This Isn't Your Father's Utility Anymore

ElectriCities Conference

Reynolds Plantation, Georgia

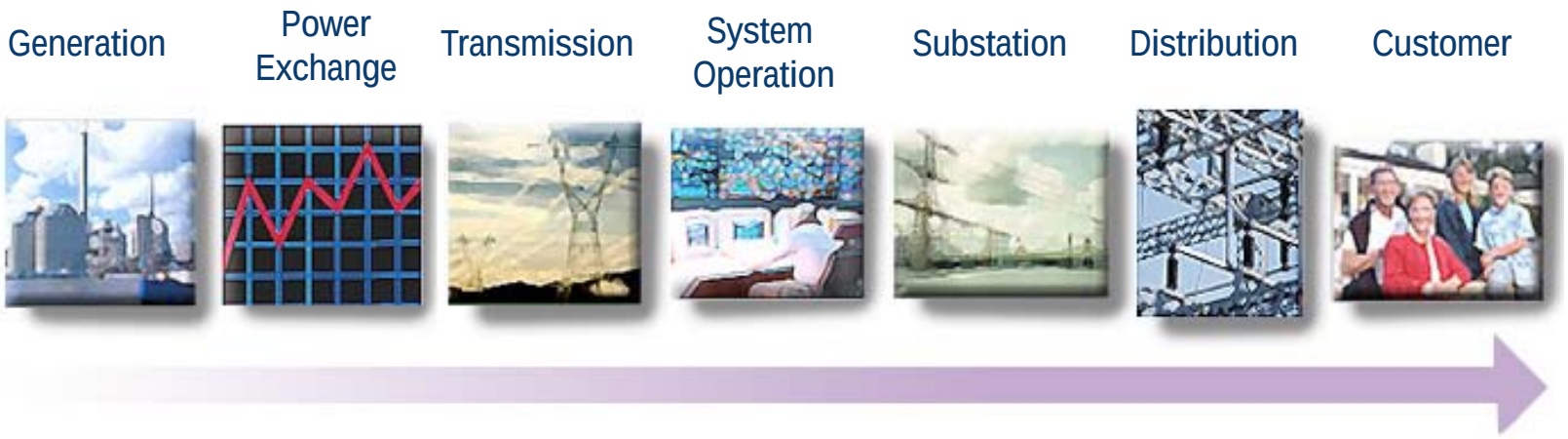
March 2010

Agenda

1. Introduction and Overview
2. The Changing Utility Paradigm
3. Smart Grid Innovation
4. Distributed Generation Innovation
5. Advanced Storage Innovation
6. The Changing Customer
7. Impact to the Energy Value Chain

1. Introduction and Overview

KEMA's services span all aspects of the energy value chain

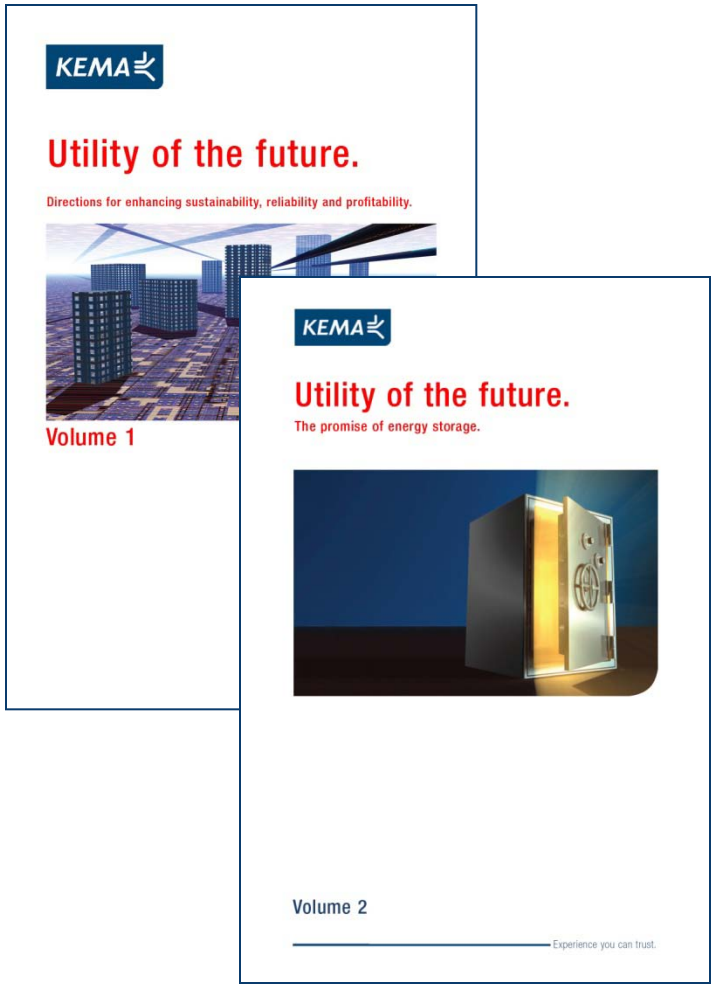


From the Generator to the Consumer
Serving The Diverse Needs of the Energy Marketplace

