Decision Making Under Uncertainty

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Northwest Power and Conservation Council

Overview

- Review
- Initial Results

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Similar to Everyday Decision Making under Uncertainty

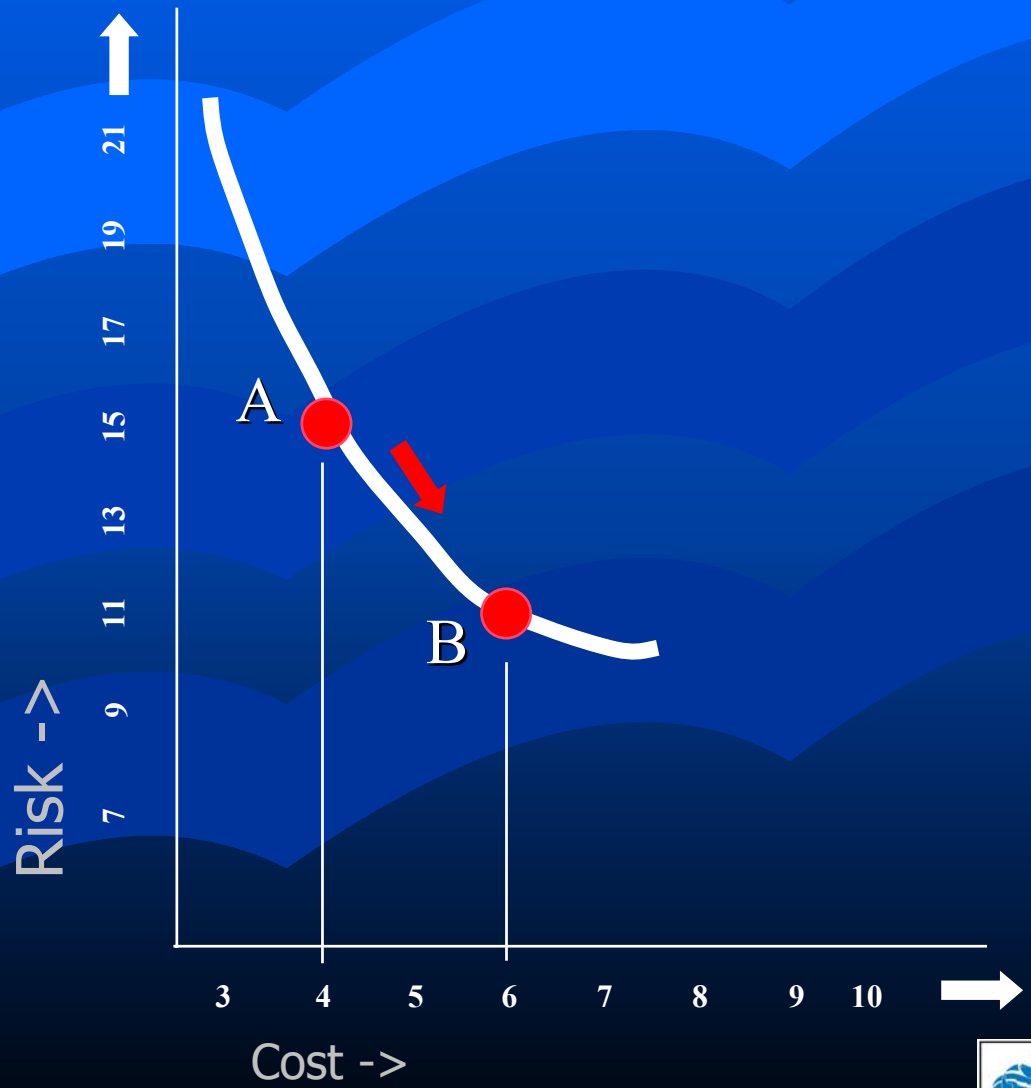
- Analogy with choosing transportation
- Cost and benefits
- Risks
  - Accidents
    - » Likelihood
    - » Protection afforded
  - Likelihood and cost of breakdowns and repairs
  - Missed meetings or appointments

The Analysis

- Possible “futures”
- Likelihood of those circumstances
- Bad outcomes

The Trade-off

- The choice of transportation depends on how we weight the costs or benefits and the risk associated with that choice

