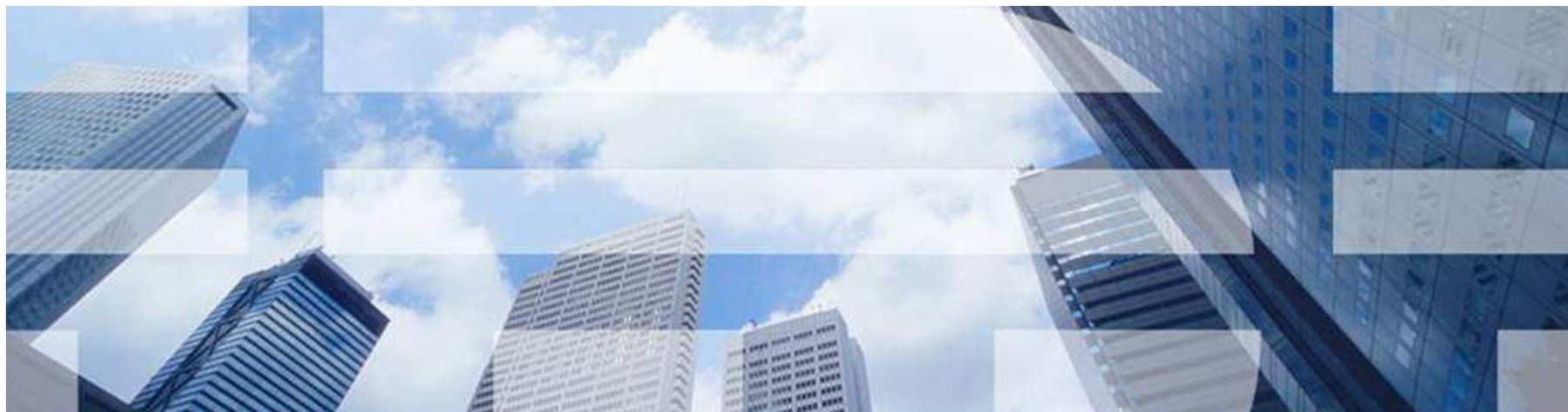




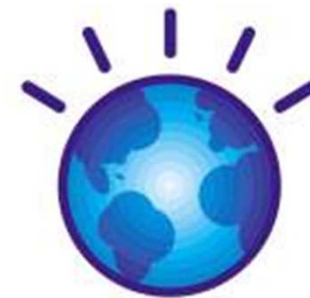
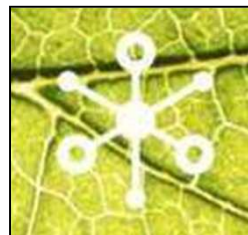
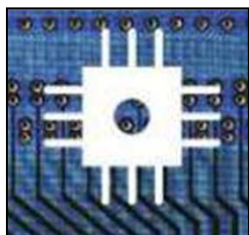
Smarter Buildings and the Smart Grid

Jim Fletcher, IBM Distinguished Engineer, Chief Architect IBM Smarter Buildings

April 2011



Something profound is happening in Smarter Buildings



INSTRUMENTED

Facilities can be fully instrumented at all levels.

INTERCONNECTED

Building systems are interconnecting in entirely new ways.

INTELLIGENT

Intelligent interaction possible with externalities.

SMARTER

Information is shared to improve building operations and occupant well-being.



The Need for efficiency in commercial buildings is clear

2025

New urban growth is driving demand for commercial buildings around the world. By 2025, buildings will be the #1 consumer of energy in the world.

50 percent

Energy waste in commercial buildings is a common problem. Up to 50% of energy and water are often wasted in many buildings.

