Chapter 18: Energy

18.1 Introduction

This chapter describes how energy demands would be affected in the short and long terms with the project alternatives. The energy use associated with the project alternatives is evaluated primarily in the form of fuel consumption. For this analysis, data on average vehicle fuel efficiencies are taken from the Bureau of Transportation Statistics (2019).

How is energy use evaluated?

In this chapter, the energy use associated with the project alternatives is evaluated primarily in the form of fuel consumption.

Vehicle fuel consumption varies with traffic characteristics. The primary traffic characteristics are traffic flow (average vehicle speed), driver behavior, the geometric configuration of the roadway, the vehicle mix (cars versus trucks), and climate and weather.

Of all the traffic-related factors, average vehicle speed accounts for most of the variability in fuel consumption and is a good predictor of fuel economy for most urban travel. Fuel efficiency under steady-flow, “cruising” driving conditions peaks at 45 to 60 miles per hour and then rapidly declines as speeds increase. At lower speeds, fuel efficiency is reduced by engine friction, underinflated tires, use of powered accessories (such as power steering and air conditioning), and repeated braking and acceleration (Davis and Diegel 2003).

The energy analysis in this chapter is based on current fuel consumption rates to provide an equal comparison between alternatives based on known fuel consumption rates and technologies. It would be speculative to develop consumption rates for 2050 since vehicle technology, percentage of electric cars, use of electric/hybrid buses, or use of hybrid trains cannot be predicted. Data from the U.S. Energy Information Administration shows that the average light-duty vehicle-miles per gallon (mpg) could increase from 25 mpg today to about 35 mpg in 2050 (EIA 2021). The same data are not available for buses, cog rail, or future gondola system electric motors. The Utah Department of Transportation expects that all of the various modes would see improvements in future energy use.

18.2 Regulatory Setting

The National Environmental Policy Act (NEPA) regulations (40 Code of Federal Regulations Section 1502.16) require an examination of the energy requirements of a proposed project and the potential of the project for conserving energy. The Federal Highway Administration’s guidelines for preparing environmental documents state that, for most projects, Environmental Impact Statements should discuss in general terms the construction and operational energy requirements and conservation potential of the alternatives, including the No-Action Alternative. A detailed energy analysis including computing energy requirements is generally not needed.

18.3 Affected Environment

In 2018, Wasatch Boulevard from Fort Union Boulevard to North Little Cottonwood Road had an average annual daily traffic volume of 16,000 to 18,000 vehicles. Assuming an average vehicle fuel efficiency of about 25 mpg, about 1,400 to 1,600 gallons of fuel were used daily over the 2.2-mile segment of Wasatch Boulevard (Fehr & Peers 2018).

In 2018, State Route (S.R.) 210 in Little Cottonwood Canyon had an average daily traffic volume of about 6,922 vehicles. Assuming an average vehicle fuel efficiency of about 25 mpg, about 2,800 gallons of fuel were used daily over the 10-mile-long road from North Little Cottonwood Road to Alta.

To equally compare alternatives, the analysis of enhanced bus service assumes a one-way, 12-mile trip, which would be similar to the travel from the gravel pit mobility hub or the 9400 South and Highland Drive mobility hub. The current ski bus service in Little Cottonwood Canyon provides 42 trips per day to the Alta ski resort over 12 hours of operation, for a total of about 1,008 round-trip miles of travel per day. Assuming an average bus fuel efficiency of 3.2 mpg, about 315 gallons of diesel fuel are consumed daily. The total personal vehicle fuel consumption plus bus fuel consumption on S.R. 210 in Little Cottonwood Canyon equals about 3,115 gallons of fuel consumed per day during the winter when the ski bus service is in operation.

What is a mobility hub?

A mobility hub is a location where users can transfer from their personal vehicle to a bus.

What is the gravel pit?

The gravel pit is an existing aggregate (gravel) mine located on the east side of Wasatch Boulevard between 6200 South and Fort Union Boulevard.

