Northwest Power and Conservation Council

Tuesday, February 27, 2007

MEMORANDUM

TO: Power Committee

FROM: Michael Schilmoeller

SUBJECT: Analysis Of The Enhanced Value Of Conservation For Addressing Risks

A customary standard for the cost effectiveness of conservation is the market price for electricity. The Fifth Power Plan, however, found that the cost effectiveness level for conservation could exceed the market price for electricity in low-risk resource plans. That is, those plans that allowed above-market cost-effectiveness levels for conservation had greater value, which reduced the cost necessary to achieve a given level of economic risk. Since publishing the Plan, various parties have expressed interest in what contributes to this enhanced value of conservation. The question is of special significance to organizations like the Energy Trust of Oregon, which has adopted the Council's approach and is advocating its use by the Oregon Public Utility Commission. This presentation summarizes a study performed to answer that question. No action or decision on the part of the Committee is necessary.

The study finds that the enhanced value of conservation stems primarily from deferral of single-cycle combustion turbines (SCCTs) that would otherwise perform the function of risk mitigation. There are also two other, smaller effects: the benefit that reduced market prices have on system cost and the increase in costs due to acquisition of additional conservation. These effects are roughly of the same magnitude and tend to offset each other.

The presentation will provide background on the Council's approach to risk and will explain the relative advantages of conservation over SCCTs in low-risk plans.

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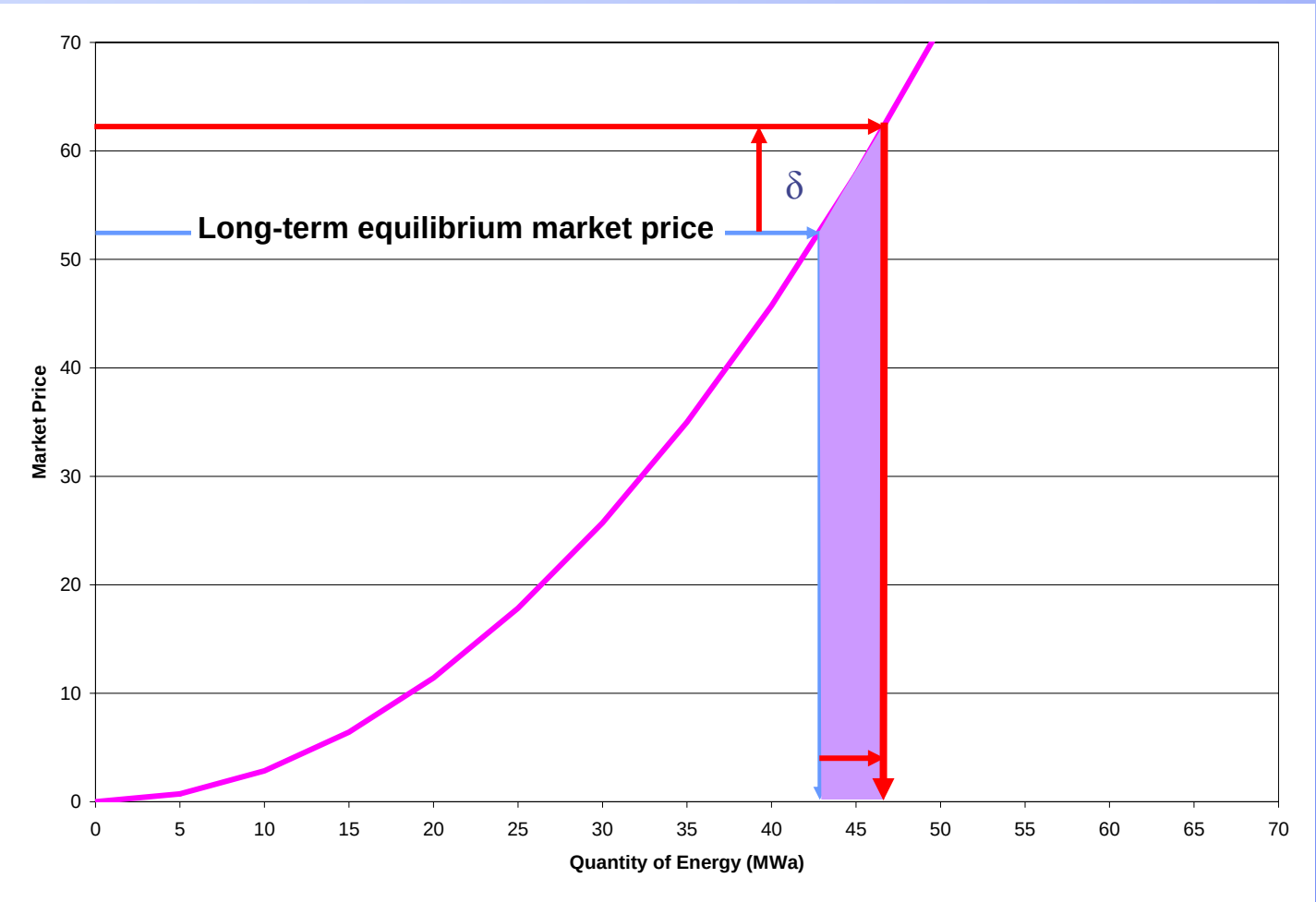
Enhanced Value of Conservation for Addressing Risk

Michael Schilmoeller

Power Committee

March 13, 2007

Conservation Supply Curve



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Overview

- Average market price: $45/MWh
- Average cost of discretionary conservation purchased at up to $5/MWh over market: $45/MWh
- Average cost of lost opportunity conservation purchased at up to $10/MWh over market: $51/MWh

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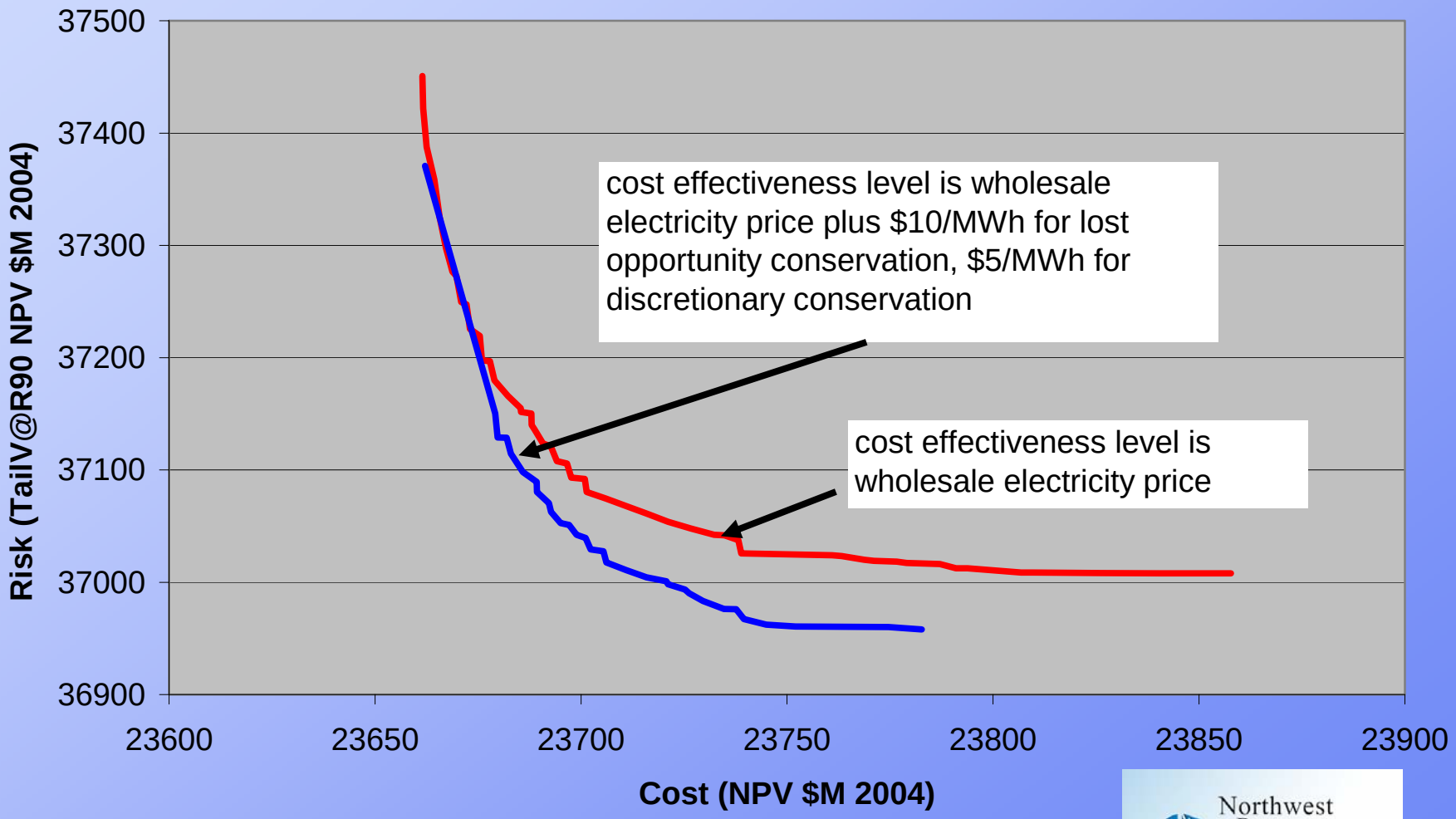
The Effect of Additional Conservation on the Efficient Frontier



