



Edison Electric Institute

Power by AssociationSM

Session 3: Market Design and Renewables

IEA Electricity Security Advisory Panel (ESAP)
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Edison Electric Institute

The Edison Electric Institute (EEI) is the association that represents all U.S. investor-owned electric companies. Our members provide electricity for 220 million Americans, operate in all 50 states and the District of Columbia, and directly employ more than 500,000 workers.

With more than \$85 billion in annual capital expenditures, the electric power industry is responsible for millions of additional jobs. Reliable, affordable, and sustainable electricity powers the economy and enhances the lives of all Americans.

EEI has 70 international electric companies as Affiliate Members, and 250 industry suppliers and related organizations as Associate Members.

Organized in 1933, EEI provides public policy leadership, strategic business intelligence, and essential conferences and forums.

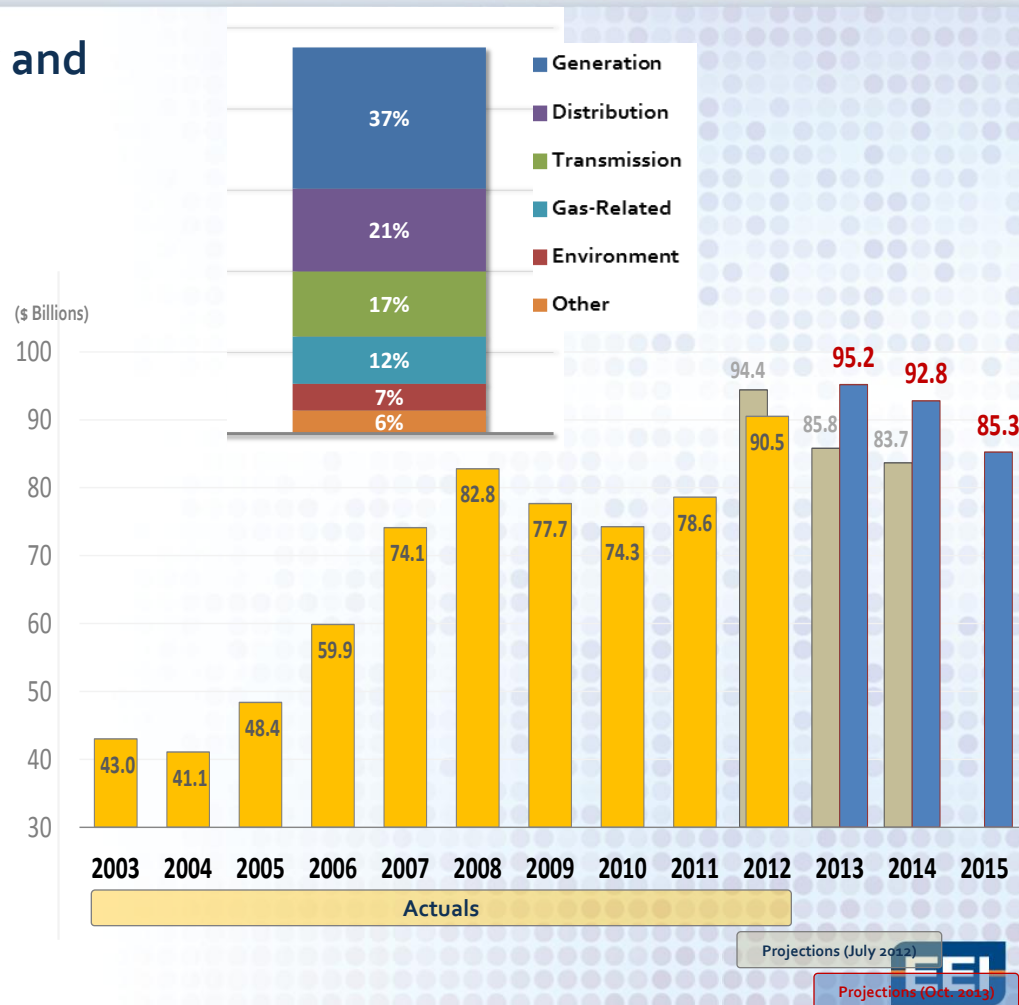
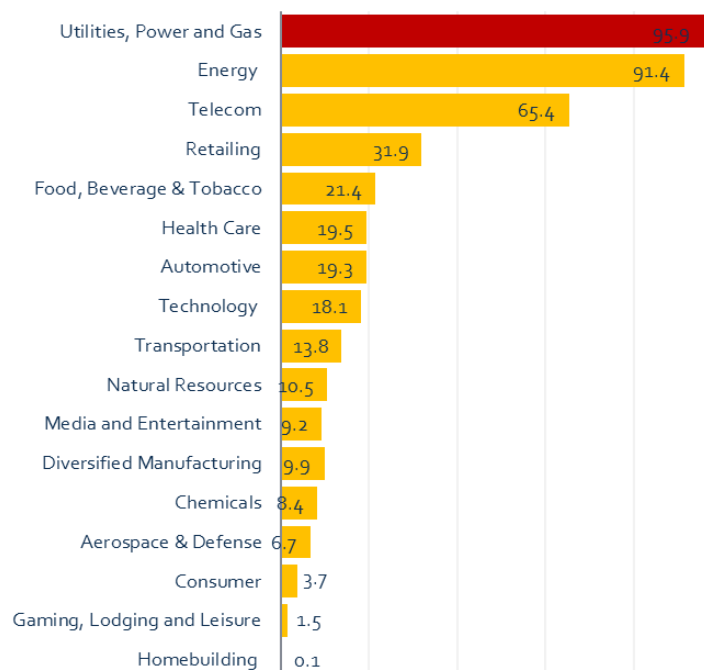


