MODERN GRID
STRATEGY

Building the Smart Grid Team

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Agenda

- **The Challenge**
- **Understanding the Smart Grid**
- **The Job of the Smart Grid Team**
- **Process and Tools**
- **Q&A**

Modern Grid Strategy Team's Role

Mission – Accelerate the modernization of the Grid in the U.S.

- Develop a vision for the Smart Grid
- Reach out to stakeholders to get input and consensus
- Assist in the identification and resolution issues
- Act as an "independent broker"
- Promote testing of integrated suites of technologies
- Communicate concepts to assist interested stakeholders

MGS is an "Independent Broker" for the Smart Grid

THE CHALLENGE

Technical Challenges

- **Consumers actively involved**
- **Transactive (financial, information, “electric”)**
- **Decentralized with 2-way power flow**
- **Fully integrated**
- **Fully instrumented**
- **Huge amount of data**
- **High granularity of control**
- **Market driven**

Design – Subset of Technical Challenges

- **Large numbers of small sources and storage**
- **Incorporating 2-way power flow into operations**
- **Micro-grids and dynamic islanding**
- **Adaptive protective “relaying”**
- **Getting the communications system right**
- **“Future proofing” the technologies**
- **Integration of new power electronics**
- **Cyber Security**
- **Autonomous decision making by agents vs. operator**

Moving to a more de-centralized model

Culture Change

A significant change management effort is needed:

- Why do we need to change?
- What is the vision?
- What is the value proposition?
- 300 Million consumers affected
- Consumer education, alignment, and motivation is critical
- Metrics needed for accountability and to monitor progress
- Active leadership by stakeholder groups needed

Our challenge is to align under a common long term vision and make our short term investment decisions consistent with the "end in mind".

Regulatory

- ***Time based rates -*** incentives for consumers to become actively involved
- ***Favorable depreciation rules –*** recovery of book value for assets that are retired early for “smart grid” reasons
- ***Policy changes that provide incentives and remove disincentives to utilities –*** investment in a Smart Grid should make business sense
- ***Clear cost recovery policies -*** uncertain cost recovery increases investment risk
- ***Societal benefits –*** quantified and included in business cases
- ***New regulatory models***

UNDERSTANDING THE SMART GRID

Smart Grid Key Success Factors

The Smart Grid is MORE:

- **Reliable**
- **Secure**
- **Economic**
- **Efficient**
- **Environmentally friendly**
- **Safe**