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Overview

- Background on the Council's approach to regional modeling and risk management
- Analysis of enhanced value of conservation

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Background on the Efficient Frontier

Because we face uncertainty, we need to find "*Plans*" that perform well over wide range of possible *"Futures"*

- *Futures* -- possible combinations of hydro conditions, loads, fuel prices, market prices, CO2 penalties and so on over planning period
- *Plans* – types and amounts of resources and earliest "be prepared to start construction" dates (options)

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…And a Bit More Abstractly…

- *Futures* – circumstances over which the decision maker has no control that will affect the outcome of decisions
- *Plans* – actions and policies over which the decision maker has control that will affect the outcome of decisions

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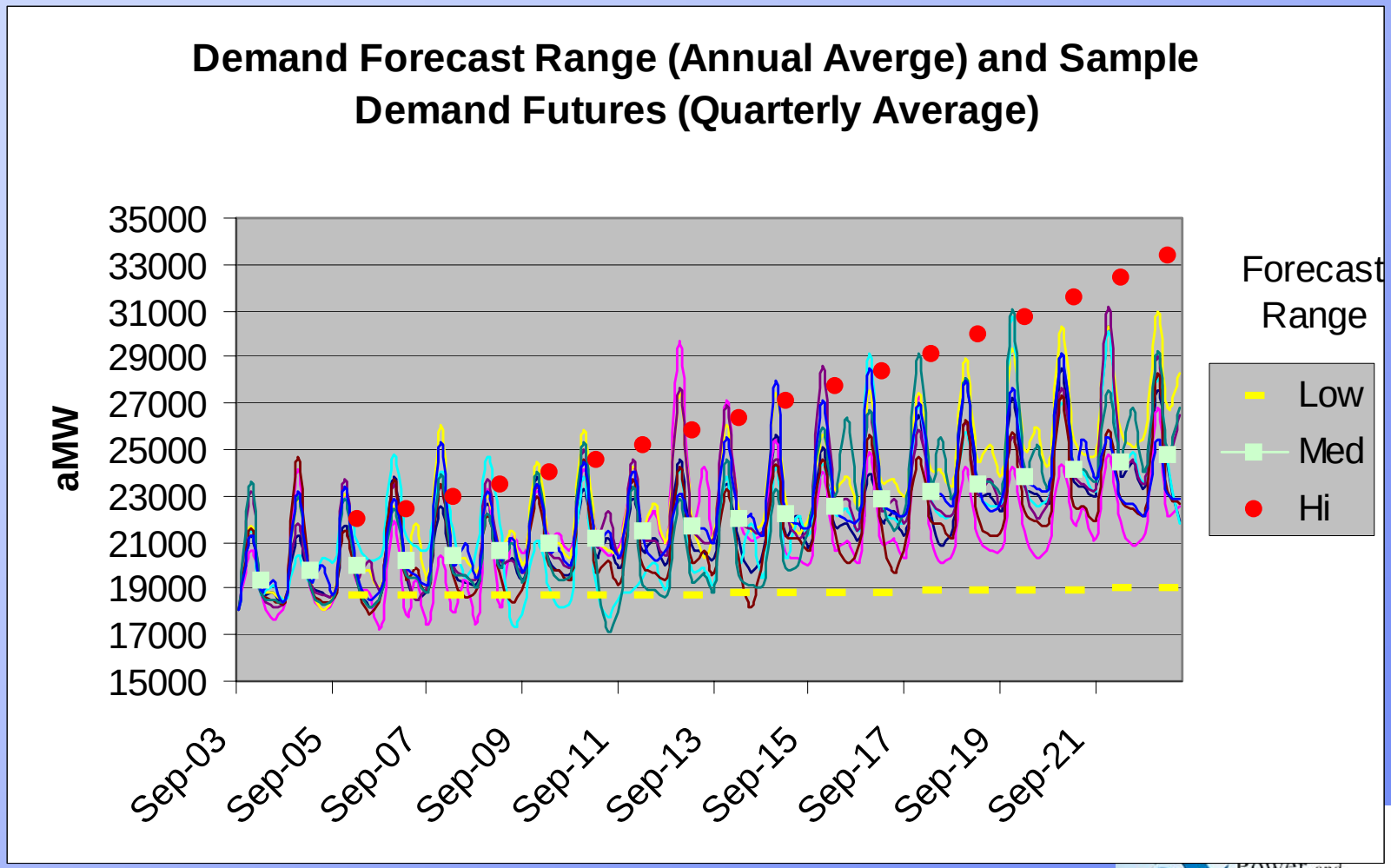
Example: Demand Uncertainty



Sources of Uncertainty

Load requirements
Gas price
Hydrogeneration
Electricity price
Forced outage rates
Aluminum price
CO2 tax
Production tax credits
Green tag value

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Plans

Resource	Characteristics	12/07	12/09	12/11	12/13	12/15	12/17	12/19
Gas CCCT	High efficiency, moderate capital cost, moderate lead time, moderate fuel cost			475	475	950	950	950
Gas SCCT	Moderate efficiency, low capital cost, short lead time, high fuel cost							
Coal	Moderate efficiency, high capital cost, long lead time, low fuel cost							
Wind	High capital cost, short lead time, zero fuel costs, intermittent				180	450	540	540
Conservation	Cost effectiveness level vs market	588	882	1176	1470	1725	1941	2157
Total		588	882	1651	2125	3125	3431	3647

These dates represent the earliest that construction would begin. All siting, licensing, and other preparation must be completed by these dates. The earliest in-service dates are 2 years later for CCCT, 1 year for SCCT, 3 years six months for Coal, and 1 year for Wind, due to construction time requirements.

All resources stated in cumulative energy (MWa). CCCT values assume five percent forced outage rate; Wind values assume a 30 percent availability.

