3.6 Energy and Climate Change

When energy is used to build or provide something, it cannot be recovered. Building the pontoon construction facility at Grays Harbor, fabricating the pontoons at the Grays Harbor facility, building pontoons at the CTC facility in Tacoma, and transporting the pontoons to their moorage locations would consume energy that would no longer be available for other purposes. These activities would also emit greenhouse gases during project construction and operation. This section discusses trends in energy use and consumption and how energy consumption associated with the project could be kept to a minimum.

What is the Energy Technical Memorandum?

This section was derived from Appendix H, Energy Technical Memorandum, which includes complete information on energy issues related to the proposed SR 520 Pontoon Construction Project.

Has any new information been developed since the Draft EIS?

No new issues related to energy and climate change were introduced and WSDOT did not conduct any new analysis beyond that which was done for the Draft EIS, although some energy use calculations were revised to reflect changes in project design since the Draft EIS.

What energy conditions are in the study area?

CTC Facility

Tacoma Power provides electricity to Tacoma and part of Pierce County and serves the CTC facility, which encompasses the study area for the CTC facility. In 2007, Tacoma Power averaged 165,122 customers and sold 6.8 million megawatt hour (MWh) of energy, producing revenues of $366 million. Tacoma Power produces or purchases power from a variety of sources, but hydroelectric power dominates the mix. Nuclear power represents 8 percent, coal 1 percent, and other sources 1 percent. As the area has continued to develop over the years, the demand for energy has increased.

Grays Harbor Build Alternatives

WSDOT used Grays Harbor County data to help determine local energy trends. Grays Harbor Public Utility District currently serves area energy needs. The public utility district had 41,414 customers in 2006 and sold 1.8 million MWh of energy, producing revenues of $113 million from energy sales. Its energy sources include 78 percent hydroelectric, 15 percent natural gas, 12 percent wood waste, and 1 percent wind. As the Grays Harbor region has continued to develop over the years, energy consumption and demand have increased in the study area, which encompasses both build alternative sites and Grays Harbor County.

Washington State Trends

According to the Washington State Department of Commerce, Washington's per capita energy consumption was approximately 200 million British thermal units (MBtus) in 2005 after averaging close to 250 MBtu from 1970 through 1999. The drop in per capita energy consumption was due to decreased energy use in some energy-intensive industries (for example, aluminum) and to higher energy prices (CTED 2009). Washington's economy is also becoming less energy-intensive because of improved technology, efficiency increases, and a shift from natural resource manufacturing to less energy-intensive industries such as software and biotechnology. Washington's per capita average energy consumption in 2005 was below the national average of 232 MBtus.

The passage of the national Energy Independence and Security Act of 2007 (Pub.L. 110-140), which revised fuel efficiency standards, is expected to lead to an increase in new vehicle fuel efficiency in the future. This Act mandates that, by 2020, the fuel economy of all new cars, trucks, and SUVs will be 35 miles per gallon (mpg). On May 19, 2009, President Barack Obama announced a national auto fuel efficiency program that will require an average fuel economy standard of 35.5 mpg by 2016 (White House 2009).

Greenhouse gas emissions 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 carbon dioxide emissions. In Washington, transportation accounts for nearly half of greenhouse gas emissions because the state relies heavily on hydropower for electricity generation. Other states rely on fossil fuels such as coal, petroleum, and natural gas to generate electricity. The next largest contributors to total greenhouse gas emissions in Washington are fossil fuel combustion in the residential, commercial, and industrial sectors at 20 percent and in electricity consumption, also 20 percent.

Fuel Consumption

Most energy consumed during project construction would be in the form of diesel fuel consumption from trucks transporting site materials, construction products, and other items to and from the site. Detailed fuel consumption data are not available at the county level; therefore, WSDOT included a discussion of statewide fuel consumption. In 2007, the transportation sector in the state of Washington consumed approximately 338 trillion British thermal units (Btus) of gasoline and approximately 143.2 trillion Btus of distillate fuel (EIA 2009a, b). Distillate fuel includes diesel fuel and fuel oils, including on-highway diesel engines for trucks and cars as well as off-highway diesel engines such as railroad locomotives.

