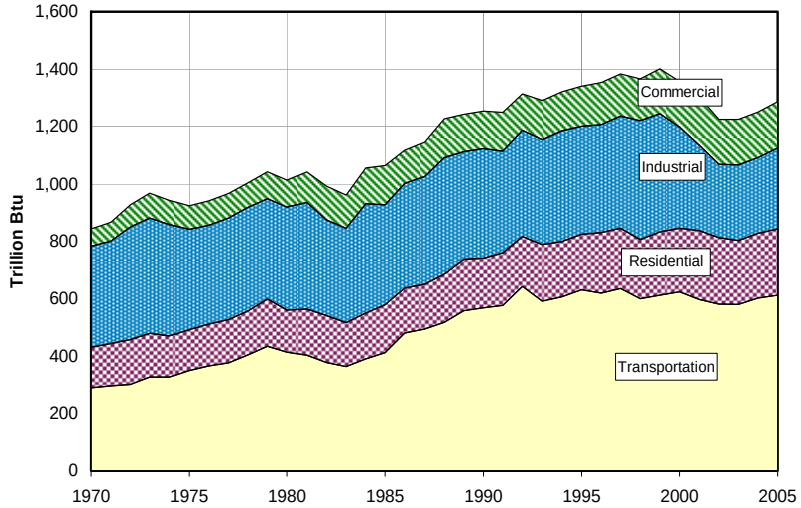
Chapter 11 Energy

1 What are the trends for energy consumption and energy generation in Washington?

According to the *2009 Biennial Energy Report* published by the Washington State Department of Community, Trade and Economic Development (CTED, 2008), energy use in Washington grew at an average annual rate of 1.8 percent between 1970 and 1999. Exhibit 11-1 shows the amount of energy consumed by the four major sectors. The transportation sector has accounted for the largest proportion of growth in Washington's energy usage, doubling since 1970.

Exhibit 11-1
Energy Consumption by Sector (1970–2005)



Source: Energy Information Administration (EIA), 2008; CTED, 2008.

Which elements of Washington Administrative Code (WAC) 197-11-444 are addressed in this chapter?

This chapter addresses:

- Section (1)(e)(i) Amount of energy required/rate of use/efficiency
- Section (1)(e)(ii) Source/availability
- Section (1)(e)(iii) Nonrenewable resources
- Section (1)(e)(iv) Conservation and renewable resources

What is a Btu?

A Btu, or British thermal unit, is a basic measure of thermal heat energy used in the power industry to describe how much heat is required to raise 1 pound of water by 1 degree Fahrenheit. In the United States, Btus are often used to describe the energy content of fuels.

mmBtu = 1 million Btus

Washington State relies on six primary sources of energy: petroleum, hydroelectricity, natural gas, biofuels, coal, and nuclear (Exhibit 11-2). Hydroelectric power provides more than two-thirds of the state's electricity, with coal, natural gas, and nuclear providing the majority of the remainder; wind and other non-hydroelectric renewable sources account for a little over 3 percent (Exhibit 11-3). Petroleum, which is imported by tanker from Alaska, represents about half of the state's primary energy usage, and natural gas almost 18 percent (CTED, 2008).

