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BEFORE

THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Application of Duke Energy Ohio to Adjust and Set Its Gas and Electric Recovery Rate for SmartGrid Deployment Under Riders AU and Rider DR-IM	)	Case No. 09-543-GE-UNC
In the Matter of the Application of Duke Energy Ohio for Tariff Approval	)	Case No. 09-544-GE-ATA
In the Matter of the Application of Duke Energy Ohio to Change its Accounting Methods	)	Case No. 09-545-GE-AAM

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**AMENDED MOTION FOR PROTECTIVE ORDER
OF
DUKE ENERGY OHIO, INC.**

Duke Energy Ohio, Inc. (Duke Energy Ohio) submitted an application in this matter on June 30, 2009, together with testimony and a motion for protective order. The motion for protective order was submitted to protect the confidentiality of information contained in an exhibit attached to the testimony of Duke Energy Ohio witness Donald H. Denton, Attachment DHD-1 (DHD-1). On August 19,. 2009, the Attorney Examiner's Entry granted the Company's motion and ordered that DHD-1 be protected for a period of 18 months and kept under seal.

Rule 4901-1-24(F), Ohio Administrative Code (O.A.C.) provides that, unless otherwise ordered, protective orders under Rule 4901-1-24(D), O.A.C., automatically expire after 18 months. Consistent with the terms of that Entry, on December 30, 2010,

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Duke Energy Ohio submitted a motion to continue the protective treatment afforded its filing, pursuant to Rule 4901-1-24(D), O.A.C.

On May 2, 2011, the Attorney Examiner issued an Entry noting that material sought to be protected under Commission rules should be redacted, rather than a wholesale removal of the document from public scrutiny. Accordingly this amended motion is submitted to request that the confidential material contained in DHD-1 be granted protection. In response to the Attorney Examiner's Entry, we submit the attachment to this motion, with material selectively redacted in DHD-1.

Certain material within DHD-1 must be protected as it constitutes confidential trade secret information, proprietary design criteria, functional requirements, and design assumptions, all of which constitute trade secret under Section 1333.61(D), Revised Code. In particular, as this material relates to the deployment of new technology that is highly competitive in the electric utility arena, the disclosure of this information would give competitors access to competitively sensitive and confidential information. The information is kept confidential by the Company and is not shared with third parties. It derives independent economic value from being unique to Duke Energy Ohio and not known to or readily ascertainable by others who might obtain economic value from its disclosure or sale.

Attachment DHD-1 is comprised of 37 pages. This document essentially lays out, in great detail, the Company's plan for the design and function of its SmartGrid. The document has been selectively redacted to protect only those portions of the plan that have not been shared outside of the Company. Only information related to the actual design of the Company's proprietary system has been redacted.

O.A.C. Rule 4901-1-24(D) allows Duke Energy Ohio to seek leave of the Commission to file information that Duke Energy Ohio considers to be proprietary trade secret information, or otherwise confidential, in a redacted and non-redacted form under seal.[1] This rule also establishes a procedure for presenting to the Commission the information that is confidential and therefore should be protected.[2]

The definition of trade secret contained in R.C. 1333.61(D) is as follows:

> "Trade secret" means information, including the whole or any portion or phase of any scientific or technical information, design, process, procedure, formula, pattern, compilation, program, device, method, technique, or improvement, or any business information or plans, financial information, or listing of names, addresses, or telephone numbers, that satisfies both of the following:
> (1) It derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use.
> (2) It is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.[3]

In analyzing a trade secret claim, the Ohio Supreme Court has adopted the following factors as relevant to determining whether a document constitutes a trade secret:

> (1) The extent to which the information is known outside the business; (2) the extent to which it is known to those inside the business, i.e., by the employees; (3) the precautions taken by the holder of the trade secret to guard the secrecy of the information; (4) the savings effected and the value to the holder in having the information as against competitors; (5) the amount of effort or money expended in obtaining and developing the information; and (6) the amount of time and expense it would take for others to acquire and duplicate the information.[4]

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[1] Ohio Admin. Code Rule 4901-1-24 (Anderson 2007)
[2] *Id.*
[3] Ohio Rev. Code Ann. § 133361(D) (Baldwin 2007).
[4] *State ex rel. Besser v. Ohio State Univ.*, 89 Ohio St. 3d 396, 732 N.E.2d 373 (2000).

The confidential material described above, if disclosed, would enable competitors to ascertain the manner in which Duke Energy Ohio designs, manages and operates its proprietary SmartGrid solution. If this information were to be made public, Duke Energy Ohio would be placed at a competitive disadvantage. With the information contained in the document, a competitor could take actions that, in the absence of this information, it would not otherwise take. Such actions might include adjusting its prices, either to win contracts on which Duke Energy Ohio may also be bidding – business the competitors otherwise would not be in a position to win – or to copy the specific design solution that Duke Energy Ohio has developed at its own expense.

The information for which Duke Energy Ohio is seeking confidential treatment is not known outside of Duke Energy Ohio, and it is not disseminated within Duke Energy Ohio except to those employees with a legitimate business need to know and act upon the information.

The public interest will be served by granting this motion. By protecting the confidentiality of the document and its existing business plans regarding the deployment of SmartGrid, the Commission will prevent undue harm to Duke Energy Ohio and its ratepayers, as well as ensuring a sound competitive marketplace.

Duke Energy Ohio considers the redacted confidential material to be proprietary, confidential, and trade secret, as that term is used in R.C. 1333.61. In addition, this information should be treated as confidential pursuant to R.C. 4901.16. The redacted version of the document includes the confidential material blacked out for the public.

WHEREFORE, Duke Energy Ohio respectfully requests that the Commission, pursuant to O.A.C. Rule 4901-1-24(D), grant its motion for protective order and continue the protected status as regards the information which is redacted in DHD-1.

Respectfully submitted,
Duke Energy Ohio

Elizabeth H Watts

Amy B. Spiller (0047277)
Associate General Counsel
Elizabeth H. Watts (0031092)
Assistant General Counsel
Duke Energy Business Services, Inc.
Room 2500 Atrium II
P.O. Box 960
Cincinnati, Ohio 45201-0960
(513) 419-1810
e-mail: amy.spiller@duke-energy.com
elizabeth.watts@duke-energy.com

CERTIFICATE OF SERVICE

I hereby certify that, on this 27th day of May 2011, the foregoing Motion of Duke Energy Ohio, Inc. has been served via regular U.S. or electronic mail to the following persons:

Ann Hotz
Office of Consumers' Counsel
10 West Broad St, Suite 1800
Columbus OH 43215

Mark Yurick
Chester Wilcox & Saxbe LLP
65 East State St, Suite 1000
Columbus OH 43215

David Rinebolt
Ohio Partners for Affordable Energy
231 West Luna St
PO Box 1793
Findlay OH 45839

Elizabeth H Watts

Elizabeth H. Watts

Duke Energy Smart Grid Implementation

Ohio Smart Grid Design Basis Document

June 2009

[redacted]		
Donald H Denton III	GM, Smart Grid Implementation Strategy and Planning	

<u>Revision 0 - 06/27/2009</u>

Prepared by Avni Patel, P.E.

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General Background

What is included in the definition of Smart Grid can be confusing and differs based on company and professional discipline. It can also be confused with the "real" power grid. It is important for the designers of Duke Energy's smart grid solutions to understand the industry's long-term vision, while still focusing on meeting today's needs. This section is provided as background for the users of this document as to how the Department of Energy (DOE) envisions the development of a Smart Grid from a national, full scale, perspective.

