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Risk and Resource Planning

An overview of the application of risk management principals and state-of-the-art analytical techniques to the resource procurement process

Presented to:

The California Public Utilities' Commission

23 April 2003

Richard Lauckhart

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HENWOOD…

- Provides software for electric industry analysis
- Provides data for electric industry analysis
- Provides consulting in electric industry analysis
- Particularly focused on Risk Analysis in the electric industry

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Our Subject Matter

- Fundamental risks faced by utilities
- Direct Cash Flow Risks that can be quantified and analyzed
- Not indirect Risks
  - Regulatory Risk
  - Legal Risk
  - Technology Change Risk
  - Departing Load Risk/Competitive Risk
  - Human Risk
  - Safety Risk

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Value at Risk vs. Cash Flow at Risk

(A definitional issue)

	VaR	CFaR
Type of Assets	Liquid, trading	Illiquid, for physical delivery
Position Value Metric	Asset Market Value	Sum of Cash Flows
Portfolio Risk Metric	Maximum expected loss from present (or benchmark) value with X% confidence	Maximum expected loss from benchmark value with X% confidence
Time Horizon	Days	Months, Years
Valuation Methods	Mark to Market	Mark to Model
Estimation Methods	1. Covariance 2. Monte Carlo	1. Monte Carlo 2. Weighted Scenarios

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Utility Risk Valuation

The attributes below and prior table demonstrate "Cash Flow at Risk" is the right measure

- Utilities have generation assets that are
  - Complicated
  - Face illiquid markets for their attributes
  - Associated with significant market volatility
- Generation assets are subject to forced outage or rainfall variation that are not easily hedged
- Utilities have retail load assets/revenue streams that are subject to weather caused volatility and are not easily hedged or sold
- Utilities have QF and other bilateral power contracts that are not liquid and which may be subject to uncertain availability (e.g. wind)
- Utility Risks are generally perceived to relate to extended time periods (e.g. months and years rather than risk associated with a change in value between today and tomorrow)
- Utility risk is generally measured in cash flow volatility rather than "mark to market" of a financial product

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Key Risk Drivers for Utilities

- Load Volatility
- Fuel Price Volatility
- Spot Market Price Volatility
- Hydro Generation Quantity Volatility
- Emission Cost Volatility
- Power Plant Availability

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Modeling Key Drivers

- Develop expected levels of key drivers
  - E.g. load, gas price, spot electricity price, hydro, etc.
- Develop volatility parameters for these drivers
  - Short Term parameters
    - Normal, lognormal, Markov Regime Switching, etc. as appropriate
    - Mean Reversion
    - Correlation Factors
  - Long Term
- Run large number of iterations using Monte Carlo

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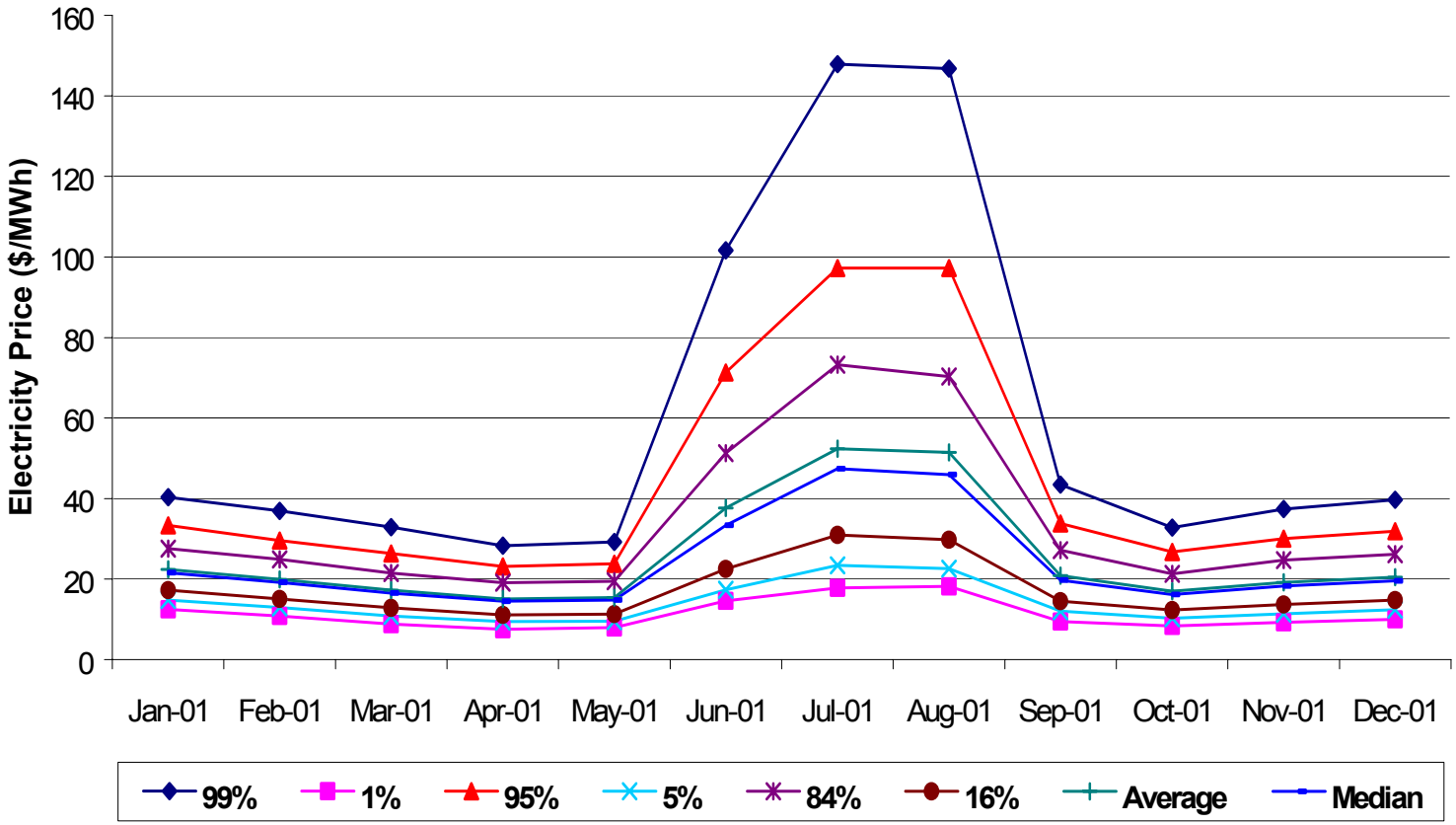
Results of Markov Regime-Switching Mean Reversion Model Seasonal Electricity Price Distribution



