2023/24 & 2024/25 Manitoba Hydro General Rate Application

Midgard Consulting Incorporated – Evidence For The Consumers Coalition

SUBMITTED BY
Midgard Consulting Incorporated

DATE
April 3, 2023

Midgard, established in 2009, provides consulting services across the electrical power and utility sector. Midgard's principals and staff have direct experience in project development, design, contract procurement, finance, construction, and operations. This combined experience has translated into mandates in project due diligence, lender's technical advisor, loan guarantee assessments, and Independent Engineer roles in Canada, the United States, and internationally. Midgard has worked for developers, utilities, government agencies, and both project lenders and equity providers.

Midgard's team has extensive experience modelling fuel sources, creating energy yield estimates, reviewing contracts, reviewing pro-formas, and assessing project risks from a construction, operations, and financial perspective.

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2 INTRODUCTION

2.1 Mandate

Midgard Consulting Incorporated (Midgard) has been retained by the Consumers Coalition to review and provide evidence on the 2023/24 & 2024/25 Manitoba Hydro ("MH" or "Hydro") General Rate Application ("GRA") before the Manitoba Public Utility Board ("PUB").

Midgard's mandate was to evaluate MH's Generation, Transmission and Distribution System Capital Investments and related plans in consideration of modern good utility practice in the areas of asset management, asset condition and health assessment, risk management, reliability performance, economic optimization and value to ratepayers.

2.2 Summary of Evidence

Manitoba Hydro is continuing a six-decade old strategy of over-investing in capital assets to serve export markets. This over-investment strategy is continuing despite major reductions in electricity growth rates and the availability of improved asset management practices aimed at economically sustaining MH's growing asset base. MH's strategy of overinvesting in its assets made sense in a pre-1985 world when electricity growth rates were high, but in today's mature electrical grid environment with markedly lower electricity growth rates and modern asset management tools, different corporate and asset management strategies are warranted.

MH's evidence demonstrates that its system is overbuilt with respect to meeting domestic needs. Moreover, MH is using its overbuilt system to support export activities and also to provide superior reliability to ratepayers as measured by SAIDI and SAIFI metrics[1] when compared to other Canadian utilities, superior reliability ratepayers do not clearly desire or wish to pay extra for.

MH is a mature electrical utility that has exited its early period of rapid growth and is now faced with shifting its focus to sustaining its asset base. Despite MH's claims that its aging assets are degrading substantially and threaten system reliability, its SAIDI and SAIFI metrics show that MH's system performance continues to be stable and superior to MH's Canadian utility peers.

MH is not unique among North American utilities – all are managing aging asset bases. As a result, modern asset management tools that have been widely adopted as best practice by other utilities are also appropriate for MH. Modern asset management tools will support the goal of economically managing and sustaining assets to the greatest benefit of ratepayers.

[1] SAIDI = System Average Interruption Duration Index, SAIFI = System Average Interruption Frequency Index. Excluding major events, so that the metrics report on the reliability factors that Hydro has the ability to directly influence through its asset management decision making (i.e., capital investments, and operations & maintenance resources).

Although MH began its asset management journey some time ago, MH's consultant AMCL finds that MH has only advanced its overall asset management maturity from 1.5 to 1.81 (i.e., still in the "Awareness" Category) since the 2016 General Rate Application. Of note is MH's weaknesses in the areas of Asset Management Decision Making, Asset Information and Risk & Review. Consequently, without good input data, tools and decision-making frameworks, MH's decision-making is impaired and does not adequately support its proposed investments or demonstrate they are appropriately prioritized.

As a result, Hydro continues to employ a top-down budget envelope approach to setting budgets that are not quantitatively connected to the assets MH is managing. MH demonstrates that it is unable to optimally or adequately prioritized its capital investment decisions, and therefore it cannot justify its implicitly subjectively determined Business Operations Capital ("BOC") investment plans. A BOC budget reduction of at least 10% is warranted until such time as MH can demonstrate its decision-making is based upon quality data, tools and decision-making frameworks.

In summary:

1) MH has overbuilt its electrical system and is using this overbuilt system to provide superior reliability to its ratepayers.
2) Ratepayers have not clearly indicated they want to pay for a superior reliability system.
3) MH's asset based is aging as expected and MH needs to increasingly transition to sustainment, rather than growth, activities.
4) MH is still beginning its asset management journey and lacks the data and associated tools to make fully informed budget prioritizations, especially regarding generation and transmission.
    a. On the distribution side there may be a need to increase sustainment expenditures, but MH has not provided evidence that demonstrates the appropriate trade-offs between capital and operations & maintenance have been made.
5) MH lacks the quality of data and decision-making frameworks necessary to support its proposed investments.
6) At least a 10% reduction in BOC capital budgets is warranted until such time as MH provides evidence that its asset decision-making is supported by quality asset management data, tools and decision-making frameworks.

2.3 Qualifications of Authors

Christopher Oakley and Peter Helland are Professional Engineers and founding principals of Midgard Consulting Incorporated. They have the relevant background, experience and expertise necessary to prepare the scope of evidence PILC has engaged them to deliver.

The Authors acknowledge their duty of independence in offering their professional opinions to the Public Utilities Board of Manitoba (PUB). Although retained by the Consumers Coalition to conduct an independent review of the GRA and present their findings to the PUB, the Authors are not advocates for PILC or any other party. The Authors are responsible for the entire content and all opinions set out in this evidence, which was prepared in accordance with their acknowledged duty of independence. If called to give oral or written testimony, the authors will offer testimony in conformity with their duty of independence.

Christopher Oakley, P.Eng.

Christopher Oakley has worked in the utility and energy business for 37 years since receiving his BSc in Electrical Engineering with a minor in Computer Engineering from the University of Calgary in 1986.

He was a founding principal of Midgard Consulting in 2009 and has been working with Midgard as an independent consultant for the past 14 years. His work with Midgard covers a broad range of utility and energy matters, from utility regulation and energy policy, to electric system planning, generation, transmission, distribution and communications project development, financing and operations.

Much of Mr. Oakley's current practice is focused on utility rate regulation, but he continues to provide consulting services on more technical matters, such as power system modeling, generation and T&D projects & operations, and powerline electrical effects.

His utility regulation areas of expertise include utility capital planning, asset management planning, resource planning, operating good practice, project development, project management and facilities siting. He regularly participates in revenue requirement proceedings, rate design and cost of service proceedings, resource plan reviews, and generation, transmission & distribution facility need and siting proceedings. His regulatory practice clients include regulators, utilities and customer groups.

Mr. Oakley regularly provides expert evidence and application review services to the British Columbia Residential Consumer Intervener Association (RCIA) in proceedings heard by the BC Utilities Commission (BCUC), including: BC Hydro's F23-F25 Revenue Requirement Application, 2022 RRA, 2021 Integrated Resource Plan, and numerous facility applications; FortisBC's Long Term Electric Resource Plan, 2021 & 2022 Rate Reviews; and Cost of Service, Revenue Requirement and Capital Project Applications filed by numerous regulated electricity and thermal energy services utilities.

Mr. Oakley has provided Transmission and Distribution System Development Plan, Asset Management Plan and Operational Expense review services to the Ontario Energy Board in more than 20 proceedings; he has provided Transmission project audit services to the Alberta Utilities Commission; and he provided capital project, asset management and risk management review services to the Manitoba Public Utilities Board in Manitoba Hydro's 2017/18 and 2018/19 General Rate Application (GRA). He has reviewed capital refurbishment and decommissioning applications and provided expert evidence for four (4) hydroelectric projects being reviewed by the Nova Scotia Utility and Review Board. He has provided capital budget guideline upgrade recommendations to the Newfoundland and Labrador Board of Commissioners of Public Utilities (NLPUB), and has reviewed multiple applications to construct, modify or decommission international transmission lines for the Canadian Energy Regulator (formerly the National Energy Board), including Manitoba Hydro's MMTP.

Mr. Oakley has provided services to multiple government agencies and government utilities. He has provided generation and transmission project deliverability and financial capability assessments to the Ontario Financing Authority ("OFA") for its Aboriginal Loan Guarantee program, and is presently providing support to both the OFA and the Ontario Ministry of Energy for the $2 billion Wataynikaneyap Transmission Project, which is the 13th of 15 projects Midgard has undertaken for the OFA. Mr. Oakley has provided resource development, transmission planning and reliability assessment services for the Yukon Energy Corporation and the Yukon Development Corporation. He participated in an Alberta Department of Energy project to assess the capacity of the aggregated Alberta distribution systems to uptake incremental distributed energy resources. He also helped prepare a system development plan for Northwest Territories Power Corporation, and did analysis for the Bonneville Power Administration of the US Department of Energy into the expected power system and hydrology consequences of terminating the Columbia River Treaty. He has provided generation resource planning services to SaskPower. He provided negotiation and technical support to Nisga'a Lisims Government (NLG) in negotiations with electric utilities and energy pipeline developers, and helped NLG develop its broadband communication utility, Lisims Communications. He is a member of the Surrey City Energy Expert Rate Review Panel, and helped prepare a Cost of Service review and update for the City of Vancouver's Neighbourhood Energy Utility.

His work for investor-owned utilities and independent power producers includes preparing the initial cost of service revenue requirement application for Ocean Falls Hydro (which included development of a hybrid pre-regulation and post-regulation depreciation schedule for existing and new assets). He helped prepare FortisBC's (FBC) 2011 Resource Plan and the BCUC Section 71 filing for the Waneta Expansion capacity purchase. He has provided acquisition due diligence, project development and EPA renewal negotiation support to independent power producers in BC, Alberta, Quebec, Washington State, Idaho, and California. He was co-owner responsible for hands-on operation and maintenance of the 10 MW McNair Creek Hydro plant on Howe Sound in coastal BC.

Mr. Oakley's last corporate role before co-founding Midgard was Vice President of Canadian Hydro Development with Brookfield Renewable Power. Prior to that he was Director of Engineering at SNC-Lavalin ATP, SNC's global T&D centre of excellence. Before that he held several roles with Aquila Networks Canada and its predecessors Utilicorp & West Kootenay Power, including Manager of Asset Deployment, Director of Power Supply and Generation (which included operation of 1000 MW of hydro plants on the Columbia, Kootenay and Pend Oreille Rivers, system control and dispatch) and Director of Revenue Management. Prior to that he was System Planning Manager at the Transmission Administrator of Alberta (predecessor of the Alberta Electric System Operator). Mr. Oakley spent the first 12 years of his professional career at TransAlta Utilities Corporation, where his roles included bulk system planning, transmission projects, substation projects, telecontrol, and inductive coordination.

Mr. Oakley has represented the Alberta Transmission Administrator, TransAlta Utilities and West Kootenay Power on the Western Electric Coordinating Council's (WECC) Planning Committee and Technical Studies Subcommittee and is co-author of the WECC's Off Nominal Frequency Load Shedding program. Mr. Oakley represented the WECC (2 Canadian Provinces, 14 US States and Baja California Norte Mexico) on the North American Electric Reliability Council (NERC) Reliability Assessment Subcommittee (RAS).

Mr. Oakley is Chair of the Board of Directors of the Traditional Learning Society of British Columbia, which oversees the 200 student Traditional Learning Academy campus and the 1,200 student TLA Online distance learning school.

Mr. Oakley is registered as a Professional Engineer in the Provinces of BC and Alberta.

Peter Helland, P.Eng.

Peter Helland is a co-founding Principal of Midgard Consulting Incorporated, has worked at Midgard for 14 years and was Midgard's CEO from its founding in 2009 until the end of 2020.

Mr. Helland received a Bachelor of Applied Science in Systems Engineering and Master of Applied Science from Simon Fraser University in 2005 and 2007 respectively, and a Master of Business Administration from the Sauder School of Business in 2005. In 2019 he received a certificate in asset management from NAMS Canada[2]

Mr. Helland's present professional practice primarily lies in the domains of engineering, regulatory and business consulting. He was the founding Director of the Residential Consumers Intervener Association (RCIA), an entity whose creation was initiated by the BC Utilities Commission to provide fair, transparent, and non-discriminatory representation of the interests of all residential utility consumers in the Province of BC in regulatory proceedings heard by the BCUC.

Mr. Helland's utility regulation areas of expertise include asset management, risk management, resource options planning, condition assessment, project development, project management and facilities siting. He regularly participates in revenue requirement proceedings, rate design and cost of service proceedings,

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[2] NAMS Canada is a subsidiary of the Institute of Public Works Engineering Australasia. NAMS Canada has a mandate to assist Canadian and North American local governments and public works entities to improve their public infrastructure assets management, and offers courses in various aspects of asset management.

resource plan reviews, and generation, transmission & distribution facility need and siting proceedings. His regulatory practice clients include regulators, utilities and customer groups.

As Director of RCIA Mr. Helland has been involved in numerous proceedings heard by the BC Utilities Commission (BCUC), including: BC Hydro's F23-F25 Revenue Requirement Application, 2022 RRA, 2021 Integrated Resource Plan, and numerous facility applications; FortisBC's Long Term Electric Resource Plan, 2021 & 2022 Rate Reviews; and Cost of Service, Revenue Requirement and Capital Project Applications filed by numerous other regulated electricity utilities.

Much of Mr. Helland's regulatory work prior to RCIA involved reviewing utility distribution system plans and transmission system plans for the Ontario Energy Board, with specific focus on asset management, condition assessment, capital spending and risk management. Mr. Helland was part of an audit team appointed by the Alberta Utilities Commission to review a major transmission project that went considerably over budget, and provided an expert report on the root causes of the spending overruns.

Mr. Helland provided a two-day seminar on asset management, risk and "Power Systems 101" for the Manitoba Public Utilities Board, and supported the Manitoba PUB in its review of Manitoba Hydro's 2017-19 GRA capital spending plans. Mr. Helland was also a lead author of an expert report commissioned by the Newfoundland and Labrador Public Utilities Board[3] (NLPUB) to review and recommended revisions to the capital budget approval guidelines utilized by the two major electrical utilities in that Province.

Mr. Helland has provided services to multiple government agencies and government utilities. He has provided generation project deliverability and financial capability assessments to the Ontario Financing Authority ("OFA") for its Aboriginal Loan Guarantee program, and is presently providing support to both the OFA and the Ontario Ministry of Energy for the $2 billion Wataynikaneyap Transmission Project, which is the 13th of 15 projects Midgard has undertaken for the OFA. Mr. Helland has provided resource development, transmission option planning, project siting and reliability assessment services for the Yukon Energy Corporation and the Yukon Development Corporation. Notably, he led the technical, economic and environmental evaluation for Yukon's "Next Generation Project" for the Yukon Development Corporation that was looking to site a major greenfield hydroelectric facility in Yukon. He also architected the Alberta Department of Energy project to assess the capacity of the aggregated Alberta distribution systems to uptake incremental distributed energy resources. He also helped prepare a system development plan for Northwest Territories Power Corporation, and supported an analysis for the Bonneville Power Administration of the US Department of Energy into the expected power system and hydrology consequences of terminating the Columbia River Treaty. He has provided generation resource planning and transmission system support

[3] Newfoundland and Labrador Board of Commissioners of Public Utilities

planning services to SaskPower. He provided negotiation and technical support to Nisga'a Lisims Government ("NLG") in negotiations with an electric utility.

His work for investor-owned utilities and independent power producers includes helping prepare the initial cost of service revenue requirement application for Ocean Falls Hydro that was accepted by the BCUC. He helped prepare FortisBC's (FBC) 2011 Resource Plan and BCUC Section 71 filing for the Waneta Expansion capacity purchase. He has provided acquisition due diligence and project development support to independent power producers in BC and Alberta. He was responsible for hands-on operation and maintenance of the 10 MW McNair Creek Hydro plant on Howe Sound in coastal BC.

Prior to Midgard, Mr. Helland worked at Oceanworks International, where he was the Senior Electrical Engineer and ultimately the Project Manager that delivered a first-in-class submarine rescue vehicle to the United States Navy for their nuclear submarine fleet and other NATO compatible submarines. During that time he gained exposure to asset management, engineering design, construction, operations, maintenance, process management, risk and risk management, failure modes and effects analysis, asset lifecycles, asset inspection, fleet sparing, and quality control and assurance systems.

Mr. Helland is a Professional Engineer registered in the Province of BC and Yukon Territory. Mr. Helland is the chair of the Investigative Committee for Engineers and Geoscientists of BC (EGBC) which is responsible for investigating professional practice and ethics violation complaints. Mr. Helland is also a trustee of the Vancouver Maritime Museum and past chair of the Board of Burnaby Family Life.

2.4 About Midgard Consulting Inc.

Midgard is a federally incorporated Canadian company with offices in British Columbia ("BC"). Midgard has been providing consulting services to the electrical power and utility industry since 2009. Midgard's work has an emphasis on strategic planning, regulatory & policy support, transmission and distribution, electricity generation engineering services (renewable and non-renewable), and energy market planning. Midgard's founding principals and senior staff have over 150 years of cumulative experience in the electric power and utility industry, and a broad spectrum of expertise and knowledge gained in numerous Canadian and international jurisdictions.

3 THE WORLD HAS CHANGED SINCE MANITOBA HYDRO'S FOUNDING

Manitoba Hydro's ("MH") stated corporate mission is to

> *"help all Manitobans efficiently navigate the evolving energy landscape, leveraging their clean energy advantage, while ensuring safe clean, reliable energy at the lowest possible cost"*.[4]

Manitoba Hydro's corporate mission appears on its face to be aligned with section 2(1) of *The Manitoba Hydro Act*, which references "*economy and efficiency*" in describing MH's activities:

> ***Purposes and objects of Act***
>
> *2(1) The purposes and objects of this Act are to provide for the continuance of a supply of power adequate for the needs of the province, and to engage in and to promote economy and efficiency in the development, generation, transmission, distribution, supply and end-use of power and, in addition are*
>
> > *(a) to provide and market products, services and expertise related to the development, generation, transmission, distribution, supply and end-use of power, within and outside the province; and*
> >
> > *(b) to market and supply power to persons outside the province on terms and conditions acceptable to the board.*

And section 39(1) of The Manitoba Hydro Act as it as it read on November 1, 2022, which references necessity in addressing the costs of maintaining the corporation's assets:

> ***Price of power sold by corporation***
>
> *39(1) The prices payable for power supplied by the corporation shall be such as to return to it in full the cost to the corporation, of supplying the power, including*
>
> > *(a) the necessary operating expenses of the corporation, including the cost of generating, purchasing, distributing, and supplying power and of operating, maintaining, repairing, and insuring the property and works of the corporation, and its costs of administration;*

Midgard identifies consistency between these statements and MH's apparent assertion that it must manage its assets in a way that offers ratepayers an acceptable level of reliability at lowest lifecycle cost without unnecessary subsidization of export activities by domestic ratepayers:

[4] Tab 07, Section 7.2.1, p. 16, l. 10-12.

> *Manitoba Hydro moved away from functional segments to a more integrated approach in which the Asset Management group is intended to optimize Manitoba Hydro's energy system across the entire asset management lifecycle to achieve the targeted levels of performance and risk at the lowest life cycle cost."*[5]

But unfortunately, MH does not appear to evaluate if exports are self-sustaining from the perspective of returning the full lifecycle cost of exports to ratepayers, but rather MH blends evaluations of both domestic load and export commitments together in its evaluation of marginal investments:

> *"Manitoba Hydro uses a single approach to the evaluation of generation investments, which recognizes the obligation to serve Manitoba load, and the value obtained from interaction with external markets (both exports and imports). Manitoba Hydro operates an integrated system in which all available generation resources are operated as required to meet Manitoba load while considering its market interactions on a least cost basis. For this reason, the incremental or marginal generation resulting from any single project is not individually allocated to serving domestic load or export and import market interactions.*
>
> *…*
>
> *Manitoba Hydro will require additional resources to reliably supply firm load, including the domestic load and firm export sales."*[6]

The significance of this "blending" is that MH cannot demonstrate it is not overinvesting in assets that are <u>not</u> fully paid for by exports although their stated "need" is driven by exports. Even though domestic ratepayers are solely responsible for the full lifecycle costs that are not offset by export revenues. As a result, although MH may state it is planning its system to minimize total net system costs, this does not mean that MH is minimizing domestic costs and rates over the full lifecycle because the full lifecycle costs are borne by domestic ratepayers but "need" is determined by a blended domestic and export "need":

> *"As a regulated utility Manitoba Hydro uses a least net cost approach to planning its system, with market interactions utilized to minimize total net system costs. The remainder of these net costs are used to form part of the revenue requirement utilized in domestic rate setting."*[7]

If exports were solely opportunistic or excess asset investment justified solely based on export forecasts, then MH would be providing "reliable energy at the lowest possible cost" to domestic ratepayers, but such evidence is not available from MH in this proceeding.

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[5] Hydro response to COALITION/MH II-119b

[6] Hydro response to COALITION/MH II-109d

[7] Hydro response to COALITION/MH II-103a

Moreover, when asked about separating investment decisions into those that were domestically driven and those that were export driven, MH responded that it continues a six-decade old strategy of over-investing in assets to serve export markets:

> *"The clear benefit of building hydro for domestic need while using markets external to the province to optimize the investments was recognized more than sixty years ago. The February 18, 1963 agreement between the Government of Canada represented by Walter Dinsdale Minister of Northern Affairs and the Government of Manitoba represented by Premier Duff Roblin, for the study of large hydro development on the lower Nelson River stated in the first paragraph "WHEREAS Manitoba has represented to Canada that the Nelson River has a power potential of in order of 4 million kilowatts of firm power, approximately 2 million kilowatts of which would be surplus to Manitoba's requirements for a considerable period and that, if any part of this potential is to be made available at economic rates in the near future, it must be developed for large markets outside Manitoba to take advantage of economies of scale in which long distance transmission of electric energy could play a vital role." [emphasis added]*
>
> *This cornerstone agreement paved the way for studies and hydroelectric development on the lower Nelson River. It also clearly articulated the key role in using markets outside of Manitoba for hydro development at economic rates. There has been sixty years of incremental investment decisions to get to where Manitoba Hydro is today."*[8]

Unfortunately, an asset management strategy that was prudent in the distant past is not necessarily prudent today and into the future for the following reasons:

1) Flattening Demand Growth Trajectory
2) Asset Demographics Reaching Middle Age
3) Middle Aged Assets <u>Need</u> Modern Asset Management
4) Modern Asset Management Strategies Exist
5) Ratepayers Need to Understand the Minimum System

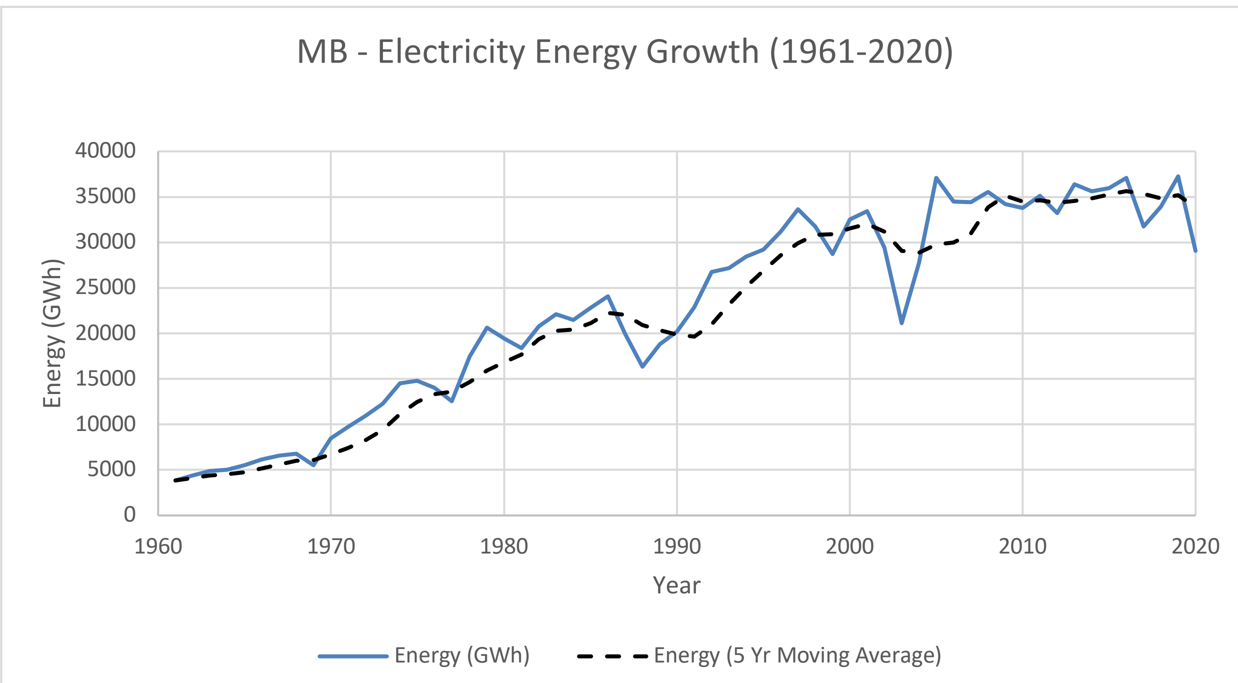
[8] COALITION/MH II-102b

4 FLATTENING DEMAND GROWTH TRAJECTORY

The “clear benefit” of building excess generation that was recognized by Manitobans more than sixty years ago was recognized during a time of massive electrical system growth. Electrical system growth rates that were more than an order of magnitude larger than recent Manitoban electrical energy growth rates over the past 20 years.