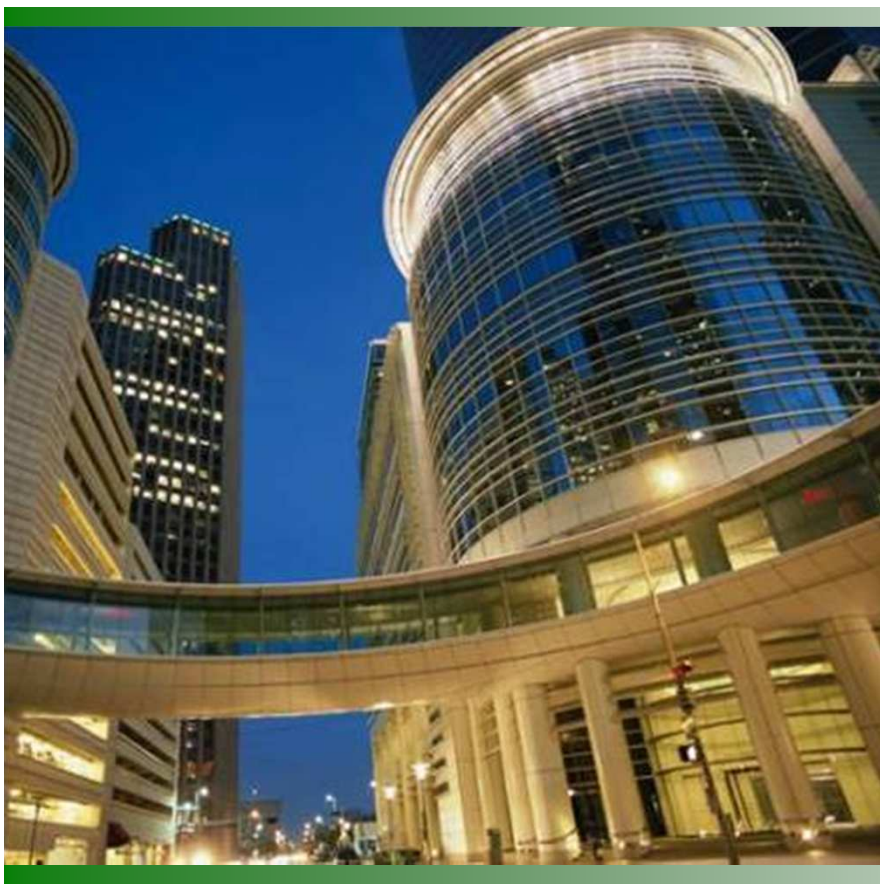
2nd / 3rd

Real estate and facilities operations is the 2nd largest expense on the income statement in most companies and 3rd most valuable or expensive single asset.



What *is* a smarter building?

Smarter Buildings are well managed, integrated physical and digital infrastructures that provide optimal occupancy services in a reliable, cost effective, and sustainable manner.



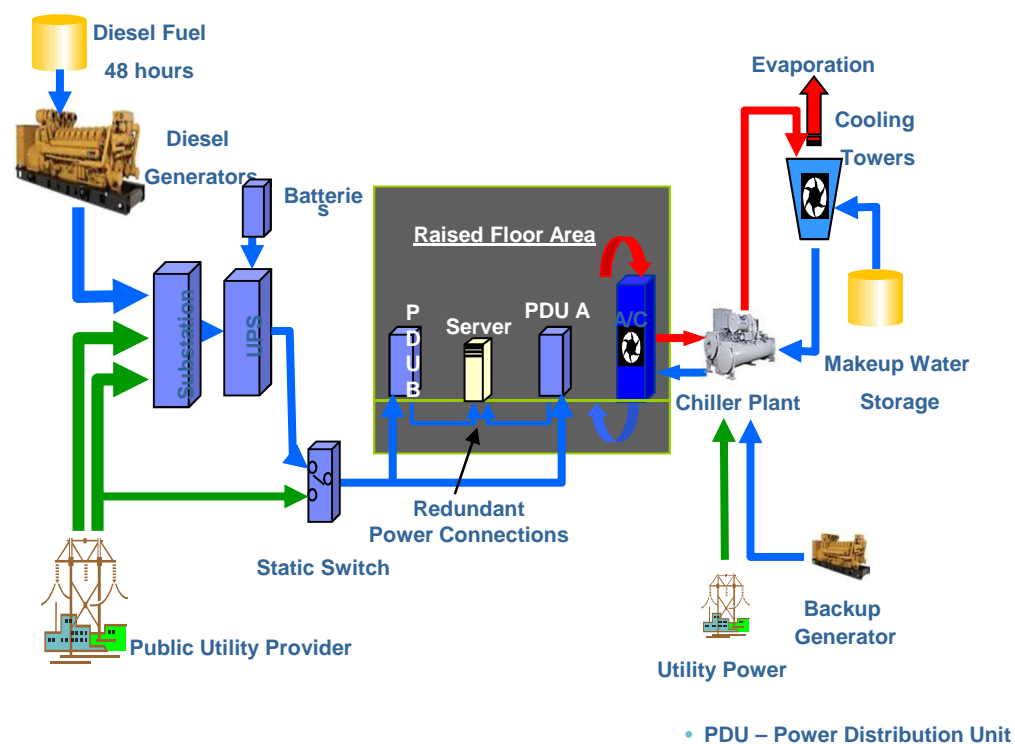
Smarter Buildings...

