



Building a Stronger and  
Smarter Electrical  
Energy Infrastructure



## ***“Smart Grid”***

### ***A Necessary Component in the Remaking of America***

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# Changing Regulatory Landscape

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## Energy Independence and Security Act of 2007 (EISA), Title XIII

### National Policy

“It is the policy of the United States to support the modernization of the Nation’s electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure...”

### Grid Modernization

Title XIII establishes *national policy* for grid modernization, creates new federal *committees*, defines their *roles and responsibilities*, addresses *accountability* and provides *incentives* for stakeholders to invest

### Accountability

Title XIII holds state regulators accountable by “requiring them to consider”:

- requiring utilities to first look at Smart Grid solutions - including societal benefits
- prior to undertaking investments in non-advanced grid technologies
- allowing utilities to recover capital, O&M and other costs
- allowing recovery of the book value of technologically obsolete assets

### Incentives

The Secretary shall establish a Smart Grid Investment Matching Grant Program to provide reimbursement of one-fifth (20 percent) of qualifying Smart Grid investments. For many stakeholders, Title XIII provides incentives that represent a significant level of funding from federal resources

# Changing Regulatory Landscape

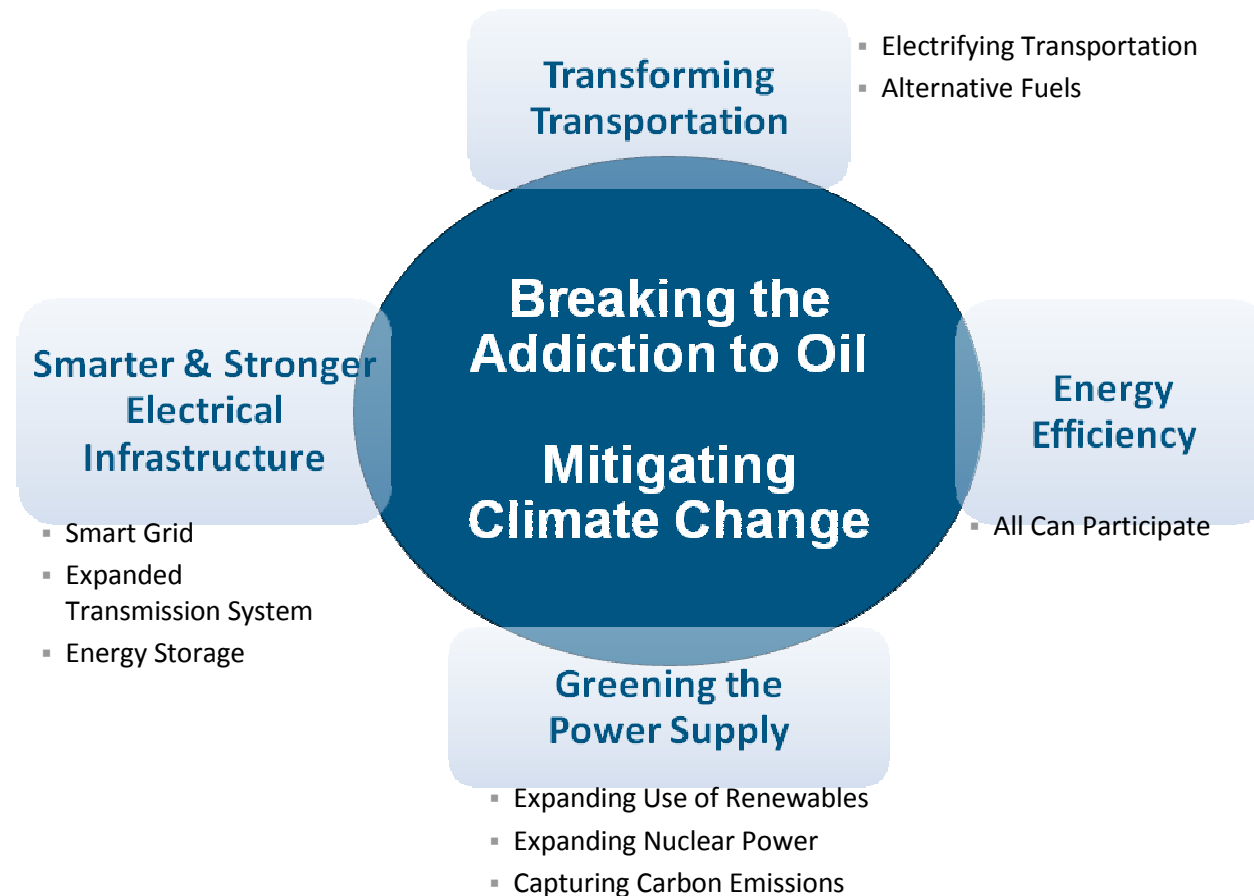
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## American Recovery and Reinvestment Plan - 2009

