Decision Making Under Uncertainty

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Northwest Power and Conservation Council

Overview

- Review
- New Considerations
- The Action Plan and Long-Term Adequacy

Review

- We make decisions under uncertainty every day. Many of the principles for evaluating resource plans are the same.
- One of our primary goals is to determine the trade-off between costs and risks of specific resource plans.

Review

- Currently, there seems to be a relatively small trade-off between risk and cost
  - The region is in a period of relative surplus, expected to last through 2008 and beyond.
  - The further out in time we add resources, the less they cost in today's dollars.
  - In a period of surplus, prices tend to be less volatile.
  - In a period of surplus, the main risk is fixed-price risk, and the plans represented by the trade-off curve have very little conventional resource capacity.

Review

- Action Plan
  - DR could significantly reduce both risk *and* cost, but we need to learn more now about the cost and potential for later implementation
  - Aggressive pursuit of lost opportunity conservation has both cost and risk advantages
  - 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
  - Evaluate the role of transmission for resources that will be completed before 2013

Review

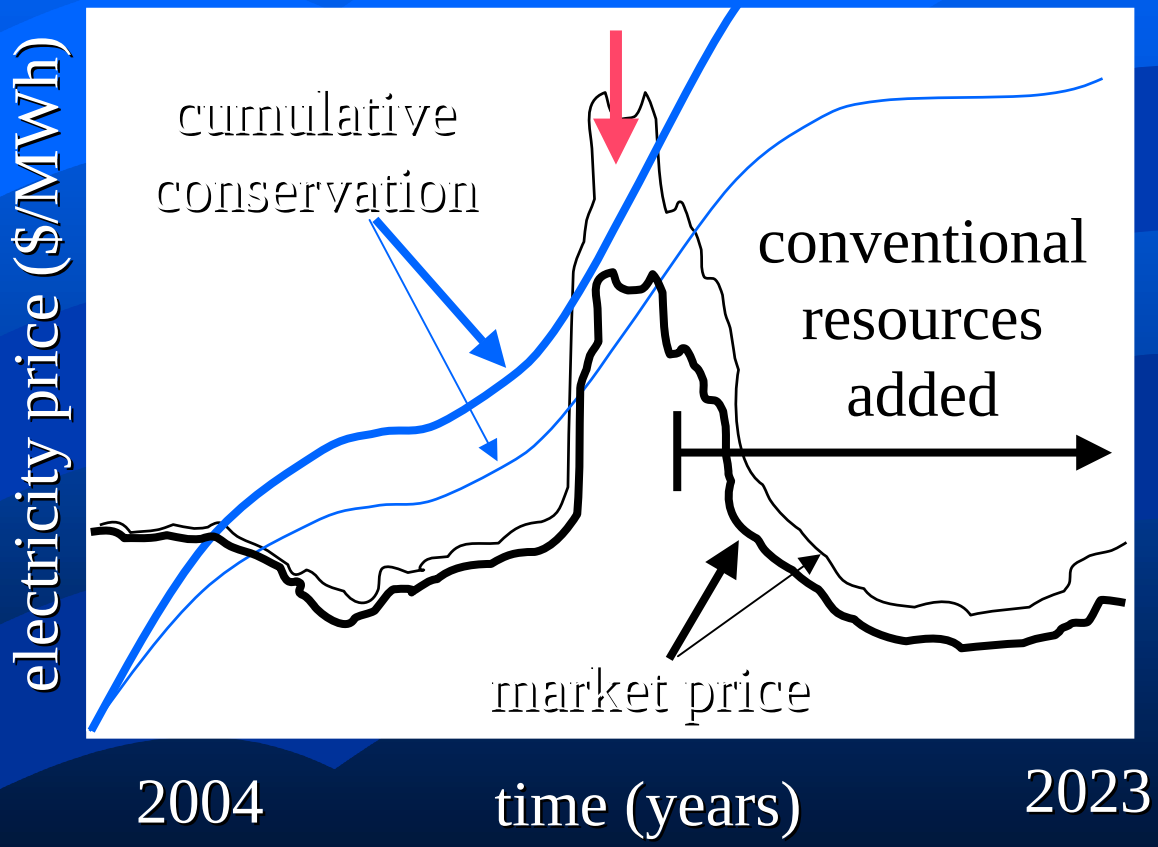
- Portfolio studies consistently concluded that aggressive pursuit of lost opportunity conservation reduces risk and cost.
- Conservation differs from other resources in several important ways.
  - The amount of conservation that you can develop, in particular lost-opportunity conservation, depends on history.
  - Conservation is assumed to be available from a host of different programs with different costs, giving rise to a non-trivial supply curve.

