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Energy Law

July 31, 2014

The seminar will begin shortly.

Questions for the panel? Email werber@eli.org.

For audio, dial 1-857-232-0300
Participant code 11233

Speaker:

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Director, Federal Regulatory Affairs
Edison Electric Institute

Edison Electric Institute

Power by Association℠

Energy Law Seminar - Electricity Markets & Regulation

ELI Summer School, July 31, 2014

Lopa Parikh
Director of Federal Regulatory Affairs
Edison Electric Institute

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.

Electricity Regulation 101

- Electric sector is one of the most heavily regulated industries in the U.S.
- Regulated by both state and federal governments

  - Separate and concurrent jurisdictions
- Current regulatory structure result of

  - How electricity historically generated

  - How business model evolved (and keeps evolving)
- Regulatory structures and tools change as industry and technology change

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How the Electric System Works

Mega What?

Watt (W) — The basic unit of measure of electric power. The power dissipated by a current of 1 ampere flowing across a resistance of 1 ohm.

Kilowatt (kW) — A unit of power equal to 1,000 watts.

Kilowatt Hour (kWh) — A unit by which residential and most business customers are billed for monthly electric use. It represents the use of 1 kilowatt of electricity for 1 hour.

- A 15-watt compact fluorescent light bulb burning for 150 hours would use 2.25 kWh of electricity.
- The average U.S. household uses approximately 958 kWh of electricity a month.

Megawatt (MW) — A unit of power equal to 1 million watts.

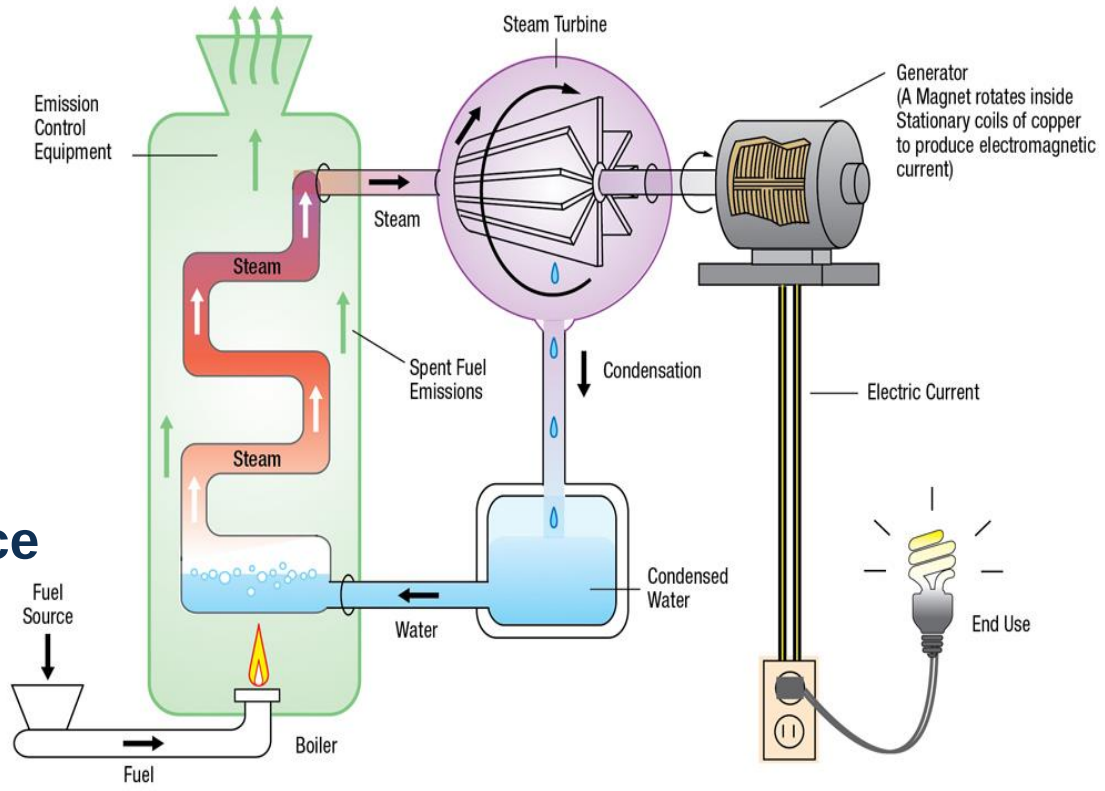
Megawatt Hour (MWh) — The use of 1 million watts (or 1,000 kilowatts) of electricity for 1 hour. This term is used most often for large-scale industrial facilities and large population centers.

Power (measured in Watts) equals its current (measured in Amps) times its voltage (measured in Volts) or Volts x Amps = Watts.

Generation:
Getting Power to Customers

The majority of electricity produced in the United States comes from thermal generation—using heat to drive the turbines that produce electricity

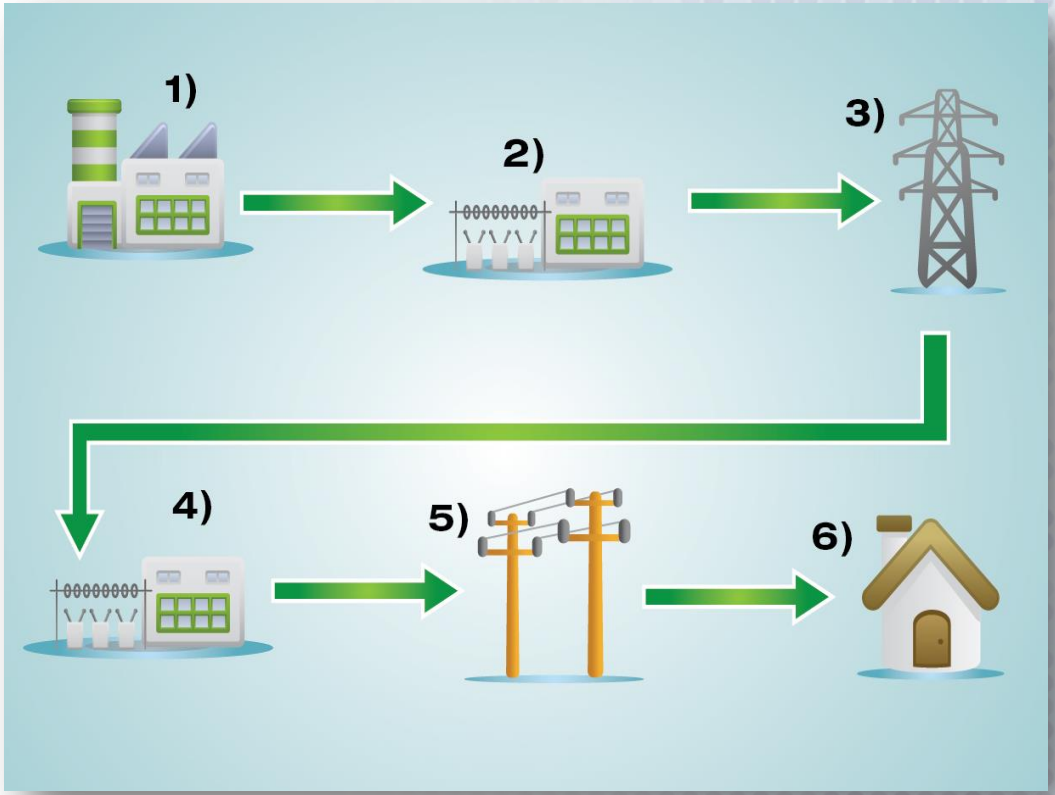
Thermal Generation



How Does the System Work?