According to the Department of Energy's documentation (see references), there are two definitions of smart grid. The following text is from DOE source:

> **The first** – called "a smart grid" – offers valuable technologies that can be deployed within the very near future or are already deployed today.
>
> **The second** – the Smart Grid – represents the longer-term promise of a grid remarkable in its intelligence and impressive in its scope, although it is universally considered to be a decade or more from realization. ...
>
> *In the short term, a **smarter grid** will function more efficiently, enabling it to deliver the level of service* we've come to expect more affordable in an era of rising costs, while also offering considerable societal benefits – such as less impact on our environment.
>
> Longer term, expect the **Smart Grid** to spur the kind of transformation that the internet has already brought to the way we live, work, play, and learn.
>
> The electric industry is poised to make the transformation from a centralized, producer-controlled network to one that is less centralized and more customer-interactive.
>
> *...A **smarter grid** makes this transformation possible...*
>
> **What Smart Grid isn't:**
>
> People are often confused by the terms Smart Grid and smart meters. Are they not the same thing? Not exactly. Metering is just one of the hundreds of possible applications that constitute the Smart Grid; a smart meter is a good example of an enabling technology that makes it possible to extract value from two-way communication in support of distributed technologies and consumer participation.
>
> Devices such as wind turbines, plug-in electric vehicles and solar arrays are not part of the Smart Grid. Rather, the Smart Grid encompasses the technology that enables us to integrate, interface with and intelligently control these innovation and others.
>
> **DOE lists five fundamental technologies that will drive the Smart Grid:**
>
> - **Integrated communications**, connecting components to open architecture for real-time information and control, allowing every part of the grid to both 'talk' and 'listen'
> - **Sensing and measurement technologies**, to support faster and more accurate response such as remote monitoring, time-of-use pricing and demand-side management
> - **Advanced components**, to apply the latest research in superconductivity, storage, power electronics and diagnostics

- **Advanced control methods**, to monitor essential components, enabling rapid diagnosis and precise solutions appropriate to any event
- **Improved interfaces and decision support**, to amplify human decision-making, transforming grid operators and managers quite literally into visionaries when it come to seeing into their systems

Relevance to Duke Energy

Duke Energy's goal is to transform the electric power grid by creating an integrated digital platform for enterprise-wide solutions resulting in improved operational efficiencies and overall customer satisfaction. Our definition aligning with DOE's Smart Grid definition includes smart grid technologies, smart energy (IT) systems, and connections with distributed resources to prepare us for the future envisioned decentralized energy infrastructure. The enhanced smart grid will include intelligent devices, communications networks, and supporting IT systems to provide two-way communications, monitoring, and control capabilities.

To deliver benefits from the smart grid to the company, our customers, and society, designers of Duke Energy's smart grid must migrate from a functional view of individual systems and design integrated cross-functional solutions to meet the future's distributed energy management business.

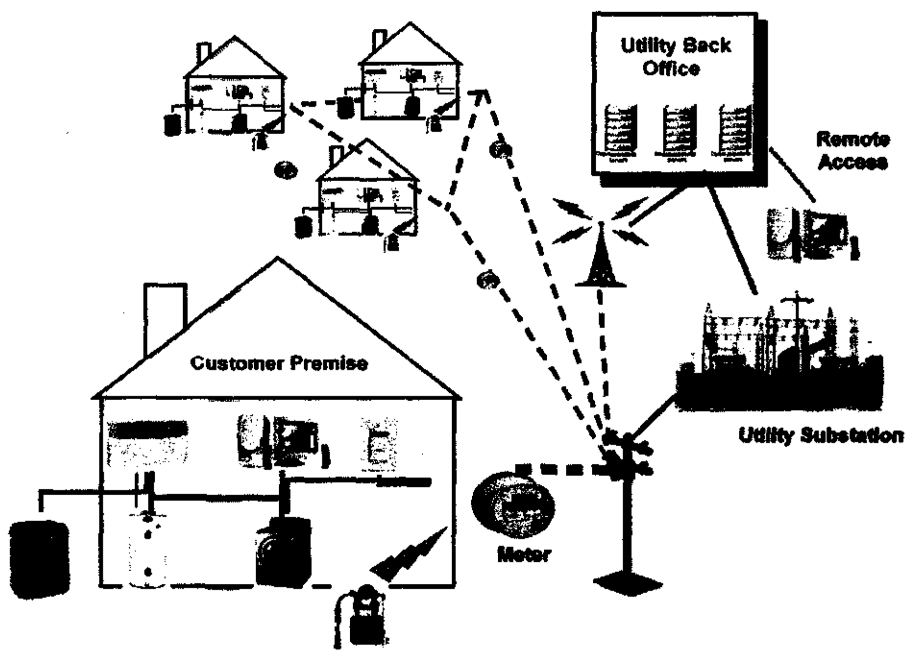


Figure 0-1 Smart Grid Concept

1 Objective of Smart Grid Design Basis Document

The Design Basis Document (DBD) guides the engineering design of the digital networked infrastructure which will be capable of delivering and receiving information from intelligent devices and automating components of the Duke Energy power system. This document states the criteria, functional requirements, standards, and assumptions, and includes supporting calculations for the design of Duke Energy's smart grid. The document also includes specific approved technology solutions to be used for mass deployment. This document will be used as the design basis for the development and implementation of smart grid infrastructure and system projects anywhere in the Duke Energy service territory.

Detailed design plans (and eventually detailed specifications) for deployment projects should meet the requirements stated in this document. The high-level design criteria for pilot projects are included in this document; however other requirements for pilots will not be included. The design basis document should be used in tandem with the Program Management Office (PMO) Playbook to ensure the design is properly implemented and integrated into Duke Energy's existing infrastructure. Project Managers should understand the scope and requirements in this document to engage in the PMO project process in order to meet the necessary milestones and deliverables from the Duke Energy Smart Grid Business Case.

The DBD is a living document, as the design of smart grid is currently an evolving process and Duke Energy recognizes that the design needs to be able to adapt to changing conditions and customer needs over time. The DBD will be updated every six months or more frequently for substantial changes or evolutions in the design. Substantial changes will be made following the approved PMO Change Control Methodology and communicated to appropriate stakeholders. The DBD is primarily an internal Duke Energy document, but a redacted version will be available for viewing by appropriate regulatory agencies at Duke Energy's corporate offices. Any copy provided to outside agencies will not contain detailed designs, security details or any proprietary information that could cause harm to Duke Energy by violating the security policies.

1.1 Intended Use of this document by Role

The intended use of the smart grid DBD depends on the role as defined below:

- Project Management Office: Ensure technical solutions selected in individual project's design scope functionally support the integrated design needs described in this document. Also, the PMO should ensure design decisions are not made from a single functional or departmental view of the individual project needs but across systems to ensure a fully integrated smart grid from end to end. The PMO will facilitate any issues related to the DBD on the project requirements during each stage review.

- Project Managers: Ensure the project's design plan and detailed specifications meet the scope and other design requirements of the DBD. Ensure functions enabled by the project and listed in the Project's Charter are operational. The project manager has accountability to validate that the DBD requirements are being followed. Any issues with the existing standards in the DBD should be raised through the Smart Grid PMO feedback process. Changes required to the DBD based on the feedback will follow the existing change control process. "Lessons Learned" that apply to the DBD for continuous improvement will be captured as part of the PMO process.

- Project Teams: Ensure the project design supports the high-level design criteria, and the functional and technical requirements in the DBD. Develop the plans for project deployment, installation and commissioning based on the requirements in the DBD.
- Other Duke Energy stakeholders: Understand the basis/requirements for the design of smart grid products and services and how they affect various systems, processes and procedures.

1.2 Scope of Duke Energy's Smart Grid Design

Duke Energy's smart grid design is focused on installation of electric and gas meters, distribution automation solutions, supporting telecommunications and development and modifications of IT systems. In the future, this document will include the requirements for smart grid technologies, and interfaces for the transmission system, home area networks and distributed resources as they become defined.

The smart grid technologies will integrate with Duke Energy's IT systems. This document will include smart grid specific functional requirements which could be enabled by Smart Energy Systems, however this document will not address the detailed system design requirements of IT systems.[1] Design requirements for Smart Energy systems will be specified in project specific documents.

This document will include the data flow requirements from field devices all the way to integrated IT systems to provide the smart grid business requirements.

The following are DBD scope exclusions:

1. Existing metering, telecommunications and IT system solutions, and transmission and distribution automation.
2. Potential use of technology or equipment. This document will only state the requirements and approved technology solutions, where applicable.
3. All bounding requirements for Alpha releases or demonstration studies specific to the smart grid. The DBD will outline the high level design criteria and functional requirements to be considered in the Initiation stage for pilots within smart grid; however, it will not define all other requirements.
4. Design requirements for home automation and distributed resources.
5. Detailed requirements of IT systems being developed for initiatives outside smart grid.

[1] For example, for circuit breakers, there will be a requirement to provide remote control and monitoring function by the distribution management system; however the distribution management system specific hardware and software requirements will not be included in the smart grid design basis document.

2 Integrated Smart Grid Design

Duke Energy's smart grid design includes several components, which must be integrated as necessary to provide a functional system which can meet all the business goals. These components include intelligent devices for metering solutions, and distribution automation systems; two-way telecommunications network, and supporting IT systems.

The following descriptions define each of the subcomponents:

- **Distribution Automation** – the existing distribution system will be transformed into an advanced distribution system with power equipment that can be operated from a remote location, such as a control center or can also be operated locally when required. Distribution automation also includes sectionalizing and self-healing technologies to improve system reliability.

