

# The Intelligent Grid and Advanced Metering



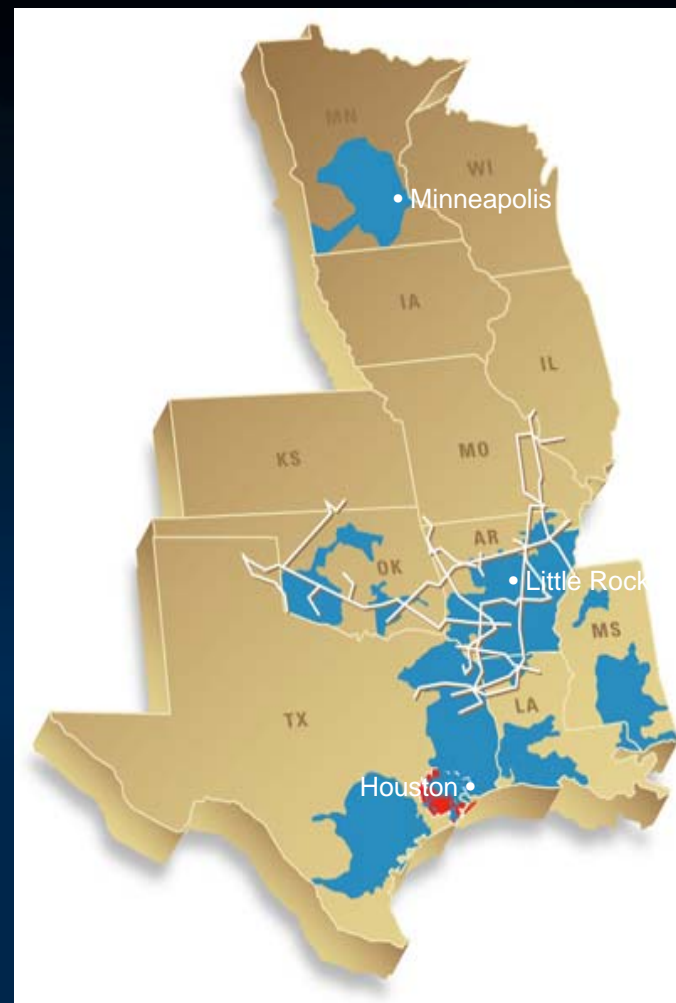
November 13, 2007

**Chuck Hackney**  
Director, Telecommunications Services  
CenterPoint Energy, Inc

# *“To be recognized as America’s Leading Energy Delivery Company... and more”*



- Public company traded on the New York Stock Exchange (CNP)
- Headquartered in Houston, TX
- Operating 3 business segments in six states
  - ▣ Electric transmission and distribution
  - ▣ Natural gas distribution
  - ▣ Interstate pipelines and natural gas gathering
- Serving nearly 5 million electric / gas customers
- \$17 billion in assets
- \$8.5 billion in revenue
- More than 9,000 employees
- Over 130 years of service to our communities



# CenterPoint Energy – Houston Electric



- Chartered in 1882
- 5,000 square-mile service area
- 1.86 million metered customers
- 73.6 billion kilowatt hours delivered yearly for about 60 certified competitive retailers
- Transmission and Distribution System
  - 3,640 miles of transmission lines
  - 34,000 miles of medium voltage lines
  - 8,000 miles of “backbone” medium voltage lines
  - 225 substations



## CenterPoint's Challenge:

Effectively monitor and control millions of line devices and miles of delivery wire which if laid end to end almost circle the earth twice around the equator.

# ***Current Electric Utility Environment***

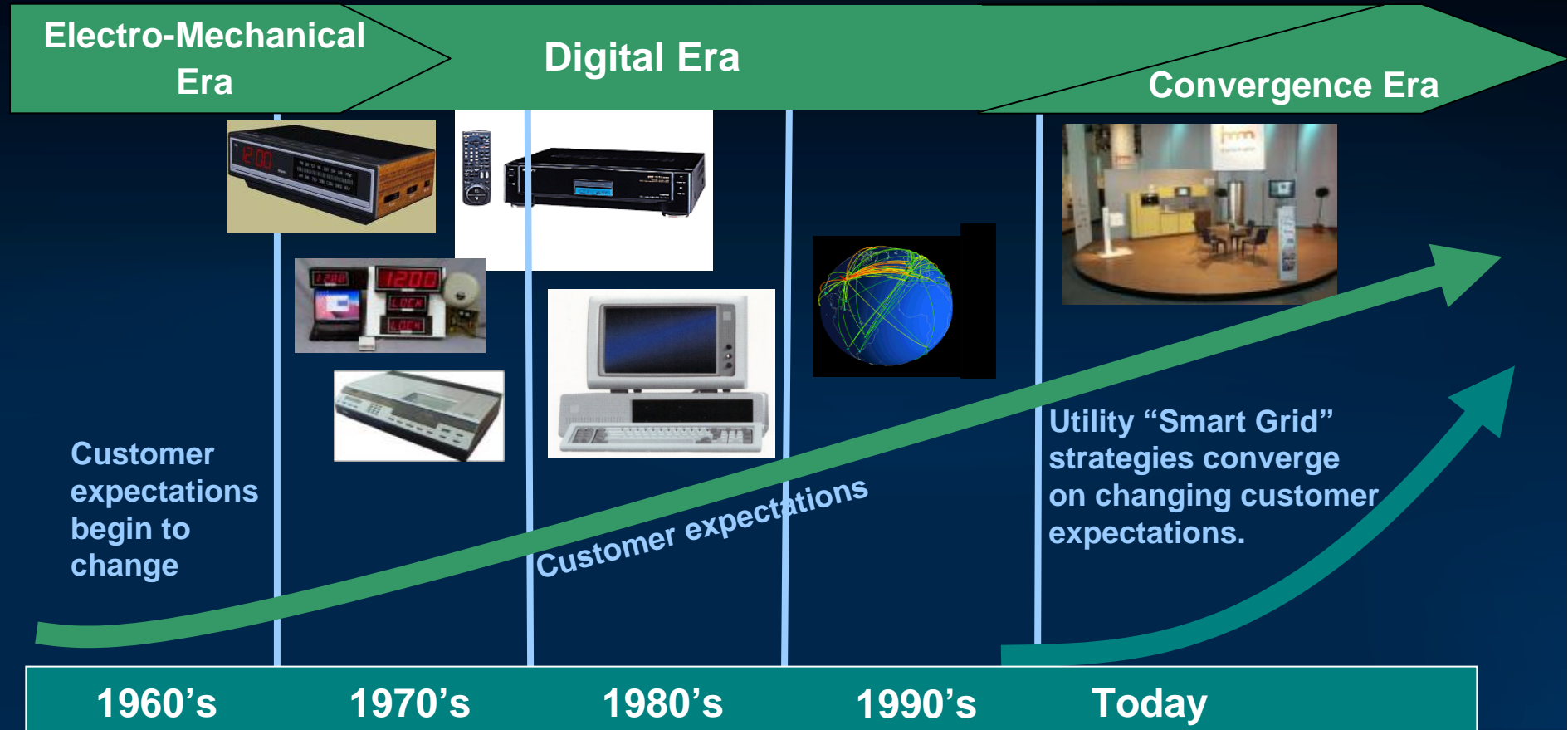


- **Increase shareholder value**
- **Increasing costs**
  - *Labor*
  - *Gas – Overall rates*
  - *Copper, aluminum, steel – Transformers / conductors*
  - *Vehicle Fuel*
  - *Taxes and franchise fees*
- **Continued regulatory pressure to decrease rates**
- **Regulatory reliability concerns / awareness**
  - *Northeast blackout*
  - *Hurricane impacts*
- **Increasing Deregulated Texas Electric Market Demands on performance**
- **Increased management / accounting controls – Sarbanes / Oxley**
- **Aging workforce – both internal and field (Knowledge / Skill Transfer costs)**
- **Electric Utility Energy Market Changes**
- **Rapidly Changing Customer Needs**