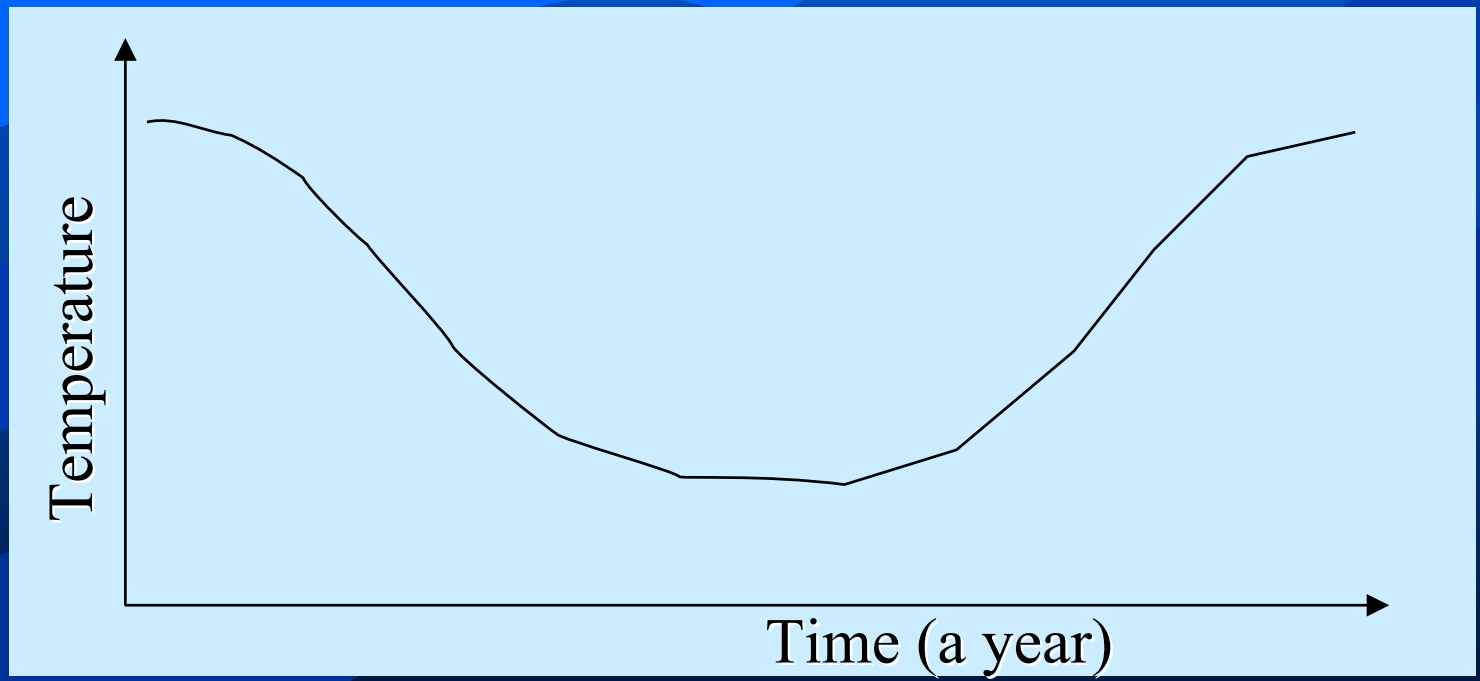


Decision Making Terms

- Risk
  - A measure of bad outcomes
- Variation
  - Normal changes in outcome, which may be highly predictable
- Uncertainty
  - The predictability of outcomes