1. Electricity is generated and leaves the power plant
2. Its voltage is increased at a “step-up” substation
3. The energy travels along a transmission line to the area where the power is needed
4. Once there, the voltage is decreased or “stepped-down” at another substation
5. A distribution power line carries the electricity
6. Electricity reaches your home or business

Electricity, Where It Comes From and How It Gets to Me



Transmission

Thick wires on tall towers carry high-voltage electricity from power plants to local communities and connect one region to another

Distribution

Thinner wires on smaller towers (or in some cases underground) carry much lower voltage power to homes and businesses

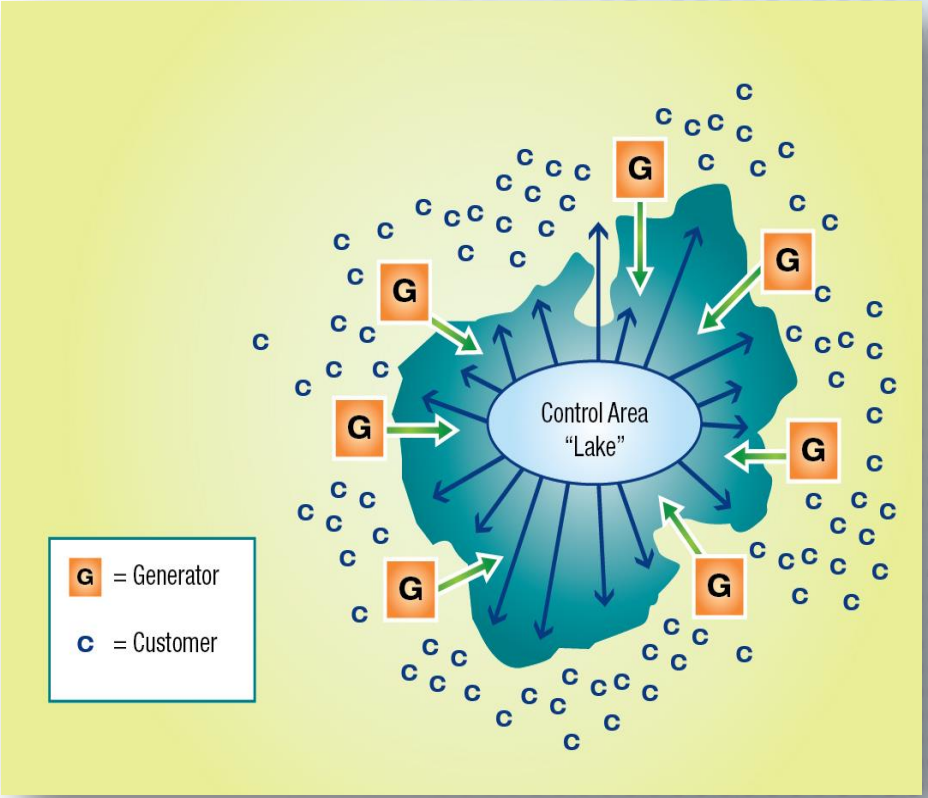
Sounds Simple, What's the Catch?

Electricity cannot be stored, so supply (generation) must be produced exactly when needed to meet customer demand and to avoid system failure

Level in electricity "lake" must be kept constant at all times

Laws of physics dictate that power flows along path of least resistance;
we cannot direct it along specific route

Individual "Lake" Model



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Electricity Basics

- Reliability = system's ability to deliver electricity to customers and to recover from any disruptions that may occur
- Generators produce electricity in low voltages
- Electricity is transported more efficiently at higher voltages : step-up transformers increase the voltage for transmission and step-down transformers decrease voltage for delivery to homes and businesses
- Supply and demand balanced to maintain voltage of 60 HZ

Overview of the Electric Industry Regulation

State Regulation of Shareholder - Owned Utilities

- **1890s—Electric utilities began to develop primarily in urban areas because of economies of scale**
- **Industry had characteristics of a "natural monopoly"**
  - A natural monopoly is where, for technical and social reasons, it is most efficient to have only one provider of a good or service
    - Exclusive utility franchises came with an obligation to serve all customers in a defined service area
    - Provided service regarded as vital to economic and social fabric of community (i.e., a "public utility")
    - Operated through large, integrated networks
    - Highly capital-intensive, requiring significant investment
- **1907—State regulation of electric utilities began in New York and Wisconsin**
  - Regulation spreads to two-thirds of states by 1920
  - Shareholder-owned utilities are now regulated in all 50 states

Federal Regulation of Shareholder - Owned Utilities

1935:

Congress passed federal legislation regulating interstate utility operations

Federal Power Act (FPA)

- Regulates interstate sales and resale of electricity, primarily of shareholder-owned utilities

Public Utility Holding Company Act (PUHCA)

- Addressed corporate structure of utilities

Energy Policy Act of 1992

- Created new class of "exempt wholesale generators" to sell power in competitive wholesale markets
- Expanded FERC's authority to order transmission-owning utilities to provide transmission access to other wholesale market players
- Increased energy-efficiency standards for buildings, appliances, and federal government
- Encouraged development of alternative fuels and renewable energy
- Reformed and streamlined nuclear plant licensing

Energy Policy Act of 2005

- Required mandatory reliability standards for all market players
- Provided penalty authority to FERC for violations
- Promoted transmission investment and facilitated transmission siting by granting FERC limited backstop siting authority
- Repealed PUHCA and strengthened FERC's consumer protection and merger authorities
- Increased energy efficiency standards
- Gave FERC stronger anti-market manipulation authority
- Reformed PURPA to suspend utility "must-purchase" obligation in competitive wholesale markets

Energy Independence and Security Act of 2007

Electricity Initiatives:

- Establishes stricter efficiency standards for variety of appliances; includes initiatives to strengthen building codes for commercial buildings
- Includes incentives to encourage development and production of electric drive transportation technologies, including plug-in hybrid electric vehicles
- Expands federal RD&D program for carbon capture and storage technologies
- Encourages deployment of smart grid technologies with federal matching funds for investment costs