- Are more cost effective by reducing energy and operating costs.
- Use active and designed-in techniques to achieve efficiency and environmental responsibility.
- Have the ability to interact with occupants inside them as well as the environment around them.
- Maintain a safer and more secure workplace.
- Communicate in real-time to supporting infrastructure (i.e. smart grid, broadband, etc.).

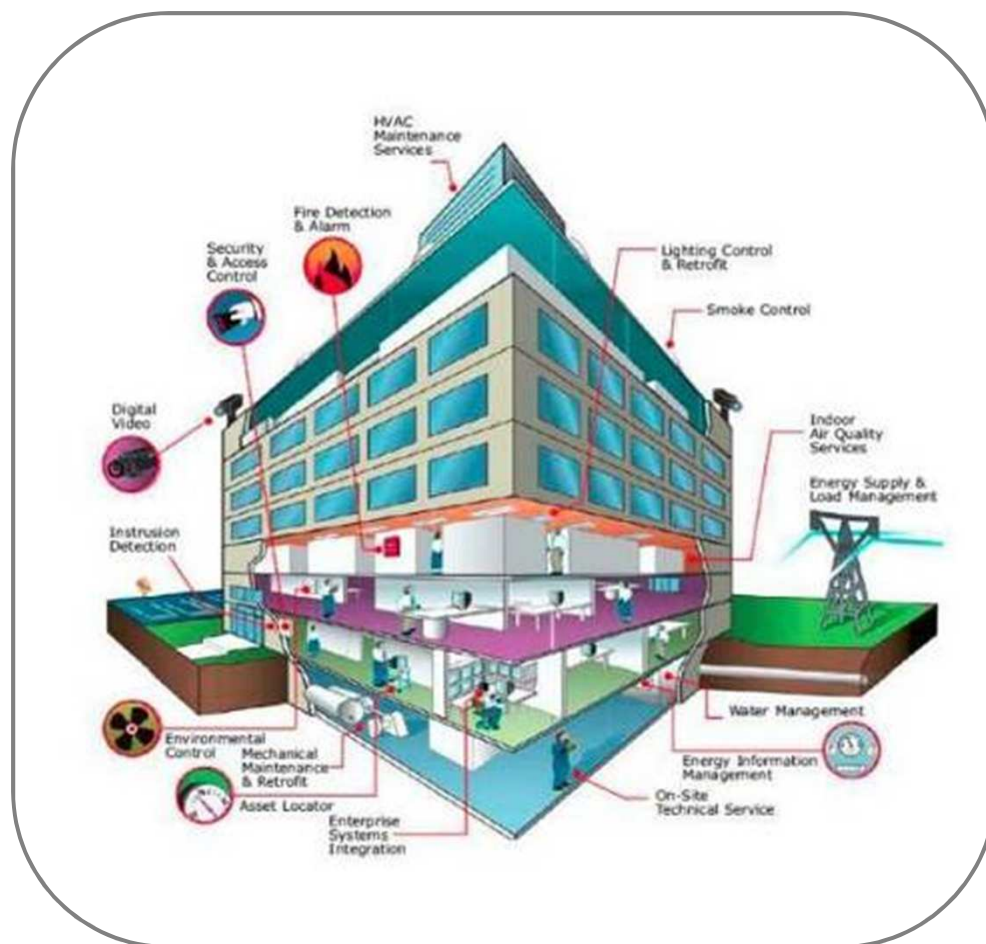
What is a smarter data center?

