DUKE ENERGY.

139 East Fourth Street, 1212-Main
Cincinnati, OH 45202

Telephone: (513) 287-4337
Facsimile: (513) 287-4386

Dianne Kuhnell
Senior Paralegal
E-mail: Dianne.kuhnell@duke-energy.com

April 1, 2019

VIA ELECTRONIC DELIVERY
Tanowa Troupe
Docketing Division
Public Utilities Commission of Ohio
180 East Broad Street
Columbus, Ohio 43215

Re: In the Matter of the DukeEnergy Ohio, Inc. Grid Architecture Status Report
Case No. 19-790-EL-GRD

Dear Ms. Troupe:

Pursuant to a Finding and Order of the Public Utilities Commission of Ohio, February 27, 2019, in Case No.18-1595-EL-GRD, please find attached Duke Energy Ohio, Inc.'s Grid Architecture Status report to be filed in the above-captioned docket.

If you have any questions, please contact me or Elizabeth Watts.

Thank you,

Dianne Kuhnell
Senior Paralegal

Enclosure

Duke Energy Ohio
Grid Architecture Status Report

April 1, 2019

TABLE OF CONTENTS

INTRODUCTION

On August 29, 2018, the Public Utilities Commission of Ohio (PUCO or the Commission) released "PowerForward: A Roadmap to Ohio's Electricity Future" (Roadmap). As set forth in the Roadmap, "in order to realize the policy objectives for PowerForward, the Commission believes that each electric distribution utility (EDU) should work towards developing a cyber-physical platform consisting of uniform core components, so that the foundation for customer engagement and market participation in providing innovative products and services is set in the state…" (page 15) "Now that the Commission has a firm understanding of the essential architecture needed to advance the modern grid, it is sensible to obtain the most recent update of where each utility stands with this architecture." (pages 16 – 17) Pursuant to the Commission's request in Case No. 18-1595-EL-GRD, Duke Energy Ohio, Inc. (Duke Energy Ohio or the Company) is providing this Grid Architecture Status Report with deployment status as of December 31, 2018.

MODERNIZING THE ELECTRIC GRID IN OHIO

Duke Energy Ohio is committed to providing safe, secure, reliable and affordable energy to our customers. With over 700,000 electric customers in the Ohio service territory, we are committed to making strategic, data-driven investments to transform the state's electric grid, making it more resilient and reliable while also making it smarter and more secure to deliver more value to Duke Energy Ohio customers. Our investments focus on improving reliability to help avoid outages and speed restoration; providing more options and controls to assist our customers with making smarter energy choices; and expanding the use of more sustainable, cleaner energy sources. These investments provide benefits to customers today and will for years to come.

Core Architecture

Duke Energy Ohio's core grid architecture is comprised of interdependent components. Each component establishes a foundation for success around which the other components must interact. These components, as outlined in the Commission's Roadmap, include Physical Grid Infrastructure (i.e. - Field Automation and Distribution Automation), Operational Communications Infrastructure, Sensing and Measurement, Operational Analytics and Standardized Access to Customer Energy Usage data.

A key step to modernizing our core grid architecture is the implementation of smart-thinking grid technology. Smart-thinking grid technology can improve reliability by quickly identifying and isolating outages when they occur, and automatically rerouting power to speed restoration to customers, thereby reducing the number of customers affected by an extended outage. This self-optimizing technology relies on an advanced network of monitoring and switching technology, as well as upgrades to power lines and other equipment. In some areas where redundant circuits are not available, battery storage and microgrid technology may be explored to restore service to customers while repairs are made.

Another significant factor in modernizing our core grid architecture is the threat of severe weather, and potential physical and cyber-attacks. These are among the greatest challenges that utilities face in an increasingly connected, digital world. Requirements to protect the grid and the risk of intrusion are orders of magnitude greater than what they were in the past and organizations that provide critical infrastructure, such as Duke Energy, are targets of cyberattacks. Therefore, the Company's modernization efforts include equipment upgrades on the distribution system, advanced sensing and measurement technology, system health tools, advanced communication and monitoring technologies, and resiliency upgrades such as system intelligence, among others to keep pace with the new world of physical and cyber threats the Company faces.

Expand Distribution System Operations

In addition to improving reliability and resiliency after an outage, the smart-thinking grid will also support the two-way power flows needed to support more innovative technologies like battery storage, electric vehicles and microgrids. Duke Energy Ohio is also exploring the use of renewables as part of the work to improve reliability.

Give Customers More Options and Control

When it comes to saving energy and money, information is power. Duke Energy Ohio wants to provide customers with the intelligent information needed to make smart energy choices to conserve and lower their monthly bills. Smart meters are the foundation that helps provide customers detailed data about their energy use – including hourly, daily and average usage – showing them how much energy they are using and when. Having this information available on a daily basis can help customers make informed energy decisions to save money before their bill arrives.

In addition to offering customers more options and controls, Duke Energy Ohio provides several options to Competitive Retail Energy Service (CRES) Suppliers for standardized access to customer energy usage data. This provides CRES Suppliers with the ability to enhance their retail offerings to shopping customers. As the result of commitments made in a stipulation that was adopted and approved by the PUCO in Case Nos. 17-032-EL-AIR, *et al.*, (December 19, 2018), Duke Energy Ohio is presently making these services more robust to enhance options for CRES Suppliers.

GLOSSARY OF TERMS

ADMS	Advanced Distribution Management System	**LMR**	Land Mobile Radio
AMI	Advanced Metering Infrastructure	**LTC**	Load Tap Changer
ANSI	American National Standards Institute	**MAS**	Multiple Address System
CAP	Capacitor	**MDMS**	Meter Data Management System
CEUD	Certified Energy Usage Data	**MDT**	Mobile Data Terminal
CG / CGR	Connected Grid Router	**MPLS**	Multi-protocol label switching
CRES	Competitive Retail Energy Service	**NERC**	North American Electric Reliability Corp.
CVR	Conservation Voltage Reduction	**NESC**	National Electric Safety Code
DCC	Distribution Control Center	**NMS**	Network Management System
DER	Distributed Energy Resource	**OMS**	Outage Management System
DGA	Dissolved Gas Analysis	**OPGW**	Optical Ground Wire
DMS	Distribution Management System	**OT/IT**	Operational Technology / Information Technology
DMV PN	Dynamic Multi-Point Virtual Private Network	**PLC**	Peak Load Contribution
ECI	Enterprise Communications Improvement	**RTU**	Remote Terminal Unit
EDI	Electronic Data Interchange	**SCADA**	Supervisory Control and Data Acquisition
FAN	Field Area Network	**SHT**	Self-Healing Team
GIS	Geographic Information System	**SOG**	Self-Optimizing Grid
IDR	Interval Data Recorder	**SONET / TDM**	Synchronous Optical Network / Time Division Multiplexing
IED	Intelligent End Device	**SVC**	Static VAR Compensator
IEEE	Institute of Electrical and Electronic Engineers	**VAN**	Vehicle Area Network
IP	Internet Protocol	**VEE**	Validation Estimation & Editing
IPR	In-Line Power Regulator	**VR**	Voltage Regulator
IVVC	Integrated Volt /VAR Control	**WAN**	Wide Area Network

GRID ARCHITECTURE PLATFORM

Component Summaries

Field Automation. Substation and distribution line field automation use digital devices, advanced controls, and communication technologies to automate the distribution power system and optimize operation of the grid. Field automation capabilities directly improve reliability. The programs listed below are part of field automation and are described in the following sections:

- Distribution Automation
- Volt-Ampere Reactive (Volt/VAR) Management
- Powerflow Controllers
- Self-Healing Teams

PROGRAM: DISTRIBUTION AUTOMATION

Description:
Distribution Automation refers to digitizing components of the distribution system to enhance monitoring and remote-control capabilities, improve reliability, provide automatic control, and ultimately achieve better load management. The enhanced capabilities are achieved through two-way communications and Supervisory Control and Data Acquisition (SCADA) systems. A foundational component of Distribution Automation already in place in Duke Energy Ohio's service territory is the Distribution Management System (DMS). The DMS integrates various information systems (including SCADA, Geographic Information System (GIS), asset management, etc.) to further enable the analysis and optimal operation of the distribution system in real-time.