Strategy, Operations, Energy Technology

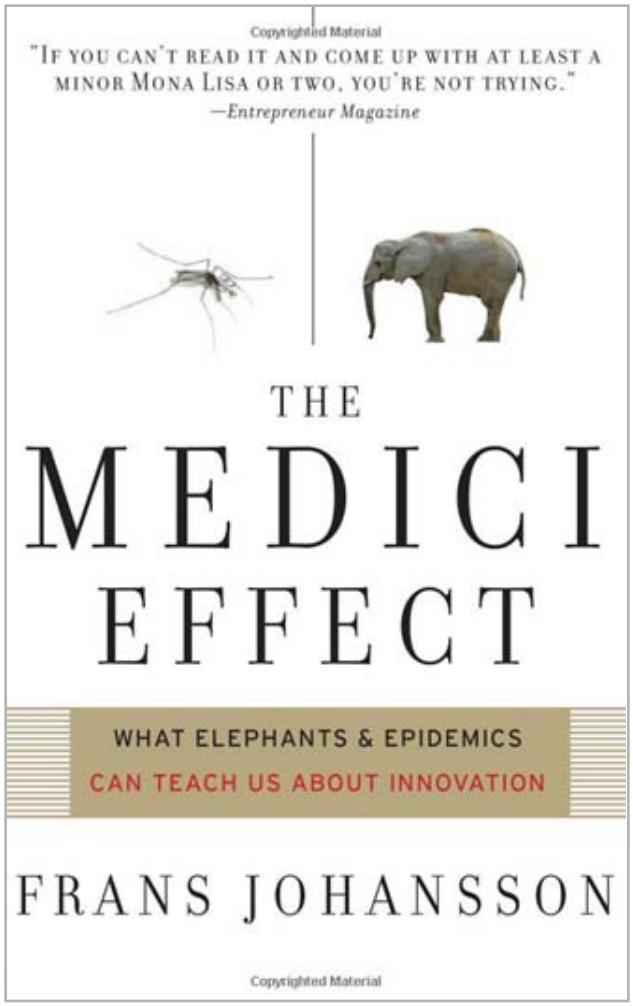
- World-Renowned Engineering, Consulting, and Testing
- Independent Advice, Expertise, and Evaluation
- Established in 1927
- Annual Revenues of $300 Million
- 1,900 Professionals in more than 20 Countries

KEMA has released the first comprehensive industry viewpoint on the "Utility of the Future"



- **2010 – "The Promise of Energy Storage"**
- **2009 – "Utility of the Future: Directions for enhancing sustainability, reliability and profitability"**
  - First of a series of publications in helping utilities achieve their smart grid goals
  - Volume 1 is an outgrowth of strategy work performed by KEMA for major utilities and other key energy industry suppliers
  - Outlines a vision of the "Utility of the Future" that is organized and managed much more like high-tech product and service companies, operating in a multi-player ecology of businesses with shifting roles

Defining Innovation



- Frans Johansson argues that *innovations* occur when people see beyond their expertise and approach situations actively, with an eye toward putting available materials together in new combinations.
- Think of *innovation* as the intersection (a.k.a., collaboration) of different disciplines to develop new services or solutions.
- For example, think of all the *innovations* that are created when we work together to solve problems.

The Power of Integration and Innovation [I^2]

Integration

+ Innovation

= Value Added Solutions

- The I^2 approach enables:
  - Consistent approach to issue(s) resolution that draws upon accumulated wisdom and experience of the entire utility.
  - Increased synergy, productivity and quality in service.
  - Enhanced solutions that leverage the utility's skills and expertise.

2. The Changing Utility Paradigm

Past and Future

- For decades utilities have responded to their customers' need for more energy
- However, there are now emerging factors that have changed the paradigm, such as:
  - Clean air and Carbon management
  - Energy independence
  - Oil and related fuel prices setting new highs
  - More electronics in our homes and offices
  - The economy

How Our Industry is Adapting

- Smart Grid:
  - AMI
  - Smart switches and line devises
  - Storage
  - OMS, DMS and CIS
  - Energy efficiency and demand response
  - Transmission phasor measurement units
- Distributed Generation:
  - Renewables
- Advanced Storage
- The Changing Customer

