

Smart Grid Technology – FirstEnergy



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**NorTech Advanced Energy Speaker Series – Smart Grid
Technology**

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Agenda

- What is a Smart Grid?
- Approach to Smart Grid Development

Smart Grid



What is a Smart Grid?

“Making sense of the chaos”

■ Variety of definitions

- Intelligent Grid = Smart Grid > AMI
- No consistent migration methodology across the industry
- Hot topic for PUC’s/DOE



What is a Smart Grid?

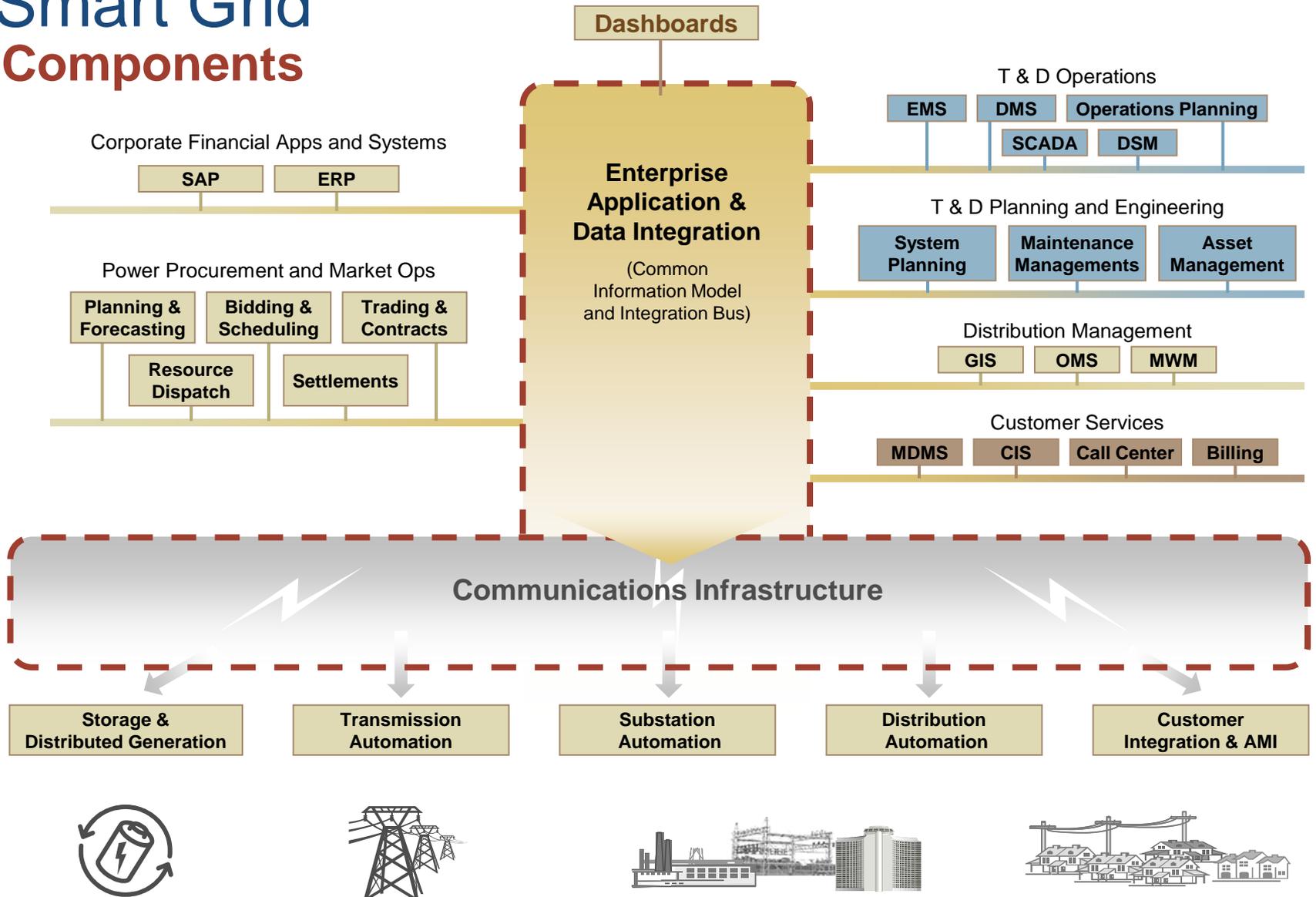
■ Smart Grid – FirstEnergy Definition

- A grid empowered by infrastructure and equipment that provides real-time, two-way communication with our supply, transmission, substation, distribution and customer assets
- **Enables:**
 - Operational efficiencies to the grid
 - Foundation for customer energy management
 - Energy efficiency and peak demand reduction
 - Distributed and customer generation/storage

It's not a question of whether such a grid can be built...but when."

