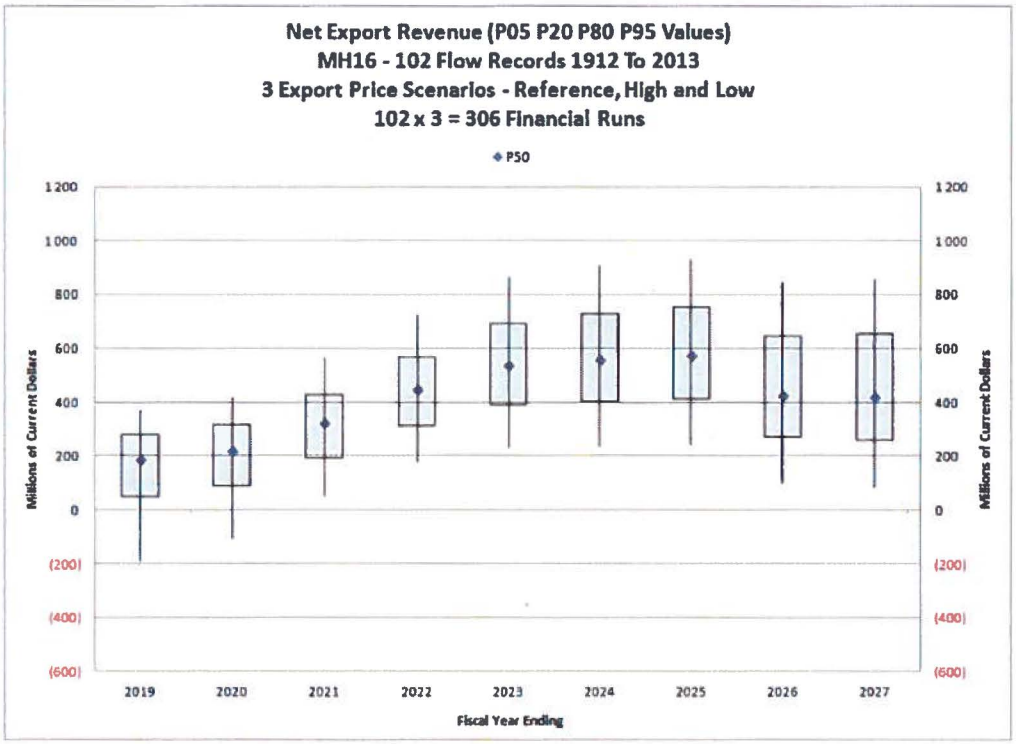


Figure 33: Net Export Revenues, and Impacts of Uncertainty

We understand from this statement, and from our discussions with MH SMEs, that MH intends for the Reference Case forecast to be a "P50" case – a reference case where there is equal chance that the results are higher or lower than forecasted.

[78] GRA Submission, Tab 4, pp. 24.

C. Reference Case Observations

There are a few areas where we believe that the assumptions or methods of producing the current export revenue forecast are not in keeping with a P50 reference forecast. These items are:

- The methodology for forecasting the export energy and capacity prices;
- The assumption that no firm energy sales will be made from the forecasted surplus dependable energy;
- The assumption that no extension of sales will occur with existing buyers when current firm contracts expire; and,
- The assumption that MH will not receive any capacity revenue associated with surplus dependable energy or opportunity sale energy over the study period.

This subsection discusses these items and the ramifications of these omissions on the reasonableness of the export revenue results.

Export Price Forecast Methodology and Result

Daymark identified several concerns with the methodology and results of the price forecasts themselves, as discussed in Section III. These concerns, when taken together, suggest that the market price forecast may be conservative relative to a P50 forecast of energy and capacity prices.

The most significant concern is that the limited of documentation of the third-party vendors forecast does not provide sufficient information to determine whether any of the vendors consider the forecast provided a P50 forecast. Consequently, the MH price forecast cannot be shown to be a P50 forecast since it is a simple average of the four forecasts. Understanding the nature of the forecasts and the assumptions underpinning them is necessary to ensure that they are being used appropriately in MH's efforts to produce a P50 forecast.

No Forecasted Capacity Revenue

MH's export revenue forecast assumes that there will be no capacity revenues derived from the uncommitted surplus dependable energy or opportunity sale energy. While it may be reasonable to assume MH cannot make additional capacity sales in the short run due to market and policy factors, those factors are short-term drivers of market dynamics. As is the case with the removal of the premium for surplus dependable

(discussed in Section IV), this is a change from the assumptions used in the 2013-2015 EEPF. The capacity revenue component included at that time is depicted in Figure 28.