- **Metering Solution** – solid-state electric meters, gas meters with communication modules, and data concentrators which can communicate with the appropriate data acquisition systems over the communication network mentioned below. Duke Energy will be replacing legacy meters, which are read manually with smart meters that can be read remotely.

- **Telecommunications Network** – field backbone network system which can use different communications modes to transmit and receive data from intelligent devices to each other and Duke Energy data centers. This network has a crucial role in integrating various smart grid technologies and providing a large enough and secure transport platform to serve the needs of all of tomorrows envisioned smart grid technologies.

- **Information Technology(IT) Systems** – the IT system will provide various Management Tools, Energy Data Bus, Network Infrastructure, and ongoing IT back-office services. Through these applications the data, from the necessary intelligent devices is made usable by customers and Duke Energy.

  The following diagram shows the potential for an integrated design view of all the smart grid components, where IT systems are defined to be comprised of Enterprise systems, Business Applications, and Operational Data Systems. Telecommunications Network is defined to include all field related wide area and local area network communications. Field Devices are defined to include transmission, distribution, and customer premise devices.

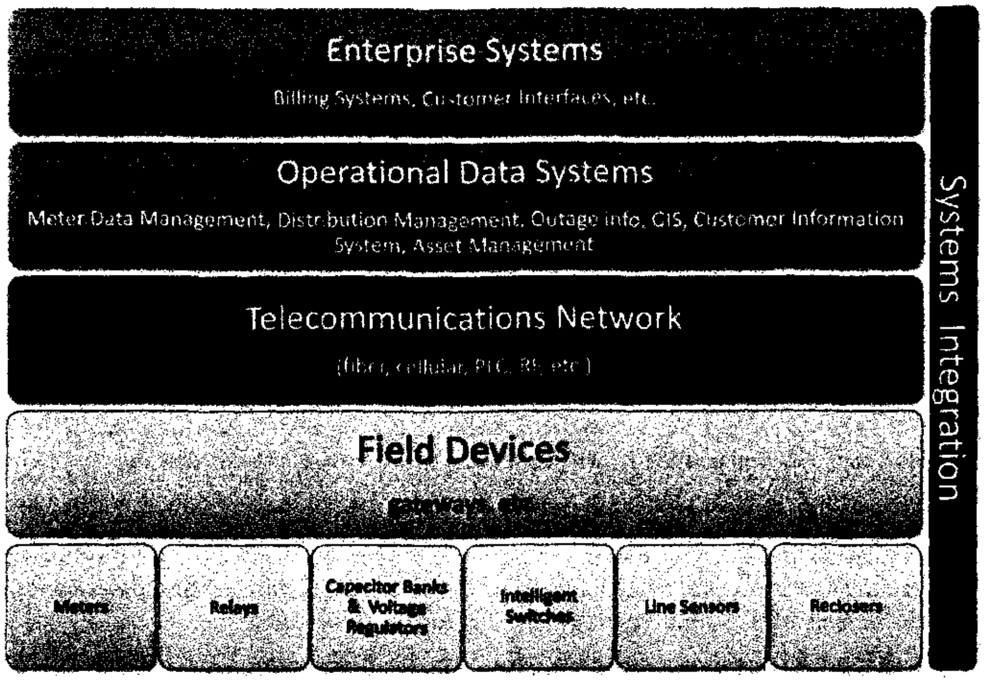


Figure 2-1 Integrated Smart Grid Design Components

2.1 *High Level Design Criteria for all Smart Grid Components*

The following high level design criteria is established to ensure the design meets the program objectives. All smart grid design components must meet the High Level Design criteria listed below, unless otherwise specified. The list is based on Duke Energy's business drivers and the Smart Grid Scorecard described by the GridWise Architecture Council and Smart Grid News. The component design must also meet additional requirements included in relevant sections.

- *Safe Design [Rationale – based on business requirement] - Design will comply with Duke Energy* Engineering Standards to ensure personnel and equipment safety. Those working on smart grid projects will have the necessary equipment, procedures and training to ensure their safety while on the job.

- Reliability [Rationale – based on regulatory requirement] - The power delivery system must maintain its high reliability standards to deliver electricity to customers. The design must consider frequency and duration of interruptions, the number of customers affected by event and power quality to improve reliability index metrics. Reliability of power delivery is attributed to many actions, including quicker fault isolation, quicker outage restoration, etc. Many design improvements will improve the reliability of our power delivery service.

- Availability [Rationale – based on business requirement] - The Telecommunciations, Distribution Automation, Metering Solution, and IT systems must meet the availability needs based on business requirements. The availability requirements align with the Smart Grid Scorecard "self-healing" category. The design must provide adequate redundancy or reliable components to address the availability criteria, such as 24x7x365 service. This includes selecting industrial graded equipment versus commercial graded equipment, if necessary, and selecting functionally tested technology solutions. These could be measured by Mean Time Between Failure (MTBF) and other factors such as how long the product has been used in similar applications.

- Distributed Intelligence [Rationale – based on optimum technical solution to meet long term smart grid vision] – Process computing will occur, when appropriate, at local controllers or microprocessors as much as possible. Distributed architecture is desired so no single point of failure in the system should be able to affect the ability of the overall grid to function. The design must include a local processor if a process meets any of the following criteria (assuming commercial availability of the devices):
    - If a process requires fast computing (in seconds or milliseconds)
    - If a process can run autonomously and it's cost effective
    - If a process needs to be self sustaining while the connection to the remote controller is non-functional

- Security [Rationale – based on regulatory requirement] – physical and cyber security will be built into the design of the architecture and its components, in such a way that future systems can sustain known or future forms of cyber attacks. Design will follow the NERC CIP guidelines or rulings by complying with Duke Energy's IT 5000 and 6000 policies where appropriate. Project manager must ensure design team has considered design impacts due to IT policies during project initial stages by reviewing the business requirements, and validating the design against the requirements.

- Scalability [Rationale – based on business needs] - the system will be configurable to meet the needs of future users, using a common set of components and products. Design approach will be modular design for future enhancements and include spare capacity for future growth.

- Maintainability [Rationale – based on business needs] - the design will consider cost effective solutions associated with routine maintenance of the field devices, hardware, applications and data. This criterion also requires design to use solutions that provide ease of integration and minimal long term maintenance and support. Design must provide health monitoring tools to easily troubleshoot and manage the smart grid. Design must provide remote software and firmware upgrades. Smart Grid Scorecard refers to this criterion as "Manageability" and "Upgradeability".

- Standardization [Rationale – based on optimum design execution and business needs] - the design will promote a high level of standardization across all areas of smart grid. This includes following industry and existing in-house standards or developing standards for new design.

- Interoperability [Rationale – based on optimum design execution and business needs] –Design solutions should make it easier to integrate new devices and applications. Duke Energy's practice is to use commercial-off-the-shelf products or open specifications. This criterion is covered as "Openness" and "Extensibility" on the Smart Grid Scorecard.

Additionally, Project Managers must ensure that failure modes of all system components are addressed and specific mitigation strategies and business continuity plans are identified.

2.2 Integrated Smart Grid Data Flow and Requirements

Data management for the Duke Energy smart grid will become a very important task. Ease of generating vast amount of data from digital devices can lead to poor and costly data management decisions upfront. The quantity of data, frequency of data updates, and the archiving of data leads to design impacts of selecting intelligent devices and data storage capability, and the design of telecommunications and IT networks.

Having stated the above, knowing all the data needs of the future will be impossible. Therefore the following principles are listed to help make better data management decisions for all of smart grid design.

- Understand who will use the data and for what and when it is needed
- Isolate the data that does not have to move
- Share data space
- Keep what you really need online and available in the primary systems
- Monitor not only the systems themselves, but the network to which they are attached and the flow of data between systems

2.3 Industry Standards

Duke Energy participates in many of the Smart Grid standards development groups. Because standards are still emerging, it is important for Duke Energy to continue to play a key role in standards bodies, helping determine the industry future. Some of Duke Energy's involvement includes:

- ANSI
- IEEE
- Open Smart Grid
- Edison Electric Institute
- EPRI
- NIST/DOE
- National Labs

This section will be updated as integrated design smart grid standards are identified and accepted to be applied to Duke Energy smart grid design. The existing standards for individual subcomponent design are included in the relevant sections.

Subject Matter experts at Duke Energy are currently assessing alignment with proposed NIST Smart Grid Interoperability Standards Roadmap for applicability on Duke Energy Smart Grid design.

3 Smart Grid Telecommunication Network

The telecommunication system is the field backbone infrastructure needed to deliver the desired functions of smart grid. This system must be scalable and robust to deliver the smart grid business requirements. The solutions must be well planned and should provide an integrated infrastructure needed for all smart grid data consumers and producers.

