Conservation Resource Advisory Committee

August 21, 2013

Northwest Power and Conservation Council

Agenda

- Welcome
- Seventh Plan Timeline
- Identify Elements for CRAC Advice
- Lessons Learned from Sixth Plan
- Discussion of EE Policy Issues

Along the way we may identify technical analyses and sensitivity studies to develop as part of Seventh Plan.

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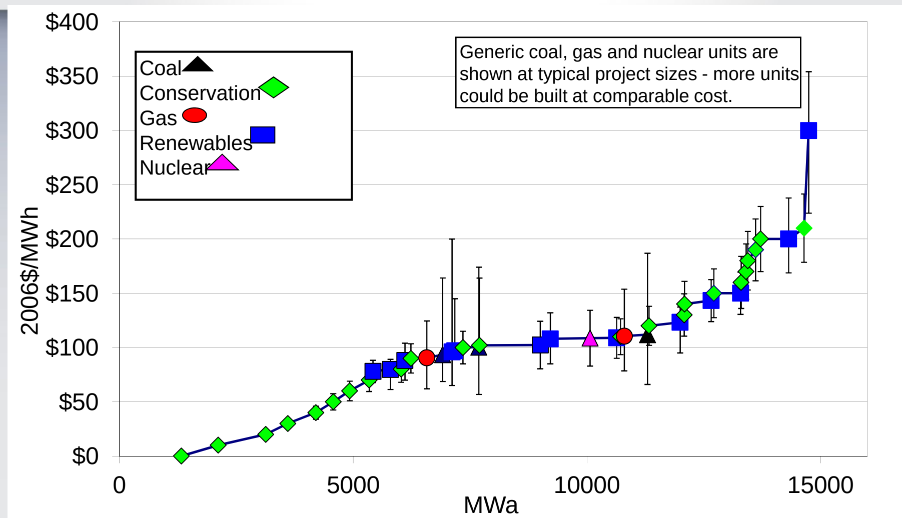
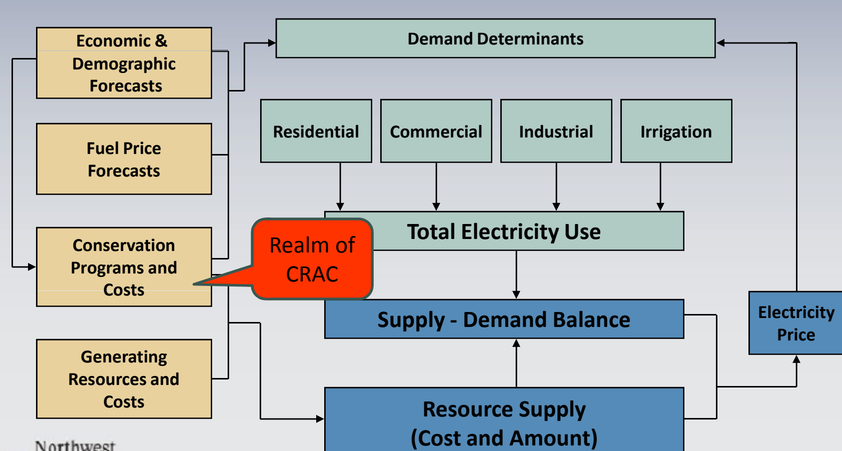
Portfolio Analysis on One Slide



slide 3

Elements of Plan Development



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Other Council Advisory Committees

- Demand Forecasting
- Demand Response
- Generating Resources
- Natural Gas
- Systems Analysis
- Resource Adequacy
- Resource Strategies
- Conservation

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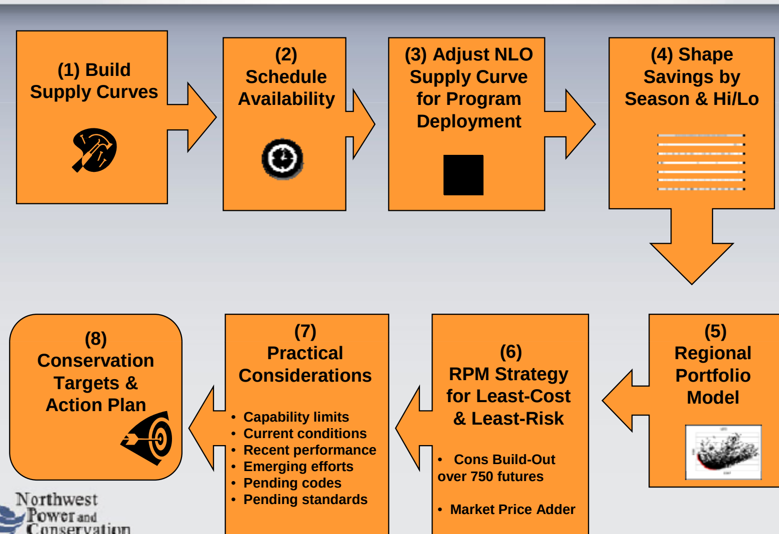
Overview of Sixth Plan EE Methodology



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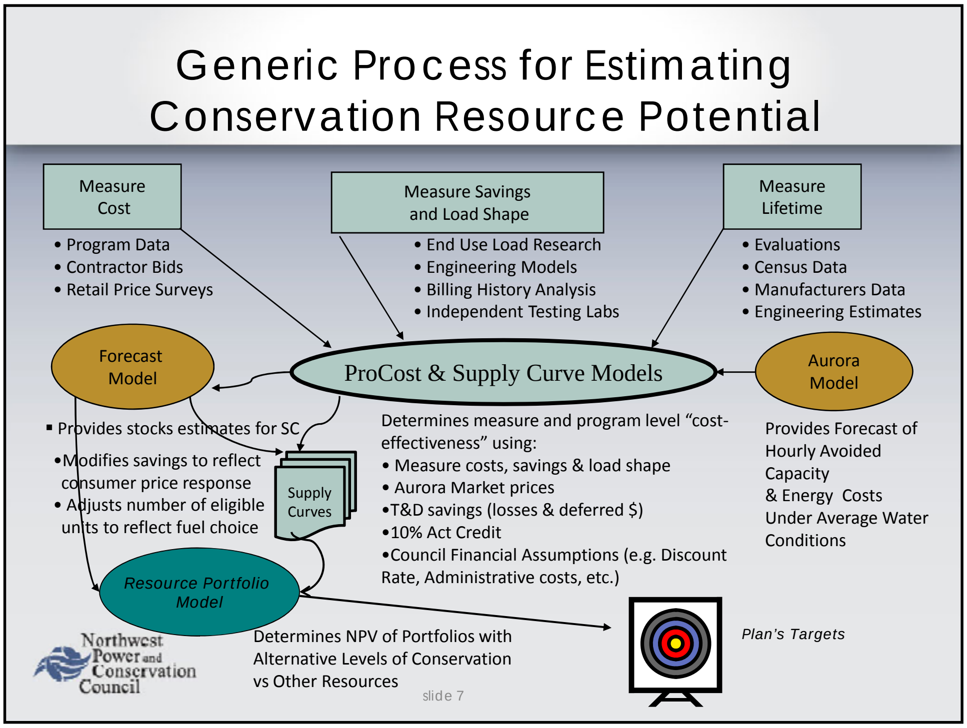
Generic Process for Estimating Conservation Resource Potential
Measure Cost
• Program Data
• Contractor Bids
• Retail Price Surveys
Measure Savings and Load Shape
• End Use Load Research
• Engineering Models
• Billing History Analysis
• Independent Testing Labs
Measure Lifetime
• Evaluations
• Census Data
• Manufacturers Data
• Engineering Estimates
Forecast Model
ProCost & Supply Curve Models
Aurora Model
▪ Provides stocks estimates for SC
•Modifies savings to reflect consumer price response
• Adjusts number of eligible units to reflect fuel choice
Supply Curves
Determines measure and program level "cost-effectiveness" using:
• Measure costs, savings & load shape
• Aurora Market prices
•T&D savings (losses & deferred $)
•10% Act Credit
•Council Financial Assumptions (e.g. Discount Rate, Administrative costs, etc.)
Provides Forecast of Hourly Avoided Capacity & Energy Costs Under Average Water Conditions
Resource Portfolio Model
Determines NPV of Portfolios with Alternative Levels of Conservation vs Other Resources
Plan's Targets
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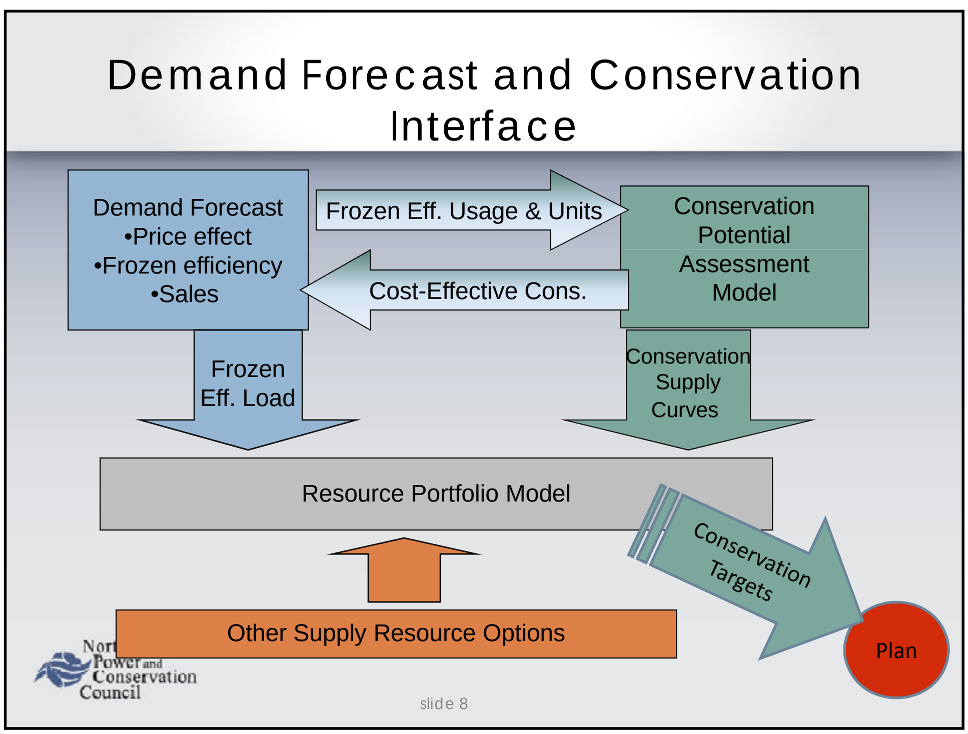
Demand Forecast and Conservation Interface
Demand Forecast
•Price effect
•Frozen efficiency
•Sales
Frozen Eff. Usage & Units
Cost-Effective Cons.
Conservation Potential Assessment Model
Frozen Eff. Load
Conservation Supply Curves
Resource Portfolio Model
Conservation Targets
Other Supply Resource Options
Plan
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slide 8

