Synapse
Energy Economics, Inc.

Review of Resource Planning around North America

Supply and Demand-Side Resource Planning in ISO/RTP Market Regimes

October 17, 2011

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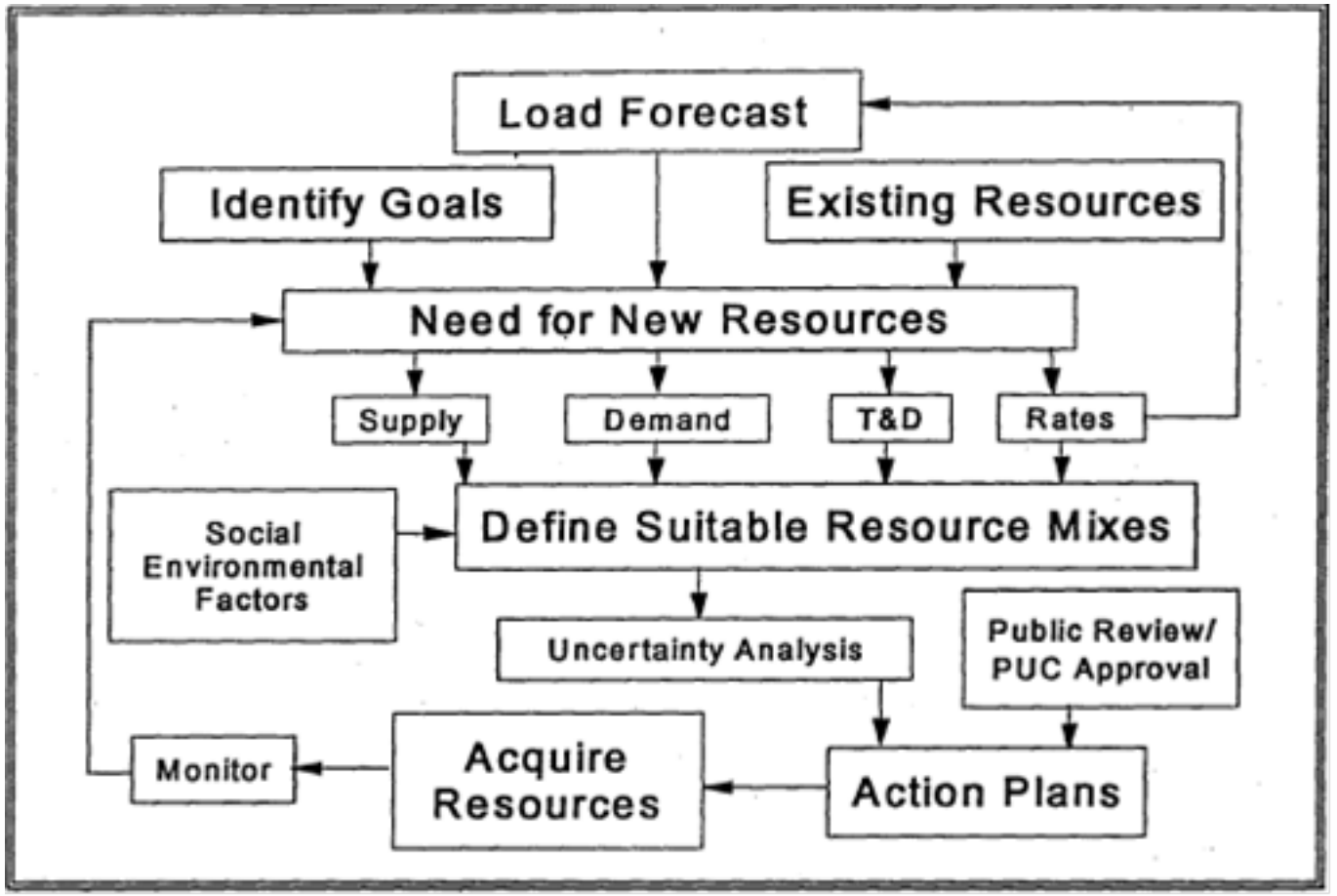
Today's presentation

- What is an IRP, and what is it for?
- State IRP rules
- Energy prices and environmental compliance planning
- Restructured markets
- Ratemaking and cost recovery

Flow chart for integrated resource planning



Source: *A Good Integrated Resource Plan: Guidelines for Electric Utilities and Regulators.* Oak Ridge National Laboratory. December 1992. page 5.

IRP process in seven steps

1. Forecast load, fuel and market power prices, and other key factors, such as likely environmental regulations or market changes;
2. Document costs and benefits of existing supply- and demand-side resources including existing generation and transmission facilities, purchase contracts, demand-side-management programs, and market purchases of power; study their strengths and weakness, challenges and opportunities;
3. Identify and characterize new supply- and demand-side resources that could be acquired over the life of the IRP, including technologies not yet commercial;
4. Develop different resource plans that could meet future load requirements, and screen them based on cost;
5. Select the best resource plans and test their sensitivity to risk factors such as load uncertainty, fuel price volatility, and regulatory uncertainty.
6. Select a preferred plan, usually based on a combination of lowest present value life cycle cost (under one or another definition of cost) and risk profile;
7. Develop an action plan for the near term, often three to five years, depending on the construction lead-time of the selected resources.

Source: *Integrated Portfolio Management in a Restructured Supply Market.* Resource Insight, Inc., and Synapse Energy Economics, Inc., prepared for Ohio Consumers' Counsel. June 2006. Pages 37 and 38.

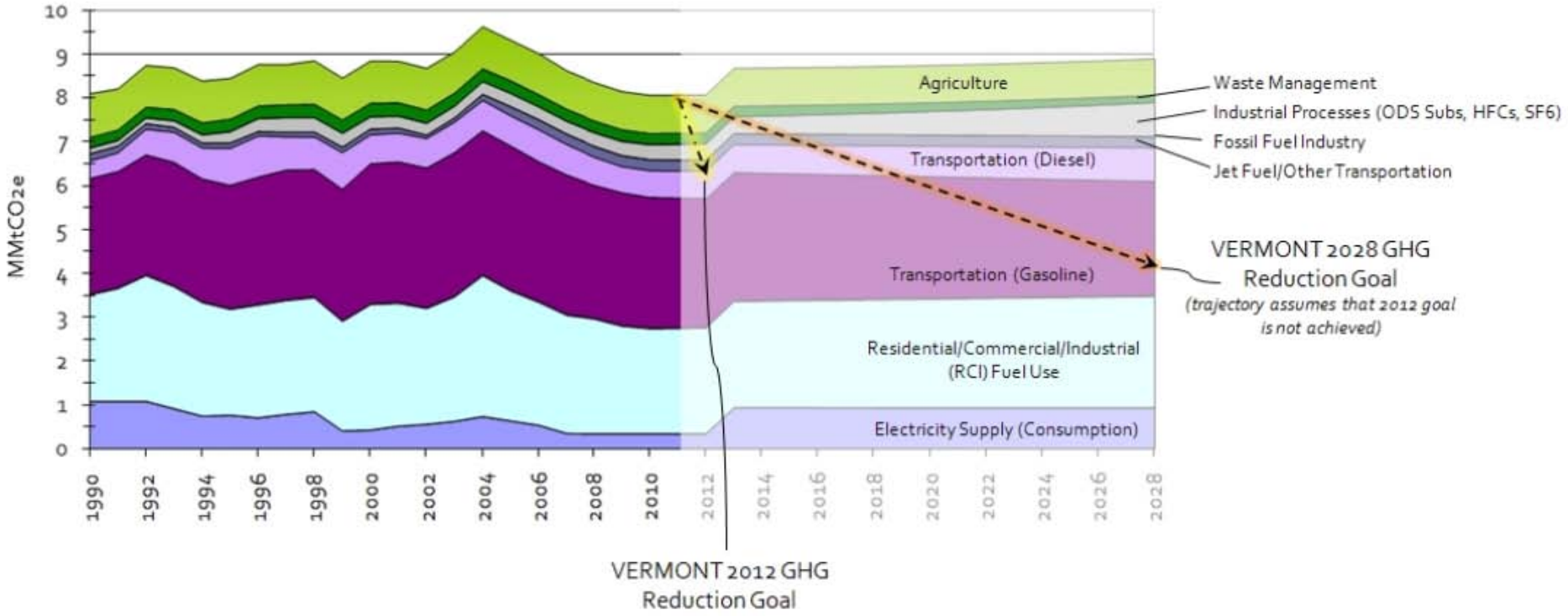
What is an IRP for?

- Planning context, information
- Action plan
- Participation (regulators, interveners, the public)
- Various types and levels of buy-in

Possible Commission activities on IRP

- Reject
- Ignore
- Acknowledge
- Accept
- Approve
- Approve specific resource decisions
- Other?

Vermont's Historical GHG Emissions, GHG Reduction Goals, and Draft Forecast of Future GHG Emissions



Source: Vermont Department of Public Service. *Vermont Comprehensive Energy Plan 2011: Facts, Analysis and Recommendations, Volume 2*. Public Review Draft. Page 14, Exhibit 1-1. 2011.

Good documentation is important

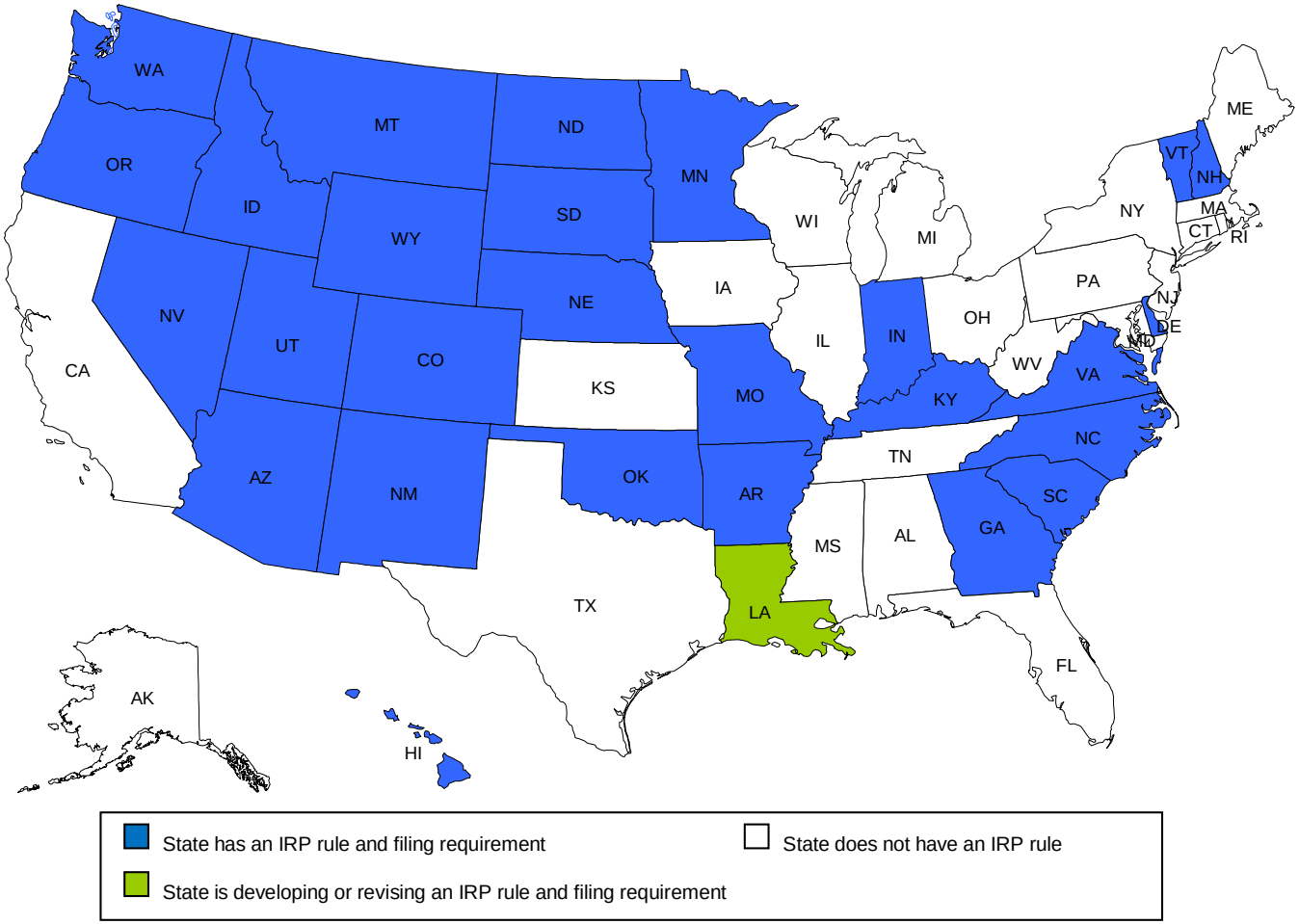
Response to data request in an ongoing IRP docket, asking for planning model information:

"The content of internal business strategy discussions constitutes confidential business information. In addition, because of ongoing litigation challenges, [the Company] presently conducts internal strategy meetings with an attorney present for the purpose of giving legal counsel and in anticipation of litigation. As a result of this litigious climate, no minutes are taken and any analyses are performed in real time. A spreadsheet tool is used to summarize data, but that tool is a proprietary, business confidential tool which has data contained therein which is also proprietary."

