Discussion Outline

1. Goals and Characteristics of a Smart Grid
2. Narrowly Define Key Objectives
3. Distribution Reliability
4. Metering, Rates, Customer Choice
   a) Metering, Gateways
   b) Rates
   c) Demand Response
   d) Technology - PCD’s, display devices, embedded controls
5. Other Key Topics
   a) Interoperability
   b) Standards and Cybersecurity
   c) Smart Grid Pilots and Projects

Key Questions and Issues

What is your vision of the Smart Grid ?

- Which customer are you trying to serve ?
  - a) Utility ?
  - b) End-user (rate payer) ?
- What problems are you trying to solve ?
- How is the “Smart Grid” different from what already exists ?

  [focus on the “what” not the “how”]
- What don’t you know ?
- What do you need to know ?

Goals and Characteristics of a Smart Grid

1. Increased use of digital information and controls technologies to improve reliability, security and efficiency of the electric grid
2. Dynamic optimization of grid operations and resources, with full cyber security
3. Deployment and incorporation of distributed resources and generation, including renewable resources
4. Development and incorporation of demand response, demand-side resources, and energy efficiency resources
5. Deployment of "smart" technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation
6. Integration of "smart" appliances and consumer devices
7. Deployment and integration of advanced electricity storage and peak shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal storage air conditioning
8. Provision to consumers of time information and control options
9. Development of standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure service the grid
10. Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services. *

*Energy Independence and Security Act of 2007 (EISA), Section 1301.

Goals and Characteristics of a Smart Grid

Goals and Characteristics		Technical Translation			
		Communication	Data Models	Automation (sensors, controls)	Customer Choice
1	digital **information** and **controls**.. improve reliability, security and efficiency [**reliability**]	●	●	●	
2	**Dynamic optimization** of grid operations and resources [**cost**]	●		●	
3	**Distributed** ..generation, ..renewables [**carbon**]	●		●	
4	**demand** response, **demand-side** resources, and energy **efficiency** **[reliability , cost]**	●	●	●	●
5	"**smart**" technologies… **optimize** appliances and consumer devices… metering, communication and distribution automation [**reliability, cost**]	●	●	●	●
6	**Integration**… smart appliances and consumer devices [**reliability, cost**]	●	●	●	●
7	Deployment and **integration** …storage, peak shaving, plug-in vehicles, thermal storage air conditioning [**reliability, carbon, cost**]	●	●	●	
8	Provision to consumers of **time information** and control options [**reliability, efficiency, cost**]	●			●
9	**standards** for communication and interoperability [**reliability, cost**]	●	●	●	●
10	lowering …**barriers to adoption** **[business model]**			●	●

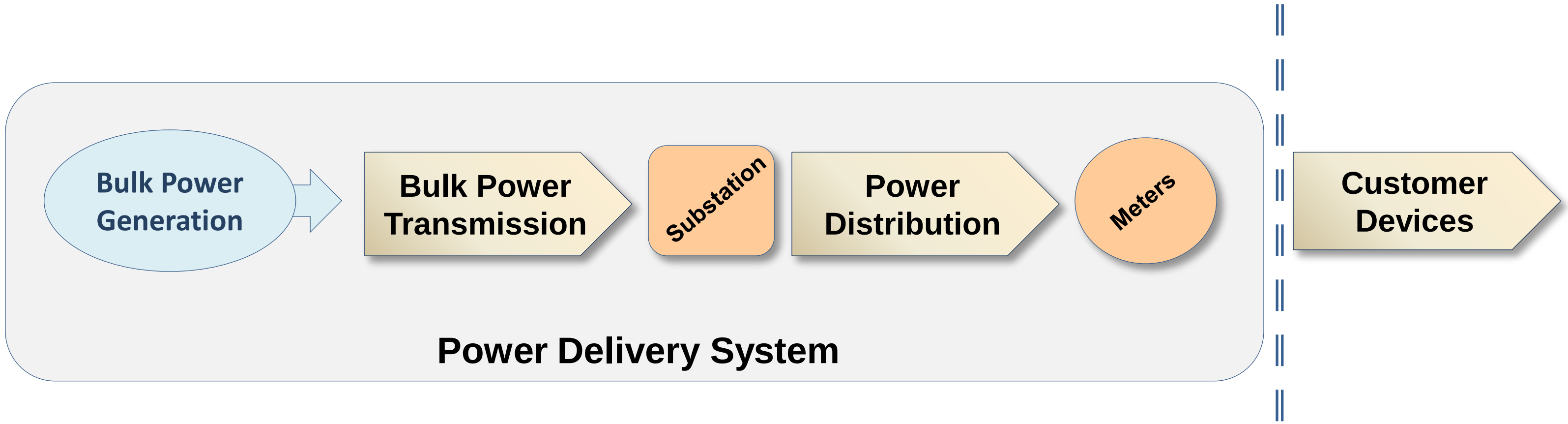
What is the Smart Grid ?

One Definition

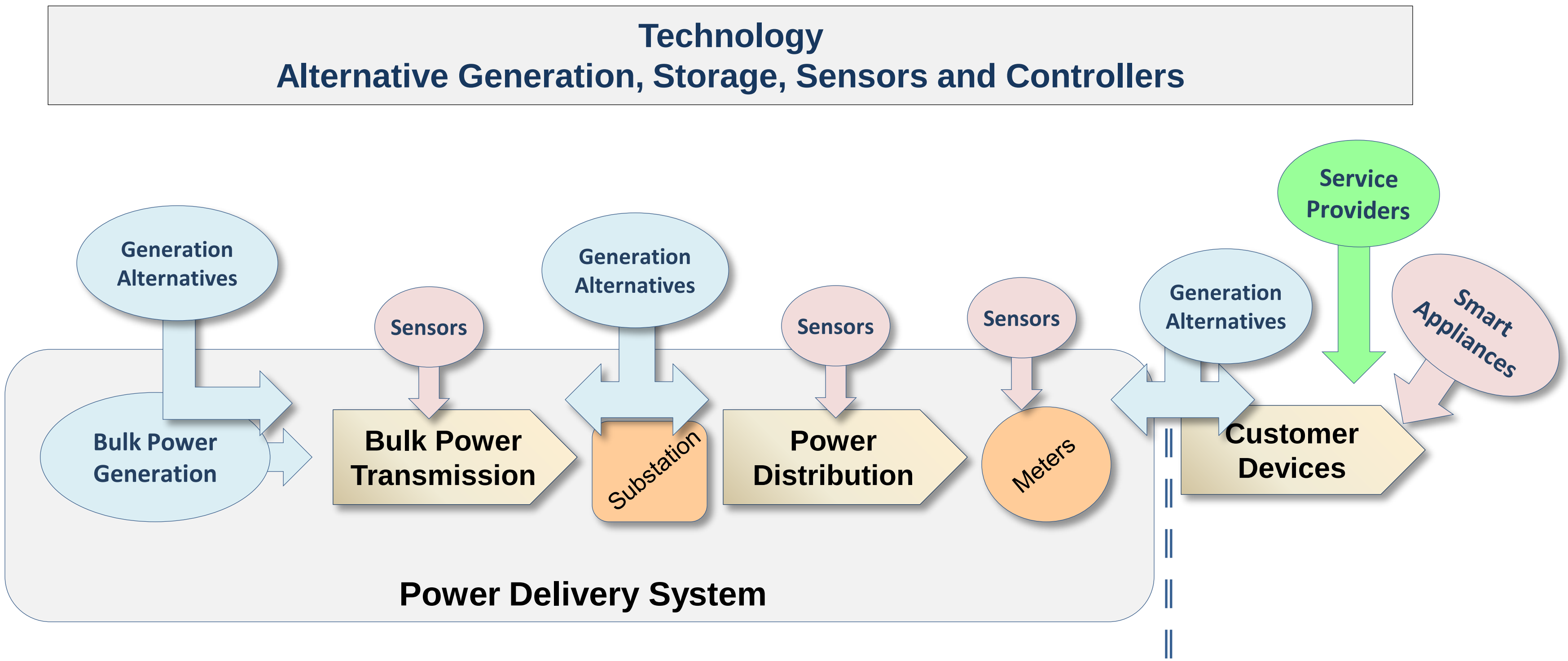
The Smart Grid is an interconnected system of information and communication technologies and electricity generation, transmission, distribution and end use technologies which will :

Promote Customer Choice	[1] **enable consumers** to manage their usage and chose the most economically efficient offering, while
Improve Reliability	[2] maintain delivery system **reliability and stability** enhanced by **automation** and
Integrate Renewables	[3] utilize the most **environmentally gentle** generation **alternatives** including renewable generation and energy storage.