Key Elements for CRAC Advice Over Development of 7P

- Performance cost & availability
  - Inputs for costs & savings analysis
  - Shape of savings for capacity analysis
- Baselines & remaining potential
  - Technical & achievable potential
- Development assumptions
  - Ramp rates, Max/Year, LO/NLO Supply, etc.
- EE development decision rules in RPM modeling
- Action Plan recommendations

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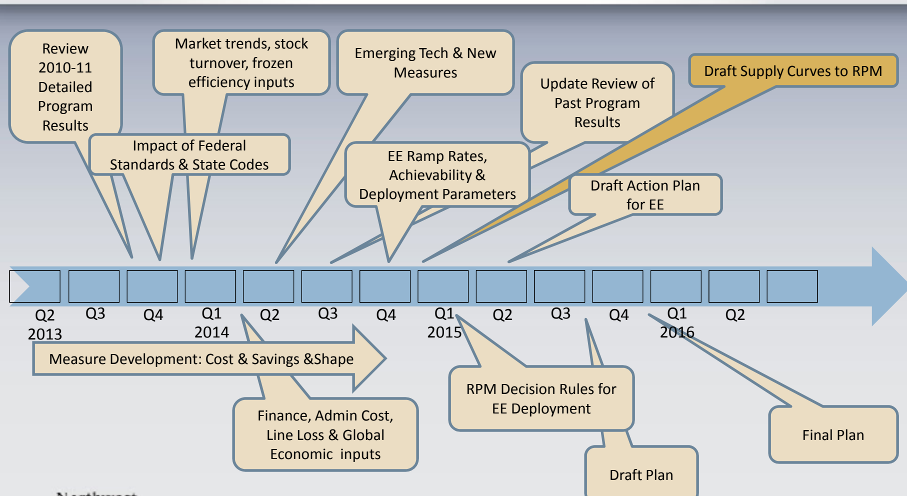
Seventh Plan Draft Timeline



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Updated August 2013

Lessons Learned Sixth Plan

- Factors affecting conservation resource development
  - Cost & amount of lost-opportunity & non-lost opportunity EE
  - Wholesale market prices
  - Carbon cost/risk
  - Load growth
  - Acquisition ramp rate assumptions
- Sensitivity analysis
- Uncertainty analysis
- Market price adder for conservation cost-effectiveness
  - How it operates as a decision rule

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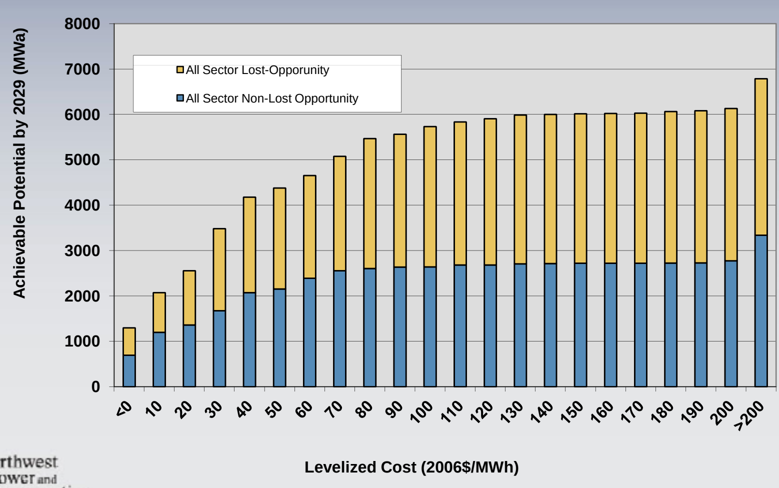
6P Size and Shape of Conservation Supply Curves



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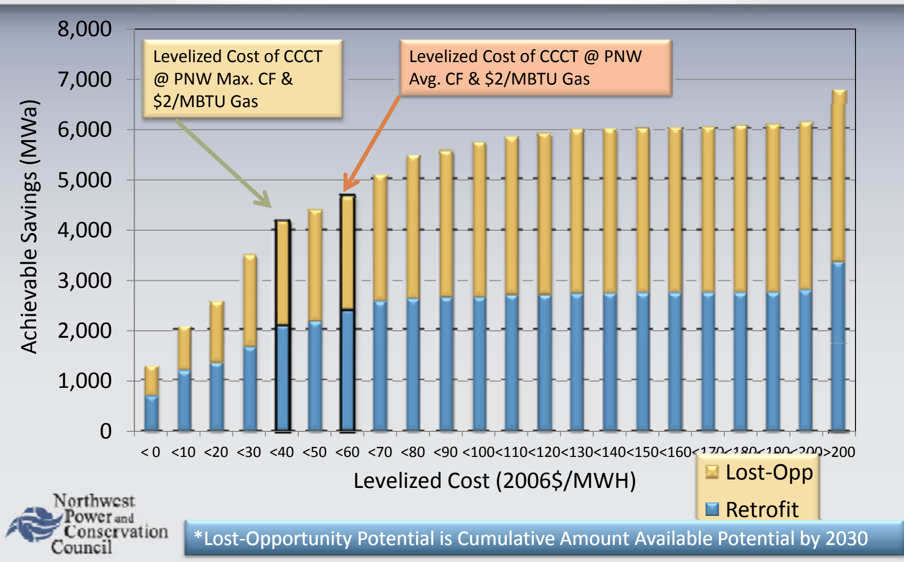
6P Two-Thirds of the 6th Plan's Achievable Potential Cost Below <$40 MWH (TRC)



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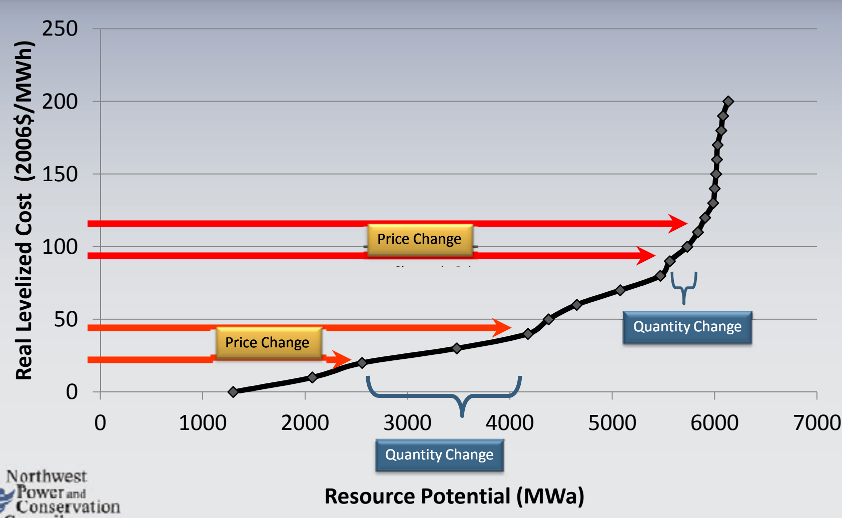
6th Plan's Non-Linear Conservation Supply Curve Has Implications for Risk Mitigation Value of Conservation



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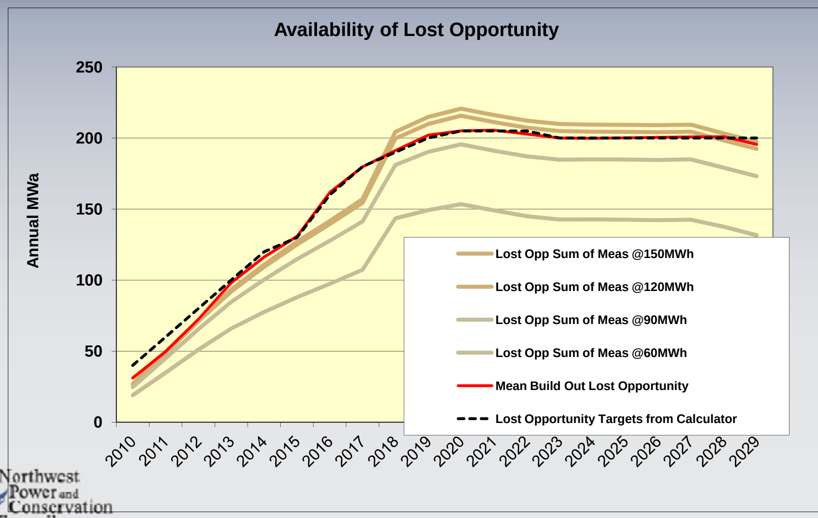
6P Available Lost-Opportunity Conservation