18.4 Environmental Consequences and Mitigation Measures

18.4.1 Methodology

The analysis for the action alternatives converted energy use to gallons of fuel so that the alternatives' energy consumption could be compared.

18.4.2 No-Action Alternative

18.4.2.1 Construction-related Energy Impacts

With the No-Action Alternative, the changes associated with the S.R. 210 Project would not be implemented. The only construction-related energy impacts would be caused by roadway maintenance and any roadway work that occurs as part of ongoing commercial and residential development in the vicinity of S.R. 210.

18.4.2.2 Direct Energy Impacts

With the No-Action Alternative, increased traffic and congestion resulting from the projected growth in the region (see Chapter 1, *Purpose and Need*) would increase overall energy requirements in 2050 compared to the existing conditions.

Wasatch Boulevard from Fort Union Boulevard to North Little Cottonwood Road is projected to have an average annual daily traffic volume of 17,000 to 25,000 vehicles in 2050 (Fehr & Peers 2018). The increase in traffic compared to existing conditions would be caused by the increase in population between today and 2050. Assuming an average vehicle fuel efficiency of about 25 mpg, about 1,500 to 2,200 gallons of fuel would be used daily over the 2.2-mile segment of Wasatch Boulevard. This would be an increase of about 7% to 37% compared to the existing conditions in 2020.

In 2050, S.R. 210 in Little Cottonwood Canyon is projected to have an average annual daily traffic volume of about 9,900 vehicles. Assuming an average vehicle fuel efficiency of about 25 mpg, about 3,960 gallons of fuel would be used daily over the 10-mile-long road (North Little Cottonwood Road to Alta), or an increase of 41% compared to 2020 conditions.

For the No-Action Alternative, the ski bus service in Little Cottonwood Canyon in 2050 is assumed to be the same as the current ski bus service—42 trips per day for a total of about 1,008 miles of travel per day. Assuming an average bus fuel efficiency of 3.2 mpg, about 315 gallons of diesel fuel would be consumed daily. The total personal vehicle fuel consumption plus bus fuel consumption on S.R. 210 in Little Cottonwood Canyon would equal about 4,275 gallons of fuel consumed per day during the winter when the ski bus service is in operation.

18.4.3 Enhanced Bus Service Alternative

18.4.3.1 Construction-related Energy Impacts

Implementing the Enhanced Bus Service Alternative (which includes widening Wasatch Boulevard) would involve operating heavy machinery with a resulting increase in energy use, since fuel would be consumed as part of the construction activities. In addition, traffic congestion would increase during construction, so more fuel would be used. The construction-related energy consumption would be temporary.

18.4.3.2 Direct Energy Impacts

With the Enhanced Bus Service Alternative, Wasatch Boulevard from Fort Union Boulevard to North Little Cottonwood Road is projected to have an average annual daily traffic volume of 18,000 to 26,000 vehicles in 2050. The 1,000-vehicle-per-day increase in average annual daily traffic volumes over the No-Action Alternative would be the result of improvements made to Wasatch Boulevard with the action alternatives. Assuming an average vehicle fuel efficiency of 25 mpg, about 1,600 to 2,300 gallons of fuel would be used daily over the 2.2-mile segment of Wasatch Boulevard. This would be an increase of about 5% to 7% compared to the No-Action Alternative in 2050.

With the Enhanced Bus Service Alternative, implementing a toll would reduce personal vehicle use in Little Cottonwood Canyon by about 30%. With a reduction of 30% in average annual daily traffic in 2050, daily traffic volumes would be about 6,930 vehicles, or similar to the existing conditions in 2020. Assuming an average vehicle fuel efficiency of 25 mpg, about 2,800 gallons of fuel would be used daily over the 10-mile-long road. This would be a decrease of about 29% compared to the No-Action Alternative in 2050. The overall reduction in energy consumption from personal vehicle use on S.R. 210 in Little Cottonwood Canyon would be beneficial.