Overview

- Generation Investment and Trends
 - Investment is Steady
 - Fuel Mix is Evolving
 - Emissions are Declining
- Market Design – Increasing Need for Flexibility
 - Importance of Fuel Diversity
 - Managing Reliability During Extreme Weather Events
 - Enabling Increased Penetration of Renewable Energy
 - Implications for Demand Response

Utility Investment in Perspective

Utilities lead in capital intensity and expenditures

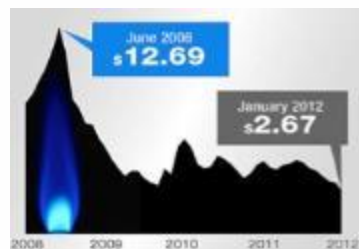


Drivers of Industry Investment

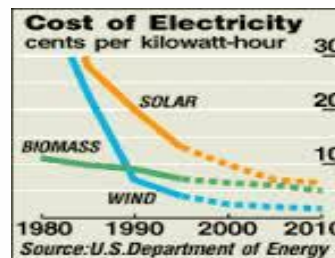
Environmental
regulations



Low natural
gas prices



Declining
technology costs



Diversification



State renewable
energy policies



Financial
incentives

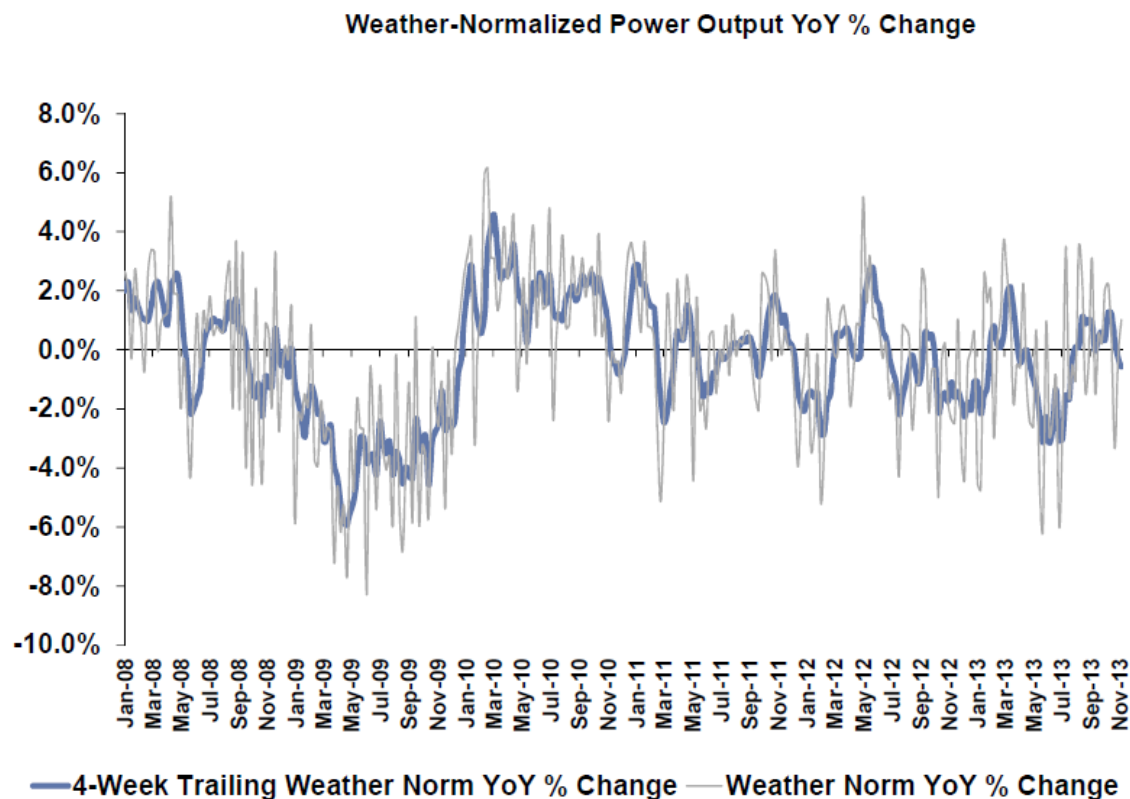


Customer
demand

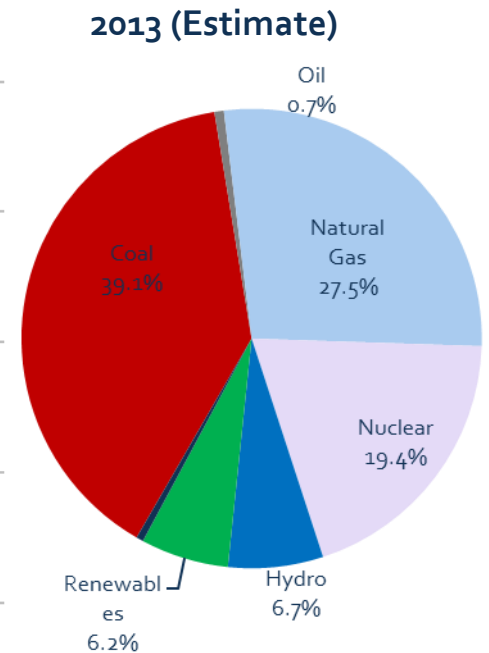
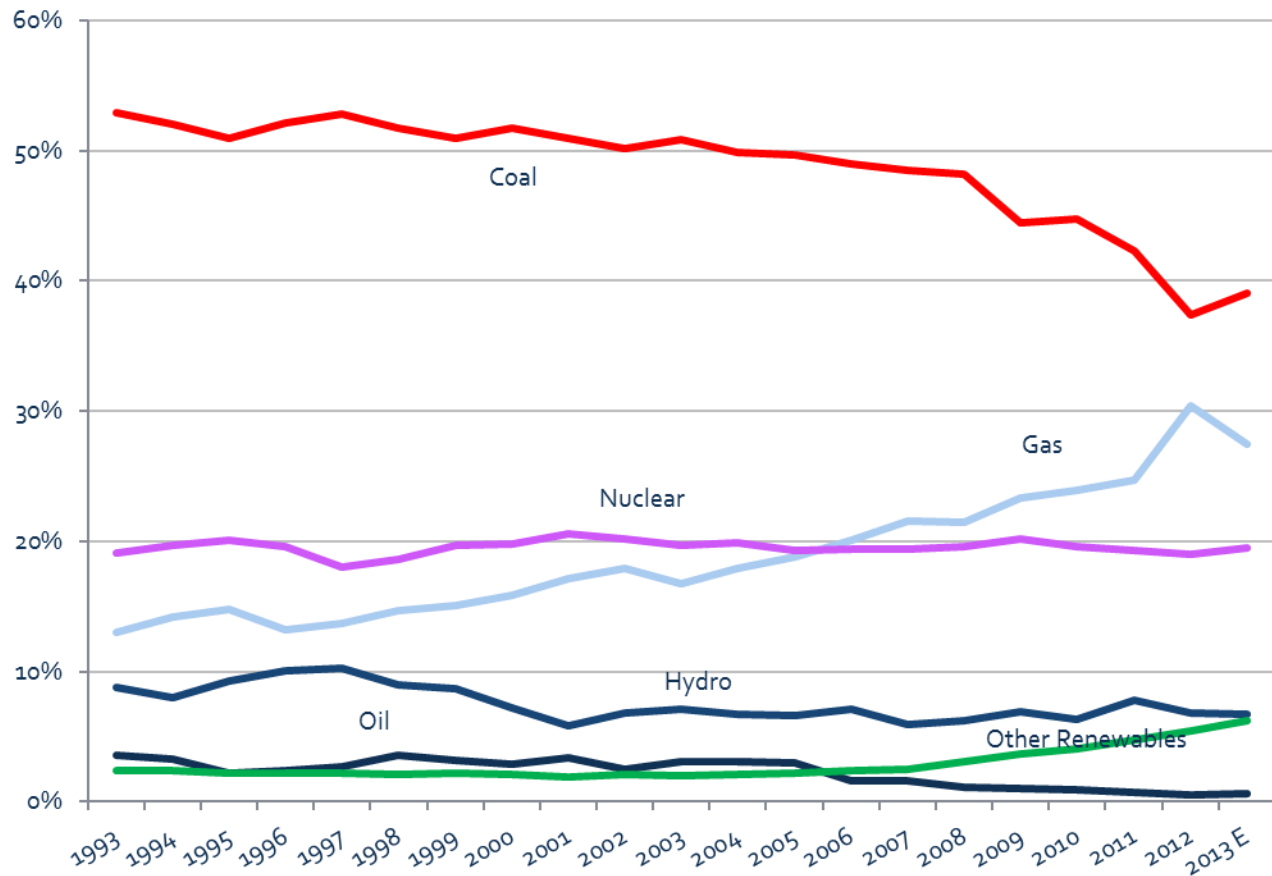


