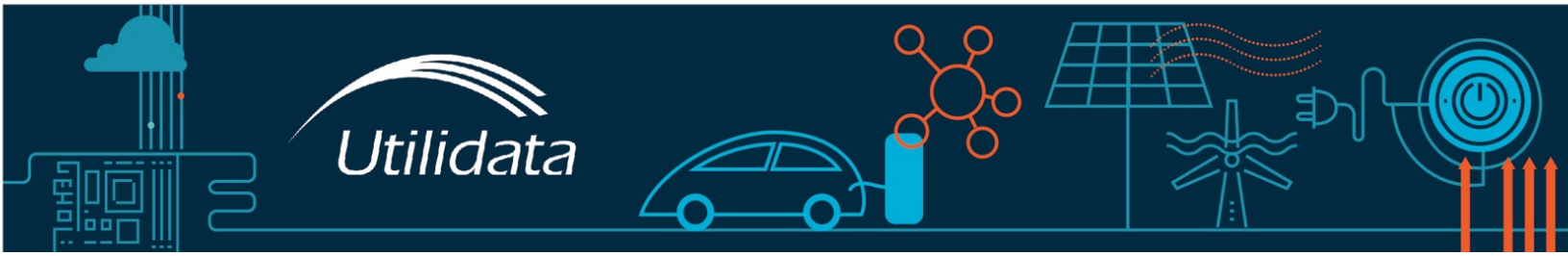

CASE STUDY: MAXIMIZING GRID MODERNIZATION INVESTMENTS

Across the country, utilities and state utility regulators are evaluating electric grid modernization investments. Ideally, grid modernization should maximize benefits to customers while minimizing costs. This balance can be difficult to achieve when deploying new technologies, and when projects are rolled out separately without clear coordination.

Working together, AEP Ohio and Utilidata have successfully integrated two major grid modernization investments – Advanced Metering Infrastructure (AMI) and Volt/VAR Optimization (VVO) – to maximize energy savings and customer benefits.

Our Approach

Ohio's PowerForward initiative seeks to promote "a distribution grid that is reliable and resilient, optimized and efficient, and planned in a manner that recognizes the necessity of a changing architectural paradigm."[1] Beginning even before this initiative was announced, AEP Ohio has been investing in AMI and VVO technologies benefitting their operations and their customers.

- **AMI:** Installed over 1 million smart meters to reduce operational costs and improve utility services by promoting reliability and energy savings.
- **VVO:** Enabled voltage optimization on nearly 100 circuits to drive 3% energy savings for customers using Utilidata technology.

Utilidata's VVO platform is the only solution to leverage near real-time data from equipment across the distribution system, including AMI. Our approach uses a variety of methods (digital signal processing, stochastic optimization and machine learning) to lower the voltage setpoint based on the specific conditions on each individual circuit, which reduces waste and saves more energy. Utilidata has evaluated the effectiveness of standalone VVO deployments, as well as VVO deployments that leverage AMI data. Working together, VVO and AMI can deliver significantly more savings.

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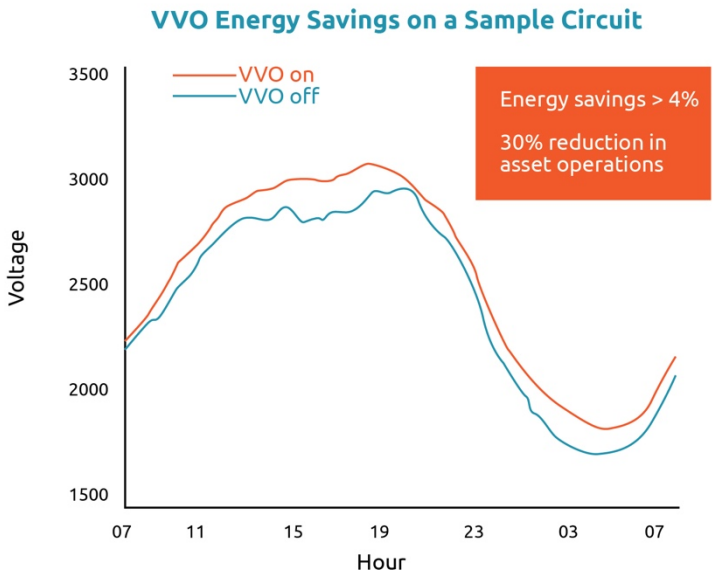
[1] PowerForward: A Roadmap to Ohio's Electricity Future. (n.d.). Retrieved from https://puco.maps.arcgis.com/apps/Cascade/index.html?appid=59a9cd1f405547c89e1066e9f195b0b1

