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# Advanced Metering and the Smart Grid

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# Objectives

1. What is “smart metering”?
  - Differentiation from AMR
  - Infrastructure requirements
2. What applications can be enabled by smart metering?
  - Demand response is just one of these applications
  - The business case should consider all the potential benefits for all the stakeholders

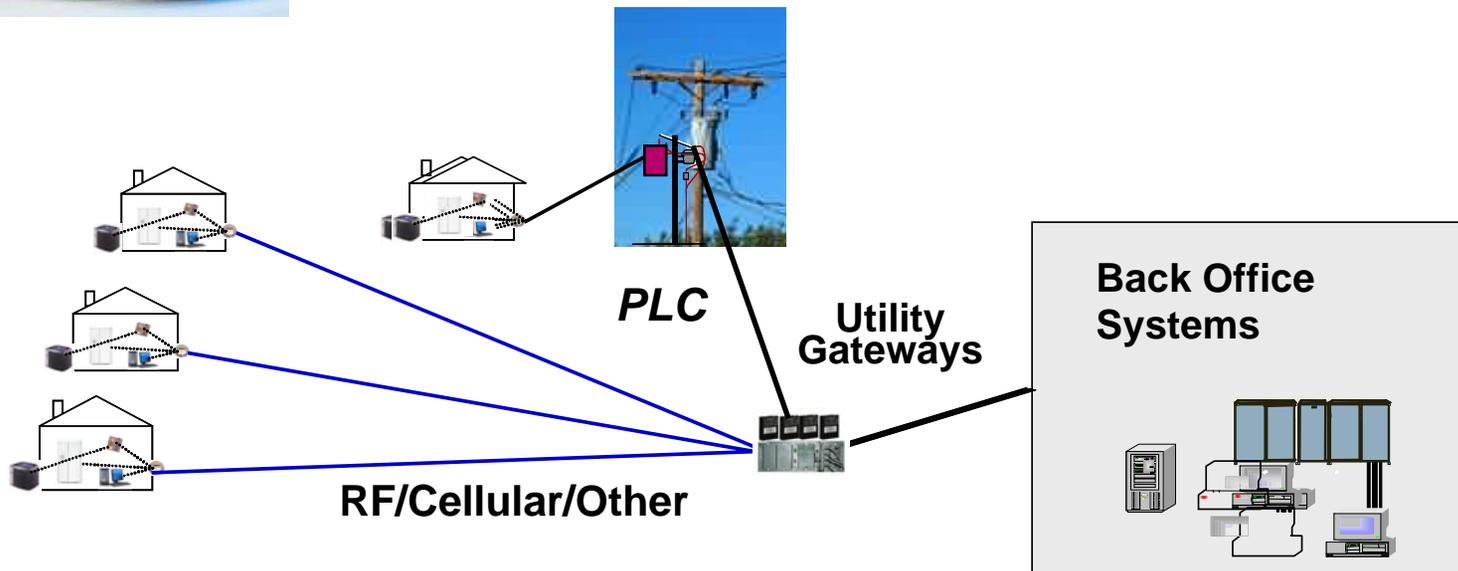
# What is Advanced Metering? Automatic Meter Reading (AMR)