As discussed in Section II, there are many sources -- utility IRPs, MISO reports, state and federal processes, and others – that indicate that it is likely that MISO will be short capacity within the next ten years, possibly as soon as 2025. Further, NSP and Minnesota Power each discuss significant need for new capacity and energy in that same timeframe in their most recent IRPs. State environmental policies, particularly in Minnesota, will result in some percentage of that required capacity to be sourced from low- or zero-carbon emitting resources.

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.

Given that, a reasonable P50 forecast should include capacity revenues from the considerable dependable energy surplus (see Figure 27). Eliminating all forecasted capacity revenues associated with surplus dependable energy represents a very conservative assumption, as it is the lowest conceivable revenue outcome for the capacity value that the surplus energy can provide.

No Firm Energy Sales

As was discussed in Section V, during the NFAT, MH projected future firm sales from surplus dependable energy. In the GRA, all available energy (after meeting provincial load and existing contracts) was presumed to be sold in the MISO energy market as opportunity sales throughout the study period.

This is a conservative assumption, as it presumes that all surplus energy, including surplus dependable energy, will only receive energy revenues and will not receive any revenues for capacity or any other attributes (e.g., long term firm pricing, storage flexibility, clean energy, or price hedging). With respect to the energy sales, the value is based on MH's market energy price forecast. For all other attributes, the assumption of no value is clearly the lowest possible value.

As has been discussed in Section II, the MISO market is widely understood to be moving from a period of surplus to a period where considerable new capacity is needed. This is reflected in the capacity market price forecasts that MH received from each of its independent market price consultants. 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. Similarly, Section II describes areas where state policy in Minnesota is increasingly valuing resources with low greenhouse gas emissions. This means that none of the uncertainty surrounding MHs ability to make firm sales or obtain added value for other attributes of its power are included in this forecast.

No Assumed Replacements for Expiring Firm Sales

In the current forecast, as fixed contracts that MH currently has in place begin to expire (see Figure 31 in Section VI), there is no assumption that these contracts will be replaced. This means that all capacity under contract receives no revenue after the contract ends and all energy is only priced as non-firm. Given that the counterparties will need to replace those products it is extremely conservative to presume, as MH has, that no amount of the energy can be resold above the spot energy price and that the capacity will have a value of zero after the contracts expire.

Available Dependable Energy

The conservative nature of the previous assumptions is further highlighted by a review of MH's filing. In the "*2016/17 Resource Planning Assumptions & Analysis*" document (Tab 7.3), MH indicates that "*the need for new resources is driven by a sustained dependable energy shortfall beginning in 2038/39.*"[79] Table 1 of that same Appendix shows surplus dependable energy of roughly 1,000 GWh or more through 2036/37.

[79] GRA Submission, Appendix 7.3, pp. 12.

Figure 34 shows the forecast of exports split between opportunity sales and firm energy sales. [redacted] 5b, 5c [redacted] Furthermore, since there is already a large volume of opportunity sales in those hours, the SPLASH opportunity pricing blocks that have the best prices will be utilized in most SPLASH runs. This means that, in addition to only pricing the energy at spot market prices, it will largely be priced below the forecasted monthly prices.

[redacted] 5b, 5c

Figure 34: Annual Export derived from SPLASH Output

D. Uncertainty Analysis Observations

MH included an uncertainty analysis to illustrate MH's view on risk by analyzing three key drivers of uncertainty: water supply variability, interest rates, and export prices.[80] Daymark reviewed this analysis at a high level to understand the context that MH provided around the reference case results.

[80] GRA Submission, Tab 4, pp. 8.

Expected Value and Risk Assignment

Uncertainty analysis is generally designed to understand what the "expected value" outcome is. Expected Value is a predicted value of a variable, calculated as the sum of all possible values, each multiplied by the probability of its occurrence. As MH stated in their filing, *"The uncertainty analysis is a sophisticated analytical tool which evaluates the impacts of the variation of multiple planning variables in order to determine a range of possible financial outcomes for the utility. The uncertainty analysis presented below combines multiple risk factors which reveals a more extensive picture of the risks facing the Corporation."*[81] This analysis is intended to show the risk that MH faces relative to meeting its 25 percent goal as well as the risks that will be borne by customers if rates are increased.