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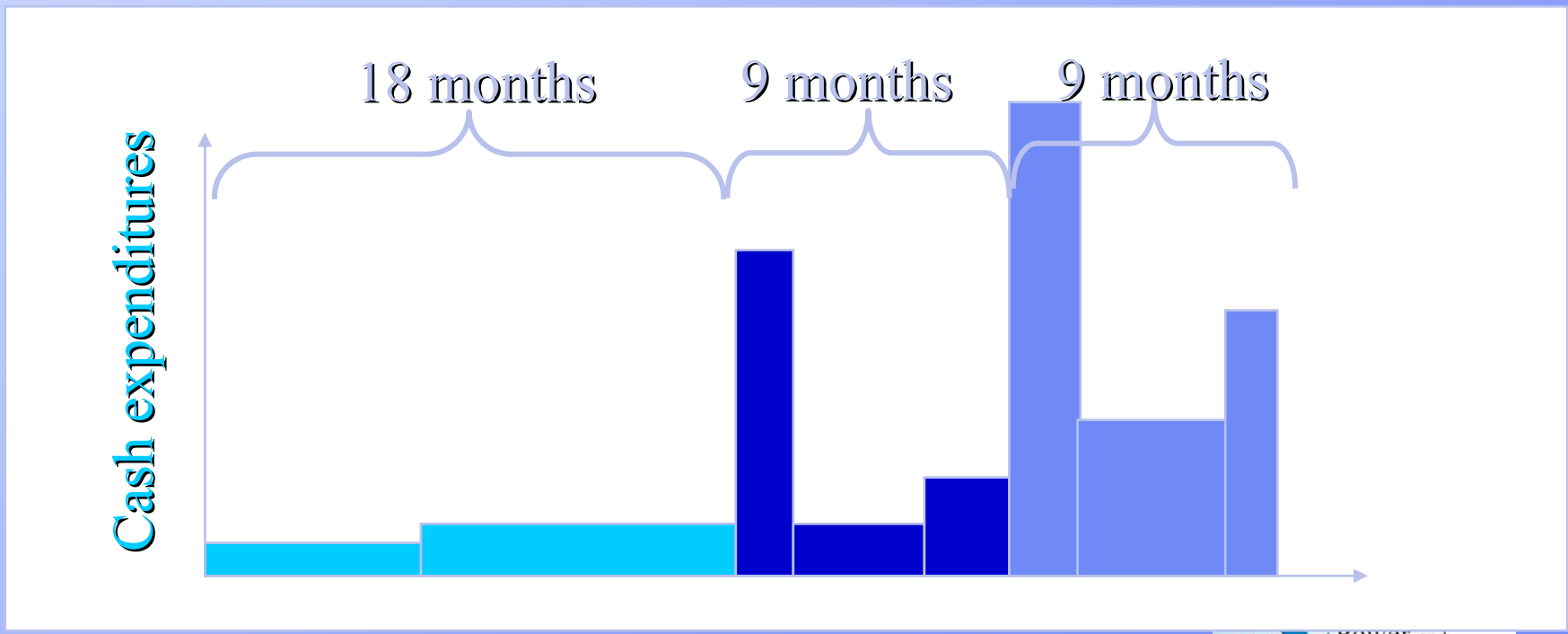
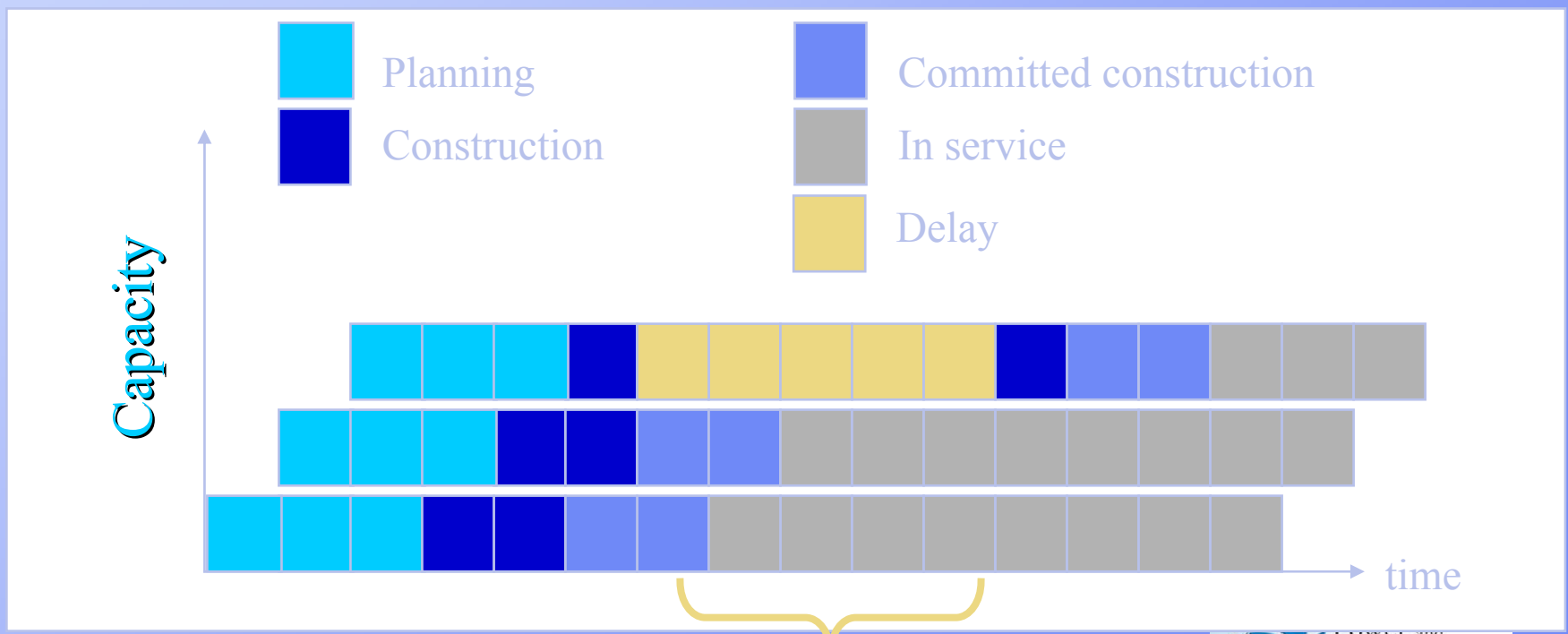
The Construction Cycle

- After an initial planning period, there typically large expenditures, such as for turbines or boilers, that mark decision points.



Modeling Cohorts

- Each period can have a cohort of plants, usually of different size or capacity
- All cohorts will be affected by changing circumstances, but may be at different stages of development



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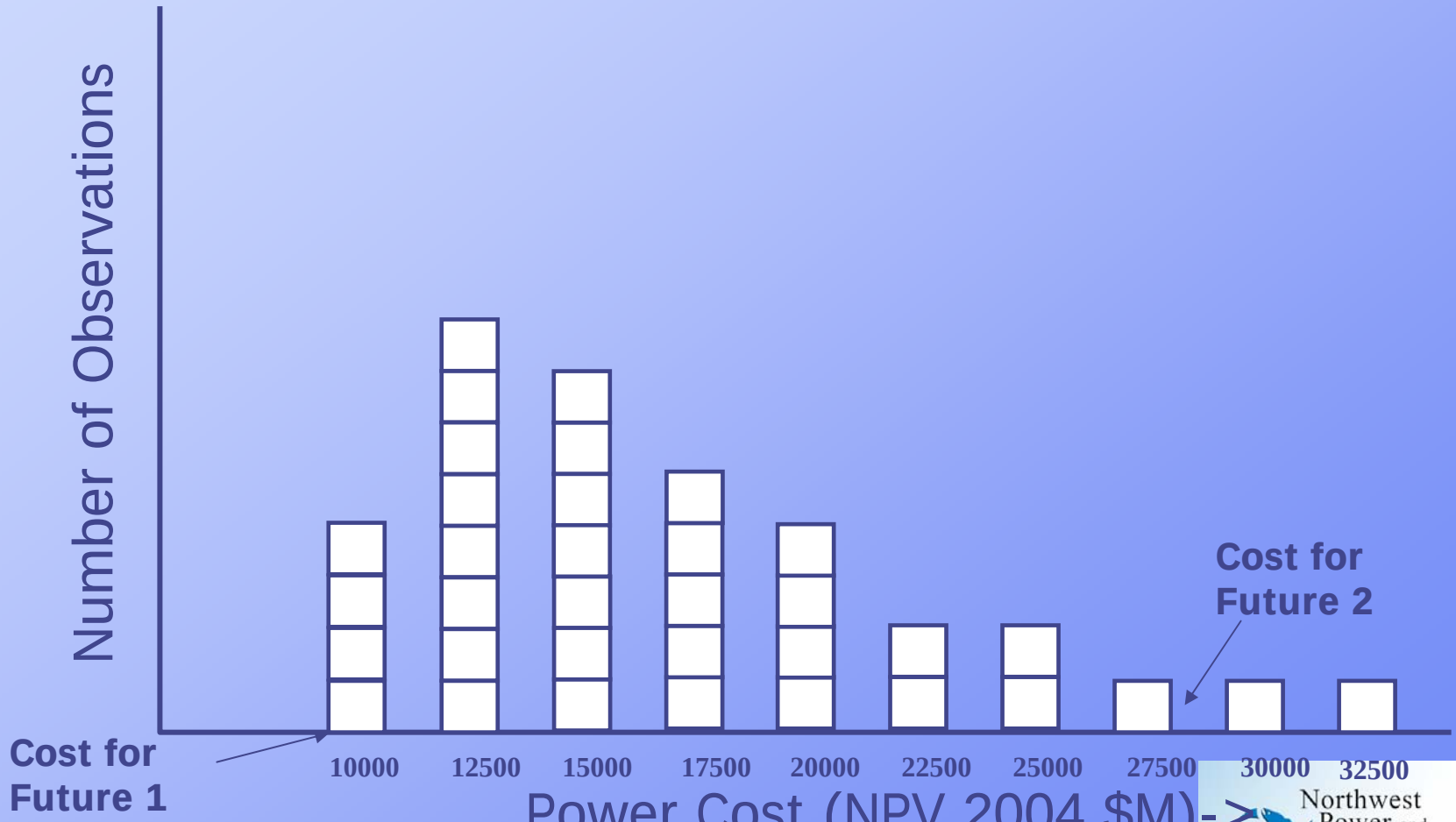
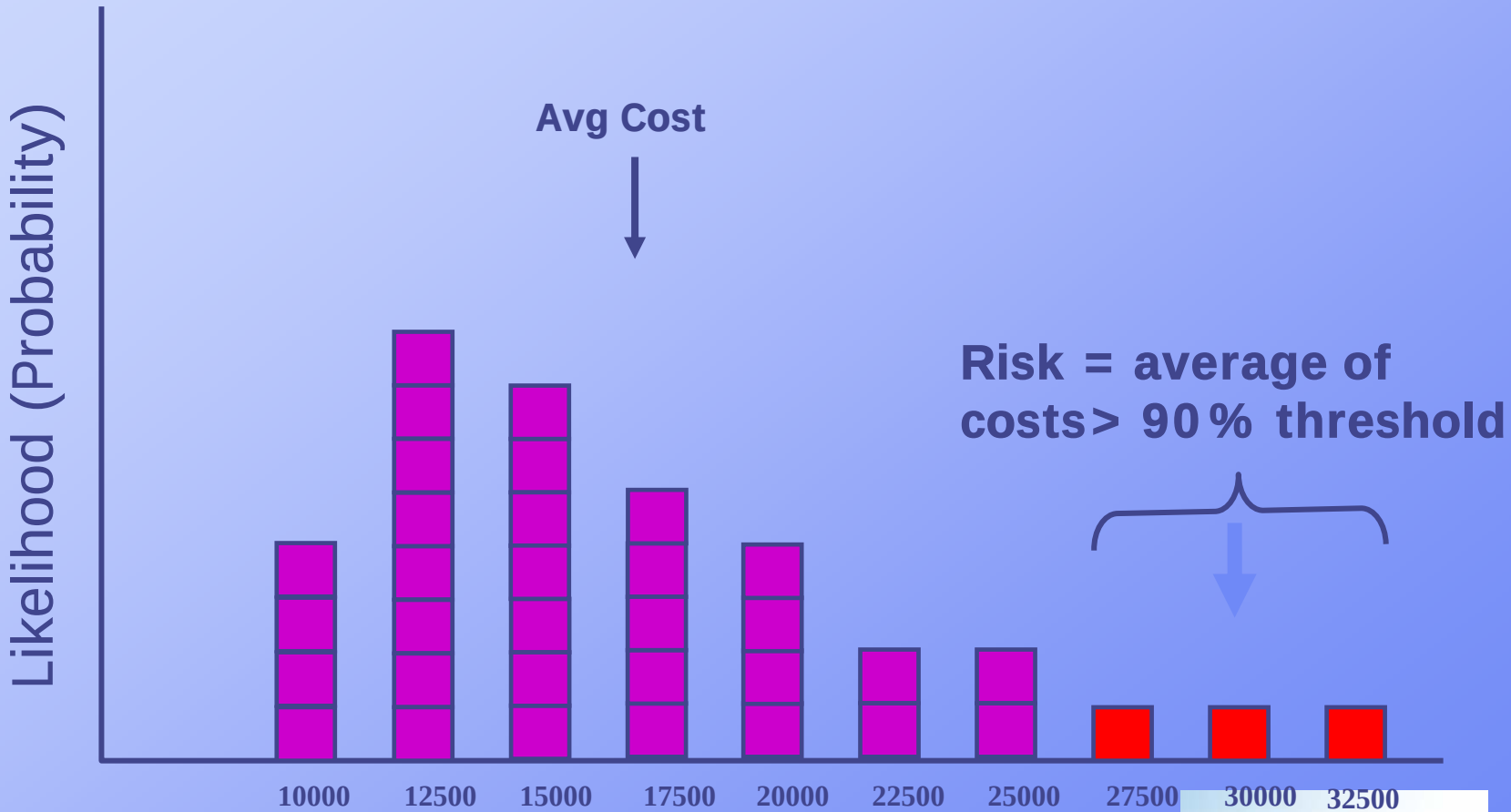
Algorithms

