MODERN GRID
STRATEGY

Mid-America Regulatory Conference

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Office of Electricity
Delivery and Energy
Reliability

Agenda

- **Smart Grid Vision**
- **What's the Value Proposition?**
- **Some Challenges and Risks**
- **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
- Promote testing of integrated suites of technologies
- Communicate concepts to assist interested stakeholders

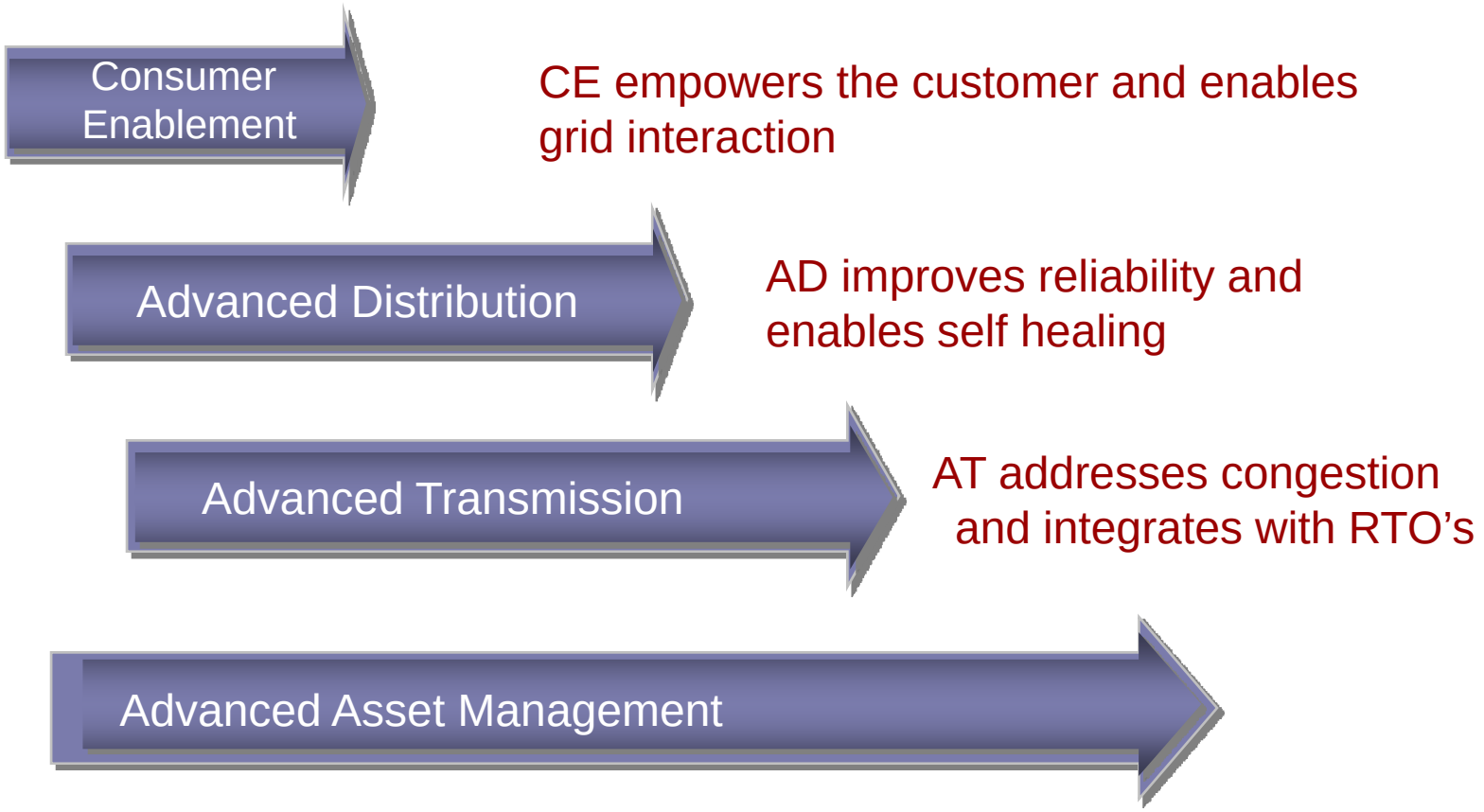
MGS is an "Independent Broker" for the Smart Grid

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

What is the right sequence?



