



Global Climate and Energy Project
Advanced Electricity Infrastructure Workshop
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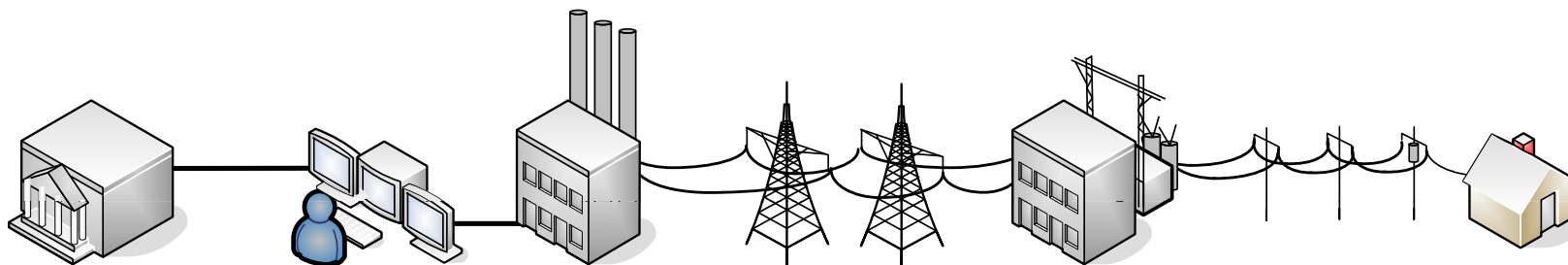
UTILITY OF THE FUTURE

Visions for the Utility of the Future

David Mohler
VP and Chief Technology Officer

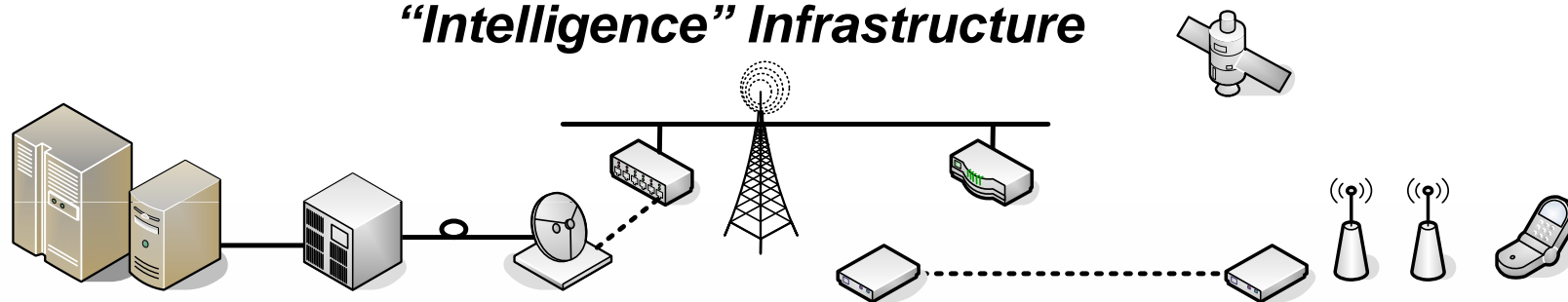


Utility of the Future Is the Integration of “Intelligence” Infrastructure with Our Electric Delivery System