Weak Demand Growth

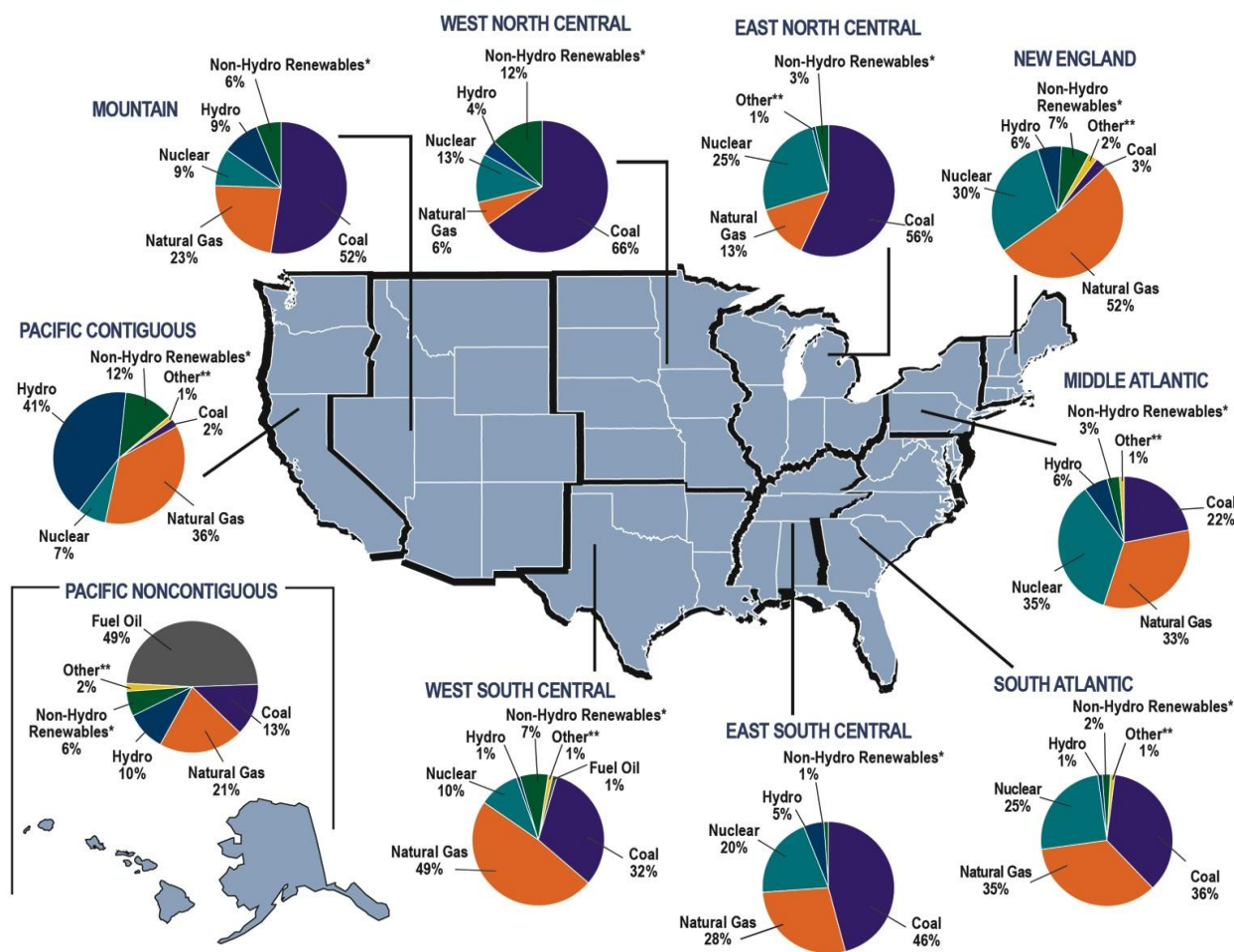
Exhibit 9: Weather normal demand remains low, with a YTD decline of 0.4%...
US weather-normalized electric output, yoy percentage change



Evolving Generation Mix



Generation Fuel Mix Varies By Region



*Includes generation by agricultural waste, landfill gas recovery, municipal solid waste, wood, geothermal, non-wood waste, wind, and solar.

** Includes generation by tires, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.

Sum of components may not add to 100% due to independent rounding.

Source: U.S. Department of Energy, Energy Information Administration, Power Plant Operations Report (EIA-923); 2012 final generation data.

February 2014

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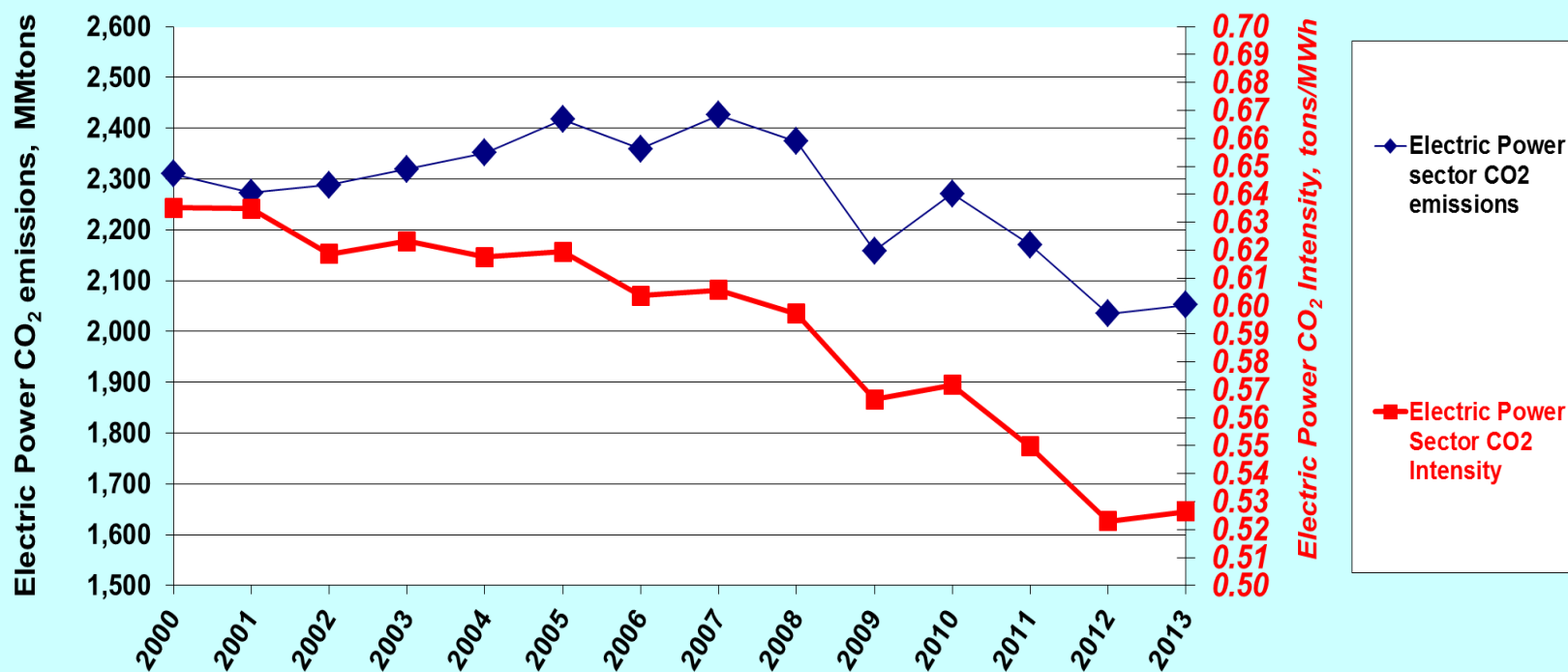
Diversity Provides Benefits