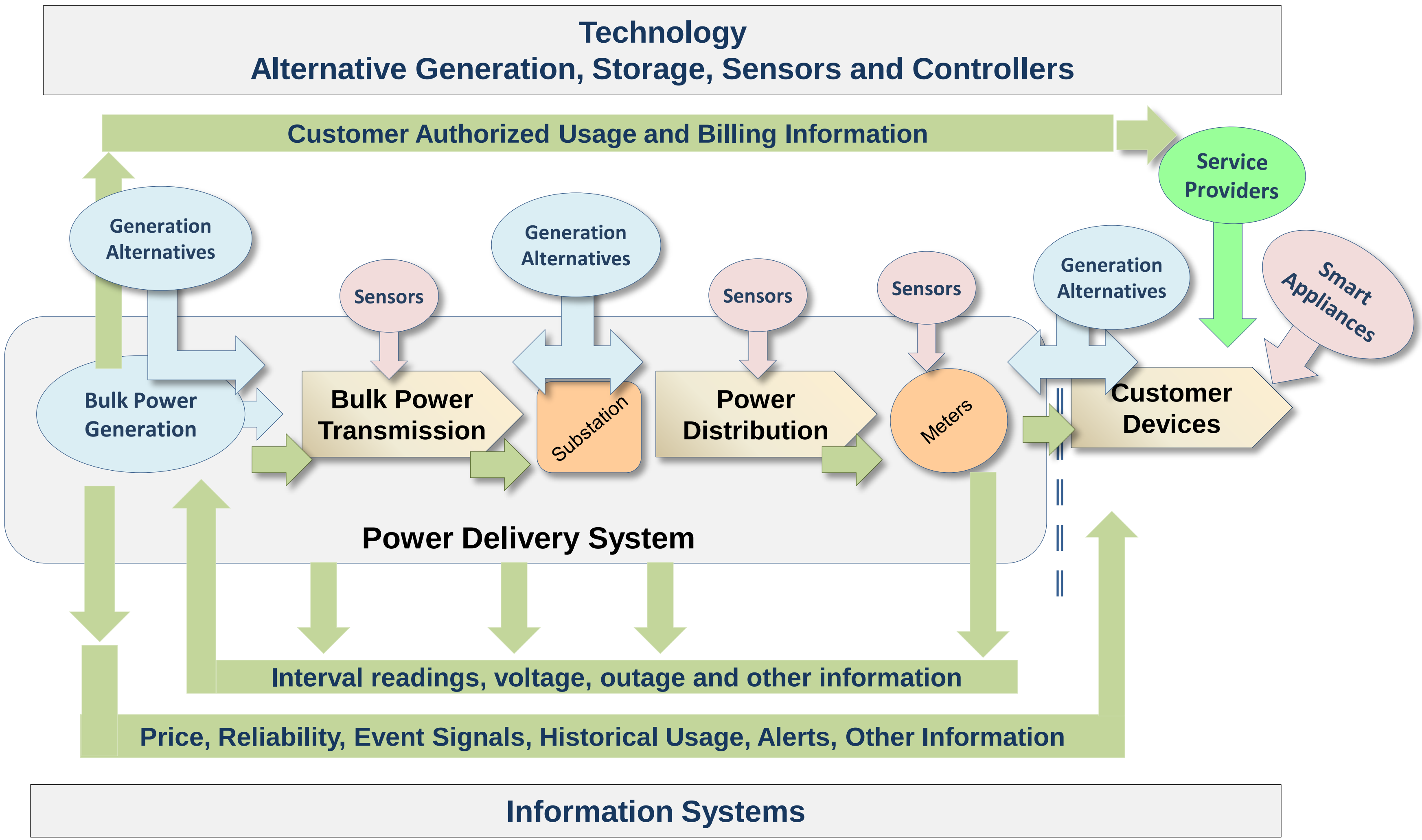
What is the Smart Grid ?



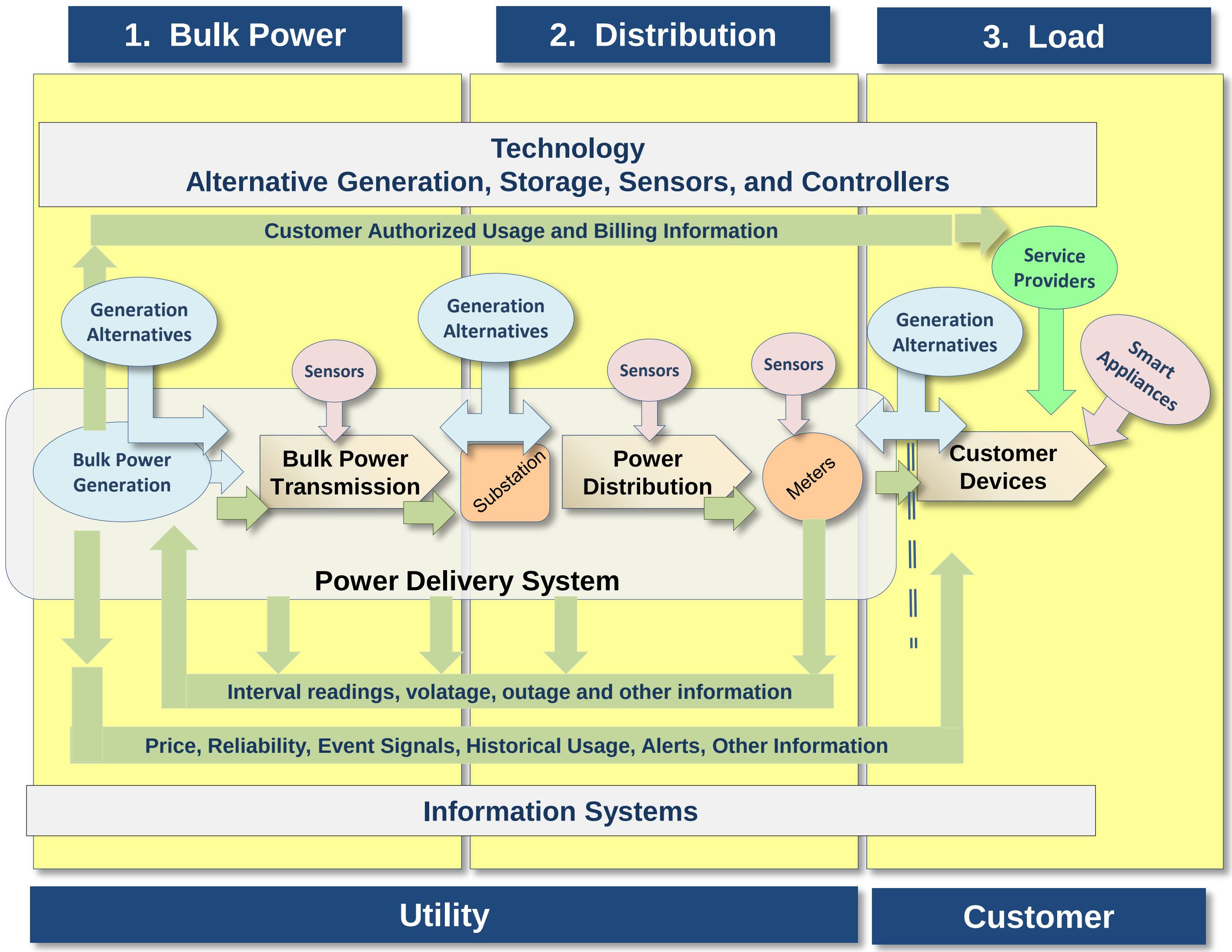
What is the Smart Grid ?



What is the Smart Grid ?



What is the Smart Grid ?



What is the Smart Grid ?

Key Objectives

	Utility		Customer
	1. Bulk Power	**2. Distribution**	**3. Load**
Promote Customer Choice	Not Relevant	Not Relevant	❑ Metering ❑ Rates & Incentives ❑ Technology
Improve Reliability & Efficiency	❑ NERC Defines Reliability ❑ Technology – [synchrophasors]	❑ Define Reliability ❑ Clarify Objectives ❑ Technology ❑ SCADA, sensors	❑ Rates & Incentives ❑ Technology
Integrate Renewables	❑ Technology ❑ Carbon Legislation	❑ Technology ❑ Carbon Legislation	❑ Metering ❑ Rates & Incentives ❑ Technology

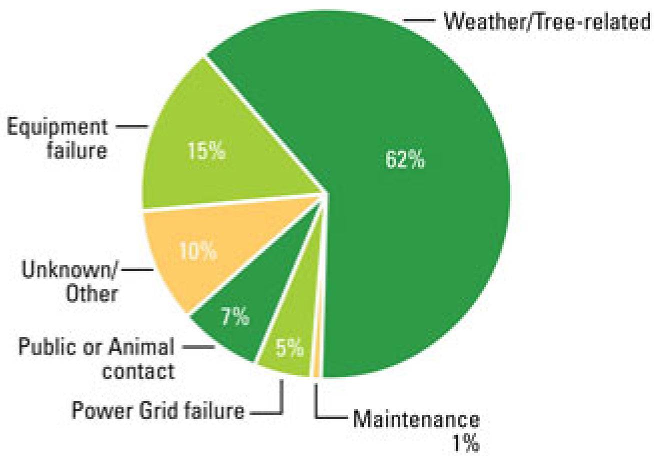
Improve Distribution Reliability

What is the Objective ?

1. **Reduce the Frequency of outages ?**
2. **Reduce Outage Duration ?**
3. **Contain the Magnitude / Scope of outages ?**
4. **Improve Customer Notification ?**
5. **Reduce Unserved kWh ?**
6. **Reduce Customer Outage Costs ?**
7. **Reduce the Outage Damage Function ?**
8. **Improve Reliability Indices ?**

Improve Distribution Reliability

Major causes of power outages in the U.S.



Momentary outages [1]

- ❑ Result from interference on power lines caused by animal or tree branch contact.
- ❑ Usually last for a few seconds or less.
- ❑ Automatic devices on power lines quickly isolate the problem and typically restore power within moments.

Sustained Outages

- ❑ Planned or accidental total loss of power caused by storms, accidents or equipment damage.
- ❑ Usually last more than five minutes.

Problems and Issues

- ❑ Bulk Power outages:
  - Reported in near real-time to both NERC and DOE
  - Reported to NERC on Form OE-417, "Electric Emergency Incident and Disturbance Report".
- ❑ **Distribution outages**
  - Reported to state regulatory agencies
  - **No standard definitions or reporting for major and sustained outages.**
  - **Power quality and momentary outages not addressed.**

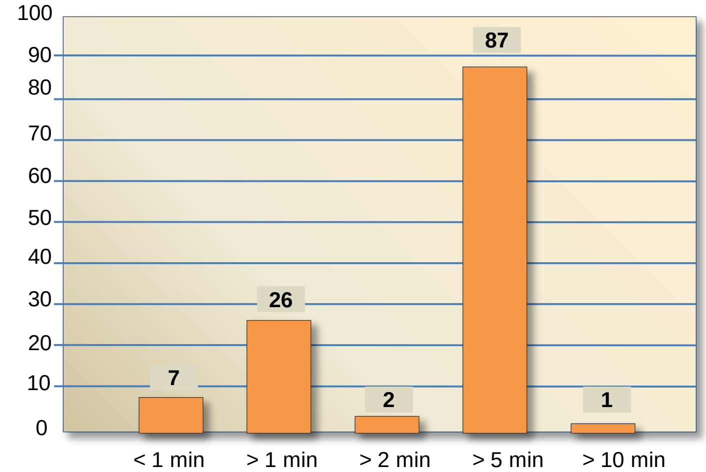


Figure 6. Utility Practices for Defining Sustained Interruptions 2

1. *Source: http://my.dteenergy.com/home/powerProblems/electricityOut/index.html*
2. *Tracking the Reliability of the U.S. Electric Power System: An Assessmenty of Publicly Available Information Reported to State Public Utility Commissions, October 2008, Eto and La Commare, Ernest Orlando Lawrence Berkeley National Laboratory.*

Improve Distribution Reliability

Defining and Measuring Reliability

- There is no consistent definition, no universally applied industry standard for defining and reporting reliability [outages].
- “Major” and “Sustained” events don’t capture power quality (sags and surges) or “momentary” outages.
- The value inherent in “outage management” is the reduction of the **customer outage cost**, which is a function of multiple variables including frequency, duration and customer type.