Rick Nicholson – energy analyst at the market research firm IDC – Fortune, May 12, 2008

Smart Grid Components



Benefits

Rewards/Benefits/Incentives May Include:

Improves and enables:

- Reliability/integrity
- Better asset utilization
- Customer satisfaction
- Line/XFMR loss reduction
- Energy efficiency
- Data availability
- Workforce productivity
- Self-restoration
- Reliability-driven maintenance

Customer benefits:

- Market price signals lead to more efficient use of electricity
- Improved system reliability due to more accurate outage location and faster restoration
- Customer can manage energy use more completely
- Reduces usage and peak demand for electricity, creating efficiencies that benefit everyone

Smart Grid Development

Potential Challenges:

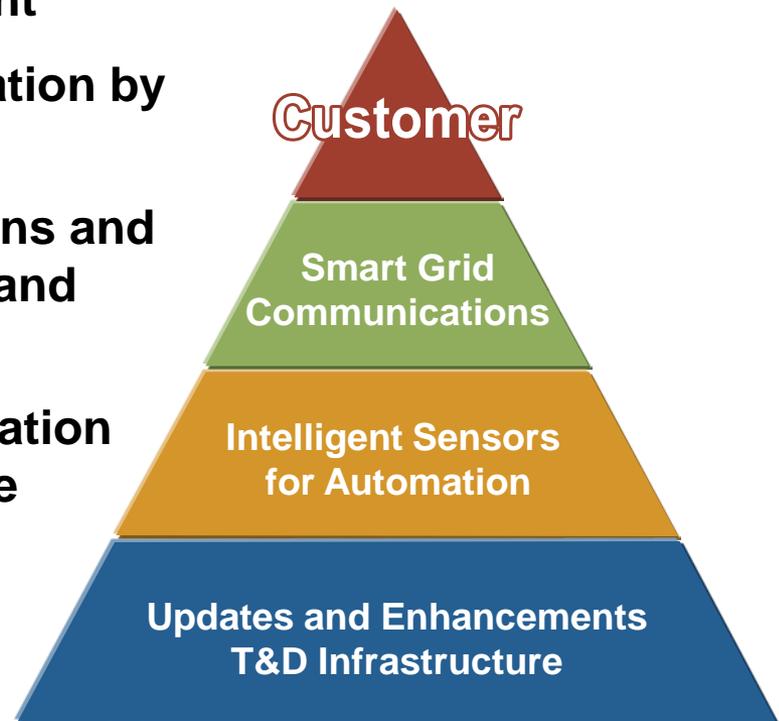
- Protection philosophy
- Planning criteria
- Communications infrastructure
- IT systems integration
- Workforce skill sets
- Costs/budgets
- Multiple regulatory landscapes
- Technology maturity/adoption
- Automating operating decisions
- Cyber security
- Customer participation
- Customer adoption

Potential Enablers:

- Regulatory recovery
- Pervasive communications of appropriate capacity
- Device interoperability
- Industry standard protocols and platforms
- Low-cost data sensors
- Simple devices
- Customer education