Fuel flexibility and innovative technology development are critical:

- Meet future energy demand
- Provide resilient, affordable, reliable electricity
- Maintain energy security and independence
- Reflect regional resource differences
- Environmentally sustainable supply

CO₂ Emissions and Intensity

Electric Power Sector CO₂ Emissions Tonnage and Intensity, 2000-2013

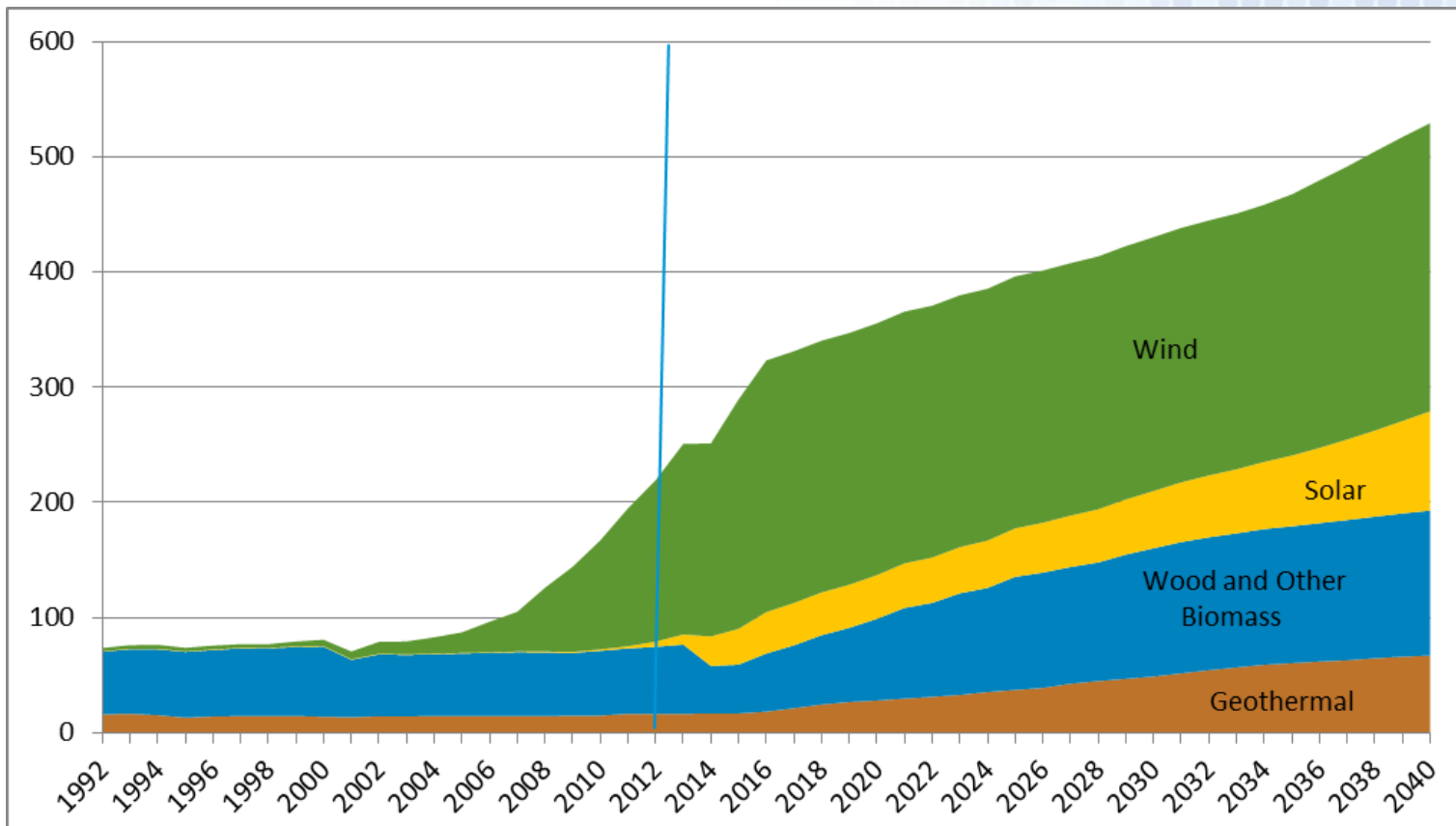


Source: Developed from U.S. Energy Information Administration, *Monthly Energy Review* March 2014