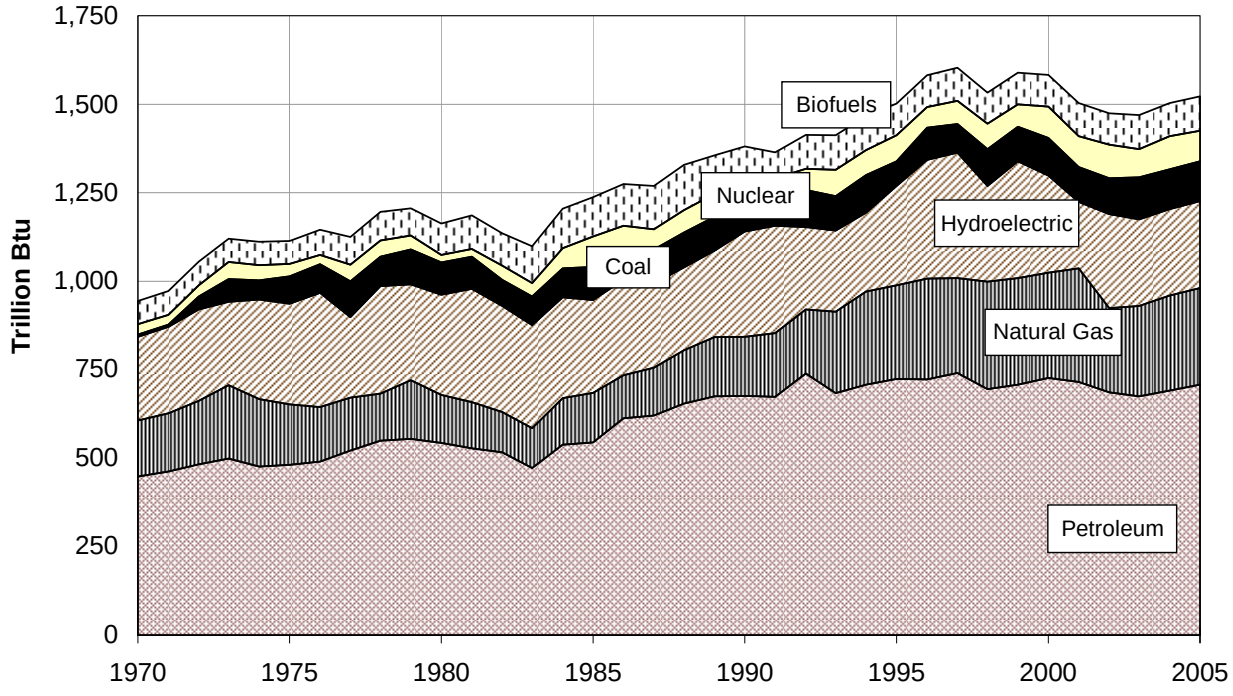
The FEIS for VISION 2040 (April 2008) includes a complete discussion of energy resources and consumption. This chapter focuses on the transportation sector, particularly the on-road mobile sources such as passenger vehicles, which are relevant to the Transportation 2040 update.

Did you know?

According to the Energy Information Administration (EIA) (2008), Washington is the leading hydroelectric producer in the nation. Washington produces 29 percent of the United States' hydroelectric power. The Grand Coulee hydroelectric power plant on the Columbia River is the highest-capacity electric plant in the United States. However, hydropower has largely reached its maximum potential in Washington State. While increased generation from existing facilities is possible, no large new projects are expected to be built in the future (CTED, 2007).

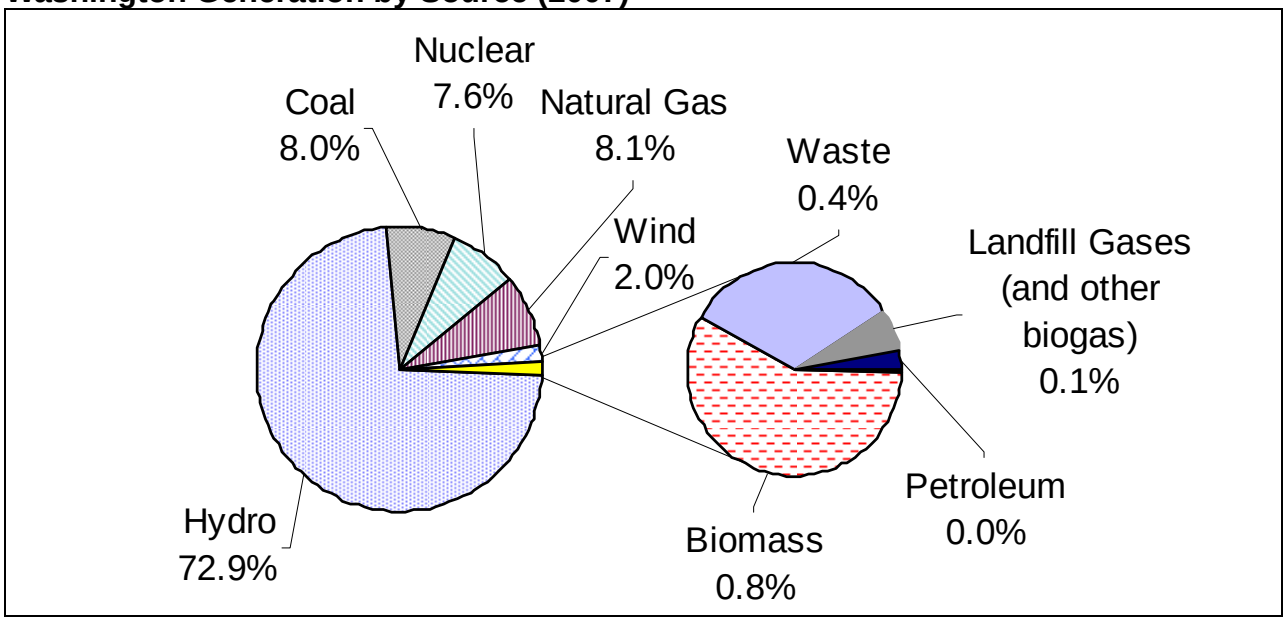
Exhibit 11-2

Total Primary Energy Consumption by Source (1970–2005)



Source: EIA, 2008; CTED, 2008

Exhibit 11-3
Washington Generation by Source (2007)



Source: CTED, 2008.

