

The Critical Role of Data Preparation in Asset Performance Management – FirstEnergy’s Experiences



**Dana Parshall
Karl Fickey**

First Energy

**Matt Zafuto
Siri Varadan**

ABB Inc.

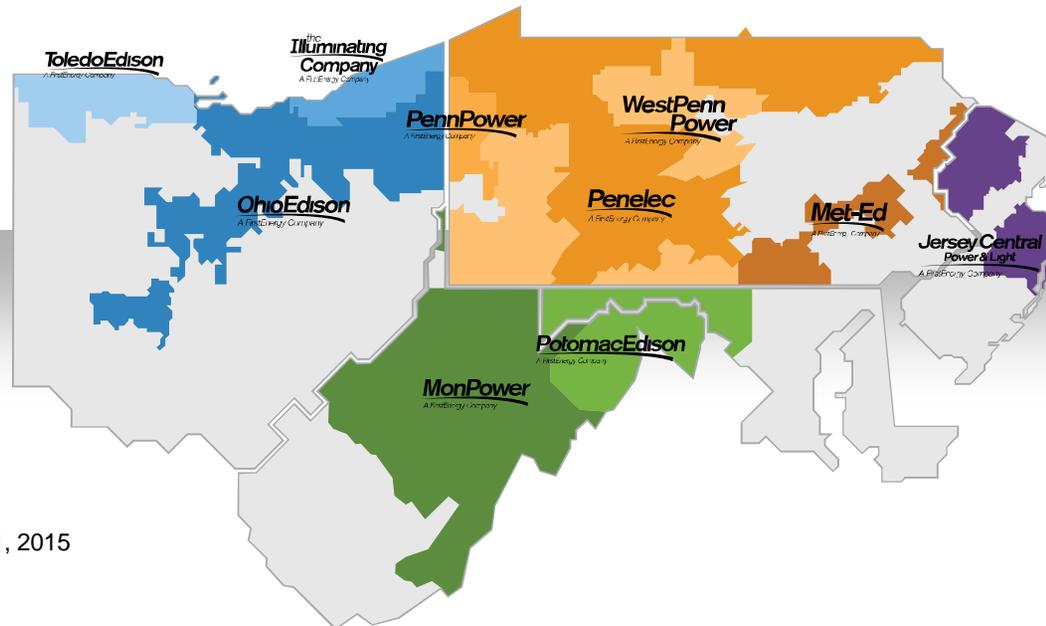


FirstEnergy[®]

TRANSMISSION

FirstEnergy (FE) Profile

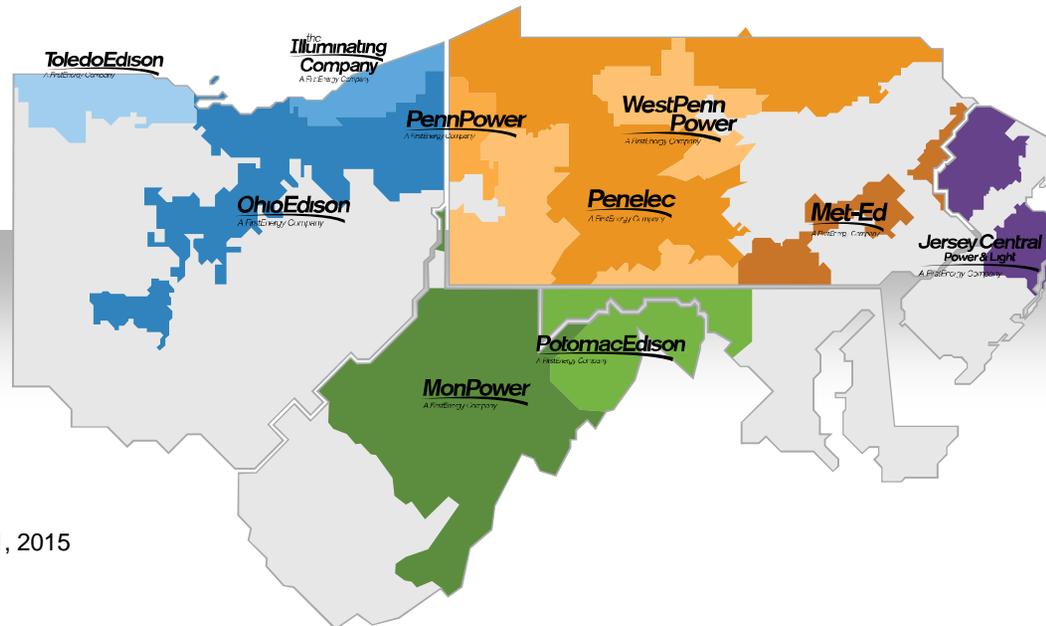
- Fortune 200 company based in Akron, Ohio
- Among the largest investor-owned electric systems in the US
- 6 million customers served in Midwest and Mid-Atlantic regions
- 10 electric utility companies in six states
- Approximately 17,000 MW of generating capacity
- 24,200 miles of transmission lines and 269,000 miles of distribution lines



