



# Electricity Storage: Technologies and Regulation

An Update for the October 8, 2012  
PNWER Energy Storage Coalition Meeting

SPIEGEL &  
McDIARMID  
LLP

# Outline

- Background
  - The industry context that provides storage's value
  - Overview of storage technologies and functional characteristics
- Changing Industry Context
- Federal Regulatory Developments

# Electricity is an energy medium

- Nobody needs “storage”
- In fact, few need “electricity”
- But everybody needs usable energy from good sources delivered to the right times and places, and
- Storage can help make that possible

# Past:

- Kinetic Energy mechanically transmitted to nearby factories (e.g., Paterson, NJ)



# Present:

- Multiple energy sources interconnected in space, but (mostly) islanded in time



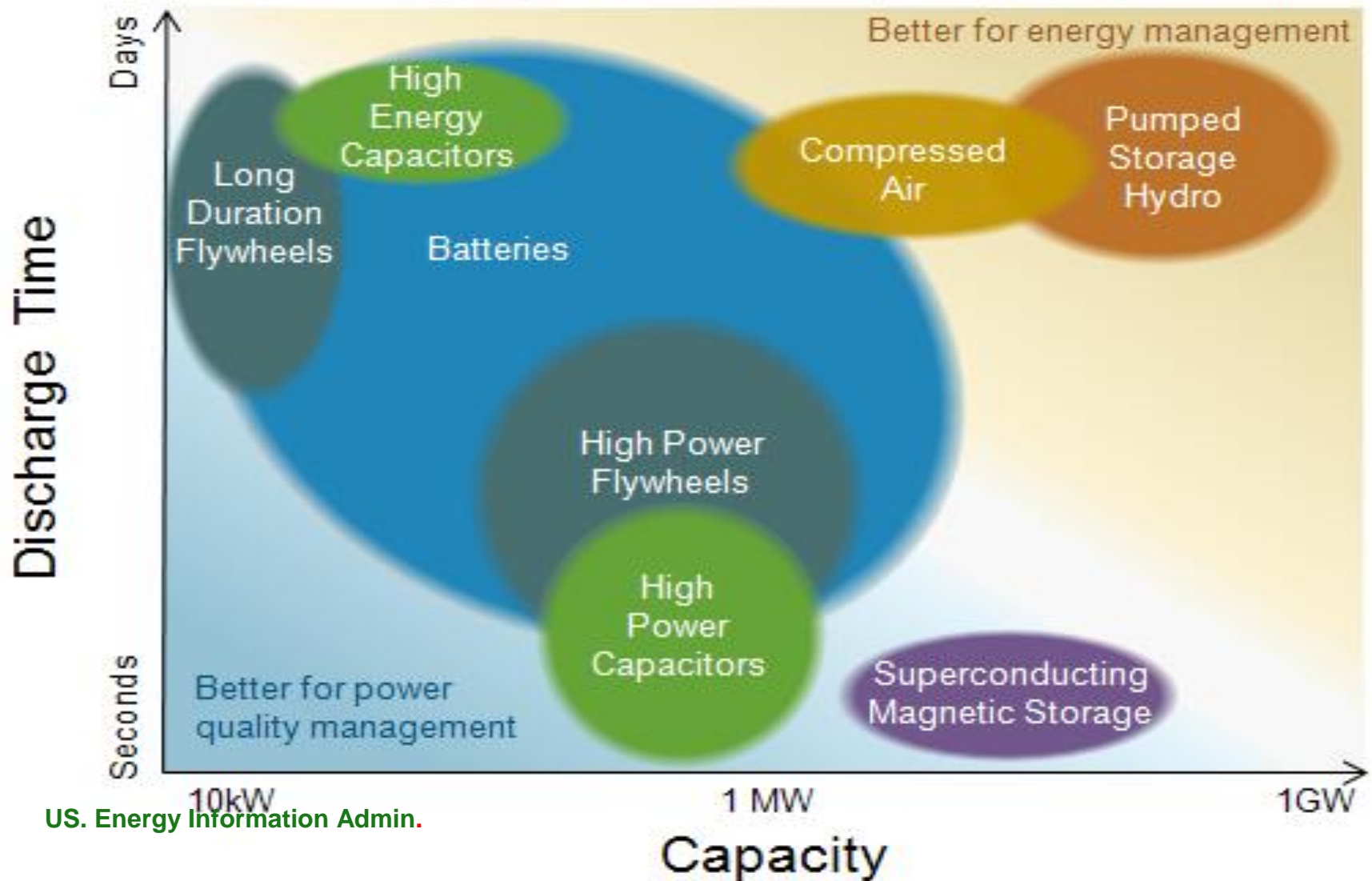


# Future?

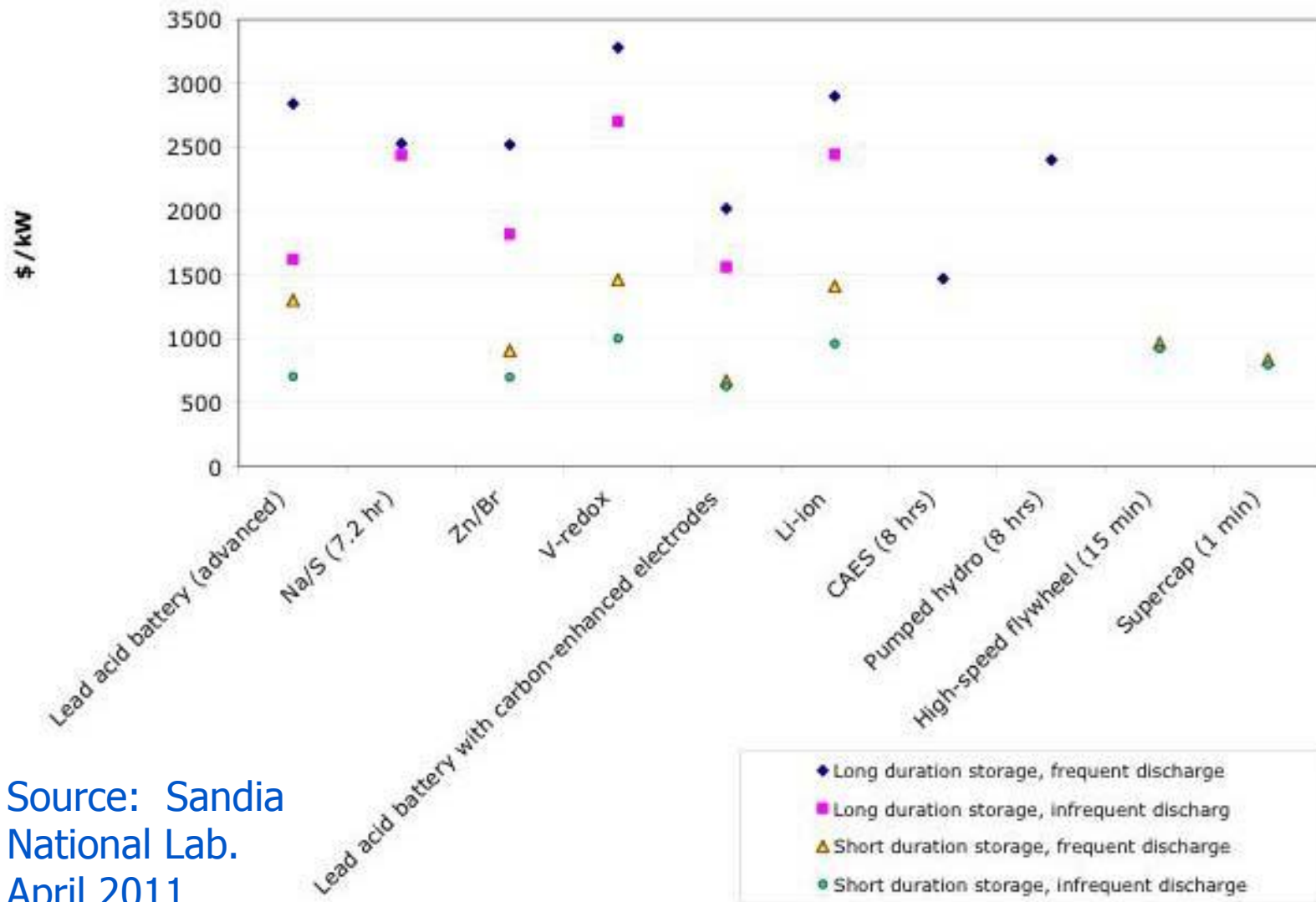
- Multiple energy sources interconnected in time and space



