



THE ECONOMIC CONTRIBUTION OF WASHINGTON STATE'S PETROLEUM REFINING INDUSTRY IN 2019

ACKNOWLEDGEMENTS

Washington Research Council has produced this report with funding from the Western States Petroleum Association. Washington state's economy is simulated using the Washington Research Council-Regional Economic Models, Inc. (WRC-REMI) model, based on published data from the state Employment Security Department and the State Department of Revenue, and detailed surveys of oil refiners operating in Washington. The results of this analysis are the sole responsibility of the Washington Research Council, a nonprofit organization committed to objective analysis of economic and public policy issues in Washington state.

1. Report Overview

This report quantifies the impact of Washington's five major petroleum refiners on the state's economy in 2019.

In 2019, the refiners directly provided 2,050 full-time jobs, paying an annual average wage of \$148,683. In addition, the refiners employed, at high wages, 3,643 contract workers on an average day, doing maintenance, capital repair and capital replacement. The refiners indirectly created additional Washington state jobs in industries from which they purchased goods and services, including transportation, construction, utilities and business services. Spending of the income earned in these direct and indirect jobs created even more jobs.

The sum of all these effects was 24,680 jobs and \$1.90 billion in personal income for Washington state in 2019. State and local governments received \$279.1 million in taxes directly from the refiners and \$85.4 million from the follow-on activities

of other taxpayers.

Also, industries that distributed refined petroleum products paid \$511 million in wages to 15,111 workers in 2019.

Because of Washington's unique tax structure, a Washington refinery's state and local tax burden in 2019 was almost three times higher than the state and local tax burden of a comparable refinery located in California.

The report updates the economic impact analyses of petroleum refining previously prepared by the Washington Research Council (WRC 2004, 2006, 2009, 2010, 2012, 2014, 2016 and 2019), drawing upon published data from the state Employment Security Department and the state Department of Revenue, a survey of Washington refiners conducted by the Council in 2020 and previous refiner surveys (Appendix A), and the WRC-REMI model of the Washington state economy (Appendix C).

Table 2: Summary of Multipliers and Economic Impacts

Refining Jobs	Multiplier	Indirect and Induced Economic Effect	Major Petroleum Refiners Total Economic Impact
2,050	12.04	22,632 jobs	24,680 jobs
	\$984,000	\$1,491,770,000 personal income	\$1,896,528,000 personal income
	\$33,980	\$67,579,000 sales and use taxes	\$69,600,000 sales and use taxes
	\$58,980	\$18,870,000 B&O taxes	\$120,800,000 B&O taxes

Source: 2020 Refiner Survey, DOR, WRC-REMI Model

2. Summary of Findings

Washington's five refineries provide 3.3 percent of the United States' refining capacity. In 2019 they processed 643.3 barrels of crude oil and other feedstocks per day. Gasoline, diesel oil, and jet fuel are the largest finished product categories, representing 46.4 percent, 24.5 percent, and 15.1 percent, respectively, of total production, with gasoline production averaging 297,000 barrels per day.

We estimate the five major refineries employed 2,050 workers in 2019, paying them an average annual wage of \$148,683—more than twice the Washington state average.

As indicated in Table 2, these jobs have a total employment multiplier of 12.04, meaning that each direct refining job generates an additional 11.04 jobs in the state, for a total employment impact of 24,680 jobs resulting from the five refineries.

Petroleum refining's extraordinarily high capital intensity, high wages, extensive use of highly paid contract labor and high taxes are the major reasons for its high jobs multiplier. The WRC-REMI model, which is used here to determine the economic impact of the industry, calculates that

each petroleum job adds \$984,000 to state personal income. Thus, the 2,050 refinery jobs ultimately contribute a total of \$1.90 billion to state personal income.

The industry is highly taxed and regulated, producing a bounty of tax and fee revenues for state and local government.

Refiners paid \$279.1 million in state and local taxes in 2019. This total included \$101.9 million in business and occupation (B&O) tax, \$131.5 million in hazardous substance tax, \$24.1 million in property tax and \$2.0 million in sales and use taxes (Table 7.2 on page 11).

In addition, the refiners paid \$16.2 million in regulatory fees in 2019 (Table 7.3 on page 11).

Including the indirect and induced effects, the refining industry generated \$69.6 million in sales and use and \$120.8 million in B&O taxes (Table 2).

Calculations of state and local taxes paid by hypothetical 160,000 barrels-per-day refineries located in Washington and California indicate that the tax burden on refineries in Washington was nearly triple that in California in 2019 (Table 8 on page 12).

Table 3: Washington Refineries

Firm	Year Constructed	Location	Major Products	Capacity (barrels/day)
BP Cherry Point (formerly ARCO)	1971	Whatcom County, northwest of Ferndale	Gasoline, diesel oil, jet fuel, calcinated coke	251,000
Phillips 66 Ferndale (formerly ConocoPhillips Tosco, BP Oil and Mobil Oil)	Mid-1950s by General Petroleum (subsidiary of Socony-Mobil)	Whatcom County, west of Ferndale	Gasoline, diesel oil, jet fuel, liquid petroleum, residual fuel oil	110,500
Shell Oil (formerly Equilon Enterprises and Texaco)	1957	Skagit County, five miles east of Anacortes	Gasoline, diesel oil, jet fuel, propane, coke, sulfur	149,000
Marathon Petroleum (formerly, Andeavor, Tesoro and Shell Oil)	1955	Skagit County, on March Point	Gasoline, diesel oil, turbine & jet fuel, liquid petroleum gas, residual fuel oil	120,000
U.S. Oil	1957	Pierce County, Tacoma Tideflats	Gasoline, diesel oil, jet fuel, marine fuel, gas oils, emulsified & road asphalt	42,000

Finally, refiners contribute generously to the communities in which they are located. The five refiners and their employees contributed \$1.8 million to various community causes in 2019. The firms themselves contributed about three-quarters of this, with the balance provided by firm-sponsored employee giving (Appendix A, Table A.11).

3. Refining in Washington State

Building and development of the industry. The oil refining industry in Washington state began in the mid-1950s with construction of refineries by Shell in Anacortes (Skagit County) and Mobil west of Ferndale on the Strait of Georgia (Whatcom County).

Following closely in 1957, Texaco built in Anacortes, and U.S. Oil constructed its refinery on the Tacoma Tideflats. In the early 1970s, in anticipation of the crude oil that would begin flowing from Alaska's North Slope, Atlantic Richfield (Arco) built its refinery at Cherry Point. Now owned by BP, this plant remains one of the nation's newest refineries. Ownership of all these facilities has been fluid over the years: In January 2019, Par Pacific Holdings acquired U.S. Oil and Refining Company. Today Washington's refining activity is concentrated at the four major plants in Whatcom and Skagit counties and the U.S. Oil plant in Tacoma. (See Table 3.)

Federal restrictions. Oil companies invest tremendous sums in their facilities in order to maintain their assets, to increase refining capacities, and to remain viable in a highly competitive global industry. In the 1970s, Washington's older oil refineries embarked on major plant modifications in anticipation of the Alaskan crude. Plans for new port facilities on Puget Sound to receive supersized tankers and new pipelines to carry Alaskan oil on to the Midwest were debated. But in 1977, before these plans could be finalized, the Marine Mammal Protection Act came up for reauthorization in Congress. Washington's then-senior senator, Warren Magnuson, preempted these plans by attaching an amendment to the reauthorization bill prohibiting construction of new ports east of Port Angeles.

