Northwest **Power** and **Conservation** Council

March 31, 3015

MEMORANDUM

TO: **Power Committee**

FROM: **Tom Eckman, Ben Kujala, Charles Grist, Kevin Smit and Tina Jayawreera**

SUBJECT: **Guidance on Scenario Assumptions**

BACKGROUND:

Presenter: Tom Eckman and Ben Kujala

Summary: Staff is seeking Council guidance on the input assumptions that should be used in the Regional Portfolio Model's (RPM) scenario analysis. The specific input assumptions in are:

- In Scenario 2B that reflects the Social Cost of Carbon, which of the estimates published by the Interagency Working Group on the Social Cost of Carbon should be used?
- In Scenarios 4C and 4D that assess the cost and risk associated with conservation resource uncertainty, what upper and lower bounds on the pace of conservation deployment should be tested?
- Should the direct impacts climate change (i.e., forecast increases in regional temperatures) be assumed in all scenarios or only as a sensitivity analysis?

Staff recommends that the Council use the Interagency Workgroup on the Social Cost of Carbon's estimate of the damage cost of climate change based on a three percent discount rate. These values are shown in Table 1 below.

Staff recommends these values for two reasons. First, they are similar to the average carbon costs assumed in Scenario 2C which randomly varies carbon prices across all futures between zero and $100 per metric ton. A comparison between the results of Scenario 2B, which assumes a specific carbon emissions cost in every future tested in the RPM and Scenario 2C, which assumes random carbon emissions cost will reveal the cost and risk associated with militating against uncertain carbon emission control policies.

The second reason the staff recommends the use of the values in the three percent column is because both lower and higher emission cost assumptions will likely be tested in other scenarios. Specifically, Scenario 2A, which is designed to reflect the Environmental Protection Agency's 111(d) regulations, will likely produce alternative "carbon control" prices that are below the estimates provided by the Interagency Working Group. Scenario 3B, which is designed to determine the lowest level of carbon emissions achievable with current technology, will likely produce alternative "carbon control" prices that are above the other estimates provided by the Interagency Working Group.

Table 1 - Interagency Working Groups Estimated Social Cost of CO_2 2015-2050 and 6th Plan Carbon Risk Scenario Average (2012$/Metric Ton)

	Discount Rate and Statistic				**6th Plan Carbon Risk Scenario (Average Across All Futures**
Year	**5% Average**	**3% Average**	**2.5% Average**	**3% 95th Percentile**	
2015	$12	$40	$62	$118	$36
2020	$13	$47	$69	$139	$52
2025	$15	$51	$75	$156	$57
2030	$17	$56	$81	$173	$58
2035	$20	$61	$87	$190	
2040	$22	$66	$94	$208	
2045	$26	$71	$100	$224	
2050	$29	$77	$106	$239	

Scenarios 4C and 4D are intended to shed insight on the impact of the maximum pace of development for energy efficiency resources. Analysis in the Fifth and Sixth power plans showed considerable increases in both cost and risk from retarding development of cost-effective conservation.

Staff recommends that the Council assume that the same total amount of efficiency available over the twenty-year planning period, but the maximum annual rate will be increased or decreased in the fast and slow

cases respectively. Staff proposes that the changes will be symmetric and applied to all cost bins and all measures. This approach will allow the Council to isolate the impacts of the changes with respect to pace alone. Staff recommends testing inputs for scenarios 4C and 4D that increase or decrease the maximum annual pace by plus or minus about one third. In Scenario 4C, the faster pace case, ramp rates would be increased in the early years and decreased in the later years to assure that total conservation available by measures remains the same over twenty years. The same is true for Scenario 4D, the slower pace case, but rates will be decreased in the early years and increased later.

Staff has yet to develop its recommendation on whether to include the indirect effects potential increase temperatures as a result of climate change. Staff analysis of these effects on the resource strategies and associated cost and risk is still underway and will be presented at both the Power Committee and Council meeting.

