ECONOMIC IMPACTS OF THE COLUMBIA GENERATING STATION

AN ANALYSIS BY THE NUCLEAR ENERGY INSTITUTE

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including more than
2,830 jobs
in Washington.

Columbia provides over
$690 million
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including more than
$475 million
in Washington.

EXECUTIVE SUMMARY

The Columbia Generating Station (Columbia), located near Richland, Washington, has long been a vital part of the region's energy portfolio, providing 100 percent carbon-free electricity since it began operating in 1984. In addition to this reliable, emission-free electricity, the plant supports hundreds of direct jobs. Employee involvement in their community also makes Columbia a significant social and economic contributor to the state of Washington and the northwestern United States. Columbia is the third largest electricity generator in Washington, and is equivalent to approximately 8 percent of the electricity generated in Washington.[1]

To quantify the economic impacts of this facility, the Nuclear Energy Institute (NEI) conducted an independent analysis. Based on data provided by Energy Northwest (Columbia's operator) and Electric Utility Cost Group (EUCG) on employment, operating expenditures and tax payments, NEI conducted the analysis using the PI+ model provided by Regional Economic Models, Inc. (REMI), a nationally recognized model. (page 10)

KEY FINDINGS

Columbia's operations provide:

Employment benefits
Columbia Generating Station supports thousands of jobs in Washington and the rest of the country through its operations. NEI estimates that the total number of jobs supported by Columbia annually is over 3,930. That includes over 2,830 jobs in Washington and more than 1,100 in the rest of the United States. These employment numbers include the number of direct and additional jobs created as a result of the expenditures from Columbia operations.

Economic stimulus
Columbia produces significant economic benefits for Washington through its plant operations. NEI's analysis finds that Columbia generates $690 million in annual economic output, which includes over $475 million for Washington and more than $215 million for the rest of the country.

2018 total economic benefits for Washington include:

- $475 million in economic output from plant operations
- $250 million increase in gross state product (GSP)
- $176 million in disposable personal income.

2018 economic benefits for the rest of the country include:

- $215 million in economic output from station operations
- $120 million increase in gross domestic product (GDP)
- $35 million in disposable personal income.

Columbia prevents emissions of approximately
778,000 cars each year

Columbia's operation will result in over
$8.9 billion in economic benefits
for Washington between 2018 and 2043.

Long-term economic stimulus

This study finds that between 2018 and 2043, Columbia's operations will generate over $8.9 billion in economic output in Washington and $425 million in the rest of the country.

Clean electricity for Washington and the Pacific Northwest

Columbia's operations generate emissions-free clean electricity. Columbia prevents the release of 3.6 million metric tons of carbon dioxide annually,[2] the same amount released by approximately 778,000 cars every year.[3] For perspective, there are estimated 2.8 million passengers cars in Washington.[4] This takes into account replacing Columbia with a natural gas combined-cycle (NGCC) plant.

Reliability benefits

Columbia provides 1,207 megawatts (gross) of around-the-clock electricity through the Bonneville Power Administration, powering homes and businesses in eight Western states. During the past five years, the station operated at more than 93 percent of capacity,[5] on par with the industry average and significantly higher than other forms of electricity generation. This reliable production helps offset potential price volatility of other energy sources (e.g., natural gas) and the intermittency of renewable electricity sources.

Tax impacts

Operating Columbia contributes approximately $13.4 million annually in local and state taxes, including $5.3 million in privilege taxes, $7.8 million in sales taxes, $227,000 leasehold taxes, and $33,000 business and occupation gross receipts taxes.[6]

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[1] *U.S. Energy Information Administration, Form EIA-923, "Power Plants Operations Report."*

[2] *Emissions prevented are calculated using the average CO_2 emissions factor (118.857 lb/mmBTU), NGCC thermal heat rate (7000 BTU/kWh) resulting to 48.7 percent thermal efficiency, and Columbia's 2016 electricity generation (9,625,622 MWh). Sources include ABB Velocity Suite, U.S. Environmental Protection Agency and U.S. Energy Information Administration.*

[3] *Calculated using Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator. https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.*

[4] *Retrieved using January 2017 release of the highway statistics from the Federal Highway Administration.*

[5] *Retrieved using ABB Velocity Suite, which sourced data from the U.S. Energy Information Administration.*

[6] *Obtained from Energy Northwest, dated June 1, 2017. https://www.energy-northwest.com/whoweare/news-and-info/Pages/EN-Pays-Privilege-Tax.aspx.*

Columbia Power Station

- Type: Boiling Water Reactor
- Commencement of commercial operation in 1984
- Located 10 miles north of Richland, Washington
- 60 year license expires in 2043
- Total gross electricity capacity: 1,207 MW

HISTORICAL BACKGROUND

The Columbia Generating Station is located 10 miles north of Richland, Washington. It consists of one boiling water reactor that produces 1,207 gross MW of non-emitting baseload power. The Columbia Generating Station is owned and operated by Energy Northwest.