***The overall utility environment is demanding higher performance  
in an ever increasing cost environment.***

# “Rapidly Changing Customer Needs”

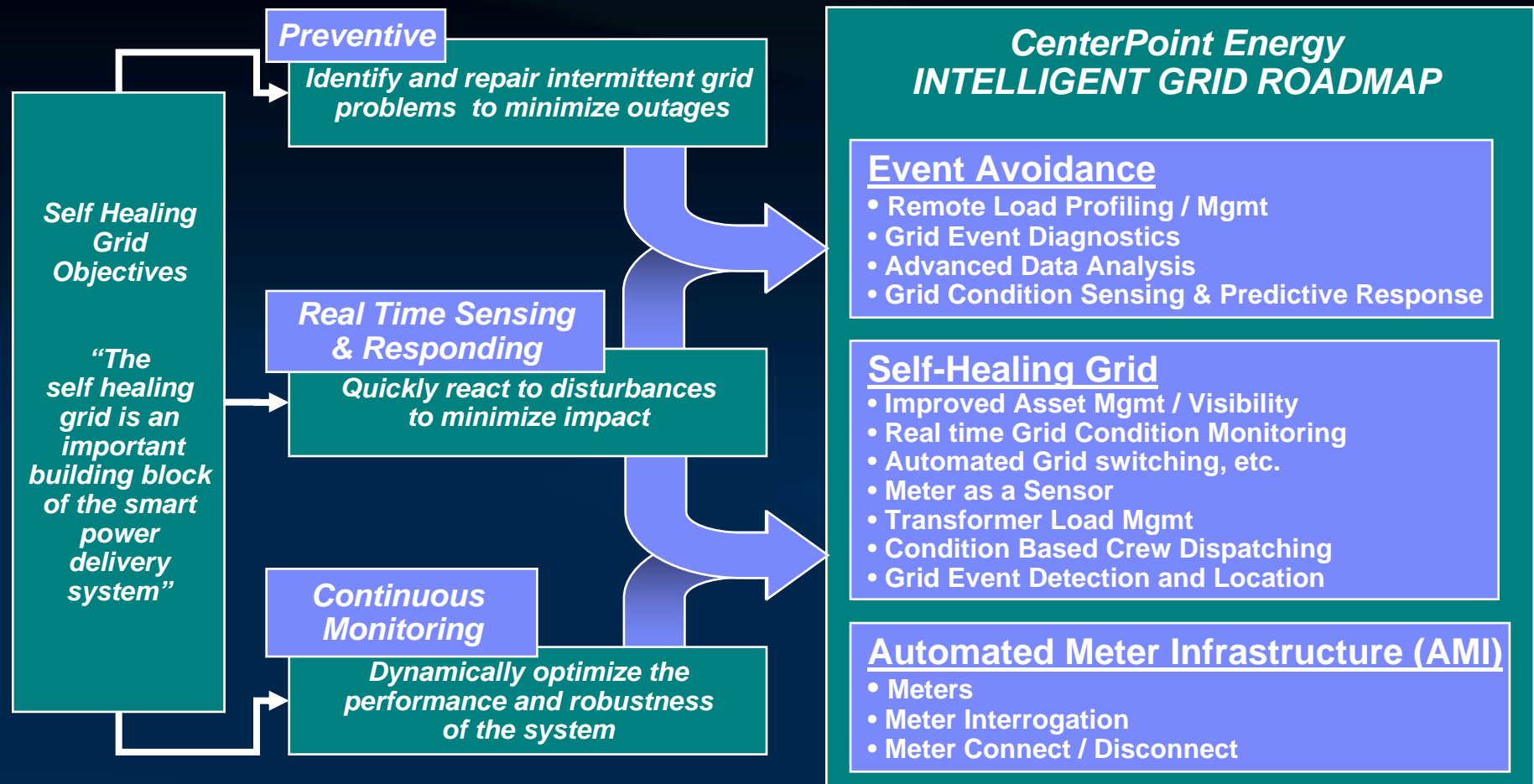
“The greatest challenge facing electric distribution is responding to rapidly changing customer needs for electricity. Increased use of information technologies, computers, and consumer electronics has lowered the tolerance for outages, fluctuations in voltages and frequency levels, and other power quality disturbances. *Source: “Grid 2030” A National Vision for Electricity’s Second 100 Years, p 7*”



# Intelligent Grid Roadmap



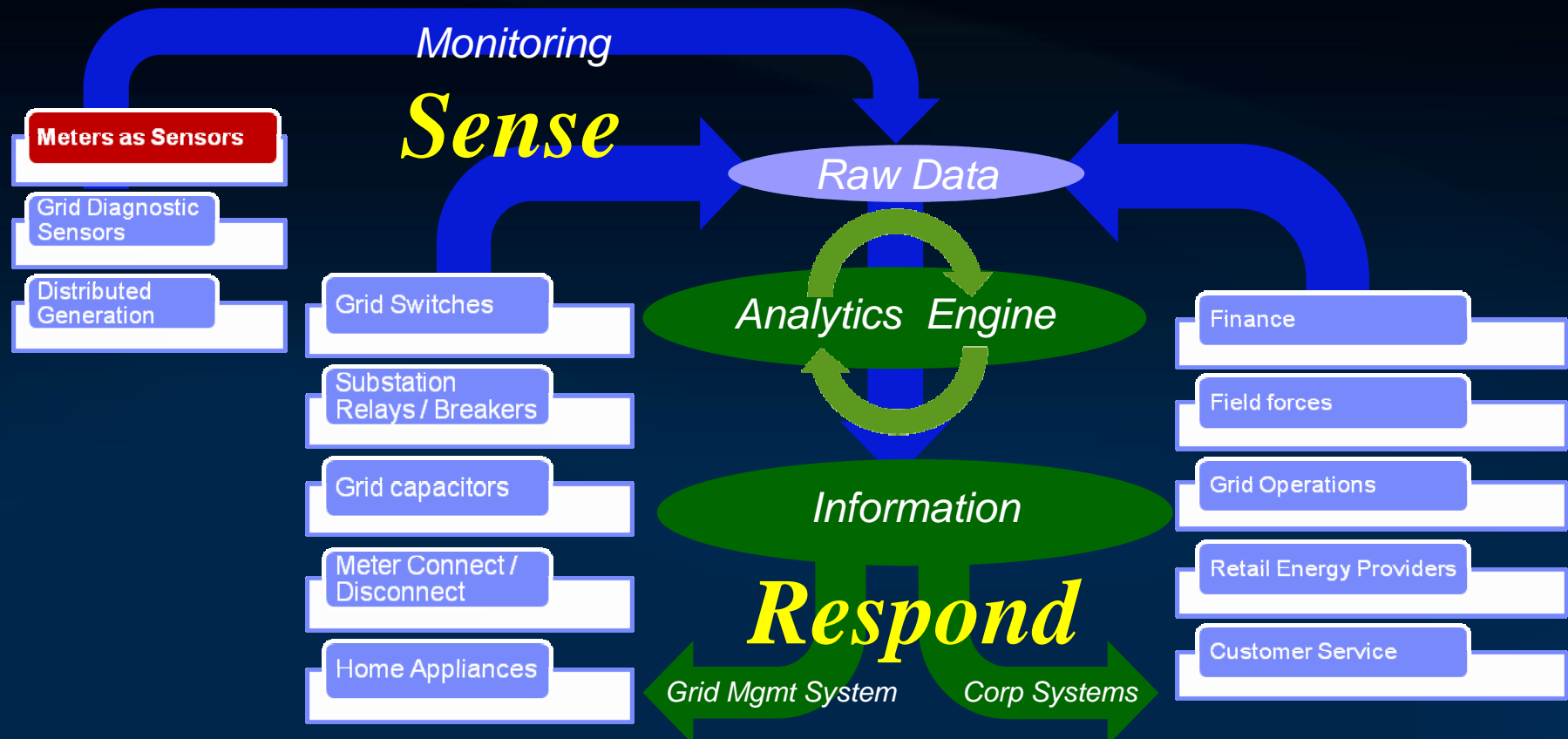
The CenterPoint Energy Intelligent Grid Roadmap aligns with the DOE's "Grid 2030" and EPRI's IntelliGrid Framework



# What Makes the Grid “Intelligent”

*Advanced meters as grid sensors.....*

*...And a robust communications network are the cornerstone to the Intelligent Grid....*

