AMI/DR Technology impacts associated the 2005 EPAct

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Energy Policy Act of 2005

- Enacted on August 8, 2005
- Established policy with 6 specific requirements and time frames for utilities and regulators related to advanced metering and demand response
- "It is the policy of the United States that time-based pricing and other forms of demand response, whereby electricity customers are provided with electricity price signals and the ability to benefit by responding to them, shall be encouraged, the deployment of such *technology and devices that enable electricity customers to participate in such pricing and demand response systems* shall be facilitated, and unnecessary barriers to demand response shall be eliminated."

Section 1252 of 2005 EPAct

- Requires utilities to offer time based rate schedules for each customer class
- Rate schedule shall enable the electric customer to manage energy use and cost through advanced metering and technology
- Requires utilities to provide a time-based meter to any customer requesting it.
- In States allowing 3rd party marketing, customers shall be provided the same time-based meter and communications devices as other customers.
- Requires State Utility Regulatory action to investigate advanced metering and demand response.
- Requires a formal report on demand response be provided to Congress by January 2007

FERC's Four Major Goals (Meeting Aug 31, 2006)

- Reduce wholesale electric prices
  - Make markets work, not protect competitors
- Incentize investment in infrastructure
  - Transmission, Generation and Demand Response
- Incentize development of technology
  - Demand response and energy efficiency
- Protect the Environment
  - Encourage Demand Response and the use of more efficient and alternate generation

Why Demand Response?

- Demand Response is viewed as a market resource for ensuring adequacy and reliability.
- With respect to grid operations, demand response can be a key factor in congestion management.
- Demand Response has proven to be a important tool for mitigating market power and reducing regulatory intervention in markets (ie avoiding price caps)
- With this proposed rule, Demand Response is put on the same footing with generation and transmission both in resource planning but in day-to-day grid operations.

Why are utilities implementing Demand Response

Customer Interactive Demand Response:

- Can provide Generation Reserves / Operating Reserves for less cost than spinning capacity.
- Creates an opportunity for the energy customer to participate in managing their usage which also benefits the Utility.
- Creates an Environmentally attractive (Green Power) option to physical generation alternatives.
- Provides the customer with new technologies that can provide increased comfort and a more flexible life style compared to traditional Load Management.
- Two-Way DR allows participation to increase from current levels of 20-40% to 80-90%

Misconceptions of Energy Policy Act of 2005

- EPACT is simply an extension of the Public Regulatory Policy Act of 1978 (PURPA) with no new teeth.
- *Reality*- Technology and consumer impacts make EPAct a much more significant policy than PURPA

- Only "regulated" utilities and public utility commissions are covered by the directives of EPACT.

- *Reality*- Language clear that both regulated and unregulated utilities. PURPA applied to utilities which exceeded 500 million kilowatt hours during any calendar year. This includes 100 electric cooperatives and 185 public utilities

- Implementation of these capabilities would require levels of investment that can't be cost justified.

- *Reality*-Advanced Metering has already been economically proven which is why 14 % of all utilities nationwide have elected to install advanced metering