Existing electrical generating capacity by fuel type

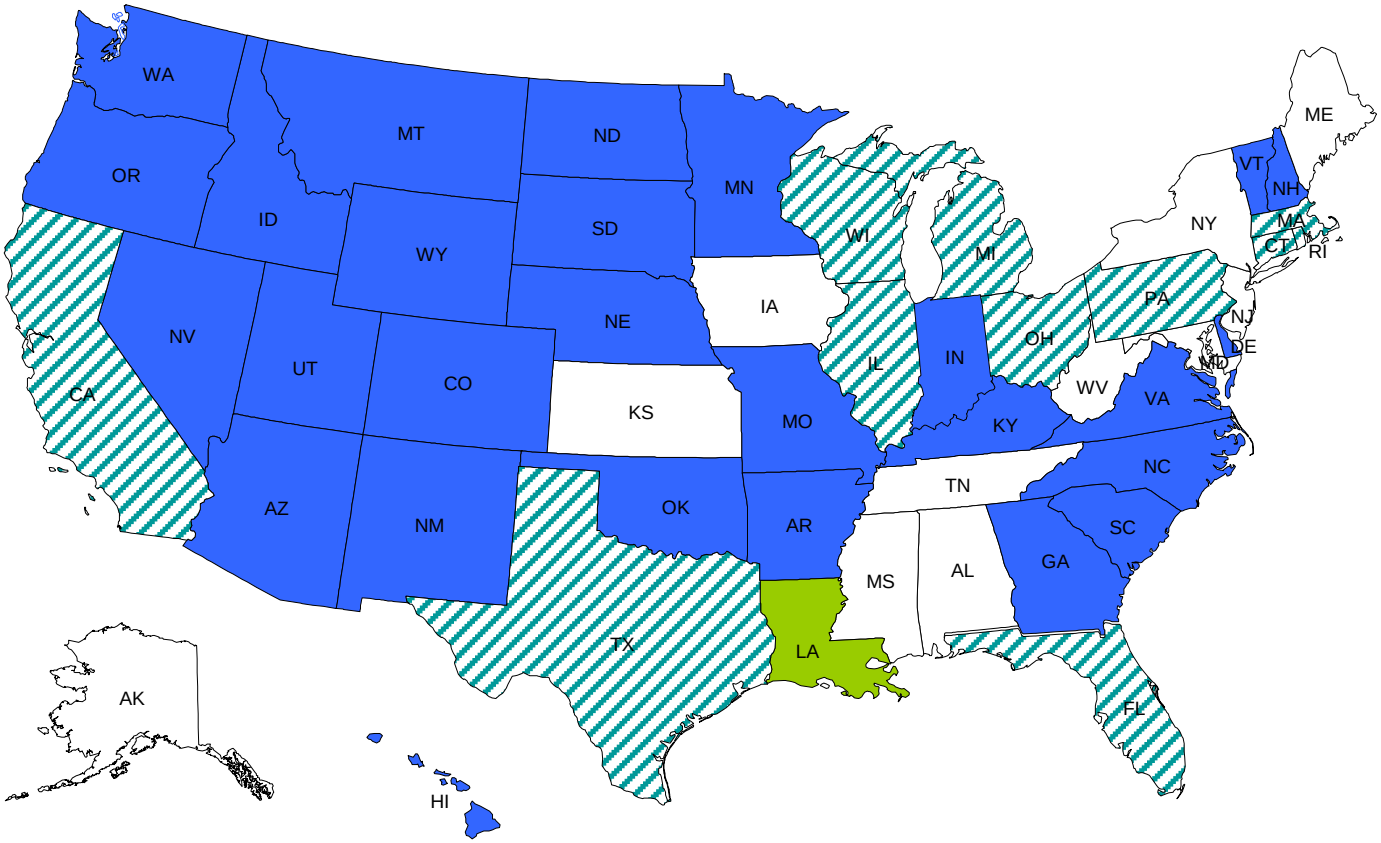
Source: EIA Form 860 2009

Presence or absence of State IRP rules



Source: *A Brief Survey of State Integrated Resource Planning Rules and* Requirements. Synapse Energy Economics, Inc., prepared for the American Clean Skies Foundation. April 2011.

Presence or absence of State IRP rules and procurement plan filing requirements



Source: *A Brief Survey of State Integrated Resource Planning Rules and* Requirements. Synapse Energy Economics, Inc., prepared for the American Clean Skies Foundation. April 2011.

Planning horizons found in IRP rules

Planning Horizon	States with Specified Planning Horizon
10 years	Arkansas, Delaware, Oklahoma, South Dakota, Wyoming
15 years	Arizona, Kentucky, Minnesota, North Carolina, South Carolina, Virginia
20 years	Georgia, Hawaii, Idaho, Indiana, Missouri, Nebraska, Nevada, New Mexico, North Dakota, Oregon, Utah, Vermont, Washington
Multiple periods	Montana
Utility determined	Colorado
Not specified	New Hampshire

Source: *A Brief Survey of State Integrated Resource Planning Rules and* Requirements. Synapse Energy Economics, Inc., prepared for the American Clean Skies Foundation. April 2011.

Frequency of IRP updates, as determined by State rules

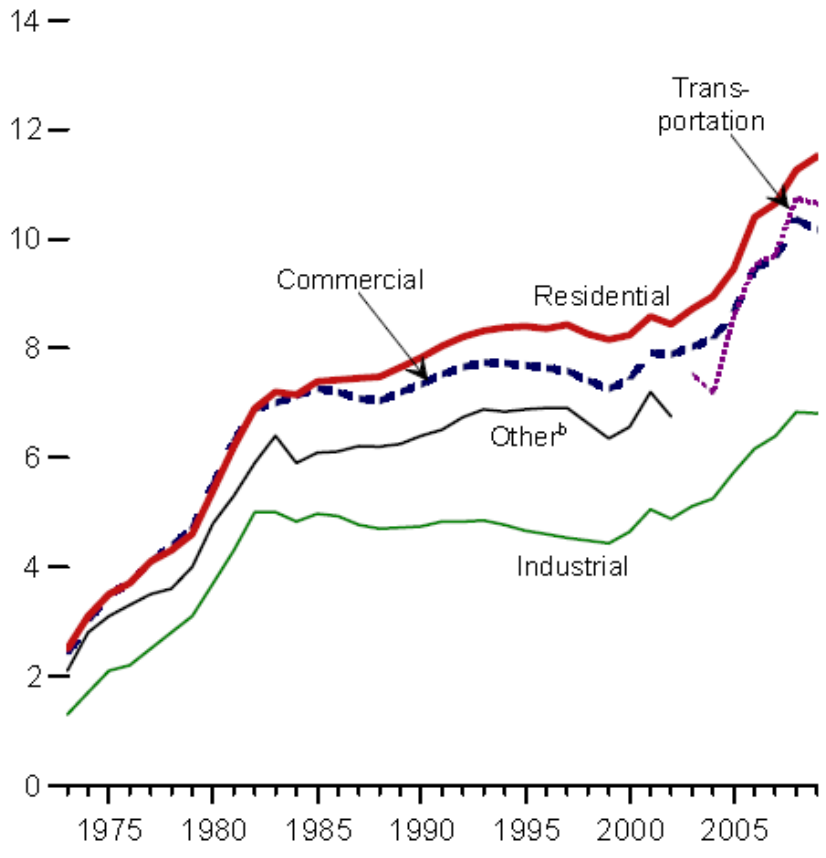
Updates Required	States with Specified Update Requirement
Every 2 years	Arizona, Delaware, Idaho, Indiana, Minnesota, Montana, New Hampshire, North Carolina, North Dakota, Oregon, South Dakota, Utah, Virginia, Washington
Every 3 years	Arkansas, Georgia, Hawaii, Kentucky, Montana, Missouri, Nevada, New Mexico, Oklahoma, South Carolina, Vermont
Every 4 years	Colorado
Every 5 years	Nebraska
Not specified	Wyoming

Source: *A Brief Survey of State Integrated Resource Planning Rules and* Requirements. Synapse Energy Economics, Inc., prepared for the American Clean Skies Foundation. April 2011.

Average Retail Prices of Electricity (left) and Cost of Fossil Fuel Receipts at Electric Generating Plants (right)

