Oregon Physicians for Social Responsibility

Replacing Columbia Generating Station with Renewable Energy

The Pacific Northwest's only nuclear power plant is getting old. Time is running out to safely decommission it while also cutting carbon emissions to address global climate change. We need a plan for a just transition to renewable energy that prioritizes workers, public health, and affordability.

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Credits:

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Topics to be covered:

1. History and context of the Columbia Generating Station (CGS)
2. Technical information on age and risks
3. Economic costs of continued CGS operation
4. Humanitarian costs of uranium extraction for consumption
5. Lack of alignment with 100% renewable goals in the PNW
6. Immorality of creating new nuclear waste
7. How to replace CGS with renewables and energy efficiency

Summary

The Columbia Generating Station (CGS) is the only remaining commercial nuclear power plant in the Pacific Northwest, and it is nearing the end of its life. The CGS is costly, risky, not aligned with clean and renewable energy benchmarks, and responsible for creating highly lethal radioactive waste. To prepare for its decommissioning, which must happen within five to fifteen years based on the expected lifespan of a reactor of this type, a comprehensive plan must be created to guarantee replacement of its power output with low cost renewable sources and energy efficiency while maintaining the Pacific Northwest's commitment to reducing carbon emissions and decreasing reliance on fossil fuels. This plan needs to be collaboratively created by the Bonneville Power Administration and local labor and environmental groups, with input from the community members and ratepayers who are the first to face the consequences of choices about energy production.

History and Context

The Columbia Generating Station (CGS) is a nuclear power plant located on the Hanford Site near Richland, Washington operated by Energy Northwest (a public power joint operating agency formerly known as "WPPSS," the Washington Public Power Supply System). CGS electricity is exclusively marketed through the Bonneville Power Administration, a federal agency that sells primarily to publicly-owned utilities in the Pacific Northwest. CGS is nearing the end of its life: the plant began operations in 1983, and its original operating license was set to expire in 2023. In May of 2012, the U.S. Nuclear Regulatory Commission agreed to extend its operating license to 2043. In practice, no nuclear power plant of its kind has operated for longer than 50 years. In fact, more than half of the 173 reactors that have closed around the world did so after only 20 to 40 years of operation.[1] CGS will have been in operation for 40 years by 2023. The decommissioning of CGS is inevitable, and the sooner the Pacific Northwest develops a thoughtful plan for this decommissioning, the better. This plan must include how to replace CGS with renewable energy and energy efficiency in a way that ensures benefits for the workers and communities in Eastern Washington who need them most.

https://www.energy-northwest.com/ourenergyprojects/Columbia/Pages/How-Columbia-Makes-Electricity.aspx

[1] Tim Judson, "Nuclear Power and Climate Action: An Assessment for the Future," *NIRS* (2018): 9.

High Costs of Nuclear Power

The initial construction of Columbia Generating Station was fraught with gross mismanagement and financial catastrophe. What started as a grand plan to create five nuclear plants that would produce unimaginably low rates actually ended with only one finished plant and the largest municipal bond default in the history of the United States[2]. The Washington Public Power Supply System (WPPSS, pronounced "Whoops") defaulted on $2.24 billion because of slowdowns, cost overruns, and technical setbacks for the nuclear plants.[3] In order to make up for their losses, the WPPSS raised rates, to the dismay of local resident ratepayers. Between 1979 and 1983, rates rose by 526 percent.[4] The WPPSS changed its name to Energy Northwest, but the legacy of mismanagement and financial ruin continues. Bonneville Power Administration continues to pay for three of the plants, including two that were never finished.

The Columbia Generating Station is currently Bonneville Power Administration's most expensive resource. During the 2017 fiscal year, BPA suffered a $249 million loss because the operating cost of CGS was over twice the cost per megawatt hour as the market price of energy.[5] CGS has failed the Market Test since 2009, meaning the costs of operating the plant are higher than market prices for the energy it produces.[6] Lazard's 2018 Levelized Cost of Energy analysis ranks nuclear power as the most expensive source of electricity generation aside from gas-fired peaker plants, and even ranks the marginal costs of existing nuclear power generation as competitive with new-build wind and subsidized solar.[7] The cost comparison between new renewable energy and existing nuclear power is likely to become even more favorable as local policies become adopted that favor renewable power (see below under "Lack of Alignment with 100% Renewable Benchmarks"). Lazard also makes a footnote in its analysis that it does not account for

[2] "Hydrothermal Power Program," *Northwest Power and Conservation Council.*
[3] Julie Cohn , review of *Nuclear Implosions: The Rise and Fall of the Washington Public Power Supply System* by Daniel Pope, *H-Energy*, March 2009.
[4] "Hydrothermal Power Program," *Northwest Power and Conservation Council.*
[5] "Updating Bonneville's Strategic Plan," *McCullough Research*, 2017.
[6] "Economic Analysis of the Columbia Generating Station", *McCullough Research*, 2013.
[7] "Lazard's Levelized Cost of Energy Analysis Version 12.0,: *Lazard*, 2018.

the social, environmental, and rate costs of externalities including the financial impact of nuclear waste disposal.