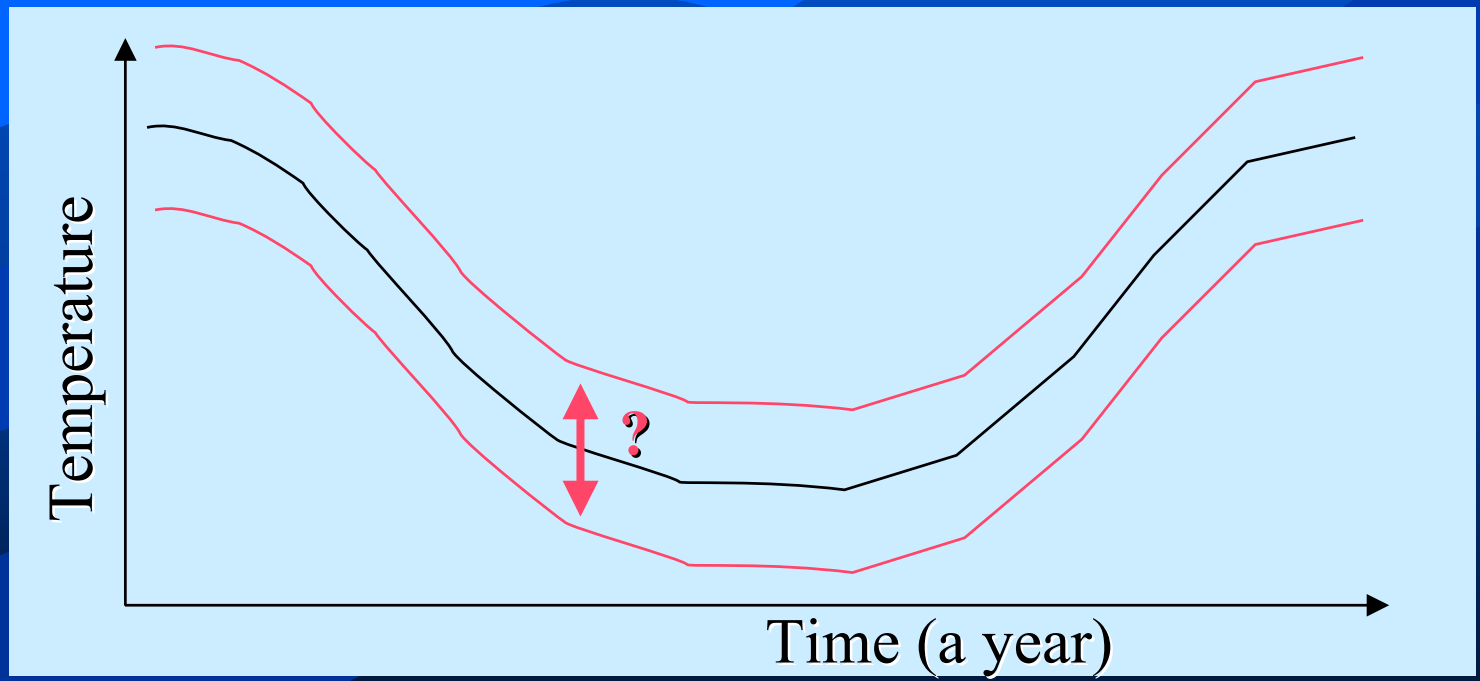
Decision Making Terms

- An example of variation is average daily temperature over the course of a year



Decision Making Terms

- For any particular day, the uncertainty in daily temperature can be large.



Decision Making Terms

- Plans
  - Future actions we can control
    - » Example: buy a 1978 Toyota corolla
- Futures
  - Future situations we can not control
    - » Example: A automobile crash in the local intersection
- Scenarios
  - Combinations of plans and futures
    - » Example: how did your Toyota fare in the crash

Power Plan Futures

- Behavior for key variables
  - Power requirements
  - Natural gas price
  - Hydro generation
  - Electricity market price
  - Aluminum price
  - CO2 tax
  - Power plant availability
- Variation and uncertainty, including jumps and complex paths; Relationships among these

Power Plans

- Specific recommendations, capacity and timing, for the construction of new additions over the next 20 years
  - CCCT
  - SCCT
  - Conservation
  - Price responsive demand
  - Wind
  - Coal