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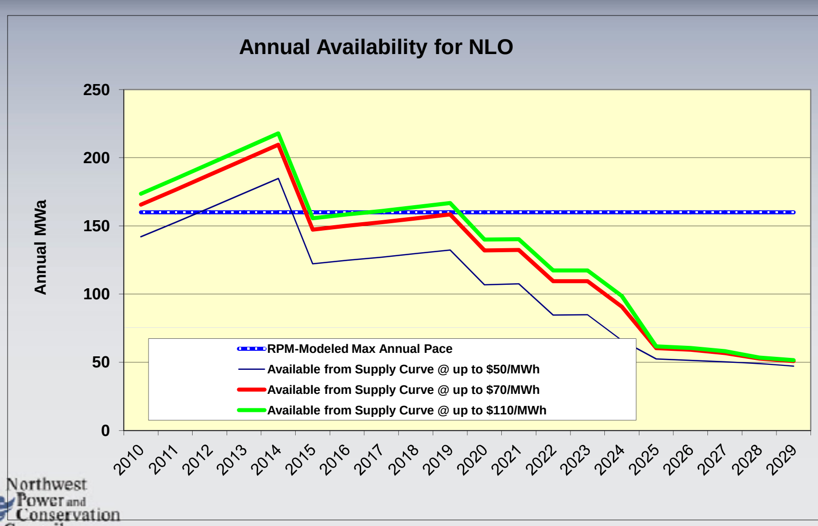
6P Available Retrofit Conservation



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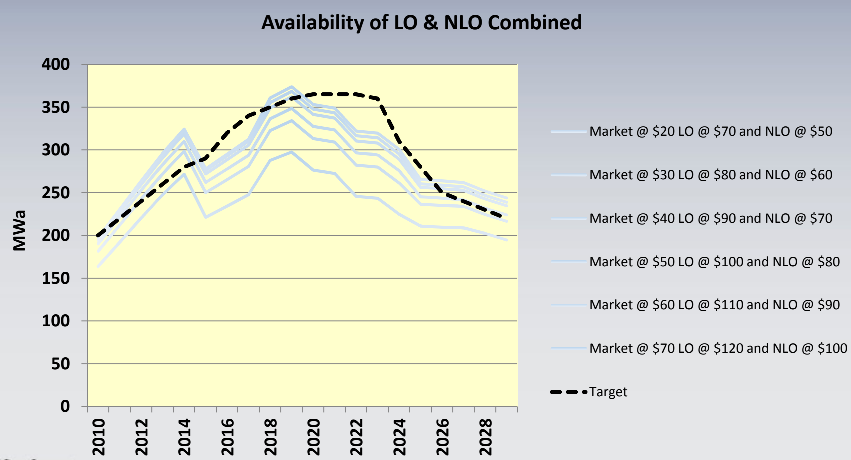
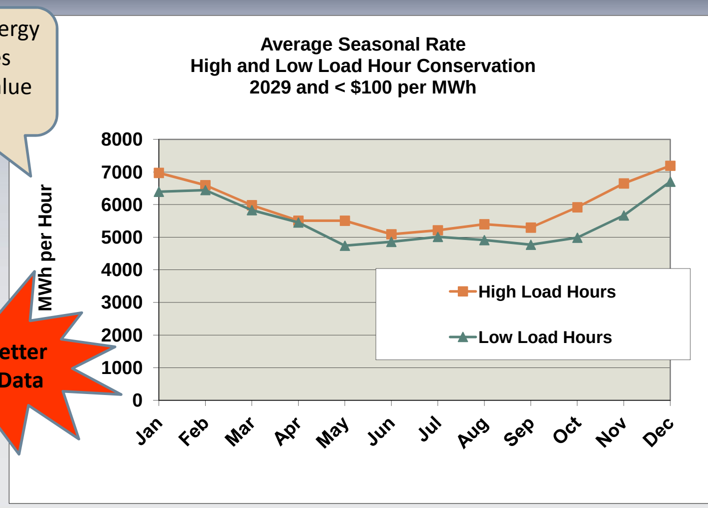
6P Maximum Availability Over Time
(Incremental)



6P Shape of Savings
(20-Year Achievable)

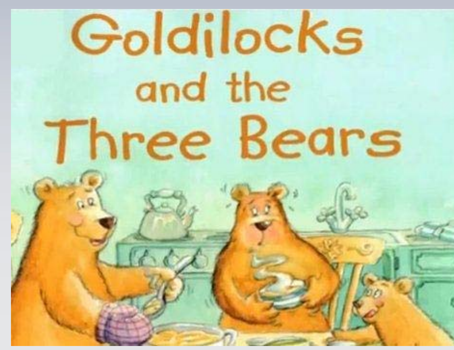
Shape of Energy Influences Capacity Value of EE



Need Better Shape Data

The Resource Planner's Problem

- Don't have too many resources
- Don't have too few resources
- Have the amount of resources that are "just right"



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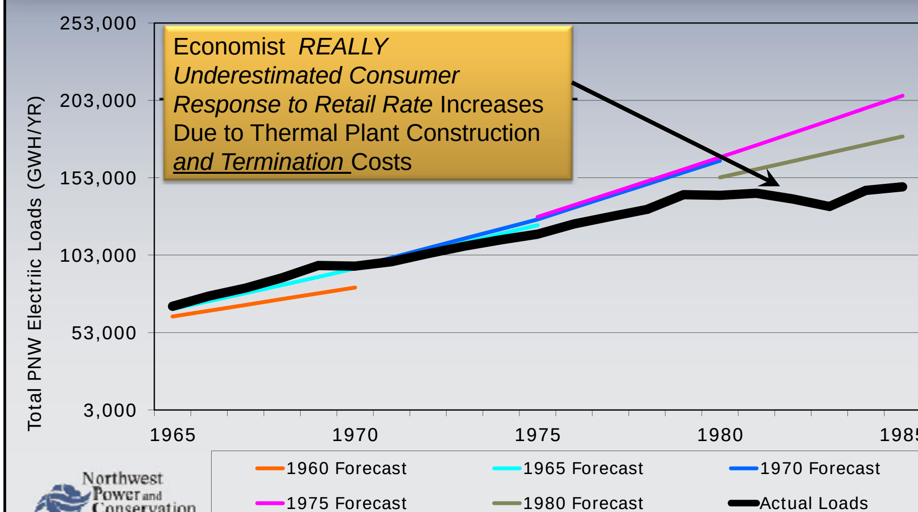
The Region Has Experienced Overbuilding



