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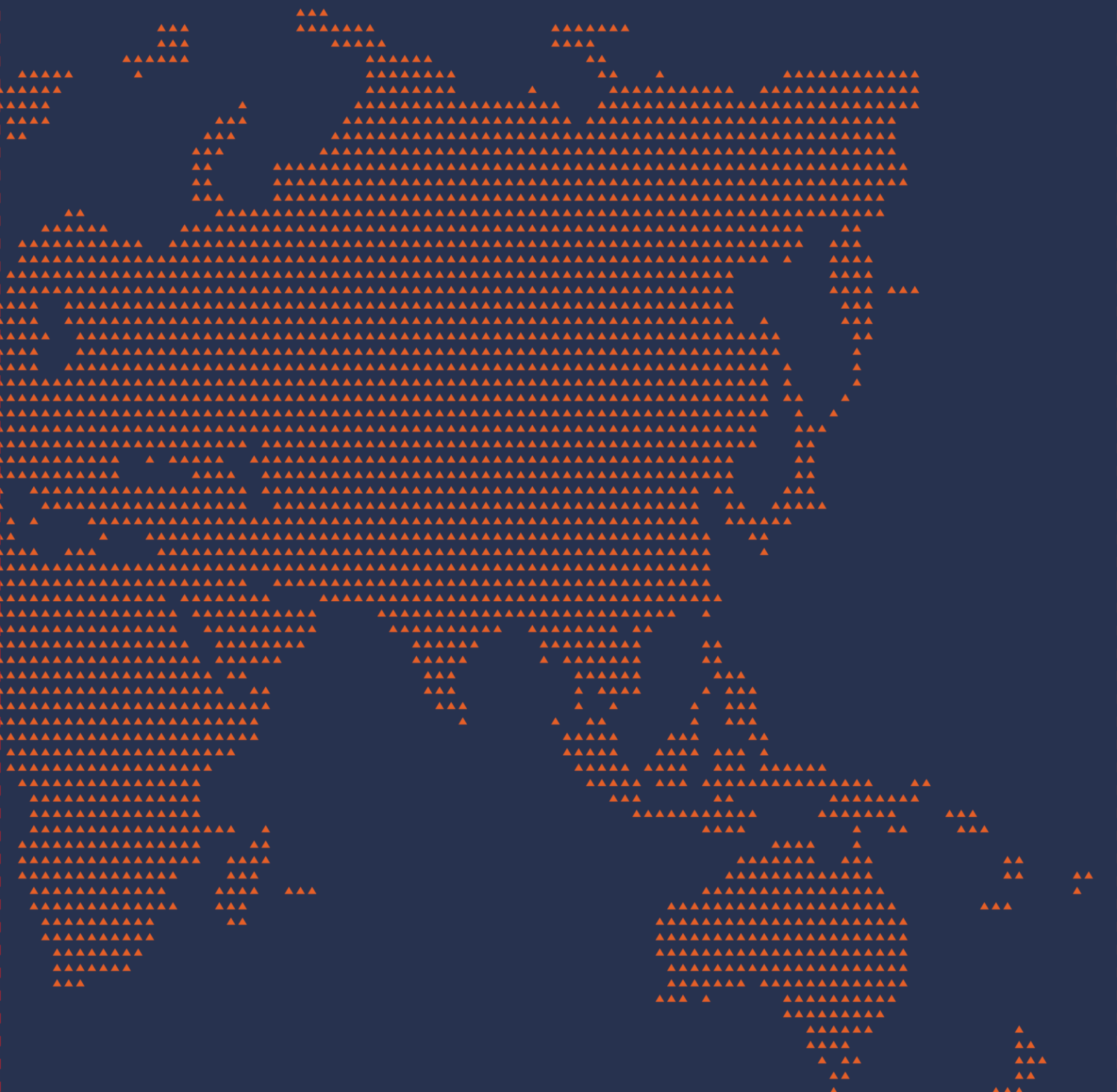

Review of Manitoba Hydro's 2017/18 and 2018/19 GRA Sustainment Capital

Final Report

Prepared For:

Public Interest Law Centre on behalf of the Consumers Coalition
Winnipeg, Canada

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Sustainment Capital

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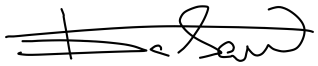

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Background

METSCO Energy Services Inc. ("METSCO") is a utility services management consultancy based in Toronto, ON. METSCO provides electric utilities, regulators and industry associations with a range of professional services in the area of power system planning and design, capital asset lifecycle optimization, operational services productivity, electrical safety, and many others. A statement of qualifications and duties is attached as Appendix B.

We have been retained by the Public Interest Law Centre on behalf of the Consumers Coalition ("the Coalition") to provide expert analysis in Manitoba Hydro's (the "Applicant" or "The Utility") General Rate Application 2017/18 and 2018/19 ("GRA"). METSCO's duties include the following:

- Reviewing the evidentiary record covering areas of capital asset management, and operating activities that support capital assets management;

- Opining – based on the evidence and our general professional expertise – whether and to what extent the applicant's evidence supports the scope and magnitude of its proposed spending plans in the area of sustainment capital;

- Providing examples of best utility practices in capital asset planning and implementation, to assist the parties in establishing the baseline of expectations that the Applicant's evidence could be expected to meet today or in the future;

- Suggesting specific initiatives – either on the part of the utility or the Regulator - to ensure that the Applicant's asset management capabilities increasingly reflect best industry practices.

METSCO's assessment of Manitoba Hydro's asset management practices contained in this report is based solely on information provided by the Applicant by way of the pre-filed evidence, responses to the Minimal Filing Requirements, information provided by Manitoba Hydro staff during the July 20th, 2017 technical conference, and the two rounds of Information Request (IR) responses. As such, our observations and recommendations are a function of the information that the company has made available in the course of the proceeding, and are subject to any further insights that may emerge in the application's later stages.

A notable limitation of this approach is that it constrains METSCO's ability to offer firm conclusions on the state of Manitoba Hydro's asset management capabilities, as we lack the visibility into the scope and nature of pertinent information that may exist beyond Manitoba Hydro's disclosures to date.

Accordingly, our observations and recommendations reflect our assessment of the degree to which Manitoba Hydro's evidence (and the state of the company's asset management practices it describes) sufficiently justifies the funding requests made by the utility. In relaying our observations along the assessment dimensions comprising the bulk of our report, it is also METSCO's intention to provide the parties in the proceeding with a practical framework, to assist in guiding further assessment of Manitoba Hydro's asset management evidence during the anticipated oral hearing and beyond.

Finally, we encourage the Manitoba Public Utilities Board ("PUB" or "MPUB") and intervenors reviewing this report to treat our observations as identification of areas of opportunity, rather than specific recommendations for programs or projects that warrant reduction, deferral or other forms of modification.

Summary

METSCO reviewed the information supplied by Manitoba Hydro regarding the scope, nature and recent evolution of its asset management frameworks, along with details disclosed on specific sustainment projects and programs that the Applicant plans to execute over the 2017/18 and 2018/19 Test Years. Within the broader sustainment portfolio, our focus was particularly on the System Renewal category, which represents approximately 39% of the Applicant's proposed Electric Business Operations budget[1]. We note, however, that the PUB may find our conclusions regarding the Applicant's asset management practices to be applicable to the capital program more generally.

Ensuring that existing asset base performs safely, reliably, and cost effectively for as long as practicable is crucial for any utility seeking to maximize customer value in the time when low growth makes it particularly difficult to address the needs of an aging asset base. Optimal asset sustainment is even more crucial for Manitoba Hydro, whose rate base is set to increase by nearly 50% as a function of two greenfield projects. The significant, and continuously evolving cost estimates for the Keeyask and Bipole III projects leave Manitoba Hydro comparatively less funding room for ongoing asset sustainment and business operations work.

Good asset management is not only a function of diligent asset stewardship – it is also a matter of cost-effective asset stewardship. Ensuring that assets are kept in an optimal working order at the lowest possible cost involves the use of analytical tools that quantify, and ideally, monetize the *risks* underlying the failure of assets. The use of quantitative risk assessment tools enables utilities to shape their plans in intricate ways that balance cost, failure risk, and ongoing performance quality considerations.

Asset risk assessment entails quantifying the probability of their failure, along with the cost consequences of such failure. Doing so involves analysis of data collected in the field (such as condition of asset base in general, and specific characteristics exhibited by equipment when it fails), along with socio-economic information such as the economic consequences of asset failures experienced by customers, or the financial implications of unmitigated safety and environmental risks.

Decisions to replace, refurbish, or enhance the maintenance levels of a particular asset class are then directed at either reducing the cost consequence of failure, and/or the

[1] Manitoba Hydro Technical Conference Presentation - July 20, p. 57

probability that failure occurs. Applied at various stages of asset lifecycles, this analysis enables utilities to decide the optimal mode of intervention for any asset at any point during its functional life. Similar analysis can take place at a system level, with monetized event risks and mitigation costs to be included in the life-cycle calculations to derive optimal intervention strategies.

Based on our observations detailed below, and subject to insights that may emerge through the remaining stages of this proceeding, we conclude that the Applicant's System Renewal capital budgets for the test years and beyond, as presented in Appendix 5.4[2], are not adequately supported by evidence. We draw this conclusion on the basis of multiple observations about the applicant's evidence and the processes underlying it, including the following:

- Limited reliance on asset health data in preparing the current plan;
- Longer, on average, asset degradation timelines than those of industry peers;
- Inconsistent quality of maintenance records underlying sustainment budgets;
- Inconsistent cost estimation practices and a history of cost underestimation;
- No external evidence to support the reasonableness of proposed capital costs;
- Manitoba Hydro's favourable reliability performance relative to industry.

In addition to offering specific observations regarding whether and how the elements of the Applicant's asset management system affect the reasonableness of its ask, we also recommend that the PUB establish a range of potential incentive mechanisms to ensure that the applicant progresses along its path of continuous improvement in asset management capabilities, while exercising increasing cost discipline. Given Manitoba Hydro's circumstances, extreme prudence and maximum precision (within the means of current capabilities) must underlie the decision-making associated with management of the existing asset base and operations activities supporting them. In reviewing Manitoba Hydro's evidence, METSCO sees numerous examples supporting the fact that the applicant has commenced taking meaningful steps in this direction.

However, the pace of its progress to date, and the extent to which the current capital plan reflects the capabilities Manitoba Hydro is beginning to acquire, suggest that the most critical capabilities that signal asset management process competence are not yet

[2] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, Tab 5, Appendix 5.4, pp. 5-6.

in place. We explore these issues in detail in Section 2, following a discussion of general asset management principles in Section 1.

Section 3, in turn, relates the findings from the previous sections to our recommended capital budget analysis, and contains observations regarding the project- and program-specific evidence provided by the Applicant.

Section 4 provides more general recommendations regarding the regulatory oversight and accountability tools that the Public Utilities Board (PUB) may wish to explore to ensure that Manitoba Hydro proceeds along the path of meaningful continuous improvement in the area of asset management. In making these recommendations, it is our firm belief that addressing the current state of Manitoba Hydro's asset management practices relative to the industry median competency levels is a combined responsibility of both the utility and its regulator.

It is METSCO's hope that the insights contained in this report generate productive discourse between the Applicant and the parties in the remaining phases of this GRA proceeding.

