Appalachian Energy Summit

APPALACHIAN STATE UNIVERSITY

**How Smart Grid Technologies Will Impact Your Campus in the Future**

Rogelio Sullivan and Liz Bowen

Breakout Session Notes

**FREEDM Systems Center**
**Future, Renewable, Electric, Energy, Delivery, and Management**

What is Smart Grid? Grid Modernization! This will result in an electric distribution system that brings information technology, modern sensors & controls, and new power systems technologies to improve electrical energy flow and use.

Smart grid is like an energy Internet with active participation from consumers.

The benefits of smart grid are many: reliability enhancement, energy efficiency, operational efficiency, power quality, security and electricity theft, environment and sustainability.

Smart Grid Characteristics: Digital systems, two-way communication, two-way power flow, accommodates distributed generation, network topology, automated restoration and eventually self-healing, many customer choices.

Smart Grid Evolution: Metering, Transmission, Distribution Network, System Integration and Operations.

Metering: 1) Analog and manual reading, digital meters with communication, 2) digital meters with communication, advanced meters allowing real-time charges and on/off capability

Transmission: 1)no automation in lines, switches, substations, 2) Full automation of HV systems and substations, PMU deployment and optimization

Distribution: 1) Little automation, 2) Partially automated switches & circuit breakers, 3) Fully, automated distribution network with remote sensing.

System Integration and Operations: 1) Online monitoring of flows, 2) total control of dispatch and usage.

Issue addressed concerning privacy of smart grid and demand-side responses from the utility. Cyber-security is a huge issue for utilities concerning privacy of user data. Vulnerabilities exist when telecommunications exist thus causing an issue within

and amongst utilities. Some consumers have expressed health concerns regarding the potential for damaging electromagnetic radiation from Smart Meters.

DoE Definition of Smart Grid Functionalities

- Supports customer participation
- Enables integration of all generation and storage options
- Enables new competitive markets and operations
- Provides power quality for the 21st century
- Enhances asset optimization and operational efficiency
- Self-healing
- Resilient against attacks and disasters

Interoperability is a critical issue inthe grid and grid modernization

DOE Smart Grid Targets are numerous.

UC San Diego has a campus scale microgrid.

Smart home integrated controls are what we will be seeing in the next couple of decades.

Utility systems: distribution automation, demand-side management, AMI (Advanced Metering Infrastructure), Microgrids, Digital Controls, and Two-Way Communication.

**ZIGBY is a form of communication signal technology for smart grids**.

Policy and Cost are huge factors in reaching the latter stages of smart grid implementation.

Consumer push-back on smart metering depends on how much education consumers have concerning what it means for energy efficiency. A certain cost-benefit analysis is needed on the consumer-side.

A Smart Grid Continuum: Sorting through different stages of grids to reach a smarter grid is necessary.

Grants and Bonds for campus smart grid projects have been used in some university deployment projects..

Appalachian Energy Summit

APPALACHIAN STATE UNIVERSITY

**How Smart Grid Technologies Will Impact Your Campus in the Future**

Rogelio Sullivan and Liz Bowen

Examples: University of California at San Diego
Colorado State University
University of Maryland
Oakland University

University of Maryland deployed many different renewables as well as a localized smart grid project. Again, various campuses listed show the continuum of smart grid implementation.

Energy Fellowship Program/Project: NC State was awarded a grant sponsored to determine feasibility of smart grid on centennial campus. It was meant to analyze smart grid strategies and technologies and address stakeholder concerns. An advisory board was implemented to guide the process of analysis, planning, and eventual implementation for smart grid projects.

NCSU Smart Grid Goals: Efficiency, Economic Development, Partnerships, Business Development, Outreach, Demonstration (includes efficiency), Research, Education.

Smart Grid Options: Tier I (NSCU)

- BAS in all new buildings
- Integrate Building Automation Systems (Enterprise Level Control System)
- Add lighting and plug load control to Building Automation Systems
- Improved building scheduling for existing buildings
- Energy dashboards in buildings
- Energy Star certification for all buildings
- Occupancy sensor retrofits
- Smart metering/increase number of Modbus ports
- SCADA upgrades (Supervisory Control and Data Acquisition)
- Automated switches on distribution systems
- Automated load shedding

Smart Grid Options: Tier II

- Exclusive use of LED outdoor and emergency lighting
- Increased use of level 2 charging stations
- 10% or more of campus vehicles drive PHEV
- PHEV energy storage to grid

Appalachian Energy Summit

APPALACHIAN STATE UNIVERSITY

**How Smart Grid Technologies Will Impact Your Campus in the Future**

Rogelio Sullivan and Liz Bowen

- Solar installations totaling 500 kW or more
- Thermal storage
- All buildings on district energy system
- Co-generation plant

Smart Grid Options: Tier III

- Purchase Centennial Campus substation
- Co-fire biogas in co-generation plant
- Ring distribution system
- Optimize transformer design
- Phasor measurement at building transformer level
- DC distribution circuit

Stakeholder concerns:
Safety and training: renewables pose threat when lines "go down"
Data ownership: protect data of students (FERPA requirement)
Reliability and Security
What makes NCSU's approach unique?

Centennial Smart Grid Concept
Leading edge technology,
Cutting edge technology (research and facilities working together),
Bleeding edge technology

Why would you want to pursue a smarter grid?

- Energy Savings
- Resiliency
- Energy Performance Contracts
    - Load reduction and supply
- Innovation and Education

Demand Charge is critical to campus savings for the long-term.