Time-period usage collected through one-way telecommunications

## Benefits

Meter Reader Labor  
Small Operating Efficiencies

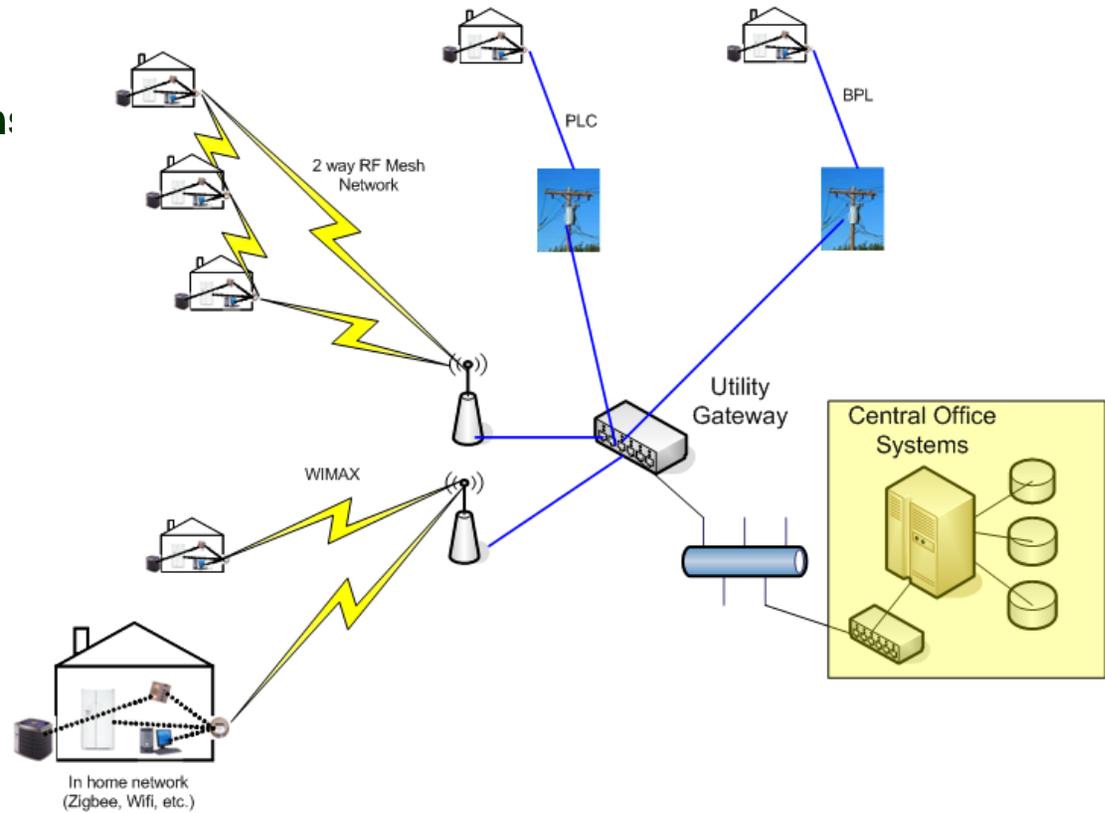


# What is Advanced Metering?

## AMI vs AMR



Interface for usage, prices, load control and intelligent grid through two-way telecommunications



### Benefits

- AMR benefits plus,
- Grid Mgmt & Operations
- Outage Management
- Energy Procurement
- Customer Services
- Distribution Automation

# The Energy Independence and Security Act of 2007

**Today, President Bush signed the Energy Independence and Security Act of 2007, which will improve vehicle fuel economy and help reduce U.S. dependence on oil.**

