Risks And Opportunities For **PacifiCorp**

STATE LEVEL FINDINGS: OREGON

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POWER GENERATION AT BONNEVILLE DAM IN OREGON

The resource planning environment for the U.S. electric energy sector is experiencing a period of rapid evolution. The energy sources once seen as "low cost"—in particular, coal-fired electricity generation—are now understood to carry high long-term costs in damage to human health, the environment, and the Earth's climate.

In our report, *Risks and Opportunities for PacifiCorp in a Carbon Constrained Economy*, we showed that companies such as PacifiCorp that own and run coal plants face unprecedented financial risks that affect both their ratepayers and their shareholders. PacifiCorp's ratepayers face the risk of high costs for environmental upgrades, higher fuel costs, high remediation costs to undo the environmental harm created by the plants such as groundwater contamination, and the risk of higher electric bills once the cost of CO2 pollution is internalized in rates. The company's shareholders face the risk that utilities will not be allowed to recover all of these costs from ratepayers.

This companion report on state-level findings in Oregon is intended to provide an overview of where Oregonians' electric power comes from today, along with a survey of available options for and benefits of expanded use of in-state energy efficiency and renewable energy resources.

ENERGY SUPPLIERS AND SOURCES

About two-thirds of Oregonians purchase their power from two regulated investor-owned utilities: Portland General Electric (PGE) (39%), and Pacific Power (28%). Pacific Power is part of the regional utility PacifiCorp—the focus of our "Risks and Opportunities" report.

The other third of Oregon's electricity comes from a number of consumer-owned utilities, including municipal utilities, rural electric cooperatives, and public power entities.[1] The consumer-owned utilities rely heavily on the state's abundant hydropower resources, while the privately owned utilities rely on a mix of sources and imported power from the broader region. While there is only one coal plant in Oregon—the Boardman plant owned by PGE, which will be closed in 2020—the two privately owned utilities rely on coal power generated out of state. PacifiCorp obtains about two-thirds of its power for its Oregon Pacific Power customers from coal, 13% from gas, and the remaining primarily from wind and hydropower. PacifiCorp's coal plants are located in Wyoming, Montana, Utah, Arizona, and Colorado.

As shown in Figure 1, electricity sold in Oregon is almost half produced by hydropower, and about one third from burning coal, with smaller contributions from natural gas (12%), wind (5.2%), and nuclear power (<3%), along with some smaller sources. The coal and nuclear power is primarily imported by the two large investor-owned utilities. Oregon's only nuclear plant, the Trojan Plant, was permanently closed in 1993 and has since been fully decommissioned. Figure 2 shows that Pacific Power's customers receive energy from a very different mix of resources.[2]

On net, Oregon is an energy-exporting state – that is, the state produces more energy (~61,000 GWh in 2012) than its residents and businesses consume during a year (~47,000 GWh). The remainder is exported to neighboring states, primarily California. This reflects the abundance of relatively low-cost renewable energy in Oregon, and it is a source of employment and economic growth for the state. However, whether or not an individual Oregon consumer gets the full benefit of their state's renewable energy resources depends on the customer's utility. For example, PacifiCorp imported about $200 Million worth of energy in 2012 from its coal fleet.[3]

RENEWABLE ENERGY

Oregon is blessed with an abundance of hydropower, giving the state perhaps the cleanest energy supply overall in the nation. Not only does hydropower itself provide abundant, low-cost energy, it is also an