The telecommunication system consists of the connectivity and data transfer between devices in a small geographic area on a local area network to Duke Energy's data centers via wide area networks. The system will allow meters, transmission and distribution automation devices, home area networks and distributed resources to have two way communications with Duke Energy's data acquisition and control systems effectively.

For Duke Energy's smart grid design, it is very important to design the optimum telecommunication system as an integrated service for all the producers and consumers of the grid. The design must not be done in an isolated or silo fashion to serve the advanced metering infrastructure versus distribution automation or other subcomponents of smart grid. Also, the telecommunication service cannot be thought of as an afterthought. Engineering must be done upfront before deployment in order to design the best possible system that is manageable. The system must be conducive to allow the distributed processing of data.

3.1 Telecommunication Network Scope

The Telecommunications Network solutions described below are based on advanced metering solutions and distribution automation pilot projects. The telecommunications portion of metering solution will encompass communications between meters to a data concentrator located in a communications node and from the node to the Duke Energy's Data Center. The distribution automation portion includes communications between substations or line devices to the Duke Energy's Data Center.

3.2 Enabling Technology and Networks

To design a smart grid telecommunication system, it requires understanding of the data sources or enabling technologies; location attributes, and distributed networks.

3.2.1 Enabling Technologies

The Telecommunications Network will allow two way communications between various field intelligent devices and appropriate data acquisitions systems.

The following chart shows the smart grid devices and their locations:

Smart Grid Enabling Hardware	Location
Electric Meters	Distribution Grid
Gas Meters	Distribution Grid
Substation IEDs	Substation
Substation RTUs	Substation
Substation SEL Processors	Substation
Substation Voltage Regulators	Substation
Substation Capacitor Banks	Substation
Line Voltage Regulators	Distribution Grid
Line Capacitor Banks	Distribution Grid
Line Reclosers	Distribution Grid
Line Sensors	Distribution Grid
Line Transformers	Distribution Grid
Intelligent Switches	Distribution Grid
Future Envisioned Technologies	
Distributed Resources	Distribution Grid
Premise Energy Controllers	Distribution Grid
Street Lights	Distribution Grid

Table 1 Smart Grid Enabling Hardware

Note: Distribution Grid could include distribution or transmission lines

Smart grid design should consider cost effective communications solutions to leverage distributed power grid infrastructure and at the same time support the distributed processing and data management architecture.

3.2.2 Smart Grid Networks

Duke Energy's smart grid architecture will be distributed to cover the vast scope of devices in the territory. Data communications are divided in the categories defined below to handle the data traffic:

- Wide Area Networks (WAN): These are defined as networks that span between urban centers; they are used as aggregation for feeder networks from locally based networks. They must be able to support large traffic volumes in both directions with seamless errors.

- Local Area Networks (LAN): Local area networks aggregate sensors and end control devices to communicate between themselves and other LANs via NANs. These networks are designed by various means including function, location, and security. For example, Duke Energy's smart grid local area networks include meter networks, substation networks, self-healing teams, etc. The general characteristic is that a large amount of data will be sent to an end-point with a smaller amount being sent into the network. Local Area Networks are also known as the access network.

- Home Area Networks (HAN): These networks allow intelligent devices at the customer premises to communicate with each other and controlled locally. These networks interface with LANs to allow communications with other devices on the grid and connectivity to Duke Energy Data Centers.

3.3 Communications Technologies

Duke Energy's smart grid will employ several communications technologies, depending on existing transport methods as well as those that are helpful in meeting the needs of evolving nature of smart grid design. Selection of transport methods will depend on several factors, including data needs.

Duke Energy's smart grid design will standardize on available technologies as much as possible to meet the integrated design criteria such as scalability and maintainability. For example, use of cellular will be prevalent to meet future bandwidth requirements and applicability in all areas of customer density. Duke Energy's smart grid design will use the following tested wired and wireless technologies:

Wired:
- Fiber Optic
- Power Line Carrier (PLC)
- Leased Circuit

Wireless:
- Cellular
- Mobile Radio (Radio Frequency)
  - Conventional Radio (900 MHz)
  - Trunked Radio (800 MHz)
  - iDEN
- Microwave

3.4 Telecommunications Network High Level Design Criteria

Criteria for selection of smart grid communications include the following:

- WAN technologies with anticipated future smart grid functionalities will primarily use Verizon cellular network.
- Substation WAN connectivity will use fiber optics, iDEN, cellular or other means if it meets the data requirements, security requirement and business need.
- Communications method for interfacing electric meters should primarily be power line carrier (PLC)
- Communications method for interfacing gas modules should primarily be 900 MHz

Combining the various means of communications into a central intelligent gateway device for efficiency and local processing of some of the data will be necessary to reduce the cost of overall communications network. This will also enable the capability of faster, autonomous local controls, process some data locally and only send other data for remote operations based on business need.

3.5 Telecommunication Network Standards

Smart grid devices must adhere to the following standards:

- Duke Energy IT 5000 and 6000 Cyber Security policy where applicable
- Vendor products must meet applicable FCC standards
- As a guideline, for Substation SCADA systems, use IEEE C37.1 - IEEE Standard for SCADA and Automation Systems.
- Applicable IEEE 802.* standards

3.6 Identifying Critical Components and Risks of Failure

The following **failure modes and mitigation strategies** have been considered to provide a robust solution:

- Radio Frequency Communications – Failure includes loss of signal due to obstructions (trees), interference, etc. The mitigation strategy is to troubleshoot, identify, and repair or forward to service provider.
- Leased Land Lines – Failure includes loss of signal due to cut/failed lines. Mitigation strategy is to troubleshoot, identify, and forward to service provider.
- Fiber - Failure includes loss of signal due to cut fibers or /failed electronic equipment. Mitigation strategy is to troubleshoot, identify, and repair or forward to service provider.
- Cellular – Failure includes loss due to network congestion, failure of backhaul circuits, and loss of power to cell sites. Mitigation strategy is to contact the service provider to resolve the issue.

3.7 Approved Telecommunications Network Solutions at Duke-Energy

Emerging nature of smart grid functionalities require development of devices not yet available in the market today. This section includes network devices and network topologies that have been approved for deployment based on demonstration projects and proof-of-concept assessments.

3.7.1 Network Devices

Transmitting data back to Duke Energy's servers from a local area network through a wide area network will require gateways and peripheral devices. Gateways are devices that are used to connect multiple end devices to a wide area network. Gateways can be microprocessor based (intelligent) or simple pass through devices. Peripheral devices are signal converters used to convert one type of signal to another, such as serial to a fiber connection. Cell modems are treated as peripheral devices in this document.

3.7.1.1 [redacted]

The [redacted] communications nodes will serve as the primary link between customers and Duke Energy's smart grid in the Midwest metering solution deployment. The communications node transfers data from Echelon meters and gas meters with [redacted] to their head end systems via the [redacted] has a mean time between failure of 12 years and [redacted] a mean time between failure of 15 years, both of which meet the desired 10 year product life requirement.

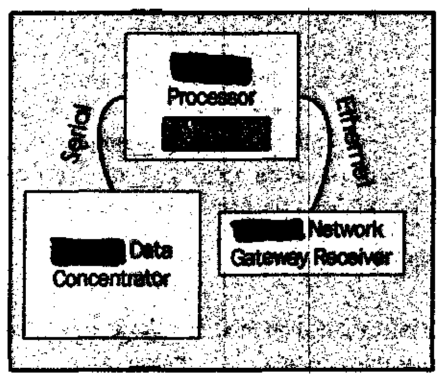


Figure 3-1: [redacted] Communications Node

Features of the [redacted] include:

- Certification to operate [redacted]
- Interfaces with any device that has a serial or Ethernet port
- Delivers high-speed data communications in cellular, PLC, Wi-Fi or a combination
- Configurable for variable roles: report or regenerate signal and accept backhaul connections (fiber, Ethernet, etc.).

The Communications Node includes:

- An [redacted] data concentrator to capture information from [redacted] Meters connected via PLC
- [redacted] to communicate with gas meters over 900MHz wireless unlicensed network
- Field device data is transmitted over a built-in cell modem to the wide area network as backhaul medium

The communications node should meet the following requirements:

- Enable reliable communication with Head End systems
- Minimize reliance on proprietary standards
- Reduce physical maintenance requirements of grid infrastructure while not requiring frequent service
- Allow remote firmware upgrades
- Meet the environmental requirements of the location they are installed in
- Not create unsafe conditions for customers, vendors or employees

3.7.1.1.1 [redacted] Node Compatible Device Types

- The [redacted] communications node is compatible with [redacted] meters or [redacted] gas meter modules. Design will include a communications node at every distribution line transformer.