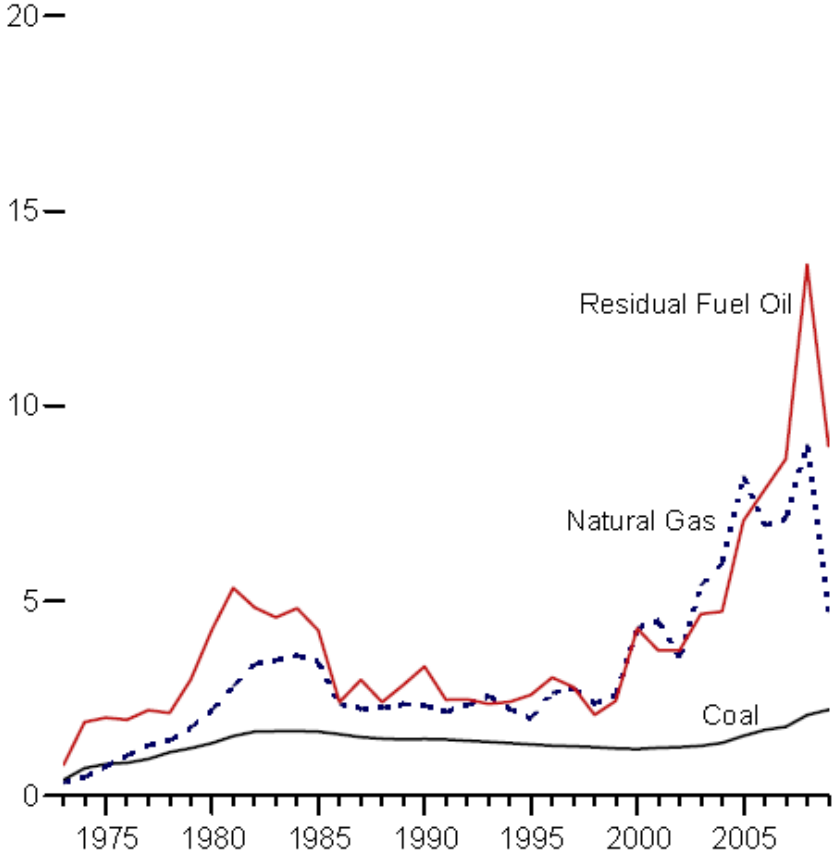
Average Retail Prices of Electricity

(Cents per kilowatthour), by sector, 1973 – 2010



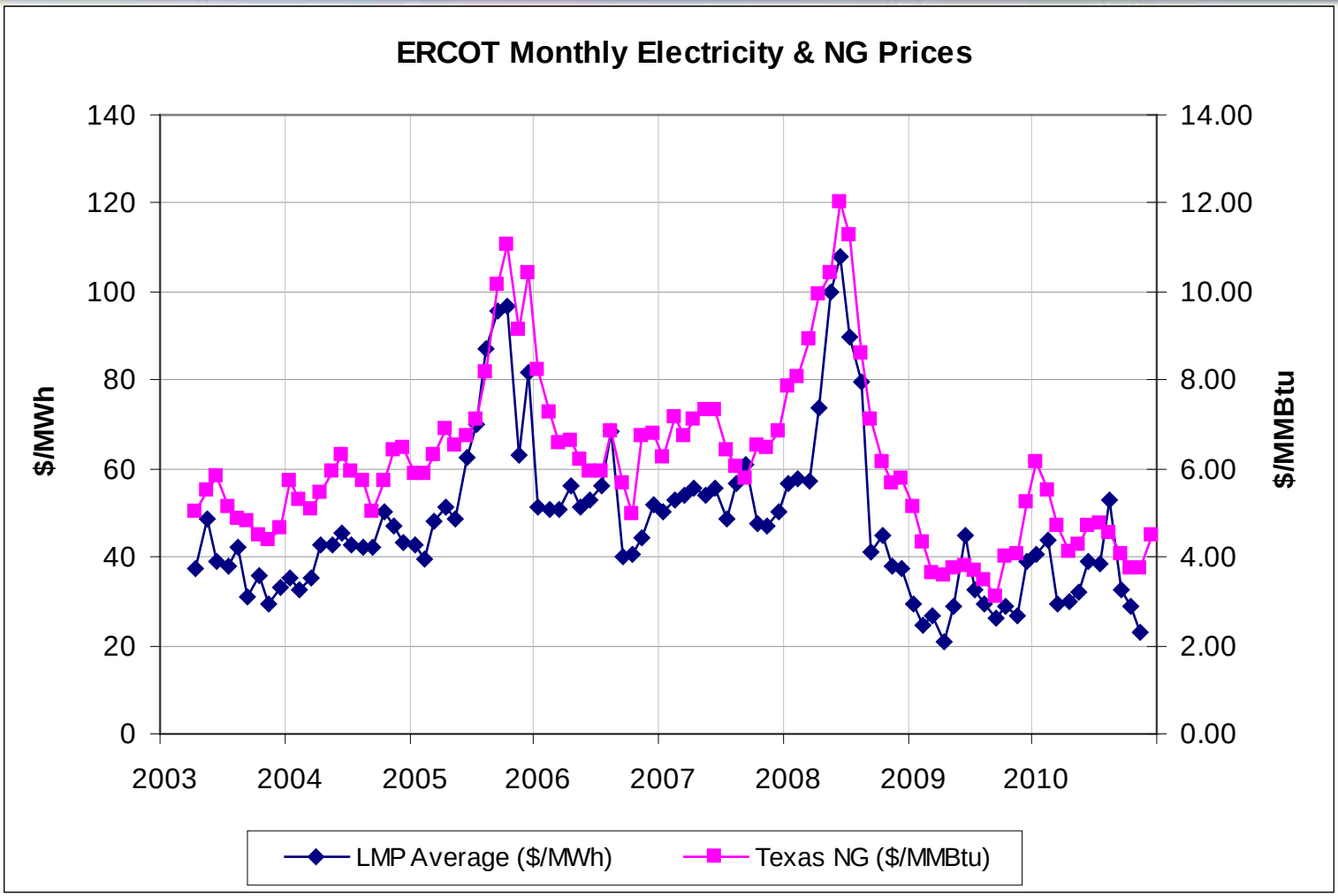
Cost of Fossil Fuel Receipts at Electric Generating Plants

(Dollars per million Btu, including taxes), costs, 1973 – 2010



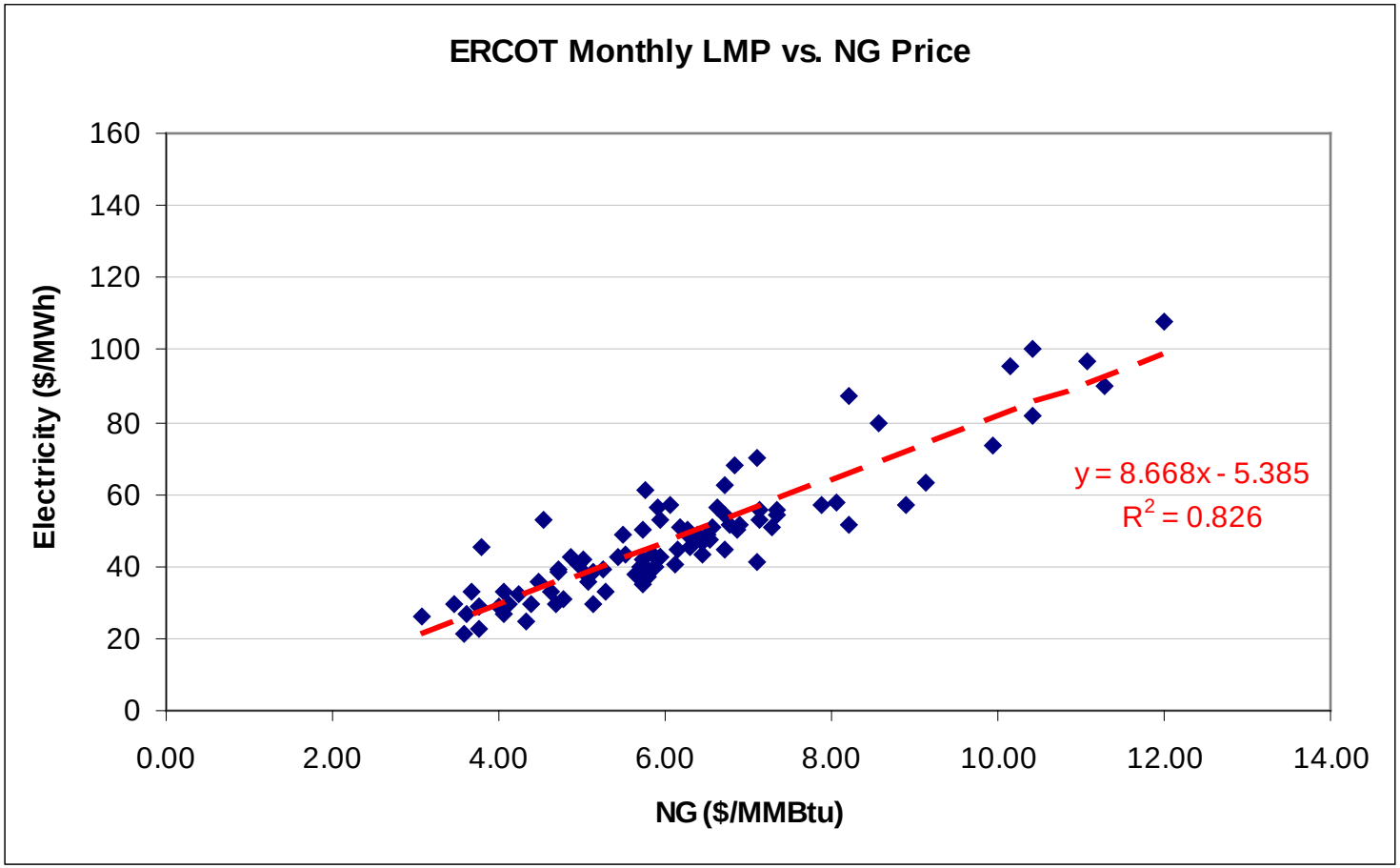
Source: U.S. Energy Information Administration / Monthly Energy Review September 2011

Correlation between natural gas prices and wholesale electricity prices



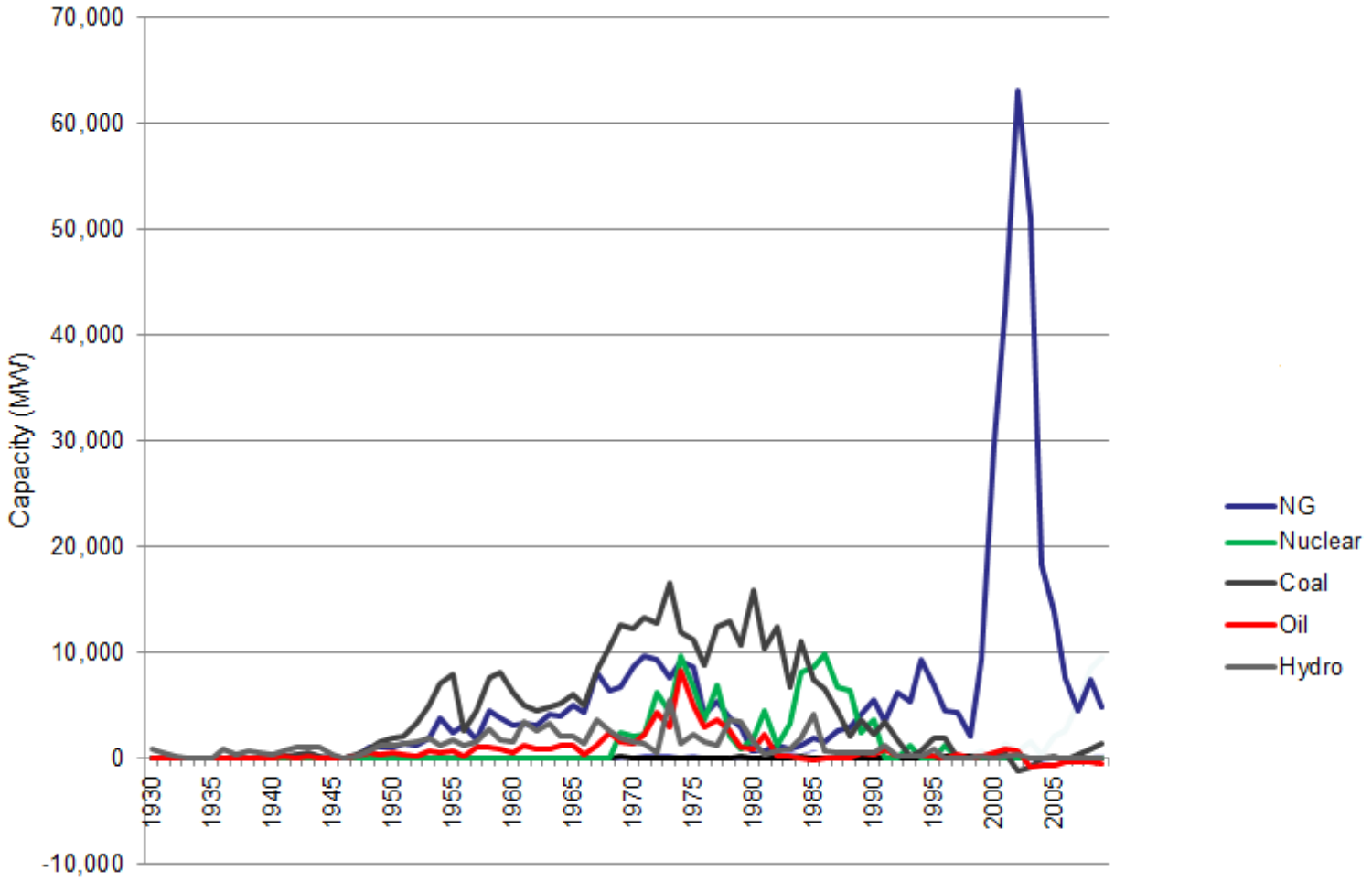
Source: ERCOT Hourly Load Data Archive, ERCOT Balancing Energy Services Market Clearing Prices Archive, EIA-423 Electric Power Monthly.