RELIABLE ELECTRICITY GENERATION

Columbia operated at a capacity factor of 94.6 percent in 2016, above the industry average of 92.1 percent. Capacity factor, a measure of electricity production efficiency, is the ratio of actual electricity generated to the maximum possible electric generation during the year. Columbia's average capacity factor over the last five years is more than 93 percent.[5]

THOUSANDS OF LOCAL JOBS

Columbia employs approximately 990 people.[7] The annual payroll and benefits are more than $140 million for permanent employees and contractors. Most jobs at nuclear power plants require technical training and are typically among the highest-paying jobs in the area. Nationwide, nuclear energy jobs pay 36 percent more than average salaries in a plant's local area.[8]

Columbia's operations avoid 3.6 million metric tons of carbon dioxide emissions each year.

SAFE AND CLEAN FOR THE ENVIRONMENT

Nuclear energy facilities generate large amounts of electricity without emitting greenhouse gases. State and federal policymakers recognize nuclear energy as an essential source of safe, reliable electricity that meets both environmental needs and demand for electricity.

Columbia, like all nuclear power plants, produces baseload power that is carbon-free. As the third largest generation resource in Washington, Columbia produced 9.6 million megawatt-hours of electricity that avoided the emission of over 3.6 million metric tons of carbon dioxide in 2016, the same amount released by approximately 778,000 cars every year.[3] [4] This takes into account replacing Columbia with a natural gas combined-cycle plant. Emissions prevented are calculated using the average CO_2 emissions factor (118.857 lb/mmBTU), NGCC thermal heat rate (7000 BTU/kWh) resulting in 48.7 percent thermal efficiency, and Columbia's generation.[9]

Columbia also prevents the release of other air pollutants such as nitrogen oxide and sulfur dioxide, which are precursors to acid rain and urban smog.

[7] *Energy Northwest provided 2017 actual employment numbers.*

[8] *"Nuclear Energy's Economic Benefits - Current and Future." Nuclear Energy Institute, 2014.*

[9] *Sources include ABB Velocity Suite, U.S. Environmental Protection Agency and U.S. Energy Information Administration.*

NATIONAL, STATE AND REGIONAL BENEFITS

NEI used the REMI PI+ model (version 2.1.2) to analyze economic and expenditure data provided by Energy Northwest (EN or agency) to develop estimates of its economic benefits from Columbia Generating Station's operations. More information on REMI can be found on page 10.

The economic impacts of Columbia discussed in this section consist of the following variables that are used to analyze these impacts.

Output
Output, in this context, refers to the economic activity generated by Columbia. The direct output is the economic activity produced by the facility. The secondary output is the value of the economic activity generated in other industries because of Columbia, as well as how people employed at the facility influence the demand for goods and services within the region.

Employment
The direct employment is the number of jobs at Columbia. Secondary employment is jobs in other industries as a result of Columbia's operations.

Gross state product
Columbia contributes to Washington's GSP, which the REMI model calculates as value of goods and services produced by labor and property—minus intermediate goods. For a nuclear plant, electricity is the final good. The intermediate goods are the components purchased to make that electricity.

This study finds that between 2018 and 2043 (the license expiration date), Columbia's operations will generate over $425 million in long-term economic output in Washington.

STATE AND REGIONAL ECONOMIC EFFECTS

Columbia's total 2018 annual economic output impact on Washington is estimated to be $475 million in direct and secondary economic impact. Columbia also contributes about $250 million to Washington's GSP in 2018.

This study also finds that between 2018 and 2043, Columbia's operations will generate over $8.9 billion in long-term economic output in Washington.

Table 1 summarizes the plant's effects on the Washington and United States economies and the GSP in 2018 from operations. Columbia's operations have substantial economic impact on other industries in Washington and on the rest of the country.