- The communications nodes will be installed on pad mount transformers or on local distribution poles. The nodes on distribution poles will be installed preferably outside of the power space in the communications common zone, when accessible or on pad mount transformers. Installation will be completed per standard installation drawings. Installation is permissible in distribution pole power regions only when implementations in the common zone are not practical. Signal strength on the [redacted] gas modules will potentially lower if nodes are placed lower on the distribution poles, so commissioning process must verify adequate communications requirements are met for each meter installation.

Ohio Deployment

The current design includes [redacted] for Ohio. On average, [redacted] will be deployed to read 4 to 5 Echelon meters. This limitation is based on the number of homes served by the secondary side of a single distribution transformer and the [redacted] The number of gas meters [redacted] at a 550 ft radius that can be read by [redacted] with a [redacted] will be based on the radio frequency capabilities of the [redacted] equipment.

3.7.2 Deployment Networks

The telecommunication system configurations for metering and distribution automation endpoints are shown below:

Configuration 1: Metering Network

(1) Support for multiple electric and gas meters to an [redacted] with cellular modem installed). Modem transmits data packets to a head end system (proprietary server from meter supplier) to the Duke Energy Data Centers via WAN:

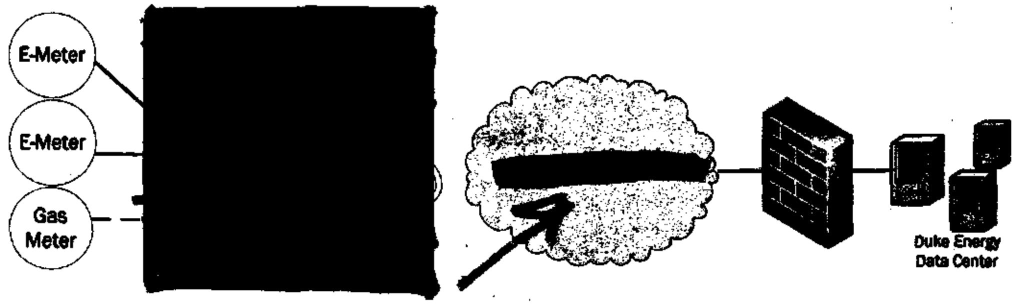


Figure 3-2 Metering Solution & Network – Dual Metering to WAN

(2) Support for electric meters only to an Ambient Communications Node (with cellular modem installed). Modem transmits data packets to a head end and to the Duke Energy Data Centers via WAN:

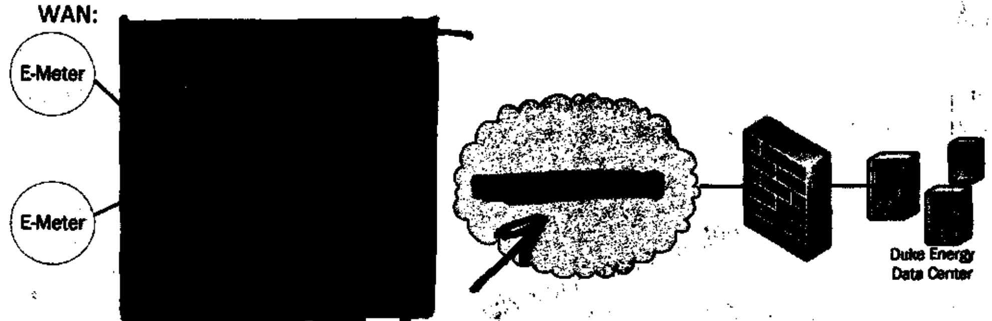


Figure 3-3 Metering Solution Network - Electric Metering to WAN

Configuration 2: Distribution Automation Network

(1) Support for Distribution Automation networks:

a. Recloser on transformer to either an iDEN or cellular modem back to the WAN:

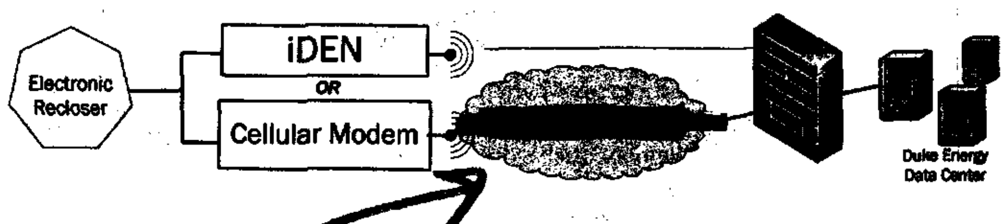


Figure 3-4 Distribution Automation - Recloser to WAN

(2) Support for Distribution Automation networks:

a. Substation network data to Duke Energy Data Centers over WAN

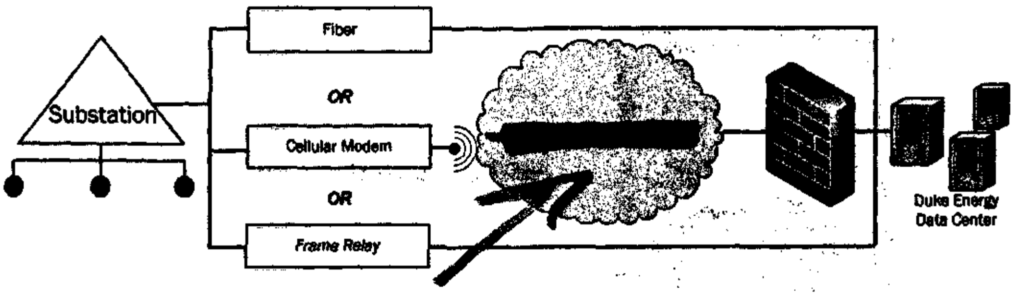


Figure 3-5 Distribution Automation - Substation to WAN

3.7.2.1 [redacted]etwork

[redacted] communicate with [redacted] uses its [redacted]rotocol to transfer data from the meter to the data concentrator and the Head End systems. Detail

[redacted] Also, this chipset is prevalent as more manufacturers use this chipset for digital communications.

3.7.2.2 [redacted]

Gas Meters located at the customer home are retrofitted with a [redacted] to transmit data to the [redacted]ver a 900MHz transmission. [redacted] are located in [redacted] The transmitter operates in the 902-928MHz range and does not require FCC licensing.

The [redacted] is compatible with residential and most commercial/industrial gas meters and can be installed on most existing and purchased gas meters, regardless of the meter manufacturer.

Installations considerations include:

- Building construction is a variable that needs to be considered in any [redacted] placement. The unique characteristics of an installation area will determine the broadcast radius.
- Using a 550' radius works in most cases where meters are located indoors, a 700' radius can be used where meters are outside. In both cases there may be patches that are inaccessible and require additional solutions (Remote transmitters, Repeaters or additional [redacted] Radius could be different based on topology of the area. The design team will evaluate the topology and install per radius recommended by the vendor.
- Radio Frequency consistency must be validated for connectivity by testing measurable results across a spectrum of seasons and weather.

Adequate polling strategy or schedule must be developed to ensure a daily read from all meters reliably. Data gathered from the transmitter must be dated for that day.

3.7.2.3 Networks inside a Substation

Networks inside a Substation include interconnections between protective relays and other intelligent devices to a remote terminal unit or a [redacted] These devices serve as intelligent gateways between the local network and wide area network. They are connected to wide area network via fiber, leased land line, company radio, or cellular modems. Figure below shows a typical network configuration, but Duke Energy Midwest has several different types of configurations at existing substations:

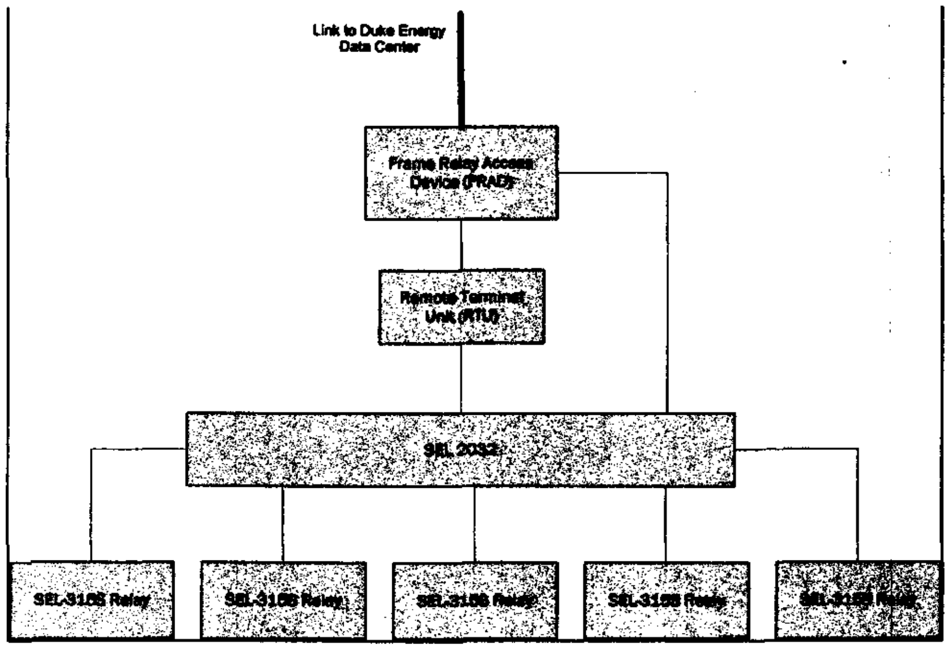


Figure 3-6 Midwest Substation Example - Network Configuration

Devices connect to the remote terminal units or communications processors serially or via Ethernet. Design for substation device integration must be according to the Engineering Standards design.