ERCOT monthly LMP vs. natural gas prices



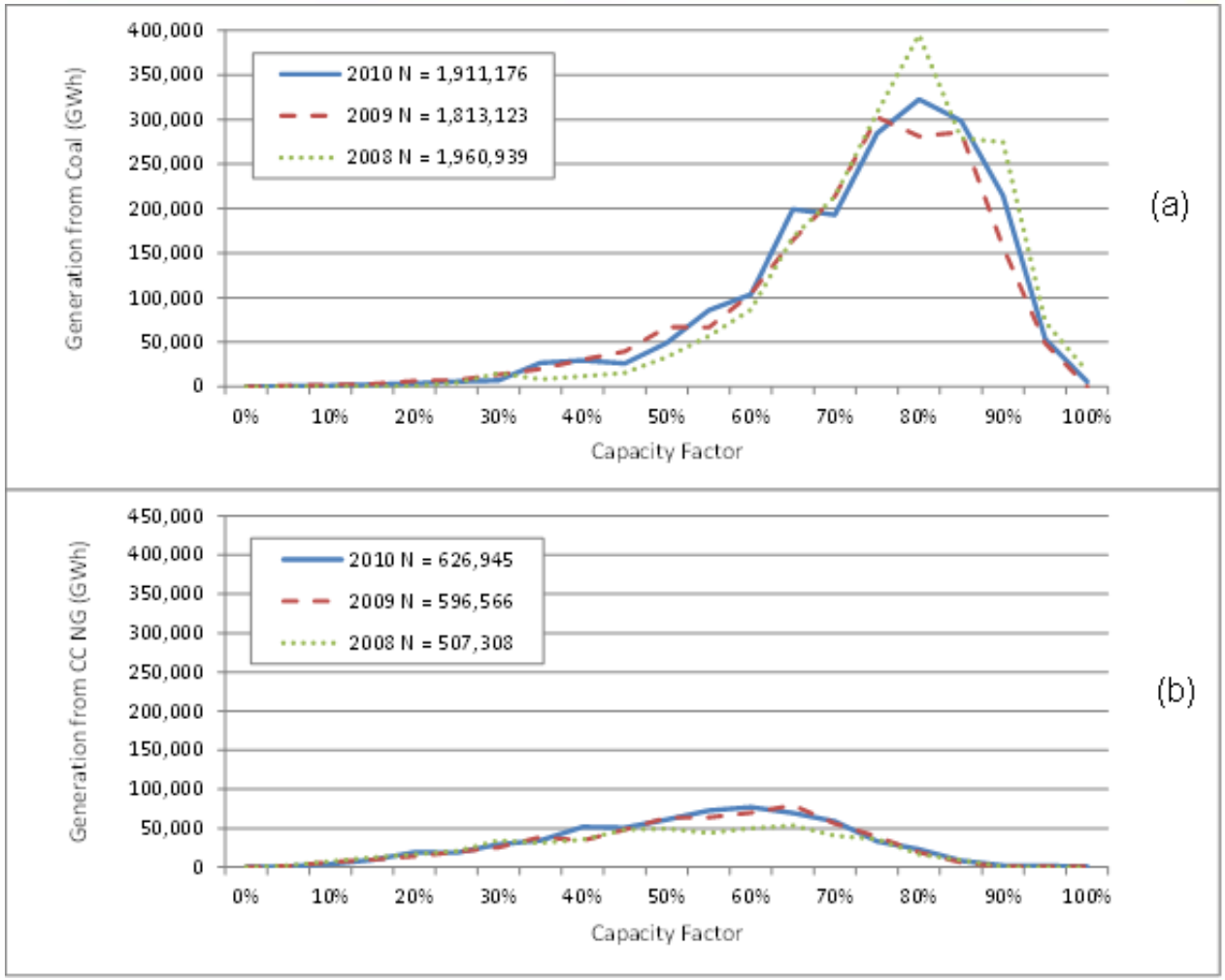
Source: ERCOT

Net capacity installed and retired in the U.S., by resource



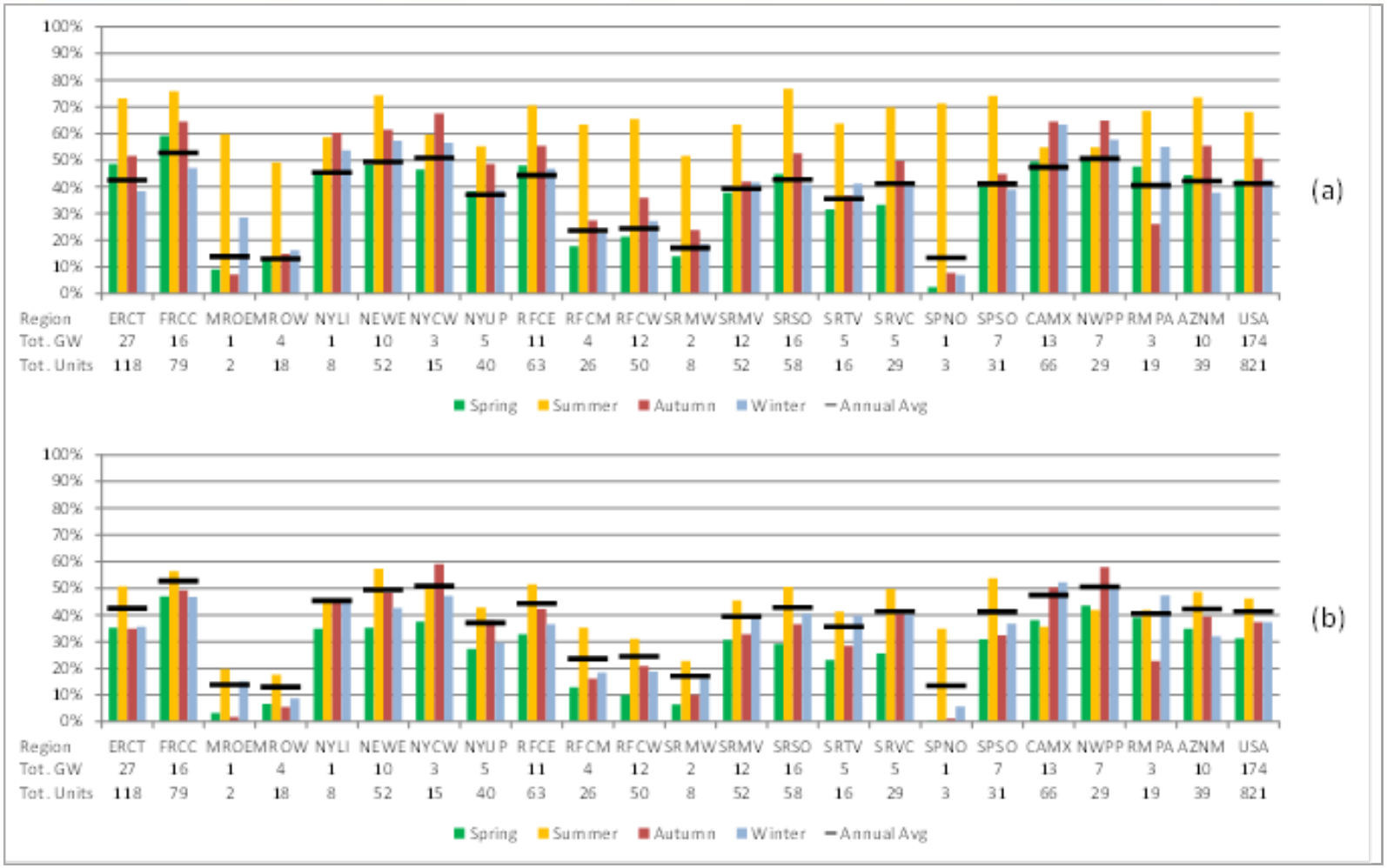
Source: *Memorandum: Using Existing Natural Gas Capacity to Displace Coal Generation, 2011 Update*. Synapse Energy Economics. Prepared for the Energy Foundation. August 2011. Page 3.

Coal (a) and CCNG (b) generation by capacity factor – 2008, 2009, and 2010



Source: *Memorandum: Using Existing Natural Gas Capacity to Displace Coal Generation, 2011 Update*. Synapse Energy Economics. Prepared for the Energy Foundation. August 2011. Page 7.

Capacity factors for CCNG units by season and region for (a) on-peak and (b) off-peak hours

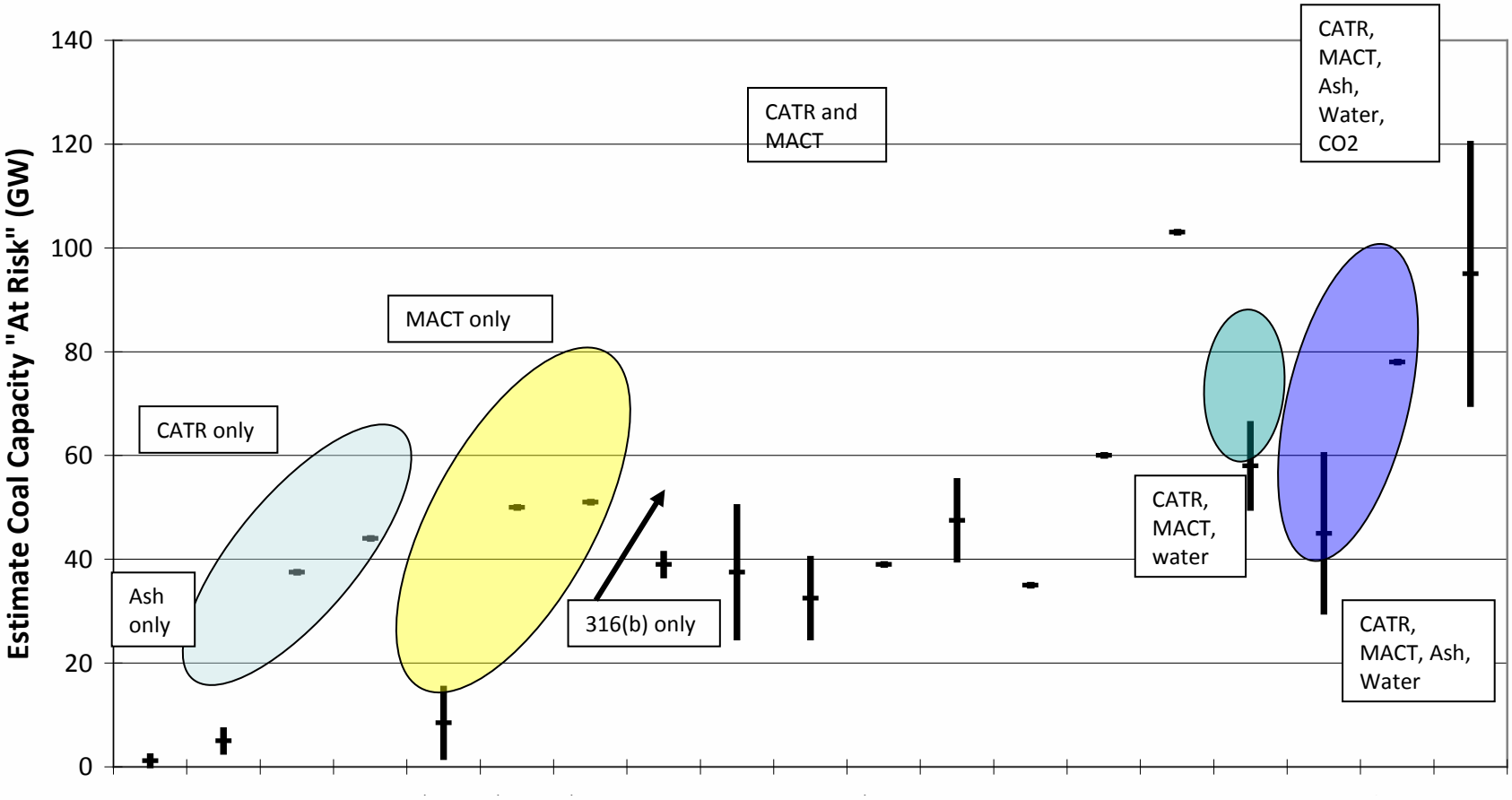


Source: *Memorandum: Using Existing Natural Gas Capacity to Displace Coal Generation, 2011 Update*. Synapse Energy Economics. Prepared for the Energy Foundation. August 2011. Page 9.

Upcoming EPA rules

Source: *Economics of Existing Coal Generation and Opportunities for Clean Electricity.* Prepared by Synapse Energy Economics for the Energy Foundation. May 2011. Slide 9.