How did WSDOT evaluate the direct effects on energy?

WSDOT used guidance in its *Environmental Procedures Manual* (WSDOT 2008b) and information in the California Department of Transportation's *Energy and Transportation Systems Manual* (CALTRANS 1983) to estimate the energy-related effects of the project build alternatives. The amount of energy used during project construction is roughly proportional to project costs; therefore, to estimate how much energy would be consumed to build a new pontoon casting basin facility, WSDOT started with the total estimated construction cost for each alternative site, and then applied an energy consumption factor developed for similar facilities. A portion of the energy consumed during casting basin facility construction would be associated with the amount of excavation and truck hauling trips. The construction cost estimates include the cost associated with these activities.

What is an energy consumption factor?

Energy consumption factors convert project costs to energy. These factors assign an energy-to-dollar ratio for construction projects and represent the energy consumed for each construction dollar spent.

Energy consumption factors include energy consumed during site preparation, mining and production of construction materials (such as Portland cement used in concrete and iron used in rebar), and transportation of materials and equipment to and from the construction site. Materials, quantities, and haul requirements would vary from one site to another, and these variances are reflected in the cost estimates to construct the new casting basin facility at each build alternative site.

During pontoon construction, WSDOT would consume energy to construct the pontoons and then tow them from the casting basins to temporary moorage locations. To estimate the diesel fuel consumed during pontoon transport, WSDOT applied these assumptions:

- The diesel fuel consumption rate would be 150 gallons per hour of operation. (WSDOT 2005).
- The average towing speed for transporting pontoons would be 3 miles per hour.
- One tugboat would tow each pontoon from its casting basin to the moorage location.
- The distances from the casting basins to the temporary moorage locations would be the following:
  - CTC site: 25 miles (to an existing marine berth in Puget Sound)
  - Anderson & Middleton site: 5 miles (to a Grays Harbor open-water location)

- Aberdeen Log Yard site: 8 miles (to Grays Harbor open-water location)

Other energy needs include manufacturing anchor chain and anchors used to store the pontoons in open water, and a small amount of energy used to light the pontoons at night.

How would construction of the casting basin directly affect energy use?

Assuming the site construction energy was consumed evenly over the 3-year construction period, the average level of energy consumption would represent a fraction (approximately 0.2 percent) of total annual gasoline and distillate fuel consumption in Washington (EIA 2009a, b). Given this, WSDOT would not expect construction of the casting basin to have a substantial effect on energy resources. Exhibit 3.6-1 presents the estimated onsite energy that would be used for casting basin facility construction. The energy consumption estimates during construction are based on the construction costs, and the construction cost estimates include the cost of hauling material to and from the site.

How can energy uses be compared?

The average U.S. car uses 69 MBtu per year; the average U.S. home uses 135 MBtu per year.

Source: EIA 2009b.

EXHIBIT 3.6-1
Site Construction Onsite Energy Use and Cost

Site	Energy Used in MBtus (gallons diesel fuel)	Cost Estimate (U.S. dollars)
CTC Facility[a]	-	N/A
Aberdeen Log Yard (Preferred Alternative)	679,000(4,900,00)	85,800,000
Anderson & Middleton	754,000 (5,400,000)	95,200,000

[a]CTC site construction is not part of this project because it already exists.
Note: 1 gallon of diesel fuel = 139,000 Btus
MBtu million British thermal unit

Aberdeen Log Yard Alternative (Preferred Alternative)

Excluding sales tax and construction engineering costs, Aberdeen Log Yard Alternative construction costs would be approximately $85.8 million. Energy consumed during casting basin construction at this site would be approximately 679,000 MBtus (based on preliminary estimates). This is equivalent to the energy used by 7,200 households during one year (based on conversion factor of 135 MBtu per year per household) (EIA 2009d).

Anderson & Middleton Alternative

Construction costs for the Anderson & Middleton Alternative would be approximately $95.2 million (based on preliminary estimates), excluding sales tax and construction engineering costs. The construction cost estimate is higher for this alternative because of required design variation to the foundation, which would be more expensive at the Anderson & Middleton site. The energy consumed during construction of the casting basin at this site would be approximately 754,000 MBtus, which is equivalent to the energy used by 7,900 households during one year (based on a conversion factor of 94.9 MBtu per year per household) (EIA 2009c).