Clarify Objectives

- What is the reliability objective (frequency, duration, cost…)?
- Is there more than one solution ?
- Where in the system will reliability investments have the greatest value ?
- How will you determine if reliability investments have been effective ?
- Should you consider standardizing reporting criteria – IEEE 1366-2003 ?

Improve Distribution Reliability: References

Reliability

- "Tracking the Reliability of the U.S. Electric Power System: An Assessment of Publicly Available Information Reported to State Public Utility Commissions", J.Eto and K.Hamachi LaCommare, October 2008, LBNL-1092E, Ernest Orlando Lawrence Berkeley National Laboratory. http://repositories.cdlib.org/lbnl/LBNL-1092E/
- "Estimated Interruption Costs for Electric Utility Customers in the United States, Draft Report, February 2009, Freeman, Sullivan &Co., Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy. http://www.netl.doe.gov/moderngrid/docs/Cost_of_Power_Interruptions_to_Electricity_Consumers_in_the_.pdf
- IEEE Standard 1366-2003 Reliability Index and Major Event Definitions.

$$\text{System Average Interruption Duration Index SAIDI} = \frac{\Sigma \text{ Customer Interruption Durations}}{\text{Total Number of Customers Served}}$$

$$\text{System Average Interruption Frequency Index SAIFI} = \frac{\Sigma \text{ Total Number of Customers Interrupted}}{\text{Total Number of Customers Served}}$$

$$\text{Customer Average Interruption Duration Index CAIDI} = \frac{\text{SAIDI}}{\text{SAIFI}}$$

$$\text{Momentary Average Interruption Frequency Index MAIFI} = \frac{\Sigma \text{ Total Number of Customers Momentary Interruptions}}{\text{Total Number of Customers Served}}$$

Customer - Load Side Issues

Two Objectives:
1. New technology
2. Substitute information for capital investment

Promote Customer Choice
- Information
- Prices and Rates
- Improve reliability
- Technology

Improve Reliability & Efficiency
- Fewer / Shorter Outages
- Reduce kWh
- Reduce Peak kW
- Support Ancillary Services
- Reduce Carbon

Integrate Renewables
- Improve Reliability
- Reduce Carbon

Three Key Decision Variables

1. Metering
2. Rates & Incentives
3. Technology

Metering and Rates

Smart Grid legislation ..... states to consider requiring utilities to invest in advanced metering capable of providing communication and interval recording capability before investing in traditional transmission or distribution systems.

PURPA Standards – Section 1307 111(d)*

(16) Consideration of Smart Grid Investments

A. Prior to investment in nonadvanced grid technologies, electric utilities to demonstrate consideration of qualified smart grid system …..

(17) Smart Grid Information

A. Standard – all electricity purchasers provided direct access, written or electronic to information from their electricity provider, specifically:
   - (i) Prices – time based wholesale and retail
   - (ii) Usage – kWh purchased
   - (iii) Intervals and Projections – daily updates on prices and usage, including hourly price and use information where available,

Section 5.1.2 (5)

Deployment of "smart" technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation.

Metering: Two Fundamental Choices

1		2	
Standard kWh Electromechanical	Remote Metering [AMR]	Advanced Metering Infrastructure [AMI]	Smart Metering
kWh Cumulative	**kWh Cumulative or TOU**	**kW Interval**	**kW Interval**
		Communication Network	**Enhanced Communication Network**
			HAN Gateway
			Remote Service Switch [connect / disconnect]
		Meter Data Management	**Enhanced Meter Data Management**

Metering: Two Fundamental Choices

Metering System	Cumulative: Standard kWh Electromechanical	Cumulative: Remote Metering [AMR]	Interval + Communication: Advanced Metering Infrastructure [AMI]	Interval + Communication: Smart Metering
Primary Function	Cumulative kWh Recording		Interval Recording	Interval Recording
Communications Capability	No	Short range one-way	Network, two-way	Network, two-way extends into customer premise
Remotely Configurable Demand Limit Connect-Disconnect Service Switch	A separate piece of equipment		A separate piece of equipment	Integrated
Home Area Network Gateway	A separate system or piece of equipment		Separate system or piece of equipment	Integrated
Cost Range per Meter [excludes customer devices]	**$22-$34**	**$40-$60**	**$70-$150**	**$130-$250**
Data Collection	Cumulative kWh		Interval kWh	• Interval kWh • Customer device status
Rate Forms Supported	Flat, Tiered, TOU		Flat, Tiered, TOU, Dynamic	
Support for Usage Information	Monthly kWh Cumulative Reads only		Remote Access Separate Service	Integrated Plus Separate Service
Obsolescence Ranking	Low	Low	Low to Moderate	Moderate to Uncertain

Obsolescence: A device may still be functional, however its continued use may become unacceptable due to (1) availability of better performing, lower cost , higher value options, (2) discontinued vendor support for one or more integrated components that inhibit performance or maintenance, or (3) legal issues that restrict continued use of one or more features.

Metering: Define "HAN" and "Use Case"

Home Area Network (HAN)

HANs are short-range communications networks that connect appliances and other devices within a home. By combining HANs with AMI, the networks would empower consumers to track their energy usage through in-home display units, program smart thermostats to respond to price signals or peak alerts from the electric utility, and monitor loads remotely. The utility, meanwhile, gains a pathway for direct load control. *

* "Way to Go?: HAN Protocols Up For Grabs", Utilimetrics Newsletter, B.Loeff, March 17, 2009.

Use Case

A **use case** describes how a system works. The use case describes the inputs, processes, outputs, and responsibilities *

* http://en.wikipedia.org/wiki/Use_case

Metering: Smart Meter AMI HAN Interface

Utility Owned

Utility Back Office
- Enhanced Billing
- CIS
- Enhanced MDM

Utility Control Center

Energy Control Signals

Price, Reliability, Control Signals

Private Fixed Networks WAN/LAN

RF–TX[1]

PLC–TX[2]

HAN Communication Options

- interval usage
- acknowledgment
- device on/off status
- outage status

Data Out

- control signals
- usage data
- message
- time sync
- meter upgrade

Data In

Smart Meter
- AMI
- Service Switch Remote Connect/Disconnect
- HAN Gateway

Consumer Owned

Third-Party Provider

RDS/FM or pager broadcast

2-Way

Broadband TV, music, security, home automation

Gateway

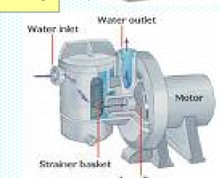
2-Way

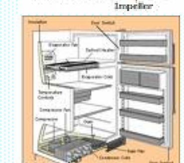
Any gateway (protocol xfr)
- Special box
- Internet modem
- Router
- Media PC
- Security panel

HAN Protocols[3]
- Bluetooth
- FlexNet
- HomePlug
- LonWorks
- 6LoWPAN
- WiFi
- ZigBee
- ZWave
- RDS
- Insteon
- RDS
- ?