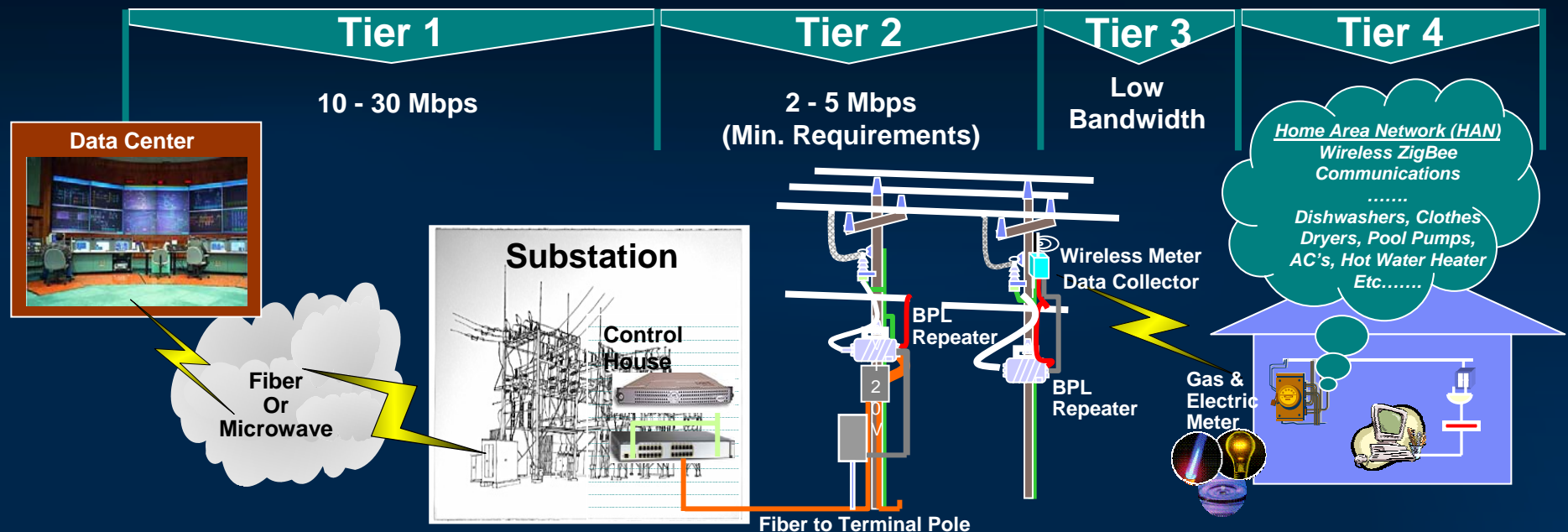


The analytics engine is the “Intelligent Brain” that will continuously receive (“Sense”) grid sensor data and will convert data to information and transmit (“Respond”) instructions to grid field devices.

# An Effective Communications Architecture that aligns with grid assets



- The backhaul communications network strategy is multi-tiered....
  - Tier 1 - Major backhaul: Data Center to the substations
  - Tier 2 - Minor backhaul: Substations to the IG device or meter relay (Utility Grade BPL)
  - Tier 3 – Wireless Meter Data Collector communicates with the meter
  - Tier 4 – Meter to ZigBee wireless connections to home energy management devices