“Smarter” data centers are specialized Smart Buildings that integrate and optimize building management and IT systems in individual buildings and groups of buildings to create facilities that:

- Constantly monitor energy and thermal information
- Optimize the use of resources in the data center
- Adjust and react to data center events and alerts
- Provide historical and real-time analytics and reporting
- Improve asset lifecycle management
- Improve processes by leveraging energy and efficiency information



The objective for making buildings Smarter is based on a few fundamental thoughts....



- Our buildings are talking to us, but we aren't listening
- We can meter almost every subsystem in a building
- We have software capability to aggregate data from disparate sources
- If we could integrate our software with these subsystems, we could analyze, process, and display data in a way that could drive higher levels of efficiency

So why is this so hard? Its not the technology ...



- Spreadsheet-based management - spreadsheets that are constantly out-of-date and little ability to manage across domains or functional areas
- Buildings and data centers are constantly in a state of change (server sprawl, virtualization projects, new cooling technologies, office moves, etc.), making it difficult to optimize around space, cooling, and power constraints
- Organizational silos that prevent optimization
- Inability to determine power consumption and costs at granular level means there is little accountability for energy usage or data to address energy regulations

IBM smarter buildings implementations

Armonk, NY



- **Facility profile:**
 - Opened September 1997
 - Capacity: 600 people
- **Scope:**
 - Lighting management
 - Metering
 - PLC – BMS integration
 - Advanced analytics
 - Fault detection & diagnostics
 - Dashboard for energy, carbon, maintenance, space, etc.

Rochester, MN



- **Facility profile:**
 - 3.3m sq. ft. multi-building, mixed use light industrial complex
 - 33 buildings – office, production, lab, data center, warehouse, CUP
 - Age of facility dates back to 1950s
 - 10 buildings per year are retro-commissioned
- **Scope:**
 - BMS/metering integration
 - HVAC sensors/metering point integration
 - Lighting management
 - Perimeter pre-heat
 - Chiller optimization
 - Advanced analytics/FDD.
 - Dashboard for energy, carbon, maintenance, space, etc.

First IBM implementations will be complete by late September 2010.

Expect 5+% energy cost reduction in already efficient buildings that have seen 7% reductions/year for the last 10 years.

Operational cost reductions expected from condition-based maintenance and prioritization of preventive maintenance.

Analytics are a key in making solutions smarter

1. Sensing-Monitoring

- Near real time data capture from BMS
- Sensors/feeds across domains
- Asset level performance monitoring

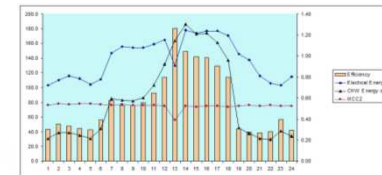


2. Data Store

- Trending analysis
- Data warehouse
- Meta data and business rules

Enterprise Reporting Feed

Targeted data acquisition

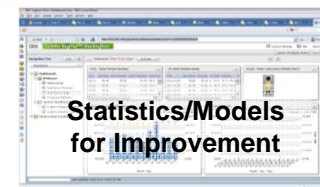


Meta-data model

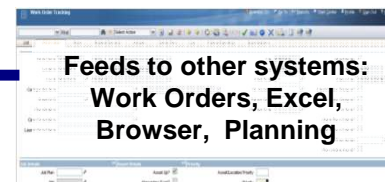
- Contextualization
- Interrelationships