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How is Cash Flow at Risk Computed?

- Simulate the uncertain key drivers for a number of iterations
- Compute the utility operating results for all the iterations
- Compute the NPV of each iteration
- View the results as a probability density

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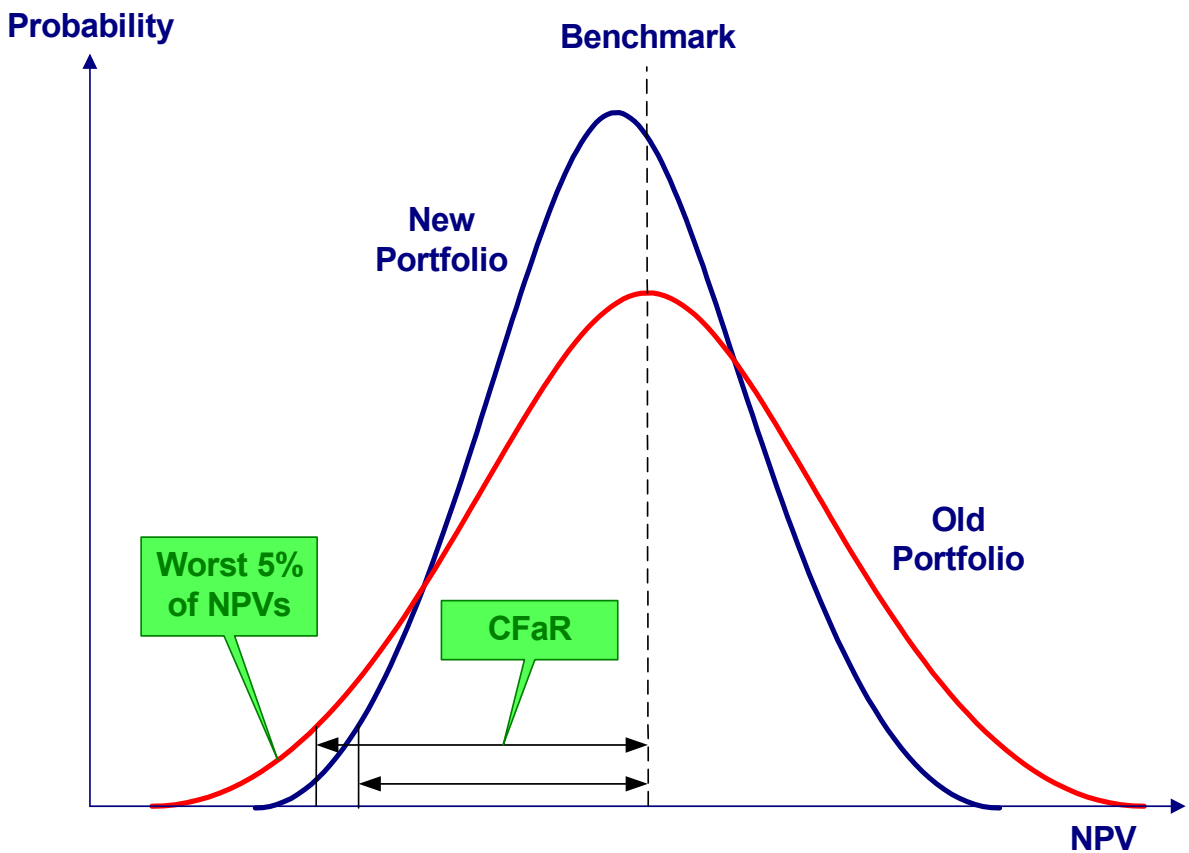
Cash Flow at Risk- different levels of risk



