# Methodology for Computing Public Benefits of Diverting Passenger Trips from Conventional Modes to HSGT Modes of Travel

## For use with the FRA/DOT Commercial Feasibility Study

by

Donald M. Rote, Zian Wang, and Anant Vyas

Center for Transportation Research
Energy Systems Division
Argonne National Laboratory

May 1, 1996

Center for Transportation Research

Energy Systems Division
ARGONNE NATIONAL LABORATORY

Work sponsored by the Federal Railroad Administration, through interagency agreements DTFR53-94-X-00022 MOD 1 and DTFR53-96-X-00029, with the United States Department of Energy, and Argonne National Laboratory

# TABLE OF CONTENTS

## 1.0 INTRODUCTION

In 1995 the Federal Railroad Administration conducted a Commercial Feasibility Study (CFS) of new high speed ground transportation (HSGT) intercity modes. The HSGT modes included guided ground transportation technologies ranging from existing steel-wheel-on-rail fossil-fueled systems in the U.S. to a proposed 300-mph maglev system. A large number of possible U.S. transportation corridors were addressed for the period 2000 to 2040.

In support of that study, a methodology was developed at Argonne National Laboratory's Center for Transportation Research (CTR) to estimate and compare energy and petroleum use, and emissions and their monetary values for future scenarios with and without the new HSGT modes. To aid in the computations of the quantities of interest, a computer code was developed and made available for use by FRA's staff and supporting contractors.

The methodology is described in the body of this report and the associated computer code is outlined in Appendix A. A listing of the computer code is given in Appendix B.

The computer code called "SEPEC" calculates the following quantities for each city pair comprising a transportation corridor:

1. Energy and petroleum use for each intercity mode and the corresponding access/egress modes. These calculations are performed with and without the new HSGT mode included in the intercity modal mix.

2. Amounts of pollutant emissions for each intercity mode and the corresponding access/egress modes. These calculations are performed with and without the new HSGT mode included in the intercity modal mix.

3. Total monetary value of the emissions of each pollutant.

It then sums the quantities for all city pairs in the corridor and calculates the differences with and without the new HSGT modes, i.e. the after case minus the before case. It also calculates the present values of the emission control cost savings for each pollutant based on the reference years 1995 and 2000.

## 2.0 ASSUMPTIONS AND INPUT DATA REQUIREMENTS

The methodology takes into account the region of the country and the counties through which the intercity route passes. It also accounts for the existing air quality in each county. Calculations are performed for the projection years 2000, 2005, 2010, 2020, 2030, and 2040. For purposes of computing present values, quantities of interest are determined for all other years by interpolation. The assumptions and input data are summarized below and described in greater detail in following sections.

It is assumed that, in general, all new HSGT technologies will follow the same routes and serve the same city pairs. This makes comparisons between technologies and between the before and after cases (i.e. the cases without and with the new technologies, respectively) straight forward. However, for some corridors, significantly different routes have been defined for lower- and higher-speed HSGT technologies. When this happens, care must be taken in making comparisons between the different HSGT technologies. Also, even if different HSGT technologies use different routes, it is important that the before and after cases, for a given HSGT technology, utilize the same routes and city pairs. Otherwise, comparisons between the before and after cases may be difficult to interpret.

2.1 Corridor and Route Data

- Corridor and route description for each HSGT technology, including
  -the city pairs comprising a route
  -the states, counties, and Electricity Market Regions (EMM's) through which the route passes
  -for each city pair, the % of the route length in each county
  -for each city pair, the % of the route length in each EMM

- Passenger miles traveled between all city pairs along each route for all intercity modes (i.e. Air Carrier, Air Commuter/Regional, Rail, Bus, Auto) before and after introduction of the new mode for each projection year.

- Estimated value of air pollution emissions or air quality and population data for each county and/or relevant metropolitan statistical area (MSA).

2.2 Energy Use and Emission Factor Data (for each new and existing mode for each projection year).

- Aircraft: Average number of seats, and energy use and emission rates by aircraft type, operating mode, and projection year. Two intercity aircraft modes are considered separately--Air Carrier and Commuter/Regional.

- Highway Passenger Vehicles: Miles per gallon, vehicle occupancy, and emissions per vehicle mile traveled per projection year. Separate factors are used for urban and rural arterial and freeway driving and for conventional vehicles, limos, and buses.

- Rail: Energy use and emission factors for both diesel-electric and all-electric rail technologies. Emission factors and fuel use rates for diesel-electric locomotives are required in terms of notch settings. For electric-locomotives and maglev, output energy for a trip is converted to input energy to the power plants comprising the utility grid in each EMM region. Electric generating efficiencies and emissions are computed based on the mix of electric power generating technologies used for each EMM region of the country for each projection year.

2.3 Access & Egress Mode Data-- The average distance traveled for access and egress in each city, the modal split (% in autos, limos, buses, and rail) for each of the intercity modes, and the corresponding energy use and emission factor data by projection year. Where appropriate, distinctions are made between business and non-business intercity trips.

## 3.0 COMPUTATION OF ENERGY AND EMISSIONS BY INTERCITY MODE

3.1 Short-Haul Air Carrier Flights

All short-haul flights are assumed to use large commercial narrow body jet aircraft. Prior to the year 2000, the commercial jet aircraft fleet consists of stage 2 & 3 aircraft types. By the year 2000 legislation requires that all stage 2 aircraft are supposed to be eliminated[1]. The FAA[1] expects that there will be some extensions granted so that all stage 2 aircraft will be out of the fleet by 2003. The short-haul jet aircraft inventory for all

US carriers (from Boeing Aircraft Co.[2]) are given in Table 1. Projected inventories, out to the year 2040 (based on FAA projections), are also given in Table 1. Note that the B737 and B757 type aircraft are subdivided into 1993(present day), 2005, and 2030 vintages, in accordance with projections made by Boeing Aircraft Co.[3]

For purposes of energy and emissions calculations, the projected aircraft inventory through 2040 are given in Table 2 in terms of three representative aircraft types: stage-2 and stage-3 B737's and stage-3 B757's. The corresponding assumed market shares of the representative aircraft types are given in Table 3. Note that for purposes of energy and emissions calculations, the actual numbers of different aircraft types is not important, only the relative percentages. Also note that the average number of seats per aircraft grows over time consistent with observations and projections made by the FAA[4].

Using fuel flow and emission factor data for jet engines used in existing stage 2 and stage 3 aircraft types[5] (i.e. vintage 1993 aircraft), weighted-average fuel flow rates and emission factors for representative aircraft are computed. The total fuel used for a trip of length L(miles) is given in the form:

$$F(\text{lb of fuel}) = a(\text{lb of fuel}) + b(\text{lb of fuel/mile}) \times L(\text{miles}). \qquad (1)$$

Results are given in Table 4. Table 4 also includes the equivalent results for the 2005 and 2030 vintage aircraft based on data obtained from Boeing Aircraft Co.[3] The intercepts (values of the constant "a" in equation (1)) obtained from Boeing were somewhat increased to account for the total fuel used during the LTO-cycle part of trips at large commercial airports. LTO-cycle emission factors were then estimated for the vintage 2005 and 2030 aircraft by multiplying the vintage 1993 LTO-cycle emission factors by the ratios of the constants "a" for the different vintages. Similarly, ratios of the constants "b" or the slopes, were used to adjust the cruising or in-flight emission factors.

The air pollutants that are emitted near airports (i.e. LTO-cycle emissions) are assigned to their respective origin and destination cities for purposes of computing the values of emissions. The in-flight emissions are considered only for purposes of estimating global warming effects.

Table 1 Jet Aircraft Inventory-All U.S. Owners and Operators. Boeing Data for End of 1992

| Year | Stage 2 Aircraft | B737-Type Stage 3 Aircraft- Vintage 1993 | Vintage 2005 | Vintage 2030 | Subtot. | B757-Type Stage 3 Aircraft- Vintage 1993 | Vintage 2005 | Vintage 2030 | Subtot. | MD80 All Vintages | AVG. No. of Seats |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Historic Data | | | | | | | | | | | |
| 1982 | 1499 | 0 | | | 0 | 2 | | | 2 | 55 | 130 |
| 1987 | 1713 | 213 | | | 213 | 98 | | | 98 | 283 | 139 |
| 1992 | 1617 | 534 | | | 534 | 327 | | | 327 | 565 | 149 |
| Growth Rate1992 | | 64.2 | 64.2 | 64.2 | | 45.8 | 45.8 | 45.8 | | 56.4 | |
| Avg.# Seats1995 | 128 | 149 | 159 | 159 | | 208.5 | 217 | 217 | | 172 | |
| Projected Data | | | | | | | | | | | |
| 1990 | 1655 | 406 | 0 | 0 | 406 | 235 | 0 | 0 | 235 | 452 | 145 |
| 1995 | 1176 | 727 | 0 | 0 | 727 | 464 | 0 | 0 | 464 | 734 | 155 |
| 2000 | 441 | 1048 | 0 | 0 | 1048 | 693 | 0 | 0 | 693 | 1016 | 166 |
| 2003 | 0 | 1240 | 0 | 0 | 1240 | 831 | 0 | 0 | 831 | 1185 | 173 |
| 2005 | | 1304 | 64 | 0 | 1369 | 877 | 46 | 0 | 922 | 1298 | 173 |
| 2010 | | 1304 | 385 | 0 | 1690 | 877 | 275 | 0 | 1151 | 1580 | 174 |
| 2020 | | 899 | 1027 | 0 | 1926 | 641 | 733 | 0 | 1374 | 2144 | 176 |
| 2030 | | 257 | 1605 | 64 | 1926 | 183 | 1145 | 46 | 1374 | 2708 | 177 |
| 2040 | | 0 | 1220 | 706 | 1926 | 0 | 870 | 504 | 1374 | 3272 | 178 |

Table 2 Inventory of Representative Short-Haul Commercial Jet Aircraft Used For Computing Energy and Emissions

| Year | Stage 2 Aircraft | B737-Type Aircraft--------- Vintage 1993 | Vintage 2005 | Vintage 2030 | B737 Subtot | B757-Type Aircraft--------- Vintage 1993 | Vintage 2005 | Vintage 2030 | B757 Subtot | Total No. Of Aircraft | Avg. No. Of Seats |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1655 | 692 | | | 692 | 401 | | | 401 | 2749 | 145.0 |
| 1995 | 1176 | 1177 | | | 1177 | 748 | | | 748 | 3101 | 155.4 |
| 2000 | 441 | 1663 | | | 1663 | 1094 | | | 1094 | 3198 | 166.5 |
| 2003 | 0 | 1954 | | | 1954 | 1302 | | | 1302 | 3257 | 172.8 |
| 2005 | | 2051 | 97 | | 2148 | 1371 | 69 | | 1441 | 3589 | 173.3 |
| 2010 | | 2051 | 583 | | 2634 | 1371 | 416 | | 1787 | 4421 | 175.2 |
| 2020 | | 1360 | 1554 | | 2914 | 970 | 1109 | | 2078 | 4992 | 178.8 |
| 2030 | | 388 | 2428 | 97 | 2914 | 277 | 1732 | 69 | 2078 | 4992 | 181.9 |
| 2040 | | 0 | 1845 | 1068 | 2914 | 0 | 1316 | 762 | 2078 | 4992 | 183.1 |

Table 3 Market Share of Representative Short-Haul Commercial Jet Aircraft

| | | B737-Type Aircraft—— | | | B757-Type Aircraft—— | | |
|---|---|---|---|---|---|---|---|
| Year | Stage 2 Aircraft | Vintage 1993 | Vintage 2005 | Vintage 2030 | Vintage 1993 | Vintage 2005 | Vintage 2030 |
| 1990 | 0.602 | 0.252 | 0.000 | 0.000 | 0.146 | 0.000 | 0.000 |
| 1995 | 0.379 | 0.380 | 0.000 | 0.000 | 0.241 | 0.000 | 0.000 |
| 2000 | 0.138 | 0.520 | 0.000 | 0.000 | 0.342 | 0.000 | 0.000 |
| 2005 | 0.000 | 0.572 | 0.027 | 0.000 | 0.382 | 0.019 | 0.000 |
| 2010 | 0.000 | 0.464 | 0.132 | 0.000 | 0.310 | 0.094 | 0.000 |
| 2020 | 0.000 | 0.272 | 0.311 | 0.000 | 0.194 | 0.222 | 0.000 |
| 2030 | 0.000 | 0.078 | 0.486 | 0.019 | 0.056 | 0.347 | 0.014 |
| 2040 | 0.000 | 0.000 | 0.370 | 0.214 | 0.000 | 0.264 | 0.153 |

Table 4a Average Fuel Flow Rates and Emission Factors for Representative Short-Haul Commercial Jet Aircraft

| | | ——B737—— | | | ——B757—— | | |
|---|---|---|---|---|---|---|---|
| | Stage 2 | Vintage 1993 | Vintage 2005 | Vintage 2030 | Vintage 1993 | Vintage 2005 | Vintage 2030 |
| Intercept (lb fuel) | 2699 | 1870 | 1393 | 1275 | 2442 | 1865 | 1654 |
| Slope (lb fuel/mi) | 12.40 | 10.35 | 7.43 | 6.15 | 12.59 | 8.75 | 7.44 |
| Corres. % Thrust | 30.00 | 32.00 | 32.00 | 32.00 | 34.50 | 34.50 | 34.50 |
| 30% Thrust FFR | 12.40 | 9.92 | 9.92 | 9.92 | 10.88 | 10.88 | 10.88 |
| Cruise ERAF* | 1.000 | 1.044 | 0.749 | 0.620 | 1.157 | 0.804 | 0.684 |
| LTO Cycle ERAF* | 1.000 | 1.000 | 0.745 | 0.682 | 1.000 | 0.764 | 0.677 |
| NOx Reduction Fac. | 1.000 | 1.000 | 0.620 | 0.620 | 1.000 | 1.000 | 1.000 |
| CO Increase Fac. | 1.000 | 1.000 | 1.110 | 1.110 | 1.000 | 1.000 | 1.000 |
| HC Increase Fac. | 1.000 | 1.000 | 1.110 | 1.110 | 1.000 | 1.000 | 1.000 |
| LTO-Cycle HC(lb) | 14.60 | 1.59 | 1.32 | 1.20 | 2.36 | 1.81 | 1.60 |
| LTO-Cycle CO(lb) | 50.75 | 27.67 | 22.88 | 20.95 | 24.02 | 18.35 | 16.27 |
| LTO-Cycle NOX(lb) | 20.83 | 17.60 | 8.13 | 7.44 | 36.78 | 28.09 | 24.91 |
| LTO-Cycle SO2(lb) | 1.457 | 1.010 | 0.752 | 0.689 | 1.319 | 1.007 | 0.893 |
| Cruise HC(lb/mi) | 0.020 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 |
| Cruise CO(lb/mi) | 0.123 | 0.035 | 0.029 | 0.026 | 0.025 | 0.019 | 0.017 |
| Cruise NOX(lb/mi) | 0.071 | 0.083 | 0.038 | 0.035 | 0.113 | 0.086 | 0.076 |
| Cruise SO2(lb/mi) | 0.007 | 0.005 | 0.004 | 0.004 | 0.006 | 0.004 | 0.004 |

* Emission Rate Adjustment Factor

NOTE: Fuel use data for Vintage 2005 & 2030 aircraft come from Boeing.

NOTE: Changes in NOx, HC, & CO emission factors due to incorporation of planned new GE engines for Stage 3, B737-300 aircraft (see letter from Koshoffer, 4/20/95)

Above note and changes made 6/28/95

Table 4b Jet Aircraft Fuel Use, Emission Factors, and Energy Use by Projection Year

| Year | LTO-Cycle Fuel Use (lb) | LTO-Cycle Energy (MBtu) | LTO-Cycle Emissions VOC (lb) | CO (lb) | NOX (lb) | SO2 (lb) | CO2 (lb) |
|---|---|---|---|---|---|---|---|
| 1990 | 2453 | 49.1 | 10.4 | 41.0 | 22.3 | 1.324 | 7714 |
| 1995 | 2322 | 46.4 | 7.34 | 35.5 | 23.4 | 1.254 | 7304 |
| 2000 | 2180 | 43.6 | 3.99 | 29.6 | 24.6 | 1.177 | 6856 |
| 2005 | 2075 | 41.5 | 2.06 | 25.9 | 25.0 | 1.121 | 6528 |
| 2010 | 1984 | 39.7 | 1.97 | 24.7 | 23.9 | 1.071 | 6240 |
| 2020 | 1831 | 36.6 | 1.82 | 22.7 | 22.3 | 0.989 | 5760 |
| 2030 | 1653 | 33.1 | 1.64 | 20.5 | 20.1 | 0.893 | 5200 |
| 2040 | 1532 | 30.6 | 1.52 | 19.0 | 18.6 | 0.827 | 4819 |

| Year | Cruise FFR (lb/mi) | Cruise (MBtu /mi) | Cruise emissions VOC (lb/mi) | CO (lb/mi) | NOX (lb/mi) | SO2 (lb/mi) | CO2 (lb/mi) | No. of Seats |
|---|---|---|---|---|---|---|---|---|
| 1990 | 11.91 | 0.238 | 0.01362 | 0.0865 | 0.0800 | 0.00624 | 37.47 | 145 |
| 1995 | 11.67 | 0.233 | 0.00918 | 0.0659 | 0.0856 | 0.00599 | 36.70 | 155 |
| 2000 | 11.40 | 0.228 | 0.00438 | 0.0437 | 0.0916 | 0.00572 | 35.85 | 166 |
| 2005 | 11.10 | 0.222 | 0.00162 | 0.0306 | 0.0940 | 0.00550 | 34.90 | 173 |
| 2010 | 10.51 | 0.210 | 0.00156 | 0.0292 | 0.0899 | 0.00526 | 33.05 | 175 |
| 2020 | 9.52 | 0.190 | 0.00145 | 0.0267 | 0.0830 | 0.00484 | 29.94 | 179 |
| 2030 | 8.37 | 0.167 | 0.00131 | 0.0241 | 0.0750 | 0.00437 | 26.33 | 182 |
| 2040 | 7.50 | 0.150 | 0.00121 | 0.0223 | 0.0694 | 0.00405 | 23.60 | 183 |

NOTE: The FAA recommends that the total hydrocarbon (HC) emission rates be converted to volatile organic compounds (VOC) using the following factor: VOC = HC * 1.0947
This factor has been incorporated into the above table.

NOTE: For purposes of calculating the value of emission control cost savings, a complete set of LTO-cycle emissions are attributed to the origin & destination city for each aircraft round trip.
The cruising emissions are distributed over the counties covered by the route.

### 3.2 Commuter/Regional Aircraft Flights

In order to distinguish between these and air carrier flights, and to be consistent with available data, all commuter/regional flights are assumed to be made with turboprop aircraft that are divided into three size ranges as indicated in Table 5. That table also gives the market shares for these size classes from FAA data and projections[1,4] and linear extrapolations thereof. Representative aircraft and engine types are shown in Table 6, and the weighted-average fuel-flow rates and emission factors based on EPA data[5] are given in Table 7.

### 3.3 Highway Passenger Vehicles

Energy and emission data for highway passenger vehicles for all states except California were derived from calculations using EPA's Mobile Source Computer Model version 5a.[6] This version, which was released in March 1993, was prepared in response to the National Academy of Science's Study that concluded that mobile source emissions based on the earlier version 4.1 were grossly underestimated. (Emission estimates reported in the National Maglev Initiative Study were based on version 4.1).

The EMFAC model[7] was used to generate two separate sets of emission factors: Northern California; and Southern California. Both the EMFAC and mobile source emission models incorporate the latest emission regulations for their applicable regions. Other options may be considered (such as TIER 2) but corresponding regulations have not been adopted yet.

The emission factors were generated on a seasonal basis and averaged to obtain annual average values for urban local roadways, urban freeways and rural freeways. Urban freeway factors were used for access/egress trips. The urban freeway factors were also used for the urban portions of an intercity trip, namely, either 30 miles or 10% of the total intercity trip mileage, whichever was larger. Rural freeway factors were used for the remaining portions of the intercity trip mileage. In addition to varying by region, the emission factors also vary by year. The emission factors are given in Table 8 out to the year 2020. Beyond 2020, the factors are not changed (not shown).

Passenger vehicle occupancy and efficiency data are given in Table 9a. The vehicle occupancy projections in Table 9a are derived from projections of household characteristics from census data and travel survey data as discussed in Refs. 8 & 9. The city and intercity mileage projections are based on data and methodology described in Ref. 10. Intercity and transit bus data are given in Table 9b. The energy intensity values are assumed to be constant (because of lack of clear trends in the historical data) and are taken from the data for 1992 given in Ref. 11. The projected mileage data are also based on the historical data given in Ref. 11.

### 3.4 New and Existing Fossil-Fueled Ground Mass Transportation Modes

These modes are described in Table 10. The data is from Ref. 12 unless noted otherwise. Fuel flow rates and emission factors for these modes are given in Table 11a in terms of notch settings. The data is from Refs. 13-14. Values for overnight idling are given in Table 11b. Diesel-electric locomotives are assumed to be left idling overnight (10 hours). No idle time is assumed for gas-turbine- and electric-powered vehicles. The number of locomotives idling overnight is based on the time to complete a round trip and the passenger seat requirement on the most heavily travelled route link or segment.