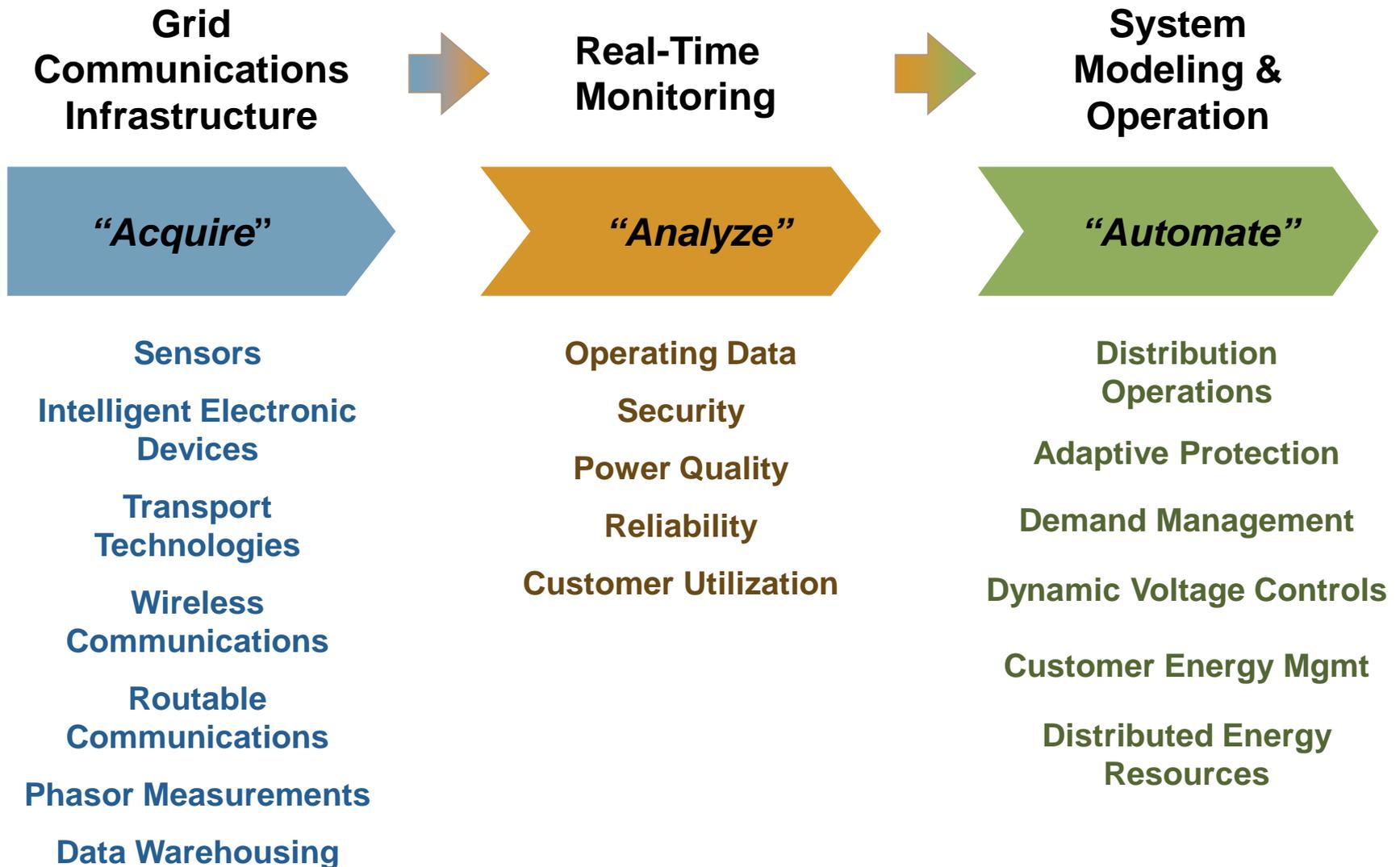
FirstEnergy – Enabling a Smart Grid

- A four-part strategy and supporting plans to modernize infrastructure is needed for grid transformation
- Updates and enhancements – replacing T&D infrastructure with updated equipment
- Intelligent sensors – preparing for automation by installing sensors and intelligent devices
- Smart Grid – implementing communications and automation to enable an efficient, secure and reliable system
- Customer – using customer usage information to improve operational efficiencies, enable demand management and support customer conservation effort