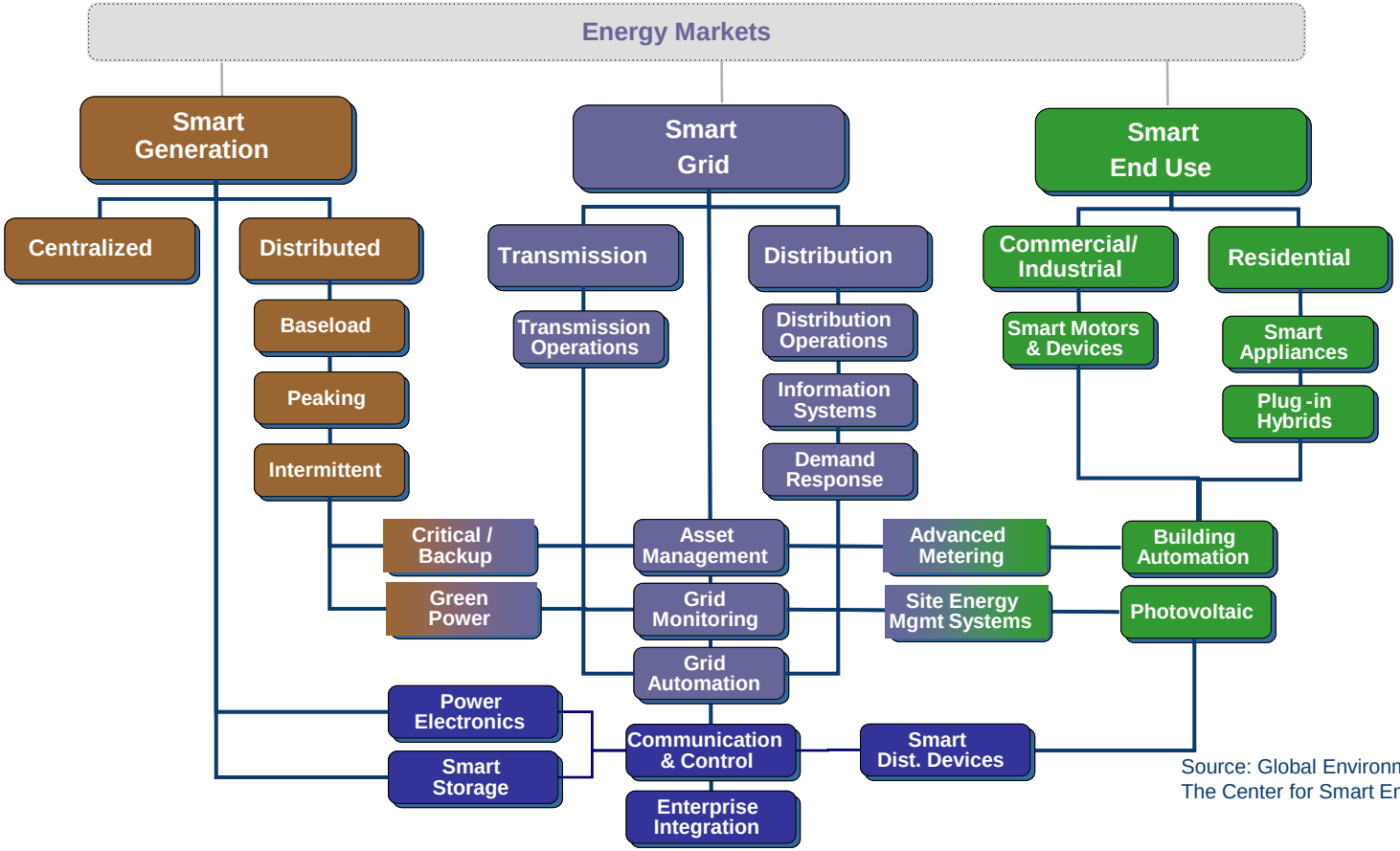
3. Smart Grid Innovation

The Smart Grid movement is well underway

- Select Smart Energy Initiatives in North America:
  - Department of Energy (DoE) Modern Grid Initiative
  - DoE Electricity Advisory Committee & Task Force
  - GridWise Alliance
  - GridWise Architecture Council
  - Demonstration projects via key national labs (e.g., Pacific Northwest)
  - Numerous utility programs – one has now filed for full deployment in two jurisdictions
- Energy Independence & Security Act of 2007 – Signed Dec.19, 2007:
  - Title XIII: Smart Grid Provisions - *It is now U.S. policy to support the modernization of the electric transmission and distribution system to maintain reliability and infrastructure protection*
  - Smart Grid Technology Research, Development and Demonstration – including matching funds
  - State Consideration of Smart Grid – encourages regulatory reviews beyond just AMI
  - Smart Grid System Report – July 2009
- American Recovery and Reinvestment Act – Signed Feb. 17, 2009:
  - Electricity Delivery & Energy Reliability (Smart Grid) - $4.5 Billion for Federal matching grants (up to 50%) and demonstration project funding
  - Energy Efficiency – $16.8 Billion for block grants to states to promote energy conservation and energy programs
  - Tax Incentives – 50% special depreciation allowance for utility property through 2009 and 30% investment tax credits for smart grid technology manufacturers

U.S. DEPARTMENT OF ENERGY | NETL MODERN GRID INITIATIVE | GRIDWISE ALLIANCE | GRIDWISE Architecture Council | KEMA

The Smart Grid concept has no clear universal definition, particularly as the boundaries vary among individual users

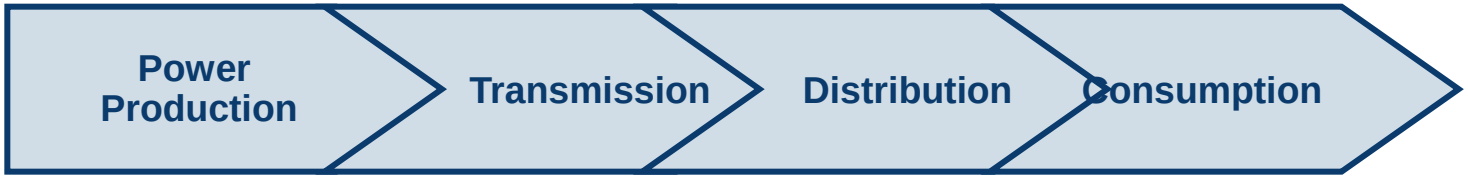


Source: Global Environment Fund and The Center for Smart Energy

Irrespective of the scope of these individual elements, a robust view of UoF should include the influences of both producers and consumers