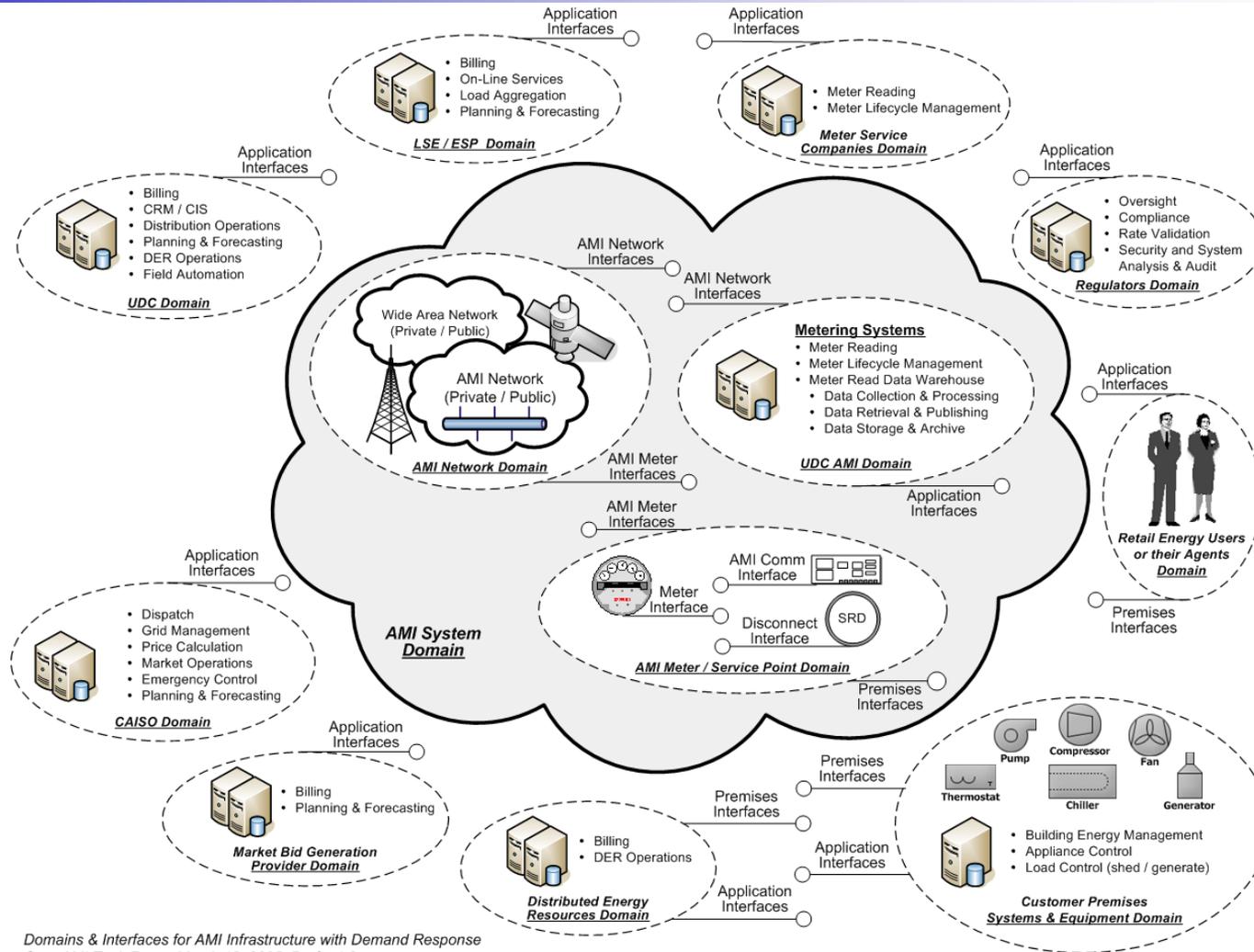
The bill the President signed today responds to the challenge of his bold "Twenty in Ten" initiative, which President Bush announced in January. It represents a major step forward in expanding the production of renewable fuels, reducing our dependence on oil, and confronting global climate change. It will increase our energy security, expand the production of renewable fuels, and make America stronger, safer, and cleaner for future generations



Dec 19, 2007

# Advanced Metering Infrastructure (AMI)

Courtesy of OpenAMI ([www.openami.org](http://www.openami.org))



Domains & Interfaces for AMI Infrastructure with Demand Response  
OpenAMI Task Force, March 18, 2005, Draft v1.0

# Dilemmas

- Dilemma Number 1
  - Many of the benefits of AMI require implementation of the virtually the entire infrastructure (e.g. widespread demand response).
- Dilemma Number 2
  - Many different stakeholders may benefit from advanced metering applications. It is complicated to build a model that effectively allocates the benefits between stakeholders.
- Dilemma Number 3
  - Solutions that meet the needs of short term objectives may not be the best solution when applications that benefit all stakeholders are considered.

