Risk Metrics for Electric Supply Portfolios and their Application in Policy Making

New York DPS Workshop in Case 06-M-1017

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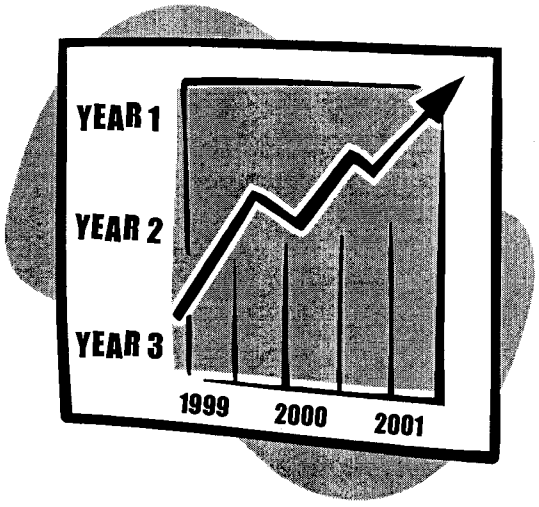
Overview

1. Choosing an electric supply portfolio
2. Risk metrics for electric supply portfolios
   - Data issues
   - Potential metrics
   - Examples of applications
   - Available software
3. Conclusions



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Overview

This presentation draws from ***Portfolio Management: Tools and Practices for Regulators***, September 2006, which Synapse prepared for the National Association of Regulatory Utility Commissioners (NARUC).

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Overview

Portfolio Management: Tools and Practices for Regulators describes:

- Portfolio Management
- Data, Models, and Tools for Portfolio Management
- Expertise and Staffing for Managers and Regulators
- Next Steps for Regulators
- Portfolio Management Activities in Selected States

For the report Synapse reviewed selected jurisdictions with retail access (NJ, ME, IL, MD, DC, DE, MA, TX, NY) and with full regulation (AL, CA, FL, HI, ID, IN, KY, LA, MN, MT, NC, OR, SC, UT, WA, BC).

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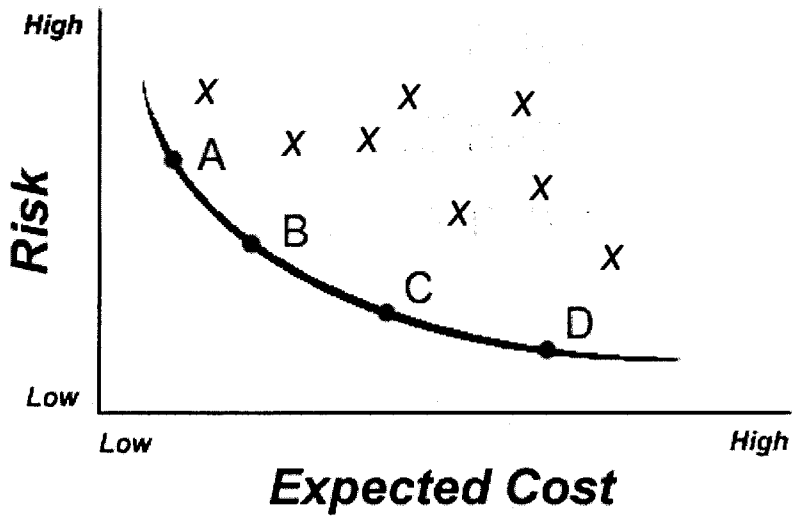
Choosing an Electric Supply Portfolio

There are numerous "optimal" portfolios. Each has an optimal expected cost for a given risk level:

Example of Resource Plan Trade-off Curve



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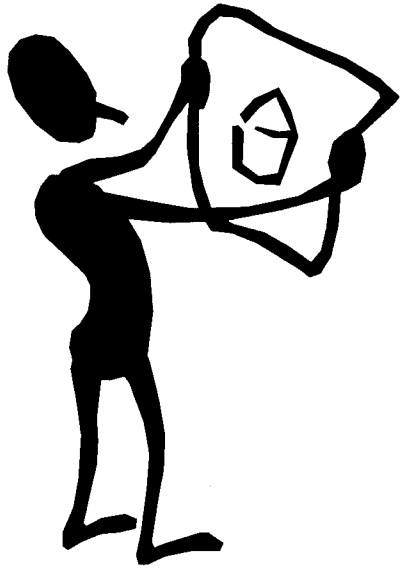
Choosing an Electric Supply Portfolio