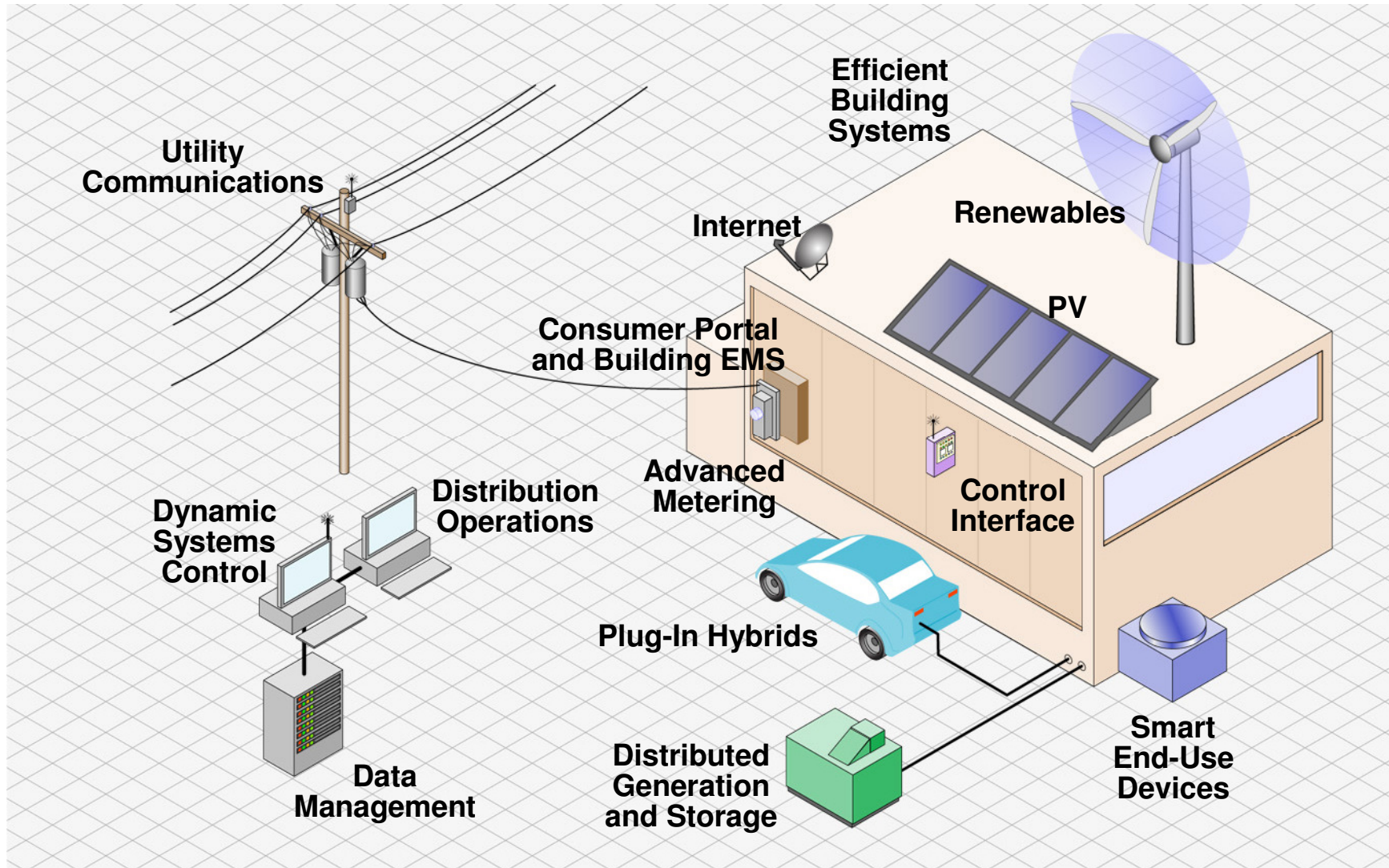
- The bill provides \$4.5 billion to modernize the nation's electricity grid with smart grid technology. The bill increases federal matching grants for the “Smart Grid” Investment Program from 20% to 50%.
- The bill provides \$2.5 billion for renewable energy and energy efficiency R&D, demonstration and deployment activities.
- The bill provides \$6 billion for a temporary loan guarantee program for renewable energy power generation and transmission projects that begin construction by September 30, 2011
- The bill provides a three-year extension of the Production Tax Credit (PTC) for electricity derived from wind facilities through December 31, 2012, as well as or geothermal, biomass, hydropower, landfill gas, waste-to-energy and marine facilities through December 31 2013.

