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Advancing Infrastructure

EPCOR Establishes Risk-based Asset Management Program for Electric Distribution Network

AssetWise Digitalizes Process to Quantify Asset Health and Achieve 15% Improvement in System Reliability

Project Summary

Organization:
EPCOR Utilities

Solution:
Utilities and Industrial Asset Performance

Location:
Edmonton, Alberta, Canada

Project Objectives:
- To quantify asset health to minimize unplanned outages and improve safety and reliability.
- To prioritize assets for proactive intervention and replacement to optimize capital spending.

Products used:
AssetWise®

Fast Facts

- EPCOR implemented a digital risk-based asset management approach for aging infrastructure along its Edmonton power distribution network.
- Working in a connected data environment using AssetWise facilitated integration with SCADA data and field inspection systems, establishing an asset health index for over 74,000 assets.
- EPCOR determined its annual risk cost for 177,000 unique assets totaled CAD$ 95 million.

ROI

- Developing a digital risk-based management solution reduced total SAIDI for outages associated with defective equipment by 43%, well below the regulated threshold.
- The utility calculated asset health for over 74,000 assets, representing 77% of the target population, with an average confidence factor of 86%.
- The predictive asset prioritization model facilitates more informed decision-making for capital investment planning and opportunities for further cost savings.

Cascading Failures Demand New Strategy

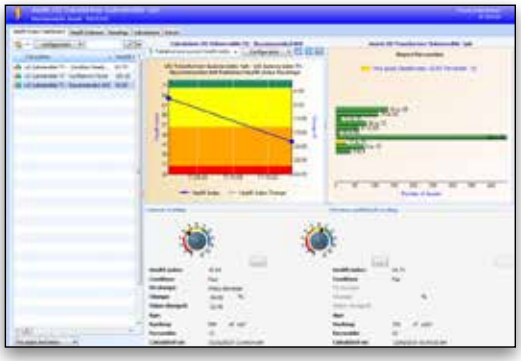
Headquartered in Edmonton, Alberta, EPCOR Utilities owns and operates electric, water, and natural gas utilities in municipalities across Canada and the southern United States. EPCOR's electric distribution system provides power to over 400,000 Edmonton customers and has over 200,000 assets, including 5,580 kilometers of circuits, 50,000 poles, and 30,000 transformers. These assets degrade due to weathering and electrical loading, with typical life expectancies ranging between 35 and 45 years. Over the past two decades, EPCOR's system average interruption duration index (SAIDI) peaked at just below the regulated threshold. Some areas of the city experienced outages 10 times more frequently than the rest of the city.

A simple demographic analysis of installed infrastructure predicted a 74% increase in the number of assets that would reach end of life over the next 10 years, compared to the previous 10 years. Historically using an age-based replacements strategy, EPCOR waited for assets to rust, leak, or fault electrically, where simple field repairs were no longer sufficient before considering replacement. Based on this end-of-life asset management approach and the demographic study, the utility would need to replace 10,000 more assets over the next 10 years. Furthermore, EPCOR's capital spending was effectively capped given a new performance-based rate structure to be implemented in 2018. To cost effectively maintain system reliability with current resources, despite the forecasted asset failure, EPCOR recognized the demand for a new asset management strategy and sought a digital solution to quantify asset health and prioritize assets for proactive intervention and lifecycle replacement.

Shifting to an Asset Health Model

Having already established an enterprise asset management system in AssetWise, which houses over a decade of asset data, EPCOR knew it was time to leverage the reliability capabilities of AssetWise to support their strategy to implement a risk-based asset management process aligned to the emerging ISO 55000 standard. The project team used AssetWise to conduct a health assessment of their geographically dispersed assets. By statistically analyzing 10 years of data, EPCOR developed failure probability curves and defined the statistical relationship between asset condition and asset failure. "Risk-based asset management means taking the probability of an asset failing and multiplying it by the impact of the asset failure and ranking your assets accordingly," explained Stephen Seewald, manager, asset performance and risk management at EPCOR. The strategy included establishing an asset health index—scoring the assets out of 100%—so that each individual asset could be more accurately placed on that failure probability curve.

To develop its asset health index in AssetWise, EPCOR evaluated asset data for 117,000 assets, including data integrated from their SCADA system to provide electrical loading information in near real-time, 19,000 outage records, and more than 1 million inspection records. By combining the health scores with the failure probability curves, EPCOR derived a more accurate probability of failure to identify assets at risk. Integrating the assets within the asset health index with the organization's geographic information system (GIS) allowed EPCOR to determine the precise location of degraded assets, revealing poor asset conditions in older neighborhoods. Aggregating that data into a dashboard for management and reporting provided an accurate visual representation of the overall condition of the distribution system, showing that nearly 8,000 poles were in poor or very



Asset health dashboards provide an accurate visual representation of degrading condition and an overall health score.

