Addressing Specific IRP Issues

EUCI Conference – IRP Intervenors' Perspectives

January 28, 2013 – Scottsdale, AZ

Bruce Biewald – CEO, Synapse Energy Economics

A Good Electric System IRP Should Include:

- Load forecast
- Reserves and reliability
- Demand Side Management
- Supply options
- Avoided costs
- Fuel prices
- Environmental costs and constraints
- Existing resources
- Fresh information
- Integrated analysis
- Time frame
- Uncertainty
- Metrics
- Valuing and selecting plans
- Cost recovery issues
- Action plan
- Documentation

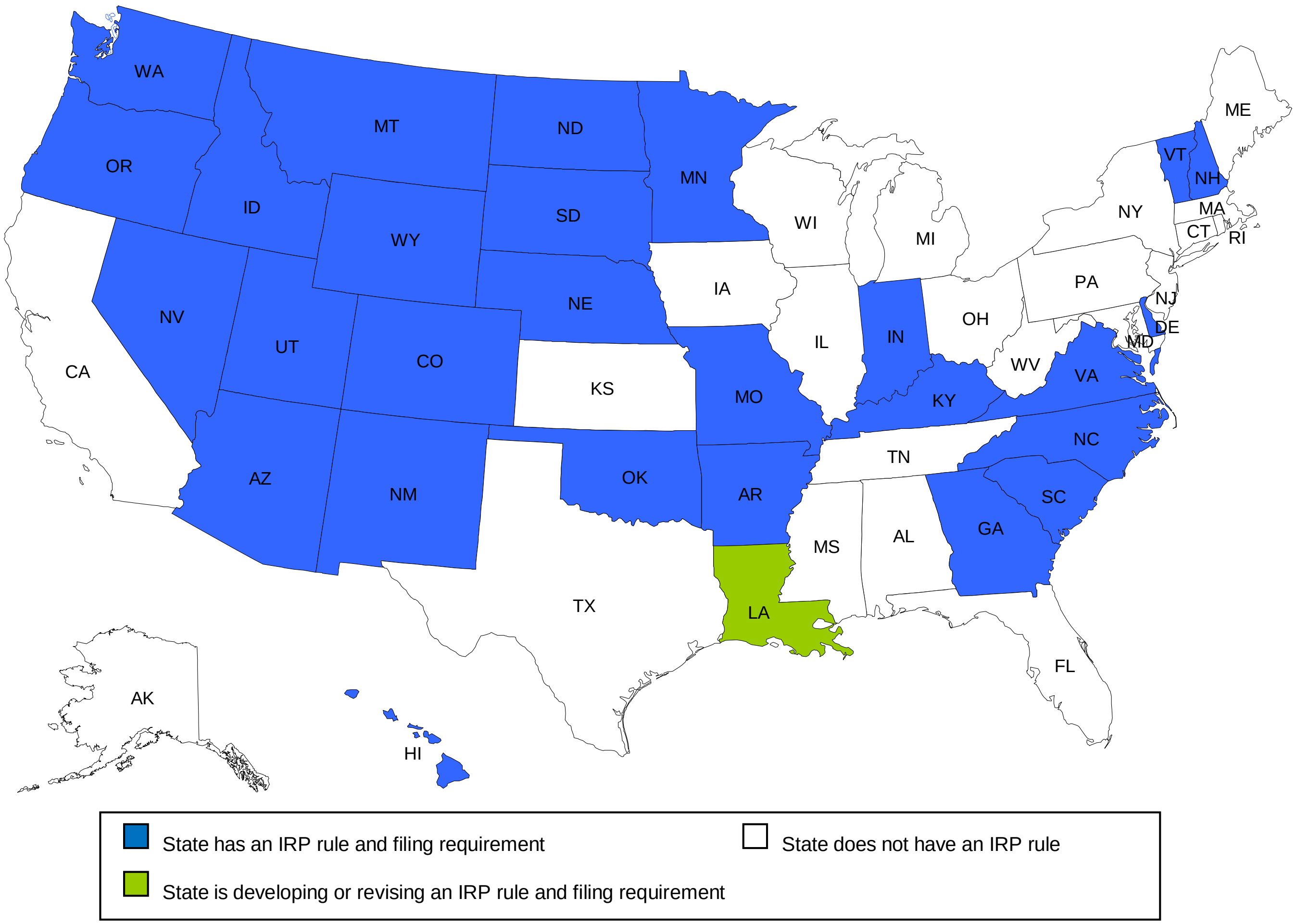
What is an IRP for?

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

Possible Commission activities on IRP

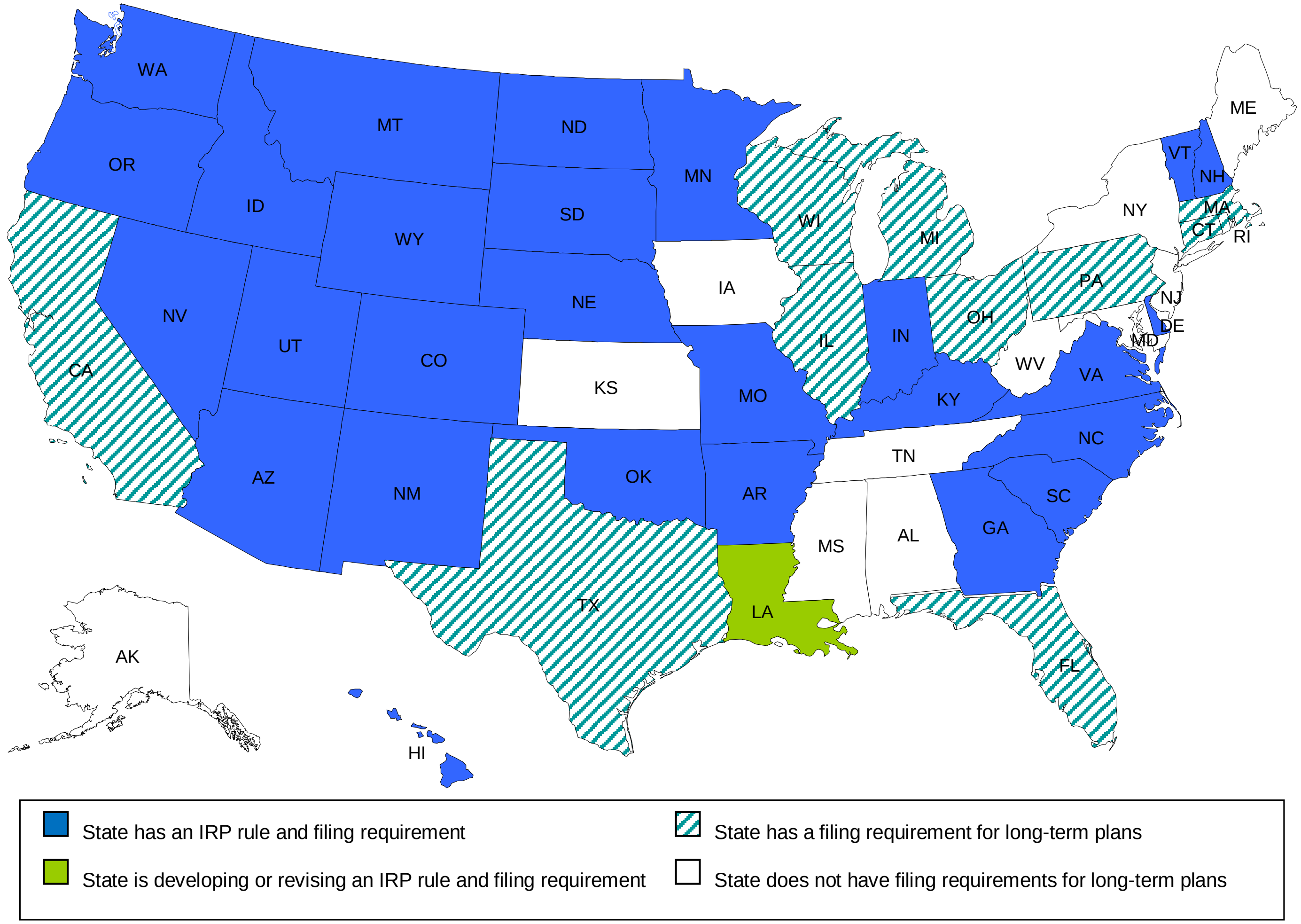
- Reject
- Ignore
- Acknowledge
- Accept
- Approve
- Approve specific resource decisions
- Other?

Presence or absence of State IRP rules



Source: Peterson & Wilson 2011

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



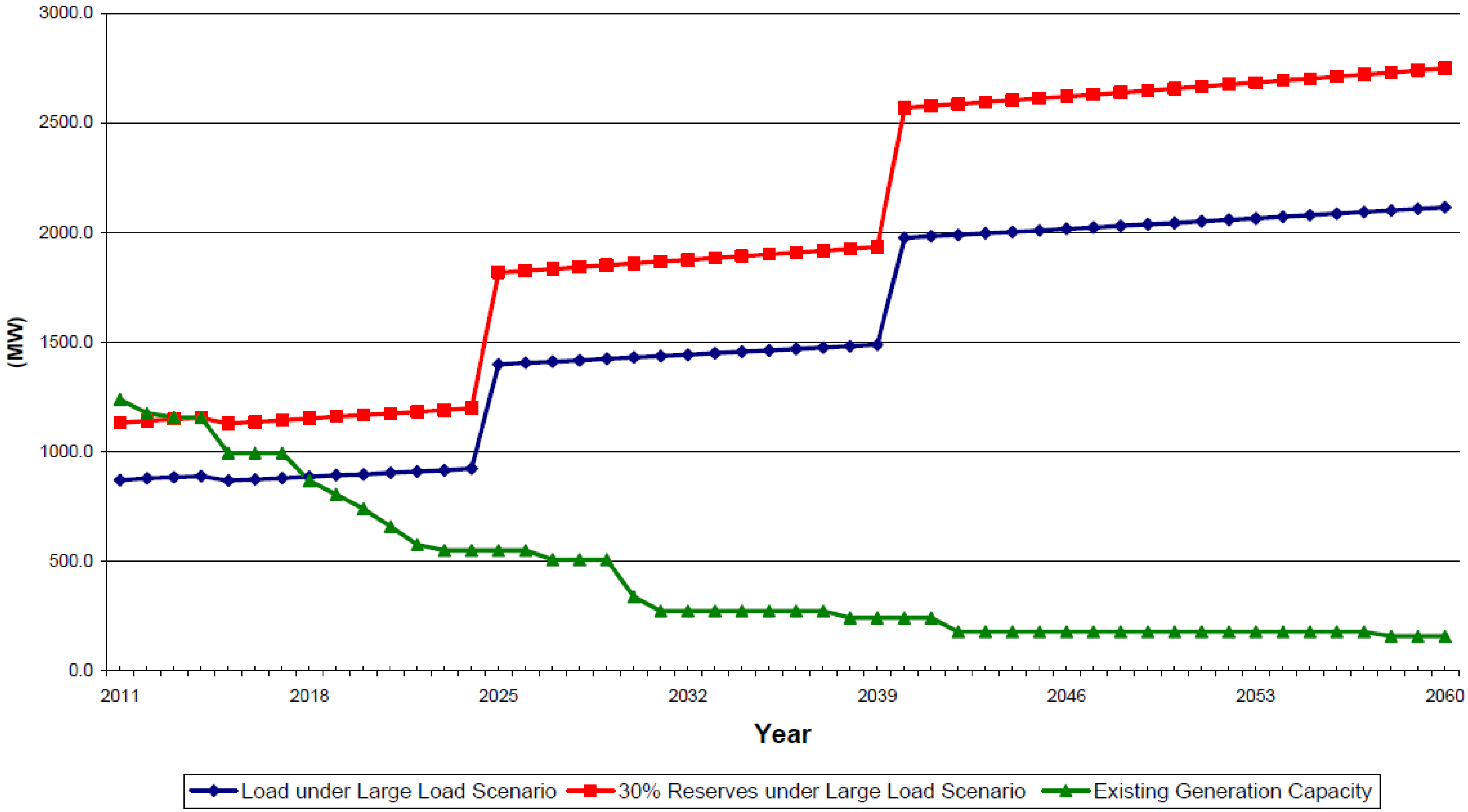
Source: Peterson & Wilson 2011

Electric Industry Structure

Generation	Transmission	Distribution	Retail Electric Service
Merchant	ISO/RTO		Competitive
Public Power		Local Distribution Companies	Default Service
Investor-Owned Utility	Utilities are Planning Authorities and Grid Operators		Cost-Based Utility Supply