Geographic isolation. This decision sealed Washington's isolation from the rest of the country's petroleum supplies by preempting pipeline construction to the upper Midwest that would have provided the Northwest with easier access to Eastern and Midwestern distribution systems.

Today, Washington's five refineries make up 3.3 percent of the nation's total refining capacity (EIA 2020a). With this state accounting for about 2.0 percent of national petroleum consumption, in-state refineries produce quantities more than sufficient for Washington's needs (EIA 2020b). In 2019, 53 percent of Washington production went to in-state customers, 40 percent was exported to other states, and 7 percent was exported to other countries.

Dependence on in-state refining. Other areas of the country—the Midwest and the East—are connected to

a larger distribution system that allows their short-term petroleum supply disruptions to be accommodated more easily than those in the West, which are not connected to the Gulf Coast and Midwest pipeline systems. West Coast consumers are supplied primarily from refineries in California and Washington.

Geographically, the three most important sources of crude oil for Washington refineries are Alaska's North Slope, the Canadian province of Alberta and the Bakken oil field of North Dakota.

Nationally, plant obsolescence and federal and state regulations requiring cleaner products and production processes have resulted in a reduction in the number of operable U.S. petroleum refineries from 301 in 1982 to 135 at the beginning of 2020. Those refineries that remain, however, are more efficient, with 6 percent more refining capacity available today than in 1982.

Over the decade prior to the 2001–03 recession, the increased demands of a growing population and economy and an increasing array of “boutique” fuels required by federal and state regulations strained capacities, with price effects felt throughout the country. The 2001–03 recession provided a respite, but capacity constraints returned at mid-decade as the economy recovered. The situation was exacerbated by hurricane damage to refineries along the Gulf Coast. During 2008–09, high crude oil prices followed by financial crisis induced demand reductions severely squeezed refinery margins. During 2010–2012, margins for North American refineries rebounded as increased crude oil production in the U.S. lowered refinery costs, while

global product prices remained high. Subsequently, the profitability of North American refineries trended lower as global refining profits converged (EIA 2014, 2016). During summer 2018, output of U.S. refineries exceeded 18 million barrels per day for the first time, although capacity utilization remained below the peak set in 1998 (EIA 2018).

The constrained supply-demand relationship combines with the West Coast's isolation to produce an economy in Washington that is unusually dependent on its in-state refining capacity. It is this industry and its relationship with the larger Washington state economy that are described in the sections that follow.

4. Industry Impact Analysis

To quantify the impact of Washington state's refineries on its economy, we use the WRC-REMI model to simulate a permanent increase in refinery employment of roughly 8 percent and measure the resulting changes in total state employment, personal income, and gross product. Dividing these resulting changes by the change in refinery employment gives "multipliers" that are then applied to the industry's total employment to calculate total economic impact. For example, in 2019 the five refineries had 2,050 employees. With a multiplier of 11.04 the total impact of the refineries was 24,680 jobs. Similarly, the refinery activities resulted in \$984,000 of state personal income for every direct job, or a total statewide \$1.90 billion in personal income.

The economic impacts of petroleum refining in Washington, however, are broader than those of most other

sectors of the economy. If petroleum prices go up, the effects are felt in the price of food and other essential consumer goods, the costs of commuting, and the cost of moving goods to market for businesses throughout the economy. In 2018, a uniform 5 cents per gallon increase in the price of petroleum products would have cost Washington buyers \$319 million.

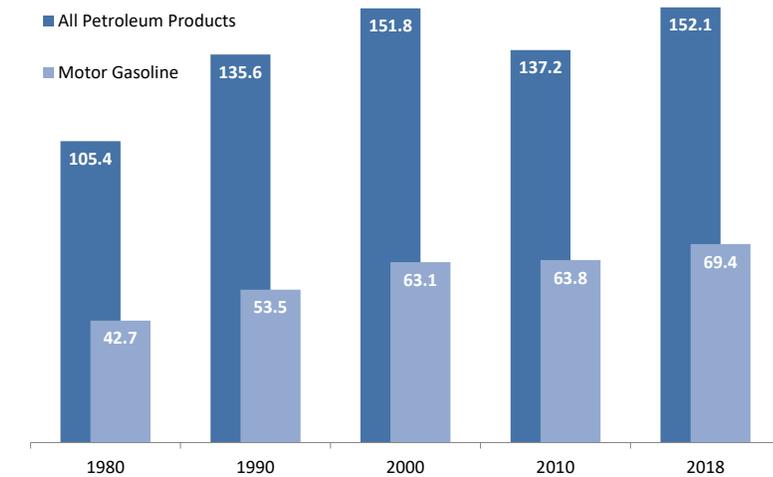
Unlike products from other sectors, alternative petroleum supplies or substitute products are not readily available in the case of an emergency. In order to fully appreciate the economic value of the petroleum refining industry in Washington, the dire economic consequences possible in a catastrophic scenario must be acknowledged. Foreign product would have to be imported, increased dock and terminal capability would be required, product prices would increase in response to diminished supply availability and stability, and these increases would be felt throughout the economy.

In the sections that follow, Washington's petroleum refining industry is described under equilibrium conditions by summarizing consumption (Section 5), production (Section 6), and the direct purchases of the five major industry refiners (Section 7). Based on these data, the WRC-REMI model calculates the effect of the five refineries on jobs, income, retail sales and use, and B&O taxes statewide (Section 9).

Section 8 presents a comparison of taxes paid by hypothetical 160,000 barrels-per-day refineries located in Washington and California.

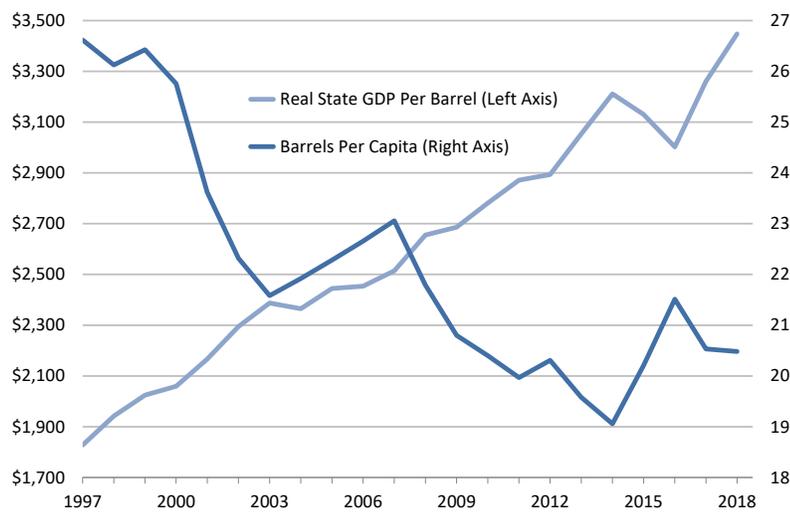
Finally, in Section 10 we provide employment, wage, and tax contribu-

Figure 5.1: Washington State Petroleum Product Consumption (millions of barrels)