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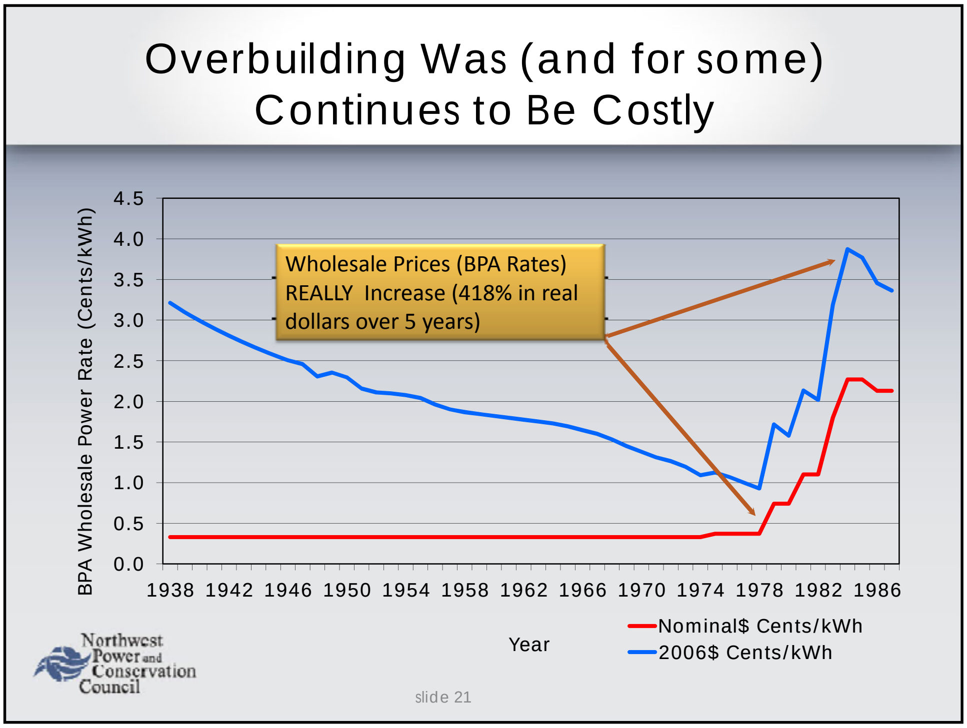
Overbuilding Was (and for some) Continues to Be Costly
BPA Wholesale Power Rate (Cents/kWh)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1938 1942 1946 1950 1954 1958 1962 1966 1970 1974 1978 1982 1986
Year
Wholesale Prices (BPA Rates) REALLY Increase (418% in real dollars over 5 years)
Nominal$ Cents/kWh
2006$ Cents/kWh
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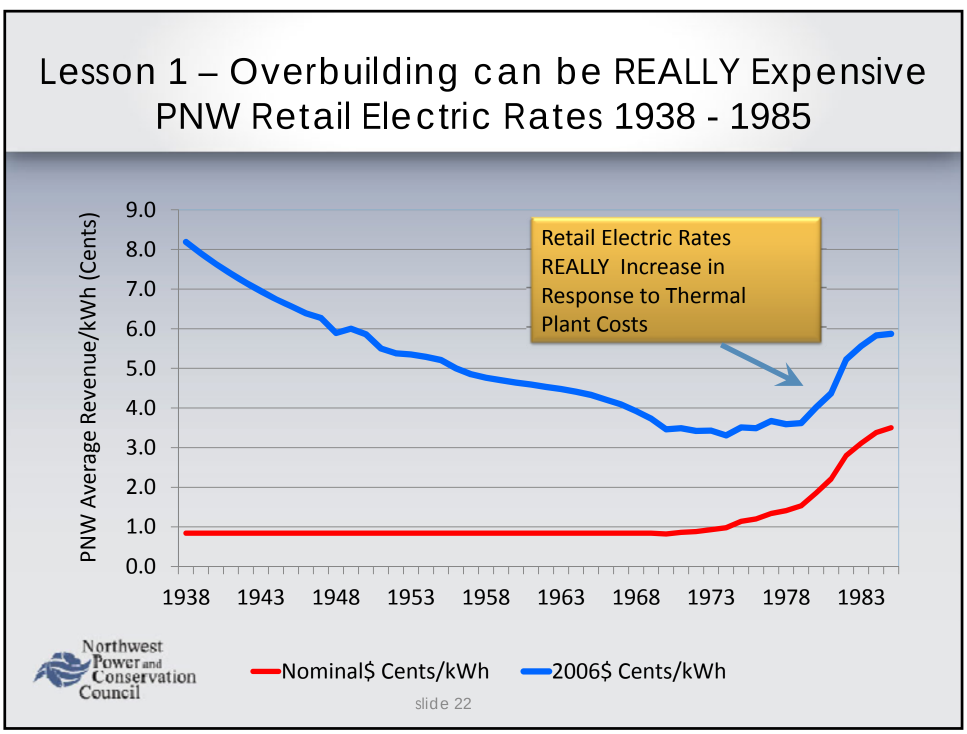
Lesson 1 – Overbuilding can be REALLY Expensive PNW Retail Electric Rates 1938 - 1985
PNW Average Revenue/kWh (Cents)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1938 1943 1948 1953 1958 1963 1968 1973 1978 1983
Retail Electric Rates REALLY Increase in Response to Thermal Plant Costs
Nominal$ Cents/kWh
2006$ Cents/kWh
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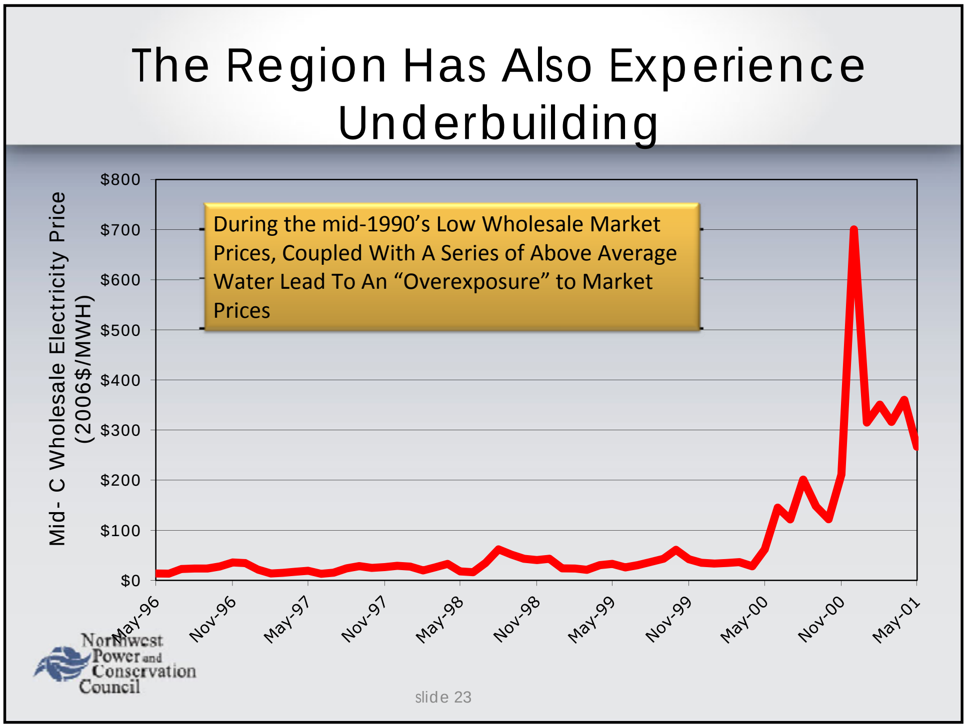
The Region Has Also Experience Underbuilding
Mid - C Wholesale Electricity Price (2006$/MWH)
$800
$700
$600
$500
$400
$300
$200
$100
$0
During the mid-1990's Low Wholesale Market Prices, Coupled With A Series of Above Average Water Lead To An "Overexposure" to Market Prices
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
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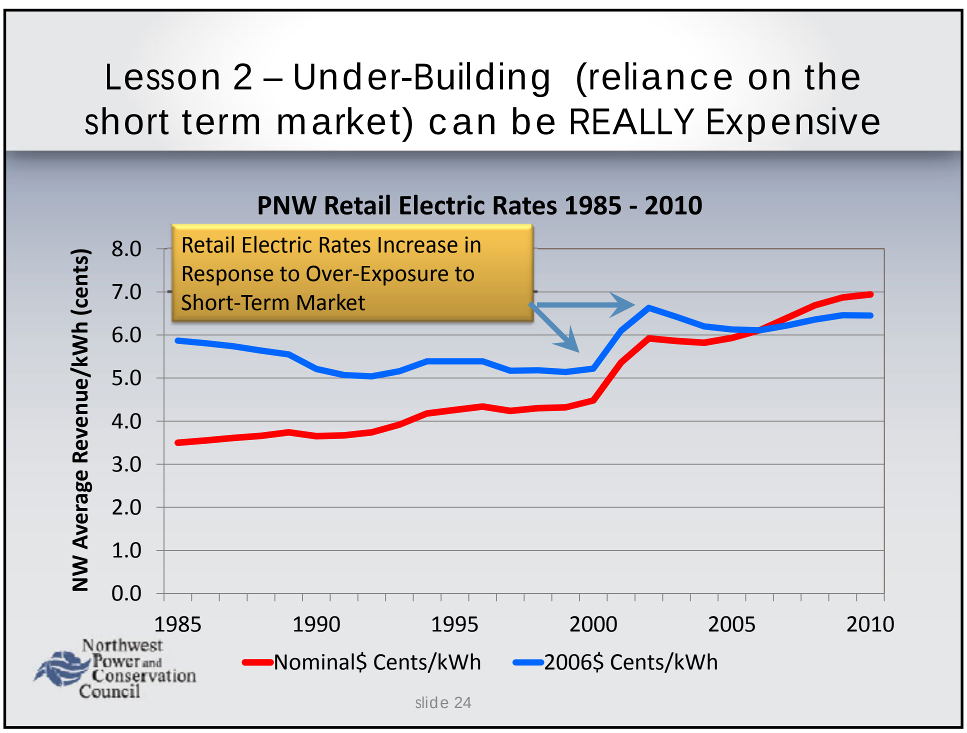
Lesson 2 – Under-Building (reliance on the short term market) can be REALLY Expensive
PNW Retail Electric Rates 1985 - 2010
NW Average Revenue/kWh (cents)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Retail Electric Rates Increase in Response to Over-Exposure to Short-Term Market
1985
1990
1995
2000
2005
2010
Nominal$ Cents/kWh
2006$ Cents/kWh
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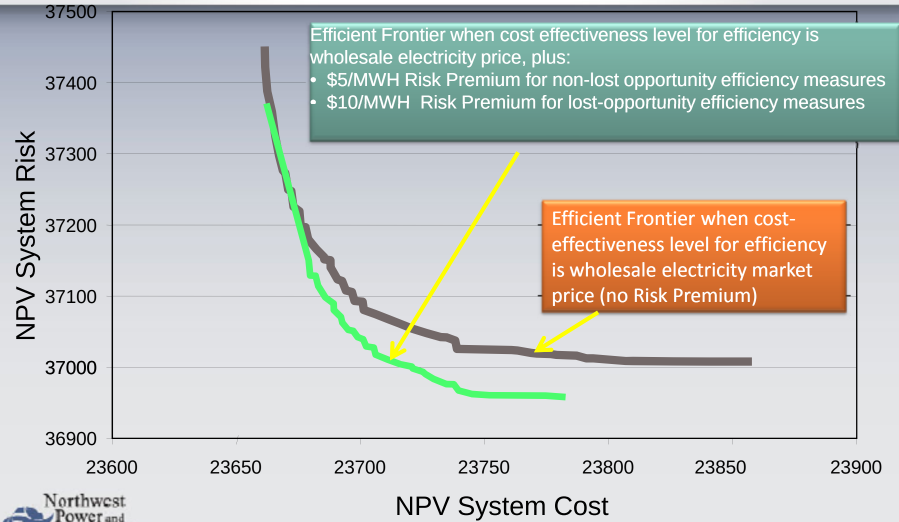
Lesson 3: Acquiring Additional Energy Efficiency Reduces both Cost and Risk