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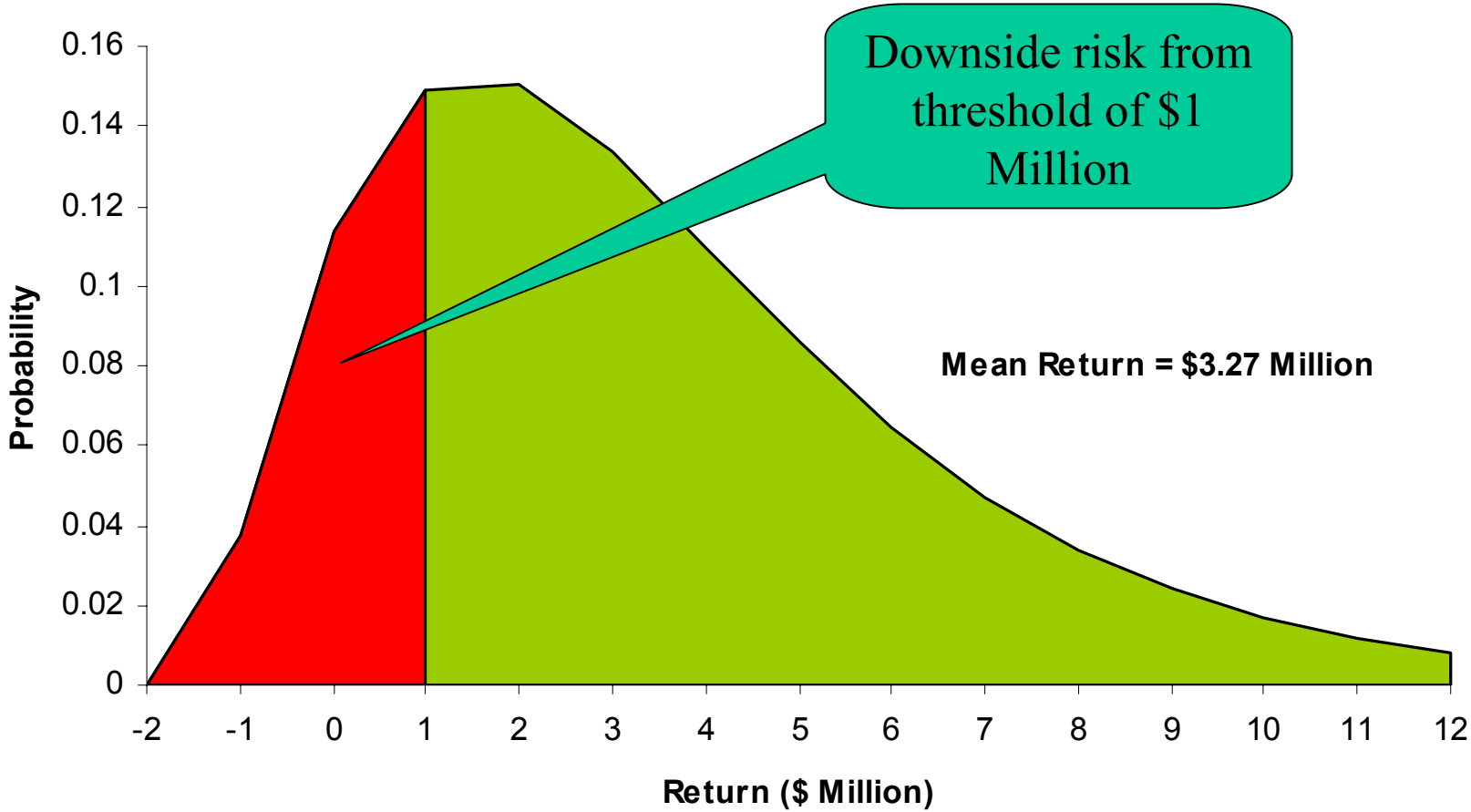
Risk Measures

Cash Flow at Risk – Downside



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Uses of Distribution of Cash Flow