Meet the Regulators

Public Utility Commission (PUC) or Public Service Commission (PSC)

State regulators: retail rates, siting of generating units and transmissions lines, safety, reliability, utility planning

Federal Energy Regulatory Commission (FERC)

Interstate sales of power, electricity markets, wholesale rates for different services, reliability, mergers

Environmental Protection Agency (EPA)

Air, water, waste and chemical regulations

North American Electric Reliability Corporation (NERC)

Develops and enforces standards to ensure reliability of bulk power system in North America

Commodity Futures Trading Commission

Dodd Frank Act imposed regulatory regime on energy market trading

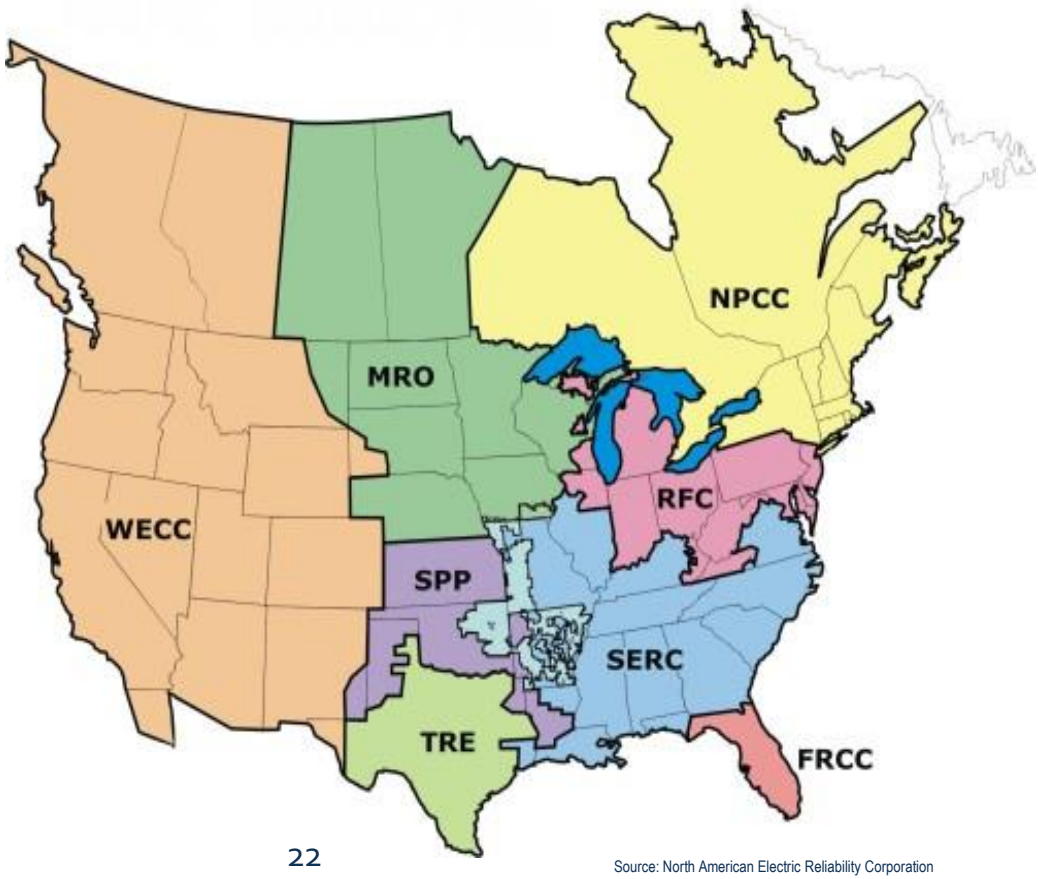
FERC's Authority

- Wholesale power and natural gas sales
- Electric transmission and gas transportation
- Electricity mergers and corporate transactions
- Regional power market rules
- Natural gas pipeline, storage, and LNG siting
- Grid reliability standards/Oversee NERC
- Police market manipulation
- Limited authority to site electric transmission
- RTOs

NERC Regional Entities

North America is divided into eight regional entities to improve electric reliability

- **FRCC:** Florida Reliability Coordinating Council
- **MRO:** Midwest Reliability Organization
- **NPCC:** Northeast Power Coordinating Council
- **RFC:** ReliabilityFirst Corporation
- **SERC:** SERC Reliability Corporation
- **SPP:** Southwest Power Pool, RE
- **TRE:** Texas Reliability Entity
- **WECC:** Western Electricity Coordinating Council



Source: North American Electric Reliability Corporation

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Market Evolution

Market & Rate Regulation, Part I

Until recently, all utilities "vertically integrated"

- One company generated electricity, transmitted it from the plant to load and distributed it to final consumers in a particular "service territory"
- No competition (a.k.a. monopoly)
- States regulated retail rates (a.k.a. no monopoly power)
  - Utilities received guaranteed rate of return on investments to serve customers (regulatory compact)
    - Investments: least cost, used and useful
    - Rates: just and reasonable
- FERC regulated sales of power between companies (interstate wholesale sales)

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Market & Rate Regulation, Part II