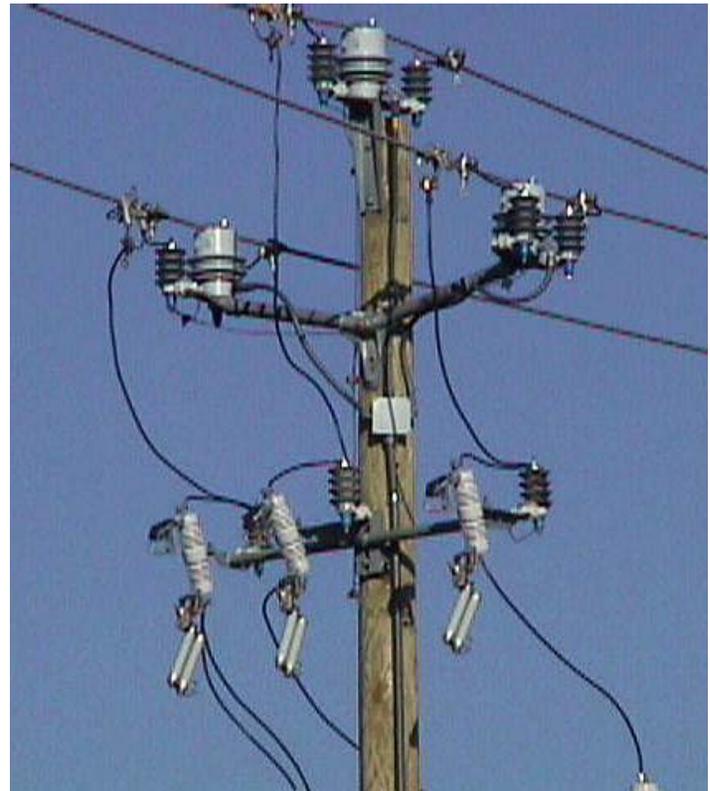
# Why AMI?

- Operational Benefits
  - Automated meter reading
  - Remote connect/disconnect
  - Theft of power detection
  - Interface to automation systems (future)
- Reliability Improvement
  - OMS integration
  - Outage location
  - Improved restoration procedures
- Energy Efficiency
  - Customer response to information
  - Support for automation systems to improve efficiency
- Societal Benefits
  - Response to emergency conditions (load control, demand response)
  - Information services
  - Advanced consumer services
  - Improved security of service