Policy Issues

- What is a reasonable balance or trade-off between price stability and price volatility? (e.g. issue 2, page 6 of August 28, 2006 order)
- What is the appropriate planning horizon? (e.g. issue 6, page 7 of August 28, 2006 order)
- Should we measure electric price volatility and if so how? (e.g. issue 3, page 6 of August 28, 2006 order)



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Choosing an Electric Supply Portfolio

- The problem of addressing risk in supply portfolios, and the associated policy issues, are neither new nor unique to either the electric industry or New York.
- In recent years stakeholders have begun placing greater emphasis on quantifying risk in order to improve transparency and decision-making.
- **The selection of a "reasonable" portfolio would be greatly informed and assisted by empirical data on the risk tolerance of the retail customers to be served.**

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Choosing an Electric Supply Portfolio

Parties are trying to choose the electric supply portfolio which offers the "best" combination of cost and risk under a range of possible future conditions.

Example:

- Plan A – high percentage of spot purchases
- Plan B – high percentage of hedges
- Plan B has a higher expected price but less exposure to extremely high prices

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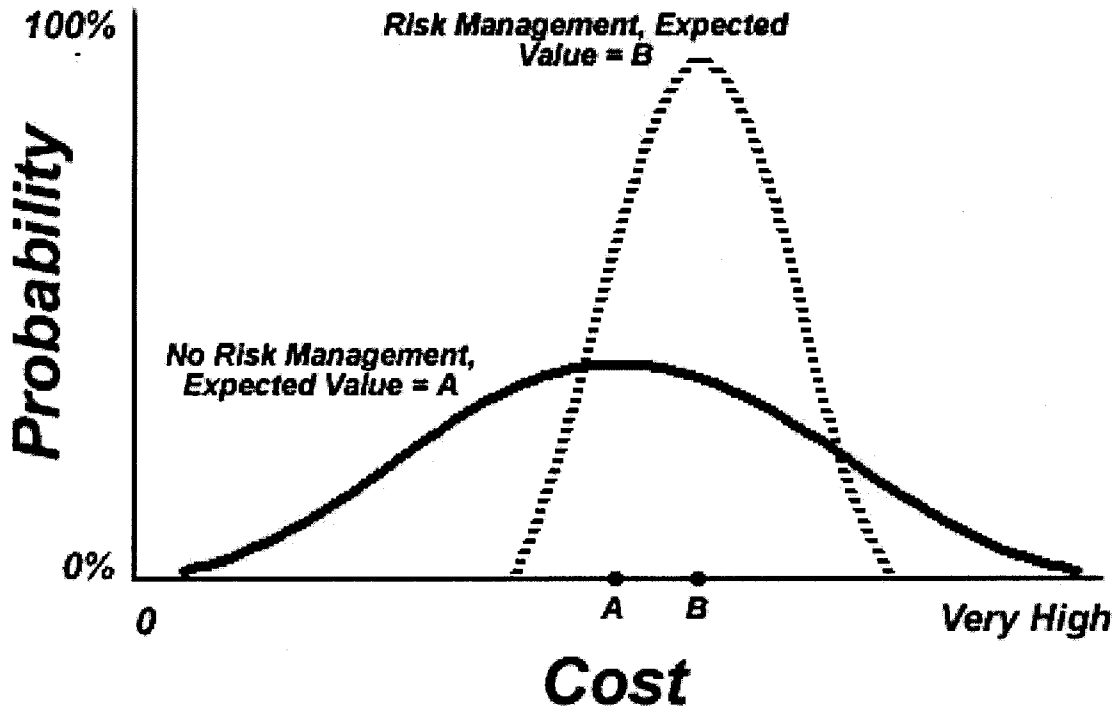
Choosing an Electric Supply Portfolio