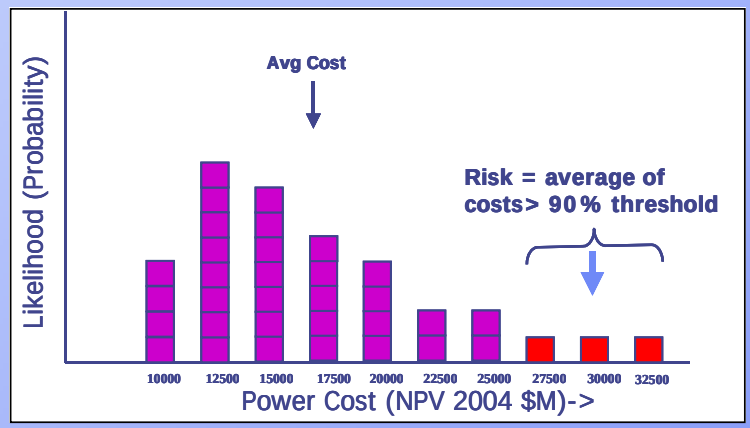
Distribution of Cost for a Plan



Risk and Expected Cost Associated With A Plan



Feasibility Space



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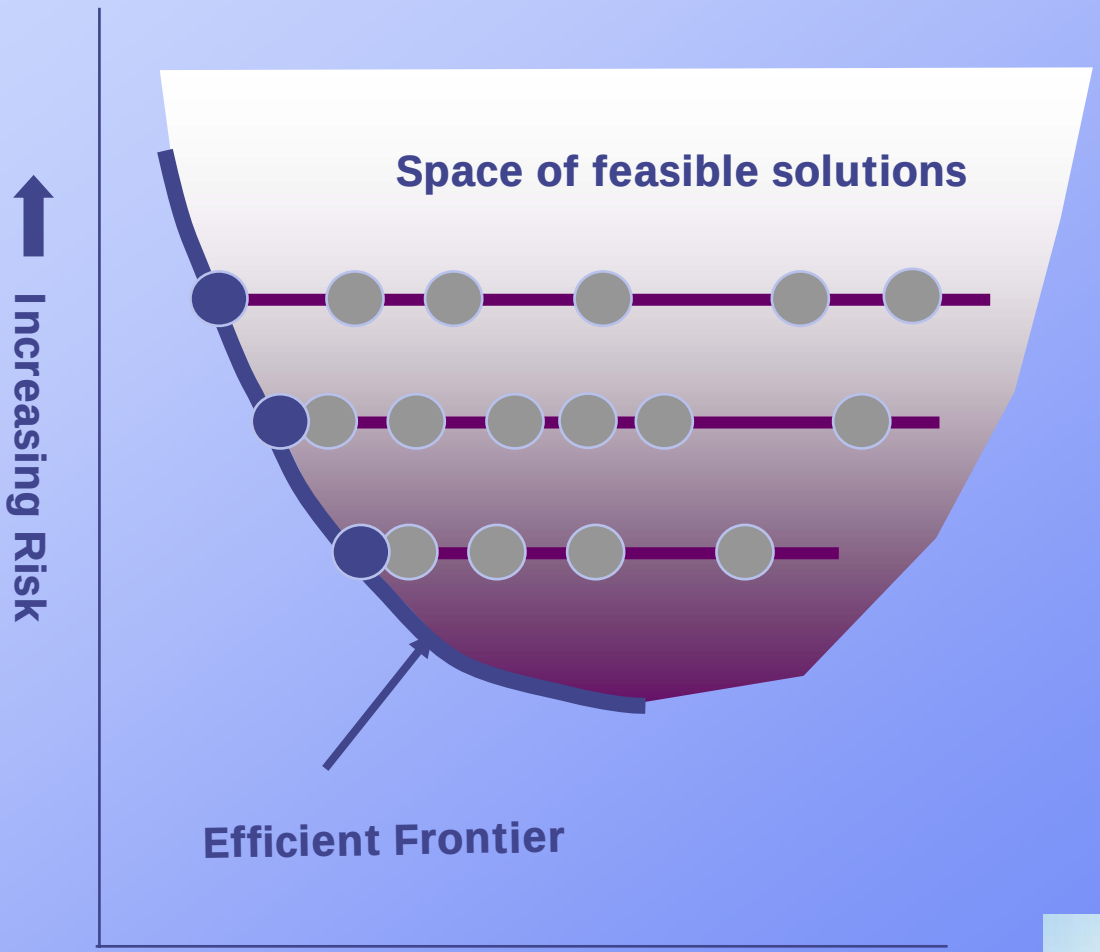
Feasibility Space