Table 5 Projections of Percent of Each Size Class in the Turbo Fleet

| YEAR | <20 Seats | 20-39 Seats | 40-74 Seats | TOTAL | Avg. no. of Seats |
|---|---|---|---|---|---|
| 1995 | 58.48 | 30.23 | 11.29 | 100.0 | 24.14 |
| 2000 | 43.55 | 36.72 | 19.73 | 100.0 | 28.75 |
| 2005 | 33.58 | 39.85 | 26.56 | 100.0 | 32.15 |
| 2006 | 31.89 | 40.39 | 27.73 | 100.0 | 32.74 |
| 2010 | 25.85 | 42.29 | 31.86 | 100.0 | 34.80 |
| 2020 | 14.63 | 45.82 | 39.55 | 100.0 | 38.63 |
| 2030 | 6.88 | 48.26 | 44.87 | 100.0 | 41.28 |
| 2040 | 1.20 | 50.04 | 48.76 | 100.0 | 43.22 |

Table 6 Representative Two-Engine Turboprop Aircraft and Engine Types

| Size Class (No. Of Seats) | Aircraft | No. of Seats | Engines Used |
|---|---|---|---|
| <20 | Brit. Aer J31 | 8 to 19 | TPE-331 |
| 20 to 39 | Saab SF 340 | 35 | CT7-5 |
| | Fokker F27 | 33 to 60 | Dart RDa7 |
| 40 to 74 | Conv. CV580 | 56 | 501D13H |
| | Namc YS-11 | 60 | Dart RDa10 |

Table 7 Weighted-Average Emission Factors & Fuel Flow Rates

| YEAR | VOC | CO | NOX | SOX | PTM | CO2 | Avg. Fuel Use (lb/ LTO-Cycle) |
|---|---|---|---|---|---|---|---|
| | ------------------LTO-CYCLE EMISSIONS (g poll./aircraft)--------------- | | | | | | |
| 1995 | 3106 | 4990 | 668 | 76 | 353 | 444710 | 312 |
| 2000 | 2901 | 5858 | 750 | 92 | 426 | 536173 | 376 |
| 2005 | 2780 | 6464 | 812 | 104 | 480 | 603247 | 423 |
| 2006 | 2760 | 6568 | 822 | 106 | 489 | 614682 | 431 |
| 2010 | 2686 | 6935 | 860 | 113 | 521 | 655302 | 459 |
| 2020 | 2550 | 7618 | 930 | 125 | 582 | 730841 | 512 |
| 2030 | 2456 | 8089 | 978 | 134 | 624 | 783016 | 549 |
| 2040 | 2387 | 8434 | 1014 | 141 | 654 | 821213 | 576 |

| YEAR | VOC | CO | NOX | SOX | PTM | CO2 | Avg. Fuel Use (lb/mi) |
|---|---|---|---|---|---|---|---|
| | --------------CRUISING EMISSION RATE (g poll./aircraft/km)----------- | | | | | | |
| 1995 | 1.11 | 10.28 | 5.12 | 0.42 | 1.88 | 2464 | 2.780 |
| 2000 | 1.36 | 12.91 | 5.26 | 0.49 | 2.18 | 2853 | 3.218 |
| 2004 | 1.52 | 14.74 | 5.40 | 0.54 | 2.40 | 3142 | 3.544 |
| 2005 | 1.54 | 15.05 | 5.43 | 0.55 | 2.44 | 3191 | 3.600 |
| 2010 | 1.64 | 16.16 | 5.52 | 0.58 | 2.57 | 3366 | 3.797 |
| 2020 | 1.82 | 18.22 | 5.68 | 0.63 | 2.82 | 3691 | 4.164 |
| 2030 | 1.94 | 19.65 | 5.80 | 0.67 | 2.99 | 3916 | 4.417 |
| 2040 | 2.03 | 20.69 | 5.88 | 0.70 | 3.11 | 4080 | 4.602 |

Table 8a Highway Vehicle Emission Factors (g/VMT) for Southern California

**Rural Arterials/Urban Freeways------------------------------**

| | VOC | CO | NOx | SOx | PM10 |
|---|---|---|---|---|---|
| **Calendar Year** | **1990** | **1990** | **1990** | **1990** | **1990** |
| LDGV(auto) | 1.45 | 20.1 | 2.13 | 0.0870 | 0.0806 |
| LDGT(Limo) | 1.92 | 22.0 | 2.47 | 0.116 | 0.117 |
| HDDV(Bus) | 1.48 | 6.76 | 18.7 | 2.65 | 2.71 |
| **Calendar Year** | **2000** | **2000** | **2000** | **2000** | **2000** |
| LDGV(auto) | 0.703 | 8.02 | 1.54 | 0.0300 | 0.0478 |
| LDGT(Limo) | 0.849 | 9.49 | 1.78 | 0.0400 | 0.0600 |
| HDDV(Bus) | 1.05 | 5.78 | 9.16 | 0.483 | 0.891 |
| **Calendar Year** | **2010** | **2010** | **2010** | **2010** | **2010** |
| LDGV(auto) | 0.338 | 2.92 | 0.647 | 0.0300 | 0.0478 |
| LDGT(Limo) | 0.478 | 5.33 | 1.08 | 0.0400 | 0.0578 |
| HDDV(Bus) | 0.961 | 5.58 | 6.30 | 0.432 | 0.435 |
| **Calendar Year** | **2020** | **2020** | **2020** | **2020** | **2020** |
| LDGV(auto) | 0.219 | 1.52 | 0.325 | 0.0300 | 0.0478 |
| LDGT(Limo) | 0.390 | 4.26 | 0.886 | 0.0400 | 0.0578 |
| HDDV(Bus) | 0.960 | 5.56 | 5.86 | 0.417 | 0.388 |

**Rural Freeways----------------------------------------**

| | VOC | CO | NOx | SOx | PM10 |
|---|---|---|---|---|---|
| **Calendar Year** | **1990** | **1990** | **1990** | **1990** | **1990** |
| LDGV(auto) | 1.77 | 46.3 | 2.69 | 0.087 | 0.081 |
| LDGT(Limo) | 2.41 | 54.3 | 2.99 | 0.116 | 0.117 |
| HDDV(Bus) | 1.19 | 7.18 | 29.6 | 2.65 | 2.71 |
| **Calendar Year** | **2000** | **2000** | **2000** | **2000** | **2000** |
| LDGV(auto) | 0.771 | 14.2 | 1.83 | 0.0300 | 0.0478 |
| LDGT(Limo) | 0.939 | 17.0 | 2.24 | 0.0400 | 0.0600 |
| HDDV(Bus) | 0.841 | 6.13 | 14.5 | 0.483 | 0.891 |
| **Calendar Year** | **2010** | **2010** | **2010** | **2010** | **2010** |
| LDGV(auto) | 0.340 | 4.76 | 0.749 | 0.030 | 0.048 |
| LDGT(Limo) | 0.486 | 8.21 | 1.37 | 0.040 | 0.058 |
| HDDV(Bus) | 0.772 | 5.93 | 9.98 | 0.432 | 0.435 |
| **Calendar Year** | **2020** | **2020** | **2020** | **2020** | **2020** |
| LDGV(auto) | 0.199 | 2.41 | 0.366 | 0.0300 | 0.0478 |
| LDGT(Limo) | 0.384 | 6.37 | 1.12 | 0.0400 | 0.0578 |
| HDDV(Bus) | 0.770 | 5.91 | 9.28 | 0.417 | 0.388 |

Table 8b Highway Vehicle Emission Factors (g/VMT) for Northern California

**Rural Arterials/Urban Freeways------------------------------**

| | VOC | CO | NOx | SOx | PM10 |
|---|---|---|---|---|---|
| **Calendar Year** | **1990** | **1990** | **1990** | **1990** | **1990** |
| LDGV(auto) | 1.25 | 21.0 | 2.28 | 0.0508 | 0.0582 |
| LDGT(Limo) | 1.73 | 22.9 | 2.64 | 0.0685 | 0.0867 |
| HDDV(Bus) | 1.48 | 6.76 | 18.7 | 2.89 | 2.71 |
| **Calendar Year** | **2000** | **2000** | **2000** | **2000** | **2000** |
| LDGV(auto) | 0.82 | 12.7 | 1.78 | 0.0448 | 0.0478 |
| LDGT(Limo) | 1.07 | 14.5 | 2.05 | 0.0597 | 0.0600 |
| HDDV(Bus) | 1.16 | 6.02 | 11.5 | 0.524 | 0.891 |
| **Calendar Year** | **2010** | **2010** | **2010** | **2010** | **2010** |
| LDGV(auto) | 0.49 | 7.03 | 1.19 | 0.0448 | 0.0478 |
| LDGT(Limo) | 0.67 | 9.65 | 1.56 | 0.0597 | 0.0578 |
| HDDV(Bus) | 1.00 | 5.68 | 7.73 | 0.470 | 0.435 |
| **Calendar Year** | **2020** | **2020** | **2020** | **2020** | **2020** |
| LDGV(auto) | 0.27 | 3.12 | 0.60 | 0.0448 | 0.0478 |
| LDGT(Limo) | 0.45 | 6.32 | 1.11 | 0.0597 | 0.0578 |
| HDDV(Bus) | 0.96 | 5.58 | 6.19 | 0.453 | 0.388 |

**Rural Freeways-----------------------------------------------------------------**

| | VOC | CO | NOx | SOx | PM10 |
|---|---|---|---|---|---|
| **Calendar Year** | **1990** | **1990** | **1990** | **1990** | **1990** |
| LDGV(auto) | 1.56 | 47.1 | 2.85 | 0.0508 | 0.0582 |
| LDGT(Limo) | 2.23 | 55.3 | 3.17 | 0.0685 | 0.0867 |
| HDDV(Bus) | 1.19 | 7.18 | 29.6 | 2.89 | 2.71 |
| **Calendar Year** | **2000** | **2000** | **2000** | **2000** | **2000** |
| LDGV(auto) | 0.966 | 24.8 | 2.14 | 0.0448 | 0.0478 |
| LDGT(Limo) | 1.27 | 29.3 | 2.54 | 0.0597 | 0.0600 |
| HDDV(Bus) | 0.927 | 6.39 | 18.3 | 0.524 | 0.891 |
| **Calendar Year** | **2010** | **2010** | **2010** | **2010** | **2010** |
| LDGV(auto) | 0.541 | 12.1 | 1.39 | 0.0448 | 0.0478 |
| LDGT(Limo) | 0.724 | 16.1 | 1.94 | 0.0597 | 0.0578 |
| HDDV(Bus) | 0.806 | 6.03 | 12.2 | 0.470 | 0.435 |
| **Calendar Year** | **2020** | **2020** | **2020** | **2020** | **2020** |
| LDGV(auto) | 0.276 | 5.01 | 0.693 | 0.0448 | 0.0478 |
| LDGT(Limo) | 0.454 | 9.55 | 1.40 | 0.0597 | 0.0578 |
| HDDV(Bus) | 0.771 | 5.92 | 9.80 | 0.622 | 0.534 |

Table 8c Highway Vehicle Emission Factors (g/VMT) for All Other States

**Rural Arterials/Urban Freeways------------------------------**

| | VOC | CO | NOx | SOx | PM10 |
|---|---|---|---|---|---|
| **Calendar Year** | **1990** | **1990** | **1990** | **1990** | **1990** |
| LDGV(auto) | 1.67 | 25.15 | 2.62 | 0.0870 | 0.0806 |
| LDGT(Limo) | 2.81 | 39.18 | 3.42 | 0.12 | 0.12 |
| HDDV(Bus) | 2.49 | 9.38 | 19.36 | 2.65 | 2.71 |
| **Calendar Year** | **2000** | **2000** | **2000** | **2000** | **2000** |
| LDGV(auto) | 0.887 | 11.11 | 1.99 | 0.0780 | 0.0702 |
| LDGT(Limo) | 1.28 | 17.41 | 2.46 | 0.104 | 0.0899 |
| HDDV(Bus) | 1.73 | 7.94 | 9.57 | 0.483 | 0.891 |
| **Calendar Year** | **2010** | **2010** | **2010** | **2010** | **2010** |
| LDGV(auto) | 0.702 | 9.10 | 1.77 | 0.0780 | 0.0687 |
| LDGT(Limo) | 0.988 | 13.51 | 2.19 | 0.103 | 0.0861 |
| HDDV(Bus) | 1.61 | 7.75 | 6.47 | 0.432 | 0.435 |
| **Calendar Year** | **2020** | **2020** | **2020** | **2020** | **2020** |
| LDGV(auto) | 0.667 | 8.41 | 1.74 | 0.0780 | 0.0687 |
| LDGT(Limo) | 0.929 | 12.41 | 2.09 | 0.103 | 0.0861 |
| HDDV(Bus) | 1.64 | 7.70 | 5.84 | 0.417 | 0.388 |

**Rural Freeways-----------------------------------------**

| | VOC | CO | NOx | SOx | PM10 |
|---|---|---|---|---|---|
| **Calendar Year** | **1990** | **1990** | **1990** | **1990** | **1990** |
| LDGV(auto) | 2.03 | 60.1 | 3.12 | 0.0870 | 0.0806 |
| LDGT(Limo) | 3.55 | 102 | 3.70 | 0.116 | 0.117 |
| HDDV(Bus) | 2.00 | 9.96 | 30.7 | 2.65 | 2.71 |
| **Calendar Year** | **2000** | **2000** | **2000** | **2000** | **2000** |
| LDGV(auto) | 0.954 | 19.9 | 2.22 | 0.0780 | 0.0702 |
| LDGT(Limo) | 1.42 | 33.7 | 2.92 | 0.104 | 0.0899 |
| HDDV(Bus) | 1.40 | 8.46 | 15.07 | 0.483 | 0.891 |
| **Calendar Year** | **2010** | **2010** | **2010** | **2010** | **2010** |
| LDGV(auto) | 0.869 | 16.8 | 1.87 | 0.0780 | 0.0687 |
| LDGT(Limo) | 1.19 | 23.6 | 2.59 | 0.103 | 0.0861 |
| HDDV(Bus) | 1.53 | 9.20 | 9.69 | 0.432 | 0.435 |
| **Calendar Year** | **2020** | **2020** | **2020** | **2020** | **2020** |
| LDGV(auto) | 0.704 | 13.9 | 1.84 | 0.0780 | 0.0687 |
| LDGT(Limo) | 0.950 | 19.2 | 2.52 | 0.103 | 0.0861 |
| HDDV(Bus) | 1.32 | 8.18 | 9.25 | 0.417 | 0.388 |

Table 9a Passenger Vehicle Occupancy and Mileage

| Year | Intercity Vehicle Occupancy | Intercity Mileage (mpg) | City Mileage (mpg) |
|---|---|---|---|
| 2000 | 1.89 | 27.51 | 19 |
| 2005 | 1.86 | 29.41 | 20.3 |
| 2010 | 1.83 | 31.31 | 21.6 |
| 2020 | 1.73 | 36.69 | 25.3 |
| 2030 | 1.7 | 40.52 | 28 |
| 2040 | 1.67 | 47.35 | 31.6 |

Table 9b Bus Occupancy and Mileage

| | -----------Intercity---------- | | | ----------Transit------------ | | |
|---|---|---|---|---|---|---|
| Year | Energy Intensity (Btu/PM) | Occupancy | Mileage (mpg) | Energy Intensity (Btu/PM) | Occupancy | Mileage (mpg) |
| 2000 | 954 | 24.14 | 6.02 | 3970 | 9.72 | 3.60 |
| 2005 | 954 | 24.75 | 5.87 | 3970 | 9.96 | 3.51 |
| 2010 | 954 | 25.38 | 5.73 | 3970 | 10.21 | 3.42 |
| 2020 | 954 | 25.38 | 5.73 | 3970 | 10.21 | 3.42 |
| 2030 | 954 | 25.38 | 5.73 | 3970 | 10.21 | 3.42 |
| 2040 | 954 | 25.38 | 5.73 | 3970 | 10.21 | 3.42 |

**Table 10 Summary of Technologies**

| Technology | Consist | Weight | No. of Seats | Accel.. Time | Accel.. Dist. (miles) | Fuel for Hotel Functions (GPM) | Efficiency | Comments |
|---|---|---|---|---|---|---|---|---|
| 79 Non Electric[1] 3500 hp | 1-4 | 362 ton 1-4 trainset (130 ton Locomotive) | 264 | 0-79 2.28 min | 2.0 | 0.396 | 0.2784[2] | Based on P-40 with Amfleet type coaches |
| 90 Non Electric 3500 hp | 1-4 | 346 ton 1-4 trainset (130 ton Locomotive) | 264 | 0-90 2.64 min | 2.7 | 0.396 | 0.3965[2] | Based on P-40 (AMD 103) with X-2000 type Coaches |
| 110 Non Elect 4000 hp(min.) | 1-4 1-3 (b/l) | 346 ton 1-4 trainset 325 ton 1-3 | 264 | 0-110 3.80 min | 5.0 | 0.396 | 0.3554[2] | Based on modified Diesel With X-2000 type Coaches |
| 125 Non Elect 4500 hp(min.) | 1-4 1-3 (b/l) | 326 ton 1-4 trainset 305 ton 1-3 (110 t power car) | 264 | 0-125 3.66 min | 5.4 | 0.396 | 0.3371[2] | Based on advanced Diesel (110t) w/X-2000 type coach |
| 125 Electric 7000 hp/loco | 1-4 1-3 (b/l) | 316 ton 1-4 trainset 295 ton 1-3 | 264 | 0-125 2.54 min | 3.7 | 240kw | 0.815[3] | Based on AEM-7 with X-2000 type Coaches |
| 150 Non Elect 7000 hp/loco | 1-4 | 316 ton 1-4 trainset (100 ton power car) | 264 | 0-150 3.86 min | 6.9 | 0.317 | 0.3217[2] | Based on Adv. Diesel Loco with X-2000 type Coaches |
| 150 Electric 7200 hp/loco | 1-4 1-3 (b/l) | 306t 1-4 (1-3 285 t) (90 ton power car) | 264 | 0-150 2.80 min | 4.6 | 240kw | 0.815[3] | Based on improved AEM-7 with X-2000 type Coaches |
| 200 Electric 6000 hp/power car | 1-8-1 (1-6-1) | 460 ton 1-8-1 (1-6-1 390t) (73 ton Power Car) | 388 284 | 0-200 6.34 min | 14.0 | 360kw | 0.817[3] | Based on TGV-A 1-8-1 |
| Maglev 8100 hp/car | 2 car 4 car | 45 ton nose (65/85 seats) 45 ton middle (105 seats) | 150 360 | 0-300 1.79 min | 5.2 | 120kw | 0.849[3] | Based on U.S. Maglev with ride comfort limit 0.16g acc |

[1]This technology comprises a mix of the older FP40-PH (3000 HP) and newer AMD103 (3500 HP) locomotives. The mix is 100% older in 1985 and progresses linearly to 100% newer by 2015.

[2]Output energy required to accel. to max. speed (K.E. + work to overcome resistance to forward motion + hotel energy) ÷ input fuel energy equivalent.

[3]Output energy from train/maglev ÷ input electric energy to substation

Table 11a Non-Electric HSGT Emission Factors and Total Fuel Flow Rates vs. Notch Setting

**79 Non-El, F40PH 3000HP** 0.24% Sulfur
Engine: EMD 16-645E3 85.8% Carbon
CARB Emission Rates (g poll./h)

| Notch Setting | PM | NOX | CO | HC | SO2 | CO2 (10^5) | Total FFR (GPM) |
|---|---|---|---|---|---|---|---|
| Idle | 34 | 1635 | 564 | 185 | 435.1 | 2.852 | 0.493 |
| 1 | 24 | 2810 | 267 | 156 | 486.3 | 3.187 | 0.551 |
| 2 | 133 | 6040 | 292 | 201 | 708.7 | 4.645 | 0.803 |
| 3 | 227 | 10179 | 329 | 247 | 939.1 | 6.155 | 1.064 |
| 4 | 258 | 15416 | 435 | 321 | 1219 | 7.988 | 1.381 |
| 5 | 336 | 20899 | 760 | 424 | 1547 | 10.14 | 1.753 |
| 6 | 545 | 25568 | 1912 | 611 | 1947 | 12.76 | 2.206 |
| 7 | 648 | 31188 | 5029 | 878 | 2478 | 16.24 | 2.808 |
| 8 | 837 | 36933 | 5908 | 1169 | 2878 | 18.86 | 3.261 |
| Brake | 80 | 4104 | 655 | 293 | 634.6 | 4.159 | 0.719 |

**79 & 90 Non-El, P40 3500HP, Dash 8** 0.28% Sulfur
Engine: GE-16-3600 85.8% Carbon
CARB Estimated Emission Rates (g poll./h)

| Notch Setting | PM | NOX | CO | HC | SO2 | CO2 (10^5) | Total FFR (GPM) |
|---|---|---|---|---|---|---|---|
| Idle | 38 | 320 | 534 | 333 | 478.3 | 2.687 | 0.465 |
| 1 | 70 | 1159 | 336 | 163 | 590.5 | 3.317 | 0.574 |
| 2 | 80 | 2742 | 569 | 182 | 702.8 | 3.948 | 0.683 |
| 3 | 154 | 5970 | 1084 | 246 | 1038 | 5.834 | 1.009 |
| 4 | 231 | 12982 | 2738 | 338 | 1375 | 7.725 | 1.336 |
| 5 | 355 | 20423 | 4335 | 399 | 1711 | 9.611 | 1.662 |
| 6 | 505 | 27127 | 8059 | 489 | 2048 | 11.5 | 1.989 |
| 7 | 519 | 31670 | 6069 | 758 | 2383 | 13.39 | 2.315 |
| 8 | 595 | 38158 | 4844 | 866 | 2720 | 15.28 | 2.642 |
| Brake | 451 | 1461 | 2914 | 1384 | 639.1 | 3.59 | 0.621 |

**110 Non-El, 4000HP**
Engine: EMD 16-710G3A 0.21% Sulfur
EMD's Projected Emission Rates 85.8% Carbon
for Yr 2000 (g poll./h)

| Notch Setting | PM | NOX | CO | HC | SO2 | CO2 10^5 | Total FFR (GPM) |
|---|---|---|---|---|---|---|---|
| Idle | 7 | 253 | 31 | 30 | 22.88 | 0.171 | 0.465 |
| 1 | 29 | 1701 | 150 | 112 | 169.7 | 1.271 | 0.617 |
| 2 | 64 | 3546 | 247 | 176 | 320.3 | 2.400 | 0.769 |
| 3 | 186 | 7325 | 264 | 319 | 665.5 | 4.985 | 1.224 |
| 4 | 244 | 8171 | 356 | 371 | 900.0 | 6.742 | 1.68 |
| 5 | 336 | 9530 | 789 | 462 | 1176 | 8.813 | 2.136 |
| 6 | 395 | 11775 | 899 | 521 | 1480 | 11.08 | 2.591 |
| 7 | 613 | 17712 | 2605 | 776 | 2214 | 16.58 | 3.047 |
| 8 | 855 | 24707 | 4672 | 1141 | 2578 | 19.31 | 3.503 |
| Brake | 96 | 1224 | 237 | 261 | 164.0 | 1.228 | 0.608 |

Table 11a Continued

**125 Non-El, AMD125-5200HP**

EMD Year 2000 Scaled Emission Rates (g poll./h) — 0.21% Sulfur, 85.8% Carbon

| Notch Setting | PM | NOX | CO | HC | SO2 | CO2 (10^5) | Total FFR (GPM) |
|---|---|---|---|---|---|---|---|
| Idle | 9.1 | 328.9 | 40.3 | 39 | 29.75 | 0.223 | 0.465 |
| 1 | 37.7 | 2211 | 195 | 145.6 | 220.6 | 1.653 | 0.663 |
| 2 | 83.2 | 4610 | 321.1 | 228.8 | 416.4 | 3.119 | 0.862 |
| 3 | 241.8 | 9523 | 343.2 | 414.7 | 865.1 | 6.48 | 1.457 |
| 4 | 317.2 | 10622 | 462.8 | 482.3 | 1170 | 8.764 | 2.053 |
| 5 | 436.8 | 12389 | 1026 | 600.6 | 1529 | 11.46 | 2.648 |
| 6 | 513.5 | 15308 | 1169 | 677.3 | 1924 | 14.41 | 3.244 |
| 7 | 796.9 | 23026 | 3387 | 1009 | 2878 | 21.56 | 3.839 |
| 8 | 1112 | 32119 | 6074 | 1483 | 3351 | 25.1 | 4.435 |
| Brake | 124.8 | 1591 | 308.1 | 339.3 | 213.2 | 1.597 | 0.608 |

**150 Non-El, Hypothetical 7000HP** — 0.21% Sulfur

Emissions scaled by g/bhph from EMD data. — 85.8% Carbon

Emission rates (g poll./h)

| Notch Setting | PM | NOX | CO | HC | SO2* | CO2 (10^5) | Total FFR (GPM) |
|---|---|---|---|---|---|---|---|
| Idle | 91.17 | 2690 | 400.4 | 137.4 | 285.5 | 2.139 | 0.37 |
| 1 | 147.2 | 4342 | 646.3 | 221.7 | 460.8 | 3.452 | 0.597 |
| 2 | 216.2 | 6380 | 949.6 | 325.7 | 677 | 5.071 | 0.877 |
| 3 | 423.4 | 12492 | 1859 | 637.8 | 1326 | 9.93 | 1.717 |
| 4 | 630.5 | 18604 | 2769 | 949.9 | 1974 | 14.79 | 2.557 |
| 5 | 837.7 | 24717 | 3679 | 1262 | 2623 | 19.65 | 3.397 |
| 6 | 1045 | 30829 | 4589 | 1574 | 3272 | 24.51 | 4.237 |
| 7 | 1252 | 36942 | 5499 | 1886 | 3921 | 29.37 | 5.077 |
| 8 | 1459 | 43054 | 6409 | 2198 | 4569 | 34.23 | 5.917 |
| Brake | 169.7 | 5009 | 745.5 | 255.7 | 531.5 | 3.982 | 0.688 |

Table 11b Over-Night Idle Fuel Flow Rates and Idle Emission Factors

| Technology | Fuel Flow Rate (GPM) | ---Emission Rate (g pollutant/hour)--- PM | NOX | CO | HC | SO2* | CO2* (10^5) |
|---|---|---|---|---|---|---|---|
| 79 NE (F40) | 0.097 | 34 | 1635 | 564 | 185 | 74.91 | 0.561 |
| 79 NE (P40) | 0.069 | 38 | 320 | 534 | 333 | 53.29 | 0.399 |
| 90 NE (P40) | 0.069 | 38 | 320 | 534 | 333 | 53.29 | 0.399 |
| 110 Non-Electric | 0.069 | 7 | 253 | 84 | 63 | 53.29 | 0.399 |
| 125 Non-Electric | 0.069 | 9.1 | 328.9 | 40.3 | 39 | 53.29 | 0.399 |
| 150 NE, 7000HP | 0.069 | 9.1 | 328.9 | 40.3 | 39 | 53.29 | 0.399 |

*Assume 0.21% S & 85.8% C

### 3.4.1 Hypothetical Trip Scenario

In order to make a comparison of the energy use and emissions among the technologies operating between various city pairs, it is desirable to adopt a consistent operating scenario for all technologies. The operating scenario or duty cycle that has been adopted for this purpose is described as follows: For each city pair, the vehicles;

accelerate from rest at the origin city center to the urban speed limit;
cruise at the urban speed limit;
decelerate to a suburban stop;
stop for a specified dwell time;
accelerate to the maximum speed;
cruise at the maximum speed;
make one or more in-route stops according to the trip length;
decelerate to a destination city suburban stop;
stop for the specified dwell time;
accelerate from rest to the urban speed limit;
cruise at the urban speed limit;
decelerate to a stop at the destination city center.

