CHAPTER 5.3 Energy

When energy is used to build something or operate a vehicle, it cannot be recovered. Project construction activities and the operation of vehicles on SR 520 consume large amounts of energy resources, particularly petroleum. Energy will be consumed during project construction by activities such as site preparation, equipment operation, and construction lighting.

Please refer to the Energy Technical Memorandum in Appendix M for additional information about the energy analysis.

Why is energy use considered in this EA?

The National Environmental Policy Act (NEPA) requires agencies to consider environmental effects when making decisions about the project.

Washington state has adopted greenhouse gas (GHG) reduction goals (Revised Code of Washington [RCW] 70.235.020). As part of its plan to reduce GHG emissions, the State has also adopted vehicle miles traveled (VMT) benchmarks (RCW 147.01.440) as one strategy to reduce transportation sector GHG emissions. Guidance on how to address GHG emissions in environmental documents prepared to meet the State Environmental Policy Act (SEPA) requirements is currently being developed. In the meantime, WSDOT is evaluating GHG emissions according to its *Guidance for Project-Level Greenhouse Gas and Climate Change Evaluations* (WSDOT 2009b).

The energy analysis estimated the amount of energy that will be consumed during project construction and the amount of energy that will be consumed by vehicles operating in the study area under both the Build Alternative and No Build Alternative.

How was information collected and what methods were used to evaluate effects?

The project team investigated energy use characteristics at both the state level and the project level. Where detailed information about energy use in the project vicinity was not available, the project team used state-level trends to help describe energy consumption at the local level. The analysis

focused on energy use associated with the proposed project and study area and did not consider energy-related effects to refineries or utilities.

The team used the guidance in Chapter 440 of WSDOT's *Environmental Procedures Manual* (WSDOT 2008b) to estimate the likely energy-related effects of the alternatives. The project team also used information provided in *Energy and Transportation Systems*, a report by the California Department of Transportation (CALTRANS 1983).

During construction of the proposed project, energy will be consumed by site preparation and construction activities, including equipment operation and construction lighting. The team used construction cost estimates provided by WSDOT to calculate energy consumption during the construction period. The analysis focused on energy use associated with the proposed project and project site.

The team then estimated the amount of energy consumed by vehicles using the facility on a broad level to approximate the amount of energy used by each alternative. Energy consumption estimates were based on travel forecasts generated by the traffic analysis (see Appendix Q, Transportation Discipline Report). The direct effects analysis includes energy consumption calculations using VMT as an indicator of volume and energy consumption rates and as an indicator of energy use. The analysis does not include the variables of traffic operations at interchanges, arterials, or local intersections.

To convert million British thermal units (MBtu) to gallons of gasoline, the total MBtu values for passenger vehicles were divided by 124,000. To convert MBtu to gallons of diesel, the total MBtu values for heavy trucks and transit buses were divided by 139,000.

What are the characteristics of the study area?

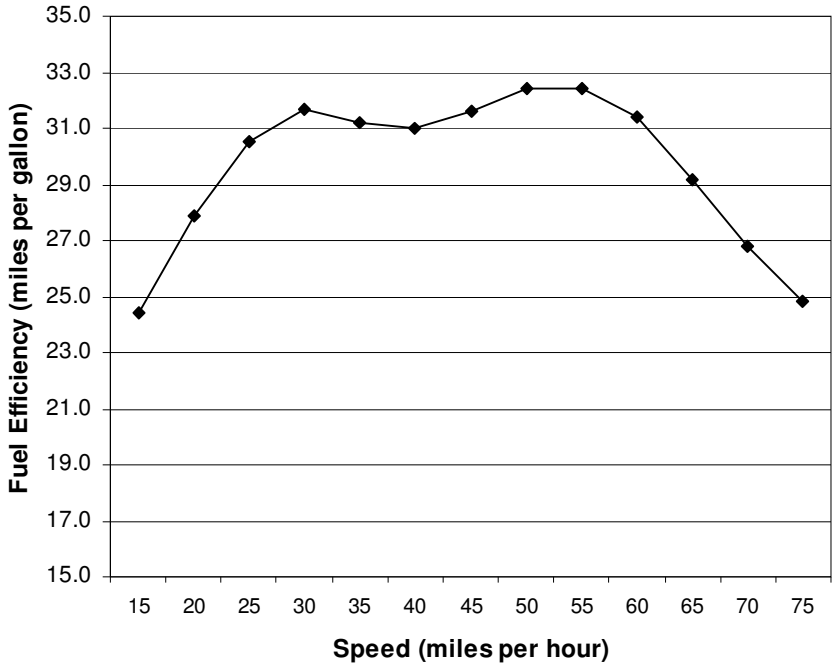
The study area for the energy analysis is the same as the study area for the traffic operations analysis—the SR 520 highway and local interchanges from the east side of the Lake Washington shoreline to the SR 520/SR 202 interchange. The study area includes the entire SR 520 corridor because the

traffic model included all vehicle trips across Lake Washington from the beginning of the trip at one end of SR 520 to the other end of SR 520. For example, if a passenger vehicle was traveling from Redmond to Seattle via SR 520, the entire trip along the SR 520 corridor was included in the traffic data and used in the energy analysis.

