Appendix E.14 - Energy

NEC FUTURE
A Rail Investment Plan for the Northeast Corridor

Energy Effects Assessment Methodology

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FINAL

Submitted by:

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1. Energy Effects Assessment Methodology

1.1 INTRODUCTION

This methodology explains how the potential effects of the Tier 1 EIS Alternatives on energy consumption will be evaluated in the Tier 1 EIS.

This methodology presents the regulatory framework, involved government agencies, expected regulatory and other outcomes of the Tier 1 EIS process and relevance to Tier 2, project-level assessments. It also identifies data sources, metrics, and methods to be used to document existing conditions and analyze environmental consequences. This methodology may be revised as the NEC FUTURE program advances and new information is available.

1.2 DEFINITIONS

Energy is an important resource for the nation's economy, and the conservation of energy is vital to the U.S. DOT goals of environmental sustainability, clean air and the reduction of greenhouse gases (GHG). Transportation uses energy required to move people and goods, and accounts for a large portion of the total energy consumed within the Study Area. Transportation energy use is generally discussed in terms of operational (direct) and construction (indirect) energy consumption.

Direct transportation energy consumption is defined, for this project, to be a function of the following operational characteristics:

- The energy source being used to supply electrical power to a train system (i.e., power plant)
- Traffic and vehicle characteristics affecting fuel consumption (i.e., volume, speed, distance traveled, vehicle mix, thermal value of the fuel being used for roadway vehicles)
- Aviation characteristics (i.e., changes in flights, thermal value of the fuel being used for aircraft) if the project affects air traffic in the study area
- The energy required to maintain the transportation facilities

Indirect energy consumption consists of the non-recoverable, one-time energy expenditures associated with the construction of the physical infrastructure associated with a project.

1.3 RELATED RESOURCES

The effects assessments from other resources evaluated as part of the Tier 1 EIS will be used to assess the effects on energy. These related resources are identified in Table 1. Note that the effects assessments for those related resources will be documented within their respective Tier 1 EIS sections.

Table 1 – Related Resource Inputs to Energy Assessment

Resource	Input to Energy
Air Quality	▪ EPA MOTOR VEHICLE EMSSION SIMULATOR (MOVES) – This model will be used to calculate the energy usage from on-road vehicles in the Affected Environment based on available traffic data ▪ Net GHG emissions changes that occur from potential losses or savings in transportation energy as a result of net vehicle miles traveled
Transportation, Operations	▪ Change in vehicle miles traveled; change in train miles

Source: NEC FUTURE JV Team, 2014

The energy assessment will, in turn, be a major input to the climate change assessment as described in the separate Climate Change Methodology.

1.4 AGENCY AND REGULATORY FRAMEWORK

The Council of Environmental Quality (CEQ) regulations for implementing NEPA require consideration of energy efficiency. Applicable guidance related to energy is listed in Table 2. This guidance will be considered, consistent with a Tier 1 level of assessment, in the evaluation of energy for the NEC FUTURE program.

Table 2 –Management and Regulation of Energy

Federal Agency	Regulatory Oversight	Description	Regulated Resource
Executive Office of the President, Council on Environmental Quality (CEQ)	▪ National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4327 and 40 CFR 1502.16 (e)	▪ Discusses “energy requirements and the conservation potential of various alternatives and mitigation measures.”	▪ Energy
	▪ National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4327 and 40 CFR 1502.16 (f)	▪ Considers the "natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.”	▪ Energy

Source: NEC FUTURE JV Team, 2014

Five strategic goals for America’s transportation system are laid out in U.S. DOT’s latest Strategic Plan. They are: Safety; State of Good Repair; Economic Competitiveness; Livable Communities; and Environmental Sustainability. With regards to environmental sustainability, U.S. DOT cites the need to improve the energy and environmental performance of the transportation sector.

Several executive orders and policies have been promulgated over the years that require or promote the consideration of energy efficiency in federal actions. These Executive Orders are listed in Table 3.

