Empowering utilities

Creating value from physical assets

Aging energy assets are a problem in many regions in North America. For example, in the Province of Ontario, the Mowat Centre's Report on the Ontario Energy Sector notes an average of $15 Billion a year will need to be invested over the next two decades just to maintain current service levels[1].

Planning for future population and growth needs

In its 2017 Long Term Energy Plan, the Province of Ontario highlights the current need to right size and expand assets at their end of life to align with the needs of a rising population.

On one hand, rising regulatory and public pressures are pushing to keep costs to a minimum and customer rates low, while on the other, utilities are faced with maintaining, upgrading or replacing aging assets and delivering reliable service to a growing population; According to Statistics Canada, the population of Canada will continue to grow over the next 45 years to between 40.0 million ~ 63.5 million in 2063[2].

As an example of increasing regulatory pressures for utilities, the Ontario Energy Board (OEB)'s 2017 Implementation Plan now includes the mandate to develop a framework to enhance utility accountability that would include incentives and consequences in relation to service quality, including reliability (target completion date Q2 2020)[3].

Similarly, while BC Hydro projects a 40 percent increase in electricity demand over the next 20 years to align with population growth and industry activity, the Clean Energy Act maintains an aggressive target of 80 percent reduction in Greenhouse Gas (GHG) emissions by 2050 – most GHG emissions in the Province of British Columbia come from producing and using energy[4].

How do utilities strike a balance between these competing challenges? First, utilities need to ensure they deploy capital effectively, and reduce lifecycle costs by applying robust Asset Management Processes. These Asset Management Processes target optimizing the use of capital by focusing on value based maintenance (as opposed to periodical maintenance), and scheduling right-sized maintenance interventions, asset upgrades, or replacement projects, at the right time, to minimize lifecycle costs while ensuring reliability of service.

1 Mowat Centre. (2016, December). Background Report on the Ontario Energy Sector. Retrieved from Mowat Centre: https://www.mowatcentre.ca/wp-content/uploads/publications/134_EET_background_report_on_the_ontario_energy-sector.pdf

2 Statistics Canada. (2015, November 30). Highlights. Retrieved from Population Projections for Canada (2013 to 2063), Provinces and Territories (2013 to 2038): http://www.statcan.gc.ca/pub/91-520-x/2014001/hi-fs-eng.htm

3 Ontario Energy Board. (2018, February 21). The Ontario Energy Board's Implementation Plan. Retrieved from Ontario Energy Board: https://www.oeb.ca/sites/default/files/OEB-LTEP-Implementation-Plan.pdf

4 Government of British Columbia. (2016, August). Sustainability: Trends in Greenhouse Gas Emissions in B.C. (1990-2014). Retrieved from Environmental ReporitngBC: http://www.env.gov.bc.ca/soe/indicators/sustainability/ghg-emissions.html

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Eight step methodology

In our experience, an effective Asset Management Process should incorporate the following eight steps:

1) Fully understand the **service levels** committed to by the organization as well as the current and projected performance against these service levels.

2) Maintaining a systematic record of individual assets (an **inventory**)—e.g., acquisition cost, original service life, remaining useful life, physical condition, repair and maintenance consistency, criticality to system performance (i.e. single point of failure is more critical than an asset with redundancy built in).

3) Performing a time-based probabilistic **Asset Health Assessment (AHA)**, using asset-class-specific Reliability Curves (i.e. P-F Curves), to determine Asset Health Trends based on unconstrained and constrained investment scenarios. This step provides decision makers with the level of investment required to reduce the level of residual risks to acceptable levels. The use of **Asset Health Indices (AHI)** which ranks asset health in a normalized and systematic manner, is key to ensure comparability and proper metrics for analysis.

4) Developing a **Project Register** of Maintenance and Capital (upgrade and replacement) projects and/or programs, based on Asset Health Trends and projected replacement costs that will ensure that service levels are met.

5) **Prioritizing Projects by** applying a tailored **Capital Allocation** risk based cost-benefits tool to ensure consistency.

6) **Refining the cost estimate** of Maintenance (Opex) and Capital Projects (Capex) for each priority project.