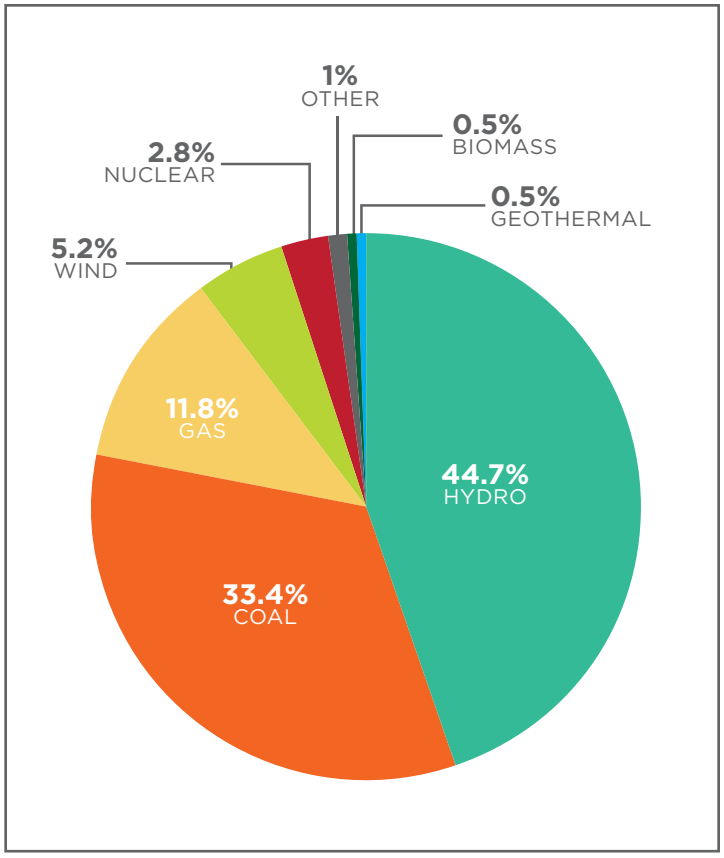

FIGURE 1. SOURCES OF ELECTRICITY SOLD IN OREGON, ALL SERVICE PROVIDERS, 2010-2012. (SOURCE: OREGON DEPARTMENT OF ENERGY)

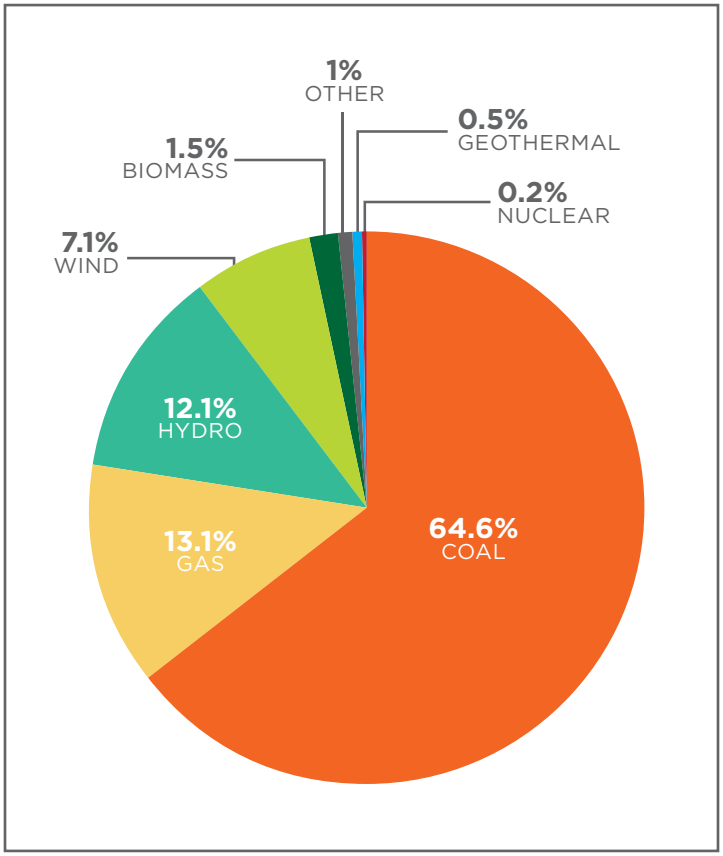

FIGURE 2. SOURCES OF ELECTRICITY SOLD IN OREGON BY PACIFIC POWER, 2010-2012. (SOURCE: OREGON DEPARTMENT OF ENERGY)

RESOURCE	CAPACITY POTENTIAL (GW)	ENERGY POTENTIAL(GWh)
UTILITY-SCALE PV	1,898	3,766,262
CONCENTRATING SOLAR	1,017	2,812,126
WIND (ONSHORE)	27	68,767
WIND (OFFSHORE)	225	962,723
GEOTHERMAL	118	932,305
BIOPOWER	2	14,684

TABLE 1. RENEWABLE ENERGY TECHNICAL POTENTIAL IN OREGON. (SOURCE: NREL, 2012)

extremely flexible energy source with inherent storage, facilitating the integration of large amounts of renewable energy.

