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All Pain, No Gain:

The Economic and Social Consequences of Green Energy Policies in the Pacific Northwest

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WEALTH & POVERTY

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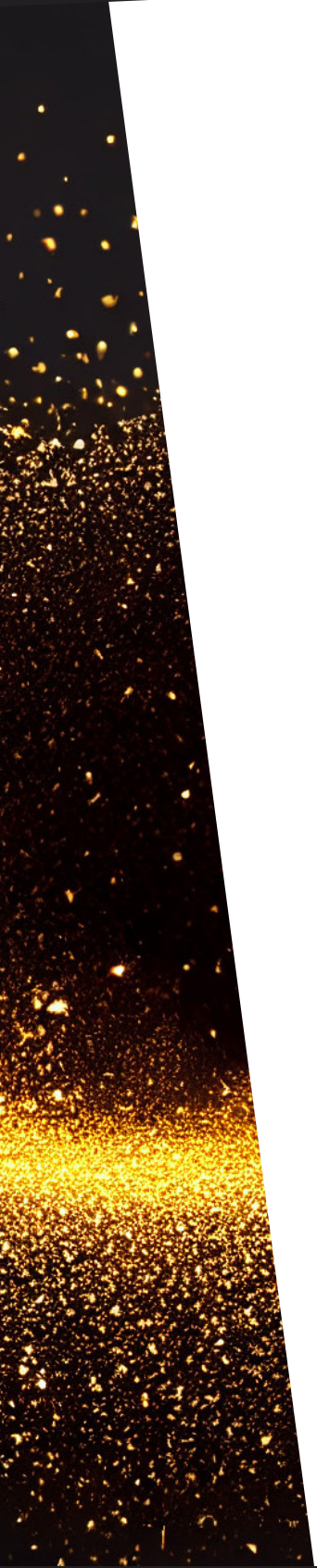


EXECUTIVE SUMMARY

Oregon and Washington state have adopted policies designed to eliminate most greenhouse gas emissions by 2050. These policies, which are modeled after ones developed previously in California include: (i) mandates for 100% zero-emissions electric generation by 2045 under the Clean Energy Transformation Act (CETA); (ii) bans on the sale of internal combustion cars and trucks, beginning in 2035; (iii) "clean fuel" standards requiring refiners to produce and sell less carbon-intensive alternative fuels; (iv) prohibitions against using fossil fuels in new homes and businesses; and (v) a carbon cap-and-trade program in Washington State.[1]

Collectively, these policies are designed to force the electrification of most of the two states' economies and to meet the increased demand for electricity with investments in emissions-free generating resources (primarily wind and solar photovoltaics), energy conservation, and direct-load control to limit electricity demand when supplies are inadequate. In addition, both states seek to increase production of "renewable natural gas" from landfills, wastewater treatment plants, and dairy farms, both to generate electricity in conventional gas-fired turbines and to supply to natural gas customers.

The policies, especially the carbon cap-and-trade program under Washington's Climate Commitment Act (CCA) and, which took effect on January 1, 2023, are increasing energy prices. The average price of gasoline, for example, has increased by an estimated 45 cents per gallon since the first of the year because of the CCA and, consequently, the state has the second highest average prices for gasoline in the country.

Although these policies are raising energy costs, adversely affecting both states' economies, and increasing energy poverty, the policies themselves will have no measurable impact on world climate. In total, the two states' annual GHG emissions are equivalent to only one *day* of world energy-related GHG emissions and are less than the average annual *increase* in world emissions over the last decade. Hence, for residents of Oregon and Washington, these policies are "all pain and no gain."

1 A similar measure was introduced in Oregon, but a walkout by Republican state legislators prevented a quorum necessary to vote on it.

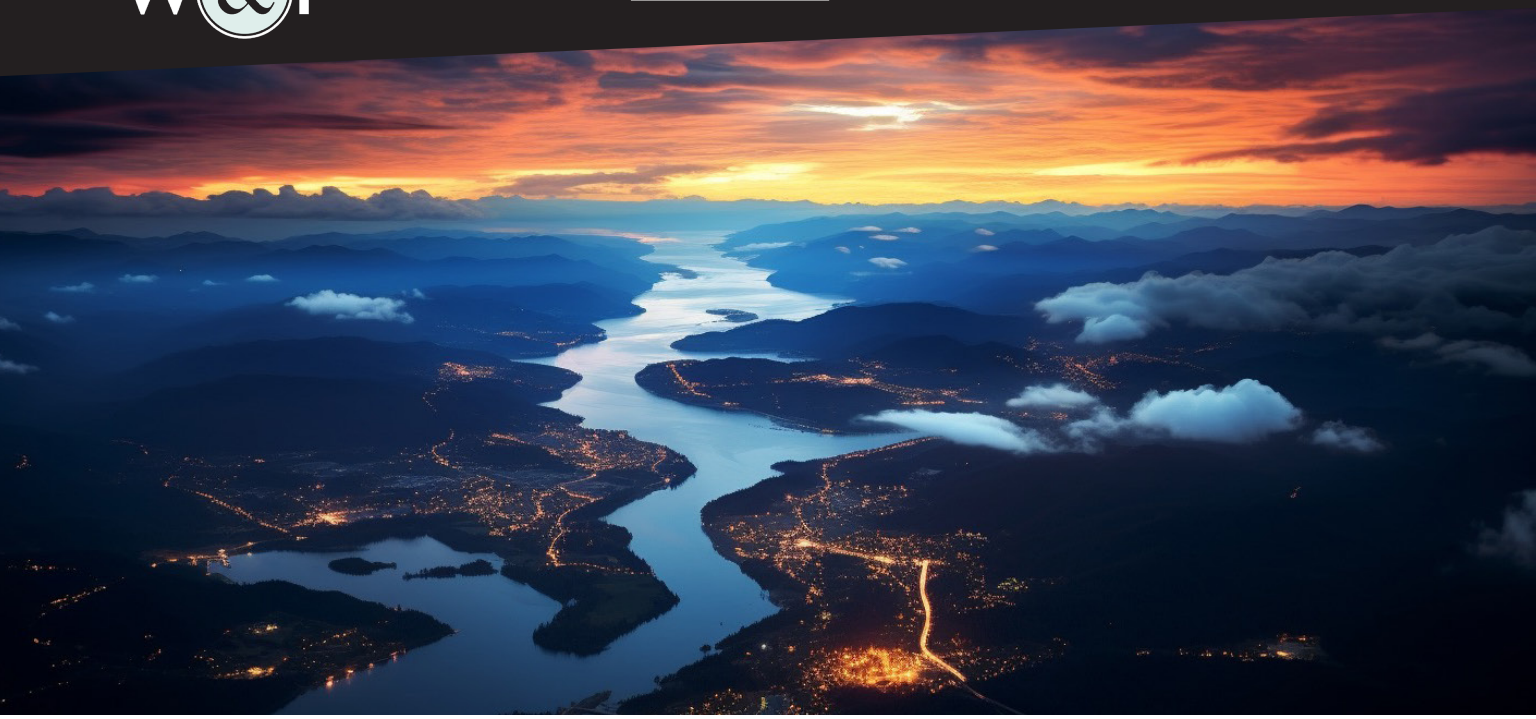
A better approach would be for Oregon and Washington to (i) emphasize market-based approaches that eliminate burdensome mandates and subsidies; and (ii) focus on providing low-cost, *reliable* energy supplies, especially emissions-free nuclear power. For example, if EVs truly are a superior, less costly technology, then consumers will adopt them without the need for mandates or costly subsidies. Forcing consumers, especially lower-income consumers in rural areas least likely to have adequate charging infrastructures, to purchase more costly EVs will exacerbate inequality. First, many lower-income consumers are unable to afford new internal combustion vehicles, much less more expensive EVs. Second, the ban on the sale of new internal-combustion vehicles after 2035 will increase the demand for used vehicles, raising their prices.

The two states' clean fuels standards are similarly flawed. They will raise costs while providing virtually no benefits. By artificially increasing demand, the "clean" fuels mandates will encourage higher prices, harming businesses and, especially, lower-income consumers.

The same is true for revised building codes that seek to ban the use of natural gas for space and water heating, as well as gas stoves. Depending on the use of natural gas to generate electricity in the two states, these bans may even increase carbon emissions. Using natural gas to generate electricity to power space and water heaters is far more inefficient and costly than simply burning natural gas directly.

Increasing the supply of emissions-free electricity should be accomplished, not with intermittent solar and wind generation, non-existent generators that burn green hydrogen, battery storage, and new high-voltage transmission lines through the Cascades to deliver power from the eastern parts of the states, as well as Idaho and Montana, but with new nuclear power plants. The WPPSS debacle should not preclude the development of new, small modular reactors, which can be added in concert with increased demand. Modular nuclear plants are efficient, reliable, and can be sited near load centers, thus obviating the need for costly high-voltage transmission lines.

Ideally, the two states' energy policies would focus on common sense approaches. However, the current policies to promote green energy and reduce GHG emissions have nothing to do with common sense or basic economics. Instead, the policies in place have created opportunities for rent-seeking and favoritism by diverting scarce resources to favored constituencies, such as wind and solar developers. Because of that, the vast majority of Oregon and Washington state residents and businesses are likely to suffer increasingly painful economic and social losses that will have no environmental benefit.



INTRODUCTION

Energy, especially electricity, is at the center of the history of the Pacific Northwest over the last century.

Those who first settled in the region in the mid-19th century, saw the rivers in the region, especially the mighty Columbia River, as a source of water to irrigate fields and transform the parched areas east of the Cascade Mountains into an agricultural powerhouse. Although agriculture was the initial rationale for harnessing the region's rivers, as the state grew, the region began to tap its vast hydropower capacity in the early 1900s with construction of four small dams on the Snake River in Idaho, which together had a generating capacity of about 200 megawatts (MW).[2] The real action, however, began with the construction of the Rock Island Dam in 1929, then Bonneville Dam and the far more massive Grand Coulee Dam in 1933. The latter, when completed in 1942, had a generating capacity of about 2,000 MW. Today, it has a generating capacity of 6,800 MW, making it America's largest powerplant by capacity.

By the time Grand Coulee was completed in 1942, World War II had created an urgent need for aluminum and airplanes for the war effort. The first aluminum smelter, located in Vancouver, Washington, began operation in late 1939. A second one, in Longview, Washington, followed in 1941. The aluminum these two plants manufactured was used by Boeing, which employed thousands of workers to build airplanes.

2 These are: Swan Falls, Dam, completed in 1901; Milner Dam, completed in 1905; Shoshone Falls Dam, completed in 1907; and Lower Salmon Falls Dam, completed in 1910.

By the mid-1960s, dozens of dams on the Columbia River System were providing well over 20,000 MW of capacity to ten aluminum smelters in Oregon and Washington. Together with Boeing, Washington state became a manufacturing and agricultural powerhouse, thanks in large part to the availability of low-cost, reliable hydropower.

The Pacific Northwest region's energy world changed markedly beginning in the 1970s. As electricity demand increased, a group of municipal utilities embarked on an ambitious—and eventually disastrous—plan to build five nuclear plants in the state. As construction costs skyrocketed and electricity demand shrank owing to a severe nationwide recession, the Washington Public Power Supply System (WPPSS or as it was pronounced "whoops") was forced to declare bankruptcy in 1983 and cancel construction of all but one of the nuclear plants.[3] Defaulting on over $2 billion in bonds, it was the largest municipal bankruptcy in the country's history up to that time.[4] The WPPSS bankruptcy changed the direction for the Pacific Northwest electric industry, effectively ending the development of nuclear power.

At the same time, the country was recovering from the economic shock of the 1973 OPEC oil embargo, which plunged the country into recession. With growing fears about reliance on petroleum and natural gas, the country emphasized switching to coal, along with new incentives to develop wind, solar, and small hydroelectric facilities through the Public Utilities Regulatory Policy Act of 1978.[5]

The 1979 OPEC oil embargo reinforced the belief that conserving energy and reducing U.S. dependence on imported oil were the most important energy policy goals. In 1980, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act,[6] which created the Pacific Northwest Electric Power and Conservation Planning Council to address both the need for electricity in the Columbia River Basin (Idaho, Oregon, Washington, and Western Montana) and the damage to the region's salmon fisheries that had been caused by Columbia River System dams.[7] The Council's energy focus has primarily been on reducing growth in electricity demand through energy conservation efforts and improved energy efficiency,[8] which are detailed in the comprehensive power plans it produces every five years. (The most recent plan was released in 2021.)

The 1979 OPEC oil embargo reinforced the belief that conserving energy and reducing U.S. dependence on imported oil were the most important energy policy goals.

3 WPPSS was organized by 17 public utilities in the state in February 1957 for the purpose of consolidating their assets to build power plants. The agency's first generating resource was the 27 MW Packwood dam, which was completed in 1963.

4 In 2008, Jefferson County, Alabama defaulted on over $4 billion in bonds in 2008. In 2013, the City of Detroit declared bankruptcy and defaulted on over $18 billion in municipal debt.

5 16 U.S.C. ch. 46 § 2601 et seq.

6 16 U.S.C. § 839-839h, P.L. 96-501. The Act created a federal-state compact between the states of Idaho, Oregon, Washington, and the western portion of Montana.

7 In 2003, the members of the Council changed its name to the "Northwest Power and Conservation Council."

8 A discussion of the scope of the Council's work on salmon fisheries is beyond the scope of this report. The Council has worked with the Bonneville Power Administration to revise that agency's operation of hydroelectric dams to benefit salmon recovery, which has reduced electricity production somewhat.

In the 1980s, the Council encouraged the Bonneville Power Administration, the marketing agency for the Columbia River system dams owned by the federal government, to restrict electric supplies to the aluminum industry. BPA also increased wholesale electric prices for aluminum smelters in the region by 500% between 1979 and 1984. The California energy crisis of 2001 exacerbated price increases, with the then BPA Administrator calling for wholesale rate increases of 300% over five years.[9]

In the last decade, Oregon's and Washington's energy priorities have shifted.