Table 3 – Executive Orders Related to Energy Efficiency in the United States

Executive Order	Summary
Executive Order 13514, Federal Leadership in Environmental, Energy and Economic Performance	▪ Promote energy security, protect the interests of taxpayers, and safeguard the health of our environment
Executive Order 13423, Strengthening Federal Environmental, Energy and Transportation Management (EOP 2007)	▪ Agencies that control their federally owned building space or pay utilities directly in leased space must report energy usage information
Executive Order 13221, Energy Efficient Standby Power Devices (EOP 2001a)	▪ Use of use external standby power devices, or that contain an internal standby power function
Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use (EOP 2001b).	▪ Weigh and consider the effects of the Federal Government's regulations on the supply, distribution, and use of energy

Source: NEC FUTURE JV Team, 2014

State departments of energy and departments of environmental protection for each affected state also have authority over energy policy and regulations within their states.

1.4.1 Regulatory Compliance

No formal agency approvals would be requested for the Tier 1 EIS. The FRA will, however, engage in on-going coordination with EPA and DOT throughout the Tier 1 EIS process to facilitate requests in subsequent Tier 2 environmental reviews. Coordination with these agencies will be consistent with the NEC FUTURE's Agency Coordination Plan and support the Statement of Principles (SOP) established between the FRA and federal regulatory agencies as part of the Council on Environmental Quality (CEQ) Pilot program.

1.5 METHODOLOGY TO ASSESS EFFECTS

This effects assessment methodology identifies the approach and assumptions for describing existing conditions of energy and environmental consequences of the Tier 1 EIS Alternatives on those resources. It identifies data sources, defines the Affected Environment considered for energy, and the approach for assessing methods to be used in evaluating potential direct effects.[1] Indirect effects,[2] such as those resulting from induced growth as a result of the Tier 1 EIS Alternatives, will be addressed in a separate methodology (see Indirect Effects Assessment Methodology).

1.5.1 Existing Conditions

Some or all of the data sources listed in Table 4 will be used to establish the existing conditions for energy.

[1] Direct Effects are caused by the action and occur at the same time and place (40 CFR § 1508.8)
[2] Indirect effects are those that occur later in time or are further removed in distance (40 CFR § 1508.8)

Table 4 – Potential Data Sources for the Evaluation of Energy[3]

Potential Source	Topic	Data Application
U.S. Department of Energy (USDOE) – Energy Information Administration	▪ Statewide Energy profile data	▪ Statewide Energy usage data by sector ▪ Statewide Fuel usage information by fuel type
U.S. Environmental Protection Agency (USEPA)	▪ Modeling parameters and guidance for the MOVES model	▪ Fuel usage information from MOVES for roadway VMT
Federal Railroad Administration	▪ Operational characteristics	▪ Energy and/or fuel usage
Surface Transportation Board	▪ R-1 Report	▪ Train fuel usage in gallons of diesel fuel converted to mBtus based on standard conversion factors for diesel fuel supplied by USDOE and USEPA.
Local and State Agencies	▪ Operational characteristics ▪ Energy Audits/Documentation of usage	▪ Fuel usage information ▪ Roadway vehicle miles traveled/fuel usage data ▪ Energy generation/ consumption
Project Generated Data	▪ Change in frequency of intercity and regional services ▪ Changes in propulsion characteristics for intercity and regional services ▪ Current and future freight service levels ▪ Vehicle miles traveled (VMT) and Vehicle hours traveled (VHT) for Tier 1 EIS Alternatives ▪ Changes in air travel demand ▪ Energy use of the train	▪ Changes in air travel demand will be translated into potential fuel savings. For a Tier 1 analysis, this will be applied to the overall regional analysis, rather than to specific airport locations. ▪ Changes in intercity, regional and freight services will be used for regional analysis of train energy ▪ Changes in VMT and VHT will be used for regional analysis of roadway energy

Source: NEC FUTURE JV, 2014

The existing conditions for energy will be documented in the Tier 1 EIS for an established Affected Environment. USDOE analyzes energy information (consumption, sectors and sources) on a statewide level, and Washington D.C. Therefore, for each state being analyzed within the NEC FUTURE Study Area, the Affected Environment will be the entire state and all of Washington D.C.