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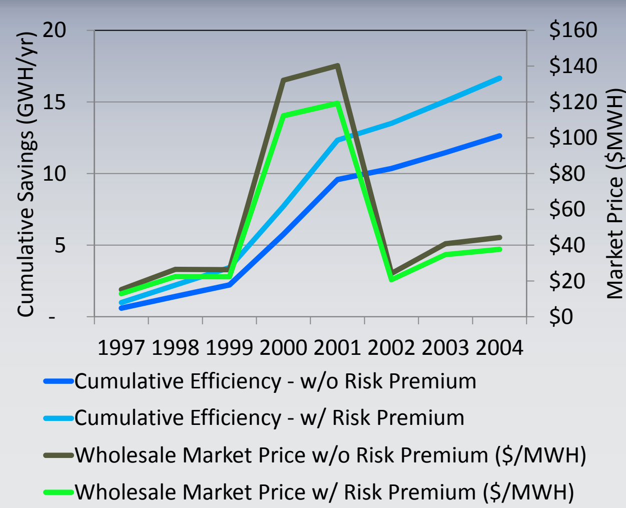
Lesson 4: Energy Efficiency Is an Inexpensive Source of *Reserve Margin*, Which Reduces Market Exposure Risk & May Moderate Wholesale Price Swings

- Efficiency's value stems from "*being there*" when a shortage hits (high prices)
- Higher levels of efficiency (lower demands) provide more price moderation



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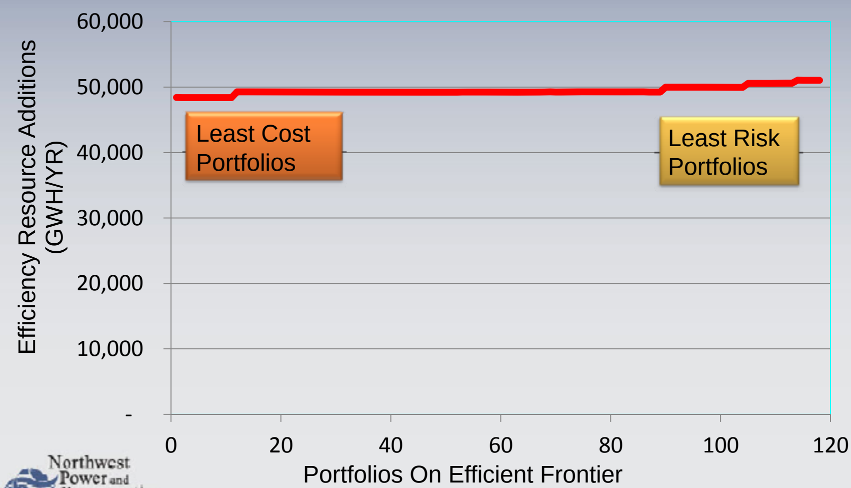
Lesson 5: Both Least Cost and Least Risk Resource Portfolios Rely Heavily on Energy Efficiency



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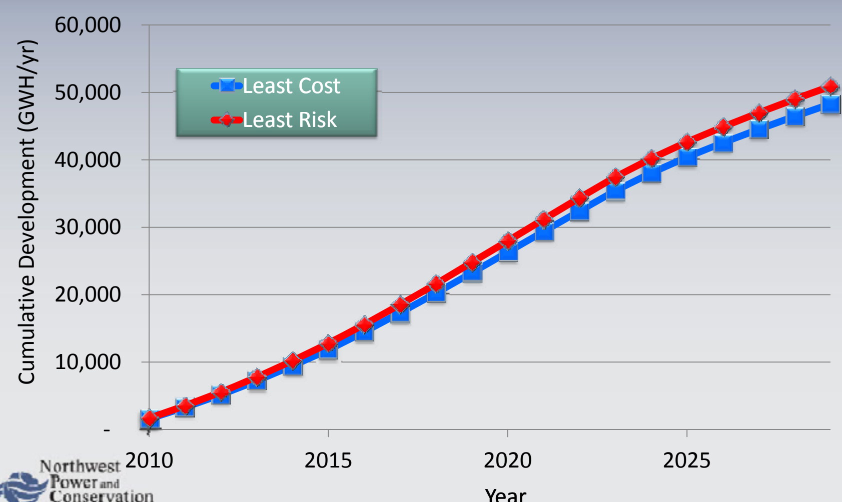
Lesson 6: The Pace of Energy Efficiency Development Does Not Vary Significantly Between Least Cost and Least Risk Portfolios



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Lesson 7: Energy Efficiency Development Does Not Change Much with Climate Policy Assumptions

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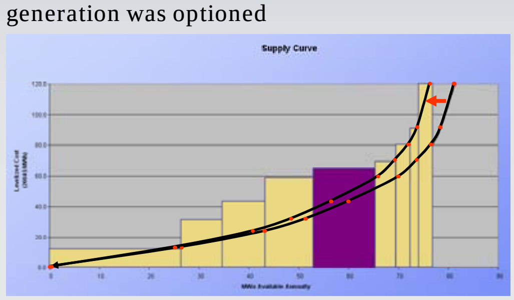
6P Lesson Learned from Conservation Uncertainty Analysis

- Analysis done after Sixth Plan
- Tested uncertain cost and price
- Findings:
  - Conservation market adders were unchanged
  - Average acquisition of conservation over the 20-year study period was unchanged
  - Additional wind generation was optioned



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Sixth Plan Cost-Effectiveness Findings: Premium Over Market Price

- Future power prices are not known
- Cannot know conservation avoided cost a priori
- Cannot know "economic" potential a priori
- So RPM tests avoided cost decision rules
- Test levels: "Apparent" market price plus premium
- "Apparent" market price proxy is last 5-year price
- Premiums tested in increments (plus 10, plus 20 …)
- RPM finds the decision rule that best reduces system cost & risk: Buy up to apparent market price plus X
- Approach meant to mimic utility system decisions

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Planning for Uncertainty in an IRP

- *Plans* – actions and policies over which the decision maker *has control* that will affect the outcome of decisions
- *Futures* – circumstances over which the decision maker *has no control* that will affect the outcome of decisions. RPM uses 750 futures to stress test plans.
- *Scenarios* – Combinations of *Plans* and *Futures* used to "stress test" how well what we control performs in a world we don't control

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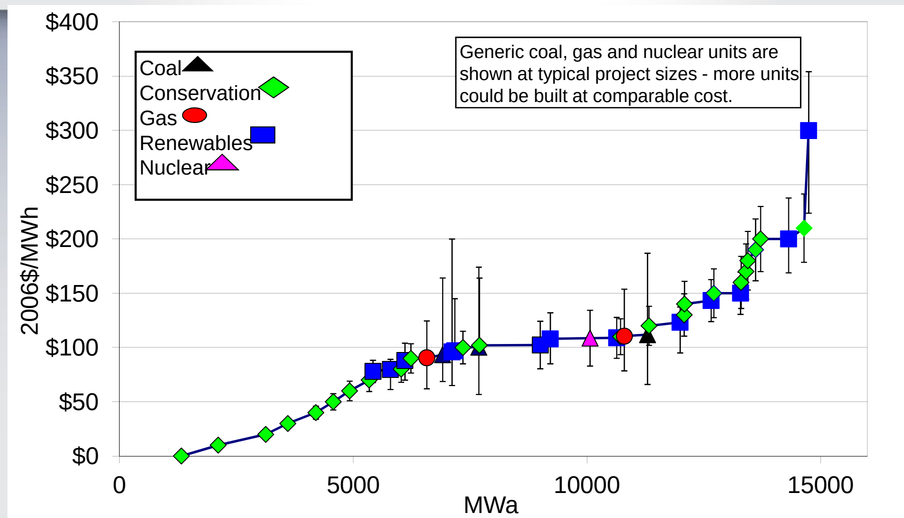
Costs Uncertain for All Resources



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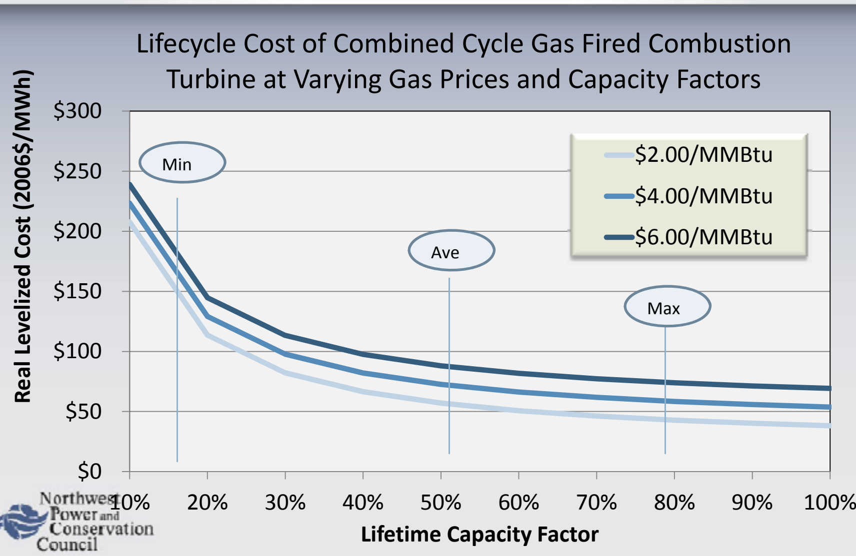
Example: Uncertain Combined Cycle Costs



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Sixth Plan EE Premium Findings

- Lost-Opportunity Conservation:
  - Market Price plus $50/MWh
- Non-Lost-Opportunity Conservation:
  - Market Price plus $80/MWh
  - Modified to Market Price plus $30/MWh

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How Cost-Effectiveness Premium Operates

- Works in conjunction with shape of supply curve
- Builds more EE when market prices are low
- Limits overbuild EE when prices are high