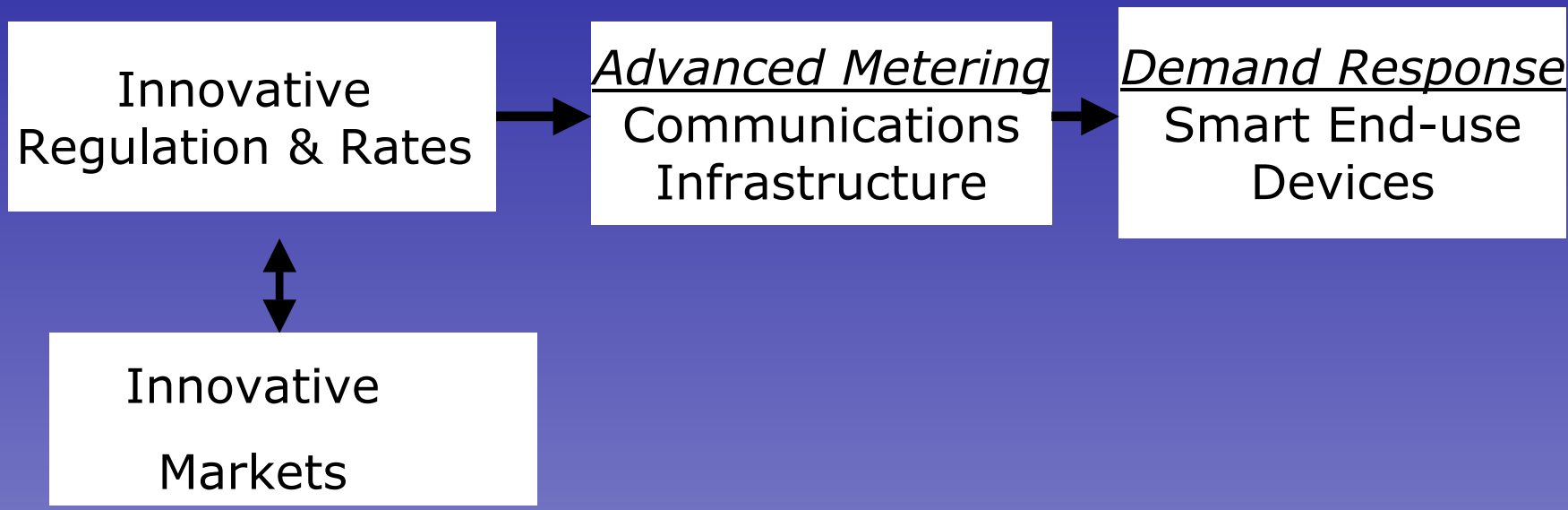
Advanced Metering

- Advanced metering is more than automated monthly meter reading.
- A comprehensive metering system that records customer consumption and other parameters hourly or more frequently and that provides for daily or more frequent transmittal of measurements over a communications network to a central collection point.
- It enables a variety of utility applications to be performed accurately, securely, and efficiently including time-differentiated tariffs, demand response, outage detection, theft detection, network optimization and market operations.
- While regulatory action may not require utilities to employ newer technologies for advanced metering, it has raised the questions for debate as to “what’s needed” and “what’s desired” from a functionality standpoint