Existing energy consumption, in terms of residential, commercial, industrial and transportation uses (broken down by sector based on fuel use from the USDOE's Energy Information Administration [EIA]) for each state and Washington D.C. within the NEC FUTURE Study Area, will be summarized (data are already calculated). Energy consumption that may be affected by the Tier 1 EIS Alternatives, such as energy from automobile vehicle miles traveled, intercity bus trips, airplane type and number of flights, and power requirements for train propulsion, will be identified by

[3] Standard conversion factors will be applied to data in order to arrive at the same units. The units in which the results will be presented will most likely be annual mBtus.

sector and fuel type (i.e., aviation fuel, motor gasoline, etc.) and summarized in terms of annual million of British thermal units (mBtus).

1.5.2 Environmental Consequences

Environmental consequences will be assessed for the Affected Environment. Potential effects of Tier 1 EIS Alternatives on energy will include 1) energy requirements of the Tier 1 EIS Alternatives; 2) net change in transportation energy consumed, on a statewide basis; and 3) a qualitative assessment of U.S. DOT efforts to meet established energy conservation goals.

The following provides the steps that will be undertaken for each state within the Study Area to identify effects on energy:

- Energy Requirements of the Tier 1 EIS Alternatives
  - Using the sources listed in Table 4, establish existing energy consumption by mode for the states within the Study Area. Similarly, energy consumption by mode will be estimated for each of the Tier 1 EIS Alternatives.
  - Evaluate effects of Tier 1 EIS Alternatives on energy consumption or conservation compared to existing conditions.
  - Qualitatively discuss energy requirements for construction of Tier 1 EIS Alternatives based on proposed construction schedule and techniques.
- Net Change in Overall Energy Consumption

  The FRA will estimate the net change in overall energy consumption by mode (automobile, air, and intercity bus) within the Study Area. The primary input to this analysis will be change in travel demand by mode as estimated by the NEC FUTURE travel demand forecasting process. Automobile energy consumption will be derived from the change in vehicle miles or vehicle hours traveled. Changes in air travel demand (changes in enplanements), however, do not translate to a single metric since the private-sector airline industry could respond to a decrease in air travel by deleting flights, down-sizing planes or a combination of both strategies. Therefore, the effects of changes in air travel will be estimated for scenarios representing the range of possible airline industry responses to changes in air travel; these scenarios will then be used to quantitatively estimate the possible change in aircraft energy requirements. Changes in demand for intercity bus are similarly difficult to forecast, since the private sector intercity bus carriers could respond to decreased ridership in a variety of ways including reducing frequency or changing service patterns. A qualitative assessment of possible response scenarios will be used to discuss changes in intercity bus energy requirements as intercity bus vehicle miles travelled are not expected to be an output from the NEC FUTURE travel demand models. The following is the step-by-step process for estimating the net change in overall energy consumption:
  - Estimate change in fuel consumption using USEPA's MOVES2010b emission program to evaluate the operational energy effects of the automobile traffic network for the Tier 1 EIS Alternatives. Vehicle miles traveled (VMT) and vehicle hours traveled (VHT) outputs from

the travel demand forecasting model will be utilized. Analysis will measure broad changes in energy consumption of the regional traffic network and not per passenger or vehicle.

- Quantitatively estimate the changes in energy requirements (either electrical or from diesel fuel consumption) of the train systems due to implementation of the Tier 1 EIS Alternatives.
- Estimate changes in fuel consumption as a result of changes in air travel demand for the Tier 1 EIS Alternatives. Possible industry responses to changes in demand will be estimated for three scenarios. These scenarios, to be developed in further consultation with FRA and industry experts, could include operating fewer flights, downsizing aircraft, or a combination of both. FRA will then estimate fuel usage by aircraft type (e.g., larger longer-distance airplanes or smaller regional planes) for each scenario based on fuel consumption data from FAA and/or The Climate Registry to calculate the range of change in overall aircraft energy consumption associated with the Tier 1 EIS Alternatives.
- Estimate changes in fuel consumption as a result of changes in intercity bus travel demand for the Tier 1 EIS Alternatives. Possible industry responses to changes in intercity bus demand will be estimated for scenarios that could include changes or reductions in markets served, changes in frequency of service, or a combination of both. These scenarios will be developed in consultation with the FRA and industry experts. An estimated change in intercity bus trips for each scenario will be used to qualitatively discuss potential changes in intercity bus energy requirements.