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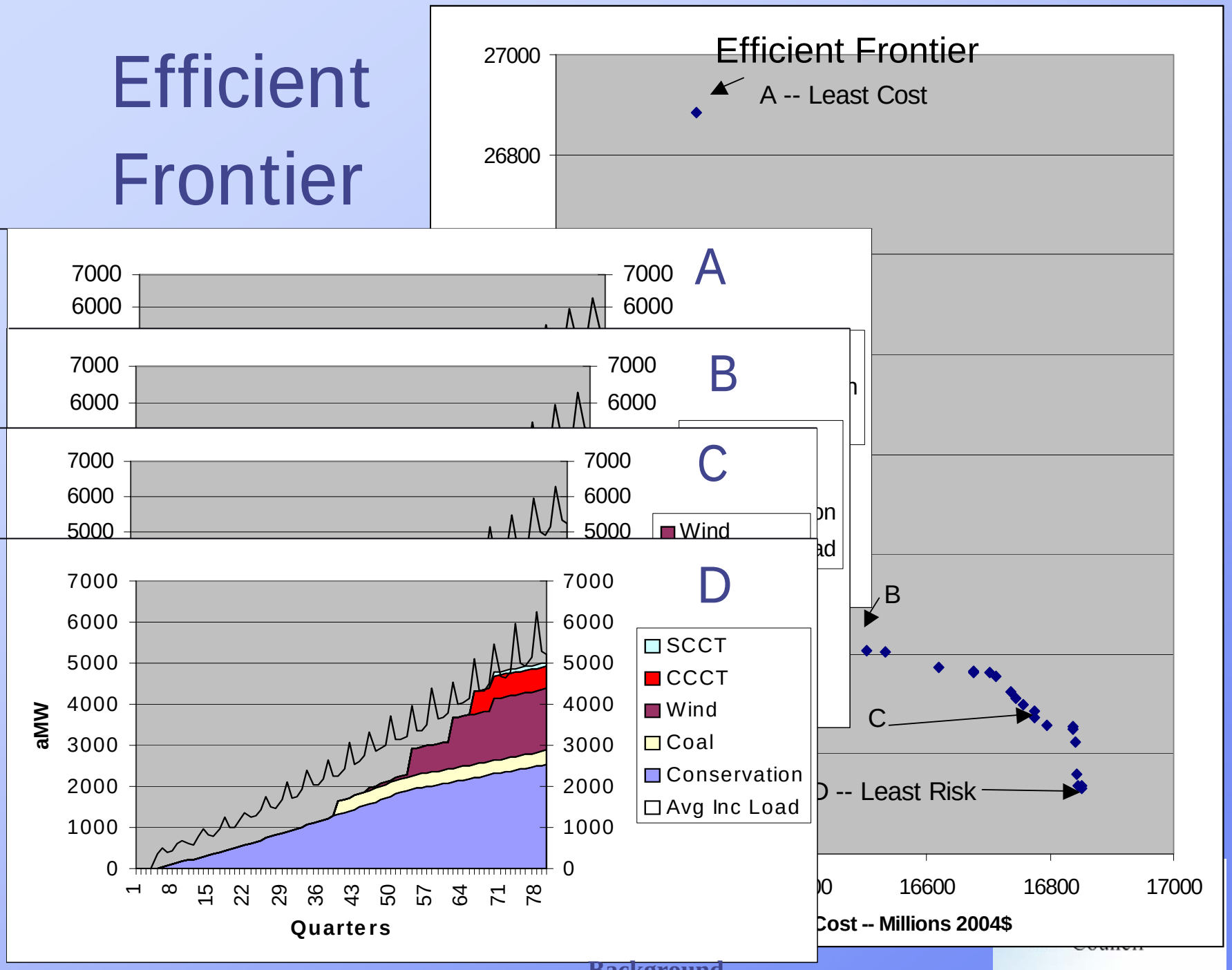
Efficient Frontier



Spinner Graphs

- Are a collection of Excel graphs that illustrate all of the relevant uncertainties and outcomes associated with a given plan, across all futures
- Illustrate “Scenario analysis on steroids”
- Link to L28X-f1232 (D)_P.xls

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Overview

- Background on the Council's approach to regional modeling and its emphasis on risk
- Analysis of enhanced value of conservation

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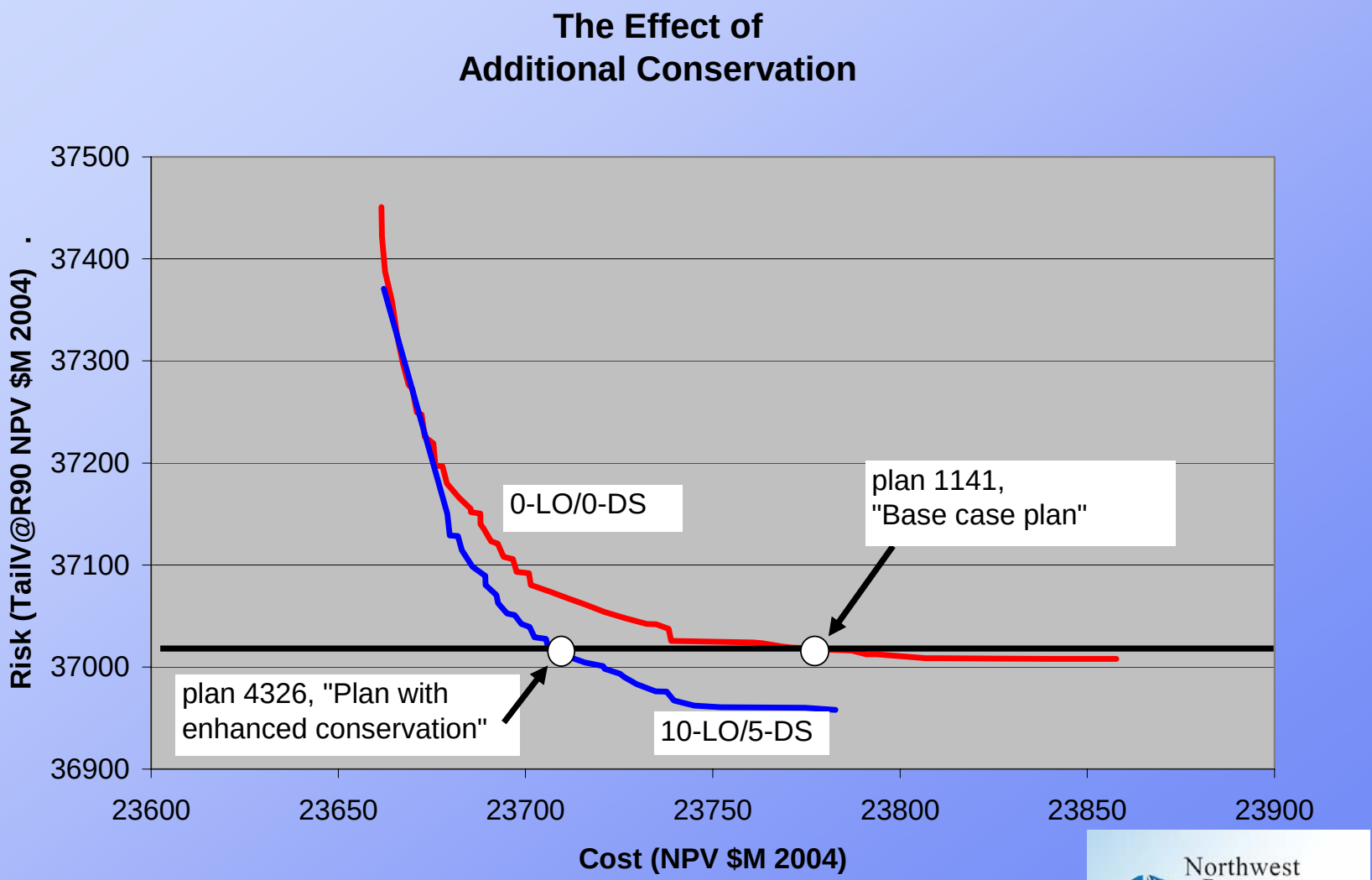
Analysis



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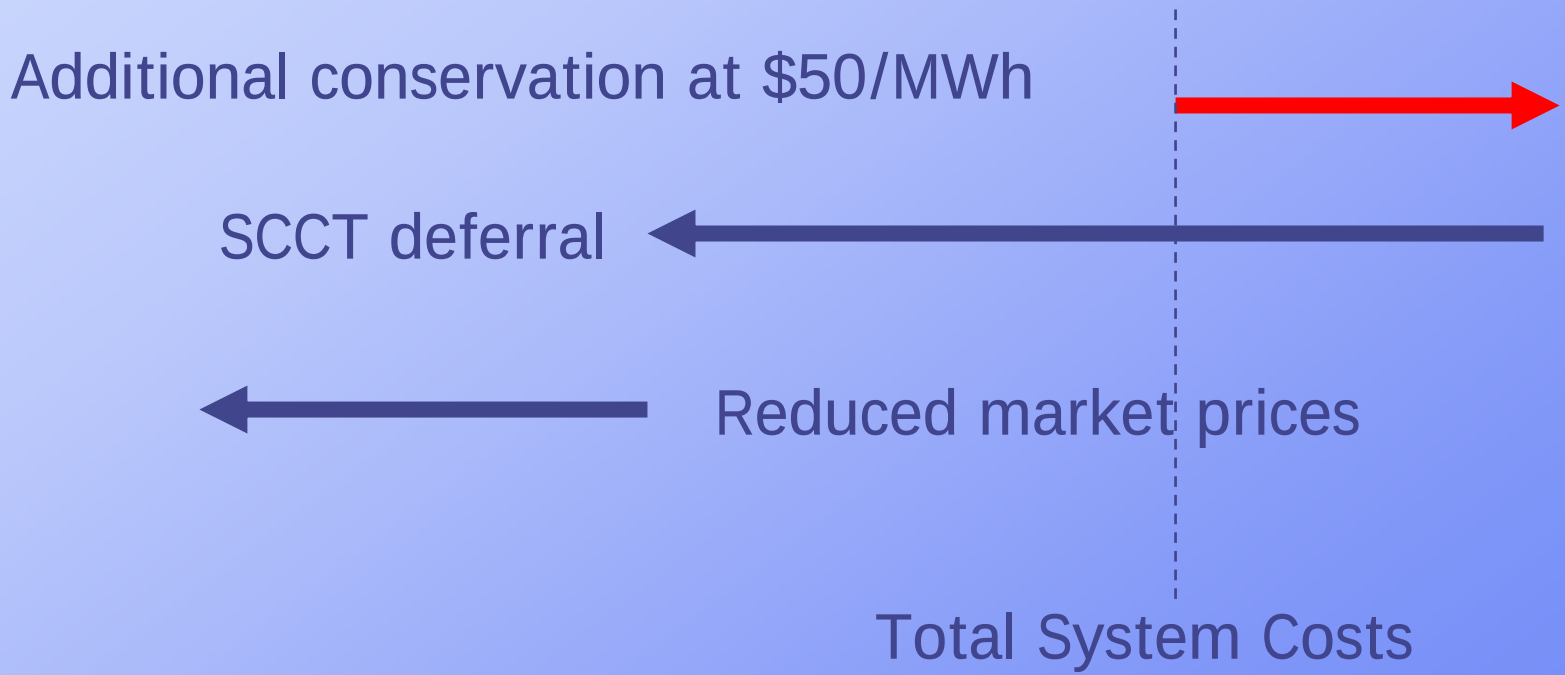
Components of Cost Reduction