Top Ten States for Advanced Metering Penetration

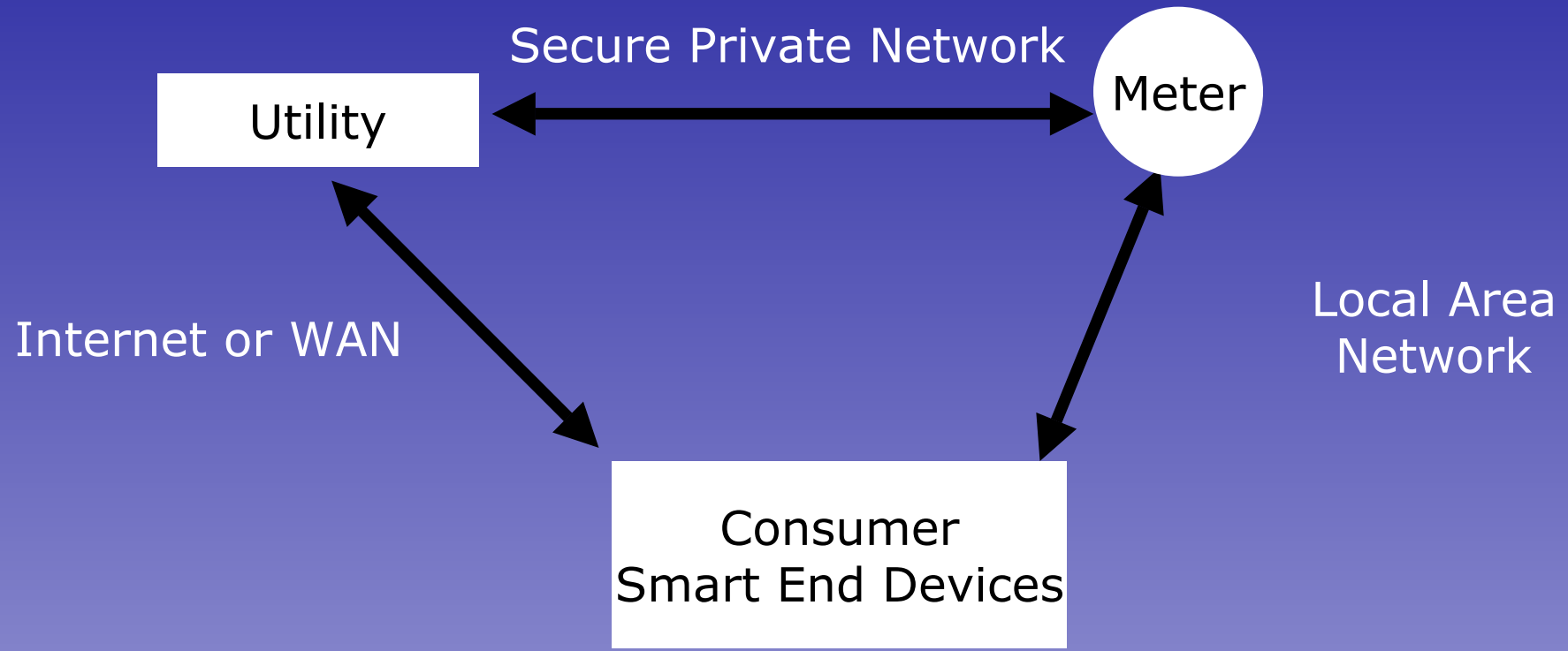
- Pennsylvania 52.5%
- Wisconsin 40.2%
- Connecticut 21.4%
- Kansas 20.0%
- Idaho 16.2%
- Maine 14.3%
- Missouri 13.4%
- Arkansas 12.9%
- Oklahoma 7.2%
- Nebraska 6.8%
- Electric Coops 13.0%
- IOU's 6%

The Four Building Blocks for Improving Electricity Utilization



Advanced Metering Communications Infrastructure
Multiple Networks Utilized

Key Enabler is the 2 way Information Exchange Between utilities and specific energy consuming devices



Requirement Guidelines for Advanced Metering Systems

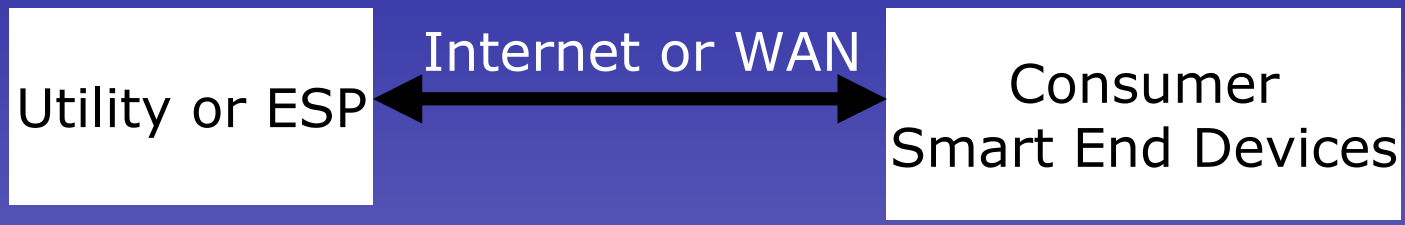
- Standard Communication Board Interface
- Standard Data model
- Security
- Two-Way Communications
- Remote Download
- Time-of-Use Metering
- Bi-Directional and Net Metering
- Long Term Data Storage
- Remote Disconnect
- Network Management
- Self-healing Network
- Home Area Network Gateway
- Multiple Clients
- Power Quality Measurement
- Tamper and Theft Detection
- Outage Detection
- Scalability
- Self-locating
- Reliability
- Interoperability
- Customer Interface