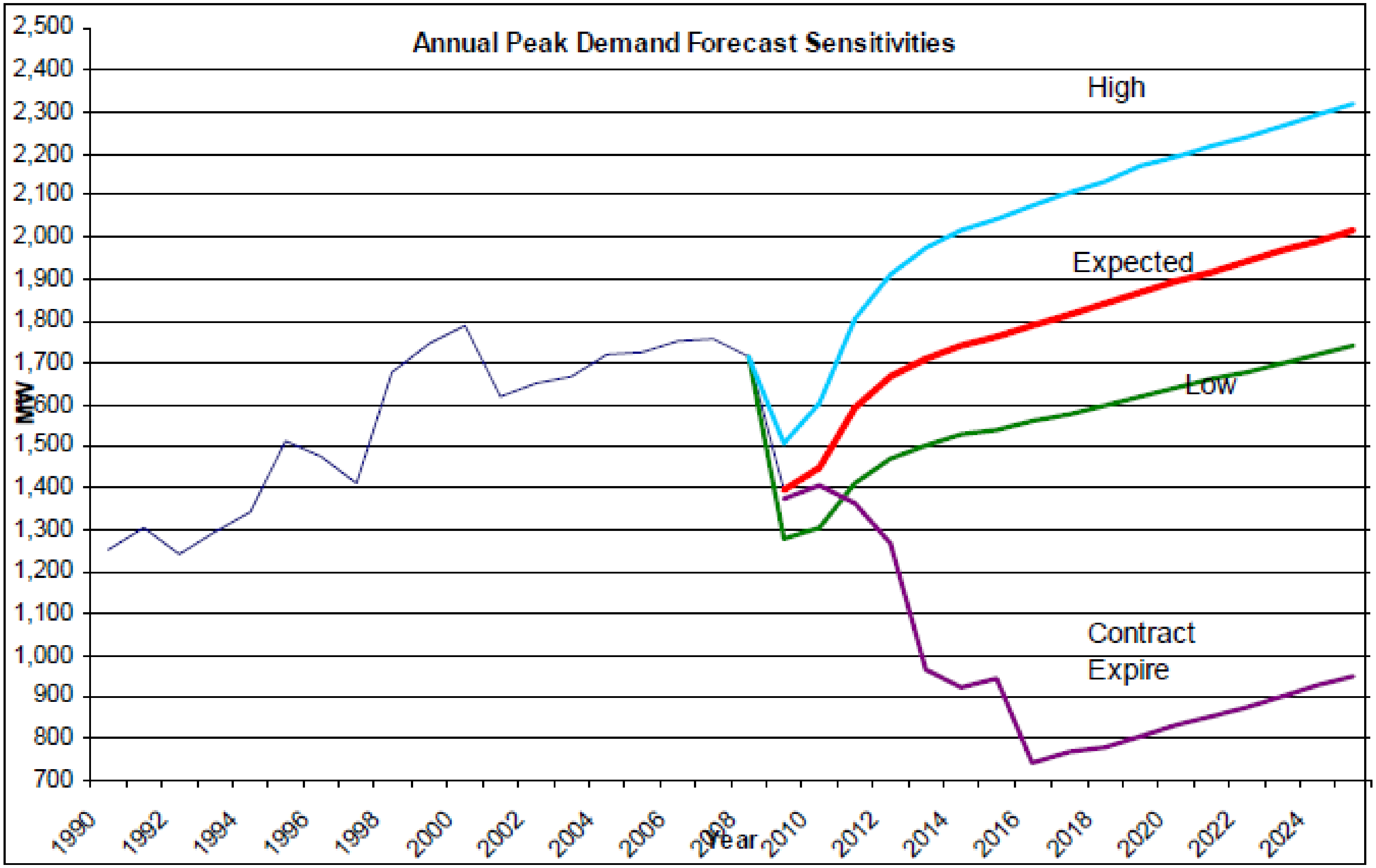
A reasonable, up-to-date, and fully documented forecast of system peak and energy requirements.

Scenario 2A Capacity Requirements Without DSM/EE



Source: Black & Veatch 2010

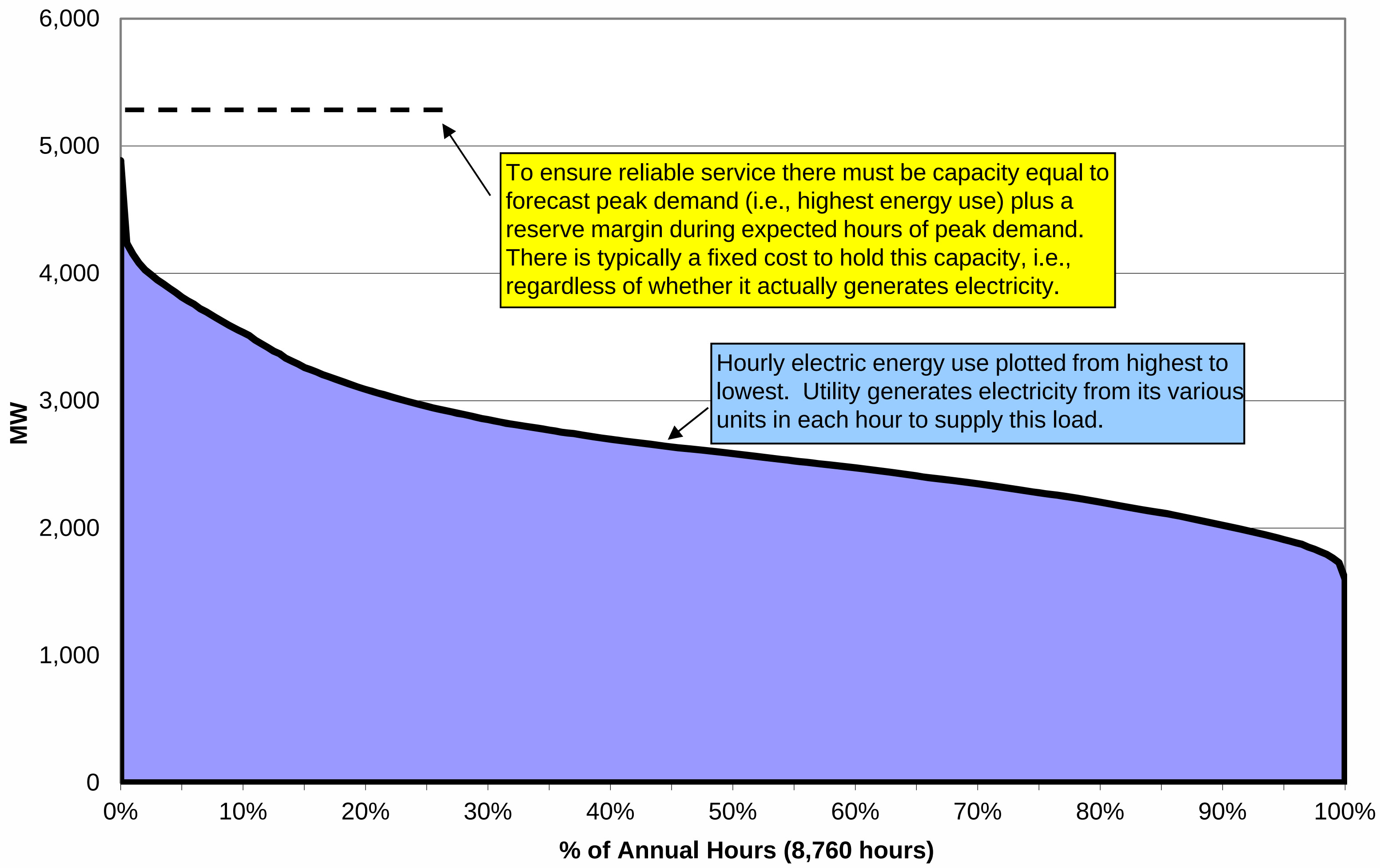
Minnesota Power's 2009 Electric Utility Forecast



Source: Minnesota Power 2009

Reserve requirements to provide capacity adequacy based on rigorous analysis of system characteristics and proper treatment of intermittent resources.

Illustrative Load Duration Curve (8,760 hours)



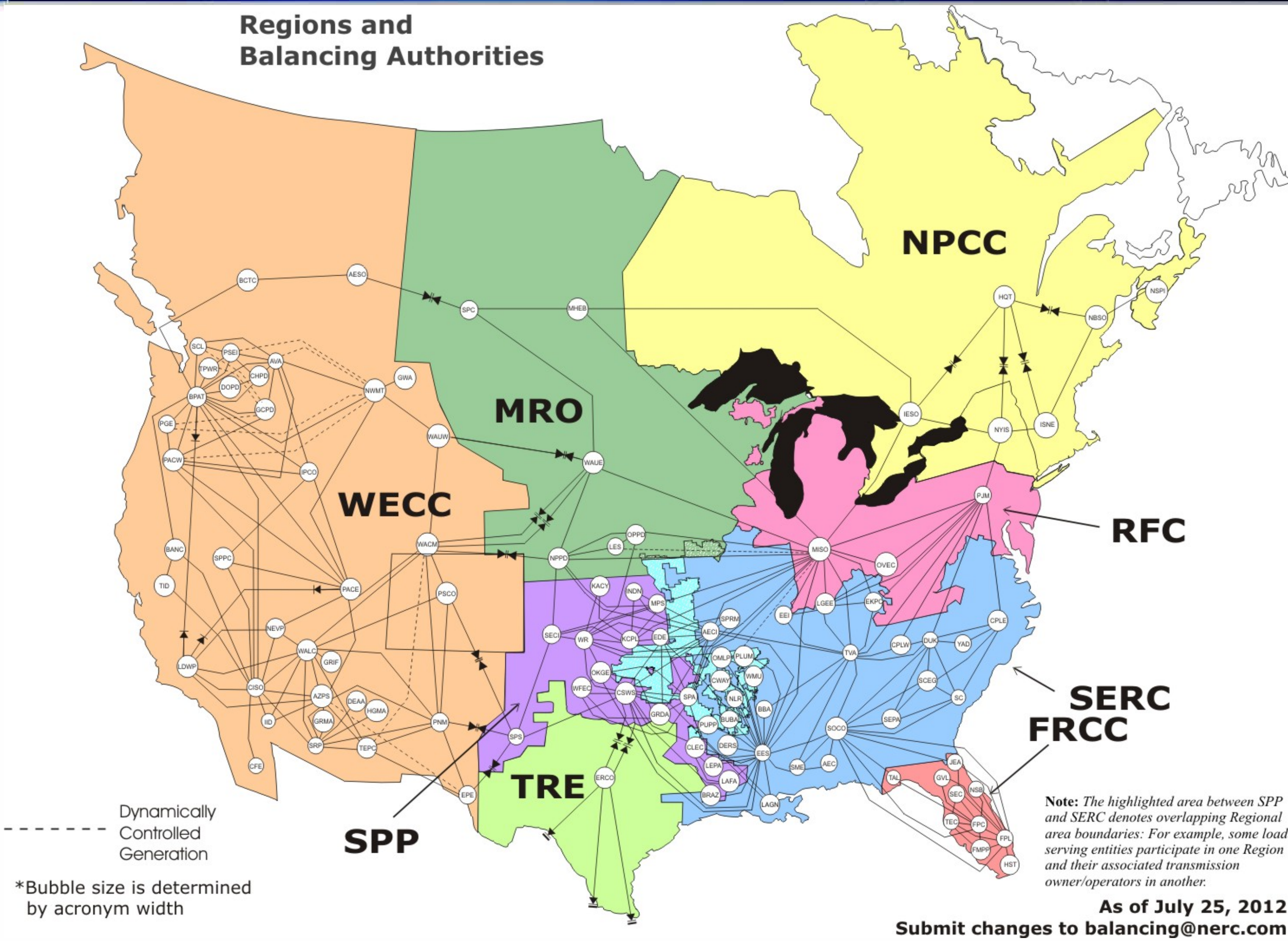
Source: Hornby, Hurley, & Knight 2011

General Characteristics of Utility Systems that Affect Reliability and Reserves Requirements

1. **Load shape**
2. **Forced outage** rates
3. **Maintenance outage** requirements
4. **Number and size** of generating units
5. **Transmission** interties with neighboring utilities
6. Availability and effectiveness of **intervention procedures**