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1. Asset Management Principles in the Context of Manitoba Hydro's Operating Circumstances

1.1. Conceptual Asset Management Fundamentals

At its simplest level, Asset Management is about effective stewardship of an organization's capital plant and equipment – performed in a financially responsible manner. Asset Management objectives are accomplished through a group of activities collectively known as an Asset Management System, designed and operationally aligned to enable the organization to prolong the operating life and continued performance of its assets, in a way that optimizes both short-term and long-term costs of doing so, and maximizes other aspects in which assets bring value to stakeholders (e.g. safety or environmental considerations).

In the context of North American regulated utilities, asset management today involves maximizing the value of the existing asset base serving their customers by providing stable and reliable service, and making economically and operationally optimal decisions regarding whether, how, and when to "intervene" in the asset base by way of replacement, refurbishment, capacity enhancements, or other procedures.

Selecting whether, how and when to intervene most effectively, is done on the basis of decisions that balance the company's overall *Objectives* with its operating realities, account for the relative *Risks* represented by potential failure or underperformance of various system components, and using empirical *Information* (such as condition of assets, statistical models predicting the likelihood of their failure, etc.) to determine the best and most cost-effective timing and types of work.

An effective Asset Management System represents a constant feedback loop framework that translates an organization's overall plans and objectives into a comprehensive Asset Management Policy, on the basis of which both longer-term Strategic Asset Management Plans and near-term Implementation Plans are developed and implemented to address the critical risks and deficiencies within the Asset Portfolio.

Among the specific tools that aid utilities in making their asset management decisions are Asset Risk Assessments - which quantify probability and impact of potential asset failures over their lifecycles or an event, helping asset planners determine which mix of work mitigates the greatest aggregate amount of risk.

Risk assessment work entails establishing statistical "failure curves" for each type of asset on the basis of past system performance and asset condition data, which tell utilities which assets are more likely to fail on the basis of which factors. The probability of failure is then correlated with impact of failure, measured in length of interruptions, numbers and types of customers interrupted, and the costs of these interruptions to each customer group. The aggregation of failure risk and failure consequence data enables utilities to prioritize potential projects across business units and asset types on the basis of consistent and comparable Risk Scores.

Supplementing risk assessments are other types of analysis, such as determination of whether and how each project, or a portfolio of projects meets the management's objectives of achieving particular *Outcomes* – such as improvement of reliability, reduction of environmental risks, or public/employee safety enhancements, among others. As with risk assessment analysis, determination of outcomes that each asset portfolio targets may involve the use of various quantitative tools – most notably utility specific reliability forecasting techniques, and more standard business case evaluation tools like Net Present Value (NPV), Payback Period, etc.

While the degree of reliance on the type and number of quantitative tools varies across utilities, the general principle underlying effective asset management comes down to relying as much as possible on objective and consistent data – collected in the field and validated by statistical analysis. While few utilities (if any) possess all the data that they would wish to have at their disposal, advanced asset managers consistently seek new ways to obtain and utilize information that would make their decision-making more precise.

The following diagram as viewed by METSCO provides a visual representation of the key inputs and outputs that together comprise a comprehensive Asset Management system.

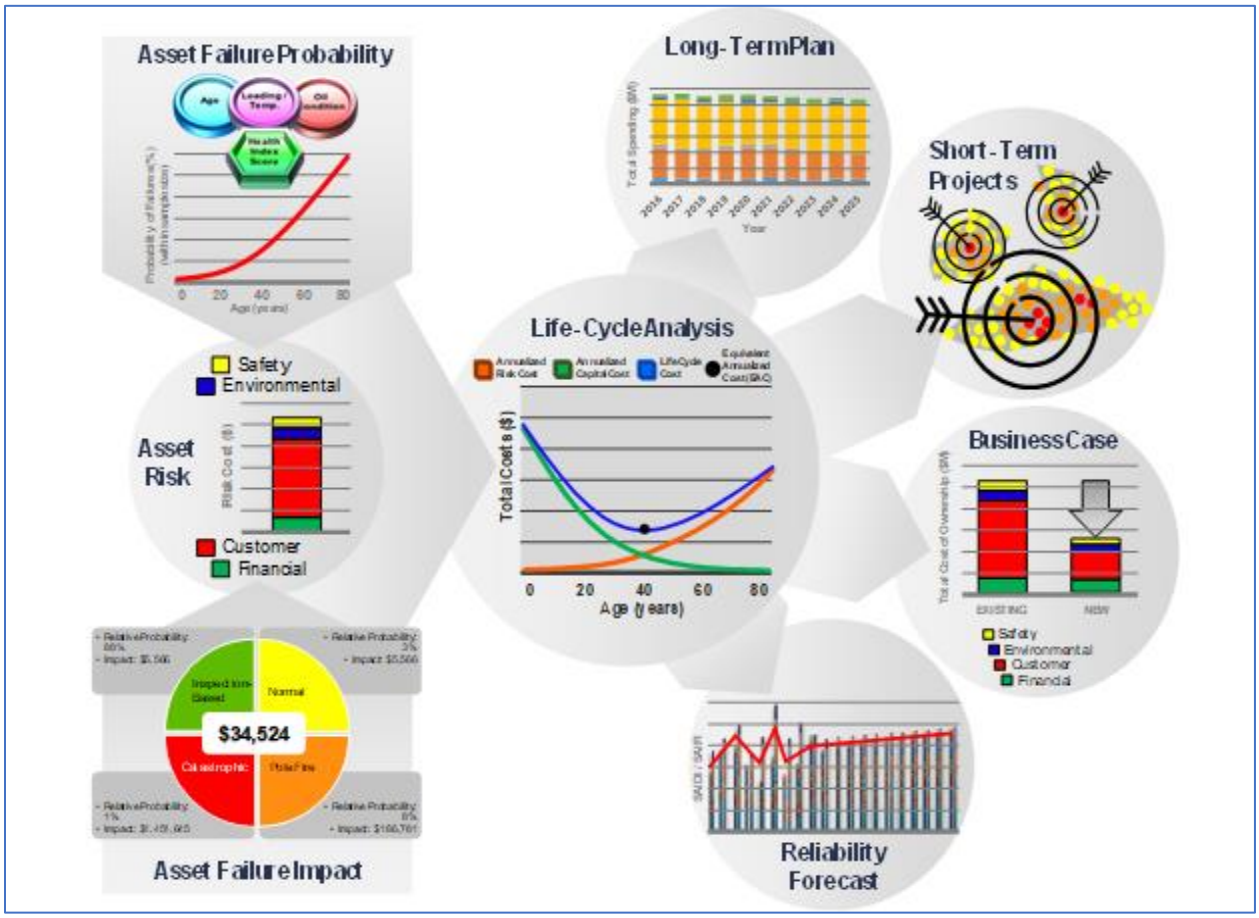


Figure 1. METSCO's Asset Management System

With all fundamental parts of an asset management framework in place, the role of a regulator becomes to oversee the extent to which all parts of the utility's asset management organization work consistently and cost effectively to deliver the strategic and operational outcomes that the regulator initially endorses[3]. This endorsement takes the form of approval of particular policies, objectives, and measurement frameworks, along with proactive articulation of the form and function that supporting evidence should take (for example, by way of filing requirements).

[3] As an example of Outcome scorecard endorsed by the Regulator, we provide the following link to the Ontario Energy Board: https://www.oeb.ca/utility-performance-and-monitoring/what-are-electricity-utility-scorecards/electricity-utility

1.2. Manitoba Hydro's 2017-2018 Asset Management Evidence

Manitoba Hydro's latest capital plan (CEF16)[4] forecasts total expenditures of $2,995 million and $3,099 million in 2017 and 2018 respectively, of which approximately 80%[5] in each year is dedicated to Major New Generation and Transmission Projects. Given the magnitude of expenditures in these categories, the 2017 and 2018 Sustainment Capital budgets of $303.4 and $279.6 million that our analysis addresses constitute comparatively modest components of the overall plan. Total Sustainment Capital budget for 2018-2027 is forecasted to be $3,549 million, representing about 25% of total capital expenditures for the period.

However, unlike the new additions to the system, the Sustainment portfolio (and particularly its largest component – the Renewal Projects) represent the portion of the spend directed at ensuring continued reliability and safety of Manitoba Hydro's existing system – while also collectively being the best indicator of the company's current Asset Management practices.

Given the amount of funding dedicated to renewal relative to new projects, extreme prudence and maximum precision (within the means of current capabilities) must underlie the decision-making associated with management of the existing asset base and operating activities supporting them.

In reviewing Manitoba Hydro's evidence, METSCO sees numerous examples of meaningful steps that the Applicant has commenced taking in the direction of asset management competence. However, the pace of its progress to date, and the extent to which the current capital plan reflects these targeted new capabilities, suggest that the most critical components of a plan that would signal competence are not yet in place. We explore these issues in detail in Section 2.

[4] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, Tab 5, Appendix 5.4, pp. 5-6
[5] *Ibid.*

2. Review of Core Asset Management Policies, Processes and Capabilities highlighted in the evidence

The application record contains a variety of evidence pointing at a number of gaps between Manitoba Hydro's current asset strategy formulation and delivery capabilities, and the industry levels corresponding to a general level of competence and consistency. This evidence includes both third-party assessments and statements of the applicant itself regarding the status of its efforts to implement entity-wide asset management policies, and/or the nature of current analytical tools underlying its asset plans.

Of particular note among are the asset management process maturity analysis prepared by the UMS Group, and the series of documents examining the prudence of the utility's decisions regarding the launch of the Keeyask and Bipole III projects, along with an operating costs benchmarking study prepared by the Boston Consulting Group (BCG).[6] The reports from both of these highly reputable expert bodies showcase a number of important insights as to material gaps between the state of Manitoba Hydro's asset management processes and the industry best practices as of the time of the firms' respective engagements with the utility in 2016. We refer to some of these insights throughout our report, as we attempt to review the extent to which the Applicant's evidence demonstrates any progress made in the past year.

The UMS Asset Management Gap Assessment Report filed by the Applicant in the Appendix 5.1 of its pre-filed evidence[7] provides a comprehensive assessment of the overall level of maturity of Manitoba Hydro's asset management processes, rating the utility's overall current status as 1.5 on a 5-point scale. METSCO does not wish to duplicate the extensive analytical work conducted by the UMS Group. We note, however, a number of the report's findings corresponding specifically to issues of policy/strategy consistency, consideration of the entirety of the asset lifecycle and risk assessment and management:

> *"Responsibilities for Asset Management are divided with a lack of clear understanding of what constitutes the Asset Manager and Service Provider roles, as well as what the responsibilities and accountabilities of each are.*

[6] PUB MFR 72
[7] Manitoba Hydro 2017/18 & 2018/19 General Rate Application, Tab 5, Appendix 5.1

In addition, the fact that Asset Management has developed independently in each Business Unit and that the Asset Management functions are split within the Business Units has led to a lack of standardization of processes (and systems) and hindered the sharing of best practices." (p.7)

…

"Some of the key elements of an Asset Management System are missing from Hydro today. These include audits, controls, and performance metrics which Leadership can use to ensure the suitability, adequacy and effectiveness of the system. Different functions within each business unit have different roles in the asset life-cycle, leading to a situation where no one group or function is responsible for optimizing total asset life-cycle cost. In addition, most asset management efforts are focused on Capital spending with minimal attention given to optimizing O&M, which is a key part of the asset life-cycle." (p.8)

…

"Different tools and methodologies are being used for key asset management processes. While these tools work well for their intended purpose, this replication of functionality hinders the ability to drive consistent practices across the business unit and is likely an inefficient use of resources.