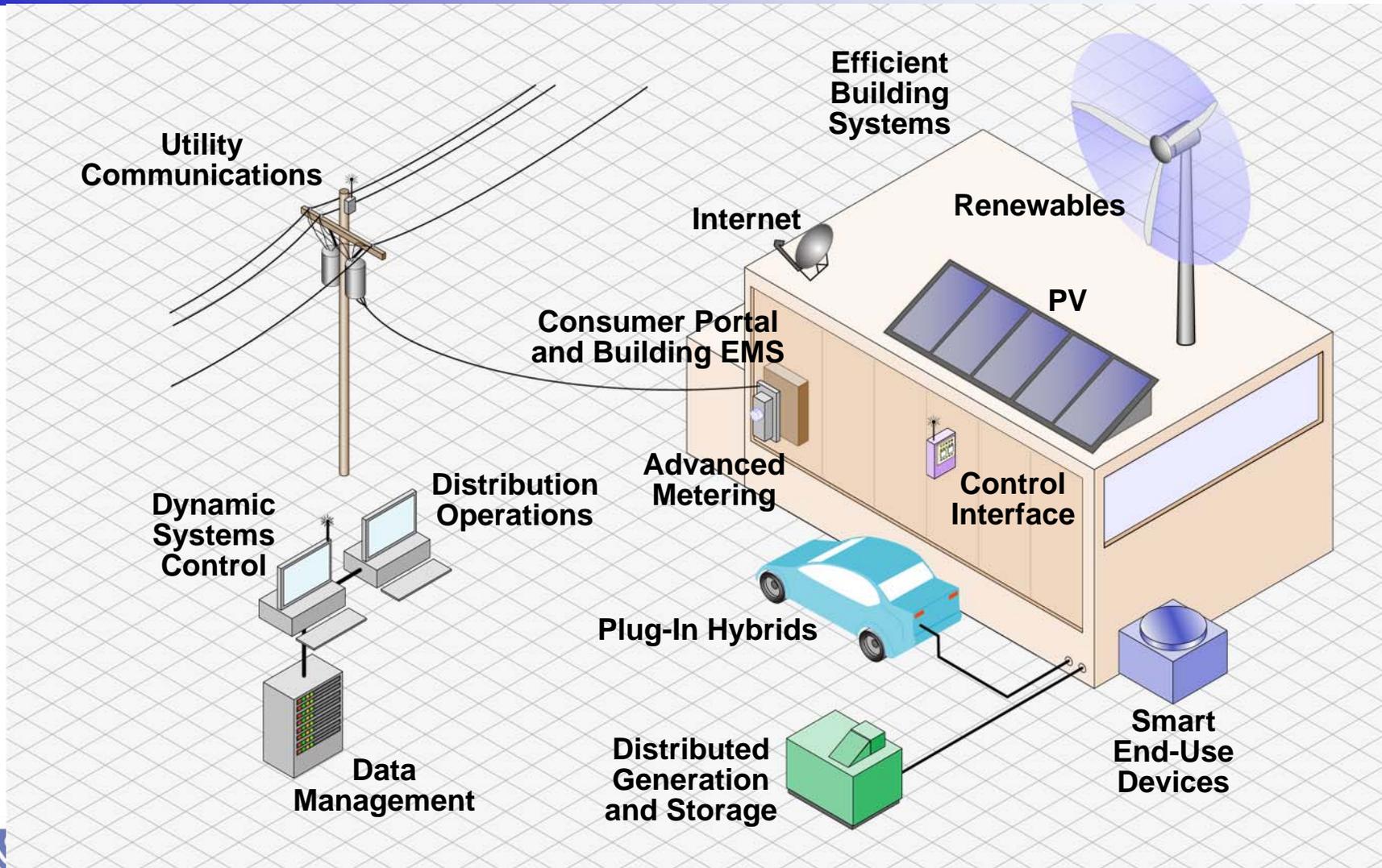
# Distribution System Applications

*What applications are possible when we have a database of load profile information from EVERY customer on the system and the ability to communicate with these meters for other information?*

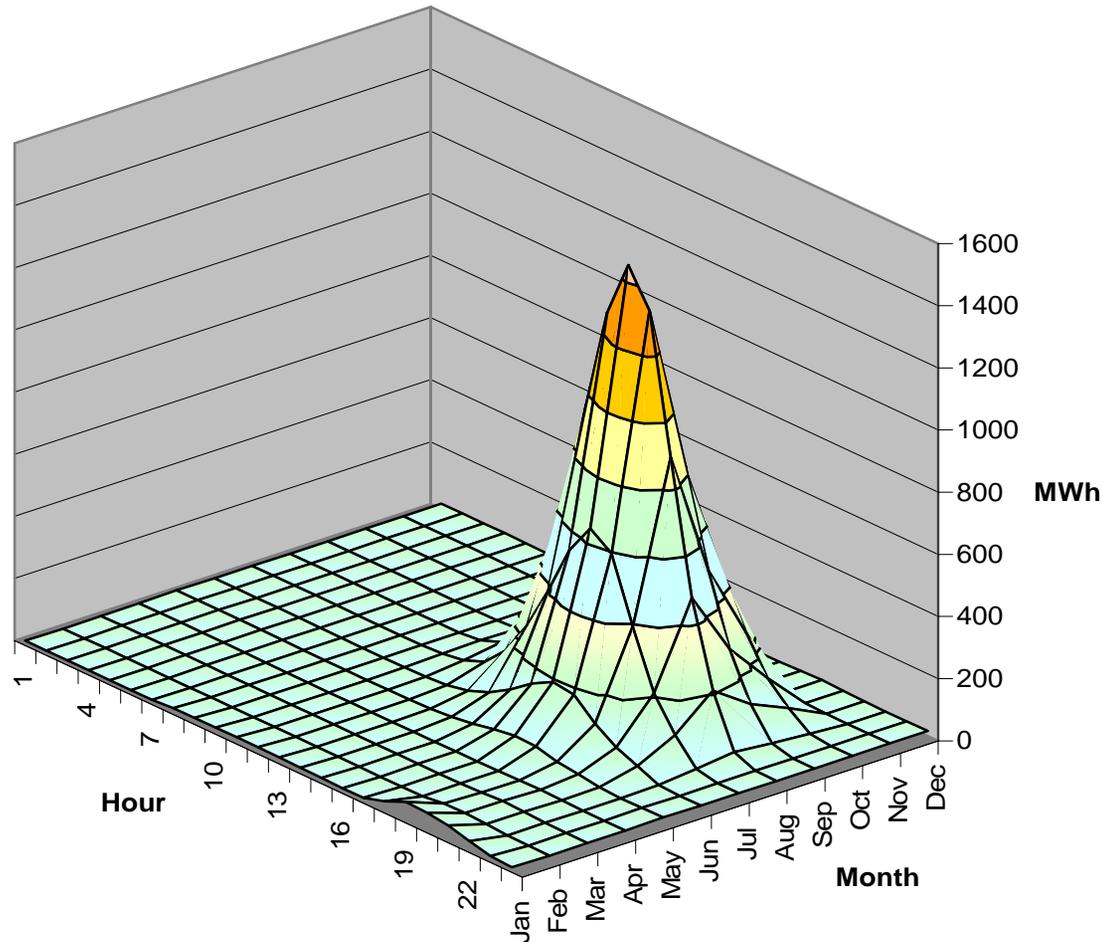
- Fault Location
- Outage Management
- Optimize efficiency, voltage control, var management, power quality
- Demand control at the distribution level (optimize investment)
- Support system reconfiguration – reliability improvement
- Asset management support (accurate loading information, operations information)
- ***Support Integration of distributed resources***