The distribution system is operated in accordance to Duke Energy standards, which are consistent with IEEE *(Institute of Electrical and Electronics Engineers)*, ANSI *(American National Standards Institute)*, NESC *(National Electric Safety Code)* standards, and NERC *(North American Electric Reliability Corporation)* guidelines. The Company monitors and manages outages with various systems, such as SCADA and the Outage Management System (OMS), along with its applicable databases.

Improved reliability will be achieved through the automation and two-way communications of system protection devices to detect, locate, and/or isolate permanent faults. An overview of several distribution automation components is contained below:

Substation Circuit Breaker Relay Controls:
Relays are very fast-acting, automatic switches designed to protect an electrical system from faults and overloading. When a relay senses a problem, it quickly sends a signal to a substation circuit breaker to trip open to protect the device from damage as well as provide protection for people. Electro-mechanical relays are being replaced with new microprocessor based relays.

Substation and Distribution Line Voltage Regulator (VR) Controls
VR's are designed to adjust primary voltage to maintain acceptable voltage levels on distribution circuits. VR's raise or lower the voltage on the distribution line to adjust voltage levels as the amount of load on the

line changes. VR controls have been replaced with new microprocessor based controls. The new controls provide communications and remote-control capability.

Substation Transformer Load Tap Changer (LTC) Controls

Transformer LTC's are designed to adjust the output voltage to maintain acceptable voltage levels on distribution circuits. LTC's work by adjusting the turns ratio between windings in a substation transformer. New microprocessor based controllers provide communications which will enable status and control to existing LTC's.

Distribution Line Capacitor (CAP) Controls

CAP controls provide power factor and voltage control and allow electricity to be distributed more efficiently across the distribution circuit. CAP controllers have been replaced with new microprocessor based controllers. The new controllers provide communications, remote-control operations capability in real time to help identify when a CAP bank is not functioning properly due to a blown fuse or other condition as well as reduce inspection requirements.

Electronic Recloser Controls

Electronic reclosers are used to isolate faulted sections of distribution circuits and reduce the exposure of outages to customers. Additional telemetry integration with electronic recloser controls provides outage information and improved fault locating capability.

Deployment Status:

Average # of Duke Energy Ohio Automated Devices (Controls) per Circuit	**5**

The following table lists the use of various distribution automation components:

Component	Deployed	Description
Substation Relay Upgrades	Y	Replace electro-mechanical relays with microprocessor based relays on distribution feeders
Substation Communications	Y	Communications capability into and out of the substations

Component	Deployed	Description
Substation VR / Controls	Y	Replace VR controls to enable communications for remote control, data acquisition and Integrated Volt/VAR Control (IVVC) capability
LTC Controls	Y	Replace LTC controls with new controls that provide communications to enable remote operation monitoring, reporting & IVVC capability
SCADA	Y	Enable remote monitoring, control and data acquisition of substation devices. The SCADA system is integrated with DMS.
DMS	Y	DMS integration of various information systems to further enable analysis & optimal operation of the distribution system.
Line VR / Controls	Y	Replace/install VR controls to enable communications for remote control, data acquisition, IVVC capability and reduction in manual inspections.
Line CAP Bank Controls	Y	Replace switched CAP bank controls to enable communications for remote control, data acquisition, and IVVC capability. On fixed CAP banks, enable remote monitoring capability and communications to detect and locate failed CAP banks.
Communications (cell modems)	Y	External cellular modems to enable communications on IVVC distribution line components (Regulators, CAPs, etc.)

PROGRAM: VOLT-AMPERE REACTIVE (VOLT/VAR) MANAGEMENT

Description:

Electric utilities are utilizing integrated voltage ampere reactive management reduction (IVVC) to improve energy efficiency, provide demand reduction and satisfy energy conservation objectives. Electric utility experience and industry studies have shown that many loads consume less real and reactive power when voltage is slightly lowered. When voltage is reduced continuously the primary intent is to conserve energy. Voltage reduction can also be used as a means of reducing power quickly during peak conditions for grid management purposes. Duke Energy Ohio has implemented IVVC in the continuous 24/7/365 mode.

IVVC is an integrated DMS advanced application. The application generates several control actions to improve system operations in order to achieve one or more user pre-defined objectives. Examples include: to keep the node voltages and branch currents inside operational limits; to change the operation point to satisfy power factor requirements at specific locations in the network; or to reduce total demand or losses on the network. Control actions can be implemented by tap position adjustments of power transformers and regulators and on/off switching of shunt capacitors.

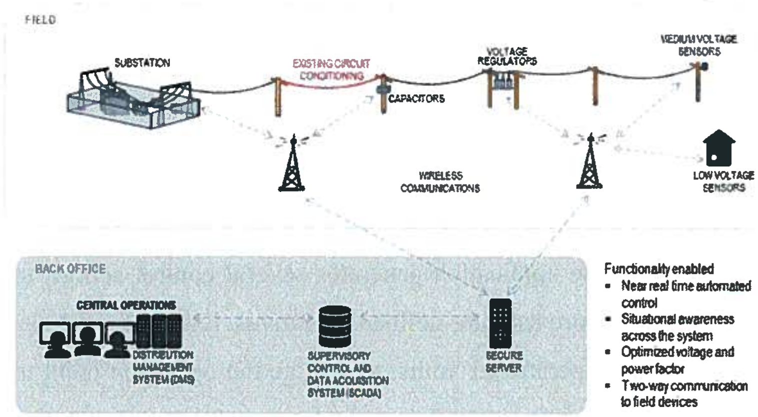
In addition, IVVC helps maintain acceptable voltage levels at all points along distribution feeders, under all load conditions, such that the delivery voltages to customers along the grid are optimized with near real-time, automated control.

Deployment Status:

% Customers in Duke Energy Ohio served by IVVC Circuits	**80%**

IVVC is currently deployed on 511-12.47kv and 34.5kv circuits in Ohio. This excludes 4kv non-SCADA circuits, downtown secondary network circuits, dedicated customer circuits and 34.5kv sub-transmission circuits.

The following graphic shows a simple circuit with multiple smart devices that communicate and are controlled from the DMS system to enable IVVC.



PROGRAM: POWERFLOW CONTROLLERS

Description:

Distribution powerflow controllers can be utilized to regulate voltage and reactive power and control harmonics. Installed on service transformer secondaries, they can be either switched capacitors or in line power regulators. Switched capacitors help to mitigate low voltage caused by conservation voltage reduction implementation or long secondary lengths causing excess voltage drop. They provide tight voltage regulation, as well as, mitigate voltage sags, swells, flicker and harmonics.

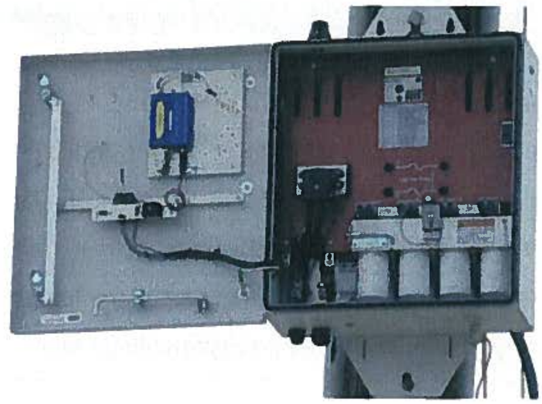
In line electronic power regulators provide secondary voltage regulation and reactive power compensation by injecting and absorbing reactive power. With a fast response time they also mitigate voltage sags, swells, flicker and harmonics. They also provide control of high secondary voltage caused by customer distributed energy resources (DERs).

Deployment Status:

Duke Energy Ohio is currently not utilizing this equipment on the distribution system. This technology is available as an option for specific applications where tighter voltage regulation is required, for higher than normal voltage drop while IVVC is being implemented or for mitigation of high service voltage caused by customer based photovoltaic systems. Plans are to have this option available for locations where powerflow technology is required versus traditional mitigation such as reconductoring or transformer replacement or where IVVC would need to be disabled.

The image below depicts a Static VAR Compensator (SVC).

SVC's are a set of electrical devices used to provide fast-acting reactive power on high voltage networks.



The image below shows an In-Line Power Regulator (IPR).