# Electricity Storage Technologies



Present Worth of 10-yr Life Cycle Cost for Energy Storage Technologies



Source: Sandia  
National Lab.  
April 2011



# Recent Developments

## ■ Changing Industry Context

- Intermittent Generation
- Pumped Storage
- Nuclear
- Natural Gas

## ■ Federal Regulation

- Uniform System of Accounts
- Frequency Regulation Pricing

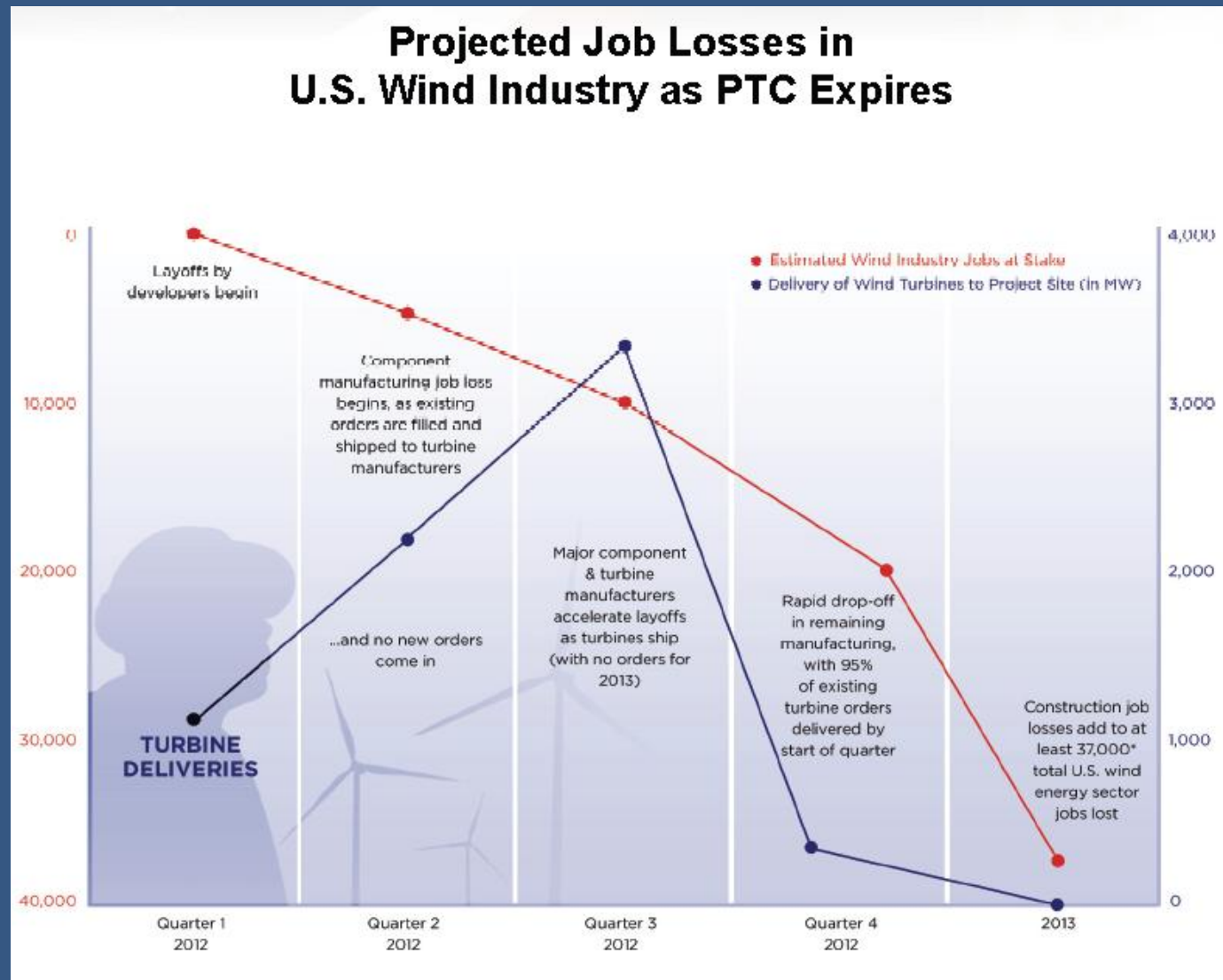
# Changing Industry Context

# New-Type Storage (Nodal Markets)

ISO/RTO Organized Market Applications				
Technology	Owner/ Technology Provider	Operating Capacity	Commercial Operation Date	ISO/RTO
Flywheel	Beacon/Beacon	Up to 3 MW	November 2008	ISO-NE
Battery	AES/A123	8 MW	December 2010	NYISO
Flywheel	Beacon/Beacon	20 MW	January 2011	NYISO
Battery	AES/Altairnano	1 MW	May 2009	PJM
Battery	AES/A123	32 MW	2011	PJM
Flywheel	Beacon/Beacon	20 MW	Expected 2013	PJM
Battery	AES/A123	2 MW	2008	CAISO
Battery	Prudent Energy	Up to 750kW	2012	CAISO
Battery	AES/Altairnano	1 MW	2011	ERCOT
Battery	Xtreme Power	36 MW	Q4 2012	ERCOT
<i>Total</i>		<i>124 MW</i>		