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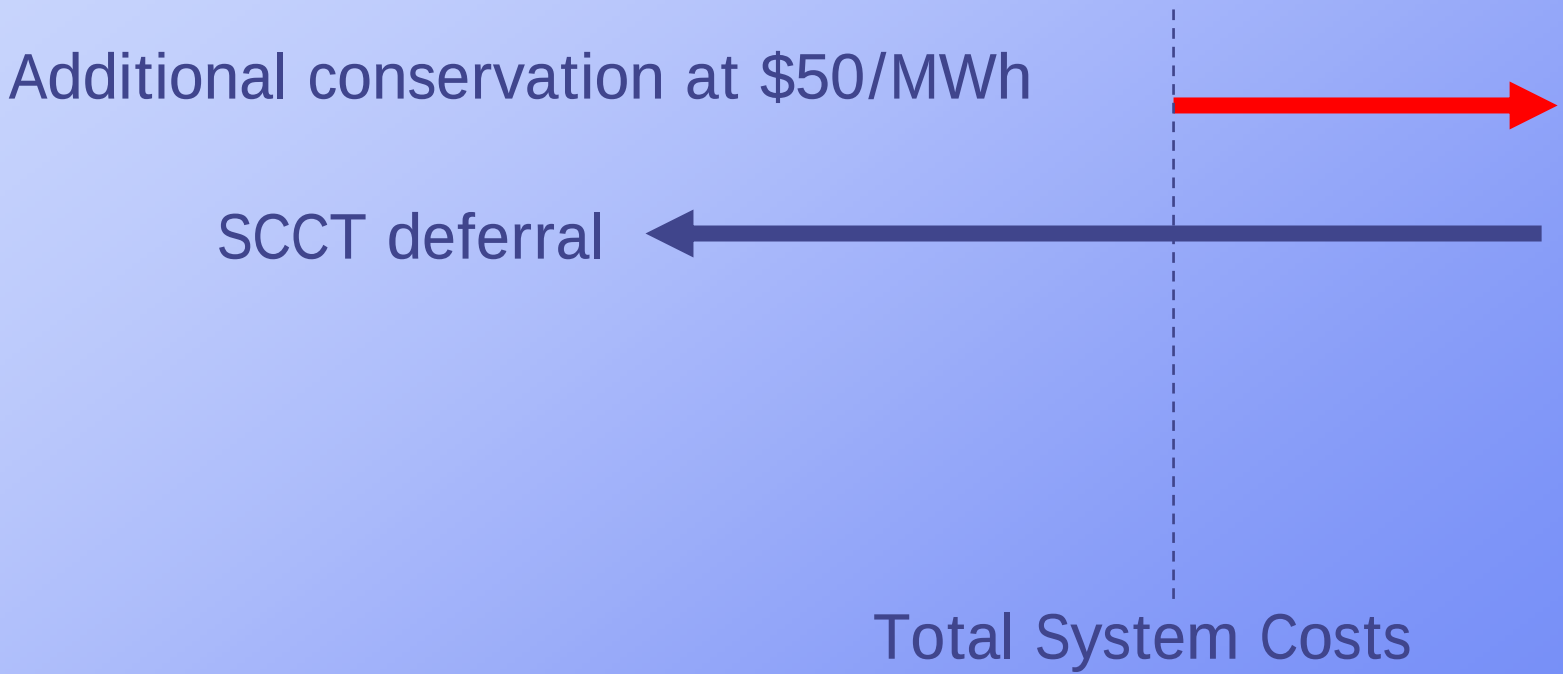
Price-takers Still See Benefits



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SCCT Deferral

- *Why* does conservation defer single cycle combustion turbines?
  - Low-capital cost resources are the traditional solution for risk management
  - SCCT have low capital cost
  - Conservation has *high* capital cost
- Under what conditions does conservation hold an advantage over SCCTs?

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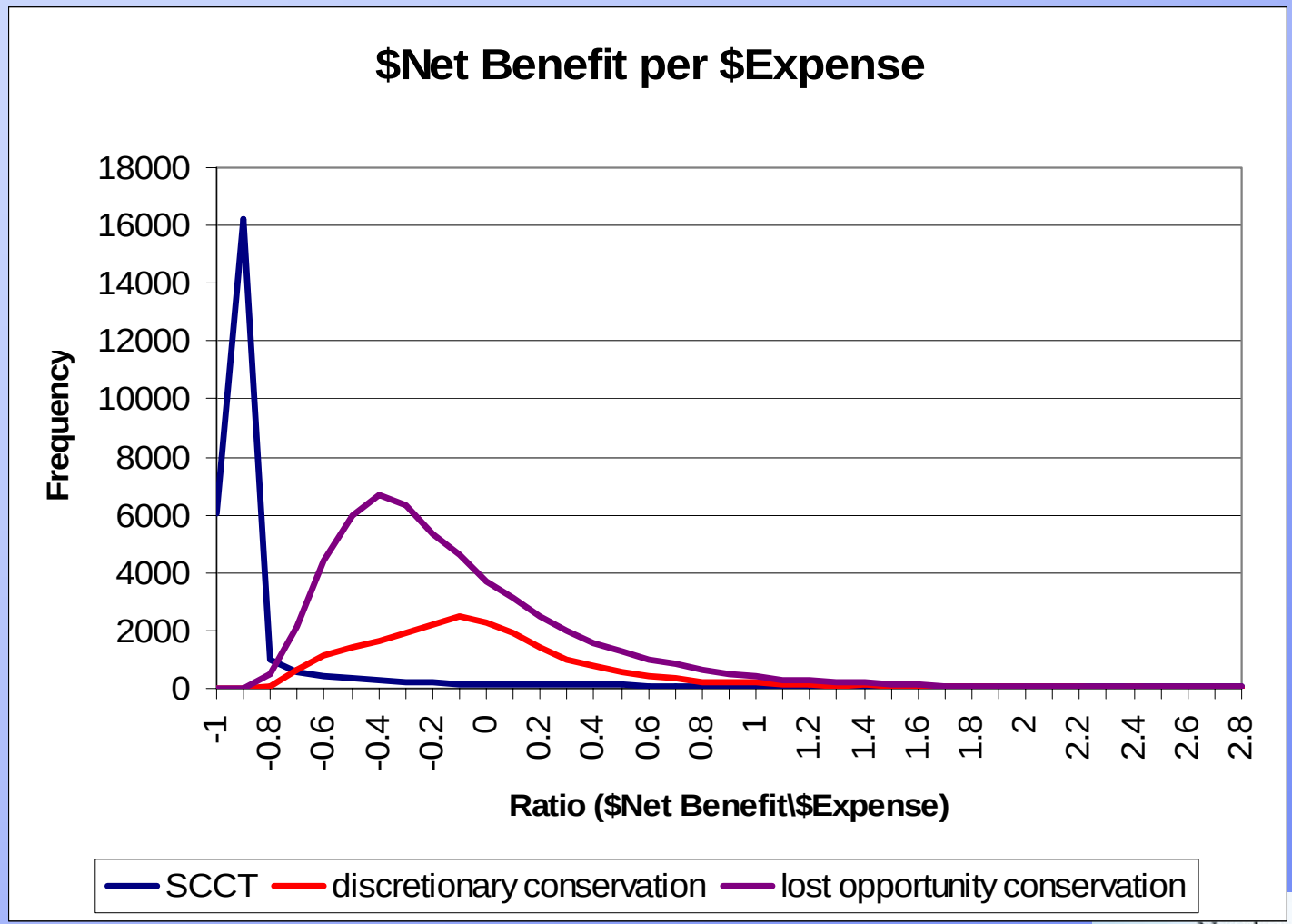
SCCT Deferral



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Value of Capacity

From the previous slide, it is evident that in this plan SCCT and conservation

- Operate under circumstances of relatively lower electricity market prices and volatility
  - This is the consequence of having the additional resources that give us protection against uncertainty
- Do not even pay for themselves
  - If we want to reduce risk, we have to pay the insurance premium of extra capacity that may not be used frequently enough to cover costs.