Electrical Infrastructure

“Intelligence” Infrastructure





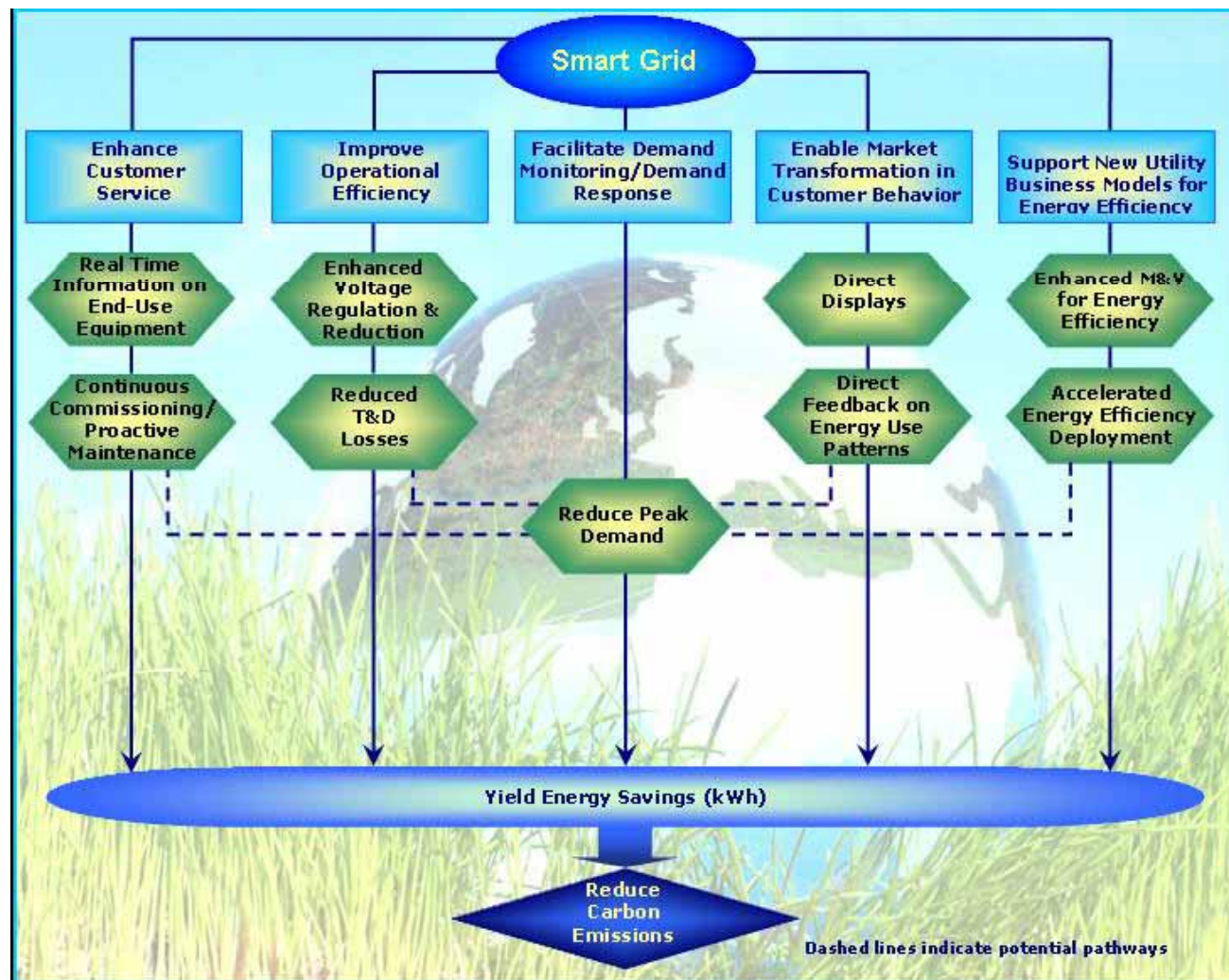
Utility of the Future will combine power delivery hardware with sensing and monitoring technology, a communications network, and information technology to enhance grid performance, create operational efficiencies, extend energy efficiency to the fullest extent possible, and support additional services to customers.

Ultimately, we see a future of networked, end-use devices interacting with the marketplace for electricity and other consumer-based services including sending “prices to devices” to enable customers to “set it and forget it” to optimize their energy consumption.

As it is fully deployed, Utility of the Future can have dramatic impacts on system reliability and customer satisfaction, as well as energy savings and CO2 reductions.

Societal Benefits Enabled by a Smart Grid

- Initial estimated impact (US, 2010): 35 – 187 billion kWh annual energy savings
- Equivalent to reducing 23 – 120 million metric tons of CO₂
- Equivalent to taking 4 to 20 million cars off the road



Source: EPRI



How Our Vision of Utility of the Future Is Viewed

Duke Plots Course Beyond the Smart Grid

Smart Grid News, 9-11-07

By Jesse Berst

“North Carolina-based Duke Energy has been quietly turning itself into one of North America's Smart Grid leaders -- if not in the quantity of its short-term deployments, then certainly in the quality of its long-term thinking.