Smart grid technologies are potentially disruptive to the traditional utility value chain, particularly for consumers

Traditional Utility Value Chain



Leading Smart Grid Considerations

Power Production	Transmission	Distribution	Consumption
• Distributed generation and energy systems • Distributed energy storage / renewable energy • Conservation voltage reduction	• Synchronized Phasor Measurement Units (PMUs) • Flexible AC Transmission • High Voltage DC • Substation energy storage	• Advanced Metering Infrastructure (AMI) • Line fault sensors • Automated reclosers • Automated Volt / VAR control • Automated voltage regulators • Automated capacitor banks	• Home area networking • Autonomous DR • Smart appliances • Distributed generation • Integration of building controls • Plug-in Hybrid Electric Vehicles • Micro energy storage • Rooftop solar energy • Pre-payment systems • Time-based pricing • Third-party service providers (e.g., DR)

Smart Grid deployment will open a $100B market in smart technologies[1]

Degree of Disruption

Minimal — *Moderate* — *Large* — *Transformational*

Note 1: Department of Energy; The Reform Institute, "The Smart Alternative: Securing and Strengthening Our Nation's Vulnerable Electric Grid"

KEMA

4. Distributed Generation Innovation

Focusing on Generation

The Installed Base versus New Generation

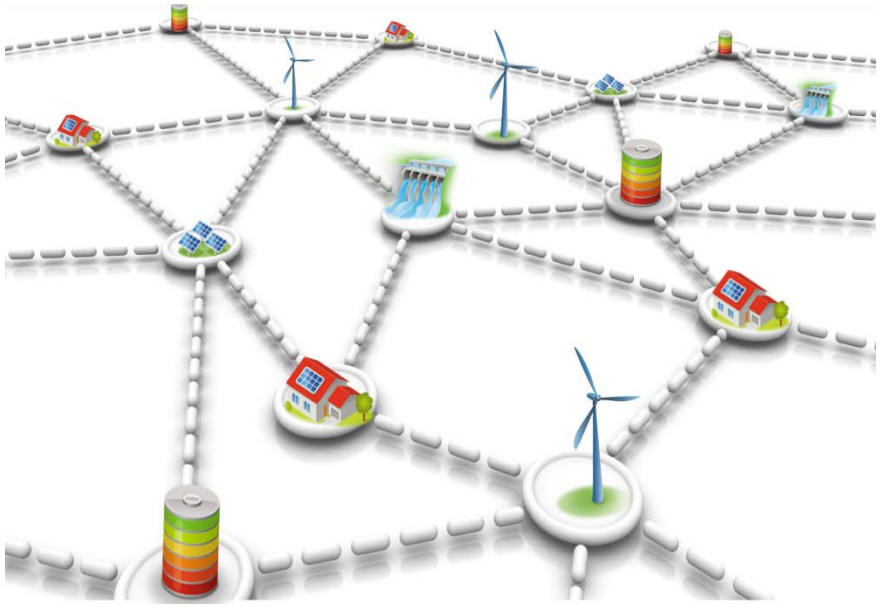
Current Installed Base

- Invest in operational flexibility – cycling,
- Address long-term fuel source – switch, co-fire, CC, hybrids
- Life extension, risk analysis
- Increase efficiency
- Improve Reliability
- Reduce Environmental Impact

New Generation Sources

- Indirect Energy – Combustion
  - IGCC, Biomass, Biofuels
- Direct Energy – Renewables
  - Solar PV, Thermal
  - Wind – On and Off Shore
- Direct Energy – Nuclear
- Electric Storage
- Distributed Generation

Distributed generation enabled by Smart Grid – energy networks need to be managed



- New DG is predominantly renewable based
- Grid coupling via controllable inverters
- Consumers have more control of their load
- New business models around Energy Network Management
- Aggregation and Control of DG

Sustainable generation business will “own” and ensure control of the load along with building, community, industrial and consumer distributed generation

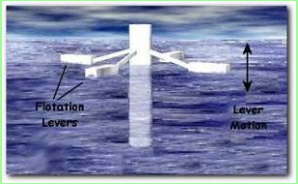
Comprehensive Renewable Energy Services Offering

Addressing All Needs

Wind & Solar

- Wind to Electricity
- Wind to Hydraulic Energy (Pump/Gen)
- Photo Voltaic (cryst/Thinfilm)
- Concentrating PV (CPV)
- Concentrated Solar Power (CSP)
- Dish Sterling Systems
- Solar Thermal (HW/HVAC)

Geo, Hydro



- Hydro generation
- Geo thermal
- Wave action
- Tidal Energy
- Nuclear

Gas, Waste & Biomass

- Waste to Energy
- Bio Fuels
- Biogas
- Biomass
- IGCC
- Co-firing with coal
- Torrification/ Pelletizing
- Algae farms