# Changing Industry Organization Landscape

## IEEE-USA National Energy Policy Recommendations



# Changing Consumer Landscape

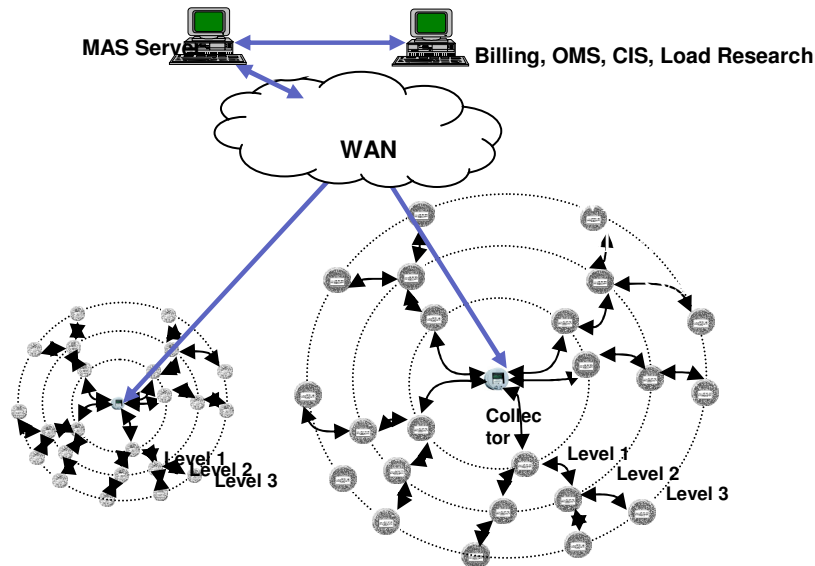




# Changing Industry Landscape

The “smart energy” industry accounts for \$20 billion in annual sales.

Its estimated growth is at least 5-10% per year over the next 5 years.



# Vision

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- “Use of advanced technologies to improve the performance of electric utility systems to address the needs of society.”
- *“... a fully automated power delivery network ... ensuring a two-way flow of electricity and information between the power plant and appliance, and all points in between. Its distributed intelligence, coupled with broadband communications and automated control systems, enables real-time transactions and seamless interface among people, buildings, industrial plants, generation facilities and the electric network.” - U.S. Department of Energy Grid 2030*
- “Its foundation is new *distributed data communication, computing, and control technologies* – efficient transfer of data and control from/to/among many field units.”

# Keys to Achieving the “Smart Grid”

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## ■ Architecture

- An integrated approach to deploy technology.
- New technology on the system must conform to this architecture.
- Should allow for efficient and economic development of new applications.

## ■ Communications

- Effective, two-way communication with all parts of the Electric Grid are essential to achieving the Vision.
- Handle very large amounts of data points to glean information.

## ■ Technology

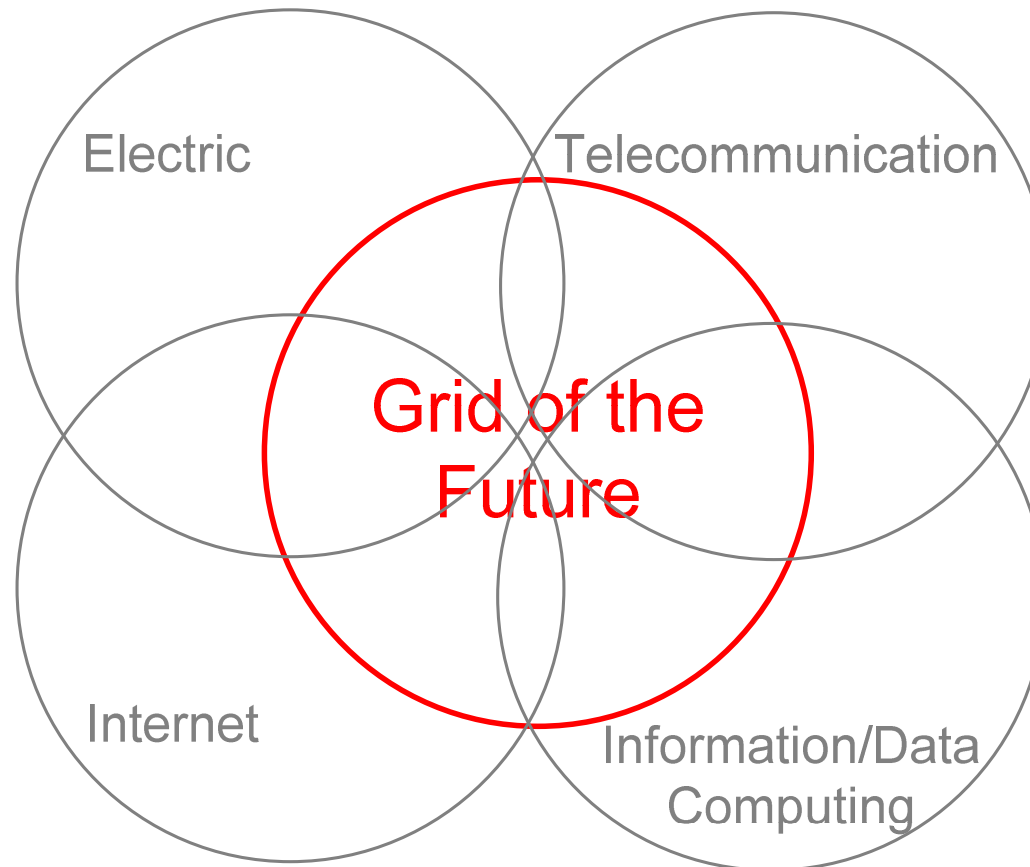
- Utilize technological enhancements in equipment and methodologies that are cost effective, innovative, interchangeable, and reliable to provide the performance enhancing capabilities throughout the electric grid.



