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

February 3, 2015

MEMORANDUM

TO: **Council members**

FROM: **Tom Eckman and Ben Kujala**

SUBJECT: **Proposed Seventh Plan Scenarios**

BACKGROUND:

Presenter: Tom Eckman and Ben Kujala

Summary: The Council's approach to development of its Power Plan involves the testing of alternative resource strategies across a range of potential future conditions. This process is referred to as "scenario analysis" and is carried using the Council Regional Portfolio Model (RPM). The primary purpose of these tests is to identify the risk and cost associated with different mixes of resources and the timing of their development. Staff has prepared a draft set of proposed scenarios for testing for the Council to consider. Staff is seeking the Council's guidance on whether these scenarios address those issues that are of most concern and or importance. In addition, staff is seeking Council guidance on the priorities for analyses.

Relevance: One of the primary tools used to inform the development of the Council's Seventh Power Plan are the results of its scenario analysis. Selection of the scenarios to be tested during the development process is a critical step in this process, since it establishes scope of the constraints and "stresses" to which potential resource strategies to which will be subjected.

Work plan: Work plan 1.D. - Develop Seventh Power Plan and maintain analytical capability. Develop draft scenarios and strategies to be analyzed and establish metrics for comparison

Background: The primary focus of this presentation will be on the potential scenarios to be analyzed for the Seventh Power Plan. A proposed set of "standard metrics" that would be used to compare scenario results will also be presented. Staff is proposing scenarios to investigate five major areas as follows:

- Carbon policy;
- Major resource loss;
- Pace of conservation development;
- Increased reliance on variable resources (PNW and CA); and
- Potential effects of climate change.

Staff is proposing for Council consideration fourteen specific scenarios to investigate these issues. Below the proposed scenarios are summarized briefly. A more detail description and purpose of these scenarios appears in the attached Table 1.

In Scenarios 1A and 1B the Regional Portfolio Model (RPM) would be run with existing policies, including those affecting renewable resource development and carbon emissions. These scenarios permit the quantification and comparison of the effects of the different carbon policy scenarios with existing policies. Scenario 1A is a run without future uncertainties regarding market electricity and natural gas prices, load growth and hydro-system output. Scenario 1B is a run without new carbon policies, but with all of the other key input uncertainties typically considered by the RPM. Comparison of 1A with 1B will illustrate how different resource strategies evolve to address the risks associated with unknown futures.

Three scenarios explore the effects of different carbon policy modeling: Scenario 2A assumes the region will need to meet the policy goal of the Obama Administration "Clean Power Plan" which is a 30 percent reduction in carbon emissions over 2005 levels by 2030. These reductions would come through testing resource strategies that rely on energy efficiency and renewable resource development and existing resource retirement and replacement. Scenario 2B proposes to set a carbon cost equal to the social cost of carbon as estimated by the US Interagency Working Group on Social Cost of Carbon (SCC). According to the Working Group:
The SCC is an estimate of the economic damages associated with a small increase in carbon dioxide (CO2) emissions, conventionally one metric ton, in a given year. This dollar figure also represents the value of damages avoided for a small emission reduction (i.e. the benefit of a CO2 reduction). Therefore, in theory, the cost and risk of the resource strategy that achieves CO2 reductions equivalent to the SCC would offset the cost of damage. Scenario 2C will model an uncertain cost of carbon varying by "future" similar to the approach in the Sixth Plan.

A fourth and fifth carbon set of scenarios explore the largest feasible carbon reductions. Scenario 3A explores the maximum carbon emissions that are feasible with currently known technologies, while Scenario 3B will considers the role of new technologies might play in achieving this goal. The staff does not presently believe that it will be possible to model Scenario 3B in the RPM. However, staff does think that it will be

feasible to use the results of Scenario 3A to define the role (and perhaps cost) new technologies would need to play in order to achieve further carbon reductions. Staff will be looking for Council guidance on how such aggressive policies should be phased in.

The final scenarios seven explore resource uncertainties. Scenario 4A examines the effect of the unanticipated loss of a major base-load resource such as the CGS. Scenario 4B looks at the loss of a significant amount of hydro capability but on a prescribed schedule. Scenarios 4C and 4D test the costs and risks associated with assuming a faster or a slower pace of conservation deployment.

Two scenarios are proposed to explore the costs and risks associated with reliance on out-of-region electricity market resources. Scenario 5A assumes that California achieves a 50 percent renewable resource goal, thus exploring the “duck” problem. Scenario 5B will evaluate the effects of different limits on the availability and price of southwest markets.

Finally, scenario 6 is proposed to look at the potential effect of climate change on regional loads and hydrogenation.

It is not clear whether there will be time for the staff to run all of these scenarios through the RPM and provide time for Council discussion of their results for the draft plan. For that reason staff is seeking the Council’s guidance on whether these scenarios address those issues that are of most concern and/or importance as well as guidance on which scenarios should have the highest priority for analysis. The Power Committee will have an opportunity to discuss these scenarios at its meetings in both February and March. Following the March meeting these scenarios will be discussed at Council’s Resource Strategies Advisory Committee meeting on March 12th and staff will propose a final list for analysis at the Council April meeting.

More Info: See Table 1 below.