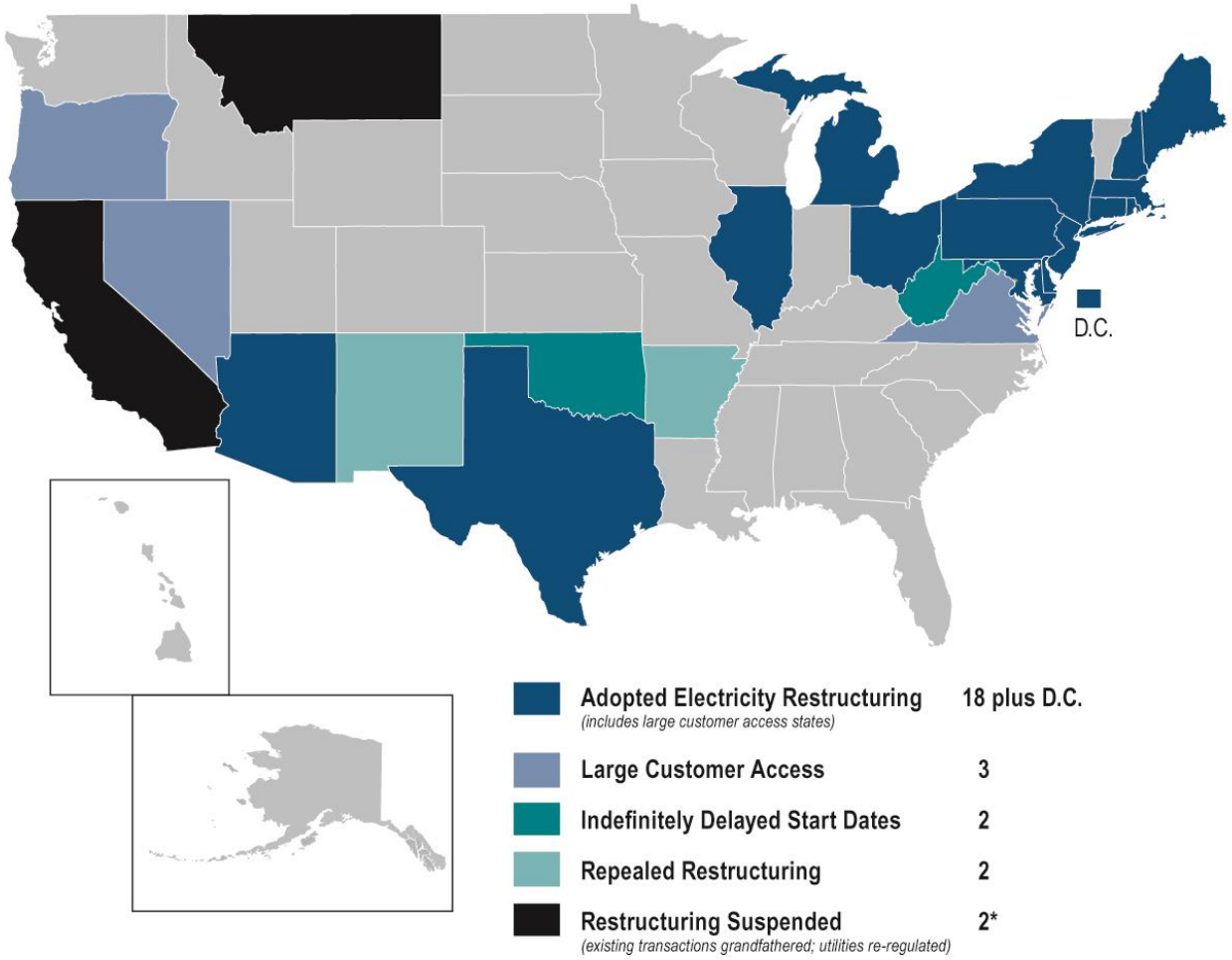
States and FERC took action to promote competition in generation and transmission

- Distribution still seen as a natural monopoly
- Some states “deregulated” utilities, separating ownership of generation and transmission functions
- Often, this facilitated retail supply competition (“retail choice”)
- FERC required transmission owners to allow non-affiliated generators to “interconnect”
  - Independent power producers don’t own transmission, don’t sell to retail customers
  - Facilitates integration of renewables/smaller generators into the transmission grid
- Changes to business model = changes to regulatory structures

Retail Restructuring

- Between 1996 and 2000 18 states plus DC passed laws and issued regulatory orders calling for the introduction of retail competition in their electricity sectors
- California energy crisis in 2000-2001 stalled the move to competitive retail markets and some states suspended or repealed their programs
- Electric restructuring allows customers to shop for a retail power provider and deregulates generation supply and pricing
- To promote competition, utilities in most restructured states were encouraged or required to divest their generation facilities

Move to Retail Choice



Market & Rate Regulation, Part III

Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) created

- Manage the reliability of the transmission grid for a state/region
- Operate wholesale power markets (and some other markets)
  - Generators bid power into wholesale markets
  - Least cost generators get “dispatched” first
  - All generators dispatched get “market clearing price” – bid of last generator dispatched
- FERC has “oversight” of these markets
- Caution: Not all states that participate in an ISO/RTO are “deregulated”

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Key FERC Orders

- FERC Orders 888 and 889 (1996) opened transmission system of all shareholder-owned utilities to qualified wholesale buyers and sellers of electricity
- Order 2000 (1999) encouraged formation of Regional Transmission Organizations (RTOs)
  - Independent System Operators (ISOs) perform similar functions
- Order 1000 (2011) requires transmission planning on a regional level and allows new entrants to participate on same basis as incumbents

RTOs and ISOs

- ISO–NE: ISO New England
- New York ISO: New York only
- PJM: Pennsylvania, New Jersey, Maryland (and rest of the Mid-Atlantic states and parts of IL)
- MISO: Midwest Independent System Operator
- SPP: Southwest Power Pool
- ERCOT: Electric Reliability Council of Texas
- Cal-ISO: California Independent System Operator