# “SMART GRID”

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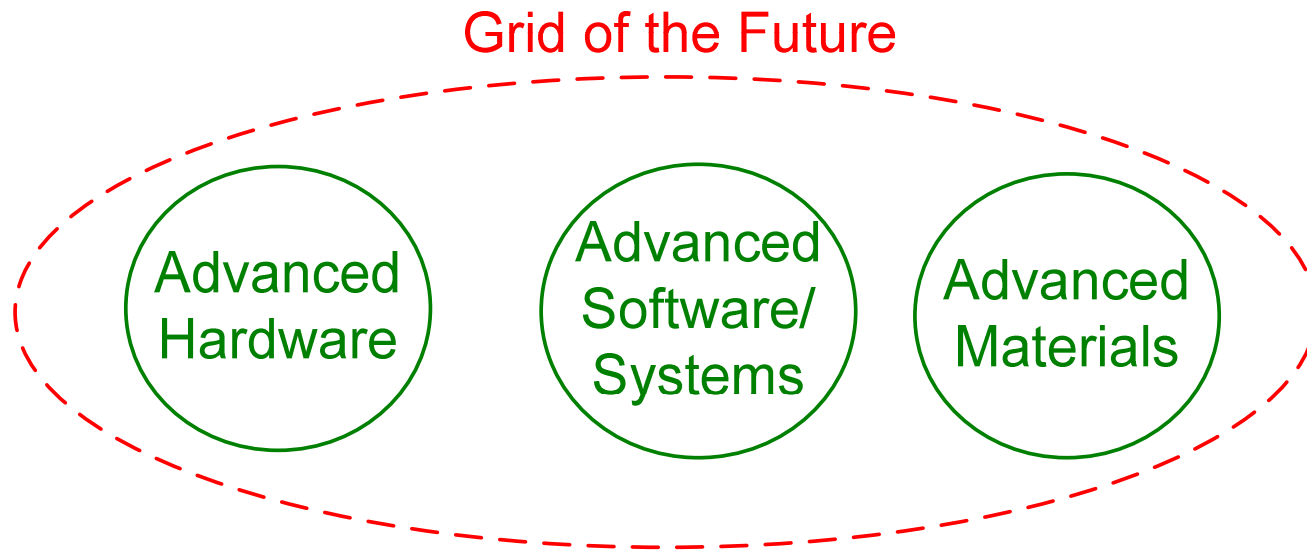
The “Smart Grid” is enabled by advanced technologies from several industries



# Technology Overview

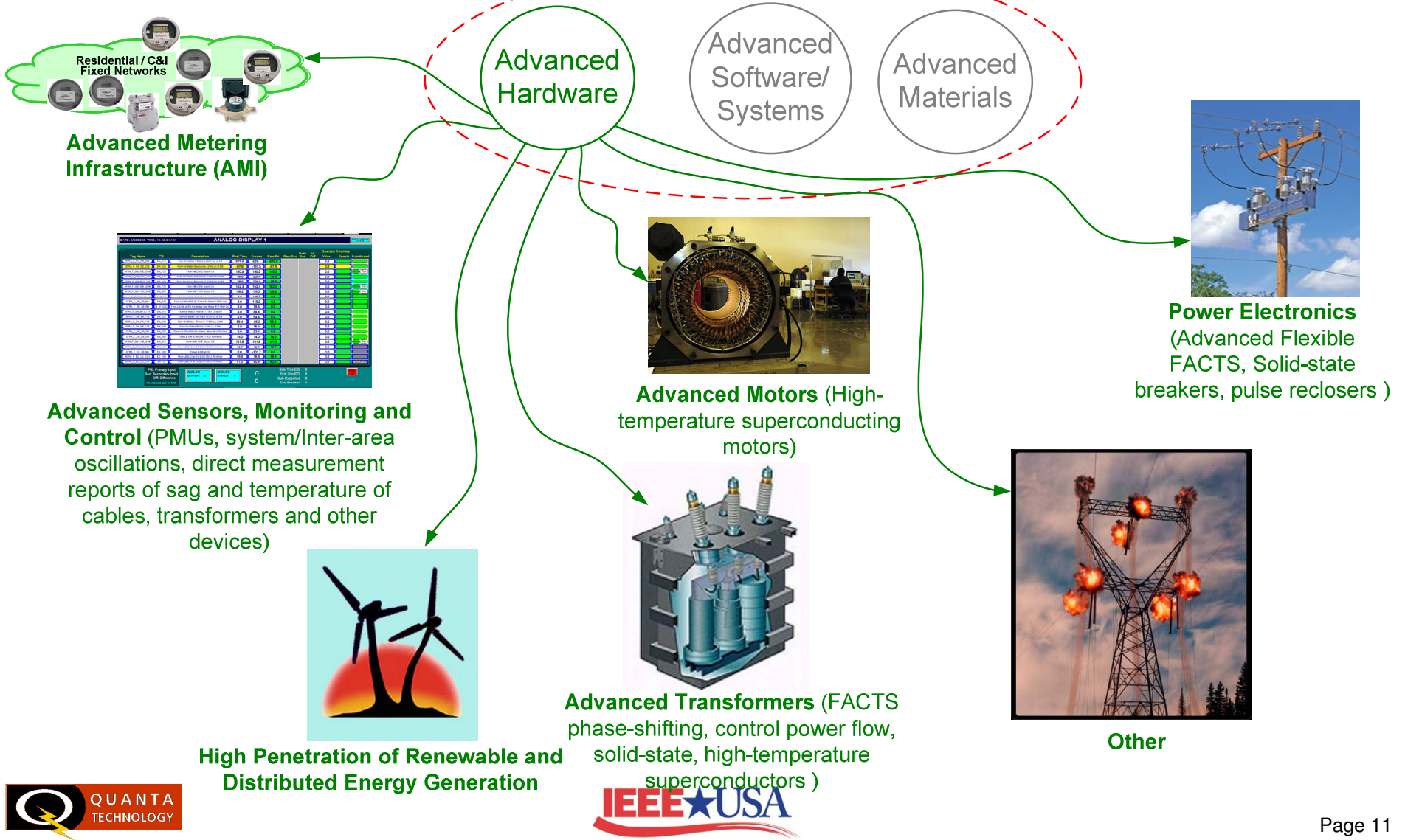
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The “Smart Grid” brings together three kinds of technologies for the electric power system:



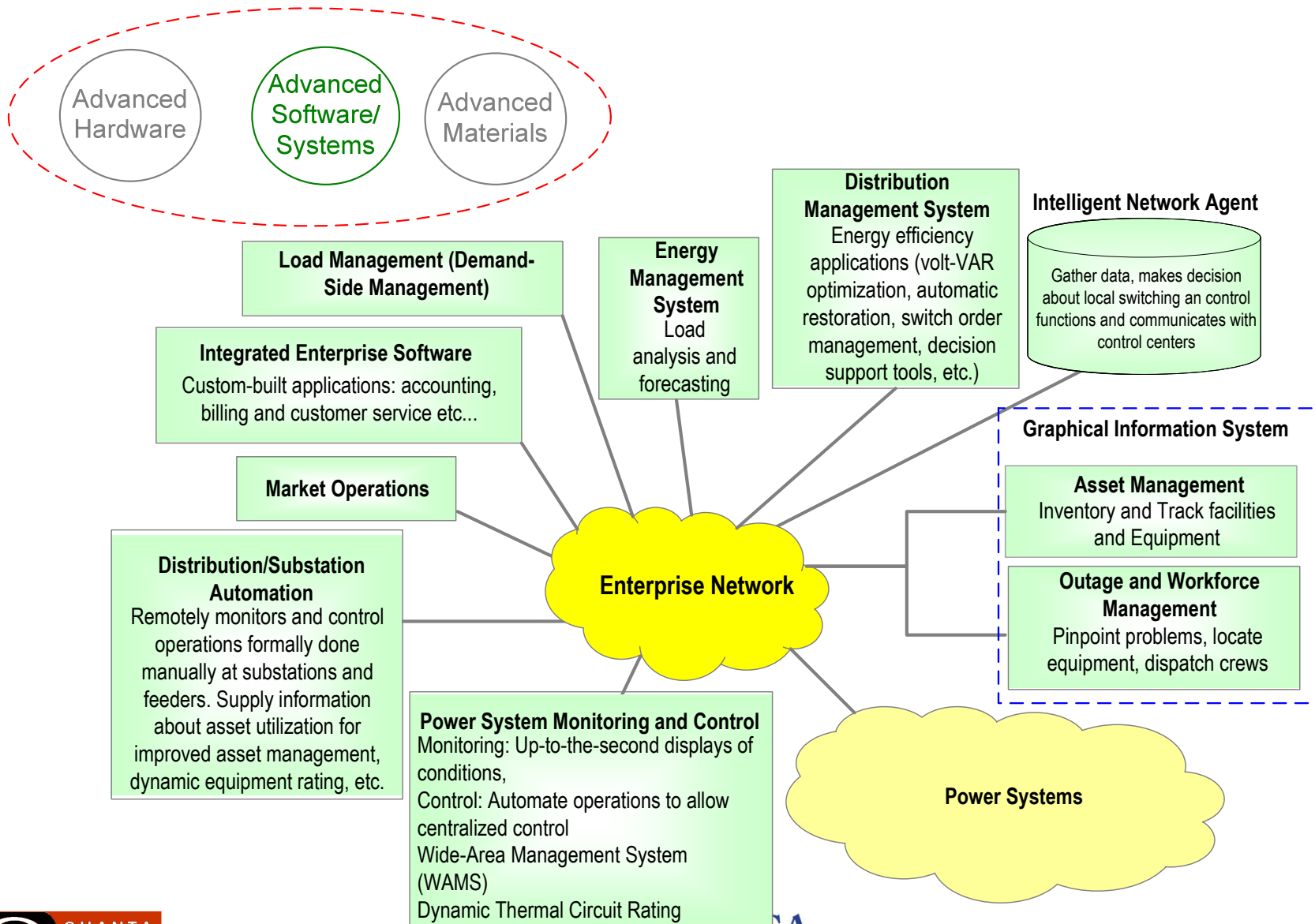
# Technology Overview

## Grid of the Future



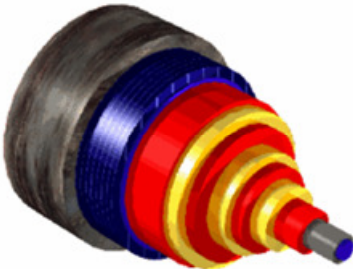
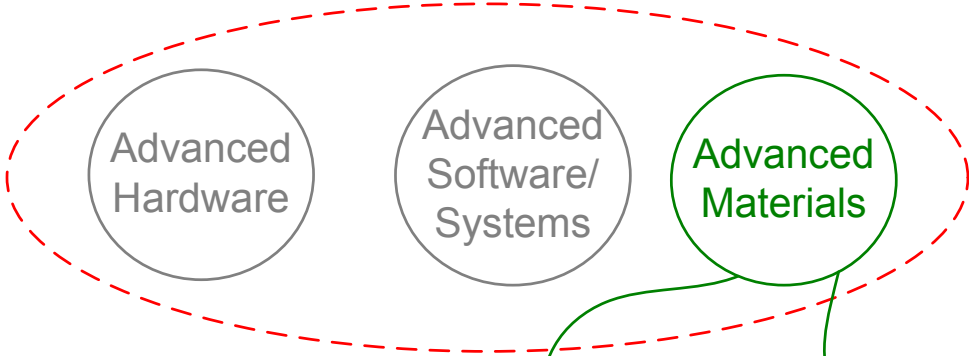
# Technology Overview

## Grid of the Future



# Technology Overview

## Grid of the Future

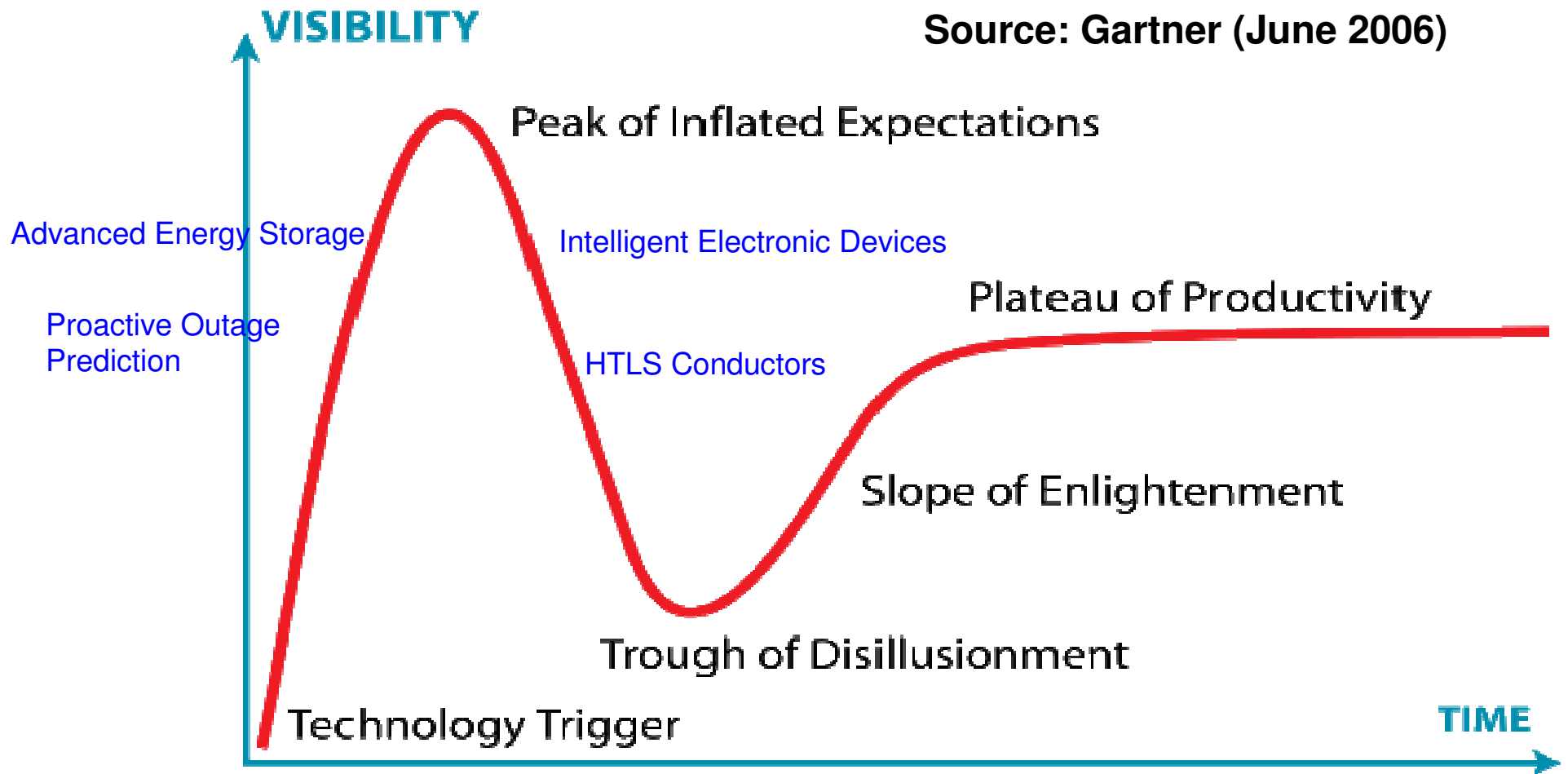


**Advanced Cables**  
(composite conductors, high-temperature superconductors)



**Advanced Energy Storage** (Super-Conducting Magnetic Energy Storage (SMES), advanced flywheels, flow batteries charge and discharge fluid between tanks, liquid molten sulfur batteries built to utility scale)