3.7.2.4 Self-Healing Teams Networks (Intelligent Switch Device Networks)

The peer to peer communications for the self-healing teams will be configured per vendor recommendations.

3.7.3 [redacted]

[redacted] are monitored by the [redacted] capable of handling no more than 10,000 devices per each NMS server when executing one-hour status checks. The current system has redundant servers. Design must offer adequate redundancy to meet the business needs.

The [redacted] pplication allows configuration of the [redacted] The system also allows for firmware and software downloads. The system is configured to perform a health check of each gateway every hour.

3.7.4 NetFlow

Cellular activity can also be monitored by the NetFlow tool. Network data for each device can be collected with its IP address. It provides a manual way of troubleshooting if a device is generating an unusual amount of data. For the future smart grid cellular network, an on-line, automatic alarming tool must be used. Cellular network activity data can be obtained from Verizon.

    - Install self-healing teams with communications link for remote control capability and data acquisition capability
    - Increase system reliability by automatic fault sectionalization
- Line Sensor Technology
    - Install line sensors with communications link for remote data acquisition
    - Increase system reliability with use of data from line sensors
    - Improved planning models with more accurate system load data

4.2 Distribution Automation Standards

- Design will comply with Duke Energy security policies IT5000 and IT6000
- The standard communications protocol for substation and distribution line devices to SCADA system will be DNP 3.0
- Design will be developed according to ANSI/IEEE C37.90, C37.90.2, C57.13; NESC; NEC standards per System Protection Manual
- Standard IEEE C37.1 should be used as a guideline for Substation SCADA system design

4.3 Distribution Automation Systems

Duke Energy's distribution system is designed to receive power at transmission voltages (69 kV and above), reduce the voltage to distribution levels (34.5 kV and below), and deliver power to customers. Distribution automation projects include voltage levels of 12.7 kV and 34.5 kV, and associated circuits and equipment.

Distribution automation focuses on substation enhancements (substation communications, breaker automation, and relay upgrades), distribution line enhancements (automated voltage regulation, increased/automated sectionalization, automated capacitor control, self-healing technology, line sensor technology), and SCADA systems enhancements.

4.4 Substation Enhancement

The purpose of substation enhancement is to install newer, more reliable equipment and digital devices with diagnostic capability to enable remote monitoring and control. This includes distribution breakers and associated protection devices, and substation LAN communications between end devices to remote terminal unit or communications processor.

The design includes relay upgrades, replacement of obsolete equipment or equipment not conducive to automation, such as hydraulic reclosers inside substation applications. Hydraulic reclosers will be replaced with circuit breakers, which are controlled by protective relays.

4.5 Distribution Line Enhancement

As part of smart grid installations, many devices will be installed on the distribution power lines. The following sections describe sectionalization and self-healing technology. Other technologies will be defined later.

4 Distribution Automation

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 will be achieved through SCADA–systems. Other advantages include outage analysis to reduce outage restoration time, and operational efficiency and better customer service, while minimizing operating costs.

The distribution system is operated in accordance to Duke Energy standards, which are consistent with IEEE, ANSI, NESC standards, and NERC guidelines. The Company monitors outages with various systems, such as Supervisory Control and Data Acquisition (SCADA) and the Outage Management System, along with its applicable databases. SAIFI, SAIDI, and CAIDI are recognized standards for measuring the number, scope and duration of outages and Ohio requires Duke Energy to annually report on these reliability indices.

4.1 Distribution Automation Scope

Distribution automation includes substation enhancements (substation communications, breaker automation, and relay upgrades), distribution line enhancements (automated voltage regulation, increased/automated sectionalization, Automated Capacitor control, self-healing technology, line sensor technology, and SCADA systems enhancements. The scope includes the following:

<u>Substation Enhancement</u>

- Replace relays in 12kV switchgear feeder breakers, 12kV outdoor feeder breakers, and 34.5kV outdoor feeder breakers
- Replace recloser installations inside substations serving as circuit exit protective devices with standard circuit breakers
- Install remote terminal units (RTUs) or [redacted] at targeted substations to allow remote configuration and SCADA capability of substation IEDs
- Establish WAN communications link to enable remote control and data acquisition for targeted substations

<u>Distribution Line Enhancement</u>

- Voltage Regulation
    - Install communications link to enable remote control and data acquisition
    - Reduce maintenance with operations monitoring/reporting capabilities
- Sectionalization
    - Install additional non-electronic and electronic reclosers to shorten feeders and improve system reliability
    - Install communications link to enable remote control and data acquisition for existing and new electronic reclosers
- Capacitors
    - Install communications link to enable remote control and data acquisition
    - Reduce maintenance with operations monitoring/reporting capabilities
- Self-Healing Technology

4.5.1 Sectionalization Enhancement

The purpose of sectionalization is to use electronic and hydraulic reclosers to reduce the number of Duke Energy customers interrupted during an outage event. Reclosers are installed at strategic points where major load divisions occur. Functional requirement of hydraulic and electronic reclosers is described in Power Delivery System Protection Manual.

An increase in recloser data points should be evaluated by the telecommunications engineering group to ensure adequate bandwidth capacity of the WAN.

Smart grid scope includes installing new reclosers and adding WAN connectivity to existing reclosers. Following are the details with each category of reclosers:

1. New – Electronic and non-electronic reclosers will be installed. Electronic reclosers will require WAN interface device. Telecommunications engineering group should be involved in selecting the best WAN interface and approve targeted area of deployment.

2. Existing – Targeted existing Electronic Reclosers will be enhanced with WAN connectivity to SCADA system to establish and enable remote monitoring and control.

WAN connectivity should be available 24 x7 x 365. Operation of devices for remote control should occur in less than 5 seconds.

4.5.2 Self-Healing Technology

The purpose of self-healing is to use electronic-controlled reclosers, intelligent switches, and circuit breaker teams to locate and isolate portions of Duke Energy's distribution system affected by faults or other events via automated switching. This also 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 customers affected during an outage event.

This technology uses intelligent, distribution line power devices, such as gang operated switches, programmable reclosers, and circuit breakers that communicate peer-to-peer via a LAN to locate and isolate a fault via automated on-site switching. The solution reduces the number of Duke Energy customers affected during an outage event. The peer-to-peer communication mode provides for response expediency.

Self-healing technology normally operates as a team concept. The devices can be disabled from a team environment and driven from a normal SCADA control if required for manual switching. . Line conditions, such as current flow, fault current, and switch position shall be available remotely.

Information generated is used by the system operating groups for intelligence and knowledge of device status and is viewable through the current Energy Management System SCADA system, Distribution Management System.

Requirements for technology, operation, installation and maintenance for self-healing devices will be defined later.

4.6 SCADA Systems Enhancements

The purpose of the SCADA system enhancements is to allow remote control and monitoring of field devices to allow operational efficiencies. It will be enabled by WAN communications links between substation remote terminal unit or communications processor to the Duke Energy data centers and between line devices to the data centers, see section 3.

The existing Areva EMS system will initially be the primary system for integrating distribution automation devices. This includes all substation and line device I/O (input/output). However, a full Distribution Management System (DMS) will be foundational to a successful smart grid, as automated devices become more widely deployed. Initial deployment devices will be later integrated in new DMS to have consistent data acquisition, graphics, archiving and other configuration as existing Distribution system components in the system.