2-Way

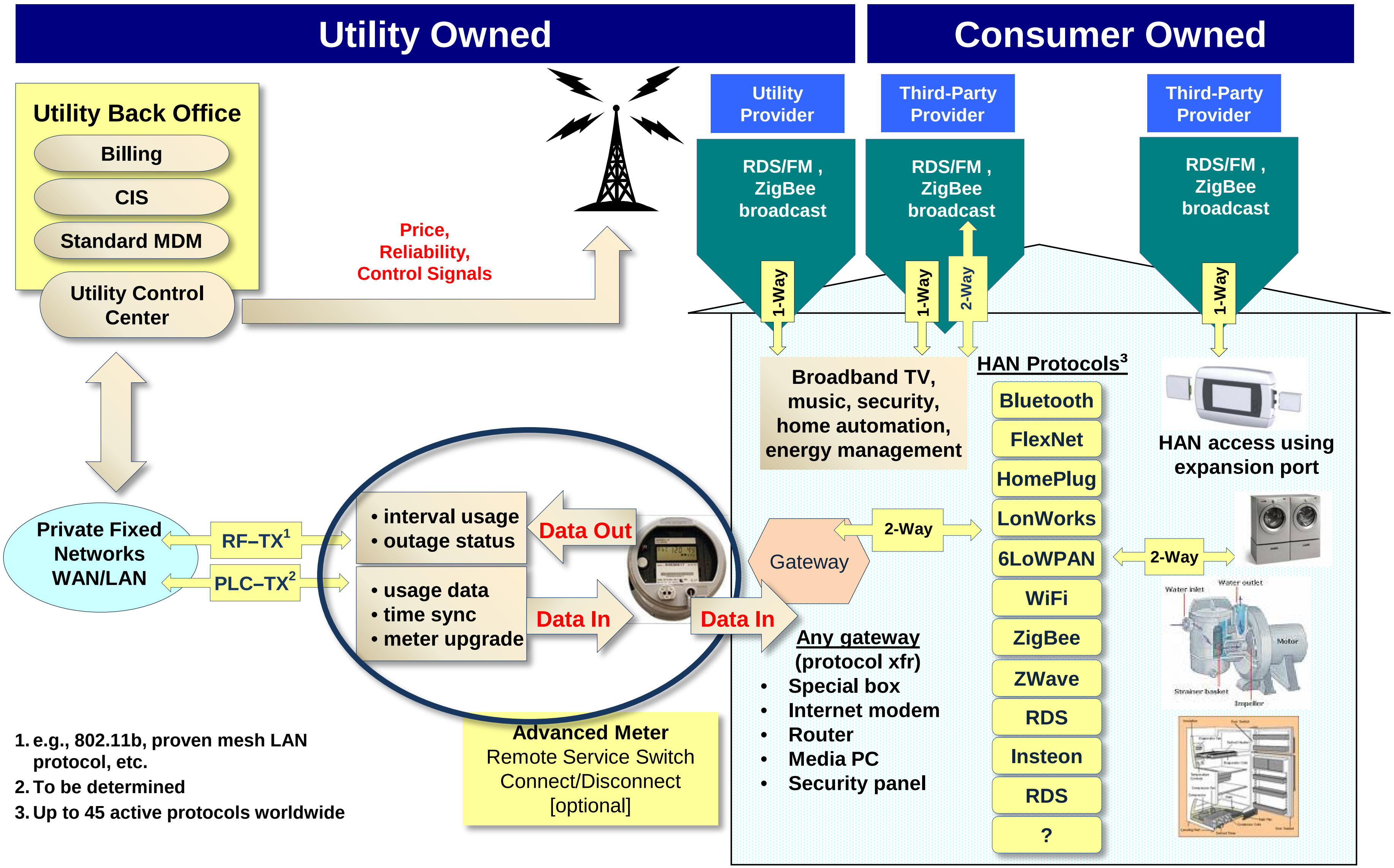
HAN access using expansion port





1. e.g., 802.11b, proven mesh LAN protocol, etc.
2. To be determined
3. Up to 45 active protocols worldwide

Metering: Advanced Meter Interface



1. e.g., 802.11b, proven mesh LAN protocol, etc.
2. To be determined
3. Up to 45 active protocols worldwide

Metering: Customer vs. Utility Rights and Obligations [1]

Rights	Obligations	Comments
1. <u>CUSTOMER CHOICE:</u> • the right to receive price and reliability signals without enrolling in utility programs • without registering their equipment with their utility.	Utilities are obligated to broadcast price and reliability signals which can be received by customer equipment that is neither registered with the utility nor used in a utility program.	• Broadcasting price and reliability signals creates “operational“ information. • Broadcasting price and reliability signals encourages open market response and equipment options.
2. <u>CUSTOMER CHOICE:</u> the right to choose if and how they will program their communicating devices to respond to price and reliability signals.	Vendors of programmable communicating devices are obligated to provide a means of setting the device to not respond to signals, and a means of overriding programming.	• Customer choice promotes participation, eliminates dropouts, and increases DR effectiveness. • Open market vendors as well as utilities should provide equipment and services to support DR. • DR systems and equipment should support a minimum required set of common functions.
3. <u>CUSTOMER CHOICE:</u> the right to purchase, rent or otherwise select any vendor, devices, and services used for energy management or other purposes in their premise.	Utilities are obligated to provide open communication protocols that do not restrict customer DR equipment or service choices.	• Common, open communication protocols promote competitive markets for DR, features and services customized to customer needs, lower costs and more rapid, widespread implementation.

Metering: Customer vs. Utility Rights and Obligations [2]

Rights	Obligations	Comments
4. <u>OPEN MARKET FOR DR</u>: Vendors have the right to compete in an open market to sell HAN related systems, devices and services to all utility customers.	Utilities are obligated to not restrict customers enrolled in utility programs, to equipment that uses the AMI communication protocol.	• Open market vendors as well as utilities should provide equipment and services to support DR. • Common, open communication protocols promote competitive markets for DR, features and services customized to customer needs, lower costs and more rapid, widespread implementation. • Customer choice promotes participation, eliminates dropouts, and increases DR effectiveness.
5. <u>OPEN MARKET FOR DR:</u> Utilities have the right to offer DR and energy management services to customers which utilize the information and communication capabilities of their AMI system.	Customers are obligated to maintain their equipment used in utility programs, in good working order, and to provide any communications translation device if needed.	
6. <u>OPEN MARKET FOR DR</u>: Customers have the right to participate in utility sponsored programs and at the same time, use equipment, not involved in the utility program, to receive price and reliability signals.	Utilities have an obligation to provide price and reliability signals through their AMI two-way signal system and through a one-way signal system.	

Metering: Key Issues

Key Issues ?

1. **Establishing a business case [costs and benefits]**
2. **System integration vs. hardware integration [AMI vs. Smart Meters]**
3. **Targeted vs. systemwide implementation**
4. **Security and privacy – who owns the data ?**
5. **Utility vs. the regulatory / customer use case**
   a) **utility programs or open markets**
   b) **Customer vs. utility control strategies**

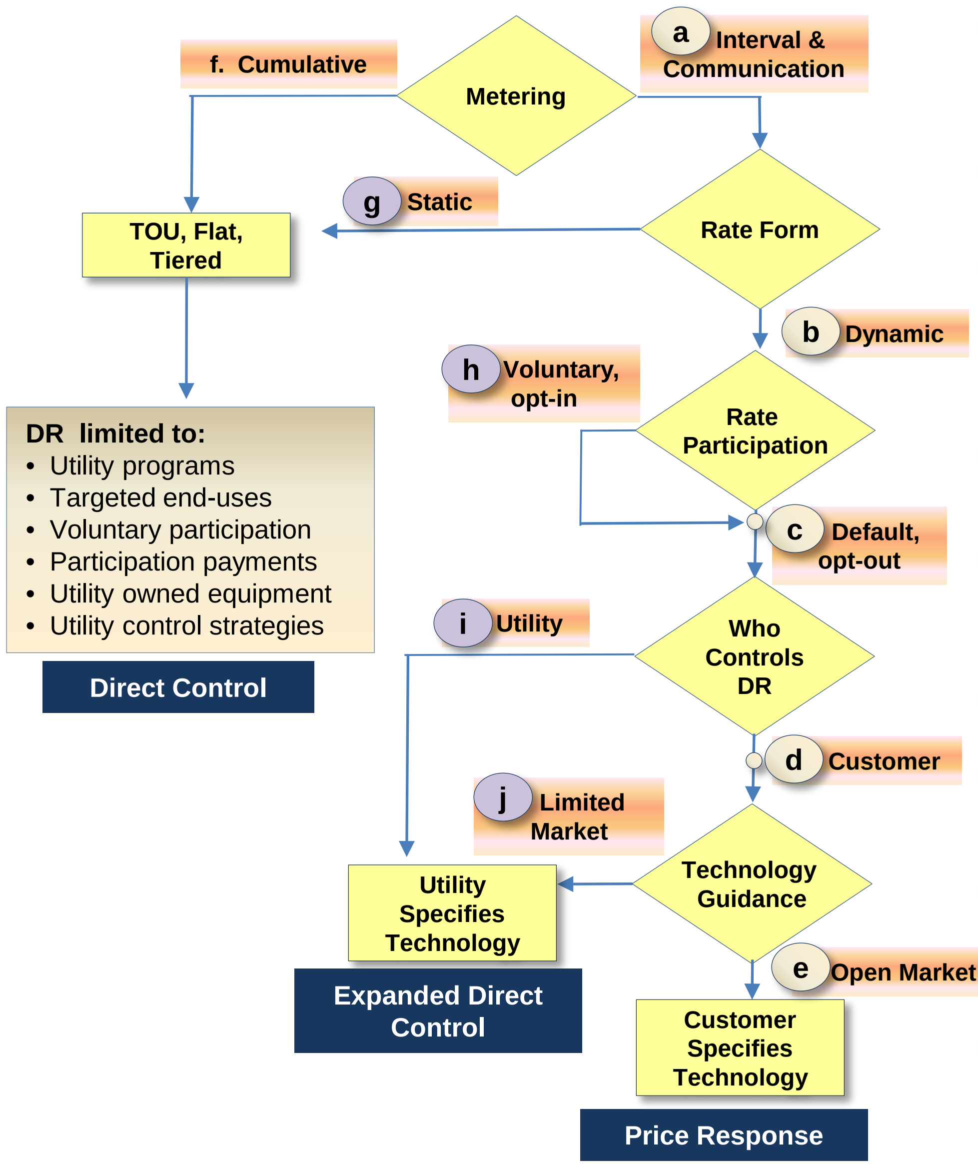
Rates: System Integration Issues

Efficiency, Demand Response, and Renewables

Requirements and Objectives – Key Questions

	#	Issue	Key Questions
Rates & Incentives	1	**Integrated Efficiency, Demand Response and Renewable Incentives**	• Should incentives for efficiency (EE), demand response (DR), and renewables be integrated into the customer rate or administered separately ?
	2	**Performance-Based Incentives**	• Should customers be rewarded or penalized based on their actual performance or should customers be paid to participate ?
	3	**Retail-Wholesale Integration**	• Should retail rates provide the capability to integrate and reflect wholesale nodal prices ?
Operations	4	**Dispatchability**	• Should demand response [DR] be automated and dispatchable ? .
	5	**Ubiquitous Availability**	• Should DR be available on all circuits throughout the utility system or be dependent upon sporadic and fluctuating participation ? • Should DR, like efficiency [EE] , be a condition of service for all customers ?
	6	**Customer Choice**	• Who should determine what, when and how to control customer loads, the customer or the utility ?
Costs	7	**Simultaneous Participation in Economic and Reliability Options**	• Should customers be allowed to maximize the value of their investments in EE, DR and renewables by simultaneously participating in day-ahead economic as well as real-time reliability options ?
	8	**Market-based Technology**	• Should customers be able to acquire automated systems and DR equipment and services through open market providers or should these devices be provided by the utility ?