While some of the Business Units have developed Asset Management Roadmaps/Strategies to guide the development of tools needed to support asset management, there is no such corporate plan to guide efforts or set boundaries for which decisions can be made at the Business Unit level and which at the Corporate level." (p. 24)

Notwithstanding these, and other noted examples of material gaps between Manitoba Hydro's practices at the time of assessment and industry best practices, UMS notes that Manitoba Hydro:

"*compares favourably against North American utilities in terms of its Asset Management maturity level, largely as a result of recent progress made (e.g., Capital Investment Optimization-C55, CVF, Asset Health Indices (AHI),*

Reliability Centered Maintenance (RCM), Failure Curves, etc.)". (p.11) (emphasis is added)

Given the emphasis placed by UMS on the above-noted advancements in Manitoba Hydro's asset management capabilities (which figure prominently in the applicant's evidence), METSCO's information requests sought further details as to the status of their implementation, and the degree to which the capital plans underlying the Test Year budgets incorporate the outputs of these tools and frameworks.

Overall, we conclude that all of the above-noted mechanisms remain in the early stages of implementation, rely primarily on analytical inputs that were not developed on the basis of the applicant's own field data, or otherwise exhibit characteristics that cast doubt on the Applicant's ability to leverage these tools in the development of the current plan. As such, and given UMS's reliance on the Applicant's deployment of these tools and frameworks in the provision of its Asset Management maturity assessment, METSCO observes that the ranking of 1.5 out of 5 may have been overstated. Our specific comments underlying this conclusion are provided below.

- ***The Corporate Asset Management framework remains undeveloped, without a clear timeline or quantifiable benefits for Manitoba Hydro's ratepayers.***

The new framework's implementation timing remains uncertain – in its response to the Coalition's IRs, the Applicant indicates that the development of strategic and operational documents for the implementation of the new Asset Management Policy, along with the roadmap outlining specific implementation steps, are yet to be initiated.[8] The Policy and Strategy were planned to be developed by Manitoba Hydro soon after the engagement with UMS, however, no progress is currently evident.[9] It is also concerning that Manitoba Hydro did not ask UMS to provide a greater detail on evaluation scoring for each functional area as a result of the asset management assessment initiative.[10]

In the continued absence of an overarching Asset Management framework, Manitoba Hydro notes that some interim governance measures have been put into place, including a new policy mandating that "all investments greater than $15M as well as each

[8] COALITION/MH-I-202
[9] COALITION/MH I-149a
[10] COALITION/MH II-67a-b

Operating Group's investment portfolio must be reviewed and approved by the Corporate Asset Management Executive Council."[11] .

METSCO notes that a centralized oversight body can be effective where it is confident that the analytical tools and processes underlying the project documents submitted for its review are themselves consistently used and interpreted across the organization. Absent this condition, a centralized oversight body may actually become as an unhelpful operating bottleneck. In addition, $15M as a threshold is nearly 5% of the total projected Business Operations Sustainment Capital in 2017. Setting the threshold too high may undermine the capability of the Council to balance costs, risk and performance of the assets.

For a representative example of a comprehensive asset management strategy, see the link to the UK Power Networks Asset Plan provided in the Appendix.

Manitoba Hydro's IR responses[12] also indicate that in April of 2017 it has established a new Strategic Business Integration Division responsible for addressing some of the functional duplication across the divisions responsible for asset management functions observed by UMS[13]. METSCO sees the commencement of efforts to eliminate functional duplication as a positive step, provided it results in timely and impactful steps, the effectiveness of which can be subsequently verified.

In its response to COALITION's IR II-66 seeking additional information as to the formal mandate, objectives, timelines, and milestones for the new division, Manitoba Hydro stated that these items "were not in the scope of this process."[14] Notwithstanding this response, METSCO concludes that the instances of functional duplication in the asset management decision making processes observed by UMS, remained in place during the timeline of the current plan's (CEF16) development.

METSCO also notes that as of September of 2017, Manitoba Hydro was yet to establish the 2017/2018 Corporate Dashboard and associated targets.[15] While it is reasonable to expect that the company's performance measurement frameworks would be in the state of transition in light of the scope of corporate changes underway, it is not clear

[11] COALITION/MH-I-177a-
[12] COALITION/MH I-177a-b
[13] For example, Tab 5 Attachment 5.1 p.19
[14] COALITION/MH-II-66
[15] COALITION/MH-I-17i

to METSCO why an interim set of measures and targets do not appear to have been adopted to maintain continued focus on performance management.

Targeted benefits of strategic asset management initiatives appear to be largely qualitative - METSCO is concerned that the benefits of planned strategic initiatives remain largely unquantified. Manitoba Hydro's evidence[16] indicates that four strategic asset management initiatives are currently underway at the company – namely the Capital Portfolio Management Program (CPM), Enterprise Asset Management (EAM), Corporate Value Framework (CVF) and Kinetrics Asset Condition Assessments (ACA). Of these, the applicant has only calculated quantifiable benefits for the EAM program, noting that the remaining strategic initiatives are "of strategic value in maturing Manitoba Hydro's asset management processes which is not practical to quantify."[17]

METSCO does not dispute the strategic importance of the selected initiatives. However, and notwithstanding the methodological and logistical issues in quantifying the value of the remaining initiatives that the Applicant brings up, the absence of quantitative benefits (however estimated) fundamentally limits Manitoba Hydro's ability to definitively gauge the value of its efforts, and prevents the PUB from holding the Applicant accountable for delivering concrete outcomes of its major continuous improvement efforts. Accordingly, it is METSCO's recommendation that the PUB direct Manitoba Hydro to establish an implementation reporting framework for all strategic asset management initiatives, grounded in both time-based and economic value-based milestones – such as specific (and verifiable by the PUB) timelines for completing successive stages of project implementation and/or quantifying – and subsequently delivering over a specified timeframe – financial or operational benefits (e.g. dollars and/or time saved through new processes).

Customer rate impact is not an explicit factor in the Corporate Value Framework – Considering the pace of dollars spending, METSCO is concerned with the Applicant's decision not to include customer rate impact as an explicit evaluation variable within the Corporate Value Framework – the mechanism it is in the process of devising to justify its spending decision prioritization.[18]

[16] COALITION/MH-II-59-a
[17] COALITION/MH-II-59-a
[18] COALITION/MH-I-197-e

METSCO agrees with the applicant's reasoning that the combined effect of all other constraints underlying the model should, in principle, lead to an optimized investment portfolio that minimizes customer rate impact. However, unlike most other investment planning optimization criteria, rate impact is fundamentally a matter of affordability and/or willingness to pay for the bundle of services provided, which is at least in part determined by local and global economic conditions.

As such, METSCO sees customer rate impact as an outcome of the utility's planning processes that should constitute a discrete higher-level restraint in the decision-making processes, whether it is part of, or outside the Corporate Value Framework model runs.

We acknowledge that there are circumstances where good utility practice or other considerations would require the utility to seek rate increases in excess of what the optimal rate impact threshold may deemed to be. However, in such circumstances the presence of a nominal threshold becomes an important data point for the utility to use in substantiating the value proposition of contemplated investments.

- ***The Asset Management plans underlying the test years were developed by aggregating a number of discrete, and in some cases, internally inconsistent approaches with varying levels of precision and reliance on field data.***

The Corporate Value Framework that the applicant describes as the fundamental element of its new asset management policy was not used "to determine which projects should be executed within CEF16."[19] While the applicant is clear in its evidence that the framework is intended for use in prioritizing future projects, the evidentiary record suggests that the current approach to project identification and prioritization may embed a number of notable gaps and/or inconsistencies, as evidenced by the following insights gained from evidence:

Inconsistent Plans and Commitments – The February 2015 Engineering Services Division's Strategic Plan was provided by Manitoba Hydro in response to the Coalition's information request for asset management roadmaps or strategies developed by business units. The plan entails an 11-slide PowerPoint presentation, which states that

[19] COALITION/MH-I-197, j) and k)

the Division's Key Strategy is to "Prepare an Asset Management Roadmap, using the ISO 55000 standard[20] for Asset Management as a guideline."[21]

While the Applicant reaffirms its intention to use ISO55000 "to guide its asset management implementation"[22], it notes that "*a better gauge of Manitoba Hydro's progress along its asset management journey is adherence to the implementation roadmap which is to be developed in Phase 3 of the Corporate Asset Management Initiative*"[23]. Given the time lag between the February 2015 commitment to establish an Asset Management roadmap informed by ISO 55000, and the fact that the new implementation roadmap is yet to be developed, it is unclear from evidence what overarching strategic principles are driving asset management decisions in the interim.

Varying Levels of Consistency in Asset Maintenance Documentation Practices – The January 2016 "Summary Report on Strategic Maintenance Plan" for the Engineering Services Division notes a number of gaps in the current maintenance processes for the Generation North and South subdivisions. In particular, it notes that the existing maintenance activities are: "inconsistent, isolated, and have not improved for a number of years."[24]

Among the specific improvements that Manitoba Hydro staff who prepared the report see as necessary, are the need for standardizing and documenting the Forced Outage Reporting and Root Cause Analysis processes, the development and documentation of asset care strategies "such as maintenance programs, condition monitoring, condition assessments, and standard procedures," and establishment of standard Maintenance Task Templates, among others.[25] The deficiencies noted in the Summary Report are concerning, given that sustainment capital budgets are directly informed by records generated in the process of maintenance work. Absent corporate-wide consistency and rigor in documentation of maintenance activities, it becomes increasingly more challenging to rely on the accuracy of sustainment capital budgets that they underlie.

[20] ISO 55000 is a comprehensive international standard covering management of physical assets, which is broadly considered to be a best practice within the utilities industry and beyond.
[21] COALITION/MH-I-181-Attachments p. 5 of 86
[22] COALITION/MH-I-149 b
[23] *Ibid*
[24] COALITION/MH-I-181-Attachments p. 13 of 86
[25] COALITION/MH-I-181-Attachments p. 18 of 86.

We note that certain standalone examples of asset-specific maintenance manuals provided by the Applicant appear to be comprehensive, well-integrated and relatively current, such as the 2014 Integrated Pole Maintenance, or the Overhead Distribution Line Refurbishment manuals.[26] However, METSCO's impression on balance is that the overarching driver of maintenance execution, documentation and work planning practices across all lines of businesses remains the "operational experience" of Manitoba Hydro's staff, that the applicant refers to in a number of IR responses.[27]

METSCO notes that it has no reason to question the expertise and experience of the Manitoba Hydro's staff. However, it is inherently more complex to effectively assess, pace and prioritize the need for, prudence of, and the optimal scale of proposed interventions on a utility-wide basis, when the overall plan presented represents an aggregation of individual asset managers' experiences, that are not necessarily grounded in consistent use of decision support tools.

Piecemeal Utilization of the Reliability Centered Maintenance Analysis (RCM) – the applicant notes that its deployment of RCM framework (considered to be among the industry best practices in managing maintenance expenditures through more focused asset class-based performance analysis) has led to decrease in maintenance tasks and hours for both the generation and transmission areas where the framework was implemented between 1999 and 2005.[28] However, it does not appear from the evidence that the framework is currently used on a consistent basis to drive further improvements, including potential application on the distribution system assets. This is in spite of the fact that a 2001 "T&D Reliability Centered Maintenance Project Final Report" filed in response to the Coalition's Information Request, showcases a positive Net Present Value calculation of over $25 million for implementing the RCM methodology within the company's Transmission and Distribution Business through to 2016/17.[29]

Lack of Quantification of the Capital-Maintenance Relationship – given its plans for increasing its volumes of asset replacements (particularly in the context of the distribution system) it is a concern that Manitoba Hydro has not undertaken a quantitative assessment of potential maintenance savings associated with higher

[26] COALITION/MH I-203-Attachments
[27] For example, COALITION/MH-I-166 f; COALITION/MH-I-180; COALITION/MH-I-183 b.
[28] COALITION/MH I-195a
[29] COALITION/MH I-203 Attachment 4, p. 31

targeted replacement volumes,[30] in spite of the fact that performing this analysis was among the among the "Key Recommendations" provided by UMS Group.[31]

METSCO acknowledges that in its experience a number of utilities struggle to quantify this relationship given a multitude of factors involved. What is particularly concerning in Manitoba Hydro's case is that the value proposition of defining this relationship work appears to be dismissed as immaterial on the basis of the claim that the current levels of asset replacements are relatively small compared to the overall population.