Both states have followed California's lead in adopting electric vehicle mandates, which will ban the sale of new fossil-fuel vehicles beginning in 2035. In 2019, Washington State enacted the Clean Energy Transformation Act (CETA), which requires the state's electric utilities to supply only electricity with zero greenhouse gas emissions by 2045.[10] Subsequently, in 2021, the state enacted the Climate Commitment Act (CCA), which seeks to reduce greenhouse gas emissions to 95% below 1990 levels — approximately 94 million metric tons equivalent ($MMTCO_2e$) — by 2050 and imposes a program that requires energy users to purchase carbon allowances to cover their emissions.[11] In the same year, the state also enacted the Clean Fuels Standard (CFS), which requires fuel suppliers to reduce the carbon intensity of fuels like gasoline and diesel.[12] Because the amount of CO_2 in fuels is a function of their chemical composition, the standard is really a mandate to blend lower-carbon fuels, such as mixing biodiesel with regular diesel fuel or using renewable diesel,[13] and purchasing what are called "CFS credits" that are produced by manufacturing transportation fuels with lower carbon intensity, such as biodiesel and compressed natural gas.[14]

Oregon has followed a similar path. In 2021, then Governor Brown signed House Bill 2021,[15] which requires the state's electric utilities to eliminate their carbon emissions by 2040.[16] Oregon also established a clean fuel standard similar to the one in Washington. Moreover, Oregon has its

9 Brian Miller, "BPA Wants Aluminum Smelters Shuttered," ALM Globest.com, April 10, 2001.
10 Washington State Dept. of Ecology, "Clean Energy Transformation Act," undated.
11 Washington State Dept. of Ecology, "Washington's cap-and-invest program," undated.
12 Washington State Dept. of Ecology, "Clean Fuel Standard," undated.
13 Biodiesel and renewable diesel are both refined from vegetable oils, animal fats, and grease. However, biodiesel is not true diesel fuel, as it contains oxygen. Renewable diesel is refined using a similar process as producing petroleum products from crude oil. For more information, see Mark Gerveni, et al., "Biodiesel and Renewable Diesel: What's the Difference?," farmdoc daily (13):22, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, February 8, 2023.
14 Saige Herbert, "What you should know about Washington's Clean Fuel Standard (CFS)?" US Energy, January 19, 2023.
15 https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2021
16 Dirk VanderHart, "Oregon lawmakers approve ambitious carbon-reduction goals for state energy grid," Oregon Public Broadcasting, June 26, 2021.

own version of a carbon cap-and-trade program, although unlike Washington state, Oregon has not established a well-defined market for carbon allowances.

Idaho has not enacted any of these same restrictions, although Idaho Power Company, the state's largest investor-owned electric utility, has set a goal of 100% clean energy by 2045.[17]

There is also growing support among environmentalists and the Biden Administration to remove four dams on the Lower Snake River in the southeast portion of Washington state to restore salmon runs. The dams, which were constructed between 1955 and 1961, have a generating capacity of just over 3,000 megawatts (MW). Earlier this year, removal of the four dams on the Klamath River in the southwestern part of Oregon and northern California began.[18] The dams, with a combined generating capacity of just 163 MW, are much smaller than those on the Lower Snake River. Nevertheless, the fight to remove those dams spanned two decades.[19] Several Indian tribes have even called for removing some of the largest dams on the Columbia River itself to restore salmon fisheries, although the prospect for such removal appears to be remote.[20]

Although electricity prices in the Pacific Northwest remain below the U.S. average, they have risen rapidly since 2010, and at a higher rate than for the U.S. as a whole.

Fossil-fuel prices in Oregon and Washington state, however, have been above the U.S. average for decades. Despite their proximity to the natural gas reserves in British Columbia and Alberta, delivered natural gas prices in Washington and Oregon historically have been above the U.S. average. By contrast, delivered natural gas prices in Idaho, especially for commercial customers, typically have been below the U.S. average.

Similarly, prices for gasoline and other petroleum products in Oregon and Washington have historically been far above U.S. averages, while prices in Idaho have been much closer to the U.S. average. This year, the impacts of Washington CCA's cap-and-trade program have exacerbated the price differences, as the CCA has been estimated to have added about 40 cents per gallon to retail gasoline prices through the first five months of 2023,

17 Jan Max Stevenson, "Idaho Power eyes more solar. But here's why clean energy remains a challenge," *Idaho Statesman*, April 30, 2023.
18 Jay Landers, "Construction begins on removal of 4 Klamath River dams," Civil Engineering Source, May 11, 2023.
19 Ashley Harell, "Inside Calif.'s Klamath River dam removal project, the largest in U.S. history," SFGate, April 13, 2023.
20 Brett VandenHeuvel, "Yakama, Lummi Nations' Historic Call for Dam Removal on Lower Columbia," Columbia Riverkeeper, November 27, 2019.

and 45 cents per gallon this summer.[21] In fact, in June 2023, the average price of gasoline in Washington State was the highest in the nation, exceeding the average price even in California, which had long held the distinction of having the highest-cost gasoline in the Lower 48 states.[22]

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Washington and Oregon's relatively high energy costs have adverse economic impacts because energy is a fundamental input to virtually all goods and services. Higher energy costs mean consumers pay more to drive, for their food, and to heat their homes. As state energy costs rise relative to other states, businesses, especially manufacturing firms that compete globally, are at an increasing competitive disadvantage. The most energy intensive industries, following the example of the aluminum smelters, may close and relocate where energy costs are lower. Others may abandon plans to invest and grow, reducing opportunities for new jobs.

Increases in energy costs also impose social costs, especially on lower-income residents. In Great Britain, for example, high energy costs have pushed millions of households into fuel poverty, forcing many to make painful tradeoffs between heating their homes and having enough food to eat.[23] Individuals who are forced to pay more for energy have less income to spend on other goods and services. Such reduced spending reverberates through the entire economy, reducing overall economic output and employment.

The report focuses on the economic and social impacts of Oregon's and Washington's green energy policies.

As we discuss, these policies will continue to raise energy costs as both states seek to reduce greenhouse gas (GHG) emissions by "electrifying" their economies. This entails replacing end-use fossil fuel use for transportation, in homes, and in businesses with electricity generated from wind and solar power. The resulting higher energy prices, which stem from --wind and solar power's inherent intermittency that requires backup generation and battery storage -- will damage both states' economies, leading to an exodus of jobs, especially jobs in the industrial sector. The economic and social

21 The estimated price impacts are based on the carbon content of gasoline, the carbon allowance auction clearing prices, and the state's mandate that gasoline be blended with 10% ethanol. By contrast, a 2021 report by the state Department of Ecology estimated the carbon tax would have less than a one cent per gallon price impact. See, Brett Davis, "Think tank: Ecology removes gas price impacts of WA's new carbon tax from its website," The Center Square Washington, May 30, 2023.
22 Source: US EIA, Weekly retail gasoline and on-highway diesel prices. Accessed July 5, 2023.
23 Suzanna Hinson and Paul Bolton, "Fuel Poverty," House of Commons Library, March 24, 2023.

impacts of renewable generation-driven price increases can be observed in European countries such as Germany and Great Britain, as well as in states like California, which has the highest electric rates in the lower 48 states.

Ironically, the policies aimed at reducing GHG emissions, even if those policies achieve "net zero," will have no measurable impact on world climate; the two states' combined total GHG emissions are less than even the average annual *increase* in world emissions over the past decade, and governments of most developing nations will not sacrifice the economic well-being of their citizens in pursuit of costly and unreliable renewable energy. Such a realization raises a simple, but important, question:

Why enact GHG reduction policies that will directly harm Oregon's and Washington State's residents, businesses, and industries, but will have no discernible impact on world climate?

RECENT TRENDS IN PACIFIC NORTHWEST ENERGY COSTS

Below we examine trends in energy prices since 2010 in Washington, Oregon, and Idaho, as they compare to overall trends in the U.S. energy prices. These trends offer a more meaningful measure of the effect of energy policies than other measures, such as expenditures per capita or per dollar of gross state product, which can be deceptive.

For example, in 2021, per capita residential energy expenditures in Washington averaged $689, whereas in Vermont, they averaged $1,433.[24] However, not only are their respective climates different, but the energy sources used to heat homes are different: over 60% of households in Washington state rely on electric heat and less than 2% use fuel oil, whereas in Vermont 40% use fuel oil and just 8% use electricity. Similarly, simple comparisons of total energy expenditures in states whose economies vary (e.g., Hawaii, which primarily relies on tourism, versus Michigan, which relies on manufacturing) provides few insights.

24 Source: US EIA, State Energy Data System, and U.S. Census Bureau, State Population Totals and Components of Change: 2020–2022.

Electricity

The average prices of electricity for all sectors in Idaho, Oregon, and Washington state have remained below the U.S. average, thanks to abundant hydroelectric generation (**Figure 1**). (The sharp uptick in average U.S. electricity prices in 2022 reflects the spike in natural gas prices that year that was driven by the conflict in the Ukraine, which reduced Russian deliveries.[25] Natural gas prices have fallen this year, which is moderating average electricity prices.)

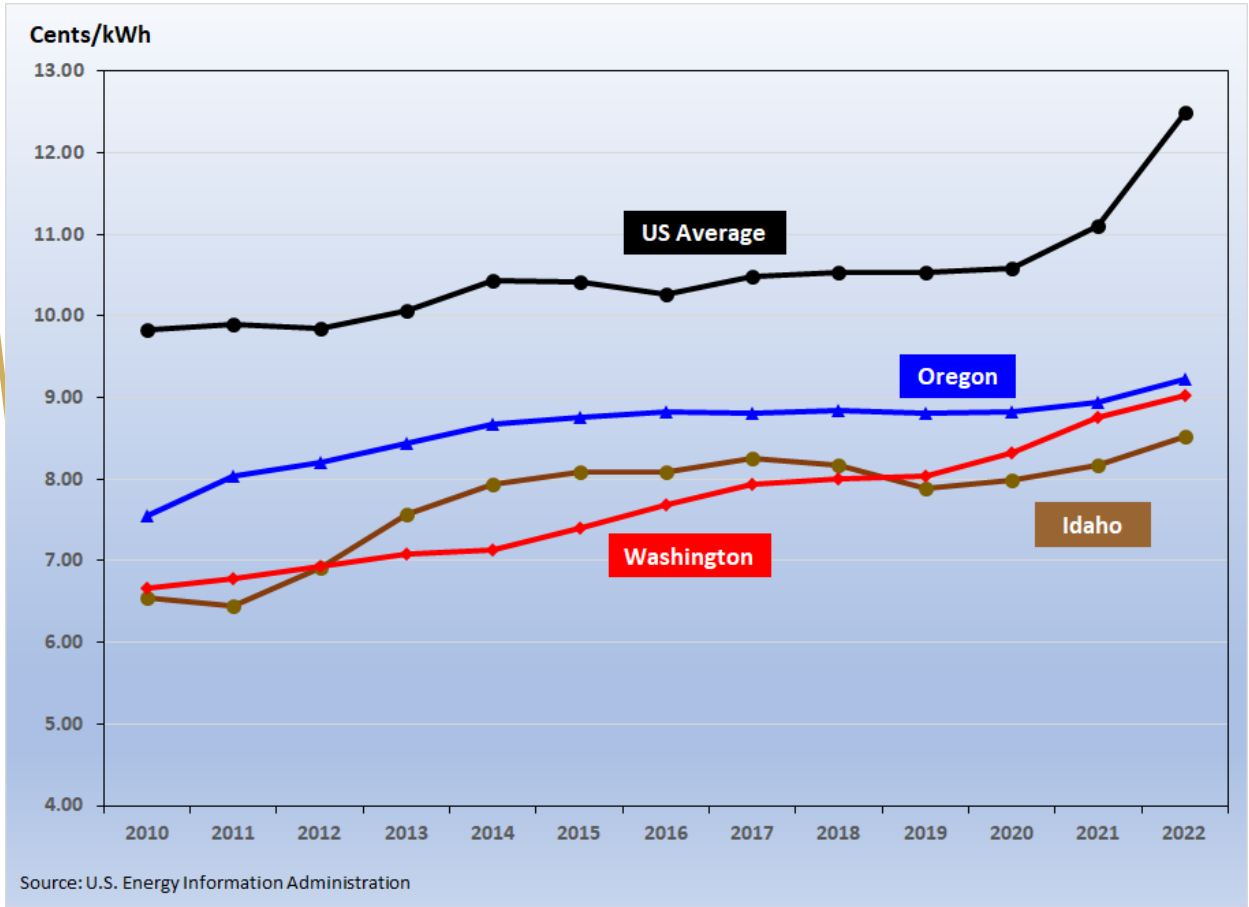

Figure 1: Average Retail Electric Prices—All Sectors

25 Paolo Agnolucci, et al., "Bubble trouble: what's behind the highs and lows of natural gas markets?," World Bank, February 22, 2023.