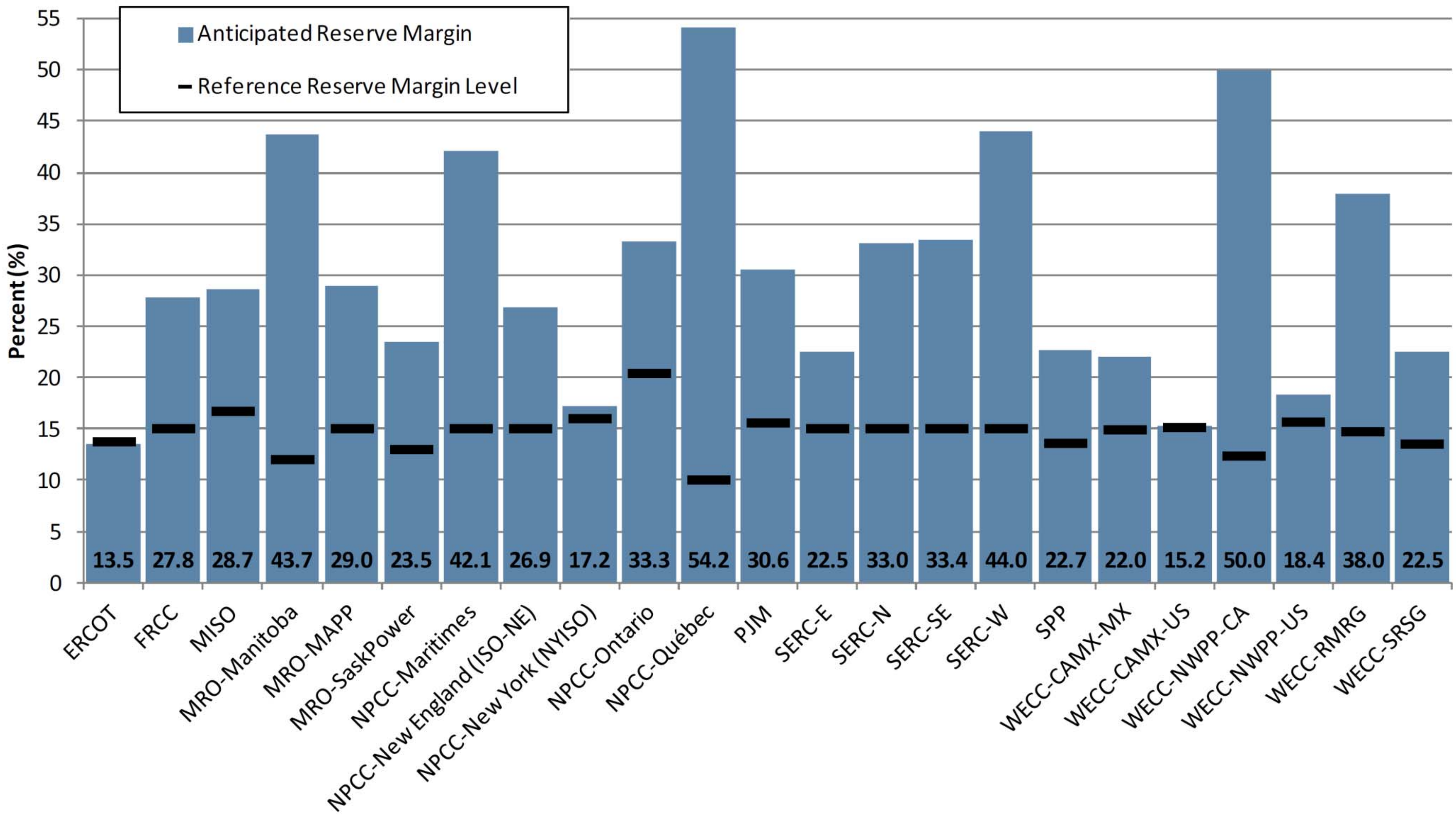
Source: Biewald & Bernow 1988

NERC Regions and Balancing Authorities



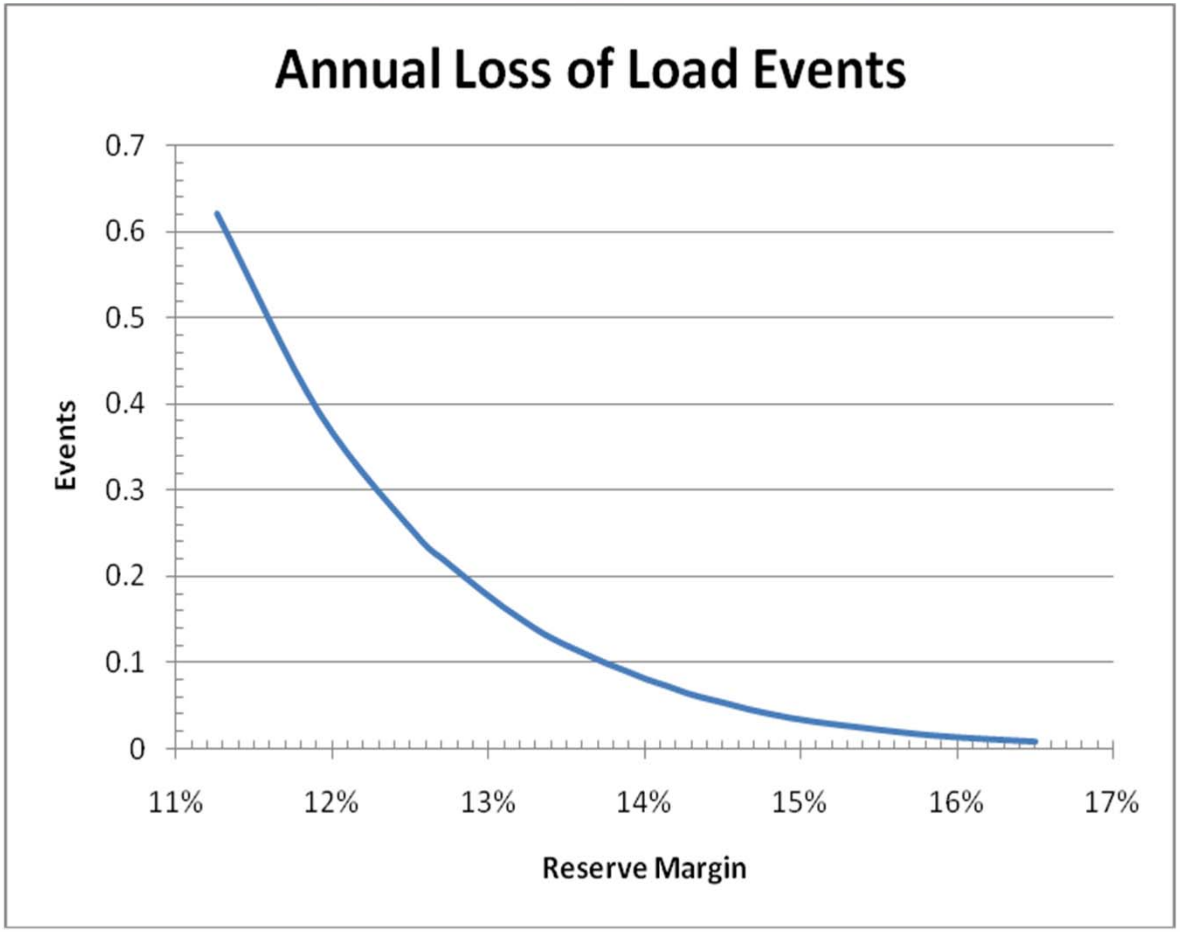
Available at: http://www.nerc.com/fileUploads/File/AboutNERC/maps/BubbleDiagram_072512.jpg

NERC Anticipated Reserve Margins for Summer 2012



Source: NERC 2012

LOLE and Reserve Margin



Source: ERCOT 2010

Where did "1 in 10" standard come from?

"The fraction of time… will be called the *loss of load duration*… expressed in terms of "so many days upon which loss of load may be expected to occur during a given number of years," say 10 or 100.

This number of days provides a first index for measuring and comparing service reliabilities."

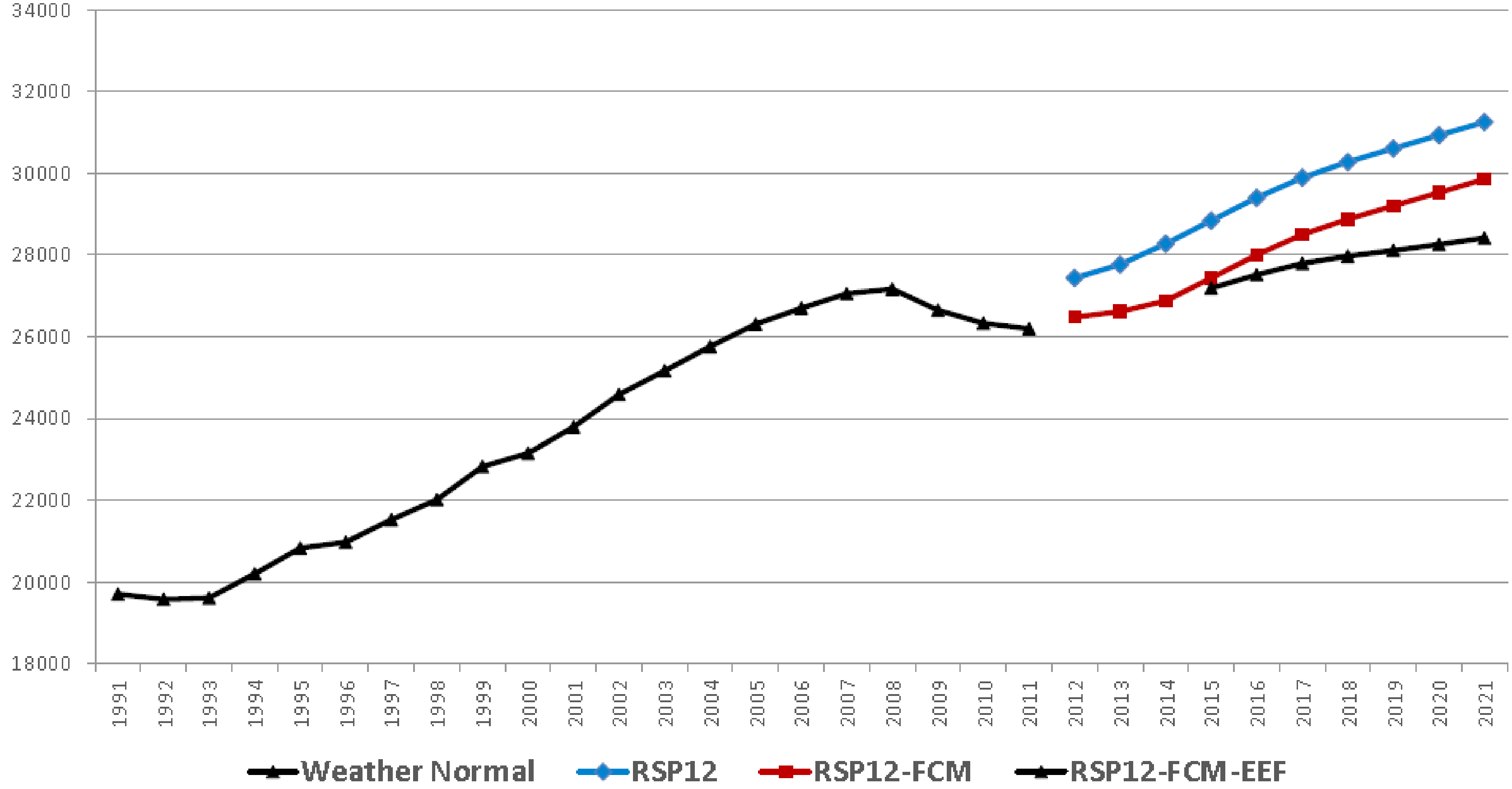
- Giuseppe Calabrese, 1947

Source: NERC 1991

Consideration of various levels of DSM savings ranging from low to something beyond “all cost effective” DSM in order to provide confidence that “all cost effective DSM” has been included.