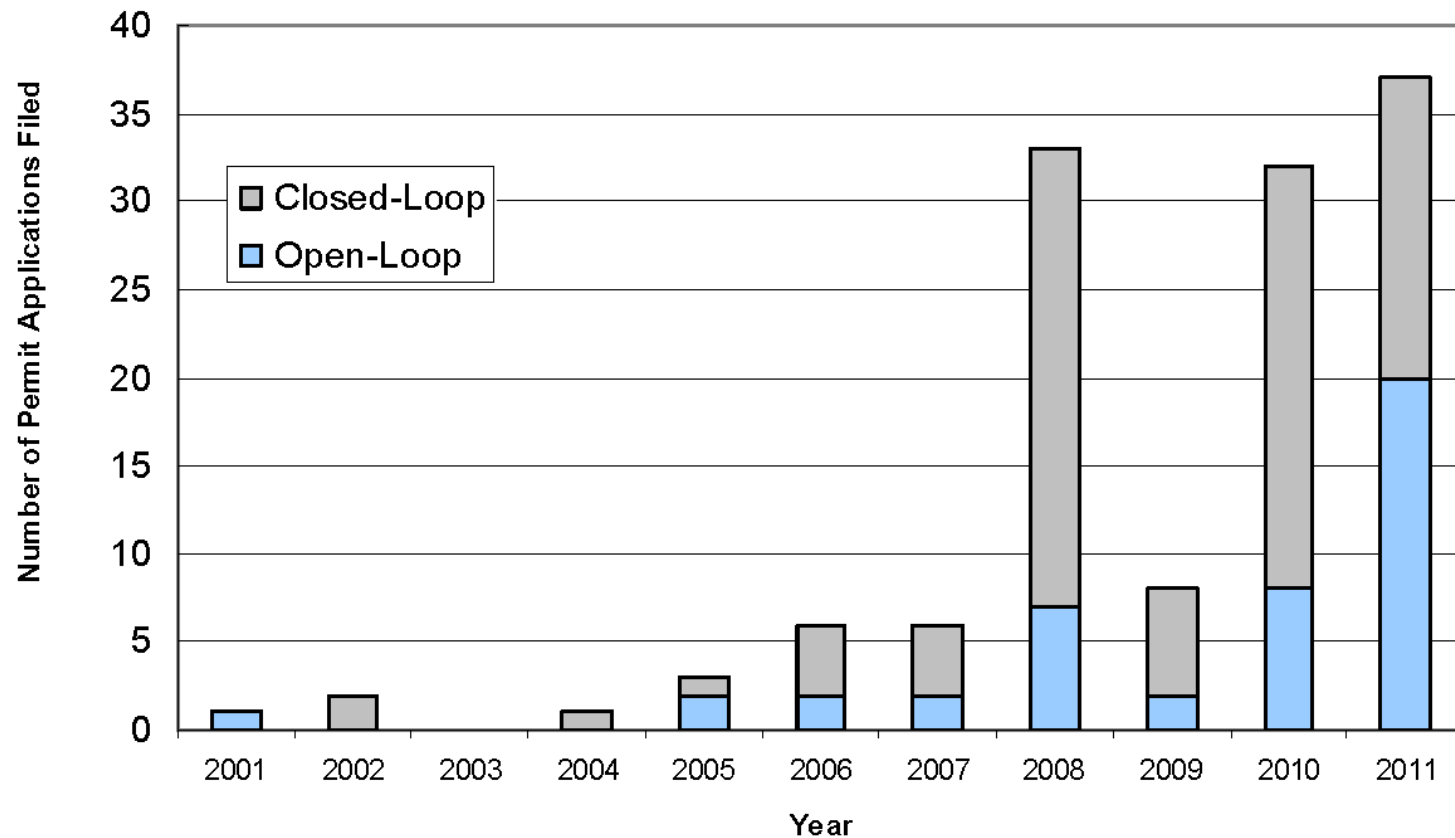
Source: Electricity Storage Association (Sept. 2012 Comments to FERC)

# Wind industry stall, or spin?



Source: AWEA