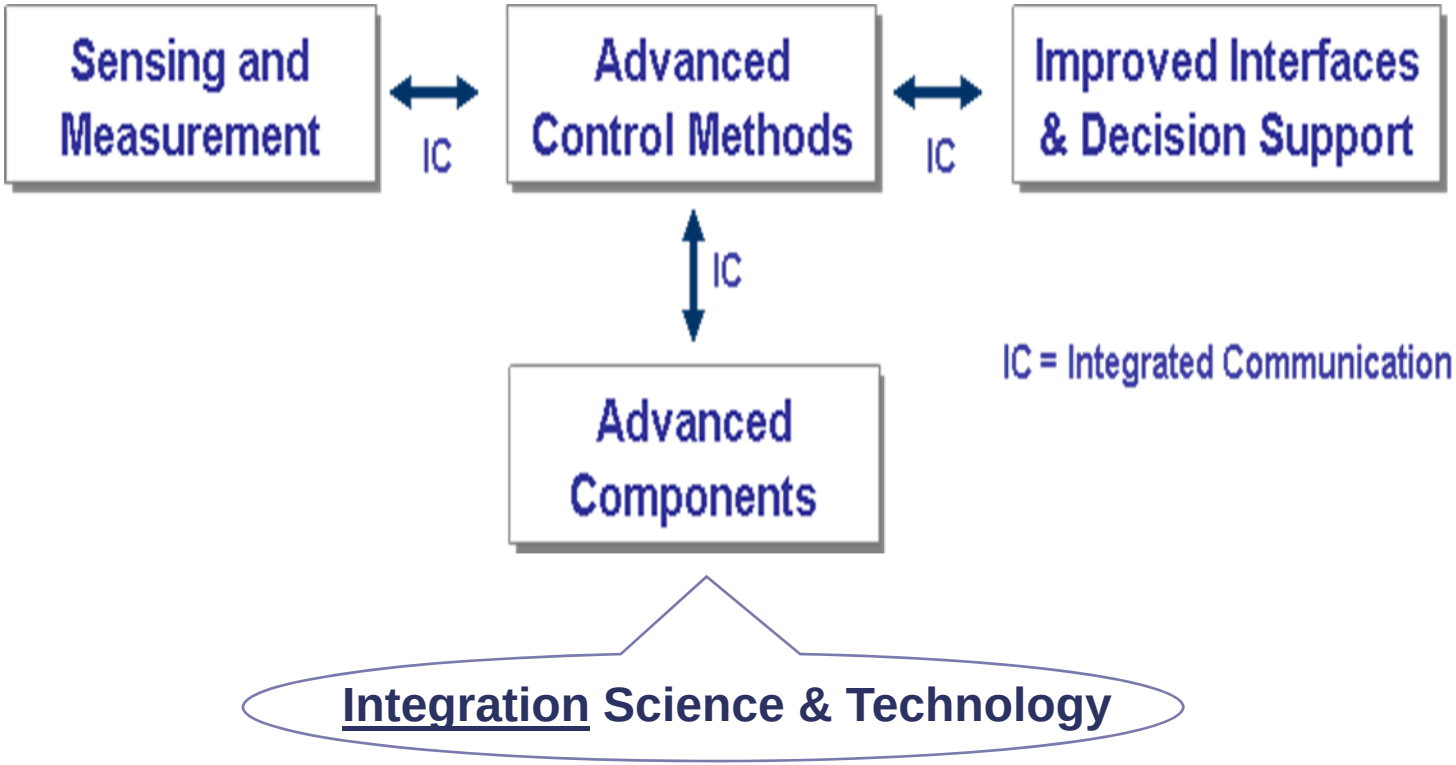
These values define the goals for grid modernization and suggest where benefits will be realized

Principal Characteristics

The Smart Grid is "transactive" and will:

- *Enable* active participation by consumers
- *Accommodate* all generation and storage options
- *Enable* new products, services, and markets
- *Provide* power quality for the digital economy
- *Optimize* asset utilization and operate efficiently
- *Anticipate & respond* to system disturbances (self-heal)
- *Operate* resiliently against attack and natural disaster