Data as of December 31, 2015

FE Profile – Assets

- Over 2,400 substations
- Over 500,000 substation assets
- Multiple state regulatory requirements
- 10 electric utility companies in six states
- Almost 10,000 utility employees
 - Over 1,000 substation employees
- Energizing the Future – Transmission Reliability program



Data as of December 31, 2015

Asset Health System Drivers

- **Need to automate equipment risk**

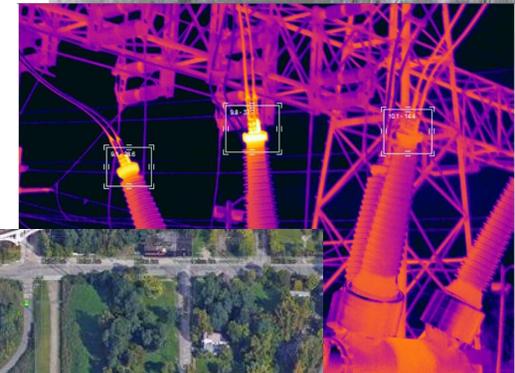
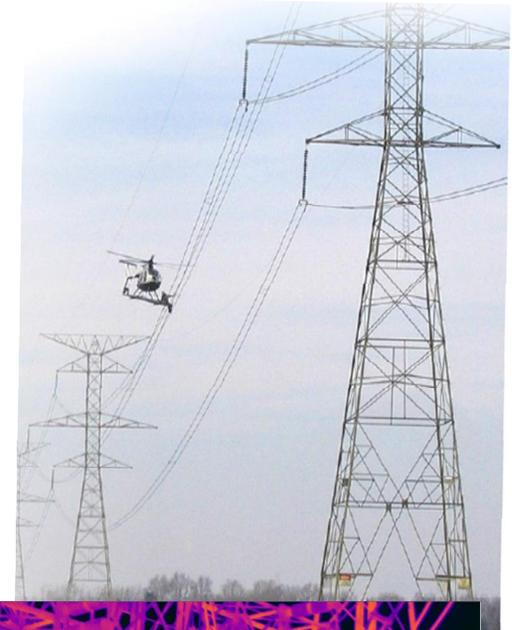
- Tie many different inputs/testing criteria
- Trend analysis
- Dashboard