7) Performing **Financial Modelling** and sensitivity analysis to compare different levels of intervention, and calculating the **Lifecycle Costs** associated to each level of intervention.

8) Drafting of an **Asset Investment Plan** that describes the proposed maintenance and capital project scopes, scheduling, and cost for the preferred scenario, as well as the cash flow requirements into the future.

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If asset failure events can be predicted before they occur, and repair or upgrade work schedules for critical systems and components can be advanced, labor overtime will be lower, emergency repairs will be minimized, and overall costs can be reduced. Many examples can be provided where capital and maintenance expenditures by utilities have been reduced by up to 20-25% or more through implementing rigorous Asset Management processes.

Developing an Asset Management Office

The process described above is necessary to achieve the desired cost reductions, and much of this effort should be undertaken by the organization in a coordinated manner with the appropriate leel of leadership and governance. Our experience supporting utilities and governments around the world in deploying Asset Management processes shows that in most cases an Asset Management Office (AMO) should be established to deliver a strong Asset Investment Plan that drives real cost savings and can be effectively communicated to the Board and regulators. The AMO should be comprised of a mix of engineering, construction, finance and risk and statistical modeling specialists, that work together to deliver the steps described above. It is important that the AMO be allowed to maintain the required level of independence from the operations' teams to ensure data, assumptions and outcomes are unbiased. In our experience, an independent expert's report validating the approach, steps, and methodology employed throughout the process will provide invaluable support to any investment plan submitted to a regulator.

This coordinated AMO approach leads to higher levels of engagement across the organization, and more buy-in from internal and external stakeholders. Generally most utilities can get the process started and have a AMO set up in a matter of months, but the cycle to arrive at a robust Asset Investment Plan will likely be longer and can last up to two years overall. It is therefore important to start the process one to two years in advance of regulatory submission deadlines.

Harnessing data over the asset life cycle

Maintaining a systematic record of individual assets or an asset inventory is the starting point for optimizing capital allocation to help minimize risks and maximize value to the organization and to stakeholders. Asset intensive organizations typically have deployed Enterprise Asset Management (EAM) solutions to manage the maintenance requirements of assets. Often, the asset related data which resides in these systems may not fully meet the needs of managing the asset over the entire life cycle.

For example, the EAM system may be configured to only identify and track maintenance procedures against the assets that require periodic maintenance leading to the absence of assets in the EAM that do not require regular maintenance.

Other typical key sources of asset information in the utility are the Enterprise Resource Planning (ERP) system, the Geospatial Information System (GIS), the real-time Energy Management System (EMS) and Distribution Management System (DMS) and their data historians. In order to reconcile the disparate asset data stores with their own data nomenclature, it is critical to organize the data and determine the system of record for each key data element through a Master Data Management (MDM) initiative. By doing this, the key data elements needed to support asset lifecycle management and capital investment decisions can be identified, cleansed if need be, catalogued, and presented in a data store for analytical purposes.

As with any analysis, the quality of the results is largely dependent on the quality of data available. Data quality does not haphazardly happen on its own; it is rather achieved through vigorous management of the data as a key "asset" within the organization, with its own set of data quality standards, clearly defined roles and responsibilities, governance, processes, and supporting technology. Then there is the challenge of turning data into information and interpreting it correctly. To accomplish this, it is important to start with the end results in mind. Key questions that should be addressed include:

- What are the assets classes and sub-classes being managed by the organization?
- What condition are the assets in and what is the remaining life expectancy?
- How much capital is required to ideally sustain the assets?
- What risks are present or will arise if asset investment is curtailed?
- What is the resultant service level based on different investment scenarios?

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These and other pertinent questions will determine the data elements and the systems of record needed to capture, store and present them for analysis. Traditionally, data analysis has been aided by building data warehouses supported by Business Intelligence (BI) solutions.

Recent advancements in artificial intelligence, machine learning and augmented reality technologies have enabled much greater capabilities in deriving predictive insights from data. These technologies help inform project investment decisions made by corporate executive teams and external experts as part of the development of **Asset Health Assessments and Asset Investment Plans**.

