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October 9, 2002

MEMORANDUM

TO: Council Members

FROM: Terry Morlan

SUBJECT: RAND Analysis on *Generating Electric Power in the Pacific Northwest*

A report by RAND entitled *Generating Electric Power in the Pacific Northwest: Implications of Alternative Technologies* has generated a lot of headlines and discussion in the region. This memorandum discusses the report and helps to put it in the context of the Council's planning process for the Pacific Northwest and other regional analyses of similar issues.

The RAND study examines three different scenarios of diversifying the regional power supply by increasing reliance on conservation and renewable resources. The first is pretty straightforward and is similar to a question the Council addresses in its planning. That is, what would be the effect of meeting some of the region's load growth with conservation and renewable resources? The other two scenarios address a similar question, but have chosen to use to regional "hot buttons" as a framework for the analysis. One looks at the effects of replacing the four Lower Snake River dams with conservation and renewables, and the other examines the effects of building enough renewables and conservation to serve the loads of the direct service industries.

RAND's measure of merit is changes in gross regional product and employment. The use of gross regional product and employment as a measure of merit is not uncommon, but it is difficult to measure such impacts, and it comes with the unavoidable conclusion that any actions taken in the electricity sector will appear insignificant in the context of the region's $400 billion economy. Predictably, the conclusion of the study was that increased reliance on conservation and renewables to displace natural gas plants, Lower Snake River dams, or serve DSI loads would have no significant impact on the regional economy.

Perhaps the most regrettable aspect of the RAND study is that it ignored the Pacific Northwest's historically strong commitment to efficiency and renewable energy. Implementation of past Council plans has resulted in the development of 1,600 megawatts of conservation over the past 20 years. The region has over 500 megawatts of wind capacity in place, including Wyoming projects owned by Pacificorp, Bonneville, and the Eugene Water and Electric Board. The RAND study was done in the context of a U.S. Energy Information Administration (EIA) forecast that assumed the region would develop 123 megawatts of wind capacity by 2020 and apparently no programmatic conservation.

The Council's power plans represent a much more detailed analysis of the potential value of conservation and renewables. In addition, the Corps of Engineers study of the economics of alternatives for the Lower Snake River was a more comprehensive analysis of the issue of dam removal. Both the Council's plan and the Corps study were done with wide and meaningful public participation and review through advisory committees, public comments and hearings. The Corps analysis was also peer reviewed by the Council's Independent Economic Analysis Board. The RAND report was reviewed internally by RAND and by Jim Lazar of Microdesign Northwest, and informally by the Northwest Energy Coalition, Save our Wild Salmon.

It is useful to contrast the basic measures of merit for the Council's planning with the RAND study. Instead of gross regional product or employment, the Council's measure of merit for its power plans has been a measure of electric system cost over time combined with measures of risk. The Council's approach is to determine how much conservation or renewable resources would be cost effective such that the total cost over time of providing electricity services in the region would be minimized. Thus, the Council's power plans are focused on the economic efficiency of providing electricity services, e.g. space heating, water heating, etc. Council plans do not attempt to evaluate the impacts of alternative electricity supplies on the entire regional economy.

The RAND study is broader in that it looks at the impacts of alternatives on production (value added) and employment in the region. One of the dangers of this type of impact analysis is that increasing the cost of providing electricity services can also appear as an increase in regional production and employment. In theory, a general equilibrium model such as RAND uses in this study should also reflect the negative effects due to the fact that if electricity costs increase for consumers they will spend less on other products and services, and if capital is wasted in electricity investments it will not be available for other more efficient investments. If modeled correctly, a less efficient (more costly) supply of electricity should result in less production and employment from a national or global perspective because resources are being used less efficiently. From a regional perspective, however, if the change in activity favors local industries, local production and employment could increase.

The RAND study takes as its basis forecasts of Pacific Northwest electricity demand and generation by the U.S. Energy Information Administration (EIA). The EIA forecast predicts the addition of 10,200 megawatts of generating capacity by 2020, 10,000 megawatts of which is expected to be natural gas-fired combined cycle turbines. The Council's forecast implies less than 7000 megawatts of needed electricity generation growth even with relatively robust DSI assumptions. The RAND study evaluates the use of different mixes of resources to meet the projected load growth. The scenarios contain different amounts of wind, solar and efficiency improvements to replace existing resources or meet part of the region's load growth. It also considers uncertainty about future natural gas prices, technological progress in renewable generation costs, and conservation costs to generate a range of results for each scenario.