This idea that uncertainty analysis shows risks for either the Company or the customer is an important one, because while some of the risks identified are completely exogenous, whether viewed from the perspective of MH or the customer, other risks are of the type that MH has some ability to control. In particular, as was discussed in Section VII.A., the risk associated with export pricing is not completely out of the control of MH with respect to the marketing of the surplus dependable energy to obtain capacity and other premium values. This has implications for determining an equitable assignment of risk to both parties.

Asymmetrical Risk

When reviewing the export revenue forecast, Daymark noted two risk components that are more likely to lead to higher revenues than to lower revenues.

First, with natural gas prices at historically low levels and without a formal market process for pricing carbon, there are more factors that could exert upward pressure on energy prices than downward. Second, with the assumption that there will be no future firm energy or capacity sales, there is no risk of a lower forecast for those values and some unexplored possibility of increased revenues.

This asymmetrical risk profile means that there is a greater weighting on forecasts above the reference case than on those below. This then leads to an expected value above the reference case. So even if the reference case was a true P50, there would be strong argument for a higher export revenue forecast as more appropriately sharing risk between the company and its customers.

[81] Ibid.

Impact on Financial Results

In addition to the question of risk profile, the potential impact of a high or low scenario on the financial results is not necessarily symmetrical. Daymark requested that MH run their uncertainty analysis step by step to show the impact of each key variable on the range of results. Figure 35 below shows the results of their analysis for the step involving Export Revenues[82]:

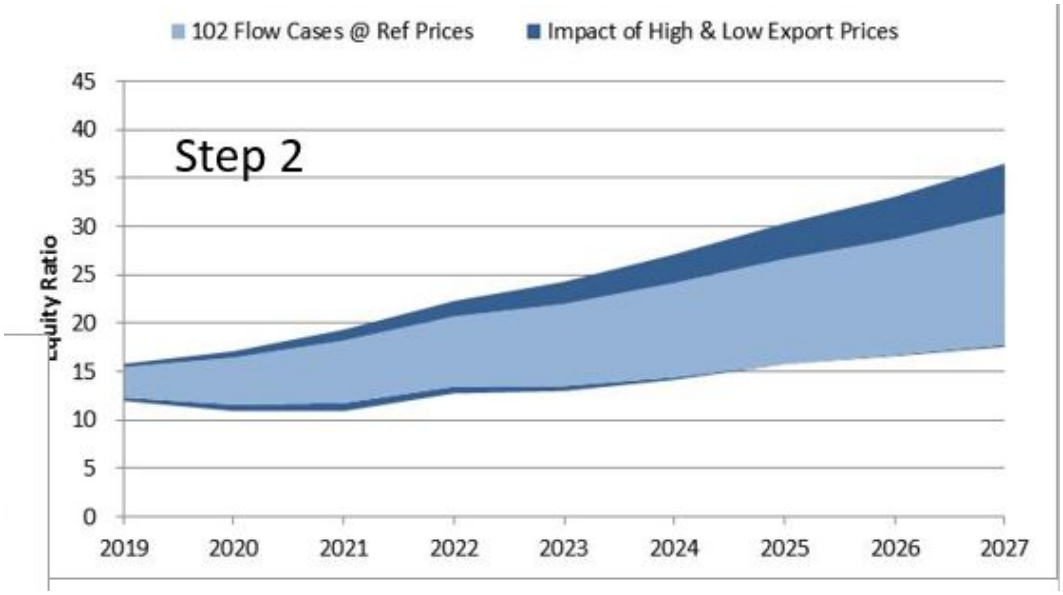


Figure 35: Isolated Impact on Equity Ratio for Hydrology & Export Revenues

In this graph, the light blue area represents the range of uncertainty around the forecast of hydrology. This was produced by accumulating the results of the 102 hydrology runs against the reference export price forecast and the reference interest rate. The dark blue color represents the additional uncertainty range produced by adding the high and low export price forecasts into the analysis, creating 306 total runs (102 hydrology runs against all 3 export price runs, all still with the reference interest rate). The results show that higher export prices have significantly more impact on the financial results than lower export prices.

[82] MH prepared confidential analysis, *Isolating impacts each comp uncertainty analysis - Tab 4*, provided via the MH confidential SharePoint site.

E. Summary of Findings

Based on our review of the export revenue forecasts for capacity and energy provided by MH, the Daymark IEC Team makes the following findings.

We have identified the follow components of the export revenue forecast that cause the forecast to be conservative/low relative to a value that is a P50 value:

- MH assumes that no revenue will be received for capacity or any other premium values from the substantial surplus dependable energy in the forecast.
- The energy market price forecast and the resultant energy revenues energy forecast is susceptible to be biased low.
- The uncertainty analysis that MH has conducted demonstrate the asymmetrical nature of the risk, with energy price risked skewed toward higher values, where the expected value of the forecast will be higher than the reference case value.