Yet, despite abundant hydroelectric resources, between 2010 and 2022, electricity prices in Washington increased by an average of 35%, in Idaho by 30%, and in Oregon by about 25% (**Figure 2**).[26] For the U.S. as a whole, for which hydroelectric generation supplied only 6% of total electric generation in 2022, the increase was about 27%. That increase was driven by the large increase in natural gas prices in 2022 (unlike in Washington, natural gas accounts for the majority of electricity generation in the U.S. as a whole). Through 2021, the overall increase in the U.S. price was just under 13% and, with the decrease in natural gas prices this year, average electricity prices in the U.S. are expected to increase only slightly, with the largest increases expected in California, Oregon, and Washington.[27]

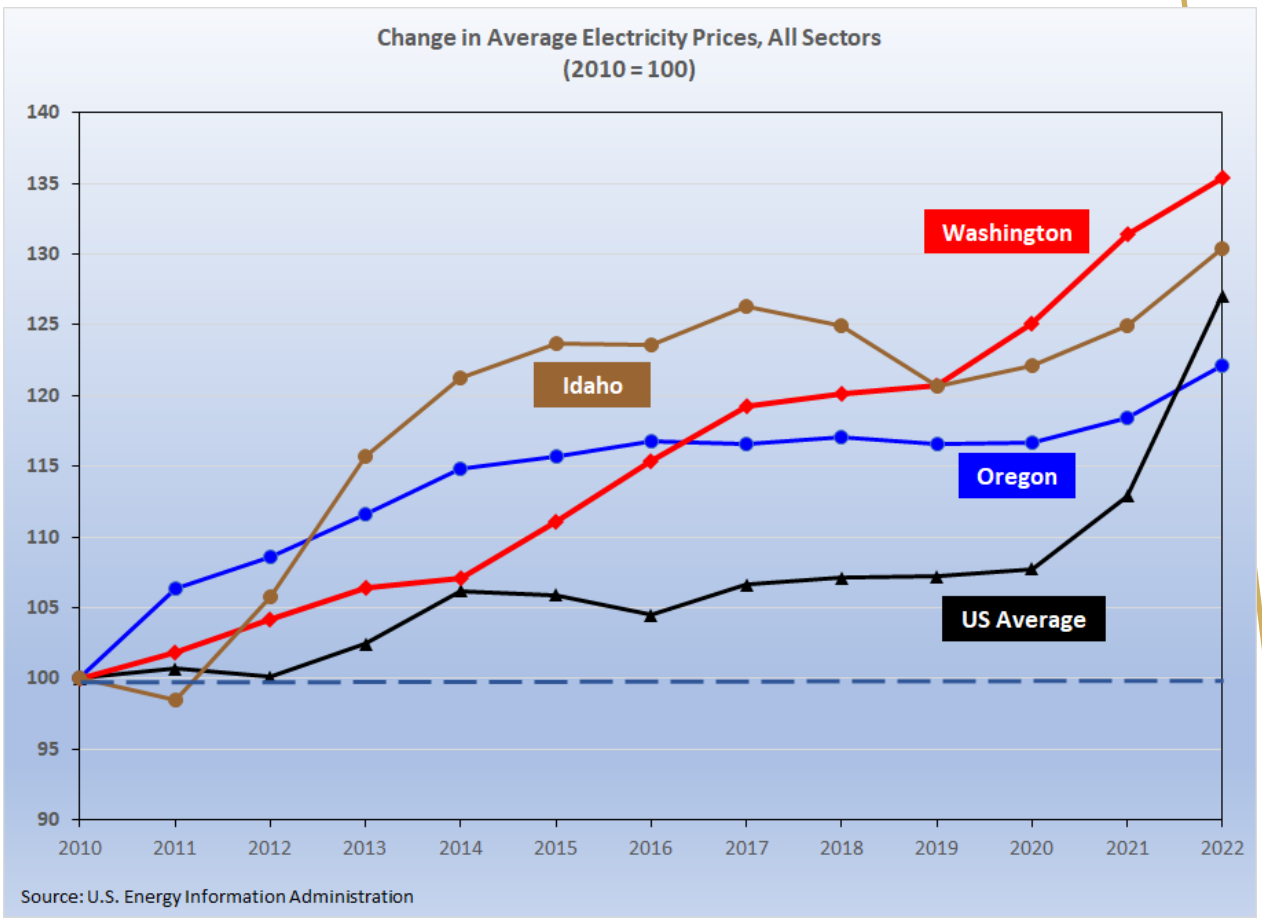

Figure 2: Change in Average Electricity Prices, All Sectors (2010 = 100)

26 Average prices in Idaho increased by about 30% between 2010 and 2022, although most of that increase took place between 2010 and 2015. The increase was driven primarily by drought and low hydroelectric output. Consequently, Idaho Power, the state's largest electric utility, was required to purchase more costly electricity generated from fossil-fuels.

27 Source: US EIA, Short-term Energy Outlook, June 6, 2023, Table 7c. (Prices are not adjusted for inflation.)

Natural Gas

Delivered natural gas prices reflect the costs of the natural gas plus the distribution infrastructure. In the residential and commercial sectors, prices in Oregon and Washington state have generally been aligned with average prices in the U.S. as a whole, while prices in Idaho have been much lower than the U.S. average (**Figures 3 and 4**).

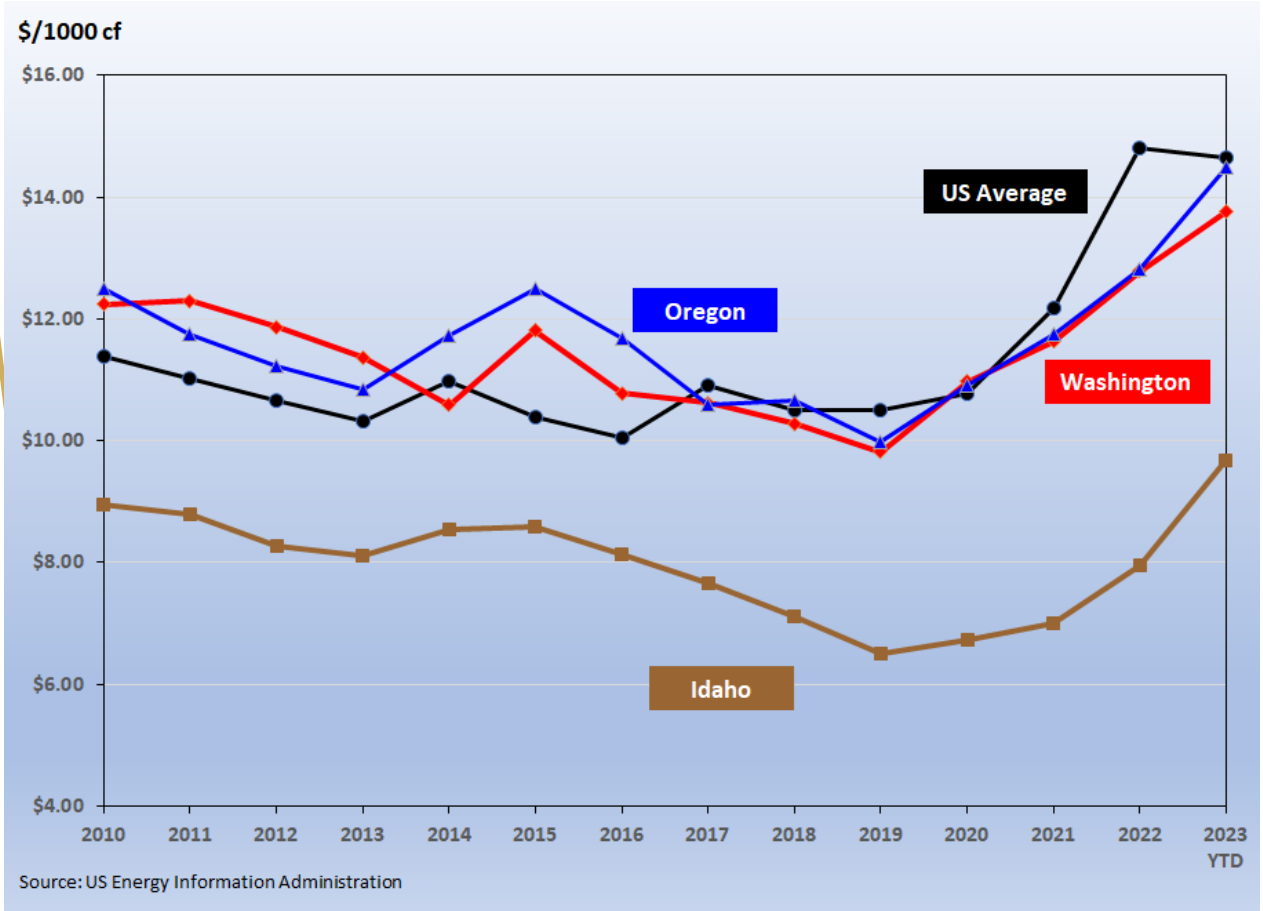

Figure 3: Average Price of Natural Gas Delivered to Residential Customers

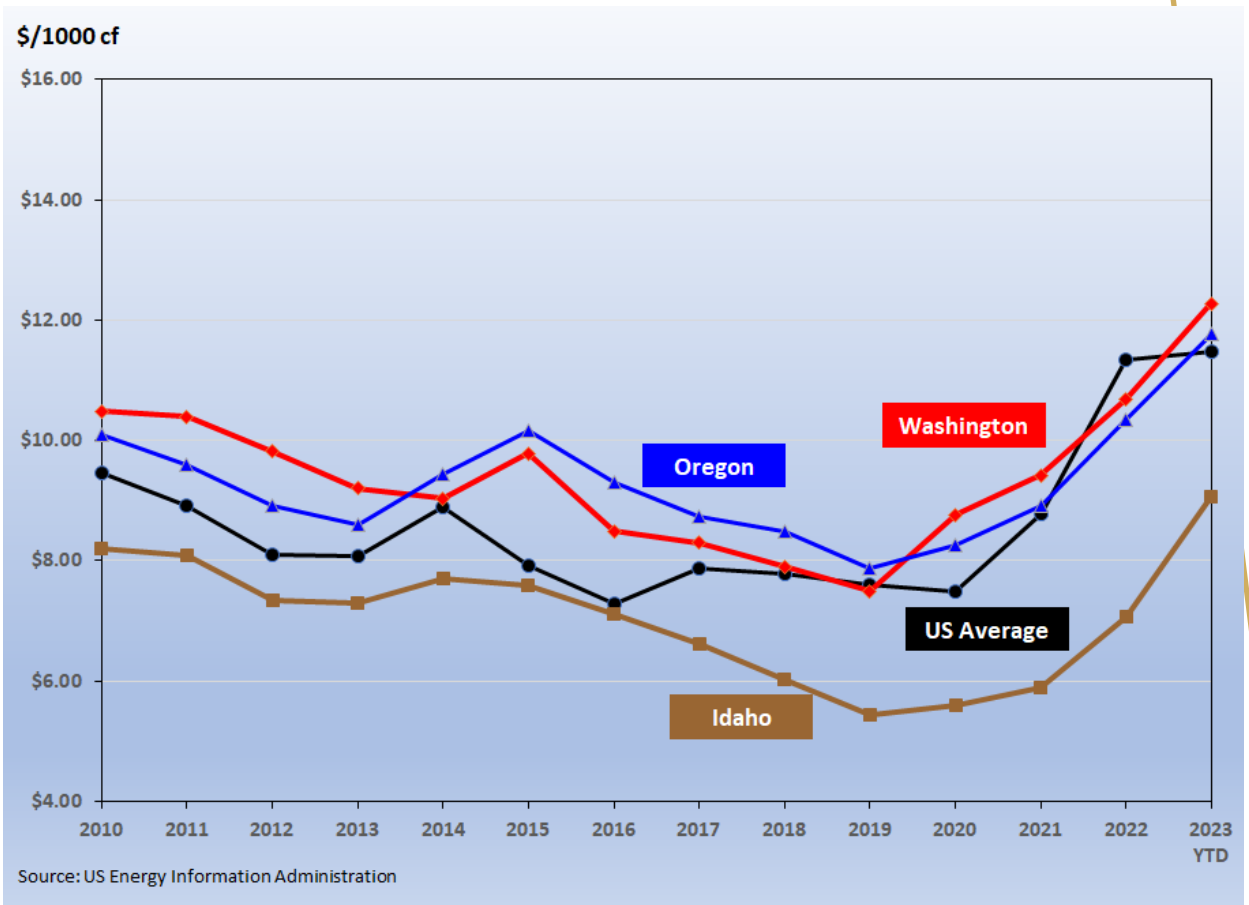

Figure 4: Average Price of Natural Gas Delivered to Commercial Customers

In the industrial sector, however, a different story emerges. While delivered natural gas prices in Idaho and Oregon have generally been aligned with average U.S. prices, industrial sector natural gas prices in Washington state have been much higher than the US average (**Figure 5**). Since 2019, industrial sector prices have risen by 64%. The Washington CCA appears to be accelerating price increases this year, while prices in the U.S. as a whole have decreased, with a price increase of about 20% through the first half of this year. In contrast, the average U.S. price for industrial customers fell by almost 30% through the first half of 2023 because of declining wholesale prices.[28]

28 In 2022, the US EIA reported that the average price for natural gas at Henry Hub, a key pricing point, was $6.45 per million Btus (MMBtu). Through the first half of 2023, the average price was $2.41 per MMBtu, a decrease of over 60%.