Oregon also has abundant geothermal energy potential, although this has not yet been widely harnessed for electricity production. Oregon also has abundant potential for both onshore and offshore wind, as well as solar resources.

Table 1 summarizes the technical potential for renewable resources in Oregon according to a 2012 study by the U.S. Department of Energy's National Renewable Energy Laboratory (NREL).[4] For perspective, total electricity sales in Oregon in 2012 were just under 47,000 GWh.[5]

The NREL data shown in Table 1 are designed to reflect an extreme upper bound on resource potential in each state, without regard to, for example, transmission accessibility or cost. However, they do suggest that there are abundant solar, wind, and geothermal resources in Oregon, enough to provide for all Oregonians' electricity needs, and to sell excess energy to other states, even if only a fraction of this clean energy potential is ultimately developed.

A more conservative study was compiled by the Western Governors' Association (WGA) in 2009, focusing only on "those areas throughout the Western Interconnection that feature the potential for large scale development of renewable resources in areas with low environmental impacts, subject to resource-specific permitting processes."[6] This study identified 2.9 GW (7,439 GWh/yr) of wind resources and 2.7 GW (19,411 GWh/yr) of geothermal in Oregon that it considered to be of sufficient quality, and concentrated enough geographically, to justify the large-scale investment in transmission required to connect it to the existing grid. The WGA study appears to be too conservative, however: according to the American Wind Energy Association,[7] there are already over 3.1 GW of installed wind in Oregon; in 2012, wind generation in Oregon had already reached 6,343 GWh,[8] enough to supply all of the electric energy needs for more than 550,000 Oregon homes.[9]

The WGA study did not identify solar zones in Oregon; however, the economics of utility-scale photovoltaics has improved significantly in the years since the study was completed, and it may be that this resource would be considered more viable in Oregon today. In fact, as of 2012 there were about 20 MW of solar capacity installed in Oregon[10]—about four times the amount installed at the time the WGA study was released. Similarly, the Oregon Public Utility Commission's recent report on solar energy[11] in Oregon found that there were more than 8,000 solar installations in the state by the end of 2013, up from about 1,000 in 2009.

Under Oregon's Renewable Portfolio Standard (RPS), electricity suppliers are subject to a requirement that they source a certain percent of their electric supplies from renewable sources.[12] For the largest utilities (PacifiCorp, Portland General Electric, and the Eugene Water and Electric Board) this requirement is currently 5%; it increases to 15% for the years 2015-2019, and 20% for the years 2020-2024, and finally to 25% in 2025 and beyond. Smaller electric suppliers have lower requirements, up to 5% or 10% of retail sales depending on their size. This obligation may be met through the production or acquisition[13] of Renewable Energy Certificates (RECs), which are produced in proportion to the energy generated at qualifying renewable generating facilities. Because the purpose of the state's Renewable Portfolio Standard is to support the development of new renewable resources, the state's legacy hydroelectric facilities (those operational before January 1, 1995) do not qualify as renewable for the purposes of this requirement. Under limited circumstances, improvements to the efficiency of existing hydropower facilities and new, low-impact projects can qualify.[14]

AN ARRAY OF SOLAR PANELS IN PORTLAND, OREGON, PORTLAND STATE UNIVERSITY CAMPUS VISIBLE IN THE BACKGROUND

CATEGORY	POSSIBLE POINTS	OREGON POINTS
UTILITY AND PUBLIC-BENEFIT PROGRAMS AND POLICIES	20	14.5
TRANSPORTATION POLICIES	9	7
BUILDING ENERGY CODES	7	5.5
COMBINED HEAT AND POWER	5	3.5
STATE GOVERNMENT INITIATIVES	7	5.5
APPLIANCE AND EQUIPMENT EFFICIENCY STANDARDS	2	1
TOTAL	**50**	**37**
RANK OUT OF 50 STATES		**4**

TABLE 2. ACEEE SCORECARD FOR OREGON ENERGY EFFICIENCY POLICIES AND PRACTICES

ENERGY EFFICIENCY

According to the most recent rankings of states by the American Council for an Energy-Efficient Economy (ACEEE), Oregon ranks fourth of the 50 states overall for policies and practices that promote energy efficiency. Oregon's scores in each category considered by ACEEE are shown in Table 2.