The SR 520 corridor is heavily used and frequently congested with traffic because it is one of only two crossings that serve residents, commuters, and other travelers across Lake Washington. The corridor is home to some large organizations whose employees and customers travel SR 520 to get to and from their places of work or destination. SR 520 is also considered a freight route. The congestion level indicates that the available roadway capacity is fully used, and traffic is forced to operate at lower speeds and with limited maneuverability.

Excessive idling and stop-and-go traffic conditions substantially reduce fuel economy compared with free-flow conditions. Because of the current conditions in the study area, there are many times throughout the day when the study area is congested and vehicles operate at inefficient speeds. Exhibit 5-14 shows the average miles per gallon (mpg) for cars and pickups traveling at speeds of between 15 and 75 miles per hour (mph). The data presented in Exhibit 5-14 are based on the results of an FHWA test and are presented for illustrative purposes to show the effect of vehicle speed on fuel efficiency. As shown, fuel efficiency is greatest when passenger vehicles are traveling between 30 and 55 mph.

Because of traffic congestion, the existing average travel speed of all vehicles driving in the study area is 29 mph. According to the Transportation Discipline Report (see Appendix Q), vehicles drive approximately 1.7 million miles daily along the SR 520 corridor, for an annualized estimate of 562 million miles. Nearly 4.0 million British thermal units (Btu) of energy are consumed by vehicles in the study area each year. Approximately 31.2 million gallons of fuel are consumed each year in the study area.



Source: DOE (2008)

Exhibit 5-14. Average Automobile Fuel Consumption Rate

How will project construction temporarily affect energy use?

During construction of the proposed project, energy will be consumed by site preparation and construction activities, including equipment operation, and by providing construction lighting.

The amount of energy used during project construction will be roughly proportional to the size and cost of the project. The construction cost for the Build Alternative in 2012 dollars is estimated at $581,000,000. The project will consume approximately 2.8 MBtu. The energy consumed during construction will be spread out over the entire construction period of approximately 4 years.

How will project operation permanently affect energy use?

Operational effects were calculated using the total energy consumed by cars, heavy trucks, and transit buses post-construction and total VMT. During operation, annual VMT in the study area under the Build Alternative will be approximately 805 million based on 2030 projections. By comparison, the VMT under the No Build Alternative will be approximately 806 million, or 0.1 percent more than for the Build Alternative.

What are greenhouse gas emissions?

Vehicles emit a variety of gases during their operation; some of these are GHGs. The GHGs associated with transportation are water vapor, carbon dioxide (CO_2), methane (also known as "marsh gas"), and nitrous oxide (used in dentists' offices as "laughing gas"). Any process that burns fossil fuel releases CO_2 into the air. CO_2 makes up the bulk of the emissions from transportation.

Vehicles are a major source of GHG emissions and contribute to global warming, primarily through the burning of gasoline and diesel fuels. National estimates show that the transportation sector (including on-road vehicles, construction activities, airplanes, and boats) accounts for almost 30 percent of total domestic CO_2 emissions. However, in Washington state, transportation accounts for nearly half of GHG emissions because Washington relies heavily on hydropower for electricity generation. Most other states rely on fossil fuels such as coal, petroleum, and natural gas to generate electricity. The next largest contributors to total GHG emissions in Washington are fossil fuel combustion in the residential, commercial, and industrial sectors at 20 percent; and electricity consumption, also 20 percent. Exhibit 5-15 shows the gross GHG emissions by sector, nationally and in Washington state.