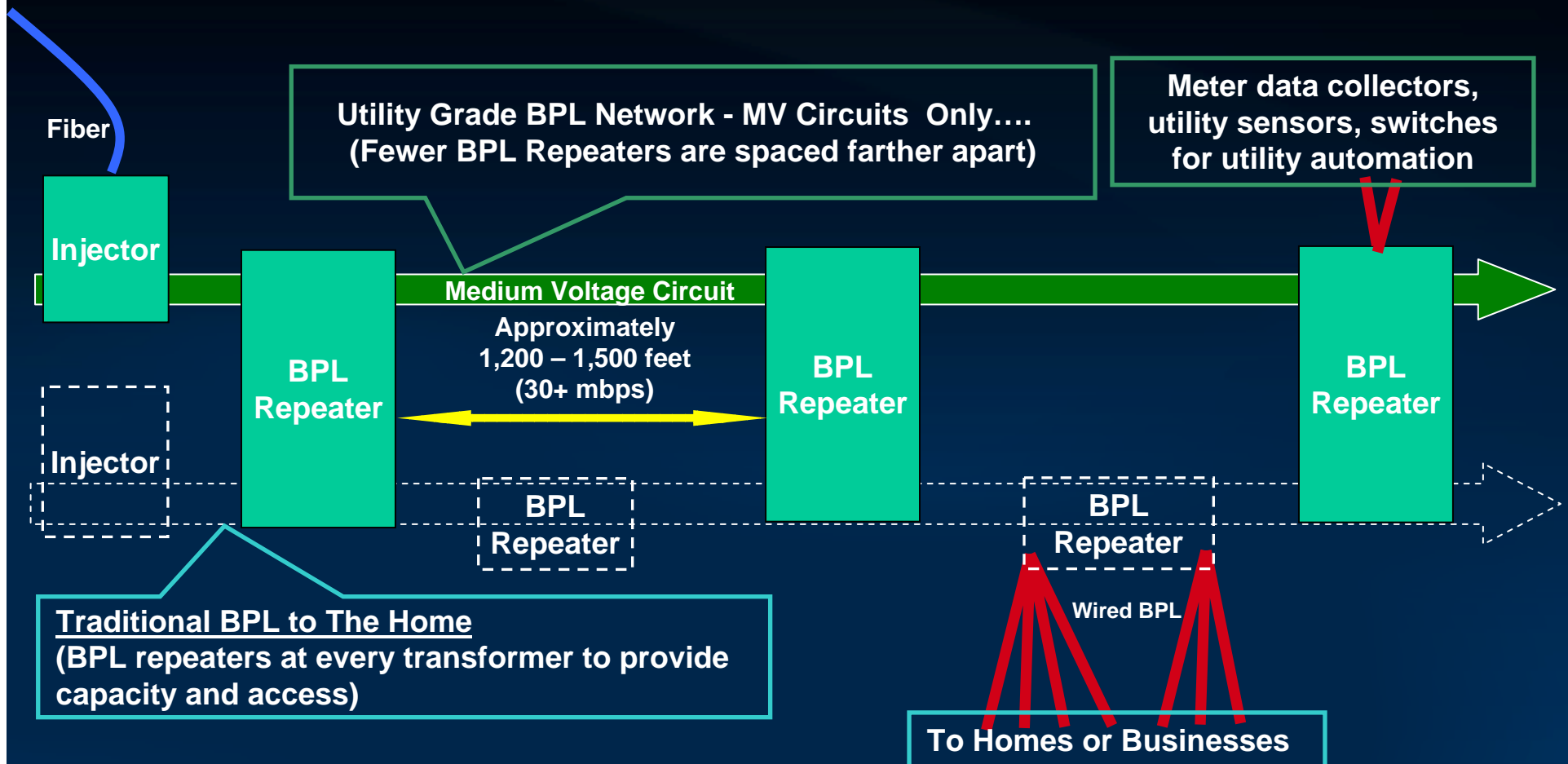


# Intelligent Grid “Utility Grade” Tier 2 Architecture

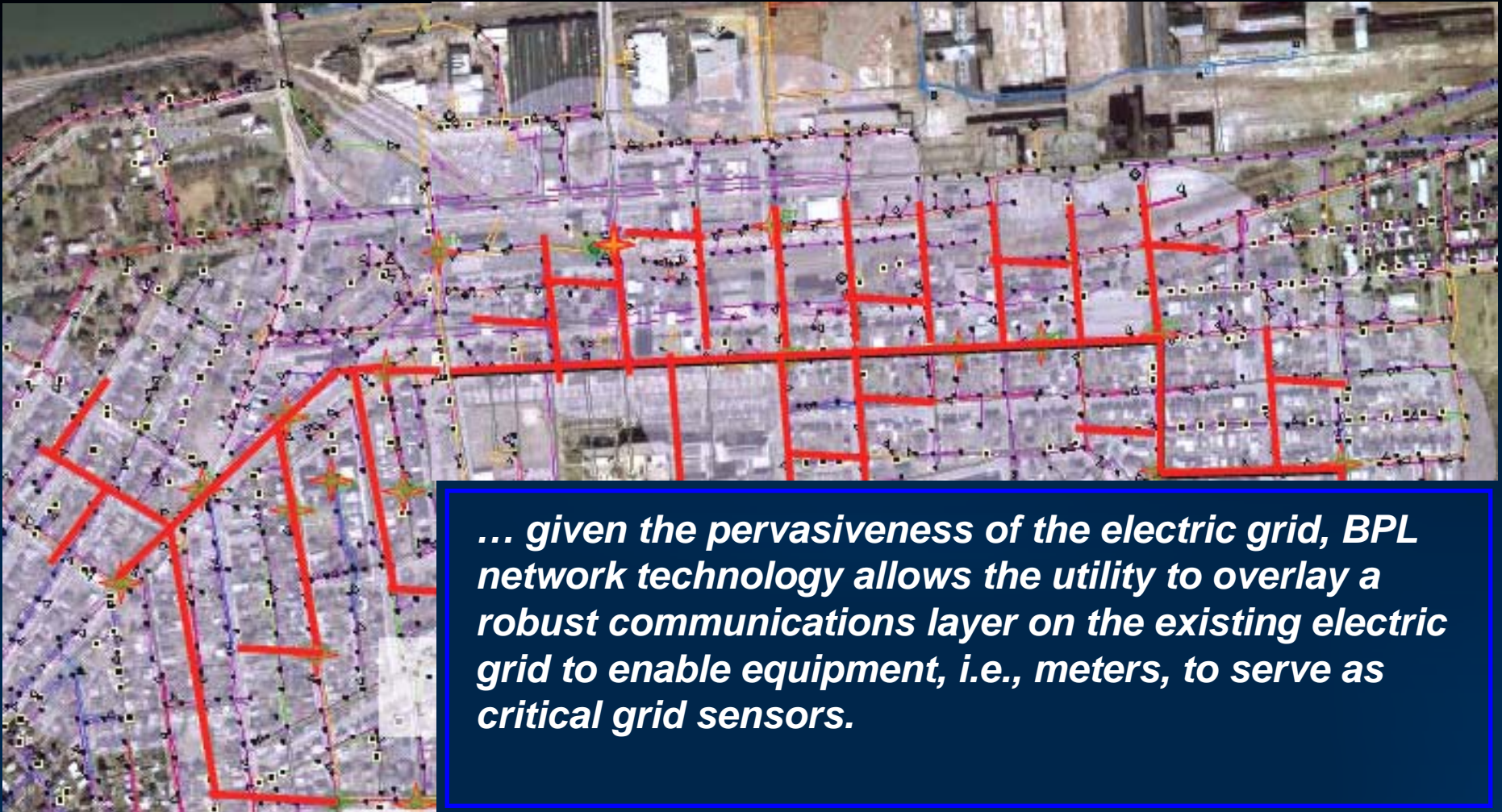


## BPL is used as a utility grade data backhaul medium.....

To meet the utility requirements, the communications architecture requires fewer BPL repeaters to achieve the necessary bandwidth.

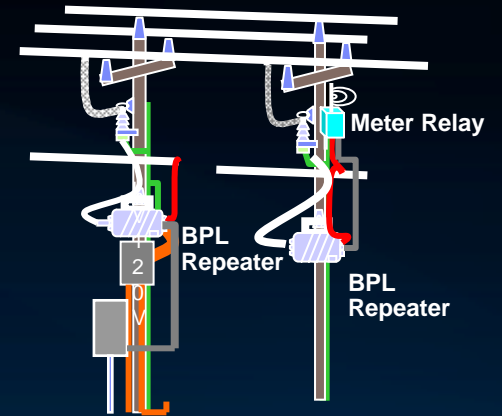


The main advantage for BPL lies in the fact that a significant portion of the network infrastructure already exists and...



*... given the pervasiveness of the electric grid, BPL network technology allows the utility to overlay a robust communications layer on the existing electric grid to enable equipment, i.e., meters, to serve as critical grid sensors.*

# Meter and In-Home Communications



Pool Pump



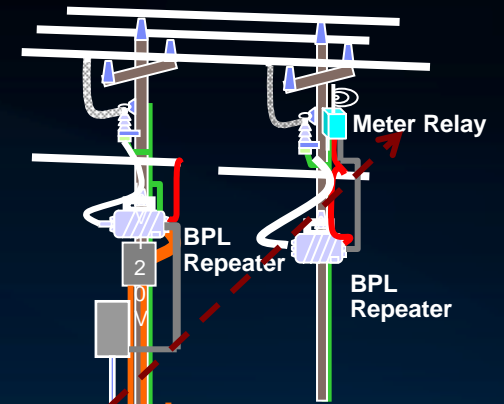
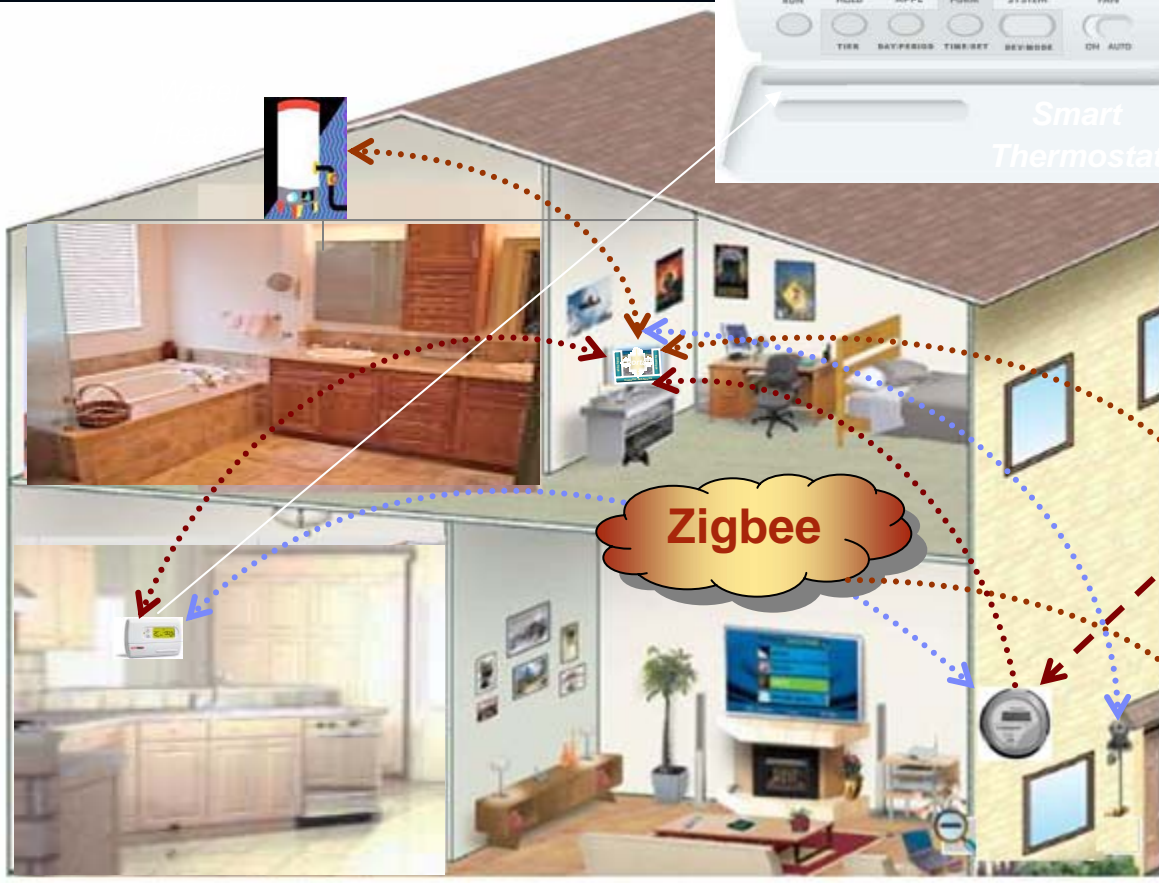
Compressor



# Meter and In-Home Communications



*Energy Management and Conservation via a Zigbee connection to home devices*



Compressor



# 2007..... *Pilot Deployment Status*



*CenterPoint Energy is working with IBM to test the end to end integration of the advanced metering and Intelligent grid components*



## AMS

Installed 9,853 advanced electric and 100 of 500 gas meters.

Integrated advanced metering software.

Integrated OpenWay Cell Relays into the BPL network.

Established 2-way communications to the meter.

Tested ZigBee HAN functionality.

## Communications

Fiber / Microwave backhaul to 3 substations complete.

20 BPL circuits (with battery backup) are communicating (99.5%+ reliability and averaging 5mbps).

## Intelligent Grid

### Testing

connectivity to automated switches, voltage regulators, etc.

# ***Technical Results from Pilot Deployment to Date***



## **Metering**

- Advanced meter network communicating via BPL with readings down to five (5) minute intervals
- Established 2 way communications to the electric and gas meters

## **Intelligent Grid**

- Established communications via BPL to line devices.

## **BPL (Network Communications)**

- Consistently achieving average 5+mbps and averaging 800 - 1,000 feet between repeaters.
- BPL repeaters are not needed at every transformer.
- Substations are an integration point for BPL circuits. No fiber runs down distribution circuits.
- Chosen BPL technology minimizes need for utility "Make Ready". Significant cost avoidance.
- Worked closely with ARRL leadership to mitigate any BPL misconceptions and/or noise issues.
- Chosen technology emits little or no noise.
- Strong Design, Construction, and Installation standards / processes are important for efficient design and build.

# Overall Observations / Take-aways to Date



- Alignment with a strong technology / business integrator, like IBM, is key (assessing alternative and emerging technologies, experience with large, complex system rollouts, and integration capabilities)
- Engage executive leadership and stakeholders early
- Showcase the strategy and technology deployment components to convey “automation” vision (CNP Technology Center)
- Strategy development and deployment is a business unit centric strategy that uses technology as an enabler. It’s a business operations technology “Pull” and not an IT “Push”.
- Advanced metering deployment strategy should be integrated into an overall “Intelligent Utility Network” and data communications strategy to leverage meter as an end-point for grid and network management.
- Robust multi-tiered communications strategy is necessary to handle the data.