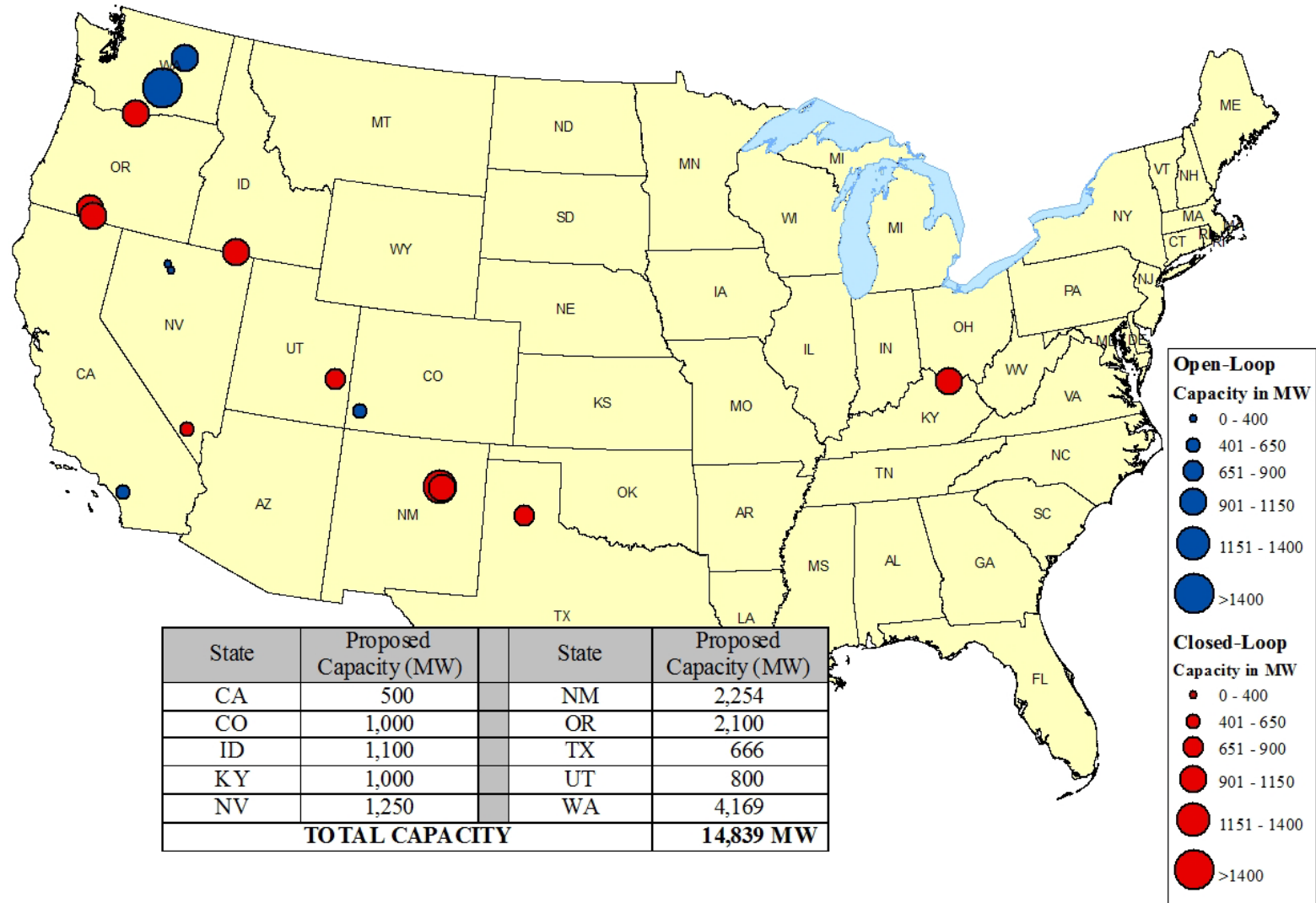
## Preliminary Permit Application Trends for Open- and Closed-Loop Pumped Storage Projects