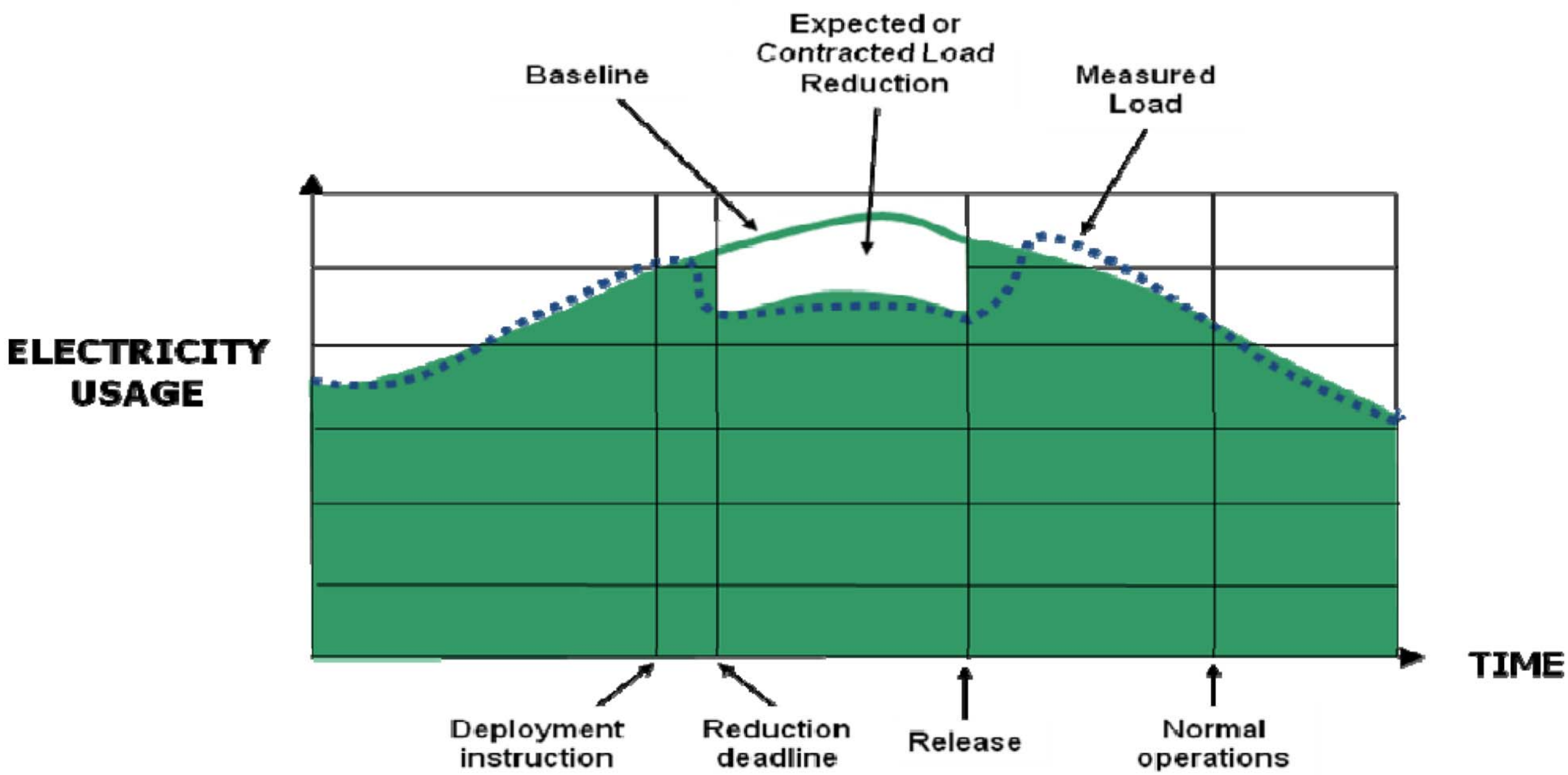
Energy Efficiency Forecasts

ISO New England Summer Peak Forecast under Various Energy Efficiency Assumptions



Source: Peterson, et al. 2012

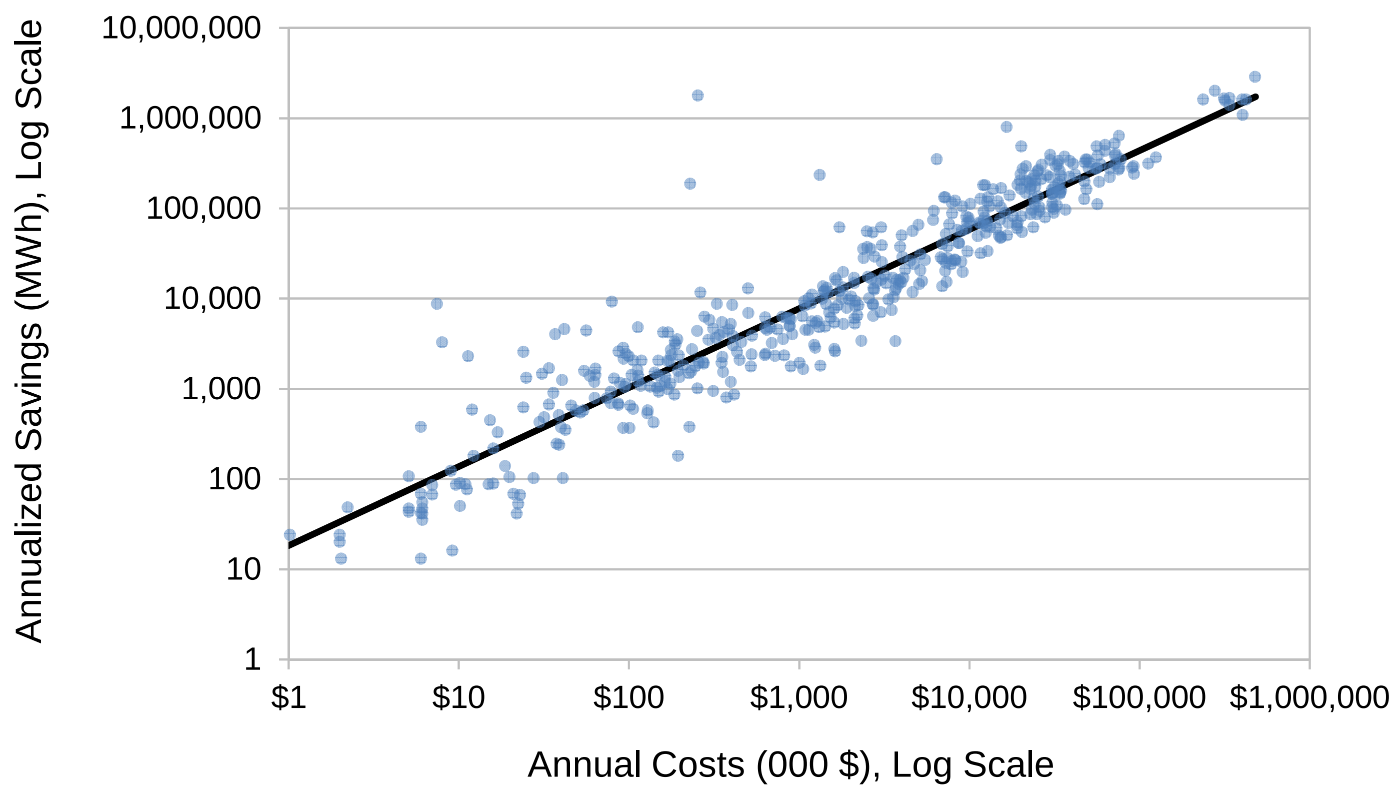
Baseline relative to a Demand Response Event



Source: NERC 2010

EE Cost vs. Savings

Program years with savings as a percent of sales greater than 0.5% (n=468)



Best Estimate Regression: $y = 18.274x^{0.875}$, $r^2 = 0.889$

Source: Synapse Analysis of EIA 861 Dataset, 2007-2011

EE Cost vs. Savings

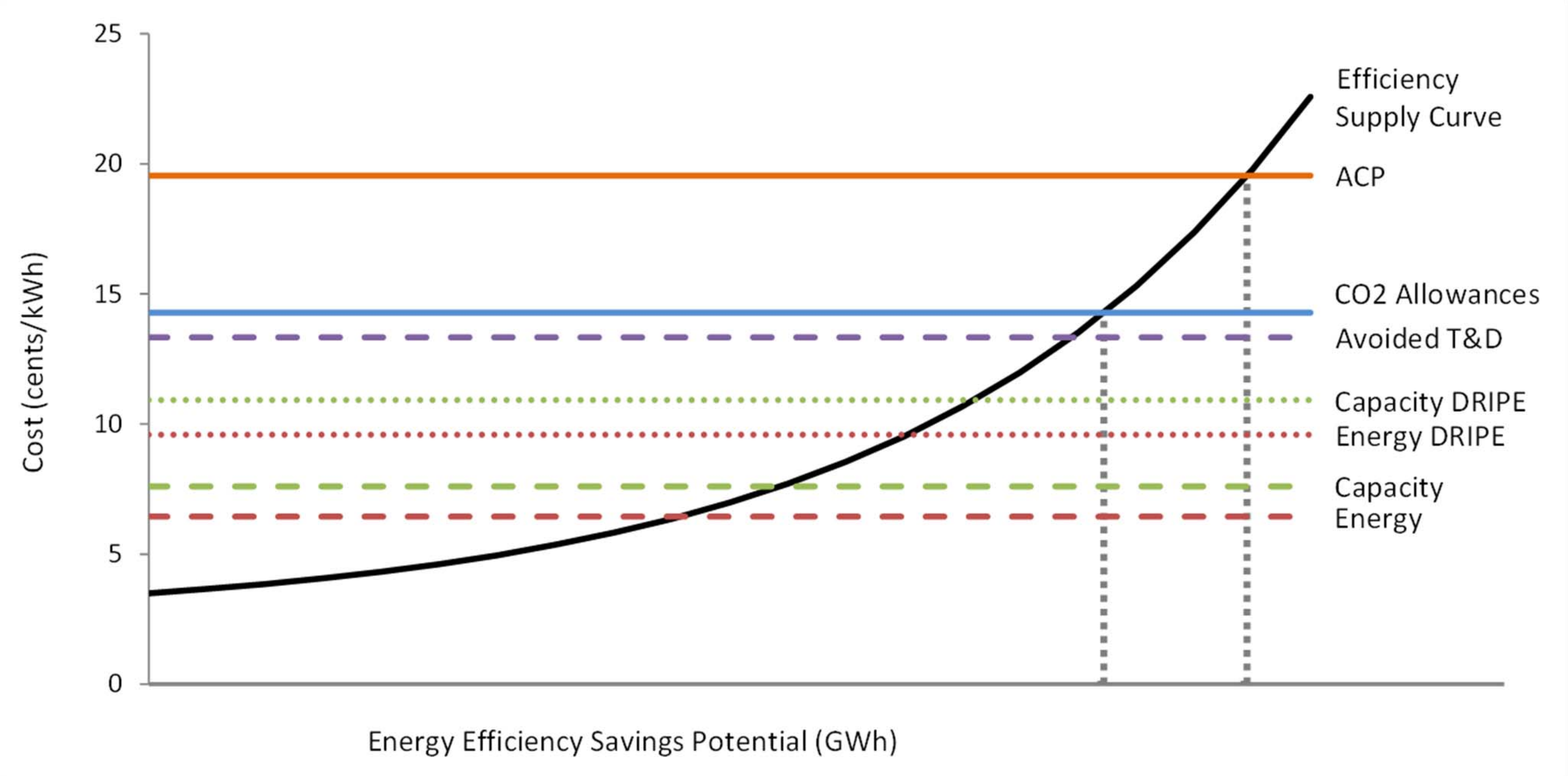
- Slope indicates cost per kWh of first year savings at 16.2c/kWh.
- Assuming 12 year measure life and 4.5 percent real discount rate this amounts to a levelized unit cost to the utility of 1.7 c/kWh by EE programs.

Consideration of a full range of supply alternatives, with reasonable assumptions for their costs, performance, and availability.

Avoided costs

A proper calculation of avoided costs (for purposes of screening DSM options) that generally should include demand and energy.

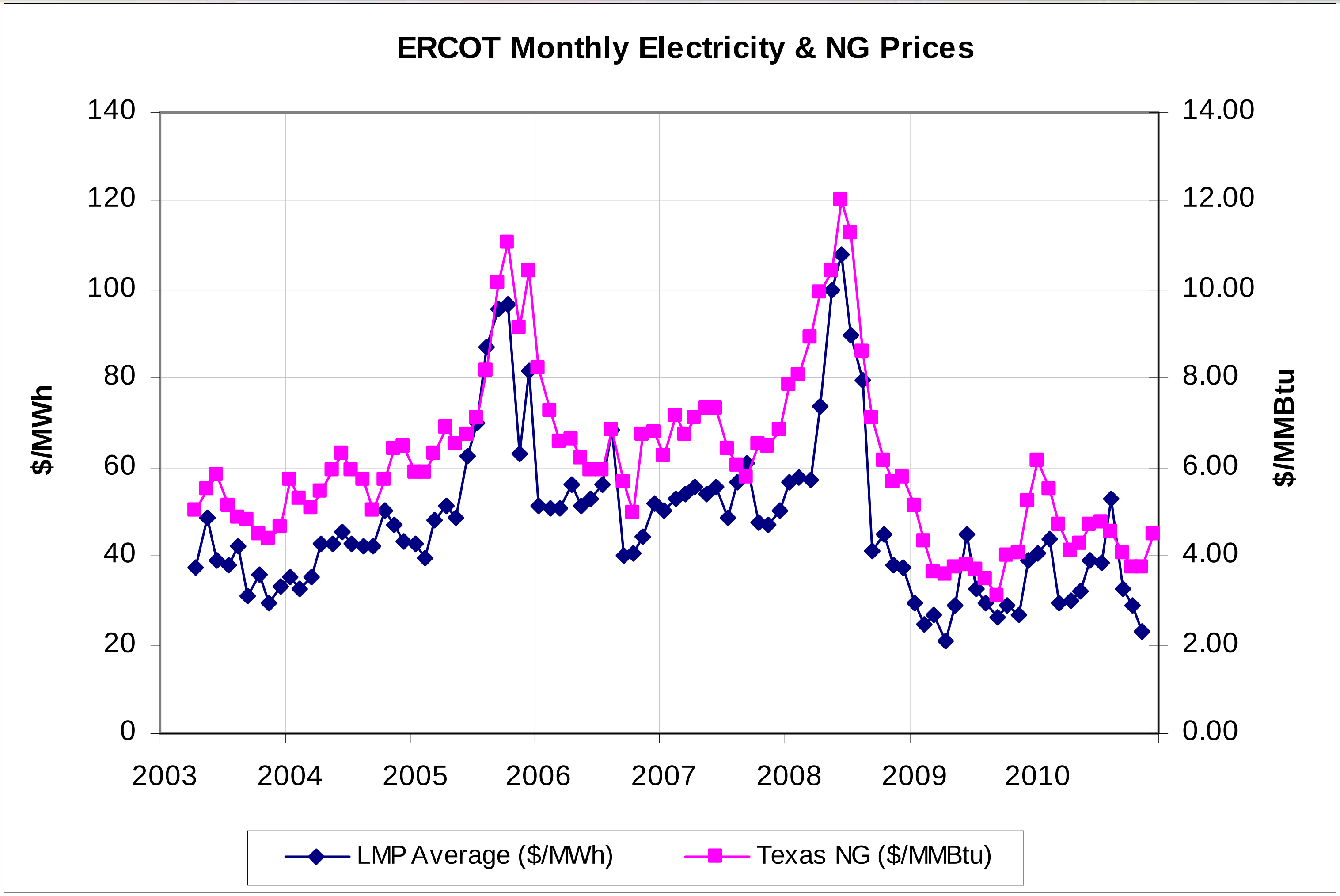
Massachusetts avoided costs – with ACP



Source: Woolf 2011

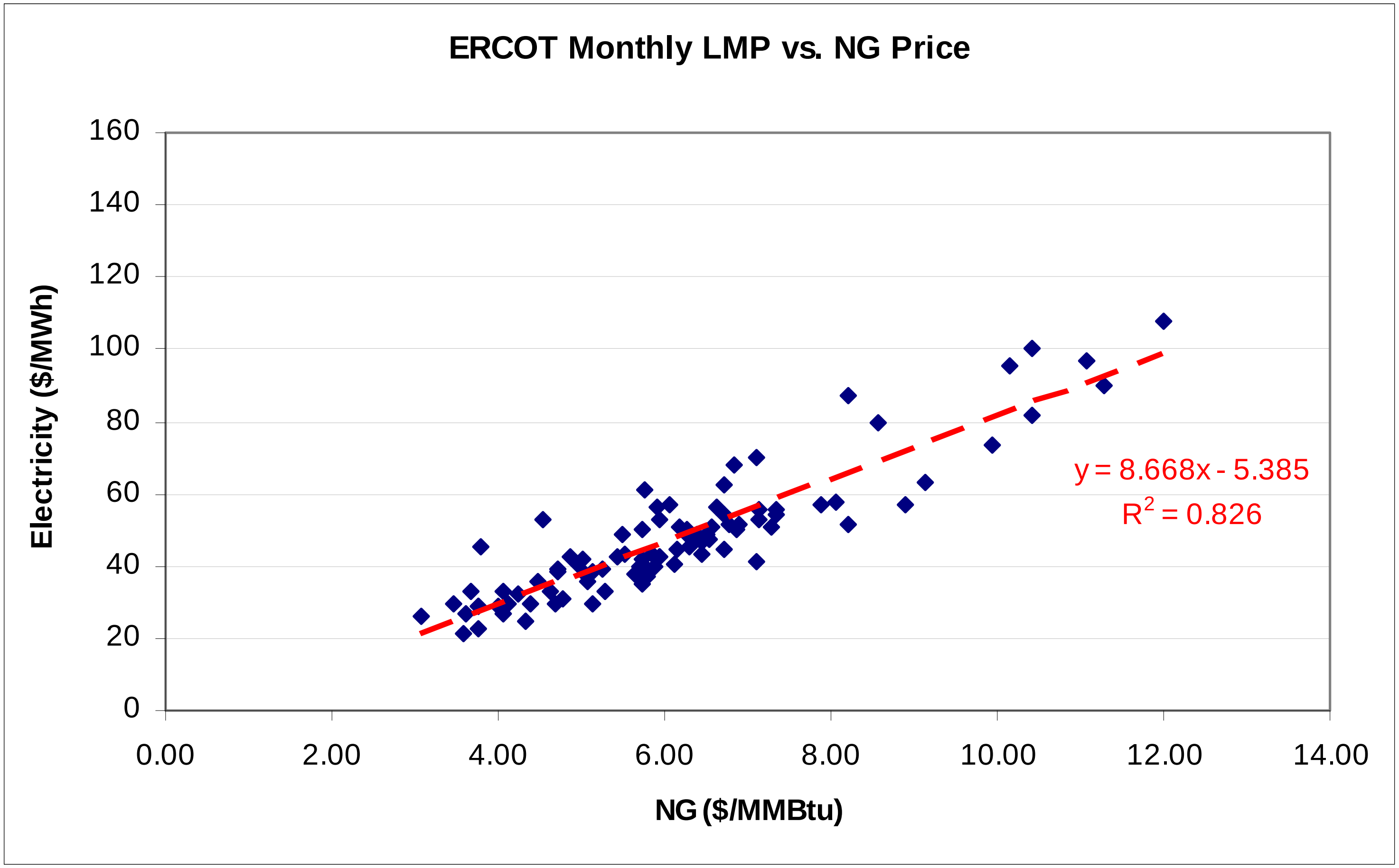
Reasonable, recent, and consistent projections of fuel prices.