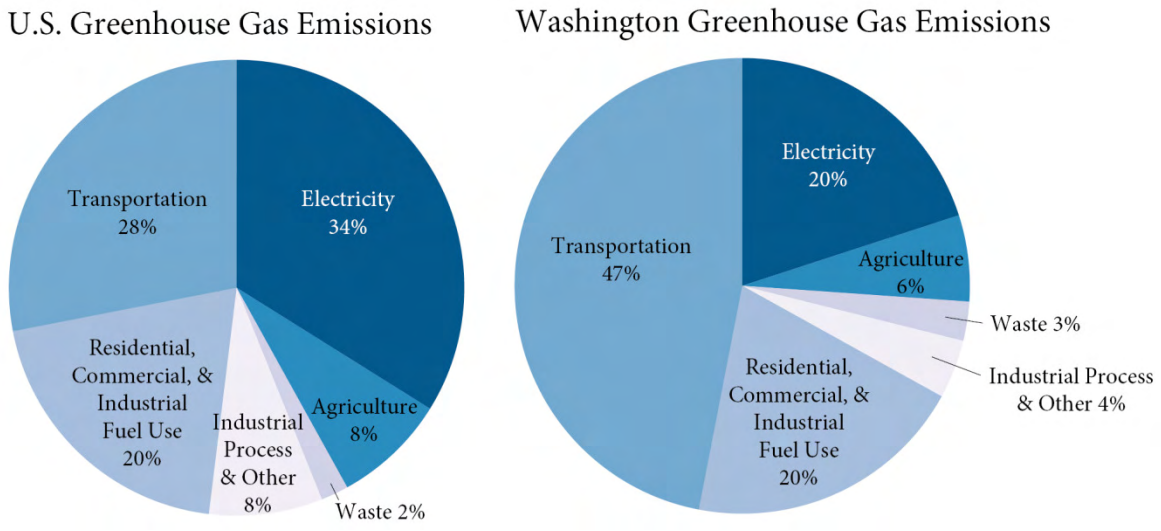


Exhibit 5-15. Greenhouse Gas Emissions by Sector, U.S. and Washington State (Ecology and CTED 2007)

Efforts to Reduce Greenhouse Gas Emissions in Washington State

In 2007, Governor Gregoire and the Washington State Legislature set GHG reduction goals for Washington state:

- 1990 greenhouse gas levels by 2020
- 25-percent reduction below 1990 levels by 2035
- 50-percent reduction by 2050

Also in 2007, the Climate Advisory Team was formed by Governor's Executive Order 0702 to find ways to reduce GHG emissions. The final report included 13 broad recommended actions.

The Legislature passed and the Governor signed House Bill 2815 in spring 2008. This bill includes, among other elements, statewide per capita VMT reduction goals as part of the state's GHG emission reduction strategy.

This bill also established the Climate Action Team, a group similar to 2007's Climate Advisory Team. This group refined the 2007 broad recommendations into specific actions the state can take to reduce emissions. WSDOT worked as a member of this group on strategies to reduce VMT and on how to include climate change in SEPA evaluations.

In addition to working with others in Washington state, WSDOT is leading the development of effective, measurable, and balanced emission reduction strategies. Current WSDOT activities that reduce GHG emissions include the following:

- **Transportation Options.** For 30 years, WSDOT has supported carpooling, vanpooling, and public transportation through the funding, building, and maintenance of the freeway HOV system, ferries, rail, and other programs. WSDOT's Commute Trip Reduction program has been partnering with employers to offer alternatives to drive-alone commuting for 17 years, and WSDOT has the nation's largest public vanpool program. These programs continue to expand, and with recent high gas prices demand for these programs has surged. These investments help reduce the number of vehicles on the roadway during peak congestion and help reduce VMT.
- **Incident Response Team (IRT).** WSDOT has 55 vehicles that patrol 500 miles of highway to clear blocking incidents quickly and safely. IRT clears 98.6 percent of all incidents in less than 90 minutes, reducing the amount of time motorists spend sitting and idling in traffic.
- **Using Biodiesel in Ferries.** Each year, the state ferry system burns approximately 17 million gallons of diesel fuel in its ferries, making the agency a significant fuel consumer in Puget Sound. In March 2008, Washington State Ferries began testing the use of biodiesel in the marine environment. Using biodiesel instead of traditional petroleum-based fuels reduces emissions of particulate matter and GHGs, improving both local air quality and the earth's climate.

In addition to working to reduce emissions on the transportation network, WSDOT is also taking action to reduce the agency's emissions. Steps include the following:

- **No Idle Policy.** In 2006, WSDOT adopted a no-idle policy to reduce fuel use and vehicle emissions. WSDOT estimates that by reducing vehicle idling by 50 percent, the agency can save as much as $500,000 annually in fuel costs.
- **Reducing diesel emissions.** In 2005, WSDOT started using 5-percent biodiesel mixed with regular diesel in maintenance vehicles operating in the Central Puget

Sound area. Currently, 25 WSDOT fueling stations have 10-percent biodiesel available, and WSDOT is working toward using 20-percent biodiesel, depending on availability.