COMMUNICATIONS MATRIX

Platform	Data Throughput	Open or Proprietary	Local Area Communication	Wide Area Communication	Applications & Limitations
Power Line Carrier	16 bps	Proprietary	No	Yes	AMR -Data throughput limits scalability and performance Communications network is grid dependent OMS - meters must be polled for outage information
902-928 MHz Radio (unlicensed)-Mesh	90 kbps	Proprietary	Yes	No	Data range limted to one mile (15 or 16 hops) individual range is 700 ft- Communication Protocol specific to the individual device or application
3G 1xEVDO, UMTS HSDPA	300-800 kbps	Open	Yes	Yes	Upstream bandwidth limited Higher operating cost/connection
BPL	200 Mbps	Proprietary	Yes	Yes	AMR/OMS - standards in development and business case is marginal due to high costs
902-928 Mhz Radio (unlicensed)-Mesh	90 kbps	Proprietary ZigBee	Yes	No	Data range limted to one mile (15 or 16 hops) individual range is 300 ft - Communication Protocol standard for all applications
GSM -cellular (Public)	144 kbps	Open	No	Yes	No data or network limitations - can experience dead zones; Ongoing cost is a concern
Analog Control Channel (Public)	32 bps	Proprietary	No	Yes	No data or network limitations - can experience dead zones; Ongoing cost is a concern
Wireless Fidelity Mesh (802.11b/g)	1-5 Mbps	Open	Yes	Yes	No Limitations - Fully scalable for all applications
Fiber Ethernet with optional power supply	> 1 Gbps	Open	No	Yes	No Limitations - Fully scalable for all applications

Information Exchange

Internet enables the 2 way Information Exchange Between Utilities and specific energy consuming devices



Internet is used for information exchange only…
no control functions and no connection to the grid

Information Exchange is NOT just meter data

Metering Data

- Interval Data, Scheduled Reads, On-Demand Reads, TOU Reads
- Load Profile, Voltage Profile, Outage Profile, Reliability indices
- Outage Detection, Notification, Network Analysis
- Tamper Detection, Notification and Revenue Recovery
- Remote Disconnect/Reconnect

Customer Data

- Thermostat Control, Water Heater temperature, Pool Pump cycle times, Air Handler temperatures, Appliance load profiles
- Community Messaging, Real Time Pricing
- Energy Management tools
- Remote messaging, notification, e-mail, text messaging

SMART End-Use Devices

Smart IP network addressable devices already exist and they provide the mechanism for the consumer to manage their energy costs:

- Air Conditioners
- Appliances
- Lighting
- Pool Pumps
- Thermostats
- Meters–Electric, Water and Gas

Innovative Rates and Regulations

Advanced Metering Technologies enable accurate quantification with regard to energy utilization which in turn allows greater innovation with regards to rates.

Energy pricing information can be delivered directly to specific end-us devices

- Time-of-Use rates
- Critical Peak Pricing
- Direct Load Control
- Interruptible/curtailable rates
- Demand bidding/buyback rates
- Emergency demand response rates
- Day-ahead hour-by-hour rates
- Real Time rates
- Special rates driven by load profile of specific end use devices

Innovative Demand Response Example

- AC receives day-ahead hourly pricing information with weather forecast through the Internet
- Consumer sets thermostat at 75° (-5°/+3°)
- AC "learns" how to optimize operation to minimize cost based on load profile, outside temp, etc.
- Information exchange allows utility to enhance revenues by offering AC monitoring service
- Smart AC measures and communicates energy usage through the network to the energy provider.