As shown in Figure 1, from 1961 to 2020, electrical growth in Manitoba increased at a rapid and sustained pace until the mid-1980’s when electrical energy growth experienced a major decline that appears to have recovered by the early 1990’s. Electrical energy from the early 1990’s to 2020 showed significantly reduced growth rates compared to the pre-1985 period with the growth from 2005 to 2020 being near zero[9]. Installed capacity (i.e., generation nameplate capacity) also follows a similar pattern as energy generation for the period from 1961 to 2020 without the major dips in growth in the late 1980s and early 2000s as shown in Figure 2.

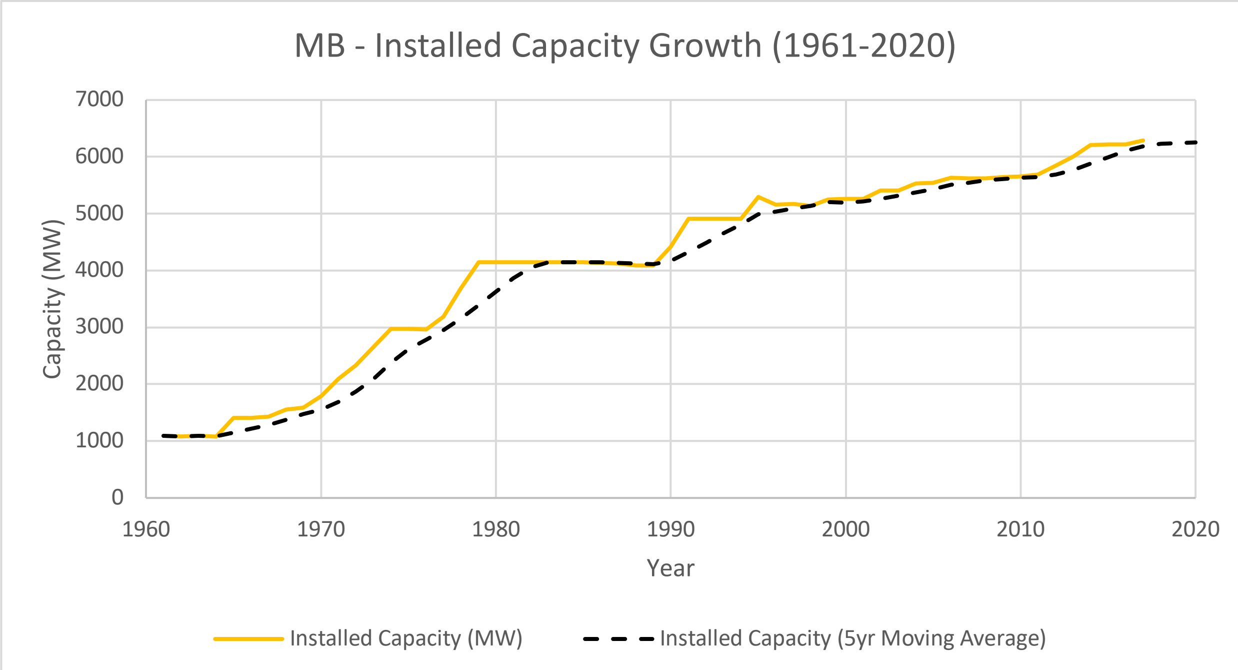
Figure 1: Manitoba – Energy Growth (1961 to 2020)[10]



[9] Although the electrical energy growth from 2005 to 2020 is significantly negative due to low energy in 2020, excluding 2020 shows that energy growth from 2005 to 2019 was near zero (37049 GWh in 2005 to 37524 GWh in 2019), a Compound Annual Growth Rate of only 0.04% (i.e. near zero).

[10] **Source:** Government of Canada, Statistics Canada, Energy Section, Electric power generation, transmission and distribution. Please refer to the attached .xlsx file for reference. *P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx.*

Figure 2: Manitoba – Installed Capacity Growth (1961 to 2020)[11]



As is evident from foregoing Figure 1 and Figure 2, there is a marked difference between the pre-1985 growth rates and post-2005 growth rates as further demonstrated in Table 1. From 1961 to 1985, the Compound Annual Growth Rate (CAGR) of energy generation was 7.69%. compared to the period from 1986 to 2019 where the energy CAGR was 1.33% and period from 2005 to 2019 which was only 0.04%[12].

Table 1: Manitoba – CAGR for Energy and Capacity[13][14]

Summary Data - Manitoba				
Period	Compound Annual Growth Rates		Average Annual Additions	
	Installed Capacity	Energy Generation	Installed Capacity	Energy Generation
MB - Early Years (1961-1985)	5.73%	7.69%	127 MW	789 GWh
MB – Modern Era (1986-2019)	1.36%	1.33%	69 MW	400 GWh
MB - Modern Era (1986-2020)	1.36%	0.56%	69 MW	148 GWh
MB - Recent 20 Years (2001-2020)	1.13%	-0.73%	61 MW	-170 GWh
MB – Recent 15 Years (2005-2019)	1.05%	0.04%	62 MW	15 GWh
MB - Recent 10 Years (2011-2020)	1.67%	-2.07%	99 MW	-671 GWh

[11] **Source:** Government of Canada, Statistics Canada, Energy Section, Electric power generation, transmission and distribution. Please refer to the attached .xlsx file for reference. *P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx.*

[12] Midgard has chosen to omit 2020 from the discussion to avoid accusations of "cherry picking" the end date due to Covid-19 impacts. However, Midgard does note that growth is near zero over the period from 2001 to 2020.

[13] **Source:** Government of Canada, Statistics Canada, Energy Section, Electric power generation, transmission and distribution. Please refer to the attached .xlsx file for reference. *P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx.*

[14] The Statistics Canada installed capacity data for 2018-2020 is absent. Therefore, capacities are actually reported up to the end of 2017.

As a result of the markedly different demand growth rates of MH's pre-1985 early years compared to more recent years of near zero growth, different asset investment strategies are warranted, otherwise ratepayers are exposed to significant stranded capital, or economically stranded capital, risks. Specifically, with today's reduced electrical growth rates that are a small fraction of the pre-1985 growth rates, today's overbuilt investments take much longer for to absorb as compared to historic overbuilding.

For example, if in the pre-1985 era MH overbuilt by 10% a project that was planned to be absorbed in 10 years, the overbuilt part of the investment would take only an additional 1.3 years to absorb[15]. However, based on recent electricity growth rates[16] a 10% investment overbuild today would take an additional 7.2 years to fully absorb, increasing the time needed to absorb the project by 70% beyond the originally planned period[17]. Consequently, since ratepayers must guarantee the revenue requirement to carry the investment regardless of its utilization ratio, the additional 70% time increase to fully absorb the project represents a material additional cost to ratepayers (i.e., an additional 25% cost in the first 20 years) [18].

Consequently, MH's strategy of overinvesting in assets made sense when electricity growth rates were high, but in today's mature electrical grid environment with low growth rates a different strategy is warranted when evaluating asset investments.

[15] At a CAGR of 7.69%

[16] At a CAGR of 1.33%

[17] Please refer to the attached .xlsx file for reference. P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx (Tab: Analysis)

[18] Please refer to the attached .xlsx file for reference. P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx (Tab: Analysis)

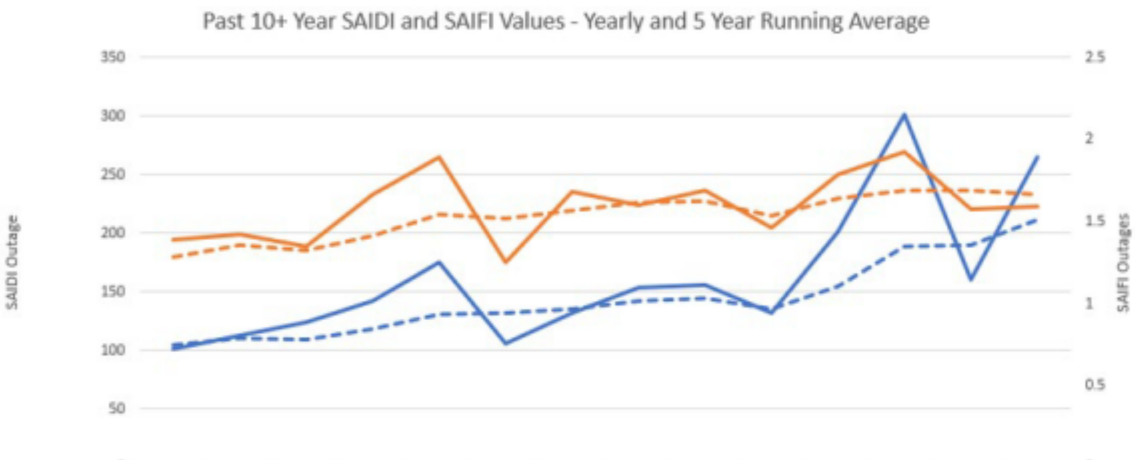
5 RELIABILITY PERFORMANCE OF MANITOBA'S ELECTRICAL SYSTEM IS SUPERIOR

The reliability performance of Manitoba Hydro's electrical system is superior compared to its Canadian utility peers. However, Manitoba Hydro has claimed in its application that its system performance is materially degrading:

> *"Manitoba Hydro electrical infrastructure assets are aging, and their condition is degrading. The overall performance of the asset portfolio has shown a declining trend in the last several years."* [19]

MH provides the following figure showing its System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) trends since FY9 to support its claims of deteriorating system performance:

Figure 3: Manitoba Hydro 5-Year Historic Average of SAIDI and SAIFI Values[20]



	FY9	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
SAIDI	101	113	124	142	175	106	132	154	156	132	201	301	160	265
SAIDI - 5YR	104	111	110	118	131	132	136	142	145	136	155	189	190	212
SAIFI	1.39	1.42	1.35	1.67	1.89	1.25	1.68	1.6	1.69	1.46	1.79	1.93	1.58	1.59
SAIFI - 5YR	1.28	1.35	1.33	1.41	1.54	1.52	1.57	1.62	1.62	1.54	1.64	1.69	1.69	1.67

SAIDI SAIDI - 5YR SAIFI SAIFI - 5YR

Unfortunately, the SAIDI/SAIFI values provided by MH include major events external to MH's control such as forest fires, ice storms, tornadoes, Godzilla[21], etc.[22]:

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[19] Tab 07, Section 7, p. 4, l. 1-3.

[20] Tab 07, Section 7.1.4, p. 15, Figure 7.8.

[21] "Godzilla" is Midgard's proxy for a range of potentially catastrophic but low probability system events, such as war, terrorism, "Carrington-class" solar flares, asteroids, earthquakes, and the like.

[22] Tab 07, Section 7.2.3, p. 22, Figure 7.10. SAIDI SAMP Results include major events such as Ice Storms and Forest Fires, which are beyond MH's ability to control – it can only react post-event to repair the ensuing destruction.

> *"Major event days were categorized as days with > 2,000,000 customer minutes of interruption with a common outage cause (excluding scheduled)."*[23]

The problem with including these external events is that as an asset manager, MH has negligible control or influence over these external events, and therefore should not be basing its investment decision making upon these external events. For example, if MH has a wood pole transmission line that a forest fire burns, the SAIDI/SAIFI impacts are not due to poor asset management nor asset condition because regardless of the asset condition the line would have burned and the act of burning was <u>independent</u> of the asset condition that MH manages:

> *"Manitoba Hydro confirms customer outage and restoration outcomes from forest fires are expected to be largely independent of asset condition."*[24]

As a result, MH should base its system reliability arguments on data that excludes external events outside MH's direct control. Consequently, when evaluating MH's system performance without external events, MH's system performance is markedly different than originally claimed. Specifically, MH's system performance is actually stable and materially better than its Canadian utility peers, as shown in Figure 4 and confirmed by MH:

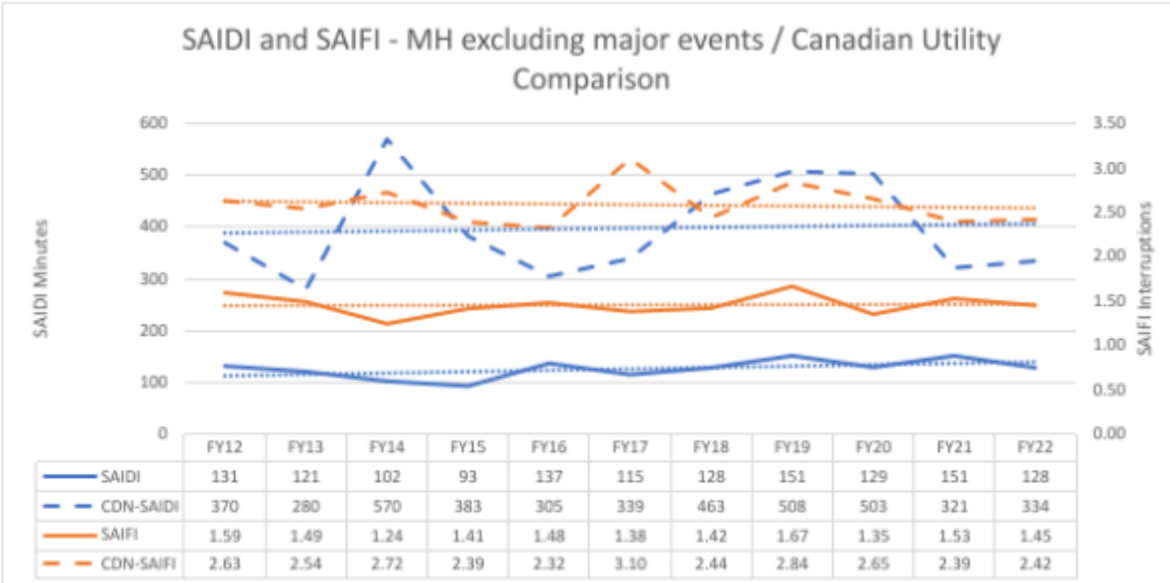
> *"Confirmed, excluding major event days, Manitoba Hydro's SAIDI and SAIFI performance is not materially trending either positively or negatively since 2012."*[25]

[23] Manitoba Hydro response to COALITION/MH I-92a

[24] Manitoba Hydro response to COALITION/MH II-77b

[25] Manitoba Hydro response to COALITION/MH II-77a

Figure 4: Manitoba Hydro – SAIDI & SAIFI, Excluding Major Events & Canadian Utility Comparison[26]



*The entire day was excluded for identified major event days

Based on Figure 4, MH's 11-year average SAIDI is 32% of its Canadian peers[27]. This is a major difference because it means that MH ratepayers experience approximately 1/3rd the average interruption duration when compared to ratepayers of MH's Canadian peers. Similarly (and only slightly less dramatically), MH's 11-year average SAIFI is 56% of its Canadian peers[28], which means that the frequency of outages experienced by MH ratepayers is just over half the frequency of outages experienced by ratepayers of its Canadian peers. Simply put, MH's system performance is markedly superior to that of its Canadian peers.

In summary, uncontrollable changes in system SAIDI and SAIFI results shown in Figure 3 are not a justification for increased asset investments because the SAIDI/SAIFI results under MH's direct control are stable as confirmed by MH and shown in Figure 4.

5.1 SAIDI/SAIFI As Investment Drivers

After removing uncontrollable external events, MH states that the three (3) primary causes for outages are equipment failure, tree contact and unknown causes:

"The top three primary outage causes account for 85% of the SAIDI value in 2022, which are:

- *42% due to Equipment Failure*
- *28% due to Tree Contact*

[26]Manitoba Hydro response to COALITION/MH I-92a-d, p. 3 of 4.

[27] . Please refer to the attached .xlsx file P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx (Tab: SAIDI SAIFI)

[28] . Please refer to the attached .xlsx file P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx (Tab: SAIDI SAIFI)

- *15% due to Unknown Causes."* [29]

Midgard will separately address each of these three (3) primary causes of outages as to their appropriateness to justify capital investments, and operations & maintenance budgets.

5.1.1 Unknown Causes

"Unknown Causes" are not a basis upon which asset investments can be justified in a regulatory proceeding, since a solution can't be determined for an unknown problem. Since "Unknown Causes" represent 15% of MH's outages, Midgard encourages MH to investigate these "Unknown Causes" and upgrade data collection and reporting to enable these events to be classified into known causes as evidence in future regulatory proceedings. Midgard acknowledges that determining actual outage causes and improving data collection reporting are subject to diminishing returns, so perfection is not expected. As MH states:

> *"Note that it is common industry knowledge that up to 70% of outages in the Canadian electric utility industry are transient, where no cause can be practically identified. This may include situations where a breaker trips and an automatic reclose is successful at restoring service. However, most of these types of transient events are under 1 minute in duration (momentary) and therefore not subject to reporting, while the events longer than 1 minute are reported and identified as 'unknown/other.' "* [30]

In Midgard's opinion, investments cannot be justified to mitigate "Unknown Causes" – MH must improve its data collection and reporting processes to better categorize these currently unknown events before proposing how to solve them.

5.1.2 Tree Contacts

In the context of asset management, which is concerned with both capital investments, and operations and maintenance ("O&M") budgets, tree contact is an operations and maintenance issue (i.e., O&M budget driver) rather than an asset condition management issue (i.e., capital investment driver). Specifically, trees contacting or falling onto transmission and/or distribution lines cause outages regardless of the asset condition of the lines and are therefore independent of asset conditions. Consequently, the appropriate level of vegetation management in and around transmission and distribution Rights of Way ("ROW") is a risk management issue pertaining to the management of trees, not the lines they grow to touch. Consequently, addressing vegetation growth in and around transmission and distribution Rights of Way ("ROW") is not a capital investment issue, it is an operational risk management issue.

Like any risk management issue, mitigating the risk associated with vegetation growth is subject to the law of diminishing returns – the marginal dollar spent managing vegetation will not be as cost effective as the first

[29] Manitoba Response to IR No. 2, COALITION/MH II-78a-c, p. 3-5 of 5.

[30] Manitoba Hydro response to COALITION/MH II-78c

dollar spent, so utilities need to demonstrate that their proposed level of vegetation management spending is cost effective at mitigating the associated risks. Vegetation management targets should not be expressed in terms of hectares cleared or trees harvested, because electric utilities are not forestry companies – the proper goal is not to maximize the tree harvest, it is to reduce operating risks to acceptable levels. Simply put, to a utility company a tree is not a tree, it is a risk; a risk that cannot be mitigated with capital investments in the at-risk utility assets located near the tree.

For clarity, Midgard encourages MH to set its vegetation management budgets so that the appropriate level of tree contact risk is mitigated per dollar spent, and that the selected level is commensurate with the risk mitigated per equivalent dollar spent on capital investments elsewhere in MH. For example, from a ratepayer perspective it would be imprudent to underspend on vegetation management and divert resources to capital investments if the marginal SAIDI and SAIFI benefits of increasing the vegetation management budget outweigh the marginal SAIDI and SAIFI benefits of increased capital investments.

Midgard has not reviewed evidence that MH balances its vegetation management operating budgets against capital investments made to improve reliability at the margin, and therefore cannot provide an opinion on the appropriateness of MH's vegetation management budget levels versus alternative capital investment budgets levels in terms of risk mitigated per dollar spent.

5.1.3 Equipment Failures

Since both Unknown Causes and Tree Contacts are not justifications for capital investments, the sole remaining primary cause of system outages justifying capital investments is equipment failure. Since MH has such superior performance when compared to its Canadian utility peers, it is challenging to accept MH's asserted confidence that its overall equipment failure rates are too high and that a blanket increase in asset renewal spending is the optimal approach to maintaining or improving ratepayer Service (reliability) outcomes.

Figure 5 and Figure 6 below show that:

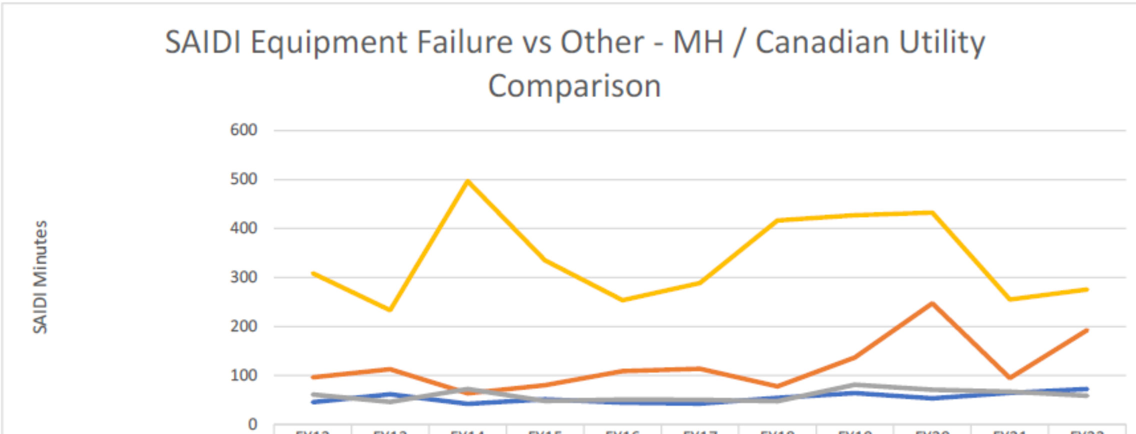
1) MH's Equipment Failure SAIDI and SAIFI performance is comparable to its Canadian peers,
2) Equipment failure is not the largest contributor to ratepayer outages.