IPR's are electronic hardware systems that combine voltage control, current control, sensing, and control logic to simultaneously regulate voltage, correct power factor, provide dynamic reactive power, cancel harmonics, and monitor power quality.

PROGRAM: SELF-HEALING TEAMS (SHT)

Description:

The purpose of self-healing is to use electronic-controlled reclosers, intelligent switches, and circuit breaker teams to locate and isolate portions of the distribution system affected by faults or other events via automated switching. This allows for supervisory controlled switching capability for work activity, such as outages and load transfer. This capability mitigates the effect of outages and reduces the impact of the number of Duke Energy Ohio customers affected during an outage event.

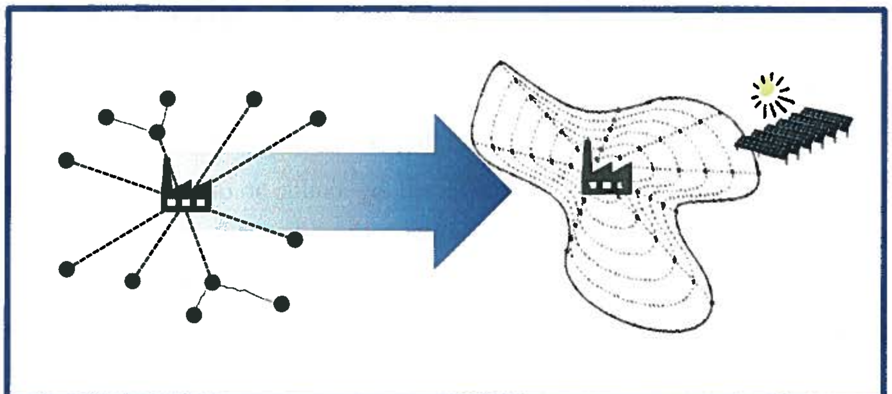
One of the primary objectives of self-healing teams (SHT) is to improve system reliability. This is accomplished by reconfiguring the electronic-controlled system protection devices (i.e.-reclosers, switches, breakers) to quickly isolate a faulted section of the power line and re-establish power to as many customers as possible. Operation of devices for load transfers of a SHT should occur in less than 5 minutes.

Deployment Status:

% of Circuits in Duke Energy Ohio on SHT	**17%**
% of Customers in Duke Energy Ohio on SHT	**32%**

Duke Energy Ohio has begun the deployment of a dynamic Self-Optimizing Grid (SOG). SOG is the concept of transforming the distribution system from a population of circuits with minimal automated alternate source capability, to a network of circuits with spare load capacity, automated inter-circuit connectivity and smaller automatically switchable line segments along the circuit. With the integration of an automated centralized control system, a sustained fault will be automatically isolated to a smaller line segment, while all other un-faulted line segments are restored from alternate sources. This concept is a shift from traditional smaller SHTs to an automated network of highly segmented circuits. The circuit segmentation goal is to limit each line segment to 3 miles of feeder exposure, approximately 400 customers or 2 MW of load. The target is to have 80% Duke Energy Ohio customers on SOG over the next several years.

The following image shows how the Self Optimizing Grid works.



The Self Optimizing Grid program transforms radial one-way circuits into a smart-thinking two-way energy network.

Substation Automation. Distribution substations have historically been equipped with limited grid asset sensing capability which has been primarily focused on large assets like transformers and circuit breakers. Traditional asset sensing consists of oil temperature and level, winding temperature, breaker gas levels, device operation counters on breakers, VR's and LTC's, load reads and station battery health. Much of the asset information was obtained by way of periodic visual inspections.

Advancements in device technology and communications have permitted many of the visual inspection points to now be obtained remotely. Temperature, device counter, gas levels, device loading and station battery health can all be obtained remotely via SCADA. This section includes a discussion on SCADA and adaptive protection.

PROGRAM: SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

Description:

SCADA plays a vital role in Distribution Automation. SCADA enables remote monitoring, control and acquisition of real time data from substation and distribution line devices. The SCADA system is integrated with the DMS system. The DMS system receives the telemetered data from the field devices through SCADA and runs the load flow model analysis. SCADA then executes the commands to the field devices.

Deployment Status:

% Duke Energy Ohio Substations with SCADA	**78%**
% Duke Energy Ohio Circuits with SCADA	**82%**

PROGRAM: ADAPTIVE PROTECTION

Description:

Adaptive protection describes the ability of protective relays to adapt to the current operating condition of the power system. Conventional relays have fixed setting parameters which may not provide the optimal protection and operation in variable operating conditions in a power system. Adaptive protection allows for variable setting and/or operating characteristics in response to changes in the power system. This is accomplished by updating the relay settings in response to a change in the power system topology or operating conditions. Topology changes can be the result of deliberate system switching or unplanned system switching from fault clearing. Adaptive protection in its simplest form can consist of multiple settings groups in a specific relay that can be manually triggered under various operating conditions.

Deployment Status:

Microprocessor relays on breakers and electronic reclosers deployed under Distribution Automation have the capability to manually implement settings changes for abnormal system topology or during live line work. The adaptive functionality is utilized to provide faster tripping and block reclosing while crews are working on live lines improving safety.

Adaptive protection is also utilized during circuit restoration following an unplanned operation. Protective relays can utilize cold load pickup functionality to change relay settings to minimize the possibility of additional operations while restoring load.

Adaptive functionality has also been used in some cases to provide proper protection coordination while the system is in abnormal topology. This application allows for the relay to provide greater protective reach when a circuit is switched to pick up load from another circuit.

Operational Communications Infrastructure. Duke Energy formed the Enterprise Communications Improvements (ECI) program to execute the projects needed to build out the operational communications infrastructure. This updated and forward-looking opportunity to enhance communications reliability represents an ideal application of the PowerFoward concept. Many distribution utilities are currently relying upon antiquated operational communications infrastructure that is unreliable and insufficient. The existence of newer technologies that allow for consistent and reliable communications is an area of improvement ideally suited to the PowerForward initiative.

Summary of Key Findings

Duke Energy's communications strategy is best summarized by the following key findings:

- If the electric grid and the gas grid are the first two grids, then the communications grid is the 3rd Grid. Like the other grids, it constitutes an important enterprise asset.
- Broadband Internet Protocol (IP) is needed from the core to the edge of the grid.
- Communications grid improvements must ensure resiliency, reliability, security, capacity and low latency.
- Electric utilities need to expand their network infrastructure, uplifting end-of-life technology and implementing a holistic network design.
- Electric utilities must improve performance of their business network to support video, mobility, data transfer, etc.
- Electric utilities need to add targeted private infrastructure (i.e. – telecommunications) to improve reliability and supportability of key network components.
- Operational Technology (OT) and Information Technology (IT) are converging, thus it is time for Duke Energy to begin integrating OT/IT and ensure the organizations have the right expertise and tools to engineer, construct and maintain the 3rd Grid.

The key work efforts or programs below are described in the following sections:

- Wide Area Network
- Field Area Network
- Communications Network Management System
- Strategic Fiber & Wireless Transport
- Next Generation Cellular
- Land Mobile Radio
- Vehicle Area Network

PROGRAM: WIDE AREA NETWORK (WAN)

Description:

Duke Energy Ohio has two physically separate Wide Area Networks (WANs) - GridWAN and BizWAN. The GridWAN supports grid communications and the BizWAN supports business communications.

Deployment Status:

Duke Energy Ohio is currently undergoing an effort to replace end-of-life data network hardware used on the GridWAN and BizWAN. The GridWAN and BizWAN are being redesigned with the intent of potentially consolidating these networks into a single network with virtual capabilities to segment and secure different types of network traffic. This enhancement will improve operational efficiency while still maintaining the levels of security and segregation needed for Grid and Business communications.

To improve automated rerouting of SCADA traffic due to various network outage scenarios, Dynamic Multipoint Virtual Private Network (DMVPN) will be implemented at Duke Energy Ohio substations. The head end infrastructure has already been implemented and additional DMVPN functionality is currently being added to improve reliability and resiliency.

A vendor has been selected for the GridWAN and BizWAN efforts and a detailed design solution and implementation schedule is currently being developed. Due to the complex nature of this work, Duke Energy Ohio anticipates the deployment of the new WAN solution and features will take several years to complete.