Illustrative probability distributions



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Choosing an Electric Supply Portfolio

- The selection process is complicated by the fact that every aspect of the future is uncertain, e.g.,
  - Load
  - Fuel prices
  - Greenhouse gas regulations
  - Electricity market prices
  - In-service dates and costs of new capacity

- Moreover, some aspects are much more difficult to predict accurately than others. For example, past natural gas prices have not been good indicators of future natural gas prices.

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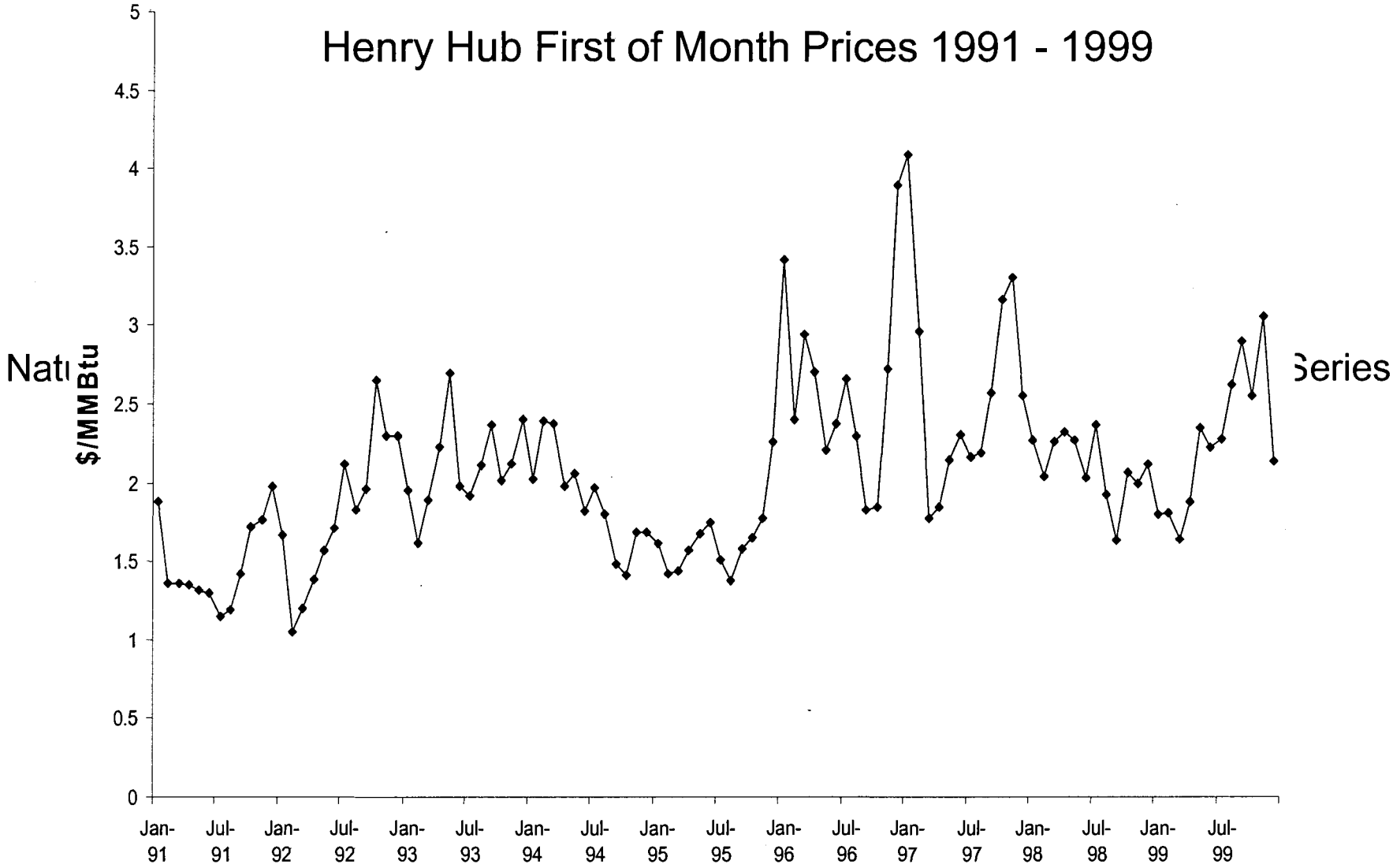
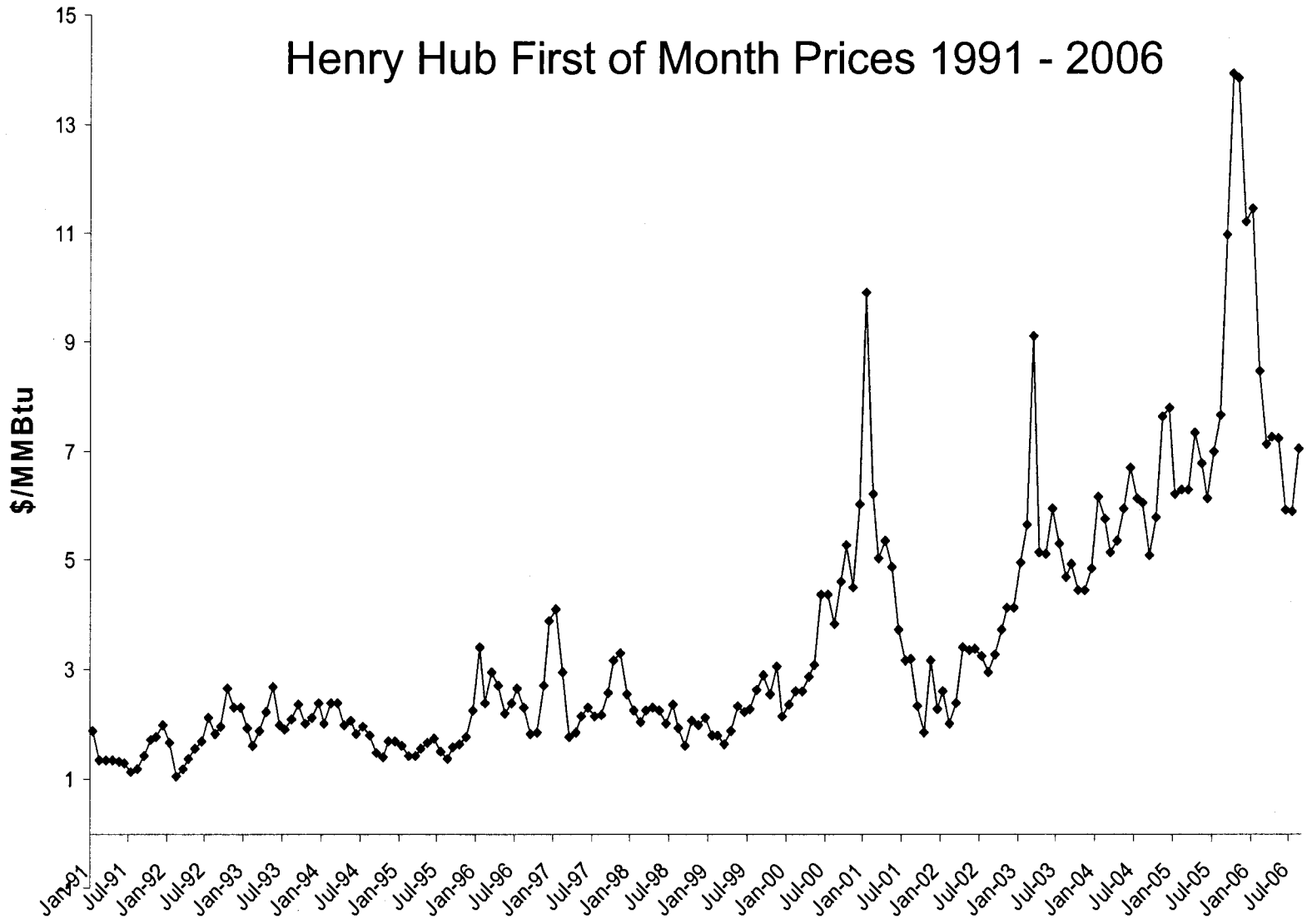
Risk Metrics for Electric Supply Portfolios