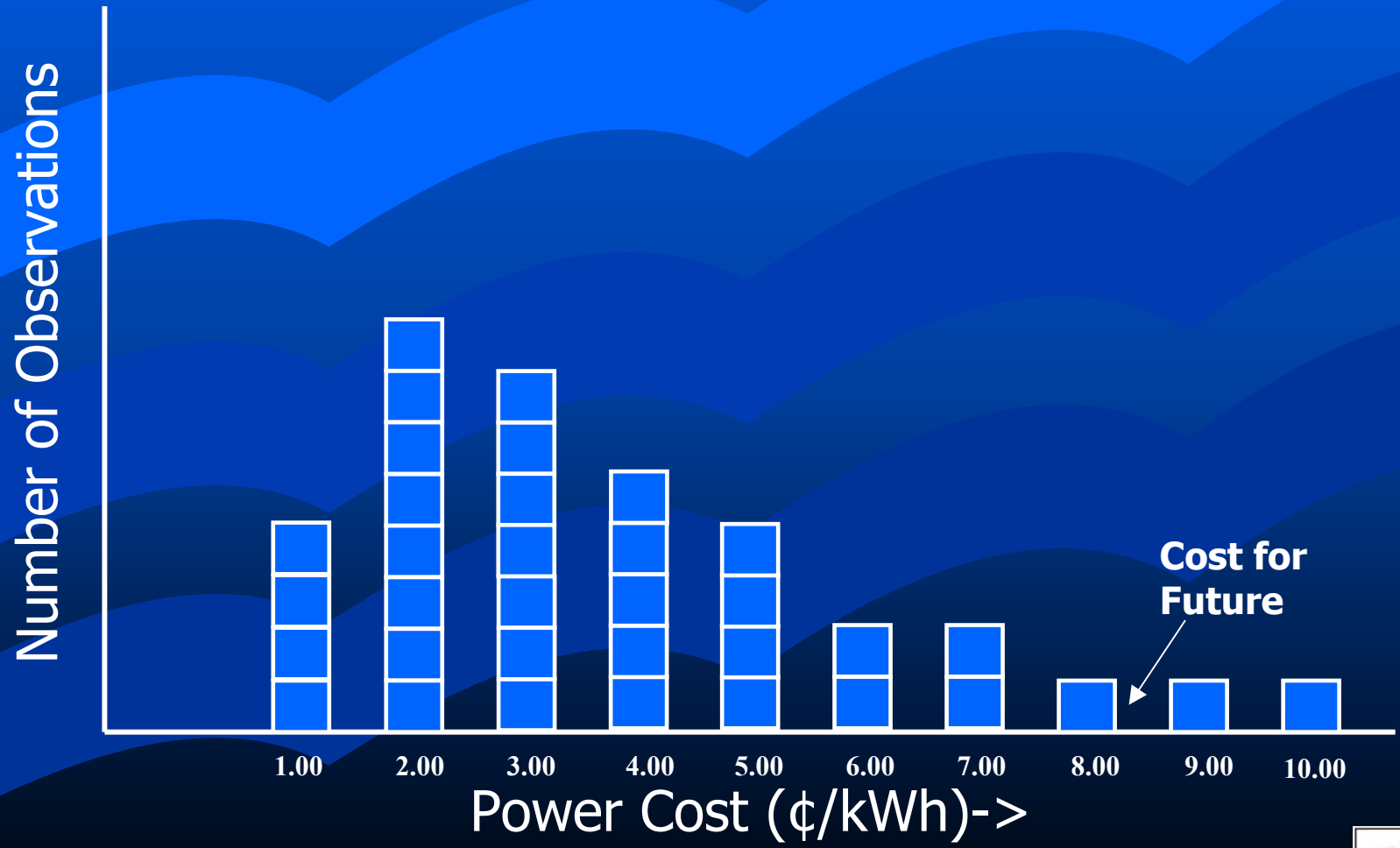
Example of a Particular Plan

	2005	2006	2007	2008	2009	2016	2021
Conservation (MW)	75	75	75	75	150	150	150
CCCT (MW)	0	500	500	1,000	1,000	1,000	3,000
SCCT (MW)	0	0	0	0	0	500	500
Coal (MW)	0	0	0	0	1,000	1,000	1,000
PRD (MW)	500	1,000	1,500	1,500	1,500	1,500	1,500
Wind (MW)	100	200	300	400	800	1,500	1,700