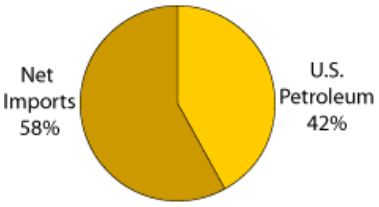
Transportation and Energy

The transportation sector represents the highest percentage of growth in energy consumption in Washington state, growing an average of 3.3 percent per year between 1983 and 1999 (CTED, 2008). Gasoline accounts for more than half of the energy used in the transportation sector, but consumption of diesel and aviation fuel has also grown significantly. The percentage of energy used by type of vehicle or activity in the transportation sector is shown in Exhibit 11-4.

Where does our petroleum come from?

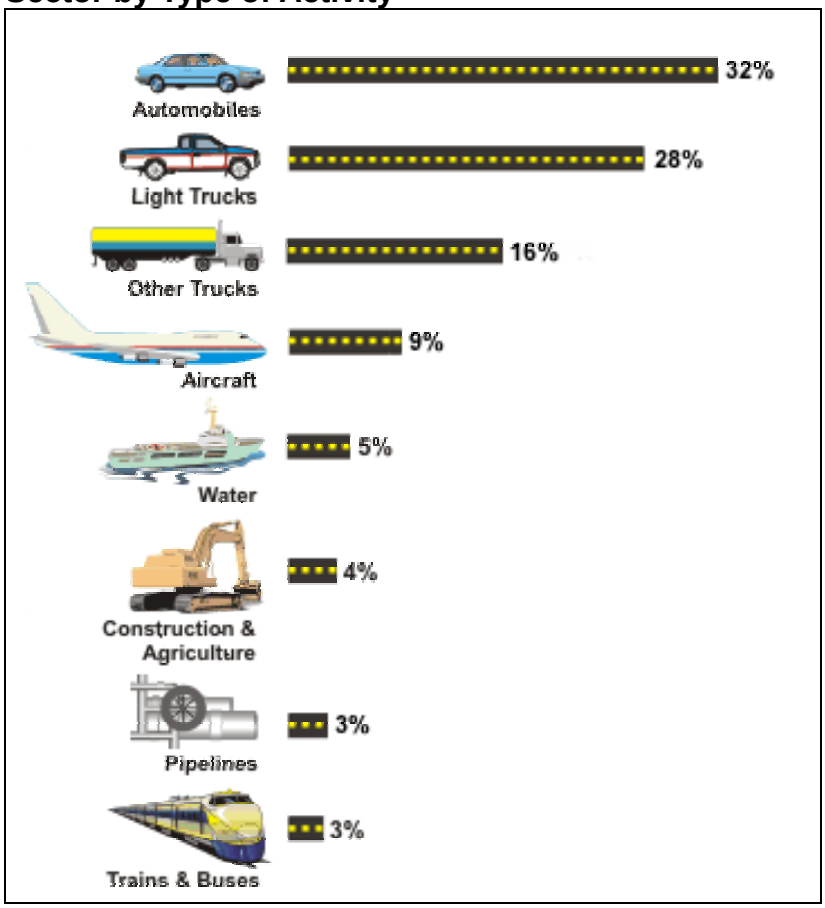
Although the United States is the third largest producer of crude oil, most of the petroleum we use is imported.

Net Imports and Domestic Petroleum as Shares of U.S. Demand (2007)



Source: Energy Information Administration

Exhibit 11-4
Percentage of Energy Used in the Transportation Sector by Type of Activity



Source: EIA

The amount of fuel consumed by the transportation sector is influenced by several factors, including the number of trips made by vehicles, the amount of congestion on the roadway system, and the mix of vehicles using the system. The amount of vehicular travel is influenced by the urban environment. This is reflected in the distances between residences, workplaces, and other travel destinations, and by the availability of public transportation and nonmotorized transportation.

In general, the demand for travel and the consumption of gasoline has outpaced any gains in vehicle fuel efficiency (CTED, 2008). While average fuel efficiency of Washington state's vehicle fleet increased between 1975 and 1992, the

increase of less fuel-efficient vehicles such as trucks and sport utility vehicles in the 1990s reversed this trend.