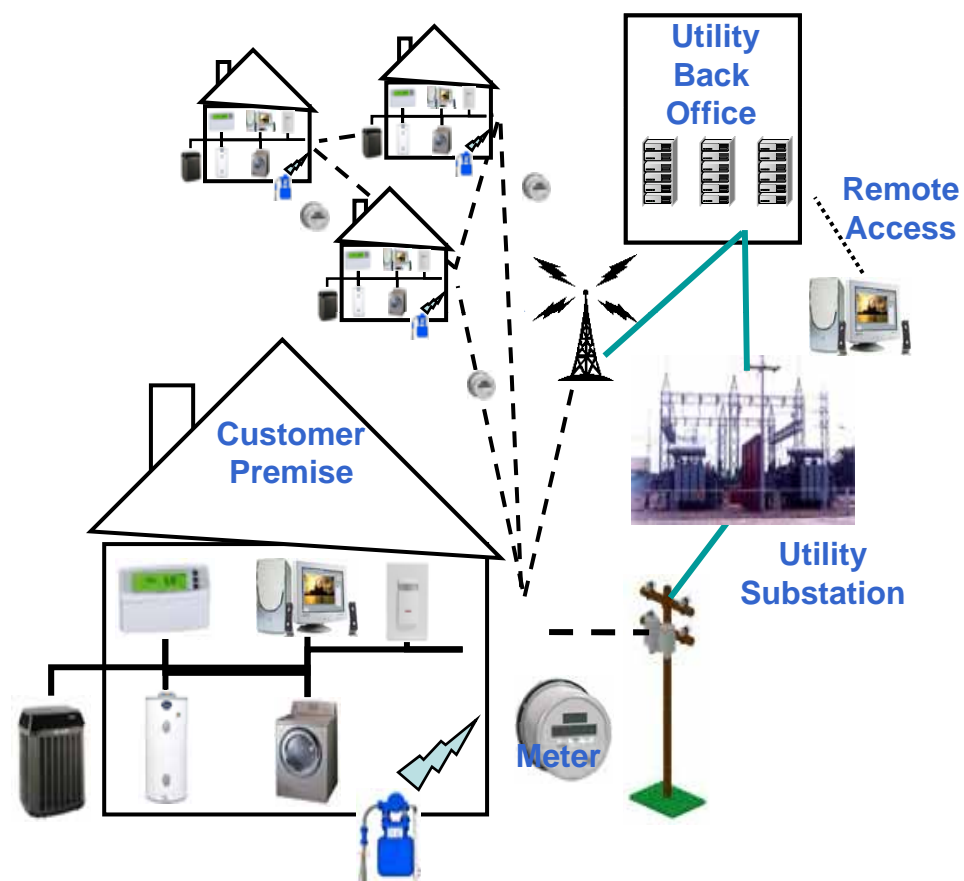
SGN Prediction: The approach Duke is taking (to planning) and the demands it is making (to vendors) will set the tone for hundreds of utilities to follow.”

Utility of the Future Will Deliver Operational Benefits

Metering	Distribution Mgmt	Outage Mgmt	Grid Modernization	Contact Center
<ul style="list-style-type: none"> ■ Automatic, remote reading ■ Read-in/read-out for customer turnover ■ Off cycle reads ■ Remote disconnect/reconnect (non-pay, move-out) ■ Improved accuracy of billing process (billing exceptions and efficiencies) ■ Revenue recovery and protection through improved read accuracy, less theft ■ Load research ■ Accident avoidance/Workers Compensation 	<ul style="list-style-type: none"> ■ VAR mgmt – ensuring Capacitor Banks are working as expected ■ Capacitor Bank Inspection ■ System Voltage Control ■ Continuous Voltage Monitoring ■ Reduction of technical losses in system due to better modeling ■ Asset mgmt – better data should help investment planning ■ Transformer Load Mgmt – monitor loads across transformers will enable longer life ■ Conservative voltage reduction – better control over the grid 	<ul style="list-style-type: none"> ■ Outage Detection & Verification ■ Reduced downtime 	<ul style="list-style-type: none"> ■ Digital communications & operational control ■ Comprehensive system information available in near real time ■ Self healing capabilities are enabled ■ Innovation from outside the utility industry can be applied to current operations 	<ul style="list-style-type: none"> ■ An increase in billing calls due to remote disconnects may be offset by: ■ Decrease in billing calls due to minimizing estimates, cancel bills, etc ■ Reduction in outage related calls and metering related calls

