3.21 ENERGY

3.21.1 Introduction

What's in Section 3.21?

This section evaluates and compares energy consumption and greenhouse gas emissions of the No-Action Alternative and each of the build packages, as measured in British thermal units (BTUs). The regional transportation system currently consists of passenger automobiles, trucks, and buses. All build packages include these modes of transportation. Package A and the Preferred Alternative also include commuter rail. Energy calculations were based on regional travel demand model projections, combining data from Denver Regional Council of Government (DRCOG) and North Front Range Metropolitan Planning Organization (NFRMPO).

Greenhouse gas emissions from transportation sources are directly related to energy consumption and primarily result from the combustion of fossil fuels in vehicles. These emissions are normally presented as the total carbon dioxide (CO_2) equivalent released, and take into account the global warming potential of each chemical species emitted from a source. For example, combustion sources emit small amounts of nitrous oxide (N_2O), which has a global warming potential 310 times that of CO_2. Each ton of N_2O emitted is equivalent to 310 tons of CO_2. All greenhouse gas emissions presented in this section are presented as a CO_2 equivalent.

Energy sources for transportation are most commonly petroleum-based fossil fuels for automobiles, trucks, trains, and buses. None of the build packages under consideration would use vehicles that run on electric power.

3.21.2 Environmental Consequences

Energy would be consumed for both the construction and operation of transportation improvements associated with all the build packages. This section evaluates and compares energy consumption and greenhouse gas emissions of the No-Action Alternative and each of the build packages (Package A, Package B, and the Preferred Alternative), using the following methodology:

- The forecast year used was 2035.
- Daily Vehicle Miles Traveled (VMT) data were estimated using the North I-25 Regional Travel Demand Model (see **Table 3.21-1**).
- The regional study area was defined as the regional transportation network, which was modeled for air quality and travel demand purposes.
- Regional energy consumption in BTUs was based on estimated changes in VMT, in accordance with the FTA's document, *Reporting Instructions for the Section 5309 New Starts Criteria* (FTA, 2006b).

- Greenhouse gas emissions were calculated from BTU estimates developed from the energy consumption estimate multiplied by standard tons of CO_2/ million BTU conversion templates, provided in the FTA's *Reporting Instructions for the Section 5309 New Starts Criteria* (FTA, 2006b).

Table 3.21-1 Daily VMT in the North I-25 Study Area

Alternative	Total Daily VMT (Auto, Truck, and Bus)
No-Action	52,410,000
Package A*	52,763,857
Package B	52,616,000
Preferred Alternative*	52,810,857

*Package A and the Preferred Alternative include annual rail miles traveled in addition to auto, truck and bus miles;
Package B includes only auto, truck, and bus miles traveled

Source: North I-25 Regional Travel Demand Model.

Daily energy consumption and carbon dioxide production were used to evaluate greenhouse gas emissions in this project. Greenhouse gas emissions were estimated by multiplying the daily energy use (tons of CO_2 per million BTU) by CO_2 conversion factors taken from the New Starts Criteria (FTA, 2006b). Passenger miles were assumed to be 96.6 percent automobiles, 3.0 percent heavy trucks, and 0.4 percent buses of the total regional annual VMT. For Package A and the Preferred Alternative, rail miles traveled accounted for less than 1 percent of total VMT.

3.21.2.1 Direct Impacts

Table 3.21-2 summarizes estimated daily energy consumption as a result of operation of the No-Action Alternative and the three build packages.

Table 3.21-2 Energy Consumption by Alternative (Daily BTUs)

Alternative	BTUs Consumed (millions)	Difference from No-Action (millions)	Percent Difference
No-Action	358,960	N/A	N/A
Package A	361,900	2,940	0.8%
Package B	360,371	1,411	0.4%
Preferred Alternative	362,222	3,262	0.9%

Source: FTA, 2006b and North I 25 Regional Travel Demand Model.

Table 3.21-3 summarizes estimated daily CO_2 production as a result of operation of the No-Action Alternative and the three build packages.

Table 3.21-3 Daily CO_2 Production by Alternative

Alternative	CO_2 Produced (Tons)*	Difference from No-Action (Tons)	Percent Difference
No-Action	27,560	N/A	N/A
Package A	27,787	227	0.8%
Package B	27,668	108	0.4%
Preferred Alternative	27,811	208	0.9%

*CO_2 Produced: All greenhouse gas emissions in the study area are presented as CO_2 equivalents.
Source: FTA, 2006b.

The No-Action Alternative would utilize less energy than any of the build alternatives. As shown in **Table 3.21-2**, Package A and Package B would use approximately 0.8 percent and 0.4 percent more energy, respectively, than the No-Action Alternative. The Preferred Alternative would use 0.9 percent more energy. The rationale for the increase in energy usage is that the added capacity provided by the build packages would attract VMT from other areas. This, in turn, would create an increase in daily VMT within the regional study area and a corresponding decrease from surrounding areas as more trips would be diverted.

These same trends were found for CO_2 production. All alternatives would produce more CO_2 (greenhouse gas emissions) than the No-Action. As shown in **Table 3.21-3**, Package A and Package B would increase CO_2 production by approximately 0.8 percent and 0.4 percent, respectively, over the No-Action Alternative; the Preferred Alternative would increase CO_2 production by 0.9 percent.

Over time (after 2035) it would be expected that the rail components of Package A and the Preferred Alternative would provide more options for lower energy consumption because more trains could easily be added. The tolled express lanes (TEL) in Package B and the Preferred Alternative would eventually fill up (with bus riders and carpoolers) especially in the segments of the corridor with only one TEL in each direction. The transit stations associated with all packages would, over time, serve as a stimulus to transit oriented development. This transit oriented development would potentially reduce energy consumption due to mixed use and higher density development, which would reduce trips.

In addition to energy consumed during operation, energy would be consumed for construction of Package A, Package B, or the Preferred Alternative. This is described in **Section 3.23** *Construction Impacts*.

3.21.2.2 Indirect Impacts

Based on projected growth rates developed by the Denver Regional Council of Governments and the North Front Range Metropolitan Planning Organization, population in the study area is anticipated to increase by 68 percent between 2005 and 2035 under the No-Action Alternative and build packages. This increase would result in substantial additional demands for energy for construction of new homes, in gasoline for automobiles, and in natural gas and electricity for utilities. It is anticipated that the additional energy demand would be directly proportionate to the increase in population as land development occurs.

3.21.3 Mitigation Measures

Mitigation of energy consumption during operations will focus on a reduction in daily VMT. This reduction can be achieved through successful transit oriented development, congestion management, and effective improvements to the roadways. These measures all work to reduce overall traffic time by increasing travel efficiency.