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What's the Value Proposition?

Who are the Beneficiaries?

- **Utilities (What's in it for my shareholders?)**
- **Consumers (What's in it for me?)**
- **Society (What's in it for us?)**

We get what we reward!

Utility Value Proposition

Opportunities

- **Rate of return**
- **Operational Benefits**
- **Improved Customer Satisfaction**

Cost

- **Risk of cost recovery**

Utilities are the engine for investment in Smart Grid

Consumer Value Proposition

Opportunities

- **More reliable service**
- **Lower bills**
- **Transportation cost savings**
- **Information, control, options**
- **Sell resources into the market**

Cost

- **“Consumer always pays”**

Is this compelling?

Societal Value Proposition

Opportunities

- **Downward pressure on electricity prices**
- **Improved reliability reducing consumer losses**
- **Increased grid robustness improving grid security**
- **Reduced emissions**
- **New jobs and growth in GDP**
- **Opportunity to revolutionize the transportation sector**

Cost

- **No incremental cost?**

Does the societal value proposition make it compelling?

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Some Challenges & Risks

Change Management

A significant change management effort is needed:

- Why do we need to change?
- What is the vision?
- Who's in charge?
- What is the value proposition?
- 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".

Technical

- **Interoperability and scalability**
- **Large number of consumers actively involved**
- **Decentralized operations with 2-way power flow**
- **Getting the communications right**
- **“Future proofing” the technologies**
- **Cyber Security**
- **Conversion of data to information to action**
- **Market driven**

Where will the skilled resources come from?

Regulatory

- ***Time based rates –*** incentives for consumers to become actively involved
- ***Clear cost recovery policies –*** uncertain cost recovery increases investment risk
- ***Policy changes that provide incentives and remove disincentives to utilities –*** investment in a Smart Grid should make business sense
- ***Societal benefits –*** quantified and included in business cases
- ***Increased PUC workload –*** impact on Smart Grid implementation

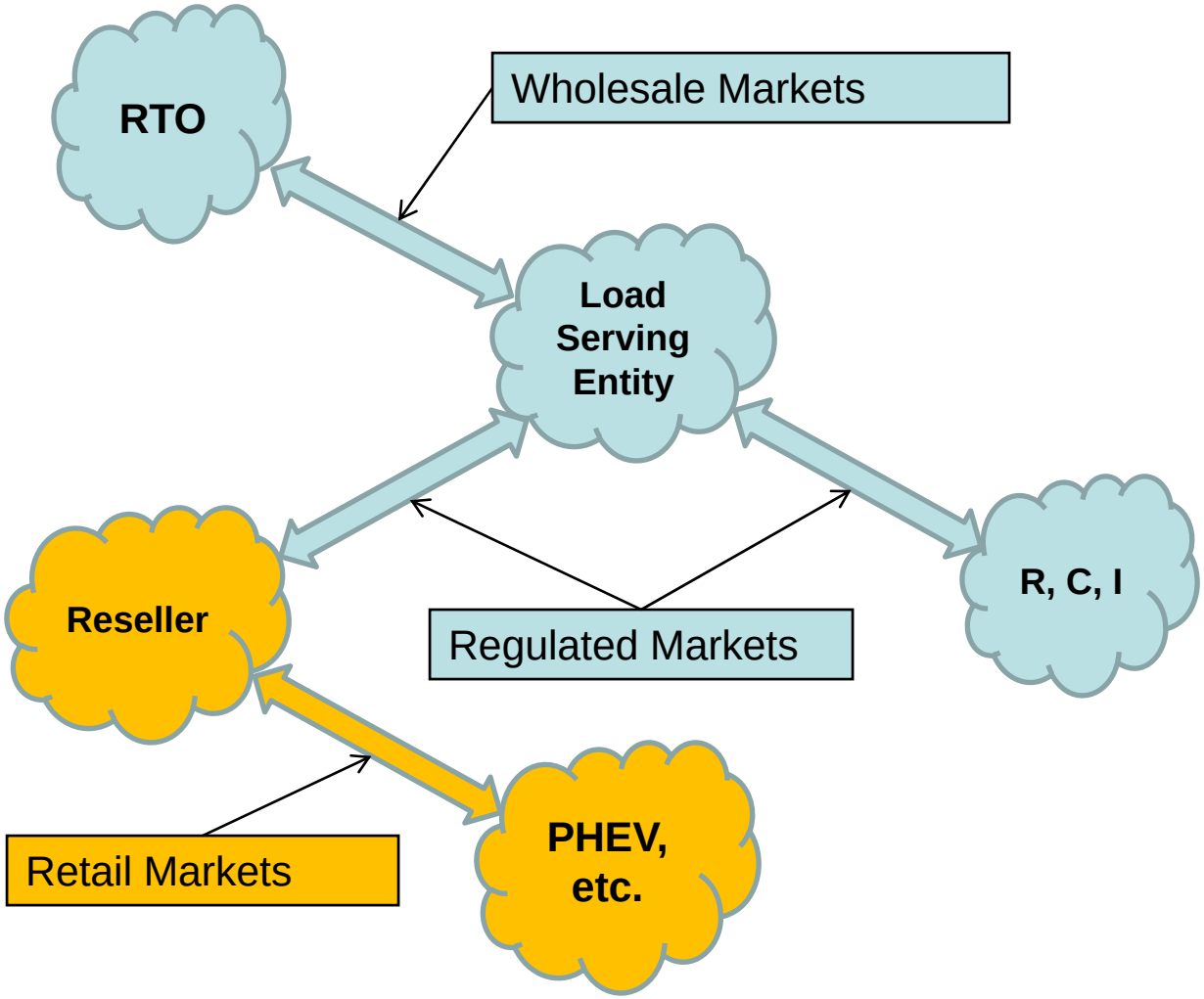
Move at the "speed of regulation"