Source: FERC Staff

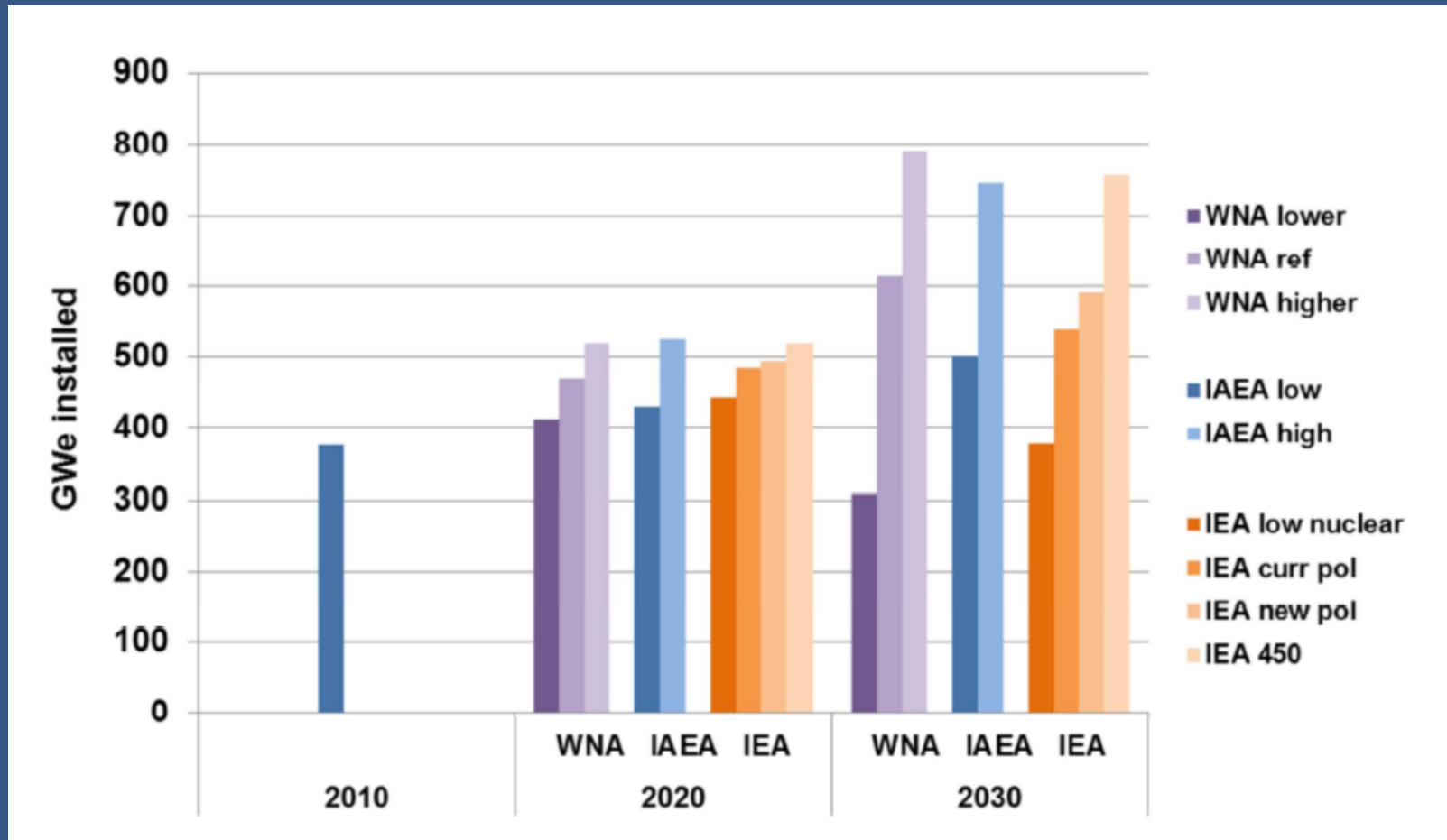


## Pending Preliminary Permits for Pumped Storage Projects



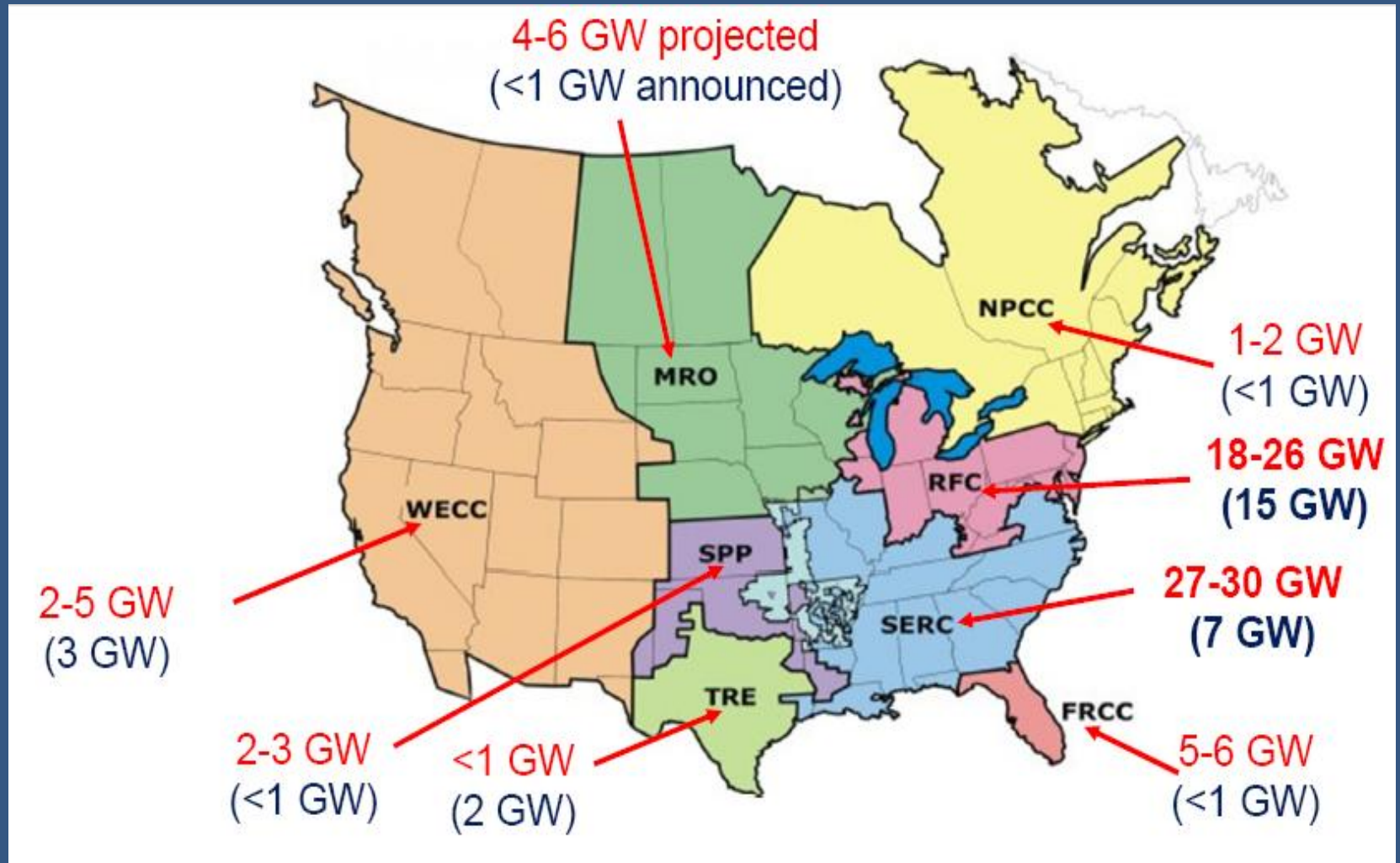
Source: FERC Staff, July 1, 2012

# Nuclear Power: Post-Fukushima, Growth Still      