# Technologies: Hype Cycle



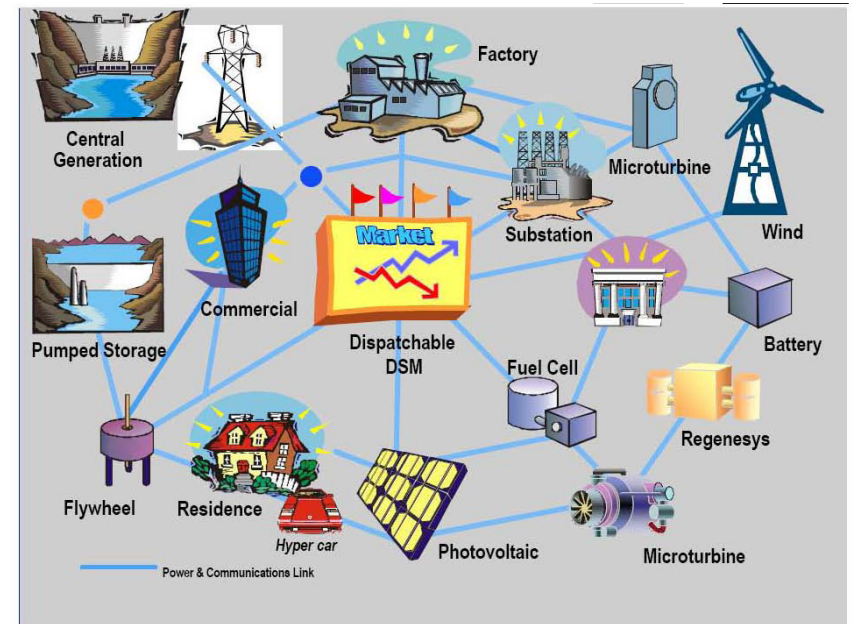


# “Smart Grid”: Evolving changes

Now	Moving Forward
Electromechanical, Solid State	Digital/Microprocessor
One-way and local two-way communication	Global/integrated two-way communication
Centralized generation	Accommodates distributed generation
Local/limited protection, monitoring and control systems	WAMPAC, Adaptive protection
"Blind"	Self-monitoring
Manual restoration	Automated, "self-healing"
Check equipment manually	Monitor equipment remotely
Limited control system contingencies	Pervasive control system
Estimated reliability	Predictive reliability
Conservative seasonal equipment rating	Operate at maximum capacity based on the actual real-time conditions
Few customer choices	Many customer choices

# Market Barriers

- Some market barriers:
  - New technology/products must always be proven :
    - Extensive field testing is required before widespread integration into power grid
  - Financial constraints:
    - Many technologies are too expensive,
    - Difficulties in financing, bonding and insuring large projects,
  - Slow-moving customers and utility industry
    - Risk-averse mentality, long scale cycles for equipment, etc...
  - Regulatory:
    - Spending the appropriated dollars meaningful in the necessary timeframe