Smart Grid Key Technology Areas



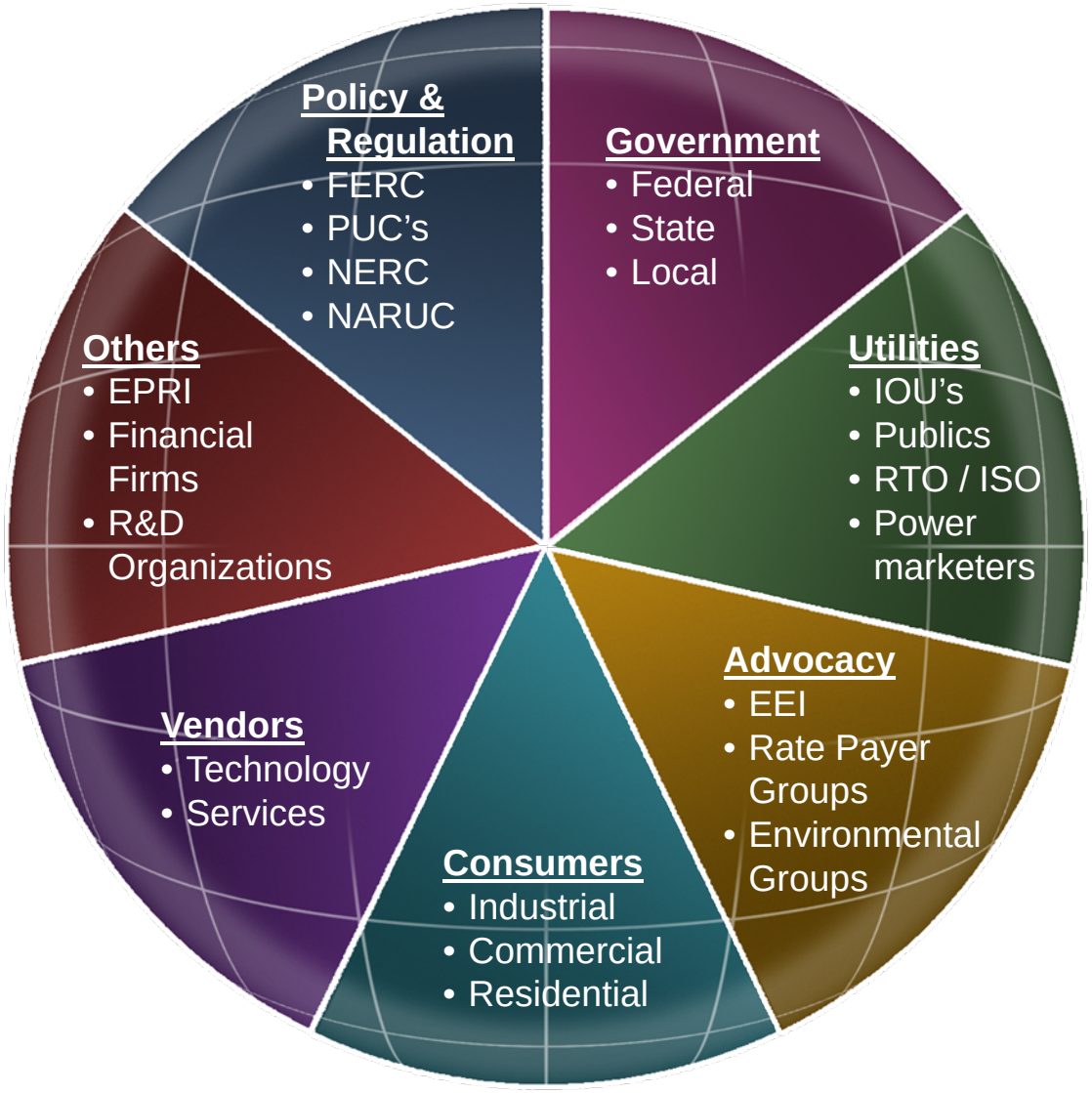
Integration – biggest gap in today's science & technology development

THE JOB OF THE TEAM

Break it down

- **Understand the vision**
- **Create the roadmap (milestones)**
- **Define the value proposition**
- **Identify and resolve barriers**
- **Apply resources**
- **Create metrics to monitor progress**

Many stakeholders



Cross – Silo

- Strategy
- Operations[n]
- Information & Communications Tech[n]
- Finance
- Rates
- Customer Service
- Maintenance[n]
- Engineering[n]
- Planning
- Regulatory Affairs
- Other

- State commission
- Consumer groups[n]
- FERC, NERC, etc
- City / Municipality[n]
- Board
- Vendors[n]
- Industry groups[n]
- Standards groups[n]
- Research organizations[n]