The enhanced bus service in Little Cottonwood Canyon would consist of 24 buses per hour to the Alta ski resort for 6 hours of operation and 12 buses per hour for 6 hours of operation, for a total of about 5,184 miles of travel per day based on a 24-mile round trip for each bus (about a 12-mile, one-way trip from either mobility hub). Assuming an average bus fuel efficiency of 3.2 mpg, about 1,620 gallons of diesel fuel would be consumed daily. The total personal vehicle fuel consumption plus bus fuel consumption on S.R. 210 in Little Cottonwood Canyon would equal about 4,420 gallons consumed per day during the winter when the ski bus service is in operation, which would be slightly more than the fuel consumption with the No-Action Alternative (4,275 gallons per day). The fuel consumption comparison does not take into account future improvements in either personal vehicle or bus fuel efficiency.

18.4.4 Enhanced Bus Service in Peak-period Shoulder Lane Alternative

18.4.4.1 Construction-related Energy Impacts

Implementing the Enhanced Bus Service in Peak-period Shoulder Lane Alternative (which includes widening Wasatch Boulevard) would involve operating heavy machinery with a resulting increase in energy use, since fuel would be consumed as part of the construction activities. In addition, traffic congestion would increase during construction, so more fuel would be used. Constructing the peak-period shoulder lanes in Little Cottonwood Canyon would consume additional energy compared to the Enhanced Bus Service Alternative. The construction-related energy consumption would be temporary.

18.4.4.2 Direct Energy Impacts

The vehicle energy use with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative would be the same as with the Enhanced Bus Service Alternative.

18.4.5 Gondola Alternative A (Starting at Canyon Entrance)

18.4.5.1 Construction-related Energy Impacts

Implementing Gondola Alternative A would involve operating heavy machinery with a resulting increase in energy use, since fuel would be consumed as part of the construction activities. In addition, traffic congestion would increase during construction, so more fuel would be used. Constructing the gondola system would consume less energy compared to the energy used to implement the Enhanced Bus Service Alternative but less than that for the Enhanced Bus Service in Peak-period Shoulder Lane Alternative. The construction-related energy consumption would be temporary.

18.4.5.2 Direct Energy Impacts

The vehicle energy use with Gondola Alternative A would be the same as with the Enhanced Bus Service Alternative except that the ski buses would not travel on S.R. 210 in Little Cottonwood Canyon, which would result in less bus fuel consumption. However, Gondola Alternative A would require bus service from both the gravel pit and 9400 South and Highland Drive mobility hubs (about a 9-mile round trip from each mobility hub). Assuming 216 daily bus trips at an average bus fuel efficiency of 3.2 mpg, about 608 gallons of diesel fuel would be consumed daily by buses traveling to the Gondola Alternative A base station from the mobility hubs.

Gondola Alternative A's gondola system would use about 35,280 kilowatt-hours of electricity per day. Using a conversion factor of 33.70 kilowatt-hours per gallon of gasoline, this equates to about 996 gallons of gasoline per day (U.S. Department of Energy 2014). The total fuel consumption for Gondola Alternative A including personal vehicle use in the canyon (2,800 gallons per day) would be about 4,404 gallons of gasoline per day.

18.4.6 Gondola Alternative B (Starting at La Caille)

18.4.6.1 Construction-related Energy Impacts

The energy consumption from implementing Gondola Alternative B would be the same as from implementing Gondola Alternative A except that an additional two gondola towers and an angle station would be required for Gondola Alternative B.

What are gondola base, angle, and terminal stations?

As used in this chapter, the term *terminal station* refers to the first and last stations on a passenger's gondola trip. Passengers board and disembark the gondola cabins at the terminal stations.

The *base station* is the terminal station at the bottom of the canyon, and a *destination station* is a terminal station at the top of the canyon.

The gondola alternatives also include *angle stations*, which are needed to adjust the horizontal direction of the cabin; passengers remain in the cabin as it passes through an angle station.

A *tower* supports the gondola cable.

