11. Energy

11.1 INTRODUCTION

This chapter assesses the potential effect of the CBD Tolling Alternative on transportation energy usage. Transportation energy use also affects air quality and greenhouse gases, both of which are evaluated in **Chapter 10, "Air Quality."**

Transportation energy use comprises operational (direct) and construction (indirect) energy consumption. Direct transportation energy is a function of traffic volumes and vehicle types that affect fuel consumption (i.e., volume, speed, distance traveled, vehicle mix, and the thermal value of the fuel being used for roadway vehicles), as well as the energy required for the tolling equipment. Indirect energy consumption consists of nonrecoverable, one-time energy expenditures associated with construction of physical infrastructure associated with a project. Energy is commonly measured in terms of British thermal units (Btu), which is defined as the amount of heat required to raise the temperature of a pound of water by 1 degree Fahrenheit. As discussed in **Subchapter 4C, "Transportation: Transit,"** the frequency of transit service is expected to accommodate any projected increase in transit ridership due to the Project; therefore, no incremental energy would be required for increased transit service.

11.2 AFFECTED ENVIRONMENT

Transportation accounts for a major portion of the energy consumed in New York State. According to the U.S. Energy Information Administration's State Energy Data System,[1] the transportation sector (including losses) was New York State's largest consumer of energy in 2019, accounting for 31.1 percent of all energy consumption in the state. Transportation energy includes the following:[2]

- Gasoline, diesel fuel, natural gas, propane, and biofuels used in cars, motorcycles, light trucks, and boats (879 trillion Btu in 2019)
- Aviation fuel (307 trillion Btu in 2019)
- Electricity used by public mass transit systems and electric vehicles (10 trillion Btu in 2019)

The residential sector consumed 29.7 percent of total energy consumption, the commercial sector 29.2 percent, and the industrial sector 10.0 percent.

1 https://www.eia.gov/state/?sid=NY.
2 https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_use/tra/use_tra_NY.html&sid=NY.

Across all sectors, petroleum was the largest of the energy sources used, which can be attributed to the transportation sector being the largest consumer of energy in New York State. Petroleum accounted for 36.2 percent of energy consumption in New York State in 2019. Natural gas followed at 34.7 percent, renewable energy at 12.9 percent, nuclear energy at 12.2 percent, out-of-state electricity imports at 3.7 percent, and coal at 0.4 percent.

11.3 ENVIRONMENTAL CONSEQUENCES

The U.S. Environmental Protection Agency's MOVES2014b emissions model was used to estimate the mobile source energy use from the mesoscale roadway network in a 12-county region, consistent with the study area used for the mesoscale air quality and greenhouse gas analyses (see Chapter 10, "Air Quality"). As discussed in Chapter 10, "Air Quality" (Section 10.1.7.1 and shown in Table 10-3), this study area captures the most concentrated area of change resulting from the Project and the vast majority of the modeled VMT change. The 12 counties analyzed include those in New York that are projected to have the largest increase in VMT (Richmond County [Staten Island]) and the largest decrease in VMT (New York County [Manhattan]) as a result of the Project, as well as those counties in New Jersey that are predicted to have the largest increase in VMT (Bergen County) and the largest decrease in VMT (Hudson County) as a result of the Project. VMT in Connecticut is predicted to decrease in both 2023 and 2045 between the No Action Alternative and the CBD Tolling Alternative; as such, Connecticut counties were not included in the energy analysis.

As with the mesoscale air quality analysis, the energy analysis evaluated the No Action Alternative and the CBD Tolling Alternative, Tolling Scenario A, for the estimated time of completion (2023) and design year (2045). Tolling Scenario A was used for the energy analysis because it is the tolling scenario that would result in the smallest reduction of VMT compared to the No Action Alternative and therefore would provide the smallest potential regional energy benefit.