How can energy sources be converted to Btu?

1 gallon of gasoline = 124,000 Btu

1 gallon of diesel fuel = 139,000 Btu

1 kilowatt hour = 3,412 Btu

How would pontoon-building operations directly affect energy use?

Exhibit 3.6-2 presents the estimated onsite energy that would be used for pontoon construction.

EXHIBIT 3.6-2
Pontoon Construction Onsite Energy Use and Cost

Site	Pontoon Construction		Cost Estimate (U.S. dollars)
	MBtus	Diesel Fuel (gallons) [1]	
CTC Facility	245,000	1,800,000	55,100,000
Aberdeen Log Yard (Preferred Alternative)	1,495,000	10,500,000	273,500,000
Anderson & Middleton	1,495,000	10,500,000	273,500,000

[1] gallon of diesel fuel = 139,000 Btus
MBtu million British thermal unit

CTC Facility

The cost of manufacturing pontoons at the CTC facility would be approximately $55 million. Energy consumed by building the pontoons and moorage anchors at the CTC facility for about 2 years would be approximately 245,000 MBtus.

Grays Harbor Build Alternatives

The cost of manufacturing pontoons at either build alternative site at Grays Harbor would be approximately $275.3 million. WSDOT would consume approximately 1.5 million MBtus of energy when building the pontoons at either build alternative site. Assuming the energy consumed during pontoon fabrication was evenly consumed over the 3-year construction period, the average estimated energy consumption needed to manufacture the pontoons is estimated to be approximately

0.02 percent of total annual energy consumption in Washington in 2007, the most recent year for which data are available (EIA 2009a, b). WSDOT does not expect that pontoon construction would substantially affect energy resources.

How would pontoon moorage directly affect energy use?

CTC Facility

The estimated diesel fuel calculation and energy use to transport the pontoons from CTC to temporary moorage are 10,050 gallons and approximately 1,400 MBtus, respectively.

Grays Harbor Build Alternatives

From the Anderson & Middleton site, the estimated diesel fuel consumption and energy used to tow the pontoons to their proposed offsite moorage location (see Exhibit 2-7 in Chapter 2) is 4,050 gallons and approximately 600 MBtus. From the Aberdeen Log Yard site, the fuel consumption and energy used would be 6,450 gallons and approximately 900 MBtus. When anchored at their moorage locations, WSDOT would illuminate the pontoons with navigation lighting at night and during poor visibility. The amount of energy consumed during illumination is expected to be minor when compared to the energy consumed during the manufacturing of the pontoons.

How would the Grays Harbor build alternatives compare in their direct effects on energy?

Exhibit 3.6-3 summarizes and compares the direct energy effects of the Anderson & Middleton Alternative with the Aberdeen Log Yard Alternative.

What indirect effects would the project have on energy?

Indirect effects related to energy consumption would occur if constructing and operating the project were to cause substantial effects on other resources, such as air quality, or affect the region’s ability to meet the energy needs. Because this project would likely make a minimal contribution to energy usage regionwide and would not result in the need to generate more energy, no negative indirect effects on other resources are expected.

EXHIBIT 3.6-3
Energy Summary of Direct Effects

	Aberdeen Log Yard Alternative (Preferred Alternative)	Anderson & Middleton Alternative
Casting basin construction	Total energy consumption during construction of the casting basin facility would be approximately 679,000 MBtus.	The energy consumption to construct the casting basin facility would be approximately 745,000 MBtus.
Pontoon-building operation	Total energy consumption during pontoon building operations would be approximately 1.5 million MBtus.	Effect would be the same.
Pontoon Moorage	Total energy consumption during towing from the casting basin facility to outer Grays Harbor would be approximately 900 MBtus.	Total energy consumption during towing from the casting basin facility to outer Grays Harbor would be approximately 600 MBtus.

MBtus million British thermal units

How would energy use be affected if the project were not built?