In 2012, Oregon Governor Kitzhaber released a new 10-year Energy Action plan for the state, including a goal of "meeting 100% of new electric load growth through energy efficiency and conservation."[15] Similarly, the Oregon 2013-2015 Biennial Energy Plan[16] states that "Energy conservation is the cornerstone of Oregon energy policy." As a result of this strong policy focus, Oregon is a national leader in energy efficiency—but as Table 2 illustrates, there is room to do more.

ENERGY, ECONOMY, AND JOBS

The energy sector is an important economic driver in every state. Oregonians spend about $13 Billion per year on energy;[17] just under $4 Billion was spent in Oregon

on electricity alone in 2014.[18] Some of those dollars support employment in the state, while others are used for fuel purchases, interstate transmission lines, and capital, operations, and maintenance costs of power plants throughout the region. The relative magnitude of these costs is highly dependent on the specific energy source: energy efficiency is on the high-employment benefits end of the spectrum with a very high percentage of resources used for labor and purchase of materials in-state; fossil generation resources require high ongoing expenditures on fuel and emissions costs, which provide little labor benefit, along with supporting workers at the plant and in the fuel supply pipeline. Renewable energy dollars are primarily spent on the costs of building each resource, split between in-state labor and materials from elsewhere. Renewable energy operations and maintenance costs are primarily directed towards labor.

Table 3 shows the employment impacts of alternative electricity generation resources in Oregon, based on the Jobs and Economic Development Impacts (JEDI) model[19] developed by the US Department of Energy's National Renewable Energy Laboratory (NREL). This Table shows that over the lifetime of each resource, wind, solar, and geothermal energy projects produce far more jobs per $Million spent than fossil fuel resources.

CONCLUSION

Oregon is a state with an abundance of clean, renewable energy resources, and is a national leader in energy efficiency programs and policies. Many Oregonians, specifically those who are served by municipal and other consumer-owned utilities, are well-insulated from the risks and costs associated with coal-fired power plants because their energy supply comes primarily from hydropower. Customers of Pacific Power in Oregon do not share this benefit—almost two-thirds of their power comes from out-of-state coal plants, exposing them to the costs of plant upgrades, future emissions costs, and future plant cleanup and site remediation costs. Developing in-state renewable resources and further investing in energy efficiency could help reduce this exposure, and would also provide economic and employment benefits to the state.

	WIND	GEOTHERMAL	SOLAR PV	GAS	COAL
JOBS PER $MILLION SPENT					
CONSTRUCTION PERIOD	2.3	2.9	8.9	2.2	3.6
ANNUAL O&M JOBS	7.7	5.6	14.1	0.8	3.6
JOBS PER MW					
CONSTRUCTION PERIOD	4.5	9.8	29.3	2.8	11.0
ANNUAL O&M JOBS	0.15	0.46	0.28	0.15	0.43
JOBS PER GWH/YR					
CONSTRUCTION PERIOD	1.3	1.4	27.9	0.5	1.6
ANNUAL O&M JOBS	0.05	0.06	0.27	0.03	0.06

TABLE 3. EMPLOYMENT IMPACTS BY GENERATING RESOURCE TECHNOLOGY IN OREGON.1 BASED ON NREL'S JEDI MODEL. 1ALL CALCULATIONS ASSUME CONSTRUCTION BEGINS IN 2016, AND MONETARY CALCULATIONS ARE IN 2012 DOLLARS. DEFAULT JEDI INPUTS WERE USED WITH THE EXCEPTION OF THE COST OF SOLAR PV, WHICH WAS UPDATED TO $3300/KWDC TO REFLECT MORE RECENT US DEPARTMENT OF ENERGY DATA (LBNL, "TRACKING THE SUN VI", AVAILABLE AT HTTP://EMP.LBL.GOV/SITES/ALL/FILES/LBNL-6350E.PDF.) VALUES ARE INDICATIVE FOR OREGON GENERALLY AND DO NOT REFLECT ANY SPECIFIC INSTALLATION OR PROJECT. 2CONSTRUCTION PERIOD JOBS ARE REPORTED IN FULL-TIME-EQUIVALENT (FTE) JOB-YEARS; I.E., IF ONE INDIVIDUAL IS EMPLOYED FOR TWO YEARS, THAT REPRESENTS TWO JOB-YEARS. 3JOBS OR JOB-YEARS AS A FUNCTION OF ENERGY PRODUCTION, ASSUMING THE FOLLOWING CAPACITY FACTORS: WIND, 38%; SOLAR PV AND CSP, 12%; GAS, 60%; COAL, 80%.