Risk Metrics for Electric Supply Portfolios



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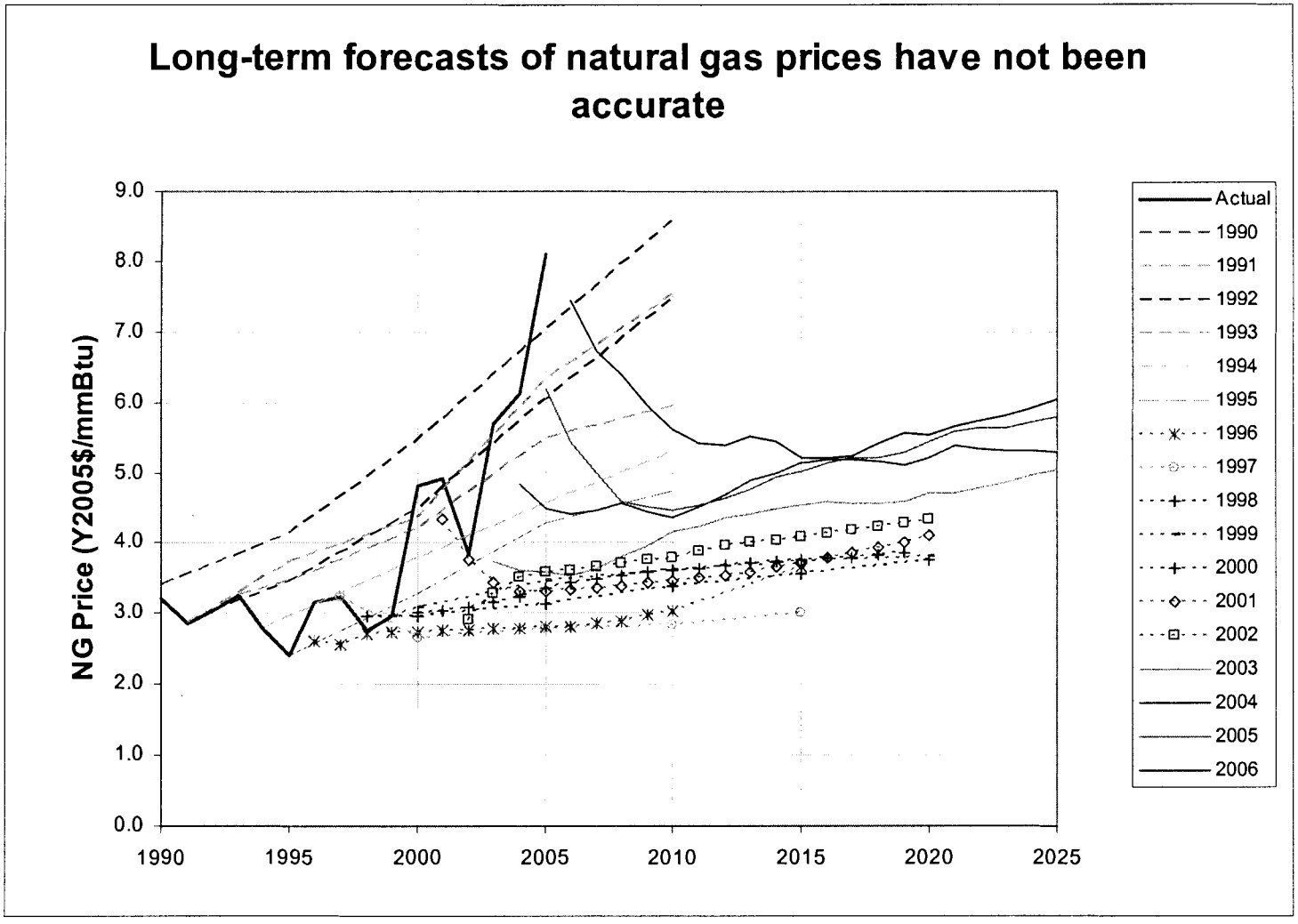
Risk Metrics for Electric Supply Portfolios



Source: Compiled by Synapse from EIA Annual Energy Outlook reports.

