4.9 Utilities, Energy, and Electromagnetic Fields

Public and private utilities in the study area provide electricity, water, wastewater management, stormwater collection, natural gas, steam, communications, and telecommunications services. Water lines and high-pressure gas mains, sewer pipes, stormwater facilities, fiber-optic cables, telephone lines and other utilities run parallel beneath streets along the alignment. This section analyzes the short-term construction and long-term operational impacts of the Center City Connector on utility provider and systems that would serve or could be affected by the project.

Project construction activities and operating vehicles, including the proposed streetcar system in the study area, would consume energy. The proposed Center City Connector vehicles would be powered by electricity; therefore, in addition to reviewing impacts on utilities, this section evaluates energy use by the project and potential impacts from electromagnetic fields (EMFs), which are produced wherever electricity is used.

Applicable Regulations

WAC 468-34 provides the accommodation of utilities within roadway rights-of-way. WAC 468-34 provides guidance on design, permits and franchise agreements for incorporating utilities in transportation projects.

4.9.1 Utilities

Electricity, water, sewer, gas, steam, and fiber-optic lines are located within eight feet of the LPA alignment centerlines. Table 4.9-1 lists the utilities, providers, and locations of utilities in the study area, which is defined as the area within public right-of-way where the project trackway, turnback tracks, access tracks, and stations are proposed, as described in Section 3.4.2. The study area also includes the proposed OMF expansion sites and on-site utility connections.

4.9.2 Existing Energy Use and Supply

According to the PSRC traffic model, the existing daily VMT for the study area is approximately 493,000 (PSRC, 2014). The daily energy use for all surface modes of traffic (transit, bus, truck, and automobile) is approximately 2.4 x 109 British thermal units (Btu) (2,440 million Btu [MMBtu]) regardless of the power sources used.

Within the study area, electric power supply is distributed through a combination of overhead and underground electrical lines. In the area of the proposed project, electrical lines are located underground. Overhead electric power trolley contact wires are present throughout the LPA corridor. Most electric trolley buses use First Avenue to turn around before returning on their route.

Vehicle Miles Traveled (VMT) refers to the auto vehicle miles traveled within the region.

Table 4.9-1 Utilities in the Study Area

Utility Type	Provider	Location within Public Right-of-Way	Types of Utilities Present
Electric Power	Seattle City Light	Network and distribution feeder lines are located underground. Depth ranges from 3 feet to 8 feet under pavement.	Lines, underground vaults, and structures
Water	Seattle Public Utilities	Water mains are generally 3 to 6 feet underground and run parallel beneath the street in various locations, but primarily close to the curb line.	Feeder main
Sewer Service	Seattle Public Utilities	Sewer and storm drain pipes are located at least 6 feet below the surface and typically run parallel beneath streets (smaller lines can be less than 3 feet underground). The system includes combined sewers, which collect stormwater runoff, in addition to wastewater.	12-inch vitrified clay pipe and ductile iron pipe 24-inch reinforced concrete pipe with 48-inch steel casing 48-inch brick Manholes
Natural Gas Service	Puget Sound Energy	Gas transmission and distribution pipes are buried underground to depths of 3 to 6 feet.	4-inch intermediate pressure
Seattle Steam	Enwave (formerly Seattle Steam)	Steam service area encompasses roughly a square-mile area of the Seattle's downtown, distributing steam in 2- to 6-inch-diameter lines (depth underground unknown).	8 to 10-inch low-pressure manholes and vaults
Telecommunications	Multiple private companies	Fiber-optic cables and telephone lines in the study area are provided by several private companies and public utilities that own fiber-optic cable and/or provide long-distance and other telecommunication services. Generally, fiber-optic cables and telephone lines are less than 3 feet underground.	Multiple cables and lines