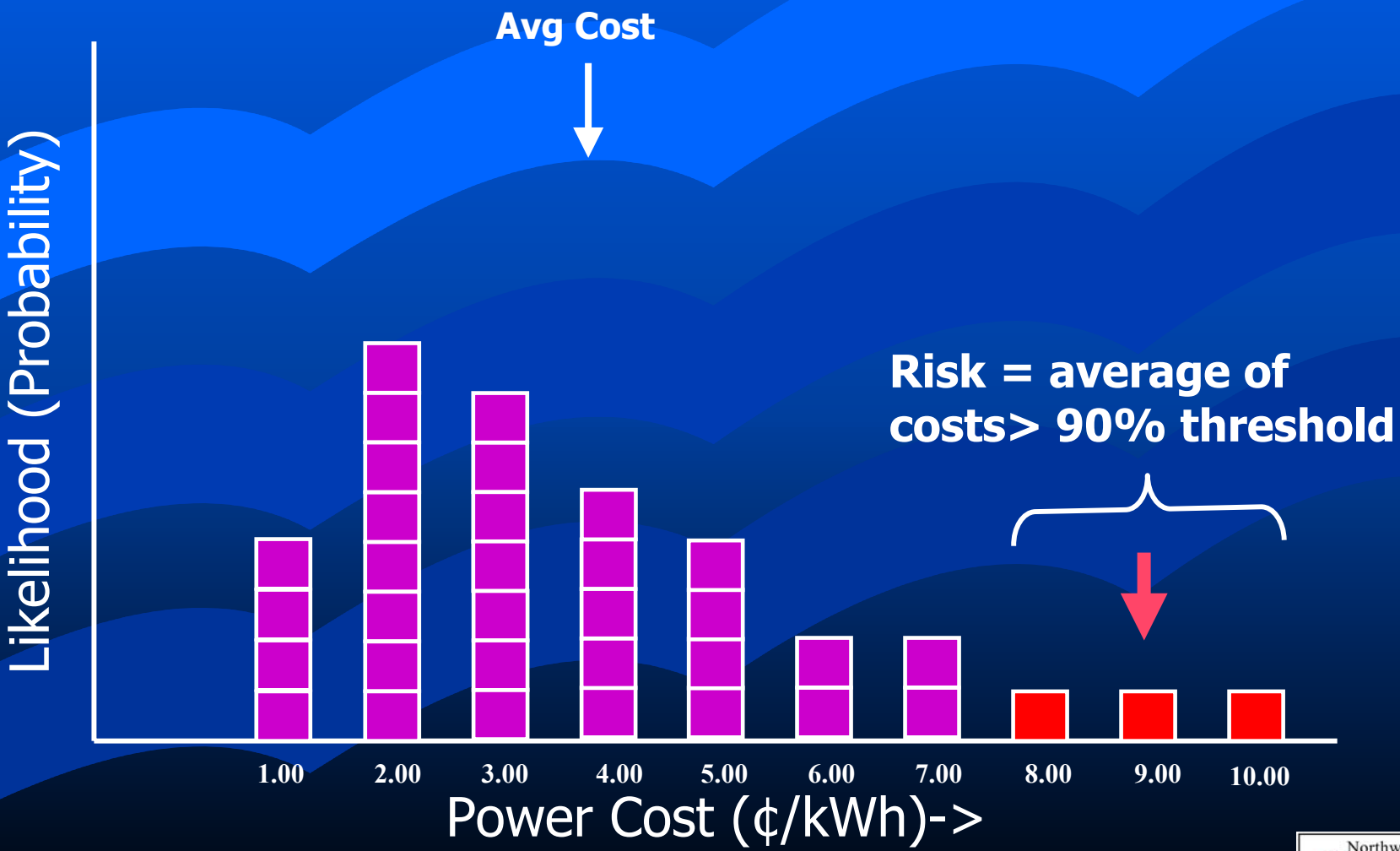
Power Plans

- We do not make decisions before we need to do so. We want as much information as possible before making a commitment
- Therefore, we want to focus on the "Implementation Plan" that identifies actions over the next three to five years.
- Preparing a 20-year plan enables us to assure our short-term implementation plan create no long-term risk and does not preclude important long-term planning options. (We want to understand the strategic significance of our short-term actions.)

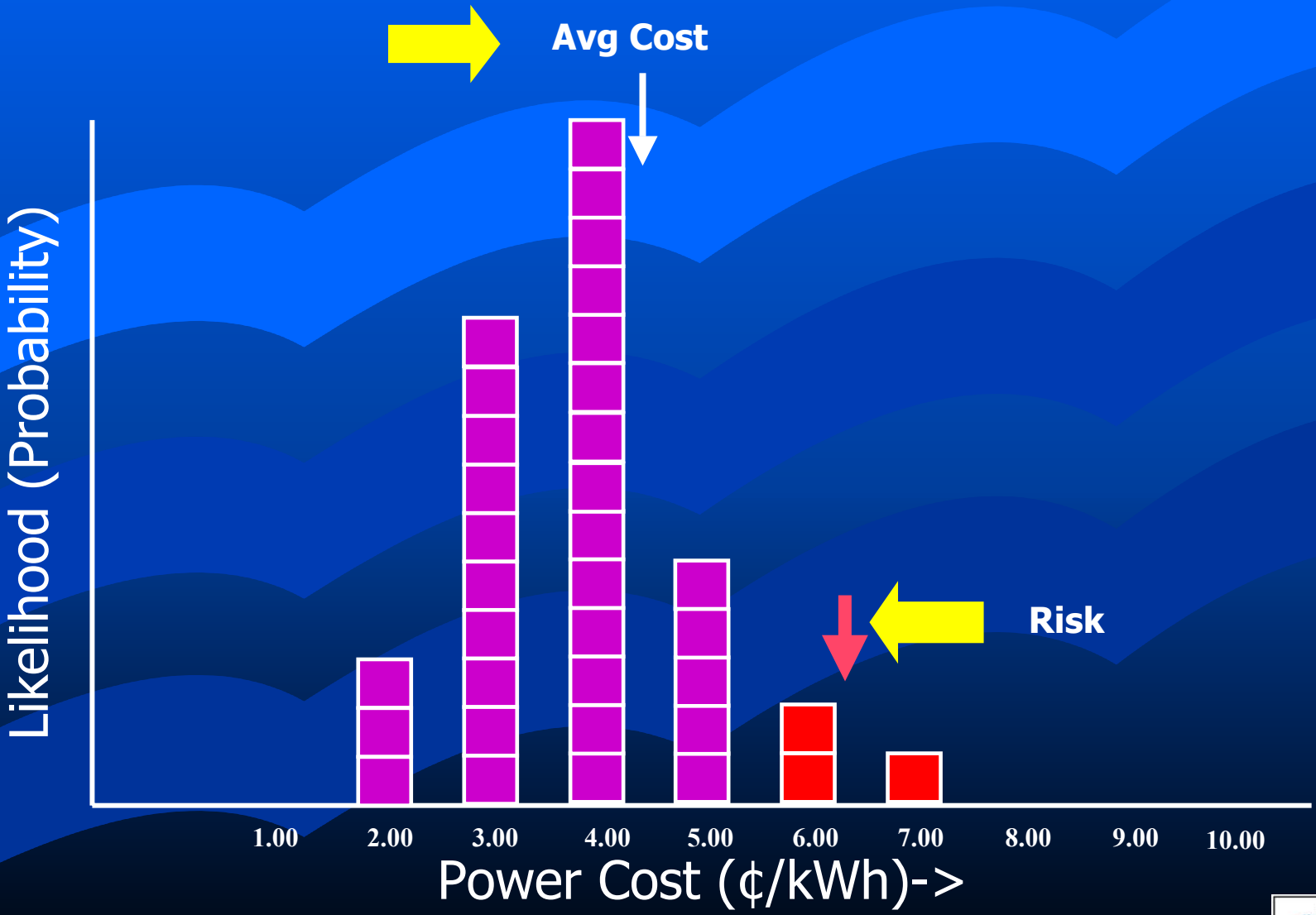
Distribution of Cost for a Particular Plan