Correlation between natural gas prices and wholesale electricity prices



Source: ERCOT Archive

ERCOT monthly LMP vs. natural gas prices

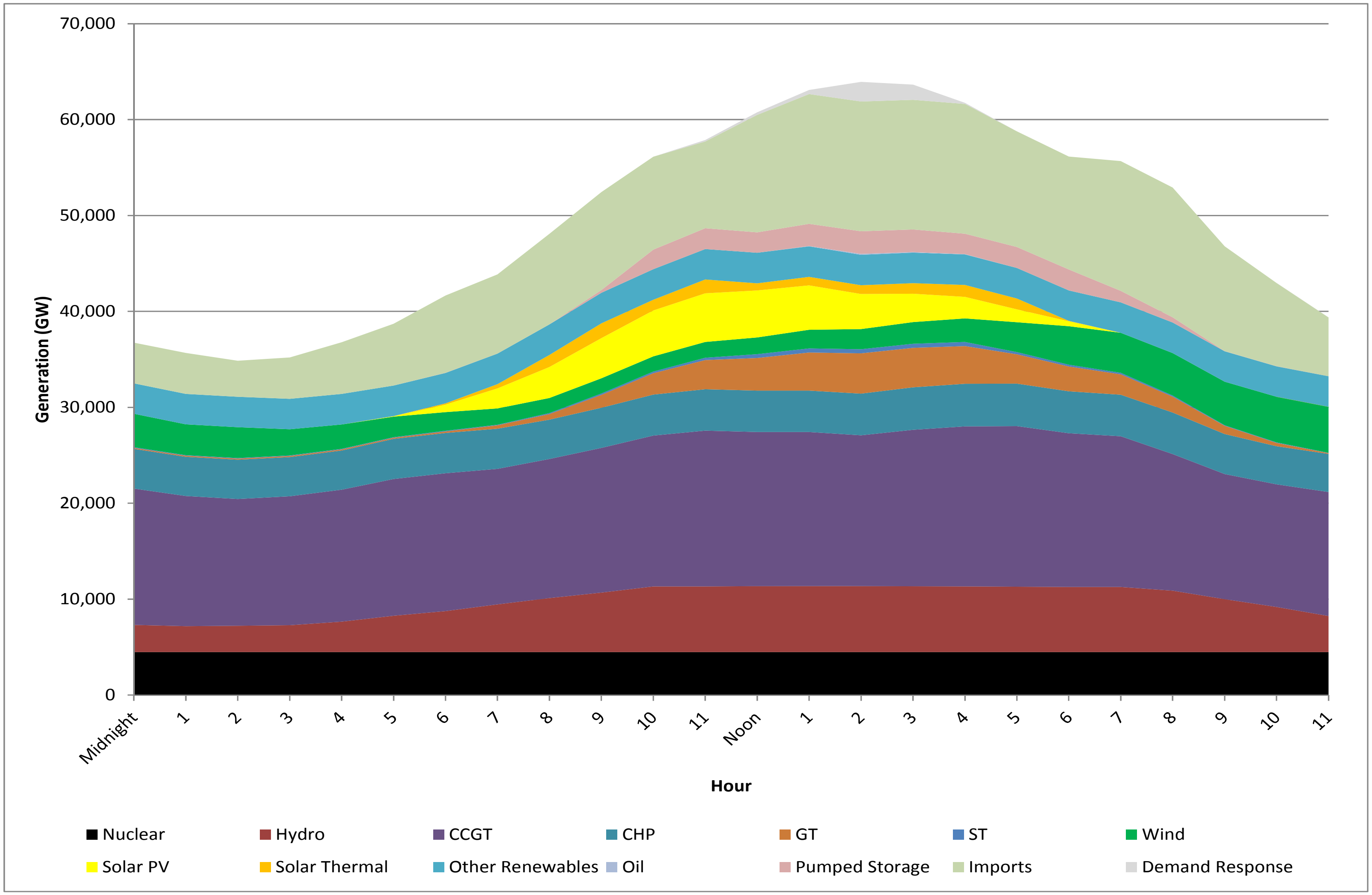


Source: ERCOT Archive

Environmental costs and constraints

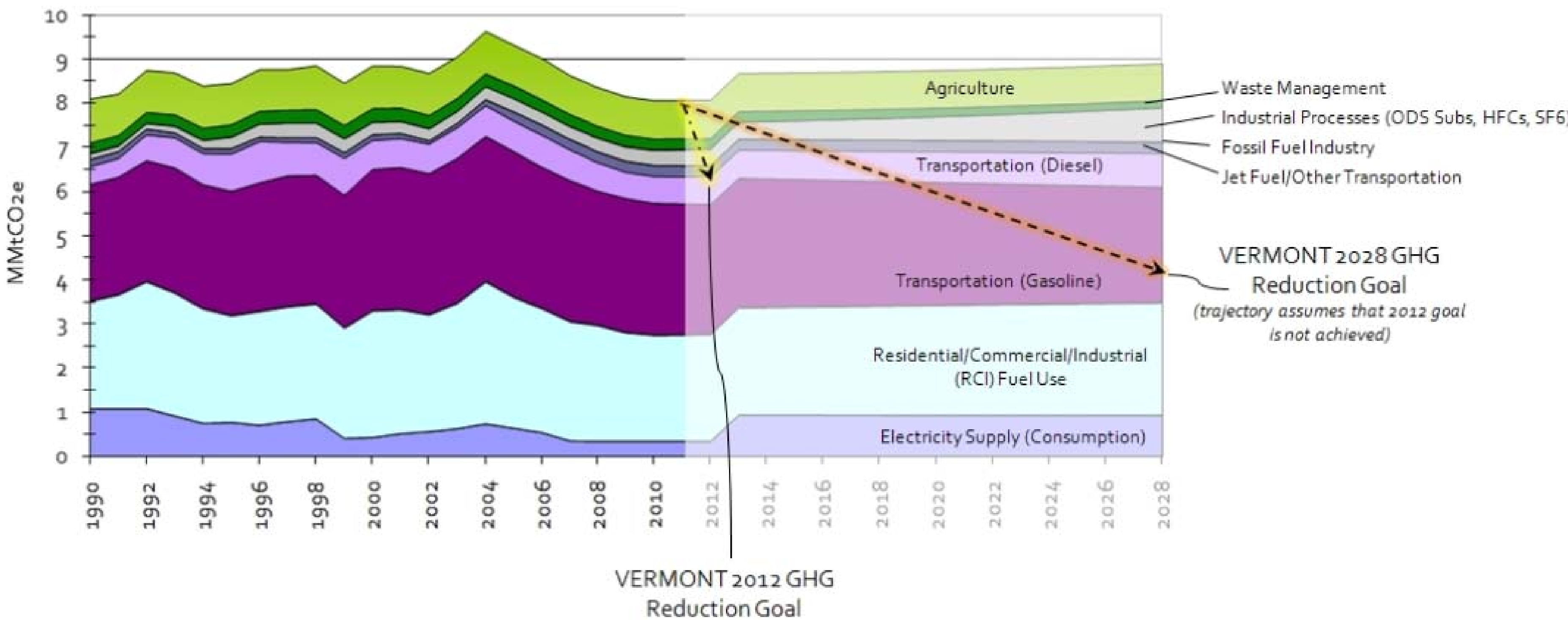
Projection of environmental compliance costs, including recognition of all reasonably expected future regulations.

Illustrative California Summer Day Dispatch 2020



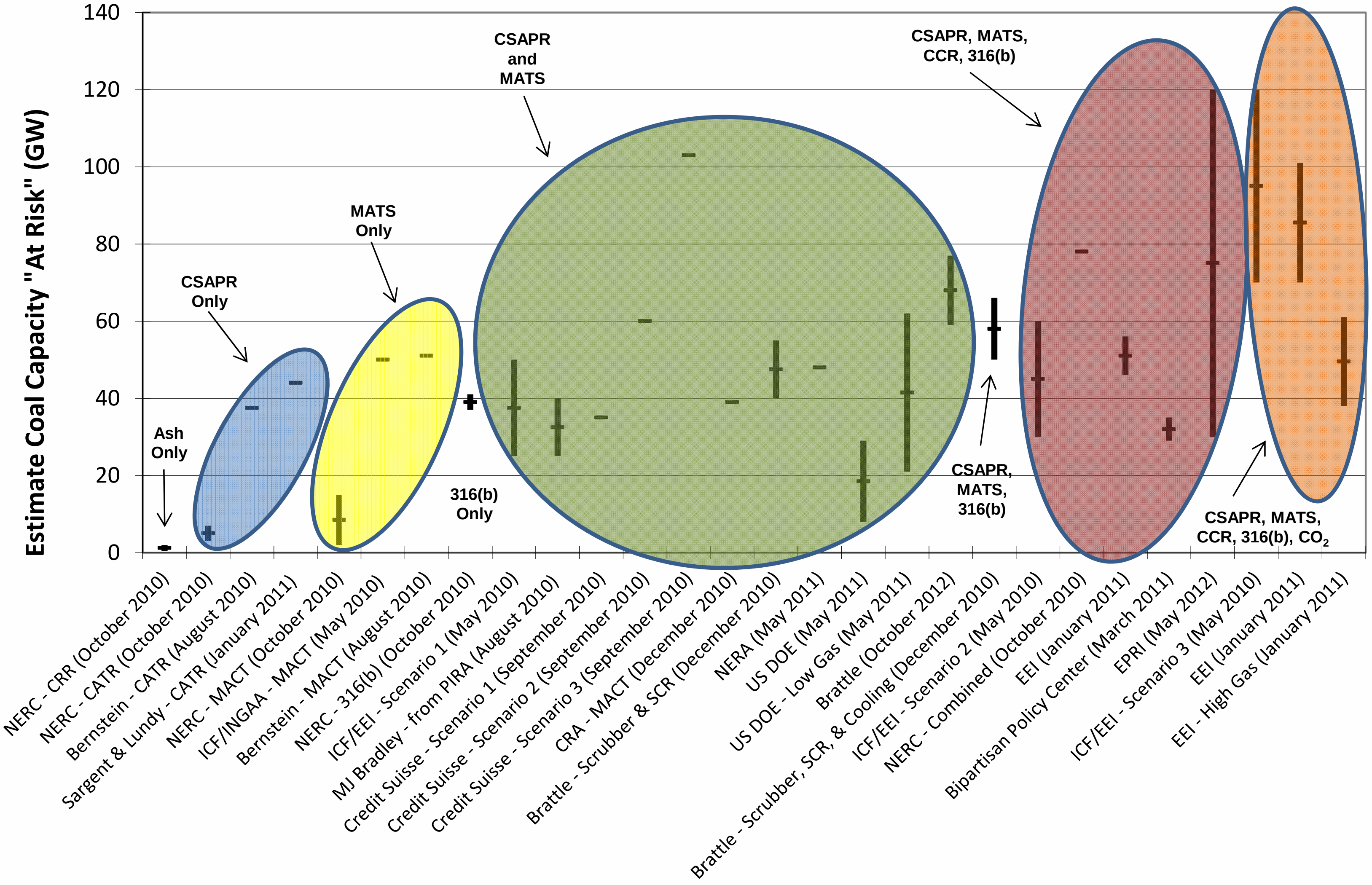
Source: Synapse Energy Economics' Plexos model results for California ISO base scenario with 33% RPS.