- Monitor changes (like a trading group does) in the cash flow due to:
  - Changes in expected spot prices
  - Plant breakdown
  - New transactions or power plants
- Evaluation of possible new transactions/contracts, etc.
- Rate considerations/budgeting

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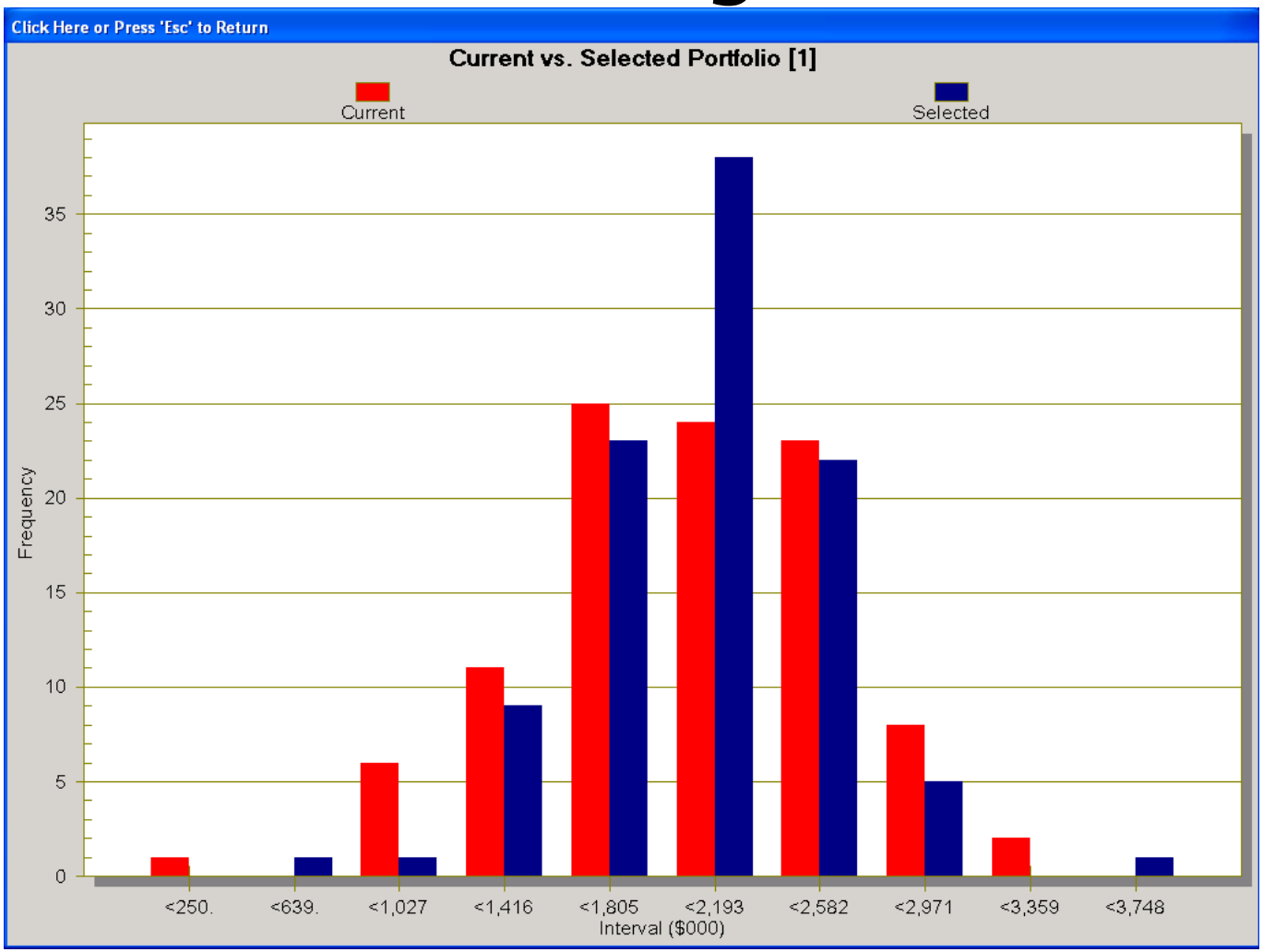
Example Use – Possible Portfolio Change



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Summary

- "Cash Flow at Risk" is the right measure to use for utilities
  - "mark-to-market" risk analysis associated with trades only provides part of the picture (the easy part)
  - Monte Carlo simulation of key risk drivers for Utilities is needed

- Use to
  - Monitor changes occurring over the indicated time horizon
  - Evaluate changes to portfolio (e.g. IRP)
  - Address rate considerations and budgeting (e.g. Tariffs)
  - Develop a hedging program that deals directly with uncertainty of complex assets

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