Columbia's output also stimulates the state's and region's labor income and employment. The plant employs approximately 990 people in permanent and contracting jobs.[10] These jobs stimulate over 2,940 additional jobs in Washington and the rest of the country.

Table 2 details the quantity and types of jobs that Columbia supports. Plant workers are included in the table's occupation categories.

Columbia's operations result in approximately $13.4 million annual local and state taxes, including $5.3 million in privilege taxes, $7.8 million in sales taxes, $227,000 leasehold taxes, and $33,000 business and occupation gross receipts taxes.[11] This is direct impact that supports the funding of local schools, police, fire departments and other important public services (page 6). There also are secondary impacts, Columbia's expenditures increase economic activity, leading to additional income and value creation, and, therefore, higher tax revenue.

NATIONAL ECONOMIC EFFECTS

Columbia's total 2018 annual economic output impact on the rest of the U.S. is estimated to be $215 million in direct and secondary economic impact. Columbia also contributes about $120 million to Washington's GSP in 2018.

Table 1

COLUMBIA'S IMPACT ON THE WASHINGTON AND REST OF U.S. ECONOMIES

(dollars in 2016 millions)

Description	Direct and Secondary Economic Output[12]	
	2018	2018 to 2043 (license expiration)
Washington		
Output	$475	$8,917
Gross State Product	$250	
Rest of United States[13]		
Output	$215	$425
Gross Domestic Product	$120	

Table 2

JOB IMPACTS FROM COLUMBIA OPERATIONS

Category	Washington	Rest of U.S.	Total
Utilities[14]	991	11	1,002
Other Services (except public administration)	397	183	580
Professional, Scientific, Technical Services	359	97	456
Retail Trade	207	61	268
Health Care, Social Assistance	198	108	306
Administrative, Waste Management Services	113	119	232
Accommodation, Food Services	104	38	142
Finance, Insurance	67	113	180
Real Estate, Rental and Leasing	59	39	98
Construction	55	4	59
Arts, Entertainment, Recreation	48	49	97
Wholesale Trade	47	43	90
Manufacturing	46	114	160
Transportation, Warehousing	39	54	93
Education Services	32	49	81
Other Industries	74	19	93
Total	**2,837**	**1,102**	**3,939**

[10] *Energy Northwest provided 2017 actual employment numbers.*

[11] *Based on 2016 numbers, obtained from Energy Northwest's public statement.*

[12] *Direct output was calculated based on a five-year average between 2012 and 2016, in 2016 dollars.*

[13] *Total output and gross domestic product for the rest of the United States are based on the direct operations of Columbia.*

[14] *Utilities sector includes direct employment at Columbia Generating Station in Washington and secondary employment from the rest of the country to support the operations.*

COMMUNITY LEADERSHIP AND ENVIRONMENTAL PROTECTION

In addition to the economic benefits Energy Northwest contributes to the Tri-Cities area in the form of jobs, income and economic output, EN and its approximately 990 employees play a major role in the health and welfare of the community. Since its inception 60 years ago, the agency has supported local community organizations and nonprofit agencies through financial support and volunteerism.

Privilege taxes

In addition to paying millions of dollars in various state and local taxes, Energy Northwest paid $5.3 million in privilege taxes in 2016. This is levied on public power utilities for the privilege of producing electricity in the state and is based on the amount of electricity generated by Columbia. Per state statute, privilege taxes are distributed to the state school fund, state general fund, and 37 separate jurisdictions within 35-mile radius of Columbia.

WORKPLACE LEADERSHIP

Employer of the Year

Recognizing Energy Northwest's veteran recruiting efforts, and as an employer who has implemented innovative job creation, retention and compensation plans that foster a thriving work environment, the Association of Washington Business (AWB) named EN its 2016 Employer of the Year. The award acknowledges the importance of promoting workforce diversity through hiring programs such as internships and veteran hiring.

Veteran hiring

The Washington Employment Security Department recognizes Energy Northwest's commitment to hiring veterans.

Since the 2016 inception of YesVets, a state program aimed at encouraging employers to say "yes" to veterans looking for jobs, EN has recruited 75 veterans from all branches of the service who made the agency their employer of choice, accounting for 35 percent of 2016 hires. Veterans make up approximately 28 percent of EN's workforce.

