



The Smart Grid Vision & Smart Meters for the Gas Industry

Terry Mohn

Chief Strategy Officer, General MicroGrids

Vice Chairman, GridWise Alliance

GeneralMicroGrids



Outline

Why look at smart grid

Defining a smart grid

Three paths to a smart grid

Systems view

Communication network is a corporate strategic investment

Is the Gas Industry ready for smart meters?

Headlines

Environment

- Green House Gas
- Energy Independence
- Economic Recovery

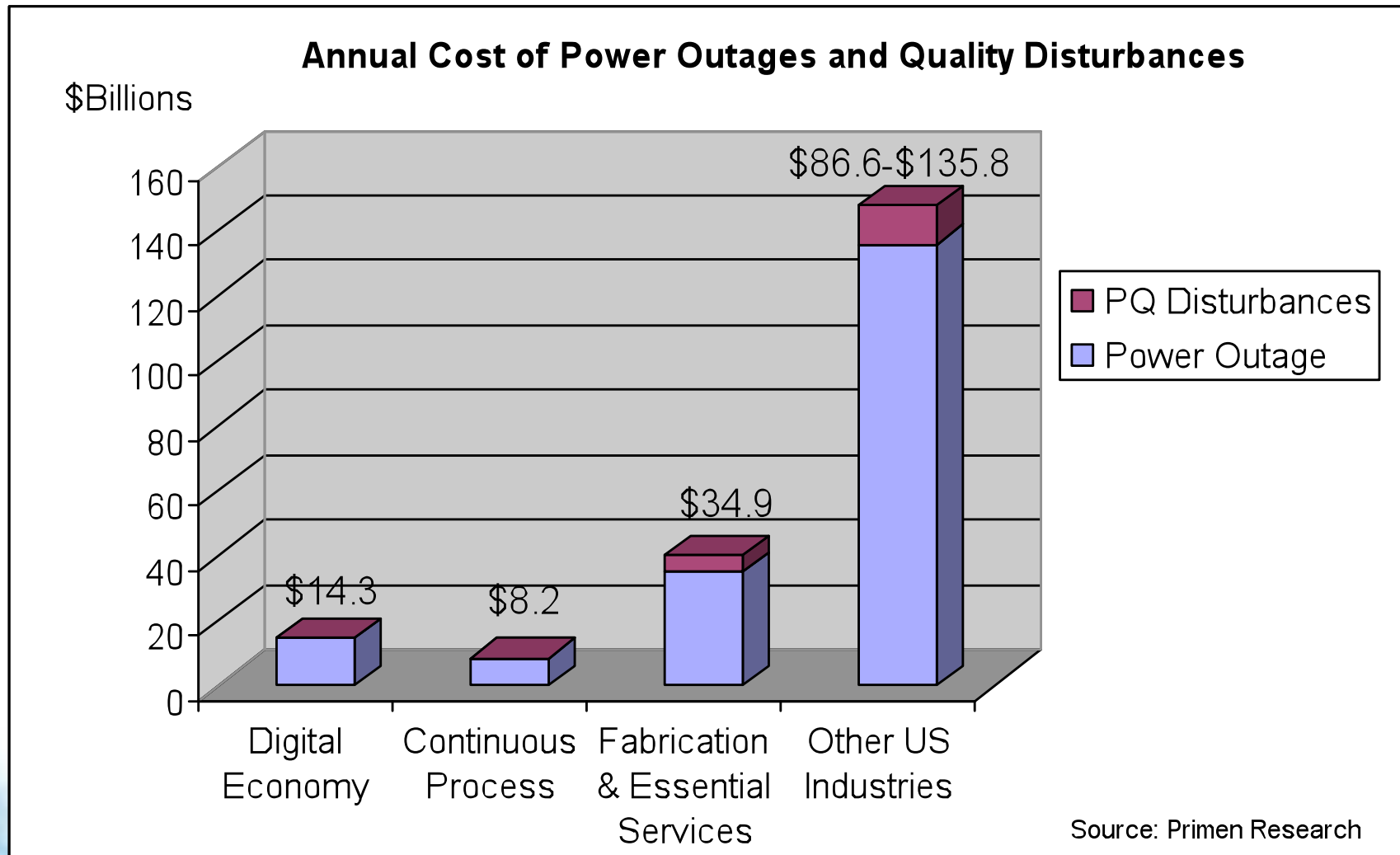


Legislation

- EPACT 2005
- EISA 2007
- EESA 2008
- ARRA 2009



