SmartGrid Technologies

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    e. Great Lakes Energy Cooperative AMR (TWACS)
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I. What is a "SmartGrid"?

Background Information

Affordable electric power is critical to our nation's prosperity, national security and public health and safety. Yet our power grid, once considered a marvel of engineering, is aging and increasingly obsolete. The electric power system has not fully harnessed the power of digital technology. For the most part, it is still making do with equipment designed in the 1950's and 1960's – before the era of the microprocessor. As a result, today's electric system is full of massive, expensive capital assets that are underutilized. Without a major shift in the way the energy system is planned and operated, nearly $500 billion of electric infrastructures must be added by 2020 to meet load growth projected by the Energy Information Agency.*

Source: http://www.gridwise.org/background.htm

What is a Smart Grid ?

A "Smart Grid" is a concept for transforming the nation's electric power grid by using advanced communications, automated controls and other forms of information technology. This concept, or vision, integrates energy infrastructure, processes, devices, information and markets into a coordinated and collaborative process which allows energy to be generated, distributed and consumed more effectively and efficiently. A "Smart Grid" enables devices at all levels within the grid (from utility to customer) to independently sense, anticipate and respond to real-time conditions by accessing, sharing and acting on real-time information.

Management, planning and operation of the electric generation, distribution and transmission system in a coordinated and collaborative approach provides many benefits such as; instantaneous communications and reaction times; productivity increases; decrease in operation and maintenance costs; and overall service improvements. When new technologies become available, they are integrated into the system wherever they provide higher value to traditional infrastructure. The advent of these technologies will rely upon seamless, plug-and-play integration of alternative generation and storage assets into the information and power network. Real-time markets will influence consumer load response so that existing assets can be used more wisely. Furthermore, small reductions in demand during times of stress will reduce peak prices, thereby helping to stabilize prices in times of limited supply.

What are the Principal Characteristics of a "Smart Grid"?

There are many ways in which to express the general characteristics which comprise a "SmartGrid", and most of them conform to the following list of features;

a) Self-Healing: A grid able to rapidly detect, analyze, respond and restore from perturbations;

b) Empower and Incorporate the Consumer: A grid able to incorporate consumer equipment and behavior in the design and operation of the grid

c) Tolerant of a Security Attack: A grid that mitigates and stands resilient to physical and cyber security attack

d) Provides Power Quality Needed by 21st Century Users: A grid that provides a quality of power consistent with consumer and industry needs

e) Accommodates a Wide Variety of Generation Options: A grid that allows and takes advantage of a wide variety of local and regional generation technologies (including renewable power and distributed generation)

f) Fully Enables Electricity Markets: A grid that fully enables maturing electricity markets

g) Optimizes Asset Utilization: A grid that employs Information Technologies (IT) and monitoring technologies to continually optimize its capital assets while minimizing O&M costs

Source:https://www.gridapp.org/eidb/meetingminutes/final%20workshop%20agenda_11-03-05.pdf

II. Why is the concept of "Smart Grid" important?

Smart Grid Issues of Importance

Transmission Side

Overall infrastructure growth driven by congestion due to increased number and separation of distance-based transactions new transmission regulations following NERC's evolution into Electric Reliability Organization (ERO) expected to become official beginning in 2007 (mandatory standards subject to audits, assessments and penalties)

SmartGrid will be an essential component of evolution to ERO as transmission owners and operators (RTOs and control areas) are required to make significant new investments in automation and information technology for compliance (liability issue for utilities failing to meet minimum reliability standards)

Side-effect of new reliability standards will be creation of increased demand for grid monitoring, security, automation and back-office information technology

SmartGrid components are most likely to reach increased demand by 2008 (most of 2007 will be required for utilities to grasp implications of pending regulations) with trickle down to distribution

Distribution Side

Increased transmission reliability requirements following implementation of ERO are like to trickle down to distribution entities in the form of at least quasi- mandatory reliability rules increased use of distribution automation driven by deferred maintenance and load growth is likely (new and retrofit substation automation and integration projects)

Distribution automation will mature as the technology becomes more available and cost effective (low-cost line and equipment monitoring, rugged and secure communications, and advanced controls and displays)

New equipment installations should be designed and installed with future-proof architecture (ability to integrate and communicate with other devices and installations from many vendors)

Increased need for the operation of distributed sources and loads to be integrated with operational control of the grid over common communication/control architecture

III. What "Smart Grid" technologies are available? (Steve Paytash table)

IV. What are the existing "Smart Grid" initiatives in the U.S.?

a) IntelliGrid (EPRI);

b) GridWise/GridWorks (DOE);

c) ModernGrid Initiative (DOE);

d) GridApp;

e) BPL Pilot Program;

f) Galvin Electricity Initiative;

g) Multispeak Initiative (NRECA)

h) Others?

V. What Michigan initiatives (past & present) are utilizing a "Smart Grid" approach?

a) "Intelli-Team circuit automation – a Consumers Energy pilot project which was focused on a region of their service territory.

b) DTE use of Distributed Energy Resources (DER), to sell power to the MISO market (@ 16 MW). Provides the ability to use load following technologies from the substation to the customer? This is a DOE funded project.

c) DTE Advanced Meter Reading project (presentation by DTE) which provide real-time demand response information

d) Others? (BPL)

VI. What "Smart Grid" approach is best for Michigan?

The various activities/technologies associated with modernization of the grid are best divided up into "major areas of focus" in order to understand the issues and how to formulate a systematic approach in dealing with them.

<u>IT Architecture and Communication Standards</u>

Architectural framework, protocols and components to enable interoperability of all systems in the nation's power grid, including what is considered the existing "legacy systems".

<u>Load Management and Monitoring Technologies</u>

Fault detection/localization/prediction and power quality monitoring with integration of communication/analysis/control techniques; monitoring and control of industrial/commercial/ residential loads for demand-side management.

<u>Advanced Distribution Technologies and Operations Concepts</u>

Interconnection technologies, distribution substation/ equipment advancements, advanced system operating concepts (intentional islanding, Microgrids, etc.)

<u>Modeling and Simulation Exercises</u>

Planning and operational support for contingencies and disturbance events, including integration with disparate databases, reconfiguration, restoration and optimization of grid performance, etc.

GridApp Model Approach

GridApp™ provides member utilities with technical and financial resources to develop and deploy grid modernization technologies that they would be unable to develop and deploy on their own. Participants in GridApp™ will benefit from:

- Pooling resources to fund best technologies/practices
- Bringing commercially available technologies into real use
- Lowering market entry barriers for new technologies
- Gaining advance knowledge of and preferred pricing on GridApp™ technologies in Core and Strategic projects
- Partaking in a forum to communicate and share technology advancements
- Becoming an effective change agent of new technologies important to the utility industry
- Forging a collective voice of the utility industry for advocacy of technology investments
- Coordinating collaborative approaches with federal/state programs to support high-priority projects