Conservation Has Unique Advantages

- If the supply curve is more or less continuous, increments of "above market" conservation can be added inexpensively.
  - This can make conservation an inexpensive source of *reserve margin*, which reduces market exposure risk and may moderate wholesale price swings.

The Value of Conservation as Reserve Margin Contribution

- The value stems from "being there" when a shortage hits
- Higher levels of conservation provide more price moderation



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New Considerations

- More insights into the value of conservation
- “New” planning criterion
- Probabilistic Treatment of Production Tax Credits, wind integration costs, and Green Tag trading values
- Sensitivity analysis and calibration with other models

Conservation Has Unique Advantages

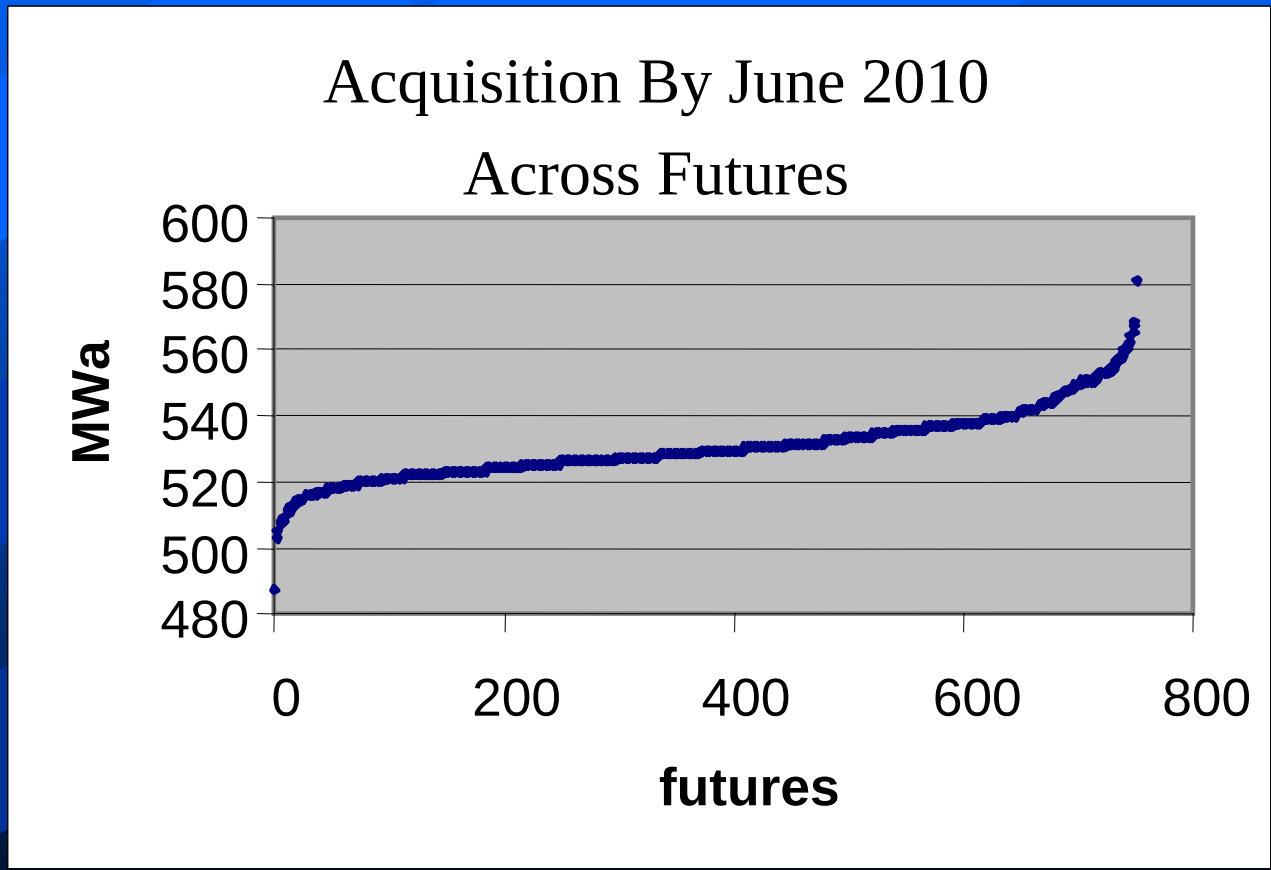
- If the supply curve has the typical concave shape associated with increasing marginal cost, sustained development can result in lower cost.
- A policy of *sustained* acquisition means we do *not* forego opportunities to acquire conservation when its cost and apparent value are less.