Setting aside the practical merits of this claim in the context of Manitoba Hydro's current financial constraints, it is precisely this type of value-for-money analysis that the Applicant would have to present along with asset condition records to substantiate its proposals to accelerate the pace of asset replacement. In the absence of this analysis, METSCO will rely on the UMS Group's conclusions in this area:

> "The financial focus of asset management at Hydro is on Capital spending, with minimal attention given to optimizing O&M (i.e., are we doing the right work, are we working efficiently, do we have the right resource mix, etc). This has led to a dearth of processes and tools to support effective decision-making around O&M expenditures, as well as weak productivity management. As operations and maintenance decisions have significant impacts on asset life, life-cycle optimization requires these functions to be managed with the same rigor as capital."[32] (emphasis added).

Absence of Clear Targets or Risk Thresholds Indicating Acceptable Level of Asset Population Health Utility-Wide – inquiries into the details of Manitoba Hydro's asset management processes reveal that the utility is yet to define a quantifiable threshold of asset health / condition by major asset type that would represent an acceptable asset risk level.[33]

Similarly, and in contrast to the Applicant's July 20, 2017 Technical Conference presentation,[34] it does not currently forecast population asset risks as a part of its asset

[30] COALITON/MH-I-176
[31] Tab 5, Appendix 5.1 p. 8
[32] Tab 5, Appendix 5.1 p. 20
[33] COALITION/MH-I-184 a
[34] p. 55

management activities.[35] Absent these types of numerically substantiated asset management strategy objectives to inform long-term asset planning and operating strategy formulation activities, a utility's approach remains reactive, rather than proactive in nature, making accomplishment of any particular planning objectives significantly more challenging, both in terms of coordination efforts and the higher likelihood of unanticipated events. In the absence of long-term asset risk mitigation goals, the replacement decisions can be considered as ad-hoc – driven by perspectives of individual managers.

Aside from the above commentary, METSCO acknowledges some notable improvements in the area of asset planning and lifecycle management, including advancements in the XLPE cable rehabilitation project, that appears to yield results that are proving to be materially more cost-effective than replacement,[36] the level of detailed information associated with the distribution system asset failure records,[37] or the general advancements in the Asset Condition assessment data accumulation developed in cooperation with Kinetrics.

Although this indicates a modicum of continuous improvement, in aggregate, the current state of processes underlying Manitoba Hydro's asset management plans as presented in evidence does not enable METSCO to support the applicant's claim that its "confidence level in its proposed sustainment investments is high, in specific reference to that the right assets are being replaced at the right time, and by selecting the most efficient alternative".[38]

- ***Manitoba Hydro's ability to fully leverage the recently procured IT decision support tools may require monitoring to ensure the utility and its ratepayers derive the optimal vale of these investments.***

METSCO understands that implementation of new IT systems and their effective integration into the existing operational frameworks is a complex and a time-consuming change management activity. However, based on our review of the applicant's evidence, we recommend that PUB may wish to monitor whether and how some of the

[35] COALITION/MH-I-205
[36] COALITION/MH-I-198 b
[37] COALITION/MH-II-63b
[38] COALITION/MH-I-180].

recently procured systems are being utilized to deliver the benefits that justified their implementation. Our recommendation is made on the basis of the following inferences:

C55 Copperleaf Software requires further work before it can deliver benefits throughout the company – while the applicant states that it is nearing the completion of the installation of the C55 software supporting its Capital Portfolio Management Program, it notes that "Full implementation of investment decision optimization will require data and process refinement, which are future steps."[39] Absent the investment optimization functionality, it is not clear to METSCO what value the Applicant can derive from this software in the interim, given that the functionality underlies the system's key purpose.

While it is METSCO's understanding that C55 software is currently used for planning purposes within the generation unit, the evidentiary record to date does not appear to clearly indicate the timing over which the Applicant plans to complete the work that would enable the platform's effective utilization across the company's other divisions involved in asset management.

The Meridium Generation Performance Management software's key capabilities remain to be activated – Manitoba Hydro procured the Meridium software to support generation compliance reporting and performance management. Whereas the Generation Performance Reporting Software (GPRS) module appears to be used, the software's other core capabilities like the Asset Performance Management, Reliability Centered Maintenance, and the Root Cause Analysis modules are not presently utilized.[40] Recognizing that software activation takes time and effort, METSCO recommends that PUB monitor the pace of the remaining work, to ensure that Manitoba Hydro derives full value from its information technology investments as soon as practicable.

- ***The extent of Manitoba Hydro's reliance on quantitative tools in asset replacement decisions could not be empirically verified, and appears to be both internally inconsistent and potentially overstated in pre-filed evidence.***

METSCO has made multiple attempts to request spreadsheets or statistical analysis containing formulas and calculations underlying some of the analytical tools in use by Manitoba Hydro. All of these requests have been either explicitly declined, typically by

[39] COALITION/MH-I-201 a-c
[40] COALITION/MH-I-181-Attachments p. 55 of 86

way of indicating that spreadsheet software was not used in conducting the calculations or statistical analysis data was not available,[41] or by providing high-level qualitative information in response to questions for specific data inputs.[42]

While it is not clear to METSCO how Manitoba Hydro can, for example, calculate asset replacement costs without the use of spreadsheet software, and ahead of the implementation of C55 capabilities, the Applicant's claim that spreadsheets are not used appears to contradict its own evidence in at least one instance – namely the "Repair-Replace Decision Guide",[43] which shows that spreadsheet work is included in the Decision Flow Diagram:

> *"5. Estimate Constant Dollar Cash Flows and Residuals - Estimate the cash flows as if interest and inflation were both zero. The spreadsheet equations will be used to discount these cash flows to create the present values.*
>
> *6. Create Spreadsheet - Create the spreadsheet in Microsoft Excel or Lotus 1-2-3. List the annual cash flows for each option. List the real discount rate and use a spreadsheet equation to list the discount factor."*[44]

Subject to further information, METSCO sees the discrepancy between the Applicant's direct Information Request responses and the original documents disclosed in other IRs as directional evidence of the lack of consistency in the practical application of asset management decision support tools that Manitoba Hydro appears to acknowledge in the latest response to a Round 2 IR seeking further clarification of the methodology used for Economic End of Life Calculation:

> "*The Operating and Corporate groups within Manitoba Hydro are currently at varying levels of sophistication in regards to calculating economic end of life and risk cost. This functionality is part of the C55 implementation and is under development. Generation & Wholesale has entered asset data for some of their major asset categories and can utilize this data to determine the economic end of life and risk cost which*

[41] For example, COALITION/MH-I-150 b, d, e, f; COALITION/MH-I-163i; COALITION/MH-I-171 a]
[42] COALITION/MH-I-188 a
[43] COALITION/MH-I-160
[44] COALITION/MH-I-161 a-d, Attachment 1, Page 20 of 22

> *is used in the planning of asset investments. Transmission and Marketing & Customer Service have just started entering asset data into C55 and will be able to make similar calculations in the future."*[45]

In addition, the definition of Economic End-Of-Life which seems to be one of the key "contributing factor in determining when to raise potential investments and for consideration of operational mitigation plans"[46] is not clear. Based on the graphs presented in Manitoba Hydro response,[47] Economic End-Of-Life is a minimum point of sum of NPV Replacement Cost, and NPV of deferral costs of direct cost and lost generation risks. The problem with this definition is that in a low interest environment used to discount the dollars to present time, and in extreme with a zero discount rate, NPV Replacement cost will stay flat. Thus, as long as the asset deteriorates with time, any asset, new or old, with any condition, very good or poor, would reach Economic End-Of-Life (minimum point) now, in the current year. This approach potentially undermines any project in the Test years that was identified based on the Economic End-Of-Life criteria.

Overall, and given the number of instances where the applicant failed to provide specific quantitative information requested, this leads METSCO to conclude that the manner in which the applicant's evidence overall refers to the use of quantitative assessment tools in its derivation of the current capital plan may overstate the actual rigor and precision that such references would typically imply.

- ***The majority of Asset Class Age Limiting Curve and/or Failure Curve data used in asset replacement analysis is based on industry data, which appears to assume shorter service lives than Manitoba Hydro's plant.***

Aside from seven asset classes specifically referenced in the Applicant's IR responses,[48] the remaining failure curve data underlying the current plan were derived on the basis of industry data, without any information regarding the variation between the industry statistics and the performance of Manitoba Hydro Assets.[49]

[45] COALITION/MH-II-64a-f
[46] COALITION/MH II-64a
[47] *Ibid.*
[48] COALITION/MH-I-166e
[49] COALITION/MH-I-166 e, f

METSCO notes that Manitoba Hydro is taking meaningful steps to address the data gaps between its own field data and the industry data used as proxies for the preparation of the current plan, as evidenced by the recently completed July 20, 2017 Asset Degradation Curve Development Study by Kinetrics.[50] However, the results of this study confirm the problematic nature of using industry curves as proxies for Manitoba Hydro's own curves, as out of nine asset classes where Kinetrics was able to compare Manitoba Hydro's own asset degradation curves to available industry data, the expert concludes that Manitoba Hydro's degradation curves exhibit a "much longer" or "longer" asset service lives in seven asset classes, with the remaining two being in line with the industry data.

Considering the timing of the report relative to the preparation of Manitoba Hydro's plan, it is reasonable to infer that the use of industry curves may have led Manitoba Hydro to overstate the probability of failure in its determination of asset volumes requiring replacement over the planning period (if the curves were ever used), particularly in the following asset classes:

Asset Class	**Kinetrics Comments re: MH Asset Service Life vs. Industry**	**Kinetrics Report Page Reference**
Transmission Transformers	"Much Longer"	p. 26
Distribution Transformers	"Much Longer"	p. 34
Generation Transformers	"Much Longer"	p. 37
>100 kV Oil Circuit Beakers	"Much Longer"	p. 42
>100 kV Air Circuit Beakers	"Longer"	p. 49
Generation Oil Circuit Breakers	"Longer"	p. 61
Electromechanical Relays	"Outer Age of Curve Range"	p. 75

While the level of evidentiary detail on the targeted number of replacements by asset class during the test years is not sufficient to make definitive conclusions as to the potential magnitude of the inferred overstatement, METSCO incorporates this finding

[50] COALITION/MH-I-160, Attachment 1

in its overall observations regarding the requested Sustainment funding levels in the following sections.

Lack of Condition-Based Data for Certain Key Distribution Asset Classes (the ultimate drive of this section is the lack of O&M optimization) - the Kinetrics 2016 Distribution Asset Condition Assessment (ACA) report findings rely to a significant degree on age-based data, as indicated by the fact that out of 23 asset classes, the Average Data Availability Index (a measure of the portion of the population for which asset health data was available) was 0% for seven asset classes, and below 50% for another nine types of assets.[51] The lack of asset health data is of particular concern with respect to the Underground Cables (HV-Oil) distribution asset class, over 40% of which is deemed to be in Very Poor condition (and thus, presumably, expected to represent a material portion of replacement work over the coming years), and to a lesser degree for the Ductline and Overhead Switches.