WSDOT and its partners are also actively implementing the 2005 Transportation Partnership Act, a 16-year plan to meet Washington state's most critical transportation needs. Many of these local, regional, and statewide transportation system improvements, in conjunction with ongoing programs, help to reduce the number of miles that vehicles need to travel each year. Together, these efforts combine to create more efficient driving conditions, offer mode choices, and help move WSDOT toward state GHG reduction goals.

How much greenhouse gas will the project produce during construction?

It is estimated that project construction will produce 209,000 metric tons (MT) of carbon dioxide equivalent (CO_2e) emissions. These emissions will be spread over the duration of construction.

The emissions estimate is based on the results of the energy analysis. Since the energy analysis is based on applying an energy conversion factor to project costs, GHG emissions are directly proportional to project costs. This methodology does not rely on an in-depth analysis of construction techniques and equipment. Actual emissions will depend on the type of equipment used and construction methods chosen.

How much greenhouse gas will be produced during project operation?

Exhibit 5-16 shows the total estimated CO_2e emissions produced during peak periods on weekdays (5:30 am to 10:15 am and 3:00 pm to 7:45 pm). These periods were compared because they are the most congested times of day. Congestion decreases fuel economy and increases GHG emissions. Changes in the roadway configuration will have the greatest effect on traffic during these time periods because of the large number of vehicles on the road and greater likelihood for congested conditions.

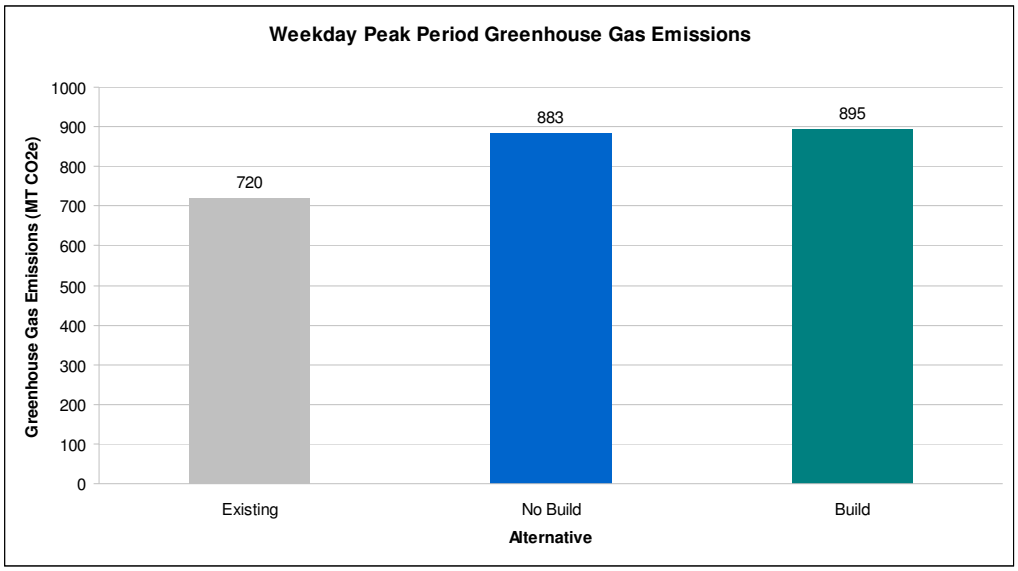


Exhibit 5-16. Daily Peak Period GHG Emissions – Metric Tons Carbon Dioxide Equivalents

The operational emissions values represent only those emissions during the peak periods on weekdays. Additional emissions are released during non-peak hours and on the weekends. Because traffic data were not available for these periods, this analysis does not include these emissions. This data limitation also precludes the calculation of annual GHG emissions for this project. However, since the weekday peak travel hours are the highest CO_2e emitting periods, the daily comparison is expected to reflect annual trends.

Although this analysis does not include any project effects to roadways other than SR 520, it is important to note that conditions on SR 520 influence, and are influenced by, traffic on other roadways in the region. The overall effect of the project on GHG emissions in the region could be lower or higher than the figures reported.

The Build and No Build Alternatives will result in similar quantities of emissions because they will affect traffic in similar ways. With both alternatives, additional traffic leads to increased congestion and more vehicles traveling below 30 mph. Vehicles traveling at below about 30 mph are less efficient than vehicles traveling at somewhat higher speeds.

What will happen to greenhouse gas emissions if WSDOT does not build this project?

Under the No Build Alternative, no road improvements to reduce traffic congestion will be implemented. GHG emissions will be similar for the Build Alternative and the No Build Alternative.