



MEMORANDUM

EUGENE WATER & ELECTRIC BOARD

Rely on us.

TO: Susan Ackerman, Chief Energy Officer
FROM: Matthew A. Schroettig, Power Resources Counsel
DATE: July 3, 2018
SUBJECT: Columbia Generating Station
OBJECTIVE: Information Only

Issue

Recently, EWEB has received public comment regarding the Columbia Generating Station (CGS) nuclear plant. Several questions focused on EWEB's ability to refuse power generated by CGS, the comparative economic viability of the plant, and the potential to replace its output (as one of the single largest carbon free resources in the region) with renewable generation. The following analysis responds to those questions, and provides additional information and context to interested parties.

Background

Today, roughly 30% of EWEB's power production comes from owned, co-owned, or non-BPA contracted for resources. However, the great majority of EWEB's power supply comes from BPA (roughly 70%, though it varies annually based on water supply).¹ This is the result of the December 2008 Power Sales Agreement between EWEB and BPA, effective through September 30, 2028, commonly referred to as the "Regional Dialogue Contract."

BPA markets power from the Federal Columbia River Power System (the "Federal System") composed of 31 federal hydroelectric projects, one non-federal nuclear project, several non-federally-owned hydroelectric and thermal projects in the Pacific Northwest, and from various contractual rights. The federal projects are built and operated by the United States Bureau of Reclamation and the Corps of Engineers and are located primarily in the Columbia and Snake River Basins. The sole nuclear project, CGS, is operated by Energy Northwest, a joint action agency representing a consortium of 27 public utility districts and municipalities across Washington.

Columbia Generating Station

The Columbia Generating Station (CGS) nuclear generator has a capacity of roughly 1,200 MW and represents approximately 4% of the electricity used in the northwest. The output of CGS is provided to BPA at the cost of production under a formal net billing agreement in which BPA pays the costs of maintaining and operating the facility. As a part of the BPA Federal System, under the Regional Dialogue Contract EWEB does not have the option to refuse power from CGS. The existing Power

¹ Available at: <http://www.eweb.org/Documents/about-us/where-your-power-comes-from-infographic.pdf>.

Sales Agreement will expire in 2028, and EWEB is currently working with BPA and the region to discuss renewal options. However, for reasons discussed below, maintaining CGS as a foundational component of the northwest resource mix is in the best interest of EWEB’s customer owners; is consistent with EWEB’s organizational core values of Safe, Reliable, Responsible, and Community; is in alignment with EWEB’s existing position on carbon emissions reductions; and supports a least-cost approach to decarbonizing the electric sector.²

In 2016, Seattle City Light (SCL) passed a Resolution intended to focus all future resource acquisitions on “clean and safe energy sources that generate the lowest amount of greenhouse gases or radioactive waste.”^{3,4} The Resolution went on to direct SCL “to promote the transition of electricity generation in the Pacific Northwest away from energy facilities that burn fossil fuels or use nuclear power.” The Resolution has been widely interpreted to mean that SCL intends to call for the closure of CGS, or to encourage BPA to somehow differentiate distinct resources within the Federal System as part of the upcoming 2028 contracting discussions.

When it comes to plant safety, CGS has more than 30 years of safe operation. In its most recent annual assessment, the Nuclear Regulatory Commission (NRC) again rated CGS at the top performance level for public safety.⁵ Additionally, in both 2017 and 2018 the Northwest Public Power Association (NWPPA) awarded Energy northwest first place in safety performance for utilities with more than 1 million hours of employee exposure.⁶ However, the majority of the public discourse and negative pressure surrounding CGS has been driven by the Physicians for Social Responsibility (PSR). The SCL resolution followed a concerted effort on the part of the Oregon and Washington chapters of PSR, which had commissioned a report on CGS by a local economist, Robert McCullough, in 2013. The report concluded that northwest ratepayers would save roughly \$1.7 billion by closing CGS.⁷ This initial report has been frequently refreshed, most recently on January 22, 2018.⁸

The updated report asserts that the output of CGS could be replaced with renewable generation resources for a benefit of roughly \$325.9 million between January 2018 and June 2027. In summary, the relevant conclusions of the report are: (1) energy from CGS can be replaced at lower cost from renewable resources and the market, and (2) replacement of CGS with intermittent, non-dispatchable resources would not impact reliability or resource adequacy. As discussed below, EWEB management believes that both of these conclusions are in error and substantially misleading.

Based on analysis from the Northwest Power Planning and Conservation Council (NWPPCC) as well as BPA rate information, the McCullough report’s recommendations actually would lead to a *cost increase* of \$310 million annually and would adversely affect regional power supply adequacy.

2 See: <http://www.eweb.org/Documents/about-us/Position%20on%20Carbon%20Pricing%20Policy-FINAL.pdf>

3 <https://seattle.legistar.com/View.ashx?M=F&ID=4525087&GUID=D7276CCF-CF14-4530-AF34-72B74D630C9E>.