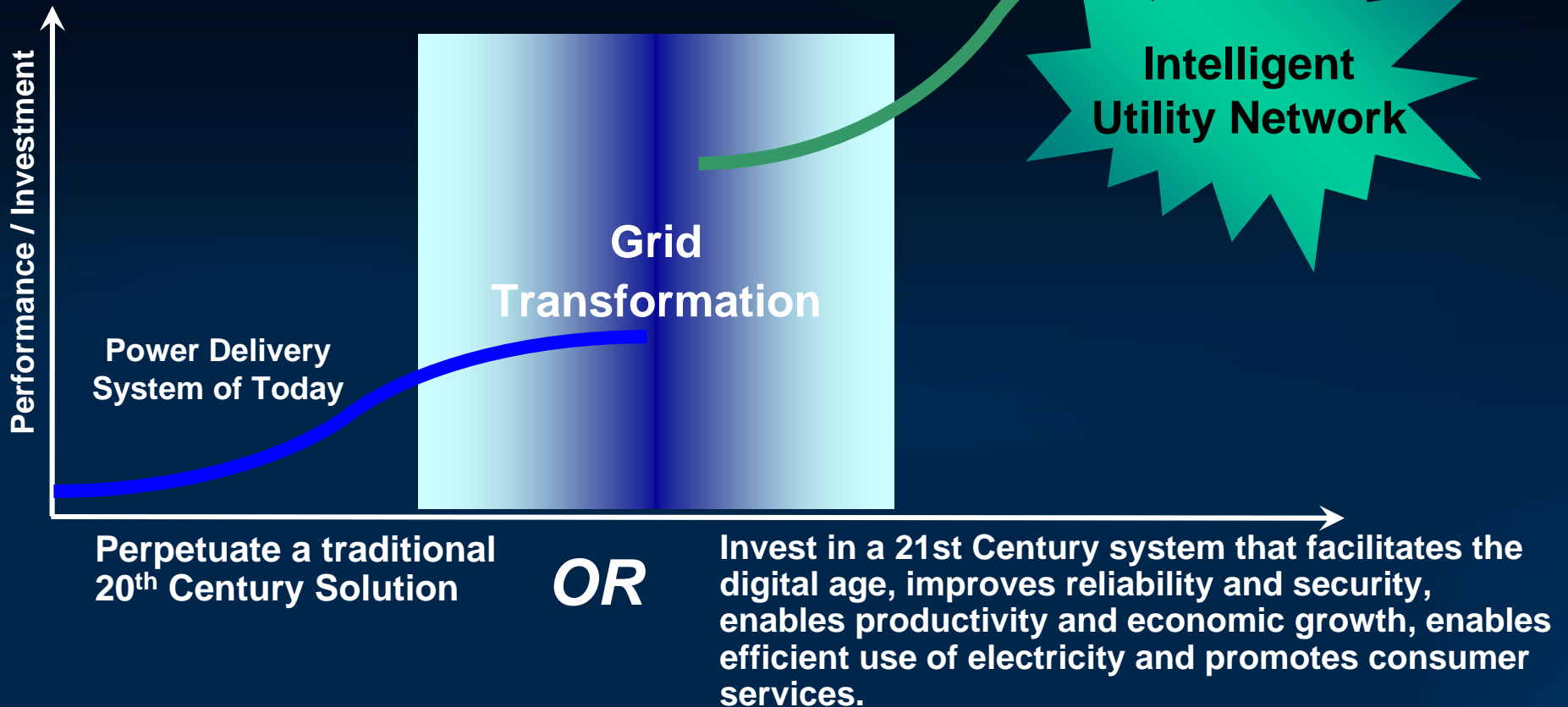
# Utility Transformation Opportunity



## Utilities are at a crossroads.....

**Fact:** According to the DOE Grid 2030 report, in the next 20 years, the U.S. will spend \$450B on electric infrastructure; just to meet load growth.

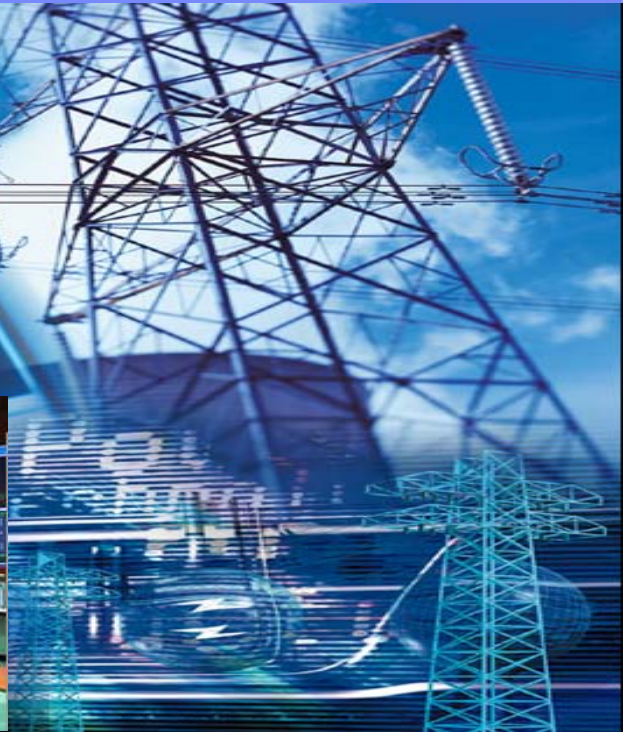
## We have a choice...