Consequences of Sustained Acquisition of Conservation

- Our portfolio studies have suggested that aggressive acquisition of conservation has cost and risk advantages
- This policy really amounts to buying more than we would have when power prices were low and not much more when power prices are high. That is, our acquisition rates get "flattened out"
  - **This brings us back to the notion of "sustained orderly development."**

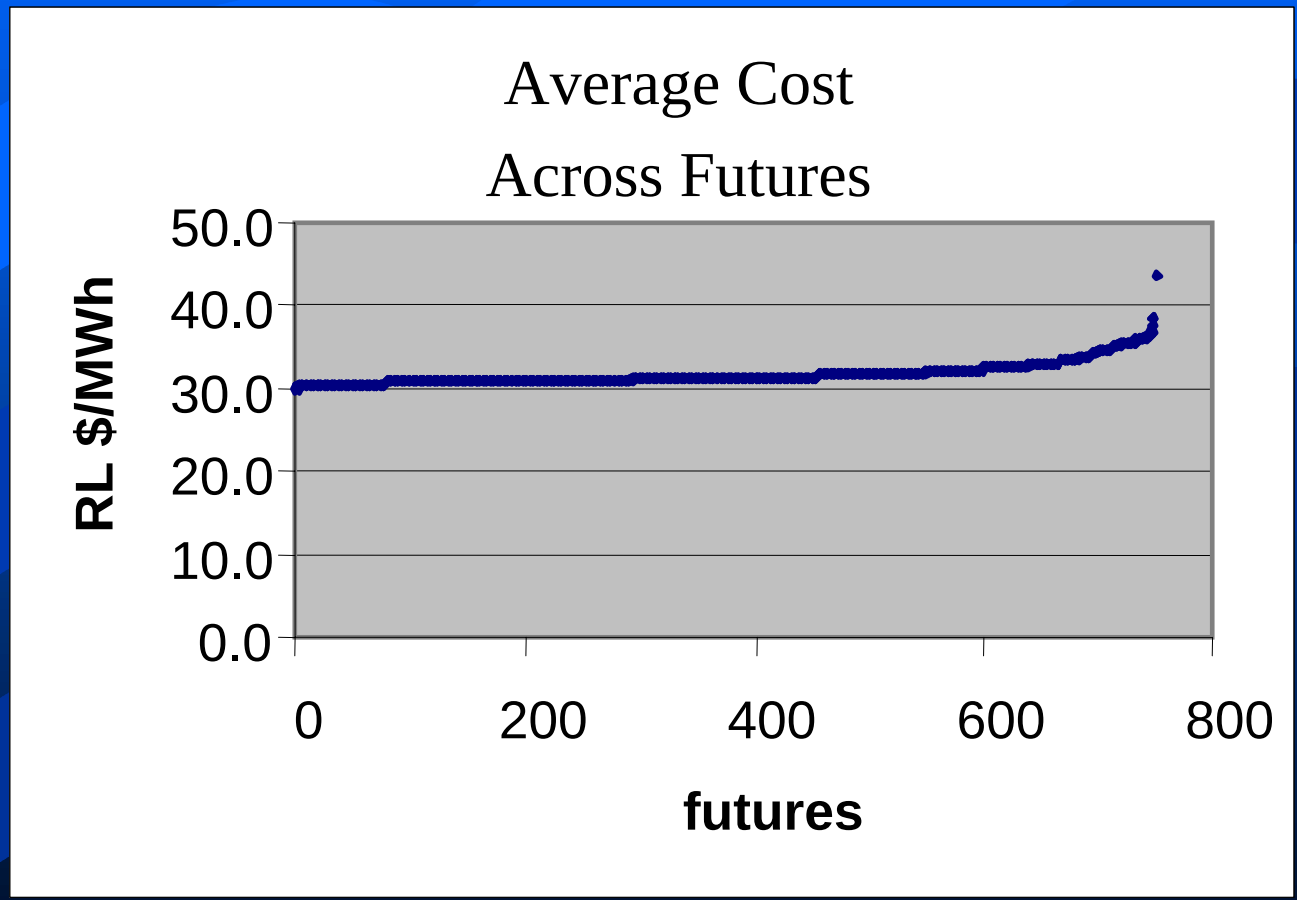
Consequences of Sustained Acquisition of Conservation