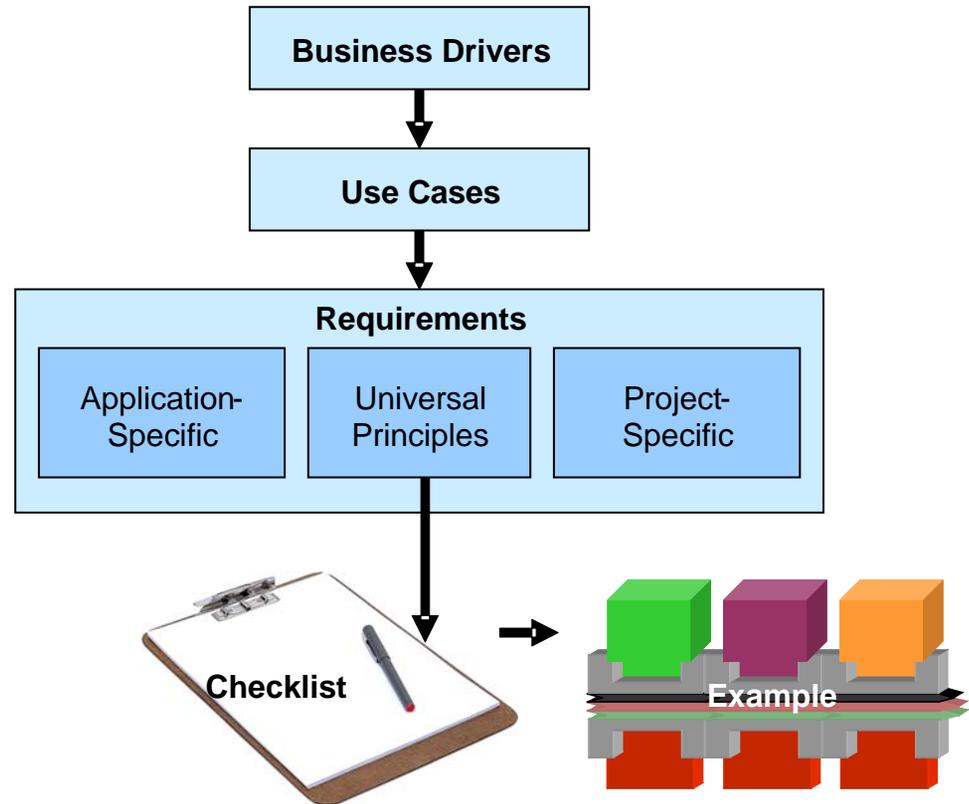
# Integration of Consumer Systems with Grid Operation