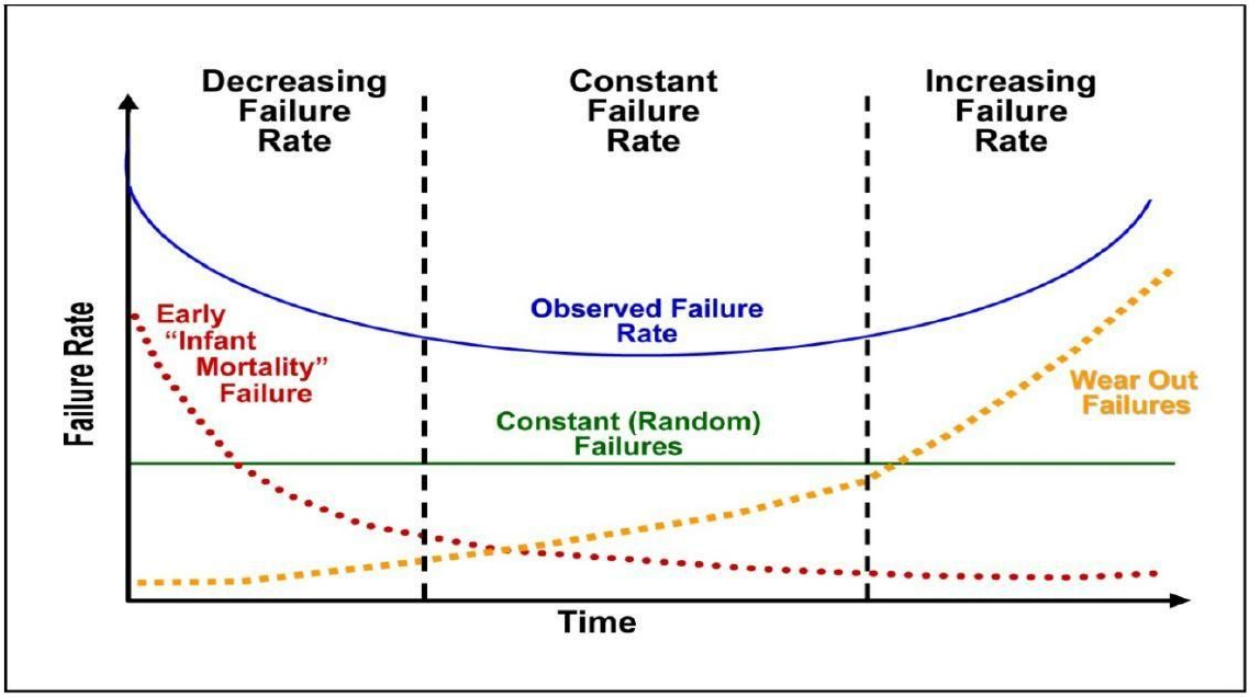

Figure 1: This figure shows the bathtub curve model of failure rate as a function of time. Courtesy of Union of Concerned Scientists
https://allthingsnuclear.org/dlochbaum/the-bathtub-curve-nuclear-safety-and-run-to-failure

As a nuclear plant like CGS reaches the end of its life, its expenses and risk of failure escalate. The lifespan of a nuclear reactor can be conceptualized as a "bathtub curve," where the lifespan is divided into three phases: break-in, middle life, and wear out (see Figure 1).[8] In order to prolongate their life in the final wear out phase, significant financial investments must be made that make the plants even less competitive and more expensive than during their middle life phase. The Fukushima Daiichi Unit 1 reactor that melted down due to tsunami flooding and failure to meet safety requirements was three weeks shy of its 40th anniversary of operation when it melted down in 2011. Fukushima

[8] David Lochbaum, "U.S. Nuclear Plants in the 21st Century: The Risk of a Lifetime." *Union of Concerned Scientists,* 2004: 3.