The number of in-route stops is given as a function of total trip distance in Table 12.

Table 12 Assumed Relationship Between Intercity Trip Length and the Number of In-Route Stops

| Range of trip lengths(miles) | No. of In-Route Stops |
|---|---|
| $40<L<100$ | 0 |
| $100<L<200$ | 1 |
| $200<L<300$ | 2 |
| $300<L<400$ | 3 |
| $400<L<500$ | 4 |
| $500<L<600$ | 5 |

In addition to the initial start at the origin city center and the final stop at the destination city center, there is one suburban stop each at the origin city and at the destination city. The dwell time for suburban and in-route stops is assumed to be 90 seconds. The urban speed limits are based on the nature of the grade crossings and noise considerations and are given in Table 13.

Table 13 Assumed Urban Speed Limits

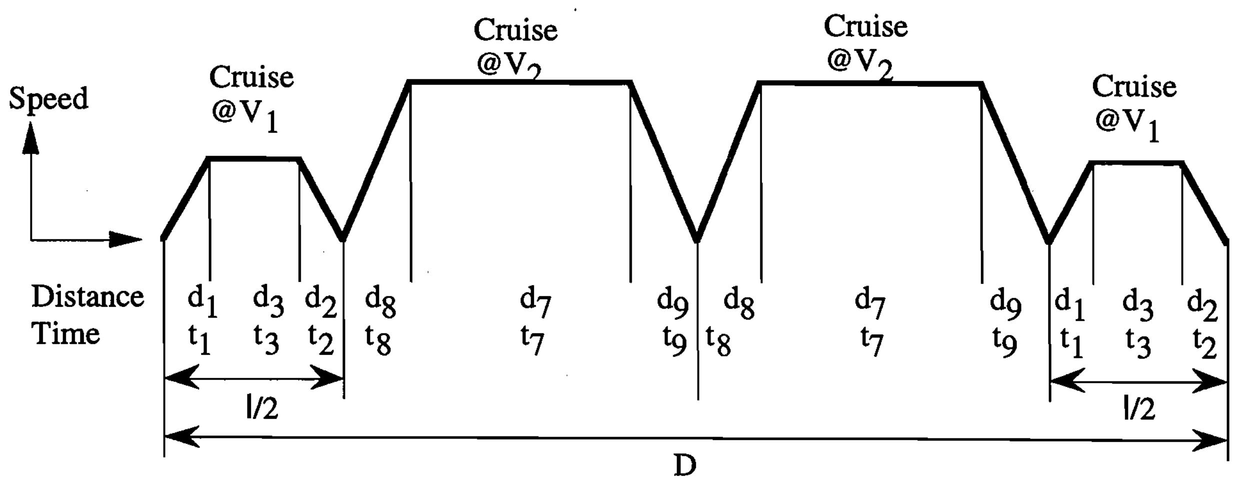
| | Urban Speed Limit (mph) |
|---|---|
| Technologies with at-grade crossings (79NE, 90NE, 110NE, 125NE, 150NE) | 50 |
| Grade-separated crossings (TGV) | 125 |
| Grade-separated crossings (Maglev) | 200 |

The average distance over which the urban speed limit applies = 30.77 miles (includes both origin and destination cities).

Figure 1 illustrates a trip profile with two suburban stops and one in-route stop. Note that the suburban stops for this illustration are at the suburban boundaries. In general, the acceleration is a function of velocity.

The maximum allowed acceleration and deceleration is +0.16g (1.569m/s^2) and -0.16g, respectively. No hills or curves are considered. Hills, curves, or additional stops would increase the total trip time of all HSGT modes relative to that of maglev.

Figure 1 Trip Profile for Two Suburban And One In-Route Stop




Hypothetical trip with two suburban stops ($N_1 = 2$), one in-route stop ($N_2 = 1$), total urban distance = l , and distance and time intervals as defined in the above diagram. Assuming $t_8 = t_9$ & $d_8 = d_9$, the total trip time for $N_1$ suburban stops, where $N_1>=2$, and $N_2$ in-route stops is given by:

$T = 2N_1t_1 + N_1t_3 + 2(N_2 + 1)t_8 +(N_2 + 1)t_7 + (N_1 + N_2)t_4$ , where $t_4$ is the station dwell time.

The total cruising time @ $V_1 = N_1t_3 = ( l - 2N_1d_1)/V_1$ .

The total cruising time @ $V_2 = (N_2 + 1)t_7 = (N_2 + 1)d_7/V_2$ ,

where $(N_2 + 1)d_7 = D - l - 2(N_2 + 1)d_8$ . Note that since the acceleration is generally not constant, the quantities $t_1$, $d_1$, $t_8$, & $d_8$ must be determined by numerical integration of the equation of motion.

### 3.4.2 Fuel Use and Emissions Calculational Procedures

The calculation of fuel use and emissions proceeds as follows: First, kinematics parameters are computed for each HSGT based on the numerical integration of the equation of motion:

$$\mathcal{F}(V) = M \times A(V) + R(V)$$

or

$$A(V) = \frac{\mathcal{F}(V) - R(V)}{M} \qquad (2)$$

where $\mathcal{F}(V)$ is the available traction force as a function of velocity and $R(V)$ is the resistance to forward motion as a function of velocity. Tabulated values of $\mathcal{F}$ & R versus velocity were supplied for each technology by the VNTSC. Integration of (2) yields the time and distance required to reach the urban speed limit and the maximum cruising speed. The power for traction is given by

$$P(V) = \mathcal{F}(V) \times V. \qquad (3)$$

From the numerically determined values of P(V), the maximum traction power $P_{max}$ can be obtained. The percent of maximum traction power is then given by 100% x $P(V)/P_{max}$.

Table 14 relates the percent maximum traction power to the equivalent notch setting (following the VNTSC recommendations).

Table 14 Relationship Between Notch Settings, % Maximum Traction Power, and Fuel Flow Rates

| Notch Setting | Nominal % Maximum Traction | Range of % Maximum Traction | Fuel Flow Rates (gal/min) | | | | |
|---|---|---|---|---|---|---|---|
| Setting | HP | HP | 79NE | 90NE | 110NE | 125NE | 150NE |
| Brake | --- | --- | 0.719 | 0.621 | 0.608 | 0.608 | 2.396 |
| Idle | 0 | 0 | 0.493 | 0.465 | 0.465 | 0.465 | 0.946 |
| 1 | 5 | 0-5 | 0.551 | 0.574 | 0.617 | 0.663 | 1.556 |
| 2 | 10 | 5-12 | 0.803 | 0.683 | 0.769 | 0.862 | 2.028 |
| 3 | 25 | 12-31 | 1.064 | 1.009 | 1.224 | 1.457 | 3.446 |
| 4 | 40 | 31-46 | 1.381 | 1.336 | 1.680 | 2.053 | 4.865 |
| 5 | 55 | 46-59 | 1.753 | 1.662 | 2.136 | 2.648 | 6.282 |
| 6 | 70 | 59-74 | 2.206 | 1.989 | 2.591 | 3.244 | 7.700 |
| 7 | 85 | 74-89 | 2.808 | 2.315 | 3.047 | 3.839 | 9.118 |
| 8 | 100 | 89-100 | 3.261 | 2.642 | 3.503 | 4.435 | 10.54 |

NOTE: The fuel required for hotel functions is included in the above data.

Table 14 together with the results of the numerical integration of Equation (2) are then used to determine the time spent at each notch setting during an acceleration episode. During deceleration, a braking notch setting is used. The power for cruising at any particular velocity say $V_1$, is given by,

$$P_1 = R(V_1) \times V_1 \qquad (4)$$

and the corresponding notch setting is also obtained from Table 14. Consequently, the total time spent in each notch setting is readily obtained for the operating scenario defined above by simply summing over all of the times spent at each notch setting as a result of accelerating, decelerating, cruising at the urban speed limit and at the maximum cruising speed, and idling during station stops.

Once the total time in each notch setting is known, the corresponding fuel and emissions in each notch setting are computed. The total emission of pollutant i for a complete trip is given by

$$\varepsilon_i = \sum_j e_{ij} \text{ (lb poll/gal fuel)} \times F_j \text{ (gal fuel/min)} \times \Delta t_j \text{ (min)}, \quad (5a)$$

the total trip fuel use is given by

$$F(\text{gal}) = \sum_j F_j \text{ (gal/min)} \times \Delta t_j \text{ (min)}, \quad (5b)$$

and the energy input is given by

$$E(\text{MBtu}) = 0.1387\ F(\text{gal}), \quad (5c)$$

where $\Delta t_j$ is the total time spent in notch setting j, $F_j$ is the fuel flow rate in notch setting j, and $e_{ij}$ is the emission factor for pollutant i in notch setting j.

The fuel flow rates are given in Table 14 for each fossil-fueled technology. For convenience, the total fuel, energy, and total emissions are expressed in the linear forms:

$$F = a + bD, \quad (6a)$$

$$E = a' + b'D, \quad (6b)$$

and

$$\varepsilon_i = A_i + B_i D, \quad (6c)$$

where D is the total trip distance in miles. Finally, because the numbers of in-route stops varies with trip length (see Table 12), the values of the parameters in Equations (6) also vary with trip distance. The results for all the fossil-fueled rail technologies are summarized in Table 15a & b.

### 3.5 New and Existing Electricity-Driven HSGT Modes

These modes are described in Table 10. Because these modes derive their power from the utility network and their associated emissions come from the combustion of fuels used to generate electric power, their treatment is necessarily different from that for the fossil-fueled HSGT modes. The derivation of the energy formulas for each trip length range for each technology is given in this section. The derivation of the electric generating efficiencies and the corresponding power plant emissions is described in Section 3.5.3.

Table 15a Non-Electric HSGT Technology Energy Formulas

| Technology | Distance Range (miles) | Energy Formulas (MBTU) | | | |
|---|---|---|---|---|---|
| **79NE (F40)** | 40 < D < 100 | 2.378 | + | 0.1455 | x D(miles) |
| | 100 < D < 200 | 3.114 | + | 0.1455 | x D(miles) |
| | 200 < D < 300 | 3.851 | + | 0.1455 | x D(miles) |
| | 300 < D < 400 | 4.587 | + | 0.1455 | x D(miles) |
| | 400 < D < 500 | 5.323 | + | 0.1455 | x D(miles) |
| | 500 < D < 600 | 6.060 | + | 0.1455 | x D(miles) |
| **79NE(P40)** | 40 < D < 100 | 1.764 | + | 0.1407 | x D(miles) |
| | 100 < D < 200 | 2.226 | + | 0.1407 | x D(miles) |
| | 200 < D < 300 | 2.689 | + | 0.1407 | x D(miles) |
| | 300 < D < 400 | 3.152 | + | 0.1407 | x D(miles) |
| | 400 < D < 500 | 3.614 | + | 0.1407 | x D(miles) |
| | 500 < D < 600 | 4.077 | + | 0.1407 | x D(miles) |
| **90NE(P40)** | 40 < D < 100 | 1.348 | + | 0.1537 | x D(miles) |
| | 100 < D < 200 | 1.781 | + | 0.1537 | x D(miles) |
| | 200 < D < 300 | 2.211 | + | 0.1537 | x D(miles) |
| | 300 < D < 400 | 2.647 | + | 0.1537 | x D(miles) |
| | 400 < D < 500 | 3.082 | + | 0.1537 | x D(miles) |
| | 500 < D < 600 | 3.518 | + | 0.1537 | x D(miles) |
| **110NE** | 40 < D < 100 | -1.262 | + | 0.1960 | x D(miles) |
| | 100 < D < 200 | -0.982 | + | 0.1960 | x D(miles) |
| | 200 < D < 300 | -0.717 | + | 0.1960 | x D(miles) |
| | 300 < D < 400 | -0.444 | + | 0.1960 | x D(miles) |
| | 400 < D < 500 | -0.172 | + | 0.1960 | x D(miles) |
| | 500 < D < 600 | 0.101 | + | 0.1960 | x D(miles) |
| **125NE** | 40 < D < 100 | -1.414 | + | 0.2160 | x D(miles) |
| | 100 < D < 200 | -1.160 | + | 0.2160 | x D(miles) |
| | 200 < D < 300 | -0.905 | + | 0.2160 | x D(miles) |
| | 300 < D < 400 | -0.650 | + | 0.2160 | x D(miles) |
| | 400 < D < 500 | -0.395 | + | 0.2160 | x D(miles) |
| | 500 < D < 600 | -0.141 | + | 0.2160 | x D(miles) |
| **150NE** | 40 < D < 100 | -1.884 | + | 0.2351 | x D(miles) |
| | 100 < D < 200 | -1.573 | + | 0.2351 | x D(miles) |
| | 200 < D < 300 | -1.261 | + | 0.2351 | x D(miles) |
| | 300 < D < 400 | -0.950 | + | 0.2351 | x D(miles) |
| | 400 < D < 500 | -0.638 | + | 0.2351 | x D(miles) |
| | 500 < D < 600 | -0.327 | + | 0.2351 | x D(miles) |

Table 15b Emission Formulas for Non-Electric HSGT Technologies

**Emission Formula: EM (g poll)= EM0 (g poll) + EMR (g poll/mile) x D (miles)**

| DistanceRange | 40<D<100 | | 100<D<200 | | 200<D<300 | | 300<D<400 | | 400<D<500 | | 500<D<600 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Poll. | EM0 | EMR | EM0 | EMR | EM0 | EMR | EM0 | EMR | EM0 | EMR | EM0 | EMR |
| **79NE (F40)** | | | | | | | | | | | | |
| PM | 76.2 | 3.27 | 97.1 | 3.27 | 118 | 3.27 | 139 | 3.27 | 160 | 3.27 | 181 | 3.27 |
| NOX | 1786 | 195 | 2549 | 195 | 3313 | 195 | 4076 | 195 | 4840 | 195 | 5603 | 195 |
| CO | 416 | 5.51 | 640 | 5.51 | 864 | 5.51 | 1087 | 5.51 | 1311 | 5.51 | 1535 | 5.51 |
| HC | 101 | 4.06 | 143 | 4.06 | 184 | 4.06 | 225 | 4.06 | 266 | 4.06 | 307 | 4.06 |
| SO2 | 252 | 15.4 | 330 | 15.4 | 408 | 15.4 | 486 | 15.4 | 564 | 15.4 | 643 | 15.4 |
| CO2(10^5) | 1.7 | 0.101 | 2.16 | 0.101 | 2.68 | 0.101 | 3.19 | 0.101 | 3.70 | 0.101 | 4.21 | 0.101 |
| **79NE (P40)** | | | | | | | | | | | | |
| PM | 48.5 | 2.92 | 71.8 | 2.92 | 95.1 | 2.92 | 118 | 2.92 | 142 | 2.92 | 165 | 2.92 |
| NOX | -31.6 | 164 | 626 | 164 | 1283 | 164 | 1940 | 164 | 2597 | 164 | 3255 | 164 |
| CO | -92.6 | 34.7 | 48.0 | 34.7 | 189 | 34.7 | 329 | 34.7 | 470 | 34.7 | 610 | 34.7 |
| HC | 137 | 4.28 | 200 | 4.28 | 263 | 4.28 | 326 | 4.28 | 390 | 4.28 | 453 | 4.28 |
| SO2 | 218 | 17.4 | 276 | 17.4 | 333 | 17.4 | 390 | 17.4 | 447 | 17.4 | 504 | 17.4 |
| CO2(10^5) | 1.2 | 0.098 | 1.55 | 0.098 | 1.87 | 0.098 | 2.19 | 0.098 | 2.51 | 0.098 | 2.83 | 0.098 |
| **90NE (P40)** | | | | | | | | | | | | |
| PM | 19.1 | 3.94 | 43.5 | 3.94 | 68.2 | 3.94 | 92.9 | 3.94 | 118 | 3.94 | 143 | 3.94 |
| NOX | -2136 | 227 | -1667 | 227 | -1204 | 227 | -733 | 227 | -263 | 227 | 208 | 227 |
| CO | -548 | 48.2 | -463 | 48.2 | -373 | 48.2 | -281 | 48.2 | -189 | 48.2 | -97.2 | 48.2 |
| HC | 151 | 4.43 | 232 | 4.43 | 314 | 4.43 | 395 | 4.43 | 477 | 4.43 | 559 | 4.43 |
| SO2 | 167 | 19.0 | 220 | 19.0 | 273 | 19.0 | 327 | 19.0 | 381 | 19.0 | 435 | 19.0 |
| CO2(10^5) | 0.9 | 0.107 | 1.24 | 0.107 | 1.54 | 0.107 | 1.84 | 0.107 | 2.14 | 0.107 | 2.44 | 0.107 |
| **110NE** | | | | | | | | | | | | |
| PM | -35.2 | 3.59 | -12.9 | 3.59 | 9.43 | 3.59 | 31.7 | 3.59 | 54.1 | 3.59 | 76.4 | 3.59 |
| NOX | -270 | 107 | 248 | 107 | 766 | 107 | 1284 | 107 | 1802 | 107 | 2320 | 107 |
| CO | 169.7 | 8.17 | 381 | 8.17 | 591 | 8.17 | 802 | 8.17 | 1013 | 8.17 | 1224 | 8.17 |
| HC | 20.6 | 4.74 | 59.8 | 4.74 | 99.0 | 4.74 | 138 | 4.74 | 177 | 4.74 | 216 | 4.74 |
| SO2 | -142 | 13.5 | -106 | 13.5 | -70.2 | 13.5 | -34.6 | 13.5 | 1.02 | 13.5 | 36.6 | 13.5 |
| CO2(10^5) | -1.1 | 0.101 | -0.79 | 0.101 | -0.53 | 0.101 | -0.26 | 0.101 | 0.008 | 0.101 | 0.275 | 0.101 |
| **125NE** | | | | | | | | | | | | |
| PM | 156 | 2.54 | 185 | 2.54 | 214 | 2.54 | 242 | 2.54 | 271 | 2.54 | 300 | 2.54 |
| NOX | 4586 | 85.0 | 5255 | 85.0 | 5924 | 85.0 | 6593 | 85.0 | 7261 | 85.0 | 7930 | 85.0 |
| CO | 926 | 3.70 | 1198 | 3.70 | 1469 | 3.70 | 1741 | 3.70 | 2013 | 3.70 | 2284 | 3.70 |
| HC | 232 | 3.86 | 283 | 3.86 | 333 | 3.86 | 383 | 3.86 | 433 | 3.86 | 483 | 3.86 |
| SO2 | 591 | 9.36 | 636 | 9.36 | 681 | 9.36 | 726 | 9.36 | 770 | 9.36 | 815 | 9.36 |
| CO2(10^5) | 4.4 | 0.070 | 4.76 | 0.070 | 5.10 | 0.070 | 5.43 | 0.070 | 5.77 | 0.070 | 6.107 | 0.070 |
| **150NE** | | | | | | | | | | | | |
| PM | 275 | 4.20 | 284 | 4.20 | 293 | 4.20 | 303 | 4.20 | 312 | 4.20 | 321 | 4.20 |
| NOX | 8114 | 124 | 8386 | 124 | 8658 | 124 | 8931 | 124 | 9203 | 124 | 9475 | 124 |
| CO | 1208 | 18.5 | 1248 | 18.5 | 1289 | 18.5 | 1329 | 18.5 | 1370 | 18.5 | 1410 | 18.5 |
| HC | 414 | 6.33 | 428 | 6.33 | 442 | 6.33 | 456 | 6.33 | 470 | 6.33 | 484 | 6.33 |
| SO2 | 861 | 13.2 | 890 | 13.2 | 919 | 13.2 | 948 | 13.2 | 977 | 13.2 | 1006 | 13.2 |
| CO2(10^5) | 6.45 | 0.099 | 6.7 | 0.099 | 6.9 | 0.099 | 7.1 | 0.099 | 7.3 | 0.099 | 7.5 | 0.099 |

### 3.5.1 Output Energy Required for a Trip

The same operating scenario used for fossil-fueled HSGT technologies (see Section 4) was also used for the electric-powered technologies. However, it is not necessary to refer to "notch settings" to compute fuel use or emissions. Hence the total output energy $E_T^o$ required for a trip of length D is given by

$$E_T^o = E_{hotel} + E_{idle} + E_{brake} + E_{cruise} + E_{accel} + E_{decel}, \quad (7)$$

where

$E_{hotel}$ = total energy required for all hotel functions on board the train (an input parameter),
$E_{idle}$ = total energy required for all idling,
$E_{brake}$ = total energy required for all braking episodes or decelerations,
$E_{cruise}$ = total energy required for all cruising at constant speeds (both urban and maximum),
$E_{accel}$ = total energy required for all accelerations, and
$E_{decel}$ = total energy required for all decelerations.