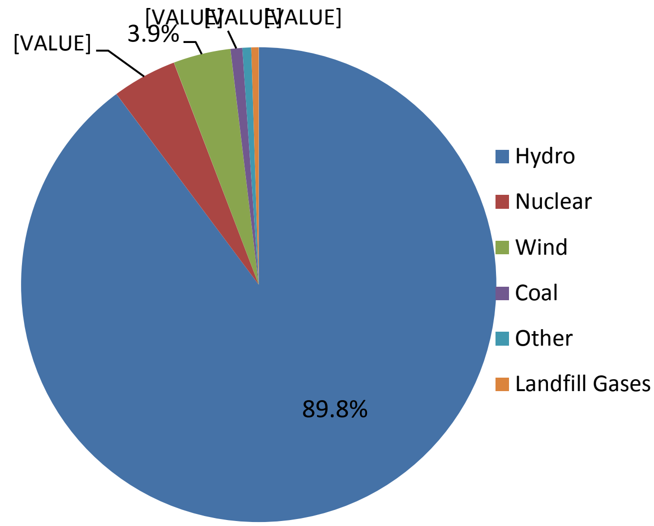
In the City of Seattle, Seattle City Light is the main provider of electricity, which is generated using a number of resources. Some of these are self-generated, with the remaining power purchased from other producers. In 2012, hydroelectric power accounted for nearly 90 percent of the utility's power generation portfolio. Figure 4.9-1 illustrates the utility's energy source mix.

In 2013, Seattle City Light sold approximately 9.5 million megawatt hours to residential and commercial customers (Seattle City Light, 2013). Of this total, the utility had about 6.1 million megawatts of company-controlled power-generating capacity.

The remaining power supply came from long-term contracts and wholesale power contracts with other providers, including Bonneville Power Administration, other utilities, independent power producers, and energy marketers across the western United States. Seattle City Light has achieved net-zero carbon emissions every year since 2005 (Seattle City Light, 2013).

Puget Sound Energy provides natural gas in the study area, which is used for electricity generation and heating. Puget Sound Energy's network consists of transmission and distribution pipes, pressure controls, meters, and service lines. Natural gas mains, along with distribution and service lines, are located within the study area.

Figure 4.9-1 Seattle City Light Electricity Generation by Type, 2012



Enwave (formerly Seattle Steam) is a district heating utility franchised by the City. Its service area encompasses roughly a square-mile area of the Central Business District, extending from Blanchard Street to King Street and from the waterfront to 14th Avenue, crossing First Hill. The company provides steam to commercial, residential, and institutional customers for space and hot water heating, along with other uses, via a system of pipes running through street rights-of-way.[1]

4.9.3 Electromagnetic Fields

EMFs are produced wherever electricity is used. EMFs create electromagnetic interference, which can cause disruptions and possibly malfunctions in some types of equipment. In addition, EMF can interfere with utilities, causing corrosion and reducing the effective life of the utilities. Power lines, overhead trolley bus cables, and the passing of truck traffic can all result in EMF in the project corridor.

4.9.4 Impacts

4.9.4.1 No Build Alternative

The No Build Alternative would not result in the relocation or disruption of any utility, nor would it result in additional energy demands. However, without new transit options, energy use, in the form of fossil fuels, would continue to rise to accommodate the transportation needs for the projected growth in population and commerce in Seattle. Although motor vehicles are becoming more efficient, the growth expectancy in Seattle would result in high demands on energy use for inner-city travel movements. Energy use is calculated by computing the number of vehicle miles traveled (VMT) using an average energy consumption per vehicle mile for the region in 2035. Using 2035 projected VMT, the No Build Alternative would require 2,974

[1] Enwave Seattle is a district energy system. In a district energy system, heat is produced at a centralized plant that generates steam (by burning natural gas, diesel oil and recycled wood) and distributes it via underground lines to nearby buildings.

MMBtus of energy (see Table 4.9-2). The No Build Alternative would not result in new sources of electromagnetic interference.