Under the No Build Alternative, the CTC casting basin facility would continue to be used for other industrial activities. No energy would be consumed at the Anderson & Middleton Alternative site because no facility is currently located there. The Aberdeen Log Yard Alternative site would likely continue to be used for log storage and other industrial purposes. No project-related energy would be consumed under the No Build Alternative.

What would the cumulative effect on energy use likely be?

WSDOT's use of the CTC facility in Tacoma and the proposed construction and operation of a Grays Harbor casting basin facility to build pontoons would consume energy and emit greenhouse gases into the atmosphere. While the relative contribution from the project would be small when compared with the statewide greenhouse gas emissions, the project would still contribute to a cumulative effect when added to the other planned projects within the study areas that would consume energy. Energy consumption and greenhouse gas emissions are two factors contributing to climate change. The sections below discuss the projects' potential contribution to climate change.

What is climate change, and what are greenhouse gas emissions?

Internal combustion engines, including those of motor vehicles, aircraft, railway locomotives, ships and power boats, and construction equipment, emit a variety of gases; some of these gases are greenhouse gases. Greenhouse gases associated with transportation are water vapor, carbon dioxide, methane (also known as “marsh gas”), and nitrous oxide (used in dentists’ offices as “laughing gas”). Any process that burns fossil fuel releases carbon dioxide into the air. Carbon dioxide comprises the bulk of the emissions from transportation.

National estimates show that the transportation sector (including on-road vehicles, construction activities, airplanes, and boats) accounts for almost 30 percent of total domestic carbon dioxide emissions. In Washington, a higher proportion of greenhouse gas emissions—nearly 50 percent—comes from vehicles because our state relies heavily on hydropower for electricity generation. Most other states rely on fossil fuels, such as coal, petroleum, and natural gas, to generate electricity.

In 2007, Governor Gregoire and the state legislature set the following greenhouse gas reduction goals for Washington:

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

Also in 2007 the Climate Advisory Team was formed by Governor’s Executive Order 07-02 to find ways to reduce greenhouse gas emissions. The final report included 13 broad recommended actions.

The Washington state legislature passed and the Governor signed House Bill 2815 in the spring of 2008. This bill includes, among other elements, statewide per capita vehicle miles traveled reduction benchmarks as part of the state’s greenhouse gas emission reduction strategy. This bill also established the Climate Action Team, a group similar to the 2007 Climate Advisory Team. This group refined the Climate Advisory Team’s broad recommendations into specific actions the state can take to reduce emissions. WSDOT worked as a member of this group on strategies to reduce vehicle miles traveled and on how to include climate change in SEPA evaluations. In 2009, Governor Gregoire signed Executive Order 09-05, which includes direction to WSDOT to continue developing greenhouse gas reduction strategies for the transportation sector. WSDOT is leading the development of effective, measurable, and balanced emission reduction strategies.

What are vehicle miles travelled?

Vehicle miles travelled—or VMT—is the number of miles vehicles travel each year. For transportation projects with set boundaries, VMT can refer to the aggregate number of miles that all the vehicles travel using the specified roadways. Per person (or per capita) VMT in Washington has been stable at 9,000 miles per person since the 1980s, meaning the statewide VMT has grown at roughly the same pace as population. Methods of reducing VMT typically target transferring trips from single-occupant vehicles to multiple person vehicles like carpools, vanpools, and transit. VMT can also be lowered by reducing the distance of travel through changes in land use.

How did WSDOT calculate greenhouse gas emissions for project construction and operation?

Energy use during facility construction and pontoon manufacture would be the main source of greenhouse gas emissions from this project.

Greenhouse gas emissions, which are reported in terms of carbon dioxide equivalent (MT CO_2e), would be proportional to the amount of energy used. Project engineers expect that energy needs to construct the Grays Harbor casting basin facility would be met with diesel fuel. During pontoon manufacturing at the CTC and Grays Harbor facilities, energy needs would be met with a combination of electrical and diesel-fueled power in an approximately 80/20 split. The actual proportion of electrical to diesel-fueled power could deviate from these estimates based on the equipment and construction methods actually used.