Figure 5 shows that MH's 11-year average SAIDI due to equipment failures is slightly better (91%)[31] than that of its Canadian peers and Figure 6 shows that MH's 11-year average SAIFI due to equipment failures is slightly

[31] . Please refer to the attached .xlsx file: P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx (Tab: SAIDI SAIFI)

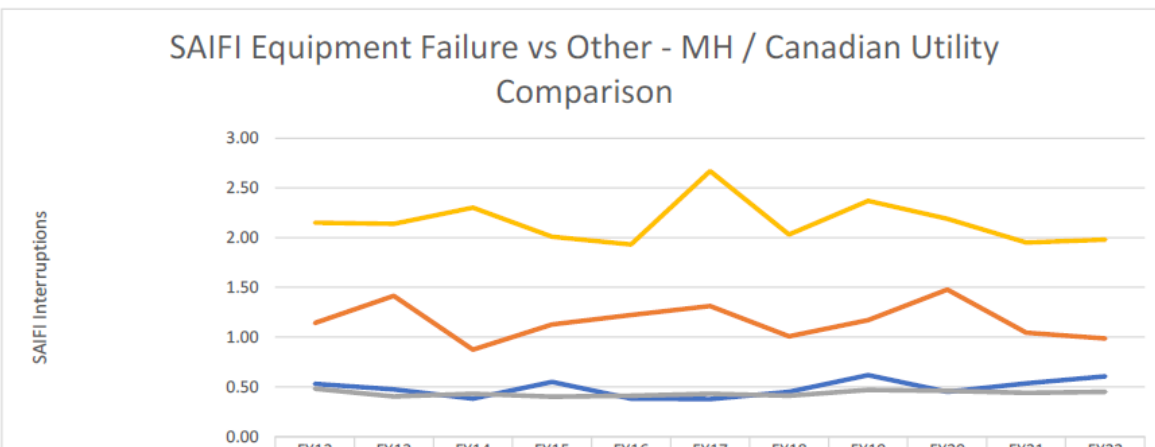
worse (112%)[32] than that of its Canadian utility peers. On balance, MH's overall equipment failure related reliability performance is comparable to that of its Canadian utility peers.

Figure 5: SAIDI Equipment Failure vs. Canadian Utility Peers[33]



	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
SAIDI - Equip Fail	46	62	42	51	45	43	54	64	53	65	72
SAIDI - excl Equip Fail	96	113	64	80	109	114	78	137	247	95	193
CDN-SAIDI-Equip Fail	61	46	73	48	51	50	47	81	71	67	59
CDN-SAIDI-excl Equip Fail	309	233	497	335	254	289	416	427	433	255	275

Figure 6: SAIFI Equipment Failure vs. Canadian Utility Peers[34]



	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
SAIFI Equip Fail	0.53	0.47	0.38	0.55	0.38	0.38	0.45	0.62	0.45	0.53	0.61
SAIFI - excl Equip Fail	1.14	1.41	0.87	1.13	1.22	1.31	1.01	1.17	1.48	1.05	0.99
CDN-SAIFI-Equip Fail	0.48	0.40	0.43	0.4	0.41	0.43	0.41	0.47	0.46	0.44	0.45
CDN-SAIFI-excl Equip Fail	2.15	2.14	2.30	2.01	1.93	2.67	2.03	2.37	2.19	1.95	1.98

[32] . Please refer to the attached .xlsx file: P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx (Tab: SAIDI SAIFI)

[33] Hydro response to COALITION/MH I-92 d-i

[34] Hydro response to COALITION/MH I-92 d-ii

Looking at distribution asset equipment failure rates in isolation, the associated potential for improving reliability performance does not by itself justify material increases in distribution sustaining spending, but the potential for improving reliability performance better justifies increased distribution sustaining spending than it does sustaining investments in generation and transmission assets, a relationship for which MH has provided no evidence in its application.

In response to Manitoba Industrial Power Users Group questions about the distribution system, MH states:

> *"Overall, an upwards trend in SAIDI and SAIFI driven by equipment failure has occurred from 2012 to 2022. When considered with the asset renewal rates shown in Appendix 7.5, Manitoba Hydro is confident that aging assets are resulting in increased failures that are resulting in an upwards trend in SAIDI and SAIFI over the past decade.*
>
> *Manitoba Hydro recognizes that response time to distribution outages is a driver for the SAIDI index. However, reducing the frequency of outages will also improve SAIDI. If the outage doesn't occur, it isn't captured in the index. Manitoba Hydro also recognizes that improving asset performance through increasing asset renewal and maintenance is the most direct way to improve the SAIFI index."*[35]

Consistent with findings in other Canadian jurisdictions, Midgard accepts MH's claim that distribution outage response time is a key SAIDI driver and improving its average response time is potentially a lower cost way to improve SAIDI rather than investing in comparatively expensive distribution assets. In fact, this appears to be the strategy that MH currently employs, because with the appropriate operations resources MH can restore service within a short period of time after a piece of low consequence equipment fails:

> *"When comparing the number of outages to SAIDI and SAIFI, it is important to consider the duration of outages (customer minutes) and the number of customers that an outage impacts (customer interruptions). Neither customer minutes or number of customers show a proportional increase with number of outages, suggesting that outages due to equipment failure typically impact customers for a shorter duration and fewer customers. For example, a blown fuse associated with an overhead transformer is an equipment failure outage that often impacts one customer, and which is restored typically within a day."* [36]

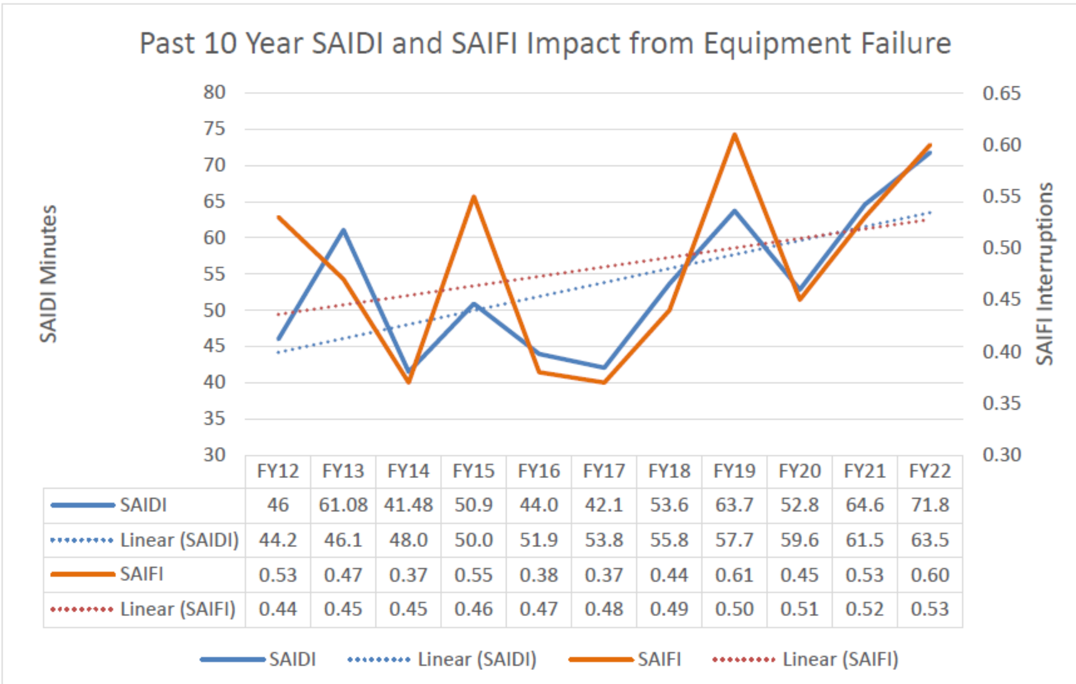
However, when it comes to improving the <u>overall</u> SAIFI, MH blends together maintenance activities (e.g., vegetation management which is a key overall SAIFI driver) and capital investments (i.e., asset renewal, which addresses probability of equipment failure). In support of its argument that it must increase

[35] Hydro response to MIPUG/MH I-75-d

[36] Manitoba response to COALITION/MH II-77a-b

investment in both distribution O&M spending and capital investment, MH provides the following figure to support its claims that it is experiencing an increasing trend of equipment failure:

Figure 7: 10 Year SAIDI and SAIFI Impact from Equipment Failure



[37]

Although Midgard does not dispute that graphical upward trends are shown in the above figure, Midgard questions the materiality of those trends in the context of MH's overall SAIDI and SAIFI trends, which are not increasing. As discussed previously MH acknowledges that improving response time to distribution outages is a key driver for improving SAIDI, and that overall SAIDI and SAIFI trends are stable. Therefore, Midgard recommends that MH select improving the response time to distribution outages as its preferred strategy rather than using SAIDI arguments to justify incremental capital investments to solve a service reliability problem that does not exist from a ratepayer perspective.

Additionally, the claimed equipment failure trend shown in Figure 7 needs to be weighed for materiality (discussed immediately below), and the "upward" trend in SAIFI must be considered in the context of MH being a mature electrical utility with a mature asset portfolio, which will be discussed in the next section.

In terms of materiality the "upward" trend in SAIFI from slightly less than 0.45 interruptions/year in FY12 to approximately 0.52 interruptions/year in FY22 represents less than 0.01 interruptions/year change, or 1 interruption per year change over a century. Moreover, this change of less than 0.01 interruptions/year should not be viewed in the context of equipment failures, but in the larger context of overall SAIFI values,

[37] Manitoba Hydro response to MIPUG/MH I-75d

since customers experience and perceive overall SAIFI, not sub-component SAIFI. As shown in Figure 4, MH's F22 overall SAIFI was 1.46 – a change of 0.01 interruptions/year is trivial in comparison to the natural variability of SAIFI from year to year, which has a standard deviation of 0.12 interruptions/year[38], and it isn't clear why customers should be required to pay higher rates to mitigate an imperceptible performance change.

In summary, although the equipment failure trend is graphically observable in isolation, when viewed in the larger context of the overall SAIDI/SAIFI performance that ratepayers actually experience, the equipment failure trend is not material in the context of MH's stable overall SAIDI/SAIFI trend.

[38] Please refer to the attached .xlsx file for reference. P0649-D012-MDL-R00-EXT - Midgard Evidence - Calculation Workbook.xlsx (Tab: SAIDI SAIFI)

6 ASSET DEMOGRAPHICS REACHING MIDDLE AGE

As Manitoba Hydro has transitioned from a rapidly growing utility in the middle of the 20th century to a mature and slower-growing utility with an aging asset base in the third millennium, it is beginning to shift the focus of its capital investments from growth to sustainment:

> *"Manitoba Hydro is committed to continually improving its asset management system to ensure sustainability of the electrical system and maximize the value provided to customers."* [39]

As a result, Manitoba Hydro is finding it necessary to increase sustainment expenditures as a proportion of its total capital investments:

> *"Many key asset populations will require significant capital intervention (i.e., overhauls or replacement, hereafter referred to as "interventions") in the next ten to twenty years in order to avoid accelerated system performance degradation and diminished supply. These increased efforts will continue into the foreseeable future to sustain an ever-growing and continuously degrading asset base."* [40]

However, MH is not facing an unexpected or unique situation with an aging asset base, nor is a "continuously degrading asset base" a surprise. In fact, the asset base has been continuously degrading since it was installed because that is what the passage of time does to assets. As a result, the fact that MH's asset demographics are aging and have always been aging does not justify an asset replacement strategy. Instead, Manitoba Hydro, like all other mature North American utilities, needs to better manage the trade-off between investing in its fully or mostly depreciated existing asset base versus replacing it with new assets. As a consequence, transitioning from a "high growth build it and we will quickly growth into it strategy" (e.g., MH's pre-1985 strategy) to an asset sustainment and optimization strategy (i.e., a mature lower growth utility strategy) is a major driver for the North American continent-wide transition to modern asset management practices which focus on extracting more value from assets:

> *"Asset management enables an organization to realize value from assets in the achievement of its organizational objectives.*
>
> *…*
>
> *Asset Management supports the realization of value while balancing financial, environmental and social costs, risk, quality of service and performance related to assets."* [41]

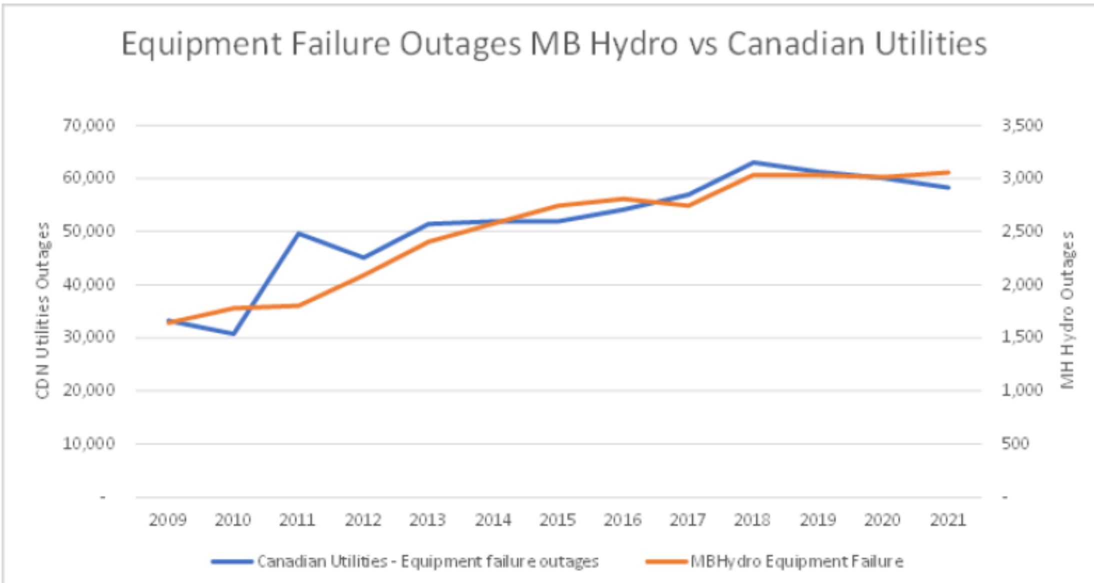
[39] Tab 07, Section 7.2, p. 16, l. 5-7.

[40] Tab 7, Section 7, p. 4, l. 5-9.

[41] **Source:** ISO 55000, *Asset management — Overview, principles and terminology*, Section 2.2, p. 1-2.

As discussed earlier, MH acknowledges that its overall SAIDI and SAIFI performance is stable, but claims that outages due to equipment failures have been trending higher since 2009, providing the following figure to support that claim:

Figure 8: Equipment Failure Outages 2009 to 2021



[42]

What Figure 8 also shows is that MH's equipment-related failure outage trend generally parallels the trends of its Canadian utility peers, which indicates that MH and its peers are experiencing a common failure driver, namely, Canadian utility infrastructure is aging. This factor causes increased rates of equipment failures and consequently drives increases in sustainment spending to renew or replace assets approaching the ends of their service lives, a common pattern experienced by all mature Canadian utilities that Midgard has reviewed over the past decade.

As a result, it is natural and expected that equipment failures will increase, both due to the increased count of assets that can fail (because most utilities grow rather than shrink their asset counts as they mature), and because older assets generally have a higher failure probability than do newly installed assets.

Utilities must decide if aging assets near the end of their service lives should be replaced or maintained in service as long as possible to provide the best value to ratepayers. In answer to this fundamental question MH recommends building new assets rather than continuing to extract low-cost value from its current assets by increasing its operational resources (e.g., reducing callout times, as discussed previously):

[42] Hydro response to COALITION/MH II-77a

> *"Note: At the historical rate of equipment failures, Manitoba Hydro operations staff can restore service within a short period of time and therefore, avoid significant impacts to SAIDI and SAIFI. However, the increasing trend suggests that additional demands to restore service will be placed on Manitoba Hydro's operations staff in the future, if assets are not renewed."*[43]

Midgard suggests that increasing operational staff resources to allow them to continue to address equipment failures in a timely manner remains the best near-term strategy for MH rather than replacing low cost (i.e., fully or mostly depreciated) assets with new un-depreciated assets.

In summary, MH should expect increased failures due to its aging asset demographics, but increased equipment failures alone do not justify replacing assets with low failure consequences, because better value may be provided to ratepayers by keeping aging assets in such classes in service longer by improving operational resource supports.

Moreover, given the cost consequences of overbuilding new (or replacement assets), and considering the aging asset demographics of a mature utility with lower growth rates, modern asset management tools are required to facilitate the sea-change from growth mode to sustainment mode, and consequently, modern asset management has been widely adopted globally as best practice for meeting these needs, as will be further discussed in the next section.

[43] Manitoba response to COALITION/MH II-77a-b

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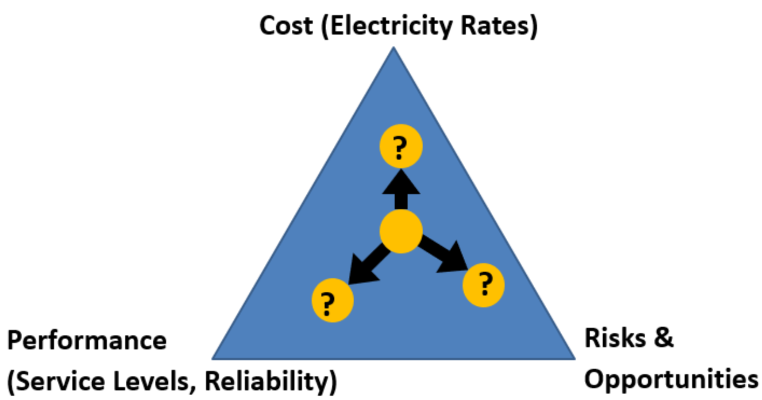
7 MIDDLE AGED ASSETS NEED MODERN ASSET MANAGEMENT

It is widely recognized that implementing a formal asset management process produces better quantified and less subjective inputs into capital investment and operational spending decisions and is considered best practice. For example, ISO 55000[44] is an international asset management standard that provides an overview of asset management, its principles and terminology, and the expected benefits of adopting asset management processes for assets of any kind. The ISO 55000 overview indicates that *"[e]ffective control and governance of assets by organizations is essential to realize value through managing risk and opportunity, in order to achieve the desired balance of cost, risk and performance"* [45], which mirrors the trade-offs the Manitoba PUB must consider between ratepayer cost, risk and system performance to reach decisions in the public interest.

Revenue requirement applications incorporate planned utility rate base additions as an important input to derive the utility revenue requirement. Since rate base additions affect the revenue requirement and consequently the rates paid by ratepayers, regulatory boards must make trade-offs between **ratepayer costs** (the proposed capital investments which will affect rates), **system performance** (the expected service quality and reliability impacts of the investments) and **risks** (the system, safety, environment and economic hazards and opportunities the investments address). This trade-off concept is illustrated in Figure 9.

Figure 9: Regulatory Trade-off Between Cost, Performance and Risk



The tension between the needs of ratepayers and utilities is recognized in the adversarial structure of typical Canadian regulatory processes. The regulatory board adjudicates applications in consideration of both the

[44] Midgard is not recommending a particular implementation or adoption of a specific asset management standard (i.e., ISO 55000) because it is beyond both the scope of this evidence, and it is best recommended by the utility to match the utility's unique circumstances. Rather reference to an asset management standard such as ISO 55000 is provided to structure the basis upon which regulatorily filed asset management data can be measured and evaluated.

[45] **Source:** International Standard, ISO 55000, *Asset Management – Overview Principles and Terminology*. First Ed., January 2014.

evidence provided by the utility applicants and the questions and counterpoint arguments submitted by interveners (who represent ratepayers or other interest groups).

What is more, modern asset management practices require both structural and cultural changes at utilities to be effective. MH has apparently started to make some of the senior level changes necessary to support development of a modern asset management program, but is lagging at making the operational level improvements and changes that must be implemented for its asset management program to become useful to effectively inform corporate capital investment decisions.

To assess the changes that MH has been making and needs to make to continue maturing its asset management program, Midgard will focus its discussion on the three documents listed below, in addition to the general evidentiary record and Midgard's experience in other Canadian jurisdictions. Two of the focus documents are drawn from MH's 2017/18 & 2018/19 General Rate Application, and the third was provided in the present General Rate Application:

1) Asset Management Gap Assessment, Report of Findings to Manitoba Hydro by UMS Group Inc. dated December 15, 2016 ("UMS Report")[46]
2) Manitoba Value Framework Implementation Document (VFID) by Copperleaf dated Nov 10, 2016 Version1.20s ("Copperleaf Report") [47]
3) Manitoba Hydro Asset Management Maturity Assessment, 39 Subject Maturity Assessment by AMCL+ dated October 24, 2022 ("AMCL Report")[48]

7.1 Manitoba Hydro Is (Still) Beginning Its Asset Management Journey

To begin its journey to mature its formal asset management processes as part of its 2017/18 & 2018/19 General Rate Application, MH contracted UMS Group Inc. to perform an asset management gap assessment which included an asset management maturity assessment.

> *"In 2016, the UMS Group Inc assessed Manitoba Hydro's asset management practices to compare them to industry best practices, as well as to international standards for asset management (PAS 55 and ISO 55000). That assessment was undertaken against a maturity scale defined by the Institute of Asset Management (IAM)."*[49]

[46] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, Appendix 5.1

[47] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, PUB MFR 107-Attachment 1

[48] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4

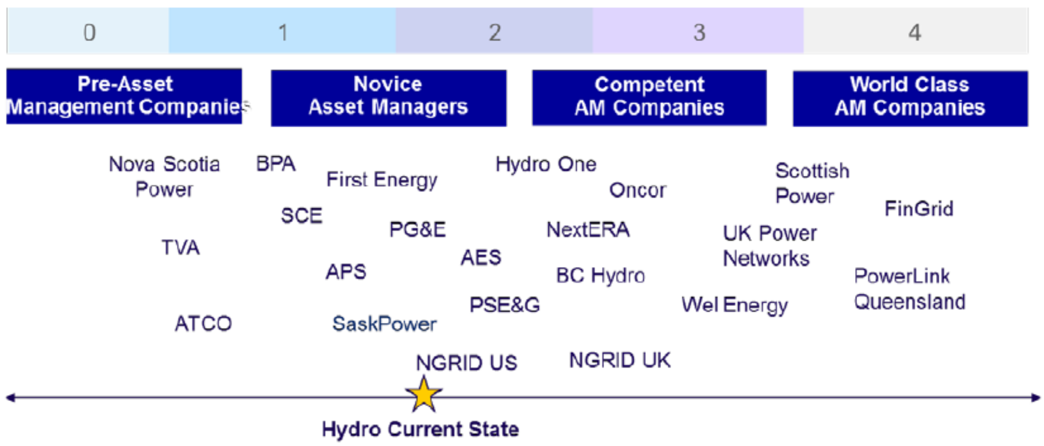
[49] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 3 of 184

The UMS Report found that MH had an overall score of 1.5 which corresponds to MH being in the "Awareness" category and moving towards the "Developing" category of asset management maturity[50].

> *"Overall, Hydro scored a 1.5 with the individual Business Unit Scores as follows: Generation Operations (GO) = 1.7, Transmission = 1.6, and Customer Service & Distribution (CS&D) = 1.3."*[51]

For context, this means that MH was an asset management laggard compared to its larger provincial Canadian utility peers such as BC Hydro, Hydro One, but similar to other provincial utilities such as SaskPower:

Figure 10: Manitoba Hydro Asset Management Maturity vs. Peers



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MH's position is not unusual in a broader North American context with its array of small and medium sized utilities because North American utilities are laggards compared to many of their global peers in terms of asset management maturity:

> *"Against the industry, Manitoba Hydro compares favorably versus North American utilities in terms of its Asset Management maturity level. However, North America lags global Asset Management best practice as embodied by utilities overseas who have been developing their capabilities for more than two decades."*[53]

In the present General Rate Application MH engaged AMCL+ to provide an updated asset management maturity assessment. The results of the asset management maturity assessment indicate that MH has been advancing its asset management maturity in select areas:

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[50] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 14 of 184

[51] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, Appendix 5.1, Page 6 of 48

[52] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, Appendix 5.1, Page 11 of 48

[53] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, Appendix 5.1, Page 6 of 48

"In 2022, Manitoba Hydro has engaged AMCL to assess the current maturity of Manitoba Hydro's asset management system. The key purpose of this assessment was to re-baseline Manitoba Hydro's asset management maturity following the organizational changes, but also to provide an additional level of insight into where good practice exists between the energy streams to support the development of a more targeted improvement plan. Manitoba Hydro also sought recommendations to reach an appropriate maturity level on the IAM maturity scale for subjects aligned to its strategic priorities, and those that will maximize benefits towards achieving their corporate goals.