- **Prioritize replacements/repairs**

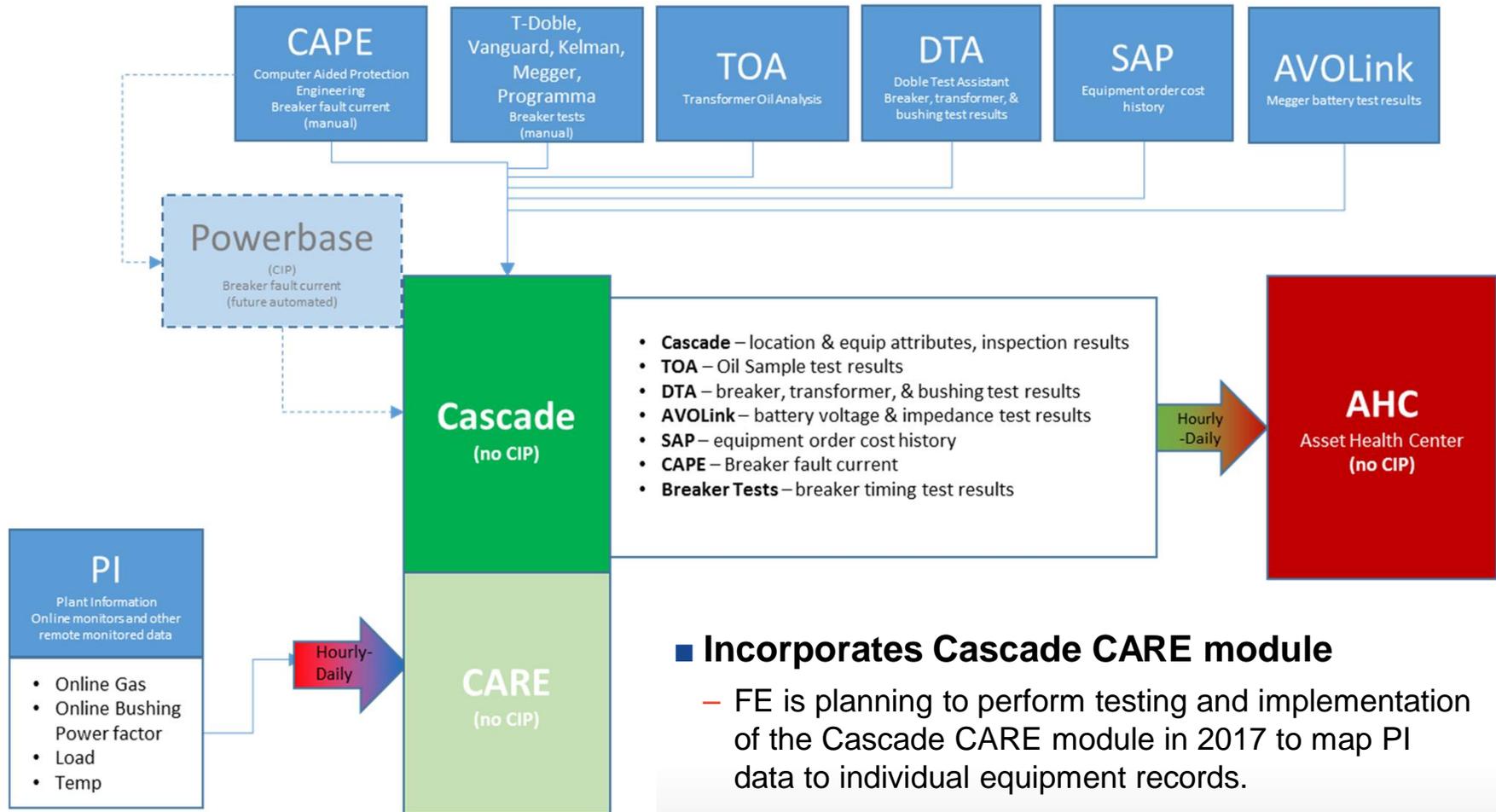
- Development of 5-/10-year plan

- **Availability of sensors/data**

- Data historically available only at testing periods



Data Integration Plan



■ Incorporates Cascade CARE module

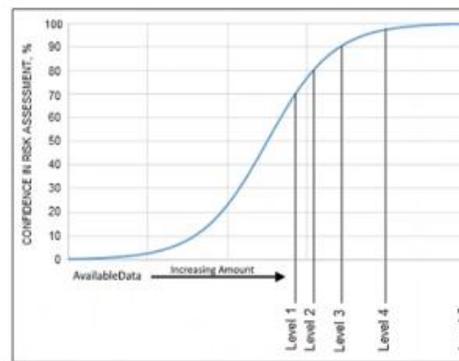
- FE is planning to perform testing and implementation of the Cascade CARE module in 2017 to map PI data to individual equipment records.
- This will facilitate easier correlation of PI data to the appropriate piece of equipment within Cascade.

Addressing data needs

- Not a onetime migration process
- Basic data parameters
- In the case of substation transformers, with only nameplate information, dissolved gas analysis, and standard oil test, it's possible to predict the transformer's health with a 70% confidence interval.
- More data increases the level of confidence with regards to predicting the health of the asset, when it will fail, and when to take action to avoid a maintenance issues.

Risk of Failure Confidence Based on Available Data

Substation Transformers



- **Level 1:** Nameplate information, full DGA, and oil quality parameters
- **Level 2:** Includes Level 1 plus loading, power factors, accessory information
- **Level 3:** Includes Level 2 plus physical condition, protection condition, and history
- **Level 4:** Includes Level 3 plus comparative data, design info, through fault info, reclosing practice, environmental risks, and spares
- **Level 5:** Includes Level 4 plus special test results, GIC susceptibility (requires onsite assessment by transformer experts)