# The Intelligent Grid and Advanced Metering

**CenterPoint  
Energy**

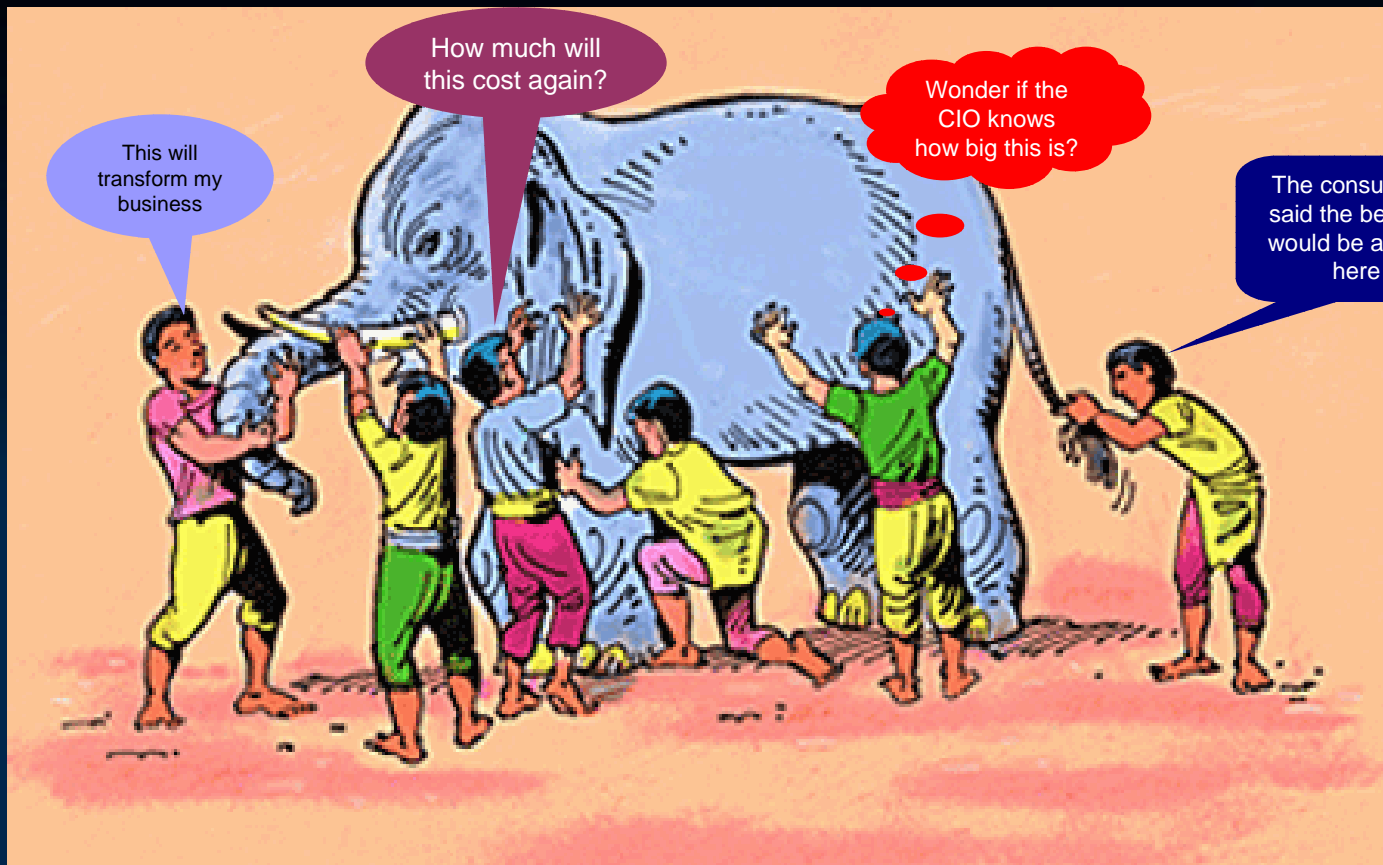
**IBM**



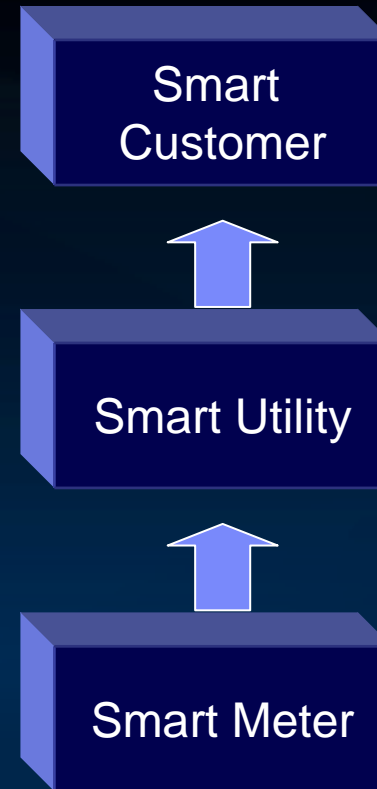
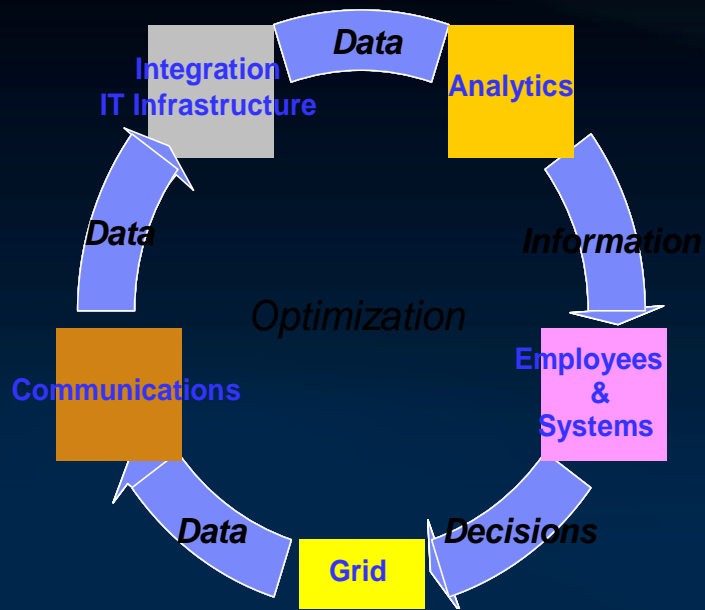
**November 13, 2007**

**Stephen J. Callahan**  
Partner  
Smart Grid Practice Leader Americas  
IBM

# Blind Men and the Elephant



# AMI is the foundation for the Intelligent Utility Network (Smart Grid) vision

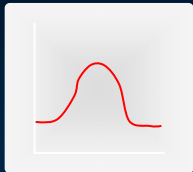


Benefits are driven by the applications that provide value to the customer and the utility



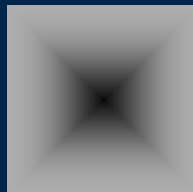
### ■ Distribution Operations / Reliability

- Outage detection and restoration
  - Identifying "single-light-out" situations
- Asset optimization
  - Asset loading
- Emergency response
  - Emergency load shedding



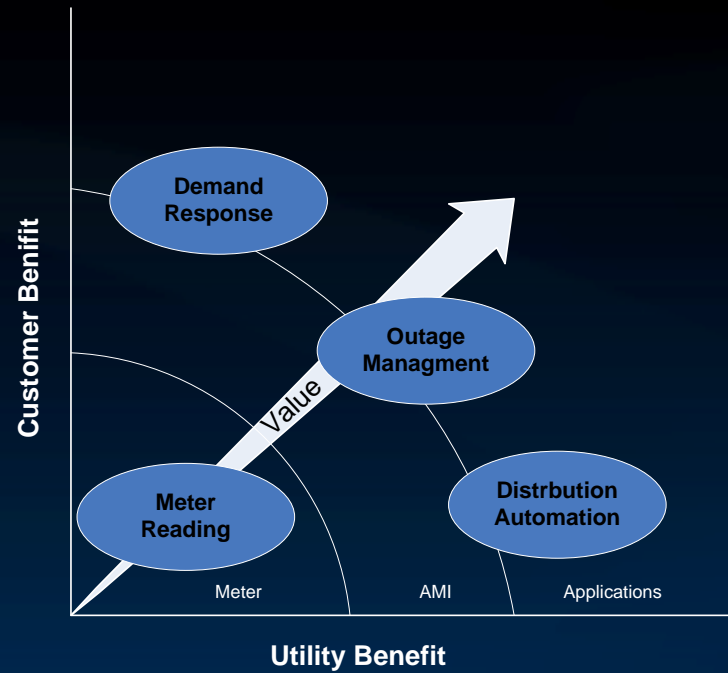
### ■ Demand Management

- Time-based pricing (TOU, CPP)
- Energy profiling and analysis
- Online energy audits / analysis
- Load control extensions



### ■ Customer Service

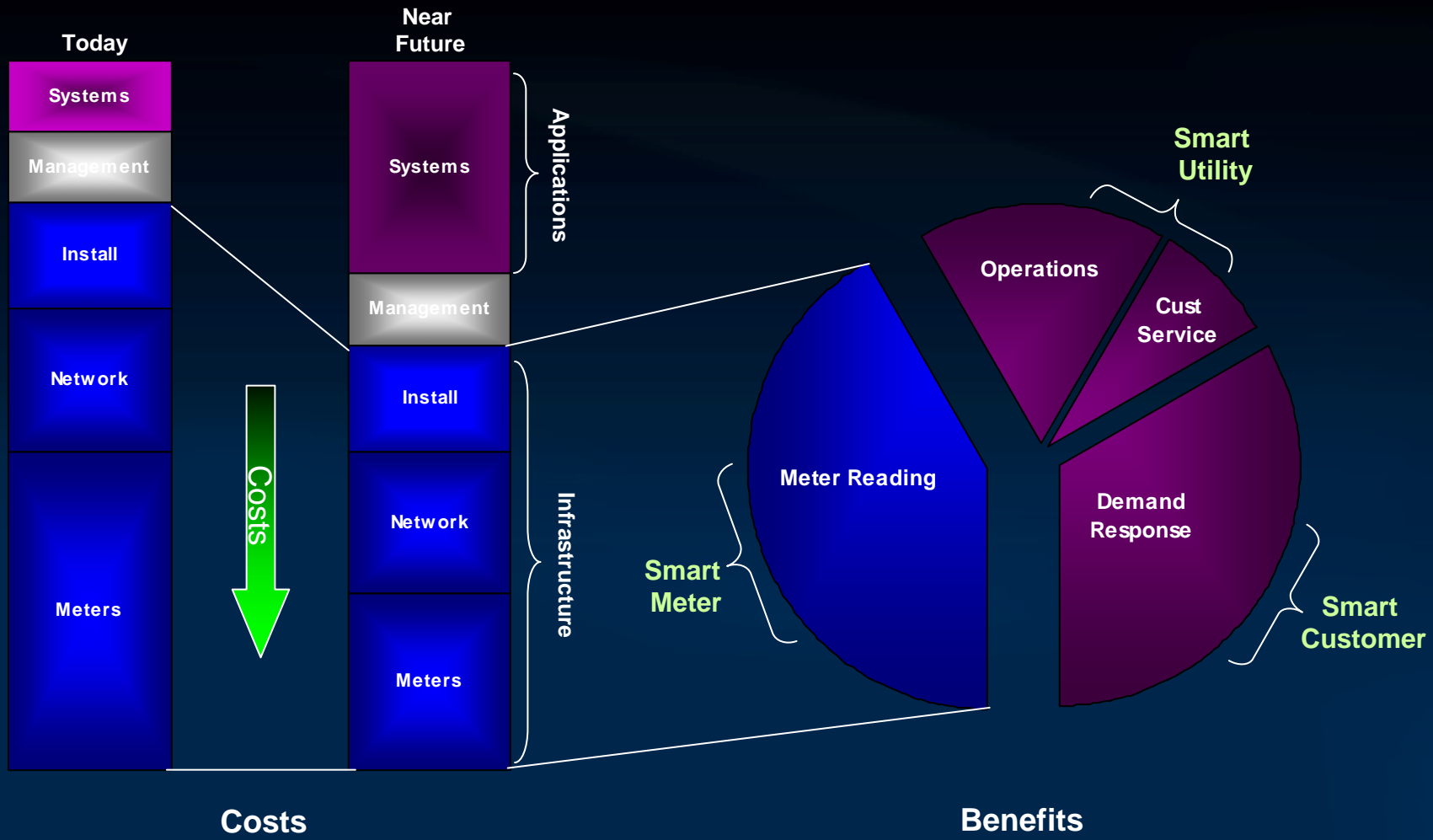
- Better customer information for CSRs
- Reduced customer call volumes