METSCO does agree with the Applicant that the development of the baseline ACA methodology is an important step on the way to enhancing its distribution asset management practices.[52] However, as the Applicant continues to study the results of the Kinetrics Study,[53] we were unable to establish the extent to which the ACA findings on asset health by class correspond to the levels of planned replacements underlying the proposed capital program.

METSCO notes that a clear link between the condition assessment date and the specific assets included in in the utility's sustainment plans, it is difficult to objectively determine whether the spend levels suggested by Manitoba Hydro are under- or overestimated. In any case, investments not driven by clear asset condition- and/or risk-based decision making may be considered as potentially inefficient.

For an example of a plan that effectively utilizes asset condition data, see the link to an Asset Management Plan by New Zealand's electricity distributor Horizon Energy provided in the Appendix.

[51] PUB MFR 92, p. 14
[52] COALITION/MH-I-163 c
[53] COALITION/MH-I-163 g

- ***Manitoba Hydro's costs estimates do not appear to reflect the discipline that PUB and ratepayers should expect from a mature utility like Manitoba Hydro.***

METSCO's review of Manitoba Hydro's evidence suggests a number of instances where the applicant's costs estimation or project cost management procedures reveal opportunities for significant enhancements, warranted by the magnitude of the underlying expenditures, good utility practice, or the gravity of the Applicant's current financial situation. We discuss specific examples presented below:

Planning estimates of various precision and maturity are grouped in a single capital portfolio – as indicated in the Applicant's response,[54] Manitoba Hydro's capital cost budgets are comprised of estimates for Generation and Transmission projects based on "best available information at the time of the estimate plus appropriate contingency," with the exception of distribution projects where a more specific set of "Design-level" estimate criteria is used.[55]

In light of the fact that that the PUB's review of a substantial portion of Manitoba Hydro's proposed capital spend relies on aggregated data, the presence of plans of varying vintages and scales of precision, fundamentally complicates the task of establishing the reasonableness of estimated costs, comparing similar projects within and across portfolios, or undertaking variance analysis between project estimates provided in different applications.

Using a sample of 49 Generation, Transmission, Distribution and Corporate Services capital projects completed over the past five years and listed in Manitoba Hydro's response,[56] METSCO calculated the following variance figures:

Project Category	Completion Estimate vs. Original Estimate	Actual Cost vs. Completion Estimate	Actual Cost vs. Original Cost Estimate
Generation (9 Projects)	105%	6%	114%
Transmission (6 Projects)	34%	12%	47%
Marketing and Customer Service (32 Projects)	26%	2%	27%
HR & Corporate Services (2 Projects)	0%	42%	42%
Combined Average (49 Projects, unweighted)	**40.5%**	**5.4%**	**46.7%**
Weighted Average (49 Projects, Weighting by Actuals)	98%	6%	106%

[54] COALITION/MH-I-191-B
[55] COALITION/MH-I-191
[56] COALITION/MH-I-186f

The first column showcases the percentage difference between the project costs estimated by Manitoba Hydro in the Original Estimate (earliest estimate performed that was presented to the regulator), and the Completion Estimate – characterized as "last approved forecast."[57] The second column showcases the average cost estimate differences between the Completion Estimate and the project's actual costs. Finally, the third column compares the cost estimate differences between the original estimate and the projects' actual final costs. The bottom two rows of the table provide calculated averages across the four project portfolios – both unweighted, and weighted by the project's final costs (that is, the percentage differences of higher-cost projects have a higher impact on the final average calculation than those of lower-cost projects, based on the portion that each represents in the total costs of all 49 projects).

Based on the above calculations, it appears that Manitoba Hydro's capital costs are on average materially underestimated relative to actuals. Subject to a review of the detailed information assumptions and specific project circumstances, a certain amount of variance, potentially as high as +/- 50% in average may be seen as justifiable in absence of detailed data and certainty in scope for an individual project.

However, when reviewing average variances across a material number of projects, METSCO would expect to see estimate variation closer to zero – as the underestimation on some projects would be offset by overestimation on others. While the sample provided by the Applicant contains 13 projects (out of the total of 49) where the costs were overestimated, the magnitude of overestimation and the projects' actual costs, does not appear to be sufficiently large to materially offset the overages on other projects in the calculation of sample averages – both weighted and unweighted.

While ratemaking considerations are outside of METSCO's area of expertise, the highlighted variance amounts warrant further consideration from the ratemaking perspective, as project completion outcomes expected to be delivered for a given investment cost implicitly approved as a part of the overall rate increase, end up, on average, requiring substantially more funding in the subsequent iterations of project plans. The estimation accuracy issues are also critical in the context of project business

[57] *Ibid.*

case justifications, as investments can appear considerably more attractive, if the net present value (NPV) calculations are based on the earliest estimates only.

Although METSCO recognizes that managing a portfolio comprised of hundreds of discrete projects that evolve on a daily basis entails accepting a degree of variability, the present estimation approach as described by the Applicant cannot facilitate the level of discipline and accountability warranted by the magnitude of spending decisions, or reflective of best practices.

We observe that further exploration of the drivers underlying the observed variances may also provide important insights into the issue of material year-over-year "Portfolio Adjustments" that the Applicant appears to largely attribute to "unpredictable and/or uncontrollable factors that hinder progress."[58]

Subject to further insights, METSCO recommends that the PUB consider directing the Applicant to explicitly incorporate the development of a more consistent estimation approach for the purposes of future regulatory submissions into the scope of strategic asset management initiatives currently underway. Absent these process refinements, the present state of affairs observed by METSCO, where project cost estimates are materially adjusted from one year to the next in a manner that lacks transparency and accountability can be expected to persist.

Limited evidence of capital cost benchmarking – based on the Applicant's responses to METSCO'S Information Requests[59] it has not undertaken any capital cost benchmarking studies (be they internal or external), or specific comparisons of capital unit costs to those of other utilities, with the exception of some limited cost components of the Keeyask project performed in as a part of its participation in an industry association.[60]

METSCO understands that to date Manitoba Hydro has not been asked to complete any such study, and recommends that the PUB direct the Applicant to undertake such a study in due course. Given the magnitude of Manitoba Hydro's capital program, METSCO submits that the Regulator would significantly benefit from an external perspective on the cost of Manitoba Hydro's capital program, particularly in light of the initial insights contained in the O&A cost benchmarking study prepared by Boston Consulting Group,

[58] COALITION/MH-II-65
[59] COALITION/MH-I-191c; COALITION/MH-I-153b; COALITION/MH-I-198a
[60] COALITION/MH-I-191c

which finds that the Applicant's operating costs (particularly in the Transmission and Distribution areas) are largely well above the industry peers' medias, and in many cases are in a fourth quartile of the sample.[61]

In the absence of capital cost benchmarking evidence, and particularly in light of the project cost estimation issues discussed above, the PUB and the parties have few tools available to determine whether and to what extent the Applicant's proposed capital expenditure plans are reasonable.

Opportunities for further Inquiries into the capital project cost management practices – by way of successive interrogatory rounds of Information Requests[62] METSCO obtained the complete capital cost breakdowns for two Major Generation and Transmission projects that Manitoba Hydro deems representative of those completed in recent years. The breakdowns, along with percentage of total cost represented by each category are reproduced below:

	Pointe du Bois Spillway Replacement ($M)		Riel 230/500 kV Station ($M)	
Category	Expenditure ($M)	Percentage of Total	Expenditure ($M)	Percentage of Total
Activity Charges	$ 43.3	7.8%	$ 37.5	11.8%
Overhead	$ 8.1	1.5%	$ 7.7	2.4%
Interest	$ 49.4	8.8%	$ 40.6	12.7%
Material	$ 2.5	0.4%	$ 87.2	27.4%
Construction and Maintenance Services	$ 390.2	69.9%	$ 124.0	38.9%
Consulting	$ 51.1	9.2%	$ 17.6	5.5%
Study Costs	$ 5.7	1.0%	$ -	0.0%
Travel Expenses	$ 3.9	0.7%	$ -	0.0%
Building and Property Costs	$ 1.9	0.3%	$ 2.1	0.7%
Motor Vehicles	$ 1.1	0.2%	$ -	0.0%
Other	$ 1.0	0.2%	$ 1.8	0.6%
TOTAL ($M)	**$ 558.2**	**100%**	**$ 318.5**	**100%**

METSCO acknowledges that it is impractical to attempt to draw significant inferences from a subset of only two projects. However, we note that there are some areas that may warrant additional inquiries during the subsequent stages of the process and beyond, including the nature of Consulting Charges (as distinct from internal staff time captured within Activity Charges and Construction and Maintenance Services, and Study

[61] COALITION/MH-I-141a,b
[62] COALITION/MH-I-185a; COALITION/MH-II-69]

Costs), or the potential overlap observed between the Activity Charges which, according to the applicant's evidence,[63] include both Travel and Motor Vehicle Costs, and the latter two categories included separately.

While the categories specifically referenced represent a minor portion of the overall project costs, METSCO believes that opportunities for further insights can be explored within all the cost categories within the context of the current proceeding or beyond, subject to stakeholders' interest. For instance, contractor costs are ultimately a variable cost component, and could potentially present opportunities for reductions. Other areas of inquiry may include contractor cost benchmarking, corporate overhead /vehicle allocation charges and engineering staff throughput efficiency.

- ***While Manitoba Hydro collects reliability performance information, reliability outcomes are not presently used as a quantitative driver of the Asset Management program.***

Reliability is not currently defined as a clear planning outcome of Manitoba Hydro's asset management strategy - while Manitoba Hydro uses SAIDI and SAIFI as Key Performance Indicators on its Corporate Scorecard, the utility does not currently forecast its reliability performance, or revise its targeted performance on a regular basis. The Applicant's IR responses indicate that it has last set corporate reliability targets in 2013, and did so "*based on a comparison of similar utilities' performance from the Canadian Electricity Association Service Continuity Committee at that time.*"[64]

Although periodic comparisons to industry peers can be informative, utilities with advanced asset management capabilities are moving towards using reliability indicators to set specific performance targets underlying their investment plans, which subsequently enable them (and their regulators) to assess the effectiveness of the plans being delivered. Most utilities use reliability as a planning outcome (for instance, many Ontario utilities), with only few having advanced reliability forecasting capabilities

For examples of reliability forecasting reports, see the links to Toronto Hydro and EPCOR filings provided in the Appendix.

[63] COALITION/MH-I-185a
[64] COALTION II-63a

However, these utilities' use of reliability data entails, at a minimum, an annual review of the variance between the current year and past year performance. Judging by the level of detail of Manitoba Hydro's responses to METSCO's requests to disaggregate the reliability data by Outage Cause Code and Equipment Failure type,[65] the utility possesses sufficient data management capabilities to integrate reliability planning and forecasting into its asset management processes but has not done so to date. METSCO recommends that the process of setting specific targets and regular variance analysis review be integrated in PUB's oversight framework of Manitoba Hydro's performance going forward.

Manitoba Hydro's Aggregate Reliability Performance Has Been Favourable – in spite of missing its targeted reliability stats in the recent years, the utility's reliability performance has been generally strong in comparison with the Canadian Electricity Association (CEA) peer group, with both SAIDI and SAIFI remaining within the first quartile over the 10-year period for which the benchmarking data is provided.[66]

While the separate reliability performance for the City of Winnipeg is less favourable than the province-wide result, Winnipeg's performance on both SAIDI and SAIFI over the 10-year period nevertheless remained above the CEA peer group median. While favourable reliability performance relative to peers is generally indicative of good asset stewardship on the part of Manitoba Hydro, it does not necessarily point to the *cost effectiveness* of asset management work, as good reliability performance may also be a function of overinvestment, or just simply lack of rigorous data collection procedures with mostly manual entries.

