MODERNIZING

THE ELECTRIC GRID

Ulteig

We listen. We solve.™

Addressing the increasing reliability, resiliency and efficiency concerns, and preparing for the future on an aging distribution system

Grid modernization is a broad term that generally refers to the process of making electric systems more resilient, efficient, reliable and optimized for Distributed Energy Resources (DER) and load side technologies. Efforts can range from distribution system hardening of traditional poles and wire systems, through asset replacements, to updating obsolete protection systems with the newest technology, (i.e. FLISR automatically locating a fault, isolating it, and restoring service to the unaffected parts of the system).

Grid modernization efforts will typically include one or more of the following goals:

- Increasing Resiliency
- Reducing Losses
- Improving Reliability
- Managing Peak Demand
- Accommodating New Dynamic Loads (i.e. Electric Vehicle (EV) infrastructure)
- Optimizing Grid Operation for DER (Solar, Wind, Block Chain and Energy Storage)

Utilities require solutions that are specific to their needs. Ulteig works directly with electric utilities on creating well-designed plans for implementing grid modernization objectives to ensure long-lasting benefits. Generally, four stages are recommended for implementing a long-term grid modernization strategy:

1 System Evaluation & Framework Design

2 Communication, Network & Data Management Design

3 Technological Solutions & Field Implementation

4 Data Analytics Processing

STAGE 1

System Evaluation & Framework Design

Because every utility is in a different position within its Grid Modernization efforts, it's imperative that each system be uniquely evaluated to pinpoint high-risk areas and develop a hierarchical solution based on the specific goals of the individual utility.

The initial stage in executing a system evaluation is to perform a distribution level study. A Geographic Information System (GIS) and power system analysis tool can be utilized to supplement these studies and the planning required at this stage to help prioritize the needs and components of the utility's grid modernization initiatives.

During the distribution level study, a thorough review of the system's reliability metrics (System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI), and Momentary Average Interruption Frequency Index (MAIFI) is recommended to help identify problem areas along with outage cause-based solutions.

Once the system evaluation is complete, a risk assessment and project identification phase is conducted. To accomplish this, system study results are merged with the reliability evaluation to identify key risk areas that should be addressed immediately to show improvement in the utility's reliability metrics.

At this level, Ulteig experts can help to identify a framework of specific projects, including new equipment implementation, and assign an estimated cost along with a projected system improvement value. This stage is vital in putting together a hierarchal list that will allow the utility to budget for the recommended projects.

Along with identifying and rectifying current issues on the utility's system, the system evaluation and framework design stage can set up the utility for success when preparing for the addition of DERs and new dynamic loads, such as EV charging stations, within the distribution system.

To view a complete list of Ulteig's electrical studies capabilities *click here*.

STAGE 2

Communication, Network & Data Management - Architecture & Design

Two systems are recommended to be in place to ensure the overall effectiveness of the Grid Modernization design implementation: a secure communication network and a method for managing the incoming data.

Determining the proper communication network is not a "one-size fits all" system. Network availability will vary based on project locations. In many cases, a single utility will need to utilize multiple communication networks to ensure overall system effectiveness. Communications options that need evaluation at this stage include fiber optics (rented or owned), licensed and unlicensed radio, satellite and cellular. Ensuring that the right networks are in place allows the new technology to communicate effectively within its designed environment as well as provide visibility of the distribution system for the utility.

Increased system visibility includes managing an enormous amount of data points. It's imperative the architecture and processes are in place to receive, store and interpret this data. Many utilities implement Advanced Distribution Management Systems (ADMS), a software platform that integrates numerous utility systems and provides automated outage restoration and optimization of distribution grid performance.

ADMS functions include automated Fault Location, Isolation, and Service Restoration (FLISR); conservation voltage reduction; peak demand management; and volt/volt-ampere-reactive optimization. In effect, ADMS transitions utilities from paperwork, manual processes, and siloed software systems to systems with real-time and near-real-time data, automated methods and integrated systems. [1]

In addition to automation, communications systems can be used to increase visibility at the distribution level. Key components using these systems include:

- Increased Data Points
  - *Power Flow*
  - *Device Status*
  - *Fault Information and Location*
- Phasor Measurement Units (PMUs)
- Advanced Metering Infrastructure (AMI)
- Improved State Estimation

By designing systems that respond automatically and relay information such as power flow and line efficiencies immediately, utilities can greatly improve system reliability, reduce grid costs and maximize effective use of energy.

STAGE 3

Technological Solutions & Field Implementation

Once the project roadmap has been laid out and infrastructure and system requirements have been selected, utilities must complete and implement the project design. A significant hurdle on this portion is navigating through the ever-changing technology available and determining the correct vendor to provide it.