Each of these energy terms is evaluated in accordance with the operating scenario described in Section 4.

$$E_{hotel} = P_{hotel} \times (T - t_d), \quad (8)$$

where $P_{hotel}$ is the hotel power (an input parameter, given in Table 10), T is the total trip time, and $t_d$ is the total decelerating time (during which electric power is regenerated for braking and hotel functions).

It is assumed that

$$E_{idle} = E_{decel} = E_{brake} = 0. \quad (9)$$

$E_{accel}$ = sum of all kinetic energy terms + work done against resistance to forward motion during all acceleration episodes.

$E_{accel}$ is obtained by integrating the equation of motion – Equation (2).

The total energy for all cruising episodes is given by

$$E_{cruise} = \sum_i P_i t_i, \quad (10)$$

where the sum goes over all cruising episodes, $P_i$ is the power required for cruising at speed $v_i$ and $t_i$ is the time spent cruising at $v_i$.

### 3.5.2 System Efficiencies

Once the total output energy is obtained and expressed in the form

$$E_T^o = a + bD, \tag{11}$$

the input energy to the power generating system, which depends upon the geographic region can be obtained from

$$E^{in} = E_T^o / \eta_{net}, \tag{12}$$

where

$$\eta_{net} = \eta_G \times \eta_T \times \eta_I, \tag{13}$$

and where $\eta_G$ = electric power generating efficiency, $\eta_T$ = transmission efficiency, and $\eta_I$ is the internal efficiency for a particular technology and accounts for all system component losses from the substation down to the propulsion motors. The term $\eta_T$ is given by

$$\eta_T = 0.95 \tag{14}$$

$\eta_G$ is geographic-region dependent and is discussed in the following section . Note that $\eta_G$ does not depend on the rail technology. Similarly, the emissions associated with generation of electric power do not depend on the HSGT technology, only on the fuel mix and electric generating technology mix which varies with geographic region. The output energies obtained from evaluating the terms in equation (7) for each electric-powered HSGT technology are summarized in Table 16. The corresponding input energies to the substations from the utility grids are also given in Table 16.

### 3.5.3 Electric Power Generating Efficiencies and Emission Factors

The process of estimating total input energy and emissions associated with the operation of electrically-driven HSGT technologies involves two key assumptions and a number of steps that are outlined below:

#### 3.5.3.1 Key Assumptions

The electric generating efficiency of a nuclear power plant is equal to its thermal efficiency (~28-32%). Some would argue that its efficiency should be taken as a much higher value, since the waste heat (the remaining 72 to 68% of the thermal energy) could be used for other purposes such as co-generation. Here it is assumed that all waste heat is lost to the environment. This is consistent with common practice in the U.S.

The electric generating efficiency of power plants fueled by renewable energy sources (hydroelectric, wind, solar, biomass, etc.) is a difficult number to estimate, and also depends upon whether such energy sources are considered to be "free" in some sense. It is common practice in the U.S. to assume that an efficiency be assigned in a manner that will not alter the overall efficiency of the electric generating system (see further discussion below). This practice will be followed here.

Table 16 Summary of Energy Formulas For Electric-HSGT Technologies

**Technology =125 EL**

| Trip Length (mi) | Output Energy (kWh) Formulas | Input Energy (kWh) Formulas* |
|---|---|---|
| 40 < D < 100 | -222.21 + 20.67 xD | -272.64 + 25.36 xD |
| 100 < D < 200 | -182.51 + 20.67 xD | -223.94 + 25.36 xD |
| 200 < D < 300 | -142.81 + 20.67 xD | -175.23 + 25.36 xD |
| 300 < D < 400 | -103.12 + 20.67 xD | -126.53 + 25.36 xD |
| 400 < D < 500 | -63.42 + 20.67 xD | -77.82 + 25.36 xD |
| 500 < D < 600 | -23.73 + 20.67 xD | -29.12 + 25.36 xD |

**Technology =150 EL**

| Trip Length (mi) | Output Energy (kWh) Formulas | Input Energy (kWh) Formulas* |
|---|---|---|
| 40 < D < 100 | -175.47 + 19.17 xD | -215.30 + 23.52 xD |
| 100 < D < 200 | -104.70 + 19.17 xD | -128.47 + 23.52 xD |
| 200 < D < 300 | -33.93 + 19.17 xD | -41.63 + 23.52 xD |
| 300 < D < 400 | 36.85 + 19.17 xD | 45.21 + 23.52 xD |
| 400 < D < 500 | 107.62 + 19.17 xD | 132.05 + 23.52 xD |
| 500 < D < 600 | 178.39 + 19.17 xD | 218.89 + 23.52 xD |

**Technology =200 EL**

| Trip Length (mi) | Output Energy (kWh) Formulas | Input Energy (kWh) Formulas* |
|---|---|---|
| 40 < D < 100 | -151.68 + 33.53 xD | -185.65 + 41.04 xD |
| 100 < D < 200 | -275.31 + 33.53 xD | -336.98 + 41.04 xD |
| 200 < D < 300 | -398.95 + 33.53 xD | -488.31 + 41.04 xD |
| 300 < D < 400 | -522.59 + 33.53 xD | -639.65 + 41.04 xD |
| 400 < D < 500 | -646.23 + 33.53 xD | -790.98 + 41.04 xD |
| 500 < D < 600 | -769.87 + 33.53 xD | -942.31 + 41.04 xD |

**Technology =300 EL**

| Trip Length (mi) | Output Energy (kWh) Formulas | Input Energy (kWh) Formulas* |
|---|---|---|
| 40 < D < 100 | 57.96 + 20.11 xD | 68.27 + 23.69 xD |
| 100 < D < 200 | 128.51 + 20.11 xD | 151.37 + 23.69 xD |
| 200 < D < 300 | 199.05 + 20.11 xD | 234.46 + 23.69 xD |
| 300 < D < 400 | 269.60 + 20.11 xD | 317.55 + 23.69 xD |
| 400 < D < 500 | 340.15 + 20.11 xD | 400.64 + 23.69 xD |
| 500 < D < 600 | 410.69 + 20.11 xD | 483.73 + 23.69 xD |

* Input energy means input electrical energy to the substation serving the HSGT technology and includes all HSGT system losses.

These assumptions should be regarded as conservative since if the waste heat can be utilized and/or if the renewable energy sources can be regarded in some sense as "free," i.e., not diminishable, then the net efficiency of the generating system would increase.

Finally, it is assumed that the nuclear and renewable generating technologies do not produce any emissions.

3.5.3.2 Calculational Steps

1. Determine the total output electrical energy required for a trip $E_T^o$ (kWh) - see Section 3.5.1.
2. Determine the corresponding input energy to the HSGT substation from the utility grid

$$E_{SS}^{in} = \frac{1}{\eta_I} E_T^o \tag{15}$$

3. Determine the required output energy from the generating system $= E_G^o = \frac{1}{\eta_T} E_{SS}^{in}$

4. Determine which Electricity Market Module (EMM) Regions the trip route passes through (See map in Fig. 2).

5. Determine the amounts of various "fuels" used to generate electrical power in those regions, i.e. the amount of coal, petroleum, natural gas, nuclear, and renewable primary energy used by Utilities and Nonutility generators that sell electric power to the grid. This data is obtained from Ref. 15.

6. Using various data sources[16-22], estimate the electric power generating efficiencies ($\eta_{G,i}$) for all generating technologies and all years of interest. (See Table 17)

7. Compute the single effective energy generating efficiency for each project year use

$$1/\eta_G = \sum_i f_i/\eta_{G,i} \quad , \tag{16}$$

where $f_i$ is the fraction of the output energy supplied by the $i^{th}$ generating technology. Note that the fractions $f_i$ vary with time. Power plants are assumed to have the average life-times shown in Table 17 and their populations are assumed to vary linearly with time.

The question arises, "What generating efficiency should be assigned to the renewable energy generating technology? Since the renewable energy generating contribution comes from a variety of different technologies including hydroelectric, wind, solar, geothermal, etc. this is not any easy question to answer. In this report, it is assumed that the renewable generating efficiency takes on a value such that the net generating efficiency of the system is unchanged. If the net generating efficiency without the renewable energy contribution is given by

$$1/\eta'_G = \sum_j{}' f'_j/\eta_{G,j} \quad ,$$

and, with the renewable term included, is given by

$$1/\eta_G = \sum_i f_i/\eta_{G,i} \quad ,$$

and it is required that

$$\eta'_G = \eta_G \, ,$$

then it follows by substitution that the renewable energy generating efficiency must be defined as

$$1/\eta_{ren} = \sum_i \left(\frac{f_i}{(1-f_{ren})}\right) \times 1/\eta_{G,i} \qquad (17)$$

Note that the prime on the summation sign in the above equqtions means that the renewable energy contribution is excluded. The prime on the $f_j$ means that the fractional contributions of the energy generating technologies have been redefined to exclude the fractional renewable energy contribution $f_{ren}$. That is,

$$f'_j = E_j/(E-E_{ren}) = f_j/(1-f_{ren})$$

Note that with $\eta_G$ so defined, the input energy to the power generating system can be related to the output energy from the generating system as follows:

$$E_G^{in} = E_G^o/\eta_G \qquad (18)$$

The effective energy generating efficiencies for each EMM region of interest are given in Table 18.

8. Again, using various data sources[18,22-24], estimate the emission factors for each generating technology $e_{ij}$ (g poll/unit of input energy), where i refers to the pollutant species and j refers to the generating technology. (See Table 17)

9. Use the following formula to define a set of net or effective emission factors:

$$e_i = \eta_G \sum_j e_{ij} f_j/\eta_{G,j} \quad . \qquad (19)$$

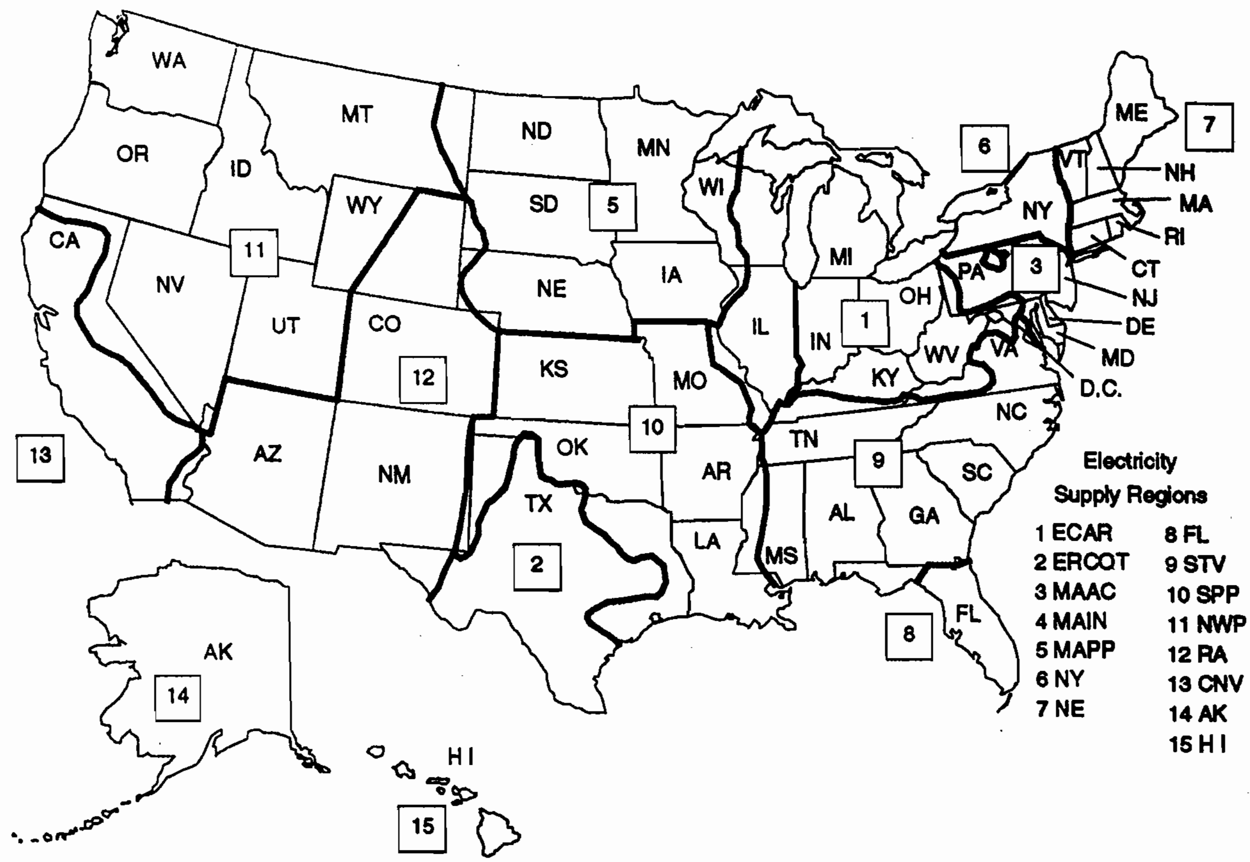
The effective emission factors in (g poll/$10^6$ Btu energy input) for each EMM region of interest are given in Table 18.

10. Compute the total emissions using

$$\varepsilon_i(\text{g poll}) = e_i\,(\text{g poll}/10^6 \text{ energy input}) \bullet E_G^{in}$$

Using the linear expressions for the total output energy required for a trip of length D,

**Figure 1. Electricity Market Module (EMM) Regions**




1. ECAR = East Central Area Reliability Coordination Agreement
2. ERCOT = Electric Reliability Council of Texas
3. MACC = Mid-Atlantic Area Council
4. MAIN = Mid-America Interconnected Network
5. MAPP = Mid-Continent Area Power Pool
6. NY = Northeast Power Coordinating Council/ New York
7. NE = Northeast Power Coordinating Council/ New England
8. FL = Southeastern Electric Reliability Council/ Florida
9. STV = Southeastern Electric Reliability Council /excluding Florida
10. SPP = Southwest Power Pool
11. NWP = Western Systems Coordinating Council/ Northwest Power Pool Area
12. RA = Western Systems Coordinating Council/ Rocky Mountain Power Area and Arizona
13. CNV = Western Systems Coordinating Council/ California-Southern Nevada Power
14. AK = Alaska
15. HI = Hawaii

Source: Energy Information Administration, Office of Integrated Analysis and Forecasting.

## Table 17 Energy Generating Technology Emission Factors and Efficiencies

| Fuel/Technology | PM | HC | CO | NOx | SOx | CO2 (10^3) | Start Year | Life Time (Y) | Thermal Efficiency %/100 |
|---|---|---|---|---|---|---|---|---|---|
| | Emis. Factors (g/10^6 BTU of fuel input) | | | | | | | | |
| **Utility Coal** | | | | | | | | | |
| a.Conv. Coal St. | 45.4 | 1.50 | 13.0 | 228 | 419 | 95.5 | <1985 | 40 | 0.340 |
| b.PFB | 45.4 | 1.50 | 2.00 | 120 | 94 | 95.5 | 1997 | 40 | 0.373 |
| c.Coal Gas. Com. Cycle | 45.4 | 1.50 | 2.00 | 43 | 34 | 95.5 | 1997 | 30 | 0.413 |
| d.MCFC/CG | 0 | 1.00 | 1.00 | 10 | 1 | 95.5 | 2000 | 30 | 0.514 |
| **Utility Pet.** | | | | | | | | | |
| a.Pet. Steam | 45.4 | 2.3 | 15.2 | 124 | 197 | 75.1 | <1985 | 30 | 0.352 |
| a.Pet. Comb. Turb. | 27.7 | 7.7 | 21.8 | 155 | 197 | 75.1 | <1985 | 30 | 0.250 |
| a.Pet. CCC | 45.4 | 2.3 | 15.2 | 124 | 197 | 75.1 | <1985 | 30 | 0.402 |
| b.Pet. Adv. Com. Cycle | 45.4 | 2.3 | 15.2 | 124 | 197 | 75.1 | 1990 | 30 | 0.414 |
| c.Pet. CT St. Injec. | 45.4 | 2.8 | 51 | 45 | 197 | 75.1 | 1993 | 30 | 0.345 |
| **Utility NG** | | | | | | | | | |
| a.Gas/Liq.St. | 1.10 | 0.6 | 17.6 | 121 | 0.3 | 53.6 | <1985 | 30 | 0.352 |
| a.Gas/Liq Comb. Turb. | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | <1985 | 30 | 0.250 |
| a.Gas/Liq.CCC | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | <1985 | 30 | 0.402 |
| b.G/L CC Adv. | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1990 | 30 | 0.414 |
| c.G/L CT St. Inj. | 6.16 | 2.8 | 50.6 | 45.0 | 0.3 | 53.6 | 1993 | 30 | 0.345 |
| d.Un.Te.FT8-CC | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1989 | 30 | 0.504 |
| e.Gas CC Adv. | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1993 | 30 | 0.503 |
| e.NG CC | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1993 | 30 | 0.454 |
| e.GEC VEGA CC | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1993 | 30 | 0.550 |
| **Utility Nuclear** | | | | | | | | | |
| a.Nuclear LWR | 0 | 0 | 0 | 0 | 0 | 0 | <1985 | 30 | 0.324 |
| b.Nucl. LMFBR | 0 | 0 | 0 | 0 | 0 | 0 | 2006 | 40 | 0.340 |
| **NonUtil.Coal** | | | | | | | | | |
| a.Conv. Coal St. | 45.4 | 1.5 | 13 | 228 | 419 | 95.5 | <1985 | 40 | 0.340 |
| b.PFB | 45.4 | 1.5 | 2 | 120 | 94 | 95.5 | 1997 | 40 | 0.373 |
| c.Coal Gas. Com. Cycle | 45.4 | 1.5 | 2 | 43 | 34 | 95.5 | 1997 | 30 | 0.413 |
| d.MCFC/CG | 0 | 1 | 1 | 10 | 1 | 95.5 | 2005 | 30 | 0.514 |
| **NonUtil. Pet.** | | | | | | | | | |
| a.Pet. Steam | 45.4 | 2.3 | 15.2 | 124 | 197 | 75.1 | <1985 | 30 | 0.352 |
| a.Pet. Comb. Turb. | 27.7 | 7.7 | 21.8 | 155 | 197 | 75.1 | <1985 | 30 | 0.250 |
| a.Pet. CCC | 45.4 | 2.3 | 15.2 | 124 | 197 | 75.1 | <1985 | 30 | 0.402 |
| b.Pet. Adv. Com. Cycle | 45.4 | 2.3 | 15.2 | 124 | 197 | 75.1 | 1990 | 30 | 0.414 |
| c.Pet. CT St. Injec. | 45.4 | 2.8 | 51 | 45 | 197 | 75.1 | 1993 | 30 | 0.345 |
| **NonUtil. NG** | | | | | | | | | |
| a.Gas/Liq.St. | 1.10 | 0.6 | 17.6 | 121 | 0.3 | 53.6 | <1985 | 30 | 0.352 |
| a.Gas/Liq CT | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | <1985 | 30 | 0.250 |
| a.Gas/Liq.CCC | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | <1985 | 30 | 0.402 |
| b.G/L CC Adv. | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1989 | 30 | 0.504 |
| c.G/L CT St. Inj. | 6.16 | 2.8 | 50.6 | 45.0 | 0.3 | 53.6 | 1990 | 30 | 0.414 |
| d.Un.Te.FT8-CC | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1993 | 30 | 0.345 |
| e.Gas CC Adv. | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1993 | 30 | 0.503 |
| e.NG CC | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1993 | 30 | 0.454 |
| e.GEC VEGA CC | 6.16 | 2.8 | 50.6 | 90.8 | 0.3 | 53.6 | 1993 | 30 | 0.550 |
| **Fuel Cells** | | | | | | | | | |
| Phos. Acid FC | | | | | | | 1997 | 30 | 0.399 |
| MCFC/CG | 0 | 1 | 1 | 10 | 1 | 53.6 | 2005 | 30 | 0.514 |
| MCFC/NG | 0 | 1 | 1 | 3 | 0.3 | 53.6 | 2005 | | 0.514 |
| MCFC/BIG | 0 | 1 | 1 | 10 | 0 | 53.6 | 2005 | | 0.514 |
| **Renewable** | | | | | | | | | |
| Utility | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| Non Utility | 0 | 0 | 0 | 0 | 0 | 0 | | | |

Table 18 Regional Electric Generating Net Efficiencies and Net Emission Factors (g/MBtu of energy input to generating plants)

**CNV**

| Year | Net Eff. | HC | CO | NOx | SOx | PM | CO2 (10^3) | Pet. used in elect. gen. |
|---|---|---|---|---|---|---|---|---|
| 1990 | 0.325 | 1.04 | 16.3 | 59.4 | 41.1 | 6.69 | 29.7 | 3.10% |
| 2000 | 0.336 | 0.85 | 13.6 | 47.6 | 34.1 | 5.65 | 24.5 | 1.69% |
| 2005 | 0.351 | 0.83 | 12.4 | 44.0 | 30.7 | 6.73 | 26.0 | 1.22% |
| 2010 | 0.373 | 0.68 | 6.94 | 37.1 | 30.3 | 9.93 | 31.3 | 0.41% |
| 2020 | 0.406 | 0.79 | 5.00 | 37.6 | 30.3 | 14.6 | 43.4 | 0.00% |
| 2030 | 0.419 | 0.89 | 5.19 | 38.9 | 26.5 | 16.5 | 50.0 | 0.00% |
| 2040 | 0.425 | 0.95 | 5.34 | 40.3 | 25.1 | 17.8 | 54.2 | 0.00% |