Although the effects of the RAND scenarios are very small in terms of the entire regional economy, the direction of effects is interesting. When 20 percent of the EIA forecast of new combined cycle plants is replaced by combinations of wind, solar and efficiency, the effect is a range of changes in gross regional product by 2020 from roughly minus 0.2 percent to plus 0.2 percent. It is clear that efficiency is the most beneficial to regional economic activity, perhaps partly because conservation tends to rely more on local supplies and labor than combined-cycle combustion turbines, although this could not be confirmed by RAND. Replacing 1,780 megawatts of new combustion turbines

with a combination of 2,800 megawatts of wind (a large amount of wind capacity is needed because of its low capacity factor) and 669 megawatts of conservation generates positive economic impacts under all but the most adverse assumptions (i.e. low natural gas prices, relatively modest technological improvements in wind cost, and higher conservation costs). Wind alone generates positive impacts only under the more optimistic assumptions in the RAND study, but would likely be negative under Council assumptions about natural gas costs. When 1,010 megawatts of solar is combined with 2,260 megawatts of wind and 535 megawatts of efficiency, the economic impacts are negative.

The scenario with the largest positive impact on the regional economy is building conservation to serve the DSI load. It results in increasing gross regional product by between 0.3 and .06 percent. Apparently, this assumes that the region could acquire over 5,000 megawatts of conservation at between $15 and $30 dollars per megawatt-hour. If I understand this scenario correctly, it differs from the first in that far more conservation is developed, and it is developed earlier than needed to serve load growth. The conservation is assumed to displace natural gas-fired generation. The conservation is probably assumed to be lower cost than combined-cycle plants and results in lower electricity costs, which stimulates the economy. However, RAND has not done a study of whether or not that amount of conservation is available at their assumed prices. In the Council's 4th power plan only 1,780 megawatts of cost-effective conservation was available at prices near $30, and at $15 less than 1000 megawatts would be available.

The effects of replacing the power generated by the Lower Snake dams also vary with the replacement alternative. Any positive economic effects are limited to around 0.1 percent of gross regional product. Replacement with combined cycle plants generates small gains in GRP in the first 10 years. Replacement with efficiency only has small positive effects under advantageous assumptions, and about equal negative effects with less advantageous assumptions. The advantageous assumptions include natural gas prices far in excess of even the Council's high forecast and a 1,250 megawatts of conservation at $15 a megawatt-hour. When wind is combined with efficiency to replace the output of the dams it generates reductions in regional gross regional product of up to 0.3 percent.

RAND uses the costs and benefits of dam removal from the Corps of Engineers study with the exception of power system costs, which are separately evaluated in RAND's model. The Corps study also looked at the economic "impacts" of replacing dams with combined-cycle combustion turbines and got generally similar results. The cost of removing dams and building replacement facilities result in increased economic activity in the near term, but lower economic activity in the longer term due to more costly power supplies. In both studies, the effects are small relative to the entire regional economy.

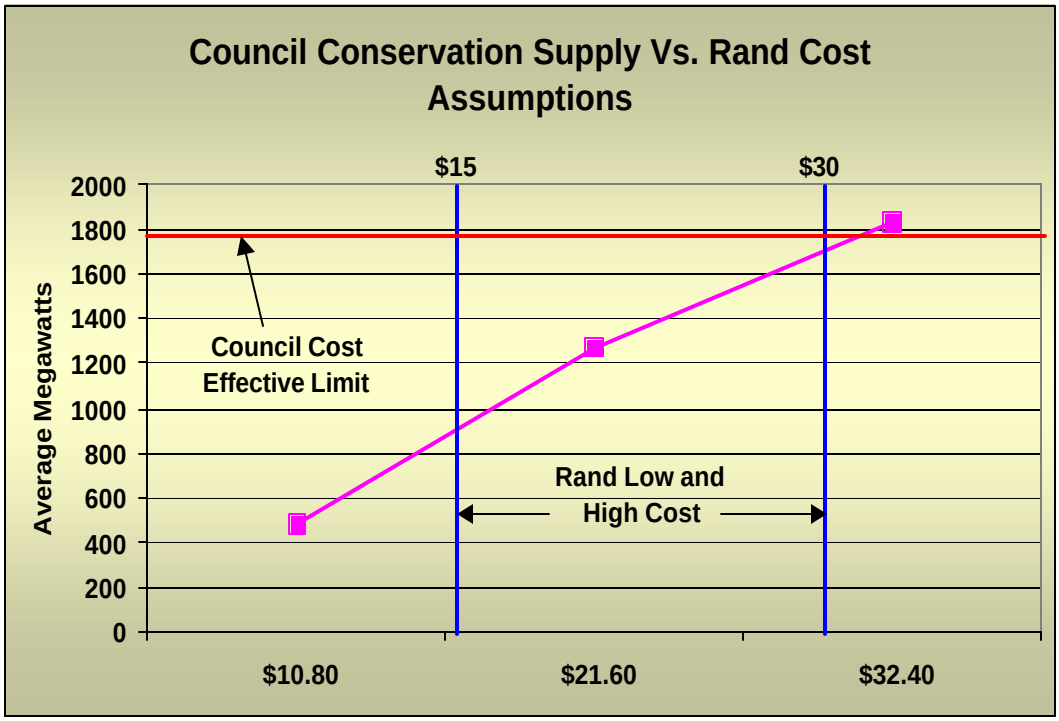
In the Corps study, the increased cost of electricity was the dominant effect of dam removal. In that study the costs recognized that in addition to paying for replacement facilities the capital cost of the dams would still have to be repaid by Bonneville and its regional consumers. It isn't as clear in the RAND dam removal scenario, or in the DSI load replacement scenario, how the stranded costs of the dams or other displaced generating resources are handled. I believe, based on RAND response to my questions, that the continuing capital cost repayment obligations are ignored, substantially understating the cost of replacing the dams.