Based on the methodology used to identify the most concentrated areas of change, the following 10 New York counties and 2 New Jersey counties were used to analyze the CBD Tolling Alternative's energy impacts:

- New York City:
  - Bronx
  - Kings (Brooklyn)
  - New York (Manhattan)
  - Queens
  - Richmond (Staten Island)
- Long Island:
  - Nassau
  - Suffolk
- North of New York City:
  - Putnam
  - Rockland
  - Westchester
- New Jersey
  - Bergen
  - Hudson

MOVES2014b was used for the energy analysis. MOVES2014b provides great flexibility to capture the influence of time of day, vehicle activity (including VMT and speeds for autos, buses, and trucks), and seasonal weather effects on energy use from vehicles. MOVES2014b calculates energy usage parameters, such as total energy use and vehicle activity (hours operated and miles traveled). From this output, energy rates (e.g., Btu/vehicle miles for moving vehicles or Btu/vehicle hours for idling vehicles) can be determined for a variety of vehicle activities. County-specific MOVES2014b input data from the New York State Department of Environmental Conservation were used in combination with link-by-link traffic data and VMT data from the New York Metropolitan Transportation Council Best Practice Model for the CBD Tolling Alternative.

11.3.1 No Action Alternative

As **Table 11-1** shows, the No Action Alternative would not implement a vehicular tolling program and therefore would not reduce energy consumption through reductions in VMT.

11.3.2 CBD Tolling Alternative

Because Tolling Scenario A was used for the energy analysis, it is expected that the other tolling scenarios with larger VMT reductions would show greater regional energy benefits.

As **Table 11-1** shows, Tolling Scenario A would result in lower energy use in the region compared to the No Action Alternative for both completion year (2023) and design year (2045) because VMT would be reduced. In addition to the change in energy usage due to changes in roadway VMT, the Project would require energy to power monitoring and tolling equipment, including network detection systems and servers that process the data collected by the network detection systems. **Table 11-1** details the energy use for these systems.

Table 11-1. Total Energy Consumption: No Action Alternative and CBD Tolling Alternative, Tolling Scenario A (2023 and 2045)

PARAMETER (Million Btu)	ANALYSIS YEAR 2023 (Completion Year)			ANALYSIS YEAR 2045 (Design Year)		
	No Action Alternative	CBD Tolling Alternative	Difference	No Action Alternative	CBD Tolling Alternative	Difference
Roadway Energy	384,117,220	381,663,310	-2,453,910	329,538,610	326,649,830	-2,888,780
Server Energy	0	945	945	0	945	945
Systems	0	5,552	5,552	0	5,552	5,552
TOTAL OPERATIONAL ENERGY	**384,117,220**	**381,669,807**	**-2,447,413**	**329,538,610**	**326,656,327**	**-2,882,283**

Source: WSP

The CBD Tolling Alternative would result in an overall benefit for the region in terms of reduced energy usage.

11.3.3 Construction Effects

The CBD Tolling Alternative is anticipated to have a construction duration of up to 310 days. Construction would begin with the deployment of various monitoring devices throughout the street networks. The estimated construction cost of the Project is $108,687,261.00,[3] which includes the following:

- **Supporting System Tolling Infrastructure Installation ($94,919,283)** includes the cost of work, labor, tolling system equipment, and materials required for the tolling infrastructure construction (except for signage and pavement markings) that would be required to achieve tolling infrastructure readiness in accordance with the contract documents. Design services are excluded in this value.
- **Signage and Pavement Marking Installation ($13,767,978)** includes the cost of work, labor, equipment, and materials required for the signage and pavement markings within NYCDOT, NYSDOT, and Metropolitan Transportation Authority controlling jurisdictions that would be required to achieve infrastructure readiness in accordance with the contract documents. Design services are excluded in this value.

Based on this cost and using the NYSDOT construction cost calculation procedures to quantify energy use, the construction of the Project would require 268,000 million Btu of energy. This energy usage is expected to be paid back through the operational energy savings (detailed in **Table 11-1**) in less than one year.

11.4 CONCLUSION

An energy analysis was completed for the Project's operational and construction phases. The operational analysis shows that the Project would reduce energy use in the region in both 2023 and 2045. The construction of the Project would require 268,000 million Btu of energy, which is expected to be paid back through the operational energy savings in less than one year. **Table 11-2** summarizes the energy-related effects of the CBD Tolling Alternative.

Table 11-2. Summary of Effects of the CBD Tolling Alternative on Energy

SUMMARY OF EFFECTS	EFFECT FOR ALL TOLLING SCENARIOS	POTENTIAL ADVERSE EFFECT	MITIGATION AND ENHANCEMENTS
Reductions in regional energy consumption	Reductions in regional VMT would reduce energy consumption.	No	**No mitigation needed.** Beneficial effects

[3] Data provided by HDR on March 28, 2022, and April 6, 2022.