Storage

- Battery technologies
- SC Magnetic Energy
- Fly wheel
- Capacitors
- Compressed air
- Ice storage
- Pumped storage

5. Advanced Storage Innovation

Advanced storage, a “game changing” technology

- Advanced technologies are offering unique performance characteristics that differ from traditional options — may force a rethinking of how we operate our electricity grid

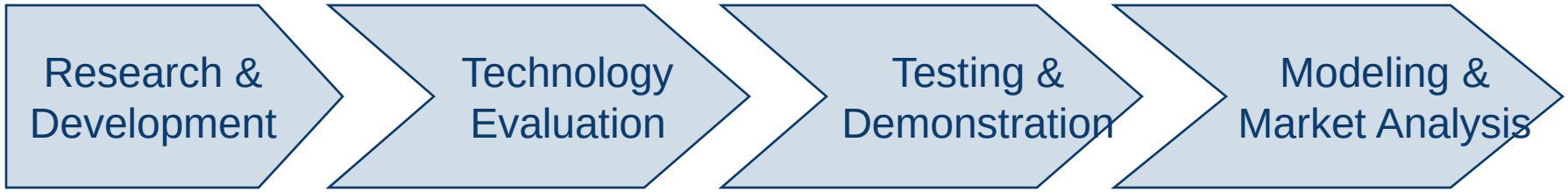
- Storage now breaks down into 3 categories:

  - Community Scale (Community Energy Storage):
    - 25-100kW devices sited on the low side of the distribution substation by utilities (e.g., demonstrations by AEP, DTE Energy, So Cal Edison)

  - Utility Scale – Emphasis on Renewables and Ancillary Services:
    - 250kW to 2 MW Modules — this is where “advanced technologies” reside

  - Bulk Storage:
    - 50 MW +
    - Pumped Hydro & CAES — above ground being demonstrated