Will Enable More Energy Efficiency

- Utility of the Future creates the infrastructure that enables the utility to communicate inside the customers' home and therefore could provide new energy efficiency programs and services for customers
- Additional customer devices would be required and would be considered as part of the save-a-watt initiative.
 - A home monitoring dashboard to indicate time differentiated pricing plus current or planned consumption activity
 - The next generation of in home load control. Examples include:
 - Air Conditioning that can be intelligently cycled based on energy signals and comfort specifications
 - Smart refrigerators with intelligent defrost cycling
 - Dishwashers that will automatically delay operation - unless over-ridden - based on preferences
 - Clothes dryers that can tumble without heat if energy pricing are above certain parameters



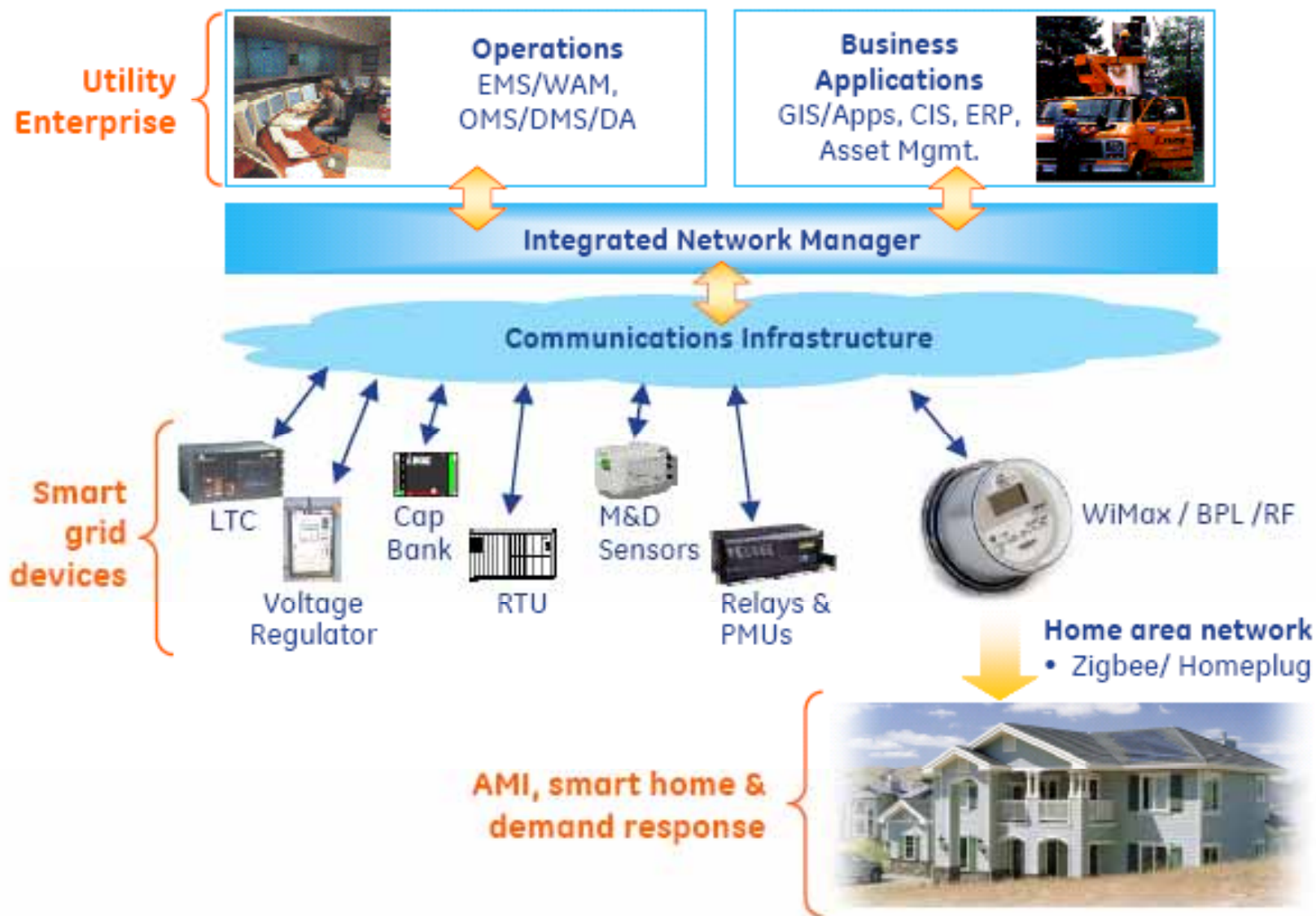


And Will Deliver Benefits to Customers

- Remote initiation, transfer, and termination of service
- Automatic disconnection and reconnection
- Prepaid metering
- Individualized pricing and additional payment conveniences
- Energy efficiency programs and energy savings for residential and nonresidential customers
- Load control initiatives
- Elimination of Meter Access Plan and estimated meter reads
- Increased power quality