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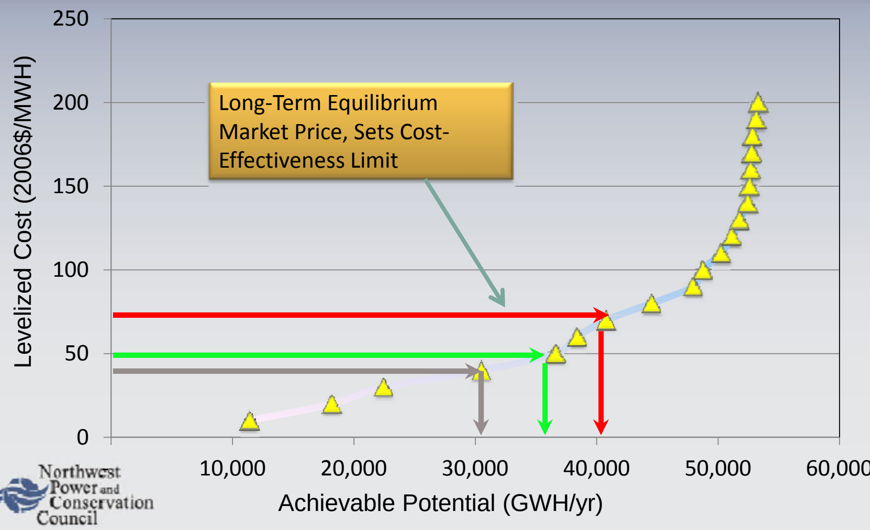
Setting A Cost-Effectiveness Limit Above Short-Term Market Prices, Acquires More Efficiency and Reduces Both System Cost and Risk



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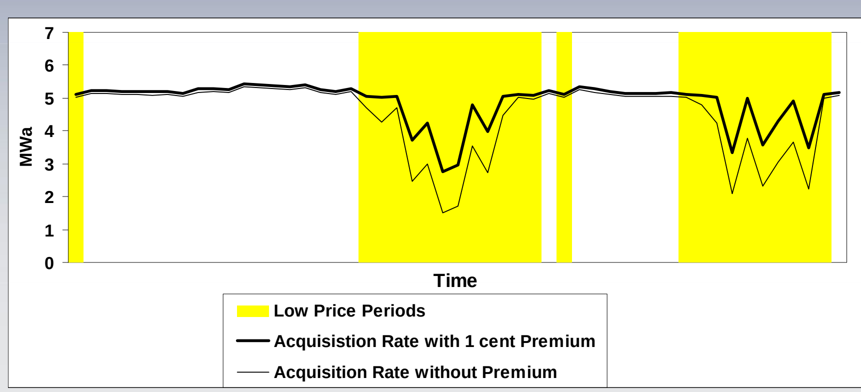
Illustrative Impact of Cost-Effectiveness Premium



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Lunch

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6P EE Development Decision Rules

- Modeling conservation development decision making used in RPM
- Important area for CRAC advice
    1. Apparent Market Price
    2. Ramp Rates - Acceleration
    3. Maximum Rate Limits
    4. Buy “Up To” Behavior
        - Sampling Non-LO
        - Sticky Downward LO
    5. Incorporate Regional Act Credit

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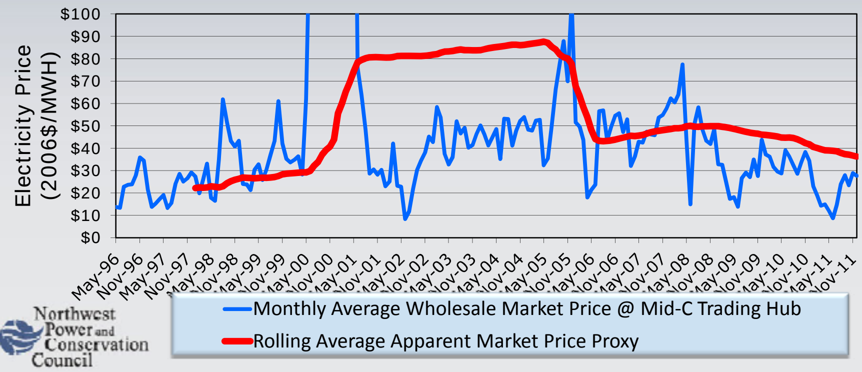
6P Apparent Market Price

- EE "Buy Up To" decisions made each quarter
- Apparent Market Price proxy in any quarter :
  - Rolling average MP past 20 quarters (5 Years)



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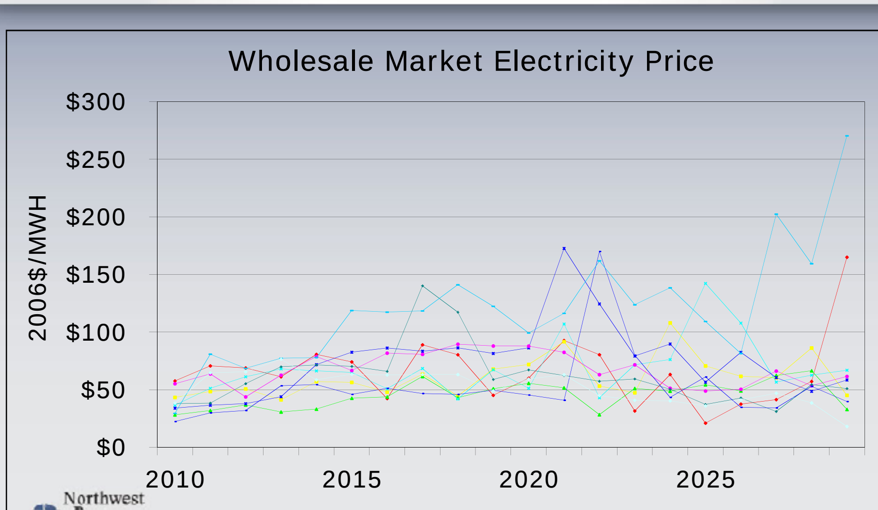
Test Premium on 750 Market Price Futures



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6P Ramp Rates & Maximum Rate Limits

- Retrofit (NLO):
  - Based on measure by measure acceleration rates
  - 160 MWa/Year Limit
  - Sample from supply curve to reflect cannot buy only cheapest first
- Lost Opportunity (LO):
  - Fan of Curves for every two years
    - Based on measure by measure acceleration rates
  - Sticky Downward
    - To reflect codes & standards not falling back

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6P Ramp Rates

Use a Bottom-Up Approach to Estimate Penetration Rates

- Estimate Annual Penetration Rates by Measure Bundle
- Distinguish Features that Impact Penetration Rate
  - Complexity of Measures
  - Delivery Mechanisms & Decision Makers
  - Current Market Saturation
  - Equipment & Infrastructure Availability
  - Subject to Code or Standard
  - Size & Cost
- (Annual Penetration Rate) x (Annual Units) x (Unit Savings)
- Then Sum of All Measure-Level Supply Curves by Year & Levelized Cost bin

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6P Penetration Rate “Families”

- Lost-Opportunity
  - Emerging Technology
  - LO Slow
  - LO Medium
  - LO Fast
- Retrofit
  - New Measure
  - In 20 Years
  - In 10 Years
  - In 5 Years

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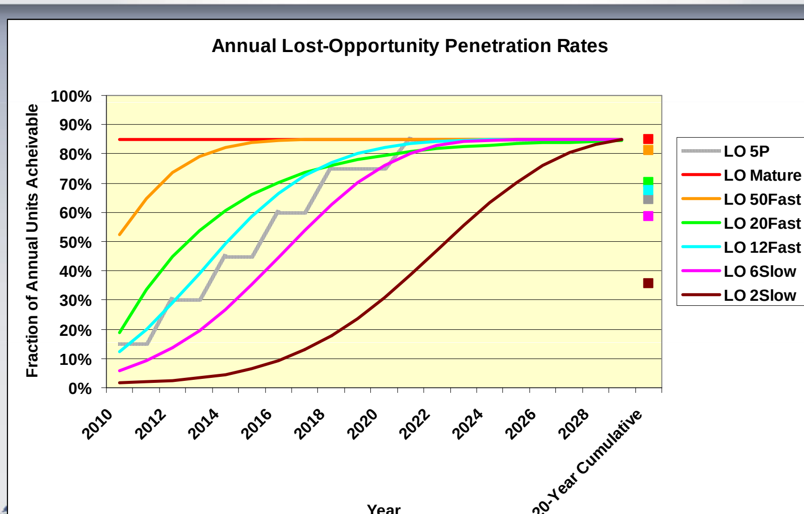
6P Family of Lost-Opportunity Penetration Rates



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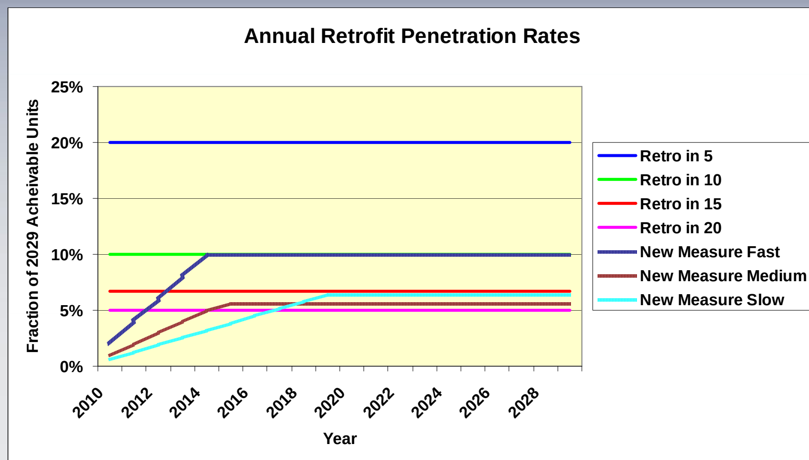
6P Family of Retrofit Penetration Rates



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6P Sampling the Discretionary Supply Curve

- Problem:
  - Can't buy only cheap conservation first
  - Programs mix high and low-cost measures
- Solution:
  - Sample from the supply curve
  - Sample based on amount in each cost bin
  - And favor bins with cost less than $40/MWh