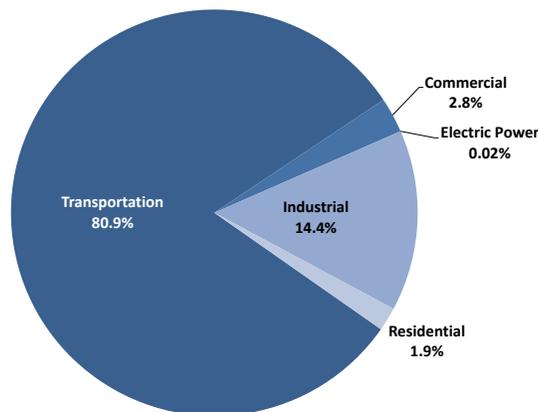
Source: EIA

Figure 5.2: Washington Petroleum Consumption Trends



Source: EIA

Figure 5.3: 2018 Consumption By Sector



Source: EIA

Detail does not sum to 100% due to rounding

tion information on the portions of the transportation, wholesaling, and retailing sectors that operate downstream of the refining process. These petroleum-related activities combine to assure that petroleum products get to their markets in Washington state and beyond. Although they would exist regardless of the presence of in-state refining, their inclusion here helps to give a complete picture of the petroleum industry in Washington state.

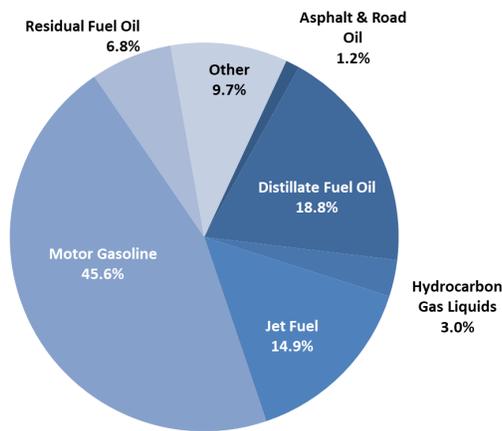
5. Petroleum Product Consumption in Washington

Washington households and businesses consumed a bit more than 152 million barrels of finished petroleum products in 2018, up 44 percent from 1980, according to the Energy Information Administration (EIA). (See Figure 5.1.) Washington’s 2018 consumption was 2 percent of the U.S. total and about 13 percent of EIA’s western Petroleum Administration for Defense (PAD) District V, which encompasses Washington, Oregon, California, Nevada, Alaska, and Hawaii. PAD District V represented 13 percent of total U.S. consumption in 2018 (EIA 2020b).

Petroleum product consumption in Washington increased by only 2 percent from 1997 to 2018. Over the period the state’s population grew by 33 percent and the output of the state economy (as measured by real gross state product) grew by 93 percent. As a result, per-capita consumption declined by 23 percent, while gross state product per barrel of petroleum increased by 89 percent. (See Figure 5.2.)

The several broad classes of customers who purchase petroleum products help to explain the state’s con-

Figure 5.4: 2018 Consumption By Product (Volume in Barrels)



Source: EIA

sumption patterns. Demand for petroleum products from industrial and residential customers decreased over the 21-year period by 22 percent and 32 percent, respectively. Transportation and commercial customer demand increased by 8 percent and 137 percent (EIA 2020b).

As shown in Figure 5.3 on page 6, commercial customers accounted for less than 3 percent of Washington's total petroleum product consumption; transportation and industrial customers together accounted for more than 85 percent.

By far, motor gasoline was the largest category of product consumed, at 45.6 percent of the total. (See Figure 5.4.)

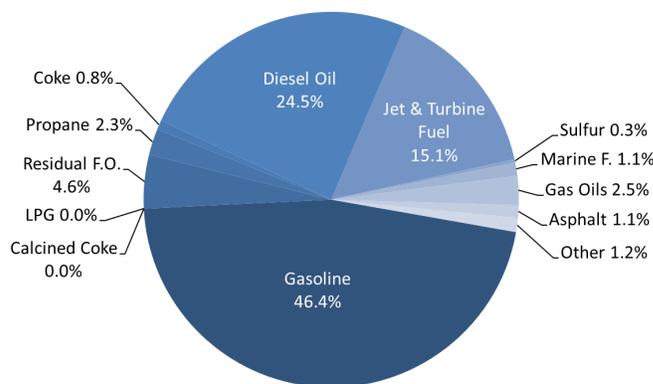
6. Refinery Production in Washington

The estimates that follow in Sections 6, 7, and 8, unless otherwise indicated, are based upon published data from the state Employment Security Department and the state Department of Revenue, and surveys of Washington refiners conducted by the Council in 2020 and previous years (Appendix A).

Finished products. Washington's refineries produced 639,500 barrels per day and more than a dozen different products in 2019. Gasoline, 297,000 barrels per day in 2019, is by far the largest product category, accounting for 46.4 percent of the total. Diesel oil and jet fuel are the next largest at 24.5 percent and 15.1 percent, respectively. (See Figure 6.1.)

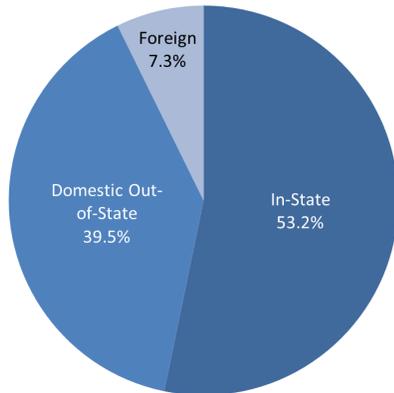
Gasoline accounted for 48.9 percent of the refineries' total \$18.0 billion in output value in 2019. Again, diesel oil and jet fuel are next, accounting for 25.7 percent and 16.0 percent,

Figure 6.1: 2019 Washington Production By Product (Volume in Barrels)



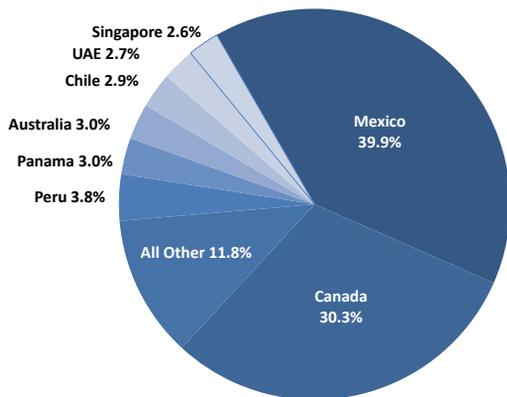
Source: 2020 Refiners Survey

Figure 6.2: 2019 Washington Production By Destination (Volume in Barrels)



Source: 2020 Refiners Survey

Figure 6.3: Top Export Markets in 2019



Source: WISER

Detail does not sum to 100% due to rounding

respectively.

Markets. In 2019, 53.2 percent of Washington refined product was sold within the state; 39.5 percent of total product was sold domestically outside Washington; and the remaining 7.3 percent was delivered to foreign buyers. (See Figure 6.2.)

The World Institute for Strategic Economic Research (WISER) provides data on the destination of foreign exports of petroleum products from Washington. In 2019, the \$2.56 billion of petroleum products exported from the state amounted to 4.2 percent of Washington’s foreign exports. Forty percent of the dollar value of petroleum product exports went to Mexico. Canada was the second most important export market, followed by Peru, Panama, Australia, Chile, the United Arab Emirates and Singapore. (See Figure 6.3; Appendix B provides more complete listings of export destinations for 2018 and 2019.)