Rates: Decision Choice Issues and Implications



a
- Interval metering provides data to support all rate forms.
- Communication supports dynamic rate, outage management, and customer information options.

b
- Dynamic rates (CPP, RTP) reflect system costs and support dispatchable economic and reliability options.

g
- Static rates do not reflect system costs or performance based rates / incentives.

c
- Default, opt-out rates create a market for DR.
- EE and DR implicit conditions of service for all customers
- DR ubiquitous system wide
- Expands and creates a market for customer ownership and competitive equipment providers.

h
- Voluntary, opt-in rates restrict market for DR to utility programs
- Limit ubiquity and value of DR.

d
- Customer choice opens the market for competitive non-utility DR suppliers and service providers

i
- Utility control disincents customer ownership and restricts competitive equipment and service provider

e
- Customer value establishes technology options
- Regulators establish: (1) Need for subsidies to address market barriers, (2) Data models - to provide interoperability, and (3) Data ownership to address security and privacy

j
- Utility establishes technology, value, and protocols.

Rates: Efficiency, Demand Response, and Renewables

Why Consider Dynamic Pricing ?

"As long as consumers have flat rates, there is little incentive to manage what is scarce. With real-time pricing, residential customers still receive a monthly bill that represents an average of electricity costs across that month. However, these customers are now afforded an opportunity to manage their bills and reduce their energy costs by shifting some of their energy use from high price periods to lower price periods."*

*"Evaluation of the 2005 Energy-Smart Pricing Plan SM, Final Report", August 1, 2006, Summit Blue Consulting, Inc., pp.ES-2.

Why Automate Demand Response ?

To use a true but often over-quoted phrase it is all about turning data into information, and information into knowledge. But even that is not enough. For grid applications to be effective we need to turn that knowledge into action.

Action is where the value is. **

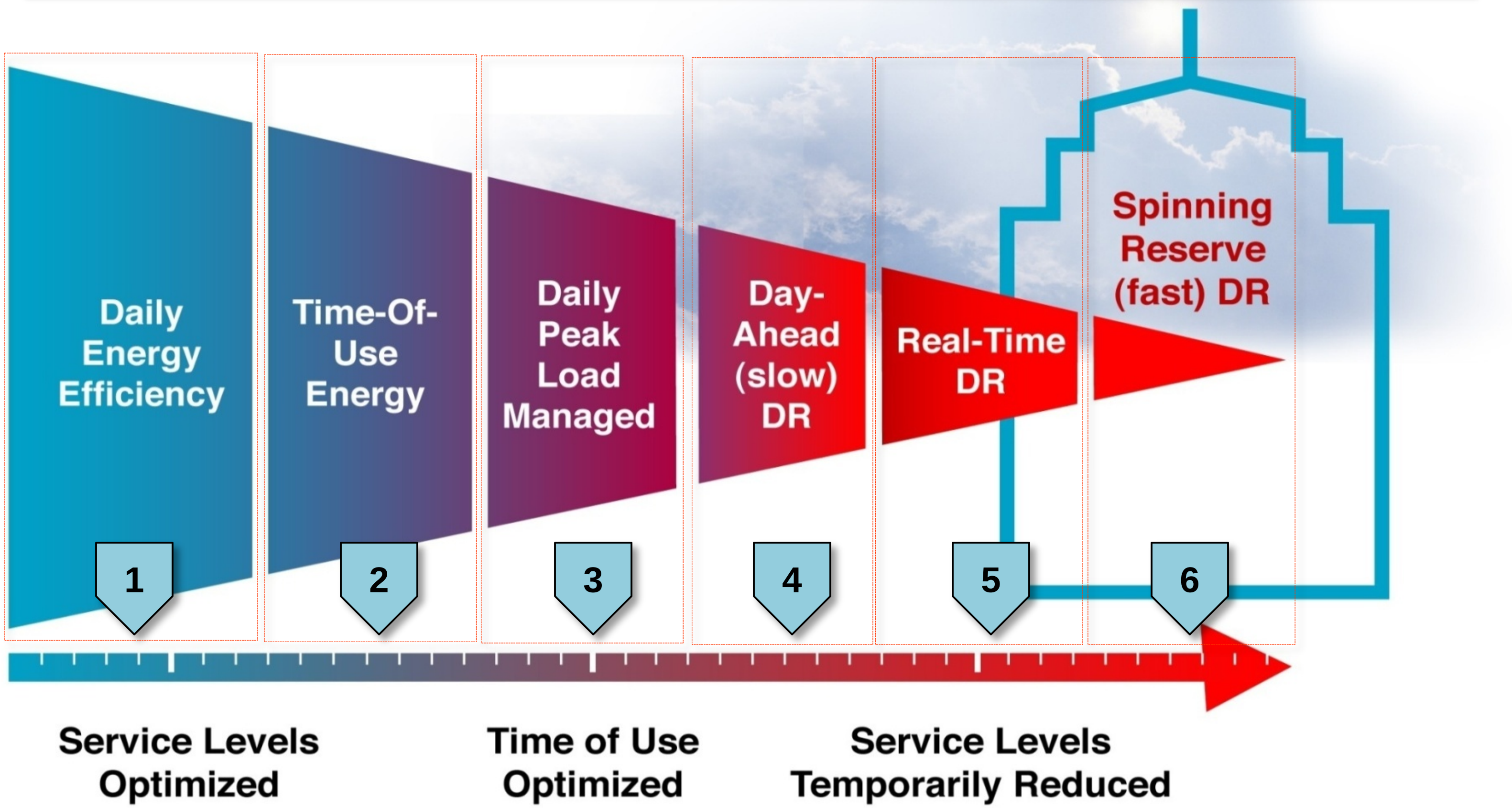
** "Smart data, dumb grid?", Mark R. Knight and Fred J. Dorow, KEMA with Ivan E. Principe and Sally A. Scripps, Consumer Energy, KEMA, 2009 Automation Insight.

Rates: Rate Designs to support a Smart Grid

Rate Design Issues		
1. Rate simplification to improve customer understanding		• Conventional rate designs are too complex • Conventional rate designs are oriented toward “monthly or periodic” billing • Rate designs need to consider the need for clear price signals a) Balance fixed vs. variable charges to provide meaningful price signals b) Address social welfare and other subsidies as adjustments to the total bill rather than an element of the rate design.
2. Rate simplification to accomodate automated demand response	.	• Dispatchable prices facilitate the automation of demand response. • Automating demand response increases its value and reduces costs to the customer, utility, and ISO/RTO. • Rate designs should provide operational capability to interface with customer energy management systems and control devices.
3. Wholesale retail rate integration		• Rate designs should consider the need to integrate wholesale and retail costs.

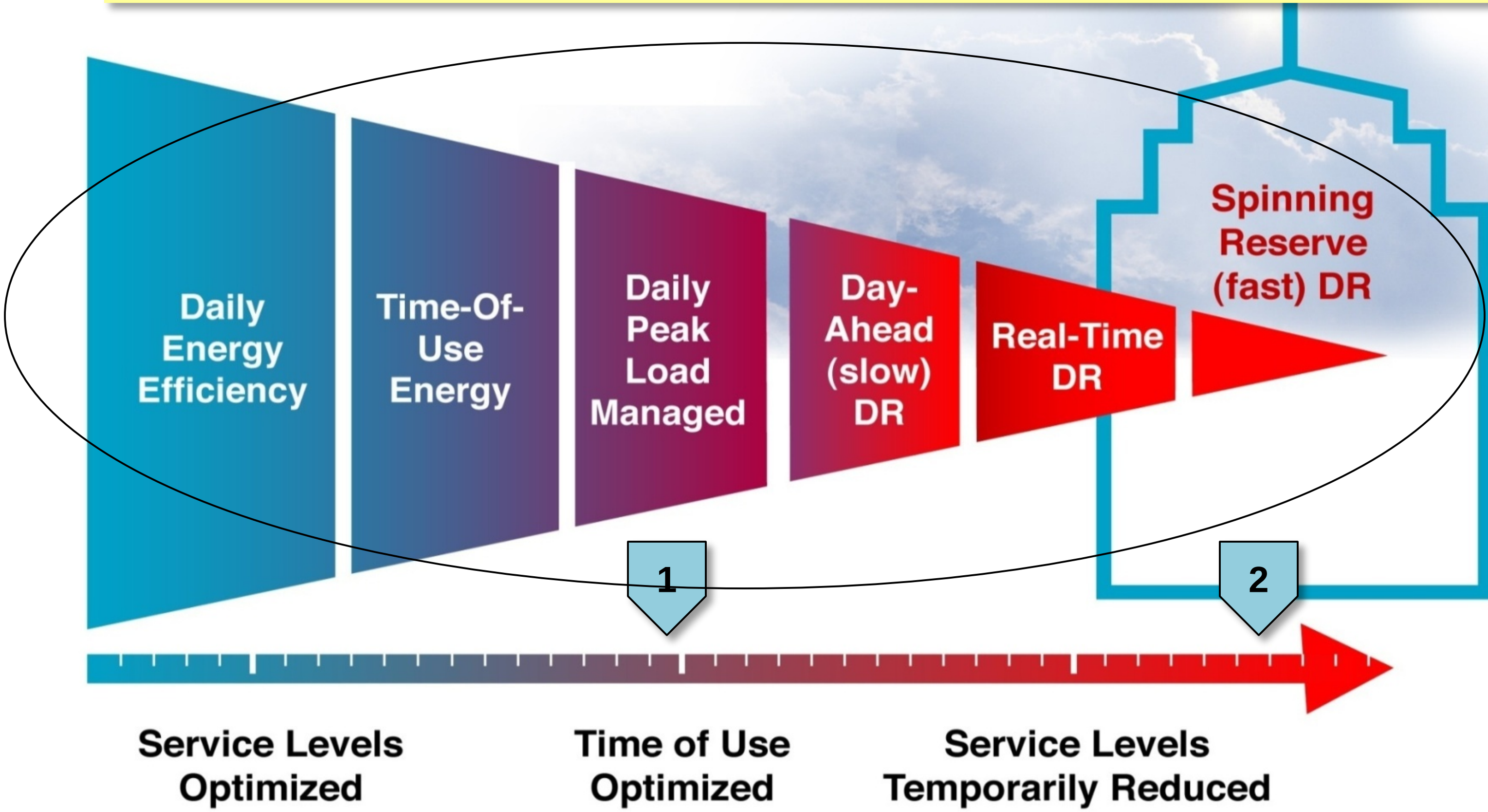
Demand Response

Under conventionally defined utility demand response programs, customers can participate in only one option at a time.