Forecast



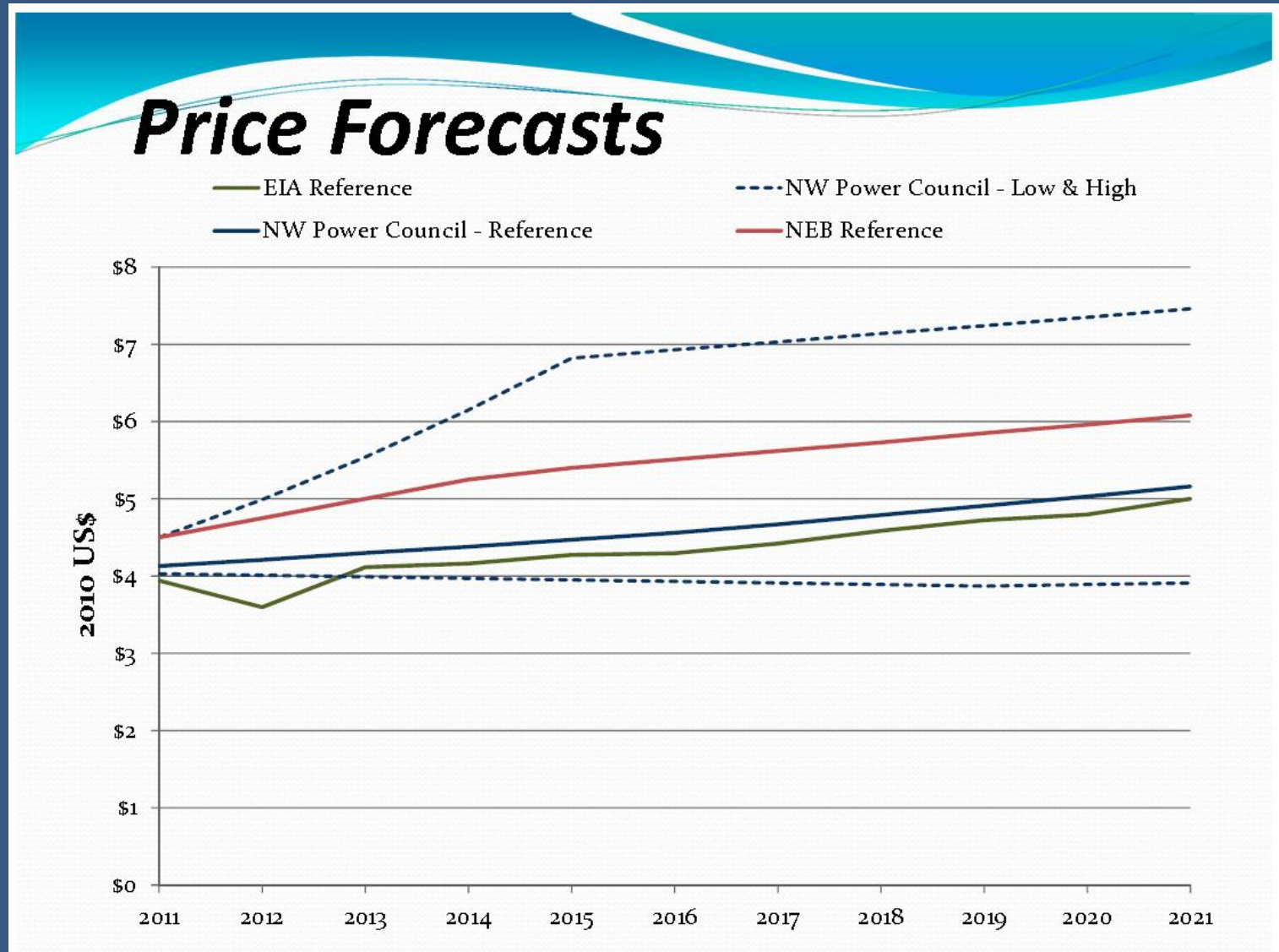
Source: IAEA, International Status and Prospects for Nuclear Power, Aug. 2012

# Coal: 59-77 GW Forecast Retirees



Source: The Brattle Group, Oct. 2012 Update of 2010 Study (atop NERC map)