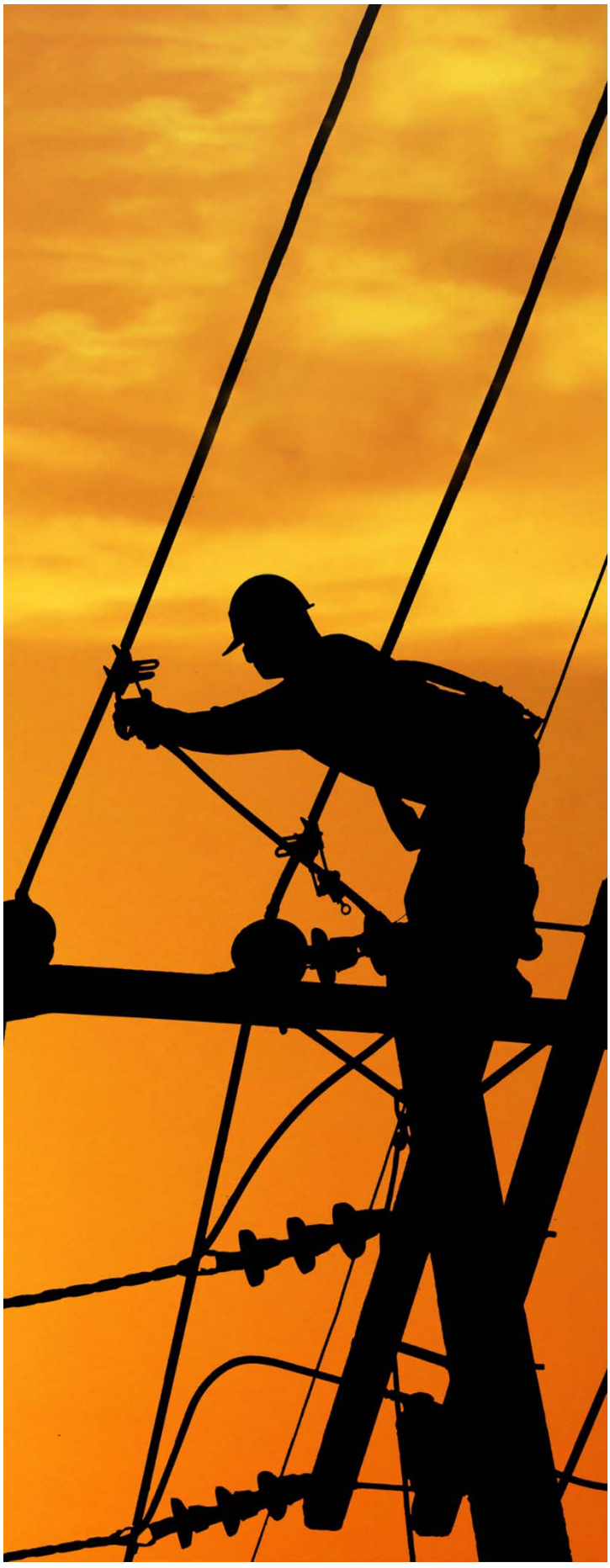
Optimizing asset health

The **Asset Health Assessment** provides a time-based model of asset health trends for the entire portfolio of assets by their respective asset classes. Combined with estimated replacement costs, it provides a useful estimate of the capital required to sustain the existing portfolio of assets in State of Good Repair to meet service levels. This information is increasingly being requested by the regulator to demonstrate the long term capital plan for a utility in support of a rate application.

Prior experience demonstrates that an **Asset Health Assessment (AHA)** will be more readily accepted by a regulator and interveners if supported by an **Asset Health Review (AHR)** prepared by a qualified independent third party to test the assumptions, calculate selected samples and compare end results. The AHR provides confirmation that the information contained in the AHA can be replicated by an independent third party using the documented approach.

The different asset classes (poles, transformers, cable, towers, facilities, IT infrastructure, etc.) are assigned Asset Health Indices (AHI) to facilitate the health assessment, and ensure comparability by utilizing quantitative metrics. Inspection results should be a major input to inform decisions on maintenance levels and requirements, and decisions on the selection of capital projects.