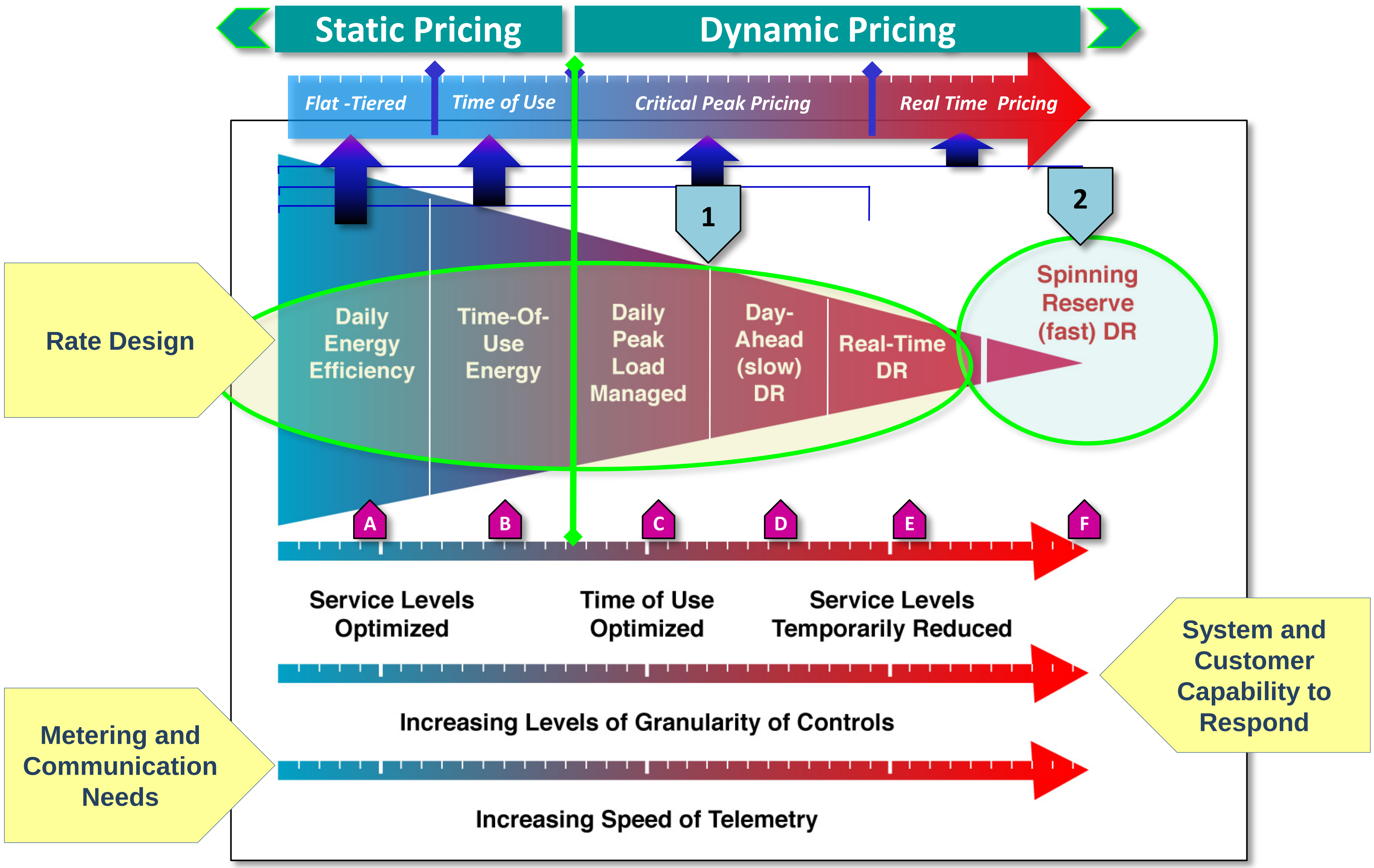


Demand Response

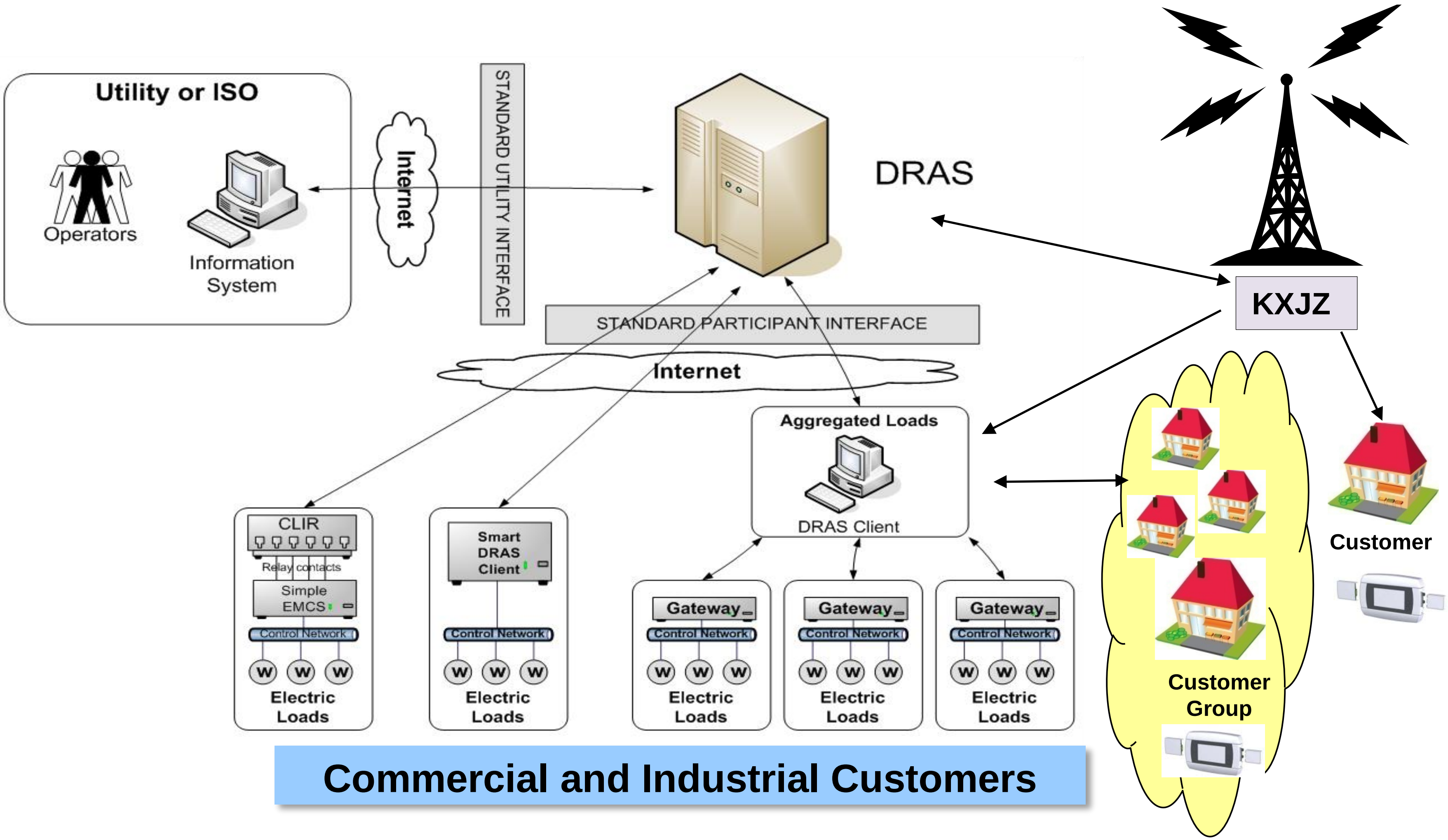
Customers subject to a dynamic rate, with the capability to receive automated price, reliability and event signals can participate in multiple options simultaneously, increasing the value and cost effectiveness for both the customer and utility.



Demand Response



Demand Response: Automated DR



Commercial and Industrial Customers

Residential – Small Commercial Customers

Demand Response: Automated DR

Automated Demand Response (AutoDR) *

an open, interoperable signaling communication, and technology platform

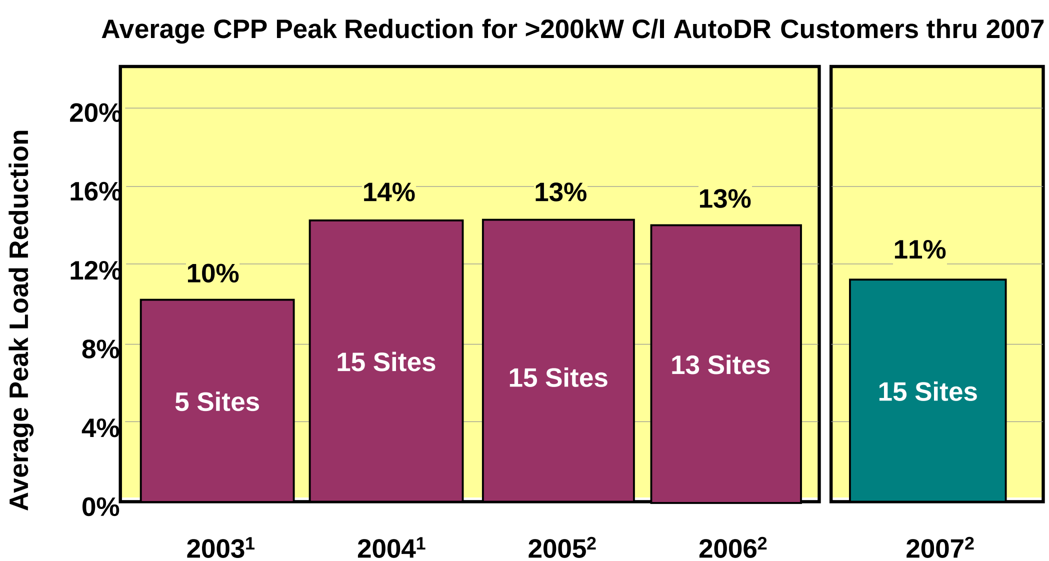
a) Customers receive automated, electronic price and reliability signals.

b) Customers link signals directly to building energy management systems and control devices

c) Customers automate customized site-specific DR strategies.

d) Utilities get dispatchable operational capability similar to conventional generation resources.