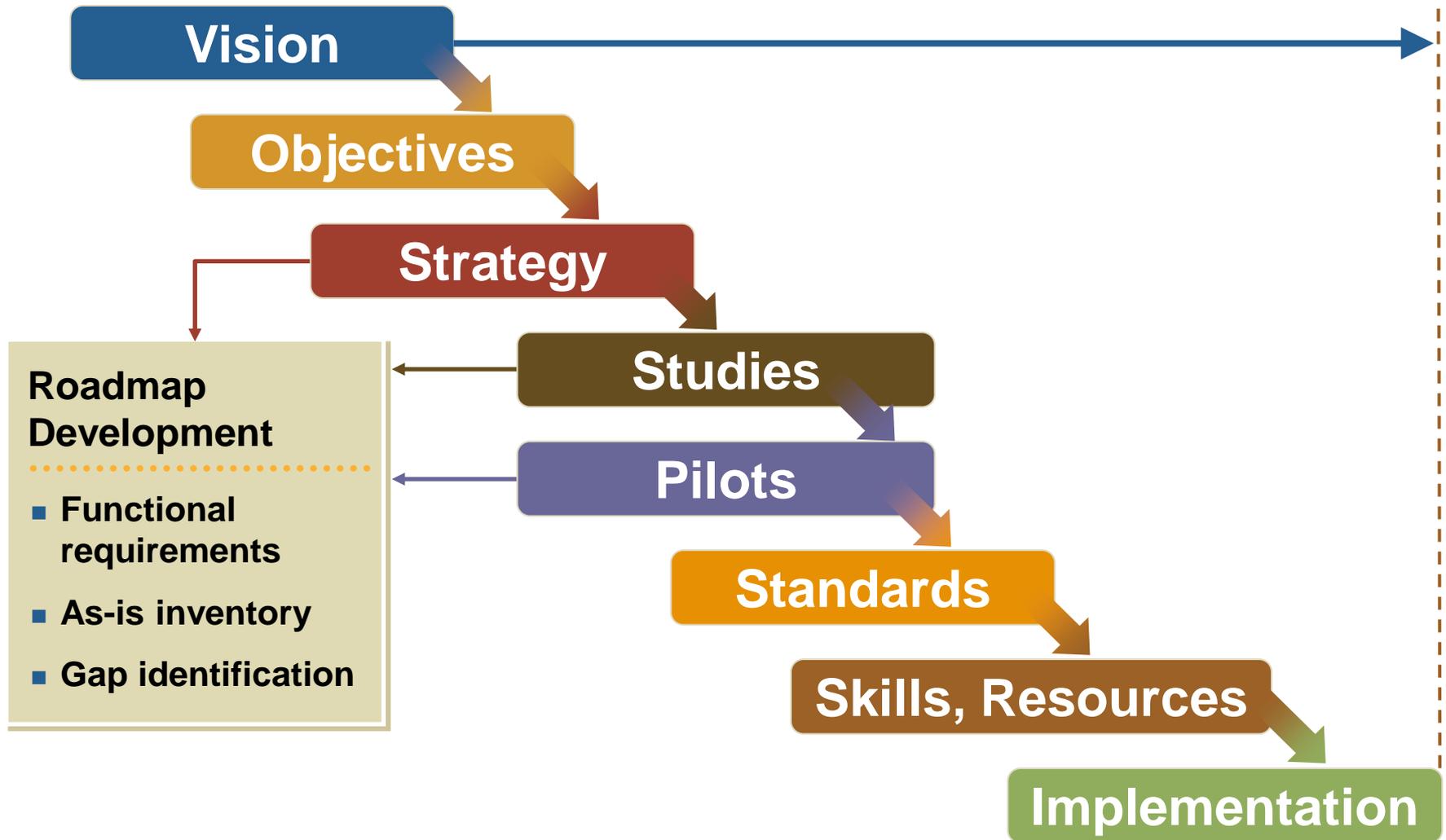


Four-stage grid transformation process

FE Smart Grid Roadmap Development with EPRI



FirstEnergy Smart Grid Process – Roadmap



Smart Grid Advancements – Federal Activity

- **2007 EISA Legislation**

- NIST Charged for Standards Development
- States Encouraged to investigate Smart Grid

- **2008 ARRA Stimulus**

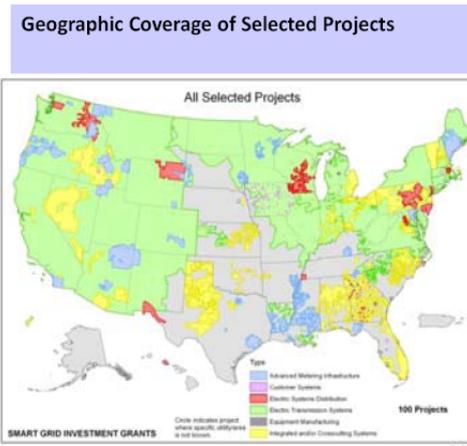
- **2009 NIST Roadmap & Smart Grid Interoperability Panel**