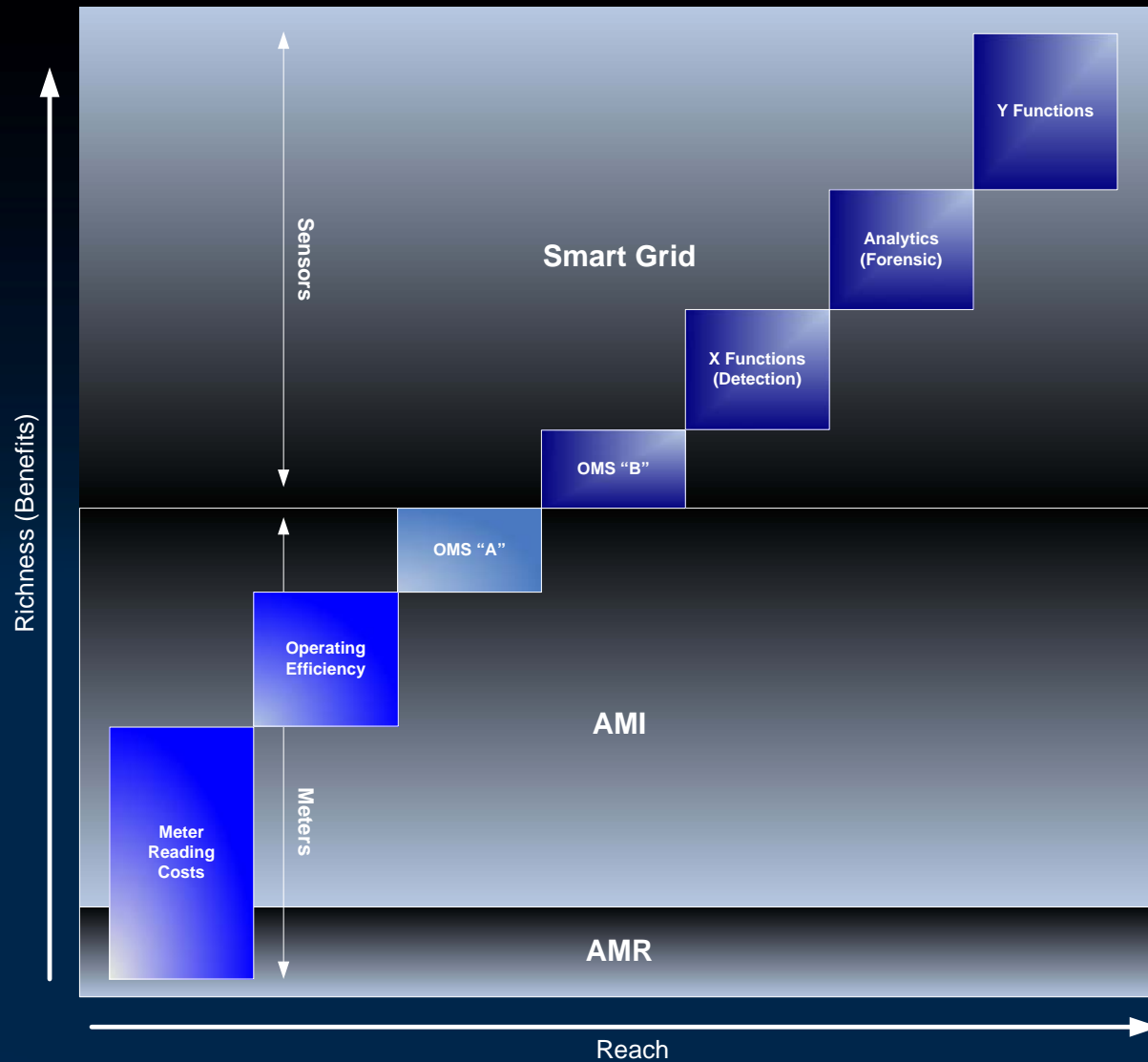
### ■ Revenue Enhancement

- Cash Flow
  - Fewer estimated bills
  - Shorter billing cycles
- Loss Identification
  - Tamper Alarms
  - Load balancing
  - Move-in detection
- Loss Response
  - Load limiting
  - Remote and virtual disconnect

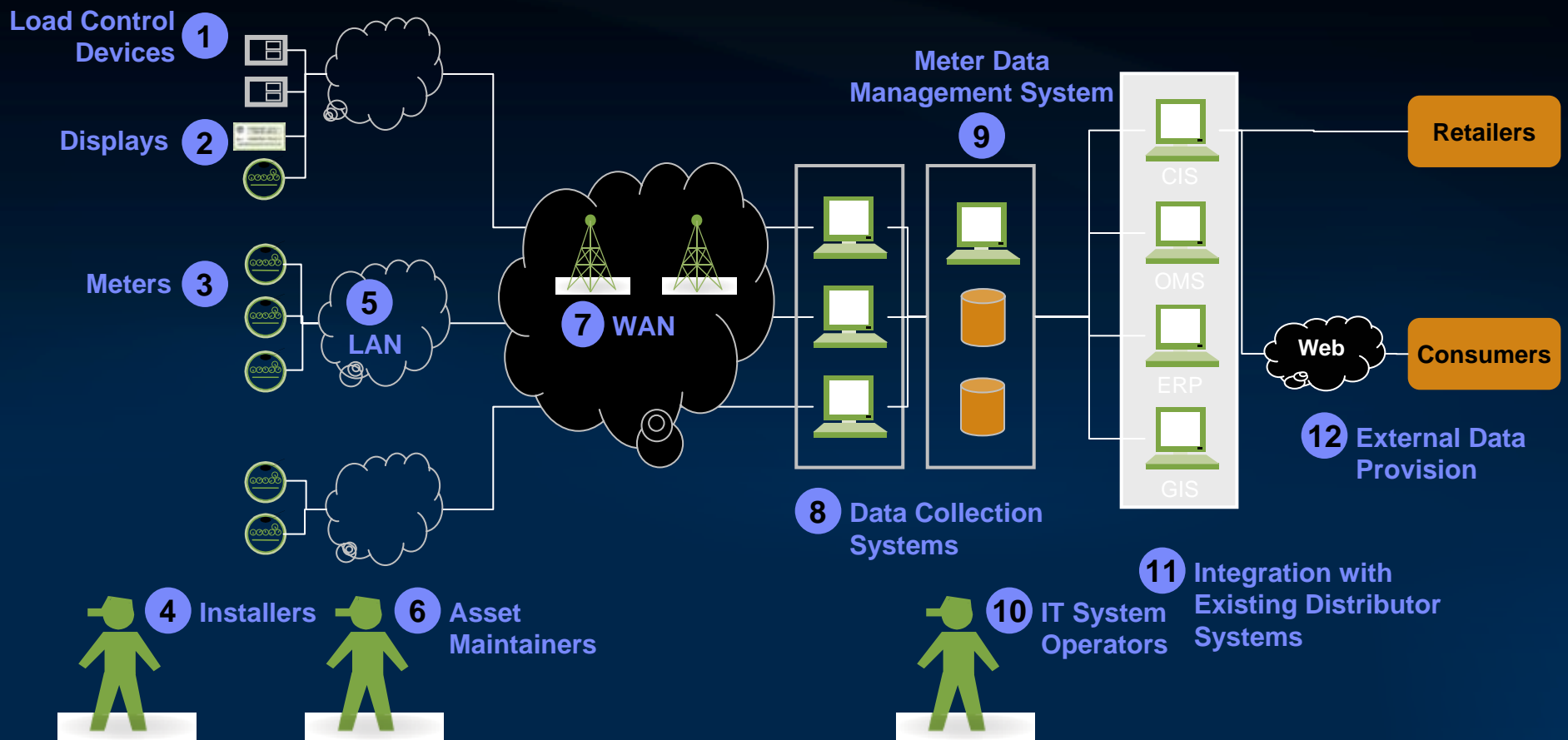
As costs of infrastructure decline the systems that provide applications will rise in importance and value