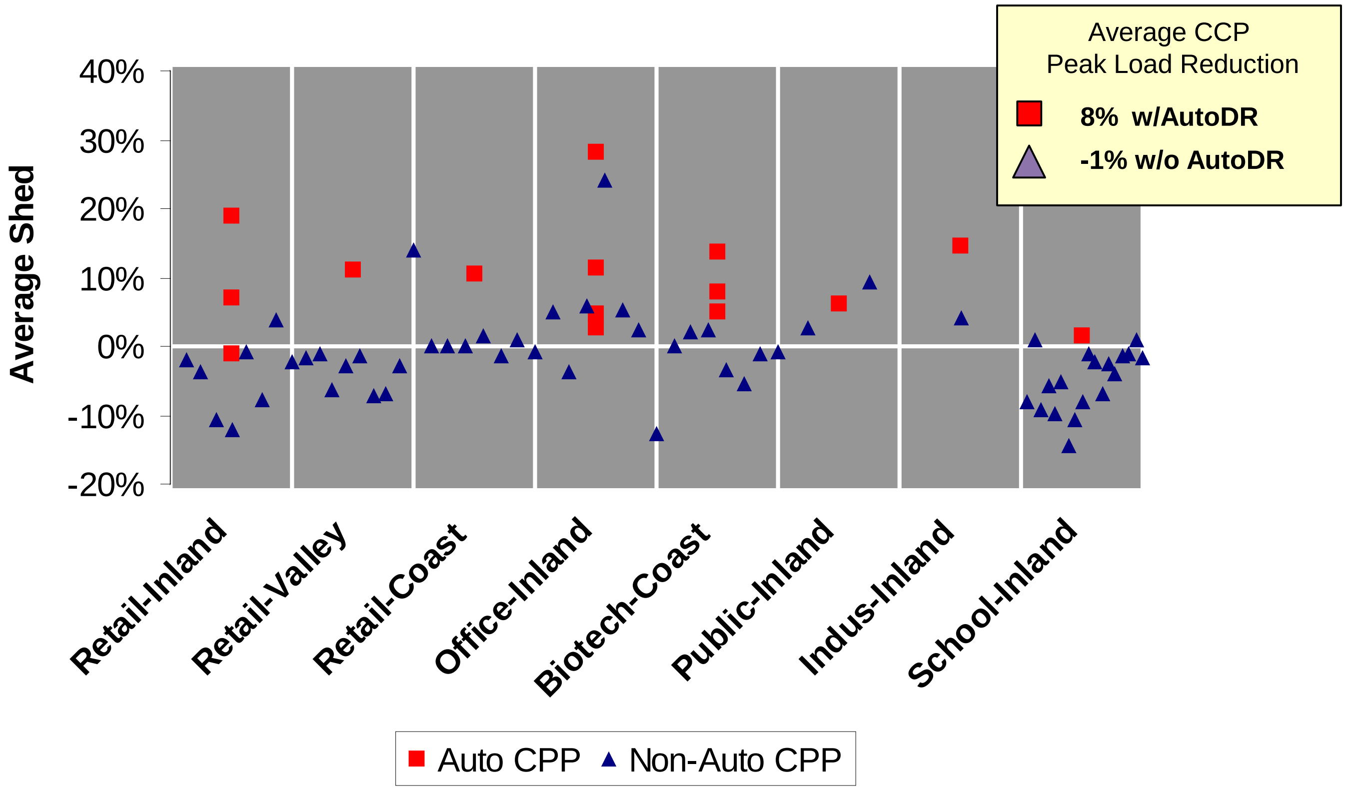
e) Supports direct control, bidding, and pricing options.



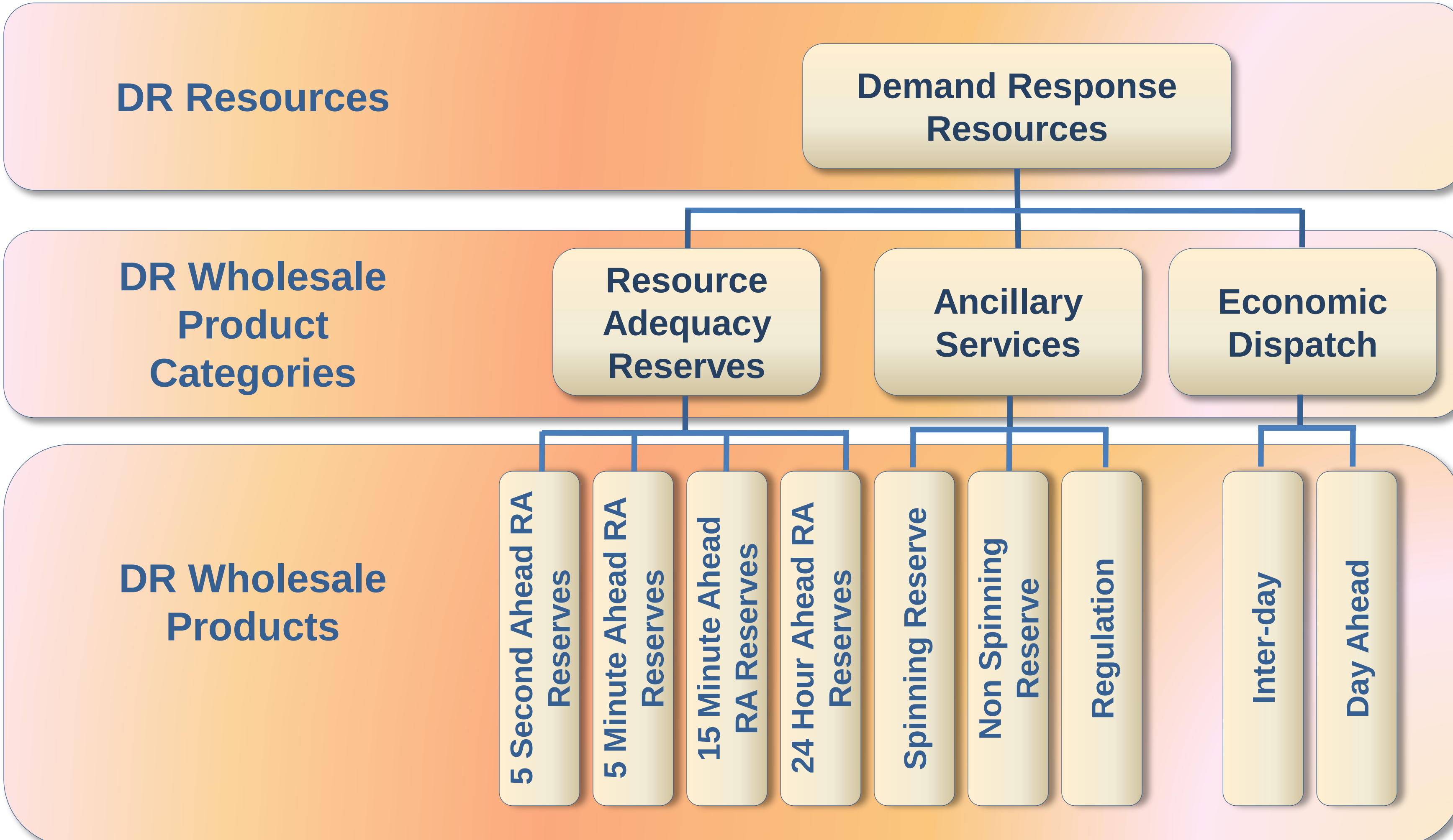
http://www.energy.ca.gov/2009publications/CEC-500-2009-063/CEC-500-2009-063.PDF

Demand Response: Automated DR

C/I > 200kW CPP Annual Average CPP Response 2007



Demand Response: Ancillary Services



* The Smart Grid's Demand Response Product Definitions: Legacies Die Hard (Part IV in a Series), George Campbell, Utilipoint International, April 14, 2009.

Demand Response: Ancillary Services

"……. it is both technologically feasible to provide spinning reserve using demand-side resources and that it may be preferable to rely on these resources (rather than the traditional form of spinning reserve, which relies on generation facilities) because of inherent advantages of demand-side resources. These advantages include:

1) response that is near instantaneous (rather than the ten minutes allowed for generating facilities to deliver full response), and
2) Responses can be targeted geographically anywhere electricity is consumed within a utility's service territory (rather than being restricted to the fixed locations of the handful of generators that are contracted to provide contingency reserve).

These advantages are especially attractive because the power curtailments required for demand-side resources to provide contingency reserves are typically very short (lasting 10 minutes or less) and may not even be noticed by customers.*

* "Demand Response Spinning Reserve Demonstration – Phase 2 Findings from the Summer of 2008", Lawrence Berkeley National Laboratory, J.Eto, Prepared for Energy Systems Integration Public Interest Research Program, California Energy Commission, April 2009, (Executive Summary, p. xv).

Conclusions:
Demand Response Spinning Reserve Demonstration*

1. *Demand-response resources can provide full response significantly faster than required by reliability rules.*

2. *The aggregate impact of demand response from many small, individual sources can be estimated reliably through analysis of distribution feeder loads.*

* "Demand Response Spinning Reserve Demonstration – Phase 2 Findings from the Summer of 2008", Lawrence Berkeley National Laboratory, J.Eto, Prepared for Energy Systems Integration Public Interest Research Program, California Energy Commission, April 2009, (Executive Summary, p. xvi-xvii).