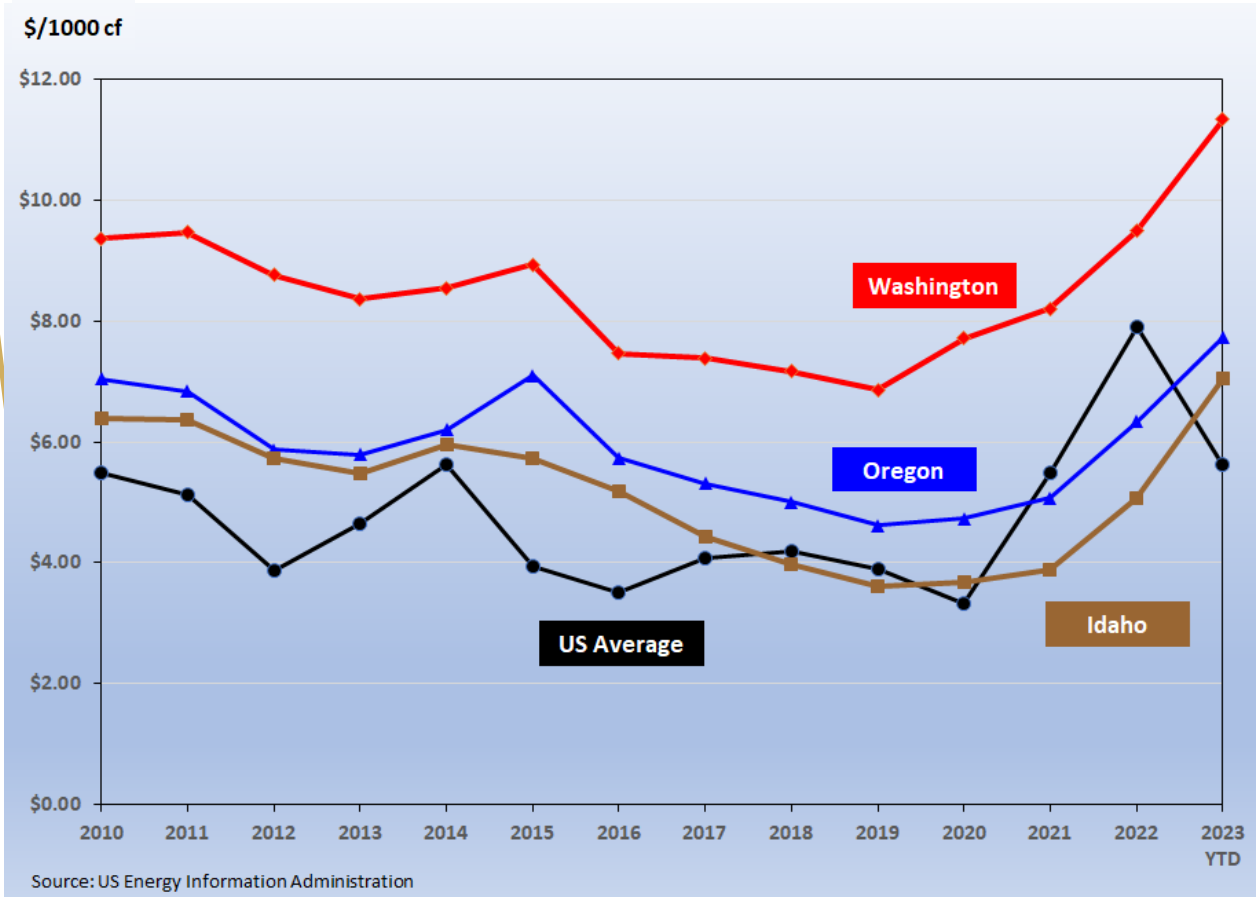

Figure 5: Average Price of Natural Gas Deliver to Industrial Customers

Petroleum Products

Petroleum accounts for over half of all end-use energy consumption in Idaho, Oregon, and Washington, primarily in the form of gasoline and diesel fuel used for transportation.

For example, in 2021, the most recent year for which data are available, total expenditures for energy in Washington state were approximately $26 billion, of which $16 billion, or 61%, was for petroleum products.[29] Of the $16 billion spent on petroleum fuels, $14.4 billion was for transportation and $8.7 billion of that was spent on gasoline.

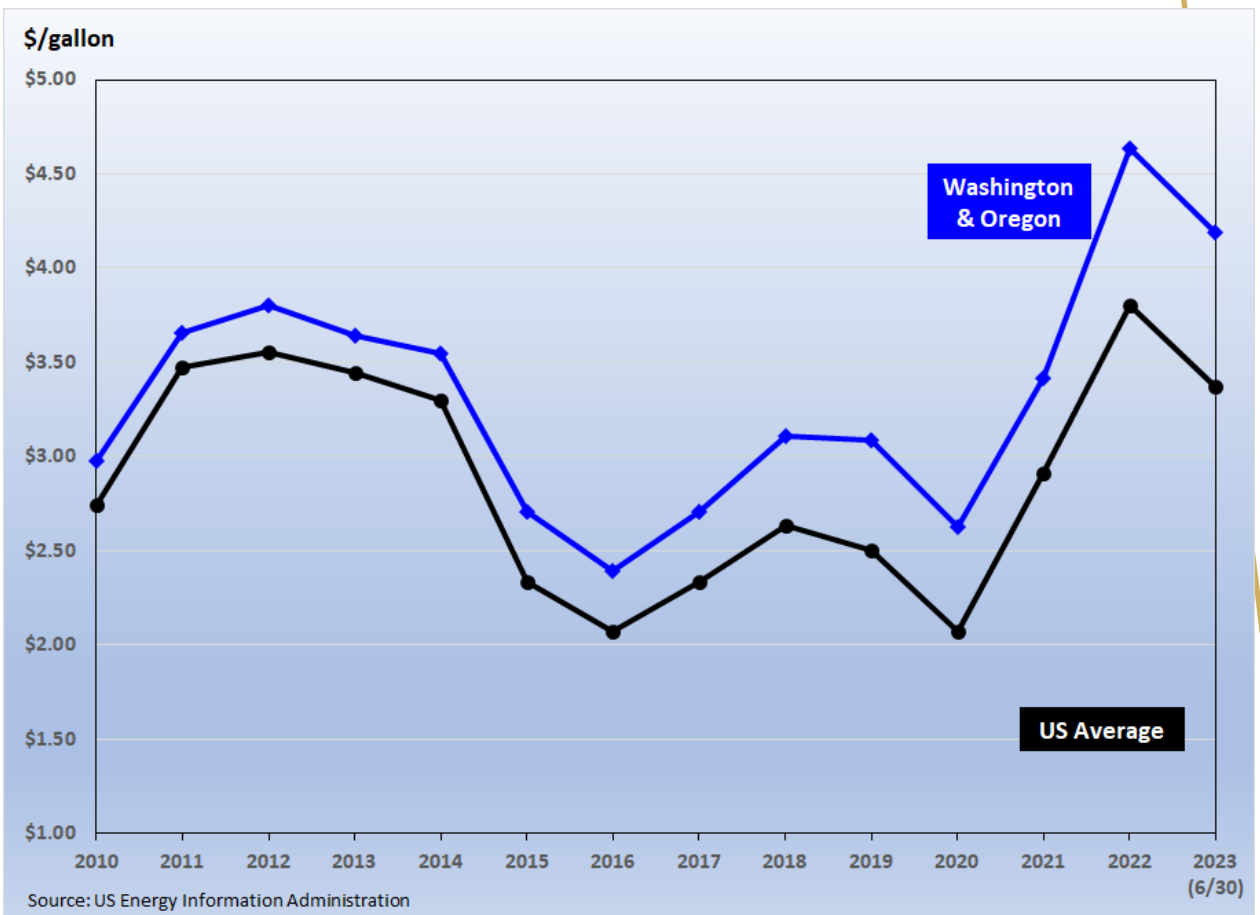

Figure 6: Washington and Oregon Gasoline Prices vs. U.S. Average

29 Source: US EIA, State Energy Data System.

Historically, average prices for regular gasoline in Oregon and Washington were almost identical, with both exceeding the U.S. average (**Figure 6**).[30] In 2022, the excess price averaged 84 cents per gallon, or 22%.

Looking just at the differences in prices through the first six months of 2023, the impact of the CCA can be seen clearly (**Figure 7**). At the beginning of the year, prices in Washington State were about 60 cents per gallon above the U.S. average. By the week of July 7, 2023, prices in Washington state were about $1.50 per gallon over U.S. prices as a whole.[31]

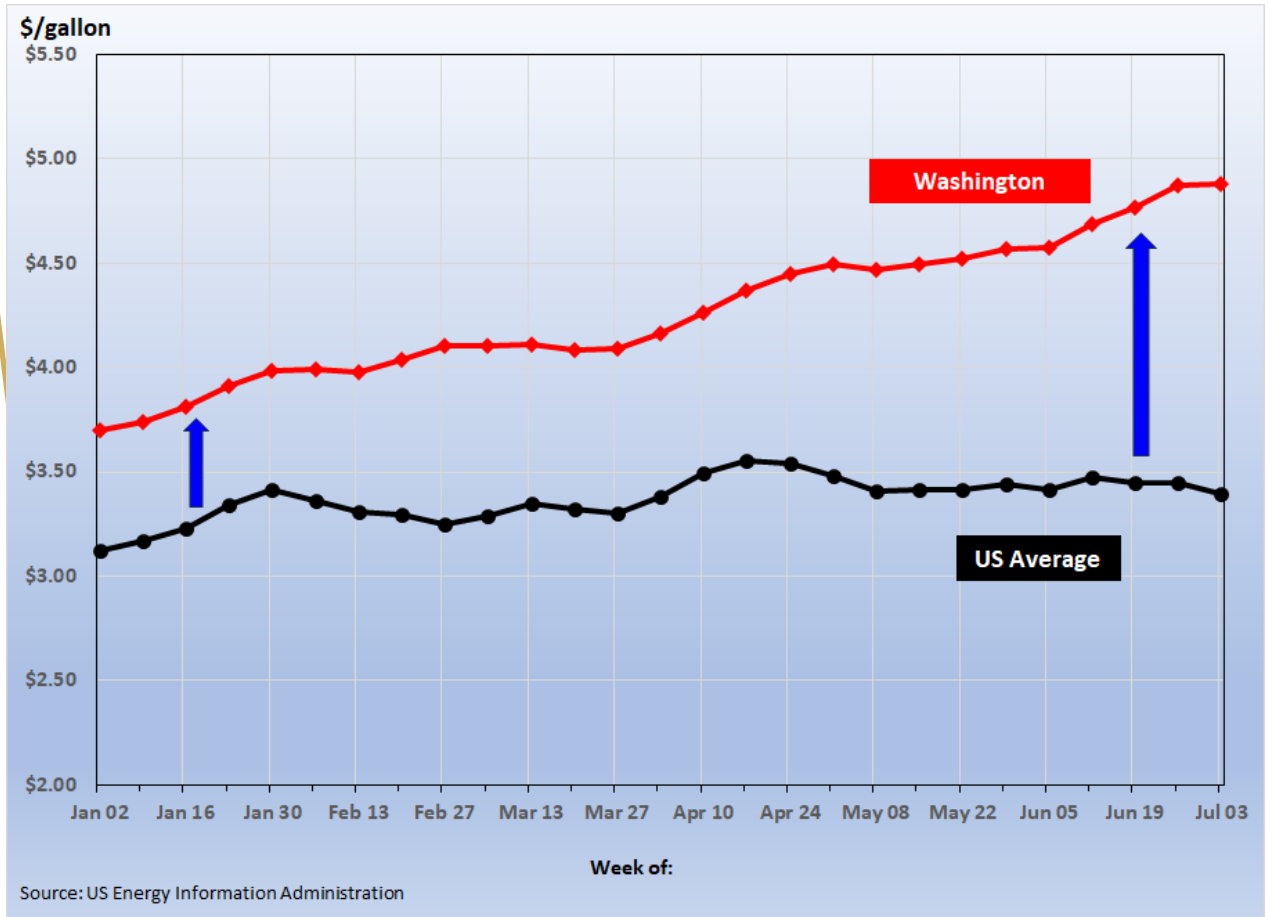

Figure 7: Washington and U.S. Average Regulator Gas Prices, Jan–Jun 2023

30 The EIA does not publish separate prices for Oregon alone. The Washington & Oregon series reflects west coast prices excluding California.

31 By the end of June, the average price of diesel fuel in Washington state was $4.94 per gallon, $1.17 per gallon higher than the average price in the U.S. as a whole. Prices in Oregon have also risen over the first half of 2023. This likely reflects increased demand for gasoline at border locations in Oregon.

As the charts above illustrate, energy costs in Oregon and Washington have risen significantly over the past decade.

Washington's implementation of the CCA has exacerbated the price increases for fossil fuels. (Because the CCA allocates allowances to the state's electric utilities, the full impact of the CCA on retail electricity prices is muted.) Given Oregon and Washington's energy policies, which will effectively force the electrification of much of the economy, the future promises more of the same. The reasons why are the subject of the next section of this report.

OREGON AND WASHINGTON'S HIGH-COST ENERGY FUTURE

A Summary of Oregon and Washington State's GHG Reduction Policies

Oregon and Washington state have adopted policies designed to eliminate most GHG emissions by 2050 (Net Zero), which are modeled after policies developed previously in California.

These are: (i) mandates for zero-emission electric generation; (ii) bans on the sale of internal combustion cars and trucks, (iii) "clean fuel" standards requiring refiners to obtain carbon allowances; (iv) prohibitions against using fossil fuels in new homes and businesses; and (v) carbon cap-and-trade programs.

Collectively, these policies are designed to force the electrification of most of the economy and to meet the increased demand for electricity with investments in emissions-free generating resources (primarily wind and solar photovoltaics), energy conservation, and direct-load control to limit electricity demand when supplies are inadequate. In addition, both states seek to increase production of "renewable natural gas" from landfills, wastewater treatment plants, and dairy farms, both to generate electricity in conventional gas-fired turbines and to supply to natural gas customers. As this section argues, these policies will raise electricity prices and lower reliability.

Zero-Emissions Electricity

The states' mandates for zero-emissions electricity supplies are set forth in Washington's 2019 Clean Energy Transformation Act (CETA) and Oregon's HB 2021. CETA requires all electric utilities to shut down any remaining coal-fired power plants by 2025. By 2030, all utilities must be "GHG neutral," meaning they can generate electricity using some natural gas if all the resulting GHG emissions are offset. By 2045, utilities must supply 100% zero-emissions electricity, with no offsets allowed (like the CFS, an "offset" allows a utility to generate electricity with fossil fuels if the carbon emissions are offset with zero-carbon sources.) CETA also contains a provision that allows utilities to slow the pace of the zero-emissions transition if it results in "rate shock."