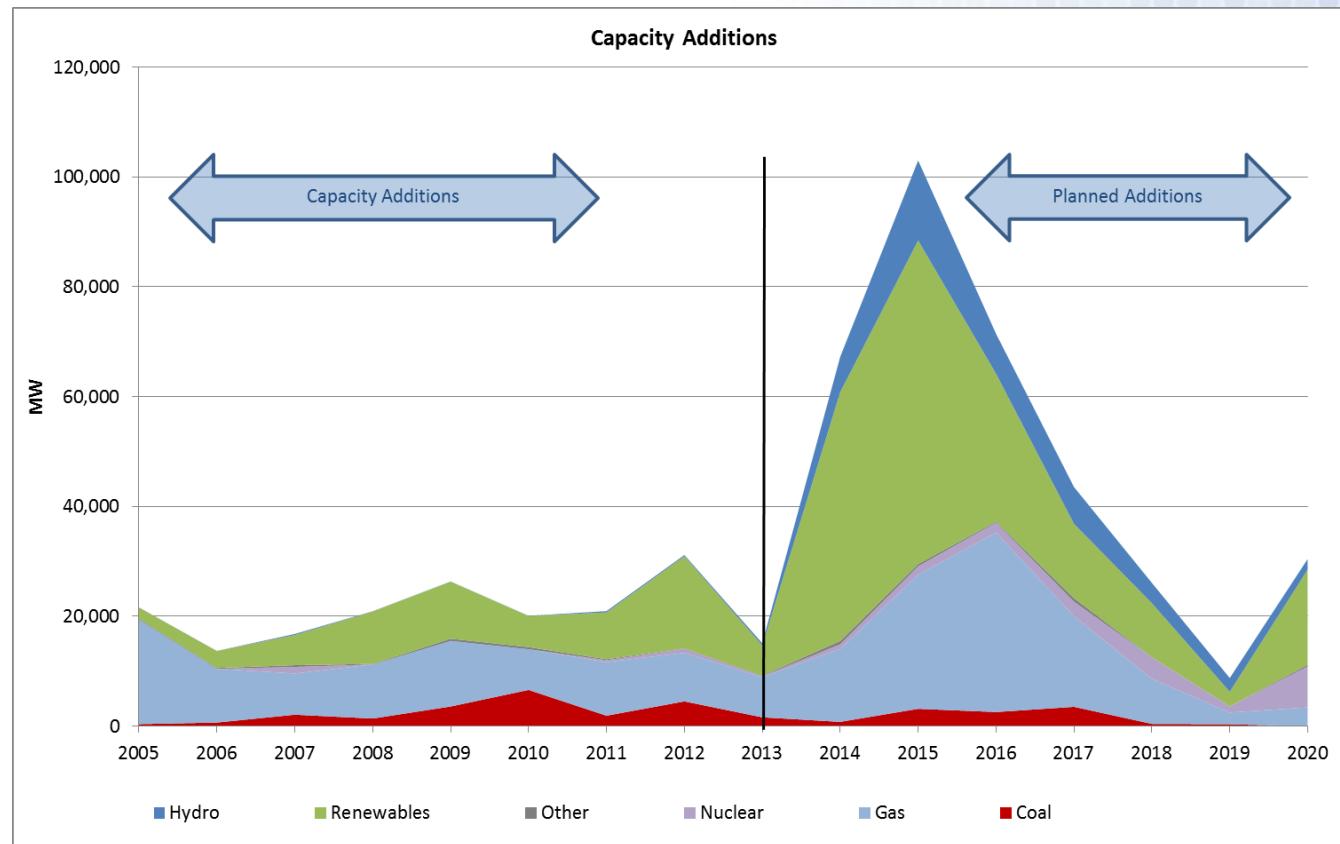
Building Renewable Power

Non-Hydro Renewable Sources More than Double between 2012 and 2040

Non-hydro generation, Billion kWh



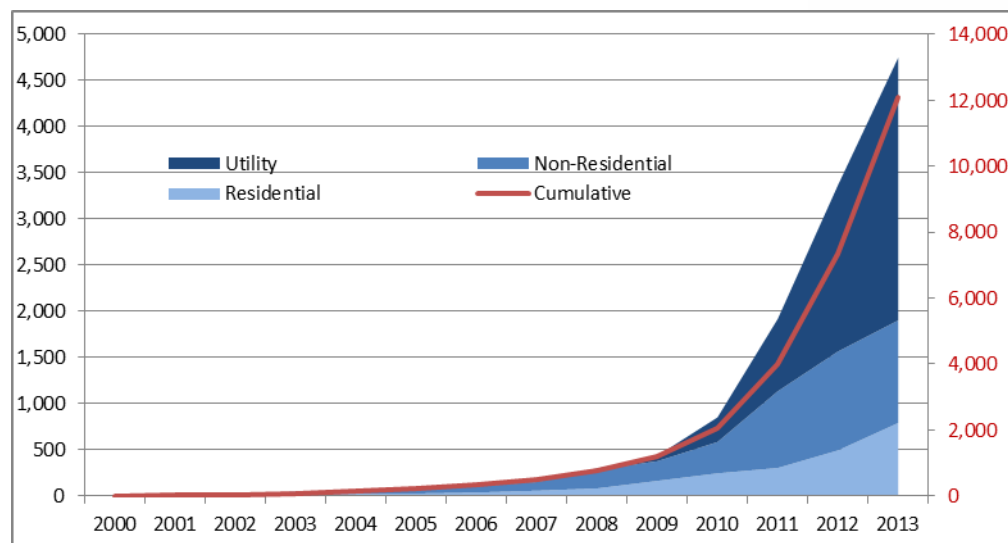
Generation Capacity Additions



Solar: Growing New Markets

Utilities lead PV installations and integration

Installed PV capacity (MWdc)