Power Disturbance Costs



Energy Prices

Average On-Peak Spot Electric Prices 2008



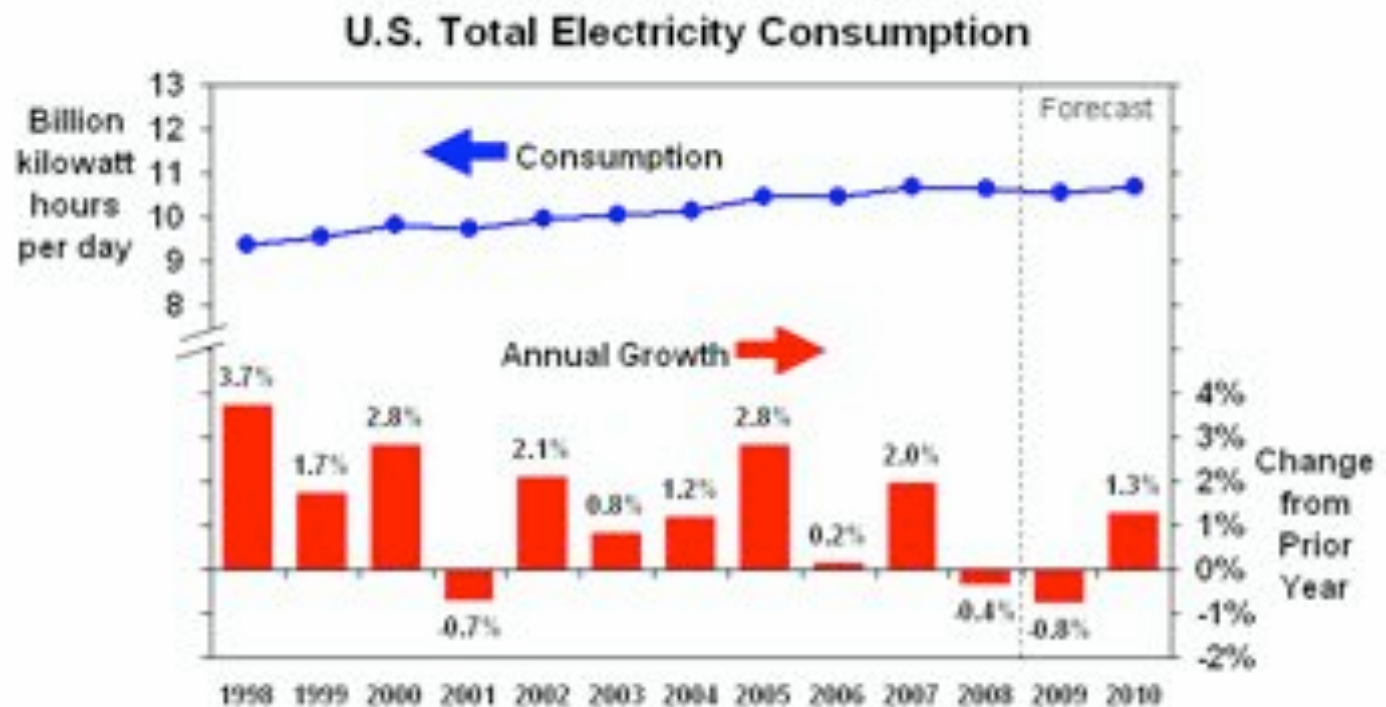
Electricity prices are a straightforward signal of anticipated price pressures between last year and this year. The map illustrates recent key summer 2008 electricity prices. In almost all, markets are signaling double-digit electricity price increases this summer over last.

- FERC 2009 Market Oversight

Energy Demand Growth

Total electricity sales are projected to continue to increase.
Electricity sales are strongly affected by the rate of economic growth.