2 What effects on energy are common to all alternatives?

All of the Transportation 2040 alternatives would provide additional transportation infrastructure, including roadway, transit, and other investments that would affect energy consumption, both in terms of construction and operations. Many of these investments would provide more alternatives to driving alone, which could result in more efficient energy consumption. It is not practicable to quantify the regional impacts from all of these investments; some may produce a higher level of energy consumption, while others may result in lower energy consumption. Overall, a significant difference is not expected among all the alternatives in electricity use for buildings.

3 What effects on energy are specific to individual alternatives?

The energy analysis conducted for the Transportation 2040 alternatives consisted of energy consumption from on-road mobile sources and buildings (residential, commercial, and industrial).

On-road mobile sources

As discussed in Chapter 6: Air Quality and Climate Change, PSRC is using the U.S. Environmental Protection Agency (EPA) draft MOVES software to estimate greenhouse gas emissions from on-road mobile sources, as well as mobile source energy rates. This method was used to estimate energy consumption from the total vehicle miles traveled in each of the Transportation 2040 alternatives. These results are shown in Exhibit 11-5.

Where can I learn more about the U.S. Environmental Protection Agency (EPA) MOVES software?

For more information about the vehicle emissions modeling software used by the EPA, refer to http://www.epa.gov/otaq/models.htm.

Exhibit 11-5[1]

Energy Consumption from On-Road Mobile Sources

	Baseline Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Preferred Alternative (Constrained)	Preferred Alternative
Annual mmBtu	327,848,000	327,431,000	331,337,000	313,669,000	311,034,000	291,782,000	306,040,000	294,005,000
Percent Change from Baseline Alternative	---	-0.13%	1.06%	-4.32%	-5.13%	-11.00%	-6.65%	-10.32%

The differences among the alternatives related to energy consumption are similar to the carbon dioxide emissions differences described in Chapter 6: Air Quality and Climate Change. Alternative 5 has the lowest energy consumption from mobile sources, while Alternative 2 has the highest value. The Preferred Alternative has lower energy consumption than any of the other Transportation 2040 alternatives, with the exception of Alternative 5. The mobile source energy consumption shown in Exhibit 11-5 does not include energy from transit vehicles. At this time, PSRC's travel demand models do not adequately represent all transit vehicle miles on the transportation network. As such, the impact from transit on energy consumption is not represented in the quantified analyses. Each of the Transportation 2040 alternatives contains different levels of transit investment for light rail, commuter rail, and bus service. Electric light rail and commuter rail vehicles have a higher rate of energy consumption per mile than do buses, but total ridership and the number of miles traveled by the vehicles may result in lower overall energy consumption.

The new Sound Transit light rail trains run on electricity.

Source: Wikimedia Commons, 2007

Stationary sources

The mobile source analysis considers what energy effects would result from the different transportation networks contained in the Transportation 2040 alternatives. Indirectly, the transportation network contained in each Transportation 2040 alternative could alter the development patterns throughout the central Puget Sound region, which could alter

[1] This exhibit has changed since the DEIS.

the energy produced by stationary sources. This indirect effect is described in the response to Question 4.

4 What cumulative effects on energy could occur if the Transportation 2040 actions coincide with other planned actions?

The existing energy use patterns in the central Puget Sound region reflect past and present cumulative effects. Future cumulative effects on energy use could be affected by other regional plans and actions. The Transportation 2040 alternatives are all based on the residential and employment growth allocations in VISION 2040's Regional Growth Strategy. Further refinements to specific land use actions and programs may be necessary to fully complement the Preferred Alternative, such as promoting transit-oriented development in specific locations.

Because approximately 90 percent of stationary energy consumption typically occurs during building operations (e.g., heating and cooling), the analysis does not incorporate estimates of construction-related energy use or the embodied energy of materials, which are imprecise or difficult to obtain. Instead, the analysis is based on data from recent surveys conducted by EIA to estimate annual building-related electricity and fuel use (refer to Appendix E for more information on the methods and sources used). The results of the stationary source energy analysis are shown in Exhibits 11-6 and 11-7.

What are cumulative effects?