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

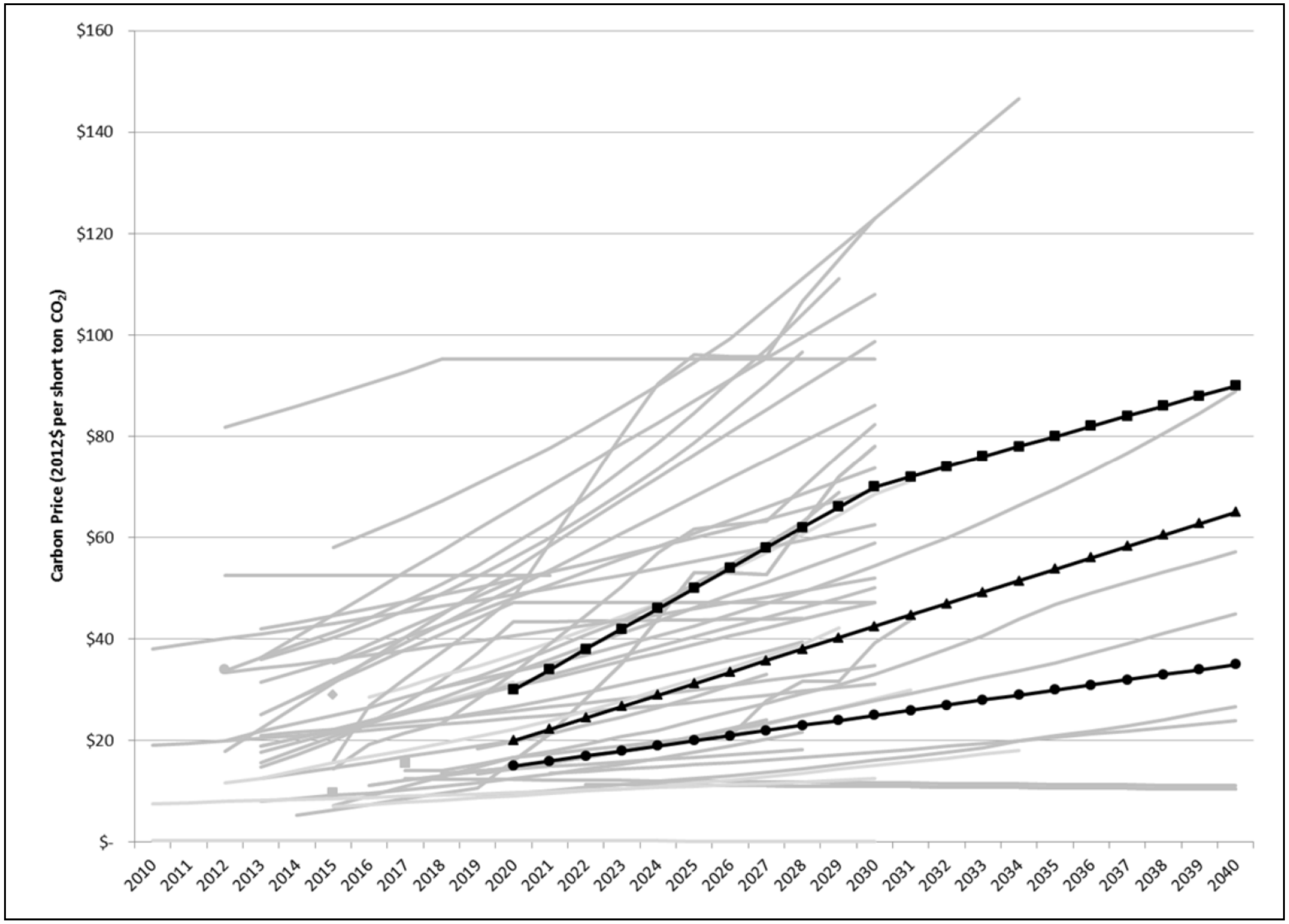


Source: Vermont Department of Public Service 2011

Studies of Coal Capacity at Risk



CO_2 Price Forecast



Source: Wilson, et al. 2012

Modifications to existing resources (including retirement) should be included in the consideration.

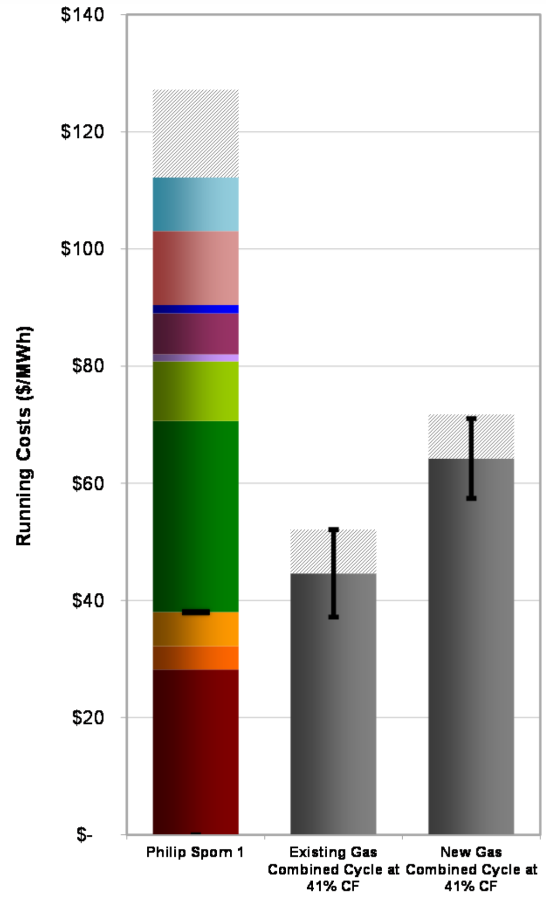
Existing electrical generating capacity by fuel type