US Solar Installations by State and



Utility scale projects

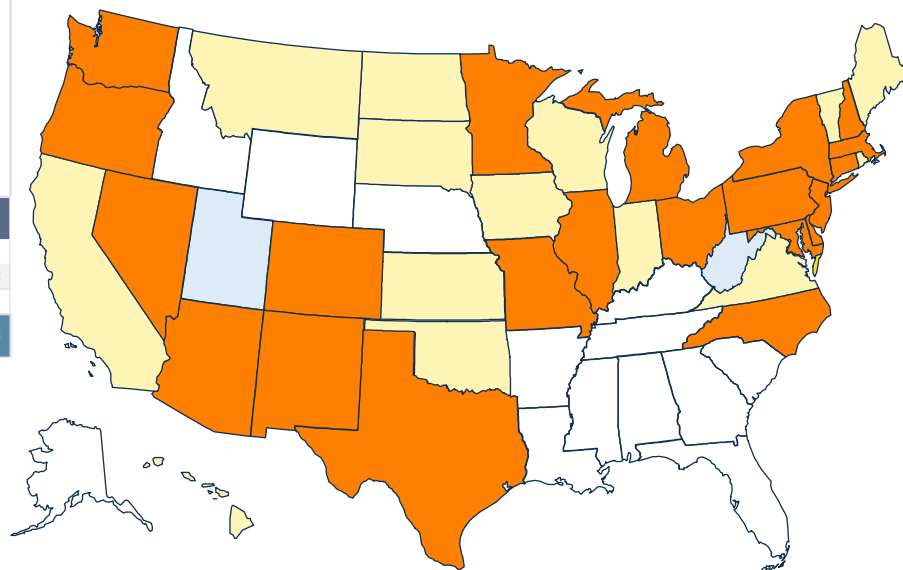
- Natural economies of scale
- Can be optimally located and sized
- Cost advantages over rooftop solar
- Allow all customers to benefit

Distributed Generation is Growing

Figure 2.1 U.S. PV Installations and Global Market Share, 2000-2012



- 17 States plus DC have RES Policies with Solar/DG Provisions; 3 others provide extra credit for DG; 2 have solar/DG goals.



- Utilities Lead PV Installations

- Renewable electricity standard with solar / distributed generation (DG) provision
- Renewable electricity goal with solar / DG provision
- Renewable electricity standard or goal



The Grid at the Center of the Transition

Services and Benefits of the Grid

- Energy transfers and transactions: buying from and selling back to the grid
- Balancing supply and demand
- Voltage and frequency control services
- Energy back up



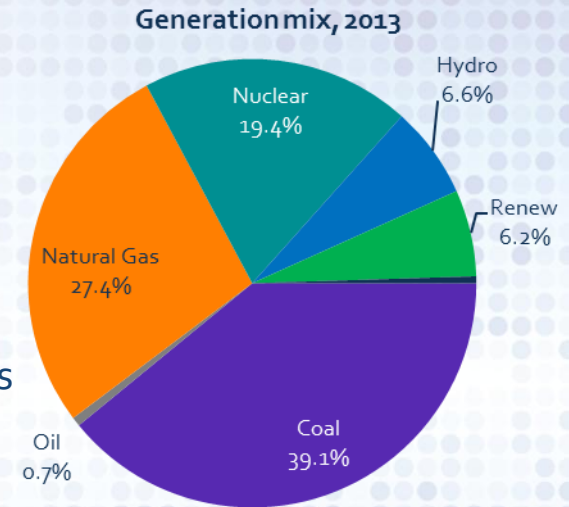
Diversity of Supply is Essential

- Fuel diversity and flexibility are critical

- Provide affordable electricity: Respond to fuel price fluctuations
- Maintain reliability and energy security: Respond to extreme events and/or supply constraints
- Improve resiliency: Respond to outages and security threats
- Integrate renewables: Respond to weather and resources variability
- Meet electricity demand: Respond to changing consumption level and patterns

- Challenges to maintaining diverse generation resources include:

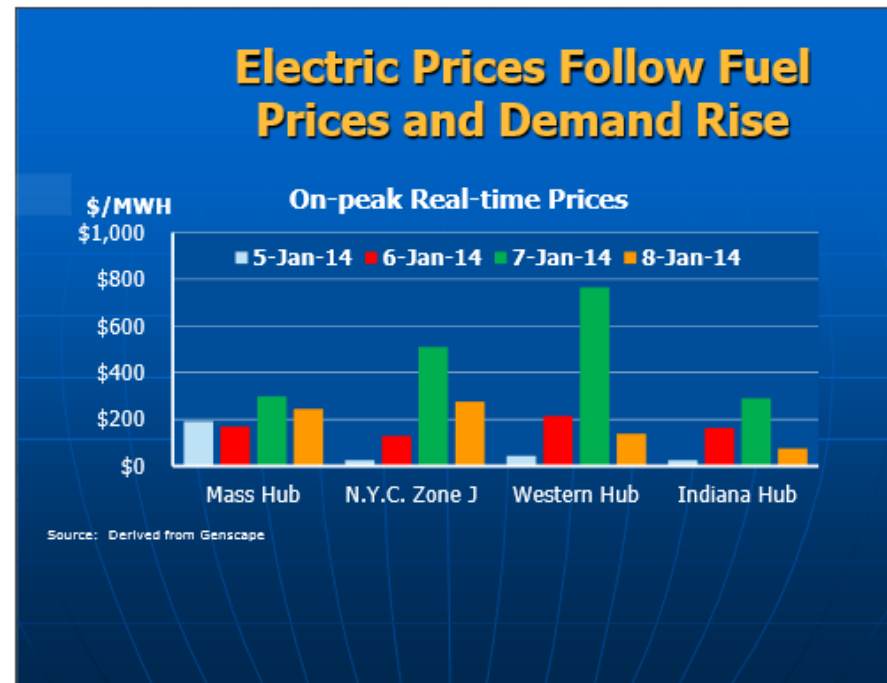
- Regulatory actions are increasing the cost of operating existing baseload generation (EPA, NRC).
- The combined impacts on wholesale markets of low natural gas prices and focus on demand response and renewable resources are making some plants uneconomic to operate.