PROCESS AND TOOLS

Understand the Vision

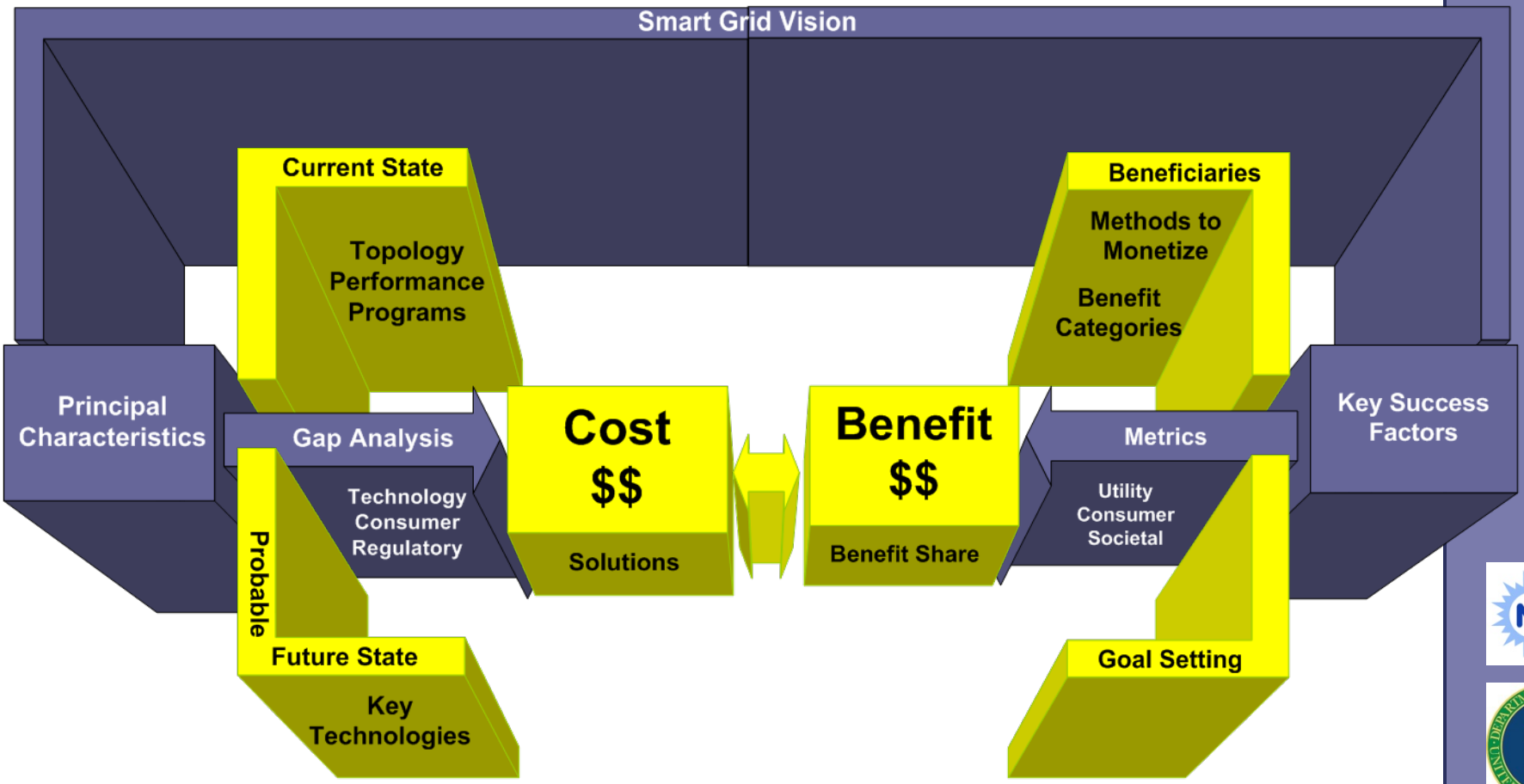
- **Use existing body of work**
  - Modern Grid Strategy
  - GridWise Architecture Council
  - Intelligrid Consortium
- **Actively learn from others – seek it out**
- **Get everyone on the same page – cannot overstate the value of this – alignment**
- **Write it down – talk it – teach it – walk it**

Create the Roadmap

- **Start at the beginning**
  - Too often we assume the beginning state and jump to the technology or process “answers” only to fail because of taking the wrong path
- **Helpful tools**
  - Smart Grid expanded gap analysis
  - Use Case process
  - Smart Grid maturity model

- **Vision**
- **High level business case**
- **High level implementation plan**
- **Use cases**
- **PMO and metrics**
- **Architecture**
- **Design**
- **Development**
- **Measured deployment**
- **Roll-out**