Critical decisions must be made when completing the overall design and implementation. Some of these specific decisions include:

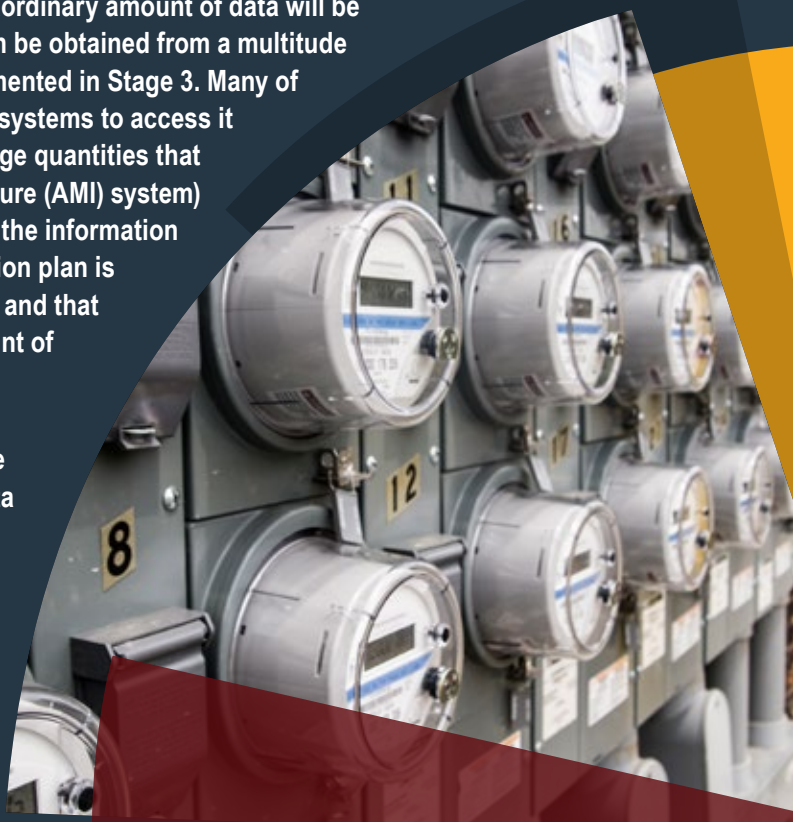
- Substation & distribution protection & control design
- Substation & distribution equipment
- Distribution line compensation
- Substation & distribution communication & network engineering
- Energy management system (EMS) & advanced distribution management systems (ADMS) support
- Project management

STAGE 4

Data Analytics Processing

After a design is implemented it is anticipated that an extraordinary amount of data will be available for the utility's consumption. This information can be obtained from a multitude of locations depending on which technologies were implemented in Stage 3. Many of these devices house data in different sites, using different systems to access it based on the manufacturer. For devices implemented in large quantities that deliver frequent data (i.e. an Advanced Metering Infrastructure (AMI) system) a separate management system may be required to ensure the information is processed and stored properly. It is vital that an integration plan is developed for this network of systems to function properly and that the framework is set in place to ensure the maximum amount of data is captured and secured adequately.

Having the ability to accurately capture this data is only the first step in this process. Deciding how to interpret that data is an entirely different challenge. With data continuously being transmitted and captured it is imperative that it is reviewed, analyzed, and acted upon on an ongoing basis. Laying out and enabling the correct processes will help ensure that this information is used to the utility's maximum benefit.



Some of the benefits and programs that can be put into place, depending on the technology implemented, can include:

- Asset Management & Health Monitoring
- Load Forecasting
- Advanced Distribution Management System
- Distributed Energy Resource Management System
- Integrated Volt-Var Optimization
- Conservation Voltage Reduction
- Visibility to the Customer
- Autonomous Data Management

At the rate emerging technology is being implemented on the system this step is proving to be very overwhelming for many utilities. However, if this stage is managed properly it can prove to be incredibly beneficial.

Conclusion

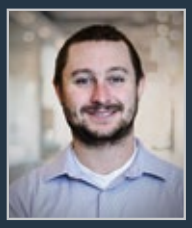
From improving your system reliability to preparing your distribution grid for future DERs, implementing a cost-effective Grid Modernization strategy is crucial. To best navigate the process, work with a qualified provider who can analyze your business and tailor a unique solution to fit your needs.

Ulteig can deliver customized Grid Modernization solutions to fit your specific initiatives. We'll work with you on the front-end to develop a unique grid modernization plan. Our networking and communications experts are ready to help you navigate the various technologies available. Ulteig understands distribution systems and the equipment necessary for successful implementation.

Once the communications infrastructure is in place, Ulteig will serve as the engineer and program manager to implement your system upgrades. Working with our partner network to gather data, we'll teach your employees how to work with and interpret that data to operate a truly modernized grid.

Contact Ulteig's Grid Modernization expert listed below to get started with a free consultation.

Contact Us



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SOURCE LINKS

1. U.S. Department of Energy: Office of Electricity Delivery & Energy Reliability. Insights into Advanced Distribution Management Systems. (2015)