Migrating Grid and Business networks to new hardware and data network architecture design provides several benefits including:

- Improved network reliability by replacing end-of-life hardware and adding new features and functions
- Moving to a packet-based network protocol (multi-protocol label switching or MPLS) to enable easier configuration, better segmentation, and enhanced cybersecurity protection for the network.
- Improved supportability and the ability for the network to be virtualized.

PROGRAM: FIELD AREA NETWORK (FAN)

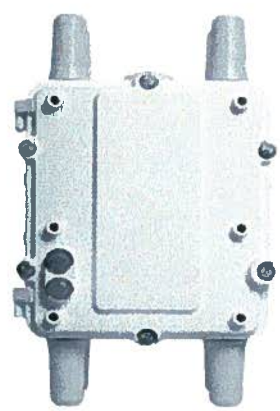
Description:

The FAN is a Cisco Connected Grid (CG)-mesh technology that is a secure wireless network platform used by Duke Energy's Itron meters. These meters form a mesh network from the connected grid router (CGR) to other meters where encrypted messages are relayed to increase the robustness of communication coverage in the field. In the event a meter is no longer communicating, the meters will reform the mesh to the best remaining optimal path back to the CGR, and (as needed) change CGRs to maintain communications. Due to the complex and dynamic nature of the mesh, a network management system, "Field Network Director," is used to maintain and provide insight into this layer of complexity. This results in a network architecture that is highly scalable, secure and adaptable to Duke Energy Ohio's metering needs.

Deployment Status:

The FAN infrastructure includes meters and CGR's. The infrastructure is currently being deployed in Duke Energy Ohio and is anticipated to be complete in 2022. The centralized systems that enable the FAN are in the process of being upgraded to handle the full complement of planned meter installations and are also anticipated to be complete in 2022. This infrastructure will replace the current Echelon node environment.

The image to the right shows an example of the CGRs used in the FAN program.



PROGRAM: COMMUNICATIONS NETWORK MANAGEMENT SYSTEM

Description:

For the purposes of this report, the Communications Network Management System has been defined as the collection of systems that enable network administrators to manage the network's independent components inside the larger communications networks. These networks are managed by a set of common tools that provide a consolidated view of the systems and by a collection of tools specific to the technologies on the individual networks.

Deployment Status:

Duke Energy is continually evaluating new network management tools and approaches. Changes to the communications network management systems are included in the various work efforts presented in the Operational Communications Infrastructure section of this report.

PROGRAM: STRATEGIC FIBER & WIRELESS TRANSPORT

Description:

The Strategic Fiber & Wireless Transport initiative provides for the end-of-life replacement of Duke Energy's privately-owned fiber and wireless transport systems. Replacement of these end-of-life systems is needed to improve network reliability and resiliency, increase data network capacity, support changing security requirements, reduce operational and maintenance expenses, and foster technology transformation.

Deployment Status:

Several work streams exist within the Strategic Fiber and Wireless Transport initiative to help improve Duke Energy's backbone communications infrastructure.

1. Fiber Optic Cable

Approximately 70% of Duke Energy Ohio fiber will be evaluated for replacement within the next 10 years. In late 2018, Duke Energy Ohio began replacing its end-of-life fiber optic cable. Duke Energy Ohio is investigating the option to expand its fiber network to connect key operations centers, substations and other critical facilities. This work stream is also investigating alternatives to using optical ground wire (OPGW) to enable Duke Energy Ohio to deploy fiber faster and less costly.

2. Optical Systems

Optical systems are the electronic systems that "light" the fiber optic cable and send signals through the cable for communications. Much of Duke Energy Ohio's optical systems use Synchronous Optical Network/Time Division Multiplexing (SONET/TDM) technology, which is becoming obsolete. An analysis has been performed to identify optical nodes that will need to be replaced. Replacement will include removing SONET/TDM systems and installing the latest packet-based technology to provide more capacity. In 2018, Duke Energy Ohio began installing new optical equipment that will position them for bandwidth expansion and modernized IP/Ethernet services.

3. Microwave

Like fiber, microwave provides high capacity connectivity to the Duke Energy Ohio communications network. It provides high speed connectivity in areas where installing fiber is not economically feasible.

Much of the current microwave uses obsolete technology. Further, current business needs require additional capacity. In 2018, Duke Energy Ohio began an effort to replace this system.

4. MAS Radio

Multiple Address System or MAS are radios that provide "last mile" wireless connectivity for substations. MAS technology is a low speed, low bandwidth system that is typically suited for serial data connections to low speed SCADA devices. Much of Duke Energy Ohio's MAS radios are at end of life, manufactured discontinued and will be replaced by newer technology, such as point-to-point and point-to-multipoint radios. This work began in 2018.

5. Towers and Shelters

Many of Duke Energy's communications towers, shelters and direct current power systems must be replaced due to age, structural issues and capacity. Duke Energy Ohio began work to replace this infrastructure in 2018.

PROGRAM: NEXT GENERATION CELLULAR

Description:

Duke Energy Ohio utilizes public cellular for advanced metering infrastructure (AMI) and SCADA communications. A significant number of these cellular connections are on 2G/3G networks that are at end of life. Duke Energy is working with its cellular carrier partners to transition these connections to their LTE networks. The Next Generation Cellular initiative will replace existing legacy 2G/3G cellular modems for Duke Energy Ohio distribution line devices and substations. These modems, which have already exceeded their life expectancy of 3 – 5 years, will be replaced with 4G and 5G modems, when available. The current 4G and future 5G cellular technologies provide greater network bandwidth or throughput, lower latency or response time, and better cybersecurity protections.

Deployment Status:

The effort to replace existing legacy 2G/3G cellular modems for Duke Energy Ohio started in 2017 and will take several years to complete. The replacement of 2G/3G modems with 4G modems not only ensures the devices remain online after carriers discontinue the 2G/3G network, but it also ensures these devices benefit from the advantages of 4G (i.e. - faster data transfer speed, lower latency, better connectivity, enhanced security, higher network capacity, longer network life, easier integration, etc.).

PROGRAM: LAND MOBILE RADIO (LMR)

Description:

The LMR Strategic Replacement project is an enterprise-wide effort to replace and improve Duke Energy's LMR systems. LMR systems are the wireless communications systems used by Duke Energy field crews to communicate and coordinate work between themselves and with dispatch operations. Currently, each Duke Energy service territory has disparate LMR systems that do not communicate with each other, nor are they interoperable (i.e. - support the ability for crews to use the same radio in each service territory).

The existing Duke Energy Ohio LMR system is at the end of life and is no longer supported by the original equipment manufacturer. The LMR Strategic Replacement Plan has been developed to replace the current LMR with a system that utilizes enhanced technology to provide reliable, sustainable, interoperable communications. This plan aligns with Duke Energy Ohio's focus on grid modernization and is an integral part of its operational communications infrastructure that will allow for consistent and reliable communications.

Deployment Status:

The LMR project is currently in the Design stage for Duke Energy Ohio. This effort is expected to take approximately two years to complete. The LMR project provides the opportunity to improve reliability, supportability, interoperability and coverage of the LMR system. As part of implementing this system, some communications towers that are aging and in need of structural repair will be replaced or repaired to accommodate the new radio equipment. Additionally, since the new radio system provides interoperability, field crews from one service territory will be able to use their radios in another service territory for outage support and other activities.

PROGRAM: VEHICLE AREA NETWORK (VAN)

Description:

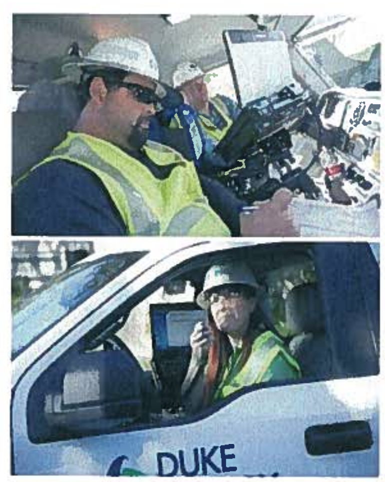
The VAN program is modernizing the Duke Energy Ohio fleet of vehicles by deploying cellular connections to each vehicle. The program consists of telematics and a mobile gateway. The VAN Telematics project will leverage the cellular connection to collect vehicle telemetry data, allowing for the analysis of vehicle driving performance, maintenance data, real-time vehicle locations, and usage of certain vehicle components such as the boom or bucket. This data will be available for use in multiple applications, such as outage management and restoration.