Innovative Rates encourage efficiency

- The enabling technology allows definitive measurement and quantification of energy savings both to the consumer and the utility.
- This can be translated into an innovative rate designed to encourage purchase of new, more energy efficient devices.
- EXAMPLES: 5 year special “packaged” rate with the purchase of a specific model of smarter more energy efficient air-conditioner
- 5 Year favorable off-peak rates packaged with the purchase of a new pluggable Hybrid-Electric Vehicle

Value of Advanced Metering Technology

Operational Improvement

- Meter Reading Accuracy
- Meter Maintenance
- Load Research
- Network Planning
- Remote Meter Reading
- Remote Meter Disconnect/reconnect

Customer Service

- Voltage Investigation (Real Time)
- Energy Consumption (Real Time)
- Outage Detection and Notification
- Outage Response information
- Energy Alerts
- Real Time Pricing

New Customers

- Pre-Pay Metering
- Time-of-Use Metering
- Proactive Power outage notification
- Power Quality Guarantees

New Revenue

- Demand Side Management
- Demand Response
- Appliance monitoring
- HVAC monitoring
- Security system notifications
- Smoke/Fire alarm notification

Financial Analysis of AMI

Fees posted on Energy Tariff Sheet	Fees charged	Internal Costs	Annual Fees
Based on 1000 meters			
Monthly Meter Fees - 1000 meters monthly	$0.00	$ 0.75 /month	$9,000
Final Meter Reading Fee - 1 % per month	$22.22	$15	$1,800
Special Meter Fee - 1 % per month	$22.22	$15	$1,800
Disconnection Fee - 3 % per month	$80.00	$60	$7,200
After hours disconnection 25 per year	$106.67	$90	$10,800
Meter Accuracy Test - 1 % per year	$115.56	$90	$10,800
Permanent Disconnection 2 % per year	$53.33	$40	$4,800
Voltage Investigation - 1 % per month	$50	Not Offered	$6,000
Load Usage investigation - 1 % per month	$50	Not Offered	$6,000
Demand Profile - 1 % per year	$50	Not Offered	$6,000
Outage notification to customer - 10 % per year	$ 2/month	Not Offered	$2,400
Home Monitoring - 5 % per year	$ 5 month	Not Offered	$3,000
Annual Revenue for 1000 meter installation			$69,600

		Unit Cost	# of Units	Total Cost
Residential Fiber Ethernet Meters with Power Supply		$150	1,000	$150,000
Service Loss/Restore Alarms-	included			$0
Momentary Outage Monitoring	included			$0
User Configured Usage Profiling	included			$0
User Configured Voltage Profiling	included			$0
User Configured Demand Profiling	included			$0
Utility Configured Alarms	included			$0
Customer Alarm Notification	included			$0
Tamper Detection	included			$0
Disconnect/Reconnect		$100	50	$5,000
Installation Cost per meter		$25	1000	$25,000
Software License				$50,000
Total fixed costs			Total Costs -	$ 230,000

Financial Analysis

Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
-$230,000	$69,600	$69,600	$69,600	$69,600	$69,600

IRR 16%

A Look Ahead

- More than 60 Vendors competing in this market (changes daily)
- Over the next 10 years, every electric meter will be an advanced meter.
- Costs for open platform metering equipment will drop dramatically with the rapid deployment of broadband networks (Wi-Max, Wi-Fi).
- Electric Utilities will exploit this opportunity and expand their metering networks into home automation services.
- Electric Utilities MUST have clearly defined technology roadmap to avoid stranded obsolete assets.
- Technology strategy should be “future proof” and consistent with the long term strategic goals of the utility.

Conclusion

- Advanced Metering and Demand Response Technology is enabling utilities to reduce costs, improve service, attract new customer and enhance revenues through innovative rate design.
- Regulatory requirements and appetite for grid information has utilities re-evaluating their long term plans with respect to advanced metering, communications infrastructure and demand response.
- Now is the time for the utility re-evaluate their advanced metering technology with respect to capabilities to ensure that it is "future-proofed"