Define the Value – Business Case



Identify and Solve Barriers*

- **Regulatory & Legislative**
  - Rate design, penalty for non-traditional approaches
  - Lack of incentives
- **Culture & Communication**
  - Don’t see burning platform
  - Consumer education
- **Industrial**
  - Skill at business case development
  - Lack of interoperability
- **Technical**
  - Integration skills

* *BARRIERS TO ACHIEVING THE MODERN GRID*, NETL MGS document, 2008

Apply Resources

- **How much and who?**
  - Skills change over length of project
  - Resource levels go up and down and up
  - Benchmark – learn from others
- **Program management office**
  - Vision
  - Business case
  - Architecture
  - Design center / authority
  - Metrics and reporting
  - Financials
- **What skills persist after the “project”**

Create Metrics – Monitor Progress

- **"Build" metrics**
  - Long, complex project
  - Milestones and deployment %
  - Pick metrics that convey a sense of progress
  - Metrics that help you "see" the critical path
- **Performance metrics**
  - Consider the DOE Smart Grid metrics (in development)
  - Required under federal grant and cost-share programs
  - Roll-up to corporate dashboard
  - Supportive of current reporting metrics (state, reliability reporting, etc)
  - Multi-year trends; don't focus on short-term

Conclusions

- **“Begin with the end in mind” – yes, really**
  - Vision, high level business case, high level implementation plan
- **Collaborate with stakeholders**
  - Begin early and stick with it throughout
- **The team**
  - Enough external silo’s, don’t need any more from the inside
  - Align it and educate it
  - Organize around a central point – PMO
  - Plan well / resource load well
- **Don’t be afraid to measure progress**
  - Objective, repeatable, critical few
  - Share and diagnose

Contact Information

For additional information, contact

Modern Grid Strategy Team

http://www.netl.doe.gov/moderngrid/

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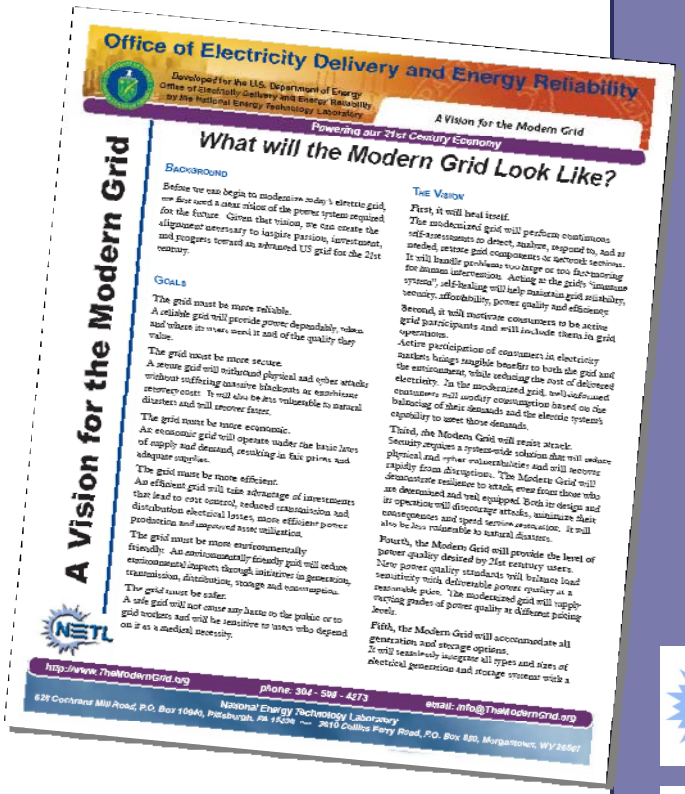
Office of Electricity Delivery and Energy Reliability

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A Vision for the Modern Grid

Powering our 21st Century Economy

What will the Modern Grid Look Like?

A Vision for the Modern Grid

Background

Before we can begin to modernize today's electric grid, we first need a clear vision of the power system required for the future. Given that vision, we can create the alignment necessary to inspire passion, investment, and progress toward an advanced US grid for the 21st century.