"AssetWise is the central system that keeps our power distribution workforce on track and provides the foundation for risk-based asset management, supporting over 117,000 assets."

– Stephen Seewald, Manager, Asset Performance and Risk Management, EPCOR Utilities

poor condition. Overall, the asset health index revealed that 17% of EPCOR's assets were in poor or very poor condition, most of them poles. Shifting to this asset health model provided EPCOR with a better understanding of its assets' condition and better means of communicating their condition through dashboards created via AssetWise.

Establishing Asset Risk Cost

Having the asset health scores was not only valuable to ensure power distribution reliability, but it also was critical in calculating the annual risk cost for each asset necessary to meet capital spending budgets. While asset health defined the probability side of the calculation, EPCOR also needed to evaluate and monetize the impact that an asset health score had financially, environmentally, and collaterally on other assets or property. This practice helped the team achieve an economic model for optimal financial and operational planning, as well as decision-making. The utility monetized all the major categories of impacts related to asset reliability.

Using Bentley's interoperable AssetWise software, EPCOR integrated data from multiple sources related to full costing on work orders and work requests, materials, supply chains, and vehicles to deliver a streamlined view of asset information. An in-depth analysis of AssetWise work order history, coupled with data from the connected digital twin model of the power distribution network, helped provide an understanding of how asset failures affect replacement cost, damage to adjacent assets, safety, and environmental cleanup. EPCOR leveraged AssetWise data with the digital twin, SCADA, GIS, and Oracle applications to evaluate electrical load risks, number and type of customers at risk, and cost of power interruption to customers. As a result, the project team established an overall annualized asset risk cost, which provided valuable input to capital asset budgeting. For the six asset classes that were analyzed, the calculated annual risk cost totaled CAD$ 95 million, with cable alone representing 60%, or CAD$ 56 million of that risk cost.

Optimizing Asset Lifecycle Management with Risk-based Approach

By applying the asset risk cost to the probability of failure, EPCOR ran a cost benefit analysis to determine the lifecycle cost. The organization prioritized the assets for lifecycle replacement to optimize capital spending within reliability targets. EPCOR will now run this analysis annually for each asset to determine the optimal time to intervene, meaning the point where carrying the risk cost of the old asset outweighs the cost of replacing it. For example, if EPCOR has a 20-year-old asset and the optimal intervention is at 35 years of age, the utility has 15 years until intervention. Therefore, the asset is not a high priority for immediate replacement because it is not economical. The higher that the asset is on the priority scale, the more likely and the sooner that it will be replaced.

Based on the prioritized list of assets, asset managers created a 10-year capital plan for long-term budgeting and specific asset scopes for building a list for the annual budget. As a predictive model, this risk-based approach now improves the whole workflow and supply chain management process, having more time to queue contracts to eliminate paying premiums for last-minute equipment orders.

Using AssetWise as the foundation for its risk-based approach to quantify and prioritize asset health and reliability cost, EPCOR has optimized its lifecycle asset management, improving its power distribution system reliability by 15%, despite the aging asset population. Working in a connected data environment using AssetWise, EPCOR calculated asset health for over 74,000 distributed assets, representing 77% of the target population, with an average confidence factor of 86%. Within the first two years of developing the asset health index and risk-based asset management program, the utility reduced defective equipment outages by 43%. Since 2014, EPCOR's asset performance has leveled and now falls within the acceptable regulated threshold. The total SAIDI was 0.833, well below the regulated threshold of 1.15 hours per customer.

Delivering Sustainable Benefits

"Do your failure mode effects analysis and failure tracking in AssetWise," stated Seewald.

The increased granularity of asset data supported in AssetWise now allows EPCOR to assign a probability of failure, criticality, and risk cost to each of the assets. The resulting information helps EPCOR identify the right actions or interventions to be applied, improving overall value of the services delivered to customers. The data also facilitates long-term planning of capital investments, enabling EPCOR to sustain electric system reliability despite increasing cost pressures and an unprecedented wave of aging infrastructure. The analysis work and its tangible results helped create opportunities for further cost savings through the use of stable, enduring contracts and improved bargaining power.

The on-going application of statically based failure curves and risk analysis is new in the electric distribution industry. According to its consulting engineering firm, EPCOR has successfully bridged the gap between engineering decisions and economic impacts, ultimately creating in-depth, quantitative business cases that are a core component in the utility's ongoing prioritization of asset infrastructure. As a comprehensive decision-making framework, EPCOR's risk-based asset management practices help apply the right decisions to the right assets at the right time, facilitating continuous improvement and evolution. "[AssetWise] helps us to provide better control over system reliability and cost for the city of Edmonton, which is essential for economic development," said Seewald.

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