Risk and Expected Cost Associated With A Plan

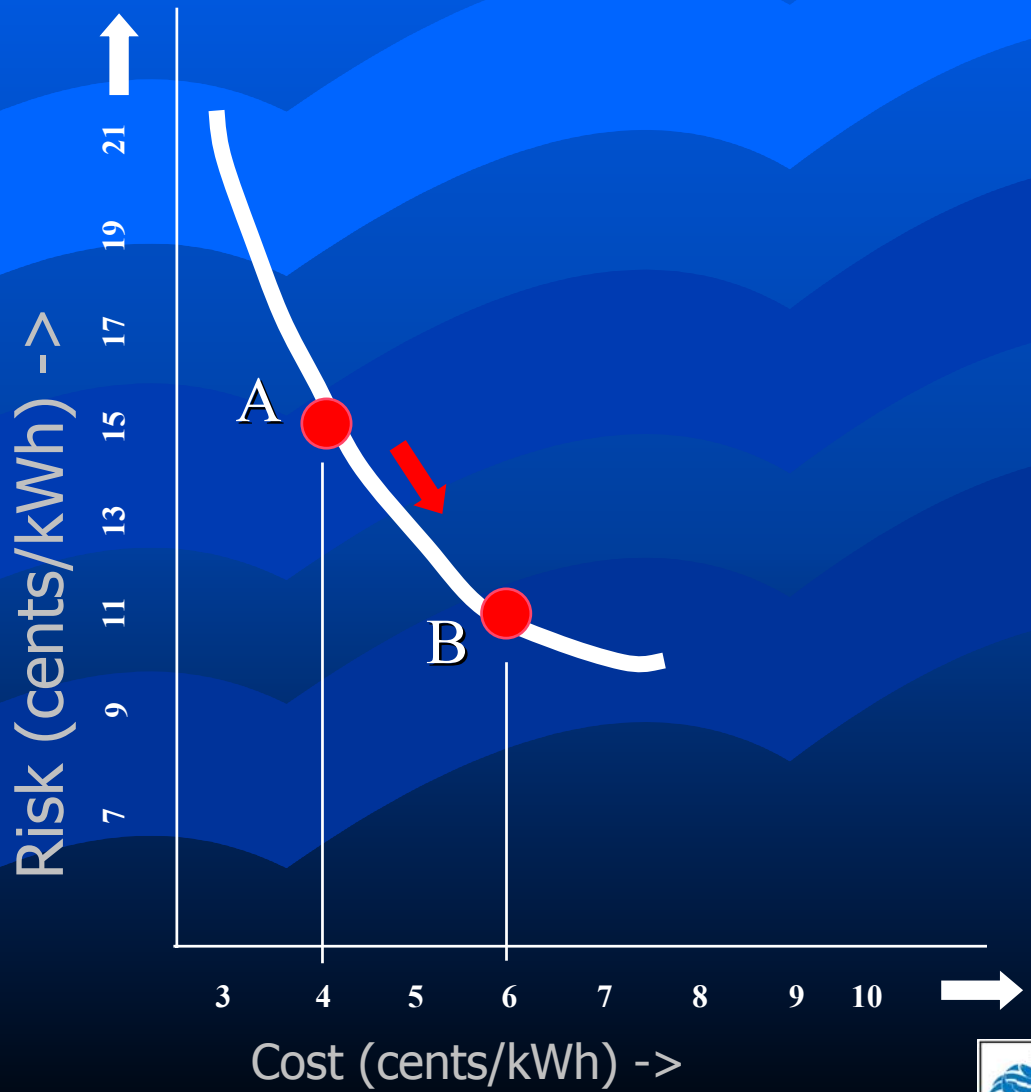


A Different Plan: The Trade-off



Staff Will Present

- Basic information about the trade-off between cost and risk



Staff Will Present

- Insights into
  - What a plan costs
  - How we expect it to perform
  - What the risks are
    - » How does the plan perform under specific futures?
    - » What are the chances we may see these futures?

Conclusions from January Presentation

- We make decisions under uncertainty every day. Many of the principles for evaluating resource plans are the same.
- We seek input on what the council needs to know about resource planning decision.
  - Staff is preparing information on the costs and risks of specific resource plans.
  - Staff intends to explain the risk management advantages of the proposed candidate plan in terms of the plan's ability to accommodate specific futures.