Product transport. Finally, 45.5 percent of all products refined in Washington was shipped by pipeline in 2019, primarily to Seattle and Tacoma markets and on to Portland. Of the remaining product, 37.6 percent was shipped by water, to Portland and other destinations along the Co-

Table 7.1: Quantity and Value of Feedstock Inputs

	2018	2019
Total Feedstock Inputs (thousands of barrels/day)	623.7	643.3
Crude Oil	592.3	612.9
Other	31.4	30.4
Total Value of Feedstock Inputs (millions of dollars)	15,045.3	14,281.1
Crude Oil	14,523.3	13,768.1
Other	522.0	513.0

Figure 7.1: Crude Oil Production, Texas, Alaska and North Dakota (1,000 BBL/D)

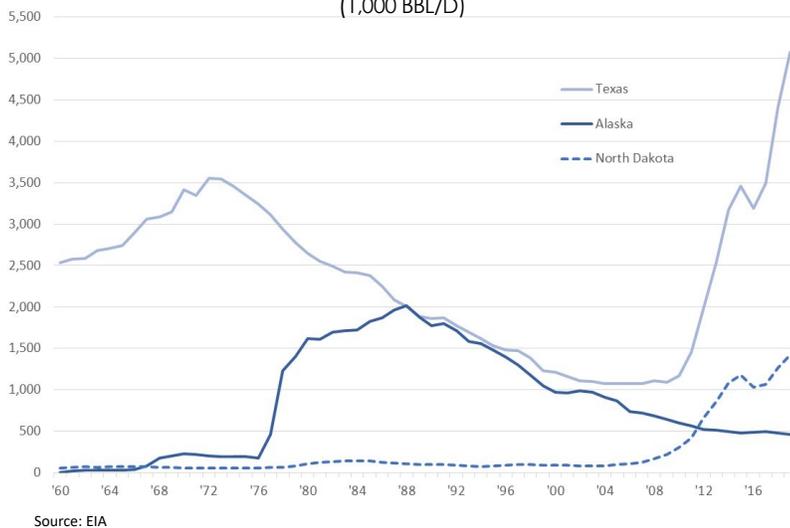
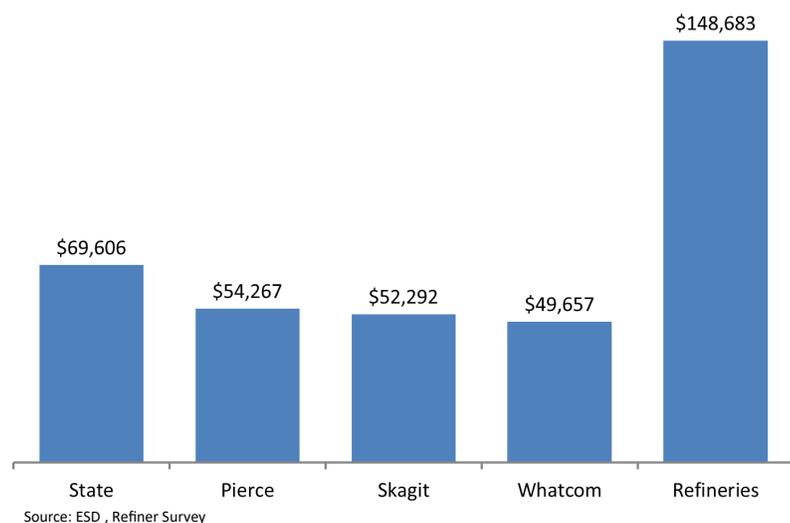


Figure 7.2: 2019 Average Annual Wages



lumbia River as well as to foreign customers; 13.5 percent went by truck; and 1.4 percent went by rail.

7. Washington Refiners: Inputs

We estimate that Washington refiners spent \$15.1 billion on feedstocks and other inputs in 2019. This section describes their main areas of expenditure.

Feedstock. Washington's petroleum refineries received 643,300 barrels per day of crude oil and other feedstock inputs (e.g., butane, isobutene, and cat feed) in 2019. The total volume of feedstock in 2019 was 3.1 percent higher than 2017. The value of 2019 feedstocks was \$14.3 billion, down 5.1 percent from 2018. (See Table 7.1 on page 8.)

In 2019, 39.6 percent of crude oil came into the refineries by water, 31.3 percent came by pipeline; and 29.1 percent came by rail. Of the crude oil, 29.6 percent was Alaskan, 19.3 percent was Canadian from conventional sources, 16.6 percent was Canadian from oil sands and 25.9 percent was from North Dakota. The remaining 8.6 percent came from various other places.

This represents a noteworthy change from 2003 when 90.4 percent of crude came by water from Alaska and no crude came to Washington by rail from North Dakota. Driving this change was the precipitous decline of crude oil production in Alaska and growth of production in North Dakota, as shown in Figure 7.1. The advances in drilling technology that triggered the North Dakota oil boom also enabled the resurgence of production in Texas.

Labor. Washington's five oil refiners

employed 2,050 workers in 2019 and paid them extraordinarily well. The refiner survey puts the 2017 average annual refinery wage at \$148,683. According to the state Employment Security Department (ESD), the overall statewide average wage was \$69,606 in 2019, less than half of the refinery average wage. (See Figure 7.2 on page 9.)

This contrast is even more pronounced when comparing refining wages with average annual wages in Whatcom and Skagit counties where the four largest refineries are located. The average annual wage in Whatcom County in 2019 was \$49,657 while in Skagit County it was \$52,292 (ESD 2020).

Refinery payrolls exceeded \$304 million in 2019. Worker benefits exceeded \$132 million, and average total compensation per employee was \$213,265.

Contract labor. Washington's petroleum refiners regularly rely on contract workers to clean and service various parts of their plant facilities and equipment, as well as to conduct scheduled major repairs and upgrades. The number of workers varies

from year to year—2,098 in 2018 and 2,239 in 2019—and represents a significant part of the employment base, especially in Whatcom and Skagit counties.

In 2019 refiners paid \$275 million for contract workers, an average of \$122,000 per worker.

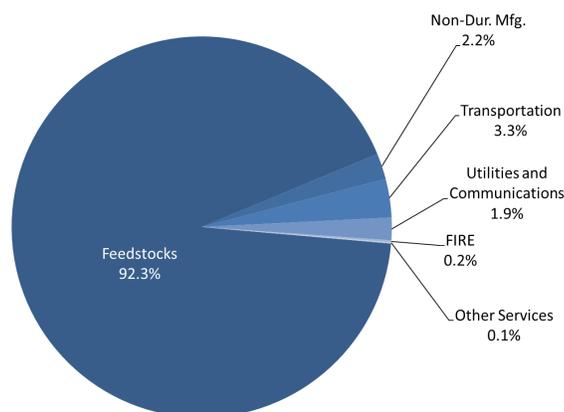
More than half of contract workers in 2019 (1,211 workers) were engaged in capital repair and replacement. In addition to this contract labor, the refiners made \$262.6 million in construction and other capital expenditures. Purposes included safety and environmental compliance, efficiency improvements and clean fuels.