Lessons are learned at each point in value chain

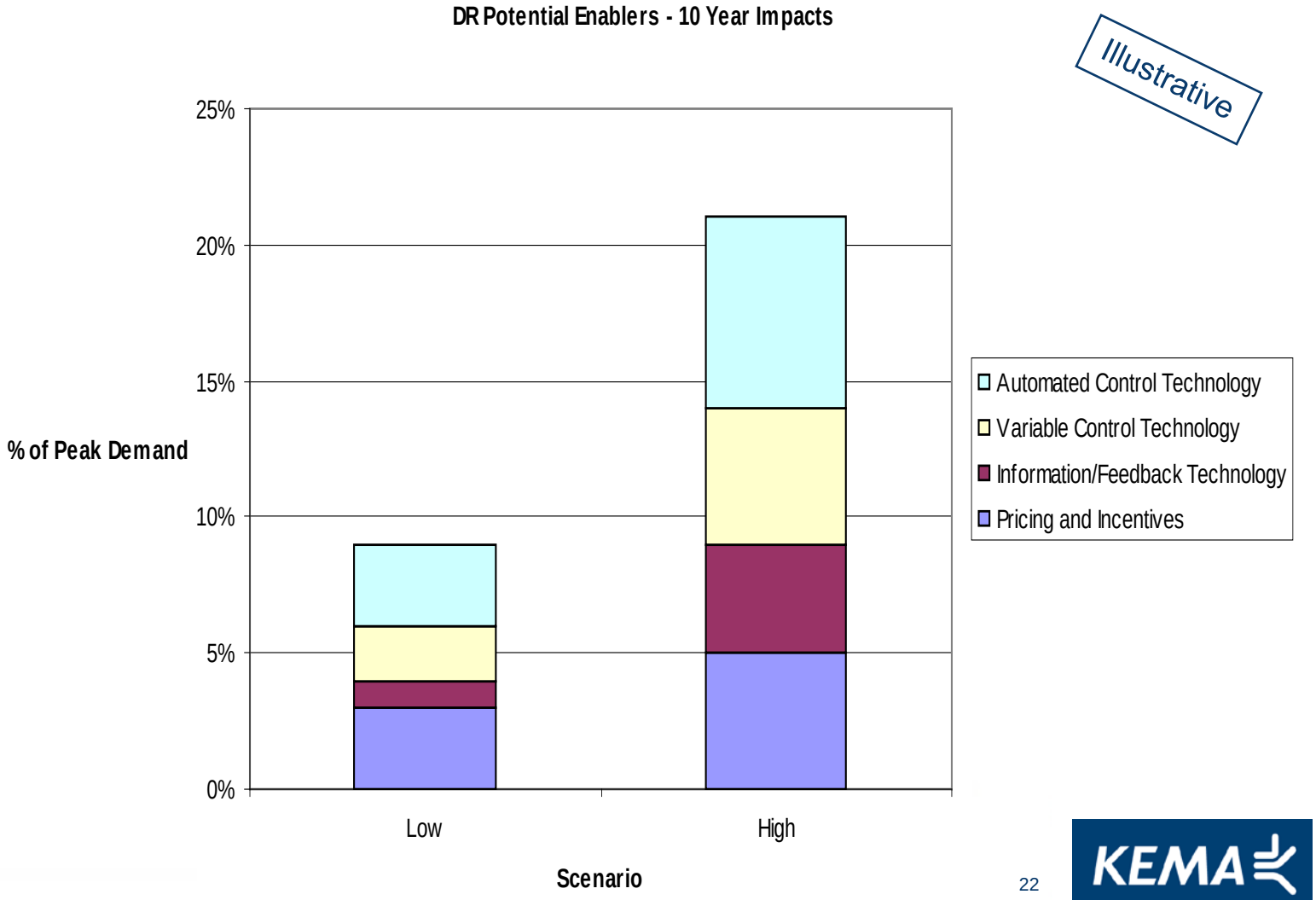


- Storage has a role in every part of the grid, but focus is in the following areas:
  - Integration of Renewables into Grid
  - Ancillary services
  - Electric Vehicles
  - Community Energy Storage – C&I Back-up Systems

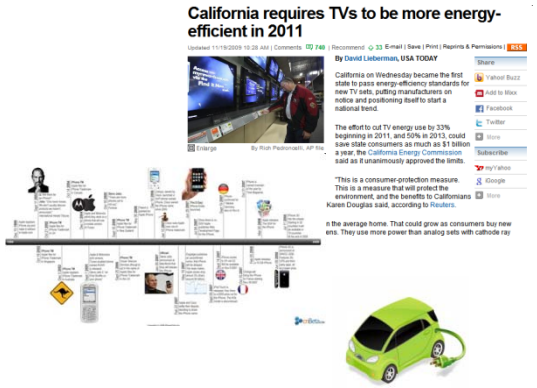
- In 2010, demonstrations will attempt to confirm performance and the value that energy storage applications can offer utilities

6. The Changing Customer

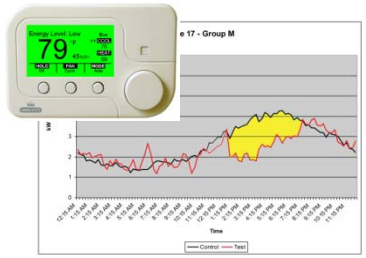
Key to unlocking the demand reduction potential of Smart Grid rests on *customer adoption of control technology*



The changing customer



- Customer-Side Technologies:
  - Adoption & Advancement of CSTs (e.g., Ref, TVs)
  - The Hand-Held Everything (e.g., iPhone)
  - Home Area Network / Building Automation
  - Electric Vehicles
  - Distributed Generation / Community Energy Storage
  - The Virtual Power Plant (technology coupled with communications)
- Social Changes:
  - Environmental Concerns “Pulls” Policy (e.g., Wal-Mart)
  - Policy & Regulatory Drive Customers (e.g., TOU as Default)
  - Household Composition
  - Telecommuting / Urban – Rural Shifts
  - Media Outreach
- Customer Behavior:
  - Economic Drivers
  - General Motivations and Barriers
  - Customer Care Experience
  - Micro Segmentation



The changing customer (continued)

7. Impact to the Energy Value Chain

Core utility functions impacted by Smart Grid

- Customer Contact
- Credit and Collections
- Billing
- System Operations
- Engineering & system planning
- Line maintenance and construction
- Substation maintenance & operations
- System protection & communications
- Generation operations