- Agency Efforts to Meet Established Sustainability Goals
  - Assess the current condition of NEC traction power system, including system architecture, power sources, operating voltage and peak loads. Constraints and vulnerabilities will also be highlighted.
  - Describe agency initiatives either underway or in the planning stages that address future energy issues including consumption, supply, distribution, and resiliency. Highlight efforts employed by agencies to reduce energy consumption, strengthen existing infrastructure or develop new “smart” or renewable energy systems.

1.5.3 Mitigation Strategies

A menu of potential mitigation measures will be developed on a programmatic scale for further consideration in Tier 2. Examples of programmatic mitigation measures for energy include the use of alternative fuels, renewable energy plans, and increasing fuel efficiency. Elements of DOT’s Strategic Plan applicable to energy usage, sustainability, and reliability will be incorporated.

1.6 TIER 1 EIS OUTCOMES

The Tier 1 EIS energy assessment will:

- Provide an overview of the existing transportation energy usage and sources of power production for the Study Area and identify potential energy savings and losses for each of the Tier 1 EIS Alternatives

- Estimate net change in overall energy consumption by mode (automobile, air, and intercity bus) within the Study Area
- Provide a comparative assessment of impacts to energy consumption from the Tier 1 EIS Alternatives and discuss the types of activities expected to consume energy, and potential ways to save energy
- Describe agency efforts to address future energy needs including supply, consumption, and infrastructure.

1.7 APPLICABILITY TO TIER 2 ASSESSMENTS

The energy impacts of the Tier 1 EIS Alternatives will be qualitatively discussed and their effects on transportation energy consumption quantitatively evaluated. The information generated from the Tier 1 EIS will be used as the basis for the more detailed quantitative analyses that would be undertaken at the Tier 2 level. The positive and negative impacts of the Tier 1 EIS Alternatives on energy usage and infrastructure will be presented in terms of overall direct (operational) and indirect (construction) impacts. Life-cycle energy consumption will be qualitatively discussed in Tier 1 and more comprehensibly discussed in Tier 2 documents.

Application of Effects-Assessment Methodology

14.1 ENERGY: APPLICATION OF EFFECTS-ASSESSMENT METHODOLOGY

14.1.1 Variations to Effects-Assessment Methodology

The following variations from the Effects-Assessment Methodology occurred during the process of developing the Tier 1 Draft EIS analysis:

- The regional energy analysis analyzed the changes in energy use under project alternatives, rather than the stand-alone No Action and Action Alternatives' baselines because of the format of the service data (presented in the form of changes between the No Action and Action Alternatives). This formed the basis for the overall analysis.
- Availability of data (vehicle-miles travelled [VMT] and rail information) on a statewide basis determined the parameters for the MOVES runs.
- Changes in intercity bus trips were analyzed qualitatively (alongside changes in aircraft trips).

14.1.2 Data Variations

The following variations from the identified data sources in the Effects-Assessment Methodology occurred during the process of developing the Tier 1 Draft EIS analysis:

- Existing energy consumption profiles for each state were obtained from U.S. Department of Energy – Energy Information Administration, Statewide Energy profile data, and are presented in table format.
- U.S. Transportation Energy Use by Mode data were obtained from U.S. Energy Information Administration and presented in table format.

14.1.3 Criteria for Analysis

Existing Conditions

- For each state and district, the energy consumption per capita is presented in a table along with the energy consumption by sector (Transportation, Residential, Commercial, Industrial) in pie chart format.
- Energy Use by Mode (Vehicles, Buses, etc.) is presented in table format.