3. Analytics

- Alerting
- Business Rule Trends
- Computational modeling
- Creation of insights that feed decisions and actions



Identified Improvement actions/projects



Feeds to other systems:
Work Orders, Excel,
Browser, Planning

5. Sustainability & Reporting

- Enterprise & Operational Dashboard
- Drilldown capability
- Alert Summary
- Work Order Management
- Maintenance of optimized position (no back sliding)



4. Improvement

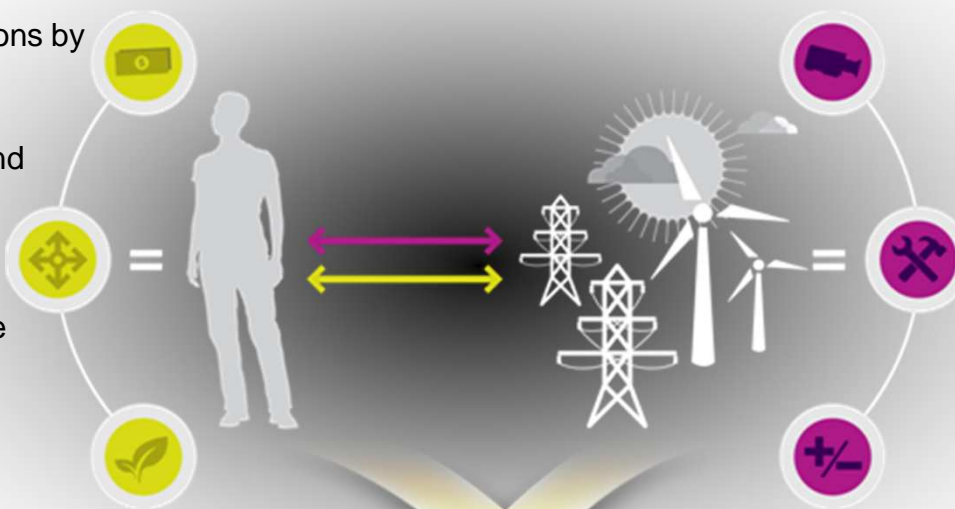
- Optimized base-line energy use
- Process changes
- Maintenance and operations activity
- Operational cost savings
- Capital cost avoidance
- Reduced energy use
- Client satisfaction



What about the utility infrastructure?

Consumers

- ▶ Take advantage of variable pricing
- ▶ Decrease carbon emissions by choosing clean electricity sources.
- ▶ Want more information and control
- ▶ Generate electricity and sell it back to the grid
- ▶ Want to be involved in the change



Utilities

- ▶ Automatically monitor the health of the grid
- ▶ Need to reduce the cost to serve
- ▶ Must adapt to the changing technology
- ▶ Must deliver to the customers expectations
- ▶ Desire to capitalise on new information sources
- ▶ React to changing demands
- ▶ Achieve operational transformation