Organized Wholesale Markets

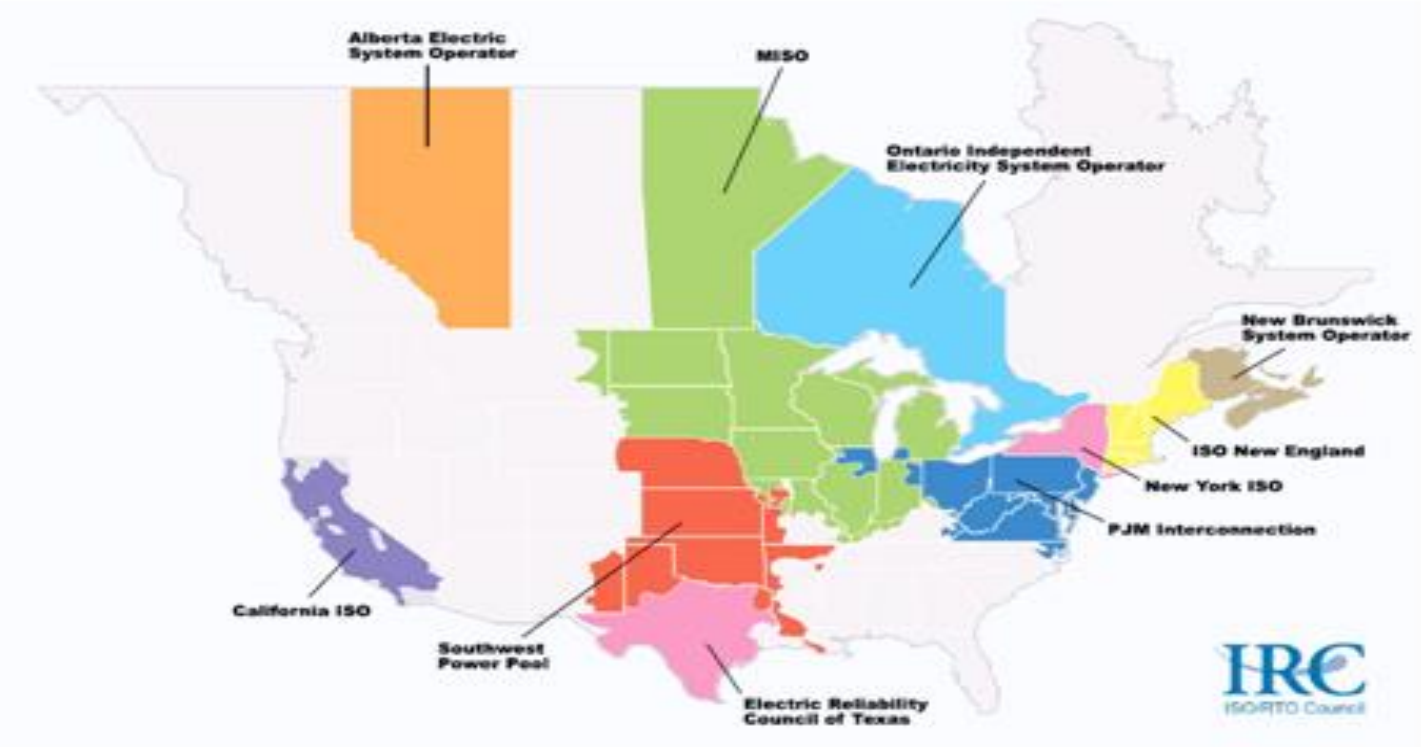


Table 7: Wholesale Electric Markets in 2006

■ Existing □ Projected

	Real-time market (RTO/ISO)	Real-time market Bilateral	Day-ahead market (RTO/ISO)	Day-ahead market Bilateral	Virtual Bidding (RTO/ISO)	Ancillary services markets (RTO/ISO)	Financial transmission rights (RTO/ISO)	Capacity (UCAP) markets (RTO/ISO)	Associated financial markets
New England	■	■	■	■	■	■	■	■[1]	■
New York	■	■	■	■	■	■	■	■[2]	■
PJM	■	■	■	■	■	■	■	■[3]	■
Midwest	■	■	■	■	■	08	■		■
Southeast		■		■					■
SPP	■	■		■					
ERCOT	■	■	09	■		■	■		
Northwest		■		■					■
Southwest		■		■					■
California	■	■	08	■	09	■	■	[4]	■

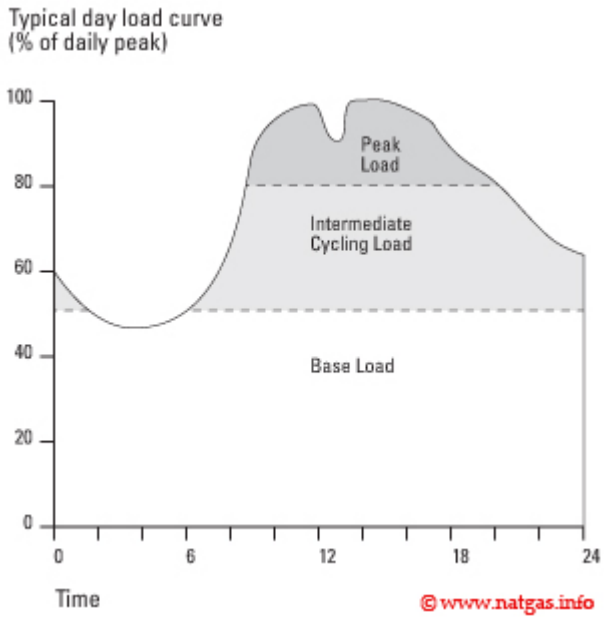
[1] Transitioning to a formal capacity market. ISO-NE's installed capacity market was replaced on December 1, 2006, with the transition period for its new Forward Capacity Market.
[2] Locational
[3] Systemwide
[4] California is considering a formal capacity market.

Generation

- Generator usage varies based on:
  - Time of the day
  - Season
  - Fuel costs and the needs of the system

- Major types:
  - Base-load
  - Intermediate
  - Peaking

Demand Curve



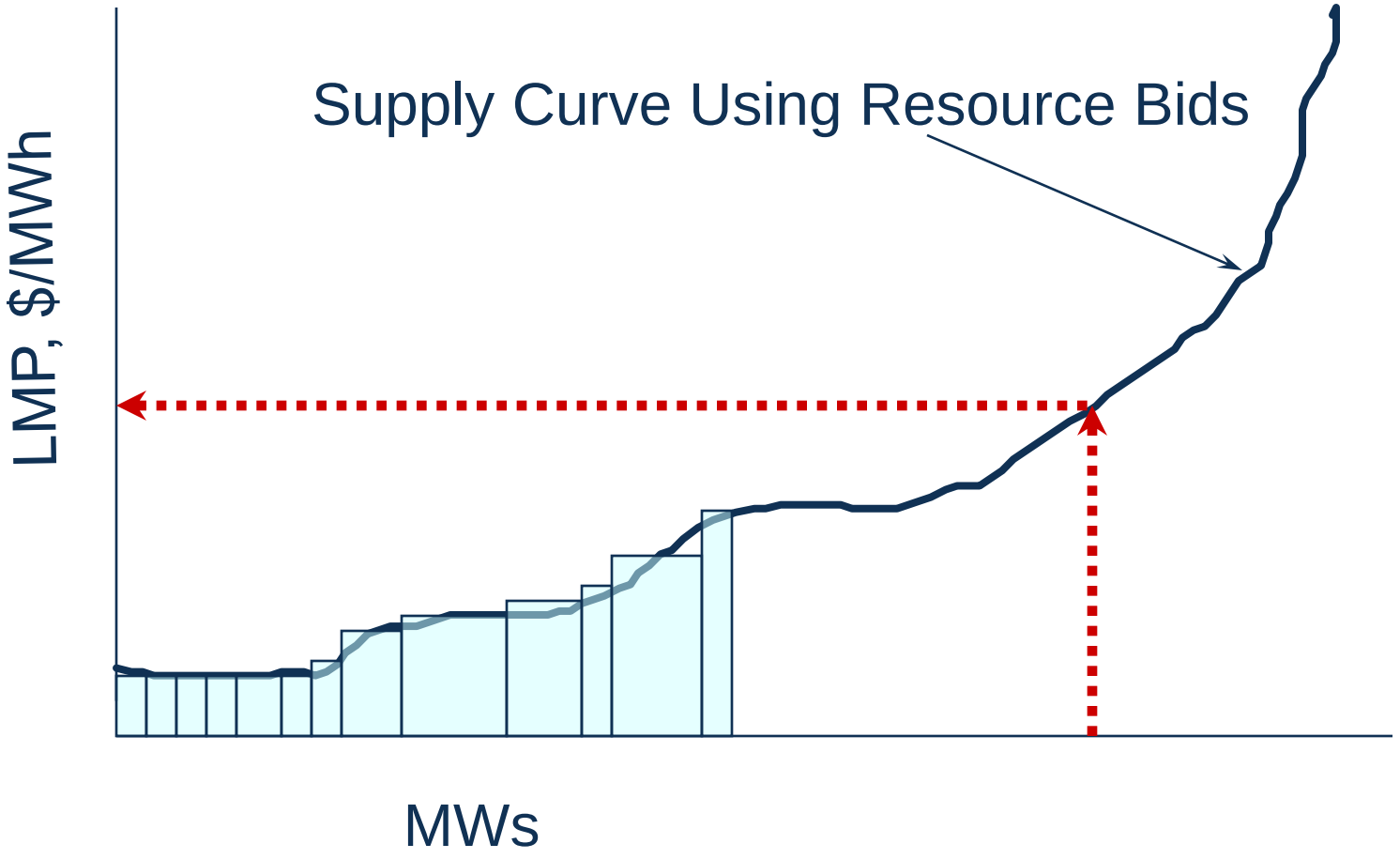
Daily demand can be broken into three distinct phases:

- base load – plants run continuously and provide daily minimum power demand; low cost to maintain and operate
- Intermediate or cycling load – plants operate during shoulder hours; flexible, moderate cost
- peak load - plants operate during peak demand periods; highly responsive to changes in demand

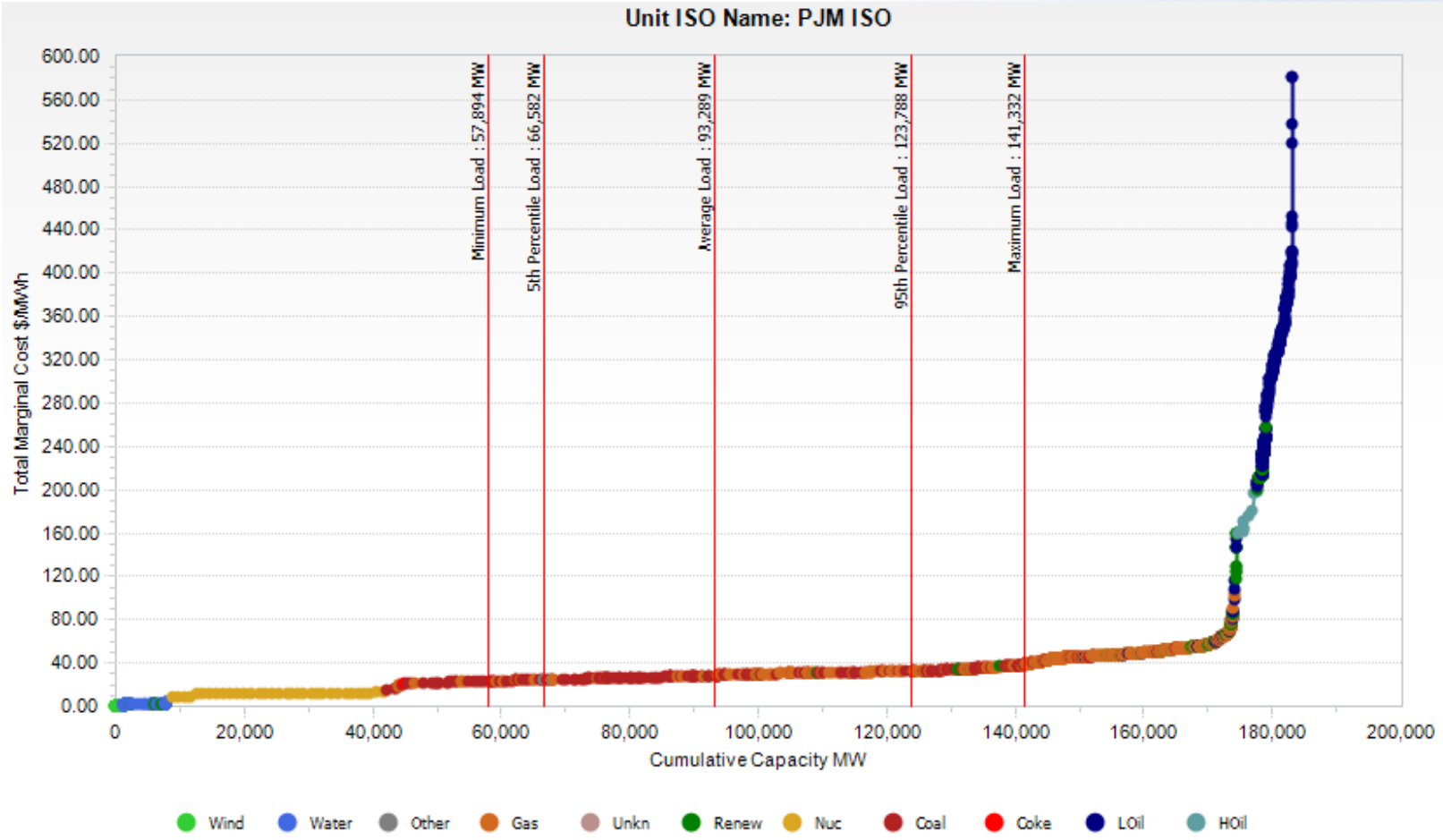
Wholesale Market Prices

- Offers to sell power are accepted by RTO or ISO in increasing price order until load is met
- Next offer to be accepted sets Wholesale Spot Market price or locational marginal price (LMP)
- LMP = generation marginal cost + transmission congestions cost + cost of losses
  - Some areas may have different LMPs due to constraints on the system
- All clearing generators receive LMP regardless of their bid