Use-Case driven data prioritization

- **Provide continuous up-to-date guidance to my organization on priorities to optimize risk and performance vs. cost.**
- **Access to historical/ evaluated events.**
- **Flag assets, initiate an action/ issue and track them in the future.**
- **See events that may contain key information about condition/ health of particular asset.**
- **All important data about health and overall condition of assets collected in one place.**
- **Maintenance Costs.**
- **Key Issues at Time by status, criticality, health, budget for Replacement and Maintenance.**
- **Cost of road to green and actions.**
- **Number/ percentage of a present condition of assets divided into groups: good, fair and bad condition.**
- **Changes of the proportions between good/ fair/ bad statuses of assets during a time period.**
- **Most Important and Worst performing assets.**
- **Asset details - sub indicators, actions & issues.**
- **Assets most needing replacement or maintenance work.**

Data Questions: AS-IS & TO-BE?

- **What tools and systems do we have that could include AssetHealth data?**
- **What historical data is available and how much? Should be back-populated?**
- **What data isn't available in existing systems and would require a new data collection system/ process?**
- **What data exists in paper form and would have to be digitalized and mapped to the AssetHealth?**
- **What data exists in digital form but would require reformatting to map to AssetHealth?**
- **What data can be ported in its as-is state to AssetHealth?**

Data Governance

- **Accuracy:** What level of data precision is required and can the existing systems/sensors provide it? If not, what changes were necessary.
- **Frequency:** How often does each parameter for each asset need to be sampled and/or transmitted? For some assets or parameters, near real-time data is essential to ensure timely response to critical issues. Decisions about the appropriate frequency of data transmission for each asset and parameter.
- **Timeliness:** Related to frequency is the issue of timeliness. Is there an optimal time to receive each piece of data.
- **Granularity:** How detailed each piece of data need to be?
- **Retention:** Asset health data history, when properly analysed, can provide valuable insights. Some data, though, contributes relatively little to that analysis. Decisions made about what data would be kept and for how long.
- **Data Cleansing/ Quality.**
- **Data Ownership/ Silos.**

Data process

- **Who does what & when (staff)?**
- **What is the architecture of the data streams?**
- **How do we maintain accuracy, required frequency and granularity?**
- **What is the deliverable?**
- **Benefits?**

Data issues and mitigation

- **Notification and Error Reporting processes.**
- **Structural integrity - Evaluates data for properties like number of digits. This includes tests to be sure that only numerical data is included for numerical values.**
- **Rules-based engine - Identify data with unexpected values. Pre-set and configured with allowable or predicted upper and lower boundaries, as an example.**
- **False positives - occurs after the data is entered into, and processed by, AHC. Some of the outputs from AHC may seem to in error, generating asset condition messages and health scores that are clearly incorrect.**

Key Advice

To Those Considering **Asset Health Solution**

Lessons Learned

- **Work with vendor to identify early what minimum data is required for calculation**
- **Determine system(s) of record for source data**
- **Spend quality time during data mapping phase of project**
 - Good data mapping and data review will reduce future implementation issues
 - Identify low-hanging fruit
 - Prioritize what will be captured/improved upon now vs. future phases
 - Evaluate benefits of additional/incremental data vs. cost of acquiring data

Key Advice

To Those Considering **Asset Health Solution**

Lessons Learned

- **Understand the inputs to the algorithms:** Work close with vendor upfront to understand precisely what data inputs the algorithms require
 - Focus efforts on what datasets drive the calculations
 - Determine how much historical data you want to back-populate
- **Review quality of data before integration to asset health tool**
 - Correct source data in system(s) of record, if necessary
 - Preference is to correct source data – corrects it for all users of data source
 - Implement data controls to minimize repeat data quality issues once data is corrected

Key Advice

To Those Considering **Asset Health Solution**

Lessons Learned

- **Dataset size:** Choose a small subset of data to get the tool set up and understand what data cleanup efforts are needed for the broader field of records
 - Allows more time upfront to understand how the tool works
- **Broader set of equipment types:** Build the plumbing upfront for more equipment types
 - Again with a small set of data (a few stations or a small area)

Key Advice

To Those Considering **Asset Health Solution**

Lessons Learned

- **Change practices/data acquisition points where it makes sense**
- **Dedicated full-time resources:** Have a team dedicated to getting the tool set up
 - Team should include not only IT resources that understand movement of data but also field and technical expertise that understands the data itself

Key Advice

To Those Considering **Asset Health Solution**

Lessons Learned

- **Make sure to thoroughly document use cases for acceptance testing**
 - Determine the length of the pilot
 - Set a threshold for when the tool will be shared to the broader audience
 - Set up notification