Relevance: Scenarios are tested in the RPM to reveal the cost and risk associated with alternative resource development strategies. Therefore, it is important that potential strategies be tested across a wide range of future conditions that reflect factors that are out of the control of regional policy makers and utilities.

Workplan: 1.B. Develop Seventh Power Plan and maintain analytical capability

- Draft scenarios and strategies to be analyzed
- Draft sensitivity studies for resource strategy

Background: History demonstrates that Council's forecast of the maximum pace of conservation acquisition is uncertain – like all forecasts. The critical issue is developing scenarios that will produce an informative test. It should be a large enough difference to produce a difference in cost and risk. At the same time the tests should be credible with respect to the increase in maximum pace that might be achieved.

The conservation supply curves include measure-specific maximum ramp rates. The ramp rates for each measure, combined with estimates of new additions, and stock turnover rates guide the overall pace at which conservation resources can be developed.

The conservation analysis uses a suite of about 8 different ramp rates for over 100 measure bundles. The net effect of the fast and slow adjustments on all the measures has the effect of shifting deployment about one year earlier or later. For example, by 2020 total available conservation is about 270 aMW higher in the fast case than the base case - and a similar amount lower in the slow case. The maximum annual difference is about 50 to 60 aMW per year.

To assess the reasonableness of the proposed changes staff compared them to historical differences in year-to-year acquisitions. The fast and slow cases are in the same range as changes that have been observed historically. The Conservation Resources Advisory Council (CRAC) was briefed on the scenario inputs at its March 24 meeting. The CRAC agreed that the proposed tests seemed credible with respect to the acceleration or deceleration available within programs. Some members suggested higher differences between base, fast and slow levels to account for market trends outside of utility programs. Another question was raised about whether the increase in pace would also require an increase in cost per kWh saved. There was general consensus that this is not necessarily true. For this reason, and in order to isolate on the impact of pace limitations, staff recommends not including a cost factor in these two scenario sensitivity tests.

Guidance on Scenario Input Assumptions

- *Scenario 2B -Social Cost of Carbon*
- *Scenarios 4C and 4D – Conservation Resource Uncertainty*
- *All Scenarios – Direct Impacts of Climate Change*

April 7, 2015

Northwest Power and Conservation Council

SEVENTH NORTHWEST POWER PLAN

Scenario Number	Scenario Name	Scenario Description	Key Stress Factors /Constraints Tested
2A	**Existing Policy *with* Uncertainty and *with certain* GHG reduction risk/target**. Proposed Policy Target = Clean Power Plan/Clean Air Act 111(d) goal (e.g., 30% below 2005 level by 2030	Existing RPS, state and federal environmental regulations, including MATS and haze, CA and BC carbon costs, state carbon limits on new generation. Distribution of values for all major sources of uncertainty across all futures. *Scenarios will test specific carbon reduction targets or costs. Example:* Resource strategies must result in 30% less GHG emissions by 2030 compared to 2005 (or some variant of this policy)	Cost and Value of uncertainty risk mitigation with known generation fleet retirements and regulatory compliance costs Delineated by 2A – 1B
2B	**Existing Policy *with* Uncertainty and *with certain* GHG reduction risk/target**. Proposed Policy Target = Mitigate to Estimated GHG Damage Cost	Existing RPS, state and federal environmental regulations, including MATS and haze, CA and BC carbon costs, state carbon limits on new generation. Distribution of values for all major sources of uncertainty across all futures. *Scenarios will test specific carbon reduction targets or costs. Example:* GHG emissions cost/price set equivalent to the US Interagency Working Group on Social Cost of Carbon (SCC)	Cost and Value of uncertainty risk mitigation with known generation fleet retirements and regulatory compliance costs. If SCC is used to represent damage cost, resulting portfolios theoretically achieve GHG mitigation equivalent to damage costs. Delineated by 2B – 1B
2C	**Existing Policy *with* Uncertainty *and with uncertain* GHG reduction risk/target**.	Existing RPS, state and federal environmental regulations, including MATS and haze, CA and BC carbon costs, state carbon limits on new generation. Distribution of values for all major sources of uncertainty across all futures. *Scenarios will test specific carbon reduction targets or costs.* GHG emissions cost/price allowed to vary across futures between $X and $Y	Cost and Value of uncertainty risk mitigation without known generation fleet retirements and regulatory compliance costs Delineated by 2C – 1B