Overview

- Review
- Initial Results

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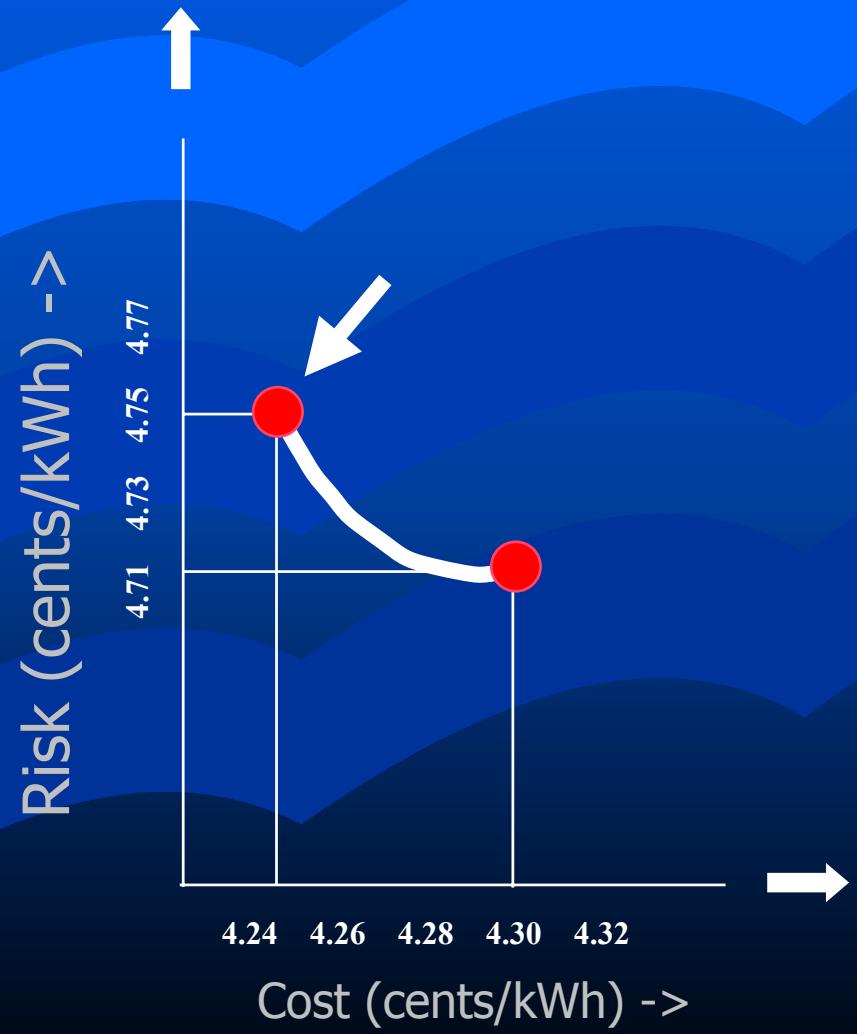
Recommendations

- Research the cost and potential for regional demand response (DR)
  - Preliminary studies suggest DR significantly reduces both risk *and* cost
- Continue support of conservation
  - Conservation additions at levels above those determined by market price reduces risk at little expected cost
  - At least a 5 mill/kWh premium
- The region appears to have sufficient conventional resources for the next four to five years, although individual load-serving entities or customers may have vastly different risk-management situations

Without Demand Response

- Least cost:
  - 500MW of CCCT today
  - 500MW of Wind Generation after 2006
  - Incent dispatchable conservation at 0.50 ¢/kWh



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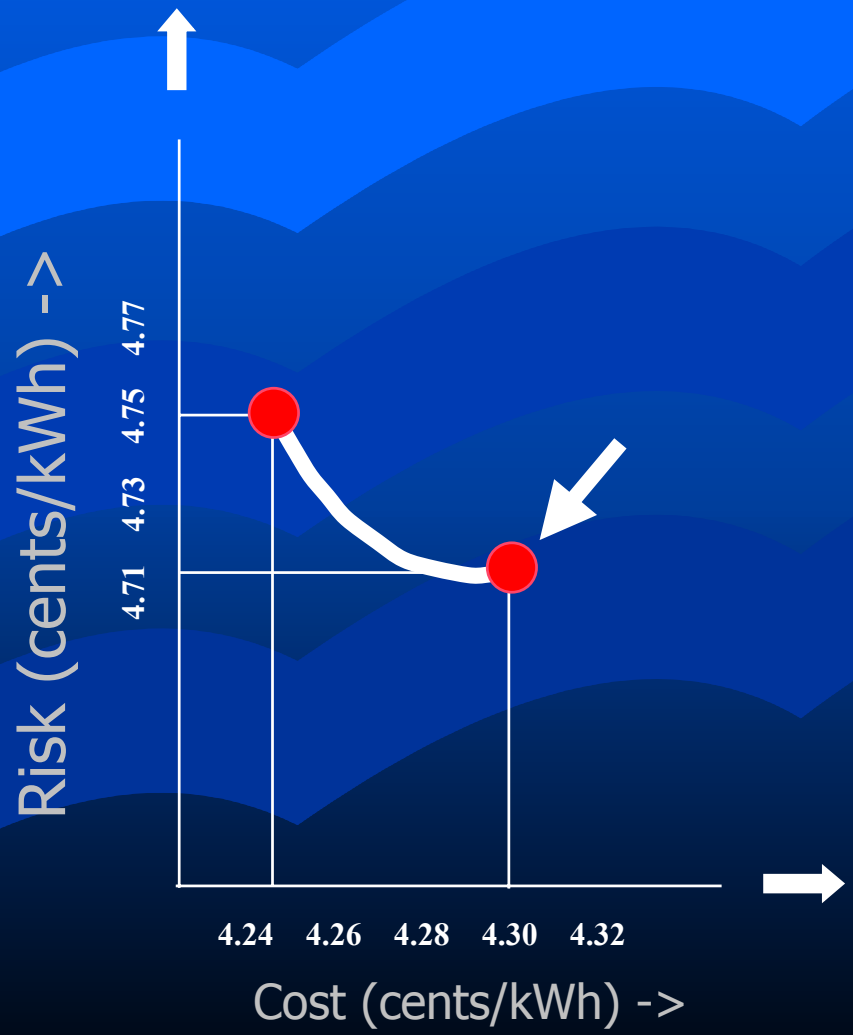
Without Demand Response