Similar to CETA, Oregon HB 2021 requires retail electricity providers to reduce greenhouse gas emissions associated with electricity sold to Oregon consumers to 80 percent below baseline emissions levels by 2030, 90 percent below baseline emissions levels by 2035, and 100 percent below baseline emissions levels by 2040.

Electric Vehicles and Clean Fleets

Both states have also followed California's ban on the sale of gasoline- and diesel-powered light trucks as of 2035,[32] which allows only the sale of fully electric vehicles, plug-in hybrids, or fuel cell vehicles. Both states are also considering California's ban on large diesel trucks, known as the Advanced Clean Fleets rule, [33] that was proposed in 2020 and formally adopted earlier this year.[34] Under the California rule, the mandated transition to zero-emission vehicles begins in 2024, and all delivery trucks must be zero-emissions by 2035. Beginning in 2036, sales of all internal combustion trucks will be banned. Similarly, in November 2021, Oregon adopted its Clean Truck Rule to follow California.[35]

32 David Steves, "Oregon, Washington join California in banning gas-powered new vehicles starting in 2035," Oregon Public Broadcasting, December 20, 2022.
33 California Air Resources Board, "California approves groundbreaking regulation that accelerates the deployment of heavy-duty ZEVs to protect public health," April 28, 2023.
34 Don Jenkins, "Washington to adopt California ban on diesel trucks," Capital Press, May 9, 2023.
35 Oregon Dept. of Environmental Quality, Clean Trucks Rule, November 17, 2021.

Clean Fuels Standards

The "Clean Fuels" standards both states have adopted requires refineries (although there are none in Oregon) and importers to reduce the carbon intensity of fossil fuels (i.e., the amount of CO_2 emitted when burned). In Oregon, the average carbon intensity must be reduced by 20% below 2016 levels by 2030 and 37% below 2016 levels by 2035. Washington state's Clean Fuel Standard, which took effect on January 1, 2023, requires a carbon intensity reduction of 20% below 2017 levels by 2034.[36]

The actual carbon content of fuels such as gasoline and diesel cannot be reduced because that content is defined by a fuel's chemical makeup. Hence, to achieve the mandated reductions in carbon intensity, refiners can improve refiner efficiency, blend biofuels into the fuels they sell,[37] or purchase credits (offsets) from producers/sellers whose fuels are below the carbon intensity mandate.

Building Electrification

In 2022, the Washington State Building Code Council (SBCC) voted to require heat pumps for all space heating/cooling and water heating in new residential home construction, beginning July 1, 2023. (In May of this year, the SBCC delayed the change until at least October 1, 2023, owing to a U.S. Court of Appeals decision overturning a similar rule in California[38] and impending legal challenges to the Washington rule.[39]) Oregon has not yet adopted any statewide mandates, but in February 2023, the City of Eugene passed an ordinance banning new natural gas hookups in new low-rise construction. However, on July 10, 2023, the Eugene City Council repealed the measure, in part because opponents were successful in placing the measure for a ballot referendum.[40] The City of Ashland passed a similar ban in June 2023.[41]

36 Washington Department of Ecology, Clean Fuel Standard, undated.
37 For gasoline, the biofuel is plant-based ethanol. For diesel, there are various forms of biodiesel, such as that made from recycled vegetable oil, restaurant grease, or animal fats. See, U.S. Department of Energy, Alternative Fuels Data Center, Biodiesel Fuel Basics, undated.
38 *California Restaurant Association v. City of Berkeley*, No. 21-16278, (9th Cir., April 17, 2023).
39 Jerry Cornfield, "WA council delays new building codes that would require heat pumps," *The Seattle Times*, May 25, 2023.
40 Nathan Wilk, "Eugene removes an ordinance restricting some natural gas hookups from the upcoming fall ballot," Oregon Public Broadcasting, July 11, 2023.
41 Buffy Pollock, "Ashland Plans to Ban the Use of Natural Gas in Newly Constructed Homes," Daily Tidings, June 9, 2023. As of writing, the City plans to publish specific rules in late summer or early fall.

Carbon Cap-and-Trade

Perhaps the most controversial policy is Washington State's Climate Commitment Act (CCA), which was enacted in 2021. The CCA requires all businesses in the state (with some exceptions, such as fuels used on farms and so-called "emissions-intensive, trade exposed" industries (i.e. those determined to be at risk of leaving the state because of the compliance costs)[42] to cover all of their GHG emissions, either with credits earned for emissions or by purchasing CO_2 allowances. (One "allowance" represents one metric ton of CO_2.) To set the price of allowances, a key feature of the CCA is an auction market.[43] The program is similar to one adopted in California, which shares a carbon market with the province of Quebec.

The cap-and-invest program is actually a carbon cap-and-trade program, in which carbon emitters (manufacturers, electric and natural gas utilities, etc.) must obtain carbon allowances for all of their CO_2 emissions. The prices of allowances are determined in auctions held by the state every three months, based on the number of allowances the state determines will be auctioned off.[44] The auctions also have floor and ceiling prices. Each year, the floor and ceiling prices will increase by five percent, plus the rate of inflation.[45] In 2023, the number of allowances was set to eight million, decreasing to six million in 2024, three million in 2025, and 1.65 million in 2026.

The first auction was held on February 28, 2023. The floor price was set to $22.20 per allowance and the ceiling price was $81.09. The auction clearing price was $48.50.[46] In the second auction, which was held on May 31, 2023, the clearing price was $56.01.[47] The clearing price rose to $63.03 in the third auction, held on August 30, 2023. Over time, the number of allowances auctioned off will decrease, which will lead to higher allowance prices and, according to CCA proponents, result in reductions in fossil fuel energy use and GHG emissions.

Under its Climate Protection Program, Oregon also intends to implement its own cap-and-trade program. Although legislation including a cap-and-trade program was introduced in 2023, it was not enacted.[48] However, the legislature is expected to continue its attempts to enact the program.

42 RCW 70A.65.080.
43 "Cap-and-invest" is used by proponents because the money raised through the sale of allowances will be "invested" in various government programs.
44 Washington State Dept. of Ecology, "Washington's cap-and-invest program," undated.
45 WAC 173-446-335.
46 Washington Dept. of Ecology, "Washington Cap-and-Invest Program Auction #1 February 2023: Summary Report," March 7, 2023.
47 Washington Dept. of Ecology, "Washington Cap-and-Invest Program Auction #2 May 2023: Summary Report," June 7, 2023. This second auction also included an "Advanced Auction" for allowances in 2026. The clearing price for those allowances was $31.12.
48 Senate Bill 522, Section 7(2).

Electrification and Increased Electricity Demand

Collectively, these policies will increase the demand for electricity, especially through efforts to force residents and businesses to rely solely on electric vehicles. Although the state's investor-owned electric utilities intend to continue implementing energy efficiency and conservation measures, such measures will not offset the growth in overall electricity consumption and peak electricity demand (**See Sidebar "Understanding Energy and Peak Demand"**).

The most recent forecast of energy and peak electricity demand in Washington state was released in December 2020, as part of the State Energy Strategy.[49] The forecasts, which were prepared by Evolved Energy Research, a California consulting firm, present different scenarios about the future. In the full electrification scenario, electricity demand doubles by 2050, even with

49 Washington State Dept. of Commerce, 2021 Comprehensive State Energy Plan. In March 2023, the state released its 2023 Biennial Energy Report. This latter report does not include an updated forecast of electricity demand. Appendix A reports increased electricity demand in trillion Btus (TBtus). In 2022, the U.S. EIA reported total electricity sales of just over 90 million megawatt-hours (MWh). (For Oregon, total sales were 53 million MWh.) In 2050, therefore, total electricity sales would be around 180 million MWh, based on that forecast. There are no forecasts of peak electricity demand, which is a crucial weakness because, when electricity demand is greatest, typically in the early morning or evening hours, solar generation is minimal, as is wind generation.

Understanding Energy and Peak Demand

Meeting the demand for electricity has two components. The first is total consumption, which typically is measured in kilowatt-hours (kWh) or megawatt-hours (MWh) (one MWh = 1,000 kWh). The other is instantaneous demand, measured in megawatts or kilowatts. One MWh, for example, is equivalent to one MW of electricity demand for one hour.

In their integrated resource plans, electric utilities report forecast annual energy consumption in average MW (aMW). One average MW for all 8,760 hours of the year equals 8,760 MWh. Electric utilities must have sufficient resources to meet both forecast total consumption over time and to meet the highest levels of instantaneous demand (called "peak demand"). In the Pacific Northwest, peak demand typically has taken place in the winter months, usually in the early evening hours.

In the last few years, increased peak demand, coupled with unavailability of wind and solar generation, has contributed to emergency situations, where consumers and businesses are urged to conserve power. For example, in September 2022, California EV owners were asked by state officials and the California Independent System Operator (CAISO, which coordinates operation of that state's electric generating plants and high-voltage power grid) to not charge their EVs between the hours of 4:00 and 9:00 P.M.[a] In Texas, below-average cold temperatures in February 2021 brought that state's power grid, operated by the Electric Reliability Council of Texas (ERCOT), to the brink of complete shutdown. ERCOT was forced to impose rolling blackouts to manage electricity demand, which increased because of the cold weather, combined with reduced generating capacity. As electrification efforts continue, the sensitivity of peak demand to weather will increase.[b]

a CAISO, "California ISO extends Flex Alert to Thursday, Sept. 1," August 31, 2022.
b Blake Shaffer, et al., "Changing sensitivity to cold weather in Texas power demand," iScience 25 (April 2022).

massive investments in energy efficiency.[50] That scenario appears to be the basis for more recent claims that, by 2050, the state will need to import significant quantities of wind and solar power to meet that doubled electricity demand.[51]

Forecasts of electricity growth in Oregon are similar to those in Washington, with electrification driving increased demand.[52]

Each year, the Pacific Northwest Utilities Conference Committee (PNUCC), an electric industry trade group, prepares a 10-year forecast of electricity demand,which complies individual utility forecast.[53] The most recent forecast shows that annual electricity consumption will increase from about 191 million MWh to about 237 million MWh, reflecting an average annual growth rate of 2.4%, *after* accounting for energy efficiency and conservation efforts. Extended out to 2050, this growth rate implies total electricity demand of about 363 million MWh, consistent with the forecast of a doubling of electricity consumption prepared for Washington state.

Although electricity demand in the Pacific Northwest historically has been greatest in the winter months, peak demand in summer is increasing more rapidly. The most recent PNUCC forecast shows winter peak demand increasing at an average rate of 2.3 percent annually and winter peak demand increasing at 1.8% per year. Coupled with the planned closure of several coal-fired power plants, the PNUCC forecast projects a summer peak deficit (i.e., the difference between forecast summer peak and the capacity of existing resources at over 11,000 MW in the 2032–2033 timeframe). That deficit supposedly will be met with the addition of almost 16,000 MW of renewable generation and battery storage, over 3,000 MW of which is unspecified "generic" renewables (**Figure 8**).[54] Looking further into the future, a review of Oregon and Washington's four investor-owned electric utilities shows they plan to construct over 16,000 MW of wind and solar generation, and almost 8,000 MW of battery storage.[55] The reliance on intermittent wind and solar, plus thousands of MW of battery storage, will lead to less reliability and much higher costs.

50 2021 Comprehensive State Energy Plan, Appendix A.
51 John Stang, "By 2050, Washington might need to buy energy from other states," *Crosscut*, February 3, 2023.
52 Recently, Portland General Electric (PGE) filed a revised Integrated Resource Plan (IRP) with the Oregon Public Utility Commission. The company's new load forecast shows an increase in electric consumption of over 40%. The reason for the change was new data centers that are planned in its service territory. See also, Pete Danko, "PGE, facing clean energy challenge, revises load forecast sharply higher as data centers sprout," Portland Business Journal, July 11, 2023.
53 Pacific Northwest Utilities Conference Committee (PNUCC), "2023 Northwest Regional Forecast," May 2023.
54 PNUCC 2023 forecast, Table 9. All of the "generic" renewable capacity is forecast to be developed by PGE. The forecast does not account for the proposed removal of the four Lower Snake River Dams, which have a nameplate capacity of over 3,000 MW.
55 These figures are based on a review of the most recent IRPs filed by Avista, Pacificorp, Portland General Electric, and Puget Sound Energy. For PacifiCorp, which also serves customers in Utah, the data are taken from its Oregon update.