18.4.6.2 Direct Energy Impacts

The vehicle energy use with Gondola Alternative B would increase over that with the enhanced bus service alternatives and Gondola Alternative A because the elimination of bus service would result in about an additional 713 gallons of gasoline fuel being used daily (for a total of about 3,513 gallons per day).

With the 0.75-mile greater distance from the Gondola Alternative B base station to the entrance to Little Cottonwood Canyon and the need for one additional angle station compared to Gondola Alternative A, Gondola Alternative B would use about 40,680 kilowatt-hours of electricity per day. Using a conversion factor of 33.70 kilowatt-hours per gallon of gasoline, this equates to about 1,206 gallons of gasoline per day (U.S. Department of Energy 2014). The total fuel consumption for Gondola Alternative B including personal vehicle use in the canyon (3,513 gallons per day) would be about 4,719 gallons of gasoline per day.

18.4.7 Cog Rail Alternative (Starting at La Caille)

18.4.7.1 Construction-related Energy Impacts

Implementing the Cog Rail Alternative would involve operating heavy machinery with a resulting increase in energy use, since fuel would be consumed as part of the construction activities. In addition, traffic congestion would increase during construction, so more fuel would be used. Constructing the Cog Rail Alternative would use more energy than would constructing the other action alternatives. The construction-related energy consumption would be temporary.

18.4.7.2 Direct Energy Impacts

The cog rail system would use diesel-electric locomotives that require diesel fuel. About 37 cog rail trips would be made per day with a round-trip distance of about 17 miles, or 629 total miles per day. Assuming a diesel-electric locomotive fuel efficiency of 0.5 mpg, about 1,258 gallons of diesel fuel would be consumed daily (DiDomenico and Dick 2014). The total fuel consumption for the Cog Rail Alternative would be about 4,771 gallons of diesel fuel per day (including personal vehicle use in the canyon of 3,513 gallons per day).

18.4.8 Summary of Energy Consumption

The list below summarizes the total energy consumption in gallons of fuel for each primary action alternative. The total energy consumption does not include vehicle use on Wasatch Boulevard except for the additional vehicle travel to the Gondola Alternative B and cog rail base station which would not be required by the other alternatives. Note that the fuel use by the gondola alternatives is a conversion from total electricity use. The gondola alternatives would not use gasoline or diesel fuel to operate the gondola.

- No-Action Alternative - 4,275 gallons of fuel per day
- Enhanced Bus Service Alternative – 4,420 gallons of fuel per day
- Enhanced Bus Service in Peak-period Shoulder Lane Alternative – 4,420 gallons of fuel per day
- Gondola Alternative A (Starting at Canyon Entrance) – 4,404 gallons of fuel per day
- Gondola Alternative B (Starting at La Caille) – 4,719 gallons of fuel per day
- Cog Rail Alternative (Starting at La Caille) – 4,771 gallons of fuel per day

18.4.9 Mitigation Measures

No mitigation measures for energy impacts are proposed.

18.5 References

Bureau of Transportation Statistics

2019 Average Fuel Efficiency of U.S. Light-duty Vehicles. April 23. https://www.bts.gov/content/average-fuel-efficiency-us-light-duty-vehicles, Accessed October 6, 2020.

Davis, S.C., and S.W. Diegel

2003 Transportation Energy Data Book, 23rd Edition. Center for Transportation Analysis, Engineering, Science, and Technology Division, Oak Ridge National Laboratory.

DiDomenico, G.C., and C. Dick

2014 Analysis of Trends in Commuter Rail Energy Efficiency. Proceedings of the 2014 Joint Rail Conference. April 2–4.

[EIA] U.S. Energy Information Administration

2021 Annual Energy Outlook 2021.

Fehr & Peers

2018 Summary of Forecasting for S.R. 210 (Urban). July.

U.S. Department of Energy

2014 Alternative Fuels Data Center Fuels Comparison Chart. October 29. https://afdc.energy.gov/fuels/fuel_comparison_chart.pdf. Accessed November 12, 2020.