Goals

The grid must be more reliable.
A reliable grid will provide power dependably, when and where its users need it and of the quality they value.

The grid must be more secure.
A secure grid will withstand physical and cyber attacks without suffering massive blackouts or cumbersome recovery costs. It will also be less vulnerable to natural disasters and will recover faster.

The grid must be more economic.
An economic grid will operate under the basic laws of supply and demand, resulting in fair prices and adequate supplies.

The grid must be more efficient.
An efficient grid will take advantage of investments that lead to cost control, reduced congestion and distribution electrical losses, more efficient power production and improved asset utilization.

The grid must be more environmentally friendly.
An environmentally friendly grid will reduce environmental impacts through initiatives in generation, transmission, distribution, storage and consumption.

The grid must be safer.
A safe grid will not cause any harm to the public or to grid workers and will be sensitive to users who depend on it as a medical necessity.

The Vision

First, it will heal itself.
The modernized grid will perform continuous self-assessments to detect, analyze, respond to, and as needed, restore grid components or network sections. It will handle problems too large or too fast-moving for human intervention. Acting as the grid's "immune system", self-healing will help maintain grid reliability, security, affordability, power quality and efficiency.

Second, it will motivate consumers to be active grid participants and will include them in grid operations.
Active participation of consumers in electricity markets brings tangible benefits to both the grid and the environment, while reducing the cost of delivered electricity. In the modernized grid, well-informed consumers will modify consumption based on the balancing of their demands and the electric system's capability to meet those demands.

Third, the Modern Grid will resist attack.
Security requires a system-wide solution that will reduce physical and cyber vulnerabilities and will recover rapidly from disruptions. The Modern Grid will demonstrate resilience to attack even from those who are determined and well equipped. Both its design and its operation will discourage attacks, minimize their consequences and speed service restoration. It will also be less vulnerable to natural disasters.

Fourth, the Modern Grid will provide the level of power quality desired by 21st century users.
New power quality standards will balance load sensitivity with deliverable power quality at a reasonable price. The modernized grid will supply varying grades of power quality at different pricing levels.

Fifth, the Modern Grid will accommodate all generation and storage options.
It will seamlessly integrate all types and sizes of electrical generation and storage element with a

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Office of Electricity Delivery and Energy Reliability

Thank You!

QUESTIONS?

NETL SMART GRID ACTIVITIES

West Virginia Smart Grid Implementation Plan

- **$540K project jointly funded by NETL, RDS, Allegheny Power, AEP, State of West Virginia, WVU, and DOE OE**
- **Results will describe approach and value proposition for implementing Smart Grid in WV**
- **Cost & benefit analysis comparing state of current electricity grid and future Smart Grid in WV**
- **Address role of coal in Smart Grid**
- **Support economic development in WV**
- **Only state-wide Smart Grid implementation plan**
- **Only second Smart Grid study to be published**

DOE RDSI Program

- **NETL is managing nine RDSI projects**
  - $55M of DOE funds over 5 years; total is >$100M
  - Primary goal is to use DER to reduce peak load by 15%
  - DER (storage and DG), DR, Communications, Automation
- **Develop technologies, tools, and techniques to integrate load management and DER**
  - Develop and demonstrate Smart Grid technologies in an integrated and intelligent T&D network
  - Advance integration technologies to access renewable energy sources
  - Demonstrate DER to decrease peak load, increase asset utilization, and defer electric system upgrades

Other NETL Smart Grid Activities

- **Smart Grid Maturity Model**
  - Roadmap of activities, investments, and best practices
  - Measures progress and level of achieving Smart Grid
- **Smart Grid Clearinghouse**
  - First-stop website for public information on Smart Grid
  - Technologies, tests and demonstrations, business cases, cost & benefits, best practices, legislation
- **Federal Smart Grid Task Force**
  - Multi-agency task force created by Title XIII of EISA 2007
  - DOE (OE&EE), NIST, DOD, USDA, DHS, EPA, FERC
- **Smart Grid and Clean Coal Relationship**