Another component of the VAN program is the potential deployment of a mobile gateway or Wi-Fi router in certain vehicles. The VAN mobile gateway will serve as a central communications hub around the vehicle, reducing the need for each device (mobile data terminal (MDT), tablet, etc.) to have a dedicated cellular connection.

Deployment Status:

The VAN Telematics effort is currently in the deployment phase and is anticipated to be complete in the next two to three years. The VAN mobile gateway effort is currently being evaluated.

The image to the right shows the vehicle mounted equipment.



Sensing & Measurement is an essential component of the modern grid. Distribution systems have historically been equipped with limited sensing & measurement capabilities. Advancements in technology such as AMI and enhanced grid sensing capability will allow utilities more visibility into their power grid as well as provide additional tools to capture power quality issues and enhance reliability. This section includes a discussion on AMI, production metering, and a discussion on grid asset sensing both inside and outside of the substation.

PROGRAM: ADVANCED METERING INFRASTRUCTURE (AMI)

Description:

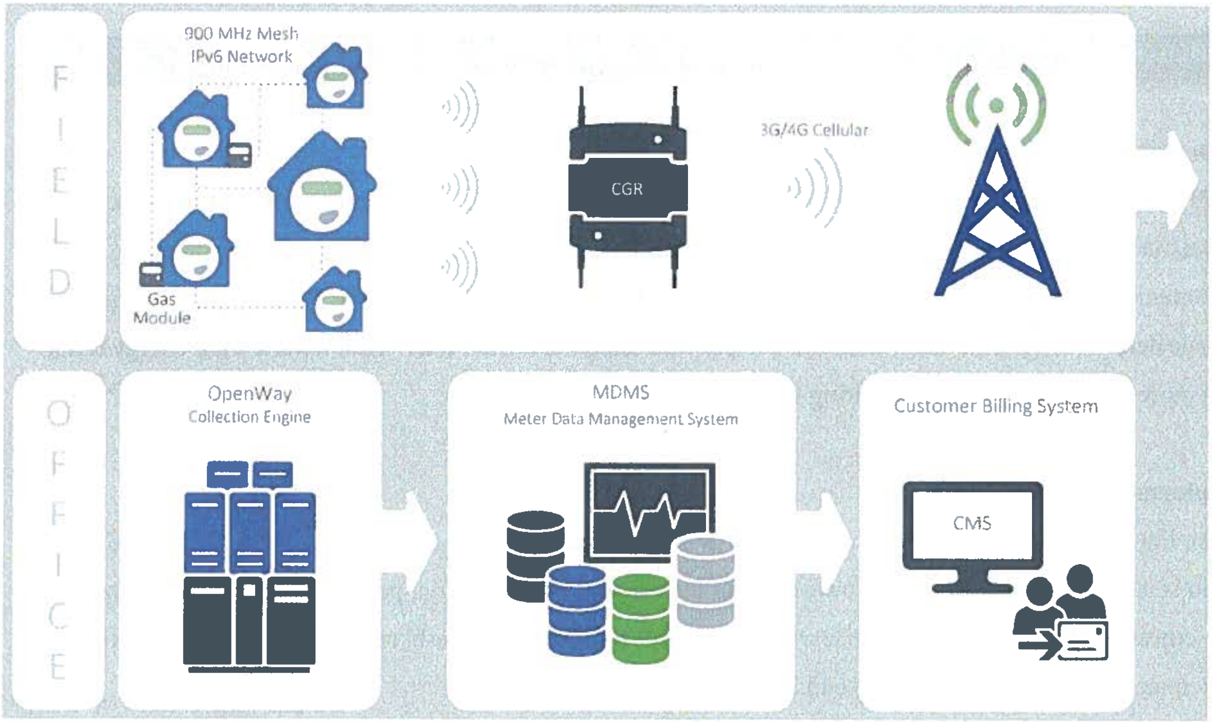
AMI is an integrated system consisting of smart meters, data management and communications infrastructure that enables two-way communication between a utility and its customers. This communication includes things such as automated meter reading, remote connects / disconnects and quicker outage detection. Additionally, smart meters provide customers with better visibility into their energy usage and more energy-saving, bill-lowering tools.

Deployment Status:

Duke Energy Ohio completed deployment of AMI for the vast majority of customers in 2015. Duke Energy Ohio is currently in the process of transitioning the original AMI solution, powerline carrier technology, to the current Duke Energy enterprise AMI standard solution, RF mesh technology. The transition is anticipated to be complete by year-end 2021.

The existing powerline carrier AMI technology has provided many operational benefits, such as: reduced metering costs, reduced meter order costs (remote connect/disconnect capability), outage restoration assistance (remote meter interrogation capability), and better non-technical energy loss identification. Customer benefits realized from the existing powerline carrier AMI technology include: daily interval customer energy usage data; the ability for customers to pick their own due date; and remote meter orders (quicker service and no appointment necessary). The enterprise standard RF mesh AMI technology will provide additional operational and customer benefits in the form of new dynamic pricing rates and usage alerts provided to customers via email.

The image below shows the flow of information for the AMI network from the field (customer's meter) to the office (customer billing system).


FIELD
900 MHz Mesh
IPv6 Network
Gas
Module
CGR
3G/4G Cellular
OFFICE
OpenWay
Collection Engine
MDMS
Meter Data Management System
Customer Billing System
CMS

PROGRAM: PRODUCTION METERING (NET METERING)

Description:

For the purposes of this report, production metering has been defined as net metering. Net metering is the net value of a customer's generation less their energy usage. Net metering is offered to qualifying customers who intend to offset part or all of their energy usage with on-site generation, as described in Ohio Administrative Code 4901:1-10-28, Duke Energy Ohio's Rider NM: Net Metering Rider and Rider NM-H: Net Metering Rider - Hospitals.

Deployment Status:

The following chart shows participation levels under the Duke Energy Ohio Rider NM: Net Metering.

Type	# of Installations	Total Capacity
Solar	1,070	19.9 MW
Wind	10	.0575 MW

There are no hospitals participating in net metering under Rider NM-H.

PROGRAM: GRID ASSET SENSORS – SUBSTATION & ENVIRONMENTAL SENSORS

Description:

Distribution substations have historically been equipped with limited grid asset sensing capability which has been primarily focused on large assets like transformers and circuit breakers. Traditional asset sensing consists of oil temperature and level, winding temperature, breaker gas levels, device operation counters on breakers, VRs and LTCs, load reads and station battery health. Much of the asset information was obtained by way of periodic visual inspections.

Advancements in device technology and communications have permitted many of the visual inspection points to be obtained remotely. Temperature, device counter, gas levels, device loading and station battery health can all be obtained remotely via SCADA. Advances in technology and communication have also allowed additional remote sensing capabilities to be implemented such as Transformer Online Dissolved Gas Analysis (DGA) monitoring; and microprocessor relays have allowed for relay health, fault data and device fault duty to be obtained remotely. Remote visibility into substation assets is complimented with onsite visual inspection using thermal imaging, partial discharge testing, portable gas analyzers for insulating oil and acoustic and vibration detection.

Deployment Status:

Substations with SCADA provide basic asset monitoring of transformer oil and winding temperature, breaker gas levels, loading levels and device operation counters for breakers, VRs and LTCs. All Duke Energy Ohio substations are thermally scanned one time per year and DGA oil samples are obtained periodically based on device size but are typically done once per year.

% Duke Energy Ohio Substations with SCADA	**78%**
% Duke Energy Ohio Circuits with Electronic Relays	**78%**

Environmental sensors are not currently deployed in Duke Energy Ohio.

PROGRAM: GRID ASSET SENSORS

Description:

Distribution Line Sensors are devices located at points along a distribution circuit at primary levels providing voltage and/or current values, and real and reactive power flow. These sensing points and the values they provide are inputs to DMS for the purpose of enabling IVVC, Conservation Voltage Reduction (CVR), megawatt reduction functions, and future advanced DMS functions.