- **2009 SGIG Awards**

Smart Grid Investment Grants

Category	\$ Million
Integrated/Crosscutting	2,150
AMI	818
Distribution	254
Transmission	148
Customer Systems	32
Manufacturing	26
Total	3,429

- 18 million smart meters
- 1.2 million in-home display units
- 206,000 smart transformers
- 177,000 load control devices
- 170,000 smart thermostats
- 877 networked phasor measurement units
- 671 automated substations
- 100 PEV charging stations



Smart Grid Investment Grants – Federal Stimulus

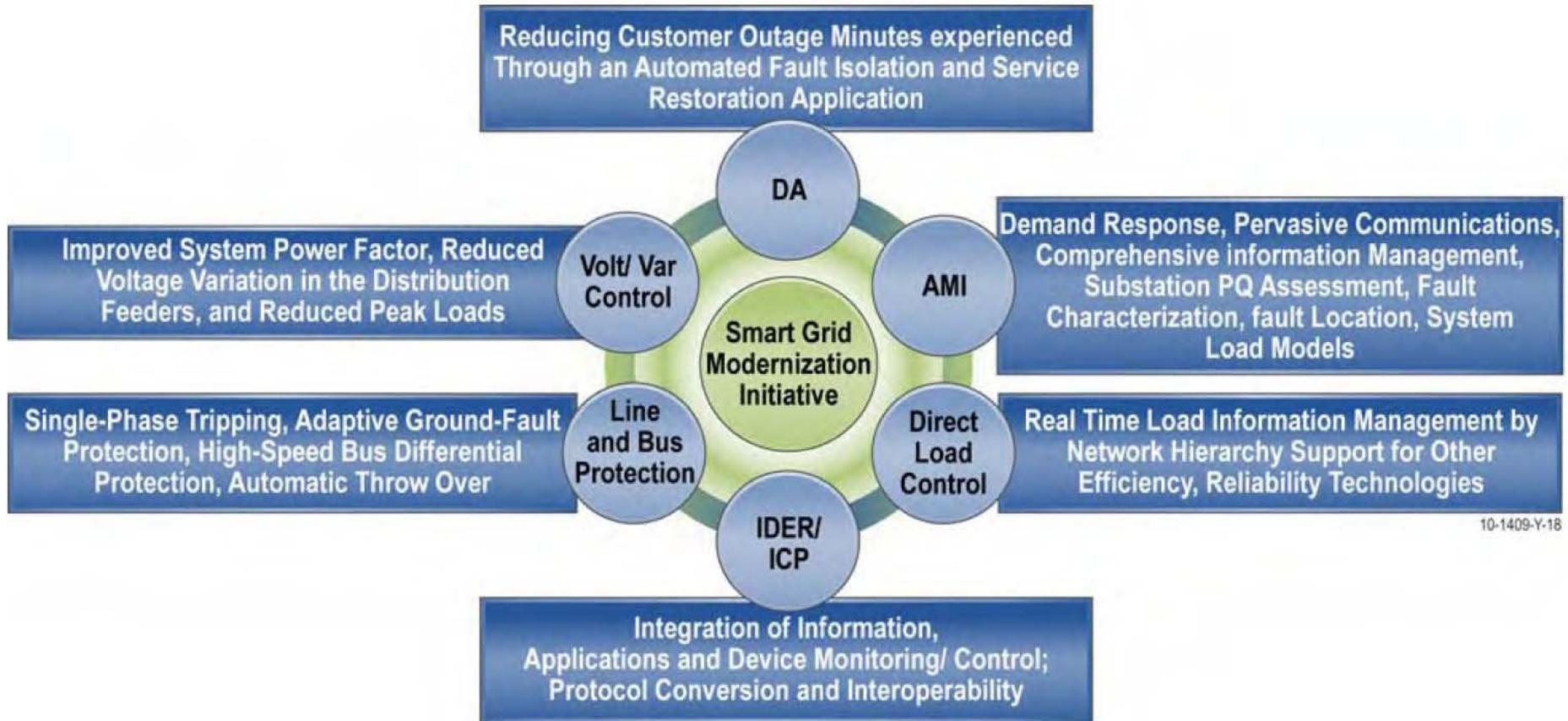
We have been selected for federal stimulus award negotiations to help meet our state mandates

DOE Smart Grid Investment Grant Application:

- **25 large awards (\$2.75B total); 75 small awards (\$650M total)**
- **FirstEnergy “Smart Grid Modernization Initiative”**
 - OH – \$72M project for grid modernization and 44,000 customer program for demand response using smart meters
 - PA – \$30M project for grid modernization and smart grid demand response initiative
 - NJ – \$12M project for smart grid demand response initiative
- **FE selected for award (\$57M) from the Department of Energy (Oct. 27, 2009)**
- **Efforts in progress for securing State cost recovery approvals for 50% match**
 - NJ funding approved
 - PA funding approved
 - OH funding under review



Smart Grid Modernization Initiative



10-1409-Y-18

Ohio Smart Grid Deployment Proposal

■ Demand Response Metering

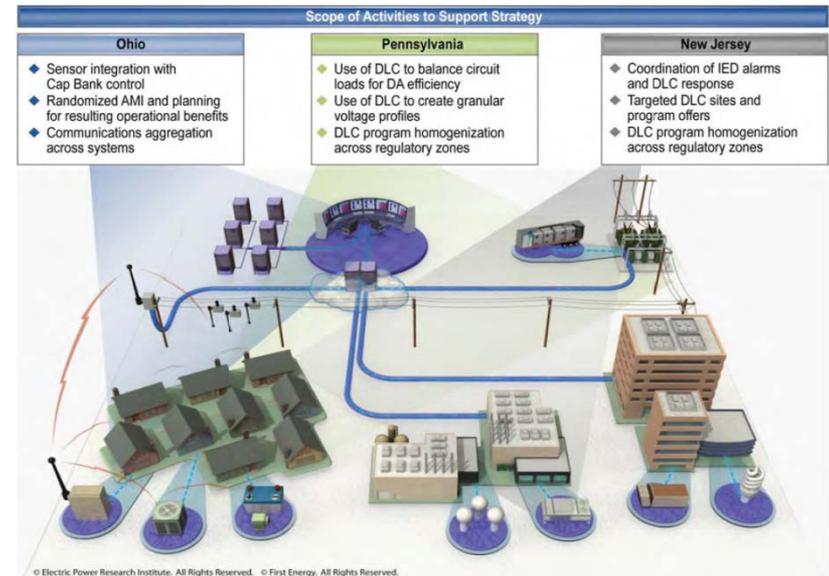
- Phase I – 5,000 customers
- Phase II – 39,000 customers
- Goals:
 - Innovative rate structure that compares customer's discretionary behavior with command and control technology
 - Peak time rebate
 - Effective use of tools that educate consumers regarding use of energy
 - Aclara Home Energy Analyzer
 - In-home display devices
 - Investigate direct load-control technologies
 - Peak Demand Reduction – study will focus on getting the maximum reduction for the least cost to residential and commercial customers

■ Distribution Automation

- 35 automated circuits

■ Advanced Voltage Control

- 35 managed circuits



Smart Grid Investment Grant – Deliverables

Investments

- Equipment Manufacturing
- Customer Systems
- Advanced Metering Infrastructure
- Electric Distribution Systems
- Electric Transmission Systems
- Integrated and/or Crosscutting Systems
- Regional Demonstrations
- Energy Storage

Transformation

Customer Empowerment

Advanced Grid Functionality

Results

- Job Creation and Marketplace Innovation
- Reduced Peak Load and Consumption
- Operational Efficiency
- Grid Reliability and Resilience
- More Distributed and Renewable Energy
- Lower Carbon Dioxide Emissions

FirstEnergy's strategy is to develop a well-planned approach to deployment of technology to enable advancements to the grid to meet the needs of our customer of the future

Energy Efficiency, Demand Response and Smart Grid

■ Next Steps

- Develop reasonable approach in concert with regulators
- Implement smart grid technologies in concert with the DOE within the developing standards
- Continue communications plan for all stakeholders and customers
- Continue to leverage advancements in technology
- Leverage what is learned through pilot project

FirstEnergy – Benefits of a Smart Grid

The Smart Grid Can Deliver

BENEFITS

- Enhanced energy security
- Reduced greenhouse gases
- Improved urban air quality
- Increased grid asset utilization

"Valley Filling"
(Energy for PHEVs)

CO₂ Emissions Urban Emissions Electricity Sales Infrastructure Requirements Utility Rates

Smart Grid