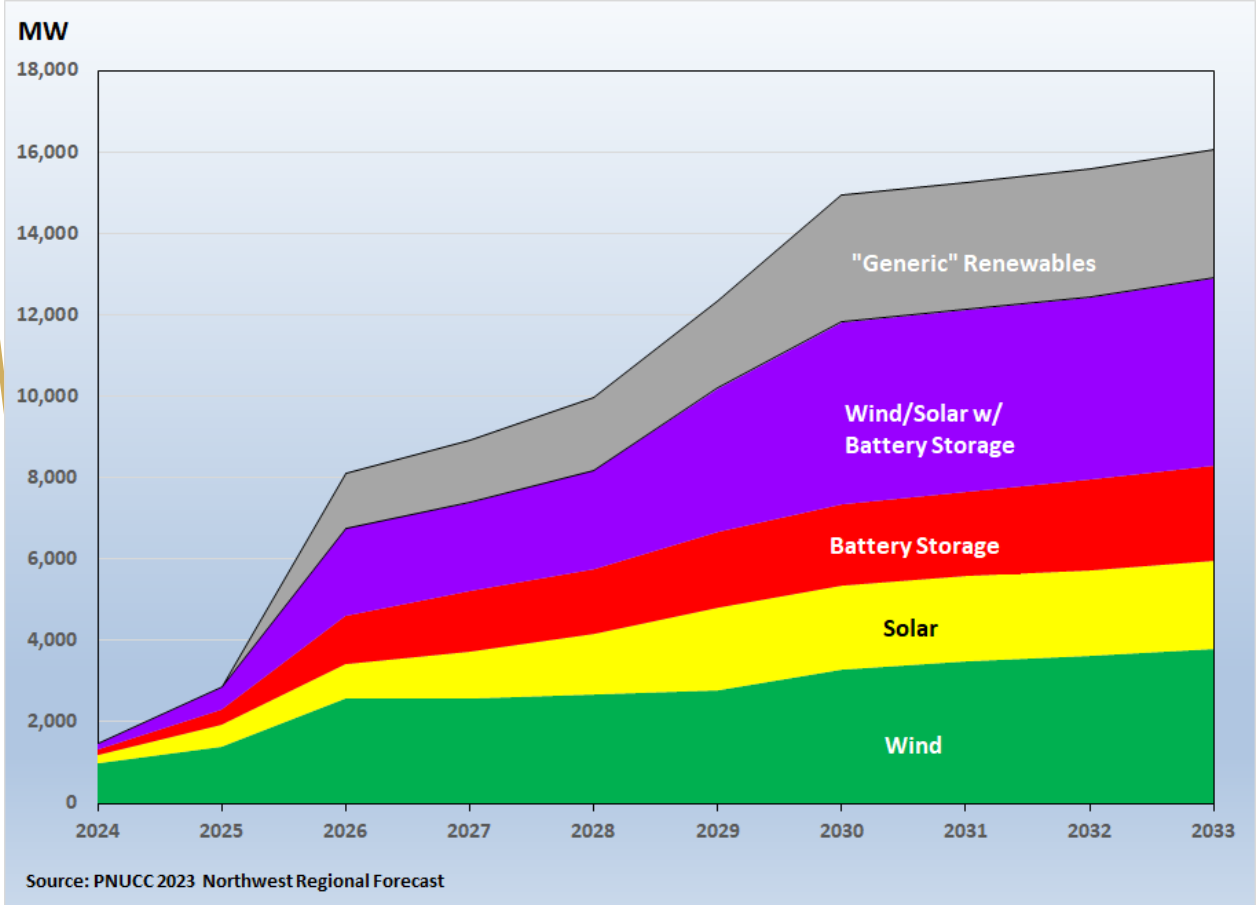

Figure 8: Nameplate Capacity of Planned Resource Additions, 2024–2033

Additionally, to meet their zero-emissions mandates, several utilities plan to build zero-emissions dispatchable resources, such as peaking generators fueled by biodiesel and so-called "green hydrogen."[56,57] Generating resources that can burn pure hydrogen—green or otherwise—do not yet exist. Assuming they will be invented by a date certain is thus problematic. Nor does the pipeline and storage infrastructure for hydrogen exist that would be required for large-scale use of hydrogen for generating electricity. Finally, manufacturing green hydrogen using electrolysis is far more costly than the current, mature

56 Green hydrogen is assumed to be manufactured through the electrolysis of water using surplus electricity generated by wind and solar facilities. But this hydrogen must also be transported and stored, which requires building an entirely new pipeline and storage infrastructure. For a brief discussion, see Puget Sound Energy, 2023 Electric Progress Report, Appendix D, p. D-21.

57 For example, the Puget Sound Energy IRP includes 1,588 MW of "CETA Qualifying" peaking generators fueled by biodiesel and green hydrogen by 2045. The Pacificorp IRP includes 1,240 MW of those resources by 2037. The Avista IRP call for 696 MW of generation fueled by hydrogen and ammonia.

technology that uses natural gas, while projections of rapid decreases in production costs appear to be overblown.[58]

The majority of new wind and solar facilities are planned for rural areas in eastern Oregon and Washington, as well as developments in Idaho and Montana. This raises two additional issues. First, opposition to siting large-scale wind and solar facilities in rural areas is increasing. Many (not all) residents in these areas object to land they have used for farming and ranching to be turned into wind and solar facilities. This phenomenon is occurring throughout the United States.[59] Several counties in eastern Washington have imposed moratoriums on new solar projects. In 2020, Benton County PUD announced its opposition to any new wind projects. In Idaho, the proposed 400 turbine, 1,000 MW Lava Ridge Wind Farm, which would be built on almost 200,000 acres of land, is opposed by many local residents and the Idaho state government.[60]

Second, because wind and solar developments require large amounts of land, they must be built far from cities like Portland and Seattle, where most electricity is consumed. This will require construction of numerous high-voltage transmission lines through the Cascade Mountains. However, transmission lines are expensive and time-consuming to build, and opposition to siting them can be intense.[61]

58 Lize Wan and Paul Butterworth, "Energy from green hydrogen will be expensive, even in 2050," CRU, February 24, 2023. On the other hand, subsidies offered for green hydrogen production under the Inflation Reduction Act supposedly could result in apparent *negative* costs. Brandon Mulder, "US green hydrogen costs to reach sub-zero under IRA; longer-term price impacts remain uncertain," S&P Global, September 29, 2022.
59 Author Robert Bryce maintains a "renewable rejection database" that provides a detailed list of facilities that have been opposed. See his article, "Voters Veto Big Wind In Ohio and Michigan: Rejections Now Total 375 Since 2015," RealClear Energy, November 11, 2022.
60 Mia Maldonado, "Clean energy, at what cost? BLM to decide what's next for Idaho Lava Ridge Wind Project," Idaho Capital Sun, May 5, 2023.
61 Rick Adair, "Lack of Cascades-Crossing Lines a Challenge to Clean Energy Goals," *Clearing Up*, March 25, 2022.

Zero-Emissions Electricity Mandates Will Lead to Higher Electric Rates

Proponents of Oregon and Washington's mandates to promote electrification and require electric utilities to meet the resulting increased electricity demand with additional zero-emissions resources[62] tend not to focus of the additional costs of doing so, and instead point to rosy forecasts of ever-lower costs. For example, many green energy advocates claim that the costs of building wind, solar, and battery storage are decreasing and will continue to do so.[63] Many also claim that the costs of electric vehicles are decreasing and will soon reach parity with internal combustion vehicles.[64] Still others suggest that renewable natural gas (RNG) will be a cost-competitive alternative to traditional natural gas supplies.[65]

These claims are not realistic. Although some of these costs, such as the cost of solar panels, have decreased, especially when compared to costs one or two decades ago, that trend has stopped. There are a few reasons for this. First, incremental technological improvements—more efficient solar panels, bigger wind turbines, and so forth—are reaching their practical limits. Second, the costs of raw materials—steel, cement copper, rare earths, and so forth—needed to manufacture and install renewable energy facilities are increasing because of increased demand, a lack

62 Zero-emissions resources include wind and solar generation, as well as renewable natural gas (RNG) for gas-fired generators (and end-use natural gas consumption for space and water heating). Zero-emissions nuclear generation does not appear to be considered as a future resource option.
63 Many advocates also claim that wind and solar costs are below those of traditional fossil generation, which begs the question as to why those resources require subsidies, including the 30% investment tax credit (ITC) for solar generation and the wind production tax credit (PTC, currently $27.50/MWh). The Inflation Reduction Act provides an additional 10% ITC if most components are manufactured domestically.
64 Jack Ewing, "Electric Vehicles Could Match Gasoline Cars on Price This Year," *New York Times*, February 10, 2023.
65 See, e.g., "Promoting Renewable Natural Gas in Washington State," Washington State University and Washington Department of Commerce, December 2018.

of technological improvements in manufacturing and production, and higher raw materials requirements.[66] For example, cement manufacturing is a mature technology; barring some unknown technological breakthrough, any technological improvements are likely to be marginal at best.[67]

Additionally, replacing fossil-fuel generation with new renewable resources, primarily wind and solar power, requires additional back-up generation and storage to "firm" those resources, that is, to ensure there is sufficient electricity at night, on cloudy days, and when the wind doesn't blow. Although Oregon and Washington benefit from the Columbia River system dams, which are ideal for "firming" renewable generation, the output of those dams is not unlimited, especially in low-water years. Thus, as electrification mandates drive a potential doubling of electricity demand in the Pacific Northwest, firming up electricity supplies increasingly will require more battery storage or so-called "Dispatchable Emissions-free Resources" (DEFRs)—generators that run on RNG or "green" hydrogen.

Experience in European countries has shown that, as renewable energy penetration increases, so do retail electric rates. In part, this has been caused by massive subsidies that are recouped from ratepayers, because wind and solar technologies are not cost-competitive, despite Europe's higher natural gas prices. In Germany, for example,

66 For a comprehensive discussion of electric vehicles, see Mark Mills, "Electric Vehicles for Everyone? The Impossible Dream," Manhattan Institute, July 2023. See also his report, "The 'Energy Transition' Delusion: A Reality Reset," Manhattan Institute, August 2022. As he states, "Claims that wind, solar, and EVs have reached cost parity with traditional energy sources or modes of transportation are not based on evidence. Even before the latest period of rising energy prices, Germany and Britain—both further down the grid transition path than the U.S.— have seen average electricity rates rise 60%–110% over the past two decades."

67 Some firms are working to develop emissions-free cement manufacturing processes. See, e.g., "Climate Breakthrough: Brimstone's Decarbonized Portland Cement First to Meet Essential Building Industry Standard, Unlocking the Potential of Net-Zero Construction," *Businesswire*, July 13, 2023.

deindustrialization is taking place because manufacturers cannot afford electricity and are abandoning the country and expanding operations elsewhere.[68]

In this country, the states that have been most aggressive in pursuing renewable energy, California, New York, Massachusetts, also have the highest retail electric rates (**Figure 9**). Those rates, moreover, have been increasing more rapidly than in the U.S. as a whole and will continue to do so, especially as high-cost offshore wind projects are built.

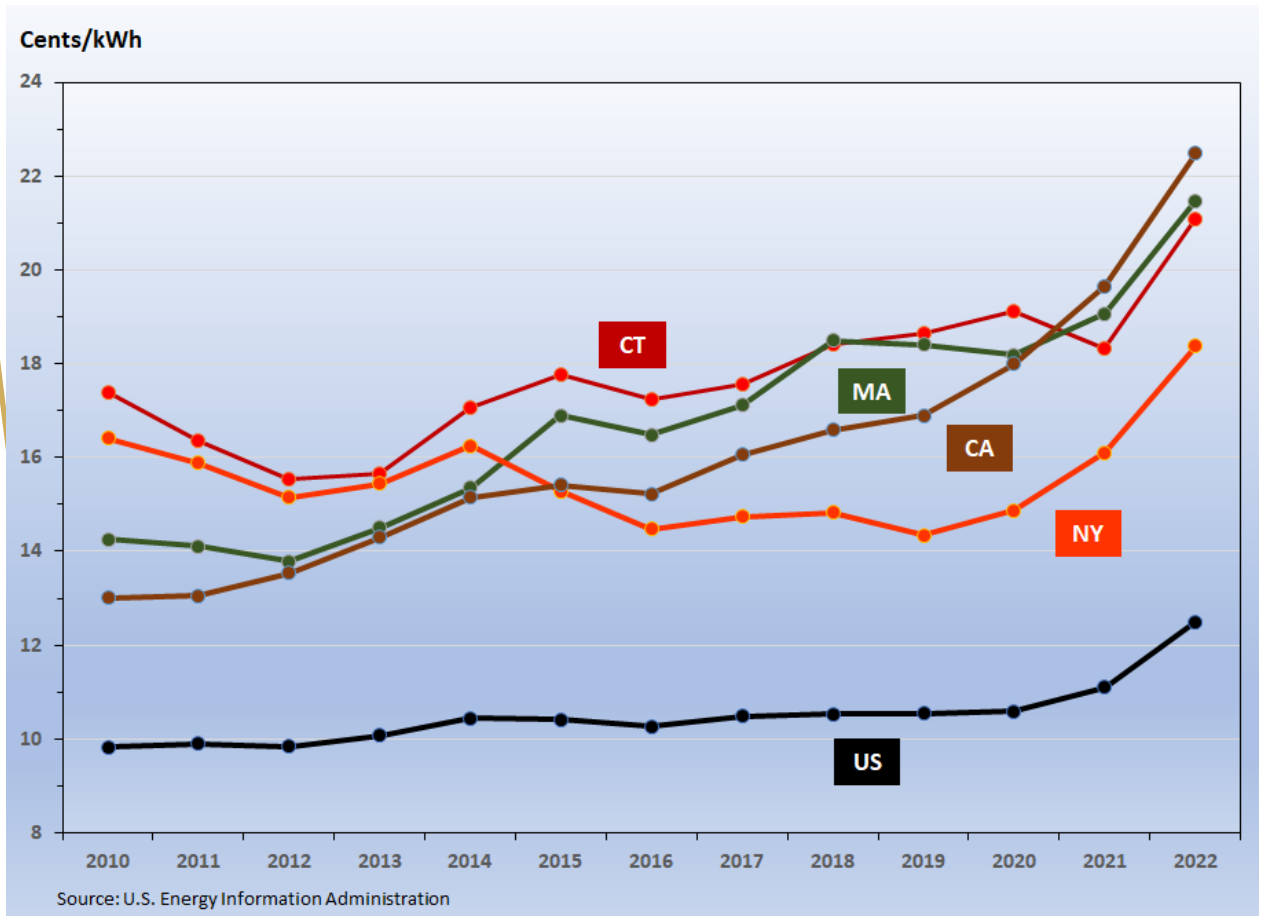

Figure 9: Average Retail Electricity Prices, Selected States and U.S.

68 Matthew Karnitschnig, "Rust Belt on the Rhine," *Politico*, July 13, 2023; Sonja Hennen, "Energy Shock – Is Germany Facing Deindustrialization?" *Forum New Economy*, May 12, 2023.