4 It is also worth noting that 27 regional PUDs, COUs, Cooperatives, and stakeholder organizations, along with the WA Governor’s office, have signed Resolutions in support of Energy Northwest and the continued operation of CGS. Available at: <https://www.energy-northwest.com/ourenergyprojects/Columbia/Pages/Member-Support.aspx>.

5 Available at: <https://www.tri-cityherald.com/news/local/hanford/article212389649.html>

6 Available at: <https://www.nwppa.org/wp-content/uploads/2017-Safety-Awards.pdf>

7 See:

https://d3n8a8pro7vhnmx.cloudfront.net/oregonpsrorg/pages/1266/attachments/original/1516225007/Economic_Analysis_of_the_Columbia_Generating_Station_%28McCullough_Research_2013%29.pdf.

8 See:

https://d3n8a8pro7vhnmx.cloudfront.net/oregonpsrorg/pages/1271/attachments/original/1517357684/20180104_Update_of_CGS_costs_and_implications_23_%282%29.pdf.

CGS – Energy Replacement Cost

The heart of the report is a comparison of the projected power costs of CGS from 2018 to 2027 with the levelized cost of energy (LCOE) from new renewable resources taken from “Lazard’s Levelized Cost of Energy Analysis – Version 11.0”, 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 and international basis.

The McCullough Research analysis takes a “median” LCOE from this report for new solar of \$37.50 per MWh and \$33 per MWh for new wind. These values might be realistic in some parts of the United States, such as the desert Southwest for solar, or the plains for wind, but they are unrealistic in the Pacific Northwest.

This is primarily because the Lazard analysis assumes extremely high capacity factors for the wind and solar resources. Specifically, the report assumes a 55% factor for wind and 30% factor for solar. This means that for 100 MW of installed generation, the report assumes that wind will generate 55 aMW and solar will generate 30 aMW on an annual basis.

In contrast, the NWPCC’s 7th Power Plan developed capacity factors of 32% for wind and 19% for solar in the Pacific Northwest. These values were vetted extensively by regional experts. Applying these more reasonable capacity figures to the Lazard levelized costs results in values of \$59.21 per MWh for solar and \$56.72 per MWh for wind.

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 that calculate the cost of converting variable resource output to a flat annual block of power known. The service is known as Resource Support Services (RSS). Under current BPA rates, these services cost \$15.46 per MWh for a wind resource and \$15.83 per MWh for a solar resource.

Therefore, using regionally vetted capacity factors from the NWPCC and BPA’s latest rates, the least expensive replacement for the power of CGS with intermittent renewables would be wind power with a levelized cost of approximately \$76.20 per MWh.⁹ Conversely, the average projected cost of power for CGS for 2018 to 2028 is \$42.93 per MWh. This difference in costs of \$33.27 per MWh at the average annual CGS output of 1,062 aMW leads to a *cost* of \$310 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.

Lastly, the latest McCullough report goes into some detail comparing CGS power costs to Mid-C market prices. But 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

⁹ This is the sum of \$56.72 per MWh LCOE, \$4.32 per MWh Variable Energy Resource Balancing Services (VERBS) charges, and \$15.16 per MWh for RSS.

the market, even if it were possible, would have a significant impact on market prices and reliability.

CGS – Capacity and Reliability Impacts

The McCullough report does not address resource adequacy or reliability implications of replacing the output of CGS with 3,000 to 5,500 MW of intermittent resources.

This is in contrast 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 2017 for adequacy in 2022 shows 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.¹⁰

Notably, the 7th Power Plan does not rely on the large scale development of intermittent resources to meet regional 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...”¹¹

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 burdened by the need to balance the intermittent resources within the hour, potentially drastically increasing costs for BPA, and consequently for EWEB customer owners.

EWEB’s Carbon Reduction Goals

EWEB was an early advocate of addressing climate change, and has publicly supported carbon pricing in Oregon, stating: “Recognizing the potential benefits to our customers, EWEB supports a Carbon Pricing Policy to meet Oregon’s adopted GHG reduction goals that is direct, efficient, economy-wide, technology-neutral, market-based, upstream, and regionally consistent.”¹² Further, as part of its support for Oregon’s then-proposed “Cap-and-Invest” legislation, in November 2017 the EWEB Board adopted Resolution 1736, a section of which is dedicated to publically stating EWEB’s support for a least-cost approach to decarbonizing the electric sector.¹³

In December 2017, the Public Generating Pool (PGP), a group of 10 Oregon and Washington consumer-owned electric utilities (including EWEB), along with Benton PUD and Energy Northwest, co-sponsored a study from E3 that looked at several ways to simultaneously achieve the environmental and economic goals in the electric sector.¹⁴ The stated purpose of the study is to contribute to the discussion on how to meet the Pacific Northwest’s decarbonization goals by exploring how the region’s electric sector could most effectively and efficiently contribute to the achievement of those goals. To that end, the study seeks to identify how to most effectively contribute to carbon emissions reductions goals in a least-cost manner.¹⁵

10 See Pacific Northwest Power Supply Adequacy Assessment for 2022. Available at: <https://www.nwcouncil.org/media/7491213/2017-5.pdf>.