Consistent with our comments regarding reliability target-setting, a utility can only evaluate the cost effectiveness of its long-term reliability performance if it progressively expands its understanding of the specific relationships between various types of asset intervention work and the ensuing performance level changes. At present, METSCO does not see material evidence of Manitoba Hydro utilizing its quantifiable reliability performance data in the way that would enable it to target specific reliability outcomes in the future.

Customer Interruption Costs (CIC) underlying the Corporate Value Framework do not reflect the preferences of Manitobans – METSCO commends Manitoba Hydro for making

[65] COALITION/MH-II-63b-e
[66] COALITION/MH-I-148g

steps to incorporate Customer Interruption Costs (that is, the cost consequences of outages of various durations experienced by various customer groups) into its Corporate Value Framework supported by the C55 software deployment.

While CEF16 was not developed on the basis of the new framework, a notable downside of the work that Manitoba Hydro is undertaking for use in future plans relates to the fact that the interruption cost data were derived from a sample of studies that are both dated, and predominantly reflect the data of utilities from the regions of North America that are both climatically and economically distinct from Manitoba. The vast majority of studies in the sample were carried out before the year 2000, with the oldest one dating back to 1989, while only two of the ten utilities surveyed are located in the U.S. Midwest – the area that most resembles Manitoba Hydro's service territory.[67]

Recognizing that CIC studies tend to be costly, METSCO nevertheless recommends that Manitoba Hydro explore the other studies available on the market that can be adjusted to local characteristics or a viability of conducting a CIC study that would be more reflective of its specific conditions, potentially in cooperation with other CEA members to manage costs[68]. However, MESTCO strongly suggests development of the Asset Management principles in full first, and only then to start implementing the decision-making tools that fit to the principles of the established Asset Management.

- ***Evidence points to potential missed opportunities for learning and continuous improvement.***

Ongoing learning and development of new competencies (including drawing insights from past failures) are fundamental elements of a successful asset management strategy, as a utility's operating, physical and economic environment is becoming increasingly dynamic. Although the Applicant's evidence showcases a number of instances where Manitoba Hydro staff acknowledge material gaps between the status quo and improvement opportunities,[69] several IR responses discussed below raise concerns as to the extent to which this learning culture is universally shared at the corporate level.

No formal "lessons learned" activities on Bipole III and Keeyask – in light of the significant planning issues associated with the genesis of both Bipole III and the Keeyask

[67] COALITION/MH-I-197-a-k-Attachment, p. 17
[68] CEATI Outage Costs, Project: T134700 #50/116.
[69] For example, internal reports filed in response to COALITION/MH-I-181.

projects, the Coalition asked Manitoba Hydro to discuss whether it took or contemplated taking any formal steps (such as planning assumptions reviews, process amendments, outreach to oversight bodies) to reduce the likelihood of similar planning oversights happening in the future.[70] In posing this question, Coalition was informed by the Boston Consulting Group's (BCG) assessment of both projects, as well as the practical outcomes of the material increases in project costs relative to the approved estimates. In its response, Manitoba Hydro states that it could not point to any specific examples stemming from Keeyask or the BCG review, adding that major multi-year capital undertakings are inherently risky and that it continuously seeks opportunities to enhance its tools and techniques.[71]

Given the magnitude of both projects' impact and the extent of methodological issues identified by BCG,[72] METSCO would expect the company to proactively carry out any number of formal "lessons learned" activities, or at least point to specific areas for improvement, such as the issues surrounding the evaluation of gas generation plant alternatives for both the transmission and the generation projects. This issue of a potential double counting alone could have had a dramatic impact on the decision, even with the reliance on the data available at the time the decision was made. In the meantime, Manitoba Hydro continued providing Information Request responses that lacked clarity in this issue, including a refusal to provide an answer.[73].

No apparent efforts to explore the UMS recommendations – based on its Manitoba Hydro's response to METSCO's Information Request,[74] the utility has not developed individual responses to the 28 overarching recommendations provided by the UMS group on the basis of its evaluation of the company's asset management functions.

Moreover, based on its response to METSCO's IR COALITION-II-67b, it appears that Manitoba Hydro may not be necessarily planning to review the detailed assessments underlying UMS Group's recommendations for the purpose of undertaking the forthcoming phases of its strategic asset management improvement initiatives. In light of the scope and nature of the consultant's observations and recommendations, METSCO is concerned that the lack of action to date may result in Manitoba Hydro

[70] COALITION/MH-I-215
[71] *Ibid*
[72] BCG September 19, 2016 Report, "Review of Bipole III, Keeyask and Tie-Line Project" p.3
[73] COALITION/MH II-74
[74] COALITION/MH-I-182b

missing out on some key learning opportunities (likely at no additional cost). As such we recommend that the PUB consider directing Hydro to provide follow up analysis.

3. Test Year Sustainment Expenditure Analysis

Key Considerations with Sustainment Expenditure Analysis

The key challenge with examining the need for or reasonableness of sustainment capital expenditures lies in the fact that the contemplated work cannot, as a rule, be permanently cancelled (the asset will eventually fail and require replacement some time in the future), short of an asset manager deciding to retire a given asset without replacing, upgrading or refurbishing it. In most cases, however, the options at an asset manager's disposal in light of the funding/labour constraints are the following:

- Proceed with a sustainment project as planned;
- Defer the entire project for a period of time;
- Break up the original scope of work, completing some items as planned, and deferring others;
- Find a way to complete the project at a lower cost;
- Explore alternative options that mitigate the risks of the asset failing.

In deciding to defer a project, in full or in part, the manager must be aware of the implications of this decision. These include creating sustainment work backlogs in the future as more assets remain unaddressed and continue deteriorating – potentially posing a greater overall risk of failure, or challenging the utility's labour force to address the larger scope of work in a shorter period of time.

It is also possible that deferral of the assets into the future and allowing them to fail before being replaced represents the most economical option for numerous asset classes. Any of these options require detailed asset analytics performed. Alternatively, a decision to defer the work may result in under-utilization of the utility's labour force in the immediate term, or incurring additional planning/design costs should the project's original scope be revised and broken up into multiple discrete projects. Each of these practical implications can significantly complicate an asset manager's decision-making process, highlighting the importance of a stable, robust and internally consistent asset management framework to assist the manager in selecting an optimal path, grounded in pre-determined asset management objectives, risk tolerance levels, and other considerations.

Finding ways to complete the work at a lower cost – is invariably one of the most challenging option to explore, given that large parts of a utility's cost structure are fixed in the short run, and the estimating procedures underlying scoping and design activities follow standard criteria. Nevertheless, opportunities to do so typically exist by way of implementing tighter controls around project's variable costs (e.g. overtime, vehicle charges), bundling (where practical) similar and physically or electrically proximate work, or otherwise.

Importantly, the order of magnitude of potential efficiencies is typically revealed by way of comparing one utility's project costs with the cost of similar projects performed by its peers. While differences in the utilities' strategic choices and access to economies of scale inevitably create comparability issues (such as when comparing costs between a rural utility that accepts lower reliability to keep customer costs down, and a large urban utility that seeks to minimize outages at all costs), these factors can generally be controlled to enable meaningful comparison[75].

Key Findings Impacting the Rigour of the Applicant's Forecasts

The preceding section of this report highlights a number of areas with the Applicant's asset management practices, planning assumptions, and current performance levels in a variety of areas that are, in METSCO's assessment relevant to the examination of the Applicant's proposed Test Year capital budgets. These are summarized in brief below:

Favourable Reliability Performance, but Some Evidence of Increases in Equipment Outages – Manitoba Hydro ranks favourably among its peers in terms of aggregate

[75] Example of the benchmarking study can be found in Hydro One recent application EB-2017-0049 Exhibit B1-1-1, Section 1.6, Attachment 1 (Pole Replacement and Station Refurbishment Program Study – Navigant and First Quartile) and Attachment 2 (Vegetation Management Program – CN Utility Inc.) http://www.rds.oeb.ca/HPECMWebDrawer/Record/569824/File/document

reliability performance,[76] but is experiencing growing trends in equipment-related outages across some categories, as shown by the table below.[77]

	2012	2013	2014	2015	2016	Total	Avg. Growth Rate	Trend
Cut-Out	473	536	578	664	762	3013	13%	
Fuse Separation	209	391	462	471	460	1993	26%	
Connector	278	353	377	396	432	1836	12%	
Transformer	286	366	387	397	359	1795	7%	
Conductor	256	275	288	293	324	1436	6%	
Insulator	147	137	109	151	123	667	-2%	
Farm Thermal	77	112	108	90	99	486	9%	
Other	30	59	80	79	77	325	32%	
Hardware	57	42	45	39	22	205	-19%	
Customer-Owned	126	25	35	8	9	203	-26%	
Arrestor	27	37	23	47	38	172	21%	
Disconnect	34	22	13	35	19	123	12%	
Pole	20	9	16	22	9	76	0%	
OCR	16	10	12	13	14	65	0%	
Protective Control Equipment	6	7	16	12	9	50	24%	

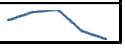
It is notable however, that the assets exhibiting the most pronounced upward trends (cutouts, fuse separations) are among the smaller and lower-cost items, while failure trends and increases across the more expensive equipment items (transformers, cables) are significantly less pronounced. Moreover, at point, there is limited evidence that equipment-related outages are affecting Manitoba Hydro's reliability at an increasing trend. Consider the following table, derived from the Applicant's IR responses:[78]

Figure - Contribution to Transmission Reliability by Defective Equipment Outages

	2012	2013	2014	2015	2016	Average	Trend
SAIDI	9%	40%	46%	5%	13%	22%	
SAIFI	4%	7%	6%	3%	4%	5%	

[76] COALITION/MH-I-148 g
[77] Modified from the Applicant's response to COALITION/MH-I-187
[78] COALITION/MH-II-63d

Figure - Contribution to Distribution Reliability by Defective Equipment Outages

	2012	2013	2014	2015	2016	Average	Trend
SAIDI	33%	46%	33%	34%	28%	35%	
SAIFI	28%	30%	31%	26%	25%	28%	

Contributions to SAIDI and SAIFI by major types of distribution equipment failure also do not appear to exhibit consistently rising trends at this point.[79] Overall, defective equipment constitutes about a third of outage causes, which in METSCO's experience is comparable with other utilities.

Based on Available Evidence, Manitoba Hydro's Equipment on Average Exhibits Longer Degradation Curves than Industry Peers.

Based on the comparative industry data provided in the latest Kinetics Asset Condition Assessment Study,[80] Manitoba Hydro's assets appear to have longer effective service lives than that of their peers. This is an important observation considering that until the release of the most recent Kinetrics report, the vast majority of Manitoba Hydro's asset failure curves were based on industry curves, rather than those of the utility's own field data. While the Applicant states that most of its replacement work is identified on the basis of combination of assessment of age- and condition-based data, METSCO cannot verify the specific methodologies used, and as such, has to rely on the insights drawn from the examination of study methodologies. As such, and subject to further insights, we conclude that the average probability of failure underlying the Applicant's asset replacement plans is overstated.