Participatory Network

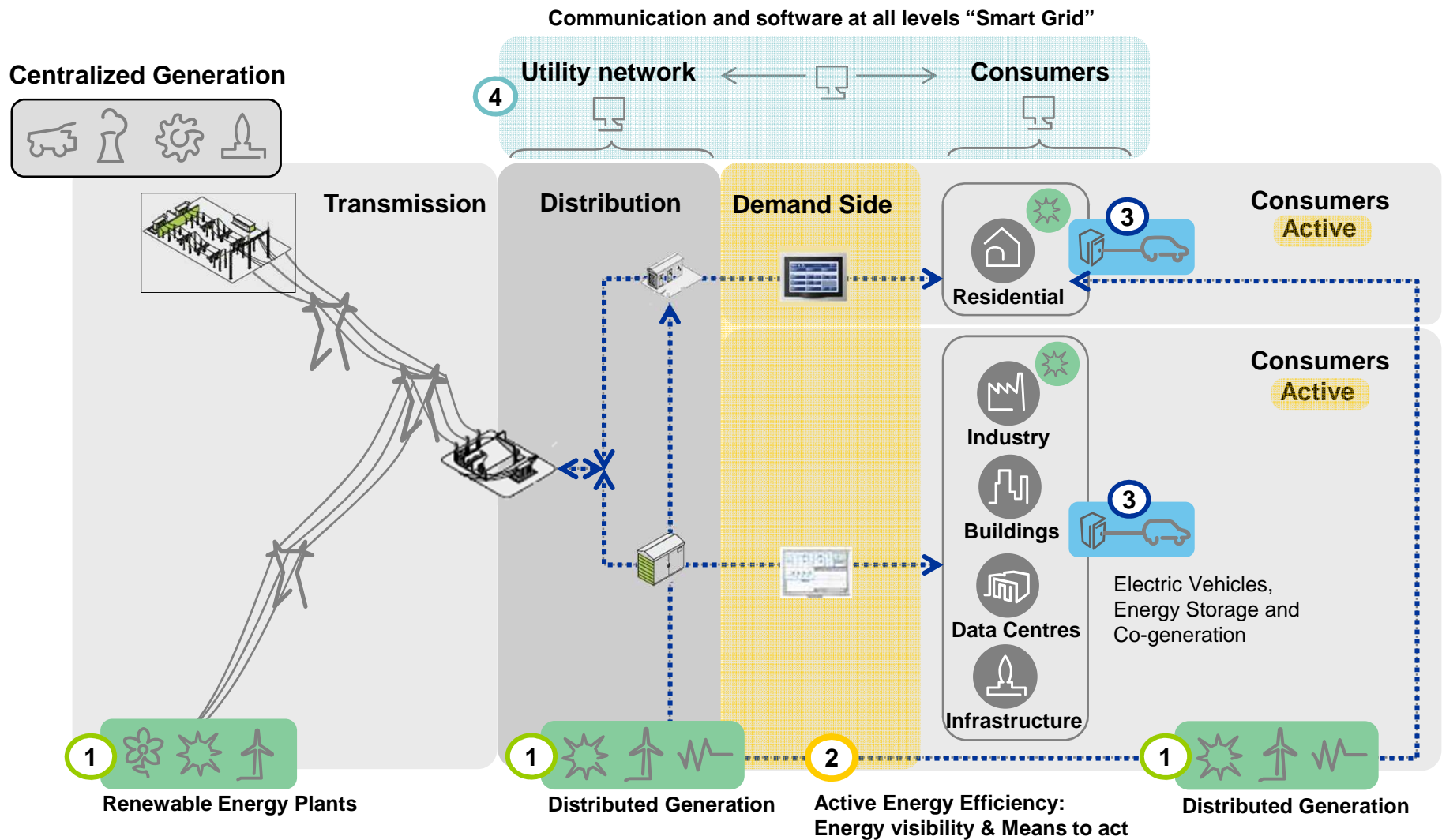
A wide variety of grid and network technology evolve to enable shared responsibility, and consumers' strong interest in specific goals creates new markets (virtual and physical) and new product demands, which balances benefits more equally between the consumers and utilities



Energy Flow
 Information Flow

Smarter Buildings and the Smart Grid

Move from one-way to two-way energy and data interaction



The Internet Analogy

Many draw parallels between the smart grid and the internet – but there are some major differences that could impact that analogy