Renewable Natural Gas and Renewable Diesel Are Not Cost-Competitive

Not only are the Oregon's and Washington's investor-owned electric utilities planning to use RNG and renewable diesel for electricity generation, but those states' natural gas distribution companies intend to blend increasing quantities of RNG for use by end-use customers. For example, Oregon's SB98, which was signed into law in 2019, encourages the voluntary substitution by natural gas distribution utilities of up to 30% of natural gas consumption with RNG, and pass along the costs to ratepayers.[69] In Washington state, HB 2580 was signed into law in 2018.[70] Like the Oregon legislation, it encourages the state's natural gas utilities to develop RNG supplies and blend those into natural gas delivered to customers.

However, supplies of RNG and renewable diesel are inherently limited by the size of their respective waste streams, such as used cooking oil for biodiesel and renewable diesel, manure, wastewater, and agricultural waste for RNG. Oregon and Washington have both prepared estimates to the technical potential for RNG production[71] (technical potential represents the theoretical maximum; economic potential represents the fraction of the theoretical maximum that is cost-effective to produce). The technical potential for Oregon was estimated to be around 10.4 billion cubic feet (Bcf) from wastewater treatment, manure, landfills, and food waste, plus 40 Bcf from agricultural and forest residues — combined equaling less than 20% of total natural gas consumption in the state of 271 Bcf.[72] The technical potential in Washington State was estimated to be around 15 Bcf, less than 5% of that state's total natural gas consumption of 338 Bcf.[73]

Production of biodiesel and renewable diesel is not cost-competitive, but supported by mandates (e.g., the Clean Fuels Standards in both states) and federal subsidies.[74] Likewise, RNG is also not cost-competitive with traditional natural

69 https://olis.oregonlegislature.gov/liz/2019R1/Downloads/MeasureDocument/SB98/A-Engrossed
70 https://lawfilesext.leg.wa.gov/biennium/2017-18/Pdf/Bills/House%20Passed%20Legislature/2580-S.PL.pdf?q=20230726094850
71 Oregon Dept. of Energy, "Biogas and Renewable Natural Gas Inventory SB 334 (2017): 2018 Report to the Legislature," September 2018; "Promoting Renewable Natural Gas in Washington State," Washington State University and Washington Department of Commerce, December 2018.
72 EIA, "Natural Gas Consumption by End Use."
73 EIA, "Natural Gas Consumption by End Use."
74 For a list of federal subsidies, see U.S. Dept. of Energy, Alternative Fuels Data Center, "Biodiesel Laws and Incentives," undated.

gas supplies. Neither the Oregon nor Washington studies addressed RNG costs. However, a 2022 study prepared for the state of Michigan did.[75] That study reported RNG costs between $10 and $71 per million Btus (MMBtu).[76] By contrast, the average citygate price of natural gas in 2022 was $5.54 in Oregon and $6.47 in Washington.[77] Moreover, prices through the first half of 2023 have been well below those levels.[78]

Supplies of RNG and renewable diesel are inherently limited by the size of their respective waste streams, such as used cooking oil for biodiesel and renewable diesel, manure, wastewater, and agricultural waste for RNG.

The federal subsidies mentioned above have led some existing refineries to convert to biodiesel production.[79] According to the US EIA, annual biodiesel and renewable diesel production capacity in Oregon was 12 million gallons and 173 million gallons in Washington state.[80] That production capacity is less than 10% of total distillate fuel consumption in both states (**Table 1**).[81]

	Production Capacity (Millions of Gallons/Year)			Distillate Consumption (2020) (Millions of Gallons)				Capacity Pct. Of Cons.
	Renewable	Bio	Total	Highway	Farm	Other	Total	
Oregon	0	12	12	598	41	118	757	1.6%
Washington	66	107	173	691	94	348	1,133	15.3%
Total	**66**	**119**	**185**	**1,289**	**135**	**466**	**1,890**	**9.8%**

Source: US Energy Information Administration

Table 1: Biodiesel and Renewable Diesel Capacity vs. Distillate Consumption

75 Philip Sheehy and Maurice Oldham, "Michigan Renewable Natural Gas Study," ICF, June 29, 2022. See also, Laura Feinstein and Eric de Place, "The Four Fatal Flaws of Renewable Natural Gas," Sightline Institute, March 9, 2021.
76 Ibid, p. 60.
77 The citygate price is the average price of natural gas delivered to a natural gas distribution utility.
78 US EIA, "Natural Gas Prices." As discussed previously, natural gas prices spiked in 2022 because of supply concerns related to the war in Ukraine.
79 For example, Marathon Petroleum converted its Dickinson, North Dakota refinery into one producing renewable diesel. The company is also converting its Martinez, California refinery to produce renewable diesel.
80 US EIA, "U.S. Biodiesel Plant Production Capacity," August 2022. For the PADD V region as a whole, which includes California, total annual production capacity was 199 million gallons, less than 3% of total distillate consumption.
81 EIA no longer publishes distillate consumption data by state. For the U.S. as a whole, total biodiesel and renewable diesel production was 2.4 billion gallons in 2022, just 4% of the 60 billion gallons of total distillate consumption.

The CCA Will Continue to Raise Fossil Fuel Prices

As discussed previously, Washington's cap-and-invest program under the CCA has raised gasoline and diesel fuel prices in Washington. Oregon's program, if enacted, will do the same. The May 2023 auction clearing price, $56.01 per metric ton is equivalent to 50 cents per gallon of gasoline. Because Washington mandates that gasoline be blended with 10% ethanol, which as a "renewable" fuel not subject to the carbon tax, the net impact on gasoline is about 45 cents per gallon. For diesel fuel, which releases about 10% more CO_2 than gasoline, the auction price is equivalent to about 55 cents per gallon.[82] In 2022, total gasoline consumption in Washington state was just over 2.5 billion gallons. Hence, at 45 cents per gallon, the total carbon tax collected would be $1.1 billion. Total distillate consumption in 2021 (the latest year for which data are available) was about 1.1 billion gallons. Assuming about 100 million gallons was for agricultural use, which is supposed to be exempt from the CCA, the total carbon tax collected would be $550 million. For natural gas, the $56.01 per allowance auction clearing price is equivalent to a tax of $2.87 per 1000 cubic feet (1000cf).[83] In 2022, end-use consumption of natural gas was just over 337 billion cubic feet, implying an overall tax on natural gas consumption of just under $1 billion. If the average allowance

82 Although the CCA specifies that fossil fuels used for agriculture and the transportation of agricultural products are exempt, farmers and ranchers are nevertheless paying more for bulk purchases of fuels. Several bills have been introduced in the state legislature to correct the situation: SB 5766 would require the Dept. of Ecology to establish a remittance program. SB5769 establishes a price ceiling offering some protection to agricultural users. Neither bill was passed by the Legislature in the 2023 session. The Washington Farm Bureau has estimated the cost to the agricultural sector will be $74 million in 2023. The Dept. of Ecology intends to form a task force to address the issue.

83 Natural gas emits 117 lbs of CO2 per MMBtu, or 117/2205 = 0.053 metric tons/MMBtu x $56.01/metric ton = $2.97/MMBtu. One cubic foot of natural gas has a heat content of 1,036 Btus. Therefore, the tax is $2.97 x 1.036 = $3.08/1000cf.

price for the year equals the May 2023 allowance price, then total expected revenue collections from the carbon tax would be $2.65 billion (**Table 2**).[84]

Fuel Source	Consumption	Carbon Tax
Gasoline	2.5 billion gallons	$1.1 billion
Non-exempt Diesel/Distillate	1.0 billion gallons	$550 million
Natural Gas	337 Bcf	$1.0 billion
Total		**$2.65 billion**

Table 2: Estimated Carbon Taxes to be Paid by Washington Consumers in 2023

As the number of available allowances is reduced over time, as the CCA requires, the auction clearing prices will increase if emissions reductions do not keep pace with the reduction in the allowance ceiling. If allowance reductions and emissions reductions follow the same path to zero by 2050, then the cumulative taxes collected over the 2023–2050 period will be about $36 billion.

Although the state legislature must determine how the auction proceeds will be spent, the CCA mandates a minimum of 35% of the funds collected be used for projects that provide a direct benefit to "vulnerable populations" within "overburdened communities," the latter defined as communities with the highest levels of air pollutants, such as particulates.[85] The cap-and-trade program administered in California, on which the CCA is based, provides some clues as to how those revenues will be spent.[86] The largest single expenditure through FY 2022, $5.4 billion, almost one-fourth of total cumulative expenditures, has been towards California's ill-fated high-speed rail project. Another $3.5 billion has gone towards "Low Carbon Transportation," and $2 billion has been spent on buses and intercity rail projects. The next largest expenditure listed is $1.4 billion for "Community Air Protection," although it is unclear what that entails.[87]

84 The first two CCA auctions raised $857 million. The Dept. of Ecology initially estimated total allowance revenues would be $1.39 billion over the four-year compliance period, 2023–2027. "Washington's Climate Commitment Act: 2022 Update on Implementation," January 19, 2022.

85 Washington Dept. of Ecology, "Identifying Overburdened Communities Highly Impacted by Air Pollution," March 2023. "Vulnerable populations" are defined in Section 2(14) of SB 5141 as those "more likely to be at higher risk for power health outcomes in response to environmental harms."

86 California Environmental Protection Agency, Greenhouse Gas Reduction Fund, Annual Report to the Legislature, April 2023.

87 California publishes a detailed database of projects, which describes "Community Protection" as projects that provide "mobile source incentives to reduce GHG emissions, criteria pollutants, and air toxics through the development of advanced technology and clean transportation. The program is comprised of sub-programs that provide a variety of disadvantaged community benefits." The state also spent $1.0 million on composting. Of the $16 billion spent so far, just over 10% went towards administrative costs. See Annual Report to the Legislature, April 2023, Appendix B, p. 75.

THE ADVERSE ECONOMIC AND SOCIAL IMPACTS OF HIGHER ENERGY PRICES

It is not unusual to see studies proclaiming that green energy mandates and subsidies will increase economic growth.

For example, a 2021 study on the impacts of the Oregon Climate Protection Program determined the program would lead to increased economic growth and jobs.[88] A 2022 study prepared for the Washington State Department of Ecology purported to demonstrate that the Clean Fuels Standard would have a minimal effect on gasoline and diesel prices and reduce the cost of electricity for electric vehicles.[89] Yet, a 2021 peer-reviewed study on biodiesel in the Pacific Northwest found that "[t]he positive economic impacts of the PNW biodiesel industry are minimal compared to what was originally predicted by policy makers in the early 2000s."[90]

While government "investments" can create jobs, whether for high-speed rail or community composting efforts, government spending typically crowds out private investment and misallocates scarce resources.[91] Moreover, by (i) ignoring the source of funds used for investment, such as tax credits; and (ii) assuming that mandates lead to lower costs

88 Oregon Department of Environmental Quality, "Oregon Climate Protection Program: Modeling Study on Program Options," June 10, 2021.
89 Dept. of Ecology, "Clean Fuel Standard Cost Benefit Analysis Report," May 12, 2022.
90 Noelle Hart and Patricia Townsend, "Biodiesel in the Pacific Northwest," Pacific Northwest Extension, Report No. PNW753, January 2021, p. 5.
91 This is not to suggest that governments should not invest in public goods, such as parks, police, and so forth. However, there is a long history of wasteful state and federal government subsidies for energy projects, from efforts to create synthetic petroleum in the late 1970s to the massive subsidies being provided to offshore wind projects and electric vehicles.

(e.g., a mandate for zero-emissions resources reduces costs for wind and solar generation, electric vehicle mandates result in prices that are below those of internal-combustion vehicles), economic impact studies can show mandates lead to increases in overall income and jobs.

The observed reality, such as in Europe, is far different; green energy mandates have led to higher energy costs and reduced economic activity.[92] In part, this is due to the need to provide backup for the majority of hours when the wind does not blow and the sun does not shine. It also ignores simple economics: the huge increase in the demand for the raw materials needed to transition to an electrified, zero-emissions economy will lead to continued increases in the prices of those materials.[93] For example, the Clean Fuel Standard will increase the demand for biodiesel and renewable diesel fuel. Given limited feedstocks and production capacity, basic economics suggests prices for those fuels will increase, rather than decrease. Another basic economic principle is that, because mandates and subsidies provide protection against the rigors of marketplace competition, they *dampen* incentive to lower costs through innovation.

As energy costs in Washington continue to increase, the impacts will be widespread, affecting the entire state economy. Consider the increase in gasoline prices, which have increased by 45 cents per gallon because of the CCA.[94] The estimated $1.1 billion increase in expenditures on gasoline means that households and businesses will have that much less to spend on other goods and services. Increased costs for gasoline and diesel fuel increases the costs to transport goods, everything from delivering flowers to long-haul trucking. While these increased costs will improve the relative competitiveness of electric vehicles, biodiesel, and renewable diesel, the net economic impacts will be negative.

The same impacts will occur as electricity and natural gas prices increase. For example, because RNG is not cost-competitive with traditional natural gas supplies, blending RNG into natural gas streams delivered by local gas utilities will increase the rates those utilities charge and consumers' bills. Similarly, businesses paying increased electric bills will have to reduce their output, increase their prices, or both. Those impacts will lead to job losses, which will in turn further reduce consumer spending, causing even greater economic losses.

Previous research on the economic impacts of higher electricity prices in Pennsylvania, for example, estimated that each $1 million increase in electricity

92 See Mark Mills, "The 'Energy Transition' Delusion: A Reality Reset," Manhattan Institute, August 2022.
93 Ibid.
94 The price increase is related directly to the cost of carbon allowances.

costs caused a loss of almost 13 full-time equivalent (FTE) annual jobs.[95] In Oregon and Washington, total expenditures for residential, commercial, and industrial customers increased by $1.34 billion between 2020 and 2022 (**Table 3**). Adjusting for the increase in retail sales between 2020 and 2022, the net increase in cost was $1.28 billion.[96] Applying the estimated impact from the Pennsylvania study, that implies an overall job loss of over 16,000 annual FTEs.