Table 4.9-2 Projected Daily VMT and Energy Consumption for 2035

Mode	Consumption Factor [a]	2035 No Build		2035 LPA		% Change in MMBtu from No Build Alternative
		Daily VMT	MMBtu	Daily VMT	MMBtu	
Automobile, Bus, and Truck Vehicles	4,949	601,000	2,974	598,000	2,960	-0.5%

[a] Consumption factor: MMBtu/vehicle mile

4.9.4.2 Locally Preferred Alternative

Operational Impacts

This section discusses how operation of the LPA may affect access to utilities in the roadway, use of electric power and water utilities, whether overall energy expenditure would change, and potential for EMF effects.

Utilities

The streetcar would be designed to avoid long-term conflicts with access to utilities for maintenance and repair. Utilities would remain in place wherever possible. Table 4.9-3 lists the range of changes to and relocations of utilities necessary to avoid conflicts during streetcar operation.

Table 4.9-3 Impacts on Utilities

Utility Type	Provider	Types of Utilities Present	Relocation or Change to Utilities
Electric Power	Seattle City Light	Lines, underground vaults, and structures	Replacing duct bank at intersection crossings on 1st Ave at Pike, Pine, and Stewart. Replacing duct bank at intersection and alley crossings on Stewart at 1st/2nd Alley, 2nd/3rd Alley, 3rd Ave, 3rd/4th Alley, and 5th Ave.
Water	Seattle Public Utilities	Feeder main	Relocation of feeder main on 1st Ave between Stewart and Jackson St and on Stewart Street between 3rd and 4th Ave.
Sewer Service	Seattle Public Utilities	12-, 6-, and 8-inch vitrified clay pipe and ductile iron pipe	No pipe relocation necessary; however, inlets at intersection may be rebuilt.
		24-inch reinforced concrete pipe with 48-inch steel casing	No relocation necessary.
		48-inch brick	No relocation necessary.

Utility Type	Provider	Types of Utilities Present	Relocation or Change to Utilities
		Manholes	Reconstruction of manholes for the top 4 to 8 inches when located within the track slab.
Natural Gas Service	Puget Sound Energy	4-inch intermediate pressure	Relocation of gas lines would to be outside of trackway throughout project limits.
Seattle Steam	Enwave (formerly Seattle Steam)	8- to 10-inch low-pressure manholes and vaults	Minor repair of expansion vault chambers (3- to 5-foot depth) from Washington to Cherry St.
Tele-communications	Multiple private companies	Multiple cables and lines	No relocation necessary.

Necessary utility connections are operational at both of the proposed OMF expansion sites. A new annex building at the South Lake Union OMF would include connections to sewer, water, and electric power. This would not be an expansion of service, because these utilities are already connected to the existing building that the smaller annex building would replace. Expansion of utility service areas would be limited to power required for OCS lines and potentially to expanding the on-site storm drainage detention systems.

The existing OMFs' drainage systems are designed to filter and recycle a high percentage of the wash and rinse water; solids, oils, soaps, and other contaminants would be filtered, settled to a sludge tank, and periodically hauled for disposal in accordance with regulations.

Some disposal to the local sanitary sewer system would be expected from the recycled, filtered washwater (see Section 4.8, Stormwater/Water Quality, for more detail on stormwater detention and treatment). The water discharged to the sanitary sewer system is and would continue to be disposed of according to local and state regulations.

Washing the additional streetcar vehicles would not affect the water providers' existing and projected water supplies because no changes would be required to the existing utility system to meet the additional demand.

Energy Demands

Operation of the Center City Connector would be a new demand on the local electrical utility, Seattle City Light. The operation of the new line is expected to require one or two additional TPSS, each of which would likely have a maximum power draw of 350 kilowatts, with a short-term overload capability of 200 percent. This represents less than 0.1 percent of the total Seattle City Light power-generating capacity. Lighting and the OMF operations would also require electricity; however, by removing the existing building and replacing it with a smaller annex building, overall power use may be reduced for this property. Seattle City Light has planned for an adequate supply to service the proposed power demands projected through 2035 and beyond. Consequently, operation of Center City Connector is not expected to have a substantial impact on the demand of the electric utility.