**ECAR**

| Year | Net Eff. | HC | CO | NOx | SOx | PM | CO2 (10^3) | Pet. used in elect. gen. |
|---|---|---|---|---|---|---|---|---|
| 1990 | 0.338 | 1.37 | 11.8 | 204 | 375 | 40.7 | 85.7 | 0.45% |
| 2000 | 0.342 | 1.33 | 10.8 | 190 | 342 | 39.8 | 84.0 | 0.03% |
| 2005 | 0.352 | 1.34 | 10.5 | 171 | 297 | 38.2 | 82.8 | 0.00% |
| 2010 | 0.364 | 1.33 | 10.2 | 148 | 244 | 34.9 | 79.5 | 0.00% |
| 2020 | 0.387 | 1.43 | 10.5 | 118 | 169 | 32.4 | 81.2 | 0.00% |
| 2030 | 0.408 | 1.47 | 10.3 | 84.7 | 89.6 | 28.7 | 79.8 | 0.00% |
| 2040 | 0.423 | 1.51 | 10.7 | 62.7 | 36.1 | 26.0 | 78.6 | 0.00% |

**ERCOT**

| Year | Net Eff. | HC | CO | NOx | SOx | PM | CO2 (10^3) | Pet. used in elect. gen. |
|---|---|---|---|---|---|---|---|---|
| 1990 | 0.329 | 1.67 | 25.9 | 136 | 155 | 19.2 | 63.1 | 0.26% |
| 2000 | 0.345 | 1.63 | 24.8 | 120 | 133 | 18.0 | 58.7 | 0.15% |
| 2005 | 0.360 | 1.66 | 24.1 | 110 | 116 | 18.7 | 60.3 | 0.12% |
| 2010 | 0.375 | 1.62 | 22.8 | 97.8 | 96.4 | 18.0 | 58.8 | 0.12% |
| 2020 | 0.402 | 1.74 | 22.8 | 84.7 | 70.0 | 19.0 | 63.3 | 0.09% |
| 2030 | 0.418 | 1.76 | 21.7 | 70.8 | 41.6 | 18.8 | 65.1 | 0.06% |
| 2040 | 0.424 | 1.76 | 20.9 | 63.0 | 23.7 | 18.6 | 66.4 | 0.03% |

**MAAC**

| Year | Net Eff. | HC | CO | NOx | SOx | PM | CO2 (10^3) | Pet. used in elect. gen. |
|---|---|---|---|---|---|---|---|---|
| 1990 | 0.332 | 1.09 | 8.98 | 127 | 224 | 25.4 | 54.6 | 5.63% |
| 2000 | 0.338 | 1.02 | 9.60 | 114 | 193 | 23.1 | 51.6 | 2.47% |
| 2005 | 0.348 | 1.07 | 10.5 | 103 | 164 | 21.9 | 51.1 | 2.17% |
| 2010 | 0.360 | 1.02 | 8.72 | 92.2 | 140 | 22.0 | 53.5 | 1.41% |
| 2020 | 0.383 | 1.11 | 8.58 | 78.1 | 101 | 22.4 | 59.6 | 0.41% |
| 2030 | 0.406 | 1.18 | 8.20 | 61.7 | 58.1 | 22.0 | 63.6 | 0.00% |
| 2040 | 0.423 | 1.25 | 8.20 | 52.0 | 30.9 | 22.1 | 67.4 | 0.00% |

Table 18 Continued

**MAIN**

| Year | Net Eff. | HC | CO | NOx | SOx | PM | CO2 (10^3) | Pet. used in elect. gen. |
|---|---|---|---|---|---|---|---|---|
| 1990 | 0.332 | 0.81 | 7.03 | 120 | 220 | 23.9 | 50.4 | 0.26% |
| 2000 | 0.337 | 0.85 | 6.75 | 118 | 211 | 25.4 | 53.5 | 0.01% |
| 2005 | 0.344 | 0.86 | 6.16 | 107 | 184 | 25.0 | 54.1 | 0.01% |
| 2010 | 0.355 | 0.88 | 5.62 | 94.8 | 155 | 24.1 | 54.9 | 0.01% |
| 2020 | 0.372 | 0.95 | 4.89 | 77.8 | 110 | 24.0 | 59.5 | 0.00% |
| 2030 | 0.389 | 0.99 | 4.04 | 58.8 | 63.5 | 23.1 | 62.1 | 0.00% |
| 2040 | 0.400 | 1.03 | 3.60 | 46.6 | 32.5 | 22.7 | 64.5 | 0.00% |

**NE**

| Year | Net Eff. | HC | CO | NOx | SOx | PM | CO2 (10^3) | Pet. used in elect. gen. |
|---|---|---|---|---|---|---|---|---|
| 1990 | 0.326 | 1.66 | 9.81 | 80.7 | 121 | 18.0 | 39.5 | 27.6% |
| 2000 | 0.335 | 1.39 | 10.9 | 70.5 | 97.2 | 14.7 | 35.3 | 18.5% |
| 2005 | 0.339 | 1.43 | 10.7 | 67.0 | 90.7 | 14.5 | 34.8 | 19.7% |
| 2010 | 0.346 | 1.27 | 10.3 | 60.2 | 78.4 | 13.1 | 32.9 | 15.8% |
| 2020 | 0.363 | 1.24 | 10.6 | 53.1 | 62.6 | 12.4 | 33.0 | 13.3% |
| 2030 | 0.385 | 1.13 | 10.5 | 42.8 | 39.9 | 10.8 | 31.7 | 9.82% |
| 2040 | 0.412 | 1.02 | 10.7 | 34.2 | 20.0 | 9.25 | 30.6 | 5.57% |

**NY**

| Year | Net Eff. | HC | CO | NOx | SOx | PM | CO2 (10^3) | Pet. used in elect. gen. |
|---|---|---|---|---|---|---|---|---|
| 1990 | 0.326 | 1.81 | 13.6 | 92.7 | 126 | 18.7 | 45.3 | 25.8% |
| 2000 | 0.330 | 1.49 | 11.9 | 76.1 | 102 | 15.1 | 37.5 | 20.0% |
| 2005 | 0.336 | 1.53 | 11.9 | 72.8 | 96.3 | 15.0 | 37.0 | 21.2% |
| 2010 | 0.346 | 1.49 | 11.5 | 67.6 | 87.3 | 14.7 | 36.9 | 20.6% |
| 2020 | 0.365 | 1.61 | 11.9 | 63.5 | 78.0 | 15.4 | 39.1 | 21.6% |
| 2030 | 0.378 | 1.65 | 11.9 | 57.5 | 62.7 | 15.1 | 40.2 | 22.0% |
| 2040 | 0.388 | 1.68 | 11.9 | 53.7 | 52.2 | 15.1 | 41.2 | 22.2% |

**NWP**

| Year | Net Eff. | HC | CO | NOx | SOx | PM | CO2 (10^3) | Pet. used in elect. gen. |
|---|---|---|---|---|---|---|---|---|
| 1990 | 0.337 | 0.505 | 4.59 | 73.6 | 133 | 14.5 | 31.0 | 0.13% |
| 2000 | 0.361 | 0.774 | 9.79 | 74.0 | 113 | 13.7 | 34.5 | 0.06% |
| 2005 | 0.380 | 0.926 | 12.4 | 70.5 | 94.9 | 13.3 | 36.5 | 0.06% |
| 2010 | 0.391 | 0.942 | 12.8 | 63.1 | 77.6 | 12.2 | 35.4 | 0.02% |
| 2020 | 0.413 | 1.13 | 16.0 | 56.4 | 50.9 | 11.2 | 37.9 | 0.00% |
| 2030 | 0.428 | 1.26 | 18.2 | 48.5 | 25.4 | 9.90 | 38.6 | 0.00% |
| 2040 | 0.437 | 1.36 | 20.2 | 44.6 | 9.67 | 9.01 | 39.3 | 0.00% |

**STV & FL***

| Year | Net Eff. | HC | CO | NOx | SOx | PM | CO2 (10^3) | Pet. used in elect. gen. |
|---|---|---|---|---|---|---|---|---|
| 1990 | 0.330 | 1.96 | 15.6 | 143 | 224 | 28.5 | 65.5 | 21.6% |
| 2000 | 0.344 | 2.09 | 19.3 | 128 | 179 | 25.1 | 62.6 | 20.4% |
| 2005 | 0.352 | 2.17 | 20.0 | 120 | 161 | 24.5 | 62.5 | 21.6% |
| 2010 | 0.364 | 2.06 | 18.1 | 112 | 143 | 25.1 | 65.7 | 18.9% |
| 2020 | 0.385 | 2.17 | 18.1 | 103 | 116 | 26.6 | 73.3 | 17.4% |
| 2030 | 0.406 | 2.20 | 17.3 | 89.0 | 81.9 | 27.0 | 78.2 | 15.8% |
| 2040 | 0.416 | 2.10 | 15.9 | 75.9 | 54.8 | 26.2 | 78.9 | 13.2% |

*There was insufficient energy data to consider the FL region separately.

the equation above can be written as

$$\varepsilon_i(\text{g poll.}) = e_i(a + bD)/(\eta_G \eta_T \eta_I) \tag{20}$$

Note that Table 18 also gives the fraction of petroleum used in generating electricity in each EMM region. This quantity is needed for estimating the amount of petroleum saved when fossil-fueled transportation modes are replaced by electrically-driven modes. The amount of petroleum used tends to be quite small especially after the year 2000 for all regions with the exception of the East Coast.

## 3.6 Access & Egress Energy and Emissions

The methodology involves developing access/egress mode shares for each inter-city mode and computation of access/egress distances and emission rates. Emission rates will be applied to energy consumption or travel distance as appropriate, to compute access/egress emissions.

### 3.6.1 Access/Egress Mode Shares

An airport ground access survey by the City of Chicago was used as a guideline in developing airport access mode shares for major metropolitan areas. The shares, shown in Tables 19 and 20, were developed for business and nonbusiness purposes. The average party size for business travel will be assumed as 1 and that for nonbusiness travel will be 1.5[25]. It is assumed that the same mode shares and party size apply to access/egress for intercity trips by rail and bus. A typical intercity bus traveler is likely to have lower income than an air traveler and therefore, is more likely to use public transportation for access/egress. However, such travelers are less likely to be diverted to the new high speed ground transportation mode. Consequently, the assumption to use the same access/egress mode shares will produce little error (i.e., little difference in before and after case for buses compared to that for other inter-city modes).

### 3.6.2 Access/Egress Distance

ANL developed population weighted average distances to airports in major metropolitan areas for the NMI study. A population center was identified for each county within a Metropolitan Statistical Area (MSA) and over the road distance for that center to airport was computed. Distance was computed as airline distance times 1.25. The factor (1.25) is common in converting airline distance to over the road distances[26]. These distances were weighted by county share of MSA population and, if applicable, by the airport shares of MSA air trips. Table 19 lists average distances for some selected MSAs.

The average distance for those using rapid transit for airport access should be shorter. The rapid transit mode is available to those inner city travelers who travel light and can access it easily. Their access distance may not always be shorter because of some circuitry involved in making rapid transit connections. It is recommended that a factor of 0.66 be applied to average airport access distances.

There was no data available on access/egress distances for inter-city rail and bus modes. These modes make multiple stops within an MSA and thus have shorter access/egress distances. It is recommended that a factor of 0.5 be used to convert airport access distances to conventional and all HSGT modes. This is consistent with the operating scenario used to compute energy and emissions in Section 3.4.1. If additional route data including extra suburban stops for maglev are anticipated, then the corresponding factor should be reduced for maglev.

### 3.6.3 Emission Rates

Emission rates for automobiles and buses were developed using U.S. Environmental Protection Agency's MOBILE model (version 5a). Emission rates for electric generation are used for rail transit where applicable. Automobile emission rates are used for private autos, rental cars, and taxi/limousines while heavy duty diesel emission rates are used for buses and airport couches. Since limousines are generally larger than normal autos, they are assigned miles per gallon values equal to those for light-duty gasoline-fueled trucks.

## TABLE 19 Baseline Air Mode Airport Access Mode Shares and Cost* for Business Trips: Year 2020

| Zone | MSA Abbrev | Drv & Prk Own/RtlCar % | Drv & Prk Own/RtlCar Cost $ | Taxi or Limo % | Taxi or Limo Cost $ | Coach or AirportBus % | Coach or AirportBus Cost $ | Mass Transit % | Mass Transit Cost $ | Free Courtesy Veh % | County Pop Wtd Dist (mi) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | NYC | 30 | 15.13 | 50 | 30.95 | 15 | 12.38 | 2 | 2.00 | 3 | 24.7 |
| 2 | LA | 40 | 51.77 | 50 | 36.92 | 7 | 14.77 | | | 3 | 39.1 |
| 3 | CHI | 35 | 11.29 | 50 | 30.73 | 10 | 12.29 | 2 | 2.00 | 3 | 24.2 |
| 4 | PHL | 35 | 9.81 | 50 | 30.81 | 10 | 12.32 | 2 | 2.00 | 3 | 24.4 |
| 5 | SF | 40 | 10.75 | 50 | 34.40 | 7 | 13.76 | | | 3 | 33.0 |
| 6 | DTW | 40 | 9.89 | 50 | 35.51 | 7 | 14.20 | | | 3 | 35.7 |
| 7 | BOS | 30 | 11.70 | 50 | 25.62 | 15 | 10.25 | 2 | 2.00 | 3 | 28.5 |
| 8 | HST | 40 | 8.70 | 50 | 32.53 | 7 | 13.01 | | | 3 | 28.5 |
| 9 | DFW | 40 | 9.90 | 50 | 31.21 | 7 | 12.48 | | | 3 | 25.3 |
| 10 | WAS | 35 | 11.60 | 50 | 25.20 | 5 | 10.08 | 7 | 2.00 | 3 | 27.5 |
| 11 | ATL | 35 | 8.71 | 50 | 25.68 | 7 | 10.27 | 5 | 2.00 | 3 | 28.6 |
| 12 | STL | 40 | 7.92 | 50 | 22.23 | 7 | 8.89 | | | 3 | 20.3 |
| 13 | MSP | 40 | 9.42 | 50 | 22.23 | 7 | 8.89 | | | 3 | 20.3 |
| 14 | SDO SAN | 40 | 9.13 | 50 | 34.40 | 7 | 13.76 | | | 3 | 33.0 |
| 15 | PIT | 40 | 8.50 | 50 | 24.75 | 7 | 9.90 | | | 3 | 26.4 |
| 16 | PHX | 40 | 8.37 | 50 | 24.18 | 7 | 9.67 | | | 3 | 25.0 |
| 17 | TPA | 40 | 8.23 | 50 | 23.59 | 7 | 9.44 | | | 3 | 23.6 |
| 18 | SEA | 40 | 10.04 | 50 | 24.92 | 7 | 9.97 | | | 3 | 26.8 |
| 19 | DEN | 40 | 8.86 | 50 | 26.34 | 7 | 10.54 | | | 3 | 30.2 |
| 20 | MIA | 40 | 9.35 | 50 | 21.90 | 7 | 8.76 | | | 3 | 19.5 |
| 21 | SLC | 40 | 7.84 | 50 | 21.86 | 7 | 8.75 | | | 3 | 19.4 |
| 22 | CLT | 40 | 8.01 | 50 | 22.60 | 7 | 9.04 | | | 3 | 21.2 |
| 23 | ORL MCO | 40 | 7.38 | 30 | 19.83 | 30 | 7.93 | | | | 14.5 |
| 24 | LAS | 40 | 8.37 | 30 | 24.18 | 30 | 9.67 | | | | 25.0 |
| 25 | BWI | 30 | 7.87 | 50 | 22.00 | 17 | 8.80 | | | 3 | 19.8 |
| 26 | CLE | 38 | 8.06 | 50 | 22.82 | 7 | 9.13 | 2 | 2.00 | 3 | 21.7 |
| 27 | KC MCI | 40 | 8.62 | 50 | 25.27 | 10 | 10.11 | | | | 27.6 |
| 28 | ELP | 45 | 6.67 | 50 | 20.03 | 5 | 8.01 | | | | 15.0 |
| 29 | CIN CVG | 40 | 7.95 | 50 | 22.36 | 7 | 8.94 | | | 3 | 20.6 |
| 30 | MKE | 40 | 7.65 | 50 | 21.02 | 7 | 8.41 | | | 3 | 17.4 |
| 31 | SMT SMF | 45 | 7.10 | 50 | 21.91 | 5 | 8.77 | | | | 19.5 |
| 32 | NO MSY | 38 | 8.35 | 50 | 24.10 | 10 | 9.64 | | | 2 | 24.8 |
| 33 | CMS CMH | 45 | 7.09 | 50 | 21.87 | 5 | 8.75 | | | | 19.4 |
| 34 | NFK ORF | 45 | 7.05 | 50 | 21.67 | 5 | 8.67 | | | | 19.0 |
| 35 | SAT | 45 | 6.38 | 50 | 18.73 | 5 | 7.49 | | | | 11.9 |
| 36 | PDX | 45 | 7.06 | 50 | 21.72 | 5 | 8.69 | | | | 19.1 |
| 37 | IND | 40 | 7.57 | 50 | 20.70 | 7 | 8.28 | | | 3 | 16.6 |
| 38 | HTF BDL | 40 | 8.42 | 50 | 24.42 | 7 | 9.77 | | | 3 | 25.6 |
| 39 | ROC | 50 | 6.95 | 50 | 21.26 | 0 | 8.51 | | | | 18.0 |

| Zone | MSA Abbrev | Drv & Prk Own/RtlCar % | Drv & Prk Own/RtlCar Cost $ | Taxi or Limo % | Taxi or Limo Cost $ | Coach or AirportBus % | Coach or AirportBus Cost $ | Mass Transit % | Mass Transit Cost $ | Free Courtesy Veh % | County Pop Wtd Dist (mi) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | OKC | 45 | 6.93 | 50 | 21.15 | 5 | 8.46 | | | | 17.7 |
| 41 | BUF | 45 | 6.93 | 50 | 21.15 | 5 | 8.46 | | | | 17.7 |
| 42 | MEM | 45 | 6.84 | 50 | 20.77 | 5 | 8.31 | | | | 16.8 |
| 43 | LUI SDF | 45 | 6.75 | 50 | 20.38 | 5 | 8.15 | | | | 15.8 |
| 44 | NSH BNA | 45 | 7.29 | 50 | 22.75 | 5 | 9.10 | | | | 21.6 |
| 45 | GSO | 50 | 7.68 | 50 | 24.45 | 0 | 9.78 | | | | 25.6 |
| 46 | JAX | 50 | 7.59 | 50 | 24.07 | 0 | 9.63 | | | | 24.7 |
| 47 | TUL | 45 | 6.82 | 50 | 20.70 | 5 | 8.28 | | | | 16.6 |
| 48 | AUS | 50 | 7.45 | 50 | 23.45 | 0 | 9.38 | | | | 23.2 |
| 49 | SYR | 50 | 6.88 | 50 | 20.92 | 0 | 8.37 | | | | 17.2 |
| 50 | TUS | 50 | 6.67 | 50 | 20.03 | 0 | 8.01 | | | | 15.0 |
| 51 | RDU | 45 | 6.68 | 50 | 20.08 | 5 | 8.03 | | | | 15.1 |
| 52 | ABQ | 50 | 6.67 | 50 | 20.03 | 0 | 8.01 | | | | 15.0 |
| 53 | RNO | 40 | 8.20 | 30 | 23.45 | 30 | 9.38 | | | | 23.2 |
| 54 | LBK LBB | 50 | 6.20 | 50 | 17.95 | 0 | 7.18 | | | | 10.0 |
| 55 | MID MAF | 50 | 6.29 | 50 | 18.37 | 0 | 7.35 | | | | 11.0 |
| 56 | OMA | 50 | 8.00 | 50 | 25.87 | 0 | 10.35 | | | | 29.1 |
| 57 | BHM | 50 | 7.00 | 50 | 21.45 | 0 | 8.58 | | | | 18.4 |
| 58 | PVD | 45 | 6.70 | 50 | 20.16 | 5 | 8.06 | | | | 15.3 |
| 59 | ALB | 45 | 7.13 | 50 | 22.05 | 5 | 8.82 | | | | 19.9 |
| 60 | RIC | 45 | 7.14 | 50 | 22.09 | 5 | 8.84 | | | | 20.0 |
| 61 | HRG MDT | 50 | 7.27 | 50 | 22.65 | 0 | 9.06 | | | | 21.3 |
| 62 | LIT | 50 | 7.60 | 50 | 24.10 | 0 | 9.64 | | | | 24.8 |
| 63 | CBA CAE | 50 | 6.25 | 50 | 18.20 | 0 | 7.28 | | | | 10.6 |
| 64 | CHA | 50 | 6.81 | 50 | 20.64 | 0 | 8.26 | | | | 16.5 |
| 65 | JAN | 50 | 6.99 | 50 | 21.41 | 0 | 8.56 | | | | 18.3 |
| 66 | MSN | 50 | 6.20 | 50 | 17.95 | 0 | 7.18 | | | | 10.0 |
| 67 | MCN | 50 | 6.57 | 50 | 19.57 | 0 | 7.83 | | | | 13.9 |
| 68 | CRW | 50 | 6.39 | 50 | 18.79 | 0 | 7.52 | | | | 12.0 |
| 69 | SAV | 50 | 6.46 | 50 | 19.12 | 0 | 7.65 | | | | 12.8 |
| 70 | PDM PWM | 50 | 6.65 | 50 | 19.94 | 0 | 7.97 | | | | 14.8 |
| 71 | SPI | 50 | 6.42 | 50 | 18.92 | 0 | 7.57 | | | | 12.3 |
| 72 | TPK | 50 | 6.39 | 50 | 18.78 | 0 | 7.51 | | | | 12.0 |
| 73 | QDC | 50 | 6.26 | 50 | 18.21 | 0 | 7.28 | | | | 10.6 |
| 74 | BOI | 50 | 6.48 | 50 | 19.20 | 0 | 7.68 | | | | 13.0 |
| 75 | BIL | 50 | 6.86 | 50 | 20.86 | 0 | 8.34 | | | | 17.0 |
| 76 | FSD | 50 | 6.29 | 50 | 18.37 | 0 | 7.35 | | | | 11.0 |
| 77 | CSP | 50 | 6.77 | 50 | 20.44 | 0 | 8.18 | | | | 16.0 |
| 78 | GFK | 50 | 6.67 | 50 | 20.03 | 0 | 8.01 | | | | 15.0 |

* The cost estimates are not relevant to this analysis.