Environmental Consequences

- Changes in energy use due to changes in roadway VMT, diesel trains and electrical trains were calculated and summarized on a statewide basis.
- The energy changes due to changes in roadway VMT under the Action Alternatives were calculated per state using state-specific national level runs of EPA's MOVES2010b program.
- The energy changes due to changes in train miles traveled (electric) under the Action Alternatives were calculated using the Center for Transportation Analysis, Energy and Transportation Science Division's Transportation Energy Data Book.

- For each state, the energy changes due to changes in roadway VMT and train-miles traveled were combined to determine each Action Alternative's overall impact on energy use within the state.
- Changes in intercity bus trips were analyzed qualitatively (alongside changes in aircraft trips).

Environmental Consequences – Stations

- Energy was not analyzed at the stations level.

Data Matrices

Total Reduction in Annual VMT over No Action - Allocated to States

State*	Alternative 1	Alternative 2	Alternative 3 via CC and PVD (3.1)	Alternative 3 via LI and PVD (3.2)	Alternative 3 via LI and WOR (3.3)	Alternative 3 via CC and WOR (3.4)
NJ	-325,264,333	-440,215,509	-485,904,713	-458,627,573	-502,128,681	-474,110,845
CT	-148,091,309	-200,428,034	-221,230,113	-208,810,960	-228,616,809	-215,860,420
PA	-125,837,990	-170,310,203	-187,986,404	-177,433,447	-194,263,119	-183,423,602
NY	-285,014,612	-385,741,196	-425,776,606	-401,874,866	-439,992,945	-415,442,165
NH	-15,162,855	-20,521,537	-22,651,431	-21,379,852	-23,407,744	-22,101,636
MA	-90,674,552	-122,719,708	-135,456,574	-127,852,474	-139,979,360	-132,168,775
RI	-28,632,402	-38,751,336	-42,773,270	-40,372,115	-44,201,435	-41,735,078
DE	-8,115,378	-10,983,422	-12,123,372	-11,442,805	-12,528,162	-11,829,114
MD	-119,707,868	-162,013,645	-178,828,760	-168,789,884	-184,799,709	-174,488,232
DC	-27,070,805	-36,637,857	-40,440,437	-38,170,240	-41,790,711	-39,458,867
VA	-105,134,373	-142,289,753	-157,057,760	-148,241,038	-162,301,792	-153,245,657
WV	-1,944,543	-2,631,760	-2,904,906	-2,741,834	-3,001,899	-2,834,398
Total	-1,280,651,019	-1,733,243,960	-1,913,134,347	-1,805,737,090	-1,977,012,365	-1,866,698,791

*The state allocations include only the portion of states within the study area.

Difference in Annual VMT over Existing (2013) - Allocated to States

State*	Alternative 1	Alternative 2	Alternative 3 via CC and PVD (3.1)	Alternative 3 via LI and PVD (3.2)	Alternative 3 via LI and WOR (3.3)	Alternative 3 via CC and WOR (3.4)
NJ	3,601,491,268	3,486,540,092	3,440,850,887	3,468,128,027	3,424,626,919	3,452,644,756
CT	1,639,741,903	1,587,405,177	1,566,603,099	1,579,022,252	1,559,216,403	1,571,972,792
PA	1,393,341,892	1,348,869,678	1,331,193,478	1,341,746,434	1,324,916,763	1,335,756,279
NY	3,155,825,999	3,055,099,416	3,015,064,006	3,038,965,746	3,000,847,667	3,025,398,447
NH	167,890,802	162,532,120	160,402,225	161,673,804	159,645,912	160,952,020
MA	1,003,994,518	971,949,362	959,212,496	966,816,596	954,689,710	962,500,295
RI	317,032,444	306,913,510	302,891,576	305,292,731	301,463,411	303,929,768
DE	89,857,577	86,989,533	85,849,583	86,530,150	85,444,793	86,143,841
MD	1,325,466,083	1,283,160,307	1,266,345,191	1,276,384,067	1,260,374,243	1,270,685,719
DC	299,741,649	290,174,597	286,372,017	288,642,214	285,021,743	287,353,587
VA	1,164,100,974	1,126,945,594	1,112,177,587	1,120,994,309	1,106,933,555	1,115,989,690
WV	21,530,959	20,843,741	20,570,595	20,733,667	20,473,603	20,641,103
Total	14,180,016,068	13,727,423,128	13,547,532,741	13,654,929,998	13,483,654,722	13,593,968,297