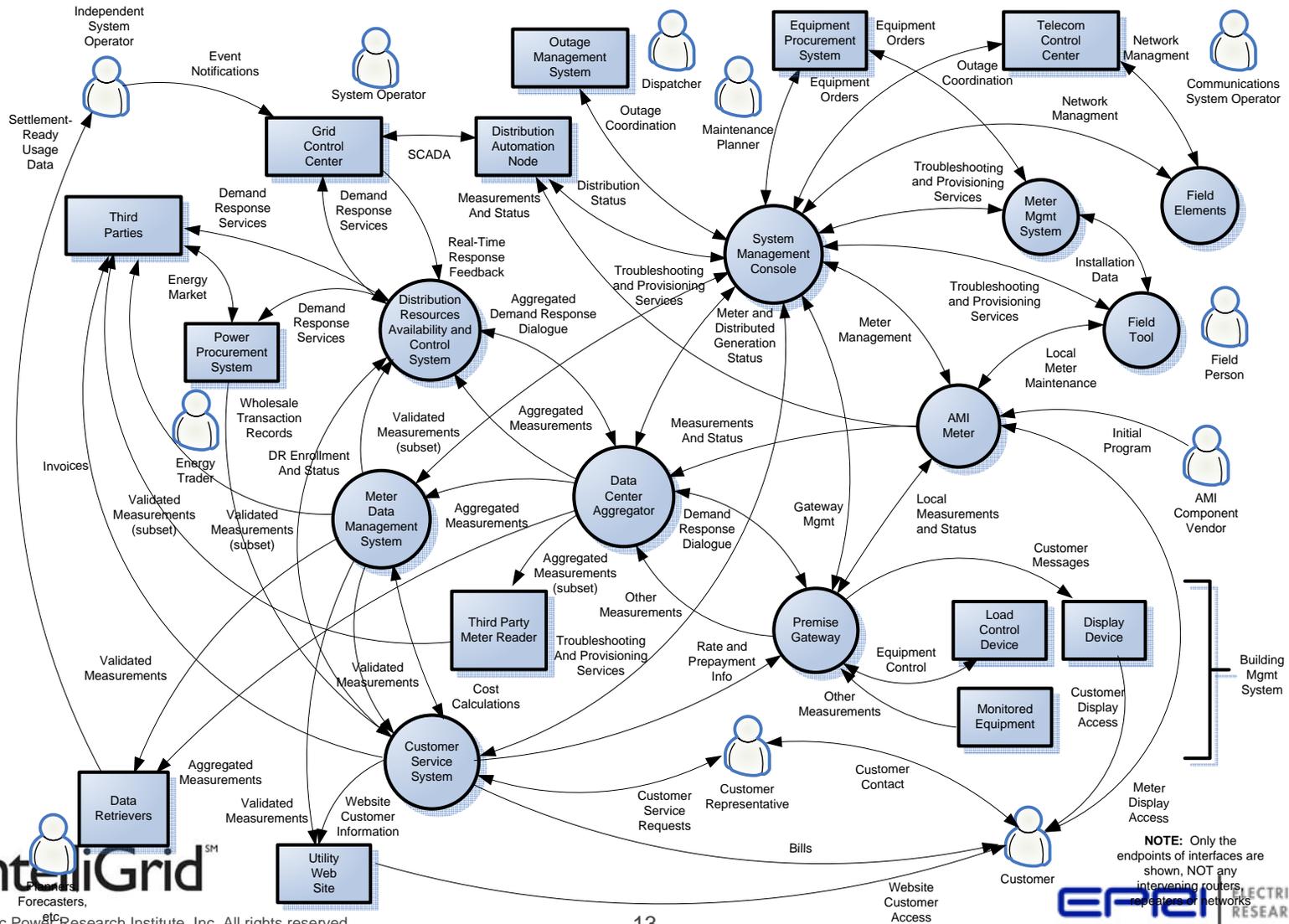
# Helping to control demand is one of the most important benefits for many systems