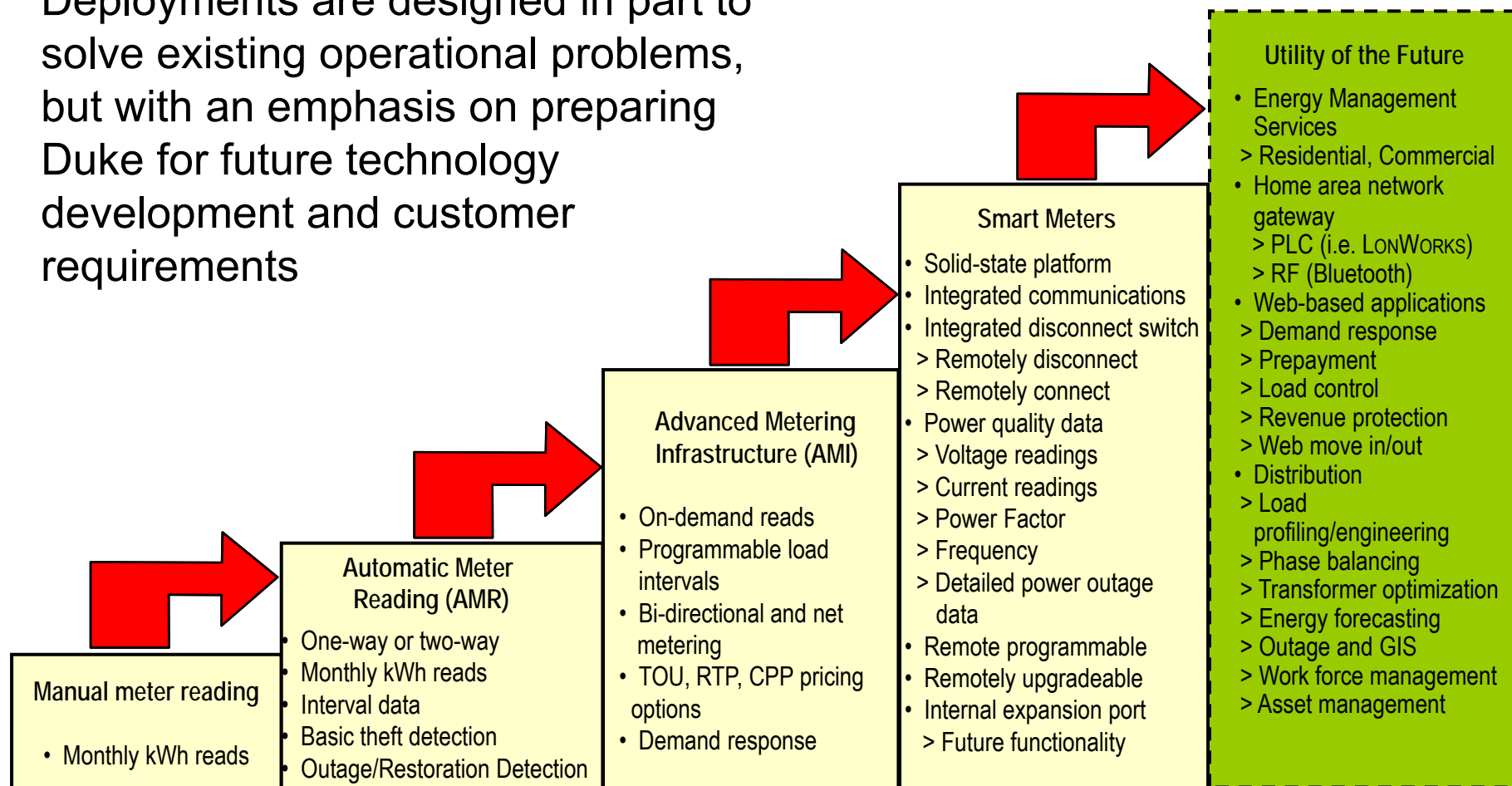
Increased reliability, fewer outages and reduced outage durations