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Animated Sampling Discretionary

Go to: Copy of Olivia Conservation 090428-Launch.xls

Copy of Olivia Conservation 090428-Launch.xls

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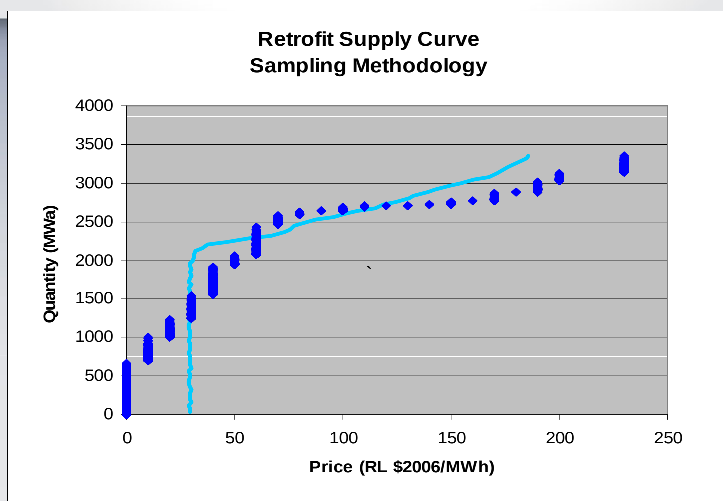
Resultant 6P Discretionary Supply Curve



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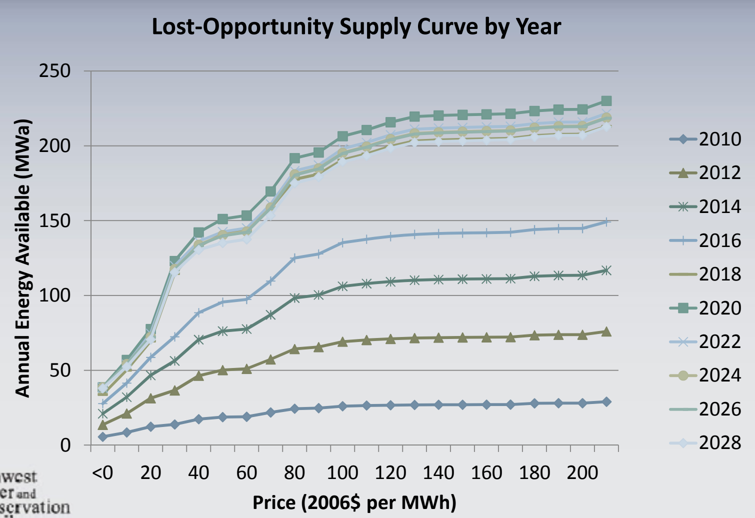
6P Lost Opportunity Supply Curve Suite



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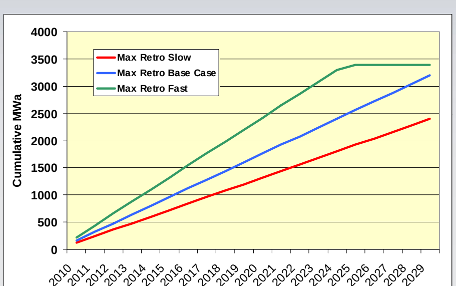
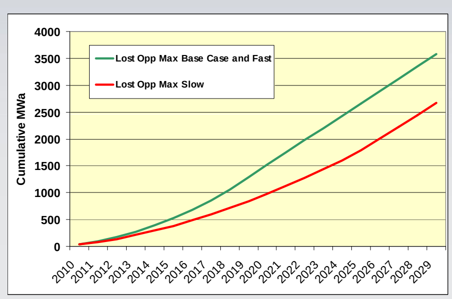
6P Results of Sensitivity Analysis

- Value of going faster
  - Retro 220 MWa/Year & LO 12-Year Ramp Up
- Cost of going slower
  - Retro 100 MWa/Year & LO 20-Year Ramp Up





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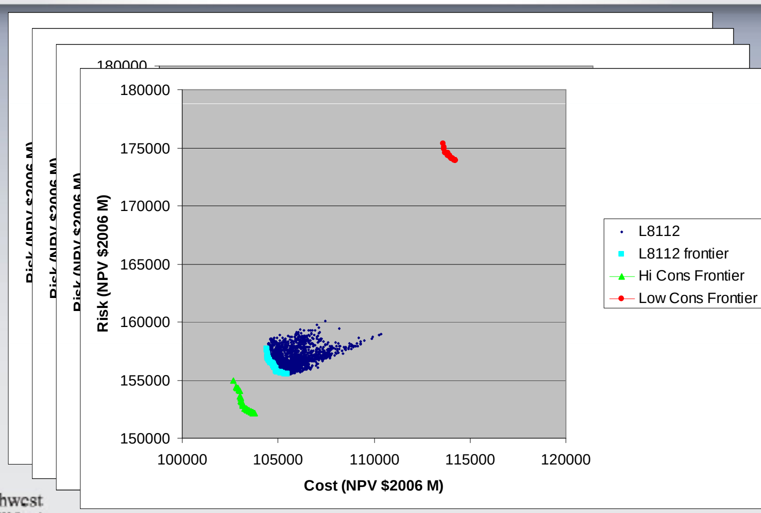
6P Efficient Frontiers for Conservation Sensitivities



Source: Draft 6P Analysis of Optimization Run_L811 090510 2101.xls

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6P Acquisition Rate Findings

- Maximum Achievable Pace is Very Important
- Faster annual pace reduces cost & risk
- Annual pace limits have dramatic effect on cost risk
- Lost-Opportunity commands high adder
  - $50/MWh over market price reduces risk along the frontier
- Retrofit commands lower adder
  - Abundant conservation at low cost ($30/MWh average)
  - $30/MWh over market reduces risk along the frontier

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Incorporating Regional Act Credit

- Regional Act:
  - EE is cost-effective at 110% of generation cost
- Credit calculated as 10% of power system value
  - Value of energy based on single 20-year market price
  - Value of deferred transmission and distribution system expansion based on kW impacts of EE
- Credit is subtracted from levelized cost of energy in the conservation supply curves

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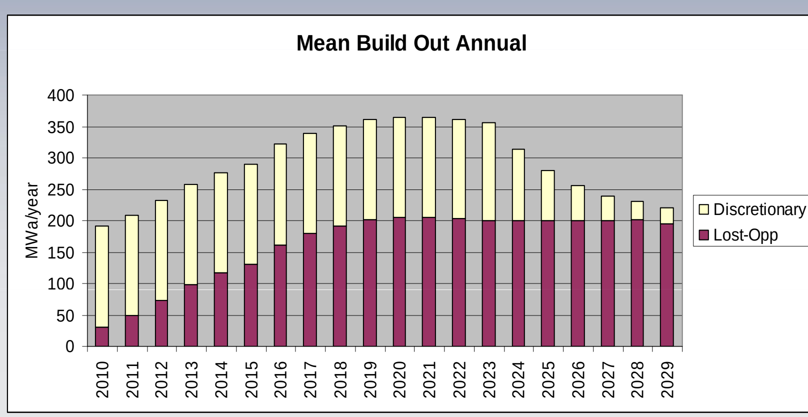
Results of Decision Rules



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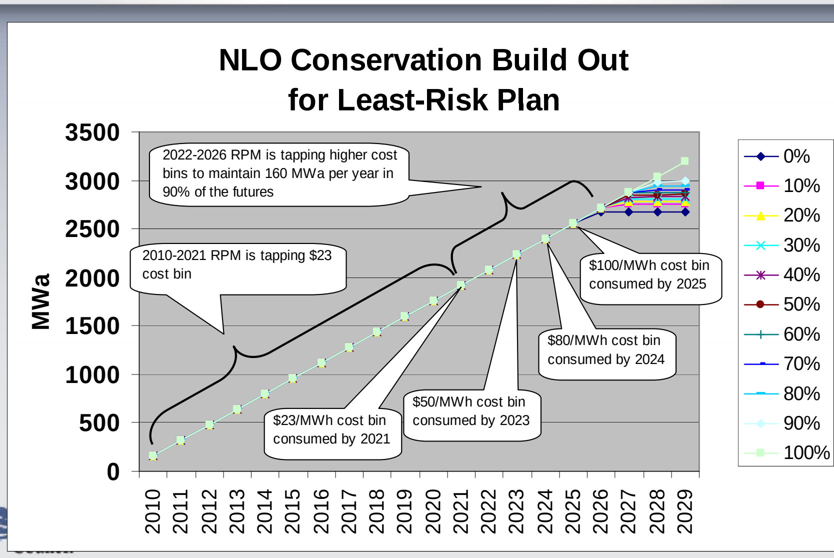
Sixth Plan Discretionary Conservation: Distribution of Build Out Futures with Cost Data Annotations



Sixth Plan Lost-Opportunity Conservation: Distribution of EE Build Out Futures

6P Deterministic Model Results

	Includes Carbon Cost?	LO Market Adder Value (2006$/ MWh)	NLO Market Adder Value (2006$/ MWh)	Lost Opportunity (MWa)	Non-Lost Opportunity (MWa)	Total (MWa)
Base Case	No	$ -	$ -	1,835	2,253	4,008
Carbon Cost	Yes	$ -	$ -	2,180	2,479	4,660
"Market Adders"	No	$ 50	$ 50	2,854	2,584	5,438
6th Plan Market Adders	No	$ 50	$ 80	2,854	2,727	5,582
Carbon+Equal Market Adders	Yes	$ 50	$ 50	3,037	2,719	5,755
Carbon+6th Plan "Market Adders"	Yes	$ 50	$ 80	3,037	2,812	5,849