While the Asset Health Assessment provides a useful long-term view of capital requirements based on probabilistic analysis, the utility must also develop a shorter-term actionable plan with specific projects and programs to maintain asset performance and ultimately meet service levels. The proposed projects and



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programs in the **Project Register** are for immediate asset needs that if not addressed, impose risk to the organization. Often the total expenditure for the proposed list of projects and programs exceed the approved budget and decisions need to be made as to which is the approved list of projects based on priorities.

Cost optimization and recovery

The prioritization of projects and application of a **Capital Allocation Methodology** needs to involve a detailed assessment of cost versus benefits in terms of reduction of corporate risks for each proposed project. The Capital Allocation Methodology should link the proposed investment improvements to the risk elements contained in the **Corporate Risk Registry**. These risk elements should ideally have specific weighting based on their importance to organizational and corporate objectives such as Reliability, Environmental Stewardship, Financial Performance, etc.

Our team at KPMG in Canada can guide the development and application of this Capital Allocation Methodology and has experience working with many organizations in this area. We can provide an impartial view in facilitating the discussions to determine and test the risk evaluation criteria and the subsequent weightings amongst the different stakeholders within the utility. Having a corporate Capital Allocation Methodology allows more clarity and transparency in communicating investment decisions internally as well as to external parties.

A common approach is to rank projects in terms of the reliability improvement expected, often by creating a ratio that expresses the cost of the project per unit increase in expected reliability performance. (Thus, this ratio could be calculated by dividing the cost of the project by the expected impact of the project on, for example, the total number of customer outage minutes.) This provides a convenient means of identifying projects that have the greatest net benefit in terms of reliability.

When developing project CAPEX **cost estimates**, there are a few key considerations, which are largely applicable to O&M projects or OPEX cost estimates:

- Different class estimates shall be required depending on the project's priority. Priority short term projects should generally be Class 3 or 2 Estimates. Long term projects should be Class 5 or 4 Estimates, according to AACE classification.
- The cost of outages should be based on historical data wherever possible.
- Capital project costs should be supported by several budgetary quotes from specialist contractors. Average or median quotes (not lowest

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quotes) should be used.

— In some cases, where megaprojects or programs (nuclear refurbishments, or large green field power plants or transmission lines) are involved, early contractor involvement (formalized through a "Definition Phase" contract) in the estimating process is recommended. Contractors should be properly compensated under such contracts to ensure the right level of effort and results. Nuclear operators in Ontario are leading the way in our industry in this regard.

— An independent audit/review of the cost estimate will provide increased comfort to the Board that estimates have been produced following AACE guidelines and identify any exclusions, limitations or embedded risks, as well as the right contingency levels. If there are any gaps, these can be closed by strengthening the Basis of Estimate and the Execution Plan prior to project execution.

Choosing the right financial model

The development of a robust financial model also requires careful thought and process. In most cases we recommend utilizing tailored (not "off the shelf") tools that help capture maintenance activity schedule and cost data in a manner that suits each organization. It is not uncommon to see anywhere between five and ten cost/cash flow scenarios that compare different levels of intervention at different points in time. In developing scenarios, engineers and finance specialists should work together with a goal of understanding what maintenance activities be optimized to reduce overall expenditures. One of the keys to a successful analysis is to ensure that different scenarios compare the risk and cost impacts of replacing or repairing for the same assets. Decisions should be based on thorough risk and financial analysis, as opposed to just gut feel or past experience.

In addition, and as part of the financial modelling effort, the organization should decide which assets should be replaced vs. repaired based on risks and historical costs or repairing vs replacing. Outage costs (including loss of revenue) should be included. Such analysis should be carried out at the asset class level and subsequently at the portfolio level.

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Finalizing your plan

Finally, in drafting and presenting an Asset Investment Plan to the Board and regulator, it is important that non-technical stakeholders across the organization understand the Plan. Often we see capital plans submitted to regulators getting rejected or not fully approved due to lack of clarity and alignment between Asset Health Review outcomes and the Capital Investment Plan presented.

Our team of Asset Management advisors in KPMG in Canada can help challenge the outcomes and polish the plan, synthesize language and actions, and tailor the materials presented to the Board so that alignment with regulatory requirements and strategic corporate objectives can be highlighted and demonstrated.

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