11 See 7th Power Plan, page 3-5. Available at: <https://www.nwcouncil.org/7thPlan>.

12 See: <http://www.eweb.org/Documents/about-us/Position%20on%20Carbon%20Pricing%20Policy-FINAL.pdf>

13 See: <http://www.eweb.org/Documents/board-meetings/2017/12-05-17/m11-res-no-1736-approval-of-eweb-2018-state-legislative-agenda.pdf>.

14 Available at: <https://www.ethree.com/e3-completes-study-of-policy-mechanisms-to-decarbonize-the-electric-sector-in-the-northwest/>

15 See: http://www.publicgeneratingpool.com/wp-content/uploads/2017/12/E3_PGP_GHGReductionStudy_2017-12-15_FINAL.pdf.

Relevant to this discussion of CGS is the study's conclusion regarding the impact of retiring existing carbon-free resources (i.e., nuclear generation) on the region's ability to achieve the goal of an 80% reduction in emissions below 1990 levels by 2050.

CGS – Retirement of Existing Carbon-Free Resources

Given ongoing regional discussions surrounding the relicensing of the Snake River Dams, along with the continued discourse surrounding CGS, the E3 study included a sensitivity analysis of the impacts of retiring 2,000 aMW of existing zero-carbon generation. Though this is not specific to CGS, the conclusion is still relevant, given both the relative size of CGS (1,200MW nameplate) and the resulting cost of replacing those resources.

In summary, the study concluded that if the region is to achieve its goal of an 80% reduction in emissions, the retirement of 2,000aMW of carbon-free generation would require the installation of 5,500 MW of new renewable generation, along with 2,000 MW of new natural gas capacity for resource adequacy, at an additional total cost to the region of \$1.6 billion per year.

The carbon-free production of CGS is one of the reasons EWEB is able to claim the lowest emissions of any Oregon Consumer Owned Utility (at 0.041 lbs CO₂/KWh) according to the Oregon Department of Energy.¹⁶ This is highlighted in a 2014 study by IHS Cambridge Energy Research Associates, which concluded that the operation of CGS prevents about 3.6 million metric tons of CO₂ from entering the atmosphere every year when compared to combined-cycle natural gas turbines, the most likely replacement resource. (For reference, CGS's output is roughly equivalent to three new base load combined-cycle natural gas plants.)

Further, looking nationwide, the continued retirement of nuclear facilities is resulting in an increase in carbon emissions and an increase in ratepayer costs. For example, an April 2018 report by the Brattle Group concluded that the retirement of four plants in Ohio and Pennsylvania would result in an increase of over 21 million metric tons of carbon dioxide emissions annually, cause a loss of zero-emissions generation greater than the total amount of renewable generation in the entire PJM region, and raise gross electricity costs for customers by approximately \$400 million for Ohio, \$285 million for Pennsylvania, and \$1.5 billion across all of PJM.¹⁷

Finally, in response to public comment regarding radiation concerns, it is worth noting that after more than fifty years of commercial nuclear energy production in the United States, including more than 3,500 reactor years of operation, there have been no radiation-related health effects linked to their operation.¹⁸

Conclusion

Currently, EWEB does not have the option to refuse power from CGS under the existing Regional Dialogue Contract with BPA. In 2028, the existing Power Sales Agreement with BPA will expire, and EWEB is currently working with BPA and the region to discuss options for renewal. However, the available analysis strongly indicates that, so long as it remains possible to do so in safe and

¹⁶ Available at: <https://www.oregon.gov/energy/energy-oregon/Pages/Electricity-Mix-in-Oregon.aspx>

¹⁷ Available at: <http://www.brattle.com/news-and-knowledge/news/report-by-brattle-economists-estimates-the-impacts-of-nuclear-retirements-in-ohio-and-pennsylvania>

¹⁸ Available at: <https://www.energy-northwest.com/ourenergyprojects/Columbia/Pages/Myths.aspx>

reliable manner, continued operation of CGS is in the best interest of EWEB's customer owners.

EWEB soon will be undertaking a full integrated electric resource planning process, to be completed at the end of 2021, for the Board's consideration. Management recommends that future resource decisions be analyzed in the context of that planning process. The June 5, 2018 revision to EWEB's Strategic Plan affirmed EWEB's commitment to responsible and sustainable stewardship. The Strategic Plan provides staff with the tools necessary to analyze and propose resource choice options that are in the best interest of EWEB customer owners.