State/Sector	2020	2021	2022	Increase
Oregon		(Millions of Dollars)		
Residential	$2,192	$2,307	$2,353	$161
Commercial	$1,418	$1,503	$1,550	$132
Industrial	$890	$1,035	$1,027	$137
Subtotal	$4,500	$4,845	$4,930	$430
Washington				
Residential	$3,639	$3,844	$4,051	$412
Commercial	$2,436	$2,619	$2,785	$349
Industrial	$1,140	$1,245	$1,292	$152
Subtotal	$7,215	$7,708	$8,128	$913
Total	**$11,715**	**$12,553**	**$13,058**	**$1,343**

Source: U.S. Energy Information Administration

Table 3: Retail Electricity Expenditures, Oregon and Washington, by Sector

Over time, consumers and businesses adjust to the higher prices by investing in energy efficiency measures (e.g., better windows, more efficient furnaces, higher-mileage vehicles). Manufacturers adjust their production processes or, as in the case of Germany, relocate where energy costs are lower. In other words, as prices change, consumers and businesses adjust their behavior to reduce the adverse economic impacts. Left alone, such behavioral adjustments dampen further price

95 Jonathan Lesser, "Renewable Energy and the Fallacy of 'Green' Jobs," *The Electricity Journal* 23, August 2010, pp. 45–53.

96 Between 2020 and 2022, total retail sales increased by 2.4 million MWh in Oregon and 3.6 million MWh in Washington State. Source: US Energy Information Administration, Electricity Data Browser.

increases. Importantly, however, the adverse economic impacts do not disappear. Just as a reduction in the rate of inflation that has plagued consumers and businesses does not mean prices have returned to their pre-inflation levels, when energy prices plateau at higher levels, the economic and social harm to consumers and businesses remains.

This is especially true for the two states' electrification efforts, which will short-circuit normal economic responses in two ways. First, the two states' electrification mandates, which will force consumers and businesses to drive electric cars and trucks, replace gas water and space heaters with electric heat pumps, and generally rely on electricity to power the entire economy, are increasing electricity demand, with most forecasts projecting a doubling of demand, even with increased investments in energy efficiency. When demand for a product increases, so do prices. It's certainly true that higher prices encourage innovation—building a better mousetrap that benefits everyone (except mice). But innovation, especially innovation that will require the development of entirely new technologies such as generators that run on pure hydrogen, is neither guaranteed nor rapid.

Second, the price increases will be exacerbated by the accompanying mandates for zero-emissions electric supplies under Washington's CETA and Oregon's HB21. By forcing utilities to develop 100% zero-emissions resource portfolios, lawmakers have increased the cost of meeting that increased electricity demand. And, through the Clean Fuels Standards adopted by both states, they are increasing the costs of substitute fuels, thus short-circuiting the ability to switch away from higher-cost electricity. (Ironically, in the 1980s, lawmakers, environmentalists, and entities like the Northwest Power and Conservation Council encouraged—and is some cases, mandated—that electric utilities provide subsidies to enable consumers and businesses to switch from electricity to natural gas.)[97]

97 At the Federal level, Title II of the Power Plant and Industrial Fuel Use Act of 1978 (42 U.S.C. 8301) required industrial electric utilities and industrial customers to maximize their use of *coal*.

The Adverse Social Impacts of Higher Energy Prices

Because energy is a fundamental component of modern life, increasing energy costs cause the greatest economic and social harm to lower-income consumers and small businesses. Higher energy costs also harm energy-intensive industries. For example, the aluminum industry in the Pacific Northwest, completely shut down while China built many new smelters to supply the metal to EVs, windmills, and solar panels.

Whether it is increased costs for gasoline[98] or increased costs for electricity and natural gas, higher energy costs increase levels of energy poverty, as exists in Europe. Increasing energy prices impose additional cost burdens on households in two ways. First, higher energy prices directly increase household costs (for example, for heating and cooling, cooking and transportation). Second, higher energy costs raise the costs of producing virtually all goods and services households consume. In developing countries, higher energy prices can push millions into extreme poverty.[99]

In some cases, higher energy costs are the result of external forces, such as the war in Ukraine, which led to higher natural gas prices in 2022. For developing countries, reducing the impacts of sudden increases in energy costs is difficult, as such countries typically have few resources to lessen the economic pain. Of course, in truly impoverished countries, millions have no access to electricity or fossil fuels. They are thus affected through higher prices, especially for food.

For Oregon and Washington state, higher energy costs are a policy choice. Ironically, the two state legislatures have imposed policies designed to increase energy costs, especially the CCA. Yet, when energy prices increase as a result, politicians immediately attempt to blame higher prices on nefarious actors, especially oil companies that are allegedly price "gouging," and collusion.[100] Washington State Representative Alex Ramel (D-Bellingham), for example, wrote that "Fuel suppliers in Washington have largely chosen to pass these costs along to their consumers, instead of accepting slightly lower profit margins."[101] Such a statement merges

98 Isabell Sawhill, "How Higher Prices Hurt Less Affluent Consumers and the Economy," Brookings, March 6, 2012.
99 Yuru Guan, et al., "Burden of the global energy price crisis on households," Nature Energy 8 (2023), pp. 304–16.
100 Laurel Demkovich, "Washington's high gas prices fuel talk of anti-gouging measures, cap-and-trade tweaks," *Idaho Capital Sun*, July 17, 2023.
101 Alex Ramel, "State legislator: Big Oil, not cap and trade, is gouging your wallet," Cascadia Daily News, July 11, 2023.

economic ignorance with political demagoguery.[102] By imposing a carbon tax on gasoline and other fossil fuels, both consumers and oil companies absorb some of the tax.[103]

Because efforts to find scapegoats typically are fruitless, governments, at least those that wish to survive politically, must provide additional subsidies to consumers to offset the higher costs of their energy policies. In California, for example, almost one-fourth of all electric ratepayers are charged lower, subsidized rates. The lost revenues are then recouped from the remaining ratepayers.[104]

Whether electric subsidies that are paid for by other ratepayers or subsidies that are collected from taxpayers as a whole, the result is wealth redistribution and still more economic distortions that exacerbate economic, and thus social, harm in the long run.[105] Yet, this is the main approach Oregon and Washington appear intent on pursuing: targeted subsidies, especially for electricity, including the myriad "investments" Washington state intends to make with the revenues from the sale of carbon allowances.

The Miniscule Benefits to Consumers and Businesses

The U.S. has embraced successful policies to reduce air pollution. The 1990 Amendments to the Clean Air Act, for example, introduced a cap-and-trade program for sulfur dioxide and oxides of nitrogen, which reduced emissions of those pollutants. Tailpipe emissions standards greatly reduced pollution from automobiles; today's cars and trucks emit about 1/100th of the pollution as those 50 years ago.

Although carbon taxes, and carbon cap-and-trade programs have been proposed by economists and environmentalists alike, the global nature of GHG emissions means that individual state policies, or even U.S. policies as a whole, will provide negligible benefits to residents. Climate change will not be "solved" by the mandate

102 There is no accepted definition of price "gouging." Moreover, there is no evidence of collusion on the part of oil companies in the state.
103 In the short run, the demand for gasoline does not change much in response to changes in price (what economists call "inelastic" demand. In such situations, most of the tax is passed onto consumers.
104 In response to California law AB 205, that state's three investor-owned electric utilities have proposed a pricing system under which ratepayers would be charged for electricity based on their incomes. Medora Lee, "California wants to make electricity more affordable for poor people by charging rich more," *USA Today*, June 21, 2023.
105 Carol Nakhle, "Energy prices and inflation: Politics trump the economics," GIS Reports, December 7, 2022.

Putting Oregon and Washington State's GHG Reduction Goals in Context

According to the Washington Department of Ecology, total state GHG emissions were 102 $MMTCO_2e$[a] in 2019, the most recent year for the agency's GHG Inventory report.[b] Of that total, about 96 $MMTCO_2e$ was energy-related, with the remainder attributed to agricultural emissions. Through 2016, Oregon's GHG emissions were about 63 million metric tons, of which about 57 million metric tons were energy-related.[c]

By comparison, in 2022, world energy-related emissions of CO_2 totaled about 34.4 billion metric tons.[d] Over the last ten years, world CO_2 emissions increased by an average of 215 million metric tons annually and increased by over 300 million metric tons between 2021 and 2022. Therefore, Oregon and Washington's total energy-related annual GHG emissions are equivalent to about one *day's* worth of world CO_2 emissions. Even if both states reduce GHG emissions to zero, the reduction will be equivalent to only about one-third of the *increase* in world CO_2 emissions between 2021 and 2022.

There is also a growing realization that individual state and even country actions to reduce GHGs will have no impact on world climate. In Great Britain, for example, former prime minister Tony Blair argued that imposing costly policies to reduce the country's GHG emissions was futile if China was not going to address its emissions, which have increased rapidly and currently account for over 30% of world energy-related CO_2 emissions.[e]

a MMCOe means "million metric tons of CO2 equivalent" and accounts for the impacts of different gases, e.g., methane, by estimating their impact on climate relative to CO2.
b Washington State Dept. of Ecology, "Washington State Greenhouse Gas Emissions Inventory: 1990–2019," Publication 22-02-054, December 2022.
c Oregon Dept. of Environmental Quality, "Oregon's Greenhouse Gas Emissions through 2015," May 2018.
d Energy Institute, Statistical Review of World Energy 2023, p. 12 (previously BP Statistical Review of World Energy).
e Chris Smyth, "Tony Blair: We can't solve climate change without China," The Sunday (London) Times, July 27, 2023.

for the states' electric utilities to meet 100% of electricity demand with zero-emissions resources. Nor will it be solved by the Clean Fuels Standards, nor the CCA's "cap-and-invest" program. In fact, even if the zero-emissions policies enacted by both states achieve their goal, the resulting GHG emissions reductions will be so miniscule as to have no measurable impact on world climate. (**See Sidebar: Putting Oregon and Washington State's GHG Reduction Goals in Context**)

The two states' zero-emissions policies will have no measurable impacts on world climate and thus will not prevent any of the adverse impacts—rising sea levels, more wildfires, worsening agricultural output, and so forth—that policymakers have cited as reasons for implementing the various zero-emissions and GHG reduction policies. (And, even if the policies did have a measurable impact, the percentage of benefits accruing to Oregon and Washington state residents would be minuscule.) The policies will, on the other hand, impose real economic and social costs, which raises an obvious question: **why enact policies that will adversely affect residents and businesses, while having no actual impact on the adverse impacts they are meant to address?**

The answer likely is a combination of virtue signaling, political expediency, and greed. "For example, the United Nations Secretary-General Antonio Guterres recently said: 'The era of global warming has ended; the era of

global boiling has arrived.' This sort of climate change hysteria, augmented by an uncritical media, aims to create a political pressure to "do something" to be seen as addressing the perceived problem." The flaws in green energy proponents' rosy predictions of ever-decreasing costs and their belief that government-directed green energy investments will increase economic growth are obvious to anyone with common sense.

The Miniscule Environmental Benefits to Consumers and Businesses

A better approach would be for Oregon and Washington to (i) emphasize market-based approaches that eliminate burdensome mandates and subsidies; and (ii) focus on providing low-cost, reliable energy supplies, especially emissions-free nuclear power. For example, if EVs truly are a superior, less costly technology, then consumers will adopt them without the need for mandates or costly subsidies. Forcing consumers, especially lower-income consumers in rural areas least likely to have adequate charging infrastructures, to purchase more costly EVs will exacerbate inequality. First, many lower-income consumers are unable to afford new internal combustion vehicles, much less more expensive EVs. Second, the ban on the sale of new internal-combustion vehicles after 2035 will increase the demand for used vehicles, raising their prices.

The two states' clean fuels standards are similarly flawed. They will raise costs while providing virtually no benefits. By artificially increasing demand, the "clean" fuels mandates will encourage higher prices, harming businesses and, especially, lower-income consumers.

The Washington CCA already is adversely affecting consumers and businesses. Higher gasoline and diesel prices are increasing consumer and business costs. Although a cap-and-trade program like the CCA (and, if adopted, the Oregon equivalent) is a market-based approach, it will have no impact whatsoever on world climate and will not mitigate projected state-level impacts from climate change.

The same is true for revised building codes that seek to ban the use of natural gas for space and water heating, as well as gas stoves. Depending on the use of natural gas to generate electricity in the two states, these bans may even increase carbon emissions. Using natural gas to generate electricity to power space and

water heaters is far more inefficient and costly than simply burning natural gas directly.

Increasing the supply of emissions-free electricity should be accomplished, not with intermittent solar and wind generation, non-existent generators that burn green hydrogen, battery storage, and new high-voltage transmission lines through the Cascades to deliver power from the eastern parts of the states, as well as Idaho and Montana, but with new nuclear power plants. The WPPSS debacle should not preclude the development of new, small modular reactors, which can be added in concert with increased demand. Modular nuclear plants are efficient, reliable, and can be sited near load centers, thus obviating the need for costly high-voltage transmission lines.[106]

Ideally, the two states' energy policies would focus on common sense approaches. However, the current policies to promote green energy and reduce GHG emissions have nothing to do with common sense or basic economics. Instead, the policies in place have created opportunities for rent-seeking and favoritism by diverting scarce resources to favored constituencies, such as wind and solar developers. Because of that, the vast majority of Oregon and Washington state residents and businesses are likely to suffer increasingly painful economic and social losses that will have no environmental benefit.

106 Several other companies have also developed modular reactor designs.

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