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Value of Capacity

- Conservation performs better than SCCT under these circumstances, because it gives value under low market prices.
- Additionally
  - The quality of capacity is better than conventional resources, because it is not subject to forced outages
  - In particular, the quality of conservation capacity is better than wind, the "other" resource candidate without fuel cost

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Conclusion

- We may have been overlooking the capacity benefits of conservation
- For low-risk plans, cost effectiveness of conservation may be higher than long-term view of average wholesale market price for electricity

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End

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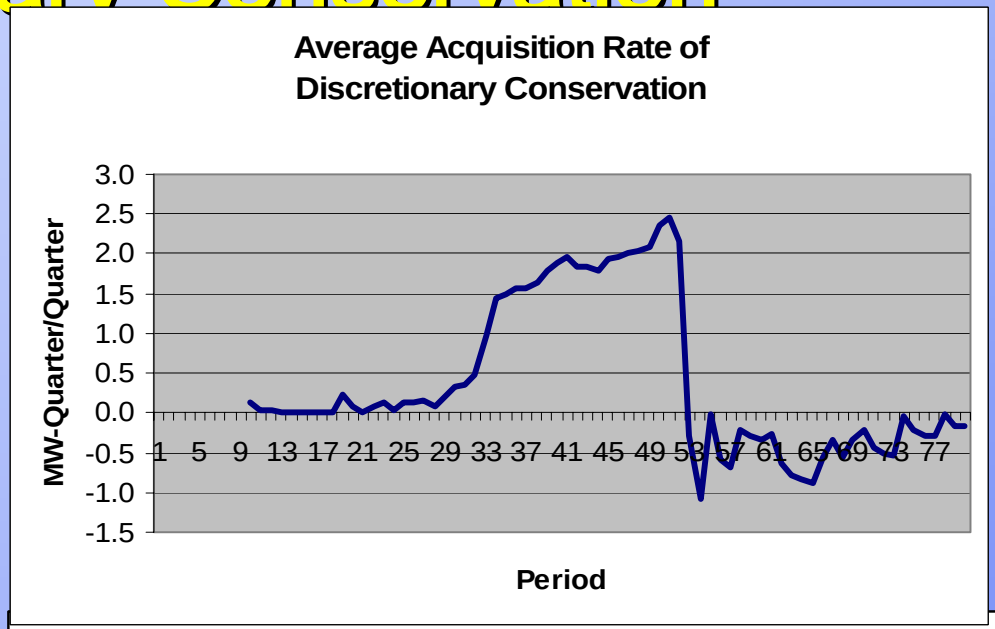
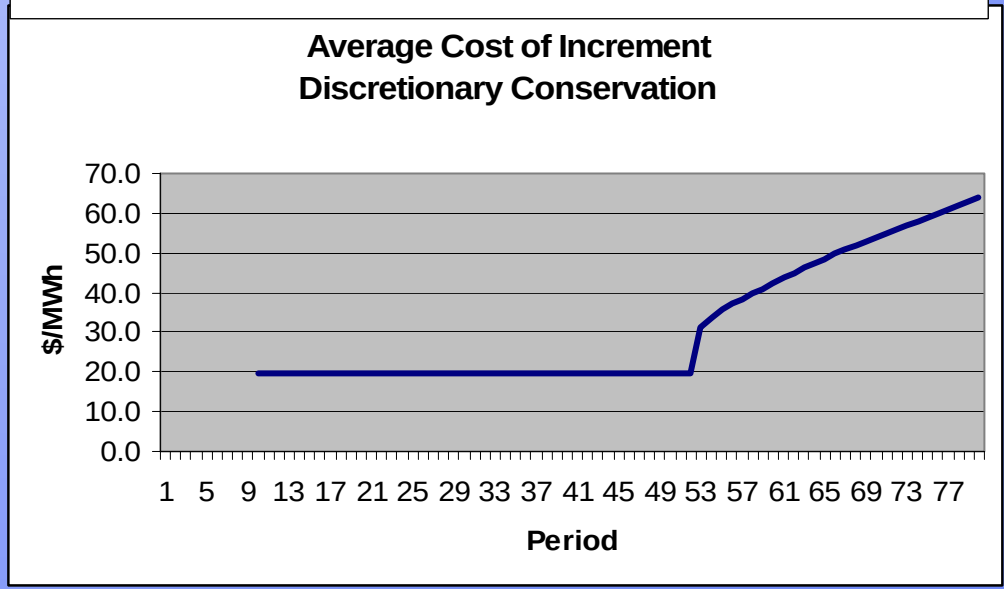
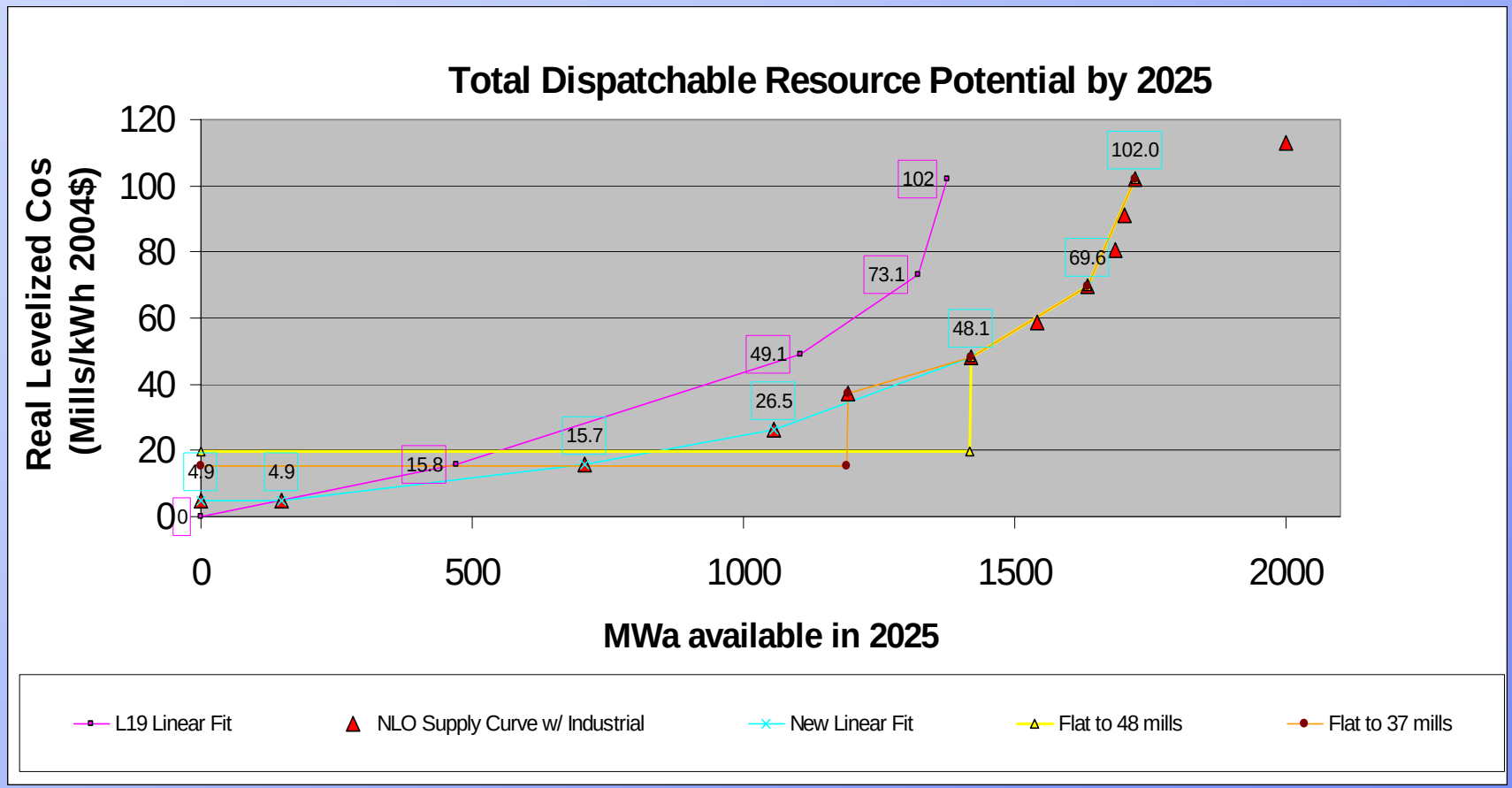
Policy Effect for Discretionary Conservation

- The non-linearity effect is more evident for discretionary conservation because of assumed ramp rate constraints.