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SEVENTH NORTHWEST POWER PLAN

Interagency Working Groups Estimated Social Cost of CO_2, 2015-2050 and 6th Plan Carbon Risk Scenario Average (2012$/Metric Ton)

	Discount Rate and Statistic				
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Reasons for Staff Recommendation

- Allows more direct comparison of "carbon control policy undercertainty
  - Scenario 2B uses *single* carbon emissions cost, set at Social Cost of Carbon (SCC)
  - Scenario 2C uses *random* carbon emissions cost between $0 and $110, with average across all futures approximately equal to SCC
- Higher and Lower carbon emissions cost tested via other scenarios (2A and 3A)

Scenario Number	Scenario Name	Scenario Description	Key Stress Factors /Constraints Tested
4C & D	**Major Resource Uncertainty** – Pace of Conservation Deployment	Determine the resources that would be developed/displaced if the deployment of energy efficiency is faster or slower than anticipated	Cost and risk associated with assumed upper and lower limits on pace of conservation in resource strategies Delineated by 4C/4D – 2C

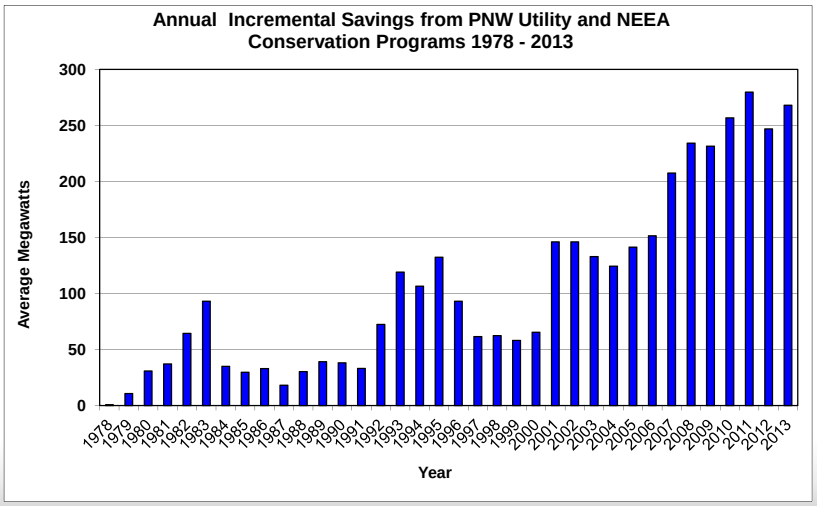
Testing the Impact of Pace of Energy Efficiency Acquisition