Regulatory

- **Consistency among state PUC's**
- **Potential cost of "Cap and Trade"**
- **Future proofing vs. stranded assets**
- **Consumer privacy concerns**
- **Integrated Resource Plans**
- **Least cost**
- **Used and useful**
- **New operating and market models**

Enable movement at the "speed of value"

What some are thinking



Some Potential Risks

- **PHEV's without a price signal**
- **AMI deployments without interoperability and cyber security standards in place**
- **Integrated communications platform without clear understanding of future requirements**
- **Deep deployment of interconnected Distributed Energy Resources without advanced distribution management systems**

Longer term planning – keeping "the end in mind"

For More Information

- The Modern Grid Strategy
- Smart Grid Newsletter
- EPRI Intelligrid
- Galvin Electricity Initiative
- GridWise Alliance
- GridWise Architecture Council
- European SmartGrid Technology Platform


Office of Electricity Delivery and Energy Reliability

Plugging America into the Future of Power

A Vision for the Smart Grid

A Vision for the Smart Grid

What is the Smart Grid?

Introduction

Many people are asking, "What is the Smart Grid?" Many more are trying to define it with short "sound bite" descriptions. These short statements cannot adequately convey the level of detail needed to provide a clear understanding. The Smart Grid isn't a "thing" but rather a "vision" and to be complete, that vision must be expressed from various perspectives - its values, its characteristics, and the milestones for achieving it.

Smart Grid Values

The transformation to the Smart Grid will require new investment and commitment by its many stakeholders. These stakeholders expect significant value in return. Understanding how this value will be created is an important step in defining the vision. Expectations for the Smart Grid are great and will be realized through advances in each of the six value areas described below:

It must be more reliable. A reliable grid provides power, when and where its users need it and of the quality they value.

It must be more secure. A secure grid withstands physical and cyber attacks without suffering massive blackouts or exorbitant recovery cost. It is also less vulnerable to natural disasters and recovers quickly.

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

It must be more efficient. An efficient grid employs strategies that lead to cost control, minimal transmission and distribution losses, efficient power production, and optimal asset utilization while providing consumers options for managing their energy usage.

It must be more environmentally friendly. An environmentally friendly grid reduces environmental impacts through improvements in efficiency and by enabling the integration of a larger percentage of intermittent resources than could otherwise be reliably supported.