yearid	stateid	pollutantid	statename	pollutantname	Emission Factor (Btu/vehicle-mile)	
					Fleet	Car
2013	9	91	CONNECTICUT	Total Energy Consumption	6,965,426	5,727,263
2013	10	91	DELAWARE	Total Energy Consumption	6,789,217	5,698,096
2013	11	91	DISTRICT OF COLUMBIA	Total Energy Consumption	7,017,625	6,083,123
2013	24	91	MARYLAND	Total Energy Consumption	6,992,852	5,710,187
2013	25	91	MASSACHUSETTS	Total Energy Consumption	7,007,971	5,859,880
2013	33	91	NEW HAMPSHIRE	Total Energy Consumption	7,044,221	5,556,803
2013	34	91	NEW JERSEY	Total Energy Consumption	6,978,293	5,846,814
2013	36	91	NEW YORK	Total Energy Consumption	6,968,387	5,763,300
2013	42	91	PENNSYLVANIA	Total Energy Consumption	7,029,397	5,675,578
2013	44	91	RHODE ISLAND	Total Energy Consumption	7,024,010	5,889,945
2013	51	91	VIRGINIA	Total Energy Consumption	7,061,740	5,700,232
2013	54	91	WEST VIRGINIA	Total Energy Consumption	7,130,507	5,460,659
2040	9	91	CONNECTICUT	Total Energy Consumption	5,720,559	4,341,809
2040	10	91	DELAWARE	Total Energy Consumption	5,559,703	4,318,269
2040	11	91	DISTRICT OF COLUMBIA	Total Energy Consumption	5,682,910	4,615,066
2040	24	91	MARYLAND	Total Energy Consumption	5,754,289	4,328,041
2040	25	91	MASSACHUSETTS	Total Energy Consumption	5,730,173	4,443,666
2040	33	91	NEW HAMPSHIRE	Total Energy Consumption	5,850,185	4,207,518
2040	34	91	NEW JERSEY	Total Energy Consumption	5,704,938	4,433,505
2040	36	91	NEW YORK	Total Energy Consumption	5,718,167	4,368,749
2040	42	91	PENNSYLVANIA	Total Energy Consumption	5,804,242	4,299,990
2040	44	91	RHODE ISLAND	Total Energy Consumption	5,738,003	4,466,844
2040	51	91	VIRGINIA	Total Energy Consumption	5,828,014	4,319,485
2040	54	91	WEST VIRGINIA	Total Energy Consumption	5,961,272	4,132,079

2040 Roadway Energy

State	Alternative 1	Alternative 2	Alternative 3			
			via CC and PVD (3.1)	via LI and PVD (3.2)	via LI and WOR (3.3)	via CC and WOR (3.4)
	annual reduction (joules)					
CT	-6.42984E+14	-8.7022E+14	-9.60539E+14	-9.06617E+14	-9.92611E+14	-9.37225E+14
DC	-1.24934E+14	-1.69086E+14	-1.86635E+14	-1.76158E+14	-1.92867E+14	-1.82105E+14
MD	-5.18101E+14	-7.01202E+14	-7.73978E+14	-7.30529E+14	-7.99821E+14	-7.55192E+14
DE	-3.50444E+13	-4.74294E+13	-5.2352E+13	-4.94131E+13	-5.41E+13	-5.10813E+13
PA	-5.41102E+14	-7.32332E+14	-8.0834E+14	-7.62962E+14	-8.35329E+14	-7.8872E+14
NJ	-1.44206E+15	-1.9517E+15	-2.15426E+15	-2.03333E+15	-2.22619E+15	-2.10197E+15
NY	-1.24516E+15	-1.68521E+15	-1.86011E+15	-1.75569E+15	-1.92222E+15	-1.81496E+15
RI	-1.27896E+14	-1.73096E+14	-1.91062E+14	-1.80336E+14	-1.97441E+14	-1.86424E+14
MA	-4.02927E+14	-5.45325E+14	-6.01924E+14	-5.68134E+14	-6.22022E+14	-5.87314E+14
Total (All States)	-5.08021E+15	-6.87559E+15	-7.5892E+15	-7.16317E+15	-7.8426E+15	-7.405E+15