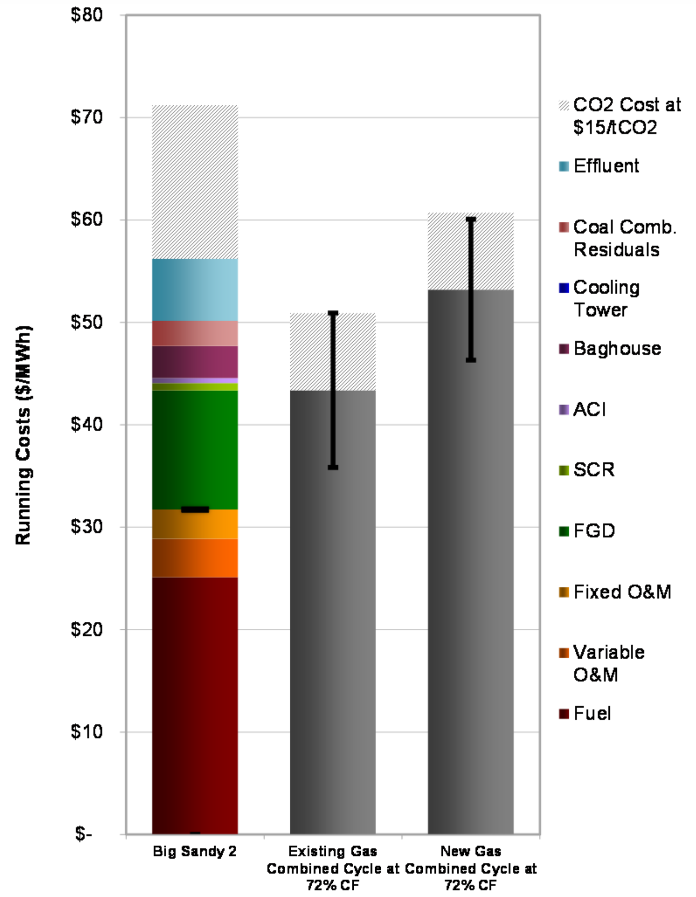
Source: EIA Form 860 2009

Coal Unit Forward Going Costs: Two Examples

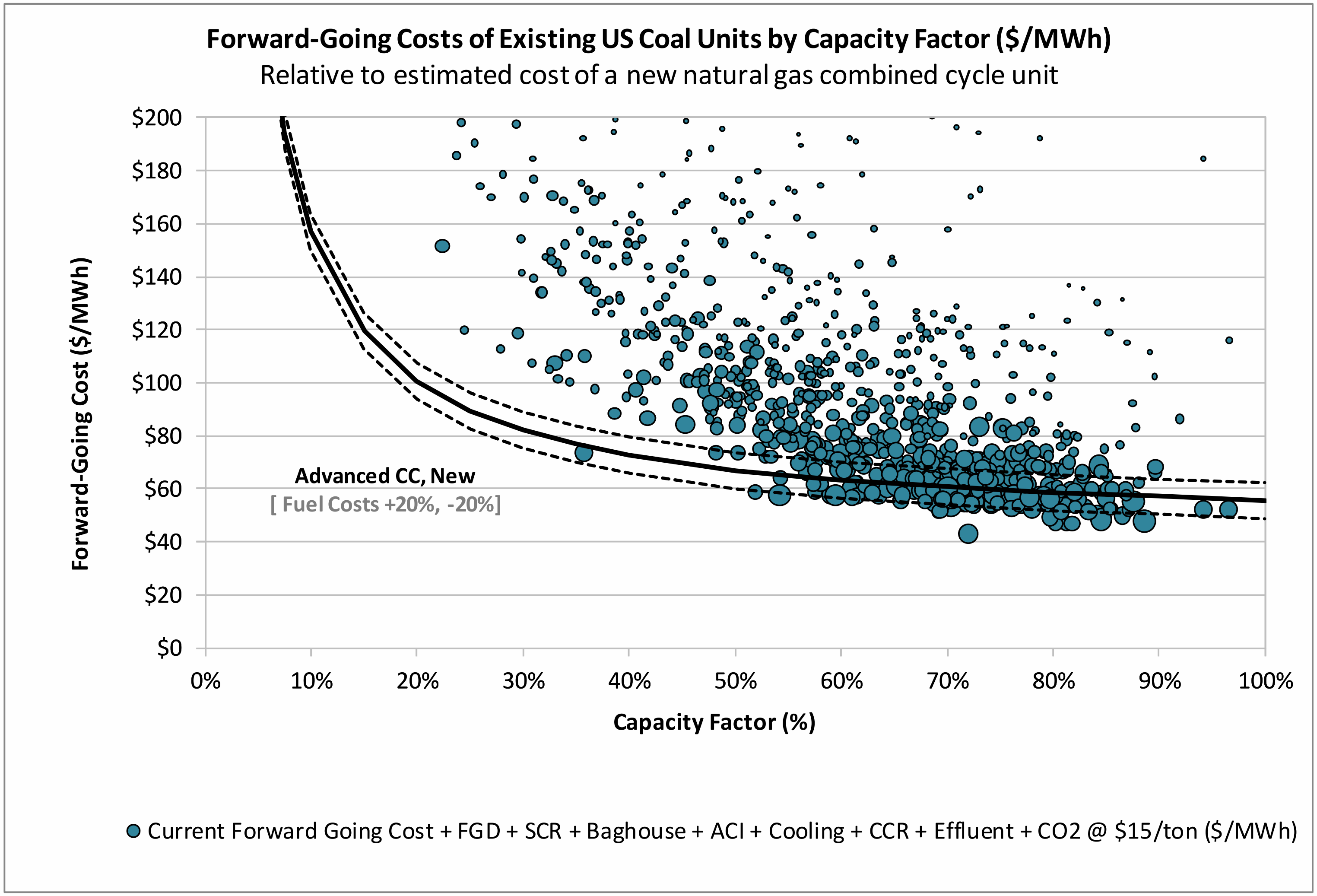
Philip Sporn 1 (AEP, WV)
152 MW

Big Sandy 2 (AEP, WV)
816MW



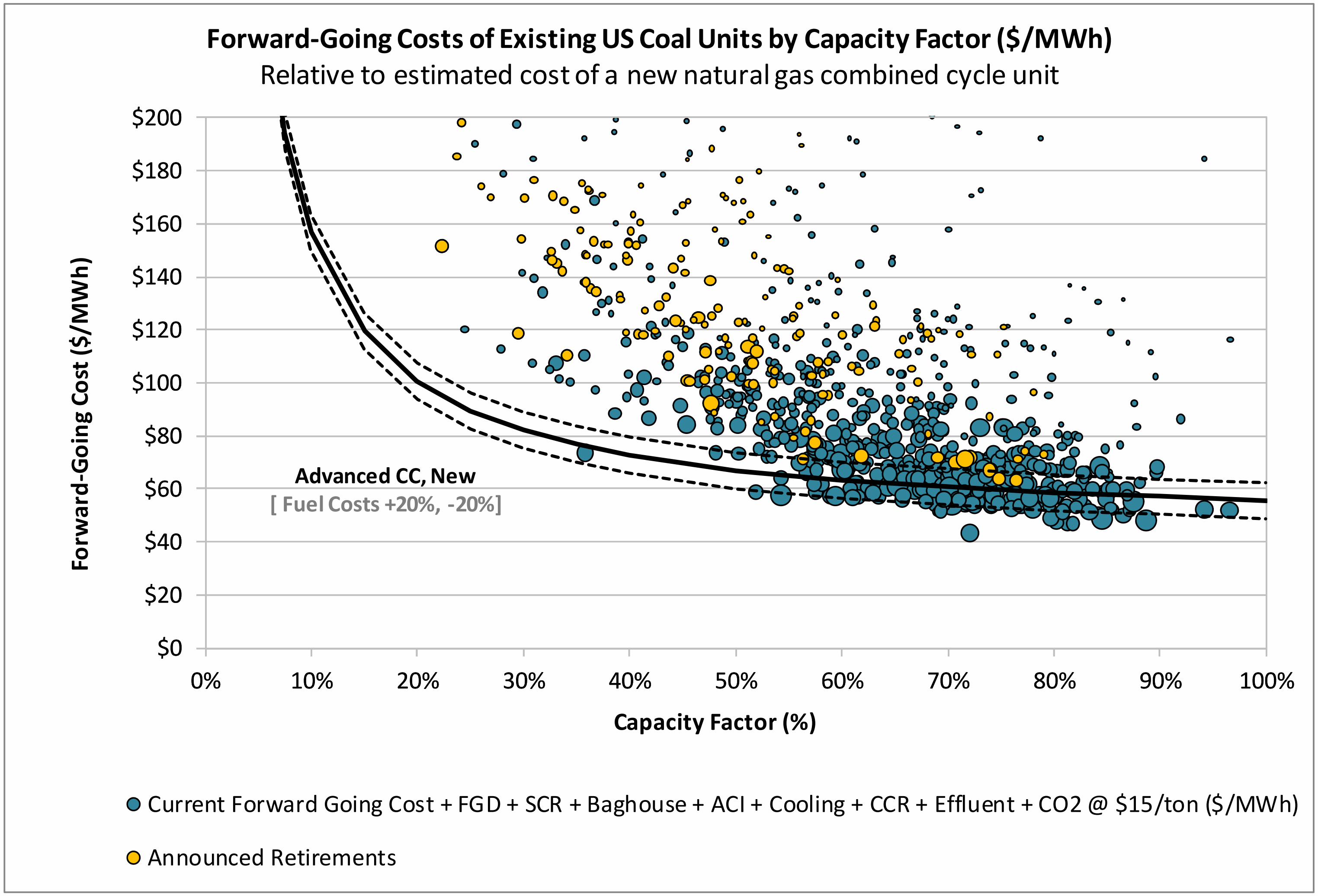


Existing US Coal Fleet Forward-Going Costs



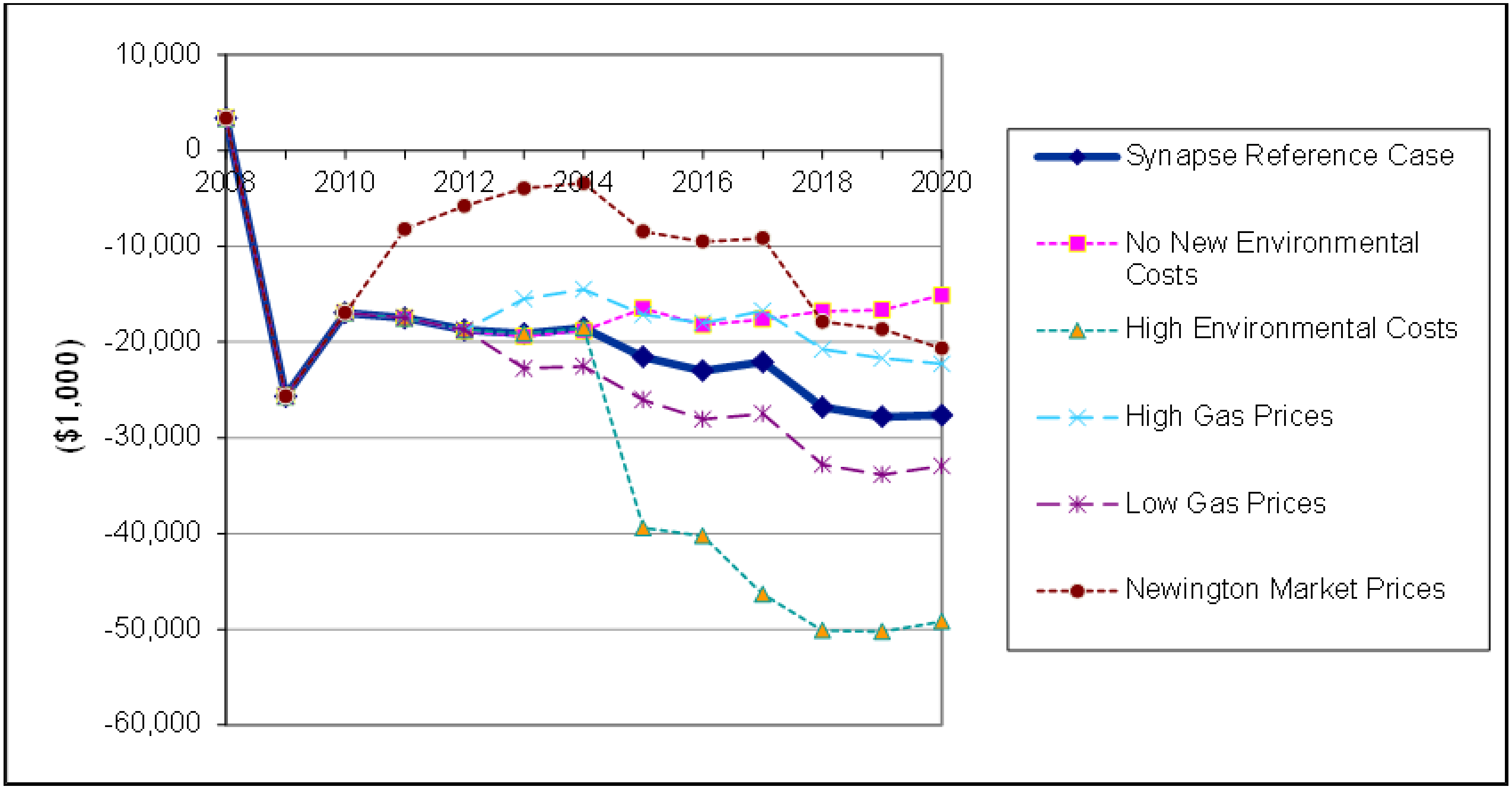
Note: Area of circles indicate MW capacity of units

Announced Retirements of US Coal Fleet



Note: Area of circles indicate MW capacity of units

Schiller 4 and 6 net revenue



Source: White, et al. 2011

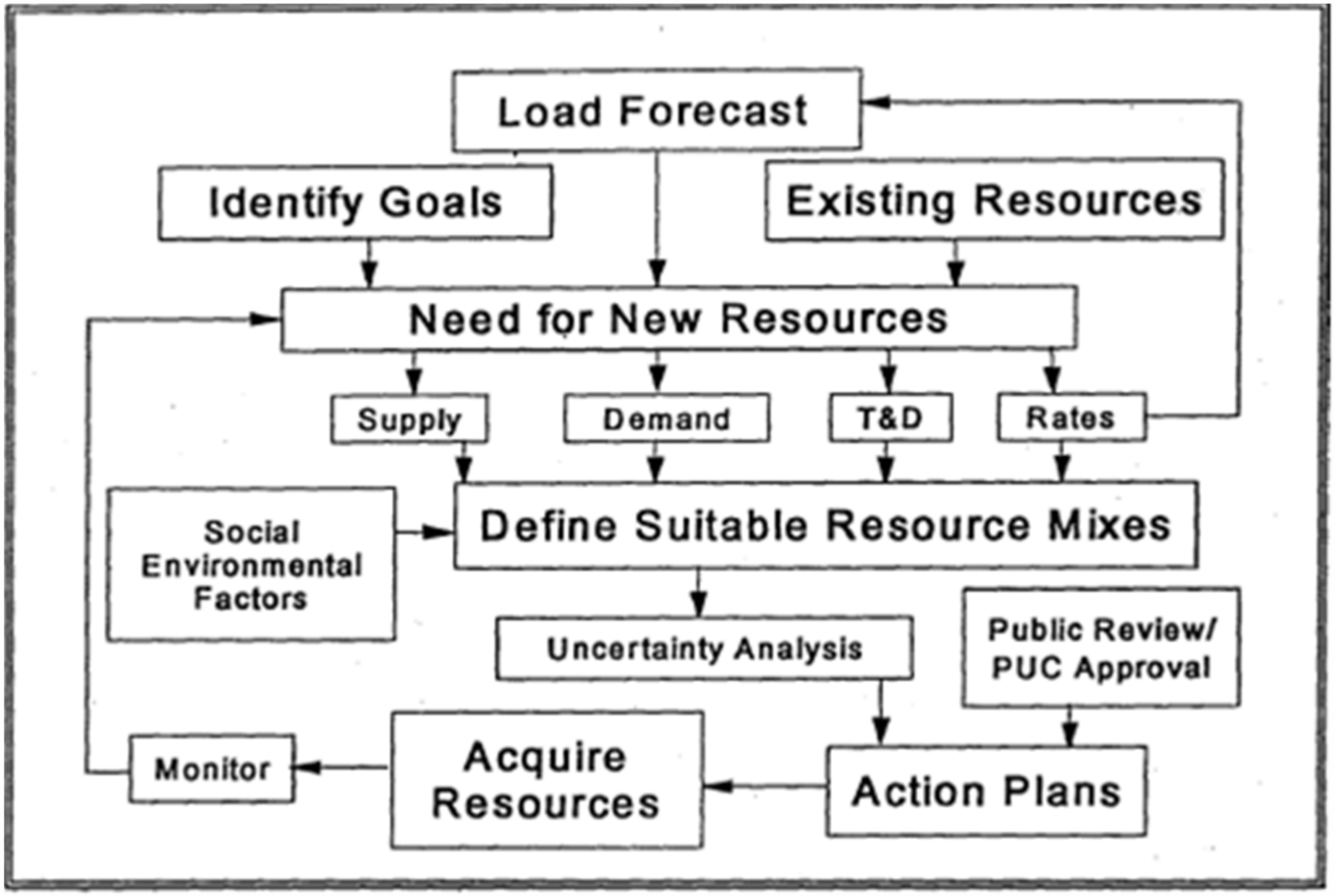
Fresh information

All of the assumptions and calculations mentioned above should be reasonably up-to-date. Construction cost estimates, for example, can be notoriously out of date within a few months, and reliance upon such estimates would be imprudent.

Integrated analysis

There are various reasonable ways to model plans, generally requiring the use optimization or simulation models. It is important that the integrated modeling does not inadvertently exclude combinations of options that deserve consideration.

Flow chart for integrated resource planning



Source: Hirst 1992

Time frame

A reasonable IRP will focus on decisions that must be made in the next few years (e.g., ramping up a DSM program, beginning construction of a new power plant) but the study period for the analysis should be sufficiently long to incorporating much of the operating lives of the new resource options, typically at least 20 years, and even then "end effects" should be considered.

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

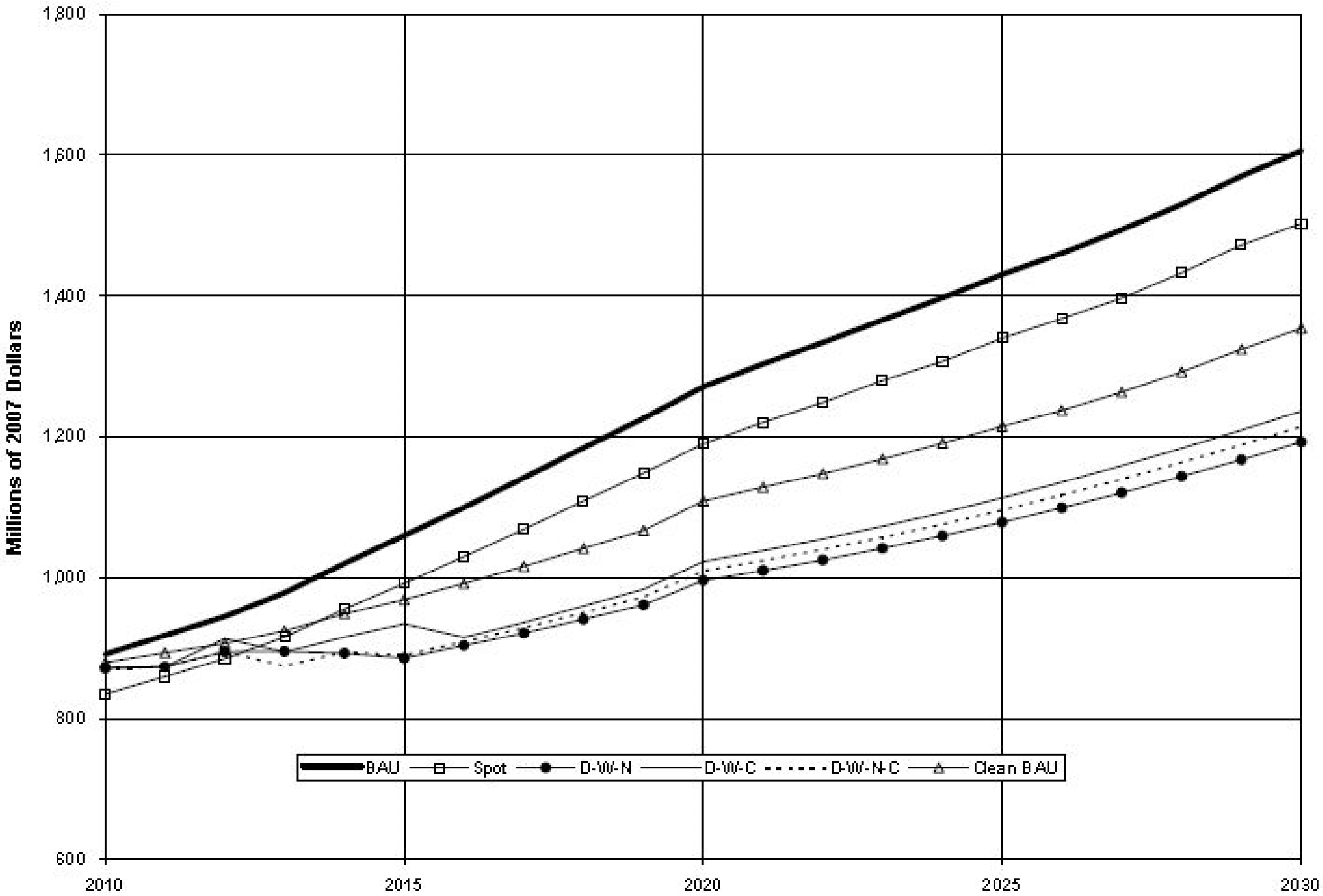
Source: Peterson & Wilson 2011

Uncertainty

At a minimum, important and uncertain input assumptions should be tested with high and low cases to assess the sensitivity of results to changes in the input values. In many cases more sophisticated techniques, combining uncertainties and/or involving probabilistic techniques are warranted.