Sensing packages can be characterized as a sensing component, the data collection/processing component (remote terminal unit or RTU, intelligent end device or IED, or meter) and a 2-way communication component that takes sensor output and formats data to a standard communication protocol, and hands the packet of data to the modem which communicates the information back to D-SCADA (Distribution Supervisory Control and Data Acquisition)/DMS. A sensing package can be an integrated, self-contained device or separate devices. Sensing devices can be installed with other assets, utilizing the metrology package of that asset.

Deployment Status:

Duke Energy Ohio has approximately 670 locations that have electronic reclosers which provide another current sensing point. Duke Energy Ohio also installed approximately 1,900 CAPs, which provide a voltage sensing point on one phase only.

Operational Analytics are key to a smarter grid performance. With the implementation of advanced technologies comes a larger influx of data. Utilities need a holistic view of their grid data to make better informed decisions and optimize grid performance. Operational analytics are used to transform the grid data into useful information to help drive strategic decision making and operational efficiencies. Included in this section is the following:

- Field Data Management
- Electrical Network Connectivity Model
- Distribution State Estimation
- Advanced Distribution Management System
- Outage Management System
- Geographic Information System
- Meter Data Management System
- Asset Management
- Workforce Management

PROGRAM: FIELD DATA MANAGEMENT-ALARM MANAGEMENT

Description:

Automated field devices provide status, analog and alarm data via remote communication to the DMS/SCADA system. Alarm levels are determined per device and per point to alert control center operators to exception level alarms. Some alarms are direct points from devices while other alarms are generated in the SCADA system based on data from the devices.

Alarm management processes are in place on the actions required for each type and level of alarm received. Alarms are also archived in an event historian for tracking and analysis purposes. Each automated device, depending on its function, is configured to provide alarms for typical quantities such as high/low voltage and current, high neutral current, switch mis-operation or failure, fault targets, battery issues, status, loss of communication, and self-test problem, among others.

Deployment Status:

DMS/SCADA has been fully deployed in the Duke Energy Ohio service territory since 2015. The Company will continue to update its DMS system as new versions and capabilities are released from the vendor.

PROGRAM: ELECTRICAL NETWORK CONNECTIVITY MODEL

Description:

The electrical network connectivity model is supplied from DMS software. The DMS software takes operational and geospatial data and combines it with the dynamic power system equipment model to produce an intelligent, real-time electronic map board that can be viewed from individual screens or large-scale displays. The system also provides the following:

- Full integration with the SCADA system for monitoring, controlling, and tagging devices;
- Online model updates without interrupting users;
- Ability to leverage the existing asset management model (usually GIS) as its data source for model building and maintenance;
- A study mode that allows private "what if" analysis of proposed switching or operational procedures; and
- Accurate phase modeling of the distribution network that allows all types of network configuration to be supported.

Deployment Status:

DMS has been fully deployed in the Duke Energy Ohio service territory since 2015. The Company will continue to update its DMS system as new versions and capabilities are released from the vendor.

PROGRAM: DISTRIBUTION STATE ESTIMATION

Description:

The DMS runs near real-time power flow which provides a solution based on convergence tolerances for real power, reactive power and voltage. The power flow solution is obtained using a nodal admittance matrix analysis technique, where the unknowns are the phase bus voltages. Within the power flow, a load estimation procedure is executed to determine the nodal load values. The load allocation procedure uses the real-time measurements from SCADA and pre-defined customer load profiles to scale the distribution system loads to the real-time measurements.

The load allocation function allocates loads (kW and kVAR) at distribution nodes to support analysis functions. Loads are allocated using load model data that takes into account actual or predicted feeder loads and the relevant type and time of day. The load allocation ensures that the load model and current network topology are consistent with metered flows, current breaker statuses, and metered loads along the distribution feeders.

Voltages and phase angles from the Energy Management System State Estimator solution can be used in the real-time power flow to initialize the distribution source voltage locations.

Deployment Status:

Distribution State Estimation has been used in the Duke Energy Ohio service territory since 2015. The Company will continue to update its DMS system as new versions and capabilities are released from the vendor.

PROGRAM: ADVANCED DISTRIBUTION MANAGEMENT SYSTEM (ADMS)

Description:

The ADMS is a multi-year program that will provide a consolidated SCADA, DMS and OMS into one platform. The Distribution Control Centers (DCC) will use this one system to manage all remote controllable electronic devices, manage the voltage on the entire distribution system, dispatch crews to outages, provide other system estimated times of restoration, and perform switching for either planned outages or emergencies, as needed. The ADMS is the critical system that manages the distribution grid.

Deployment Status:

Currently, Duke Energy must maintain two separate models for the DMS and OMS because they are two separate vendor products. Duke Energy is continuously working to ensure the two models are aligned and consistent so that Operations personnel can look in either tool and receive the exact same information. This is very challenging. Efficiencies will be gained when the two systems are consolidated onto one platform and only one model needs to be maintained. Duke Energy Ohio has plans to upgrade to the newest SCADA System and DMS in a new secure domain. This is a critical step to being able to upgrade to the final ADMS platform.

PROGRAM: OUTAGE MANAGEMENT SYSTEM (OMS)

Description:

The OMS used by Duke Energy Ohio is the Oracle Network Management System (NMS). It allows Duke Energy to process calls from live agents, interactive voice response, text, Internet Outage Reporting, etc. and predict where to send field crews in both textual and graphical formats. It is the source for estimated time of restoration communications during blue sky and major storm situations. Included in the Oracle NMS suite of tools is a Business Intelligence Oracle Utilities Analytics solution used to provide the ability for running both operational and after the fact reporting.

The OMS has multiple interfaces to various systems used at Duke Energy such as the outage notification system for proactive communications, estimated time of restoration updates and restoration confirmation to customers. These interfaces include:

- SCADA/DMS system. When field SCADA devices are known "out", they are shown as "out" in the OMS, including the self-healing networks.
- Mobile work management system. This interface allows field crews to update in real-time what they are finding in the field for quicker and improved customer communication.
- AMI outage reporting. This interface allows pinging for status updates and "power up" messaging to be sent back to the OMS.
- Other interfaces include the work management system for follow-up construction work.

The OMS system is used in control room operations and in the field for capturing damage assessment and real-time updates during storm situations. The OMS system is standardized at Duke Energy whereby performers operating the system in any Duke Energy service territory can assist each other seamlessly during major storm events for improved storm restoration.

Deployment Status:

As noted in the ADMS section, Duke Energy Ohio has plans to upgrade to the newest SCADA System and DMS in a new secure domain. The OMS system is a part of this upgrade.

PROGRAM: GEOGRAPHIC INFORMATION SYSTEM (GIS)