Projected coal capacity "at risk" under various regulatory policies

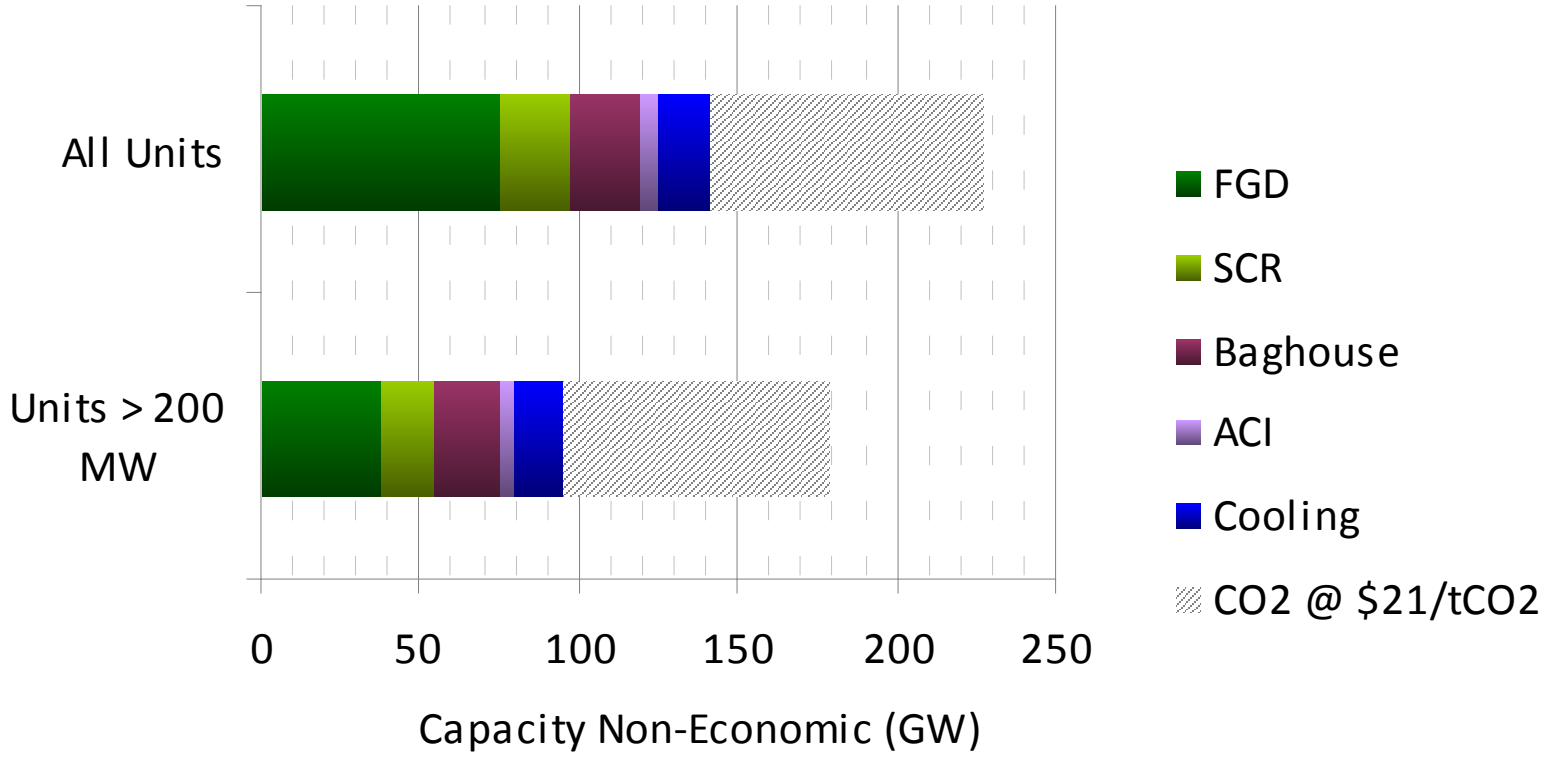


Source: *Economics of Existing Coal Generation and Opportunities for Clean Electricity.* Prepared by Synapse Energy Economics for the Energy Foundation. May 2011. Slide 10.

Observations Based on Coal-at-Risk Studies

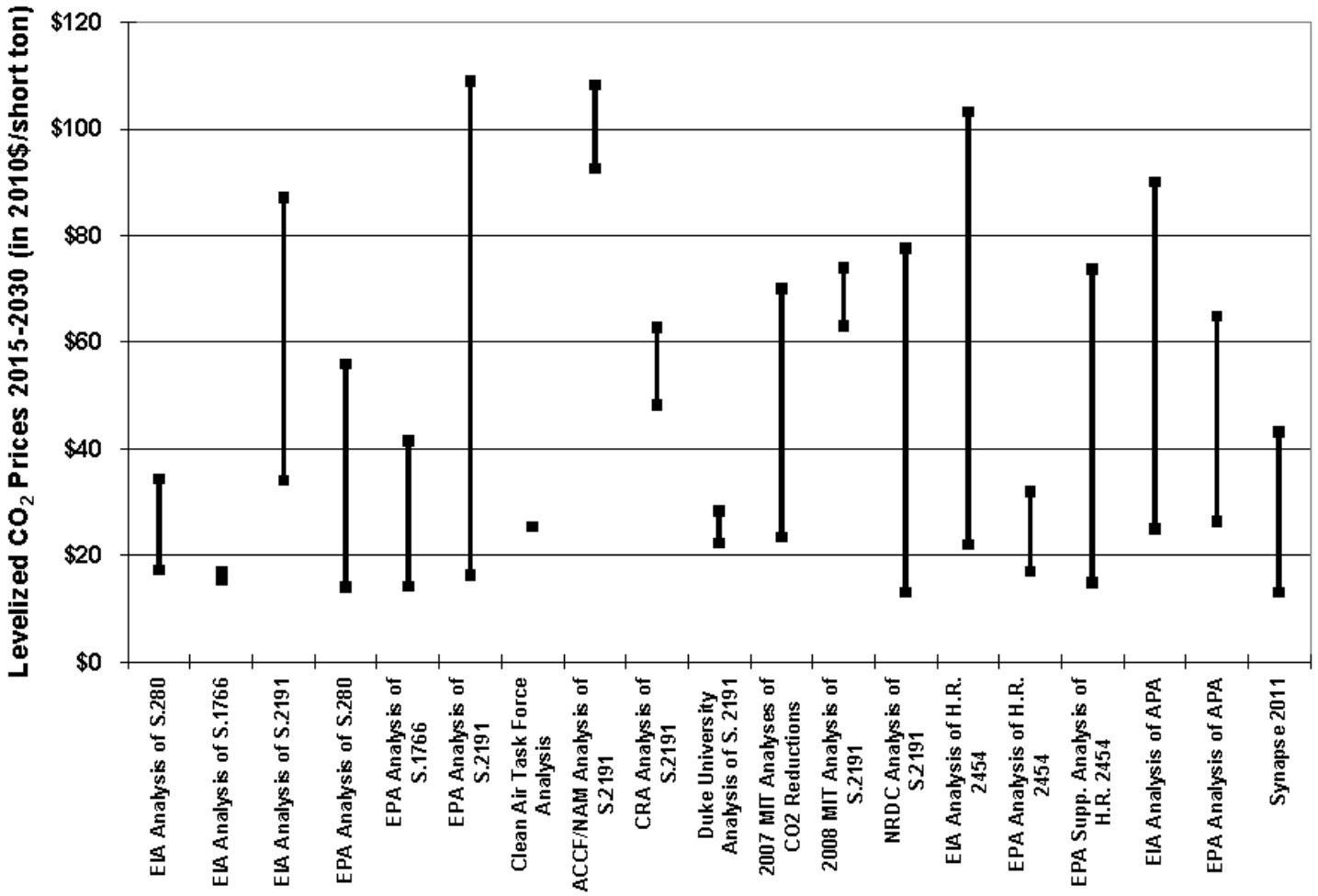
- Comprehensive regulation results in more coal at risk
- Natural gas prices—within the bandwidth modeled—do not explain differences in study results regarding plants at risk
- Regulatory details (e.g., flexibility) have a big impact on plants at risk
- Only one analysis included CO_2 cost, a significant omission!

U.S. coal units affected by environmental regulations (non-economic with respect to existing natural gas)



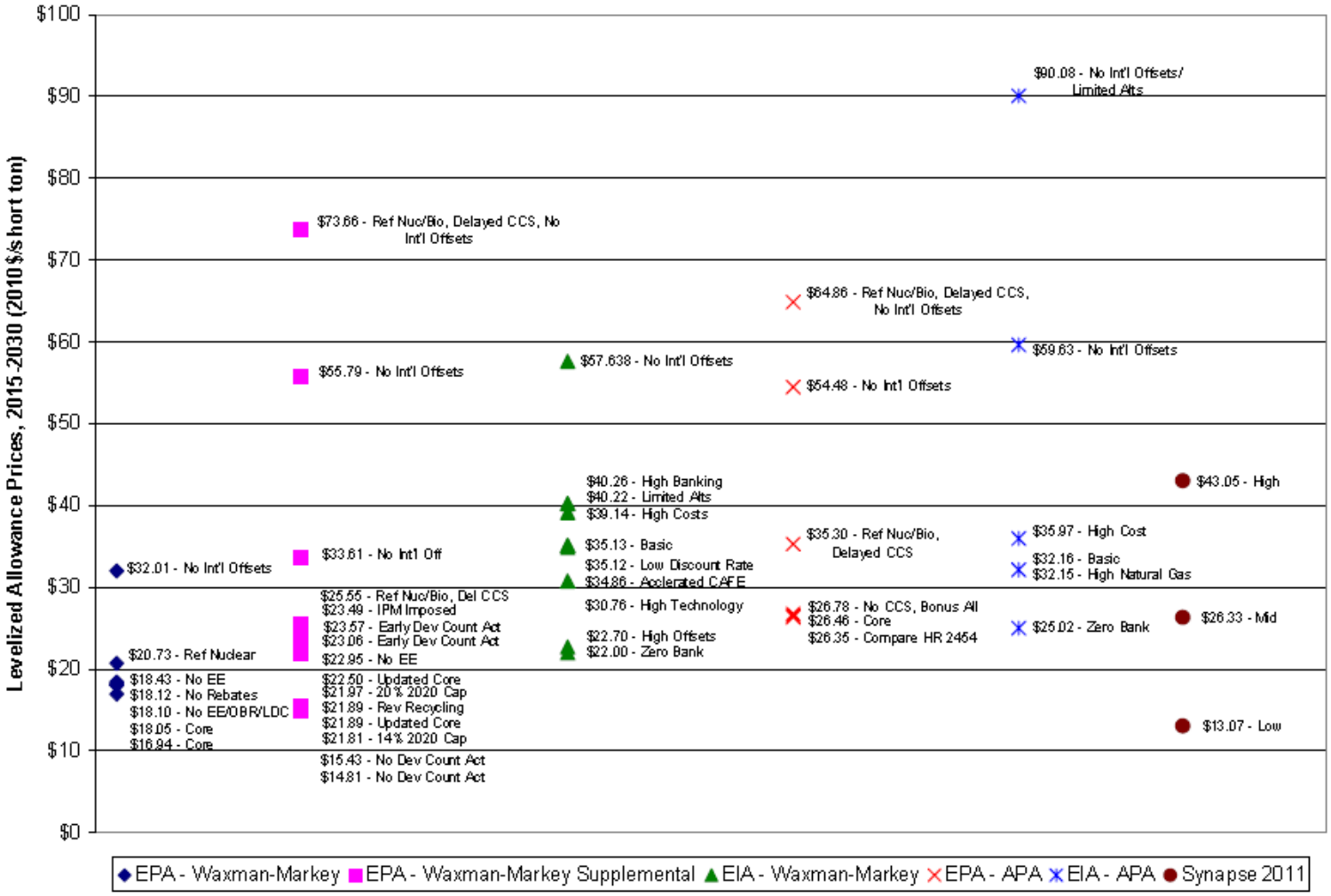
Source: *Economics of Existing Coal Generation and Opportunities for Clean Electricity.* Prepared by Synapse Energy Economics for the Energy Foundation. May 2011. Slide 14.

GHG allowance price projections based on analyses of federal legislative proposals – levelized



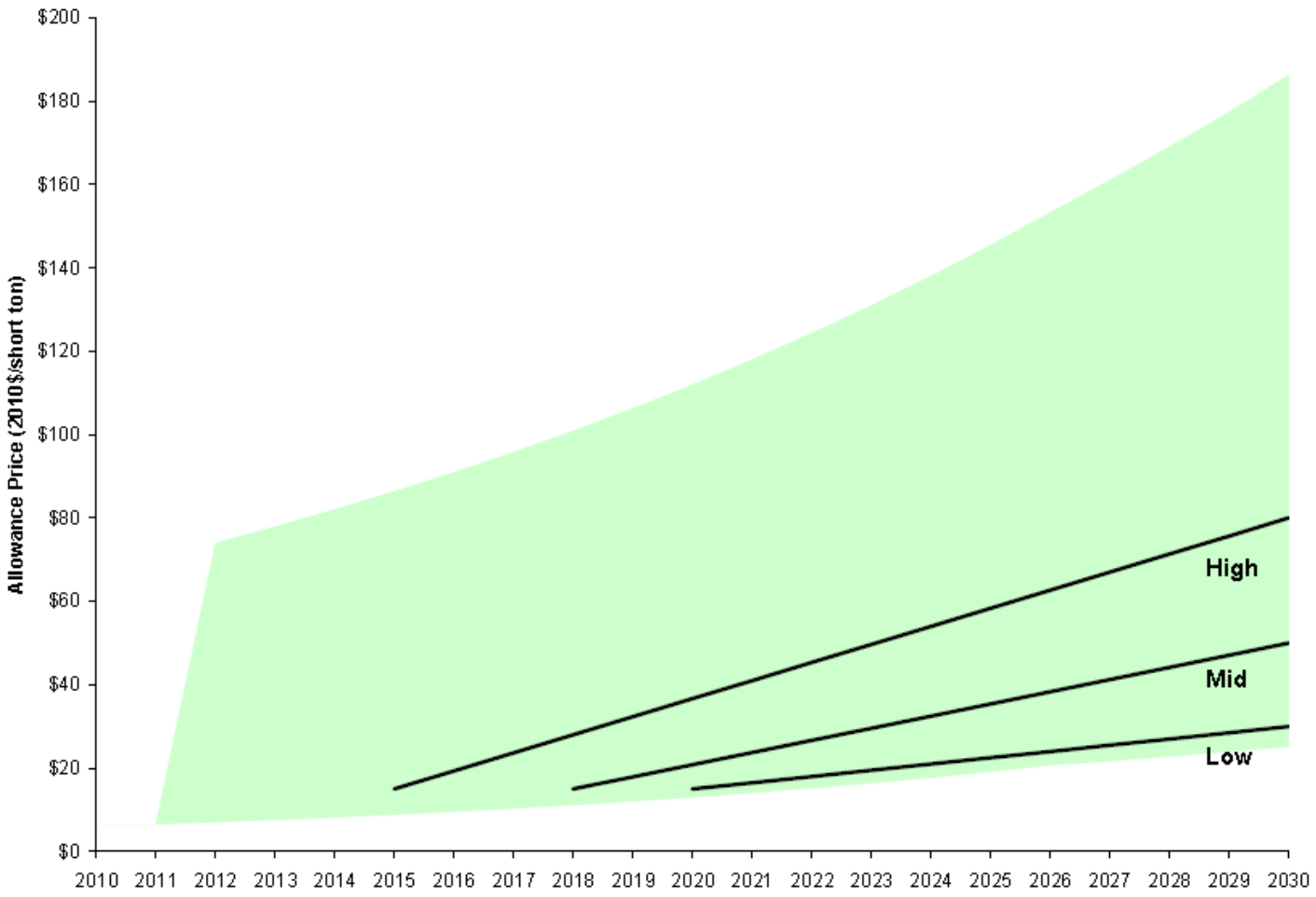
Source: *2011 Carbon Dioxide Price Forecast.* Synapse Energy Economics. February 2011. Page 9.