Risk analysis for residential standard offer procurement strategies

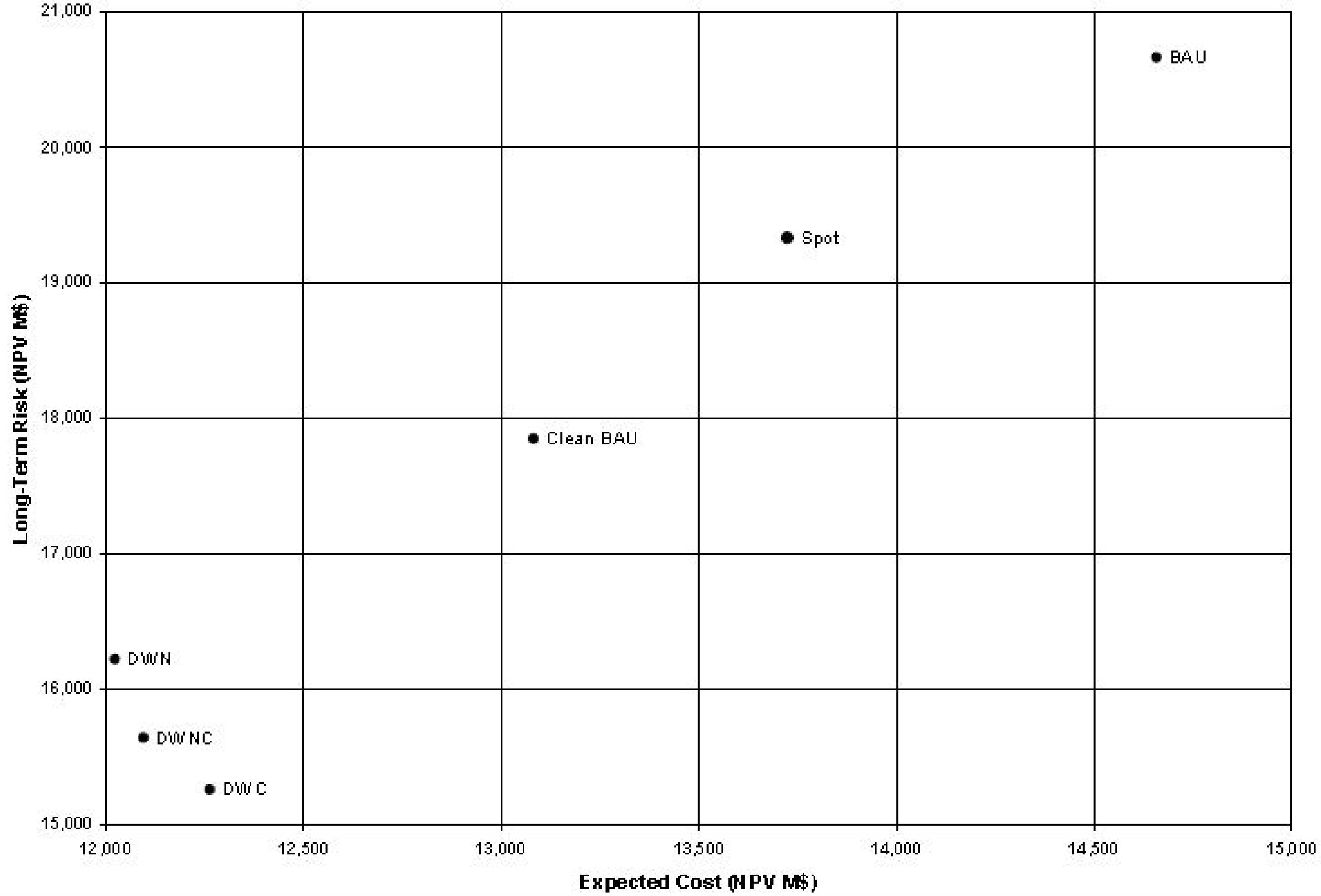
Expected Annual Portfolio Costs



Source: Chernick, et al. 2008

Risk analysis for residential standard offer procurement strategies

Long-Term Cost vs. Risk by Portfolio



Source: Chernick, et al. 2008

Metrics

Generally the "present value of revenue requirements" is the primary metric to be minimized in an IRP process. Other important metrics can include minimizing risks, environmental costs, rate or bill increases, and so on.

Valuing and selecting plans

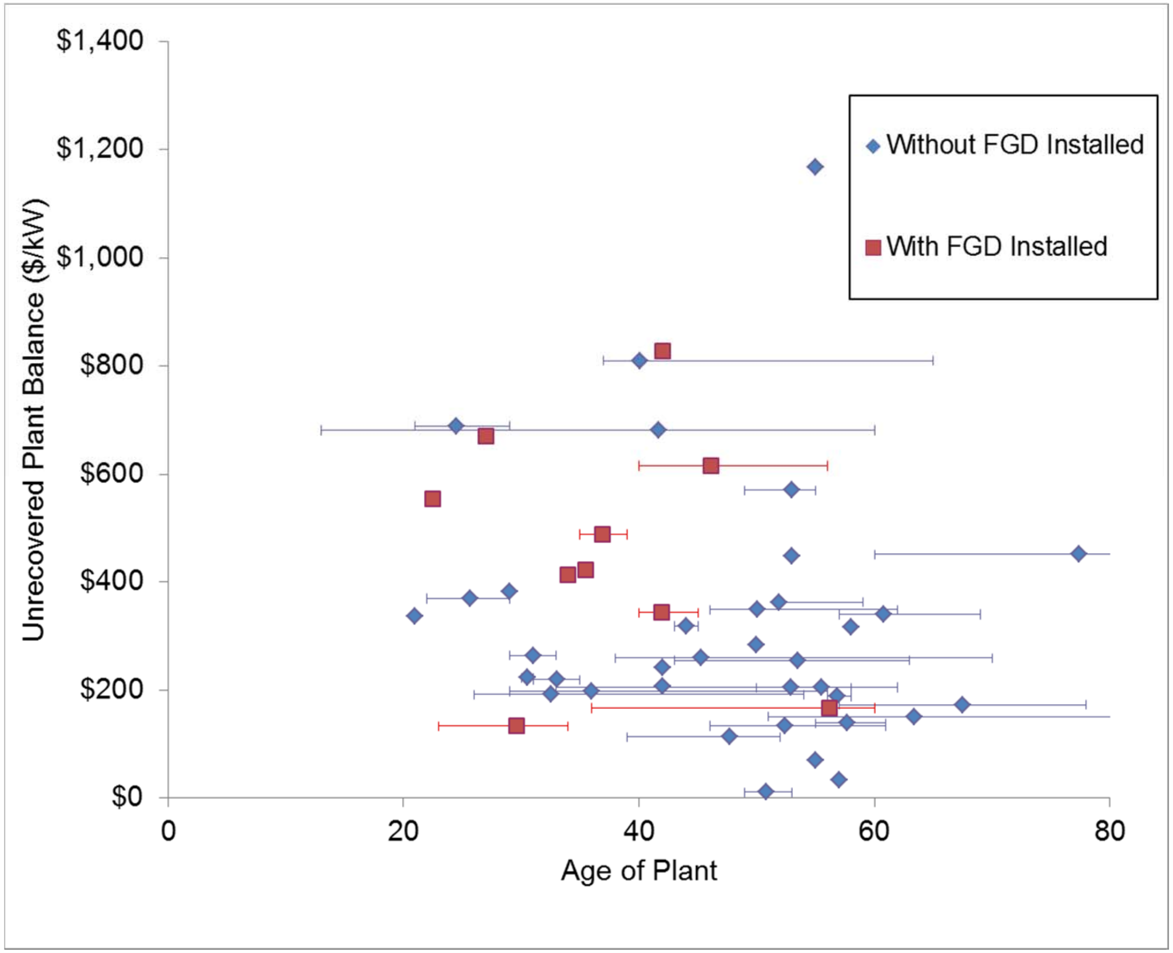
There are often multiple stages of running scenarios and screening in developing an IRP, and there are various reasonable ways to approach this. What is essential is that the process be done in a manner that applies the metrics in a reasonably transparent and logical manner, without inappropriately screening out resource options or plans that deserve consideration in the next stage.

Cost recovery issues

Cost recovery is important, but may be handled separately from IRP.

 |

Old Coal Plants Have Significant Investment in Rate Base



- Data from data collected from 41 coal plants owned by eight utilities.
- Average plant age weighted by capacity: ~45 years
- Average plant capacity: ~636 MW
- Average unrecovered plant balance: ~$347/kW
- Average unrecovered balance as a percentage of Total Cost: ~50%

 |

Regulatory Treatment of Retired Power Plant(s)

Ohio

- Docket 10-1454-EL-RDR
- Order: January 12, 2012
- Ohio Power sought approval for a rider to recovery unamortized plant balance of $58.7 million for Sporn Unit 5 (450 MW, 1960)
- Commission dismissed the case citing closure not subject to approval and no statutory basis for recovery of closure costs

Alabama

- Docket U-5033
- Order: September 7, 2011
- Alabama Power sought authorization to establish regulatory asset treatment and amortization schedule for generating units to be retired early as a result of EPA regulations
- Commission approved request

Action plan

A good IRP will generally include a specific discussion of the implications of the analysis for what needs to be done in the near-term, and specific plans for getting those near-term items done.

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: Peterson & Wilson 2011

Documentation

A proper IRP report will include discussion of the inputs and results, and appendices with full technical details. Only items that are truly sensitive business information should be treated as confidential, because such treatment can hinder important stakeholder input process.

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."

A good electric system IRP should include: (part 1 of 5)

- **Load forecast**. A reasonable, up-to-date, and fully documented forecast of system peak and energy requirements.
- **Reserves and reliability**. Reserve requirements to provide capacity adequacy based on rigorous analysis of system characteristics and proper treatment of intermittent resources.
- **Demand Side Management**. Consideration of various levels of DSM savings ranging from low to something beyond “all cost effective” DSM in order to provide confidence that “all cost effective DSM” has been included.
- **Supply options**. Consideration of a full range of supply alternatives, with reasonable assumptions for their costs, performance, and availability.

A good electric system IRP should include: (part 2 of 5)

- **Avoided costs**. A proper calculation of avoided costs (for purposes of screening DSM options) that generally should include demand and energy.
- **Fuel prices**. Reasonable, recent, and consistent projections of fuel prices.
- **Environmental costs and constraints**. Projection of environmental compliance costs, including recognition of all reasonably expected future regulations.
- **Existing resources**. Modifications to existing resources (including retirement) should be included in the consideration.

A good electric system IRP should include: (part 3 of 5)

- **Fresh information**. All of the assumptions and calculations mentioned above should be reasonably up-to-date. Construction cost estimates, for example, can be notoriously out of date within a few months, and reliance upon such estimates would be imprudent.
- **Integrated analysis**. There are various reasonable ways to model plans, generally requiring the use of optimization or simulation models. It is important that the integrated modeling does not inadvertently exclude combinations of options that deserve consideration.
- **Time frame**. A reasonable IRP will focus on decisions that must be made in the next few years (e.g., ramping up a DSM program, beginning construction of a new power plant) but the study period for the analysis should be sufficiently long to incorporating much of the operating lives of the new resource options, typically at least 20 years, and even then "end effects" should be considered.

A good electric system IRP should include: (part 4 of 5)

- **Uncertainty**. At a minimum, important and uncertain input assumptions should be tested with high and low cases to assess the sensitivity of results to changes in the input values. In many cases more sophisticated techniques, combining uncertainties and/or involving probabilistic techniques are warranted.
- **Metrics**. Generally the "present value of revenue requirements" is the primary metric to be minimized in an IRP process. Other important metrics can include minimizing risks, environmental costs, rate or bill increases, and so on.
- **Valuing and selecting plans**. There are often multiple stages of running scenarios and screening in developing an IRP, and there are various reasonable ways to approach this. What is essential is that the process be done in a manner that applies the metrics in a reasonably transparent and logical manner, without inappropriately screening out resource options or plans that deserve consideration in the next stage.

A good electric system IRP should include: (part 5 of 5)

- **Cost recovery issues**. Cost recovery is important, but may be handled separately from IRP.
- **Action plan**. A good IRP will generally include a specific discussion of the implications of the analysis for what needs to be done in the near-term, and specific plans for getting those near-term items done.
- **Documentation**. A proper IRP report will include discussion of the inputs and results, and appendices with full technical details. Only items that are truly sensitive business information should be treated as confidential, because such treatment can hinder important stakeholder input process.

References

- Biewald, B., and S. Bernow. *Electric Utility System Reliability Analysis: Determining the Need for Generating Capacity.* Boston: Energy Systems Research Group, 1988.
- Black & Veatch, 2010, *Alaska Railbelt Regional Integrated Resource Plan (RIRP) Study*, Final Report, prepared for the Alaska Energy Authority, February 2010.
- Chernick, P., R. Hornby, J. Wallach, and D. White. *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.
- ERCOT. *2010 ERCOT Target Reserve Margin Study.* Electric Reliability Council of Texas, Inc., 2010.
- ERCOT Hourly Load Data Archive, ERCOT Balancing Energy Services Market Clearing Prices. Archive, EIA-423 Electric Power Monthly.
- Hirst, E. *A Good Integrated Resource Plan: Guidelines for Electric Utilities and Regulators*. Oak Ridge National Laboratory. December 1992.
- Hornby, R., D. Hurley, and P. Knight. *A Review of Demand Response Potential in the United States.* Synapse Energy Economics, Inc. Prepared for the U.S. Environmental Protection Agency. 2011.

References (continued)

- Minnesota Power. *Minnesota Power's 2009 Annual Electric Utility Report (Advance Forecast Report – AFR).* July 2009.
- NERC. *2012 Summer Reliability Assessment.* Atlanta: North American Electric Reliability Corporation, 2012.
- NERC. *Reliability Assessment 1991-2000: The Future of Bulk Electric System Reliability in North America.* North American Electric Reliability Council, 1991.
- NERC. *Reliability Assessment Guidebook Version 2.1.* Princeton, NJ: North American Electric Reliability Corporation, 2010.
- Peterson, P., and R. 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.
- Peterson, P., D. Hurley, S. Jackson, and M. Schultz. *The Road to Better System Planning: ISO-New England's Revised Energy Efficiency Forecast.* Synapse Energy Economics, Inc. Prepared for Connecticut Office of Consumer Counsel. April 2012.
- Vermont Department of Public Service. Vermont Comprehensive Energy Plan 2011: Facts, Analysis and Recommendations, Volume 2. Public Review Draft. 2011.

References (continued)

- White, D., D. Hurley, and J. Fisher. *Economic Analysis of Schiller Station Coal Units*. Synapse Energy Economics, Inc. Prepared for Conservation Law Foundation, July 2011.
- Wilson, R., P. Luckow, B. Biewald, F. Ackerman, and E. Hausman. *2012 Carbon Dioxide Price Forecast.* Synapse Energy Economics, Inc. October 2012.
- Woolf, T. Energy Efficiency Cost Effectiveness: Updating the Standard in MA in Light of the GWSA. Synapse Energy Economics, Inc. September 2011.

Synapse reports are available at www.synapse-energy.com.

