14.0 ENERGY USE

This chapter quantifies the expenditure of energy associated with the alternatives under study in this Draft Environmental Impact Statement (EIS). Energy is consumed in the construction, maintenance and operation of transportation systems. Transportation energy use is typically evaluated in terms of direct energy and indirect energy. Direct energy involves energy associated with the direct operation of the transportation system, consisting primarily of vehicle propulsion energy. Indirect energy consumption involves the energy expenditures associated with the physical implementation of the transportation system (facility and vehicle construction).

Energy is commonly measured in terms of British Thermal Units (BTUs), or the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. This unit of measurement provides a comparison of energy consumption for energy produced from different sources, such as petroleum, coal, nuclear and wind power.

14.1 Affected Environment

According to the U.S. Energy Information Administration (EIA), gross energy use in the U.S. was estimated at 101.5 quadrillion BTUs in 2007. Of this total, 29 quadrillion BTUs were consumed by transportation, representing approximately 28 percent of the nation's gross energy consumption. Energy sources used for transportation include petroleum, coal, natural gas and electricity. Petroleum accounted for 95 percent of the energy used by transportation, and natural gas and renewable energy accounted for 2 percent of the energy used by transportation.

Transportation in the state of North Carolina accounts for 2.6 percent of total energy use in the U.S. (State Energy Profiles, 2009). Transportation energy in the Charlotte region is primarily derived from petroleum-based fuels (e.g., gasoline and diesel fuel). A small portion of the regional transportation energy is derived from electricity used to provide power to the existing LYNX Blue Line light rail service. Electricity is provided by Duke Energy, the sole provider of electrical power to the Charlotte region.

14.2 Environmental Consequences – Direct Energy

The following sections quantify the regional transportation system energy expenditures associated with direct operation of the alternatives under study. Table 14-1 illustrates the annual vehicle propulsion energy use for motorized vehicles, as well as for light rail vehicles.

Table 14-1
Comparison of 2030 Estimated Daily Energy Consumption

Vehicle Class	Regional VMT (Daily)			Daily Energy Consumption (BTU millions)		
	No-Build	Light Rail Alternative[a]	(BTU/ Veh-mile)[3]	No-Build	Light Rail Alternative	Light Rail[a] vs. No-Build
Passenger Vehicles [1]	83,661,197	83,519,938	5,960	523,743	497,779	**-842**
Commercial Vehicles [1]	11,287,284	11,287,284	23,260	262,542	262,542	**0**
Bus [2] (Diesel)	45,541	46,994	37,310	1,699	1,753	**54**
Light Rail [2] (Electric)	3,624	7,737	62,797	228	486	**258**
Total	**94,997,646**	**94,861,953**		**788,212**	**762,560**	**-530**

Notes: [a] Represents energy consumption of both the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option since no change in energy consumption is anticipated between the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option.
Sources: [1]Passenger and Commercial VMT from AECOM and Metrolina Regional Travel Demand Model, 2009; [2]Bus and Light Rail VMT from *LYNX BLE Bus and Rail Operating and Maintenance Quantities and Costs*, 2009; and *LYNX BLE LRT Operating and Maintenance Quantities and Costs*, 2009; [3]*Transportation Energy Data Book: Edition 27- 2008* (U.S. Department of Energy, 2008, Chapter 2, Table 2.12 and Table 2.16).

14.2.1 No-Build Alternative

The regional direct transportation energy consumption for the No-Build Alternative is estimated to be 788 Billion BTUs per day in 2030.

14.2.2 Light Rail Alternative

The Light Rail Alternative would extend the existing LYNX Blue Line light rail service system and the bus network would be modified and enhanced throughout the Northeast Corridor to maximize transit coverage and transit access to the light rail service. As a result, the daily energy consumption for electric Light Rail service would increase by 258 million BTUs and the energy use for bus service would increase by approximately 54 million BTUs compared to the No-Build Alternative.