5 Metering Solution

Duke Energy's smart grid Metering Solution encompasses smart meters, data concentrators, and meter data acquisition systems. This enables Duke Energy to measure, collect, process, and analyze energy usage from intelligent meters, through various communication media on request or on a pre-defined schedule. This section covers requirements for meters, data concentrators, and the meter data acquisition systems, also called Head End systems. All of these components are supplied by the vendor as a complete packaged solution. The Head End systems interface with the meter data management system (Duke Energy's EDMS) to further process the meter data and integrate it with the customer information system (CIS) and other business systems. The EDMS and other systems are part of the IT systems described in section 6.

5.1 Metering Solution Scope

Meter Solution scope covers the equipment and systems required to ensure meter data flows across the network (no normal state manual intervention) from the meter to the EDMS. Metering solutions may be a proprietary or open solution, and may be wired or wireless, depending on the area, regulatory compliance issues, communications availability and cost of the deployment solution.

Scope Exclusion:

1. Duke Energy's accounts which are presently being read remotely are not being targeted currently. These accounts already have automated metering installed due to size and/or complexity of the contract (i.e. totalization, special rates, etc.)
2. The ability to communicate through the Meter to a Home Area Network device.
3. Metrotech (transportation and interruptible gas meters)

5.2 Metering Solution Standards

- ANSI C12 Standards for Electricity Metering
- Duke Energy Engineering Service's 2009 Electricity Metering Specification
- ANSI B109.1, .2, .3 for gas meters

5.3 Metering Solution System Components

The Duke Energy metering solution has four major components in addition to the telecommunication network that must work in concert to provide the stated functionality of the smart meters deployed as part of Duke Energy's smart grid program. Those four components are the 1) Meter, 2) Field Data Concentrator, 3) Head End system, and 4) EDMS. IT systems cover information for EDMS. The following criteria should be used in architecting the other three components of metering solution system.

5.3.1 Meters

The electricity meter serves as an end point node which measures the customer's consumption and demand usage; monitors the integrity of the installation and reports abnormalities (i.e. loss of power, power restoration, voltage extremes, tamper detection, etc.).

The gas metering solution is an integrated unit, compatible with Duke's existing metering population. The gas meter module is mounted between the gas meter and the meter's index, without any modifications to the meter. Gas metering data will include the module serial identification, gas consumption reading, any tamper and non-usage indicators, and data verification errors.

5.3.1.1 Electric Meters

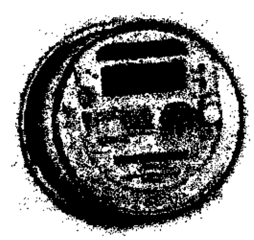
The following types of metering applications exist in the Duke Energy service area:

- Form 1S 120 volt single phase self contained service
- Form 2S 240 volt class 200 single phase self contained service
- Form 2S 240 volt class 320 single phase self contained service
- Form 3S and 4S 240 volt single phase transformer rated service
- Form 5S polyphase 3 wire transformer rated service
- Form 9S polyphase 4 wire transformer rated service
- Form 12S 120/208 volt self contained network meter
- Form 12S 240 volt self contained meter for delta service
- Form 16S 120/208 volt self contained meter for wye service

The following section describes the requirements for electric meters.

5.4 Metering Solution Security

The metering solution design components will comply with IT 5000 and IT 6000 security policies for smart grid design. Meters and other field devices will comply with IT 6000 policy guidelines, while Head End systems will comply with IT 5000 policy. Physical and cyber security requirements will be based on these policies to ensure the design is safe. Smart grid project teams must ensure the design meets these policies.



5.5 Approved Smart Grid Technology Solution for Deployment

The following metering solutions are approved for Duke Energy smart grid deployments.

Electric Metering

The [redacted] electric meter integrates reading multiple channels of data with an information display. An [redacted] manages meters and provides the connectivity infrastructure between these devices through low voltage power line and the Communication Node. The data concentrator automatically discovers meters, ensures reliable communications, securely configures devices to communicate on the encrypted network, coordinates the two-way delivery of device data, including metering data, and monitors the health and operation of the devices on an ongoing basis. The [redacted] will be installed in the Communications Node. The head end system software, [redacted] collects and reports consumption, load profile channels, limited power quality, and other events. The [redacted] system, integrates with Duke Energy's Energy Data Management System, enables remote control, remote firmware upgrades, and remote configuration o[redacted] meters and data concentrators.

Gas Transmitter Module and Meter

Smart Grid technology for gas meters is slightly different than for electric meters; th[redacted]for gas meters is not a meter, but an add-on module. It is an integrated unit compatible with many gas meter brands. The transmitter is mounted under the glass between the gas meter and the meter's index without any modification to the meter itself. Gas meters located at the customer home are retrofitted with a transmitter to send out data to the [redacted]ver a 900MHz transmission. Th[redacted]are located in Communications Node. It is one way communication. Neither the [redacted] module nor data concentrator has data logging capability. However, the network supports polling a concentrator on set intervals to gather the current data in the concentrator. The concentrator timestamps the last reading received. The [redacted]head end system provides tamper protection and alarm, non-usage notification, and data profiling.

Gas meters that cannot be retrofitted in the field due to meter age, installation configuration or other impediment are removed and replaced with a new gas meter. Duke Energy is using [redacted] residential gas diaphragm meters for majority of advanced metering infrastructure and smart grid gas meter applications in Ohio and supplemented wit[redacted]

5.5.1 [redacted]

The [redacted] electric meter is designed to meet needs of residential and small commercial energy consumers. These devices integrate operating features with a software controlled disconnect switch, a comprehensive information display, and optional usage of [redacted]bi-directional power line communications system. Each meter can be automatically managed by the [redacted]ystem via an [redacted] and can also act as a repeater to reach other meters.

[redacted] meters will be programmed to read 5 or more channels of data. This data includes KWH Out; KVARH Out; Instantaneous Voltage; KWH In; KVARH In, and others if required to meet business requirements. The data will be stored in intervals. The [redacted] meters will store the data for 10 days, after which the data registers are overwritten. Integrated disconnect switch controllable manually via an external push button will be disabled.

5.5.2 [redacted]

A data concentrator manages meters and other devices on low voltage power line networks and provides the connectivity infrastructure between these devices and [redacted]. The [redacted] automatically discovers meters, creates and optimizes repeating chains as needed to ensure reliable communications, securely configures devices to communicate on the encrypted ANSI and EN standard [redacted] power line network, coordinates the bi-directional delivery of device data including metering data, and monitors the health and operation of the devices on an ongoing basis.

The data concentrator communicates to the meter every 5 minutes to verify the status of the meter. The data concentrator stores the meter data and communicates the data to th[redacted]once a day. The data concentrator will store the data for a minimum of days identified by the business need as part of the smart grid project. The design should specify spare capacity for future requirements. Normally minimum spare capacity should be at least 20 percent if possible.

The [redacted] will be installed in the communications node. [redacted] connects to the meters via PLC and to the node via serial cable.

5.5.3 [redacted]

Deployments in 2009 will use [redacted] The system runs on redundant servers that are load balanced.

The following are the requirements for interface of Head End systems to EDMS:

- Provide a read interface
- Provide billing reads from queue
- Provide interval interface
- Provide event codes
- EDMS messages to Echelon (commissioning)
- EDMS messages to Echelon (Remote Order Fulfillment)

6 IT Systems

IT systems include the functional capabilities necessary to enable the services associated with the smart grid to the back office and Enterprise applications and services of smart grid. A number of existing Enterprise IT systems will be affected by smart grid enhancements including supply chain, work management, asset management, outage management, meter management, and customer management.

This section covers the processes and projects that are in place or will be needed to successfully implement smart grid solutions. The IT systems design requirements are covered in individual project charters. Configuration requirement for Data Processing, Analysis and special applications and architecture hardware design requirements are not included in this section.

6.1 IT Systems Scope

The focus of this phase of the architecture development is the high level conceptual architecture that will govern work within *and across* the following functional areas:

- Duke Energy's EDMS – The collection, storage, normalization of data (from proprietary to Duke Energy language) and processing (editing and validation) between customer meters and Duke Energy systems.
- Enterprise Customer Systems (ECS) - Processes and services focused on all forms of customer interaction.
- Distribution Management System – system that enables the visualization and control of the distribution system. It also provides for power flow calculations, simulations, switching, fault location projections, and device status visualization and alarming.