Cumulative effects address the impact on the environment that results from the incremental impact of the action being considered when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Exhibit 11-6[2]

Energy Consumption from Buildings (Total Annual Values)

	Baseline	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Preferred Alternative (C)	Preferred Alternative
Fuel (mmBtu)								
Residential	133,705,000	133,641,000	133,703,000	133,633,000	133,616,000	133,624,000	133,638,000	133,685,000
Non-residential	64,810,000	64,402,000	63,187,000	63,562,000	64,319,000	64,550,000	66,150,000	64,211,000
Total	198,515,000	198,043,000	196,890,000	197,195,000	197,935,000	198,174,000	199,788,000	197,896,000
Electricity (mWh)								
Residential	19,096,000	19,095,000	19,098,000	19,093,000	19,099,000	19,090,000	19,085,000	19,093,000
Non-Residential	1,162,000	1,183,000	1,133,000	1,158,000	1,089,000	1,252,000	1,182,000	1,144,000
Total	20,258,000	20,278,000	20,231,000	20,251,000	20,188,000	20,342,000	20,267,000	20,237,000

Note: mWh = megawatt hours

Exhibit 11-7[3]

Energy Consumption from Buildings (Percent Change from Baseline Alternative)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Preferred Alternative (C)	Preferred Alternative
Fuel (mmBtu)	-0.24%	-0.82%	-0.66%	-0.29%	-0.17%	-0.64%	-0.31%
Electricity (mWh)	0.10%	-0.13%	-0.03%	-0.35%	0.41%	0.04%	-0.10%

Each of the six alternatives includes the same number of households and employment; therefore, a modest variation of stationary energy consumption among alternatives was expected. This conclusion was confirmed by the energy consumption analysis. In summary, stationary energy use can be considered equivalent among all six alternatives because the percent change of any action alternative compared to the Baseline Alternative is less than 1 percent. The Preferred Alternative has a similar pattern of building energy consumption, at less than a 1 percent difference from the Baseline Alternative.

The minor variation is largely a reflection of differences in nonresidential building energy consumption among the alternatives because businesses consume more energy than houses. Alternatives with less nonresidential—and particularly, less industrial—area (such as Alternative 2) show less total building-related energy consumption, despite higher relative

[2] This exhibit has changed since the DEIS.

[3] This exhibit has changed since the DEIS.

levels of residential consumption. The differences among the alternatives are so minor they are within the margin of modeling error.

5 How can the effects to energy be mitigated?

Potential mitigation measures for energy impacts from the Transportation 2040 alternatives include conservation and continued transition to renewable and alternative energy sources. Specific to the transportation sector, such measures could include the following, many of which are components of the alternatives:

- Increase carpooling, public transit, and nonmotorized programs and facilities.
- Expand telecommuting and telecommunications.
- Reduce vehicle idling.
- Improve the regular maintenance of vehicles to improve efficiency.
- Increase fuel-efficient vehicles in the fleet, including moving towards all electric light truck and passenger vehicle fleets.

The potential for improved vehicle and fuel technologies and the use of alternative fuels is discussed more fully in Chapter 6: Air Quality and Climate Change. A more thorough analysis is included as part of the Transportation 2040 plan.

Between now and 2040, there would likely be improvements in renewable energy technologies, including solar, wind, tidal, and geothermal. Only a small fraction (a little over 3 percent) of the electricity produced in 2007 was generated from renewable energy sources (biomass, geothermal, wind, or solar). The Northwest Power and Conservation Council published their Fifth Power Plan on May 13, 2005. The plan includes the goal of producing 1,100 megawatts of energy from wind generation between 2005 and 2014. Puget Sound Energy concluded in its least cost plan that it will accelerate energy efficiency and early fuel conservation and build the

Solar energy is a renewable source of energy.

infrastructure to generate 10 percent of its energy through renewable resources.

Legislation passed by the Washington State Legislature in 2005 (SB 5101, SB 5111) provides incentives and tax breaks for installing renewable energy infrastructure or establishing renewable energy production businesses. In early 2009, President Obama established ambitious nationwide goals for renewable energy production, including ensuring that 10 percent of electricity comes from renewable sources by 2012, and 25 percent by 2025.

The goal of many of the conservation policies from all sectors is to reduce energy consumption, especially during times of peak demand, while still maintaining comfort and productivity. Coordinated planning of energy utilities with transportation and other corridor infrastructure projects could also help energy providers reduce costs and effectively meet energy transmission and growth demands.

6 Are there any significant unavoidable adverse impacts to energy?

Significant unavoidable adverse energy impacts that may be anticipated from the Transportation 2040 alternatives, including the Baseline Alternative, include the following:

- Higher prices of fuel and other energy sources as demand increases
- Habitat reduction resulting from construction of new energy generation infrastructure required to meet increased demand, such as dams, natural gas refineries, and wind farms
- Emission of greenhouse gases and other air pollutants from burning fossil fuels
- The potential for reduced availability of energy resources such as fossil fuels