Synapse CO2 trajectories and GHG allowance price projections for HR 2454 and APA 2010 – levelized 2015 - 2030



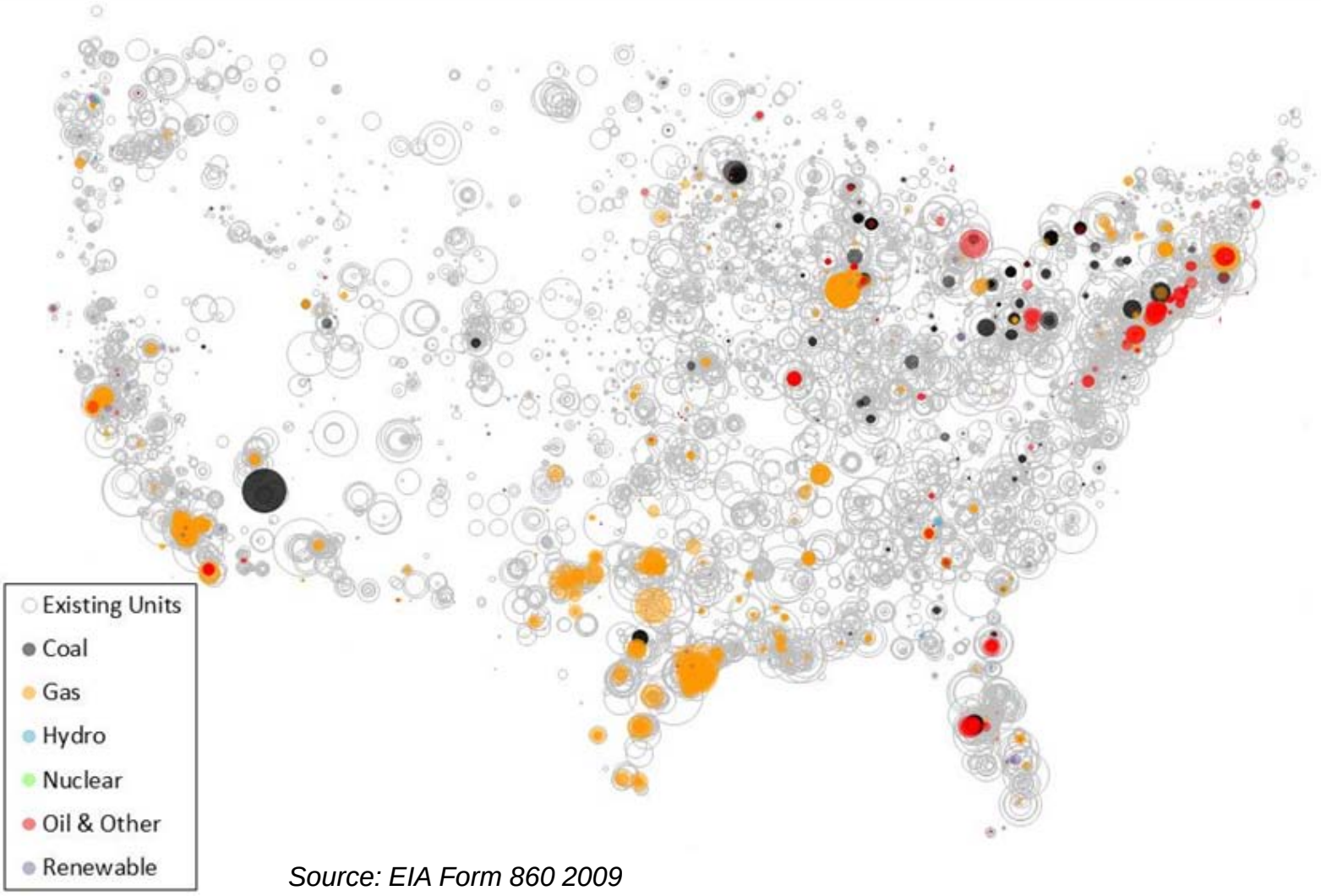
Source: *2011 Carbon Dioxide Price Forecast.* Synapse Energy Economics. February 2011. Page 21.

Synapse 2011 carbon price forecast



Source: *2011 Carbon Dioxide Price Forecast.* Synapse Energy Economics. February 2011. Page 1.

Retired electrical generating units as of 2009 (Incomplete)