There are other supportive functions impacted, Supply Chain & HR

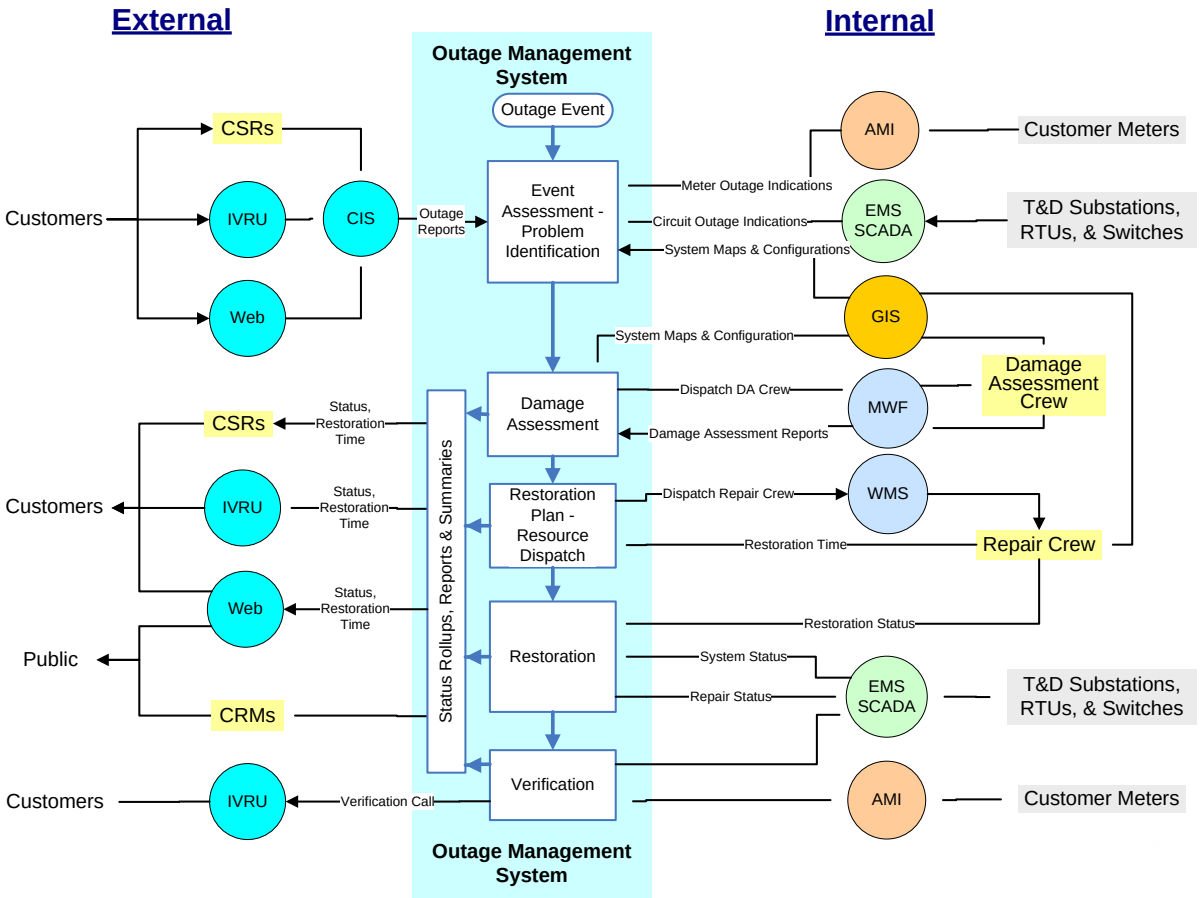
Smart Grid Impact — Customer Contact

- Customer service representative will have a host of information to analyze customer's issues before the customer calls
  - Identify service problems
    - Which side of the meter
    - Identify service drop issues
    - Loss of service
  - Billing and consumption issues
    - High bill complaints
    - Pro actively recommend energy savings options
    - Theft of service
  - Service Requests
    - Turn on/off for move-in or move-out
    - Aggregate meter readings

The time may come when in bound call centers convert to out bound

Smart Grid Impact — Customer Contact

Information systems — Leading practice



Smart Grid Impact — Credit & Collections

- Credit & collections representative will have a host of information to analyze customer's issues and the ability to:
  - Shut off remotely for non-pay
  - Offer pay as you go
  - Analyze a customer's use to support energy reduction
  - Limit the amount of energy used
  - Remotely turn on service

Will reduce the turn off / on cost significantly by eliminating the need for field crews / dispatching personnel to participate in this action — minimize customer gaming the collection process

Smart Grid Impact — Billing

- This may not reduce a significant amount of the processing cost, but will offer customers opportunities to better control their energy spend
  - Time of use rates
  - Real time pricing
  - Pay as you go
  - Proactively inform customers of:
    - Changes in energy pricing
    - Changes in consumption

Allow the tailoring of energy offerings to better match the needs of the individual customers-proving customer service

Smart Grid Impact — System Operations

- System operations will benefit from Smart Grid technology in the following ways:
  - Automatically switch power flows to compensate for line faults
  - Automate switching and tagging
  - May minimize after hours call outs
  - Allow line reconfiguration without loss of system configuration during major natural disasters
  - Permit self-healing depending on the state of the distribution system
  - Identify outage clusters once the backbone is returned
  - Identify secondary customers still out

This is one of the most controversial areas, but KEMA believes with the right processes safety will be even higher

Smart Grid Impact — Engineering & System Planning

- Engineering and system planning will be enhanced
  - Will have real time data on line and equipment loadings
  - Improved line balancing
  - Identify opportunities to reduce line losses
  - Identify opportunities to reinforce system
  - Support asset management

