Memorandum

To: PPC Executive Committee Members and Alternates
PPC Members

From: Michael Deen
Kevin O'Meara
Chris Weber

Date: February 28, 2017

Re: "Replacing the Columbia Generating Station with Renewable Energy" Report from McCullough Research

Introduction and Summary

On February 15th, 2017 a new report was released by the consulting firm McCullough Research entitled "Replacing the Columbia Generating Station with Renewable Energy." It was also promoted by the anti-nuclear advocacy group Physicians for Social Responsibility (PSR). The abstract from the report reads as follows:

> This report estimates the savings to Northwest ratepayers by permanently closing the Columbia Generating Station (CGS) nuclear power plant and re-placing it with wind and solar energy, for which prices have dramatically fallen. The net present value benefit of replacing CGS with renewable resources is estimated to be between $261.2 million and $530.7 million over the period March 2017 through June 2026.

In summary, the relevant conclusions of the report are based on an analysis that alleges: (1) the energy from CGS can be replaced at lower cost from renewables; and, (2) replacement of CGS with intermittent, non-dispatchable resources would not impact reliability or resource adequacy. As discussed below, both of these conclusions are incorrect and substantially misleading. Based on analysis from the Northwest Power Planning and Conservation Council (NWPCC) as well as BPA rate information, the McCullough report's recommendations actually would lead to a *cost* of $271 million annually and would adversely affect regional power supply adequacy.

Energy Replacement Cost

The heart of the report is a comparison of the projected power costs of CGS from 2017 to 2026 with the levelized cost of energy (LCOE) from new renewable resources taken from "Lazard's Levelized Cost of Energy Analysis – Version 10.0", which is a study produced

by the international Lazard "financial advisory and asset management firm." The Lazard study projects a range of potential LCOE values for new resources on a national basis.

The McCullough Research analysis takes a "median" LCOE from this report for new solar of $42.50 per MWh and $31 per MWh for new wind. Although these values might be realistic in some circumstances, they are wildly inconsistent with the values produced specifically for this region by the NWPCC.

The least expensive new renewable resources in terms of levelized cost in the 7th Power Plan is $61.43 per MWh for utility scale solar and $102.45 per MWh for wind. Many options are significantly higher. Although the report cites the NWPCC and the 7th Power Plan in other instances, the choice to rely on a minimally documented, national level report for levelized resource costs rather than the extensively vetted regional analysis used by the NWPCC is not explained.

In addition to drastically understating the cost of new renewable resources in the Northwest, the McCullough Research report ignores the value difference in energy between baseload generation and intermittent resource output. BPA has a specific set of rates for the purpose of financially converting the output of variable resources to a flat annual block of power known as Resource Support Services (RSS). Under the proposed rates for BP-18, these charges would amount to $15.98 per MWh for a wind resource and $16.30 per MWh for a solar resource.

Using regionally vetted analysis from the NWPCC and BPA's latest proposed rates, the least expensive replacement for the power of CGS with intermittent renewables would be utility scale solar facilities in Idaho at a total cost of $78.84 per MWh.[1]

Conversely, the average projected cost of power for CGS for 2017 to 2026 is $45.62 per MWh. Adding the implicit cost of transmission for CGS power to make the resources comparable leads to a total delivered cost for CGS of $48.50 per MWh.

This difference in costs of $30.33 per MWh at the average annual CGS output of 1,019 aMW leads to a cost of $271 million annually were the report's recommendations to be implemented.

This result is consistent with a scenario analysis conducted in the 7th Power Plan that examined the change in regional portfolio cost for the planned retirement of a 1,000 MW carbon free resource. That analysis found an increase in regional power costs of $3 to $6 billion on a net present value basis over 20 years.

[1] This is the sum of $61.43 per MWh LCOE, $1.11 per MWh Variable Energy Resource Balancing Services charges, and $16.30 per MWh for Resource Support Services.

Lastly, this latest McCullough report reuses comparisons of CGS power costs to Mid-C market prices from earlier reports. As PPC staff discussed in further depth previously when reviewing those reports, this is not a valid comparison. Market purchases are not directly comparable to physical generating assets that are dispatchable, carbon-free, and have well defined costs. Additionally, the output of CGS is so substantial on a regional basis that replacing that power through the market, even it if were possible, would have a significant impact on market prices.

Capacity and Reliability Impacts

The McCullough report is also unconcerned with the resource adequacy or reliability implications of replacing the output of CGS with 2,500 to 4,000 MW of intermittent resources. This conclusion appears to be based on a cursory examination of selected utility Integrated Resource Plans and installed nameplate capacity for generators in the WECC as a whole.

Again, this is in direct contradiction to the analysis of the NWPCC. The NWPCC conducts a rigorous, annual Pacific Northwest Power Supply Adequacy Assessment which looks forward five years. The most recent assessment conducted in 2016 for adequacy in 2021 already shows significant potential for resource deficiencies based on the planned retirements of the Boardman, Centralia and Colstrip Units 1 & 2 coal facilities. Retirement of CGS would significantly exacerbate these issues.[2]

Also, the 7th Power Plan specifically does not rely on the large scale development of intermittent resources to meet capacity needs, instead calling for demand response measures as available or natural gas generation. This is specifically because "power production from wind and solar PV projects creates little dependable peak capacity and increases the need for within-hour balancing reserves…."[3]

Replacing CGS output with intermittent resources would be doubly restrictive for BPA in terms of capacity. Not only would the baseload capacity of CGS be gone, but hydro system flexibility would be further restricted by the need to balance the intermittent resources within an hour.

[2] See Pacific Northwest Power Supply Adequacy Assessment for 2021. Available at: https://www.nwcouncil.org/media/7150591/2016-10.pdf

[3] See 7th Power Plan, page 3-5. Available at: nwcouncil.org/7thPlan