The full scope of this engagement included four main components:

1. Assess maturity against the 39 subjects defined by the Global Forum on Maintenance & Asset Management (GFMAM) for asset management
2. Assess progress against 2016 assessment recommendations
3. Assess the expected maturity score on completion of the existing asset management objectives
4. Recommendations for areas of improvement"[54]

In the AMCL Report, AMCL finds that MH has advanced its overall maturity from 1.5 to 1.81 (i.e., still in the "Awareness" Category) and that advancement rate is not abnormal:

"Manitoba Hydro's overall Asset Management Maturity Score has increased from 1.5 to 1.81.

…

This assessment has shown that Manitoba Hydro has made good progress on its Asset Management journey and an Asset Management Maturity Score of 1.81 is consistent with peer organizations in North America who are on a similar journey."[55]

Although Midgard may not entirely agree with AMCL that MH is making "good" progress (MH is certainly not making <u>rapid</u> progress, considering that the Manitoba PUB has been issuing decisions and orders requiring MH to improve its asset management competence to better justify its capital investment plans and decisions since 2008[56]), Midgard acknowledges that overall progress is being made. Considering MH's score of 1.81 in context, a score of three (3.00) would indicate broad conformance with the ISO 55001 standard[57] that would be used to assess asset management maturity.

[54] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 3 of 184

[55] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 5 of 184

[56] See, for example, PUB Order 116/08 at p 101; Order 5/12 at 105; Order 73/15 at 68; Order 59/16 at 31; and Order 59/18 at 111-112.

[57] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 4 of 184

However, MH's progress is not uniform, and it is lagging in key areas (i.e., GFMAM Groups[58]) that are relevant to the Board decisions necessary as part of this General Rate Application:

Figure 11: Manitoba Hydro Asset Management Maturity Scores

GFMAM Groups		SCORE					
Group	Subject	Enterprise & Support Functions	EGen	ETx	EDx	GDx	Company Average (Weighted)
1	Asset Management Strategy & Planning	2.05					2.05
2	Asset Management Decision Making	1.79	1.83	2.25	1.75	2.22	1.83
3	Lifecycle Delivery Activities	2.03	2.02	1.89	2.34	2.14	2.09
4	Asset Information	1.32					1.32
5	Organisation & People Enablers	2.13					2.13
6	Risk & Review	1.42	2.00	3.00	2.00	3.00	1.45
	Average *(Weighted)*	1.75	1.98	2.00	2.20	2.17	1.81

[59]

Although MH appears to be achieving better scores at the high level GFMAM Groups such as Asset Management Strategy & Planning (Company Score = 2.05) and Organization & People Enablers (Company Score = 2.13), MH is lagging in the foundational GFMAM Groups. Specifically, MH is lagging in Asset Information (Company Score = 1.32), Risk & Review (Company Score = 1.45), and Asset Management Decision Making (Company Score 1.83).

To be direct, without good information (i.e., Asset Information) and tools to evaluate that information (i.e., Risk & Review, and Asset Management Decision Making), the quality of MH's investment decisions and trade-offs is seriously impaired because MH is still firmly in the "Awareness" stages in these key areas.

Midgard does not want to minimize the maturity advancements MH has made at the higher levels, as evidenced by evaluations such as:

> *"Manitoba Hydro has since undergone significant organizational restructuring to centralize its asset management functions. The Asset Management Division is within the Asset Planning & Delivery (AP&D) business unit. This newly formed division comprises approximately 100 staff who were brought together from separate operating groups, i.e. generation, transmission, and distribution, to a central asset management group, creating a centre of expertise."*[60]

However, MH still has a long way to go, both to develop adequate sources of information upon which to base its asset management decisions and to develop tools with which to use that information effectively. AMCL

[58] Global Forum on Maintenance & Asset Management (GFMAM)

[59] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 4 of 184

[60] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 3 of 184

also recognizes that significant hard work is required by MH to address areas of continuing deficiency before MH's overall assessed asset management maturity level will advance to "Developing":

> *"These objectives remain appropriate, and although some of them require significant effort to implement, Manitoba Hydro has credible plans in place to achieve them. Combined with the recent reorganization, Manitoba Hydro is well placed to further improve its asset management maturity as they embed a culture of continuous improvement, including identifying and adopting best practices."*[61]

Advancing towards best practices will mean addressing material deficiencies in MH's Asset Information, Risk & Review, and Asset Management Decision Making. These concerns are the focus of the following discussion because MH's deficiencies in these areas are directly relevant to the investment and budget decisions being sought in this General Rate Application. And these concerns are echoed in the AMCL Report:

> *Three specific areas that AMCL has highlighted as being interdependent in terms of maturity are asset information, risk and review, and asset management decision making. Effective asset management decision making is founded on a clear understanding of current asset performance and future operating risk, coupled with a consensus understanding of operating costs, failure costs, and the cost of asset repairs and renewals. A complete understanding of asset-related costs, risk and performance relies on adequate asset data.*
>
> *Therefore, Manitoba Hydro's ability to improve the score in Group 2: Asset Management Decision-Making is constrained by the current maturity of Group 4: Asset Information. However, it is impractical to attempt to mature these areas sequentially. AMCL has recommended three areas, outlined below, that must evolve in parallel. This includes defining the information needed to support incremental improvements in risk based decision-making, and developing the asset information strategy and improvement plan.*
>
> *Asset Information*
>
> - *Develop an asset information strategy that sets out the approach for defining future information needs and gaps and agree priority areas with the business.*
> - *Review, improve and implement data standards for assets and operational data that will support asset decision making.*
> - *Review and improve asset data assurance processes, data quality requirements to support decision making.*

[61] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 6 of 184

- *Review information systems' current capability and future requirements and develop an improvement plan.*

Risk & Review

- *Review current performance indicator monitoring and develop leading indicators that will drive asset decision making.*
- *Determine whether the current operating risk is stable, improving or deteriorating.*
- *Develop a resilience index that can be derived consistently across the asset base.*
- *Ensure the existing financial fixed asset register is maintained consistently with the physical asset register.*
- *Capture actual capital and operating costs with consistent yardsticks at sufficient granularity to develop capital and operational cost models.*

Asset Management Decision Making

- *Ensure there is sufficient detail to define how asset classes contribute to organizational objectives.*
- *Develop a standard format and structure for asset cost models.*
- *Review planned preventive maintenance schedules and align with resourcing strategy.*
- *Integrate operations and maintenance decision-making with capital decision-making."*[62]

Midgard agrees with AMCL that these are the three key areas most impairing MH's ability to further advance its asset management maturity. At the core of its findings, AMCL is saying (among other things) that MH needs to improve the quality of its asset data, it needs to ensure the collected asset data supports decisions that forward its asset management objectives, and its decisions must integrate capital and operations & maintenance considerations. To that end, the following discussion will focus on the three key identified areas.

7.2 Asset Management Decision Making

AMCL makes a perceptive set of observations regarding the limitations MH's asset management decision making and the incorporation of Copperleaf C55 into that decision making:

"• A risk-based needs evaluation process includes an asset needs database population and solution scope development phases. Solution options consider multiple scenarios and alternatives, which are then evaluated against the CVF and processed through C55. All capital projects and programs are

[62] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 7-8 of 184

validated through C55, but it is not clear how operational solutions and no-build scenarios are evaluated from an operating impact and future risk perspective.

• Given the extensive use of C55 and the CVF, aligning the CVF to current corporate objectives and Strategy 2040 is advised.

• C55 is not used to determine the top-down level of investment required to maintain current performance levels nor where it should be directed; this would be a valuable tool in achieving AM Objective# 7: Maintain A Historic Level of Asset Performance."[63]

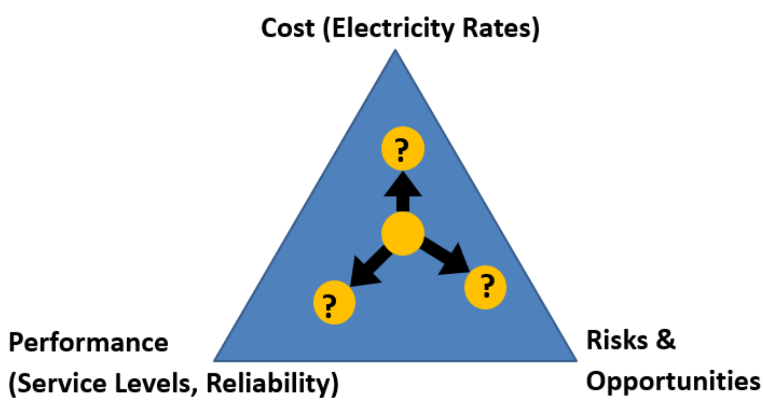
Based on these conclusions, Midgard understands that risk-based decision making requires better quality data inputs and decision-making processes that address multiple scenarios and alternatives. Decision making frameworks need to support the decision being made (e.g., Strategy 2040 and the delineation between domestic and export-driven investments). The existing tools and frameworks do not currently determine the investments and expenditures required to maintain system performance levels and evaluate the impact that changing investment levels would have on system performance and risks.

Based on these understandings the following are a series of identified areas where MH's asset management decision making should be improved.

7.2.1 Ratepayer Desires Actually Matter

As described previously, asset management decision-making involves trade-offs between Cost (Electricity Rates), Performance (Service Levels, Reliability) and Risks & Opportunities, as shown in the following figure:

Figure 12: Regulatory Trade-off Between Cost, Performance and Risk



Since there is not unlimited money available from ratepayers with which to fund Performance (Reliability), mitigate Risks and seek Opportunities, the desires of ratepayers play a central role in determining acceptable

[63] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 18 of 184

trade-offs. However, MH does not appear to genuinely or actively solicit ratepayer desires regarding the trade-offs that the Manitoba PUB is asked to adjudicate:

> *"The fourth concern with respect to Strategy 2040 for rate-setting purposes, is that there is a weak underpinning with respect to MH's interpretation with respect to customer preferences involving tradeoffs between reliability and lower rates.*
>
> *It is unclear how customer research and engagement as to customer preferences has influenced Strategy 2040 and the underlying spending priorities and costs. There are some passages in the Application that allude to these considerations, such as Section 3.3 of the Application, where MH states that:*
>
> > *"When establishing its projected rate path, Manitoba Hydro is guided by…priorities are informed by and reflect what Manitoba Hydro has heard directly from customers. Customer research and engagement indicates that although Manitobans continue to stress the importance of low Manitoba Hydro rates, when asked to weigh the importance of lower rates versus tradeoffs in reliability, customers have indicated that reliability of products and services is more important and must be balanced."*
>
> *While MH conceded that it did not undertake any direct engagement with customers specific to the rate increases sought in the Application, it did provide a 2019 Customer Perceptions Study and a 2022 Reputation Study.*
>
> *The key findings from the 2019 Customer Perceptions Study conducted by PRA Inc., can be summarized as follows:*
>
> - *When it comes to MH's priorities, Manitobans strongly favor keeping rates as low as possible over other aspects. Of concern is that MH received the lowest performance rating for keeping rates as low as possible;*
>
> *…*
>
> *To support its spending priorities in terms of reliability and customer service, MH appears to emphasize the portion of the 2019 Perceptions Study that it uses to interpret that customers have indicated that reliability of products and services is more important than lower rates. The questions that customers were asked with respect to these tradeoffs and the responses, are as follows :*
>
> - ***Q48: In your view, how to you think MH should address the number of customer power outages?*** *The mean response to this question was 5.28 on a scale of 1 to 10 where 0 was keeping power rates lower and 10 reducing the number of power outages even if it means higher rates; and*
> - ***Q49: In your view, how do you think MH should address the length of time customers are without power?*** *The mean response to this question was 5.55 on a scale of 1 to 10*

where 0 was keeping power rates lower and 10 reducing length of outages even if it means higher rates.

The concerns with respect to MH's interpretation of this customers survey is that they fail to consider the overall findings of the survey and they are based on leading questions. The perceptions and tracking surveys clearly demonstrate customers assess MH's overall service levels and reliability as high, with scores well in excess of 8 out of 10. In contrast, scores with respect to the price of electricity lags in the range of 6 out of 10.

The rates-reliability tradeoff questions appear to ignore these overall findings and specify that there is a problem in terms of number and duration of outages and then prompt respondents on what should be done about them. In this regard, the tradeoff questions appear to be leading, they don't provide the customer with an option that improved reliability is not needed and instead presuppose the need to address reliability. Even with the leading questions, the responses are balanced around the score of 5 and are not overwhelming supportive of additional spending to improve reliability. Caution should be exercised in the interpretation of such questions that there isn't a solution searching for a problem.

Therefore, there is a concern with respect to how much weight that MH should place in these survey findings.

More importantly, a few questions in a particular customer survey, would obviously not be sufficient business justification for the expenditures in the magnitude that would be necessary to significantly improve customer outages for MH."[64]

And when it comes to setting actual targets against which to evaluate MH's target system performance, MH does not intend to use ratepayer feedback at all until some future date:

"The current target is to maintain the levels of safety and reliability in the delivery of energy services to which Manitobans are accustomed, while minimizing costs. Future targets will be established in consultation with customers to establish the desired balance of level of service (i.e. performance & risk)and cost."[65]

MH simply uses average past performance as the most appropriate forward-looking target:

[64] Darren Rainkie, "Manitoba Hydro 2023/24 & 2024/25 General Rate Application Revenue Requirement Evidence" (3 April 2023) at section 3.6.

[65] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.2, Page 5 of 40

> *"SAIDI and SAIFI are industry accepted metrics used to assess distribution system reliability performance. The target SAIDI of <148 and target SAIFI of <1.59 are based on the average performance over the previous 5 years (2014-2018)"*[66]

> *"Confirmed, MH has regarded performance over the 5 years (2014-2018) as its "historical performance." In alignment with Manitoba Hydro's Strategic Asset Management Plan objective 7, which refers to maintaining historical performance, these performance targets were used to give context to the recent history of SAIDI and SAIFI performance."*[67]

As a result, the evidence indicates that MH is not basing its Performance (Reliability) targets on a customer-driven tradeoff, and it does not intend to use customer feedback to modify its reliability targets, but rather intends to continue basing its reliability target on a 5-year historic average of its superior performance relative to its Canadian utility peers. An example of good practice guidelines in respect of seeking customer preferences, based on academic literature review and implementation, can be found in evidence submitted in the recent BC Hydro 2021 Integrated Resource Plan as part of a survey performed by Innovative Research Group[68].

7.2.2 Capital Planning and Budgeting

Budget Control via Forced Ranking

Forced-ranking processes[69] are necessarily applied by all capital-constrained organizations with more potential projects than money to pay for them, which effectively means all organizations except those with unlimited budgets (i.e., fictional) or no spending plans.

In an organization with fully developed and functionally mature asset management and risk management processes, the entire portfolio of potential capital projects across all business groups can be ranked by unit value created (with value scores that integrate factors such as expected net income, reliability improvement, risk mitigation, etc.) per dollar spent, because an organization with mature asset and risk management processes can consistently assess and attribute value-creation across dissimilar projects. Note that an

[66] Manitoba Hydro response to COALITION/MH I-95a

[67] Manitoba Hydro response to COALITION/MH II-82

[68] BC Hydro 2021 Integrated Resource Plan, Exhibit C7-8, PDF 93 of 246, https://docs.bcuc.com/Documents/Proceedings/2023/DOC_69670_C7-8-RCIA-Written-Evidence-Midgard.pdf

[69] Forced-ranking is a screening process applied to abridge a superset of alternatives, items or expenditures within a maximum envelope. The envelope can limit (for example) the number of items (e.g., # of standby seats available on an airplane) or the total value of expenditures allowed to pass the screening step. Forced ranking as applied to capital spending portfolio decisions involves applying an overall spending limit (capital envelope) to a prioritized listing of potential capital expenditures. A running total of cumulative costs is summed for all projects in the list, and all expenditures with lower priority than the lowest priority project that fits within the envelope are rejected (or deferred to a subsequent spending period). See Enwin example in this section.

effective valuation methodology is able to consistently account for non-negotiable considerations such as legislated mandatory projects, or unacceptable safety or environmental risks.

Asset Management in MH Budgeting – Meaningful Decision Support?

MH's description of its capital budgeting process indicates that its Asset Management group recommends capital planning targets *"based on the already committed spend (i.e. projects in progress) and the known asset risks from the Corporate Value Framework ("CVF") evaluation of the potential investments."*[70] However, MH then notes that *"Investments related to Fleet, Corporate Facilities, Information Technology and Tools and Equipment, are recommended by the areas responsible for these investments"*[71], which means those potential investments are developed separately from the investments recommended by Asset Management, and presumably their values are determined using different parameters.

As discussed in other sections of this evidence, MH's Asset Management and Risk Management processes and data are presently not sufficiently mature to meaningfully support consistent risk assessments across diverse business groups, adequately prioritize dissimilar investments, or enable quantified value-based decision-making. It must therefore be surmised that the above-described processes result in a portfolio of projects with an inconsistent valuation basis and a cumulative cost larger than the available pool of capital funds, hence the need for negative portfolio adjustments:

> *"The "Other Projects, Programs & Portfolio Adjustments" line items, in the Capital Expenditure Plan provided in Appendix 7.7, do not include any specific projects or programs greater than $10M. The* ***portfolio adjustments*** *capture future anticipated capital expenditures related to business operations capital over the 20-year forecast period and also* ***balance the capital plan sum of all projects to high level targets set for capital spend in each year*** *(i.e. capital global budget or envelope as described in MIPUG/MH I-79 a)."*[72]

MH does not clarify exactly how the *"high-level targets"* the portfolio adjustments are intended to balance are determined, but they are clearly not the same *"capital planning targets"* set by the asset management group, since these portfolio adjustment line items are separate from the projects in the combined portfolios assembled separately by Asset Management and *"the areas responsible for"* the other investments.

In the next capital budgeting step,

> *"the recommended capital targets are evaluated* ***along with Manitoba Hydro's long term financial situation****. Senior management reviews and approves the targets and the capital expenditure plan*

[70] Manitoba Hydro response to MIPUG/MH I-79a

[71] Manitoba Hydro response to MIPUG/MH I-79a

[72] Manitoba Hydro response to COALITION/MH I-122m

> *proceeds through Manitoba Hydro's governance model, as described in Coalition/MH I-91 a, which includes approval by the Manitoba Hydro-Electric Board ("MHEB") and government."* [Emphasis added]

Presumably the overall capital spending targets are therefore determined in discussions between the senior management team, the MHEB and the Government. How the overall capital envelope is then allocated between projects in the Generation, Transmission & Distribution business groups is not clarified in evidence, but the implication is that the group that lobbies most effectively for its cause will be allocated the biggest envelope. The negative portfolio adjustment values are then established to balance the "too large" cumulative capital portfolio costs within the envelope set for each business group.

Since MH's Asset Management and Risk Management processes and data are presently not sufficiently mature to be fit for purpose to support consistent risk assessments across diverse business groups, adequately prioritize dissimilar investments, or enable quantified value-based decision-making, in the interim MH will necessarily continue to rely on top-down senior management decisions to determine the overall capital envelope and how it is allocated between the different business groups.

And absent consistently value-prioritized project lists, each business group will be unable to quantifiably determine which potential investments are above the marginal value/cost threshold within each year's budget envelope and which fall below and must be deferred to future years. So applying forced-ranking will not properly cull the lowest value per dollar spent projects, either within individual groups or across the company.

7.2.3 How Others do Asset Management and Capital Planning

The Ontario Energy Board and Asset Management

All Ontario regulated utilities are required by the Ontario Energy Board (OEB) to support any proposed test period capital spending in their incentive regulation re-basing applications by including (as appropriate) a Transmission System Plan[73] or a Distribution System Plan[74], either of which must incorporate an Asset Management Plan.

As discussed in the OEB Handbook for Utility Rate Applications:

> *"The OEB established a new framework for electricity distribution rate regulation in 2012. The Renewed Regulatory Framework for Electricity is a foundational policy: it articulates the OEB's goal*

[73] Ontario Energy Board, Filing Requirements For Electricity Transmission Applications, Chapter 2 – Revenue Requirement Applications, Exhibit 2 – Transmission System Plan

[74] Ontario Energy Board, Filing Requirements For Electricity Distribution Rate Applications – 2018 Edition for 2019 Rate Applications, Chapter 5 – Consolidated Distribution System Plan

> *for an **outcomes-based approach** to regulation **which aligns the interests of customers and utilities**. Key principles of the RRFE include the expectation for **continuous improvement**, **robust integrated planning and asset management** that **paces and prioritizes investments**, strong **incentives to enhance utility performance**, ongoing **monitoring of performance against targets**, and **customer engagement to ensure utility plans are informed by customer expectations**." [Emphasis Added]*

Although the OEB's asset management planning requirements are just a decade old and have evolved somewhat in practice, every Ontario utility, from the largest to the smallest, is expected to adhere to the prevailing filing guidelines. The OEB has demonstrated that it will order material reductions in allowed capital spending if utilities do not support their proposed projects and programs with appropriately robust, quantified asset management information.

Consequently, Ontario's utilities have had to rapidly up their asset management games.

ENWIN Utilities

Enwin Utilities is the distribution utility that serves the City of Windsor, Ontario. Although its asset management processes and capabilities are still maturing, Enwin has been utilizing its asset management systems to rank its proposed capital projects by value created and risk mitigated per dollar spent since at least its 2019 incentive regulation re-basing (revenue requirement) application[75].

As stated by Enwin in the referenced application:

> *"ENWIN began using the Kinectrics PROSORT tool for prioritization of investment across asset categories and investment portfolios based on ENWIN's business values and their attributes. Projects are ranked based on the ratio of the risks that are mitigated and the associated benefits resulting from the cost incurred. The tool provides a means of **evaluating the cost/benefit relationship of dissimilar projects** so that the **most cost-effective risk minimization for customers is prioritized for action**. It also serves as a **guideline for providing a consistent approach to decision making**, and for **optimizing the overall risk to the investment portfolio**. This analysis will be performed annually."[76] [Emphasis Added]*

Enwin further states:

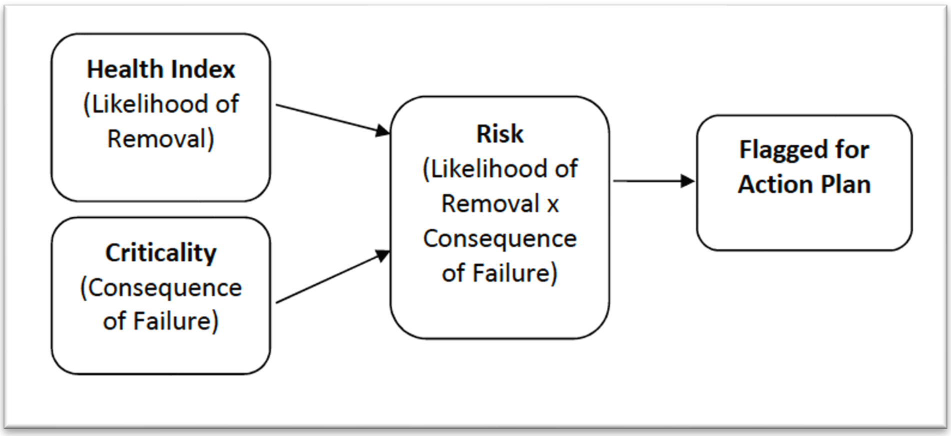
> *Reliability risk and consequence of asset failure are part of ENWIN's AMPRO and dealt with in project pacing and prioritization. **ENWIN analyses the risk of proposed projects in terms of their likelihood and consequence profile**. The **projects are prioritized by dividing the total cost of the project by the***

[75] Ontario Energy Board Proceeding EB-2019-0032

[76] EB-2019-0032 Exhibit 2: Rate Base, pdf.78

change in the risk score *which calculates the "Risk Reduction Factor". This is performed using PROSORT."*[77] *[Emphasis Added]*

Enwin provides the following figure to show how it combines the assessed condition of assets and their criticality into a risk score that is used to prioritize each sustaining project:



[78]

Enwin describes the steps it takes to populate its prioritized project table:

ENWIN calculates the "Total Risk Score" before a project is implemented, and a Total Risk Score after the project is completed to calculate the "Change in Risk Score".