Case Study:

The January 2014 Polar Vortex (I & II)

- Load exceeded forecasts by 7-9% in PJM and MISO.
- Increased demand and pipeline constraints led to a surge in natural gas prices to more than **\$70/MMBtu** in the Northeast and Mid-Atlantic.
- On-peak avg. real-time wholesale electricity prices reached **\$765/MWh in PJM** and **\$510/MWh in the NY-ISO**.
- Minimal wholesale electricity price impact in the central U.S., despite record natural gas demand since the region relies on coal for ~2/3 of its total electric generation.



Sources: FERC: <http://www.ferc.gov/legal/staff-reports/2014/01-16-14-bulk-power.pdf>
EIA: http://www.eia.gov/naturalgas/weekly/archive/2014/01_09/index.cfm#tabs-supply-3

Fuel Diversity is Key to Surviving Extreme Weather and Supply Disruptions

- **A variety of generation sources helped maintain reliability during the Polar Vortex:**
 - Record storage withdrawals helped meet increased demand for natural gas.
 - Dual-fueled generators were able to rely on oil during times of gas pipeline constraints.
 - The nuclear fleet operated at 95% capacity at the height of the polar vortex. (NEI)
 - Coal plants, many currently slated for retirement, were employed to help meet demand.
 - Regional wind generation was strong, providing PJM with 3,500 MW while electricity prices averaged more than \$500/MWh. (AWEA)

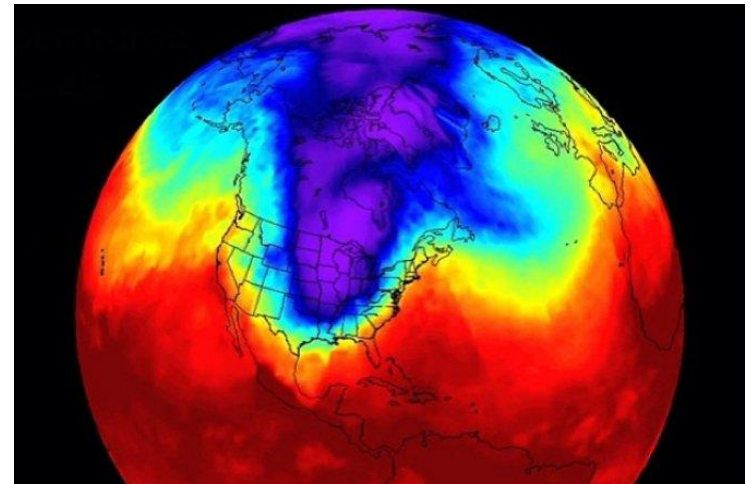


Image Source: NASA

Enabling Increased Penetration of Renewables

- Large-Scale (FERC Order 764) – Integrating Variable Energy Resources
 - Intra-hour scheduling (15 min.)
 - Improved forecasting tools
 - Cost recovery of ancillary services
- Small-Scale Resources (FERC Order 792) – Small Generator Interconnection Procedures
 - Pre-application reporting
 - Revised thresholds for fast track application process
 - Supplemental review screens

Enabling Increased Penetration of Renewables

- Ancillary Services (FERC Order No. 755) – Frequency Regulation Compensation in Organized Wholesale Power Markets
 - Provides payment for performance for faster ramping resources
- Regional Planning (FERC Order 1000) –
 - Recognizes that changes in generation mix influence the need for new transmission
 - Implements regional planning and cost allocation reforms

Implications for Demand Response

- Order 719 (October 2008) – requires RTOs and ISOs to make market rule changes to facilitate DR participation in wholesale markets including
 - Comparable participation in ancillary service markets
 - permit an aggregator of retail customers (ARC) to bid demand response on behalf of retail customers directly into the organized energy market unless prohibit by state regulation
- All RTOs allow demand resources to participate to varying degrees in energy, capacity and ancillary service markets.
- Order 745 (March 2011) required the RTOs and ISOs to compensate demand resources at full LMP when certain conditions were met.

Implications for Demand Response

- EEI, EPSA, NRECA and APPA filed petitions with the Court of Appeals appealing FERC Order 745
- United States Court of Appeals for the District of Columbia issued an Opinion on May 23, 2014 vacating Order 745 in its entirety
 - Encroaches on states jurisdiction to regulate retail markets
 - Requiring payment of full LMP was arbitrary and capricious
- Discussion and litigation likely so premature to discuss ramifications of Opinion

Thank you!

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