A Smarter Grid...Reality or Hype

*Tulane Engineering Forum*

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Did you know?

• In 2009, the smart grid industry was valued at about $21.4 billion

• By 2014, it will exceed at least $42.8 billion

• Given the success of the smart grid’s in the U.S., the world market is expected to grow at a faster rate, surging from $69.3 billion in 2009 to $171.4 billion by 2014
So what’s making Smart Grid headlines?

- ‘Smart Grid’ may be vulnerable to hackers
- Duke responds to regulatory denial with new case for AMI
- PG&E Struggles Against Customer Anger Over Smart Meters
- Obama Putting $3.4B Toward ‘Smart’ Power Grid
- Oncor Customers to Pay for “Smart Meter” Mistake
- The New York Times: Efficiency, not just alternatives, is promoted as an energy saver
- Senator Udall Introduces Renewable Electricity Standard Bill
- Plug-In Hybrid Cars Touted as ‘Game-Changing Technology’
Is today’s grid a dumb grid?

In just a little over 125 years, through technology, ingenuity and billions of man-hours, today’s electrical grid powers the largest interconnected machine in the world ... almost NONSTOP
Evolution of Power Generation

- **1850**: Coal first used to generate electricity
- **1900**: First Commercial Power Plant Opens
- **1900**: AC used commercially
- **1900**: AP&L formed (beginning of Entergy)
- **1914**: First fully automated plant (Little Gypsy)
- **1925**: Hydro Power developed (Niagara Falls)
- **1925**: Pneumatic Controls developed
- **1925**: Heat rate Technology developed
- **1950**: Nuclear generating technology
- **1950**: Emission control technology first used
- **1975**: Micro processors used in power plants
- **1975**: Cathod Ray Technology (CRT) used to run plants
- **1975**: Load Frequency Technology deployed
- **1975**: Wind technology developed
- **2000**: Electronic rounds used to acquire data
- **2000**: Radio graphic and ultrasonic technology used at plants
- **2010**: CCGT Plants widely used
- **2010**: Smart signal software technology
- **2010**: Phased array technology

**Notable Events**

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Evolution of the Transmission Grid

1960
Flexible AC Transmission Systems

1970
Dynamic Line Monitoring
High Temperature superconductors
Composite conductors
High Voltage Direct Current

1980
Distributed superconducting magnetic energy storage systems (D-SMES)
Large Shunt Capacitor banks

1990
Static VAR Compensators
Single Pole Switching (SPS)

2000
Coordination Capacitor Bank Controls
Series capacitors

2010
Dynamic Reactive Power Compensation Systems
Phasor Measurement Units (PMUs)
Evolution of the Distribution System

- Edison Patents
- Electric Distribution System

- Single Customer Transfer Switch
- Radial Reclosers

- Fixed Capacitors
- SCADA

- Fuse Switches
- Real-Time Fault Location

- Local Voltage Regulation

- Fault Indicators

- Local Volt/VAR Control

- Micro-processor Controls/Relaying

- Switched Capacitors

- Automatic Feeder Reconfiguration

- 1850
- 1900
- 1925
- 1950
- 1975
- 2000
- 2010
Today’s Power Grid

- 3,100 U.S. electric utilities
- Over 1000 GW and 3700 Billion kWh of electricity successfully 99.7% of the time without interruption.
- Today’s U.S. power grid consists of a maze of five million miles of distribution lines and 400,000 miles of transmission lines.
- One of, if not the most important services known to man when it comes to economic growth and quality of life.
- Throughout history, utilities have leveraged technology to improve the grid -- new technology continues to expand possibilities
Did you know?

36.8% Projected growth in Worldwide energy demand by 2030

1/4 Proportion of worldwide CO₂ emissions created by power generation

170 BILLION Kilowatt-hours wasted each year by consumers due to inefficient power usage
What it means to be smart...

• Intelligence infused into systems and processes
• Computers – that’s a no-brainer
  ...but cars, appliances, roadways, power grids, clothes, even natural systems such as agriculture and waterways
• Not just the grid...but a smarter planet
• We must ask ourselves “what is our aspiration in the smart grid space?”
  Is it improving efficiency, reliability, life quality, environment

It's really about information...extracting value from data!!!
Elements of a Smart Grid

**Grid**
- Renewables, nuclear, biofuels, etc.
- Phasor Measurement Units
- Voltage Control, Distribution Automation, substation control
- Smart Meters, In-home devices, web portals
- PHEVs, Storage, Smart Appliances

**Customer**

Communications Infrastructure

Meter Data Management Systems
Did you know?