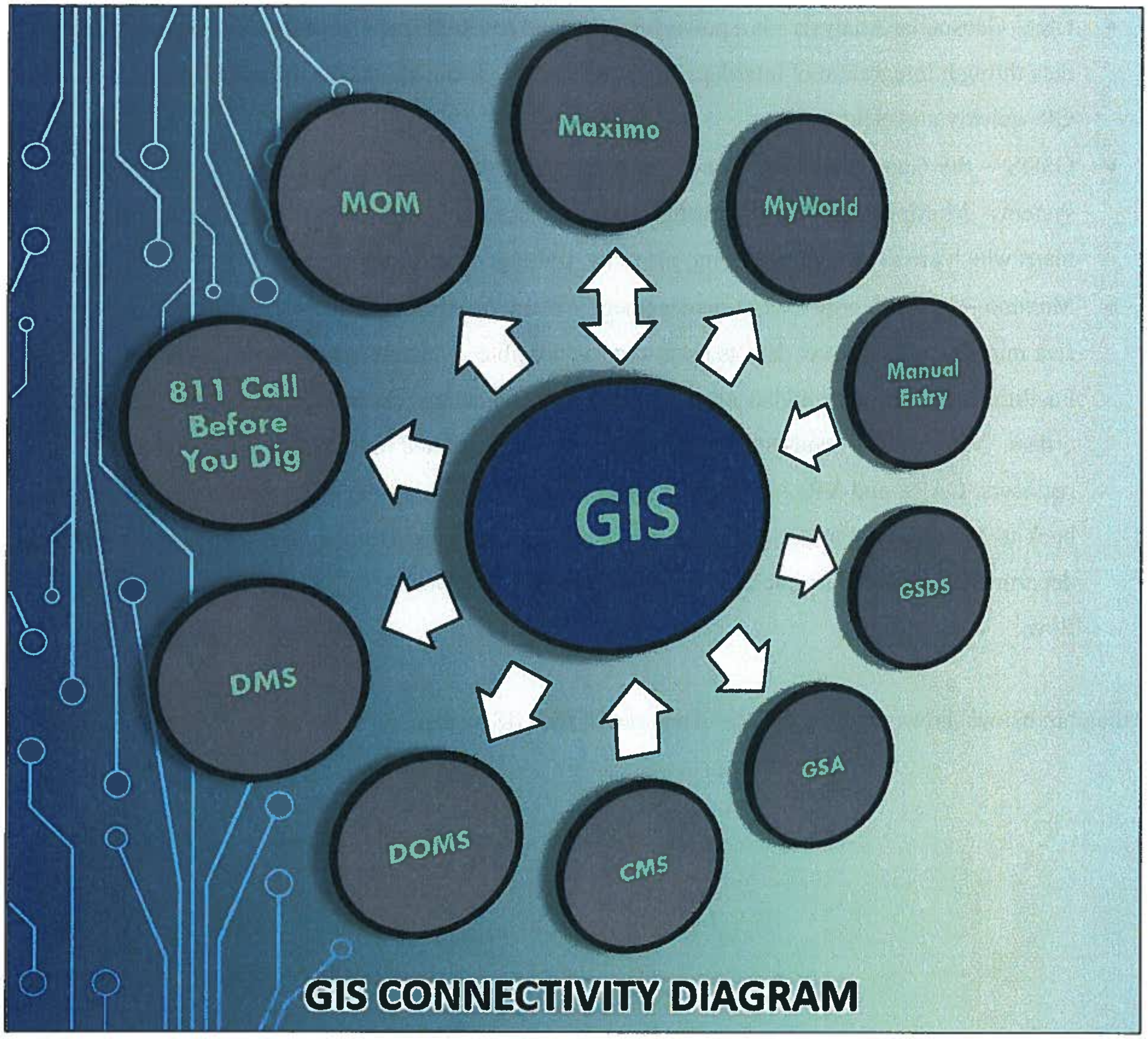
Description:

The GIS is the storage platform for gathering, managing, and modeling Duke Energy Ohio's electric & gas facilities. It displays geographical and relational placement of facilities, while also recording physical and informational characteristics of the specific equipment. Attributes such as size, type, kind, install date, load capability, and connectivity are just some of the available information. The location and attribute data is used to feed downstream systems to ensure accurate information is available. GIS supports the following systems:

- DMS- Distribution Management System is used for modeling and load balancing of electric circuits. It receives data from the GIS.
    - The GIS stores equipment from circuit breaker to customer meter so modeling and management can be effective in DMS. It also raises the first awareness to connectivity issues so it can be corrected before it flows into downstream systems.
- DOMS – Distribution Outage Management System is used for monitoring customer outages, planned or otherwise. It receives data from the GIS.
    - The GIS attaches and displays customer data from the Customer Management System to a physical location. Account number, address, and secondary location identifiers such as 'BARN' or 'GARAGE are easily accessed. This data along with relational locations of key equipment supports fast assessment and efficient customer restoration, as well as, minimizing planned outages.
- MOM- Mobile Offline Mapping displays specific data from the GIS that can be accessed when not connected to Duke Energy's network. It is used in the field by crews to navigate, assess sites & equipment, and record issues.
- MyWorld – is an online version of the GIS for general use in all departments. It is used in planning, routing, engineering, and equipment verification.
- 811 Call Before You Dig- is a national service that provides assessment of underground utilities for customers that wish to dig on their property. All underground gas and electric lines in the GIS are sent to the 811 centers to reduce risk of harm to customers and equipment. This ensures safety and cost reduction for both Duke Energy Ohio and the customer by keeping damage and restoration costs low.

- GSA- Geospatial Analysis – is a powerful query and research spatial tool that leverages enterprise data through integration of interdepartmental systems. It can access the information stored in the GIS quickly and efficiently.
- GSDS – the Geospatial Data Store - is a relational database that leverages interdepartmental systems. Multiple products are created from it by accessing data from the GIS including circuit maps which are used in engineering, planning, routing, and restoration.
- Maximo – Duke Energy's asset management system, Maximo, and the GIS communicate every five minutes to keep asset data as up-to-date as possible. Maximo sends work orders to the GIS. Facilities are manually added or augmented by technicians via information from these work orders. Maximo also sends attribute data that has been updated in the assets it maintains, such as reclosers, CAPs, and VRs. Once the assets are manually input, the GIS then sends information back to Maximo assigning global IDs for assets that are used for identification across multiple departments and software packages. This also initiates the work order to proceed through its work flow.

The diagram below shows the flow of data in and out of the GIS system.



Deployment Status:

The GIS is fully deployed in Duke Energy Ohio. Housed assets are updated daily.

PROGRAM: METER DATA MANAGEMENT SYSTEM (MDMS)

Description:

MDMS processes and stores customer interval usage and event data collection to create billing determinants, provide the ability for remote order fulfillment, perform data analytics (i.e. - non-technical energy loss detection), and support customer programs and services that are enabled by AMI.

Deployment Status:

Duke Energy Ohio currently has an operational MDMS as part of its the overall AMI solution. A first-generation MDMS (EDMS) was deployed in 2007. In 2014, a second generation MDMS was deployed to take advantage of system improvements and enhancements. In support of providing Customer Energy Usage Data (CEUD) to CRES providers, the MDMS system will be upgraded over the next several years. **Refer to the "Standardized Access to Customer Energy Usage Data" section of this report for details of those upgrades.**

PROGRAM: ASSET MANAGEMENT

Description:
Duke Energy Ohio assets such as substation transformers, breakers, reclosers, reactors, etc. are managed real time in the DMS. Substation real time data such as status, analog values, and alarm data is provided via remote communication to the DMS/SCADA system. Through monitoring the real-time load and alarms levels, processes are in place to direct the actions required by the operators for each type and level of alarm received. These actions will reduce the physical stress on the asset and reduce the risk of an asset failure by managing the device within the designated operating limits.

Alarms are archived in an event historian for tracking and analysis purposes. Each automated device depending on its function, is configured to provide alarms for typical quantities such as high/low voltage and current, high neutral current, switch mis-operation or failure, fault targets, battery issues, status, loss of communication, self-test problem, etc. Analysis of the archived alarms can lead to system reconfigurations and/or system upgrades that will improve the operating capabilities/efficiency of the distribution system.

Deployment Status:
DMS/SCADA has been deployed in Duke Energy Ohio since 2015. The Company will continue to update its DMS system as new versions and capabilities are released from the vendor.

PROGRAM: WORKFORCE MANAGEMENT

Description:

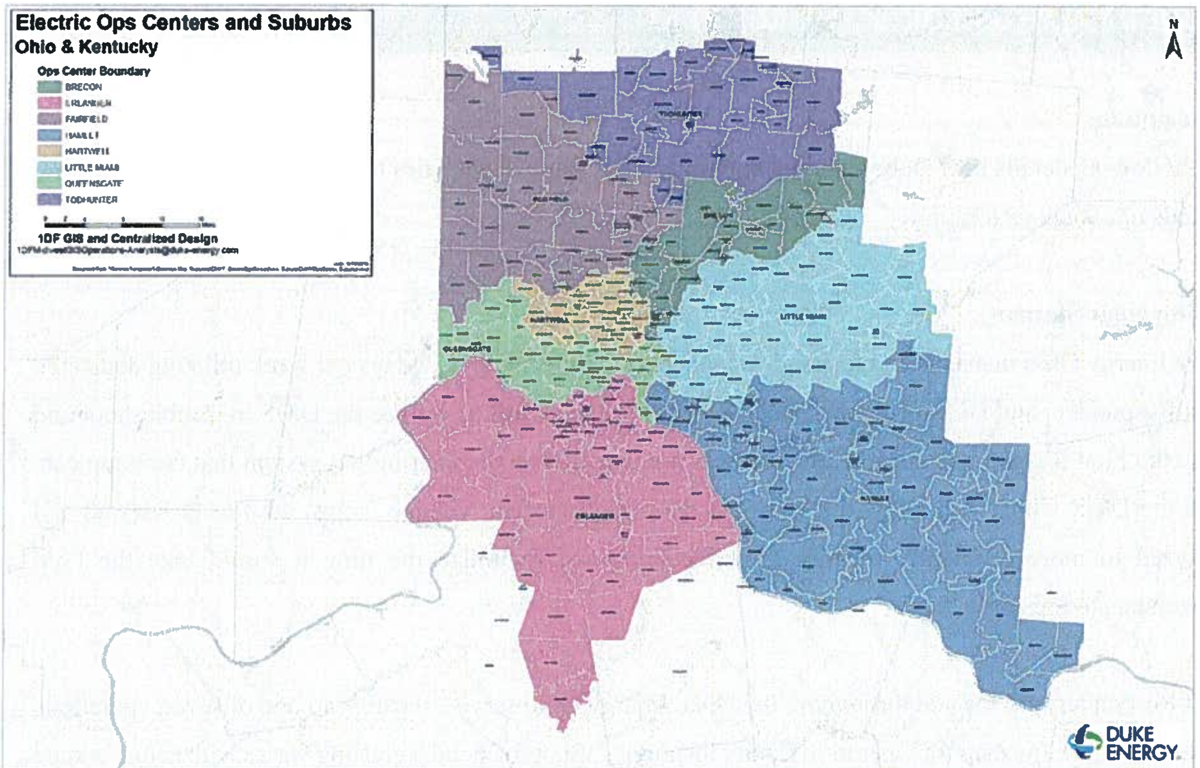
The following details how Duke Energy Ohio utilizes operational analytics to manage its workforce during periods of outage restoration.

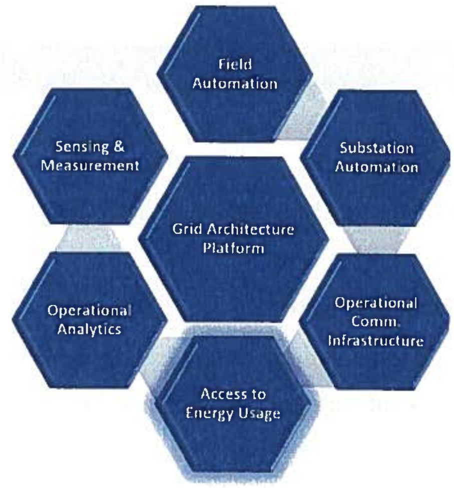
Deployment Status:

Duke Energy Ohio manages and responds to outages 24 hours per day, 7 days per week utilizing dedicated First Responders and DCC personnel. The DCC utilizes the OMS as well as the DMS to troubleshoot and route the First Responders via a MDT. Devices are installed on the distribution system that communicate with the DMS which will allow for real time data (fault current, voltage, amps, etc.) to be viewed and analyzed to more efficiently identify fault locations and minimize the time it would take the First Responders to locate the fault.

First Responders are located throughout the Duke Energy Ohio service territory in one of seven operations centers. (See below map for Operation Center locations). First Responder staffing varies with actual outage and expected outage volume. As outage volumes increase, additional resources can be obtained from other Duke Energy service territories in Indiana, Florida and the Carolinas, as well as, through the Great Lakes Mutual Assistance group.

The following map shows the electric operation centers supporting the Duke Energy Ohio and Duke Energy Kentucky service territories. Seven of the eight operation centers are in Ohio, with one center (Erlanger) located in Kentucky.


Electric Ops Centers and Suburbs
Ohio & Kentucky
Ops Center Boundary
BRECON
FAIRFIELD
TODHUNTER
1DF GIS and Centralized Design
N
DUKE ENERGY



Standardized Access to Customer Energy Usage Data (CEUD). This section will describe the CEUD that is currently available to CRES Suppliers and the CEUD that will be available to CRES Suppliers in the next several years. This includes system enhancements that will facilitate identification of customers with billing quality interval CEUD; uploading of residential authorizations to release CEUD; increased system capacity to handle larger volumes of data; and next day usage. The CEUD being provided to CRES Suppliers will be enhanced in the next several years as described in the following section.

PROGRAM: CUSTOMER ENERGY USAGE DATA

Description:

Duke Energy Ohio provides CRES Suppliers access to CEUD data as outlined below.

Deployment Status:

CEUD obtained by Duke Energy Ohio is available to CRES Suppliers from three sources: the Pre-enrollment list, Electronic Data Interchange (EDI), and the Supplier Portal.

1. Pre-enrollment List – The Pre-enrollment List provides twelve months of monthly customer usage data for all customers, except for those customers who have opted out of the list. Customers can opt out of the pre-enrollment list online, by written request, or by calling the customer care center. The list also includes load profile indicators, current and future Peak Load Contribution (PLC) values, and indicates whether a customer is receiving service from a supplier. It is important to note that this list does not contain customer account numbers.

2. EDI – CEUD is also available through an EDI transaction. EDI can provide both monthly and interval customer usage data for up to twelve months and interval data is provided in 15-minute intervals. The interval data from EDI is only available for those customers, typically commercial, who have an Interval Data Recorder (IDR) meter.

# of Duke Energy Ohio IDR meters	**5,147**

3. Portal – An internet Portal is available to CRES Suppliers to obtain CEUD on a per-customer basis. That is, a CRES Supplier can request information, subject to having obtained the proper authorization, one customer at a time. The Portal provides both monthly and interval customer data, as described below.
    a. The Portal provides up to 24 months of monthly customer usage data (as well as current and future PLC values) for all customer classes. Residential customer data is included with proper authorization.
    b. The Portal provides hourly interval customer usage data for customers who have either an IDR or an AMI meter. This data can be requested for the most recent 12- or 24-month

billing period. Each hourly interval indicates whether the data in that interval is of billing quality.

Enhanced availability to CEUD data will be available to CRES Suppliers over the next several years. Included in the Commission's Order in Case Nos. 17-0032-EL-AIR, *et al.*, (December 19, 2018), is an agreement that Duke Energy Ohio will provide enhancements that include, among other things, customer/meter identification, residential customer authorizations, billing, and "Next Day" usage.

These enhancements include:

1. Methods to identify customers that have billing quality interval CEUD. This will include all customers with AMI Itron meters that are certified on the MDMS. MDMS performs Validation, Estimation and Editing (VEE) on interval CEUD. This enhancement will keep the customer lists current. As meters are transitioned from Echelon to Itron, CRES Suppliers will be able to market to customers included on the lists. The lists include a Sync List (a list of customers by supplier), a Pre-Enrollment List, and the Portal. These enhancements are anticipated to be available by mid-2019.

2. System enhancements to facilitate the bulk uploading of residential authorizations to release interval CEUD. Currently, CRES Suppliers can upload authorizations one at a time via the CRES Portal. This enhancement would add functionality for customers to self-authorize the release of interval CEUD on the authenticated duke-energy.com website. These enhancements are anticipated to be available at the beginning of 2020.

3. System enhancements for billing. These enhancements will allow for the following:
    a. Larger volumes of data to flow through EDI transactions, including system management tools.
    b. Add the ability for CRES Suppliers to receive interval CEUD from AMI meters, like the functionality they currently have with IDR meters.
    c. CRES Suppliers can enter their interval CEUD charges on the Company's bill using "Bill Ready Billing." Bill Ready Billing is the process by which the Company sends usage data to the CRES Supplier, who then calculates the billing amount and sends the amount back to Duke Energy Ohio to place on the bill. This enhancement will allow CRES Suppliers to

offer electric commodity products of their choosing, without potential limits as to what can be calculated in Duke Energy Ohio's billing systems.

These enhancements are anticipated to be available at the beginning of 2021.

4. System enhancements to provide "Next Day" usage. This will allow CRES Suppliers the ability to obtain hourly interval CEUD the day after power is consumed. The enrollment of a customer and the transmission of "Next Day" interval CEUD will be made via EDI transactions. Using EDI will automate both the initiation and daily processes, as well as, allow large volumes of customers to be eligible for the "Next Day" services that CRES Suppliers may offer. These enhancements are anticipated to be available at the beginning of 2022.