The results of the energy analysis (see Exhibit 3.6-1) were converted to gallons of diesel fuel and kilowatt hours of electricity based on the factors of 139,000 Btu per gallon diesel and 3,412 Btu per kilowatt hours (EIA 2009e).The results of the energy analysis include fuel needed to transport materials to the site and remove excavated materials. The quantity of diesel fuel needed to tow pontoons to temporary moorage sites was calculated separately.

What effect would the project have on greenhouse gas emissions?

CTC Facility

WSDOT's use of the CTC casting basin facility to build pontoons would release an estimated 27,000 MT CO_2e total. These emissions would be spread out over the duration of the project.

Grays Harbor Build Alternatives

Total greenhouse gas emissions resulting from constructing and operating the casting basin facility at the Anderson & Middleton Alternative site—including emissions from haul trucks—would be an estimated 245,000 MT CO_2e; using the Aberdeen Log Yard Alternative site would contribute an estimated 239,000 MT CO_2e. Thus, greenhouse gas emissions from constructing and operating the Anderson & Middleton Alternative site would be about 2 percent higher than from using the Aberdeen Log Yard Alternative site; this difference falls within the margin of error for current methodologies. The methodology used to calculate emissions uses construction costs in the equation. Because construction costs at the Anderson & Middleton site are anticipated to be higher, the calculations for emissions at that site are higher. From the perspective of greenhouse gas emission effects, however, the two sites should be considered equivalent. The project is expected to have a negligible contribution to total greenhouse gas emissions in Washington state during the years this project is in construction and operation.

Exhibit 3.6-4 lists the estimated emissions from each proposed pontoon construction site. The total emissions released from the project would be the sum of emissions from the CTC site and from the selected Grays Harbor alternative site because pontoons would be built at both locations.

EXHIBIT 3.6-4
Project Greenhouse Gas Emissions

Site	Site Construction (MT CO_2e)	Pontoon Construction (MT CO_2e)	Total Emissions[a] (MT CO_2e)
CTC Facility	-	27,000	27,000
Aberdeen Log Yard (Preferred Alternative)	50,000	162,000	218,000
Anderson & Middleton	56,000	162,000	212,000

[a]Totals might not add up due to rounding.

MT CO_2e metric tons carbon dioxide equivalent

At the Grays Harbor casting basin facility, preparing the site and constructing the facility would release about half of the project emissions; the other half would be emitted while manufacturing the pontoons. Based on the project engineers' estimated number of truck trips and potential sources and dumpsites for materials, material transport would likely make up about 2 percent of facility construction emissions and less than 1 percent of pontoon construction emissions.

Did the project consider future conditions related to climate change?

Governor Gregoire committed the state to preparing for and adapting to the effects of climate change as part of Executive Order 07-02. A focus sheet entitled "Preparing for Impacts" (Ecology 2008b) briefly summarizes the key climate changes that Washington is likely to experience over the next 50 years:

- Increased temperature (heat waves, poor air quality)
- Changes in volume and timing of precipitation (reduced snow pack, increased erosion, flooding)
- Ecological effects of a changing climate (spread of disease, altered plant and animal habitats, and negative impacts on human health and well-being)
- Sea-level rise, coastal erosion

The selected site would be graded to allow stormwater to run off the site more easily and protect the site against rises in sea level and from waves during a large storm. If waves overtop the shoreline protection, then the site might close temporarily. WSDOT engineers expect that the site would be reoccupied and any damage would be reparable.

The new casting basin facility would be designed to last indefinitely. As part of its standard design, the project would incorporate the following features to make the facility resilient enough to withstand the potential effects of long-term climate change:

- Protecting the site from damage resulting from wave action during large storm events.
- Protecting the surrounding harbor from potential contamination with waters from inside the casting basin (care will be taken to avoid mixing waters).
- Containing compromised waters in the casting basin with exterior walls tall enough to keep water in the basin from mixing with outside water during large storm events.
- Using native vegetation, driftwood, and other natural materials to protect and stabilize the shoreline in locations exposed to low wave energy, and minimizing erosion and colonization with the use of nonnative, invasive plant species.