## TABLE 20 Baseline Air Mode Airport Access Mode Shares and Cost* for Nonbusiness Trips: Year 2020

| Zone | MSA Abbrev | Drv & Prk Own/RtlCar % | Drv & Prk Own/RtlCar Cost $ | Taxi or Limo % | Taxi or Limo Cost $ | Coach or AirportBus % | Coach or AirportBus Cost $ | Mass Transit % | Mass Transit Cost $ | Free Courtesy Veh % | Friend/Relative** % | Friend/Relative** Cost $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | NYC | 16 | 18.88 | 10 | 30.95 | 20 | 12.38 | 4 | 2.00 | | 50 | 4.88 |
| 2 | LA | 20 | 18.14 | 10 | 36.92 | 15 | 14.77 | | | | 55 | 7.14 |
| 3 | CHI | 20 | 15.80 | 10 | 30.73 | 15 | 12.29 | 5 | 2.00 | | 50 | 4.80 |
| 4 | PHL | 20 | 13.83 | 10 | 30.81 | 10 | 12.32 | 5 | 2.00 | | 55 | 4.83 |
| 5 | SF | 30 | 15.18 | 10 | 34.40 | 10 | 13.76 | | | | 50 | 6.18 |
| 6 | DTW | 30 | 13.61 | 10 | 35.51 | 10 | 14.20 | | | | 50 | 6.61 |
| 7 | BOS | 22 | 16.47 | 10 | 25.62 | 15 | 10.25 | 3 | 2.00 | | 50 | 5.47 |
| 8 | HST | 30 | 12.48 | 10 | 32.53 | 10 | 13.01 | | | | 50 | 5.48 |
| 9 | DFW | 30 | 13.98 | 10 | 31.21 | 10 | 12.48 | | | | 50 | 4.98 |
| 10 | WAS | 25 | 16.31 | 10 | 25.20 | 13 | 10.08 | 7 | 2.00 | | 45 | 5.31 |
| 11 | ATL | 20 | 12.50 | 10 | 25.68 | 15 | 10.27 | 5 | 2.00 | | 50 | 5.50 |
| 12 | STL | 30 | 11.19 | 10 | 22.23 | 10 | 8.89 | | | | 50 | 4.19 |
| 13 | MSP | 30 | 13.19 | 10 | 22.23 | 10 | 8.89 | | | | 50 | 4.19 |
| 14 | SDO SAN | 30 | 13.19 | 10 | 34.40 | 10 | 13.76 | | | | 50 | 6.19 |
| 15 | PIT | 30 | 12.14 | 10 | 24.75 | 10 | 9.90 | | | | 50 | 5.14 |
| 16 | PHX | 30 | 11.93 | 10 | 24.18 | 10 | 9.67 | | | | 50 | 4.93 |
| 17 | TPA | 30 | 11.71 | 10 | 23.59 | 10 | 9.44 | | | | 50 | 4.71 |
| 18 | SEA | 30 | 14.21 | 10 | 24.92 | 10 | 9.97 | | | | 50 | 5.21 |
| 19 | DEN | 30 | 12.75 | 10 | 26.34 | 10 | 10.54 | | | | 50 | 5.75 |
| 20 | MIA | 30 | 13.06 | 10 | 21.90 | 10 | 8.76 | | | | 50 | 4.06 |
| 21 | SLC | 30 | 11.05 | 10 | 21.86 | 10 | 8.75 | | | | 50 | 4.05 |
| 22 | CLT | 30 | 11.33 | 10 | 22.60 | 10 | 9.04 | | | | 50 | 4.33 |
| 23 | ORL MCO | 30 | 10.28 | 10 | 19.83 | 35 | 7.93 | | | 5 | 20 | 3.28 |
| 24 | LAS | 30 | 11.93 | 10 | 24.18 | 35 | 9.67 | | | 5 | 20 | 4.93 |
| 25 | BWI | 25 | 11.10 | 10 | 22.00 | 15 | 8.80 | | | | 50 | 4.10 |
| 26 | CLE | 25 | 11.41 | 10 | 22.82 | 15 | 9.13 | 2 | 2.00 | | 48 | 4.41 |
| 27 | KC MCI | 30 | 12.34 | 10 | 25.27 | 10 | 10.11 | | | | 50 | 5.34 |
| 28 | ELP | 35 | 9.36 | 10 | 20.03 | 5 | 8.01 | | | | 50 | 3.36 |
| 29 | CIN CVG | 30 | 11.24 | 10 | 22.36 | 10 | 8.94 | | | | 50 | 4.24 |
| 30 | MKE | 30 | 10.73 | 10 | 21.02 | 10 | 8.41 | | | | 50 | 3.73 |
| 31 | SMT SMF | 35 | 10.07 | 10 | 21.91 | 5 | 8.77 | | | | 50 | 4.07 |
| 32 | NO MSY | 25 | 11.90 | 10 | 24.10 | 20 | 9.64 | | | | 45 | 4.90 |
| 33 | CMS CMH | 35 | 10.06 | 10 | 21.87 | 5 | 8.75 | | | | 50 | 4.06 |
| 34 | NFK ORF | 35 | 9.98 | 10 | 21.67 | 5 | 8.67 | | | | 50 | 3.98 |
| 35 | SAT | 35 | 8.87 | 10 | 18.73 | 5 | 7.49 | | | | 50 | 2.87 |
| 36 | PDX | 35 | 10.00 | 10 | 21.72 | 5 | 8.69 | | | | 50 | 4.00 |
| 37 | IND | 30 | 10.61 | 10 | 20.70 | 10 | 8.28 | | | | 50 | 3.61 |
| 38 | HTF BDL | 30 | 12.02 | 10 | 24.42 | 10 | 9.77 | | | | 50 | 5.02 |
| 39 | ROC | 40 | 9.83 | 10 | 21.26 | | 8.51 | | | | 50 | 3.83 |

| Zone | MSA Abbrev | Drv & Prk Own/RtlCar % | Drv & Prk Own/RtlCar Cost $ | Taxi or Limo % | Taxi or Limo Cost $ | Coach or AirportBus % | Coach or AirportBus Cost $ | Mass Transit % | Mass Transit Cost $ | Free Courtesy Veh % | Friend/Relative** % | Friend/Relative** Cost $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | OKC | 35 | 9.78 | 10 | 21.15 | 5 | 8.46 | | | | 50 | 3.78 |
| 41 | BUF | 35 | 9.78 | 10 | 21.15 | 5 | 8.46 | | | | 50 | 3.78 |
| 42 | MEM | 35 | 9.64 | 10 | 20.77 | 5 | 8.31 | | | | 50 | 3.64 |
| 43 | LUI SDF | 35 | 9.49 | 10 | 20.38 | 5 | 8.15 | | | | 50 | 3.49 |
| 44 | NSH BNA | 35 | 10.39 | 10 | 22.75 | 5 | 9.10 | | | | 50 | 4.39 |
| 45 | GSO | 40 | 11.03 | 10 | 24.45 | | 9.78 | | | | 50 | 5.03 |
| 46 | JAX | 40 | 10.89 | 10 | 24.07 | | 9.63 | | | | 50 | 4.89 |
| 47 | TUL | 35 | 9.61 | 10 | 20.70 | 5 | 8.28 | | | | 50 | 3.61 |
| 48 | AUS | 40 | 10.65 | 10 | 23.45 | | 9.38 | | | | 50 | 4.65 |
| 49 | SYR | 40 | 9.70 | 10 | 20.92 | | 8.37 | | | | 50 | 3.70 |
| 50 | TUS | 40 | 9.36 | 10 | 20.03 | | 8.01 | | | | 50 | 3.36 |
| 51 | RDU | 35 | 9.38 | 10 | 20.08 | 5 | 8.03 | | | | 50 | 3.38 |
| 52 | ABQ | 40 | 9.36 | 10 | 20.03 | | 8.01 | | | | 50 | 3.36 |
| 53 | RNO | 30 | 11.65 | 10 | 23.45 | 35 | 9.38 | | | 5 | 20 | 4.65 |
| 54 | LBK LBB | 40 | 8.57 | 10 | 17.95 | | 7.18 | | | | 50 | 2.57 |
| 55 | MID MAF | 40 | 8.73 | 10 | 18.37 | | 7.35 | | | | 50 | 2.73 |
| 56 | OMA | 40 | 11.57 | 10 | 25.87 | | 10.35 | | | | 50 | 5.57 |
| 57 | BHM | 40 | 9.90 | 10 | 21.45 | | 8.58 | | | | 50 | 3.90 |
| 58 | PVD | 35 | 9.41 | 10 | 20.16 | 5 | 8.06 | | | | 50 | 3.41 |
| 59 | ALB | 35 | 10.12 | 10 | 22.05 | 5 | 8.82 | | | | 50 | 4.12 |
| 60 | RIC | 35 | 10.14 | 10 | 22.09 | 5 | 8.84 | | | | 50 | 4.14 |
| 61 | HRG MDT | 40 | 10.35 | 10 | 22.65 | | 9.06 | | | | 50 | 4.35 |
| 62 | LIT | 40 | 10.90 | 10 | 24.10 | | 9.64 | | | | 50 | 4.90 |
| 63 | CBA CAE | 40 | 8.67 | 10 | 18.20 | | 7.28 | | | | 50 | 2.67 |
| 64 | CHA | 40 | 9.59 | 10 | 20.64 | | 8.26 | | | | 50 | 3.59 |
| 65 | JAN | 40 | 9.88 | 10 | 21.41 | | 8.56 | | | | 50 | 3.88 |
| 66 | MSN | 40 | 8.57 | 10 | 17.95 | | 7.18 | | | | 50 | 2.57 |
| 67 | MCN | 40 | 9.19 | 10 | 19.57 | | 7.83 | | | | 50 | 3.19 |
| 68 | CRW | 40 | 8.89 | 10 | 18.79 | | 7.52 | | | | 50 | 2.89 |
| 69 | SAV | 40 | 9.01 | 10 | 19.12 | | 7.65 | | | | 50 | 3.01 |
| 70 | PDM PWM | 40 | 9.32 | 10 | 19.94 | | 7.97 | | | | 50 | 3.32 |
| 71 | SPI | 40 | 8.94 | 10 | 18.92 | | 7.57 | | | | 50 | 2.94 |
| 72 | TPK | 40 | 8.89 | 10 | 18.78 | | 7.51 | | | | 50 | 2.89 |
| 73 | QDC | 40 | 8.67 | 10 | 18.21 | | 7.28 | | | | 50 | 2.67 |
| 74 | BOI | 40 | 9.04 | 10 | 19.20 | | 7.68 | | | | 50 | 3.04 |
| 75 | BIL | 40 | 9.67 | 10 | 20.86 | | 8.34 | | | | 50 | 3.67 |
| 76 | FSD | 40 | 8.73 | 10 | 18.37 | | 7.35 | | | | 50 | 2.73 |
| 77 | CSP | 40 | 9.51 | 10 | 20.44 | | 8.18 | | | | 50 | 3.51 |
| 78 | GFK | 40 | 9.36 | 10 | 20.03 | | 8.01 | | | | 50 | 3.36 |

* The cost estimates are not relevant to this analysis.
** The access/egress distance will be doubled (round trip) for this option.

3.6.4 Emission Calculations

Emission rates are multiplied by corresponding energy or distance to obtain total emissions. Electric generation emission rates are computed as grams per unit input energy and are multiplied by energy per passenger mile and by average distance to compute the total emissions corresponding to electrically-powered access/egress modes.

Emission rates for automobiles and buses are computed as grams per vehicle mile. For access and egress it is assumed that the auto-occupancy rate is 1 for business travel and 1.5 for nonbusiness travel. The occupancy rate of 20 is used for buses and airport coaches is given in Table 9b.[27]

# 4.0 ESTIMATING THE MONETARY VALUE OF EMISSIONS SAVINGS

The monetary value of the emissions reductions resulting from replacing conventional mode trips with new HSGT technology trips is computed separately for each corridor. For each route, it is necessary to determine the percent of the total trip distance in each county.

## 4.1 Monetary Value Based on Avoided Emission Control Costs in Each County

The estimated emission control costs are taken from Ref. 28. This report lists results for various pollutants and selected regions of the U.S. It also provides regression formulas for those regions for which explicit emissions values are not currently available. The report authors recommended that the regression formulas given below be used only when explicit values are not available ($ = 1989 constant $):

$$NO_{x,\,cost} = 40{,}000 + 5.71\ln(pop) + 15{,}100\ln(0_3) \qquad (21)$$

$$ROG_{cost} = 30{,}200 + 385\ln(pop) + 12{,}000\ln(0_3)$$

$$PM_{10,cost} = -16{,}800 + 793\ln(pop) + 3{,}790\ln(PM_{10})$$

$$CO_{cost} = -6{,}390 + 579\ln(pop) + 2{,}110\ln(CO)$$

where:

$NO_{x,\,cost}$ = $NO_x$ control-cost-based value ($/ton)

$ROG_{cost}$ = ROG control-cost-based value ($/ton)

$PM_{10,cost}$ = $PM_{10}$ control-cost-based value ($/ton)

$CO_{cost}$ = CO control-cost-based value ($/ton)

pop = total population (in $10^3$)

$0_3$ = highest second daily maximum 1-hr ozone concentration (ppm)

$PM_{10}$ = highest arithmetic mean $PM_{10}$ concentration (ug/m$^3$)

CO = highest second maximum nonoverlapping 8-hr CO concentration (ppm)

The input values required for the regression relationships, namely the concentrations and populations are listed in Ref 29.

Even if a particular county is already in compliance with all the NAAQS's, the values of the emissions saved in that county is still not zero. This follows from several considerations. First, emissions from one county generally impacts the air quality in neighboring counties. Second, emissions are regulated at both the state and national levels by a variety of regulations including source performance standards, prevention of significant deterioration, and emission caps (such as the $SO_2$ emission cap). Such regulations are often not directly connected with compliance with the NAAQS's. Third, emission controls required on some types of sources such as on motor vehicles must be bought and maintained regardless of the level of compliance of a particular county with the NAAQS's. Consequently, counties that have either extremely low values obtained from application of the above regression equations, or for which no air quality data exists, are assigned the following minimum values based on analyses of available data:

| Pollutant | (value in $/ton) |
|---|---|
| $SO_2$ | 600 |
| ROG | 1800 |
| CO | 300 |
| $NO_x$ | 1900 |
| $PM_{10}$ | 300 |
| $CO_2$ | 15 |

Note that the term "ROG" meaning "reactive organic compounds" is used here interchangeably with volatile organic compounds (VOC). The conversion from hydrocarbons (HC) to VOC generally involves multiplication by a numerical factor that is close to unity.

Carbon dioxide ($CO_2$) emission reductions are assigned a value of $15/ton based on several reported results cited in Ref. 28. That value is based on $CO_2$'s impact on the global green-house effect not on the status of a corresponding $CO_2$ air quality standard, since there are no such standards in the U.S. Pollutants for which ambient air quality standards have been established are: CO, Pb (lead), $NO_2$, $O_3$, $PM_{10}$, and $SO_2$. Of these, Pb is not considered in this study because of lack of data. In addition, $O_3$ (Ozone) is not an effluent from combustion but rather is the result of atmospheric chemical reactions involving the combustion products NO and VOC (Volatile Organic Compounds). The terms $NO_x$ and $SO_x$ are frequently used to represent all important oxides of nitrogen and sulfur, respectively. $PM_{10}$ is considered to be that fraction of the total suspended particulate matter present in the atmosphere responsible for human health effects. Unfortunately, at present, there is relatively little reliable emission data for the types of $PM_{10}$ sources considered in this study.

Even though an ambient air quality standard exists for $SO_2$, the ambient concentration is not used as the basis for estimating the value of $SO_2$ or $SO_x$ emissions. The reason is that the air quality standard is not the controlling factor in the case of $SO_x$. Instead, legislatively-mandated emission caps designed to reduce emissions of $SO_x$ and their corresponding acid rain impacts are the controlling factor. The value of $600/ton of $SO_x$ is based on estimates for the value of emission allowances traded on the commodities market. See, for example, Refs. 30 and 31.

The emission control costs for each corridor and for each county within that corridor are given in Table 21. Both single and combined corridor routes are shown in that table. The percent of the route distance within each county is also given.

Table 21 Emission Control Costs

| Corridor A | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 279.76 | 100.00 | | | | | | |
| Cook | 16.67 | 5.96 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Lake | 19.05 | 6.81 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Porter | 16.67 | 5.96 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| La Porte | 9.52 | 3.40 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Berrien | 28.57 | 10.21 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Cass | 23.81 | 8.51 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Van Buren | 19.05 | 6.81 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Kalamazoo | 23.81 | 8.51 | 5794 | 300 | 6701 | 600 | 300 | 15 |
| Calhourn | 29.76 | 10.64 | 5604 | 300 | 6698 | 600 | 300 | 15 |
| Jackson | 33.33 | 11.91 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Washtenaw | 30.95 | 11.06 | 6899 | 1897 | 6635 | 600 | 3585 | 15 |
| Wayne | 28.57 | 10.21 | 6899 | 1897 | 6635 | 600 | 3585 | 15 |
| **Corridor B** | | | | | | | | |
| Corridor Total | 82.33 | 100.00 | | | | | | |
| Cook | 20.00 | 24.29 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Lake | 24.00 | 29.15 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Kenosha | 12.00 | 14.57 | 6635 | 906 | 6777 | 600 | 1744 | 15 |
| Racine | 12.00 | 14.57 | 6635 | 906 | 6777 | 600 | 1744 | 15 |
| Milwaukee | 14.33 | 17.41 | 6635 | 906 | 6777 | 600 | 1744 | 15 |
| **Corridor C** | | | | | | | | |
| Corridor Total | 271.88 | 100.00 | | | | | | |
| Chicago | 15.63 | 5.75 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Du Page | 7.03 | 2.59 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Will | 31.25 | 11.49 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Grundy | 12.50 | 4.60 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Livingston | 29.69 | 10.92 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| McLean | 47.66 | 17.53 | 3176 | 300 | 3668 | 600 | 300 | 15 |
| Logan | 26.56 | 9.77 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Sangamon | 32.81 | 12.07 | 3325 | 300 | 3670 | 600 | 300 | 15 |
| Macoupin | 39.06 | 14.37 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Jersey | 3.13 | 1.15 | 8721 | 2233 | 9237 | 600 | 4213 | 15 |
| Madison | 23.44 | 8.62 | 8721 | 2233 | 9237 | 600 | 4213 | 15 |
| St. Clair | 3.13 | 1.15 | 8721 | 2233 | 9237 | 600 | 4213 | 15 |
| **Corridor D** | | | | | | | | |
| Corridor Total | 121.6 | 100.00 | | | | | | |
| San Diego | 56.76 | 46.67 | 17500 | 1100 | 18300 | 600 | 1000 | 15 |
| Orange | 43.24 | 35.56 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Los Angeles | 21.62 | 17.78 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |

Table 21 (Continued)

| Corridor F | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 263.28 | 100.00 | | | | | | |
| Miami/Dade | 15.63 | 5.93 | 5944 | 2219 | 5500 | 600 | 1816 | 15 |
| Broward | 25.00 | 9.50 | 5944 | 2219 | 5500 | 600 | 1816 | 15 |
| Palm Beach | 51.56 | 19.58 | 5944 | 2219 | 5500 | 600 | 1816 | 15 |
| Martin | 25.00 | 9.50 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Okeechobee | 26.56 | 10.09 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Highlands | 39.06 | 14.84 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Polk | 51.56 | 19.58 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Osceola | 17.97 | 6.82 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Orlando/Orange | 10.94 | 4.15 | 5256 | 576 | 5271 | 600 | 1225 | 15 |
| | | | | | | | | |
| Corridor Total | 248.44 | 100.00 | | | | | | |
| Miami/Dade | 15.63 | 6.29 | 5944 | 2219 | 5500 | 600 | 1816 | 15 |
| Broward | 25.00 | 10.06 | 5944 | 2219 | 5500 | 600 | 1816 | 15 |
| Palm Beach | 51.56 | 20.75 | 5944 | 2219 | 5500 | 600 | 1816 | 15 |
| Martin | 25.00 | 10.06 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Okeechobee | 26.56 | 10.69 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Highlands | 39.06 | 15.72 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Polk | 42.19 | 16.98 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Tampa/Hillsborou | 23.44 | 9.43 | 6652 | 955 | 6714 | 600 | 2145 | 15 |
| | | | | | | | | |
| Corridor Total | 92.34 | 100.00 | | | | | | |
| Orlando/Orange | 10.94 | 11.84 | 5256 | 576 | 5271 | 600 | 1225 | 15 |
| Osceola | 17.97 | 19.46 | 1848 | 300 | 1900 | 600 | 300 | 15 |
| Polk | 40.00 | 43.32 | 1848 | 300 | 1900 | 600 | 300 | 15 |
| Tampa/Hillsborou | 23.44 | 25.38 | 6652 | 955 | 6714 | 600 | 2145 | 15 |
| **Corridor H** | | | | | | | | |
| Corridor Total | 408.37 | 100.00 | | | | | | |
| Lane | 32.56 | 7.97 | 4742 | 659 | 5263 | 600 | 300 | 15 |
| Linn | 29.07 | 7.12 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Benton | 4.65 | 1.14 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Marion | 46.51 | 11.39 | 4736 | 1256 | 5263 | 600 | 300 | 15 |
| Clackamas | 16.28 | 3.99 | 6455 | 2122 | 6711 | 600 | 1739 | 15 |
| Multnomah | 11.63 | 2.85 | 6455 | 2122 | 6711 | 600 | 1739 | 15 |
| Clark | 19.07 | 4.67 | 6455 | 2122 | 6711 | 600 | 1739 | 15 |
| Columbia | 12.79 | 3.13 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Cowlitz | 20.93 | 5.13 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Lewis | 25.58 | 6.26 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Thurston | 25.58 | 6.26 | 5203 | 1936 | 5267 | 600 | 1836 | 15 |
| Pierce | 27.91 | 6.83 | 5023 | 1936 | 5267 | 600 | 1836 | 15 |
| King | 34.88 | 8.54 | 5490 | 2639 | 5274 | 600 | 3003 | 15 |
| Snohomish | 39.53 | 9.68 | 5490 | 2639 | 5274 | 600 | 3003 | 15 |
| Skagit | 25.58 | 6.26 | 1800 | 807 | 5262 | 600 | 300 | 15 |
| Whatcom | 25.581 | 6.26 | 1800 | 807 | 1900 | 600 | 300 | 15 |
| Vancouver | 10.23 | 2.51 | 4676 | 1166 | 5262 | 600 | 300 | 15 |

Table 21 (Continued)

| Corridor I | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 827.08 | 100.00 | | | | | | |
| Harris | 60.42 | 7.30 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |
| Fort Bend | 35.42 | 4.28 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |
| Wharton | 13.54 | 1.64 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Colorado | 35.42 | 4.28 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Fayette | 25.00 | 3.02 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Gonzales | 20.83 | 2.52 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Cardwell | 11.46 | 1.39 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Guadalupe | 37.50 | 4.53 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Bexar | 16.67 | 2.02 | 5330 | 1158 | 5272 | 600 | 1649 | 15 |
| | | | | | | | | |
| Dallas | 31.25 | 3.78 | 9627 | 1933 | 10356 | 600 | 2312 | 15 |
| Ellis | 23.96 | 2.90 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Navarro | 35.42 | 4.28 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Freestone | 4.17 | 0.50 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Limestone | 33.33 | 4.03 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Falls | 8.33 | 1.01 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Robertson | 33.33 | 4.03 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Brazos | 35.42 | 4.28 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Grimes | 27.08 | 3.27 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Waller | 15.63 | 1.89 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |
| Harris | 60.42 | 7.30 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |
| | | | | | | | | |
| Dallas | 31.25 | 3.78 | 9627 | 1933 | 10356 | 600 | 2312 | 15 |
| Tarrant | 31.25 | 3.78 | 9627 | 1933 | 10356 | 600 | 2312 | 15 |
| Johnson | 25.00 | 3.02 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Hill | 8.33 | 1.01 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Bosque | 38.54 | 4.66 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| McLennan | 26.04 | 3.15 | 4587 | 300 | 5261 | 600 | 300 | 15 |
| Bell | 33.33 | 4.03 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Williamson | 37.50 | 4.53 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Travis | 25.00 | 3.02 | 5134 | 392 | 5269 | 600 | 366 | 15 |
| Hays | 25.00 | 3.02 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Comal | 25.00 | 3.02 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Bexar | 16.67 | 2.02 | 5330 | 1158 | 5272 | 600 | 1649 | 15 |