Non-labor operating expenditures. Non-labor operating expenditures are mostly for feedstocks—crude oil—and intermediate processed crude (which will be refined further into higher grade products) and chemicals and catalysts to be applied to the crude to produce various final products. These purchases show up in two categories: feedstocks and nondurable manufactured goods (primarily intermediate petroleum products and chemicals). Combined, these two categories account for more than 92 percent of all non-labor operating expenditures.

Significant amounts are also spent on utilities and transportation, which together accounted for \$655.6 million in 2019. Utilities expenditures, including electricity, gas and communications, totaled \$242.2 million in 2019, and transportation totaled \$413.4 million. Transportation expenditures were primarily for waterborne transport of inbound and outbound product (Appendix A, Table A.7).

Taxes. Refiners paid \$279.1 million

Figure 7.3: 2019 Non-Labor Operating Expenses



Source: 2020

Detail does not sum to 100% due to rounding

Table 7.2: Taxes Paid by Refiners in 2019

	(Millions)	% of Total
Retail sales and use tax	\$2.0	0.7%
Business and occupation tax	\$101.9	36.5%
Property tax	\$24.1	8.6%
Unemployment compensation tax (state only)	\$1.4	0.5%
Hazardous substance tax	\$131.5	47.1%
Oil spill tax	\$12.5	4.5%
Petroleum Products Tax	\$5.4	1.9%
Motor vehicle fuel tax	\$0.1	0.0%
Other	\$0.1	0.0%
Total	\$279.1	

Source: DOR, Refiners Survey

in state and local taxes in 2019 (See Table 7.2). The amount paid in 2018 was lower, \$263.3 million.

The state hazardous substance tax (HST) contributed the largest share of total taxes paid in 2019—\$131.5 million, 47.1 percent of the total. Prior to July 1, 2019, HST was an ad valorem tax at the rate of 0.7 percent of wholesale value. On July 1, 2019, HST became a volumetric tax, with a rate indexed annually for inflation. The initial rate was \$1.09 per barrel. On July 1, 2020 the rate became \$1.13 per barrel. Petroleum products constitute a large portion of the products subject to the tax.

Ranking a close second was the business and occupation tax, \$101.9 million, 36.5 percent of the total. Refineries are subject to this tax under either the manufacturing or wholesaling categories, at the rate of 0.484

percent.

Next in line was the property tax, \$24.1 million and 8.6 percent of the total tax bill.

The fourth most costly tax in 2019 was the oil spill tax, \$12.5 million. It is a tax of 5 cents per barrel on crude oil or petroleum products that are transported by ship, barge, railroad or (beginning April 1, 2018) pipeline in Washington and delivered to an in-state terminal. Of the proceeds, 4 cents are paid into the oil spill administration account and 1 cent into the oil spill response account. When the oil spill response account is fully funded, the 1 cent tax is suspended; when the account is short of funds, the tax is resumed. The 1 cent response tax was last suspended from April 1, 2013 to Dec. 31, 2015. Through a credit, the tax is effectively eliminated for crude oil or petrole-

Table 7.3: Regulatory Fees Paid by Refiners in 2019 (Dollars)

	Amount	% of Total
Air operating registration and permit fees	\$2,075,152	12.8%
Waste disposal fees	\$2,453,679	15.2%
Wastewater discharge fees	\$744,475	4.6%
Building Inspection Fees	\$18,000	0.1%
Building permit fees	\$5,293,000	32.8%
Other	\$5,566,482	34.5%
Total	\$16,150,788	

Source: Refiners Survey

um products exported from the state.

The petroleum products tax is another tax unique to the petroleum industry. The current rate on this tax is 0.3 percent of product value. Revenues from this tax are dedicated to the pollution liability insurance program, which assists owners of underground storage tanks in obtaining insurance for upgrading and replacing tanks and preventing leaks. This tax is suspended when the pollution liability insurance program account balance exceeds a trigger value. The tax was suspended from July 1, 2017 through March 31, 2018 and from April 1, 2019 to January 1, 2020. Refiners paid \$5.4 million in 2019.

The refineries reported paying \$2.0 million in sales and use taxes in 2019. Currently the sales and use tax rate paid by four of the refineries is 8.5 percent, while the rate paid by the other refinery is 10.2 percent.

Fees. In addition, the refiners paid \$16.2 million in regulatory fees in 2019. These included building permit fees (\$5.3 million), air operating registration and permit fees (\$2.1 million), and waste disposal fees (\$2.5 million). (See Table 7.3 on page 11.)

8. Comparison with Taxation of a

California Refinery

Table 8 compares the taxation of hypothetical refineries that processed 160,000 barrels of crude oil per-day in Washington and California in 2019.

We focus on six major taxes. One of these taxes—the corporate income tax—is levied in California but not in Washington. Two of these taxes—the business and occupation tax and the hazardous substance tax—are levied in Washington but not in California. The remaining three taxes—the sales and use tax, the property tax and the oil spill tax—are levied in both states.

The overall 2019 tax burden in Washington, \$72.5 million, was nearly three times the burden in California, \$25.1 million. This is largely due to the fact that the Washington refinery pays more in B&O and hazardous substance taxes than the California refinery pays in corporate income tax.

Corporate income tax. California’s primary business tax is a corporate income tax. To avoid the complications inherent in state-level income taxation of multi-state businesses, we assume that the corporation owning the refinery does business only in California. California’s corpo-

Table 8: Taxes on a 160,000 Barrels per Day Refinery, 2019 (Millions of Dollars)

	Washington	California
Corporate Profits Tax		\$ 10.7
Business & Occupation Tax	\$ 26.6	
Hazardous Substance Tax	\$ 34.3	
Property Tax	\$ 6.2	\$ 7.8
Sales & Use Tax	\$ 2.1	\$ 2.3
Oil Spill Tax	\$ 3.3	\$ 4.2
	<u>\$ 72.5</u>	<u>\$ 25.1</u>

rate income tax rate is 8.84 percent. Based on financial information filed with the U.S. Securities and Exchange Commission, we estimate the taxable income for a 160,000 barrels-per-day refinery to be \$121.5 million and the corporate income tax due to be \$10.7 million.

B&O tax. The B&O tax is Washington’s primary business tax. It is a tax on a business’s gross receipts. Our 160,000 barrel per day refinery has refined product sales of \$5.50 billion. This results in a B&O tax obligation of \$26.6 million at the manufacturing/wholesaling rate of 0.484 percent.

The B&O tax is a tax on gross income, without any deductions for the costs of making the goods or services sold, while the corporate income tax is a tax on net income, after deduction of these costs. The B&O tax tends to be more burdensome than a corporate income tax for low margin businesses such as refining.