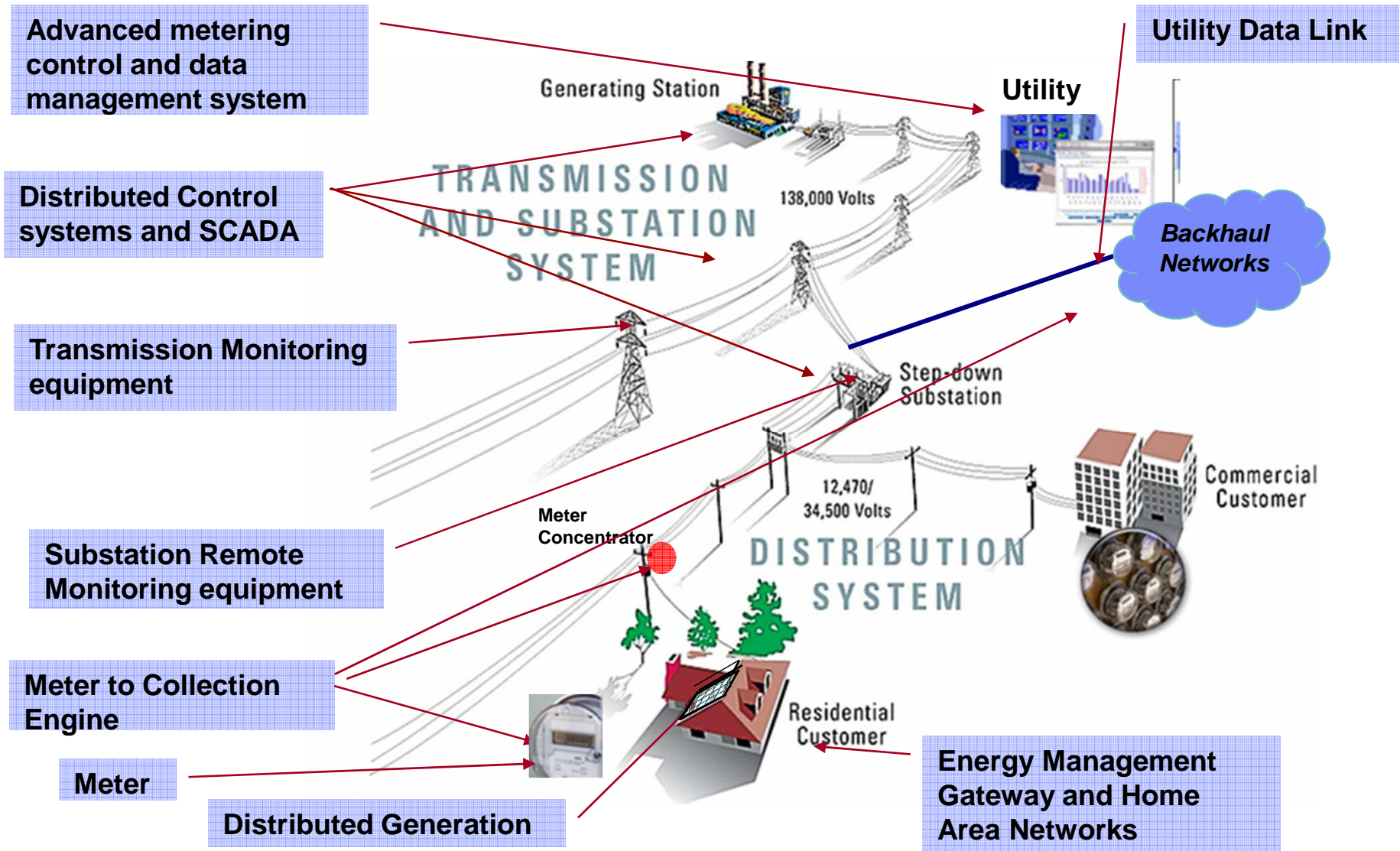
■ The internet

- Significant and growing value for the consumer
- The service to the home is open and the service provider provides an information “pipeline” into and from the home
- The internet connection is priced “all you can eat”
- The value of the “pipeline” increases as usage increases
Vonage, Netflix, Pandora, Google, email, internet banking, shopping, etc
- The internet service provider has lost its value-add connection to the consumer
Remember AOL?

■ The Smart Grid and AMI

- The current business values are predominantly focused towards the producer
- The producers want variable pricing which means potentially reduced consumption and higher costs to consumers without any clear values for consumers at this point
- What are the “Vonage, Netflix, and Pandora”’s for the Smart Grid and AMI?
- What if internet access had been priced with consumption-based and time-of-day pricing?

A Smart Grid needs security management across the supply chain



QUESTIONS?



AND THANK YOU!