Projects are prioritized and ranked by taking the total cost of the project and dividing it by the total Change in Risk Score, which equals the "Risk Reduction Factor". The project prioritization tool (PROSORT) includes a provision to add incremental benefits that impact the Total Risk Score if investments are prioritized for such projects. For example, projects that provide Health benefits such as adding more capacity to areas that are projected for future load growth, or projects that increase the overall reliability of the system, are captured by the tool. This approach ensures that investments are taking place for each category in the most effective manner."[79]

Enwin uses the following risk matrix to select and prioritize capital projects: [80]

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[77] EB-2019-0032 Exhibit 2: Rate Base, pdf.161

[78] [78] EB-2019-0032 Exhibit 2: Rate Base, pdf.230

[79] EB-2019-0032 Exhibit 2: Rate Base, pdf.230

[80] EB-2019-0032 Exhibit 2: Rate Base, pdf.277

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	Factor	Values	Categories	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
Consequence	0.3	Safety	Life/Health	Injuries not requiring medical attention	Minor injuries/First Aid	Serious Injury/Medical Aid/Hospitalization	Life Threatening Injury/Multiple serious injuries	Death/Multiple life threatening injuries
			Property Damage	Minor loss to utility property, <$5k	Loss to Customer/Utility property/claims for damages, $1k - $10k	Damage to buildings/vehicles requiring major repairs, $10k - $100k	Serious damage to buildings/vehicles - non-repairable, $100k - $1 million	Damage to multiple properties, >$1 million
	0.25	Financial	Customer Costs	Minor inconvenience, no claims	<$1,000	$1k - $100k	$100k - $1 million	>$1 million
			Utility Costs	Minor inconvenience	<$1,000	$1k - $100k	$100k - $1 million	>$1 million
			Fines/Penalties	Inquiries from Regulators	Audits from Regulators	Order for change from Regulators	Fines >$50k, $1k/day	Fines >$100k, $1k/day
			Legal/Insurance	No implications	Claims for Damages, settled by Insurance	Lawsuits likely to be settled, <$100k	Lawsuits likely to be defended in court, <$1 million	Lawsuits >$1 million, Insurance claim in excess of deductible
	0.25	Reliability	Customer Disruption	<10 Customers affected, Customers out <1hr	<500 Customers affected, majority of affected customers out < 1 hour, SED	1 feeder out, Majority of affected customers out 1-8 hours, MED	>1 feeder out, Majority of affected customers out 8-24 hours, MED	Station out for >8 hours, Majority of affected customers out >1 day, MED
	0.2	Sustainability	Environmental Damage	Minor clean-up required	MOE Notification required, clean-up required	Major cleanup required, cleanup last 1 day - 1 week	Major cleanup required, barricading/area restrictions,	Irreparable harm to environment, large fines, charges
			Non-Compliance	Reported to Regulators	Inquiries from Regulators	Audits from Regulators	Sanctions from Regulators	Threat or Loss of Distribution License, Severe Penalties Imposed
			Reputational Damage	Brief social media comments	Adverse reports on local papers, media	Adverse regional media reporting, loss of faith in ability to operate, loss of jobs	Adverse provincial media reporting, loss of senior staff jobs	Adverse provincial media reporting, sale of company
Likelihood	1	Expected to occur in the next 5 years	Almost Certain	9	25	68	184	500
	2	Will probably occur in the next 5 years	Likely	7	19	51	139	379
	3	Might occur in the next 5 years	Possible	5	13	34	93	253
	4	Doubtful to occur in the next 5 years	Unlikely	2	6	17	46	126
	5	May occur but only in exceptional circumstances	Rare	1	3	7	19	51

The ultimate output of Enwin's project prioritization process is shown in the following table, which was filed with its 2019 revenue requirement application:

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2020 Capital Investment by Priority List

Project Number	2020 Capital Investment Description	Capital Investment Category	Capital Investment $ '000	Capital Contribution $ '000	PROSORT Priority $/CRBF	Cumulative Investment $ '000
1	O/H Customer Connections	System Access	535	(165)	1	370
2	U/G Customer Connections	System Access	525	(335)	1	560
3	Bridge Plaza Relocation	System Access	1,000	(1,000)	1	560
4	Ambassador Bridge Twin Span	System Access	1,000	(1,000)	1	560
5	Road Widening Projects (City Driven Specifics)	System Access	1,090	(260)	1	1,390
6	Riverside Vista Project (City Driven Specifics)	System Access	1,150	(370)	1	2,170
7	Wholesale Metering: Keith TS Feeders	System Access	475	(120)	1	2,525
8	Meter work - new customers (enhancement)	System Access	415		1	2,940
9	Meter work - end of life (sustainment)	System Renewal	35		1	2,975
10	Meter Population Replacement / Upgrade (MIST Meters)	System Access	515		1	3,490
11	Reactive Replacement of Failed Equipment (U/G, O/H)	System Renewal	180		1	3,670
12	Reactive Replacement of Failed Cable	System Renewal	90		1	3,760
13	Reactive Replacement of Transformers	System Renewal	245		1	4,005
14	Reactive Pole Replacement	System Renewal	50		1	4,055
15	Reactive Pole Pulling	System Renewal	50		1	4,105
16	Reactive Hardware Replacement Program	System Renewal	100		1	4,205
17	Reactive Manhole/Vault Rehabilitation	System Renewal	20		1	4,225
18	Retest Smart Meters	System Renewal	145		1	4,370
19	Miscellaneous TS Equipment, EOL Replacement - Reactive	System Renewal	75		1	4,445
20	Weld / Meter Shop / Stores / Garage Misc Site - Reactive	General Plant	75		1	4,520
21	Pole Sustaining Program	System Renewal	3,300		155	7,820
22	Manhole Rebuild Program	System Renewal	150		685	7,970
23	Submersible Sustainment Program	System Renewal	690		790	8,660
24	O/H 3-Phase Transformer Sustainment	System Renewal	110		1,444	8,770
25	Removal of PMH-4 & PMH-Specials	System Renewal	25		1,634	8,795
26	UG PadMount Sustaining Program	System Renewal	255		1,737	9,050
27	Switching Unit Sustaining Program	System Renewal	300		2,206	9,350
28	Radial Branch Backups (23M2 - Single Phase)	System Renewal	35		2,271	9,385
29	Sectionalizing Load Break Switches	System Service	150		2,395	9,535
30	Feeder Tie	System Service	115		3,063	9,650
31	Automating Underground Switching Units	System Service	550		3,378	10,200
32	Green Energy Plan/Walker 2 Reactors - Transfer trip pilot	System Service	200		7,380	10,400
33	Radial Branch Backups (55M1)	System Service	125		7,886	10,525
34	Meter Tank Replacement	System Renewal	110		8,593	10,635
35	Underground Cable Sustainment (Sub Division)	System Renewal	510		9,910	11,145
36	Customer SU Vault Sustainment	System Renewal	400		13,245	11,545
37	Walker Road-Foster to Airport Rd	System Renewal	750		14,778	12,295
38	Conductor Upgrade (23M2 LPT1)	System Service	350		15,338	12,645
39	Vacuum Switch Replacements	System Renewal	200		16,216	12,845
40	CPP Switch Controller Replacements	System Renewal	100		16,216	12,945
41	Conductor Upgrade (55M21 LPT1)	System Service	180		20,013	13,125
42	SCADA Misc Sustaining	System Renewal	45		20,419	13,170
43	SCADA communications Equipment	System Service	150		20,419	13,320
45	Life Cycle Upgrades	General Plant	500		21,917	13,820
46	GIS Evolution and Integration	General Plant	210		26,333	14,030
47	SAP Evolution	General Plant	100		26,333	14,130
48	Network Infrastructure Update and Cyber Security	General Plant	100		26,333	14,230
49	Customer Relationship, Billing and IVR	General Plant	240		26,333	14,470
50	Strategic Enhancements and Tools	General Plant	230		26,333	14,700
51	Feeder Reliability Improvement Project - Prince to Brock	System Service	1,200		26,351	15,900
52	25M7 Feeder Ring Project	System Service	380		29,921	16,280
53	Site Rhodes	General Plant	1,520		30,089	17,800
54	Hydro Operations Vehicles	General Plant	1,280		76,794	19,080
55	Hydro Metering Vehicles	General Plant	95		76,794	19,175
56	Hydro Engineering Vehicles	General Plant	70		76,794	19,245
57	Site Rhodes Vehicles	General Plant	120		76,794	19,365
58	Mail Room Vehicles	General Plant	35		76,794	19,400
59	SCADA FCI's	System Service	70		84,948	19,470
60	Operations Tools	General Plant	85		84,948	19,555
61	Engineering Tools	General Plant	5		84,948	19,560
62	Meter Shop Tools	General Plant	5		84,948	19,565
63	Records Management System	General Plant	330		92,222	19,895
64	Feeder Balancing	System Service	50		100,000	19,945
65	Engineering Power Quality	System Service	5		100,000	19,950

[81]

[81] EB-2019-0032 Exhibit 2: Rate Base, pdf.375

Midgard has cited the Enwin case because it provides a simple, clear example of how using modern asset management and risk management processes enables more transparency of the value being added by proposed capital spending, and therefore provides a useful basis for discussion the merits of the capital investments proposed at the lower value margin between a utility, its regulator and interveners in rate applications. If the regulator and interveners have confidence in the utility's asset management and risk management processes, and if the utility can demonstrate that the marginal projects make sense in the proposed year, all parties should be able to agree that the overall proposed project portfolio should be approved.

Note that this project ranking methodology is useful when applying forced ranking due to capital constraints, because the least value-adding projects per unit of investment are found at the bottom of the list. This may be one reason many utilities are reluctant to use this approach in regulatory filings.

Note that by citing this example, Midgard is not endorsing the parameter weightings, risk ratings and prioritized project list submitted by Enwin in the referenced filing, but Enwin's quantified asset management-based approach to capital project ranking creates an opportunity for robust and transparent testing of Enwin's capital plans by the OEB and interveners.

7.2.4 Time Value of Money Matters to Customers

MH demonstrates in its IR responses that it lacks appreciation for the time value of money from a customer perspective. MH indicates it does not consider that capital project deferrals will provide any meaningful relief to customers, since the projects still need to be done some day:

> *"A deferral of capital expenditures would only temporarily reduce finance expense until the deferred expenditures are undertaken at a later date. Depending on the nature of the expenditure and the duration of the deferral, the consequences of the deferral could result in higher future capital expenditures and possibly higher finance expense."* [82]

Deferring projects can enable real dollar reductions in rates over the long term, especially considering the cumulative economic benefits that would accrue by deferring multiple low-urgency projects. Although the nominal dollar cost of the deferred project may increase due to inflationary pressures, customers allocate today's saved dollars to higher value objectives such as food, clothing, shelter, education, health care, leisure, financial investing, and/or future cost reductions (e.g., energy efficiency).

Despite MH's above stated apparent disregard for the time value of money, MH has a Weighted Average Cost of Capital ("WACC") of 5.75%[83]. This 5.75% WACC means that a dollar spent next year saves customers 5.75%

[82] Manitoba Hydro response to COALITION/MH I-20a

[83] Manitoba Hydro response to PUB/MH I-11

over a dollar spent today, and this benefit of deferred spending compounds each year. Since there is no evidence on record that MH expects inflation or its nominal dollar cost increases to consistently exceed 5.75% over the planning period (as the above MH quote appears to imply), deferring expenditures has real financial value to ratepayers. For example, deferring a fixed cost $1 Billion dollar investment by only one year is equivalent to reducing the cost to ratepayers today by $57.5 Million in terms of net present value.

MH demonstrates a similar lack of concern for the time value of money (exacerbated by aggressive assumptions about the average domestic customer's investment risk appetite), when it initiates large projects ahead of domestic customer need to capture at-risk export revenues with assets that it knows will be domestically unnecessary and/or underutilized when commissioned and for an extended period following commissioning. Customers carry substantial cost risk if revenues from generation and transmission projects developed early to capture at-risk export energy sales opportunities fail to meet revenue expectations for the first 5 or 10 years, even if the facilities ultimately prove to be beneficial over the longer term. Such a situation also introduces intergenerational inequity, as those who paid for the costliest front-end years (on a Net Present Value basis) are not necessarily those who will benefit most when the investment has been amortized.

7.2.5 System Versus Individual Asset Focus

In its Asset Management Policy, MH states:

> *"In managing our assets we aspire to: …*
>
> *3. Focus on the system rather than the individual asset."*[84]

And when asked to clarify its understanding of this statement in terms of the impact that the addition of assets that would then have redundancy MH responded:

> "… in general, the addition of redundancy to any element within a system will result in some reduction of system risk. At the asset level, the criticality of each asset part of that redundant set will be reduced as a failure of a redundant component will not affect the system."[85]

With the important statements being that as redundancy is added, the criticality of, ratepayer risks posed by, the now redundant assets is reduced because the "failure of a redundant component will not affect the system". This means that MH at some level recognizes two things:

1) As redundancy is added to the system, the importance of now redundant assets is reduced because there is no affect (or minor) effect on the system and ratepayers when a redundant asset fails.

[84] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.1, Page 1

[85] Manitoba Hydro response to COALITION/MH I-93a

2) Justifications for replacing assets must be made not at the asset level (i.e. the asset is in poor condition and therefore must be replaced), but at the system risk level (i.e. the risk the asset is posing to the system due to its degraded condition, which accounts for the condition of the other assets in the redundant part of the system).

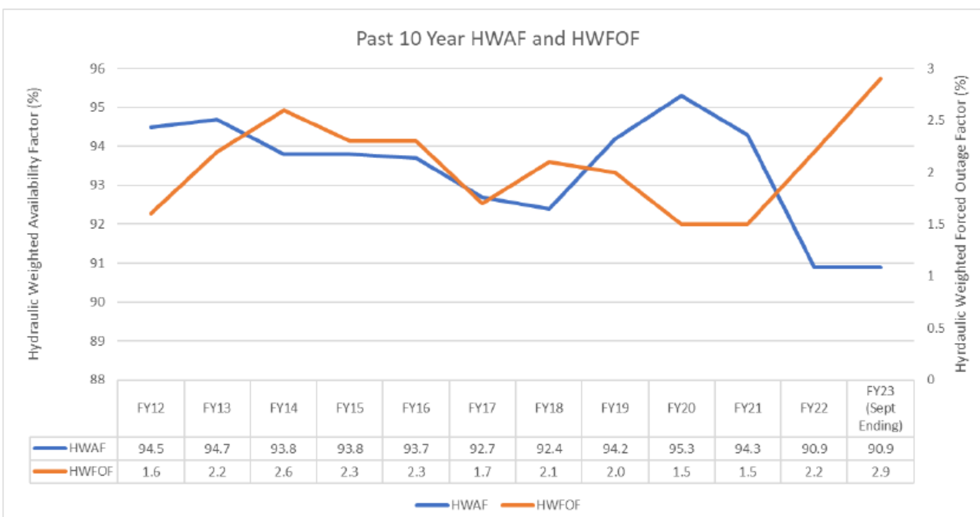
But despite this understanding MH then provides evidence to argue assets must be replaced because of their condition, not their effect on the system. This inconsistency in approach is shown in the discussion around generation equipment failures and Hydraulic Generation Weighted Availability and Forced Outage Factors.

Generation

In the evidence, MH argues that generation forced outages are increasing and therefore investments must be made to address degrading asset condition:

“Generation performance is showing gradual decline in Hydraulic Weighted Availability Factor (“HWAF”), though the year-to-year values have varied, as demonstrated by the blue trend line in Figure 7.1 below. …

Figure 7.1 Trend of Hydraulic Weighted Availability and Forced Outage Factors (%)



	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23 (Sept Ending)
HWAF	94.5	94.7	93.8	93.8	93.7	92.7	92.4	94.2	95.3	94.3	90.9	90.9
HWFOF	1.6	2.2	2.6	2.3	2.3	1.7	2.1	2.0	1.5	1.5	2.2	2.9

”[86]

“Typically, intervention drivers are the prevention of lost generation due to unit unavailability or opportunity with a hydraulic turbine intervention.

…

[86] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Tab 07, Page 6-7 of 51

Overall, Manitoba Hydro has seen the Hydraulic Generation Weighted Forced Outage Factor ("WFOF") increase and availability decline since Fiscal Year 2019/20 (See figures below). WFOF includes consideration of the amount of generation affected by an equipment forced outage.

…

The figures above show the relationship between aging assets and generation performance decline. The need to intervene on assets that exceed economic life in order to restore performance is apparent."[87]

And in response to queries about the system impact, rather than asset impact, of a forced generator outage, MH confirmed that there is typically no system impact:

"Confirmed. A single forced generator outage will not normally result in an outage to domestic customers due to the typical available generating capacity is greater than domestic load and imports are also possible."[88]

As a result, after reviewing the evidence there is an apparent contradiction between the asset management policy that declares MH will focus on system rather than individual assets, but then provides investment justifications based solely on individual assets rather than system impacts. Given this apparent contradiction, it is not at all clear that MH is following its own Asset Management policies.

For clarity, Midgard does not dispute the normal and expected process that as MH's generation assets age their performance degrades over time, as stated by MH:

"Age demographics of generator assets provide important insight into the effect of aging 1 assets on generation system performance. Since 2011, the generators which are currently 2 "beyond economic life" (27%) have demonstrated a lower availability factor (83%) and a 3 higher weighted forced outage factor (8.4%), compared to new or newly overhauled 4 generators that have a higher availability factor (93%) and much lower forced outage factor 5 (1.5%)."[89]

What Midgard questions is whether normal asset aging and associated performance degradation is having any meaningful impact upon the system and ratepayers as evidenced by stable overall SAIDI/SAIFI metrics (see Section 5) and the above confirmation that generation outages do not cause system outages. Consequently, evidence indicates that MH has sufficient surplus generation resources such that at least some, or all, of its generation assets can be permitted to degrade further before intervention is warranted

[87] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.5, Page 7-8 of 78

[88] Manitoba Hydro response to COALITION/MH I-96a

[89] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Tab 07, Page 9 of 51

from a ratepayer risk and system impact standpoint. What is more, MH staff are also of the opinion that surplus exists and is being used to successfully maintain service levels:

> *"There is a perception amongst interviewees that Hydro is currently making use of existing system redundancy spare capacity to maintain levels of service while awaiting investment. However, there is no corporate view of how much reserve/spare capacity is used across the province."*[90]

In summary, despite its asset management policy of focusing on system impacts rather than individual assets, MH continues to justify generation asset investments on an asset focused basis rather than a system focused basis. Moreover, the asset focus is continuing even though MH staff appear to understand at some intuitive level that surplus exists to support a successful strategy of utilizing already available surplus generation to maintain existing levels of service as generation asset condition naturally degrades.

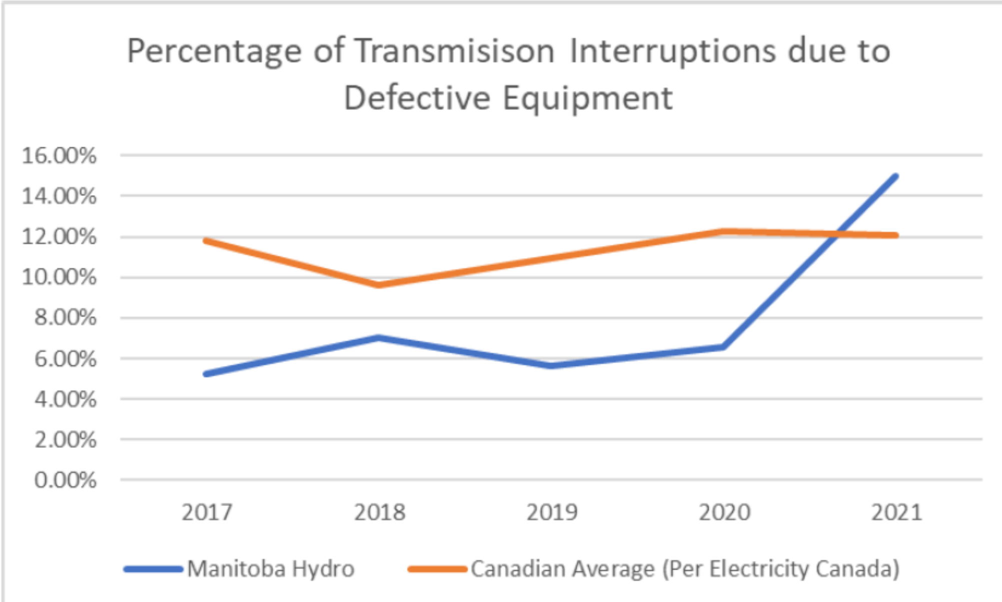
AC Transmission

The same pattern of investment justification on the basis of an asset focus rather than a system focus also appears to be present in AC transmission as well:

> *"Manitoba Hydro is observing a decline in the performance of its AC transmission system. 7 There has been a recent increase in the number of outages caused by defective equipment 8 on the transmission system, of which there are a variety of root causes, including age-9 related failures.*
>
> *…*

[90] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 23 of 184

Figure 7.3 Transmission Interruptions due to Equipment Failure



"[91]

However, although Transmission System Average Interruption Duration Index ("T-SAIDI") with major events which are outside MH's direct control is showing a negative trend, when MH describes their T-SAIDI and Transmission System Average Interruption Frequency Index ("T-SAIFI") without major events, MH states that T-SAIDI is "aligned with historic values" and T-SAIFI has shown a slight improvement in the last 10-years:

> *"Over the last decade, T-SAIDI [with major events] is showing a negative trend which indicates line outages are taking longer to restore than in previous years. This trend is influenced heavily by the significance of several major weather events that have occurred in recent years. Excluding these major events, such as significant wildfires and the October 2019 storm, results in T-SAIDI values for fiscal years 2019, 2020 and 2022 of 78.68, 42.75, and 100.48, respectively, which is more aligned with historic values. Due to such significant influence from uncontrollable weather events, arriving at conclusions regarding the impacts of asset degradation on this metric is difficult.*
>
> *Manitoba Hydro's T-SAIFI has shown slight improvement in the last 10 years."[92]*

But MH insists that despite a trend of improvements in T-SAIDI, increasing equipment failure rates is the issue to address:

[91] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Tab 07, Page 9-10 of 51

[92] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Tab 07, Page 11 of 51

> *"Despite the improvement in T-SAIFI overall, equipment failure is contributing negatively to the trend."*[93]

Consequently, MH again appears to be ignoring is asset management policy of focusing on the system rather than assets, and justifies investments solely on the basis of equipment failure rates despite improving AC Transmission performance. As a result, Midgard would recommend that any increases in AC transmission budgets be denied and budget get static because the current budget levels are leading to improving AC transmission performance.