The richness and reach of these applications will drive significant value for the utility and customers



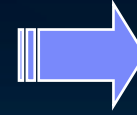
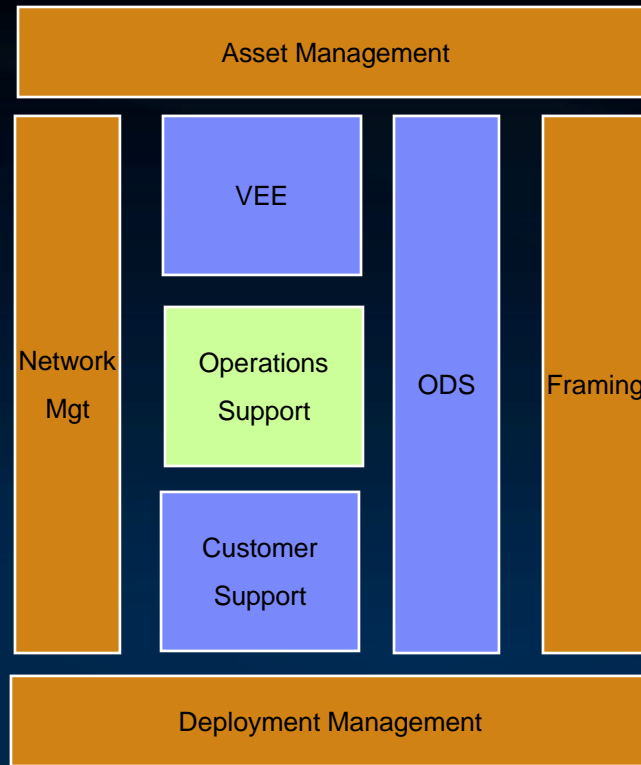
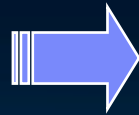
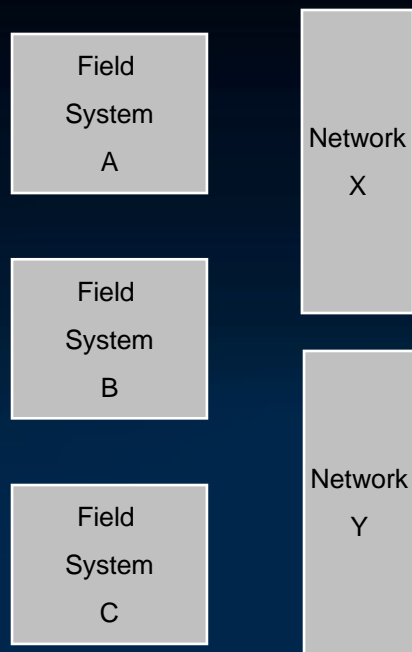
# The Pervasiveness of the Challenge



# Integration between the AMI field systems and enterprise applications enables a complete “re think” of the enterprise application framework



## AMI Field Systems and Networks



## Customer Enterprise systems



Core Function

Provided in all viable systems

Customer Specific

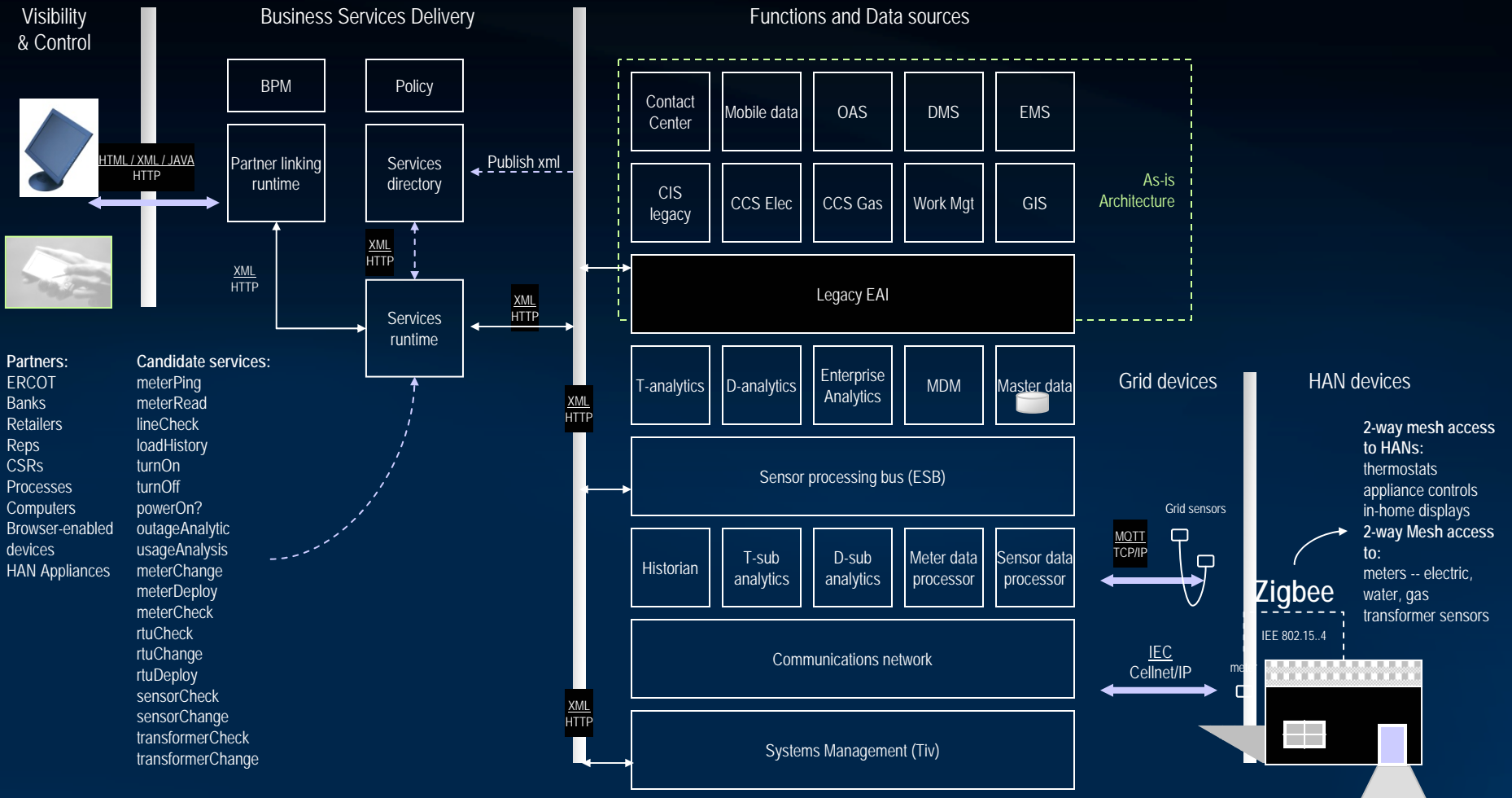
Variable based on customer enterprise strategy

Differentiated

Strategic area of development



# SOA – A Strategic Necessity



## The imperative of “Open”

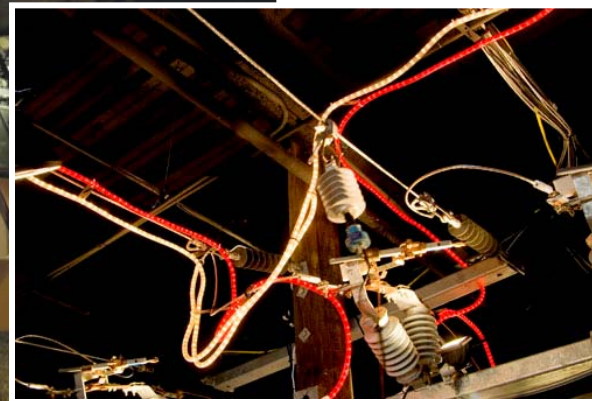
- The “Open” movement is enabling infrastructure interoperability to help companies respond to ever-changing business needs
- Open standards and new process standardization efforts reduce business complexity and better integrate work teams with the information they need in order to innovate
- New IP practices are shaping innovation models that serve to differentiate new ideas while driving for more open, collaborative innovation

## Realizing the value of Smart Meter innovation



- AMI is the foundation for the Intelligent Utility Network (IUN)
- To achieve the benefits of IUN a smart meter, a smart utility and a smart customer are required
- A smart meter is a strategic application enabler (i.e. a means not an end)
- The “value applications” support an informed and empowered customer (smart customer) and a situational aware and proactive utility (smart utility)
- The proven strategy of open standards will drive cost of implementation down and drive innovation up

# Questions?



**CenterPoint Energy Technology Center**