The components of the export revenue forecast that we reviewed and found to be reasonable include the forecast of surplus dependable energy and opportunity sale energy and MH forecast of revenues to be derived from existing firm contracts.

APPENDIX A

Daymark Energy Advisors

Scope of Work

DAYMARK ENERGY ADVISORS

Scope of Work

Export Pricing and Revenues Review

1. Review Manitoba Hydro's electricity export price forecast and third party consultant forecasts, including the low and high case forecasts, in the context of current MISO market conditions and factors influencing future MISO prices. The third party consultant forecasts are to be taken as a "given" and are to be assumed to be reasonable and accurate with respect to the other tasks in this Scope of Work. Notwithstanding that the third party consultant forecasts are to be accepted for the purposes of this review, if the IEC identifies significant issues or inconsistencies with the third party consultant forecasts in the course of its general review, those issues or inconsistencies are to be identified in the IEC's reports.

2. Review and assess Manitoba Hydro's forecast of exportable surplus energy and capacity by on-peak and off-peak period, taking into account expected inflow conditions, reservoir levels, and tie line capacities.

3. Review Manitoba Hydro's forecast for export revenues and fuel & power purchases for the next twenty years and assess whether the forecast of net extraprovincial revenue is reasonable. As an independent review of the extraprovincial revenues arising from contracted energy and capacity sales was undertaken at the 2014 NFAT (Exhibit LCA-5 in response to CSI Undertaking UT-34), a review of Manitoba Hydro's export contracts and estimation by the IEC of firm energy revenues and capacity revenues is not required for any contracts that were contemplated and assessed at the NFAT. Manitoba Hydro's updated export revenues, volumes, and unit prices by contract and by year will be provided as part of PUB MFR-84. The firm energy and capacity revenues in PUB MFR-84, for those contracts evaluated by the IEC at the NFAT, are to be taken as "given", so long as the firm energy and capacity revenues are aligned with the independent analysis from the NFAT after adjusting for changes in forecast exchange rates and escalation.

4. Assess the reasonableness of changes in Manitoba Hydro's forecasting methodology that eliminates the assumed premiums for surplus dependable energy and capacity sales.

5. Provide comments on the factors influencing the MISO market and trends that are affecting market prices, including but not limited to:

   (a) state and federal policies on electricity generation and emissions;

   (b) existing generation mix;

   (c) expected new generation to be installed in the next 20 years;

   (d) forecasted generation retirements in the next 20 years;

   (e) supply and demand balance in the northern MISO region; and

   (f) factors that may affect Manitoba Hydro's ability to export energy and capacity into the MISO market.

6. Provide a report to be placed on the public record that provides the Consultant's findings, opinions, and non-commercially sensitive supporting information.

7. Provide a non-public report to the PUB that provides commercially sensitive information and additional calculations supporting the findings.

Public and Commercially Sensitive Load Forecast Review

8. Review Manitoba Hydro's 2017 Load Forecast and assess the changes with respect to the 2014 Load Forecast.

9. Assess Manitoba Hydro's load forecasting methods for Residential, Mass Market, and Top Consumers segments and compare to industry best practices with respect to:

   (a) the econometric and end-use forecasting methodology;

   (b) the elasticity methodology used to evaluate how Manitoba Hydro evaluates the implications of rate increases and new technology on electricity demand.

   (c) Manitoba Hydro's economic assumptions including population growth, GDP growth, and price elasticity;

   (d) the reliability of the short and long-term domestic load forecast modelling;

(c) the extent to which Manitoba Hydro has used appropriate scenario planning to examine the potential impact of changes in the industry, the Manitoba and Canadian economies, available technology (generation and loads) and energy efficiency measures (costs and cost effectiveness);

(f) the appropriate use of probability analysis of projected load forecasts;

(g) the extent to which retrospective load analysis provides confidence in the load forecast;

(h) the reasonableness of peak demand and energy trends including seasonal variations in load forecasting; and

(i) impacts on load forecasts resulting from potential fuel switching, particularly in light of recent trends in the cost of natural gas and potential carbon taxes.

10. Assess other aspects of the load forecasting methodology including transmission and distribution losses.

11. Evaluate the historical performance of Manitoba Hydro's load forecasting methodologies for Residential, Mass Market, and Top Consumers segments.

12. Review the commercially sensitive load forecast for Top Consumers and assess the reasonableness of the forecasting methods and forecast.