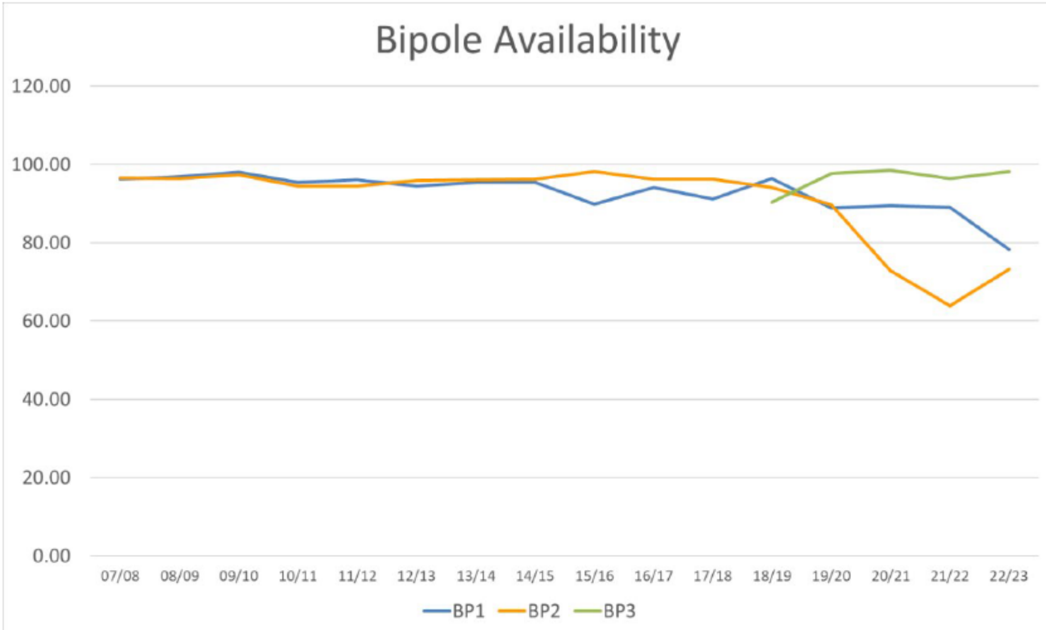
DC Transmission

The same pattern of investment justification for DC investments appears on its face to include both a system focus (albeit from an export market perspective, i.e., the "costs to Manitoba MH in lost revenue", rather than any domestic service reliability considerations) and an asset focus:

> *"The HVDC transmission system … consists of significant corporate investments in very specialized assets that enable transmission of power from generation stations in the Northern part of the province to the more populous Southern part of the province. As such, outages to the HVDC system can have significant costs to Manitoba Hydro in lost revenue and, in certain circumstances, can put the ability to provide power to all Manitobans in jeopardy.*
>
> *Trends in recent years have shown HVDC system reliability is declining significantly, as shown in Figure 7.6 below. The performance decline is attributed to the failure of aging assets, as well as the availability of compatible components and appropriate labour resources to perform maintenance and restoration.*
>
> *Even though the addition of Bipole III as a third, well-performing HVDC transmission line, has lessened the impact of outages to Bipole I and II, any outage event remains significant to system performance.*

[93] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Tab 07, Page 11 of 51

Figure 7.6 Reliability of HVDC System



"[94]

As shown in the figure above, Midgard acknowledges that Bipole II (and to a lesser extent Bipole I) have seen reductions in availability over the past few years, and Midgard does not dispute MH's assessment that its Bipole assets are aging. Similar to previous however, the operative question becomes determining whether Bipole availability reductions are actually causing system and ratepayer impacts that warrant the proposed investments. Based on a review of the available evidence consideration of this tradeoff is absent.

When queried about the Bipole transfer capacities, MH stated:

> *"Bipole full capacities are as follows:*
>
> - *BPI – 1854MW at the rectifier for temperatures above 30°C, the capacity is limited to 1669MW due to limitations of some converter transformers.*
> - *BPII – 2000MW at the rectifier*
> - *BPIII – 2000MW at the rectifier*
>
> *Collectively the total transmission capacity is approximately 4461MW for temp >28°C and 4818MW for temp <28°C, due to other ac system restrictions."*[95]

[94] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Tab 07, Page 12-14 of 51

[95] Manitoba Hydro response to COALITION/MH I-99a

And when queried about the customer load that was shed historically due to a Bipole failure the answer was none, but caveats were provided regarding the absence of Keeyask:

> *"MH has not shed customer load outside of curtailable load in the past 5 operating years due to an HVDC outage. Therefore, the answer to this question is none."*[96]

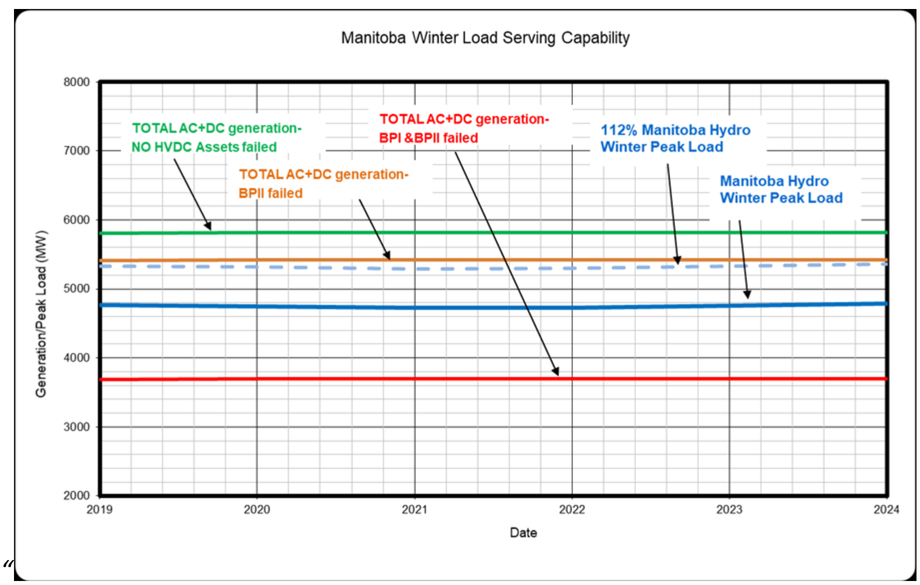
> *"The 5-year timeframe between 2018 and 2023 reflects a unique situation with Bipole III in service with Keeyask Generating Station not fully in commercial service. Future HVDC outage impacts are likely to differ significantly from the past five years as Keeyask Generating Station is coming into full service adding 630 MW of generation capability and thus more power is likely to be delivered through the HVDC system."* [97]

But in any case, MH correctly identifies the crux of the issue:

> *"Loss of domestic load serving ability depends on the load, the availability of the remaining ac generation and the availability of power for import in the MISO market."*[98]

And provides figure and explanatory text that shows with one Bipole failed (in this case Bipole II) all domestic load could be served, and <u>even with two Bipoles failed</u>, MH could still supply domestic load in most cases:

"



> *When more HVDC assets fail (ie. BPI&BPII failed) the total AC and DC generation curve could fall below the 112% Manitoba Winter Peak load. This shortfall would not necessarily result in load*

[96] Manitoba Hydro response to COALITION/MH I-99g

[97] Manitoba Hydro response to COALITION/MH I-99h

[98] Manitoba Hydro response to COALITION/MH I-99e

> *shedding in Manitoba, if the short fall is not excessive. However, in such conditions, Manitoba will not be assured of being self-sufficient in meeting its load and would have an Manitoba Hydro 2023/24 & 2024/25 General Rate Application increased dependence on imports from the MISO market to serve Manitoba load. Import contracts of 950 MW and an import capability up to 1400 MW can be a source of supply to meet this shortfall. However, it is not a guaranteed supply from the MISO market for extended periods. In the event that the MISO market is unable to supply the energy required, the Manitoba load may not be adequately supplied."*[99]

As a result, the ratepayer impact of a single Bipole failing is near zero, because there is sufficient redundancy in the DC and AC transmission systems to meet domestic loads even at peak times. And consequently, the criticality of the increased failure rates of Bipole I and Bipole II is lower than indicated by MH when focusing on impacts at a system rather than asset level because it would take more than one Bipole failure, and typically more than two Bipole failures to result in an impact to domestic ratepayers.

7.2.6 Copperleaf C55: Only As Good As Its Inputs

During the 2017/18 & 2018/19 General Rate Application Midgard reviewed the planned implementation of Copperleaf C55. Based on that evidence and evidence in the current General Rate Application Midgard is of the same opinion as it was previously. Copperleaf C55 ("C55") is a suitable tool for its intended purpose but that it requires high quality inputs, and surrounding asset decision making structures to yield high quality results. As a result, since C55 is a suitable tool, the remainder of the following discussion will focus on the types of inputs it requires, best practices to achieve those inputs, and deficiencies in MH's inputs. Data deficiencies lead to "garbage-in/garbage-out" problems with MH's asset management decision-making.

But first some background on the core engine that drives C55 and associated asset management decision making, a risk equivalency matrix. As provided in the Copperleaf Report, its value-based decision-making approach is governed by the C55 value frameworks:

[99] Manitoba Hydro response to COALITION/MH I-99e

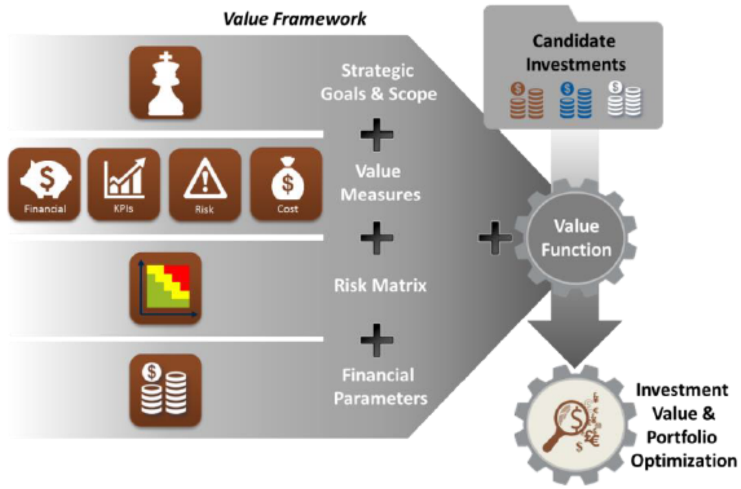


Figure 2 - Value Framework [100]

And values are determined, evaluated and optimized as follows:

> *"All Value Measures can be classified into four main types: Financial Benefits; Key Performance Indicators; Risk Mitigation; and Cost. Financial Benefit Value Measures capture the Capital and O&M savings such as labor cost saving, fuel cost saving, other capital and/or O&M cost saving, as well as the hard dollar benefit of productivity increases. Value Measures related to Key Performance Indicators also result in productivity and performance increases, but are often expressed as productivity increases due to efficiency improvements. Value Measures related to Risk Mitigation are used to express the benefit of an investment through the reduction of risk. Finally, the Cost of an investment is taken directly from the investment forecast, but may include other costs anticipated as a result of executing the investment (i.e., increases in O&M). The combination of these Value Measures will result in a net value for each investment.*
>
> *All Benefit Value Measures are calculated using the same criteria: consequence of the investment multiplied by the probability of the benefit being achieved. However, as illustrated in Figure 3, Risk Mitigation Value Measures are calculated using the Risk Matrix which is described in detail below.*

[100] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, PUB MFR 107-Attachment 1, Page 8

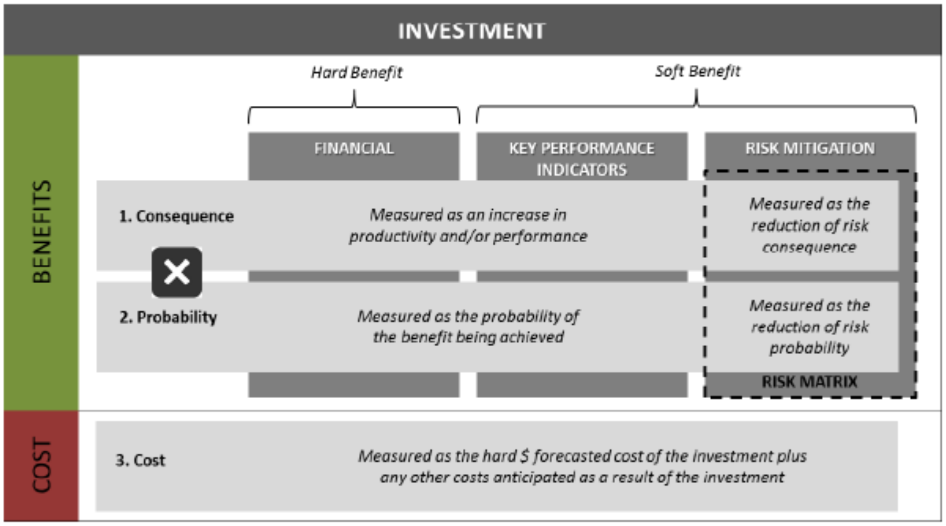


Figure 3 - Value Measure Calculation

"[101]

Among the value framework inputs are a supporting set of consequence and probability definitions that are inputs to the Risk Matrix that is a key input to the value function optimization engine. A partial listing of the consequence and probability definitions are reproduced here for discussion purposes with the remainder available in the Copperleaf Report along with a more complete discussion of C55[102]:

Figure 13: Sample Copperleaf C55 Consequence Definitions

Existing Manitoba Hydro risk consequences were aligned with the more granular consequence levels to provide flexibility for investment risk evaluation.

CONSEQUENCE	CONSEQUENCE 100,000	CONSEQUENCE 30,000	CONSEQUENCE 10,000	CONSEQUENCE 3,000	CONSEQUENCE 1,000	CONSEQUENCE 300	CONSEQUENCE 100	CONSEQUENCE 30	CONSE-QUENCE 0
Financial	>$50 million annually	>$15 million annually	>$5M annually	>$1.5 million annually	>$500K annually	>$150K	>$50K annually	<$50K annually	None
IT Capacity	N/A	Lack of capacity (or currency) of a system that impacts significantly (e.g. 10% average decrease in productivity) for more than 1500 employees.	Lack of capacity (or currency) of a system that impacts significantly (e.g. 10% average decrease in productivity) for more than 500 employees.	Lack of capacity (or currency) of a system that impacts significantly (e.g. 10% average decrease in productivity) for more than 150 employees.	Lack of capacity (or currency) of a system that impacts significantly (e.g. 10% average decrease in productivity) for more than 50 employees.	Lack of capacity (or currency) of a system that impacts significantly (e.g. 10% average decrease in productivity) for more than 15 employees.	Lack of capacity (or currency) of a system that impacts significantly (e.g. 10% average decrease in productivity) for more than 5 employees.	Lack of capacity (or currency) of a system that impacts significantly (e.g. 10% average decrease in productivity) for more than 1 employee.	None
Export Transfer Capacity	Lost revenue due to inability to export > $50M annually	Lost revenue due to inability to export > $15M annually	Lost revenue due to inability to export > $5M annually	Lost revenue due to inability to export > $1.5M annually	Lost revenue due to inability to export > $500K annually	Lost revenue due to inability to export > $150K annually	Lost revenue due to inability to export > $50K annually	Lost revenue due to inability to export < $50K annually	None
Lost Generation	Calculated risk > $50M annually	Calculated risk > $15M annually	Calculated risk > $5M annually	Calculated risk > $1.5M annually	Calculated risk > $500K annually	Calculated risk > $150K annually	Calculated risk > $50K annually	Calculated risk < $50K annually	None

[103]

[101] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, PUB MFR 107-Attachment 1, Page 9

[102] Midgard recognizes that the actual values used by Hydro may be different than described in the Copperleaf Report. Midgard's analysis and conclusions do not depend on the specific values selected by Hydro, whether they are the same or different than in the Copperleaf report. For example, Midgard expects that Financial Parameters (Page 11 -15) and Value Function Conversion Factors (Page 22-23) will be updated periodically. Specific value selections are not the focus of this evidence.

[103] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, PUB MFR 107-Attachment 1, Page 16

Figure 14: Sample of Copperleaf C55 Probability Definitions

Existing Manitoba Hydro risk probability levels were aligned with the more granular probability levels to provide flexibility for investment risk evaluation.

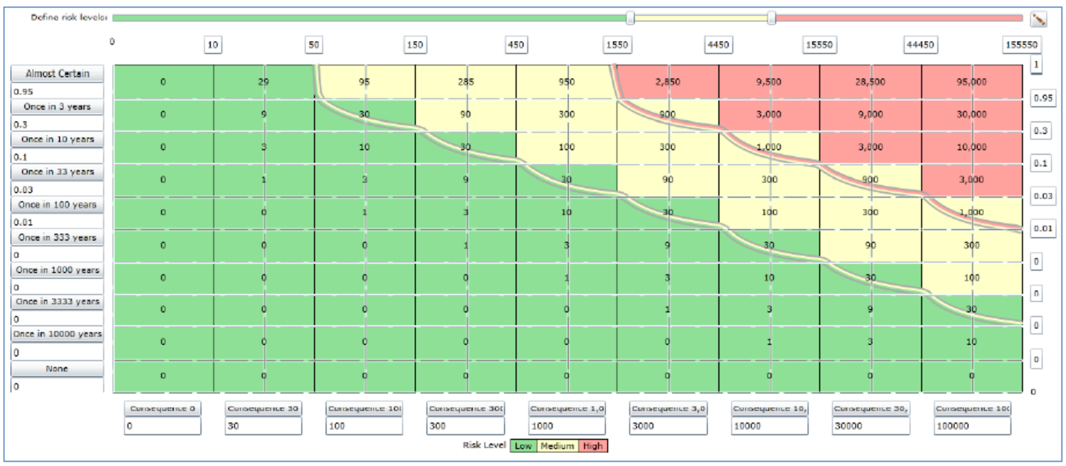
Almost Certain	Once in 3 years	Once in 10 years	Once in 33 years	Once in 100 years	Once in 333 years	Once in 1000 years	Once in 3333 years	Once in 10000 years	None
Imminent (>95% chance of occurring this year)	Approximately 30% chance of event occurring this year (e.g. 1 in 3-year event)	Approximately 10% chance of event occurring this year (e.g. 1 in 10-year event)	Approximately 3% chance of event occurring this year (e.g. 1 in 33-year event)	Approximately 1% chance of event occurring this year (e.g. 1 in 100-year event)	Approximately 0.3% chance of event occurring this year (e.g. 1 in 333-year event)	Approximately 0.1% chance of event occurring this year (e.g. 1 in 1,000-year event)	Approximately 0.03% chance of event occurring this year (e.g. 1 in 3,333-year event)	Approximately 0.01% chance of event occurring this year (e.g. 1 in 10,000-year event)	Event unlikely to occur in next 10,000 years

Table 3 - Probability Levels

104

The importance of the probability and consequence definitions is that they are key inputs to the risk matrix used by C55 and that the quality of the probability and consequence inputs determine the quality of the risk matrix results:

Figure 15:Sampe of Copperleaf C55 Risk Matrix



	Consequence 0	Consequence 30	Consequence 100	Consequence 300	Consequence 1,000	Consequence 3,000	Consequence 10,000	Consequence 30,000	Consequence 100,000
Almost Certain (0.95)	0	29	95	285	950	2,850	9,500	28,500	95,000
Once in 3 years (0.3)	0	9	30	90	300	900	3,000	9,000	30,000
Once in 10 years (0.1)	0	3	10	30	100	300	1,000	3,000	10,000
Once in 33 years (0.03)	0	1	3	9	30	90	300	900	3,000
Once in 100 years (0.01)	0	0	1	3	10	30	100	300	1,000
Once in 333 years (0)	0	0	0	1	3	9	30	90	300
Once in 1000 years (0)	0	0	0	0	1	3	10	30	100
Once in 3333 years (0)	0	0	0	0	0	1	3	9	30
Once in 10000 years (0)	0	0	0	0	0	0	1	3	10
None (0)	0	0	0	0	0	0	0	0	0

Figure 4- Risk Matrix

The value for each value in the risk matrix is computed by multiplying the middle value of the consequence by the middle value of the probability. For example, a "Consequence 10,000" consequence has a middle value of "10,000" (average of 4,450 and 15,550) and an event occurring at least every "Once in 10 years" has a value of 0.1. The result is that a "Consequence 10,000" consequence event with a frequency greater than once in 10 years is valued at 1,000 Value Units. For risk types such as "Lost Generation Risk" where the probability and consequence are calculated based on the asset attributes, or for "Transmission Reliability" where the impact is calculated by a model, the computed value units are used as the models provide a more accurate placement on the risk matrix (i.e. not just the cell in the Risk Matrix).

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Consequently, although C55 can be an effective tool, its effectiveness is only as good as the data it is fed, and MH's inputs are deficient in areas that impair C55's effectiveness and MH's asset management decision making. The quality of C55's inputs will be discussed further in the next section, with a specific focus on the quality of the probability inputs to C55's risk matrix.

[104] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, PUB MFR 107-Attachment 1, Page 20

[105] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, PUB MFR 107-Attachment 1, Page 20

7.3 Asset Information

Regarding Asset Information, the AMCL Report makes a set of carefully worded findings regarding the limitations of MH's asset information:

> *"• An Asset Information Strategy is currently under development; Manitoba Hydro has acknowledged the as-is state of asset information and is establishing a plan to define the to-be state of its information needs and types to support asset decision-making.*
>
> *• A high-level roadmap is in development that will illustrate the asset information systems and technology strategy.*
>
> *• There is the intention to enable better data and analytics, with plans in place to do so.*
>
> *• The Digital and Technology business unit is working with Asset Information & Standards section to align the data management approach and define governance, ownership, roles, and responsibilities."* [106]

In more direct terms, MH is firmly at an "Awareness" stage (Score = 1.32[107]) with its asset information, record keeping, its ability to manage its asset data, and analytics to track progress. In the future an Asset Information Strategy will improve these areas of deficiency. However, as of today, MH's asset information is of poor quality, lacks the necessary information systems to store, access and utilize the data effectively, and is absent metrics to track and plan improvement.

Based on these AMCL findings, Midgard strongly recommends that MH place a focused and sustained effort on improving its Asset Information. As stated before, without good data, the tools (e.g. C55 and decision making frameworks) will be ineffective despite their apparent potential. It is concerning to Midgard that MH is lagging so markedly in this area when Asset Information is the foundational underpinning of all asset decision making. Midgard acknowledges that MH's top-down budget envelope approach discussed in Section 7.2.2 mutes the need for asset information because asset information does not meaningfully inform budget setting activities, but asset and resource planning cannot be effective without adequate asset information.

Some of MH's peer utilities are advancing their Asset Information maturity in a meaningful manner, for example, Hydro One Networks Inc. (HONI). Midgard is not suggesting that HONI is perfect or that it has completed its asset management journey, but HONI demonstrates what can be achieved if a utility applies a focused and sustained effort to collecting and interpreting asset information.

[106] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 18 of 184

[107] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 18 of 184

7.4 Risk and Review

Building on the challenges facing MH's Asset Information discussed above, MH's risk and review activities are consequently so impaired as to be effectively non-existent. AMCL identifies the following findings for the emerging "Awareness" (Score = 1.42) that MH has in risk and review:

> *"• ToR for the Enterprise Risk Management (ERM) framework exist and are consistent with the CVF.*
>
> *• The Asset Risk Management Framework will need to be consistent with the ERM and CVF*
>
> *…*
>
> *• There is a performance management framework but no systematic way of disaggregating targets and actual values to asset class level; there is no evidence of performance forecasting. In addition, there is insufficient data to support this analysis.*
>
> *• The Asset Risk Management group has identified assets to create Asset Health Indices (AHIs) for and a harmonization exercise such that the health indices are aligned between asset classes.*
>
> *• Unit cost models are not in place for the lifecycle delivery activities and asset interventions.*
>
> *• An assurance framework with an audit function, a manual and audit charter, codes of conduct, processes, and procedures is in place. However, this needs to be expanded to include the AM System.*
>
> *• Service outcomes measures such as SAIDl6 and SAIFl7 are monitored and reported and used to indicate whether the performance of the asset management system is meeting customer requirements. Leading indicators to consider include; number of asset classes that have AHI in place, progress against improvement plan, unmitigated known risks etc."*[108]

Based on the AMCL Report findings, MH has plans to improve its risk and review frameworks and tools, but they are often ineffective, absent or siloed in a manner than renders them ineffective for improving asset management practices. In short, MH is firmly in the "Awareness" category in the Risk and Review area, and similar to Asset Information, Midgard is concerned that MH is lagging so markedly in this area given that Risk and Review is foundational to asset decision-making. What is more, establishing objective rather than subjective AHIs for all key assets and transitioning to using economic life to drive decisions were key recommendations of the 2016 UMS Report, and whose present status can be summarized as: MH has done "some" work and plans to do more work in the future:

[108] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 19 of 184

> *"Manitoba Hydro has some Asset Health Index (AHi) algorithms for the Electric Transmission, Distribution and HVDC systems."[emphasis added]*[109]
>
> *"Manitoba Hydro identified a need to improve its asset condition assessment methodology for its key assets."* [110]
>
> *For expected/economic life, … Manitoba Hydro does not have survival curves for these asset classes. Manitoba Hydro plans to use the in service year and removal information to estimate the survival curves for transformers and wood poles, this work will be completed in summer 2023."*[111]

Deficiencies related to a lack of Asset Information are clearly problematic for risk and review, but lacking asset costs models, lacking Asset Health Indices (AHI) for key assets, and having inconsistent AHI between asset classes, renders use of these risk and review inputs pointless. Again, without high quality inputs, MH cannot make high quality asset management decisions, and therefore Midgard strongly recommends risk and review be an area of focused and sustained improvement.