It must be safer. A safe grid does no harm to the public or to grid workers and is sensitive to users who depend on it as a medical necessity.

Smart Grid Principal Characteristics

The Smart Grid can be considered a "transactive" agent. That is, it will enable financial, informational, as well as "electrical" transactions among consumers, grid assets, and other authorized users. Its functionality is defined by the following seven principal characteristics:

First, it will enable active participation by consumers. The smart grid will give consumers information, control, and options that enable them to engage in new "electricity markets." Grid operators will treat willing consumers as resources in the day-to-day operation of the grid. Well-informed consumers will modify consumption based on the balancing of their demands and resources with the electric system's capability to meet those demands.

Second, it will accommodate all generation and storage options. It will seamlessly integrate all types and sizes of electrical generation and storage systems using simplified interconnection processes and universal interoperability standards to support a "plug-and-play" level of convenience. Large central power plants including environmentally friendly sources, such as wind and solar farms and advanced ancient plants, will continue to play a major role even as large numbers of smaller distributed resources, including Plug-in Electric Vehicles, are deployed.

Third, it will enable new products, services, and markets. The Smart Grid will link buyers and sellers together – from the consumer to the Regional Transmission Organization. It will support the creation of new electricity markets from the home energy management system at the consumer's premise to technologies that allow consumers and third parties to bid their energy resources into the electricity market. The Smart Grid will support consistent market operation across regions.

http://www.oe.energy.gov/

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Questions?

Contact Information

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Back Up Slides

Why Modernize the Grid?

- Demand is going up
- Prices going up
- Unreliability is costing consumers billions of dollars
- Today's grid is vulnerable to attack and natural disaster
- An extended loss of today's grid could be catastrophic to our security, economy, and quality of life
- The benefits of a modernized grid are substantial

Running today's digital society through yesterday's grid is like running the Internet through an old telephone switchboard.

Reid Detchon, Energy Future Coalition

Other considerations

- **Jobs and the economic downturn**
- **U.S. dependence on foreign energy sources**
- **Climate change**
- **National security**
- **50 coal plants canceled / delayed since January 2007**
- **Impact of electric vehicles**

Value Proposition

Cost to Modernize

- **$165B over 20 years**
  - $127B for Distribution
  - $38B for Transmission
- **~$8.3B per year (incremental to business-as-usual)**
- **Current annual investment - $18B**

Benefit of Modernization

- **$638B - $802B over 20 years**
- **Overall benefit to cost ratio is 4:1 to 5:1**

(Source: EPRI, 2004)

Thus, based on the underlying assumptions, this comparison shows that the benefits of the envisioned Future Power Delivery System significantly outweigh the costs. (EPRI, 2004)

Consumer Enablement Solutions

- **Smart Meters & 2–way communications**
- **Consumer Portal / Home area network**
- **Meter Data Management**
- **Time of Use Rates**
- **Customer Information System**
- **IT upgrades**
- **Customer Education**
- **Demand Response and DER**

CE empowers the customer and supports grid operations

Advanced Distribution Solutions

- **Smart sensors and control devices**
- **Distribution Management System**
- **Advanced Outage Management**
- **Distribution Automation**
- **Geographic Information System (GIS)**
- **DER and Micro-grid operations**
- **Advanced protection and control**

Advanced Distribution enables “Self Healing”

Advanced Transmission Solutions

- **Substation Automation**
- **Advanced regional operating applications (RTO)**
- **Wide Area Measurement System (WAMS)**
- **Advance materials and power electronics**
- **Hi-speed information processing**
- **Modeling, simulation, and visualization tools**
- **Advanced digital protection**

Deeply integrated with CE, AD, and AAM – AT optimizes transmission operations

Advanced Asset Management Solutions

- **Advanced sensors**
  - System Parameters
  - Asset “health”
- **Integration of grid intelligence with other processes:**
  - Operations to optimize asset utilization
  - T&D planning
  - Condition-based maintenance
  - Engineering, design, and construction
  - Work and resource management
  - Customer service

Integration of CD, AD, and AT with asset management processes will dramatically improve grid operations and efficiency

The "Big Picture"