Distribution Asset Class-Specific Health Data Underlying the Kinetrics Report is not Consistently Reliable

Of the 23 asset classes examined in the Kinetrics Asset Condition Assessment Report for the distribution plant,[81] the Average Health Data Availability Index (a measure of the portion of the population for which asset health data was available) was 0% for seven asset classes, and below 50% for another nine types of assets. Along with the evidence pointing at issues with reliability and consistency of Manitoba Hydro's current

[79] COALITION/MH-II-63d
[80] COALITION/MH-I-160]
[81] PUB MFR 92, p. 14

maintenance record keeping,[82] this further puts to question the Applicant's claim that asset health/condition was a material driver in developing the Sustainment Capital work program.

Of note is the fact that Manitoba Hydro has no health data on the condition of its underground cables – the asset class that Kinetrics nevertheless classifies as being in Very Poor condition for over 40% of the population and expect that the Applicant will have to replace in large quantities. We also note that the Applicant's evidence showcases advancements in its ability to rejuvenate certain types of the underground cable at about the third of a cost of replacement,[83] which suggests opportunities to manage the costs of intervention within this specific asset class.

On the balance of the above information, it is our interim conclusion that age – not condition – was a predominant factor in determining the work program.

The Applicant's Estimation Practices Suggest that the Current Program Costs may be Materially Overstated.

As discussed above, the Applicant's evidence indicates that it uses a wide variety of estimates in terms of their precision when preparing capital plans for regulatory filings,[84] which has consistently resulted in underestimation of planning cost estimates relative to actuals. Our examination of 49 project costs across generation, transmission and distribution businesses[85] revealed an average underestimation of 46.7% between the actual project costs and their initial estimates – a number that increases to 106% if the average is weighted by projects' final costs (suggesting that larger project costs are, on average, underestimated to a larger degree). While the applicant appears to materially underestimate the costs of individual projects, it appears to consistently overestimate its achievable levels of in-service additions. Based on the data provided by Manitoba Hydro,[86] between 2014/15 and 2016/17 the Applicant came short of its forecasted in-service additions by the weighted average of 11% within the Major New Generation and Transmission category, and 18.4% in the Business Operations Capital category.

[82] COALITION/MH-I-181-Attachments p. 13 of 86
[83] COALITION/MH-I-198b
[84] COALITION/MH-I-191
[85] COALITION/MH-I-186
[86] COALITION/MH I-142a-d

As we noted before, over/under-estimation is not necessarily evidence of poor forecasting, and may be driven by a number of justifiable reasons both within and outside of the Applicant's control. However, consistent underestimation of individual project costs exhibited by Manitoba Hydro, paired with the issue of variability of estimate precision across the program portfolio, point at potential project cost management issues that bear further exploration.

The Applicant Supplied no Peer Comparison Information to Support the Reasonableness of Its Capital Costs As discussed in the introductory section of this part of our report, one way to address the issue of increasing sustainment needs is to find ways to do the work at lower cost, which normally starts with comparing one's costs with those of its peers to establish the baseline level, along with the magnitude of potential opportunities. In the context of this application, METSCO does not see a way for the PUB to undertake such an assessment on behalf of Manitoba Hydro, as the Applicant has not provided any evidence as to how its capital costs compare to those of its peers. Absent this information, the Regulator is unable to establish the reasonableness of the Applicants forecasts on the basis of objective external evidence.

METSCO does note that the applicant provided a copy of an O&A benchmarking study prepared by the Boston Consulting Group,[87] which suggests that the Applicant's operational costs, particularly within the Transmission and Distribution businesses, are materially above the industry median, and in many cases, are in the fourth quartile of the dataset.

While capital and maintenance expenditures are not directly comparable, a material portion of capital costs is based up of capitalized labour (as much as 50%-70% based on the two project examples provided by the Applicant).[88] While METSCO recognizes that the bulk of Manitoba Hydro's capital construction work is performed by external crews, that is not the case for all projects. As such, METSCO believes that there may be opportunities for cost management within the proposed capital budget.

The only potential point of comparison between the Applicant's capital costs and those of its peers comes from Manitoba Hydro's statement that its average cost to replace a distribution pole used for planning purposes is $3,500, and ranging between $1,000 and

[87] Tab 10, Appendix 10.12
[88] COALITION/MH-I-186

$10,000 depending on a variety of factors.[89] METSCO compared this average estimate to a recently released Navigant/First Quartile pole replacement unit cost benchmarking study filed by Hydro One Networks in the context of its distribution rate application to the Ontario Energy Board (OEB).[90] The peer group average cost of pole replacement within the benchmarking study is $7,105, which would suggest that Manitoba Hydro compares quite favourably on that particular capital cost metric, even when considering that the applicant's evidence suggests that the RUCES tool that uses the $3,500 estimate has a +/- 30% accuracy[91] (which would increase the upper range of an average estimate to $4500). However, we make this observation subject to further analysis of the costs components underlying both Manitoba Hydro's and the study's calculations, and verification of the extent to which Manitoba Hydro's in-service addition costs match the $3,500 planning estimate.

On balance, however, the PUB has very little in the way of external information to validate the reasonableness of the Applicant's cost forecasts from the perspective of efficiency and cost effectiveness, and a number of reasons listed throughout this report (including those supported by the analysis of third parties like UMS and BCG, who were retained by the Applicant) to believe that opportunities for efficiencies are available.

The Applicant Showcased an Ability to Reduce Test Year Cost Estimates by Revising Project Scopes, Deferring or Cancelling Projects

The applicant's response to the Coalition's information request MH-I-167a-b suggest that it has already taken steps to revise down the initial Test Year estimates for some of the material projects comprising its Test Year System Renewal portfolios by revising project scopes, (e.g. HVDC Bipole 2 Wall Hall Bushings), cancelling (Slave Falls Spillway Rehabilitation), or deferring projects, (e.g. Bipole 2 Thyristor Valve) in whole or in part.[92]

While few of the projects that underwent cost revisions described in the above-referenced IR had material expenditures planned for the Test Years, the fact that the applicant was able to make these adjustments, is indicative of the possibility that

[89] COALITION/MH-I-198b
[90] Navigant and First Quartile Consulting "Distribution Unit Cost Benchmarking Study Pole Replacement and Substation Refurbishment" p.14. Filed in Hydro One Networks Distribution Application to the Ontario Energy Board: EB-2017-03-31, Ex. B1-1-1, S. 1.6 Att. 1.
[91] COALITION/MH-I-198b
[92] All examples are drawn from Manitoba Hydro's response to COALITION/MH-I-167a-b

similar adjustments can be made throughout the remainder of the projects comprising the Sustainment Capital program, particularly the System Renewal projects below the materiality threshold that in aggregate make up $146 and $147 million (or 65% and 68% respectively) of Manitoba Hydro's Test Year System Renewal budgets.[93]

METSCO's Observations on Opportunities for Reductions Based on Project-Specific Information

When examining the list of projects included in the Appendix B of Appendix 5.4 of Exhibit 5,[94] and judging exclusively on the project names/descriptions in the absence of other details, METSCO observes that contained within this list are multiple smaller projects the timing of which may be more discretionary in nature – such as multiple area voltage upgrades, transformer capacity enhancements or additions in the areas where existing facilities are reaching their rating limits, or feeder capacity enhancements where opportunities for deferral may exist by way of revisiting engineering load forecast assumptions or long-term load transfer activities, among others. Similarly, METSCO observes that opportunities may exist to reduce the scope of projects that currently include material civil infrastructure investments not directly related to the electrical equipment's reliability and/or employee and public safety.

Finally, METSCO observes that opportunities may exist to reduce the planned capital expenditures associated with procurement of certain spare inventory parts, such as the Bipole 2 Valve Hall Bushing replacement units, which, based on METSCO's understanding, are being procured to replace the existing inventory of spare parts given that the company appears to be changing the equipment standard away from using porcelain oil-filled bushings. While porcelain bushings are indeed considered to be a legacy technology, METSCO sees no reason why the Applicant could not defer the complete conversion to the new technology until such time as the existing inventory of spare units has been used up, considering that the Applicant plans to install the existing spare units should a failure occur between now and the time when the new type of bushings are procured.[95]

[93] Tab 5, Appendix 5.4 p.6
[94] *Ibid*. Appendix B, pp.9-2
[95] COALITION/MH-I-192-b

Subject to any additional insights that would materially alter METSCO's understanding for the reasons underlying the contemplated procurement, we believe that this, and similar types of proactive inventory procurements can be deferred or even cancelled.

Assuming that similar replacement strategies were contemplated elsewhere in the plan, METSCO believes that there may be an opportunity to examine these assumptions in the following stages of the proceeding.

CONCLUDING OBSERVATIONS

Based on our observations related to the manner in which the Applicant supported its proposed expenditure levels with quantifiable and objective evidence, and subject to further inquiries, METSCO believes that the Applicant has not provided sufficient justification for the magnitude of Sustainment Renewal funding requested for the Test Years. We make this observation on balance of evidence regarding the longer failure degradation timelines of the applicant's plant, the lack of consistent condition-based evidence to support all the investments, the generally favourable reliability performance lack of pronounced impact of equipment failures on reliability performance, and consistent evidence of the company's tendency to underestimate its capital cost estimates.

METSCO looks forward to discussing and refining its observations and recommendations over the remainder of the current GRA proceeding.

4. Regulatory Oversight Recommendations

Having discussed our specific observations and recommendations with respect to the Applicant's Sustainment portfolio, this section of our report provides recommendations on the specific steps that the PUB could take to effectively oversee and incent Manitoba Hydro's improvements in asset management capabilities. In general, and on balance of all evidence METSCO reviewed to date, it is our recommendation that *greater outcome-oriented accountability should be at the core of Manitoba Hydro's relationship with the regulator going forward*.

In response to the majority of Coalition's interrogatories seeking clarification as to the exact scope, nature, and robustness of tools and processes underlying the applicant's capital asset management programs, Manitoba Hydro responded that these initiatives are by and large in nascent stages, with key implementation activities set to occur in some time in the future. METSCO notes that the timelines for the initiative with Roadmap yet to be developed will most likely be years away, as change management implementation estimates frequently understate the complexity of operational, technological, and cultural barriers encountered during detailed implementation – much like they tend to overstate the pace and magnitude of achievable synergies and savings.

While Manitoba Hydro appears to acknowledge that the changes it is targeting are going to take time, the utility's reassurances that work to improve its capital planning and implementation efficiency and effectiveness is underway, are not in themselves sufficient to view the capital budgets presented in this filing as adequate or acceptable. Given the complexity of change management efforts ahead, and the scale and scope of major greenfield projects underway, the likelihood of attaining the targeted process improvements (and cost efficiencies that they ultimately target) should be reinforced by establishing clear and consequential accountability frameworks between the utility and its regulator. Based on METSCO's understanding – few, if any, such accountability tools are in use to date within PUB's framework of regulating Manitoba Hydro's asset management performance.