- Median rate: 75 MWa per year
- Maximum rate: 82 MWa per year



Cost of Sustained Acquisition of Conservation

- Median rate: 32 $/MWh
- Maximum rate: 43 $/MWh



Conclusions Regarding Conservation

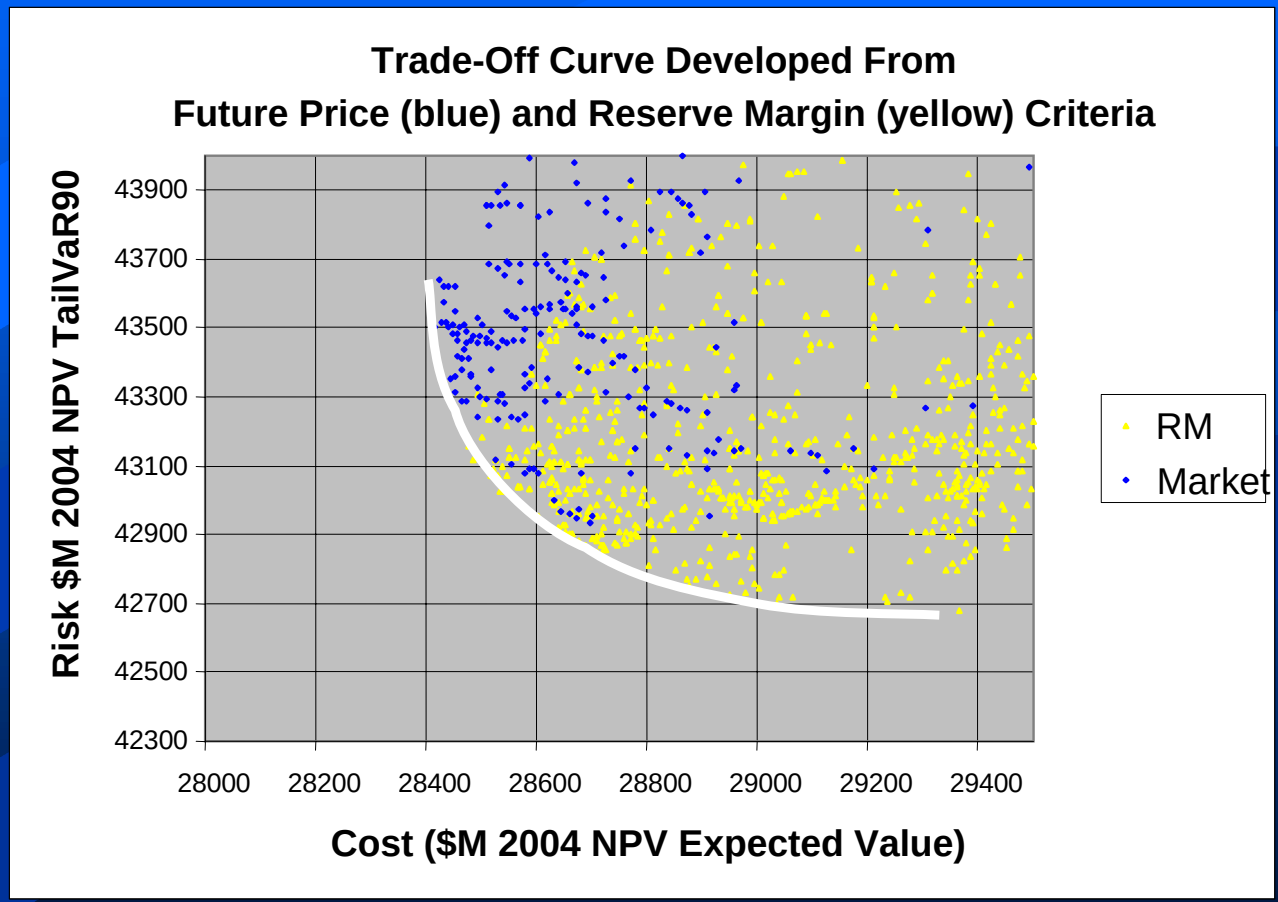
- "Aggressive pursuit of conservation continues to have cost and risk advantages"
- This policy is consistent with our current cost effectiveness threshold of about $37/MWh or lost opportunity acquisition target of 75 MWa/year
- Not elsewhere discussed here: Schedulable conservation target would be about 80MWa per year at an average cost of $14/MWh