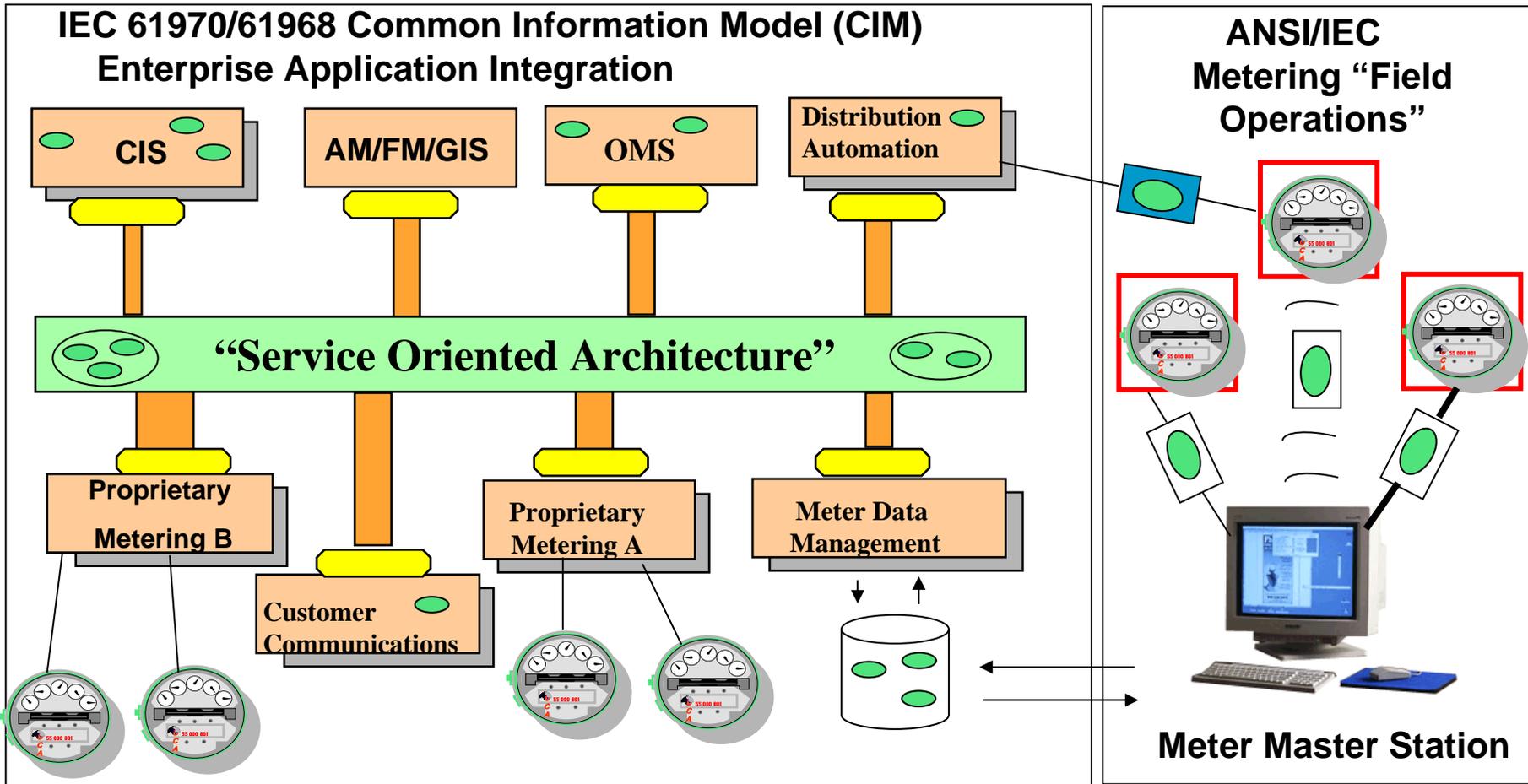
# Methodology for defining the requirements of an advanced metering infrastructure



# AMI Architecture Development- AMI Interactions



# Integrating Advanced Metering with Information Infrastructure



# Conclusions

- Many AMI applications
- Benefits to many different stakeholders
- Requirements development process is based on the applications
- Different versions of AMI may be appropriate in different situations
  - System characteristics
  - Customer characteristics
  - Load characteristics