How is Energy Priced – Wholesale Market - LMP



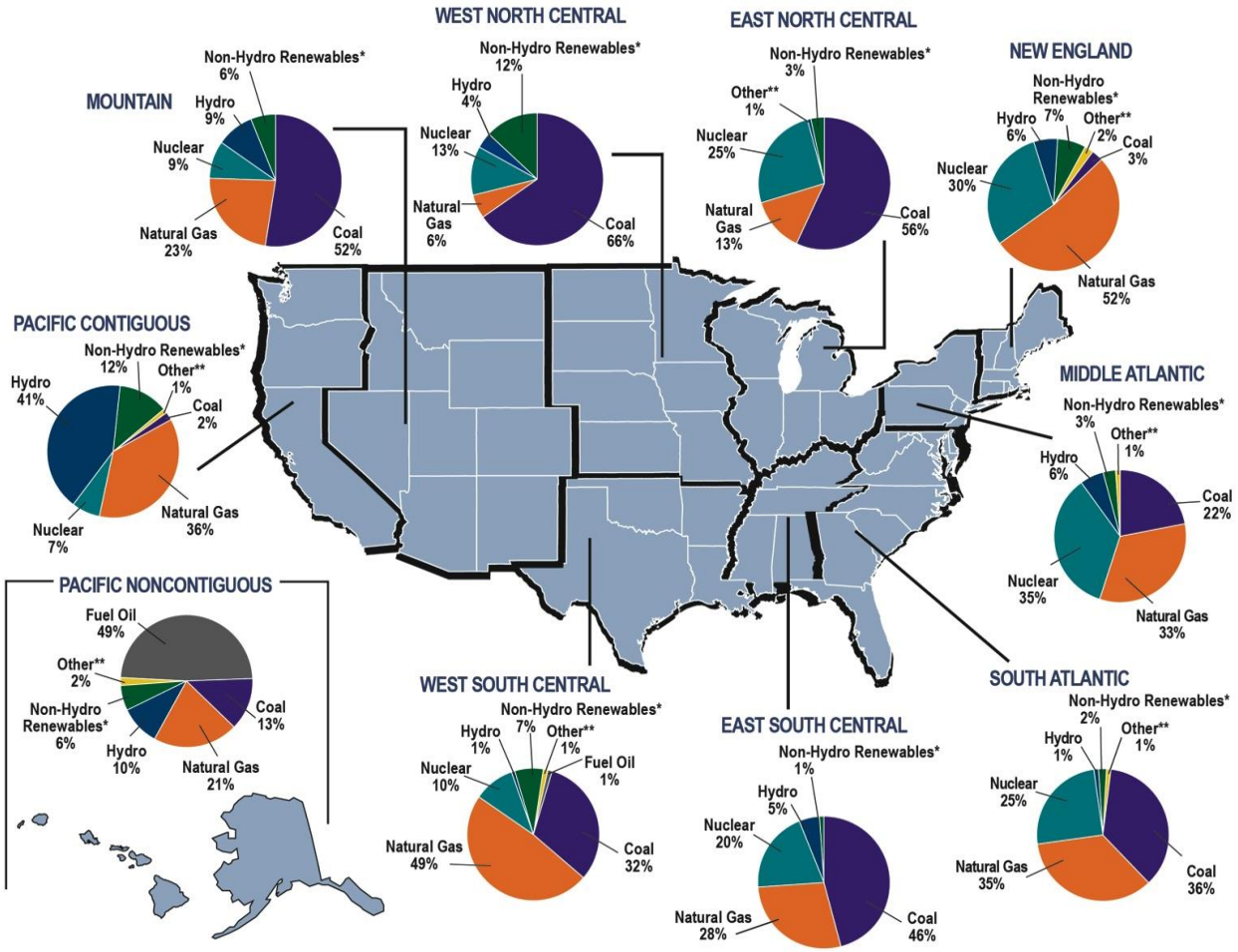
PJM Supply Curve



Source: Ventyx, The Velocity Suite. Curve includes all operating units. Cost and dispatch based on calculated and modeled data for

Evolution Contines

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.

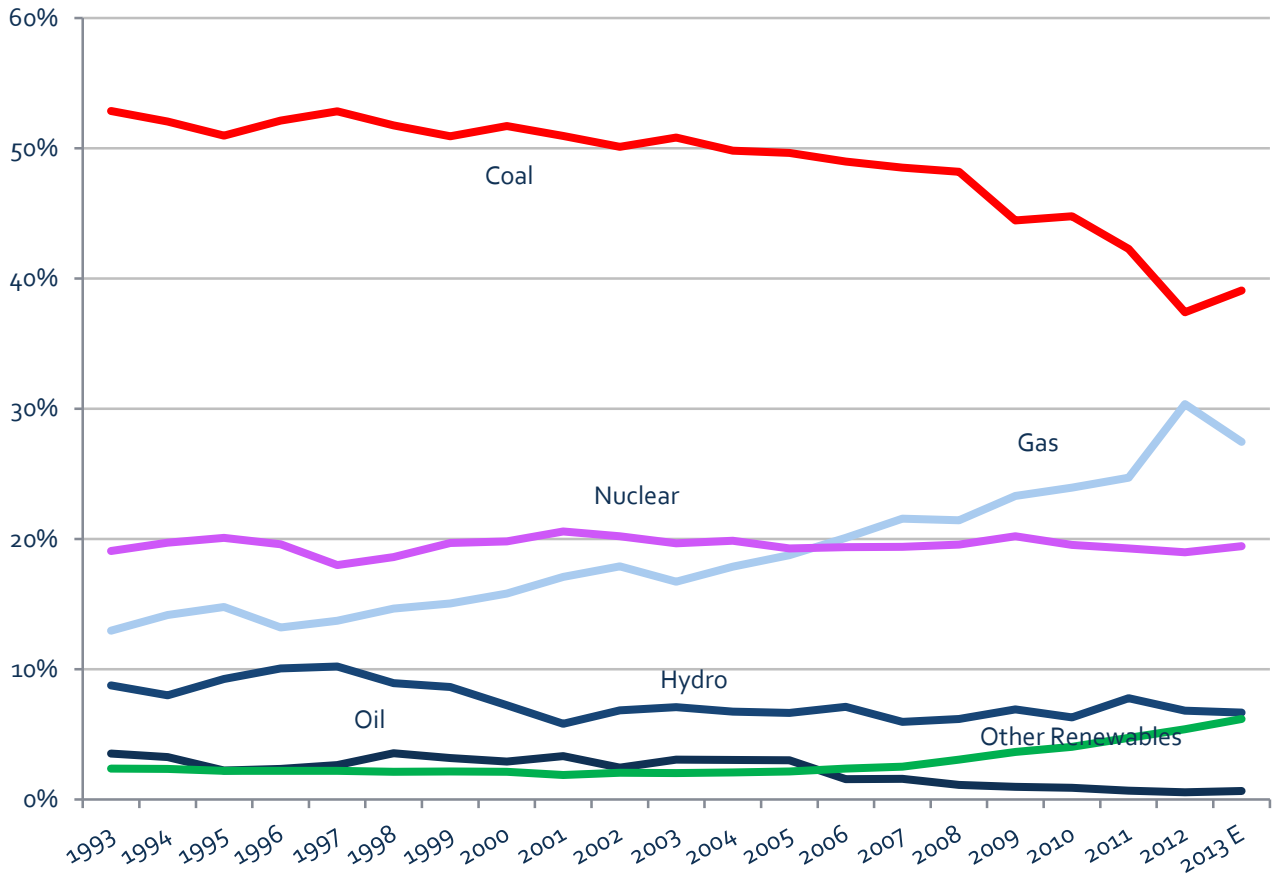
Sum of components may not add to 100% due to independent rounding.

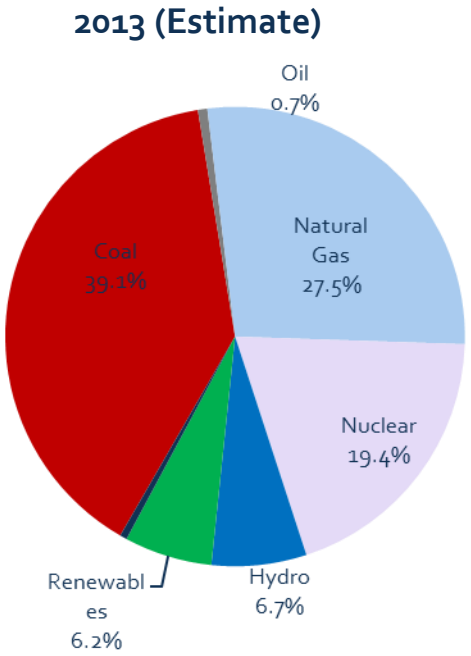
Source: U.S. Department of Energy, Energy Information Administration, Power Plant Operations Report (EIA-923); 2012 final generation data.