DOE Report,
February 2009

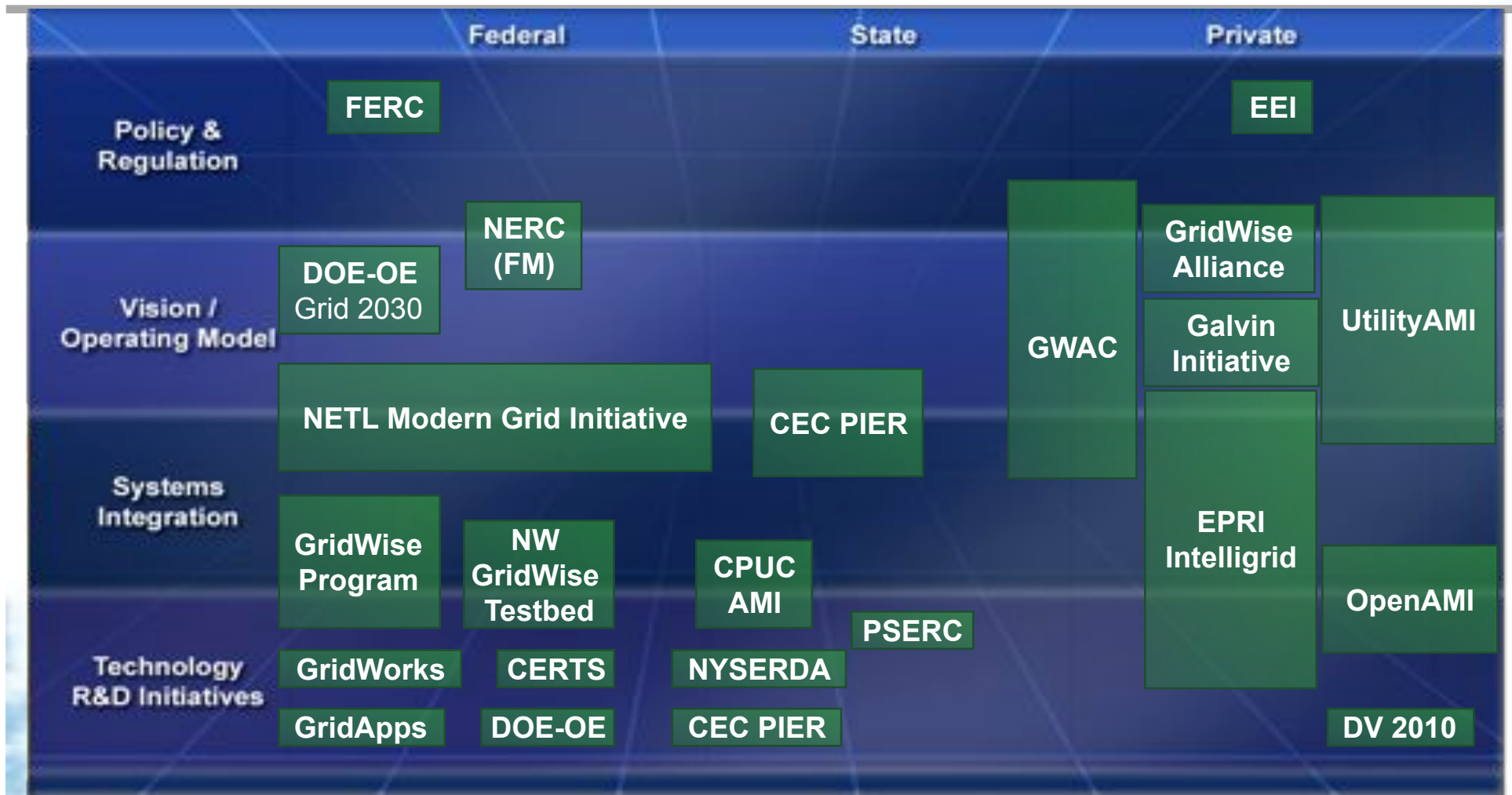


Short-Term Energy Outlook, February 2009



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Diverse Stakeholders



A smart, integrated grid

Detects and fixes emerging problems

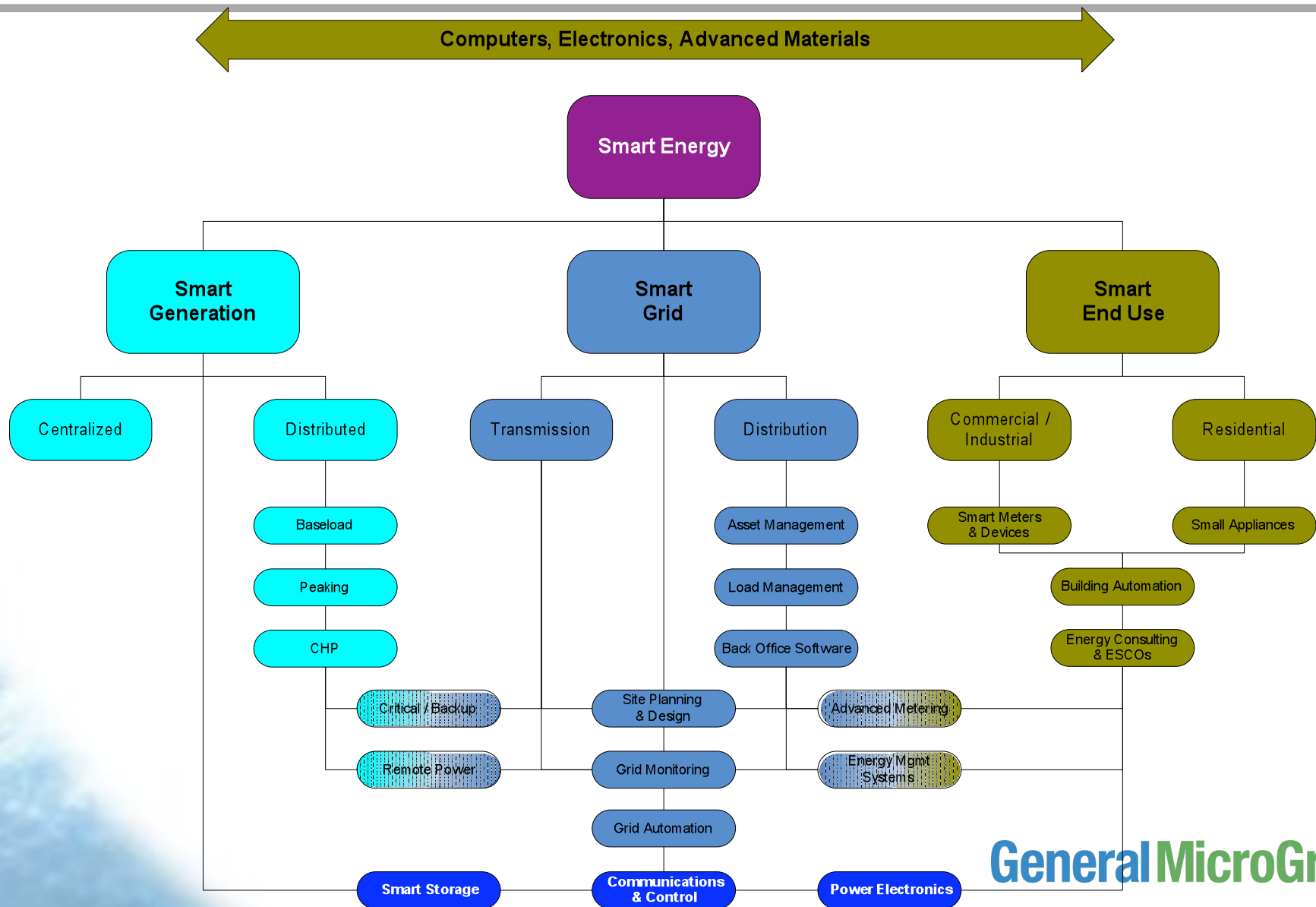
Incorporates measurement, diagnostics and feedback

Re-routes power flows

Enables loads and distributed resources

Incorporate advances in IT and communication technologies

Elements of a Smart Grid



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Characteristics

Self-healing

- A grid able to rapidly detect, analyze, respond and restore from perturbations.

Empower and incorporate the consumer

- The ability to incorporate consumer equipment and behavior in the design and operation of the grid.

Tolerant of attack

- A grid that mitigates and stands resilient to physical and cyber security attacks.

Provides power quality needed by 21st century users

- A grid that provides a quality of power consistent with consumer and industry needs.

Accommodates a wide variety of generation options

- A grid that accommodates a wide variety of local and regional generation technologies (including green power).

Fully enables maturing electricity markets

- Allows competitive markets for those who want them.

Optimizes assets

- A grid that uses IT and monitoring to continually optimize its capital assets while minimizing operations and maintenance costs.

Technologies

Grid-wide integrated communications

- Internet for the power grid

Sensing, metering, measurement

- Digital two-way communication devices
- Enable generation connect and disconnect
- Enhance operator information

Advanced control capabilities

- Computer based grid monitoring
- Enables dispatch of distributed resource

Advance grid components











































- Energy storage
- Distributed generation

Decision Support

- Analytics to guide grid operators
- Semi-autonomous agent software

Characteristics and Key Technologies

 = high influence
  = medium influence
  = low influence

Characteristic Mutual Influence To Key Technology	Self Healing	Empowers Consumer	Attack Tolerant	Power Quality	Generation Options	Enables Energy Markets	Asset Optimization
Integrated Communications							
Digital Power System							
Automated Distribution							
Transformed Metering							
Integrated DER							
Enhanced Efficiency							

Three paths to starting a regional smart grid

Organic – business as usual

- Huge capital expenditures as assets retire
- New technologies lead to declining costs