Technology: Evolution to a Smart Grid

Commercially Available

Programmable Communicating Thermostat 1999

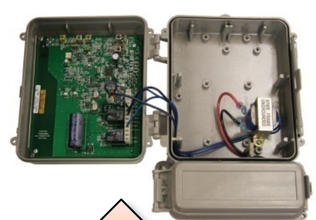
CEC PCT Cost Effectiveness Benchmark

Programmable Communicating Thermostat

CEC PCT First Release Commercially Available 2009

Programmable Communicating Thermostat

$300 | $200 | $150 | $100 | $0



Conventional Air Conditioner Control Switch mid 1970's

Commercially Available

PCD Embedded Controls

Projected 2009

Demand Response Equipment Evolution

- Switches to thermostats
- Thermostats to embedded controls
- Utility to customer control

Technology: Interoperability Defined

"The ability of a system or product to work with other systems or products without special effort by the customer."[1]

1. **Exchange meaningful, actionable information between two or more systems across organizational boundaries**
2. **Assure a shared meaning of the exchanged information**
3. **Achieve an agreed expectation for the response to the information exchange, and**
4. **Maintain the requisite quality of service in information exchange (i.e. reliability, accuracy, security)."[2]**

1. Docket No. PL09-4-000, 126 FERC 61,253, 18 CFR Part Chapter 1, Proposed Policy Statement and Action Plan, March 19, 2009.
2. Interoperability Path Forward Whitepaper, p.1-2, 2005, GridWise Architecture Council.

Technology: Interoperability Defined

Interoperability

Utility Programs

- Vertically Integrated
- Utility owns equipment
- Utility installs / maintains
- Utility controls

Control Signals

Interoperability is a regulatory issue.

Open Market

- Horizontally Integrated
- Customer owns equipment
- Third party installation
- Customer / Third party maintains
- Customer controls

Price, Event Signals

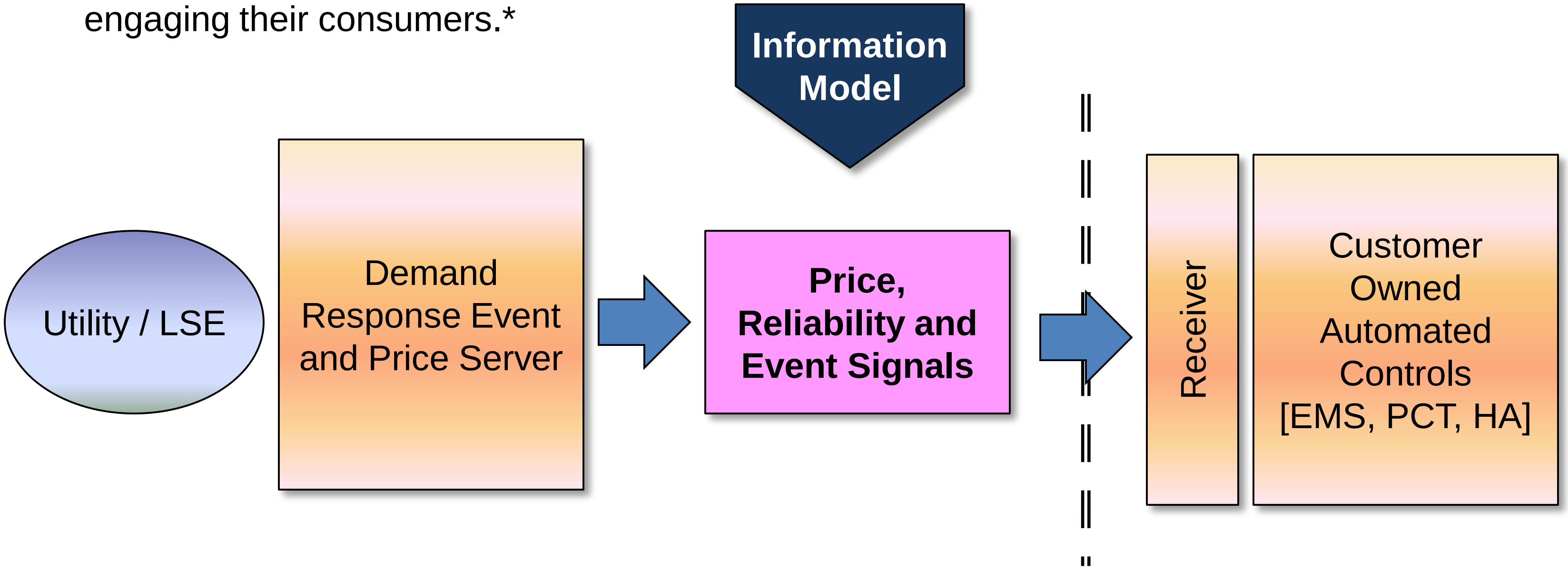
Interoperability is a market issue.

Technology: Interoperability Hardware …U-SNAP

- The **U-SNAP Alliance** is an open industry association developing an industry standard for connecting energy aware consumer products with smart meters.
- The Alliance will create and publish a standard, establish testing and certification procedures for product conformance and educate consumers, utilities and vendors on the benefits of the standard.
- Alliance membership is comprised of utilities, manufacturers, consultants and other parties interested in developing or deploying the standard. For more information, or to find out how to join the Alliance, please visit www.usnap.org

Technology: Interoperability Data Model … Open AutoDR

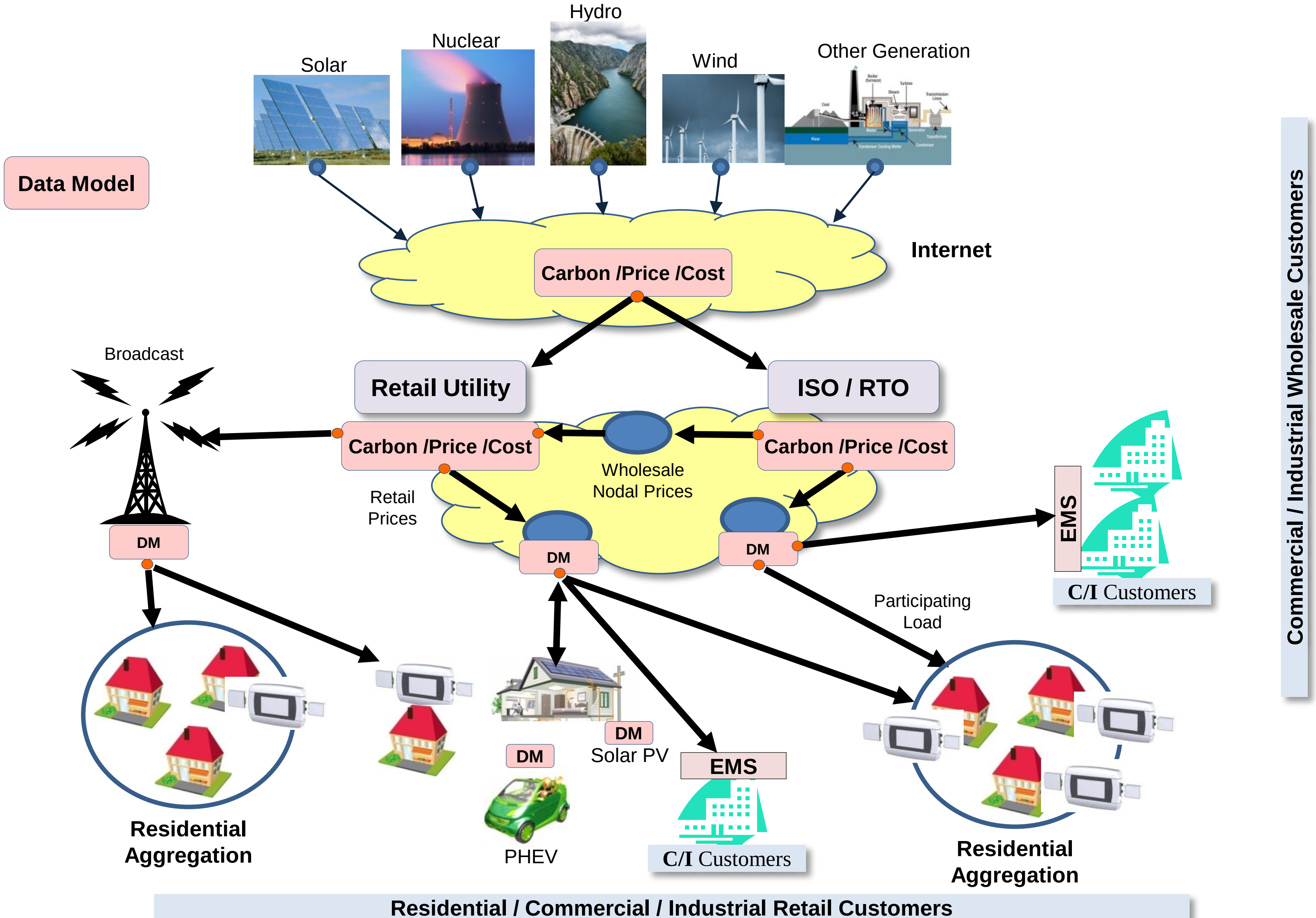
The **OpenADR** standard outlines specific communication models that use the Internet to send DR signals to end-use customer systems. The standard, initially developed for commercial and industrial applications, may be leveraged in residential settings to reduce cost, promote interoperability among DR technologies and allow utilities and energy providers to better manage pricing and critical load issues while actively engaging their consumers.*



•"Tendril Achieves First Open ADR Compliant Platform", January 29, 2009, http://www.tendrilinc.com/2009/01/tendril-achieves-first-open-adr-compliant-platform-2/

Technology: Interoperability Data Model

Integrating Wholesale – Retail Prices, Carbon, and Demand Response



Cyber Security

1. The integrity of data communicated – is the data correct
2. The authentication of the communications – whether the communication is between the intended Smart Grid device and authorized device or person
3. The prevention of unauthorized modifications to Smart Grid devices and the logging of all modifications made
4. The physical protection of Smart Grid devices
5. The potential impact of unauthorized use of these Smart Grid devices on the bulk power system.
6. Preventing unauthorized collection and use of customer data.

NIST – in process.

New Pilots or a Transition Plan ?

1. **What decision(s) do you need to make ?**
2. **What information and what answer is necessary to support that decision ?**
3. **What is the best approach for obtaining the information and answers ?**
   a) **Pilots are short-term experiments well suited to test technology engineering performance and to guage customer perception.**
   b) **Pilots are not good for evaluating long-term infrastructure, market, or structural changes.**
4. **If the key issues are political or policy oriented, are there long-term transition options worth considering ?**