Northwest Power and Conservation Council

Wednesday, May 25, 2011

MEMORANDUM

TO: Council Members

FROM: Ken Dragoon and Michael Schilmoeller, Council staff

SUBJECT: Replacing Retired Coal Plants: Findings of the Sixth Power Plan

After the recent announcements about plans to retire the Boardman and Centralia coal-fired power plants, questions arose about how the Council's Sixth Power Plan addresses the potential retirement and replacement of coal plants. Terry Morlan prepared a summary memo (attached) to addresses these questions. The memo points out that the resource portfolio strategy used in the Sixth Power Plan anticipated the potential for an even higher level of coal plant retirement than the combined capability of Boardman and Centralia. The resource portfolio strategy recommended the region site and permit as much as 3,700 megawatts of new combined-cycled plants for construction in 2019, with completion as early 2022. The least-risk strategy suggests any additional resource requirement could be met by other accommodations, such as decreased economy exports of energy.

This is an opportunity to have a more complete conversation about the resource portfolio recommendation in the Sixth Power Plan. Staff looks forward to discussing any new questions the Council may have.

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Coal Plant Replacement in the Sixth Power Plan

Introduction

Recent actions to retire two of the region's coal-fired power plants have raised questions about how the capability of these plants will be replaced. PGE's Boardman coal plant in Oregon is scheduled for retirement by 2020, and the Centralia coal plant, an independent power plant in Washington owned by TransAlta, will be phased out between 2020 and 2025 based on legislation recently passed in Washington.

These two coal plants have generating capacity of nearly 1,920 megawatts. Assuming average availability factors of 84 percent, their energy generating capability totals 1,626 average megawatts per year. Between 2002 and 2009 the two plants actually generated 1,417 average megawatts of energy per year, which amounts to about 7 percent of 2009 regional electricity load.

The retirement of coal plants that provide consistent baseload generation, combined with the rapid development of variable wind generation, has raised the question of how the region will replace coal plants and reliably meet load. This question was addressed in the Council's Sixth Power Plan.

Sixth Power Plan

The Sixth Power Plan included reduced use of coal-fired generation in some of the scenarios examined. In the carbon risk scenario, which is the scenario that is most consistent with the plan's resource strategy, carbon penalties were treated as an uncertain and random climate policy decision. Seven hundred-fifty different futures were simulated in the Council's regional portfolio model. Carbon penalties could be introduced at different points in the 20-year planning period and could have values anywhere from $0 to $100 per ton of emitted carbon. The average price of carbon by the end of the planning period in 2030 over all 750 futures examined was $47 per ton.

In each future, existing coal plants were dispatched with that future's carbon penalty included in their operating cost. The plan searched for a resource strategy with the lowest average cost over the 750 futures while keeping the risk of very high-cost futures low. In futures with high carbon penalties, existing coal plants incurred high costs and were dispatched less frequently. To mitigate that cost risk, other existing resources were used more and some additional lower-carbon resources were built. As a result of these changes in resources, the average carbon emissions from the Northwest power system decreased enough over time to meet the types of carbon reduction goals espoused by Washington and Oregon, adopted in the Western Climate Initiative, and proposed in federal legislation. In the carbon risk scenario, it was not assumed that existing coal plants would be retired, but in reality, if the use of a coal plant becomes too infrequent it would likely be retired.

The Council also analyzed a coal retirement scenario in which coal-fired plants were retired from service in sufficient amounts to achieve similar levels of carbon emissions as the carbon risk scenario. These scenarios replaced the coal generation with other resources that would minimize the costs of, and risk to, the regional power system. In the coal retirement scenario that omitted carbon pricing risk, 2,700 average megawatts, or about 54 percent of the region's coal-fired generation capability, were phased out between 2012 and 2019. While this is more than the combined capability of Boardman and Centralia, it provides an idea of how the region could most cost-effectively replace retired coal-fired generation and how power system costs might be affected.

Replacement Resources

In both of the above scenarios, the carbon emissions of the regional power system were reduced enough to meet currently adopted or proposed goals by 2030. Whether coal plants are retired, as in the coal retirement scenario, or just utilized less as in the carbon risk scenario, their contributions to meet regional electricity demands have to be replaced.

In the carbon risk case, the adjustment in other resources to replace the use of coal can be quantified by comparing to a scenario without carbon risk. This scenario was named current policy in the Council plan. The resources used to replace retired coal plants in the coal retirement scenario can be quantified by comparing to the same current policy scenario.

The table below shows the average changes across the 750 futures of energy produced from different sources in 2030 in these two comparisons. Because coal-fired generation is the source of over 85 percent of carbon emissions from the Northwest power system, reducing coal-fired generation in both scenarios is what reduces carbon emissions to current targets. The reduction of coal use is slightly less in the carbon risk case because in some futures there is a zero or small carbon penalty and the coal-fired plants continue to operate much as they do now. When the plants are retired, however, they are not available to operate regardless of conditions experienced in the various futures.

	Change from Current Policy Scenario	
	Coal Retirement	Carbon Risk
Reduced existing coal-fired generation	-2020.7	-1716.4
Increased use of existing natural gas-fired generation	281.4	353.7
Conservation change	253.1	322.8
Renewables change	-20.8	-27.1
New natural gas generation	403.0	288.4
Reduced net exports	1102.7	773.6
Net	-1.3	-5.0

As shown in the "Net" line the reduced coal generation is replaced by other changes in generation. The mix of substituted generation is similar in both scenarios. Existing natural gas-fired generation is used more intensively and new natural gas plants are built and operated. The

use of renewables does not change significantly because it is primarily driven by the share of electricity consumption that must be provided from renewable sources according to state standards. Additional conservation is cost-effective in both scenarios, but the change is small relative to the total conservation in all scenarios, which is about 6,000 average megawatts. The rest of the difference is made up from changes to electricity imported and exported from the region at different times and in different futures. On net in both comparisons, net exports are reduced providing increased energy to the region.

Cost

Closing coal plants and replacing the energy as shown above increases future power system cost. Compared to the current policy scenario, the carbon risk scenario raises the net present value system cost by 14 percent and the coal retirement scenario increases it by 15 percent. However, the current policy scenario does not reduce future carbon emissions from their recent levels, whereas the reduced use of coal scenarios reduce carbon emissions by 35 to 40 percent when combined with the aggressive efficiency improvements that are cost-effective in all scenarios.