Discretionary Conservation Supply Curve



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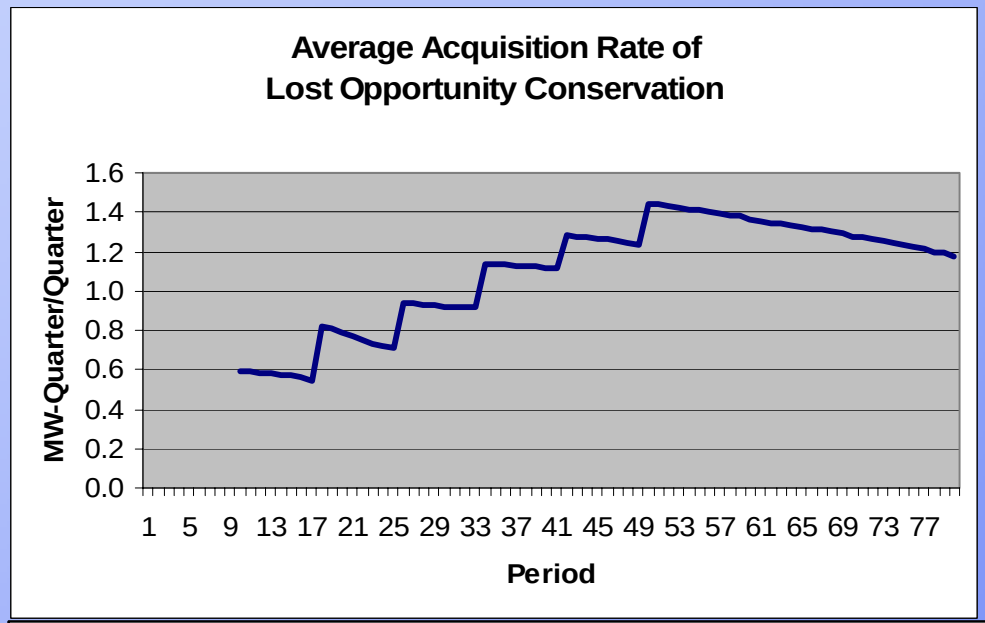
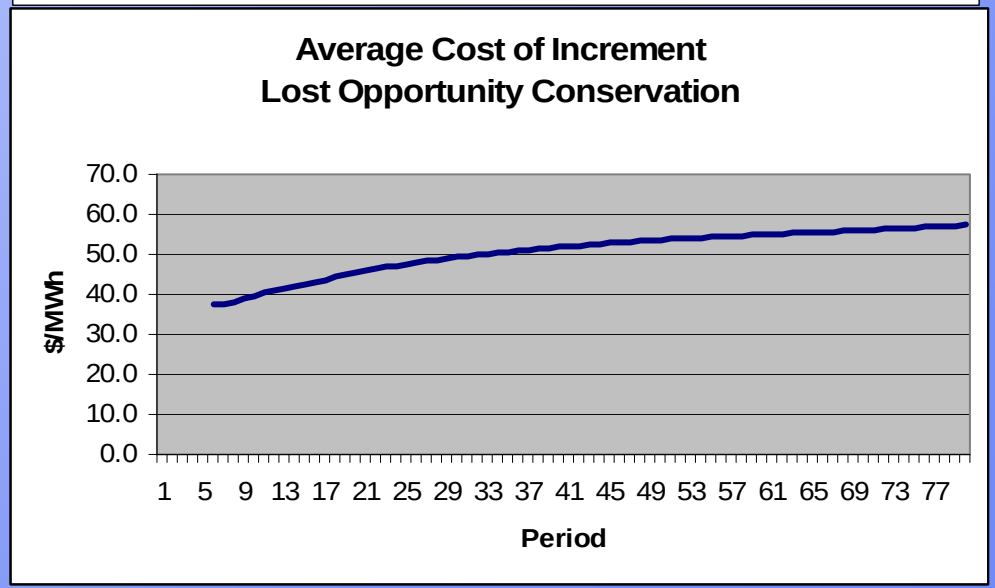
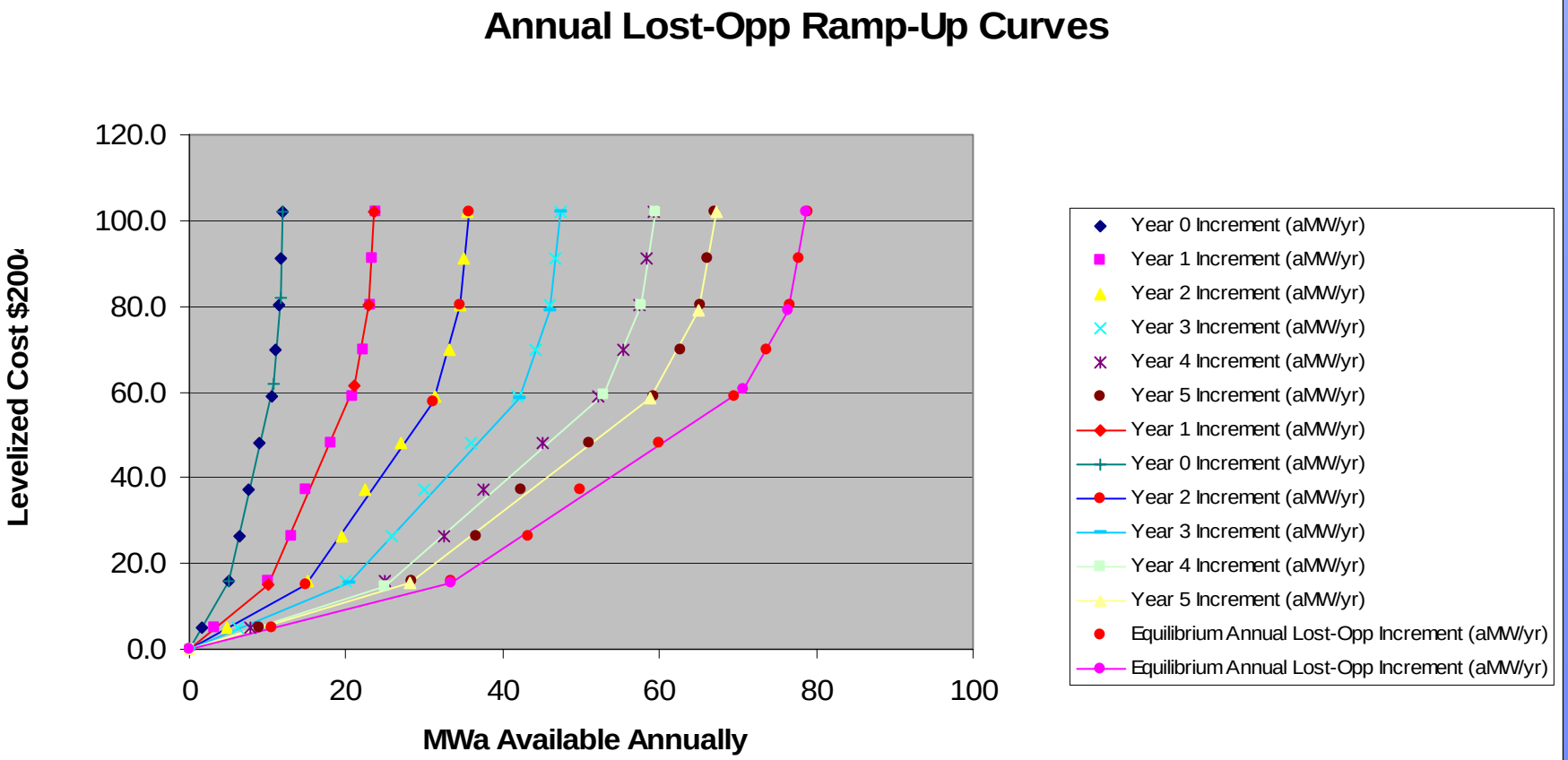
Policy Effect for Lost Opportunity Conservation

- Lost opportunity conservation more consistent, less non-linearity effect.





Lost Opportunity Conservation Supply Curve



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SCCT Deferral

$$\lambda = \frac{\text{Gross Value in Market - Operating Cost - (RL Fixed O \& M + RL Investment)}}{\text{RL Fixed O \& M + RL Investment}}$$

$$= \frac{\text{Net Value in the Market - RL Fixed Cost}}{\text{RL Fixed Cost}}$$

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