February 2014

EEI

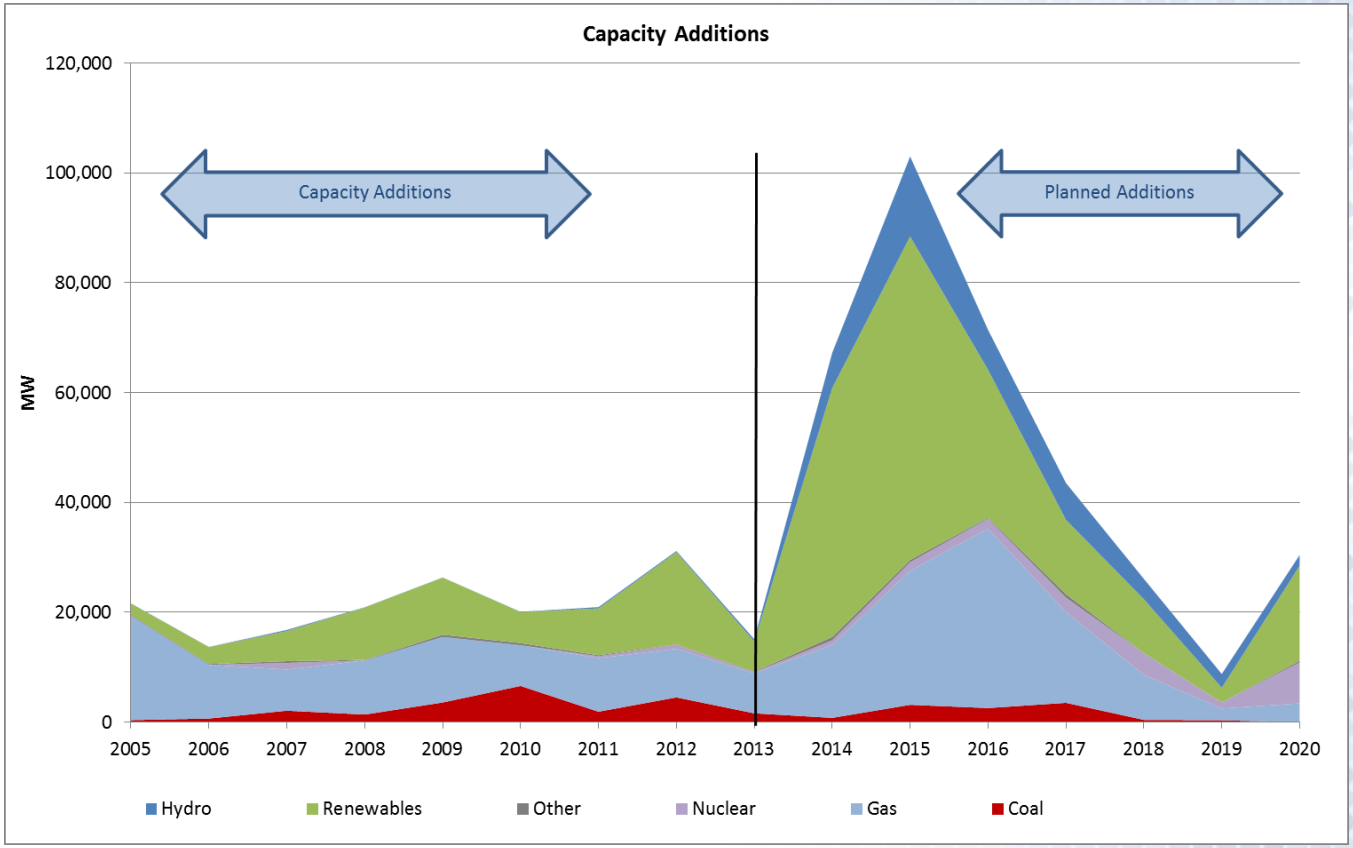
Evolving Generation Mix





Source: DOE – Energy Information Administration

Generation Capacity Additions



Data source: Ventyx Inc., The Velocity Suite. Data and status as of January 1, 2014

Challenges Integrating Natural Gas and Renewables

- Infrastructure Challenges
  - Additional pipeline capacity may be needed to accommodate increased demand for natural gas in some locations
- Operational Challenges
  - Electric/gas coordination – additional flexibility needed in scheduling and nomination cycles in some regions
  - Overall gas demand is likely to increase, so is variability
  - Increased O&M expenses likely for gas plants
- Cost Recovery Challenges
  - Increased renewables impact on market prices
  - Flexible pipeline service contract options

Additional Flexibility is Needed

- Increased penetration of renewables means increased need for flexibility.
  - Generators that can respond to rapid changes in renewable generation.
  - Greater coordination between balancing areas to managing variability and reduce curtailment.
  - More flexible contracting arrangements between electric and gas sectors.
  - Ability to manage schedule changes intra-hour.
  - Additional transmission to deliver renewable generation to load.

Electric & Gas Coordination

Communication of Operational Information Between Natural Gas Pipelines and Electric Transmission Operators (FERC Order No. 787)

- Enables increased sharing of non-public operational information between utilities and pipelines

Coordinating of the Scheduling Processes of Interstate Natural Gas Pipelines and Public Utilities (FERC Docket No. Rm14-2)

- Proposed changes to intraday scheduling cycles and the start of the gas day

Ancillary Services

Frequency Regulation Compensation in Organized Wholesale Power Markets
FERC Order No. 755

- Provides payment for performance for faster ramping resources
- Payment includes a capacity payment and a payment for performance

FERC reviewing comments: "Third-Party Provision of Reactive Supply and Voltage Control and Regulation and Frequency Response Services." (Docket No. Ad14-7)

FERC will hold staff workshops this fall to examine regional price formation issues. (Docket No. Ad14-14)

Regional flexibility is needed.

Remaining Challenges

- Regional differences - Different market structures and fuel mixes necessitate a variety of solutions.
- Flexibility and diversity – Increased renewables affect markets and require increased fuel diversity and flexibility. Proper price signals are critical.
- The value of the grid – *The* enabler of technology deployment and reliability.
- Need to maintain fuel diversity. All resources were needed to keep the lights on during the polar vortex.

Elk River Chemical Spill

Questions

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The Role of State Leadership in Cooperative Federalism

What approach do states take with regard to leadership and how will the state/federal partnership evolve with the new EPA Clean Power Plan?

Free – Open to the Public – In-person only – Includes networking event

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The Omni Shoreham Hotel, Washington, DC

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