How Benefits Will Be Delivered



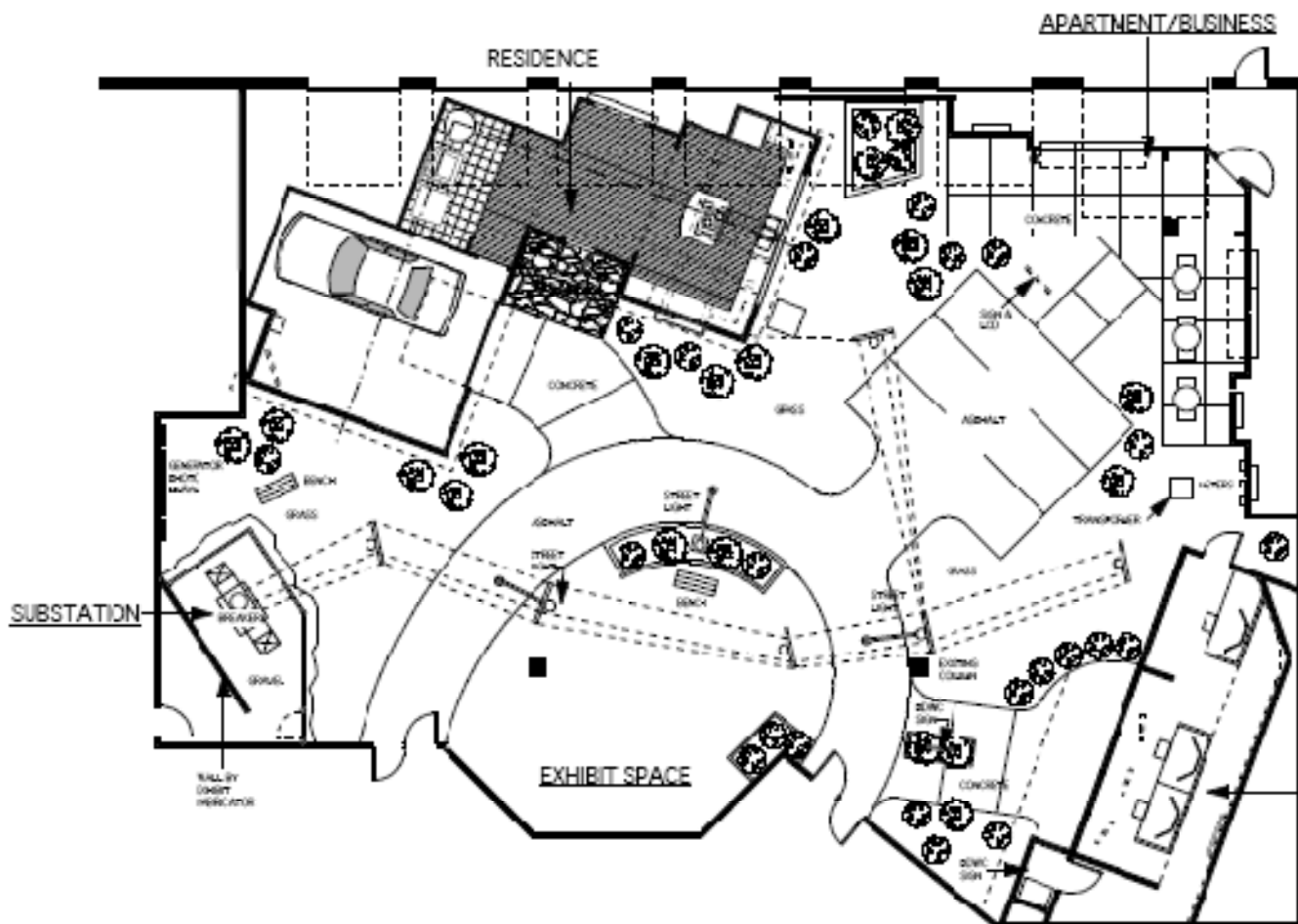
We Are Building for Future Needs

Deployments are designed in part to solve existing operational problems, but with an emphasis on preparing Duke for future technology development and customer requirements