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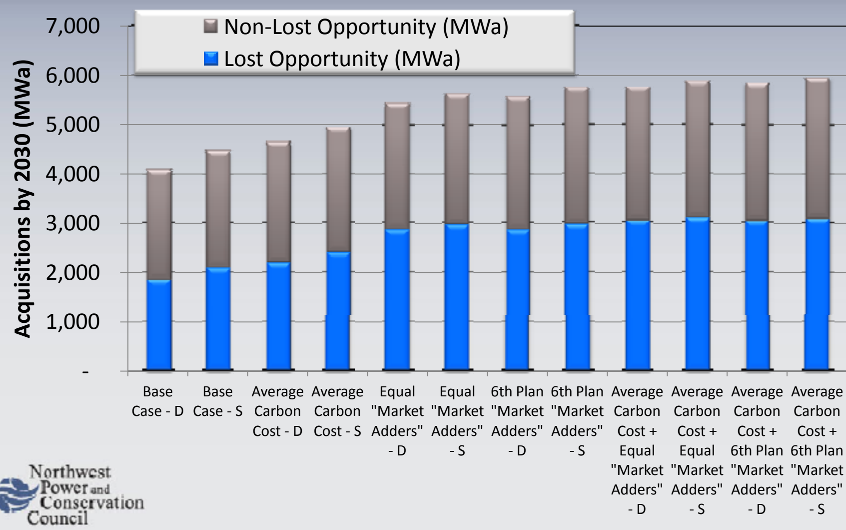
6P Stochastic Model Results

	Includes Carbon Cost?	LO Market Adder Value (2006$/ MWh)	NLO Market Adder Value (2006$/ MWh)	Lost Opportunity (MWa)	Non-Lost Opportunity (MWa)	Total (MWa)
Base Case	No	$ -	$ -	2,072	2,405	4,477
Carbon Cost	Yes	$ -	$ -	2,395	2,552	4,947
"Market Adders"	No	$ 50	$ 50	2,963	2,672	5,635
6th Plan Market Adders	No	$ 50	$ 80	2,963	2,787	5,750
Carbon+Equal Market Adders	Yes	$ 50	$ 50	3,092	2,787	5,859
Carbon+6th Plan "Market Adders"	Yes	$ 50	$ 80	3,092	2,867	5,958

Northwest Power and Conservation Council

6P Impact of Conservation Acquisition Decision Rules on Total Acquisitions



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Cost Effectiveness Premium Deterministic Sources of Value

- Capacity deferral and displacement
  - Based on shape of energy saved – hour, day, month
  - Impact anticipated kW peaks & peak resource needs
  - Frees up flexible resources
- Reducing RPS obligations
- Potentially
  - Cost reduction even for surplus utilities
  - Opportunities to develop and resell
- Purchases at below-average prices
  - The “constant-dollar averaging effect”

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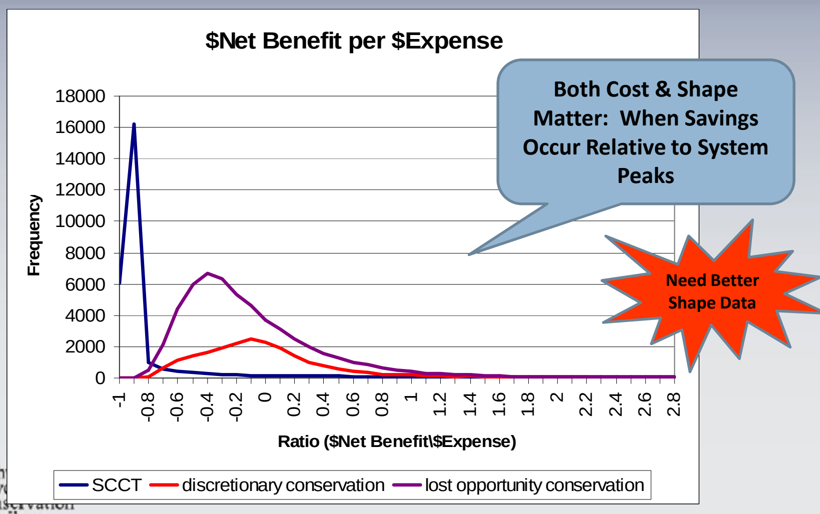
6P Capacity "Hedge" Value of Conservation Compared to Gas Peaker



Cost Effectiveness Premium Risk Mitigation Sources of Value

- "Strategic" risk mitigation
  - fuel price exposure
  - wholesale power prices
  - carbon risk
- Superiority in both low-market and high-market futures relative to fuel-based resources
- "Inverse elasticity" effect

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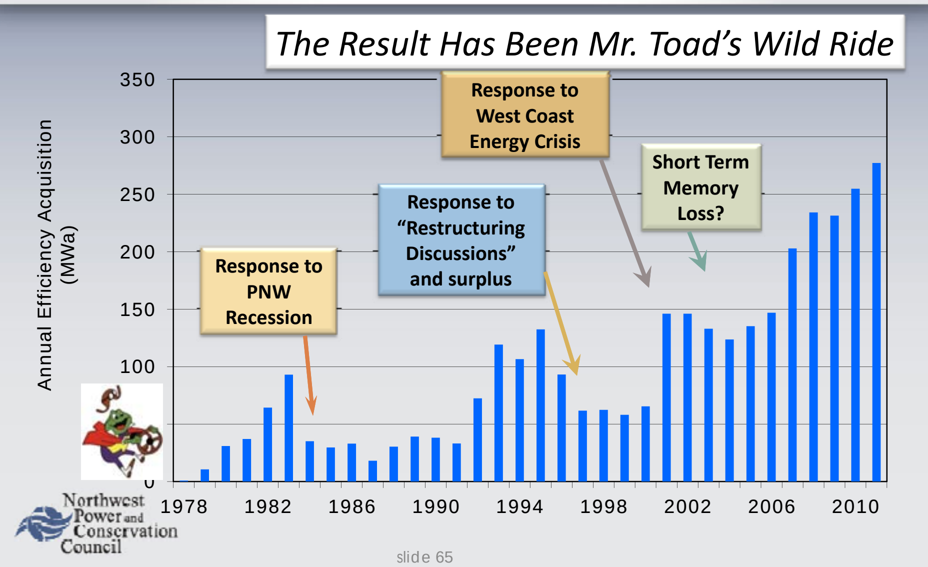
Historically Utility the Pace of Utility Efficiency Development Has Been Tied to Short Term Market Conditions



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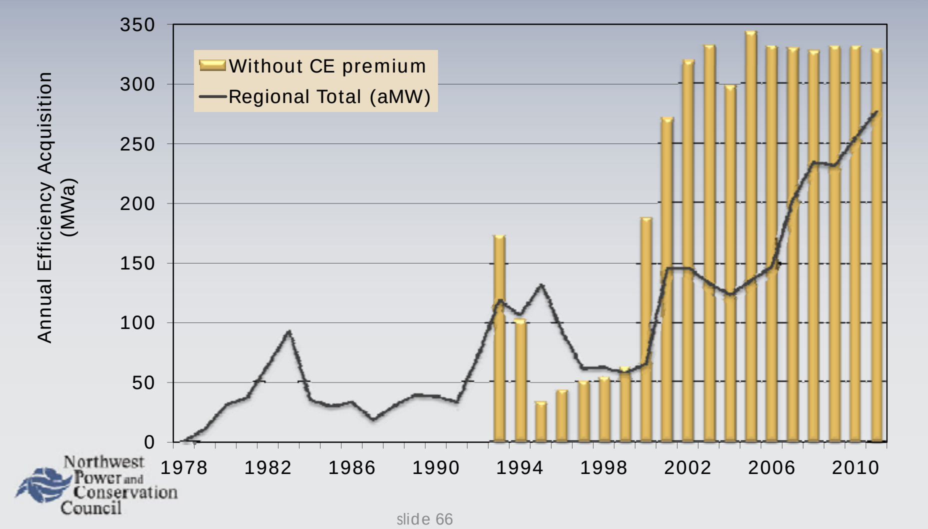
Modeled Acquisition

No Cost-Effectiveness Premium



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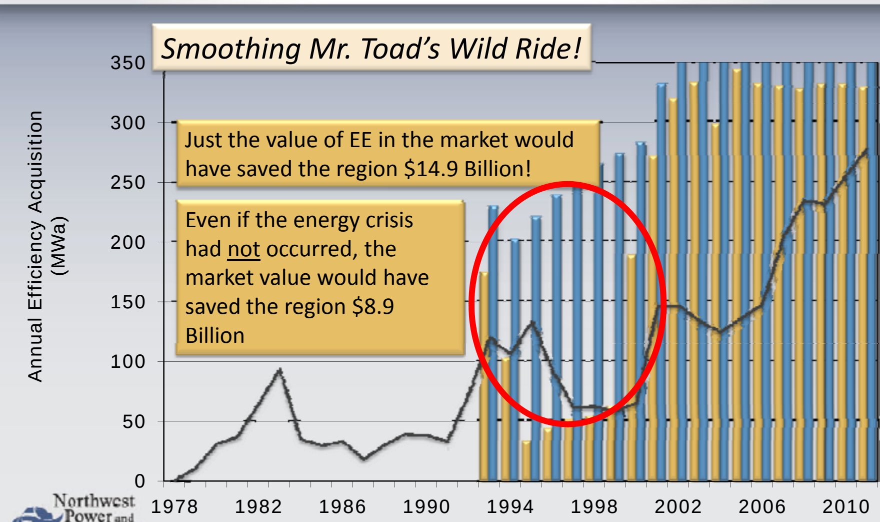
Modeled Acquisition

With Cost-Effectiveness Premium



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Discussion

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