ENDNOTES

1 For details, see the Oregon Department of Energy website, "Where does Oregon's electricity come from?" at *http://www.oregon.gov/energy/pages/oregons_electric_power_mix.aspx.*

2 Data on sources of power for Oregon providers from the Department of Energy, available at *http://www.oregon.gov/energy/Pages/Oregons_Electric_Power_Mix.aspx.*

3 Based on 2012 average wholesale price of energy of $23/MWh at Mid-Columbia. *http://www.eia.gov/electricity/wholesale/*.

4 National Renewable Energy Laboratory (NREL), 2012, "U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis". Technical potential is defined as "the achievable energy generation of a particular technology given system performance, topographic limitations, environmental, and land-use constraints" (p.1) without consideration of economic or market factors.

5 US DOE Energy Information Administration (EIA) State Data Tables, available at *http://www.eia.gov/electricity/data/state/.*

6 Western Governors' Association, "Western Renewable Energy Zones – Phase 1 Report", 2009, p.2.

7 *http://www.awea.org/Resources/state.aspx?ItemNumber=5189.*

8 EIA State Data Tables - See Footnote 5.

9 According to the U.S. Energy Information Administration, Oregon homes use an average of 957 kWh per month. See *http://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf.*

10 Oregon Department of Energy, "Oregon Solar Electric Guide", available at *http://www.oregon.gov/energy/RENEW/Solar/docs/PVGuide.pdf.*

11 Public Utility Commission of Oregon, Investigation into the Effectiveness of Solar Programs in Oregon, July 2014, p.2.

12 See *http://www.puc.state.or.us/consumer/Renewable%20Portfolio%20Standards%202012.pdf* for details.

13 The largest utilities in Oregon can meet up to 20% of their obligation through purchase of unbundled RECs.

14 For details, see *http://www.oregon.gov/energy/RENEW/Pages/RPS_home.aspx.*

15 Governor's 10-year Energy Action Plan, available at http://www.oregon.gov/energy/Pages/Ten_Year/Ten_Year_Energy_Plan.aspx.

16 *http://www.oregon.gov/energy/docs/reports/legislature/2013/ODOE%202013%202015%20EnergyPlan.pdf.*

17 Biennial energy plan, p.33.

18 EIA annual electric retail revenue by state, available at *http://www.eia.gov/electricity/data/state/revenue_annual.xls.*

19 *http://www.nrel.gov/analysis/jedi/.*

ABOUT THE AUTHOR

Ezra D. Hausman, Ph.D. is an independent consultant on energy and environmental economics based in Auburndale, Massachusetts.

In his sixteen years consulting on energy market issues, Ezra has provided expert testimony in over two-dozen cases, delivered numerous reports and presentations, and offered other expert services for clients including federal and state agencies; offices of consumer advocate; legislative bodies; cities and towns; non-governmental organizations; foundations; industry associations; and resource developers. His specific areas of expertise include:

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- *Electricity and generating capacity market design*
- *Integrated Resource Planning and portfolio analysis*
- *Economic analysis of environmental and other regulations, including regulation of greenhouse gas emissions, in electricity markets*
- *Quantification of the economic and environmental benefits of displaced emissions associated with energy efficiency and renewable energy initiatives*
- *Mitigation of greenhouse gas emissions from the supply and demand sides of the U.S. electric sector.*

Ezra holds a Ph.D. in atmospheric science from Harvard University, an S.M. in applied physics from Harvard University, an M.S. in water resource engineering from Tufts University, and a B.A. degree in psychology from Wesleyan University.