Table 21 (Continued)

| **Corridor J** | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 449.19 | 100.00 | | | | | | |
| New York | 13.51 | 3.01 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Bronx | 1.35 | 0.30 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Westchester | 29.73 | 6.62 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Putnam | 16.22 | 3.61 | 5300 | 300 | 2460 | 600 | 5333 | 15 |
| Dutchess | 37.84 | 8.42 | 5852 | 300 | 6702 | 600 | 300 | 15 |
| Columbia | 29.73 | 6.62 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Rensselaer | 13.51 | 3.01 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Albany | 14.86 | 3.31 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Schenectady | 17.57 | 3.91 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Montgomery | 37.84 | 8.42 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Herkimer | 25.68 | 5.72 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Oneida | 29.73 | 6.62 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Madison | 12.70 | 2.83 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Onondaga | 32.43 | 7.22 | 5068 | 1757 | 5268 | 600 | 1600 | 15 |
| Cayuga | 10.81 | 2.41 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Seneca | 13.51 | 3.01 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Wayne | 17.57 | 3.91 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Ontario | 2.70 | 0.60 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Monroe | 25.68 | 5.72 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Genesee | 28.38 | 6.32 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Erie | 32.43 | 7.22 | 5216 | 1372 | 5270 | 600 | 852 | 15 |
| Niagara | 5.41 | 1.20 | 5701 | 300 | 6701 | 600 | 300 | 15 |

Table 21 (Continued)

| Corridor K | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 390.75 | 100.00 | | | | | | |
| Washinhton D.C. | 11.00 | 2.82 | 7943 | 2507 | 8031 | 600 | 2391 | 15 |
| Anne Arundel | 5.00 | 1.28 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Howard | 10.00 | 2.56 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Baltimore City | 7.50 | 1.92 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Baltimore | 15.00 | 3.84 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Harford | 18.75 | 4.80 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Cecil | 21.25 | 5.44 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| New Castle | 20.00 | 5.12 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Gloucester | 13.75 | 3.52 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Camden | 7.50 | 1.92 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Philadelphia | 2.50 | 0.64 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Burlington | 10.00 | 2.56 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Bucks | 10.00 | 2.56 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Mercer | 15.00 | 3.84 | 7945 | 1066 | 9226 | 600 | 300 | 15 |
| Somerset | 25.00 | 6.40 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Richmond | 10.00 | 2.56 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Kings | 0.50 | 0.13 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Queens | 0.50 | 0.13 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| New York | 0.75 | 0.19 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Essex | 2.50 | 0.64 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Hudson | 0.50 | 0.13 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Bronx | 1.25 | 0.32 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Westchester | 10.00 | 2.56 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Fairfield | 36.25 | 9.28 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| New Haven | 25.00 | 6.40 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Middlesex | 8.75 | 2.24 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| New London | 22.50 | 5.76 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Washington | 28.75 | 7.36 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Kent | 10.00 | 2.56 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Providence | 5.00 | 1.28 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Bristol | 16.25 | 4.16 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Norfork | 17.50 | 4.48 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Suffolk | 2.50 | 0.64 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Boston | | 0.00 | 5300 | 820 | 6500 | 600 | 5333 | 15 |

Table 21 (Continued)

| Corridor G | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 410.25 | 100 | | | | | | |
| Mecklenburg | 10 | 2.44 | 5300 | 1500 | 5300 | 600 | 1800 | 15 |
| Cabarrus | 22.8 | 5.56 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Rowan | 13.64 | 3.32 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Davidson | 19.09 | 4.65 | 5200 | 300 | 5300 | 600 | 300 | 15 |
| Randolph | 6.36 | 1.55 | 1800 | 300 | 1900 | 600 | 1500 | 15 |
| Guilford | 27.27 | 6.65 | 5200 | 1400 | 5300 | 600 | 300 | 15 |
| Alamance | 15.45 | 3.77 | 4400 | 300 | 5300 | 600 | 300 | 15 |
| Orange | 14.55 | 3.55 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Durham | 9.09 | 2.22 | 5100 | 1500 | 5300 | 600 | 480 | 15 |
| Wake | 23.64 | 5.76 | 5100 | 1500 | 5300 | 600 | 480 | 15 |
| Johnston | 22.73 | 5.54 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Wayne | 1.82 | 0.44 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Wilson | 16.36 | 3.99 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Nash | 7.27 | 1.77 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Edgecombe | 18.18 | 4.43 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Halifax | 12.73 | 3.10 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Northampton | 18.18 | 4.43 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Greensville | 7.27 | 1.77 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Southampton | 3.64 | 0.89 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Sussex | 12.73 | 3.10 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Dinwiddie | 14.55 | 3.55 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Colonial Heights | 3.64 | 0.89 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Chesterfield | 14.55 | 3.55 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Henrico | 14.55 | 3.55 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Hanover | 8.18 | 1.99 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| King William | 9.09 | 2.22 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Caroline | 25.45 | 6.20 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| King George | 5.45 | 1.33 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Charles | 19.09 | 4.65 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Prince George | 3.64 | 0.89 | 7900 | 2500 | 8000 | 600 | 2400 | 15 |
| Fairfax | 8.18 | 1.99 | 7900 | 2500 | 8000 | 600 | 2400 | 15 |
| Falls Church | 0.36 | 0.09 | 7900 | 2500 | 8000 | 600 | 2400 | 15 |
| Alexandria | 0.36 | 0.09 | 7900 | 2500 | 8000 | 600 | 2400 | 15 |
| Arlington | 0.36 | 0.09 | 7900 | 2500 | 8000 | 600 | 2400 | 15 |

Table 21 (Continued)

| Corridor AA | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 454.17 | 100.00 | | | | | | |
| New York | 5.56 | 1.22 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Bronx | 2.78 | 0.61 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Bergen | 11.11 | 2.45 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Rockland | 16.67 | 3.67 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Westchester | 13.89 | 3.06 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Orange | 29.17 | 6.42 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Ulster | 41.67 | 9.17 | 4708 | 300 | 5263 | 600 | 300 | 15 |
| Greene | 23.61 | 5.20 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Albany | 27.78 | 6.12 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Schenectady | 16.67 | 3.67 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Montgomery | 36.11 | 7.95 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Herkime | 25.00 | 5.50 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Oneida | 25.00 | 5.50 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Madison | 11.11 | 2.45 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Onondaga | 31.94 | 7.03 | 5068 | 1757 | 5268 | 600 | 1600 | 15 |
| Cayage | 13.89 | 3.06 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Wayne | 2.78 | 0.61 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Seneca | 11.11 | 2.45 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Ontario | 26.39 | 5.81 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Monroa | 23.61 | 5.20 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Genesee | 25.00 | 5.50 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Erie | 27.78 | 6.12 | 5216 | 1372 | 5270 | 600 | 852 | 15 |
| Niagara | 5.56 | 1.22 | 5701 | 300 | 6701 | 600 | 300 | 15 |
| **Corridor BB** | | | | | | | | |
| Corridor Total | 1402 | 100.00 | | | | | | |
| Dallas | 18.75 | 1.34 | 9627 | 1933 | 10356 | 600 | 2312 | 15 |
| Ellis/Navarro/Hill | 60.42 | 4.31 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| McLannan | 33.33 | 2.38 | 4587 | 300 | 5261 | 600 | 300 | 15 |
| Falls | 33.33 | 2.38 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Milam | 36.46 | 2.60 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Robertson | 4.17 | 0.30 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Burleson | 4.17 | 0.30 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Brazos | 30.21 | 2.15 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Grimes | 22.92 | 1.63 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Waller | 10.42 | 0.74 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |
| Harris | 43.75 | 3.12 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |
| Houston | | 0.00 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |

Table 21 (Continued)

| Corridor BB | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 308.33 | 21.99 | | | | | | |
| Dallas | 18.75 | 1.34 | 9627 | 1933 | 10356 | 600 | 2312 | 15 |
| Ellis/Navarro/Hill | 60.42 | 4.31 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| McLannan | 33.33 | 2.38 | 4587 | 300 | 5261 | 600 | 300 | 15 |
| Falls | 33.33 | 2.38 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Milam | 44.79 | 3.19 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Williamson | 16.67 | 1.19 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Travis | 32.29 | 2.30 | 5134 | 392 | 5269 | 600 | 366 | 15 |
| Caldwell | 19.79 | 1.41 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Guadalupe | 34.38 | 2.45 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| San Antonio | 14.58 | 1.04 | 5330 | 1158 | 5272 | 600 | 1649 | 15 |
| | | | | | | | | |
| Corridor Total | 209.38 | 14.93 | | | | | | |
| Houston | | 0.00 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |
| Harris | 43.75 | 3.12 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |
| Waller | 10.42 | 0.74 | 14006 | 2689 | 15744 | 600 | 3412 | 15 |
| Grimes | 22.92 | 1.63 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Brazos | 30.21 | 2.15 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Burleson | 4.17 | 0.30 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Robertson | 4.17 | 0.30 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Milam | 44.79 | 3.19 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Williamson | 16.67 | 1.19 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Travis | 32.29 | 2.30 | 5134 | 392 | 5269 | 600 | 366 | 15 |
| Caldwell | 19.79 | 1.41 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Guadalupe | 34.38 | 2.45 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| San Antonio | 14.58 | 1.04 | 5330 | 1158 | 5272 | 600 | 1649 | 15 |
| **Corridor DD (Route I15)** | | | | | | | | |
| Corridor Total | 141.86 | 100.00 | | | | | | |
| San Diego | 53.49 | 37.70 | 17500 | 1100 | 18300 | 600 | 1000 | 15 |
| Riverside | 47.67 | 33.61 | 3500 | 2900 | 6000 | 600 | 5700 | 15 |
| Orange | 22.09 | 15.57 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Los Angeles | 18.60 | 13.11 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| **Corridor DD (Route I5)** | | | | | | | | |
| Corridor Total | 119.77 | 100.00 | | | | | | |
| San Diego | 58.14 | 48.54 | 17500 | 1100 | 18300 | 600 | 1000 | 15 |
| Orange | 40.70 | 33.98 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Los Angeles | 20.93 | 17.48 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |

Table 21 (Continued)

| Corridor EC+D | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 569.83 | 100.00 | | | | | | |
| San Diego | 64.06 | 11.24 | 17500 | 1100 | 18300 | 600 | 1000 | 15 |
| Orange | 50.00 | 8.77 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Los Angeles | 55.77 | 9.79 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Ventura | 49.04 | 8.61 | 9100 | 300 | 9100 | 600 | 900 | 15 |
| Santa Barbara | 88.46 | 15.52 | 9100 | 300 | 9100 | 600 | 900 | 15 |
| San Luis Obispo | 73.08 | 12.82 | 9100 | 300 | 9100 | 600 | 900 | 15 |
| Monterey | 90.38 | 15.86 | 9100 | 300 | 9100 | 600 | 900 | 15 |
| San Benito | 16.35 | 2.87 | 9100 | 300 | 9100 | 600 | 900 | 15 |
| Santa Clara | 52.88 | 9.28 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| San Mateo | 25.00 | 4.39 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| San Francisco | 4.81 | 0.84 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| **Corridor EE + DD (Route I5)** | | | | | | | | |
| Corridor Total | 524.98 | 100.00 | | | | | | |
| San Diego | 58.14 | 11.07 | 17500 | 1100 | 18300 | 600 | 1000 | 15 |
| Orange | 40.70 | 7.75 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Los Angeles | 89.68 | 17.08 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Bakersfield | 75.00 | 14.29 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Tulare | 52.08 | 9.92 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Kings | 2.08 | 0.40 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Fresno | 29.17 | 5.56 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Madera | 46.88 | 8.93 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Merced | 41.67 | 7.94 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Santa Clara | 62.50 | 11.91 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| San Mateo | 21.88 | 4.17 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| San Francisco | 5.21 | 0.99 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| **Corridor EE + DD (Route I15)** | | | | | | | | |
| Corridor Total | 549.39 | 100.00 | | | | | | |
| San Diego | 53.49 | 9.74 | 17500 | 1100 | 18300 | 600 | 1000 | 15 |
| Riverside | 47.67 | 8.68 | 3500 | 2900 | 6000 | 600 | 5700 | 15 |
| Orange | 22.09 | 4.02 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Los Angeles | 89.68 | 16.32 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Bakersfield | 75.00 | 13.65 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Tulare | 52.08 | 9.48 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Kings | 2.08 | 0.38 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Fresno | 29.17 | 5.31 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Madera | 46.88 | 8.53 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Merced | 41.67 | 7.58 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Santa Clara | 62.50 | 11.38 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| San Mateo | 21.88 | 3.98 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| San Francisco | 5.21 | 0.95 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |

Table 21 (Continued)

| Corridor EV+D | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 646.08 | 100.00 | | | | | | |
| San Diego | 64.06 | 9.92 | 17500 | 1100 | 18300 | 600 | 1000 | 15 |
| Orange | 50.00 | 7.74 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Los Angeles | 128.27 | 19.85 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Kern | 96.25 | 14.90 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Tulare | 15.00 | 2.32 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Kings | 47.50 | 7.35 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Fresno | 36.25 | 5.61 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Madera | 32.50 | 5.03 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Merced | 45.00 | 6.97 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Stanislaus | 27.50 | 4.26 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| San Joaquin | 46.25 | 7.16 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Contra Costa | 45.00 | 6.97 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| Solano | 5.00 | 0.77 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| Alameda | 7.50 | 1.16 | 10200 | 2200 | 10400 | 600 | 2600 | 15 |
| | | | | | | | | |
| Corridor Total | 619.83 | 100.00 | | | | | | |
| San Diego | 64.06 | 10.34 | 17500 | 1100 | 18300 | 600 | 1000 | 15 |
| Orange | 50.00 | 8.07 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Los Angeles | 55.77 | 9.00 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Los Angeles | 72.50 | 11.70 | 18900 | 9300 | 26400 | 600 | 5700 | 15 |
| Kern | 96.25 | 15.53 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Tulare | 15.00 | 2.42 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Kings | 47.50 | 7.66 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Fresno | 36.25 | 5.85 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Madera | 32.50 | 5.24 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Merced | 45.00 | 7.26 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Stanislaus | 27.50 | 4.44 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| San Joaquin | 46.25 | 7.46 | 9100 | 3200 | 9100 | 600 | 5200 | 15 |
| Sacramento | 31.25 | 5.04 | 9100 | 5000 | 9100 | 600 | 2800 | 15 |
| **Corridor MM** | | | | | | | | |
| Corridor Total | 329.52 | 100.00 | | | | | | |
| Dade | 16.39 | 4.98 | 5944 | 2219 | 5500 | 600 | 1861 | 15 |
| Broward | 26.23 | 7.96 | 5944 | 2219 | 5500 | 600 | 1861 | 15 |
| Palm Beach | 55.74 | 16.92 | 5944 | 2219 | 5500 | 600 | 1861 | 15 |
| Martin | 21.31 | 6.47 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| St. Luie | 34.43 | 10.45 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Okeechobee | 14.75 | 4.48 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Indian River | 3.28 | 1.00 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Osceola | 59.02 | 17.91 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Orange | 31.15 | 9.45 | 5256 | 576 | 5271 | 600 | 1225 | 15 |
| Osceola | 8.20 | 2.49 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Polk | 34.43 | 10.45 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Hillsborough | 24.59 | 7.46 | 6652 | 955 | 6714 | 600 | 2145 | 15 |

Table 21 (Continued)

| Corridor FF | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 393.75 | 100.00 | | | | | | |
| Arlington | 5.00 | 1.27 | 7943 | 2507 | 8031 | 600 | 2391 | 15 |
| Wash. DC | 10.00 | 2.54 | 7943 | 2507 | 8031 | 600 | 2391 | 15 |
| Anne Arundel | 15.00 | 3.81 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Howard | 12.50 | 3.17 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Baltimore City | 10.00 | 2.54 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Baltimore | 11.25 | 2.86 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Harford | 17.50 | 4.44 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Cecil | 18.75 | 4.76 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| New Castle | 20.00 | 5.08 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Delaware | 15.00 | 3.81 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Philadelphia | 10.00 | 2.54 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Bucks | 22.50 | 5.71 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Mercer | 11.25 | 2.86 | 7945 | 1066 | 9226 | 600 | 300 | 15 |
| Somerset | 13.75 | 3.49 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Middlesex | 12.50 | 3.17 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Essex | 10.00 | 2.54 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Hudson | 1.25 | 0.32 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Bronx | 5.00 | 1.27 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Westchester | 20.00 | 5.08 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Fairfield | 28.75 | 7.30 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| New Haven | 22.50 | 5.71 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Middlesex | 16.25 | 4.13 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Hartford | 3.75 | 0.95 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Tolland | 18.75 | 4.76 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Windham | 22.50 | 5.71 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Providence | 2.50 | 0.63 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Worcester | 15.00 | 3.81 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Norfolk | 18.75 | 4.76 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Suffolk | 3.75 | 0.95 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Boston | | 0.00 | 5300 | 820 | 6500 | 600 | 5333 | 15 |

Table 21 (Continued)

| Corridor FF+G | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 803.29 | 100.00 | | | | | | |
| Charlotte/Mecklenburg | 10.00 | 1.24 | 5300 | 1500 | 5300 | 600 | 1800 | 15 |
| Cabarrus/Rowan | 36.44 | 4.54 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Davidson | 19.09 | 2.38 | 5200 | 300 | 5300 | 600 | 300 | 15 |
| Randolph | 6.36 | 0.79 | 1800 | 300 | 1900 | 600 | 1500 | 15 |
| Guilford | 27.27 | 3.40 | 5200 | 1400 | 5300 | 600 | 300 | 15 |
| Alamance | 15.45 | 1.92 | 4400 | 300 | 5300 | 600 | 300 | 15 |
| Orange | 14.55 | 1.81 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Durham/Wake | 32.73 | 4.07 | 5100 | 1500 | 5300 | 600 | 480 | 15 |
| Johnston-Dinwiddie | 135.45 | 16.86 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Colonial Heights/Chestfld. | 18.19 | 2.26 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Henrico | 14.55 | 1.81 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Hanover | 8.18 | 1.02 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| King William-King George | 40.00 | 4.98 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Charles | 19.09 | 2.38 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Prince George-Falls Chur. | 12.18 | 1.52 | 7900 | 2500 | 8000 | 600 | 2400 | 15 |
| Wash. DC | 15.00 | 1.87 | 7943 | 2507 | 8031 | 600 | 2391 | 15 |
| Anne Arundel-Baltimore | 48.75 | 6.07 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Harford | 17.50 | 2.18 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Cecil/New Castle/Del. | 53.75 | 6.69 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Philadelphia | 10.00 | 1.24 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Bucks | 22.50 | 2.80 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Mercer | 11.25 | 1.40 | 7945 | 1066 | 9226 | 600 | 300 | 15 |
| Somerset/Middlesex | 26.25 | 3.27 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Essex-Bronx | 16.25 | 2.02 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Westchest | 20.00 | 2.49 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Fairfield | 28.75 | 3.58 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| New Haven | 22.50 | 2.80 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Middlesex | 16.25 | 2.02 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Hartford | 3.75 | 0.47 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Tolland/Windham | 41.25 | 5.14 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Providence | 2.50 | 0.31 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Worcester | 15.00 | 1.87 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Norfolk/Suffolk | 22.50 | 2.80 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Boston | | 0.00 | 5300 | 820 | 6500 | 600 | 5333 | 15 |

Table 21 (Continued)

| Corridor FF+AA | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 1064 | 100.00 | | | | | | |
| Wash. DC | 15.00 | 1.41 | 7943 | 2507 | 8031 | 600 | 2391 | 15 |
| Anne Arundel-Harford | 66.25 | 6.23 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Cecil/New Castle/Del. | 53.75 | 5.05 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Philadelphia | 10.00 | 0.94 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Bucks/Mercer | 33.75 | 3.17 | 8620 | 2113 | 9159 | 600 | 2554 | 15 |
| Somerset/Middlesex | 26.25 | 2.47 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Essex-Bronx | 16.25 | 1.53 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Westchest/Fairfield | 48.75 | 4.58 | 7221 | 1389 | 6276 | 600 | 3333 | 15 |
| New Haven | 22.50 | 2.12 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Middlesex | 16.25 | 1.53 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Hartford | 3.75 | 0.35 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Tolland/Windham | 41.25 | 3.88 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Providence | 2.50 | 0.24 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Worcester | 15.00 | 1.41 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Norfolk/Suffolk | 22.50 | 2.12 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Boston | | 0.00 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Wash. DC | 15.00 | 1.41 | 7943 | 2507 | 8031 | 600 | 2391 | 15 |
| Anne Arundel-Harford | 66.25 | 6.23 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Cecil/New Castle/Del. | 53.75 | 5.05 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Philadelphia | 10.00 | 0.94 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Bucks | 22.50 | 2.12 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Mercer | 11.25 | 1.06 | 7945 | 1066 | 9226 | 600 | 300 | 15 |
| Somerset/Middlesex | 26.25 | 2.47 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Essex-Bronx | 16.25 | 1.53 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Bronx-Westchest | 44.44 | 4.18 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Orange | 29.17 | 2.74 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Ulster/Greene | 65.28 | 6.14 | 4878 | 527 | 5266 | 600 | 414 | 15 |
| Albany | 27.78 | 2.61 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Schenectady/Montgromer | 77.78 | 7.31 | 4092 | 726 | 4187 | 600 | 514 | 15 |
| Oneida | 25.00 | 2.35 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Madison | 11.11 | 1.04 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Onondaga | 31.94 | 3.00 | 5068 | 1757 | 5268 | 600 | 1600 | 15 |
| Cayage-Ontario | 54.17 | 5.09 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Monroa | 23.61 | 2.22 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Genesee | 25.00 | 2.35 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Erie | 27.78 | 2.61 | 5216 | 1372 | 5270 | 600 | 852 | 15 |
| Niagara | 5.56 | 0.52 | 5701 | 300 | 6701 | 600 | 300 | 15 |