- The world's largest smart meter deployment was undertaken by Enel SpA, the dominant utility in Italy with over 27 million customers. Between 2000 and 2005 Enel deployed smart meters to its entire customer base.
Of the 154 million electric meters in the United States and Canada, Chartwell estimates that about 6.5%, or 10 million, are smart.

Primary AMI functionalities include remote reads, remote connect / disconnect, outage mgt.

SGIG projects should increase deployment activity.
A Smarter Grid is a technology evolution...

The concept of a “smarter” grid envisions a future electricity delivery infrastructure that is brought about by advances in several areas of technology.
Policy And Technology Expected To Exert Differing Pressures on Energy Demand

Legislative and Regulatory Policy, Emerging Technology

- Utility driven DSM
- Efficiency Programs
- Advanced metering
- Smart Grid
- End use Energy Supply

Sales and Load Forecast

- Plug in Hybrids
- New technologies (Plasma TV, etc.)
- New end-use technologies

Emerging Technology
Key Industry Challenges

- Lack of Standards
- Economic and Capital Deployment
- Volume, Scope and Technology Immaturity
- Limited Control of Technical Devices
- Cost Recovery
Entergy Guiding Principles

A smarter grid is a long term vision, not a near-term certainty, which is why we believe in making a sustainable commitment to development of technology solutions.

We must effectively manage smart grid challenges to:

- Using a disciplined, measured approach to ensure technology maturation
- Engage regulators on solutions to achieve full and timely recovery
- Take a long-view of implementation (7 to 15 years)
- Plan for change management for all stakeholders
- Advocate open interoperability standards and incremental scalability
- Ensure end-to-end system security
- Ensure consideration for Low Income and Elderly Customers to access programs
- View a smarter grid as an essential part of a portfolio of options for our environmental strategy
Entergy in the Smart Grid Space

**Entergy System**
- SGIG Phasor Measurement Unit Deployment Project

**Entergy Arkansas**
- Quick Start pilot programs
- Agricultural Load Control Program Pilot completed
- Expansion of Agricultural Load Control Program to 1800 points

**Entergy Texas**
- 9 Energy efficiency programs

**Entergy Gulf States Louisiana**
- AMI and DSM pilot programs completed in Baton Rouge
- Web Portal Expansion planned for 2010
- TOU pilot program to be filed with LPSC 3Q10
- Energy Efficiency Docket Item

**Entergy Mississippi**
- Energy Efficiency education program
- Small scale DSM pilot
- Small scale C&I smart meter pilot

**Entergy Louisiana**
- Fort Polk AMI pilot
- Geaux Green Program
- Energy Efficiency Docket Item

**Entergy New Orleans**
- Energy Smart Energy Efficiency Program
- AMI-DSM Pilot (SGIG)
Did you know?

• One US Dept. of Energy study calculated that internal modernization of US grids with smart grid capabilities would save between 46 and 117 billion dollars over the next 20 years.
A Smarter Grid enables a Smarter Planet

We must think beyond a smarter grid and drive a more global effort that enables a smarter planet.

- In 1900, only 13% of the world's population lived in cities
- By 2010, there will be 59 metropolitan areas with populations greater than five million—up 50% from 2001
- By 2050, that number will have risen to 70%
- **We are adding the equivalent of seven New York’s to the planet every year**

Within smarter cities lie opportunity for smarter transportation, buildings, public safety, education.....
Smarter Cities

Safe neighborhoods. Quality schools. Affordable housing. Traffic that flows. It’s all possible.

Smarter Transportation

In the U.S. alone, 3.7 billion hours are lost to people sitting in traffic every year, and 2.3 billion gallons of fuel—enough to fill 58 supertankers—burn needlessly, at a cost of $78 billion per year.

Smarter Public Safety

NYPD Historical Perspective

% of change in crime rates 2008 vs 2001

-19.4% Murder
-32.8% Rape
-19.9% Robbery
-29.6% Fel. Assault
-36.8% Burglary
-4.8% Gr. Larceny
-57.8% G.L.A.

-27.47% TOTAL

Smarter Education

With better management, measurement and processes, it is estimated effectiveness of school systems could be raised 22% at the existing spending levels

Smarter Buildings

Buildings account for 70% of current U.S. electricity use.
Thank You!