The accountability tools METSCO recommends that MPUB establish, subject to further insights generated through the remainder of this proceeding, can entail the combination of the following:

- Proactive expenditure reductions in the Sustainment and Business Operations portfolios – along with variance accounts to capture any under/over spend, recoverable subject to detailed ex-post review of the variance drivers and their controllability.
- Project-specific implementation milestones incorporating at-risk funding incentives (e.g. rate increases are allowed if the Applicant achieved specific milestones or targets set by the Regulator) – such as those for implementation (and evidence of utilization) of the key asset management improvement initiatives, or progress along the UMS asset management maturity scale, as confirmed by subsequent assessments by UMS.
- Stricter oversight of cost and timing of capital project deliveries – it is METSCO's understanding that to date, Manitoba Hydro is in a position to materially alter the scope and nature of its capital program delivery across major categories, by way of simply updating its forecasts, and notifying the regulator at a future junction. While deviations from forward test-year forecasts are inevitable (and in many cases, efficient) in a multi-driver/multi-project utility capital program environment, a degree of oversight and accountability over the scope, timing and costs of projects forecasted and those ultimately delivered in a particular year, would help ensure continuous planning and execution improvements, to the extent that analysis of variance drivers would yield insights to be incorporated into future process improvements.
- Progress Reviews of quantitative benchmarking of capital and operating expenditures on a company-wide and/or functional area basis, tied to funding (rate) approvals. The O&A cost benchmarking and the Asset Management Maturity assessment performed by BCG and UMS respectively, are important first steps – as both highlight the sizeable gaps between the applicant's status quo and the mid-range of industry best practices. It is important to ensure that the insights gained through benchmarking performed to date, are translated into actionable and verifiable plans for improvement.
- Key Performance Indicators – grounded in sufficiently rigorous assessment of the baseline level and multi-year target levels, themselves established on the basis of data-driven planning exercises.

METSCO recommends that these and other potential accountability tools are progressively integrated into the PUB's oversight of Manitoba Hydro. Doing so would invariably involve a learning curve for both the utility and the Regulator. Yet, in METSCO's opinion, the benefits of starting this work without delay significantly outweigh the implementation costs and growing pains along the way.

Appendix A: Links to Informative Examples of Advanced Asset Management Documents Prepared by Other Utilities

1. UK Power Networks Asset Management Plan Production Summary Report: http://library.ukpowernetworks.co.uk/library/en/RIIO/Main_Business_Plan_Documents_and_Annexes/UKPN_Asset_Plan_Production_Process.pdf

2. Horizon Energy (New Zealand) Asset Management Plan:

http://www.horizonnetworks.nz/sites/default/files/Horizon%20Energy%202016-2026%20Asset%20Management%20Plan_0_0_0.pdf

3. Toronto Hydro Reliability Forecast – filed as a part of the utility's Distribution System Plan

http://www.torontohydro.com/sites/electricsystem/Pages/2015CIR.aspx#exhibit2b

4. EPCOR's Reliability Projection Model (RPM)

https://www2.auc.ab.ca/Proceeding22672/ProceedingDocuments/22672_X0076_AppendixB-1-2_0076.pdf

5. Ontario Energy Board – Distributor Scorecards

https://www.oeb.ca/utility-performance-and-monitoring/what-are-electricity-utility-scorecards/electricity-utility

6. Hydro One Application EB-2017-0049, Exhibit B1-1-1, Section 1.6, Attachment 1 (Pole Replacement and Station Refurbishment Program Study – Navigant and First Quartile) and Attachment 2 (Vegetation Management Program – CN Utility Inc.)

http://www.rds.oeb.ca/HPECMWebDrawer/Record/569824/File/document

Appendix B: Qualifications and Duties of METSCO

Statement of Qualification – Thor Hjartarson

Mr. Thor Hjartarson completed his Master's Degree in Electrical Engineering at the University of British Columbia in 1990. Mr. Hjartarson is a licensed Professional Engineer in the province of Ontario and the member and past president of the Icelandic Society of Electrical Engineers. Over his 25+-year career in electrical engineering and utility asset management, Mr. Hjartarson amassed a wealth of practical experience and continuous exposure to innovative approaches and best practices in the areas of risk-based asset health and lifecycle optimization approaches, overhead and underground plant maintenance, generation integration, reliability forecasting and smart grid technologies, among many others.

Mr. Hjartarson's professional experience spans a variety of progressively senior management roles in both the utility environment, electricity system equipment manufacturing, and professional management consulting. As a Senior Supervising Engineer of the Acres International – a manufacturer of transmission and distribution equipment, Mr. Hjartarson undertook extensive technical studies and process audits ahead of new equipment integration on behalf of clients like the BC Transmission Corporation, Hydro One Networks Inc. the Russian Federal Grid company, and the Moses Hydroelectric Station in New York, USA.

Between 2005 and 2006, Mr. Hjartarson led several major asset condition assessment projects on behalf of utility clients for Kinetrics Inc., including generation, transmission and distribution work for ENMAX in Calgary, Hydro Ottawa Ltd., Exelon, Idaho Power and a variety of international utilities. In 2007-2012, Mr. Hjartarson applied his asset management expertise at Toronto Hydro in the capacity of the Manager of System Reliability Planning, where he led the development of the company's asset management evidence, along with helping establish the utility's Smart Grid program through a suite of feasibility studies and implementation projects for feeder automation, transformer smart metering and asset analytics. At Toronto Hydro, he was involved in four rate filings where he was a leader in the capital planning justification of the submittals.

Most recently, in the capacity of the Managing Partner and CEO of METSCO, Mr. Hjartarson led the development of advanced asset analytics, maintenance

optimization, and smart grid projects for EPCOR in Edmonton, ENMAX in Calgary, Toronto Hydro, Portland General Electric, BC Hydro, Guelph Hydro, Hydro Ottawa, Ontario Energy Board and many others. Mr. Hjartarson is also an accomplished author and speaker with other 30 publications and presentations in professional magazines and industry conferences, including the facilitation of a Smart Grid workshop for the World Bank.

Mr. Hjartarson's expertise in asset planning, maintenance and performance optimization practices spanning Europe, Asia and North America positions him optimally to offer strategic advice for utilities in various states of asset management maturity and sophistication. His participation in the Manitoba Hydro rate case in the capacity of the Head of METSCO's expert team will benefit of stakeholders involved to advance the common objectives of ensuring that the applicant's asset management policies are both sustainable and efficient.

Statement of Qualifications – Alexander Bakulev

Mr. Bakulev received his Diploma's degree (5-year full-time undergraduate education) with a specialty in Mathematical Methods of Economics and Candidate of Science in Economics (3-year full time post-graduate program) from the St. Petersburg State University, Russia in 2003 and 2007 respectively. His area of expertise includes asset management, financial analysis and business case development.

As a partner of METSCO Energy Solutions Inc. (METSCO), Mr. Bakulev contributed his extensive utility asset management and operations optimization experience to a variety of management consulting projects in the areas of asset lifecycle optimization, risk management and business case project justification, including work for EPCOR, ENMAX, Hydro One Remote Communities Inc., Toronto Hydro, Southern Power, SaskPower and many other utilities.

Prior to joining METSCO in 2014, Mr. Bakulev leveraged his extensive academic background in economics and econometrics in a variety of positions and assignments with Toronto Hydro, which included direct oversight of the company's asset sustainment portfolio planning and risk-based asset lifetime optimization processes. Mr. Bakulev also led the company-wide productivity improvement program and acted as a manager of Toronto Hydro's inaugural five-year Custom Incentive Regulation Rate Application to the Ontario Energy Board, where he contributed to the filing strategy

development and oversaw preparation of extensive benchmarking studies in the areas of asset management and operating efficiency.

Upon moving to Canada in 2008, Mr. Bakulev acted as a project manager in a management consultant company and led several large projects to implement asset condition assessment programs and risk-based life-cycle decision-making procedures in hydro generation, transmission and distribution utilities.

Mr. Bakulev is also a co-author of several publications and research papers for the Institute of Electrical and Electronics Engineers, the International Council on Large Electric Systems (CIGRE) and the Centre for Energy Advancement through Technological Innovation, related to asset management and risk-based optimization, and he made numerous presentations at industry conferences, educational courses and workshops.

Mr. Bakulev has provided an expert opinion on behalf of METSCO to the Ontario Energy Board in the regulatory proceedings where he was tasked to conduct assessments of distribution system plans proposed by utilities applying for Ontario Energy Board rate increases.

Mr. Bakulev's involvement in the Manitoba Hydro rates proceeding will entail providing his extensive practical experience and academic expertise in the areas of quantitative analysis underlying asset investment and sustainment decisions and operational process optimization and rationalization approaches.

Statement of Qualifications – Dmitry Balashov

Dmitry Balashov received a Master of Public Administration degree from the Queen's University School of Policy Studies in 2008, where he specialized in Canadian Energy Policy and Trade Policy. Mr. Balashov is currently completing his Executive Master of Business Administration degree at the University of Toronto's Rotman School of Management, where his areas of concentration include Energy Project Finance, Utility Operations Productivity and Corporate Governance. While completing his Master of Business Administration, Mr. Balashov acted as an adjunct instructor of Rotman's Capstone Course on Utility Productivity for the first-year full-time Master of Business Administration program students, sponsored by the Ontario Ministry of Energy.

Mr. Balashov has nearly a decade of experience in Canadian energy policy and utilities regulation. Between 2008 and 2011, he worked in the Ontario Ministry of Energy's

Supply, Transmission and Distribution Policy Division, where he took part in developing a framework capacity allocation and grid integration policies for the Feed-In Tariff renewable generation program, and undertook feasibility studies for transmission connection of Northern Ontario's off-grid communities. Between 2011 and 2013, Mr. Balashov Acted as a Senior Policy Advisor in the Energy Ministry's Regulatory Affairs and Strategic Policy Division, where he liaised on behalf of the Province with Hydro One Networks on all relevant financial, regulatory and governance issues.

Prior to joining METSCO in May of 2017, Mr. Balashov spent four years in progressively senior positions at Toronto Hydro's Legal and Regulatory Affairs Division. Since 2015, Mr. Balashov occupied the position of Lead, Regulatory Process and Analytics, where he was responsible for the development and implementation of Toronto Hydro's internal programs and regulatory strategies on the issues of utility productivity, operating expenses, and asset management. In his role, Mr. Balashov led the development, defence and implementation of Toronto Hydro's 2015-2019 Custom Incentive Regulation Rate Application in the areas of Operation Maintenance & Administration, Productivity and Performance Management.

While at Toronto Hydro, Mr. Balashov also took active part in over 25 Ontario Energy Board policy consultations and working groups on a variety of subjects related to utility regulation and performance management. He will leverage this experience, along with his academic background in finance and energy economics throughout the Manitoba Hydro proceeding.

Duties of the METSCO team

The following duties were assigned to the METSCO team in the Manitoba Hydro General Rate Application 2017/18 and 2018/19.

The Public Interest Law Centre retained METSCO's services to assist the Consumers Coalition with its participation in the Public Utilities Board review of Manitoba Hydro's Application on issues related to Manitoba Hydro's sustaining capital, including a good practice consideration of Hydro's management of its portfolio.

METSCO's duties include the following tasks:

1. Conducting a detailed review of the processes, data, asset risks, failure rates, business cases, and unit costs in Manitoba Hydro's Application, as well as the methodology used by Manitoba Hydro relating to the necessity and justification for:
    a. sustaining capital expenditures, and
    b. management oversight of large capital projects.

    This task includes:

    - assisting in the development of the overall case theory;
    - preparing briefings for the Consumers Coalition;
    - developing information requests;
    - assisting in the identification of required additional expertise; and,
    - providing briefings to other experts as required.
2. Preparing a critical analysis of Manitoba Hydro's sustaining capital expenditures and, if necessary, providing written and oral evidence, and drafting supplemental information requests and preparing responses to any information requests the Consumers Coalition receives

METSCO's retainer letter includes that the firm is to provide evidence that:

- is fair, objective and non-partisan;
- is related only to matters that are within their area of expertise; and
- to provide such additional assistance as the Public Utilities Board may reasonably require to determine an issue.

METSCO's retainer letter also includes that their duty in providing assistance and giving evidence is to help the Public Utilities Board. This duty overrides any obligation to the Consumer's Coalition.