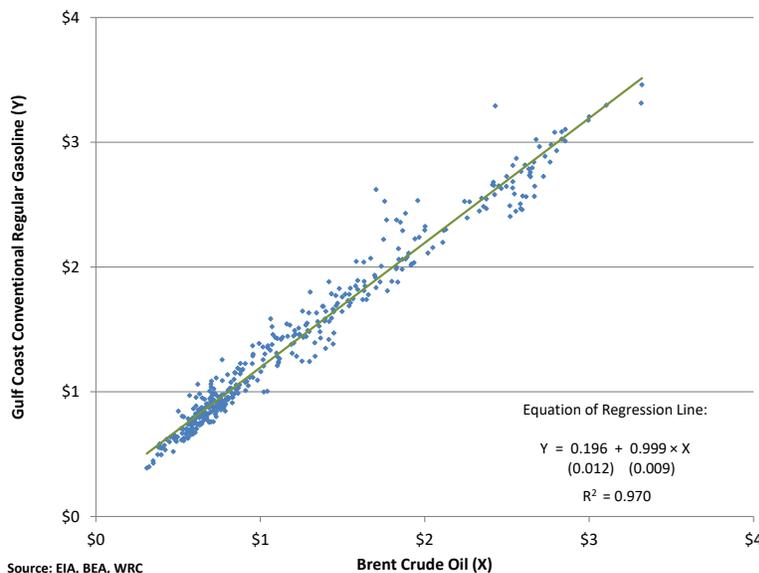
Refinery margins as a percentage of revenue are particularly low when crude oil prices are high. In the long run, the prices refiners pay for crude oil passes directly through to the prices they receive for products, as Figure 8 illustrates. On the figure we have plotted the monthly average U.S. Gulf Coast spot price of conventional regular gasoline against the monthly average spot price of the benchmark European Brent crude oil (measured in dollars per gallon in both cases) from May 1987 to November 2020. The slope of the regression line through the data points is almost exactly equal to one.

Hazardous substance tax. Returning to the taxes listed in Table 8, the hazardous substance tax is a second gross receipts tax levied by Washington state. Based on the taxes paid by the refineries in our survey, we estimate that paid by a 160,000 bbl/day refinery to be \$34.3 million.

Property tax. We assume that the Washington refinery is in Skagit County and that the California refinery is in the city of Martinez. We estimate that the taxes that would be paid by a 160,000 bbl/day refinery in Anacortes to be \$6.3 million. Based on the difference in property tax rates between Skagit County and Martinez, we estimate that such a refinery in Martinez would pay \$7.8 million in property taxes.

Sales and use tax. In 2019, the combined state and local sales tax rates were 8.5 percent inside the Skagit Transit District in unincorporated Skagit County and 9.25 percent in Martinez. Based on the survey of Washington refineries, we estimate transactions subject to the sales and use taxes to be \$24.7 million and the

Figure 8: Monthly Average Spot Prices May 1987 – November 2020
Gulf Coast Conventional Regular Gasoline vs. Brent Crude Oil
2012 Dollars Per Gallon



amount paid to be \$2.1 million in Washington and \$2.3 million in California.

Oil spill tax. Both states impose an oil spill tax. The rate in Washington is 5 cents per barrel. As we noted above, in Washington, 1 cent of the 5 cents is sometimes suspended. The full 5 cents was collected in 2019. Based on the amounts paid by Washington refineries in 2019, we estimate that the 160,000 barrel per day refinery would pay \$3.3 million in Washington. The oil spill tax rate in California is 6.5 cents per barrel, with no credit for exported product. The oil spill tax paid in California is then \$4.2 million.

9. Petroleum Refining Industry Direct, Indirect and Induced Economic Impacts

The economic impact of refineries on the state's economy can be divided into three primary categories: direct, indirect, and induced effects:

- The **direct** effects are those in the industry itself—the refinery jobs and payroll, and the taxes paid by the refiners.
- The **indirect** economic effects include the jobs, wages, and taxes of upstream suppliers of the refineries—not only the suppliers of crude oil, but also the construction companies and contract workers used for plant maintenance and repair and the office product and equipment suppliers, for example. The indirect economic effects also include the jobs, wages, and taxes of the supply chains of those suppliers.
- Finally, the **induced** effects are the jobs, income, and taxes contributed by firms in industries that supply daily consumables and

services—e.g., food, dry cleaning, banking—to workers holding the direct and indirect jobs.

The relationship between the direct jobs, income, and tax effects in an industry and their indirect and induced effects are captured by multipliers, which are calculated using the WRC-REMI model of the Washington state economy.

The employment multiplier for the petroleum refining industry is 12.04. Applying this multiplier to the 2,050 direct refinery jobs in 2019 gives a total state employment impact of 24,680 jobs.

This is large compared to employment multiplier typically seen in studies that use input-output models. For example, the 2007 Washington state Input-Output Study (2014) calculates that the employment multiplier for manufacturing/construction overall is 2.65. For the petroleum and coal products manufacturing sector (the “three-digit” sub-sector of manufacturing that contains the petroleum refining industry) the state study calculates an employment multiplier of 6.80.

The WRC-REMI model finds larger impacts because it is a more complete model of the state economy than the state Input-Output model. The REMI model incorporates many significant behavioral responses to changes in prices and costs that are not picked up by a simple input-output model: The wage rate depends on the supply and demand for labor. Migration and labor force participation rates respond to changes in wage rates. Consumer purchases of specific goods and services respond to changes in relative prices and personal income. In addition,

producers adjust production methods in response to changes in relative costs, market shares respond to changes in regional production costs, and investment rises in response to increases in output.

Two channels of impact captured by the REMI model and absent from the Input-Output model are particularly important in explaining the high employment multiplier the WRC-REMI model finds for petroleum refining: government spending of the tax revenues paid by the refineries and investment spending by the refineries and their suppliers. When these two channels are turned off, the employment multiplier calculated for petroleum refining with the WRC-REMI model is 8.05. Government spending of the tax revenue generated by refining adds 2.81 to the multiplier, while investment spending adds 1.18.

Several additional factors contribute to the petroleum refining industry's large multiplier. First, petroleum refiners pay high wages. Thus, the employment induced by refinery employee spending is relatively great. Second, the petroleum industry ranks high in the ratio of in-state supplied intermediate inputs (including contract labor) to employee income. For this reason, indirect employment is relatively high. And some of these

indirect jobs (e.g. contract labor) pay unusually high wages.

The WRC-REMI model calculates that each refining job results in an additional \$984,000 of state personal income. At 2019 employment levels, the industry adds \$1.896 billion to state personal income.

In 2019 state and local sales and use taxes averaged \$0.0345 for each dollar of state personal income. With the income multiplier of \$984,000 each petroleum refining job results in \$33,980 in state and local sales taxes or a total of \$69.6 million.

The refiners directly paid \$101.9 million in B&O taxes in 2019. In 2019 state B&O taxes averaged \$0.0094 for each dollar of personal income. Multiplying this rate by \$1,492 million—the increase in state personal income we ascribe to the 2,050 refinery jobs net of the wages and benefits of the refinery workers—gives \$18.9 million additional induced and indirect B&O tax revenue, for a total of \$120.8 million, or \$58,980 per direct job.

These impacts can be expressed in terms of the hypothetical Washington refinery producing 160,000 barrels of product a day that was analyzed in Section 8. In 2019, this refinery would have provided 535 jobs, and these workers would have re-

Table 9: Impact of a 160,000 Barrels Per Day Refinery

535 Direct Jobs
+5,908 Additional Jobs Elsewhere in the State Economy
\$105.3 Million Direct Compensation
+\$389.4 Million Additional Personal Income Elsewhere in the Economy
\$27.1 Million Direct Taxes
+\$22.6 Million Additional Sales, Use and B&O Taxes Elsewhere in the Economy

Source: WRC

ceived \$105.3 million in wages, salaries and benefits. In addition to the direct jobs and income, the refinery would generate 5,908 jobs and \$389.4 million in personal income elsewhere in the state's economy. The refinery itself would pay \$27.1 million in state and local taxes. In addition to these direct taxes, the indirect and induced activities generated by the refinery would provide \$22.6 million in sales, use and B&O tax revenue. (See Table 9 on page 15.)