Daiichi Unit 1 was in the wear out phase of the nuclear power plant "bathtub curve," illustrating the huge potential costs of an accident at CGS as it enters its wear out phase.

The costs of continued and additional nuclear waste management is not negligible. If CGS were closed in 2019, the potential nuclear waste storage and disposal cost savings would have been between $459 million and $1.18 billion.[9] Given that the United States has not yet determined a safe and feasible permanent storage solution for the nation's high-level radioactive waste, it is both immoral and economically unsound to continue creating nuclear waste when cheaper and cleaner alternatives exist (see below under "Untenable Nuclear Waste").

Humanitarian Crisis of Uranium Mining

Another issue with nuclear power generation is the humanitarian crisis of mining used to acquire the uranium necessary for generating nuclear power. Mining for uranium has devastating consequences for land and people. In addition to the negative health impacts of other types of mining, uranium mining is more dangerous because of the radioactivity of the material.

Workers in the mines and the communities living near them face health consequences such as increased risk of cancer and birth defects, both during the mining process and after the mines are abandoned.[10]

The communities that bear the disastrous burden of uranium mining disproportionately tend to be low-income, people of color, and/or indigenous people, thus serving as yet another example of the environmental injustice caused by energy extraction.[11] For

[9] Robert Alvarez, "Update Report On Spent Nuclear Fuel Management and Closure Date Cost Comparison at the Columbia Generating Station," *Institute for Policy Studies,* 2017.
[10] "Health Effects of Uranium Mining", *Preconference of the IPPNW-World Conference,* 2010.
[11] Geoffrey Fettus, et al., "Nuclear Fuel's Dirty Beginnings: Environmental Damage and Pubic Health Risks From Uranium Mining in the American West," *Natural Resources Defense Council*, 2012.

example, the Navajo Nation is still fighting to clean up the legacy of over 500 abandoned uranium mines that continue to pose health and safety threats. Exposure to uranium is linked to kidney failure and cancer.[12] Extracting and enriching uranium also necessitates large amounts of power, which is inherently counterproductive for a process meant to generate energy.

Lack of Alignment with 100% Renewable Benchmarks

Washington, along with five other states, Washington DC, and Puerto Rico, is committed to 100% clean, renewable energy.[13] There are also over one hundred cities and eleven counties committed to this goal. In the 2019 state legislative session, Washington passed eight different bills that together will transform the energy system of the state. SB 5116, the Washington Clean Energy Transformation Act, states that utilities must go greenhouse gas neutral by 2030 and by 2045 use only non-emitting resources and renewable resources.[14]

While the nuclear energy industry portrays itself as "clean" simply because nuclear fission does not generate greenhouse gases when generating electricity, in actuality, clean and renewable energy goals can be met without nuclear power. In fact, the costs and delays of existing and new nuclear projects mean that meeting clean energy goals is more effective without pursuing nuclear power. Nuclear industry insider William Von Hoene of Exelon Corporation has predicted that due to the high cost of new nuclear builds, no new nuclear power plants, including small modular reactors ("SMRs"), will ever be constructed in the United States[15]. Many cities, states, and counties have made 100% clean energy commitments that explicitly name nuclear power as a non-qualifying, unacceptable energy resource. The Pacific Northwest cities and counties that are committing to 100% renewable plans that do not allow nuclear power include: Whatcom

[12] "For The Navajo Nation, Uranium Mining's Deadly Legacy Lingers," *NPR*, 2016.
[13] "100% Commitments in Cities, Counties, & States," *Sierra Club.*
[14] Sean O'Leary, "8 Bills That Transform Washington's Energy System," *NW Energy Coalition*. 2019.
[15] "Exelon Exec Sees No New Nukes In U.S.—Ever," *Institute for Energy Economics and Financial Analysis*, 2018.

County, WA; Multnomah County, OR; Spokane, WA; Portland, OR; Milwaukie, OR; Edmonds, WA;

Part of the reason why nuclear power doesn't fit in with clean and renewable energy goals is because it does not mix well with renewable energy. The lack of flexibility with large baseload resources such as CGS increase the likelihood of "overgeneration" conditions.[16] As more and more renewable energy sources are installed, such as solar and wind energy, less room will be available on the grid for nuclear power. Since renewable energy sources are variable in their output, energy distribution systems need to be made more adaptable.[17] Otherwise, the system would encounter overgeneration problems and would periodically need to be disconnected in order to maintain electric system reliability. In other words, we cannot fully take advantage of increases in renewable energy production while still relying on the inflexible energy output of CGS.