Power Committee
April 7, 2015

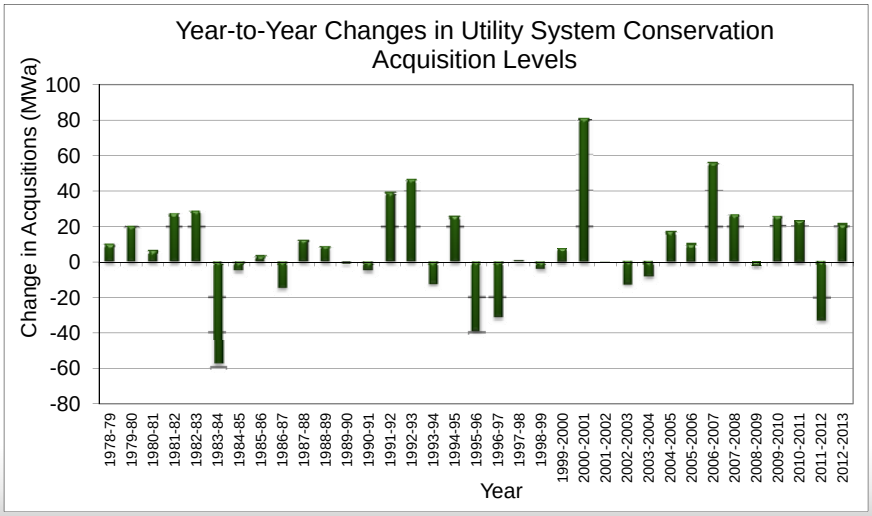
Acquisition Rate Sensitivity Testing
Scenarios 4C & 4D

- Problem:
  - Maximum EE acquisition rates uncertain
- Purpose:
  - What is the value of going faster or slower?
  - What is impact on EE avoided cost?
  - What are the resource consequences?
  - What are the revenue requirements?
- Tool: Regional Portfolio Model
  - Test slow & fast MAX achievable penetration
- Decision: What ranges to test?

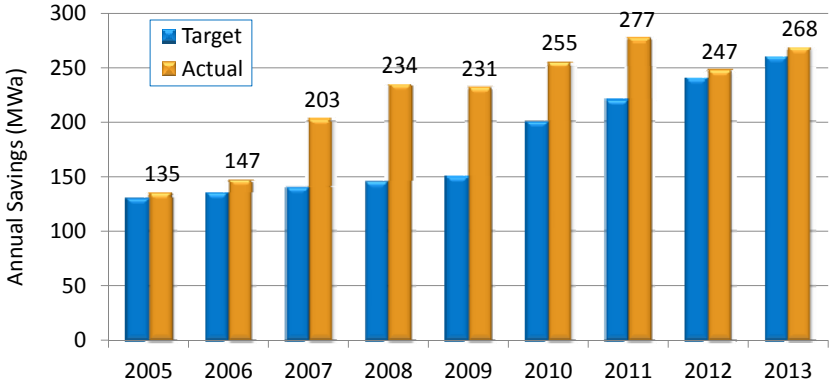
Efficiency Acquisition Rates Have Been Volatile



Year-to-Year Conservation Acquisitions Have Varied By Over 50 aMW/year



Planning Estimates Can Be Humbled by Reality



Five years where achievements exceeded targets by over 40%

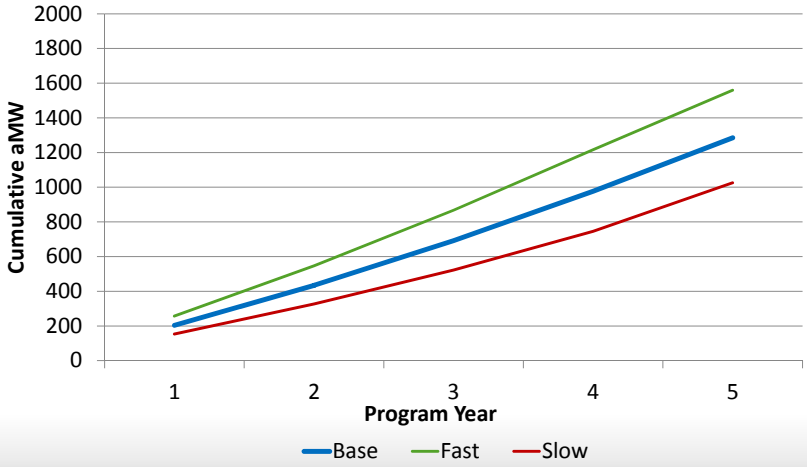
Ramp Rate Sensitivity Testing

Staff Recommendation:

- Shift Program Ramp Rates
  - *SLOW:* Proportional Shift Later in Time
  - *FAST:* Proportional Shift Earlier in Time
- Applied to all measures & all cost bins
- Test symmetric shifts
- Keep total 20-year acquisition constant
- Test needs to be credible

Impact of Shifts: Cumulative

First Five Years, All Measures All Cost Bins (33% shift)



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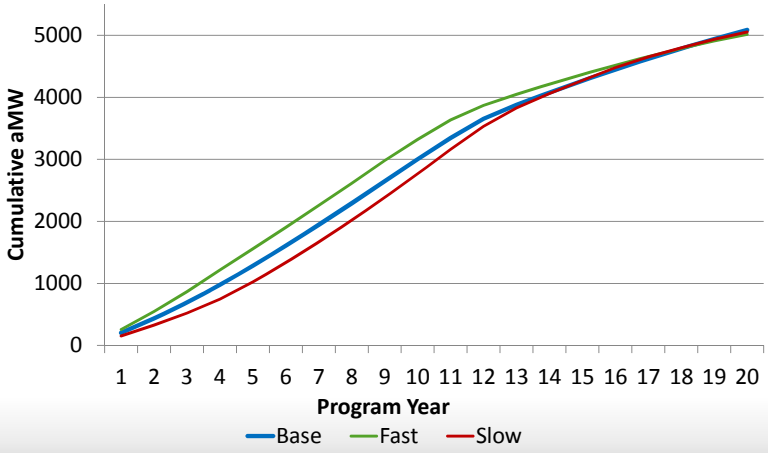


Advice from Conservation Resource Advisory Committee

- Reviewed approach at March 24 meeting
- Discussion about magnitude of shift
- Discussion about cost of acceleration
- General agreement about approach
  - Magnitude is credible
  - Test impact without cost changes

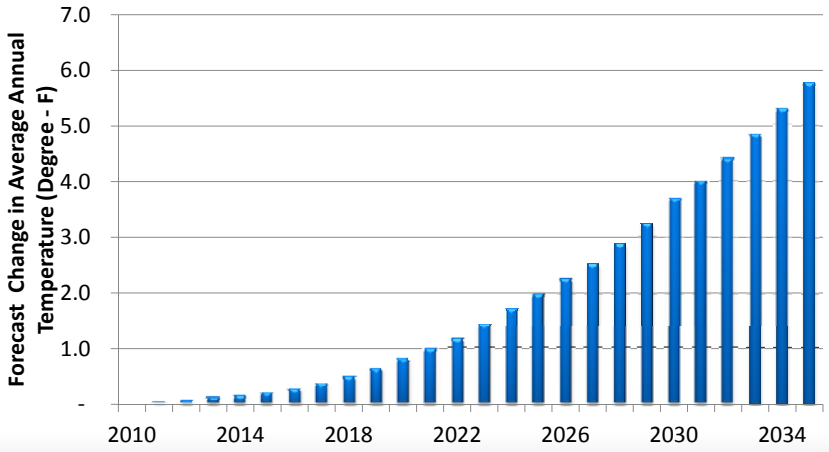
Climate Change –
Direct Effects of Projected Temperature