Utility of the future

- Spread costs across several projects

Smart Meter

- Communication infrastructure is key
- Digital electric meters are also sensors

Smart Meter - It's more than meters, it's foundational

Digital Meters

- Data storage
- Calibrated
- Upgradeable Software
- Bi-directional, secure communication
- “near” real-time rates and energy measurement

Remote connect and disconnect

Home Area Network

Designed for distribution automation,
distributed generation, autonomous islanding

Net metering for consumer generation choices

- Hydrogen
- Solar
- Electric vehicles

New utility applications – OMS, DMS, GIS,
ERP, SOA

Fiber and wireless everywhere – transmission
and distribution

Blurring the lines between IT and Electric T&D



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Systems View

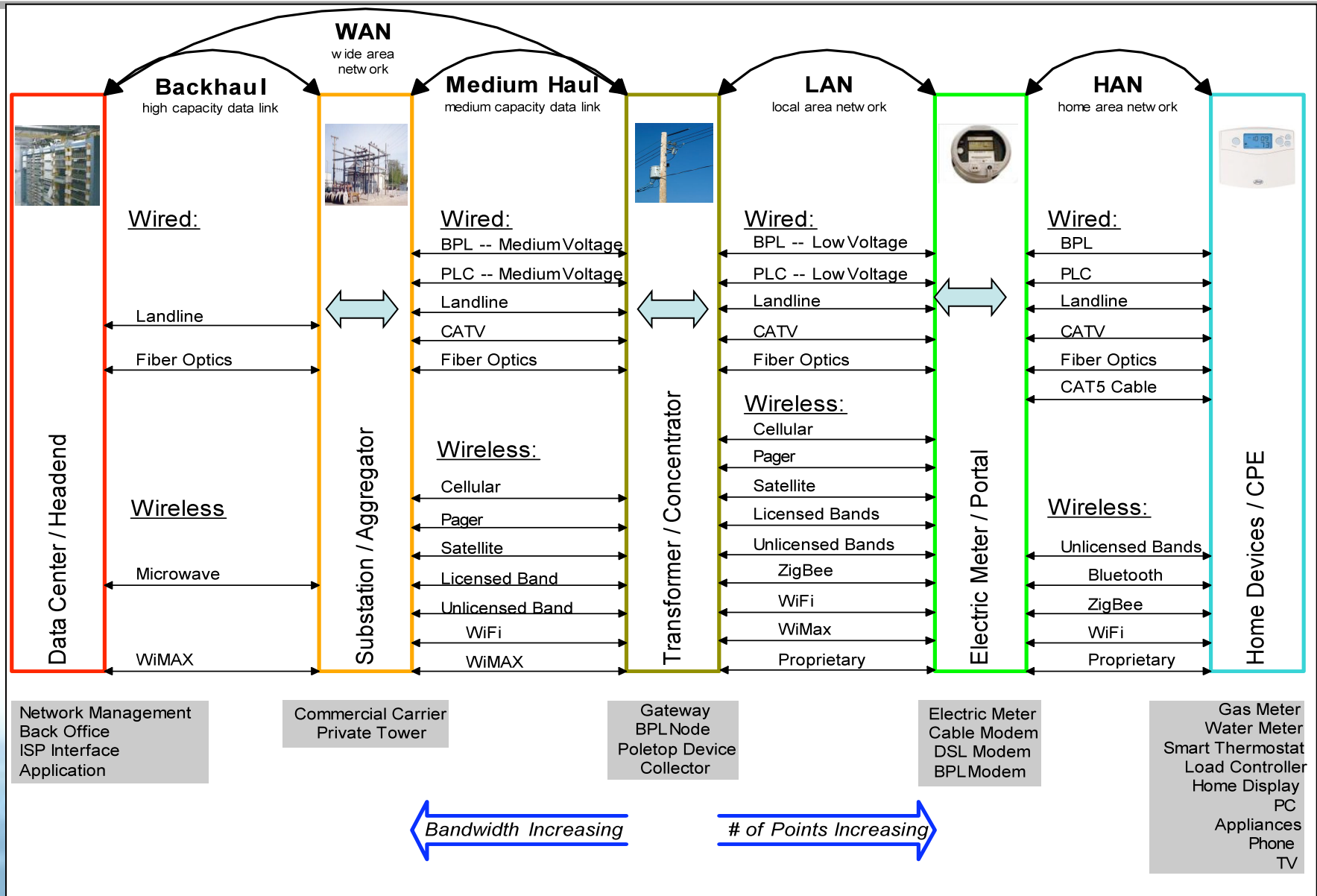
The “Systems View” perspective takes a holistic and objective approach to a subject, including technical, economic, regulatory, political, and societal aspects.