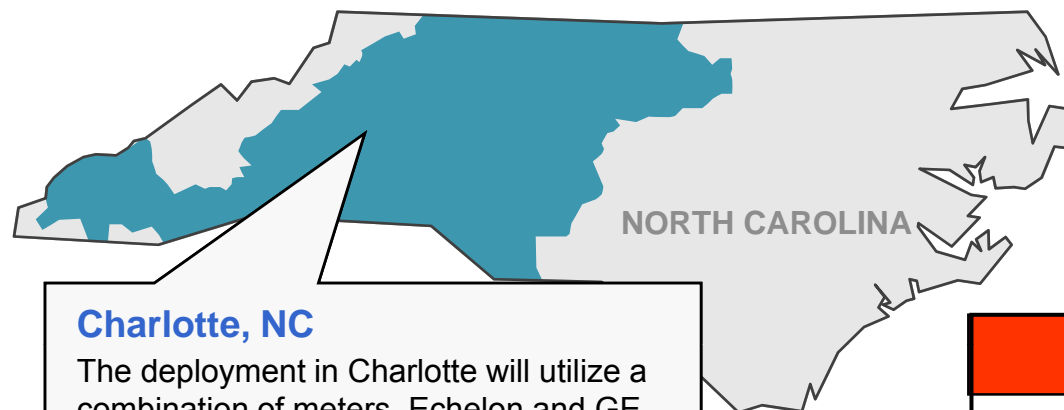


Demonstration Labs Will Bring Utility of the Future To Life

- Provides a “hands on” experience of how the assets work
- Energy efficiency concepts as well as utility operations are part of the design
- Integration of distributed generation and energy storage to show leading edge concepts
- Partnership opportunities with Universities, other non-profits and vendors are being explored



North Carolina



Charlotte, NC

The deployment in Charlotte will utilize a combination of meters, Echelon and GE, and other distribution devices connected with an RF mesh wireless network and digital cellular technology.

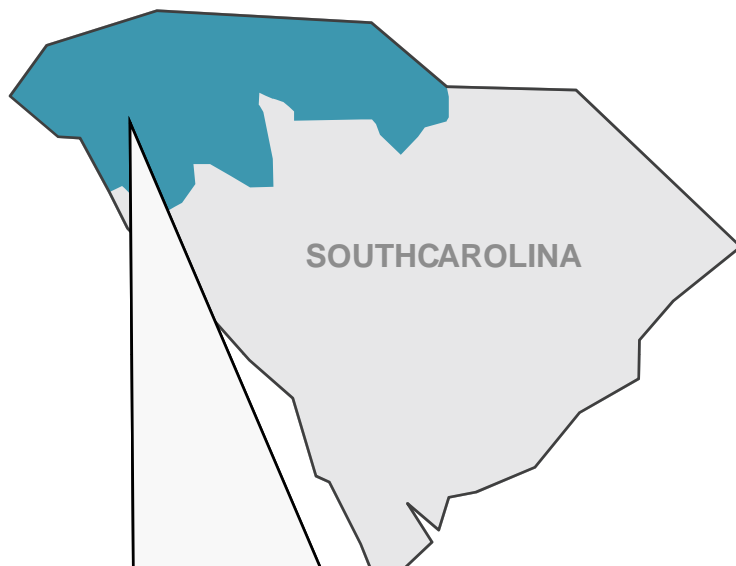
Line sensors, substation equipment and capacitors will be connected to the network.

A select number of customers, less than a dozen will also be asked to participate in communication to the home trials.

Overview

- Cost of initial deployments: \$3 to \$5 million
- Number of endpoints: 6,000 to 8,000
- Timeline: Deployment of communication technology to commence in October with endpoints connected in November/December
- Project Manager: David Staggs

South Carolina



Upstate SC

The deployment will test the communication architecture in a rural environment as well as connectivity to the endpoints, including meters, capacitors, transformers and line sensors.

In home communication will also be tested with a small number of customers. In home battery backup and renewable generation facilitation will also be part of the deployment.

Overview

- Cost of initial deployments: \$1 to \$2.5 million
- Number of endpoints: 2,500 to 4,000
- Timeline: Communication technology will be deployed in October, connecting existing distribution assets. New line sensors will be deployed in the October/November. Meters and other endpoints will be installed, as available, in December and the first quarter of 2008.
- Project manager: Ron Burkhalter

Ohio



Cincinnati, OH

The Cincinnati deployment will configure GE and Echelon meters along with communication systems from Silverspring Networks and digital cellular.

Distribution assets will also be connected to the network and back office integration systems. Customers will be connected to an online portal where energy information gathered from the system can be delivered to shape energy usage.

Overview

- Cost of initial deployments: up to \$34 million
- Number of endpoints: $\geq 75,000$
- Timeline: Deployment will be coordinated with electric rate case
- Project Manager: Avery Adams