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Risk Metrics for Electric Supply Portfolios

- General agreement on appropriate measure of cost - present value of expected revenue requirements

- No general agreement on appropriate measure of risk. For example, see *The Trouble with Risk Measures* by Andy Dunn in October 2006 Public Utilities Fortnightly.

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Risk Metrics for Electric Supply Portfolios

A Few of the Numerous Possible Measures of Risk	
Coefficient of Variation (CV)	Measures variation in price relative to mean price over a defined period. For example a fixed price would have a CV of 0.
Beta	Measures volatility of portfolio relative to volatility of an index. Does not capture risk of the portfolio independent of market risk.
Extreme Value	Measures the difference between expected cost and some estimate of worst-case cost.
Value at risk	The maximum reduction in value (or increase in supply cost) that could occur over a specified period at a given confidence level.

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Risk Metrics for Electric Supply Portfolios

Jurisdictions using quantitative measures of risk

	California	Montana, Oregon, Washington
Application (years)	Short (1 to 3 years)	Long (15 to 20 years)
Risk Measure	teVAR (value at risk to expiration of positions)	$TailVaR_{90}$ (Average NPV of worst 10% of outcomes)

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Risk Metrics for Electric Supply Portfolios

- VaR can be used to measure the cost increase that has a certain probability of occurring (risk level) during a certain time period.
- For example the VaR for a 1 year horizon at the 85% level is the extra cost a portfolio has a 15% chance of incurring over the next year.
- Inputs to calculation of VAR of a portfolio
  - Estimations of correlation and volatility
  - Probability distributions (Representative distributions can be created using Monte Carlo simulation and other methods).

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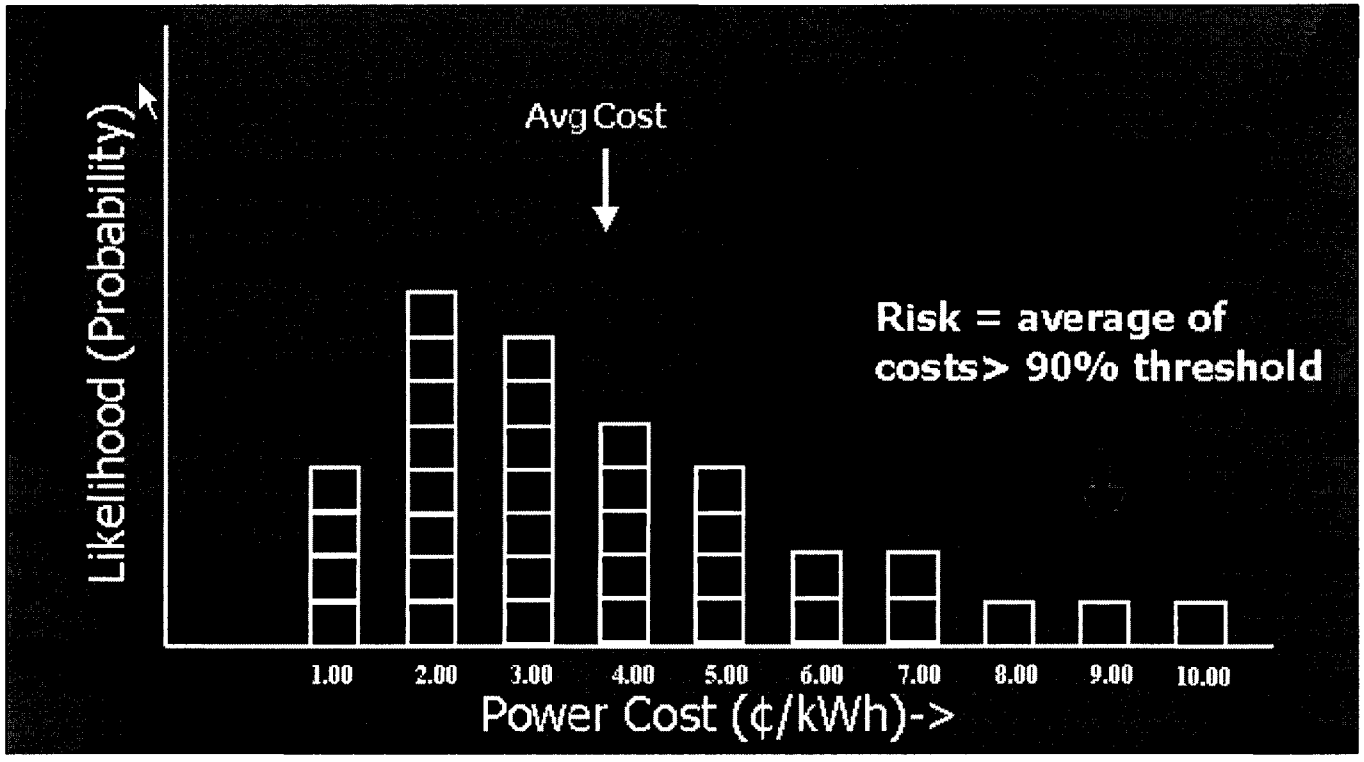
Risk Metrics for Electric Supply Portfolios