The LPA would alter the mixture of transportation modes in downtown Seattle by shifting some trips from motor vehicles to transit. This in turn would alter total use of energy, because streetcars, which are powered by electricity, can carry more passengers using less energy resources than the automobile. Due to the array of destinations and origins, energy attributed to transportation can only be computed at the regional scale, which may not reflect all the shifting of trips internal to the City of Seattle. Table 4.9-2 (on page 4.9-4) presents the daily projected 2035 regional VMT with the LPA operational and with the No Build Alternative (see *Center City Connector Transportation Technical Report (SDOT, 2015)* for more detail on VMT projections). When compared to the No Build Alternative, the LPA would result in a slight reduction of the region's passenger VMT and therefore less energy consumption as people shift to more energy-efficient streetcar and transit options. Using only the regional model, energy use during project operation would result in approximately 0.5 percent less energy use than the No Build Alternative.

Electromagnetic Fields

No negative impacts caused by EMFs from the streetcar are anticipated. There are no known EMF-sensitive facilities, such as buildings housing highly sensitive equipment, that could be affected by EMFs from the LPA electrical system, including the OCS and TPSS, nor are there sensitive facilities around either of the OMF expansion sites. In addition, utility lines that cross under the trackway would be insulated in accordance with city standards, or cathodic protection systems to prevent corrosion damage from passing streetcars.

Construction Impacts

Utilities

The construction phase would include relocation of utilities as needed to minimize long-term conflicts with maintaining or accessing utilities corridors. Relocating underground utilities would involve pavement demolition, excavation, repaving, ground support systems, groundwater control, relocation effects on other localized utilities, dust and noise control, short-term traffic disruptions, and lane or sidewalk closures. For aboveground utilities, direct effects typically include placement of new or temporary poles.

Direct effects on utilities could include short disruptions to utility service during the cutover from existing to temporary service feeds and again when permanent utilities are completed. Occasionally, during construction, unintended disruptions occur. Disruptions of utility service during relocations would likely be minimal because temporary connections to customers would typically be established before relocating utility conveyances. However, inadvertent damage to underground utilities could occur during construction if utility locations are uncertain or misidentified. While such incidents do not occur frequently, they could temporarily affect services to customers served by the affected utility while emergency repairs are made. Efforts to minimize impacts would include potholing and preconstruction surveys to identify utility locations and outreach to customers to inform them of potential service disruptions.

All required improvements would be installed per the 2014 Edition, City of Seattle Standards for Municipal Construction and Standard Plans for road, Bridge and Municipal Construction. After completion, the project would not result in an impact on demand or delivery of utility services in the study area.

Energy Demands

The energy used during construction would be a non-recoverable use of resources. Estimates of energy consumption during construction are directly related to construction costs. With a projected cost of $64.5 million, the energy consumed over the maximum 2-year period is projected to be 201,610 MMBtu[2], which is the equivalent of providing the energy needs of approximately 2,400 residential homes for 1 year. This would be lost energy use, but the energy savings from operations would compensate for the loss in less than 15 years.

Electromagnetic Fields

The period of construction would not result in damage from EMF.

4.9.5 Mitigation Measures

Once utilities are relocated, no adverse effects on utilities, energy consumption, or electromagnetic interference are anticipated; therefore, no mitigation measures are proposed.

During construction, no adverse effects on energy consumption or electromagnetic interference are identified; therefore, no mitigation measures are proposed. However, to mitigate risk of disrupting utilities during construction, SDOT will develop a utility relocation plan prior to construction, which will include coordination with utility providers to minimize potential disruptions through detailed construction schedules and sequencing. When more than a short service disruption may be needed, temporary connections to businesses and residences will be provided.

[2] The California Department of Transportation (Caltrans) was employed to derived energy consumption factors for the construction of different light/streetcar rail transit facilities in Energy and Transportation Systems, and these factors are still widely used in the industry today (Caltrans, 1983). Because the Caltrans report was developed using 1973 construction dollars, the energy consumption factors were adjusted to account for the change in construction costs. The California Construction Cost Index was used to adjust the factors to 2014 dollars.