Untenable Nuclear Waste

The Columbia Generating Station is located on land leased from the Department of Energy's Hanford nuclear site, the most polluted zone in the western hemisphere. The nuclear waste at Hanford is the legacy of plutonium production for nuclear weapons during World War II and the Cold War, and the historical and ongoing spent fuel from nuclear power production at CGS.

In fact, in just 32 years, CGS produces the same amount, in curies, of radioactive waste generated during the entire Cold War.[18] As of 2014, CGS had generated approximately half of the total concentration of radioactive wastes on the Hanford site. CGS is the last reactor still operating at the Hanford site, and at this rate, CGS will continue to add to the problem of stockpiled nuclear waste. The Department of Energy does not have a long

[16] "Joint Proposal for the Orderly Replacement of Diablo Canyon Power Plant with Energy Efficiency and Renewables," 2016: 3.
[17] Tim Judson, "Nuclear Power and Climate Action: An Assessment for the Future", *NIRS,* 2018: 10.
[18] Robert Alvarez, "The Hazards of High-Level Radioactive Waste in the Pacific Northwest: A Review of Spent Nuclear Fuel Management at the Columbia Generating Station," 2014.

term plan for the waste that currently exists, making it irresponsible to add more waste at Hanford to deal with.

How to Replace Columbia Generating Station with Renewable Energy and Energy Efficiency

Human-caused climate change is one of the greatest public health crises that the world has ever faced. Our region needs to create a plan to replace the power output of CGS with renewable energy and energy efficiency, not fossil fuels that would increase greenhouse gas emissions. The Intergovernmental Panel on Climate Change (IPCC) reports that we have until 2030 to drastically reduce our greenhouse gas emissions, in order to avoid large scale climate catastrophe.[19] In order to reach these goals, we need to make the most of the time and money we have at our disposal. We cannot afford to continue spending resources on aging, expensive, dangerous nuclear power generators. We must instead plan to decommission existing nuclear power plants and replace them with renewable energy and energy efficiency.

Replacing CGS with a new nuclear plant as a way of mitigating carbon emissions is not the solution that some wish it to be. All the problems with CGS that are causing it to close would be present in a new nuclear plant - the cost is too high, the risk of catastrophe is too great, the humanitarian impact of uranium mining is too devastating, the relationship with 100% clean and renewable energy benchmarks is too fraught, and the waste is too dangerous and unmanageable. Considering the many regulatory hurdles and time necessary for construction, it is difficult to imagine how a new nuclear plant would come online fast enough to address urgent carbon reduction goals.

Replacing CGS without increasing carbon emissions is possible through a combination of renewable energy sources and energy efficiency. Renewable and clean sources of energy like wind and solar are not only carbon-free, they are also gaining prominence

[19] "Summary for Policymakers of IPCC Special Report on Global Warming of 1.5oC approved by governments." Press Release. *Intergovernmental Panel on Climate Change.* 2018.

while lowering in cost.[20] From 2007 to 2017 in the United States, nuclear energy output has declined slightly by 1 million MWh[21], while wind and solar have increased by 313 million MWh. In contrast, nuclear power generation appears to only be increasing in cost. It is crucial that renewable energy sources of power play a prominent role in the plan for replacing CGS.

Energy efficiency projects are drastically less expensive and more effective than building new nuclear power plants. Energy efficiency reduces the amount of energy required to provide the same level of energy services, often at a greatly reduced cost. For example, in 2012 South Carolina utilities spent $9 billion to attempt to construct nuclear plants that ultimately proved too costly and were abandoned. If they would have spent that money on energy efficiency programs instead, they could have paid for 219 million MWh in electricity savings, the amount of energy that would have been produced by the nuclear plant over twelve years.[22] A similar example of the benefits of energy efficiency is seen in New York. If the New York Public Service Commission would have initiated energy efficiency instead of subsidizing nuclear plants, it would have generated a net cost savings to electricity consumers of $3 billion.[23]

Energy efficiency projects also have positive public health outcomes. In fact, if the United States reduced energy consumption by 15% for one year, a study found that there would be more than six lives saved each day, up to $20 billion in avoided health harms, and nearly 30,000 fewer asthma episodes.[24] Avoiding fossil fuel emissions and potential nuclear accidents is a winning combination for public health. Reducing the need for new energy sources through energy efficiency programs must be a part of the equation for replacing the output of CGS.