Energy Northwest continues to expand its partnership with regional military organizations and veterans by participating in job fairs held at military bases. These are opportunities for EN employees to share their nuclear industry career advice with service members, veterans and military spouses preparing to transition to a different work environment. In many cases, the training and skills acquired by military professionals directly correlate to position requirements—and veterans have a strong sense of pride, which corresponds with EN's culture of excellence. Victory Media, an organization founded by veterans to help military members transition into civilian careers, also recognizes EN as a "Top 10 Military Friendly Employer."

ENVIRONMENTAL STEWARDSHIP

Generating clean energy is an important step in reducing the effects of climate change and vital to protecting the environment for current and future generations. Energy Northwest has produced carbon-free energy for more than 50 years and is committed to doing its part to take care of the environment.

This commitment is demonstrated daily with the agency's Environmental Management System (EMS). The system guides employees to systematically identify, manage, control and monitor environmental impact through the use of the triple bottom-line concept, which incorporates values important to fiscal responsibility, environmental protection and social responsibility.

The corporate strategic plan contains annual initiatives to improve environmental performance at all agency facilities. One of those initiatives improved energy efficiency by replacing inefficient lights with light emitting diode fixtures and installing occupancy sensors in office buildings and warehouses. These initiatives save more than 80 megawatt-hours of energy annually.

Recycling plays a large role in reducing waste and all agency facilities participate in the recycling program. Each year, the agency recycles hundreds of tons of plastic, aluminum, paper, cardboard and metal.

Energy Northwest moves forward with a goal to achieve and maintain environmental excellence by fostering environmental stewardship at all facilities and operations. Actions include reducing electrical consumption and fuel use, employee carpooling, installation of electric vehicle charging stations, and removing or replacing purchased gases to reduce environmental impact.

To ensure the EMS is effective and continues to improve, Energy Northwest uses NSF International Strategic Registrations, an accredited registrar, to verify EMS conformance annually. Energy Northwest maintains its EMS certification to the International Organization for Standardization 14001 standard for environmental management.

COMMUNITY ENGAGEMENT AND OUTREACH

Energy Northwest employees contribute both their time as volunteers and provide financial support—about $150,000 annually—to numerous organizations in the community:

Benton Franklin Head Start program

Since 1980, the Energy Northwest team has brought holiday cheer to more than 13,000 local children in low-income families, by fulfilling wishlists from children in the Benton Franklin Head Start program. EN employees have dressed as Santa and elves have delivered thousands of toys and clothing to participating schools.

March of Dimes

Each year the Energy Northwest March of Dimes campaign raises more than $25,000 through payroll deductions and other activities, including a sitewide silent auction for items donated by senior management, and a communitywide three-mile walk. Donations support neonatal birth centers and local families in need.

United Way

The annual United Way campaign raises tens of thousands of dollars each year to help the community provide hot meals to elderly neighbors, provide disaster relief planning for the community, and support youth development programs, including at-risk programs.

Energy Experience day
Energy Northwest and its employees are committed to inspiring and supporting the next generation of workers who will develop the energy technologies of tomorrow. EN's outreach to students studying science, technology, engineering and mathematics (STEM) was recognized by AWB with its 2016 Employer of the Year award. AWB singled out EN's participation in the annual Energy Experience, a day of show-and-tell to teach seventh and eighth grade students about the different forms of energy generation, conservation, and options for college and careers in energy and environmental science. More than 600 students, teachers and adult leaders attend the event as part of National Public Power Week.

Nuclear Science Week
Since October 2014, Washington state has celebrated all things nuclear during Nuclear Science Week. EN employees visit local schools and speak to students, who share the visits on social media via smartphone cameras. In the Washington state 2016 Nuclear Science Week proclamation, Gov. Jay Inslee stated, "Nuclear energy in our state and nation is helping to reduce carbon emissions and plays a vital part in the state's diverse mix of environmentally responsible generating resources."

Kids Engineering Day
Energy Northwest volunteers plan and take part in Marie Curie STEM Elementary School's Kids Engineering Day. The annual event is attended by more than 300 elementary school children and their parents. Through hands-on activities, EN team members show their passion for STEM curriculum.

Columbia Fountain
To mark Energy Northwest's 60th anniversary as a public power leader in the Pacific Northwest, EN leadership and employees unveiled a fountain created from a test nuclear fuel assembly. Columbia Fountain, an outdoor exhibit at the REACH Museum in Richland, stands 15 feet tall and weighs approximately 1,500 pounds. It represents the tremendous benefits nuclear energy brings to the community. The exhibit educates visitors about the clean, carbon-free power Columbia Generating Station brings to the region.