13. Coordinate with other IECs who are reviewing price elasticity impacts on electricity demand in order to minimize duplication of analysis.

14. Provide a report to be placed on the public record that provides the Consultant's findings, opinions, and non-commercially sensitive supporting information.

15. Provide a non-public report to the PUB that provides commercially sensitive information and additional calculations supporting the findings.

APPENDIX B

Daymark Energy Advisors

Documents Relied Upon

Consistent with the agreement between Daymark Energy Advisors and the Manitoba Public Utilities Board, the following appendix provides a reference to the documents that were relied upon to develop this Independent Expert Consultant Report.

This appendix is organized into two sections. The first is a list of the documents relied upon that are already part of the record in this docket. The second is an annotated bibliography of additional documents relied upon that are not already part of the record in this docket.

Documents in the Record

Document Name:	Confidential or Non-Confidential:	
GRA Submission, Appendix 3.1, "*Integrated Financial Forecast (IFF16)*", April 2017.	Non-Confidential	
GRA Submission, Appendix 7.3, "*Manitoba Hydro 2016/17 Resource Planning Assumptions & Analysis,*" July 25, 2016.	Non-Confidential	
GRA Submission, Tab 4, "*Financial Targets and Uncertainty Analysis,*" May 12, 2017.	Non-Confidential	
Vintage of Consultant Forecasts for MH16 Update	Confidential	
PUB MFR 79 Updated - CONFIDENTIAL	Confidential	
1-b RAW [redacted] FORECAST EastLTTables052317CONF table 20	Confidential	3a
2017 Energy Price Forecast V3	Confidential	
2 [redacted] Performance Review - CHARTS CONF	Confidential	3a
2017 Energy Price Forecast V3	Confidential	
2015 EEPF Final	Confidential	
PUB MFR 79U-CONFIDENTIAL	Confidential	
2016 EEPF	Confidential	
Staff Report to the Secretary on Electricity Markets and Reliability	Confidential	
2017 Energy Price Forecast V3	Confidential	
PUB-MH II-37a-b	Confidential	
MH PUB 1.19a	Confidential	
PUB-MH II-37a-b	Confidential	
PUB-MH I-19d	Confidential	
COALITION-MH I-62a-e, PUB-MH I-19d	Confidential	
PUB-MH I-19d	Confidential	
MFR 84	Confidential	

Annotated Bibliography of Additional Documents

Document Name:	Confidential or Non-Confidential:
Manitoba Hydropower's website, accessed November 2017, available at: http://www.manitobahydropower.com/who-we-are.shtml	Non-Confidential
SNL Financial, an entity that provides electric-industry-specific market data obtained from public and private companies worldwide, http://www.snl.com/	Non-Confidential
NFAT Chapter 5, available at: http://www.pubmanitoba.ca/v1/nfat/pdf/hydro_application/nfat_business_case_chapter_05_the_manitoba_hydro_system_interconnection_and_export_markets.pdf	Non-Confidential
Federal Energy Regulatory Commission, "*Electric Power Markets: Midcontinent (MISO)*", accessed November 2017, available at: https://www.ferc.gov/market-oversight/mkt-electric/midwest.asp	Non-Confidential
MISO website, accessed November 2017, available at: https://www.misoenergy.org/AboutUs/Pages/FactSheet.aspx	Non-Confidential
MISO, "*MTEP16 MISO Transmission Expansion Plan*", Full Report 2016, available at: https://www.misoenergy.org/Library/Repository/Study/MTEP/MTEP16/MTEP16%20Full%20Report.pdf	Non-Confidential
Analysis Group, "*Electric System Reliability and EPA's Clean Power Plan: The Case of MISO*," June 8, 2015, available at: http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_clean_power_plan_miso_reliability.pdf	Non-Confidential
Wisconsin Public Utility Institute, "*Today's Trends, Tomorrow's Energy Needs*", slide 13; 2016 YTD is depicted as of March 2016.	Non-Confidential
Potomac Economics, Independent Market Monitor for MISO, "*2012 State of the Market Report for the MISO Electricity Markets*," June 2013.	Non-Confidential

Document Name:	Confidential or Non-Confidential:
Potomac Economics, Independent Market Monitor for the Midcontinent ISO, *"2016 State of the Market Report for the MISO Electricity Market, Analytic Appendix,"* June 2017, available at: https://www.misoenergy.org/Library/Repository/Report/IMM/2016%20State%20of%20the%20Market%20Analytical%20Appendix.pdf	Non-Confidential
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