Results from VVO Deployment without AMI

AEP Ohio has deployed VVO for roughly 10 years, and it has delivered, on average, 3% energy savings by intelligently reducing high voltages and eliminating potential wasted energy. Savings are measured by turning VVO off for a day and on for a day and comparing the energy usage. This is among the most reliable forms of measurement and verification for an energy efficiency program.



In addition, we measure the operations of the distribution equipment to determine if they were running more or less often when VVO was engaged. Utilidata's active, holistic controls allow devices to operate more efficiently, leading to an approximately 30% reduction in equipment operations.

Results from VVO + AMI

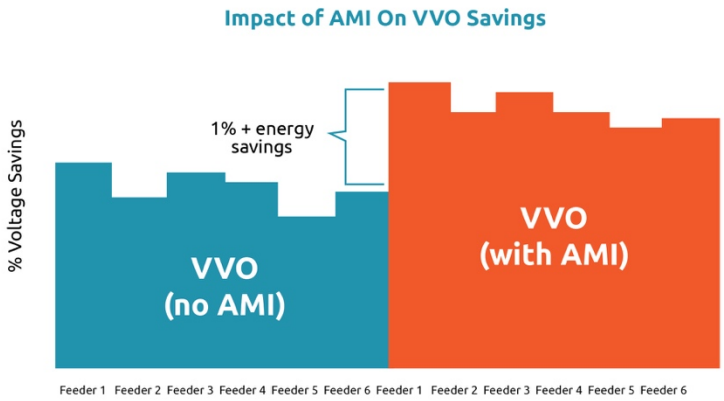
AEP Ohio is now testing a new Utilidata module that takes voltage data from AMI and applies proprietary algorithms to find the most relevant information for fine tuning a VVO scheme. This application filters through a massive amount of data, allowing VVO to utilize AMI as an end-of-line sensor to improve system visibility and customer savings.

This new technology has been deployed in 16 circuits and in its first 6 months of operation is yielding on average another 1%+ energy savings.

Value of VVO + AMI

The 4% energy savings that AEP Ohio and Utilidata achieved with VVO + AMI is roughly double even the most aggressive annual state energy efficiency mandates across the U.S. These savings are also cheaper to achieve than most energy efficiency programs, and importantly they don't require that customers actively engage with energy data or contribute any out-of-pocket expenditures. Customers of all income types simply enjoy lower bills from a more efficient grid.

The savings that result from combining AMI data with VVO greatly strengthens the cost/benefit case for deploying AMI infrastructure, by adding contributing meaningful customers savings.



Future Applications

AEP Ohio and Utilidata's integration of AMI data into a VVO deployment shows how grid modernization efforts can, and should, be coordinated to deliver greater value to customers. Utilidata is currently testing this combination of smart hardware and sophisticated software on additional use cases, such as improving reliability and more cost-effectively integrating distributed energy resources, like rooftop solar and electric vehicles. These new use cases will enable utilities like AEP Ohio to continue to reap additional benefits from their grid modernization investments.

> "Integrating AMI data and VVO is showing some very promising results. This kind of innovation allows us to drive down bills, while modernizing the grid and improving performance – **a win-win for us and our customers.**"
>
> *– Scott Osterholt, Director Grid Modernization and Risk Management, AEP Ohio*