- Least risk:
  - Incent dispatchable conservation at 2.50 ¢/kWh



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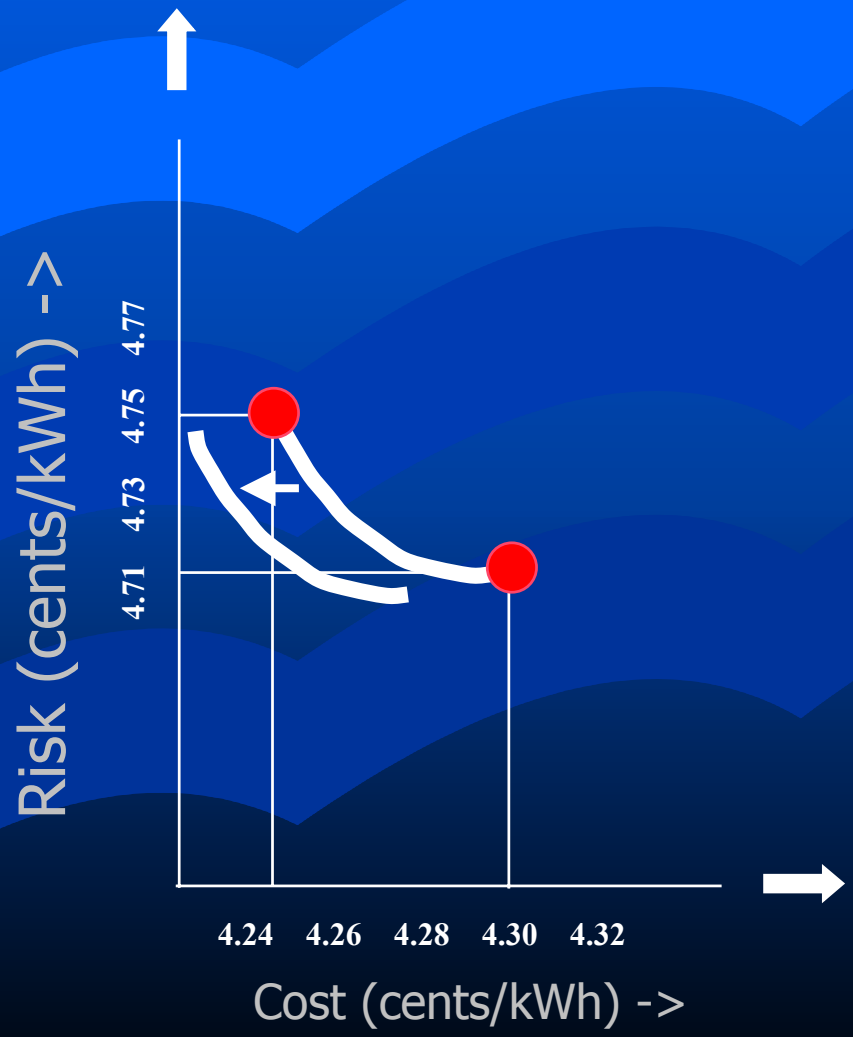
With Demand Response

- Demand Response moves the entire trade-off curve to the left



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Response Under Futures

- We consider how the plans respond to particular futures
- These futures have been chosen to emphasize the strengths and weaknesses of each plan

Other Information

- ... Is in development. We want to show the relative improvement on the trade-off curve as demand response is added as a planning option.
- ... I will forward that information as it becomes available.

Recommendation

- Pursue research into DR
- The advantages of conservation are more evident when we explicitly consider uncertainty

End

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