State	Alternative 1	Alternative 2	Alternative 3			
			via CC and PVD (3.1)	via LI and PVD (3.2)	via LI and WOR (3.3)	via CC and WOR (3.4)
	annual reduction (MMBtu)					
CT	-609,431	-824,810	-910,415	-859,307	-940,813	-888,318
DC	-118,414	-160,263	-176,896	-166,966	-182,803	-172,602
MD	-491,065	-664,611	-733,590	-692,408	-758,084	-715,784
DE	-33,216	-44,954	-49,620	-46,835	-51,277	-48,416
PA	-512,866	-694,117	-766,158	-723,148	-791,739	-747,562
NJ	-1,366,810	-1,849,852	-2,041,845	-1,927,223	-2,110,021	-1,992,286
NY	-1,180,181	-1,597,267	-1,763,045	-1,664,073	-1,821,912	-1,720,252
RI	-121,222	-164,064	-181,091	-170,925	-187,138	-176,696
MA	-381,902	-516,869	-570,514	-538,487	-589,563	-556,666
Total (All States)	-4,815,107	-6,516,807	-7,193,175	-6,789,373	-7,433,349	-7,018,582

2040 Train Energy

State	Train Type	Energy Use (Btu/Day) / Freight (hp-hr)					
		Alternative 1	Alternative 2	Alternative 3			
				via CC and PVD (3.1)	via LI and PVD (3.2)	via LI and WOR (3.3)	via CC and WOR (3.4)
DC	Electric Trains	2.19E+07	4.89E+07	7.09E+07	7.09E+07	7.09E+07	5.01E+07
DC	Diesel Trains	0.00E+00	-8.76E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MD	Electric Trains	4.27E+08	8.32E+08	1.27E+09	1.27E+09	1.27E+09	8.64E+08
MD	Diesel Trains	0.00E+00	-1.80E+06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
DE	Electric Trains	1.00E+08	2.12E+08	2.86E+08	2.86E+08	2.86E+08	1.80E+08
DE	Diesel Trains	0.00E+00	8.12E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PA	Electric Trains	2.08E+08	4.66E+08	7.25E+08	7.25E+08	7.25E+08	4.23E+08
PA	Diesel Trains	6.58E+06	6.17E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NJ	Electric Trains	3.38E+08	6.96E+08	1.14E+09	1.14E+09	1.14E+09	7.27E+08
NJ	Diesel Trains	-6.58E+06	-7.65E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NY	Electric Trains	2.90E+08	6.20E+08	1.19E+09	1.38E+09	1.38E+09	8.51E+08
NY	Diesel Trains	0.00E+00	-1.20E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CT	Electric Trains	9.89E+08	1.51E+09	1.82E+09	1.94E+09	1.80E+09	9.42E+08
CT	Diesel Trains	0.00E+00	-1.72E+08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RI	Electric Trains	1.55E+08	1.04E+08	3.84E+08	3.84E+08	2.07E+08	1.07E+08
RI	Diesel Trains	0.00E+00	-1.48E+08	0.00E+00	1.08E+04	1.08E+04	1.08E+04
MA	Electric Trains	2.14E+08	2.91E+08	6.99E+08	6.99E+08	1.05E+09	7.31E+08
MA	Diesel Trains	0.00E+00	-3.14E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total (All States)	Electric Trains	2.74E+09	4.78E+09	7.58E+09	7.90E+09	7.93E+09	4.88E+09
Total (All States)	Diesel Trains	-2.98E-08	-3.52E+08	0.00E+00	1.08E+04	1.08E+04	1.08E+04