# New Gas Supplies Bring Forecast Price Stability

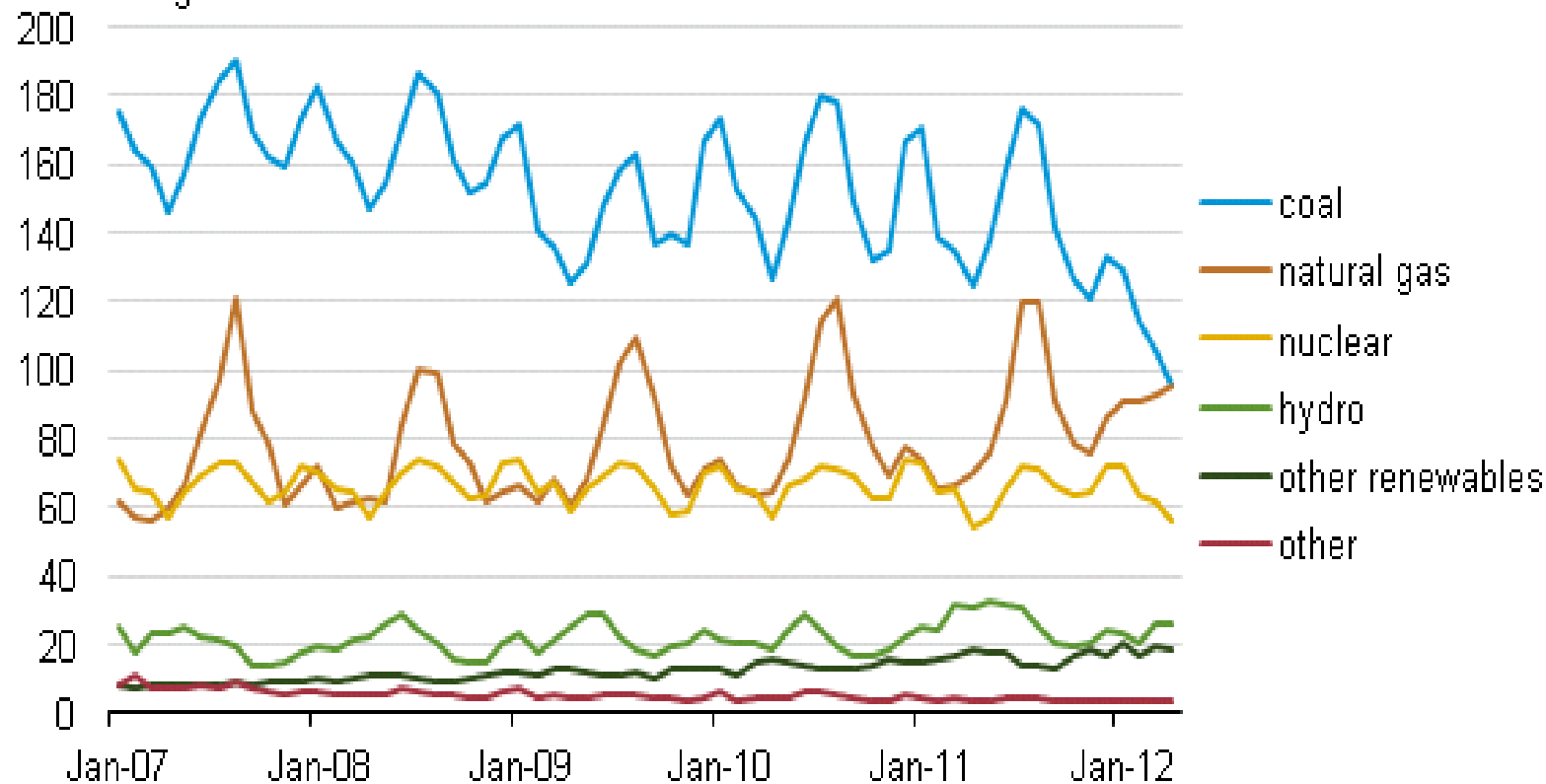


Source: Northwest Gas Ass'n, at Oregon PUC Natural Gas Outlook Workshop, July 2012

# Monthly coal- and natural gas-fired generation equal for first time in April 2012

## U.S. monthly net electric power generation, January 2007 – April 2012

million megawatthours



Source: U.S. Energy Information Administration, [Electricity Data Browser](#).

[Download CSV Data](#)



# So, Some Key Questions:

- Why store electricity instead of storing natural gas and rainfall?
- Do carbon costs necessitate intermittent generation and its storage?
- What types of storage are the best first bets?
- Who makes these decisions, and who bears risks and costs?
- Ownership and regulatory modes?

# Federal Regulation Update

# Uniform System of Accounts

- FERC June 2012 Notice of Proposed Rulemaking (Docket No. RM11-24)
- New/Revised Electric Plant Accounts
  - Account 348: Energy Storage Equipment – Production
  - Account 351: Energy Storage Equipment – Transmission
  - Account 363: Energy Storage Equipment – Distribution
- Functionalize original cost recording by ratemaking of retail commission or other primary rate regulator
- First charge-up energy included in original cost installed



floor wax AND dessert topping?

# USoA Continued

- New storage Expense accounts
  - Production function storage: O&M = 548.1 & 553.1
  - Transmission function storage: O&M = 562.1 & 570.1
  - Distribution function storage: O&M = 582.1 & 592.1
- Cost of energy to re-charge storage facilities
  - Energy purchased for storage separated from other power purchases, but can be aggregated across storage facilities
  - Energy self-generated for storage accounted for in existing fuel expense accounts
- No new Revenue accounts



# New FERC Form 1 Report Pages

- Energy Storage Operations, pp.414-16
- Applies to “Large” plants,  $\geq 10$  MW
- Disaggregated by individual facility
  - Current function (production, transmission, distribution)
  - MWh charged, MWh discharged (by function), MWh losses
  - MWh sold
  - Revenues from sale of stored energy
  - Purchased power costs
  - Fuel costs
  - Other costs
  - Plant costs (original, experimental, CWIP) by function

# Frequency Reg. Pricing in RTOs

- Order 755 (Oct. 2011); reh'g denied Feb. 2012.
  - Applies to “Organized” wholesale markets
  - Requires increased frequency regulation payments to nimbler resources – resources that can rapidly vary controlled output
  - Regulating resources must be paid
    - For “capacity” = availability, including opportunity costs
    - For “performance” = “mileage” = each as-instructed ramp ↓↑
- Aims to pay more to storage facilities, e.g. flywheels, that ramp rapidly ↓↑ and so provide > value than conventional AGC

# Cal. ISO Order 755 Compliance

- FERC Docket No. ER12-1630
  - Filing approved with modest conditions Sept. 20, 2012 (Cal. ISO, 140 FERC ¶ 61,206)
  - Resources can now include in their regulating capacity offers their own calculation of inter-temporal opportunity costs (e.g., cost of discharging now instead of later)
  - “Mileage” payment, bid-based, market-clearing per “mile”
    - $\text{Mileage} = \sum |\text{value}|$  of instructed moves @ 4-second intervals
    - Factor for each resource’s historical ramping accuracy
- Revised Cal. ISO market rules approved for effectiveness January 1, 2013

# Freq. Reg. Pricing outside RTOs

- June 2011 Notice of Inquiry
  - Extend Order-755-like pricing outside RTOs?
  - Market pricing for ancillary services sold to Transmission Owners by non-TOs?
- Non-Accounting half of June 2012 NOPR
  - Transmission tariff payments to regulating resources must account for “speed and accuracy”
  - Loosens *Avista* policy on market-based pricing for ancillary service sales by non-TOs to TOs:
    - Sellers who control less than 20% of the historically needed ancillary service quantity presumed to lack market power.
    - OKs prices up to the OATT Sched. price of purchasing TO, or highest OATT Sched. price among multiple TOs.



## QUESTIONS?

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