It includes the complete recognition of the power system as one integrated machine having many interdependent parts.

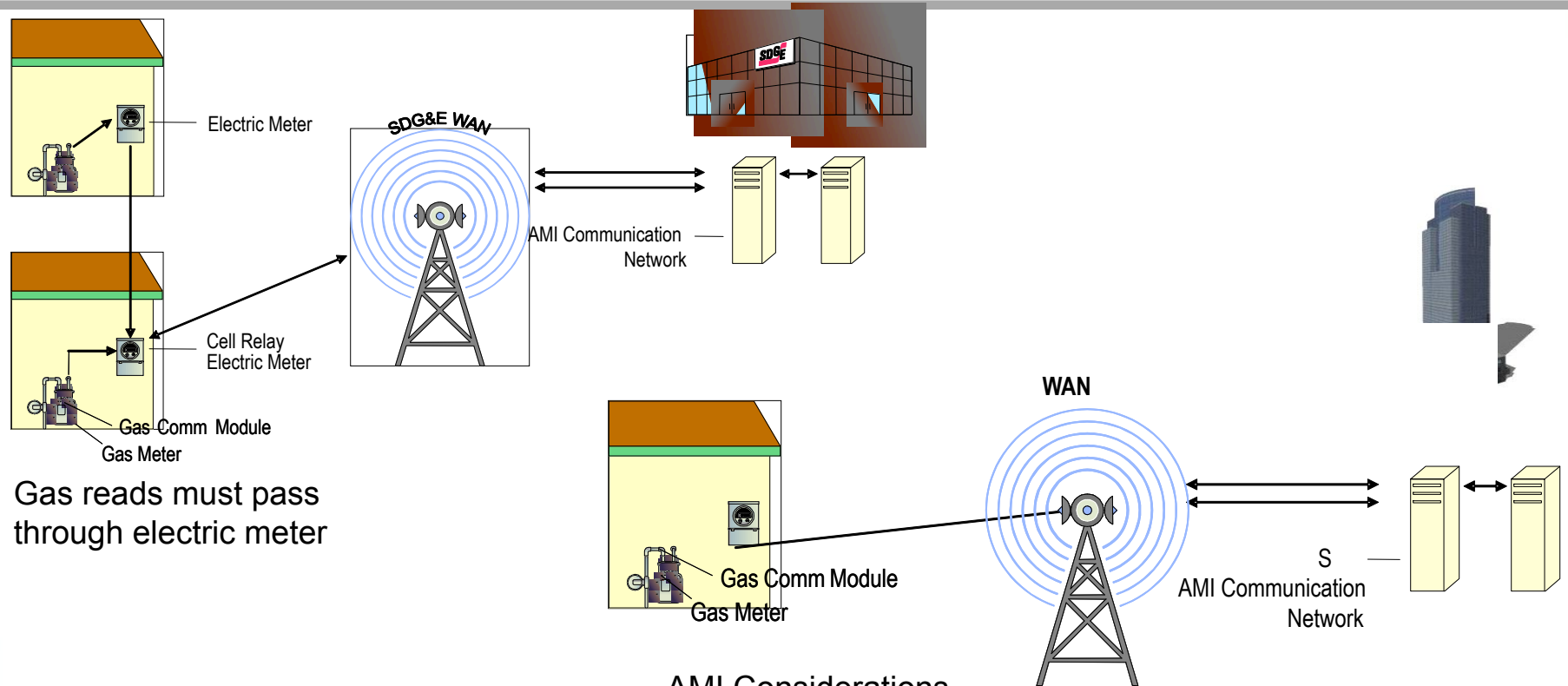
It recognizes that solutions can come from a wide and diverse range of sources.

A “Systems View” also takes account of the full range of costs and benefits to society associated with the provision of reliable power.

Utility Area Network



AMI Technology Architectures



AMI Considerations

- Capable to include water & electric meter
- 20 year battery life
- 2-way communications network
- Hourly reads collected daily

Summary

Strong commitment to standards development

IT is a partner towards any business strategy

Consider an IP-centric network

Smart Meters could be foundational

Communication systems designed for additional uses

Q/A

Terry Mohn

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Vice Chairman, GridWise Alliance

Terry.mohn@generalmicrogrids.com

GeneralMicroGrids