- Should direct effects of temperature change be assumed in all scenarios

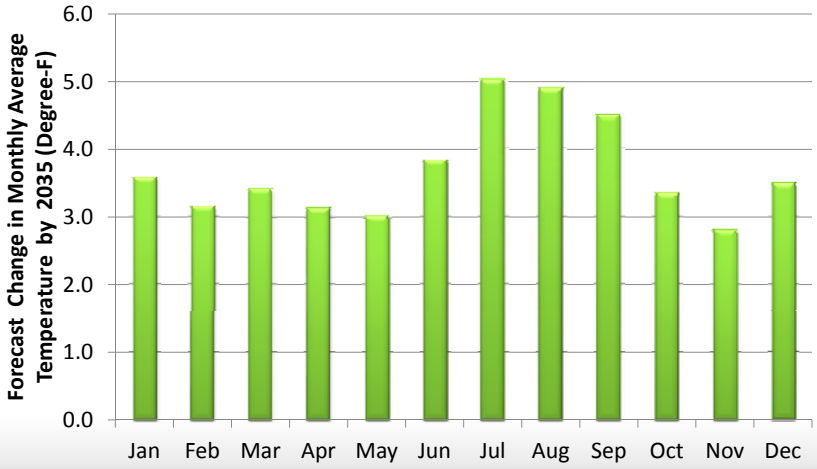
OR

- Treated separately as a sensitivity study

Northwest Average Annual Temperature Are Forecast to Increase

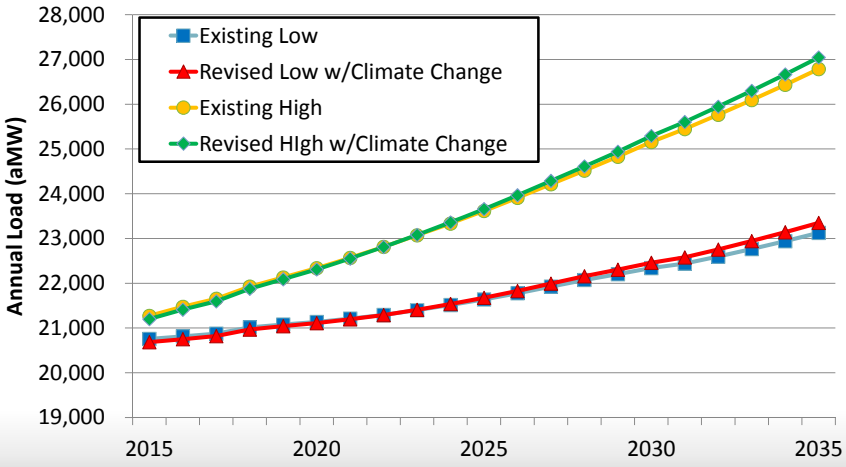


Summer Temperatures Are Projected To Increase More Than Winter Temperatures



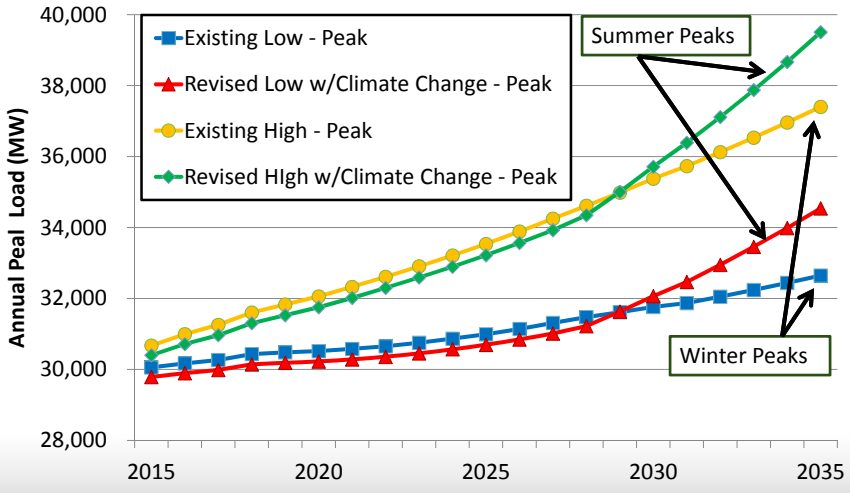
Annual Loads Are Forecast to Increase Slightly Due To Potential Climate Change Temperature Affects

(Frozen Efficiency Load Forecasts)



Annual Peak Loads Are Forecast to Increase Due To Potential Climate Change Temperature Affects

(Frozen Efficiency Load Forecasts)



Results of RPM Analysis

- Analysis is underway
- Results will be presented at the Power Committee and Council meetings