Table 1 - DRAFT Potential Scenarios for Testing in RPM

Scenario Number	Scenario Name	Description/Purpose of Scenario	Key Stress Factors Tested	Modeling Approach
1A	Existing Policy ***without*** Uncertainty, w/o GHG reduction risk	Existing RPS, state and federal environmental regulations, including MATS and haze, CA and BC carbon costs, state carbon limits on new generation. Average value across all futures for all major sources[1] of uncertainty.	Known generation fleet retirements and regulatory compliance costs	Use single future with expected values for load growth, gas prices, hydro-output, market prices, etc..
1B	Existing Policy ***with*** Uncertainty, w/o GHG reduction risk	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. No carbon regulation or cost risk.*	Cost and Value of uncertainty risk mitigation with known generation fleet retirements and regulatory compliance costs Delineated by 1B – 1A	Standard model setup with zero carbon tax and no emission limit. RPM enhancement needed to make SW market availability a risk variable. Council staff to modify RPM.
2A	Existing Policy ***with*** Uncertainty and ***with certain*** GHG reduction risk/target. Example 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	RPM enhancement needed to model physical emission limits as a constraint. Without model enhancement an external process must be used to establish schedule for retiring coal plants to meet emission limits. Council staff will assess options and present to Council for guidance.

[1] "Major variables" will be identified through Council, staff and stakeholder review.

2B	Existing Policy ***with*** Uncertainty and ***with certain*** GHG reduction risk/target. Example 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	Model fixed carbon tax per year based on social cost of carbon, no stochastic variation. Implementing this scenario requires RPM enhancement that by Council staff.
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	Standard model setup with carbon tax uncertainty and no emission limit.
3A	Lowering carbon emissions with current technology	Determine lowest feasible power system carbon emissions resource strategies using ***only available*** generation, storage and energy efficiency ***technologies***, including anticipated cost reductions. May include retirement of all regional coal plants and replacement with no or lower carbon emitting resources.	Cost and risk of minimizing power system GHG emissions feasible with existing technology Delineated by 3A – 2C	Retire all plants that exceed a maximum emissions standard. Retirement schedule to be determined.
3B	Lowering carbon emissions with emerging technology (e.g., storage, CO_2 heat pumps, SSL)	Determine lowest feasible power system carbon emissions resource strategies ***using emerging*** generation, storage and energy efficiency ***technologies***, including anticipated cost reductions. May include retirement of all regional coal plants and replacement with no or lower carbon emitting resources.	Cost and risk of minimizing power system GHG emissions feasible with emerging technology Delineated by 3B – 3A	Not possible to model this scenario directly. Staff will use contribution of remaining GHG emitting resources to derive proxy non-GHG emitting resource need from 3A.

4A	Major Resource Uncertainty - ***Unexpected*** Loss of Major Resource (e.g., CGS Forced Retirement)	Determine the resource strategies best suited to managing the unanticipated loss of a major (>1000 MW) non-GHG emitting resources	Cost and risk associated with unanticipated loss of major, non-GHG gas emitting resource Delineated by 4A – 2C	Generate a random time series that takes out CGS permanently, at an unexpected time.
4B	Major Resource Uncertainty ***Anticipated*** Loss of Major Resource(s) (e.g., Snake River Dam Removal,)	Determine the resource strategies best suited to managing the loss of a major hydro resources	Cost and risk associated with replacement of existing hydro-generation. Delineated by 4B – 2C	Phased in reduction in hydro-system output, modeled by applying adjustment factor to existing system output
4C	Major Resource Uncertainty – Faster Pace of Conservation Deployment	Determine the resources that would be displaced if the deployment of energy efficiency is faster than anticipated	Cost and risk associated with assumed upper and lower limits on pace of conservation in resource strategies Delineated by 4C – 2C	Change ramp rates and rerun the conservation supply curves. Basically, just a different conservation supply curve.
4D	Major Resource Uncertainty – Slower Pace of Conservation Deployment	Determine the resources that would be developed if the deployment of energy efficiency is slower than anticipated	Cost and risk associated with assumed upper and lower limits on pace of conservation in resource strategies Delineated by 4D – 2C	Change ramp rates and rerun the conservation supply curves. Basically, just a different conservation supply curve.
5A	Integration of Variable Resources (i.e., Managing the NW Impact of the "Duck Curve"/50% CA RPS)	Determine the resource strategies that would best serve the region should CA achieve a 50 percent RPS using primarily solar PV	Cost and risk associated with potentially large extra-regional surpluses available at low prices during certain periods of the day and year Delineated by 5A – 2C	Need Aurora price curve by water year assuming scheduled solar build-out. Minor RPM enhancement required to synchronize water year and market electricity prices..
5B	Southwest Market Liquidity Variability	Determine the resource strategies that would best serve the region under different scenarios of Southwest market availability uncertainty.	Cost and risk associated with uncertainty in price and liquidity associated with the Southwest Market. Delineated by 5B – 2C	Change fixed limit from external markets in RPM.
6	Climate Change	Determine the impact on resource strategies under forecast future hydro-power output conditions and load conditions	Change in hydro output and system load shape Delineated by 6 – 2C	Phased in change in hydro-system output and load shapes