10. Washington Petroleum Industry: Downstream Activities

Washington's petroleum refiners rely on a number of industries to distribute their product to consumers. These include transportation (pipelines, barges, trucks, and rail) and transportation support facilities (terminals, stockyards, and bulk stations), wholesalers, and retailers (gasoline stations and fuel oil dealers).

These downstream industries exist due to petroleum product consumption in our economy, not as a result of petroleum refining. Presumably, if the refineries were gone or if they had never existed in Washington, finished petroleum products would be imported to terminal and stockyard facilities, transported to retail destinations within the state, and

sold to consumers through systems much like those that currently exist, together with similar job, wage, and tax effects. Even so, their direct economic contribution is substantial and their role in the larger petroleum industry is crucial. This section describes the employment, wages, and taxes associated with these industries.

Of the total finished products produced by Washington's refineries, 48 percent leaves through pipeline to markets in Seattle and Tacoma and beyond. Another 38 percent goes by water to Seattle, Portland, or elsewhere with the remaining 14 percent of product shipped by rail or truck. A bit more than 50 percent of product is delivered to retailers for consumer sales within the state of Washington (Appendix A, Tables A.4 and A.5).

Jobs and wages. According to detailed data reported to the Bureau of Labor Statistics (BLS) for 2019, the most recent year for which such data are available, there were about 1,600 employers in these downstream industries. Together, they paid \$503 million in wages to 16,078 workers. These are all workers covered by unemployment insurance in these industries, so the number includes both full-time and part-time workers. Table 10 on page 16 shows these data for each industrial classification

Table 10: Employment and Wages by Industry, 2019

Industry (NAICS Code)	Firms	Total Wages Paid	Average Employment	Average Annual Wage
Petroleum bulk stations and terminals (4247100)	28	\$85,696,053	1,043	\$82,163
Other petroleum merchant wholesalers (424720)	78	\$68,864,255	923	\$74,609
Gasoline stations with convenience stores (447110)	1,394	\$306,028,416	12,066	\$25,363
Other gasoline stations (447190)	64	\$33,539,306	951	\$35,267
Refined petroleum product pipeline transport (486910)	3	\$16,536,209	128	\$129,189

Source: BLS

with its corresponding North American Industrial Classification System (NAICS) code.

Among the downstream industries there are three broad tiers of employment and pay:

- Refined petroleum products pipelines employ a small number of highly paid workers—128 workers made \$129,189 on average in 2019.

- Bulk stations and terminals, wholesalers, and fuel oil dealers employed 1,966 workers who earned on average \$78,619 in 2019.
- Gasoline stations generate a large wage bill with a lot of lower-wage and part-time jobs. In 2019, this industry's 1,442 employers paid total wages of \$339.6 million to 13,017 workers.

Since 2004, the Washington Research Council has biannually surveyed the five refiners operating in Washington state. One of the refiners declined to participate in the 2020 survey. The numbers presented below are our estimates of industry outputs and revenues in 2018 and 2019. We have based these estimates on revenues reported by all refiners to the state Department of Revenue for purposes of the state Business and Occupation Tax, employment reported by all refiners to the state Employment Security Department for purposes of the unemployment insurance tax, responses received to the 2020 survey, and responses received to the 2018 survey, in which all five refiners participated.

A.1 Quantity and Value of Feedstock Inputs	2018	2019
Feedstock Quantity (KBLS/Day)		
Crude Oil	592	613
Other	31	30
Total	624	643
Feedstock Value (\$K)		
Crude Oil	14,523,331	13,768,070
Other	521,998	512,990
Total	15,045,329	14,281,060
A.2 Quantity and Value of Output	2018	2019
Output Quantity (KBLS/Day)		
Gasoline	296	297
Diesel Oil	144	157
Jet and Turbine Fuel	91	97
Calcined Coke	-	-
LPG	-	-
Residual Fuel Oil	38	30
Propane	9	14
Coke	6	5
Sulfur	1	2
Marine Fuels	4	7
Gas Oils	11	16
Emulsified and Road Asphalt	7	7
Other	15	8
Total	623	640
Output Value (\$K)		
Gasoline	9,294,804	8,801,625
Diesel Oil	4,805,324	4,630,396
Jet and Turbine Fuel	2,925,890	2,877,136
Calcined Coke	210,538	208,053
LPG	117,341	116,059
Residual Fuel Oil	807,822	621,148
Propane	100,906	79,901
Coke	46,049	24,239
Sulfur	2,436	1,338
Marine Fuels	133,895	75,385
Gas Oils	172,386	209,019
Emulsified and Road Asphalt	166,539	186,113
Other	224,497	173,201
Total	19,008,427	18,003,612

A.3 Origin of Inputs 2019 (KBBL/Day)	Crude Oil	Other
Alaska	182	6
Canada (Conventional)	118	-
Canada (Oil Sands)	102	-
Bakken	159	2
All Other Origins	53	24

A.4. Destination of Output 2019 (KBBL/Day)	Washington	Other U.S.	Foreign	Total
Gasoline	137	147	13	297
Diesel Oil	88	59	10	157
Jet and Turbine Fuel	71	16	10	97
Calcined Coke	-	-	-	-
LPG	-	-	-	-
Residual Fuel Oil	14	11	4	30
Propane	14	-	-	14
Coke	0	-	5	5
Sulfur	1	-	0	2
Marine Fuels	7	-	-	7
Gas Oils	2	11	3	16
Emulsified and Road Asphalt	2	5	-	7
Other	3	3	1	8

A.5 Mode of Transport 2019	Pipeline	Water	Truck	Rail
Feedstocks (KBBL/Day)				
Crude Oil	200	240	-	173
Other	2	15	0	14
Outputs (KBBL/Day)				
Gasoline	170	98	29	-
Diesel Oil	76	56	24	0
Jet and Turbine Fuel	50	31	14	-
Calcined Coke	-	-	-	-
LPG	-	-	-	-
Residual Fuel Oil	-	30	-	-
Propane	2	-	10	2
Coke	-	-	5	0
Sulfur	-	-	1	1
Marine Fuels	3	3	-	-
Gas Oils	-	16	-	-
Emulsified and Road Asphalt	-	-	2	5
Other	1	5	-	0

A.6 Employment and Contract Labor	2018	2019
On-Site Employment		
Number of FTE Employees	2,171	2,050
Total Payroll (\$K)	295,294	304,800
Total Employee Benefits (\$K)	128,537	132,393
Contract Labor		
Expenditure (\$K)		
Service and Maintenance	170,691	202,014
Capital Repair and Replacement	80,516	73,187
Total	251,207	275,201
Number of Contract Workers (FTE)		
Service and Maintenance	827	1,027
Capital Repair and Replacement	1,270	1,211
Total	2,098	2,239
% of Contract Labor from Outside WA State		
Service and Maintenance		
Capital Repair and Replacement		

