Grid Transformation in the United States of America

Michael Heyeck
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CIGRE
August 2014
GAS Exceeds COAL in 2035; 50+ GW COAL Retired
More COAL Retirements Probable; NUCLEAR Stressed

Source: 2014 Annual Energy Outlook - EIA.gov
US Electricity Generation

Game Changer – Shale Gas

Trillion Cubic Feet

Shale Gas Supply Boom; Potential LNG Exporter
U.S. Nears Goal of Energy Independence

Source: 2014 Annual Energy Outlook - EIA.gov
US Electricity Generation
Gas & Market Prices Drop

Henry Hub Spot Natural Gas Prices

2012 $/MBtu

Market Prices Stress Coal and Nuclear Economics
Lower Prices Create Headroom For Grid Modernization

Source: 2014 Annual Energy Outlook - EIA.gov
US Electricity Generation

Renewables Advance

- Non-Hydro Renewable Sources Grow 3.2% Annually
- Game Changer – Solar Grows 7.5% Annually

Source: 2014 Annual Energy Outlook - EIA.gov
US Electricity Demand

Stagnation

2012 to 2040 > Typical Home Down 4% (to 11.6 MWh/yr)
2012 to 2040 > Lighting Down 65%

Source: 2014 Annual Energy Outlook - EIA.gov
US Utility Business Model

At Risk

Stagnating Demand

Behind Meter Resources

Increasing Costs

“Rate X kWh” Model at Risk?


Source: EPRI
Grid Yesterday: Generation to Wires to Customers; 100+ Minutes Out Per Year “OK”

Source: EPRI
Grid Today: Generation to Wires to Customers; Some Behind Meter Resources; Better Reliability Demanded

Source: EPRI
Grid Tomorrow: **Seamless Macro and Micro Coordination; 21st Century Reliability; Energy Packages; Opportunity!**

Source: EPRI
US Grid Tomorrow

Rooftop Solar

Storage

Micro-Generation

Fuel Cells

EVs

Opportunities to GROW!

Grid Tomorrow: Distributed Energy Resources Will Compete or Complement Central Station Resources?

Source: EPRI
Grid Tomorrow: Distributed Resources Face Challenges; But NO Show Stoppers!

Source: EPRI
Grid Tomorrow: Transmission Enables U.S. Fuel Transformation and Grid Integration; Next Generation EMS Needed for Data and Control Challenges

Source: EPRI
US Grid Transformation

Foundational Elements

• Grid Modernization
• Communications Standards
• Interconnection Rules
• Integrated Planning and Operations
• Informed Policy and Regulations

Grid Tomorrow: 21st Century Utility Business Model Welcome!

Source: EPRI
Special Thanks to Clark Gellings, Past-President, USNC and Electric Power Research Institute (EPRI) for Contributions

Other sources include US Energy Information Administration (EIA.gov)

2014 Annual Energy Outlook (Reference Case)