The RAND study is placed in the context of diversifying the electricity supply of the Pacific Northwest. However, the actual value of diversity is not directly analyzed as it has been in the

Council's plans. The study recognizes that building gas-fired generation is a substantial diversification from the hydroelectric dominated system. The analysis scenario that looks at replacing some of the gas-fired growth with conservation and renewables is a valid diversification scenario that, although not evaluated directly by RAND, could have risk reducing benefits. It is difficult to see, however, how the dam removal scenario fits into this framework. Putting aside the debate regarding the impact of the four Lower Snake dams on salmon, which was not evaluated in the RAND report, it is difficult to see how eliminating a nearly costless resource, even though it depends on uncertain water conditions, could reduce expected system cost through risk diversification. The costs of dam removal need to justified in terms of environmental and fish benefits, a case which has not been made by RAND.

RAND has seen these comments, and suggested some clarifications. They also asked that I attach a document that explains their approach and objectives for their study. That document is attached.

Attachment


Council Conservation Supply Vs. Rand Cost Assumptions
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$30
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1600
1400
1200
1000
800
600
400
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Average Megawatts
Council Cost Effective Limit
Rand Low and High Cost
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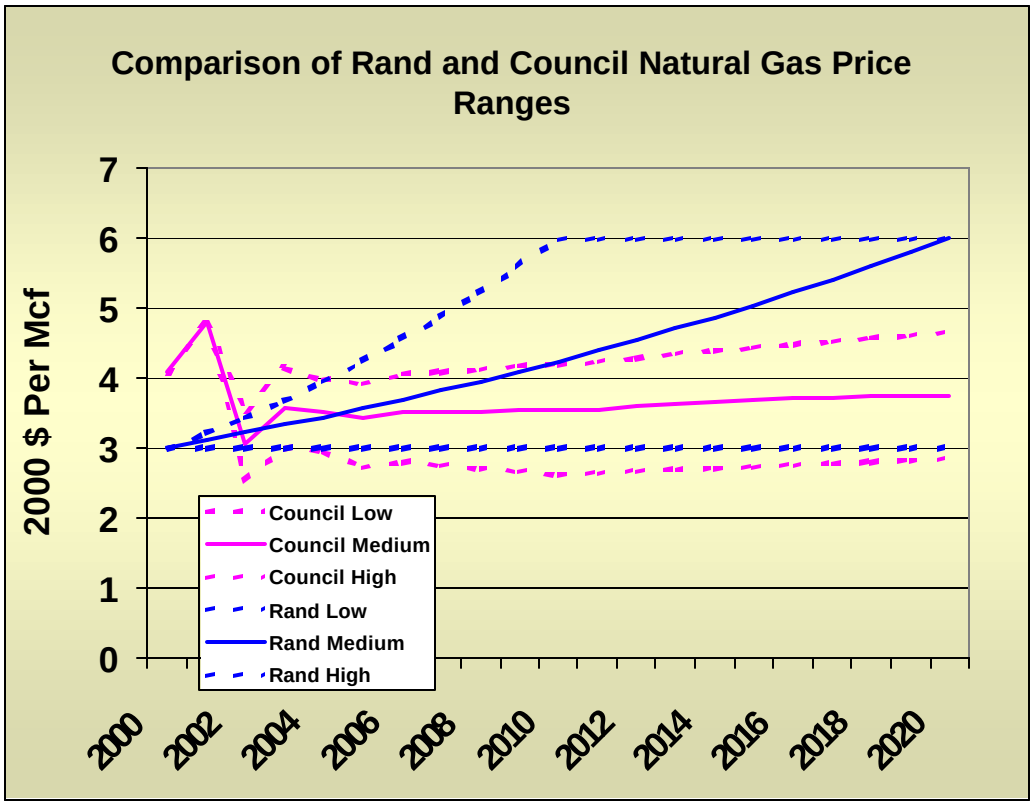
$21.60
$32.40


Comparison of Rand and Council Natural Gas Price Ranges
7
6
5
4
3
2
1
0
2000 $ Per Mcf
Council Low
Council Medium
Council High
Rand Low
Rand Medium
Rand High
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