In the final analysis this could help to minimize CapEx expenditures

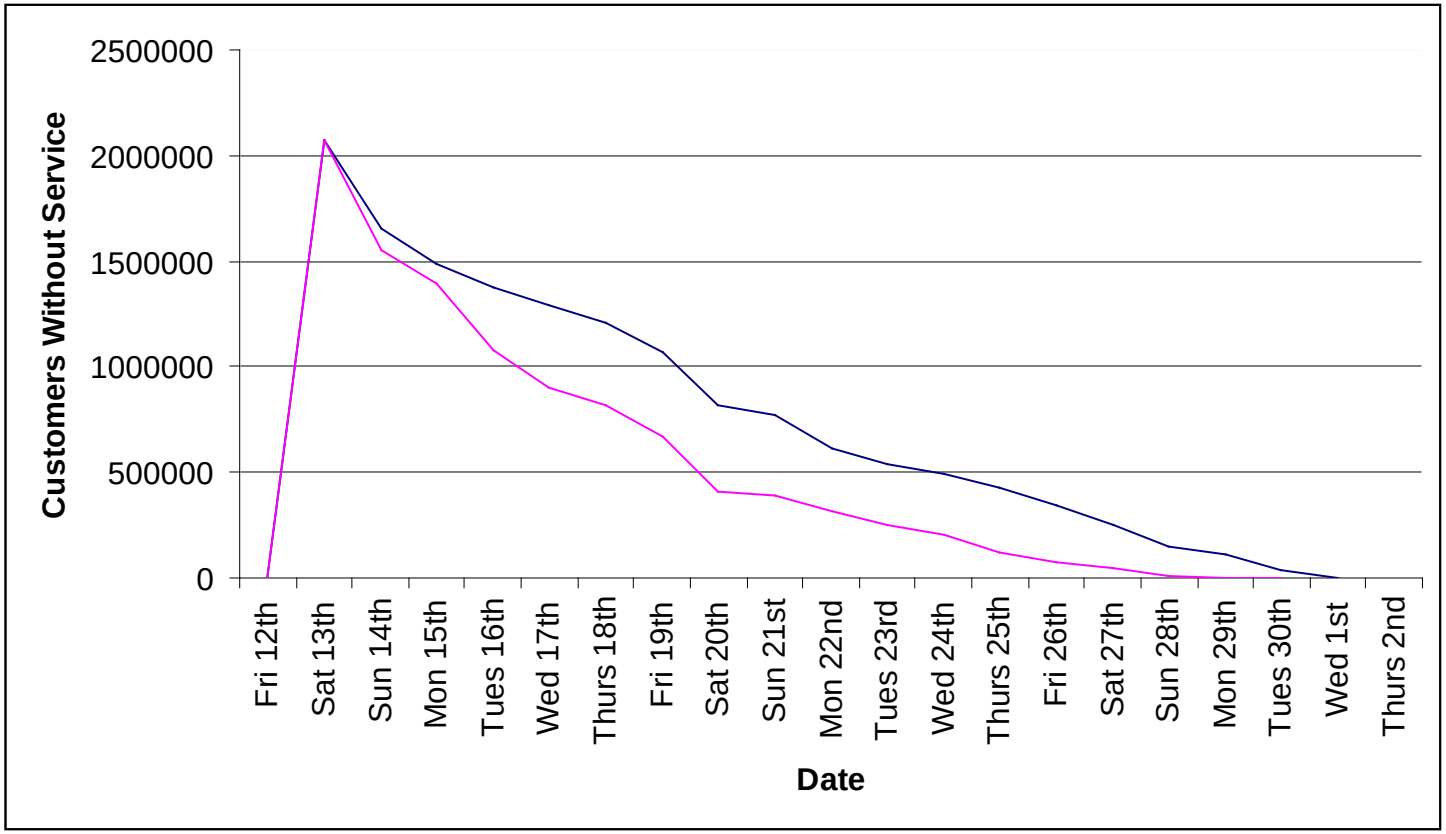
Smart Grid Impact — Line Maintenance and Construction

- Can reduce O&M costs and improve safety
  - Reduce the number of overtime calls
  - Automatically perform switching activities
  - Minimize the need to do turn –on/offs
  - Simplify switching & tagging procedures
  - Enhance line safety
  - Accelerate customer restoration

Offers significant opportunities to reduce costs and improve safety

Smart Grid Impact — Line Maintenance and Construction

Dynamic feeder switching – one event analyzed . . .



It is estimated that more customers would be returned more quickly had smart switches been installed. The red lines shows that the overall restoration could have been reduced by two days.

Smart Grid Impact — Substation Maintenance & Operations

- Can reduce O&M costs and improve safety
  - Optimize program maintenance
  - Condition based maintenance
  - Improve the repair / replace decision
  - Identify a more cost effective maintenance and inspection schedule

Offers significant opportunities to reduce costs and improve operations

Smart Grid Impact — System Protection & Communications

- Can reduce O&M costs and offer significant improvements in line protection
  - Reduce the windshield time
  - Provide additional line protection
  - Pinpoint fault locations and types
  - Eliminate the need to train techs in analog systems
  - Plug & Play

Offers significant opportunities to reduce costs and improve operations through advanced protection schemes

Smart Grid Impact — Generation Operations

- Change the form of generation
  - Create virtual plants
  - Use storage to provide continuity of service
  - Use storage to shave peak requirements
  - Improve load flows

Change the way we think about generation

Impact to the Utility Organization

Changes in customer understanding of and behavior around energy use & prices

Policies that 'nudge' or mandate time-based pricing & the use of enabling tech

Advances of storage technology and rules related to its capital deployment & use

Advances of electric transportation technology & impact on relative economics

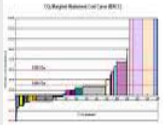
Supply / demand fundamentals and corresponding price levels & volatility

Federal / regional policies on wholesale market design, resource adeq. and trans.

Policies related to climate change & corresponding impact on rates

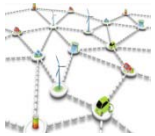
Policies related to renewable energy and its impact on rates & relative economics

Non- smart grid related costs that impact electric rates



Electric end use technology development

Policy maker views of regulated smart grid investments and non-rate base alternatives



Technology advances and the relative economics of distributed generation

Development of retail electricity competition and customer choice

New entrants, new stakeholders and breakthrough technologies

This isn’t your father’s utility anymore, but what will it be?

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