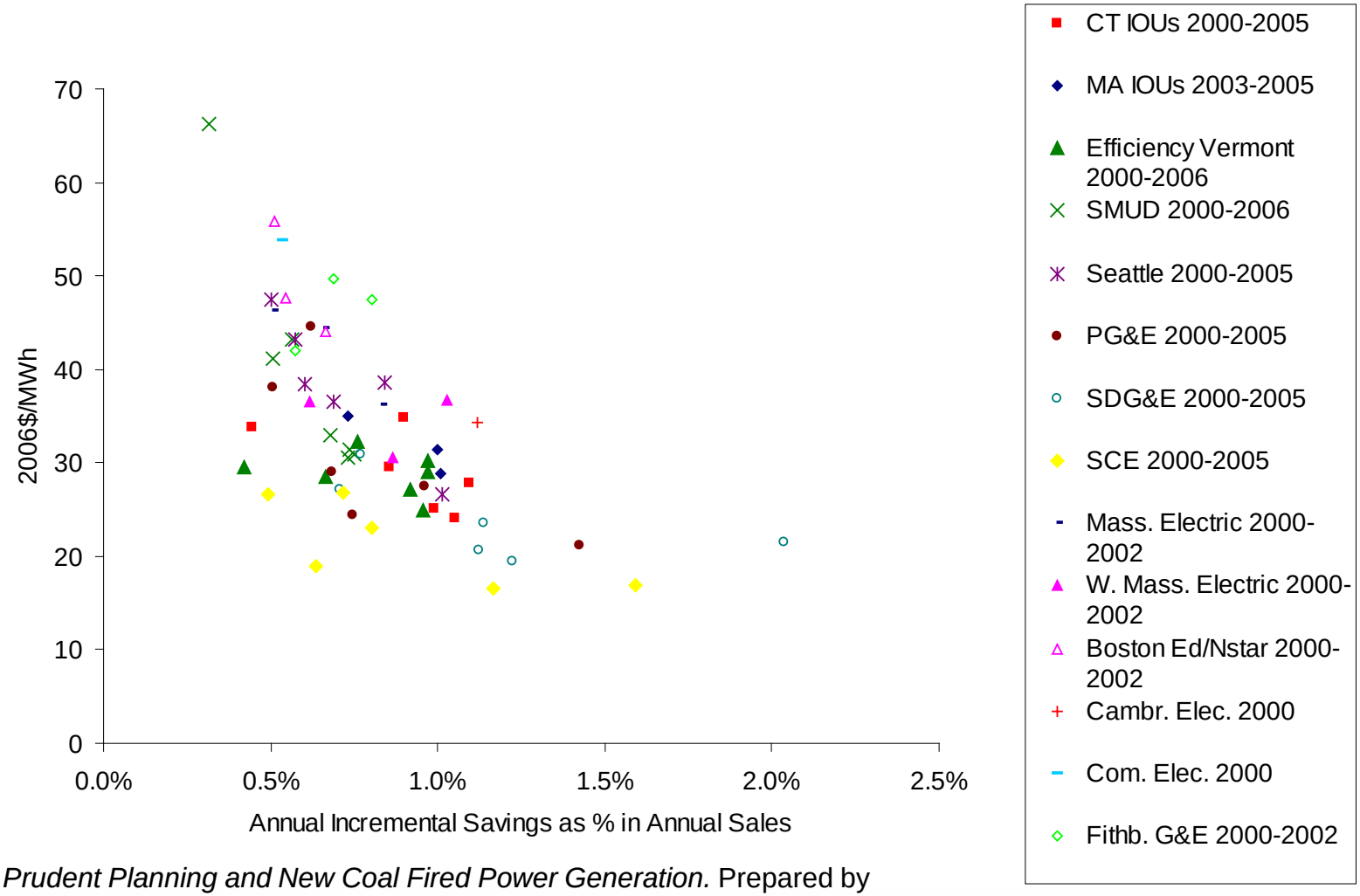


Source: EIA Form 860 2009

Existing electrical generating capacity by fuel type

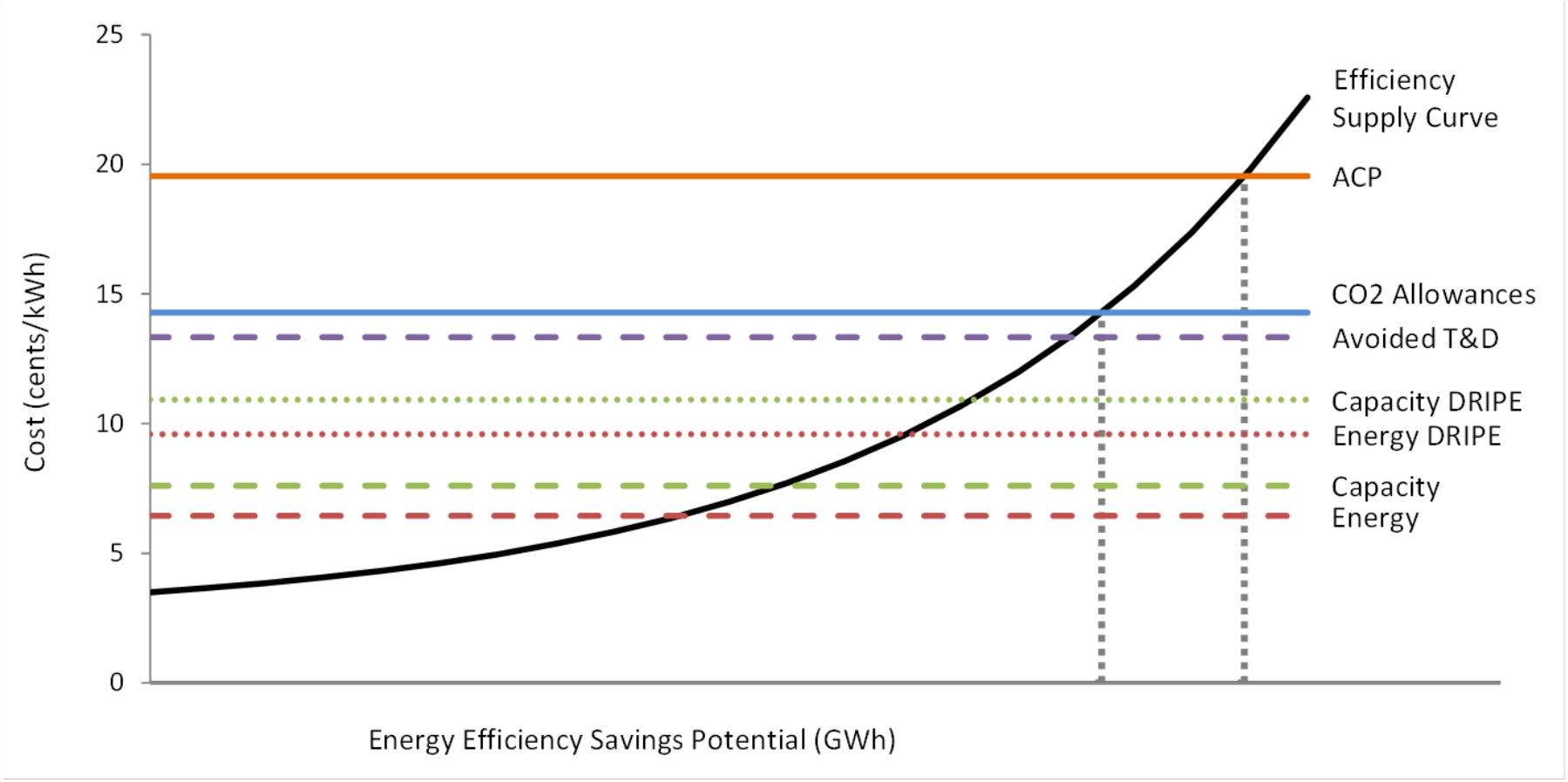
Source: EIA Form 860 2009

Electric utility energy efficiency costs



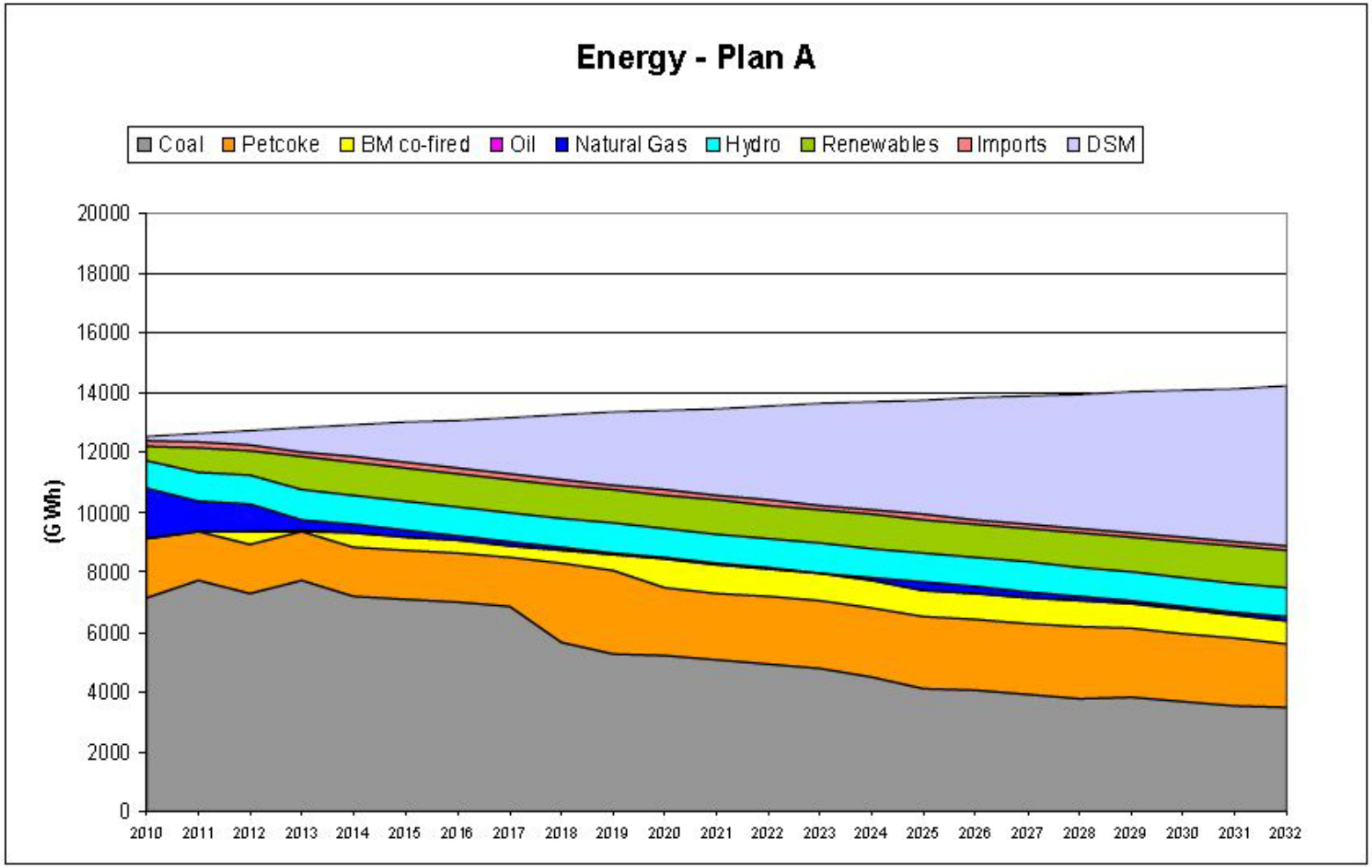
Source: *Prudent Planning and New Coal Fired Power Generation.* Prepared by Synapse Energy Economics for CERES Conference 2008. April 2008. Slide 7.

Massachusetts avoided costs – with ACP



Source: Woolf, Tim. *Energy Efficiency Cost Effectiveness: Updating the Standard in MA in Light of the GWSA*. September 9, 2011. Slide 8.

Nova Scotia Power IRP



Source: Nova Scotia Power, Inc. *2009 Integrated Resource Plan Update Report*. Presented to the Nova Scotia Utility and Review Board. November 2009. Page 24.

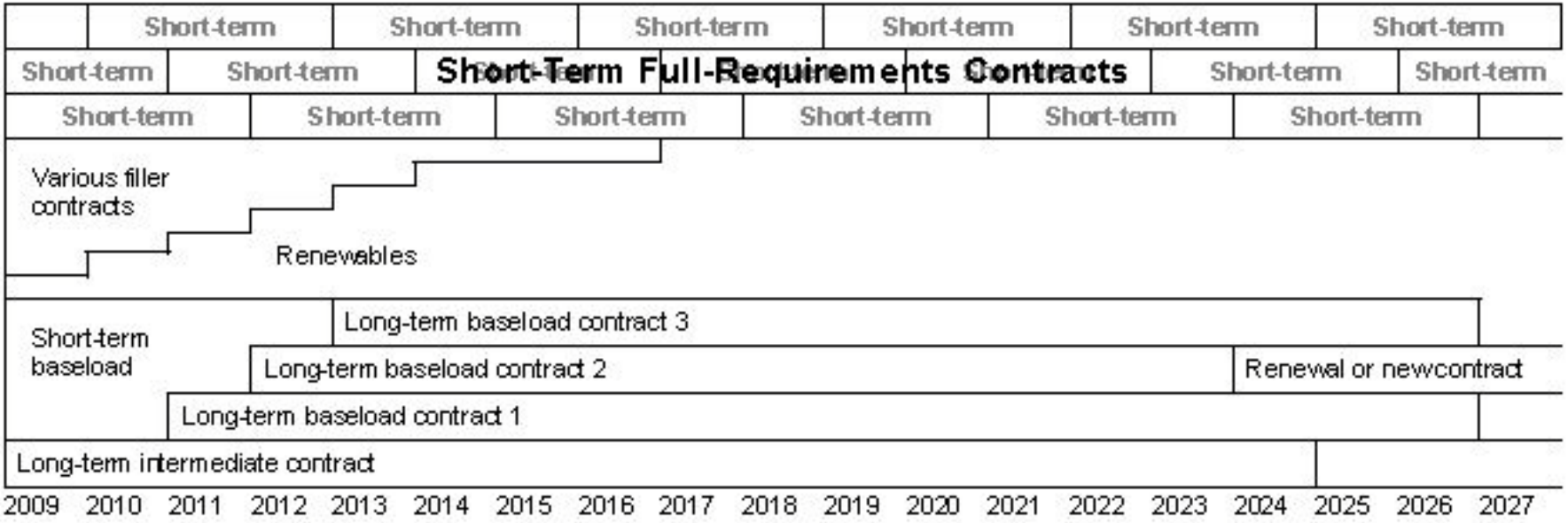
ISO role in planning

The ISOs could seek to identify the least-cost alternative to relieve transmission constraints, which may be some combination of the following:

- Transmission additions
- Targeted additions of supply-side generation
- Additions of distributed generation on the customer side of the meter
- Energy-efficiency investments
- Load management and demand response
- Generation re-dispatch

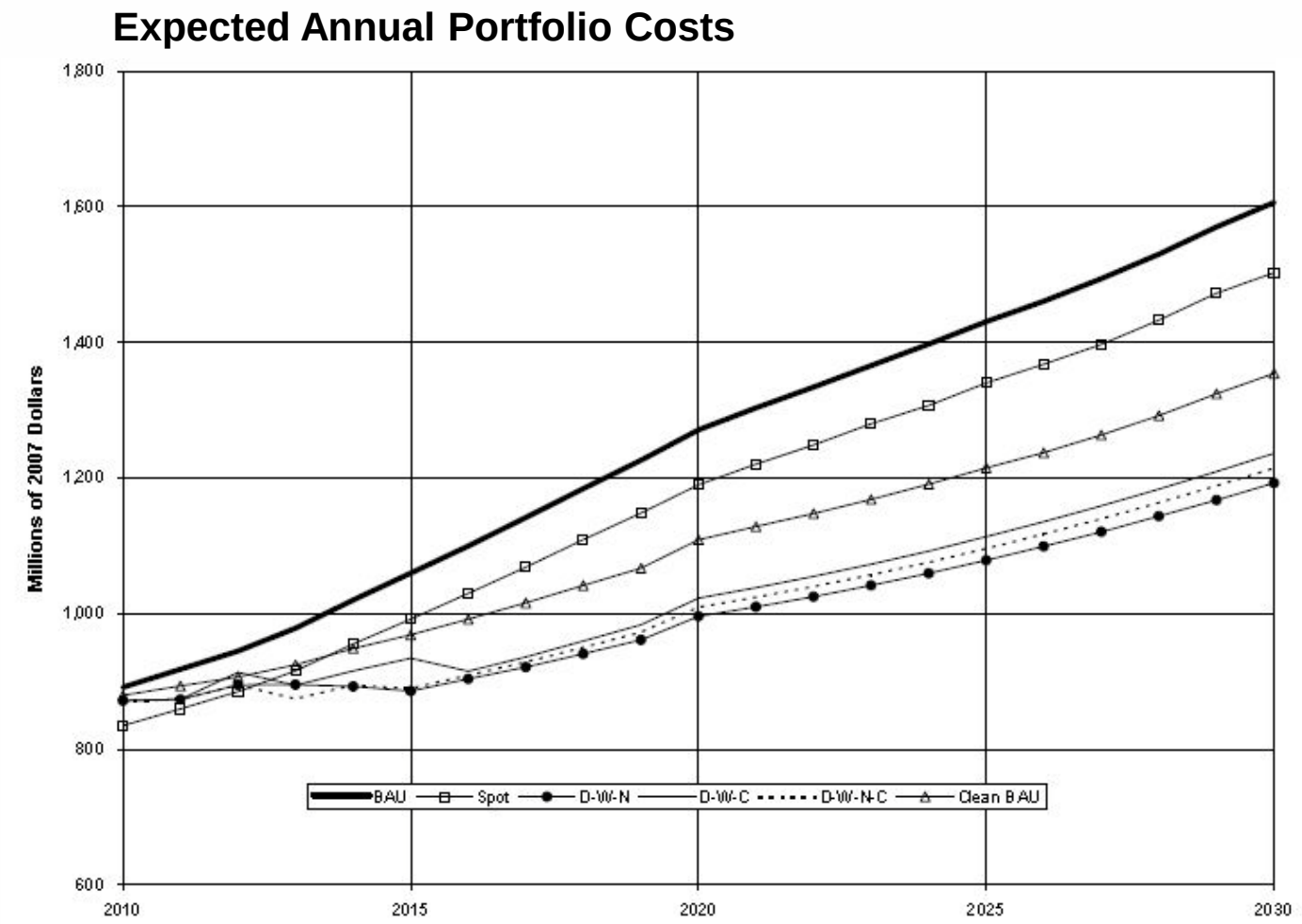
The ISO should be willing to support alternatives financially, to the extent that alternatives avoid the embedded costs of transmission additions or the congestion costs of generation re-dispatch.