"New" Planning Criterion

- Our resource plans implicitly assume a rule for deciding when to add resources
- Until March, we have used expected future market prices to determine when resources are added
- Our recent studies using reserve margin criteria, that is, critical water total resources surplus to requirements, can result in a lower-risk plan

"New" Planning Criterion

- Using reserve margin tends to give us more expensive, but less risky plans



Other New Considerations

- Probabilistic treatment of Production Tax Credits, wind integration costs, and Green Tag trading values
- Sensitivity analysis and calibration with other models
  - Duration of electricity price jumps,
  - natural gas price volatility,
  - CO_2 uncertainty,

Conclusions from New Considerations

- Under no circumstances is construction for any conventional resource started before December 2011 and no conventional resource would be brought into service before June 2013
- Our Action Plan, which calls for no new resources in the next five years, is supported by these additional studies

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Typical Low-Risk Resource Construction Schedule

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			1000				
Gas SCCT	Moderate efficiency, low capital cost, short lead time, high fuel cost							0
Coal	Moderate efficiency, high capital cost, long lead time, low fuel cost			500				500
Wind	High capital cost, short lead time, zero fuel costs, intermittent				500		3500	
Conservation	*Cumulative* total:	567	891	1215	1539	1863	2187	2511

CCCT, SCCT, Coal, and Wind are incremental, calendar year additions (MW); Conservation is cumulative (MWa)

These dates represent the earliest that construction would begin. 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.

Evaluation of Portfolio Plan Using Traditional Means

- Reserve Margins (resources surplus to loads) are maintained at healthy levels under most futures
- Loss of Load Probability, another traditional measure of reliability, never exceeds four percent over the study time period. This has been regarded as adequate in prior Council studies.

Valuation of Resources

- Demand Response
  - From our prior evaluation, we expect demand response potentially could reduce cost by $150 M and TailVaR90 risk by $700 M NPV (2004$)
- Conservation and Wind
  - Each reduce cost by about $500 M NPV
  - Each reduce TailVaR90 risk by about $1.5 B NPV
  - The effect of foregoing both conservation and wind would be greater than the sum

Conclusions

- Our Action Plan seems to be holding
  - No resource additions before June 2013 appear to be necessary
  - A sustained level of conservation development reduces cost and risk
  - Demand response warrants better understanding
  - We need to evaluate the role of transmission for resources that will be completed starting 2013

End