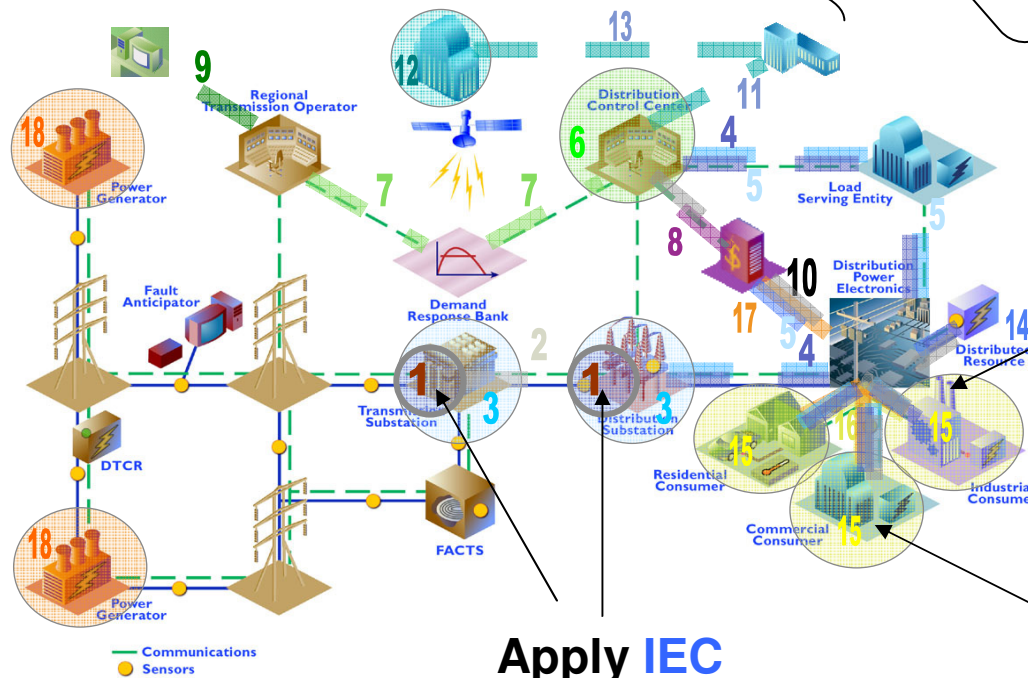


# Standards Supporting the “Smart Grid”

Develop and implement consistent systems management and security policies

Apply **IEC 61970** and **61968 (CIM, GID)** for Enterprise Data Sharing

**R&D:**  
Integrate and Harmonize  
**IEC 61850**  
**IEC 61968**  
**ANSI C12**  
Standards

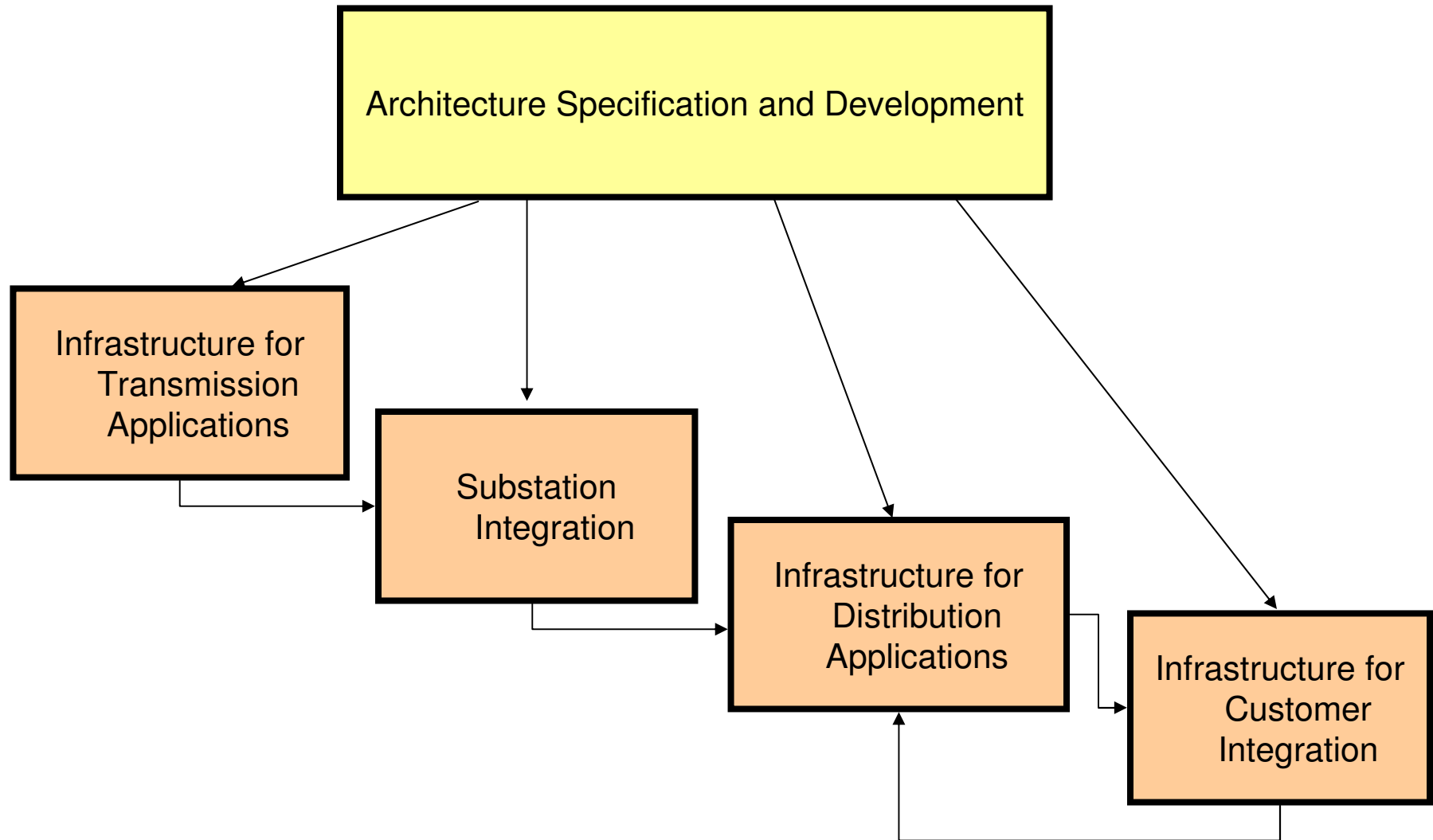


Apply **ANSI C12** for Revenue Metering

Apply **IEC 61850** for Real-Time Controls

Apply **ASHRAE BACnet™** for Building Automation

# Road Map Overview



# Recommendations to IEEE

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- Actively lead the development of a Road Map to identify new and updates of existing standards affecting “Smart Grid”
- Actively work to effectuate a cultural change to modernize and strengthen the electric grid today
- Review and modify, if appropriate, IEEE’s functional structure in light of the need to remake America
- Identify industry experts who can lead and respond to technical concerns affecting “Smart Grid”
- Actively work with federal and state regulators to develop and promote “Smart Grid” legislation



# Thank You

*“Running today’s digital society through yesterday’s grid is like running the Internet through an old telephone switchboard”*

*Energy Future Coalition*

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