6.2 IT System Design Principles

The IT systems design must comply with the Enterprise Wide Technology Architecture (EWTA). Duke Energy's EWTA is composed of numerous areas of knowledge and governance known as domains. Directives, practices and standards are defined for each domain. These domains are illustrated the figure below:

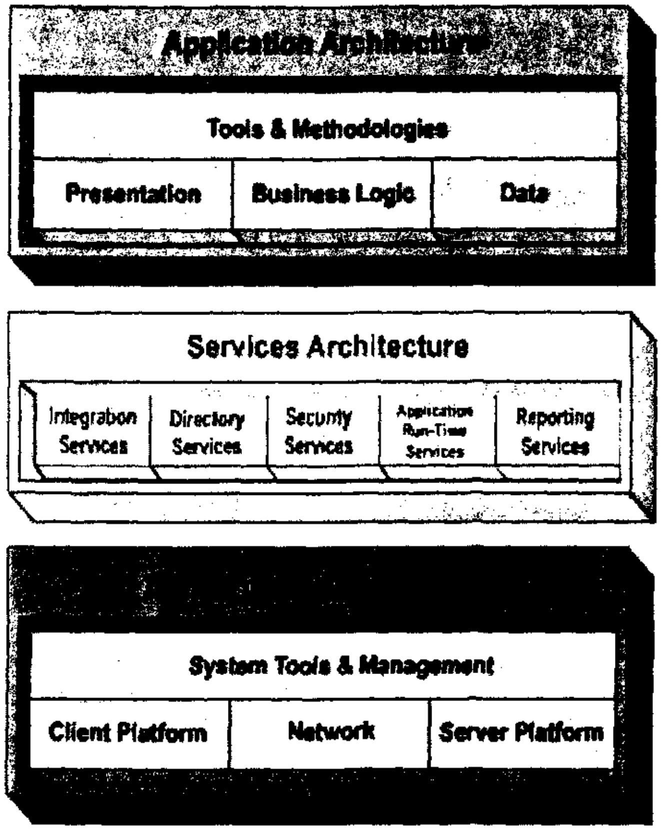


Figure 6-1 IT EWTA Architecture Components

7 Reference

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2. Direct Testimony of Tony R. Adcock On Behalf of Duke Energy Ohio, July 31, 2008.
3. National Council on Electricity Policy: Electric Transmission Series for State Officials

   Demand Response and Smart Metering Policy Actions Since the Energy Policy Act of 2005: A Summary for State Officials
4. IEEE Standard for SCADA and Automation Systems C37.1™ 2007
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8 Glossary of Terms and Acronyms

8.1 Definitions

Term	Definition
Automated Metering Infrastructure (AMI)	[Ohio Testimony: Arnold] **AMI** is a metering and communication system that records customer usage data over frequent intervals, and transmits the data over an advanced communication network to a centralized data management system. The usage data is made available to the utility and customers on a frequent and timely basis.
Automated Meter Reading (AMR)	**AMR** generally includes remote access to the meter, monthly kWh reads, interval data, and basic theft, outage and restoration detection.
Architecture	Describes the philosophy and structural patterns that frame the technical and economic designs, demonstrations, implementations and standards
CAIDI	Customer Average interruption Duration Index (CAIDI) is the average interruption duration or average time to restore service per interrupted customer, and is expressed by the sum of the customer interruption durations divided by the total number of customer interruptions.
Circuit Breaker	A protective device with the primary function to provide over-current protection for the backbone feeder.
Collection Box (Ohio)	[Ohio Testimony: Arnold] A collection device is like a computer and is responsible for the actual collection of data from each meter and the relaying of that data to DE-Ohio. At each collection box, there is a data collector, a modem and a processor.
Design Basis	The functional capabilities, specifications, drawings, design criteria, and performance specifications, where applicable.
Distribution Automation (DA)	[Ohio Testimony: Adcock] Distribution automation is a term used to describe the transformation of an existing distribution system which requires manual on site operation of power equipment to an advanced distribution system with power equipment that can be operated from a remote location such as a control center.
Distributed Network Protocol (DNP)	A communications protocol that establishes a set of standard rules for data representation, signaling, authentication and error detection required to send information over a communications channel used between components in process automation to contain costs.
Energy Data Management Systems (EDMS)	Duke Energy's version of a meter data management system. The EDMS collects meter reads from various head ends, provides validation, estimation, and editing functions for internal data, produces reports on meter reading statistics, etc.

Term	Definition
Enterprise Service Bus	A software architecture for middleware that provides fundamental services for more complex architectures. For example, an ESB incorporates the features required to implement a service-oriented architecture (SOA). In a general sense, an ESB can be thought of as a mechanism that manages access to applications and services (especially legacy versions) to present a single, simple, and consistent interface to end-users via Web- or forms-based client-side front ends
Evaluation	An appraisal to determine whether or not facilities and quality assurance programs are capable of producing a quality product, or providing a quality service and generating evidence that supports decisions of acceptability.
Event	An occurrence that falls outside of normal operations, such as an equipment outage, fault, storm, etc
Fiber	A company owned or leased fiber optic channel.
Internet Protocol (IP)	A method or *connectionless protocol* by which data in the form of packets is sent from one computer address to another computer address on the Internet. The protocol also specifies the way data is broken into packets and the way those packets are addressed for transmission.
Kilobits per second (Kb/sec)	A unit of data transfer rate equal to 1,000 bits per second.
Leased Land Line	A metallic or fiber optic channel leased from the local telecommunications company.
Network	A general term used for an aggregation of different components or systems. When using network, be more specific. smart grid network design includes telecommunication network, IT network, SCADA network, etc.
Orchestration	The sequential arrangement of services to automate or execute a business process
Radio Frequency Company	owned spread spectrum or MAS (Multiple Address System) radio equipment
Recloser	Automatic protective devices used to interrupt both temporary and permanent faults. Reclosers are almost always downstream of another automatic reclosing device, such as the circuit breaker or another recloser.
Relay	Electronic device that represents a time/current curve designed to calculate operating conditions and trip circuit breakers when an over-current event occurs (limited to circuit breaker devices and distribution feeder exits).
Remote Terminal Unit (RTU)	A microprocessor controlled electronic device which interfaces field devices to a distributed control system or SCADA system by

Term	Definition
	transmitting telemetry data to the system and/or altering the state of connected objects based on control messages received from the system.
Response Time (Display)	The time interval from the request of a new graphical screen display on a video display device to the completion of the display.
Response Time (System)	An expression of the amount of time it takes for a change in a process parameter to be reflected in the measured states of the process.
SAIDI	System Average Interruption Duration Index – Average duration of a customer outage.
SAIFI	System Average Interruption Frequency Index - Average number of system customers who experience and outage.
Sectionalization	[Ohio Testimony: Adcock] Sectionalization is a term used to describe the utilization of protective devices such as electronic, hydraulic, and vacuum reclosers to reduce the number of consumers interrupted during an outage event. Reclosers are installed in strategic points where major load divisions occur.
Self-healing teams	Teams which consist of devices that communicate and isolate portions of the distribution system affected by a fault or other event, thus minimizing the impact of an event. Self-healing teams consist of multiple "sources", and multiple feed "routes" or "paths".
Service Oriented Architecture	A software architecture that supports the deployment, operation, and orchestration of services to automate and streamline business processes.
Smart grid	A transformed electricity distribution network or "grid" that uses robust two-way communications, intelligent devices, and enterprise systems to improved the efficiency, reliability, and safety of power delivery and use.
Standards	Facilitate interoperation across independent design and resulting implementations
Supervisory Control and Data Acquisition (SCADA)	An application for process control, the gathering of data in real-time from remote locations in order to control equipment and conditions.
Technology	Utilization of intelligent distribution line power devices, such as switches, programmable reclosers and circuit breakers that communicate via a local area communication network to locate and isolate a fault via automated on site switching thereby reducing the number of consumers affected during an outage event.
UDDI	An open industry initiative, sponsored by OASIS, platform independent XML based registry enabling businesses to publish service listings and discover each other and define how the services or software applications interact over the Internet.

Term	Definition
Validation	A process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the quality of a specific data set.
Verification	The process of evaluating the completeness, correctness, and conformance/compliance of a data set against the method, procedural, or contractual specifications.
Voltage Reduction/Voltage Conservation	[Ohio Testimony: Adcock] Voltage reduction and voltage conservation are terms used to describe reducing system demand by lowering substation station output voltage.

8.2 Acronyms

Acronym	Meaning
AMI	Automated Metering Infrastructure
ANSI	American National Standards Institute
EPRI	Electric Power Research Institute
FAT	Factory Acceptance Test
I/O	Input/Output
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
IEEE	Institute of Electrical and Electronics Engineers
MHz	Megahertz
OEM	Original Equipment Manufacturer
OPC	OLE for Process Control
QA	Quality Assurance
SAT	Site Acceptance Test
SOA	Service Oriented Architecture
SOE	Sequence of Events
THD	Total Harmonic Distortion
VAC	Volts Alternating Current
V&V	Verification and Validation