7.4.1 Asset Health Indices

Since Asset Health Indices are used throughout the organization, and in particular as inputs to C55 and other decision-making frameworks that forecast remaining asset life and maintenance requirements, Midgard highlights two aspects of common concern. Specifically, in many cases MH's AHIs do not accurately represent asset health or asset condition and therefore are not an accurate indicator of failure probability. As such, they are not fit for their intended purposes (e.g., as an input to C55 or as support for other asset planning decisions).

When queried about the completeness of MH's AHI methodologies, deficiencies and plans to close deficiency gaps, MH responded:

> *"The table below shows details of the existing asset health index (AHI) methodologies.*
>
> *Currently, gaps and deficiencies exist where:*
>
> - *AHI methodologies have not been established for certain asset classes, but are currently considered to be warranted;*
> - *Some existing AHI methodologies are not used for decision making;*
> - *AHI results are not calculated in a computerized maintenance management system (CMMS); or,*
> - *AHI results are not fit for purpose where calculated results:*

[109] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 69 of 184

[110] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, Appendix 7.4, Page 72 of 184

[111] Manitoba Hydro response to COALITION/MH II-83b

- *do not appear to accurately reflect the condition of assets;*
- *do not contain the necessary input required to estimate end of asset life; or*
- *are inconsistent with other methodologies used throughout the corporation.*

Manitoba Hydro plans to close the deficiency gap with the Asset Risk Management Framework Implementation Plan alongside other asset management initiatives. Implementation of the Asset Risk Management Framework is a multi-year plan that includes the creation of new AHIs, the re-affirmation of some existing AHIs and the affirmation of industry AHIs methodologies.

Asset Class	AHI Established	AHI Used for Decision Making	AHI Implemented in CMMS	AHI Fit for Purpose
Generators	Yes	Yes	No	Some assets
Hydraulic Turbines	Yes	Yes	No	Some assets
Exciters	Yes	Yes	No	Some assets
Governors	Yes	Yes	No	Some assets
Powerhouse Buildings	No	N/A	N/A	N/A
Dams	Yes	Yes	No	Yes
Circuit Breakers				
Transmission/Distribution	Yes	Yes	Yes	Yes
Generation	Yes	Yes	No	Some assets
HVDC	No	N/A	N/A	N/A
Medium Voltage Switchgear	No	N/A	N/A	N/A
Battery Banks	Yes	No	No	No
Station Power Transformers				
Transmission/Distribution	Yes	Yes	Yes	Yes
Generation	Yes	Yes	No	Some assets
HVDC Converter Transformers	Yes	No	No	No
Padmount Transformers	No	N/A	N/A	N/A
Overhead Transformers	No	N/A	N/A	N/A
Transmission System Steel Structures and Foundations	Yes	No	No	No
Transmission System Wood Pole Structures	Yes	No	No	No
Transmission System Overhead Primary Conductor	Yes	No	No	No
HVDC Converters	Yes	No	No	No
HVDC Synchronous Condensers	Yes	No	No	No
HVDC Electrode	Yes	No	No	No
Underground Cable	No	N/A	N/A	N/A

Asset Class	AHI Established	AHI Used for Decision Making	AHI Implemented in CMMS	AHI Fit for Purpose
Subsurface Utility Chambers	No	N/A	N/A	N/A
Duct Lines	No	N/A	N/A	N/A
Distribution Wood Poles	No	N/A	N/A	N/A
Distribution Overhead Primary Conductor	No	N/A	N/A	N/A
Streetlight Standards	No	N/A	N/A	N/A

"[112]

As a result of the AHI deficiencies, they are inconsistently used for decision-making, not always suitable for use in the various asset management tools and frameworks, and are often not fit for intended purpose (e.g., to evaluate asset health), with the following results noted by MH:

> *"Due to missing AHI information from the asset portfolio, the sustainment capital investment plan communicated in Tab 7 is impacted in the following ways:*
>
> - *Investment decision-making.*
> - *Long-term spending targets"* [113]

This means that without effective AHI, MH's investment decision-making, long-term spending targets, and asset intervention planning is impaired and non-optimized, which leads to higher average lifecycle costs.[114].

7.4.2 AHI Used to Determine Probability of Asset Failure

Of additional concern regarding MH's AHIs is the conflation of asset condition with the "risk" posed by asset failure. MH appears to be holding onto the premise the AHI determines both asset health and the risk posed by the asset. This approach is problematic because C55 requires a clear determinant of probability of failure to inform its risk evaluation. As discussed in Section 7.2.6 it is C55's role to perform the risk evaluation using a risk matrix that is aligned with MH's corporate risk management program. That risk matrix combines probability of asset failure with consequence of asset failure to determine overall risk.

A properly derived asset failure curve[115] can be used to estimate the probability of asset failure based on current asset condition or health index, as shown in Figure 16 below:

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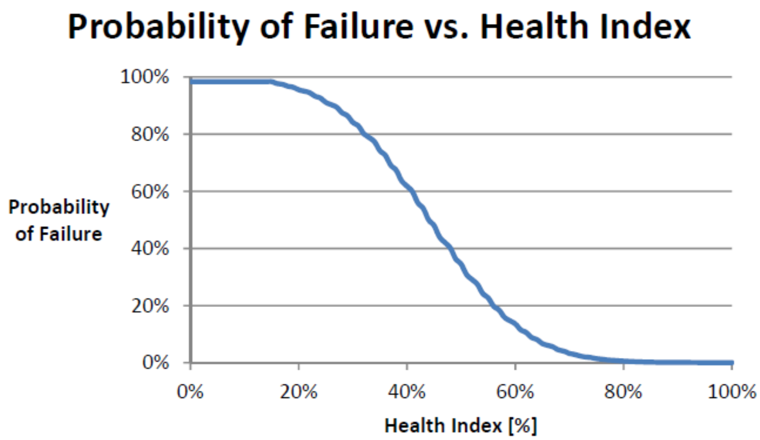
[112] Manitoba Hydro response to COALITION/MH I-100a

[113] Manitoba Hydro response to COALITION/MH I-100b

[114] Manitoba Hydro response to COALITION/MH I-100b

[115] Or Asset Survival Curve with some math performed to estimate probability of failure based on asset condition.

Figure 16: Probability of Asset Failure vs. Asset Health Index



For probability of asset failure to be accurately estimated, the health index (asset condition) input should only include asset health/condition parameters, not other parameters that conceal or modify actual asset condition and thereby contaminate the database. Unfortunately, MH's current AHI approach appears (at least in several observable instances) to include non-asset condition related factors that impair its fitness for accurately determining probability of asset failure (e.g. including spares in AHI assessments).

MH does not appear to have developed or used probability of failure curves for its assets beyond simple observations such as that assets in better health should have a lower probability of failure than assets with worse health:

> *"Manitoba Hydro has not quantified the expected failure frequency using AHIs. Manitoba expects the failure frequency for assets with an AHI value between 0 and 2 to be elevated in comparison to an asset with an AHI greater than 2."*[116]

But MH does understand that probability of failure curves provide a statistical expectation and that deviations from the average occur, as demonstrated in its response to a query about DC wall bushings that are all in "Fair" or better condition:

> *"DC wall bushings are tested regularly and units that do not pass testing are replaced with spares prior to failure occurring in service. Manitoba Hydro does not consider the replacement of DC wall bushings to be urgent. Rapid degradation is not anticipated for many units above 20 years of service age. Although some wall bushings are anticipated to fail in the next 1 to 2 years, spare bushings will be used to replace bushings that do not pass testing."*[117]

[116] Manitoba Hydro response to COALITION/MH II-91a

[117] Manitoba Hydro response to COALITION/MH II-93a

Evidence also shows that MH conflates asset condition as a determinant of probability of asset failure with the risk posed by an asset when it fails. For example, MH modifies the apparent asset health of voltage dividers from Fair condition (AHI score of 4-6) to Very Poor (0-2) solely due to lack of availability of spares:

> *"In the voltage divider AHI methodology, the in-house availability of spares is considered and has a positive impact on the resulting AHI. Manitoba Hydro chose to include spares as a parameter since the consequences incurred from a failure when spares are available are relatively minimal. Currently, Manitoba Hydro has spare voltage dividers for the 45- to 50-year-old units. If a voltage divider fails a test, the voltage divider can be replaced with the spare within a short time frame. Without these spares, the 45- to 50- year-old units would have an AHI score of 0 to 2."*[118]

And MH reports the actual asset condition when spares are not available, as is the case for Direct Current Current Transducers ("DC Current Transducer" or "DCCT"):

> *"The 40–50-year-old DCCTs are conventional series type of DC current transducer. This device consists of two saturable reactors each having two winding, an AC supply and a rectifier circuit. The reason for the 0-2 AHI score is the DCCT in this age range are above their expected lifetime, the failure rate has increased, and Manitoba Hydro has an insufficient number of spares. Spare units are no longer available from the manufacturer"* [emphasis added][119]

The presence or absence of spares does not change the actual asset condition (and hence probability of asset failure), it changes the consequence of failure because in these cases the consequence is related to the time it takes to return the asset (or asset system) back to service. Evaluating risk, as discussed previously in Section 7.2.6, is the combination of probability and consequence is the domain of tools such as Copperleaf C55, not AHI.

Using AHI to calculate risk is inappropriate because it ignores other risks that are also being evaluated by C55 and other potentially mitigating circumstances such as electrical system architecture and redundancy which materially reduce risk[120]. Based on Midgard work across Canada it recognizes that MH may argue that other utilities include spares and other consequence factors in their AHI calculations, and MH would be factually correct. However, MH would not be correct to state that the practices of other utilities justify MH's use of spares as an input to its AHI calculations because MH's AHI calculations are, or ultimately will be, inputs to Copperleaf C55. And C55 requires that MH remove consequence factors from its AHI calculations so that a probability of asset failure can be estimated. MH is on an asset management maturity journey, and that journey will require that MH relinquish past practices that may have made sense before modern tools such as

[118] Manitoba Hydro response to COALITION/MH II-94a

[119] Manitoba Hydro response to COALITION/MH II-95a

[120] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, PUB MFR 107-Attachment 1, Pages 15-23

C55 were available (e.g., AHI was a proxy for risk evaluations in the absence of better tools), but now that MH is integrating C55 into its Asset Management processes, MH must respect the data needs of C55 and similar modern tools or their use will be rendered futile.

In summary, MH admits in evidence that its AHIs are flawed and not fit for purpose. Quality AHIs are a key prerequisite to MH advancing its asset management maturity, as it attempts to fully integrate new tools such as C55. As result, asset investment and planning decisions based on MH's current AHI data and methodologies are impaired, leading to non-optimized asset decisions and plans, which is inevitably leading to higher average lifecycle costs.

8 ASSET MANAGEMENT STRATEGIES

In the evidentiary record there is little discussion regarding the asset management strategies that MH employs for its different asset classes. The following discussion integrates some of the previous discussions about SAIDI/SAIFI, risk, and ratepayer outcomes, and outlines some reasons why asset management strategies are also an important planning tool to reduce costs. In certain cases, Midgard wants to endorse MH's strategies as an encouragement to find other assets for which similar strategies could be followed to achieve cost savings. The cases are also illustrative of the types of decision making that can lead to cost savings for ratepayers using the risk management tools that MH is beginning to develop.

8.1 Distribution Asset Equipment Failures

Midgard recommends that MH continue its current asset management strategies for its distribution assets such as those employed for pole top transformers which are managed under a run-to-fail strategy that is both normal and appropriate from a Canadian utility practice perspective, and risk management perspective. As stated by MH:

> *Currently, Manitoba Hydro does not track individual failures as a category for the pole top transformers. While Manitoba Hydro does not determine why a transformer was removed from service, there are multiple reasons why a transformer may be removed. Some of these reasons include end of life failure, increased load, relocation and pole failure. Due to the relatively short duration of outages and minimal number of customers impacted by individual pole top transformer failures, the current asset strategy for pole top transformers is replacement due to in-service failures (i.e., run-to-failure)."* [121]

MH is not incorrect when it states that aging of its distribution assets is leading to overall increases in failure rates of those assets[122], but Midgard asserts it is also the correct strategy to continue letting some assets run-to-fail (or near failure) because it maximizes the value that is extracted for ratepayers from those assets, minimizes rates, and as demonstrated in Figure 4 has not compromised MH's superior system performance relative to its Canadian utility peers. In short, it is expected that due to aging asset demographics distribution asset renewal investments will increase, but not a step increase of unnecessary pre-emptive replacements, but rather a moderate risk-informed increase coupled with increased numbers of reactive replacement as the assets naturally age out at the end of their lives (i.e., after maximum asset value has been extracted rather than premature replacement). To balance the expected increases in asset failure rates due to aging out, MH

[121] Manitoba Hydro response to COALITION/MH II-98e

[122] In response to MIPUG/MH I-75-d Hydro stated *"When considered with the asset renewal rates shown in Appendix 7.5, Manitoba Hydro is confident that aging assets are resulting in increased failures that are resulting in an upwards trend in SAIDI and SAIFI over the past decade."*

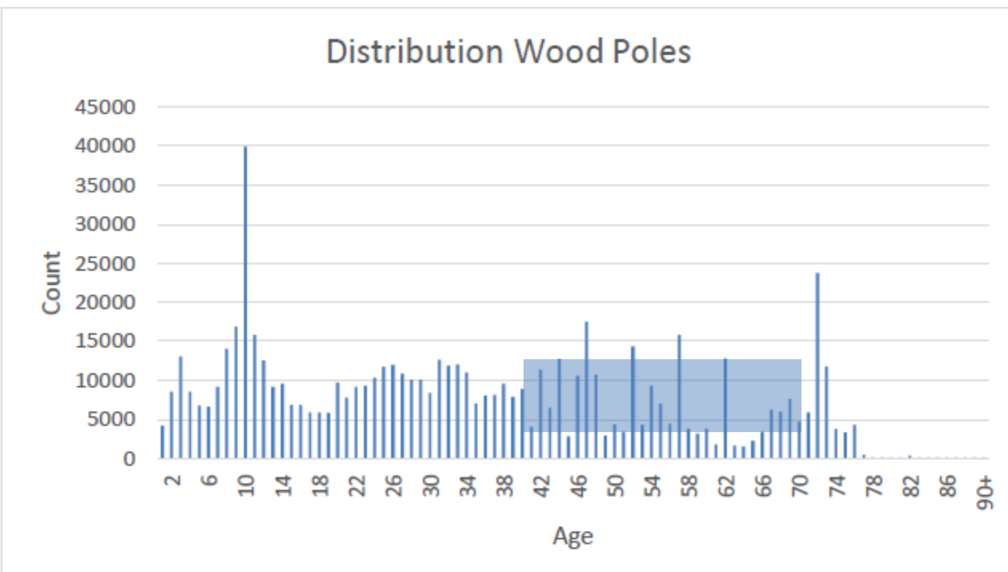
should commensurately increase maintenance crew resources available to respond to asset failures in a timely manner, thus both maximizing asset value extraction (i.e., thereby minimizing rates) and minimizing response times (i.e., managing SAIDI in a cost-effective manner).

And Midgard expects that Distribution will need to increase the number of distribution crews servicing poles and pole system asset renewals/replacements. The following is a simplified case study of expected replacements for two low risk assets that are replaced at failure or near failure[123]:

1) Distribution Wood Poles
2) Underground Cables

MH provided asset data for distribution wood poles stating that MH has no current Asset Health Index ("AHI") methodology for wood poles. MH does not know its wood pole population count beyond estimating that the total population exceeds 1 million poles, with ages known for 670,000 poles and unknown for 300,000+ poles, the majority of which are estimated to be between 40 and 70 years of age[124] as shown in Figure 17.

Figure 17: Distribution Wood Poles (Modified)



[125]

[123] Run to Failure is a suitable strategy for many assets that have low consequence of failure because they can be replaced reasonably quickly once they fail (e.g., pole top transformers or rural distribution poles). Run-"Near"-to-Failure is another suitable strategy for assets that have low consequence of failure in a global utility sense but benefit from economies of scale/scope when entire groupings of assets are replaced (e.g., poles and cross arms on a contiguous distribution feeder in urban areas serving a larger number of customers per pole whose replacement benefits from reduced mobilization costs when replaced as a group).

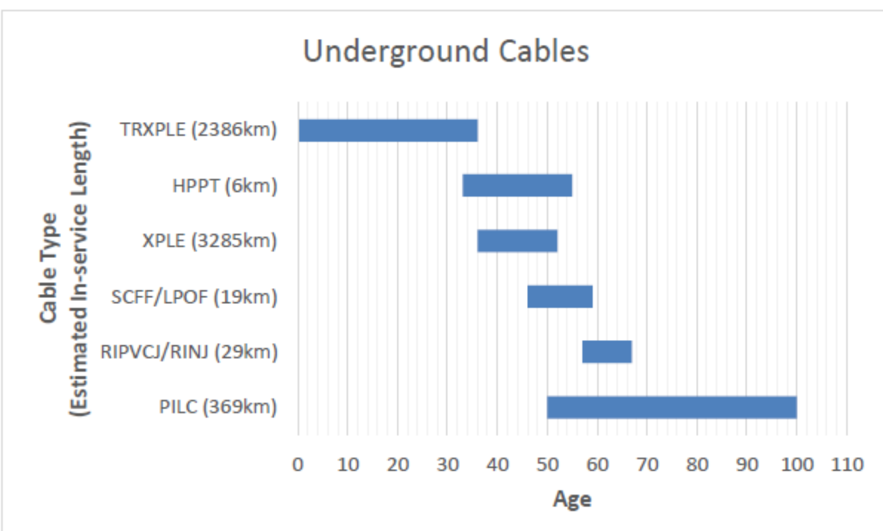
[124] Response to COALITION/MH I-105a

[125] The base figure was provided in Response to COALITION/MH I-105a. The blue shaded area represents the approximately 300,000+ wood poles with ages 40 to 70 years, or 10,000 poles per year in the demographic profile.

This lack of asset date means that that MH does not know what assets it is managing, cannot systematically provide an estimate of the health of its distribution wood pole fleet, and cannot plan beyond being reactive to situations as they arise. Based on a simplified demographic analysis it is clearly apparently that the current asset replacement rate of 5000 poles per year[126] is too low over the long run because a 0.5% turnover rate implies a 200-year distribution wood pole life[127] which is almost triple the 70-year life at which wood poles are expected fail due to condition-related reasons[128]. Therefore, although it is likely that the appropriate long-term wood pole replacement rate is materially higher than 5000 poles/year, MH is unable to determine how much higher. Therefore, MH should be planning to increase the rate at which it replaces its distribution wood poles, but MH cannot accurately estimate that rate or its timing because MH lacks the asset data necessary to plan the associated sustainment activities.

The situation is similar for underground distribution cables, namely that MH has inadequate asset records to support sustainment planning. For example, where MH has asset ages for only 70% of its wood pole distribution assets, asset age is unavailable for most of its underground cables and MH resorts to using the "era in which each cable type was installed" to estimate asset age (i.e., it estimates cable ages based on the historical eras when different cable technologies were in common use rather than actual cable portfolio demographic data). MH provided the following figure which shows cables with ages estimated to range from 0 to 100 years:

Figure 18: Underground Cables



[129]

[126] Response to COALITION/MH I-105a

[127] 1 million poles replaced at a rate of 5000 poles/year yields a turnover rate of 0.5% which implies a 200 year average pole life.

[128] 1 million poles replaced at a rate of 5000 poles/year yields a turnover rate of 0.5% which implies a 200 year average pole life.

[129] Response to COALITION/MH I-105a

This pervasive lack of asset date means that that MH does not know what assets it is managing, cannot systematically reliably estimate the health of its underground cable fleet, and cannot plan beyond reacting to failures as they occur. Based on a simplified demographic analysis it is apparently that the current asset replacement rate of 37 km per year[130] is too low over the long run because a 0.63% turnover rate implies a 160-year underground cable life[131] which is more than four (4) times the 30 to 40 year life at which underground cables are expected to fail due to condition-related reasons[132]. Therefore, it is likely that the long-term underground cable replacement rate is materially higher than current 37 km/year, but how much higher cannot be determined by MH. Therefore, MH should be planning to increase the rate at which it replaces its underground cables, but MH cannot specify that rate or its timing MH lacks the asset data necessary to plan sustainment activities.

Although MH does not have adequate asset records with which to plan its sustainment activities and forecast expected asset replacement rates and timings, there a likely a few factors that may be masking its current planning deficiencies:

1) Actual Asset Lives are Longer: Actual condition-based asset lives may be longer than MH estimates (e.g., its wood poles last longer than 70 years, its underground cables last longer than 30 to 40 years).
2) Asset Demographics are Still Maturing: MH has exited a period of high new build growth (i.e., pre-1985 growth levels) but its asset demographics are still skewed young enough that an long-term steady state sustainment pace has not been reached.

These factors will likely allow MH to continue replacing distribution assets at relatively low rates in the near term, but the prognosis is that sustainment replacement rates for certain asset will increase to higher stable levels over the longer term.

In summary, based on the available evidence, MH lacks the data necessary to support adequate sustainment planning, may still have young enough asset demographics to support near-term reduced levels of sustainment spending, and has identified increasing its O&M crew resources as a cost-effective approach to maintaining its reliability metrics because:

1) MH has identified that it can improve SAIDI results by increasing its O&M resources to reduce call out times.
2) MH has a run-to-fail (or near fail) strategy for low-risk assets such as pole top transformers, wood distribution poles and underground cables.

[130] Response to COALITION/MH I-105a

[131] A 0.63% implies a 160 year average cable life.

[132] Response to COALITION/MH I-105a

3) MH cannot accurately estimate its sustainment needs due to inadequate asset records (e.g., lack of age and asset condition data)
4) The currently planned replacement rates for some asset types (e.g., 5000 distribution wood poles/year, 37 km/year of underground cables) are expected to be inadequate over the longer term as these assets age.
5) MH's distribution asset demographics indicate that future sustainment spending increases will likely be required due to aging assets, but degraded performance is not yet showing up in MH's SAIDI/SAIFI metrics.

9 RATEPAYERS NEED TO UNDERSTAND THE MINIMUM SYSTEM

9.1 What Do Customers Want?

In the simplest possible terms, customers want value and are willing to pay for it (limited by their capacity to do so). Electric service is considered valuable by customers, and an attribute of electric service valued by customers is reliability. However, reliability is subject to diminishing returns on investment, and achieving perfect reliability would be an imprudent utility target. Similarly, customers expect a certain level of reliability, but their appetite for increasingly high levels of reliability is moderated by the associated rate impacts.

