Blazing the trail to asset performance improvements, cost reductions & risk mitigation with ABB Ability™ Ellipse® APM
Blazing the trail to asset performance improvements, cost reductions and risk mitigation: FirstEnergy’s experience and lessons learned on the journey to data-driven, condition-based asset management with ABB Ability™ Ellipse® APM
The client
FirstEnergy

FirstEnergy, headquartered in Akron, Ohio, includes one of the nation’s largest investor-owned electric systems with more than 24,000 miles of transmission lines and a diverse generation fleet with a capacity of nearly 17,000 MW. Its 10 regulated distribution companies serve six million customers in the Midwest and Mid-Atlantic regions.
The challenge

FirstEnergy set a goal to migrate from its traditional, retroactive operational reporting and time-based maintenance to a predictive maintenance and prescriptive analytics strategy driven by field data. FirstEnergy realized the migration would require collecting and compiling relevant data in near-real time to determine the health of their assets. The first step: Create the required data streams to feed its asset performance management (APM) solution, ABB Ability™ Ellipse® APM, formerly known as Asset Health Center.
ABB’s solution

Assessing the data

As with all analytical solutions, Ellipse APM requires the data entering the solution be timely, accurate, relevant and appropriately formatted to provide meaningful results. So the first step was for FirstEnergy engineers, IT professionals and field personnel to collaborate with the ABB Ability Ellipse APM team to define the data requirements.

Ellipse APM accommodates many parameters; the more parameters provided, the greater the validity and accuracy of output – albeit with more inherent complexity. With years of data, FirstEnergy understood it was best to take incremental steps in the implementation process by identifying only the data that would lead to valid results. For substation transformers, as an example, in stage one of implementation, using only nameplate information, dissolved gas analysis and standard oil test results, Ellipse APM can provide health predictions with 70% confidence (Figure 1). Subsequently, from stage 2 to 5, FirstEnergy identified additional data sources such as power factor and fault history to increase that confidence level to over 90%.

“...The team assessed all available data from the Ellipse APM perspective,” says Dr. Siri Varadan, Director, Product Management for Ellipse APM. “Where was the data, what format was it in and what transformations were needed to adapt it to the needs of Ellipse APM? As we explored the FirstEnergy data ecosystem, we identified some digital sources, but much of the data was paper-based, collected during testing sequences. Still, FirstEnergy was relatively well-positioned thanks to its use of a consistent set of tools and procedures across its ten operating companies.”

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Figure 1: Risk of failure confidence based on available data (substation transformers)
Evaluating data gaps and solutions

Knowing what data was needed and available, the data acquisition team conducted a gap analysis to scope the necessary effort to create the required data streams. A notable gap was the absence of electronic test results for transformers and bushings such as power factor, winding resistance, turns ratio, etc., which are critical to accurately scoring the health of these devices and predicting their life. Acquiring the readings digitally would require a connection between Ellipse APM and FirstEnergy’s enterprise asset management system, Cascade.

Another gap related to substation battery banks. Data was available only as a paper file at field locations. The solution in this case was to dispatch people to all of the substations to collect and consolidate the data in digital form.

Detecting data issues

As the team began establishing data streams, they also established layered checkpoints to ensure that only quality data would be passed into Ellipse APM. The first two checkpoints occurred prior to each data transfer into Ellipse APM, with the third occurring after all data was input. The checkpoints were designed to ensure integrity, including:

- **Structural integrity**: Does the data have the right number of digits, is it properly formatted (string/ alphanumeric), is it in the right unit of measure, etc.?
- **Data integrity**: Is the data within expected ranges/parameters?
- **Output integrity**: Is Ellipse APM producing outputs/recommendations that are logical or is there evidence of false positives?

“The gap analysis outlined our available data as well as the data gaps that would have to be addressed,” says Dana Parshall, FirstEnergy’s Director of Asset Management & Records Control. “This effort also provided the general roadmap for our journey to establishing the required data streams. We chose to start in one geographic location and prioritize the largest assets first, which included about 250 devices (transformers, circuit breakers, and batteries) at 32 locations.”
“An additional failsafe built in to Ellipse APM is validation that the system has enough data to generate relevant recommendations,” explains Varadan. “The Ellipse APM interface is an analytical dashboard that uses easy red/yellow/green visual indicators to rate asset health risk. When Ellipse APM lacks the required data to make a valid assessment, an asset’s health is represented with a grey indicator.”

Moving ahead with continuous improvement

With the initial data obtained and validated, FirstEnergy was able to feed ongoing streams of properly-formatted data from a variety of sources into the new Ellipse APM solution. And as with any analytical decision process, the more data flowing in, the more refined the output becomes, meaning FirstEnergy can expect continuous improvement in Ellipse APM’s ability to identify potential risk in advance of it becoming a significant problem.

Lesson learned

As it would be for any company with the size and history of FirstEnergy, the journey to a condition-based maintenance strategy has had challenges along the way. Yet the realized rewards and the future potential gain of operational improvements far exceed the pain. The utility now benefits from the most highly-ranked APM technology solution available according to the Navigant Research 2017 APM Leaderboard Report.

“Prioritizing the assets or functions that were best prepared for migration created a foundation that we can now scale for future success,” says Parshall. “Knowing the data integrity issues within our systems before embarking on the APM journey, we knew it would not be easy. Dedicating separate teams to the project apart from the resources for sustaining operations was a win for us.”