Additional community involvement
The Energy Northwest team also is involved with supporting the Special Olympics, the American Cancer Society, the Red Cross, Junior Achievement, and Columbia Basin College's Math, Engineering & Science Achievement program. The agency's chapter of Women in Nuclear regularly engages local children with hands-on technical learning activities. EN also partners with Columbia Basin College to support its nuclear technology associate degree program, which produces a pool of candidates for entry-level technical trade positions within the industry. Subject matter experts from EN and the U.S. Department of Energy assist with curriculum development and instruction, and students receive internship opportunities at Columbia Generating Station.

ECONOMIC IMPACT ANALYSIS METHODOLOGY

This analysis uses the REMI PI+ version 2.1.2 model to estimate the economic and fiscal impacts of the Columbia Generating Station.

REGIONAL ECONOMIC MODELS INC.

Regional Economic Models Inc. (REMI), headquartered in Amherst, Massachusetts, is a modeling firm specializing in services related to economic impacts and policy analysis. It provides software, support services, and issue-based expertise and consulting in almost every state, the District of Columbia, and other countries in North America, Europe, Latin America, the Middle East and Asia.

The REMI model has two main purposes: forecasting and analysis of alternatives. All models have a "baseline" forecast of the future of a regional economy at the county level. Using "policy variables," in REMI terminology, provides scenarios based on different situations. The ability to model policy variables makes it a powerful tool for conveying the economic "story" behind policy. The model translates various considerations into understandable concepts like GDP and jobs.

REMI relies on data from public sources, including the Bureau of Economic Analysis, Bureau of Labor Statistics, Energy Information Administration and the Census Bureau. Forecasts for future macroeconomic conditions in REMI come from a combination of resources, which serve as the main framework for the software model needed to perform simulations.

POLICY INSIGHT PLUS

REMI's Policy Insight Plus (PI+) is a computerized, multiregional, dynamic model of the states or other subnational units of the United States economy. PI+ relies on four quantitative methodologies to guide its approach to economic modeling:

1. Input/output tabulation (IO)—IO models, sometimes called "social accounting matrices" (SAM), quantify the interrelation of industries and households in a computational sense. It models the flow of goods between firms in supply chains, wages paid to households, and final consumption by households, governments and the international market. These channels create the "multiplier" effect of $1 going further.
2. Computable general equilibrium (CGE)—CGE modeling adds market concepts to the IO structure. This includes how IO structures evolve over time and how they respond to alternative policies. CGE incorporates concepts on markets for labor, housing, consumer goods, imports and the importance of competitiveness to fostering economic growth over time. Changing one of these will influence the others—for instance, a new knife factory would improve the labor market and then bring it to a head by increasing migration into the area, driving housing and rent prices higher, and inducing the market to create a new subdivision to return to "market clearing" conditions.
3. Econometrics—REMI uses statistical parameters and historical data to populate the numbers inside the IO and CGE portions. The estimation of the different parameters, elasticity terms and figures gives the strength of various responses. It also gives the "time-lags" from the beginning of a policy to the point where markets have had a chance to clear.
4. New economic geography—Economic geography provides REMI a sense of economies of scale and agglomeration. This is the quantification of the strength of clusters in an area and their influence on productivity in that sector. The concentrated labor in an area is specialized to serve companies, thus, their longterm productivity grows more quickly than that of smaller regions with no proclivity in that sector.

CONCLUSION

ECONOMIC AND EMPLOYMENT IMPACTS

NEI's analysis finds that Columbia generates more than $690 million in annual economic output in the United States through its continued operations. This includes over $475 million for Washington and more than $215 million for the rest of the United States.

Additionally, NEI's analysis finds that Columbia supports more than 3,930 jobs annually, which includes over 2,830 jobs in Washington and more than 1,100 elsewhere in the United States from continued operations.

FURTHER BENEFITS OF COLUMBIA

The station's economic benefits—from taxes and through wages and purchases of supplies and services—are considerable. In addition, plant employees further stimulate the local economy by purchasing goods and services from businesses around the area, supporting many small businesses in Washington and elsewhere in the country.

The facility generated 9.6 million megawatt-hours of emission-free electricity in 2016, enough to serve the yearly needs for almost 990 thousand homes, all while producing carbon-free power.

The Columbia Generating Station is a leader economically, fiscally, environmentally and socially within Washington and has far-reaching economic impacts across the Northwest.

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