MH explains in Section 3.3 of its GRA application that customers want reliable service and justifies much of its planned test period (and beyond) capital spending on the basis that all or most of its proposed investments are necessary to maintain (or increase) its present level of service reliability even though MH's reliability is superior to its Canadian utility peers.[133]. As discussed in Section 5, MH has not demonstrated that its service reliability is deteriorating nor that it needs to be urgently improved. MH has also not demonstrated that customers are prepared to pay materially higher rates to cover investments that will marginally improve reliability. On the contrary:

> *"The key findings from the 2019 Customer Perceptions Study conducted by PRA Inc., can be summarized as follows :*
>
> - *When it comes to MH's priorities, Manitobans strongly favor keeping rates as low as possible over other aspects. Of concern is that MH received the lowest performance rating for keeping rates as low as possible;"* [134]

Since domestic ratepayers bear 100% of the cost risk for MH's capital investments, they require and deserve visibility of the value that is being delivered to them by existing MH facilities and the value they can expect to receive from planned investments. However, for domestic customers to adequately understand the value obtained from proposed investments, they need to know which planned investments are necessary to provide them with their desired level of service, and which are intended largely or entirely to achieve other objectives, such as export sales.

[133] For outage causes that can be managed by the utility, excluding major events such as extreme meteorological events, forest fires and Godzilla.

[134] Darren Rainkie, "Manitoba Hydro 2023/24 & 2024/25 General Rate Application Revenue Requirement Evidence" (3 April 2023) at Section 3.6.

9.2 Caveat Emptor

As noted, domestic customers are ultimately responsible to bear 100% of the cost risk of MH's capital investments, and MH readily admits that it has made substantial investments surplus to the prevailing needs of domestic customers:

> *"The clear benefit of building hydro for domestic need while using markets external to the province to optimize the investments was recognized more than sixty years ago. The February 18, 1963 agreement between the Government of Canada represented by Walter Dinsdale Minister of Northern Affairs and the Government of Manitoba represented by Premier Duff Roblin, for the study of large hydro development on the lower Nelson River stated in the first paragraph "WHEREAS Manitoba has represented to Canada that the Nelson River has a power potential of in order of 4 million kilowatts of firm power, approximately 2 million kilowatts of which would be surplus to Manitoba's requirements for a considerable period and that,* ***if any part of this potential is to be made available at economic rates in the near future, it must be developed for large markets outside Manitoba to take advantage of economies of scale in which long distance transmission of electric energy could play a vital role.""*** [135]

MH further claims that this planning approach remains valid going forward since doing the analysis to determine what would be necessary to serve its domestic customers is impractical:

> *"To develop a hypothetical minimum system with a minimum or even no interconnections and presumably with predominately thermal resources*[136] *so as to avoid material trade in export markets would require Manitoba Hydro to revisit countless resource and transmission planning decisions made since 1963*[137] *– as explained in Manitoba Hydro's response to COALITION/MH-II-102b. This hypothetical exercise is not practical or relevant to the Application."* [138]

Moreover, MH demonstrates that it continues to perpetuate its historical surplus facility investment philosophy as evidenced by its recent capital additions such as Keeyask, Bipole III and MMTP, assets which have been justified or advanced ahead of domestic need to enable MH to satisfy or expand its export market

[135] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, COALITION/MH II-102a-b

[136] It isn't clear why thermal resources would be necessary to *"avoid material trade in export markets"* for Manitoba Hydro to model a Minimum System focused on serving domestic loads, as there is no reason a theoretical Minimum System cannot incorporate interconnections made to other systems if that is the only way to mitigate extreme low water year hydrology. It is possible the intended point in the referenced statement is that using thermal resources to mitigate extreme low water year hydrology energy deficits is unavoidable, and that drawing on external MISO "unclean" thermal resources is acceptable but building "unclean" thermal resources in Manitoba would be unacceptable. If so, this would be an illogical position, but in any case, it is unnecessary to assume zero interactions with unclean neighbours to develop a Minimum System, it is only necessary to determine what part of the system is needed to provide reliable service to domestic customers and what is not.

[137] It also isn't clear why it would be necessary to *"revisit countless resource and transmission planning decisions made since 1963"* to determine a Minimum System, as further discussed below.

[138] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, COALITION/MH II-102a-b

activities. MH's philosophy of investing in surplus facilities ahead of need was noted by the Manitoba PUB at least as far back as Order 20/07:

> *"It is has been MH's recent policy and practice to make investments in generation and transmission with the export market in mind. Generation additions are advanced and capital and operating expenditures incurred to make the most of the export potential."*[139]

The 2014 NFAT Report also confirms MH's approach to early or surplus investing, for example at page 20:

> *"Based on these factors, the Panel concludes that new generation will likely be required no later than 2024. However, there are compelling economic, financial and commercial reasons to advance the Keeyask Project to 2019."*[140]

And from page 116:

> *"The Panel concludes that the firm and opportunity revenues from Keeyask are not sufficient to pay all of the in-service costs of Keeyask, the 750 MW interconnection, and Bipole III. As a result, domestic customers are required to make up the shortfall through rates. Keeyask is required by domestic customers after 2024. Until then, the export revenues will continue to defray some of the in-service costs and mitigate some of the risk associated with the project."* [141]

Although the potential to earn potential export revenues that may defray associated ratepayer risk is noted in these references, they remain at-risk early investments in surplus facilities for which ratepayers bear the cost responsibility, whether or not the anticipated offsetting export revenues live up to expectations.

9.3 "Trust Me"

In defense of going forward with a planning approach it originally adopted during a period of high load growth experienced from the 1960s to 1985 which encouraged multi-billion-dollar investments in surplus facilities entirely or largely intended to support at-risk export activities, MH explains:

> *"Manitoba Hydro's domestic customers can have confidence that any cost they may bear for investments that may be surplus to Manitoba load serving requirements provides domestic customer benefits."* [142]

[139] PUB Order 20/07 at page 8

[140] Public Utilities Board, "Needs For And Alternatives To (NFAT) Review of Manitoba Hydro's Preferred Development Plan - Final Report (20 June 2014) at page 20

[141] Ibid. page 116

[142] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, COALITION/MH II-102a-b

It then goes on to qualitatively expand on the reasons it plans the way it does without quantifying the claimed benefits, providing references to domestic ratepayer focused benefits studies, or showing how benefits can be calculated and validated by ratepayers.

While MH may be able to demonstrate that its incremental surplus investments are producing incremental gross export revenues, it has not provided quantified evidence that would enable domestic customers to develop an informed confidence that "*any cost they may bear* [emphasis added] *for investments that may be surplus to Manitoba load serving requirements"* will provide net benefits.

MH has not demonstrated in its application or IR responses that investments such as Keeyask, Bipole III and MMTP are not surplus to the Minimum System MH presently requires to provide reliable domestic service. Without knowing the Minimum System, the magnitude of the surplus bulk transmission and generation system cannot be quantified, which eliminates the possibility of calculating associated benefits net of all-in costs, and prevents customers from knowing if planned incremental investments are surplus to the Minimum System required to provide reliable domestic service.

9.4 "At Least We're Doing Better than the Neighbours"

MH compares its electric rates to those in other Canadian jurisdictions to demonstrate that its historical approach to surplus capital investment has produced superior benefits for Manitoba ratepayers. For example, MH implies that its rates are lower than those paid by ratepayers in neighbouring Saskatchewan largely because of its historical approach to making surplus facility investments:

> *"From a Manitoba domestic customer perspective, the series of decisions launched February 18, 1963 have been beneficial. Tab 8, Figure 8.7 (included below) provides a comparison of rates in other provinces that were in effect April 1, 2022 versus Manitoba Hydro rates assuming the 2021/22 3.6% rate is confirmed and the two 2.0% proposed rate increases are approved for Manitoba.* ***Residential bills in Manitoba are projected to be about two-thirds of what a Regina residential customer pays, based on 2022 rates.*** *Saskatchewan rates will be even higher after accounting for SaskPower's approved 4% rate increase implemented September 1, 2022 and further 4% rate increase to be implemented April 1, 2023."*[143] [Emphasis added]

This claim ignores MH's own evidence that the most critical factor underlying the prevailing rate differential is that Saskatchewan doesn't have Manitoba's hydro resource potential:

> *"The alternative sixty years was thermal development sequence similar to how Saskatchewan developed their system. Sixty years ago, both Manitoba and Saskatchewan had similar populations of just over 900,000 people.* ***Lacking large scale hydro resources,*** *Saskatchewan*

[143] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, COALITION/MH II-102a-b

used coal from the Estevan region and later natural gas generation to meet their domestic requirements." [144] [Emphasis added]

MH conflates benefits that largely accrue to having massive river systems (with origins in Alberta, Saskatchewan and the USA) that flow into Lake Winnipeg and from thence down the Nelson River into Hudson's Bay, with the efficacy of its historical and prevailing surplus capital investment approach. Nor is it reasonable to imply that SaskPower is somehow a less prudent planner and investor than MH simply because Saskatchewan has not been gifted with similar natural hydrological or geographic bounties.

To be more equitable, MH should compare its performance against itself and/or the small group of its almost entirely hydro-centric peers (i.e., BC Hydro and Hydro Quebec are the only validly comparable utilities in North America) rather than against utilities that do not enjoy the natural benefits that large rivers, natural water reservoirs, and topography provide MH. Amongst this group, MH is middle of the pack, with Quebec Hydro providing the lowest electricity costs to its ratepayers.

9.5 "Past Performance Is Not Necessarily a Guide to Future Performance[145]"

Although exports may produce revenues, any corresponding benefits must be calculated net of the associated lifecycle costs. Furthermore, since export counterparties do not bear capital cost risk of the transmission and generation investments that enable those exports, should external market revenues diminish or cease for any reason domestic customers would continue to bear cost responsibility for the export investment (i.e., sunk capital) that is not covered by a diminished or entirely absent offsetting export sales revenue stream. Domestic ratepayer underwriting of the revenue requirement required to support export investments is becoming an even more important consideration with MH's signaling of a pending shift away from its historical level of reliance on export market revenues as implied in Strategy 2040 (GRA Appendix 2.1).

The longer-term domestic customer cost risk associated with investments made entirely or largely to support exports is substantial. This is in part due to the asymmetry between the expected economic service lives of large utility assets like transmission lines and generating stations, and the duration of typical firm export contracts[146]. Risks are also exacerbated because future export revenue streams can be impacted by a wide range of factors outside of MH's control (e.g., natural gas prices, US renewable energy enabling tax policy), so any evaluation of the expected benefits of exports must also include a risk-adjusted revenue stream projection.

[144] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, COALITION/MH II-102a-b

[145] Standard investment prospectus disclaimer.

[146] This temporal asymmetry is more extreme for opportunistic export sales.

Consequently, forward-looking investments in facilities surplus to the Minimum System necessary to serve domestic loads should be presented for approval with a business case that shows the risk-adjusted return on investment over the economic life of the subject facilities – in the case of investments intended to support external market activities, the risk-adjusted expected revenue stream should be reduced by the associated operating costs (including fuel costs, such as the opportunity costs of using valuable stored water to generate the export energy) and the full carrying costs of the capital investments needed to enable those exports.

9.6 The Minimum System

As discussed above, to clearly understand the value that existing and planned MH facility investments are respectively providing and will provide to domestic ratepayers, they need to know:

1. The portion of the existing system required to serve them reliably (the "Minimum System")[147]
2. The portion of the existing system that is surplus to domestic service requirements
3. The reason for each planned future investment, i.e.:
    i. to serve domestic loads;
    ii. to serve export markets;
    iii. to reduce operating costs (e.g., by reducing losses); or
    iv. to achieve other corporate or legislative goals.

Item 3 includes all planned investments, for example, equipment refurbishments or replacements that may be needed to maintain the Minimum System asset portfolio in service. However, attributing all sustaining investments to domestic customer requirements would be inappropriate if customers do not have visibility of the Minimum System needed to serve them reliably.

Without this information, domestic customers are unnecessarily prevented from knowing what proportion of the utility revenue requirement they are obliged to cover through rates is associated with serving them, and what proportion is related to other purposes such as supporting at-risk exports.

9.7 Determining The Minimum System

Despite MH's claim that determining its Minimum System is not tractable, it is within the analysis capabilities of MH, a provincial utility that plans and operates its own generation and modern hybrid AC/DC electrical system. And since other similarly resourced entities can perform or obtain Minimum System studies for their

[147] The enhanced Minimum System that includes incremental investments to economically optimize losses caused by providing domestic service can be referred to as the "Optimal System". It is appropriate for a utility to make investments to economically optimize losses (where the capital investment is paid off by the reduced losses). However, allocating cost responsibility for incremental loss optimization investments between domestic customer loads and external market sales must recognize that losses are proportional to the square of the transmitted power (assuming constant voltage). So, for example, if domestic demand is 2000 MW and exports are 500 MW, the incremental losses on the Bulk System attributable to the exports are 56% greater than the domestic losses, not 25% greater.

jurisdictions, there is no fundamental technical barrier that prevents MH from determining the Minimum System it needs to reliably serve its domestic customers. For example, Minimum System analysis has been recently applied in Alberta for rate design purposes for a Provincial-scale transmission system[148].

To quell MH's concerns that conducting a Minimum System analysis would be intractable, some simplifying assumptions can be made to facilitate Minimum System categorization of MH's system assets:

1. Transmission & Distribution: Functionally divide lines into Bulk, Regional and Point of Delivery/Distribution by voltage class:
    a. Bulk: 230 kVAC & above, DC Bipoles;
    b. Regional: 25 kV< X < 230 kV (e.g., 69 kV & 138 kV);
    c. Distribution: 25 kV and below.
2. Substations: Substations would be classified as Bulk, Regional or Distribution based on their nominal secondary voltage.
    a. For Substations with multiple secondary voltages (e.g., 500 kV / 230 kV / 138 kV), the proportion of asset value associated with producing each secondary voltage would be assigned to the respective secondary classification, i.e., the 500/230 kV portion of a substation would be considered Bulk System and the 230/138 kV portion would be classified as Regional.
3. Generation: Generating stations would be considered bulk system assets for the purpose of minimum system categorization, as would their switchyards and any dedicated (or largely dedicated) interconnection lines between generating plants and the bulk system, regardless of nominal voltage.
4. Regional Transmission and Distribution Systems: To further simplify the analysis, MH's Regional and Distribution systems can be categorized as Minimum System[149] facilities, since MH serves the entire Province, i.e., there are no separate regional load-serving utilities.
    a. Note that this simplified Minimum System categorization for all these facilities assumes that MH has historically applied good utility practice in planning its distribution and regional transmission systems (i.e., they are not over-designed, and they do not service the export market).
5. Customer Transmission Interconnections: Any dedicated transmission interconnections to load customers would also be classified as Minimum System, regardless of nominal voltage.

[148] Alberta Utilities Commission (AUC) Proceeding 26911, 2021 Alberta Electric System Operator (AESO) Bulk and Regional Rate Design and Modernized DOS Rate Design Application

[149] Or Optimal System, to the extent that the facilities have been designed to economically minimize losses. This categorization does not impact application of the simplifying assumption.

6. Renewable Independent Power Producers: To the extent they are a significant generation resource, since Renewable IPPs are centrally planned as part of MH's supply resource portfolio, they should be categorized as Bulk System facilities.

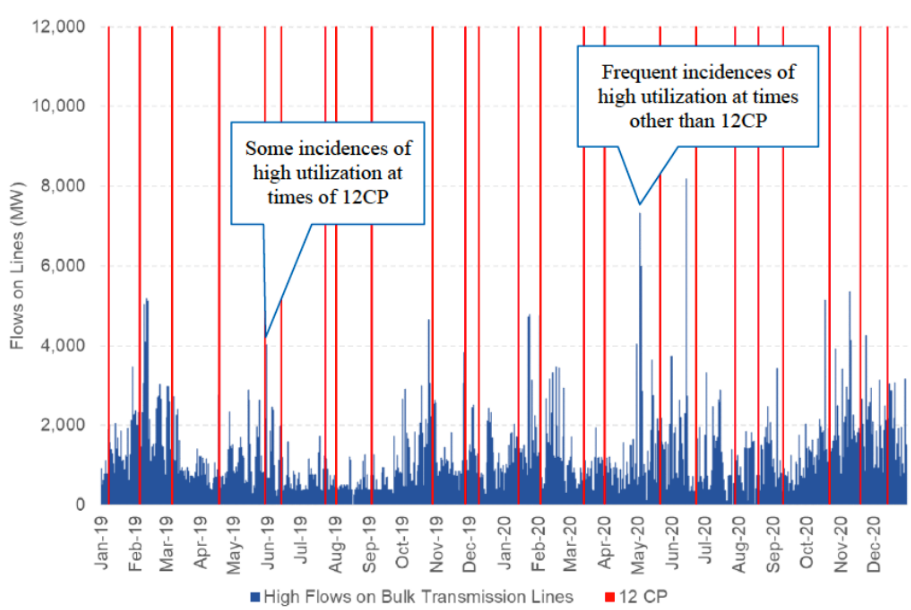
After making these simplifying assumptions, only the Bulk transmission and generation portions of the system require further analysis to determine the appropriate allocation between Minimum System and surplus.

9.8 Example: AESO Minimum System

The 2021 Alberta Electric System Operator (AESO) AESO Bulk and Regional Rate Design and Modernized DOS Rate Design Application[150] is an illustrative example of applying Minimum System analysis to determine system cost drivers. Although the AESO application related to rate design for different customer classes, a similar approach can be easily adapted and applied to determine the proportion of MH's system attributable to serving domestic customers versus other purposes.

The 2021 AESO analysis observed that maximum daily flows on the Alberta bulk system are not primarily driven by domestic monthly coincident system peak demand (12CP). Figure 19[151] below shows the monthly coincident Alberta system peak days for each month in 2019 and 2018 as vertical red lines and bulk system daily high flows as vertical blue lines.

Figure 19: Example - Alberta Minimum System Drivers



[150] AUC Proceeding 26911

[151] AUC Proceeding 26911, Exhibit 0038, Appendix D – NERA Expert Report – AESO Band R Tariff Design_000049.pdf

As can be seen in Figure 19, in most cases Alberta bulk system loading is not directly correlated with system coincident monthly peaks, which is partly attributable to significant efforts by regional utilities and large industrial customers to reduce loads during monthly coincident peaks following substantial demand charge increases driven by recent significant transmission capital investments intended to enhance internal Alberta energy market functionality and reduce constraints on in-merit generation.

Creating a similar graph for the MH bulk transmission system facilities would be instructive to demonstrate the relationship between domestic demand and bulk transmission system asset utilization. To create such a graph the monthly coincident domestic system peak demand days would be derived from domestic load demand data extracted from MH's SCADA system. A similar graph could also be created for MH's generation facility portfolio by mapping aggregate daily generation production over multiple years against coincident domestic peaks.

For MH's system additional powerflow and resource adequacy studies may also be required to determine the proportion of the Bulk Transmission and Generation portfolio that represents the Minimum System required to serve existing and forecast domestic loads. Such analysis could be undertaken as a sub-set of MH's normal planning efforts by setting exports to zero under the study scenarios – this would still enable MH to schedule imports as necessary to serve domestic loads (which, if necessary, would justify classifying some portion of the interconnections with external systems as Minimum System).

As discussed above in Determining the Minimum System, all Regional and Distribution facilities are assumed to be minimum system. Only the Bulk Transmission and Generation Minimum System elements (or portfolio proportions) need to be classified through additional analysis.

9.9 Transparency is Worth the Effort for Customers

There would be limited value to evaluate the proportion of MH's existing facilities that represent Minimum System for the purpose of retroactively determine the prudence of historical investments since these are now sunk costs that domestic ratepayers bear responsible to underwrite. However, understanding the appropriate Minimum System starting point from which to evaluate future incremental investments would enable customers to determine the intended primary purpose of those incremental investments (i.e., to serve domestic customer loads or to support export market transactions), and that would be immensely valuable to ratepayers and presumably the Manitoba PUB.

Ultimately, if MH's incremental investments in generation and transmission capacity are truly creating net benefits for domestic customers over all time frames, applying a minimum system methodology similar to that described in this section would allow MH to quantifiably demonstrate those benefits, and thereby enable customers to hold informed confidence "*that any cost they may bear for investments that may be surplus to Manitoba load serving requirements provides domestic customer benefits*". [152]

[152] Manitoba Hydro 2023/24 & 2024/25 General Rate Application, COALITION/MH II-102a-b

10 CONCLUSIONS AND RECOMMENDATIONS

Manitoba Hydro is continuing a six-decade old strategy of over-investing in capital assets to serve export markets. This over-investment strategy is continuing despite major reductions in electricity growth rates and the availability of improved asset management practices aimed at economically sustaining MH's growing asset base. MH's strategy of overinvesting in its assets made sense in a pre-1985 world when electricity growth rates were high, but in today's mature electrical grid environment with markedly lower electricity growth rates and modern asset management tools, different corporate and asset management strategies are warranted.

MH's evidence demonstrates that its system is overbuilt with respect to meeting domestic needs. Moreover, MH is using its overbuilt system to support export activities and also to provide superior reliability to ratepayers as measured by SAIDI and SAIFI metrics[153] when compared to other Canadian utilities, superior reliability ratepayers do not clearly desire or wish to pay extra for.

MH is a mature electrical utility that has exited its early period of rapid growth and is now faced with shifting its focus to sustaining its asset base. Despite MH's claims that its aging assets are degrading substantially and threaten system reliability, its SAIDI and SAIFI metrics show that MH's system performance continues to be stable and superior to MH's Canadian utility peers.

MH is not unique among North American utilities – all are managing aging asset bases. As a result, modern asset management tools that have been widely adopted as best practice by other utilities are also appropriate for MH. Modern asset management tools will support the goal of economically managing and sustaining assets to the greatest benefit of ratepayers.

Although MH began its asset management journey some time ago, MH's consultant AMCL finds that MH has only advanced its overall asset management maturity from 1.5 to 1.81 (i.e., still in the "Awareness" Category) since the 2016 General Rate Application. Of note is MH's weaknesses in the areas of Asset Management Decision Making, Asset Information and Risk & Review. Consequently, without good input data, tools and decision-making frameworks, MH's decision-making is impaired and does not adequately support its proposed investments or demonstrate they are appropriately prioritized.

As a result, MH continues to employ a top-down budget envelope approach to setting budgets that are not quantitatively connected to the assets MH is managing. MH demonstrates that it is unable to optimally or adequately prioritized its capital investment decisions, and therefore it cannot justify its implicitly subjectively determined Business Operations Capital ("BOC") investment plans. A BOC budget reduction of at

[153] SAIDI = System Average Interruption Duration Index, SAIFI = System Average Interruption Frequency Index. Excluding major events, so that the metrics report on the reliability factors that Hydro has the ability to directly influence through its asset management decision making (i.e., capital investments, and operations & maintenance resources).

least 10% is warranted until such time as MH can demonstrate its decision-making is based upon quality data, tools and decision-making frameworks.

In summary:

1) MH has overbuilt its electrical system and is using this overbuilt system to provide superior reliability to its ratepayers.
2) Ratepayers have not clearly indicated they want to pay for a superior reliability system.
3) MH's asset based is aging as expected and MH needs to increasingly transition to sustainment, rather than growth, activities.
4) MH is still beginning its asset management journey and lacks the data and associated tools to make fully informed budget prioritizations, especially regarding generation and transmission.
    a. On the distribution side there may be a need to increase sustainment expenditures, but MH has not provided evidence that demonstrates the appropriate trade-offs between capital and operations & maintenance.
5) MH lacks the quality of data and decision-making frameworks necessary to support its proposed investments.
6) At least a 10% reduction in BOC capital budgets is warranted until such time as MH provides evidence that its asset decision-making is supported by quality asset management data, tools and decision-making frameworks.

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