Passenger vehicle travel within the corridor would be significantly reduced by the improved transit service, thereby reducing passenger vehicle energy consumption by 842 million BTUs per day. Overall, the implementation of the Light Rail Alternative would result in an estimated net reduction in regional energy use of 530 million BTUs compared to the No-Build Alternative. Therefore, less energy would be consumed and an overall benefit would result. No negative impacts would result under the Light Rail Alternative.

14.2.3 Light Rail Alternative – Sugar Creek Design Option

The Light Rail Alternative – Sugar Creek Design Option would have the same operating characteristics and would result in the same reductions in direct energy consumption as the Light Rail Alternative. Therefore, no difference in impact would result from the selection of this design option.

14.3 Environmental Consequences – Indirect Energy

The following sections quantify indirect energy expenditures associated with construction of transportation infrastructure and acquisition/replacement of buses and/or light rail vehicles. Energy factors for various construction categories are used to estimate the amount of energy necessary to extract raw materials, manufacture and fabricate construction materials, transport materials to the work site and to complete construction activities. Thus, the estimated values capture energy consumption required from the source of the raw materials to the finished project. Local consumption of fossil fuels to operate construction equipment and transport materials is typically a small portion of the total indirect energy. There is a positive correlation between the cost of a project and total energy use associated with manufacturing, transport and construction activities: the higher the cost of a project, the higher the total energy use.

14.3.1 No-Build Alternative

No new transit facilities or light rail stations would be constructed in the corridor under the No-Build Alternative; therefore, no indirect energy consumption impacts are anticipated.

14.3.2 Light Rail Alternative

The Light Rail Alternative consists of the construction of the light rail guideway including track and structures, stations, park-and-ride facilities, systems components and other related infrastructure. It also includes the acquisition of additional light rail vehicles. Table 14-2 tabulates the estimated indirect energy consumption for the various components. Compared to the No-Build Alternative, the Light Rail Alternative is estimated to consume an additional 4,101 Billion BTUs of total indirect energy. The operational savings discussed in Section 14.3 outweigh the indirect energy consumption over the life of the project and would not constitute a potential impact.

Table 14-2
Comparison of Estimated Indirect Energy Consumption

Category	Light Rail Alternative[a] (BTU Billions)
Guideway	1,623.6
Systems	1,293.2
Stations/Parking	1,022.0
Maintenance Facility	94.2
Infrastructure Subtotal	4,033.0
Vehicles	68.0
Total	**4,101.0**

Notes: [a] Represents the Light Rail Alternative and the design options as no change between the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option would occur.
Sources: CATS BLE Team - *15% Preliminary Engineering Design Plans and Cost Estimate;* Energy Factors from *Energy and Transportation Systems* (Caltrans, 1983).

14.3.3 Light Rail Alternative – Sugar Creek Design Option

The Light Rail Alternative – Sugar Creek Design Option is estimated to result in the same indirect energy consumption as the Light Rail Alternative as it would not substantively differ in overall infrastructure and the number of rail vehicles required. Therefore, no difference in impact would result from the selection of this design option.

14.4 Mitigation

14.4.1 Light Rail Alternative

The expanded transit service of the Light Rail Alternative would provide a more energy-efficient transportation system for those who would otherwise use fuel-operated vehicles. The Light Rail Alternative would have a positive effect on direct operating energy consumption for transportation due to reduced energy consumption compared to the No-Build; therefore, mitigation is not warranted. Over the life of the proposed project, the operational savings would outweigh the indirect energy consumption. Construction-related impacts, along with mitigation and preventative measures, are discussed in Chapter 18.0: Construction Impacts.

14.4.2 Light Rail Alternative – Sugar Creek Design Option

The proposed Light Rail Alternative – Sugar Creek Design Option is estimated to result in the same energy consumption impacts as the Light Rail Alternative. Therefore, no additional mitigation would be required.