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[20] Tim Judson, "Nuclear Power and Climate Action: An Assessment for the Future", *NIRS* 2018:5.
[21] Schneider, Mycle, Antony Froggat, et. al. "Nuclear Power: Strategic Asset, Liability or Increasingly Irrelevant? The World Nuclear Industry Status Report," 2018.
[22] Tim Judson, "Nuclear Power and Climate Action: An Assessment for the Future", *NIRS* 2018.16.
[23] Tim Judson, "Nuclear Power and Climate Action: An Assessment for the Future", *NIRS* 2018:18.
[24] Sarah Hayes and Cassandra Kubes, "Saving Energy, Saving Lives: The Health Impacts of Avoiding Power Plant Pollution with Energy Efficiency," *American Council for an Energy-Efficient Economy* and *Physicians for Social Responsibility,* 2018.

As with other changes in power generation, it is crucial that the phase out of CGS is done within the framework of a just transition from extractive energy resources to a renewable, regenerative energy economy. Such a transition must support workers and all those most greatly impacted by global health crises. The definition of Just Transition from the Climate Justice Alliance reads:

> Just Transition is a vision-led, unifying and place-based set of principles, processes, and practices that build economic and political power to shift from an extractive economy to a regenerative economy. This means approaching production and consumption cycles holistically and waste-free. The transition itself must be just and equitable; redressing past harms and creating new relationships of power for the future through reparations. If the process of transition is not just, the outcome will never be. Just Transition describes both where we are going and how we get there.[25]

A just transition in this context means that policies must be put in place to ensure that workers at CGS, the local community, and communities on the front lines of climate change and inequality in Eastern Washington receive benefits and do not suffer as a result of the closure of CGS.

People who work at CGS deserve to be treated with dignity and given a guarantee that they will be able to maintain financial security after the plant's closure. We must recognize the sacrifices they have made and the difficult and high-risk work they have done. They did not cause the climate crisis or damage from nuclear power, and they must not be left behind in the process of transitioning away from nuclear power.

As many workers as possible should stay on with CGS during the decommissioning process. For those who need to find other employment after CGS closes, there must be a robust job training program to give them the tools to transition into other living-wage

[25] "Just Transition: A Framework for Change," *Climate Justice Alliance.*

positions. Hanford site clean-up requires many identical and similar skills to nuclear plant workers. Other types of job training include those in the renewable energy sector, efficiency upgrades, infrastructure, and manufacturing. CGS can follow the lead of the Diablo Canyon nuclear facility, whose operating licenses will expire in 2025.[26] Pacific Gas & Electric (PG&E) is initiating a Retention Program that will provide incentives to retain employees during the last years of operation and the decommissioning process. They will also provide retraining and development programs to empower employees to work on decommissioning or elsewhere within PG&E. Lastly, they will give severance packages to employees when they complete their jobs. These decisions were made through collaboration with the union that represents many of the employees.

Efforts also must be made to compensate for the tax revenue to the state and local community that will lost after CGS closes. According to Energy Northwest itself, the company paid a record high of $5.3 million in privilege taxes to the state of Washington in 2017, with parts of those funds going to the state school fund, state general fund, and jurisdictions within a 35-mile radius.[27] To compensate for the closure of the Diablo Canyon nuclear facility, PG&E has agreed to pay San Luis Obispo County about $50 million.[28]

Funding to support workers and the local community could be raised from a fee on energy corporations or a small fee on energy sales.

[26] "In Step With California's Evolving Energy Policy, PG&E, Labor and Environmental Groups Announce Proposal to Increase Energy Efficiency, Renewables and Storage While Phasing Out Nuclear Power Over the Next Decade," *Pacific Gas & Electric*, 2016.
[27] John Dobken and Anna Markham, "Record generation from CGS yields largest privilege tax payment to state" 2017
[28] Pacific Gas & Electric: "In Step With California's Evolving Energy Policy, PG&E, Labor and Environmental Groups Announce Proposal to Increase Energy Efficiency, Renewables and Storage While Phasing Out Nuclear Power Over the Next Decade." 21 June 2016.

Conclusion

Circumstance and preventive caution demand that the Columbia Generating Station be closed sooner rather than later. The closure of the Diablo Canyon nuclear plant in California by 2025 will leave CGS as the final operating commercial nuclear power plant in the West Coast of the United States. Due to the financial costs and occupational and public health risks of its extended operation as well as environmental justice and climate concerns in the region, we recommend that a collaborative plan to decommission the Columbia Generating Station and replace it through a just transition to clean, renewable energy be established between the Bonneville Power Administration and regional labor and environmental groups, following the model of the Diablo Canyon agreement in California.[29]

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