Integrated portfolio management in a restructured supply market



Source: *Integrated Portfolio Management in a Restructured Supply Market*. Resource Insight, Inc., and Synapse Energy Economics, Inc., prepared for Ohio Consumers' Counsel. June 2006. Page 31.

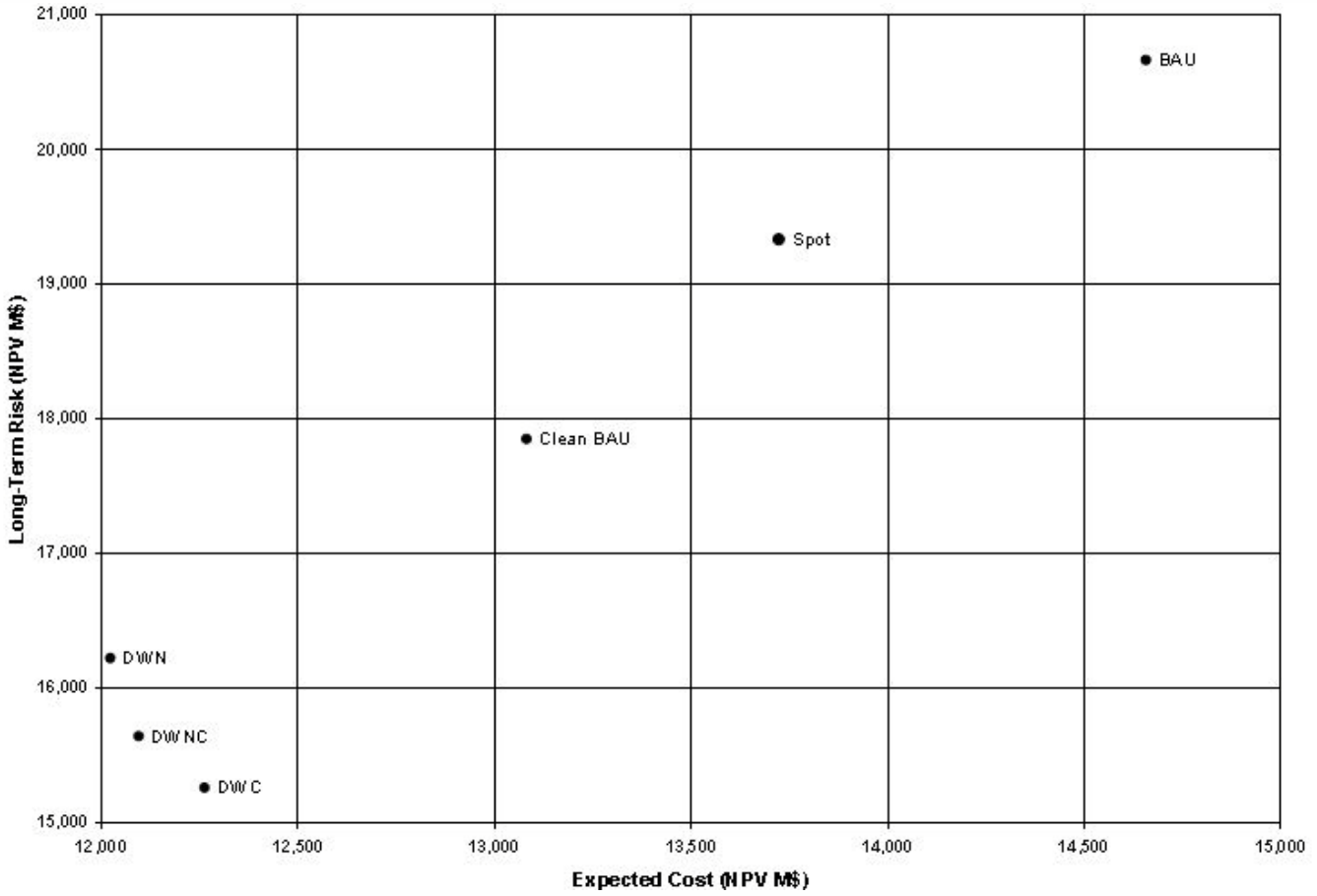
Risk analysis for residential standard offer procurement strategies



Source: *Risk Analysis of Procurement Strategies for Residential Standard Offer Service*. Resource Insight, Inc. and Synapse Energy Economics, Inc. Prepared for the Maryland Office of People's Counsel. March 2008. Page 4.

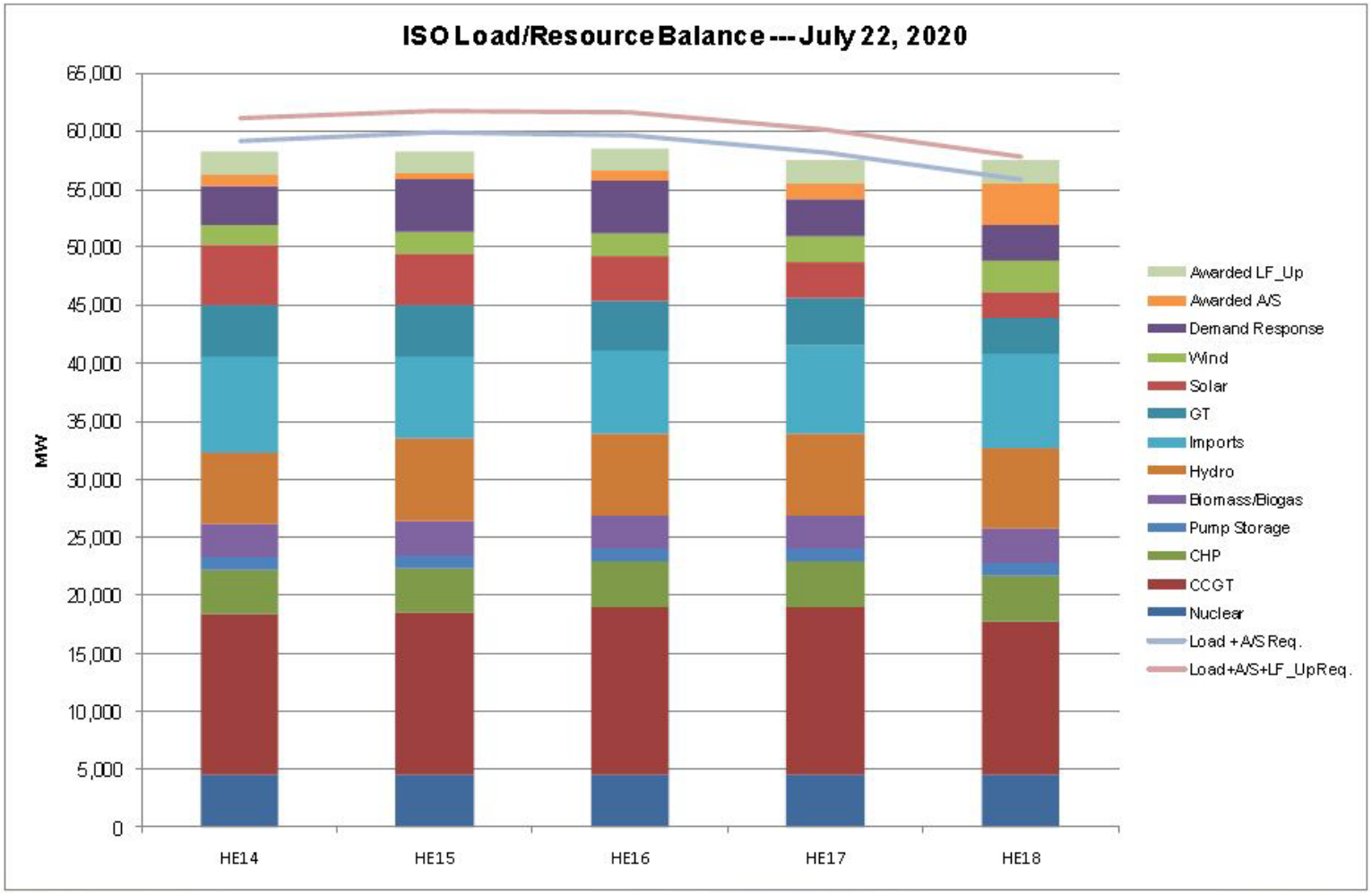
Risk analysis for residential standard offer procurement strategies

Long-Term Cost vs. Risk by Portfolio



Source: *Risk Analysis of Procurement Strategies for Residential Standard Offer Service*. Resource Insight, Inc. and Synapse Energy Economics, Inc. Prepared for the Maryland Office of People's Counsel. March 2008. Page 4.

Loads/resources balance for July 22, 2020 High Load Scenario: California ISO



Source: Rothleder, Mark. *Renewable Integration Study Next Steps*. California ISO Working Group Meeting. October 7, 2011. Slide 25.

Prudence

1. Imprudence can occur in procurement, construction, management, and planning
2. Proving imprudence is difficult. Retrospective analyses can be involved
3. Prudence standards should include not just decision making with what information a planner had at the time, but also that the planners ACTIVELY SEEK OUT RELEVANT INFORMATION
4. Other key planning requirements:
   a) Should rely on up-to-date and realistic construction cost estimates
   b) Should include reasonable expectations of environmental regulations, including CO2 price forecast in the reference case, and analyze high and low sensitivities
   c) Should include full consideration of alternatives

Prudence - Ratemaking

1. Costs that are deemed to be imprudently incurred should not be recovered from customers in rates
2. Exclude cost recovery for damages incurred as a result of imprudence
3. Not that damages could be much greater than the expected losses estimated in the retrospective analyses
4. Utility regulators and PUC review can play a role in prudence determinations. Pre-approval and implications

Used and Useful

- A utility asset can be PHYSICALLY not "used and useful" in providing utility service
  - Examples: retired power plant, disconnected T&D equipment, uninstalled meters
- A utility asset (or power contract) can be ECONOMICALLY not "used and useful." Or, "used but not useful."
  - Examples: $5 billion nuclear plant, excess generating capacity, over-market purchased power contract, stranded costs

Used and Useful - Ratemaking

1. Assets that are not physically used and useful should be removed from ratebase (excluded entirely from cost recovery)
2. Assets that are not economically used and useful should be treated with phase-in and/or cost sharing. The logic is that shareholders earn a “risk premium” in their allowed ROE, and that “reward” is to compensate them for risk. Monopoly regulation as a proxy for market forces (see James Bonbright’s “Principles of Public Utility Rates.”)
3. Phase-in over time (with a return) has been applied to excess generating capacity
4. Recovery “of but not on” can produce a roughly 50/50 disallowance

Poor electric system planning practice

- Passive attitude toward information
- Rely on out-of-date construction cost estimates or energy price forecasts
- Ignore environmental regulations, or treat them “at the end” as a sensitivity case
- Overly constrain alternatives such as renewables and energy efficiency

IMPRUDENT!

Good electric system planning practice

- Actively seek out relevant information
- Rely on up-to-date and realistic construction cost estimates and energy price forecasts
- Include reasonably expected environmental compliance in the reference case, and analyze high and low sensitivities
- Include full consideration of alternatives

PRUDENT

Referenced Materials

- Biewald, Bruce. *Economics of Existing Coal Generation and Opportunities for Clean Electricity.* Prepared by Synapse Energy Economics for the Energy Foundation. May 2011.
- Biewald, Bruce. *Prudent Planning and New Coal Fired Power Generation.* Prepared by Synapse Energy Economics for CERES Conference 2008. April 2008.
- Biewald, Bruce, Jeremy Fisher, Ezra Hausman, and Patrick Knight. *Memorandum: Using Existing Natural Gas Capacity to Displace Coal Generation, 2011 Update*. Prepared for the Energy Foundation. August 2011.
- Biewald, Bruce, Ezra Hausman, Lucy Johnston, David White, and Rachel Wilson. *2011 Carbon Dioxide Price Forecast. Synapse Energy Economics*. February 2011.
- Chernick, Paul, Anna Sommer, William Steinhurst, Kenji Takahashi, Jonathan Wallach, and Tim Woolf. *Integrated Portfolio Management in a Restructured Supply Market*. Resource Insight, Inc., and Synapse Energy Economics, Inc., prepared for Ohio Consumers' Counsel. June 2006.
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- Nova Scotia Power, Inc. *2009 Integrated Resource Plan Update Report*. Presented to the Nova Scotia Utility and Review Board. November 2009.
- Peterson, Paul, and Rachel Wilson. *A Brief Survey of State Integrated Resource Planning Rules and* Requirements. Synapse Energy Economics, Inc., prepared for the American Clean Skies Foundation. April 2011.
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