A.7 Operating Expenditures Other than Labor or Feedstock (\$K)	2018	2019
Non-Durable Manufactured Goods		
Petroleum Products	552,802	417,591
Other Non-Durable Goods	105,380	110,684
Total	658,182	528,275
Durable Manufacturing	-	11,146
Construction (Operating Expenditures Only, Capital Expenditures on page 4)	3,254	3,206
Transportation		
Rail	176,936	231,007
Trucking	606	627
Automobiles	-	-
Waterborne	142,775	151,757
Air	-	-
Other	38,225	29,968
Total Transportation	358,542	413,359
Utilities and Communications		
Electricity	53,572	61,858
Gas	129,464	154,862
Other	23,886	25,497
Total U&C	206,922	242,216
Finance, Insurance and Real Estate	28,784	20,108
Business Services	11,725	8,107
Other Services	3,288	6,131

A.8 Non-Labor Capital Expenditures	2018	2019
Equipment (\$K)	134,630	106,243
Materials and Supplies (\$K)	156,372	144,707
Construction (\$K)	5,525	11,658
Contract Labor (\$K)	75,551	51,005
Other (\$K)	-	-
Total	372,078	313,613
A.9 Taxes and Fees (State and Local)	2018	2019
Taxes (\$K)		
Retail Sales and Use tax	1,828	2,021
Business and Occupation Tax	107,551	101,930
Property Tax	25,317	24,134
Unemployment Insurance Tax	1,684	1,389
Industrial Insurance Premium	4,666	4,414
Hazardous Substance Tax	107,491	131,532
Oil Spill Tax (Do Not Include Federal Tax)	14,475	12,485
Other	230	112
Regulatory Fees (\$K)		
Air Operating Registration and Permit Fees	1,931	2,075
Waste Disposal Fees	1,774	2,454
Wastewater Discharge Fees	993	744
Building Inspection Fees	21	18
Building Permit Fees	5,665	5,293
Other	5,866	5,566
A.10 Estimated Services and Retail Trade	2018	2019
Food Services (\$K)		
Associated with Contract Labor	1,208	1,526
Associated with Business Visitors	582	628
Total	1,790	2,154
Hotel and Motels (\$K)		
Associated with Contract Labor	672	698
Associated with Business Visitors	909	576
Total	1,582	1,275
Other Trade and Services (\$K)		
Associated with Contract Labor	663	504
Associated with Business Visitors	626	461
Total	1,289	965
A.11 Contributions	2018	2019
Corporate	1,893	1,342
Firm-Sponsored Employee Giving	398	466
A.12 Other	2018	2019
Estimated Business Visitors from Outside Washington	2,020	2,210

	2019		2018	
Mexico	\$1,020,476,086	1	\$747,426,176	2
Canada	\$773,979,948	2	\$1,087,071,039	1
Peru	\$97,988,903	3	\$125,543	30
Panama	\$76,748,654	4	\$19,723,130	12
Australia	\$75,794,036	5	\$116,379,657	4
Chile	\$74,347,408	6	\$128,556,756	3
United Arab Emirates	\$69,688,897	7	\$24,660,000	10
Singapore	\$66,191,717	8	\$111,191,668	5
New Zealand	\$47,698,059	9	\$40,059,424	7
Netherlands	\$44,667,282	10	\$28,437	34
Brazil	\$28,540,000	11	\$36,800,000	8
Bahamas	\$24,513,576	12	\$22,580	35
Oman	\$24,198,375	13	\$26,153,255	9
Belgium	\$20,592,000	14	\$41,151,986	6
Malaysia	\$19,497,950	15	\$651,538	21
South Africa	\$15,341,000	16	\$11,480,000	14
Taiwan	\$15,119,319	17	\$22,569,519	11
Japan	\$12,736,259	18	\$11,116,413	15
Honduras	\$12,341,368	19	\$0	
Qatar	\$11,377,000	20	\$7,340,000	16
Mozambique	\$8,383,680	21	\$2,870,000	18
India	\$5,058,049	22	\$1,145,474	19
Argentina	\$4,702,845	23	\$0	47
China	\$3,294,112	24	\$14,949,599	13
Thailand	\$826,084	25	\$662,603	20
Dominican Republic	\$556,747	26	\$299,612	22
Philippines	\$252,890	27	\$166,590	27
Maldives	\$231,931	28	\$0	
Costa Rica	\$200,511	29	\$241,679	25
Colombia	\$195,225	30	\$126,291	29
Indonesia	\$189,568	31	\$269,509	23
Guatemala	\$134,332	32	\$167,301	26
Russia	\$125,525	33	\$260,734	24
Bolivia	\$62,753	34	\$90,934	31
Ecuador	\$43,510	35	\$148,312	28
Vietnam	\$41,034	36	\$4,125	42
Trinidad And Tobago	\$28,132	37	\$0	
El Salvador	\$12,067	38	\$0	
Nicaragua	\$11,521	39	\$0	
Andorra	\$11,180	40	\$0	
French Polynesia	\$9,557	41	\$2,849	46
Korea, Republic Of	\$8,544	42	\$40,361	32
Jamaica	\$8,132	43	\$0	
Hungary	\$7,087	44	\$0	
Venezuela	\$6,595	45	\$0	
Marshall Islands	\$5,250	46	\$5,489	41
Norway	\$5,216	47	\$0	
Israel	\$4,218	48	\$0	
France	\$3,648	49	\$0	
Switzerland	\$3,118	50	\$0	
Saudi Arabia	\$2,511	51	\$4,638,000	17
Other			\$101,681	
Total	\$2,556,263,409		\$2,458,698,264	

The Washington Research Council uses a model of the Washington state economy constructed especially for WRC by Regional Economic Models, Inc. Because it allows supply and demand to respond to changes in prices and wages, and permits substitution among factors of production, the WRC-REMI model is more elaborate than the standard input-output models commonly employed to estimate regional economic impacts (Treyz 1993).

The standard input-output model fails to model the numerous capacity constraints within the economy, the processes that set prices for goods and services and the responses of consumers and producers to changes in these prices. In the input-output model, industry and labor supply are perfectly elastic—so prices and wage rates do not matter.

Prices and wages do matter in the WRC-REMI model. The model divides the state into two sub-regions: The Seattle Metropolitan District (King and Snohomish Counties) and the balance of the state. There are 66 private industrial sectors within each sub-region, as well as four governmental sectors. Within each sub-region the model tracks inter-industry transactions, much as an input-output model would.

Unlike an input-output model, however, the WRC-REMI model incorporates a number of significant behavioral responses to changes in prices and costs: The wage rate depends on the supply and demand for labor, migration and labor force participation rates respond to changes in wage rates, and consumer purchases of specific goods and services respond to changes in relative prices and personal income. In addition, producers substitute among production factors in response to changes in relative factor costs, market shares respond to changes in regional production costs, and investment rises in response to increases in output.

This report uses version PI+ 1.7.2 of the WRC-REMI model. We use a custom regional control with the standard responses of government spending to changes in economic activity turned off. We increase government spending via the state and local government spending policy variables based on taxes refiners report paying. Additionally we increase investment using the nonresidential investment policy variable, based on the amount refiner reported investment exceeds that predicted by the REMI model's investment equation.

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