$TailVaR_{90}$ example (Source – NWPCC)



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Risk Metrics for Electric Supply Portfolios

Planning and Risk Management Software	
Primarily Risk Management in Short-term	
Model	Company
BookRunner	Risk Advisory www.riskadvisory.com
Edur	OpenLink www.olf.com/energy
Epsilon & Entegrate	SunGard www.sungard.com
ICTS Symphony	Trade Capture www.tradecapture.com

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Risk Metrics for Electric Supply Portfolios

Planning and Risk Management Software	
Planning and Risk Management in long-term	
Model	Company
Electric Generation Expansion System (EGEAS)	Electric Power Research Institute www.epri.org
PowerBase Suite	New Energy – Siemens www.newenergyassoc.com
EnerPrise Capacity Expansion	Global Energy Decisions www.globalenergy.com
AURORA	EPIS www.epis.com
RISKMIN	Electric Power Research Institute www.epri.com
Planning and Risk	Global Energy Decisions www.globalenergy.com
Kiodex Risk Workbench	Sungard Kiodex www.sungard.com/kiodex
NWPCC Regional Portfolio Model	Northwest Power & Conservation Council www.nwcouncil.org
PLEXOS for Power Systems	Plexos www.plexossolutions.com
Energy 2020	www.energy2020.org

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Conclusions

- There are multiple "optimal" supply portfolios.
- Risk metrics and software are available to identify and evaluate them.
- Metrics, software and their results are only as good as the input data.
- Keep it simple.

Thank you!

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Rick is a Senior Consultant at Synapse Energy Economics. Rick has also worked as a regulatory consultant with CRA International, formerly Tabors Caramanis & Associates, and with the Tellus Institute. He specializes in planning, market structure, ratemaking and contracting in the electricity and natural gas industries. Over the past 20 years he has provided expert testimony and litigation support on these issues in approximately 100 proceedings on behalf of utility regulators, consumer advocates, energy marketers, gas producers, and utilities.

Earlier in his career he served as Assistant Deputy Minister of Energy with the Province of Nova Scotia and as a Member of the Canada-Nova Scotia Offshore Oil and Gas Board.

Rick has a Master of Science in Technology and Policy from MIT and a Bachelor of Industrial Engineering from Dalhousie University.