Table 21 (Continued)

| Corridor K+G | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 804.29 | 100.00 | | | | | | |
| Charlotte/Mecklenburg | 10.00 | 1.24 | 5300 | 1500 | 5300 | 600 | 1800 | 15 |
| Cabarrus/Rowan | 36.44 | 4.53 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Davidson | 19.09 | 2.37 | 5200 | 300 | 5300 | 600 | 300 | 15 |
| Randolph | 6.36 | 0.79 | 1800 | 300 | 1900 | 600 | 1500 | 15 |
| Guilford | 27.27 | 3.39 | 5200 | 1400 | 5300 | 600 | 300 | 15 |
| Alamance | 15.45 | 1.92 | 4400 | 300 | 5300 | 600 | 300 | 15 |
| Orange | 14.55 | 1.81 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Durham/Wake | 32.73 | 4.07 | 5100 | 1500 | 5300 | 600 | 480 | 15 |
| Johnston-Wilson | 40.91 | 5.09 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Nash | 7.27 | 0.90 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Edgecombe-Dinwiddie | 87.27 | 10.85 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Colonial Heights/Chestfld. | 18.19 | 2.26 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Henrico | 14.55 | 1.81 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Hanover | 8.18 | 1.02 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| King William-King George | 40.00 | 4.97 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Charles | 19.09 | 2.37 | 7400 | 300 | 8000 | 600 | 450 | 15 |
| Prince George | 3.64 | 0.45 | 7900 | 2500 | 8000 | 600 | 2400 | 15 |
| Fairfax | 8.18 | 1.02 | 7900 | 2500 | 8000 | 600 | 2400 | 15 |
| Falls Church | 0.36 | 0.05 | 7900 | 2500 | 8000 | 600 | 2400 | 15 |
| Washinhton D.C. | 15.00 | 1.86 | 7943 | 2507 | 8031 | 600 | 2391 | 15 |
| Anne Arundel-Harford | 56.25 | 6.99 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Cecil-Camden | 62.50 | 7.77 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Philadelphia | 2.50 | 0.31 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Burlington/Bucks | 20.00 | 2.49 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Mercer | 15.00 | 1.86 | 7945 | 1066 | 9226 | 600 | 300 | 15 |
| Somerset | 25.00 | 3.11 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Richmond | 10.00 | 1.24 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Kings-New York-Bronx | 6.00 | 0.75 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Westchester | 10.00 | 1.24 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Fairfield | 36.25 | 4.51 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| New Haven | 25.00 | 3.11 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Middlesex | 8.75 | 1.09 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| New London | 22.50 | 2.80 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Washington/Kent | 38.75 | 4.82 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Providence | 5.00 | 0.62 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Bristol/Norfork/Suffolk | 36.25 | 4.51 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Boston | | 0.00 | 5300 | 820 | 6500 | 600 | 5333 | 15 |

Table 21 (Continued)

| Corridor K+AA | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 1048 | 100.00 | | | | | | |
| Washinhton D.C. | 11.00 | 1.05 | 7943 | 2507 | 8031 | 600 | 2391 | 15 |
| Anne Arundel-Harford | 56.25 | 5.37 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Cecil-Camden | 62.50 | 5.97 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Philadelphia | 2.50 | 0.24 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Burlington/Bucks/Mercer | 35.00 | 3.34 | 8524 | 1964 | 9168 | 600 | 2232 | 15 |
| Somerset/Richmond | 35.00 | 3.34 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Kings-New York-Bronx | 6.00 | 0.57 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Westchester | 10.00 | 0.95 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Fairfield | 36.25 | 3.46 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| New Haven | 25.00 | 2.39 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Middlesex | 8.75 | 0.84 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| New London | 22.50 | 2.15 | 8558 | 1784 | 8930 | 600 | 1941 | 15 |
| Washington/Kent | 38.75 | 3.70 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Providence | 5.00 | 0.48 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Bristol/Norfork/Suffolk | 36.25 | 3.46 | 7253 | 1145 | 8021 | 600 | 1357 | 15 |
| Boston | | 0.00 | 5300 | 820 | 6500 | 600 | 5333 | 15 |
| Washinhton D.C. | 11.00 | 1.05 | 7943 | 2507 | 8031 | 600 | 2391 | 15 |
| Anne Arundel-Harford | 56.25 | 5.37 | 8711 | 2218 | 9237 | 600 | 2731 | 15 |
| Cecil-Camden | 62.50 | 5.97 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Philadelphia | 2.50 | 0.24 | 8958 | 2637 | 9125 | 600 | 3681 | 15 |
| Burlington/Bucks/Mercer | 35.00 | 3.34 | 8524 | 1964 | 9168 | 600 | 2232 | 15 |
| Somerset/Richmond | 35.00 | 3.34 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Kings-New York-Bronx | 6.00 | 0.57 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Bronx-Westchest | 44.44 | 4.24 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Orange | 29.17 | 2.78 | 5300 | 820 | 2460 | 600 | 5333 | 15 |
| Ulster/Greene | 65.28 | 6.23 | 4878 | 527 | 5266 | 600 | 414 | 15 |
| Albany | 27.78 | 2.65 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Schenectady/Montgromer | 52.78 | 5.04 | 5177 | 928 | 5270 | 600 | 616 | 15 |
| Herkime | 25.00 | 2.39 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Oneida | 25.00 | 2.39 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Madison | 11.11 | 1.06 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Onondaga | 31.94 | 3.05 | 5068 | 1757 | 5268 | 600 | 1600 | 15 |
| Cayage-Ontario | 54.17 | 5.17 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Monroa | 23.61 | 2.25 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Genesee | 25.00 | 2.39 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Erie | 27.78 | 2.65 | 5216 | 1372 | 5270 | 600 | 852 | 15 |
| Niagara | 5.56 | 0.53 | 5701 | 300 | 6701 | 600 | 300 | 15 |

Table 21 (Continued)

| Corridor A+B+C | Distance (mile) | % Total Distance | ROG ($/Ton) | CO ($/Ton) | NOx ($/Ton) | SOx ($/Ton) | PM10 ($/Ton) | CO2 ($/Ton) |
|---|---|---|---|---|---|---|---|---|
| Corridor Total | 1365 | 100.00 | | | | | | |
| Chicago | | 0.00 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Cook-Racine | 68.00 | 4.98 | 7635 | 1555 | 7765 | 600 | 2824 | 15 |
| Milwaukee | 28.66 | 2.10 | 6635 | 906 | 6777 | 600 | 1744 | 15 |
| Racine/Kenosha/Lake | 48.00 | 3.52 | 7829 | 1682 | 7957 | 600 | 3034 | 15 |
| Cook | 36.67 | 2.69 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Lake/Porter | 45.23 | 3.31 | 7503 | 2003 | 7614 | 600 | 3477 | 15 |
| Berrien | 28.57 | 2.09 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Cass/Van Buren | 42.86 | 3.14 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Kalamazoo | 23.81 | 1.74 | 5794 | 300 | 6701 | 600 | 300 | 15 |
| Calhourn | 29.76 | 2.18 | 5604 | 300 | 6698 | 600 | 300 | 15 |
| Jackson | 33.33 | 2.44 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Washtenaw/Wayne | 59.52 | 4.36 | 6899 | 1897 | 6635 | 600 | 3585 | 15 |
| Detroit | | 0.00 | 6899 | 1897 | 6635 | 600 | 3585 | 15 |
| Wayne/Washtenaw | 59.52 | 4.36 | 6899 | 1897 | 6635 | 600 | 3585 | 15 |
| Jackson | 33.33 | 2.44 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Calhourn | 29.76 | 2.18 | 5604 | 300 | 6698 | 600 | 300 | 15 |
| Kalamazoo | 23.81 | 1.74 | 5794 | 300 | 6701 | 600 | 300 | 15 |
| Van Buren/Cass | 42.86 | 3.14 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Berrien | 28.57 | 2.09 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| La Porte/Porter-Cook | 61.90 | 4.54 | 7912 | 2125 | 8024 | 600 | 3705 | 15 |
| Chicago | 15.63 | 1.15 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Du Page-Livingston | 80.47 | 5.90 | 6359 | 1661 | 6467 | 600 | 2840 | 15 |
| McLean | 47.66 | 3.49 | 3176 | 300 | 3668 | 600 | 300 | 15 |
| Logan | 26.56 | 1.95 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Sangamon | 32.81 | 2.40 | 3325 | 300 | 3670 | 600 | 300 | 15 |
| Macoupin-St. Clair | 68.75 | 5.04 | 4789 | 1135 | 5068 | 600 | 1990 | 15 |
| St. Louis | | 0.00 | 8721 | 2233 | 9237 | 600 | 4213 | 15 |
| Milwaukee | 28.66 | 2.10 | 6635 | 906 | 6777 | 600 | 1744 | 15 |
| Cook-Racine | 68.00 | 4.98 | 7635 | 1555 | 7765 | 600 | 2824 | 15 |
| Chicago | 15.63 | 1.15 | 9024 | 2457 | 9137 | 600 | 4324 | 15 |
| Du Page-Livingston | 80.47 | 5.90 | 6359 | 1661 | 6467 | 600 | 2840 | 15 |
| McLean | 47.66 | 3.49 | 3176 | 300 | 3668 | 600 | 300 | 15 |
| Logan | 26.56 | 1.95 | 1800 | 300 | 1900 | 600 | 300 | 15 |
| Sangamon | 32.81 | 2.40 | 3325 | 300 | 3670 | 600 | 300 | 15 |
| Macoupin-St. Clair | 68.75 | 5.04 | 4789 | 1135 | 5068 | 600 | 1990 | 15 |
| St. Louis | | 0.00 | 8721 | 2233 | 9237 | 600 | 4213 | 15 |

## 4.2 Determining The Monetary Values of Emissions Savings In a Corridor

For modeling convenience, each transportation corridor is broken down into its constituent city pairs. The energy and petroleum usage and the emissions are computed for each city pair using the methods described earlier. The counties traversed by the route linking a city pair are then identified and the emissions are distributed to each county in proportion to the percent of the city pair trip length in that county. The emissions contributed to each county from all modes and all city pair routes traversing that county are summed up and a monetary value is assigned in accordance with the estimated monetary value of emissions savings in that county (see Sec. 4.1). This is done for the cases with (after case) and without (before case) the new HSGT mode included and then the differences (after case minus before case) are calculated for each county. The emission savings and associated monetary values are then summed over all the counties constituting a corridor.

Mathematically, the above processes can be represented as follows:

First let $f_j$ = the fraction of a city-pair route length passing through county j. Then the total city-pair trip emissions $\varepsilon_i$ (grams pollutant i) are allocated to each county j by

$$\varepsilon_{ij} = \varepsilon_i f_j \,. \qquad (22)$$

Let the value of pollutant i emissions in county j be represented by $\upsilon_{ij}$ ($) and the corresponding control cost be represented by $c_{ij}$ ($/g). Then

$$\upsilon_{ij}\ (\$) = \varepsilon_i\ (\text{g poll i}) \times f_j \times c_{ij}\ (\$/\text{g}), \qquad (23a)$$

and the monetary value of the emission savings of pollutant i in county j is given by

$$\upsilon_{ij}\ (\text{after}) - \upsilon_{ij}\ (\text{before})\,. \qquad (23b)$$

The total value of all the emissions for the route or trip is given by

$$\upsilon(\$) = \sum_{i,j} \upsilon_{i,j}\ (\$), \qquad (24a)$$

and the monetary value of all pollutant savings for the route is given by

$$\upsilon\ (\text{after}) - \upsilon\ (\text{before}) \qquad (24b)$$

If fossil-fueled technologies are considered, emissions $\varepsilon_i$ in Equation (22) come from the technologies themselves in the form $A_i + B_iD$ and are divided into the county fractions $f_j$.

If electric-powered technologies are considered, the emissions $\varepsilon_i$ come from the power generating system and are also given in the form $A_i + B_iD$. However, in the use of electric-powered technologies, one additional complication arises because of the EMM regional dependence of the power plant emissions. If only one EMM region is involved, then the emissions are divided into the county fractions $f_j$ just as for the fossil-fueled technologies.

## Table 22. Relation Between Routes and EMM Regions

| Route | Major City Pair | EMM Region % |
|---|---|---|
| A | Chi-Det | MAIN (6)<br>ECAR (94) |
| B | Chi-Mil | MAIN (100) |
| C | Chi-St.L | MAIN (100) |
| D | LA-SD | CNV (100) |
| F | Mi-TA | FL (100) |
| G | Wash-Char | STV (100) |
| H | Eug-Van | NWP (100) |
| I | Tex Tri | ERCOT (100) |
| J | NY NF | NY (100) |
| K | Bos Wash | NE (48.1)<br>MAAC (51.9) |
| AA | NY-NF | NY (100) |
| BB | Tex Tri | ERCOT (100) |
| DD | LA-SD I-15<br>I-5 | CNV (100)<br>CNV (100) |
| EC | LA-SF (Coastal) | CNV (100) |
| EE | LA-SF (Inland) | CNV (100) |
| EV | LA-Oak/Sac (Inland) | CNV (100) |
| FF | Bos-Wash (Inland) | NE (47.9)<br>MAAC (52.1) |
| MM | Mi-Or/Ta | FL (100) |

However, if the route passes through more than one EMM region then the total output electric energy generated for the HSGT technology is apportioned to the various EMM regions according to the fractional distances in each EMM region and the input energies and emissions are calculated for each region. Then those emissions are in turn sub-divided amongst their respective counties. For example, if the route passes through two EMM regions, say 40% through region I and 60% through region H, then

$$E_I^{in} = 0.4E^o / \eta_{net,I} \text{ and } E_H^{in} = 0.6E^o / \eta_{net,H} \quad (25)$$

Note that the net efficiencies for each EMM region are needed to convert their fractions of the output energy to input energy. Then the corresponding emissions are given by

$$\varepsilon_{I,i}(\text{g poll i}) = e_{I,i}\,(\text{g poll i / unit input energy}) \times E_I^{in} \quad (26)$$

and

$$\varepsilon_{H,i}(\text{g poll i}) = e_{H,i}\,(\text{g poll i / unit input energy}) \times E_H^{in}$$

The EMM regions associated with each route are listed in Table 22.

### 4.3 Present Value Calculations

Once the value of the emissions savings (S) has been determined for each projection year, the value for all other years can be obtained by interpolation. Then the present value of those savings can be estimated using the formula

$$\text{Present value} = \sum_{n=0}^{N} Sn/(1+i)^n$$

where the sum extends up to N years beyond a reference or base year, and i is the inflation or discount rate, calculations were performed for the base years 1995 and 2000 and a discount rate of 7%. Since the final projection year was 2040, the value of N was 45 for the base year 1995 and 40 for the base year 2000.

## 5. PETROLEUM PRODUCT PRODUCTION EFFICIENCY

The production of petroleum produces such as gasoline is relatively energy intensive (although not as intensive as the production of electricity) and should be accounted for in the energy changes associated with replacing trips on petroleum-based transportation modes with those using electricity-powered modes. The production processes peculiar to petroleum products include import of crude oil (roughly 50% of the total crude oil used in the U.S. is imported and that fraction is expected to grow with time) and petroleum refining. Other processes such as extraction and domestic transport are common to all fuel types and are not explicitly addressed in this analysis since their net impacts on total energy saved are expected to be quite small.

Since some petroleum products require more refining operations than others, a number of investigators have developed a methodology for allocating the amount of energy consumed by refinery operations to various products. (See Ref. 18 (Vol. 2) for details of the allocation methodology and other references) Table 23 summarizes the results for 1990.

Table 23 Petroleum Refinery Energy Use

| Product | Refinery Energy Use (Btu used/Btu of product) |
|---|---|
| Gasoline | 0.145 |
| Reformulated Gasoline | 0.182 |
| Residual Oil | 0.045 |
| Diesel | 0.065 |
| Kerosene | 0.028 |

Table 24 gives the net fraction of total petroleum consumed in the U.S. that is imported ($\delta$)[32].

Table 24 Fraction of Total Petroleum Imported

| Year | Net Imports ($10^{15}$ Btu/Y) | Consumption ($10^{15}$ Btu/Y) | Fraction Imported |
|---|---|---|---|
| 1990 | 14.37 | 33.55 | 0.428 |
| 1992 | 13.93 | 33.65 | 0.414 |
| 2000 | 23.51 | 38.23 | 0.615 |
| 2005 | 26.22 | 40.29 | 0.651 |
| 2010 | 27.32 | 42.00 | 0.650 |
| Annual Growth | | | |
| 2000-2010 | 0.381 | 0.377 | - |
| 2020 | 31.13 | 45.77 | 0.680 |
| 2030 | 34.94 | 49.54 | 0.705 |
| 2040 | 38.75 | 53.31 | 0.727 |

Defining $\alpha_i$ as the refinery energy used to produce product i (Btu used/Btu product i), and $\beta$ as the amount of energy used to transport foreign petroleum to the U.S. (Btu used/Btu petroleum imported), the net petroleum product efficiency for product i is given by

$$\eta^{i}_{pp} = \text{Energy output/Energy input}$$
$$= E^o/\{(1+\alpha_i)\, E^o[(1+\beta)\,\delta + (1-\delta)]\}$$
$$= 1/[(1+\alpha_i)\,(1+\beta\delta)] \qquad (27)$$

Table 25 summarizes data for a selection of large tankers used to transport petroleum. The energy intensities for these tankers are expressed in two ways: (1) Energy (Btu) consumed by the tanker per metric ton (tonne).mile where it is assumed that the same value applies to both full and empty (except for ballast) trips, and an average value of 56.643 Btu/tonne.mile is used; (2) Energy (Btu) consumed by the tanker per Btu of product delivered. This latter value includes the energy consumed for a round trip. To compute this quantity it is assumed that residual fuel oil is used by the tanker (149,700 Btu/gal) and the product delivered is crude oil (138,100 Btu/gal). From this data, an average value of 0.01432 Btu fuel per Btu product is assigned to $\beta$.

Table 25 Petroleum Import Tanker Energy Use

| Dead Wt tonnes (000) | Cargo Wt tonnes (000) | Max Speed knots | HP (000) | HP/ tonne cargo | Specific Fuel Use (lb/ HP·h) | Fuel Flow Rate (lb Fuel/ t·mile) | EI (Btu/ tonne·mi) | Fuel Flow Rate (tonnes /d) | Fuel/ Trip thru Suez | Fuel/ Trip Around Cape | Round trip EI* (Btu/ Btu) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 225 | 215 | 16 | 50 | 0.233 | 0.3 | 0.00379 | 71.5 | 161 | 3901 | 4921 | 0.0181 |
| 40 | 35 | 16 | 15 | 0.429 | 0.3 | 0.00698 | 132 | 48.2 | 1170 | 1476 | 0.0333 |
| 92 | 86 | 17 | 24 | 0.279 | 0.3 | 0.00428 | 80.8 | 77.1 | 1762 | 2223 | 0.0204 |
| 265 | 250 | 15 | 35 | 0.140 | 0.3 | 0.00243 | 45.9 | 113 | 2913 | 3674 | 0.0116 |
| 400 | 390 | 15 | 45 | 0.115 | 0.3 | 0.00201 | 37.9 | 145 | 3745 | 4724 | 0.0096 |
| | 40 | 14.5 | | | | 0.00839 | 158 | | | | 0.0401 |
| | 300 | 14.5 | | | | 0.00256 | 48.4 | 138 | | | 0.0122 |
| Assumed Avg. = | | 15 | | | | 0.003 | 56.6 | | | | 0.0143 |

* EI(BTU Residual Fuel Oil/BTU Crude Oil) = Energy used (Btu fuel/tonne.mile)*2*4935(miles) /Crude oil energy content (3.903*10^7 Btu/tonne)

Persian Gulf to Charleston via Suez Canal= 10,725 miles; via Cape = 13,530 miles

Trip time at 16 knots (18.4 mph) = 24.29 days via Suez; and 30.64 days via Cape

NOTE: Fuel flow data for the first five rows are from Mark Laskie, Maritime Administration, 5/4/95, 202 366 4447. Data for the last two rows was conveyed by John Harding from Rus Byington, Maritime Adm.,5/4/95. According to Rus Byington, typical trip times are 53d & 67d for Canal & Cape routes, respectively. These must be round trip times!

Using Eqn (27) and the values of $\alpha$, $\delta$, & $\beta$ given in Tables 23-25, respectively, the resulting values of $\eta^{i}_{pp}$ for various products and years are given in Table 26. These values should be applied to the energy formulas used to express the energy use in terms of total trip distance D for each petroleum-product-fueled transportation technology depending on the particular fuel type used:

| | |
|---|---|
| Autos | 50/50 Gasoline Mix |
| Heavy Duty Trucks & Buses | Diesel |
| Diesel & Turbine Locomotives | Diesel |
| Aircraft | Kerosene |

Table 26 Net Petroleum Production Efficiency For Various Products. Assumed Energy Used for Importing Petroleum is 0.01432 Btu / Btu Imported

| Year | Fraction of Petroleum Imported | Petroleum Products: Conventional Gasoline | Reformulated Gasoline | 50/50 Mix Of Gasolines | Kerosene | Diesel | Residual |
|---|---|---|---|---|---|---|---|
| 1990 | 0.428 | 0.868 | 0.841 | 0.854 | 0.967 | 0.933 | 0.951 |
| 1992 | 0.414 | 0.868 | 0.841 | 0.854 | 0.967 | 0.933 | 0.951 |
| 2000 | 0.615 | 0.866 | 0.839 | 0.852 | 0.964 | 0.931 | 0.949 |
| 2005 | 0.651 | 0.865 | 0.838 | 0.852 | 0.964 | 0.930 | 0.948 |
| 2010 | 0.65 | 0.865 | 0.838 | 0.852 | 0.964 | 0.930 | 0.948 |
| 2020 | 0.68 | 0.865 | 0.838 | 0.851 | 0.963 | 0.930 | 0.948 |
| 2030 | 0.705 | 0.865 | 0.838 | 0.851 | 0.963 | 0.930 | 0.947 |
| 2040 | 0.727 | 0.864 | 0.837 | 0.851 | 0.963 | 0.929 | 0.947 |

## 6. Estimating The Monetary Value of Energy Savings

Once the energy and petroleum savings have been determined, the monetary value of those savings can be readily estimated by multiplying by the energy prices. Current energy prices can be obtained from the most recent edition of Ref. 33. The energy prices as of January 1996 are as follows:

Crude Oil--------------$16.75/barrel or 40¢/gal (avg. refiner acquisition cost of imported crude in Oct.1995). This is equivalent to $2.89/MBtu or 0.9¢/kWh.

Gasoline---------------$1.209/gal (avg. for 1995, all types). This is equivalent to $9.672/MBtu or 3.3¢/kWh.

Aviation gasoline------ $0.97/gal (Oct.,1995, before taxes). This is equivalent to $8.07/MBtu Or 2.75¢/kWh.

Jet Fuel (kerosene)-----$0.55/gal (Oct.,1995, before taxes). This is equivalent to $4.07/MBtu or 1.39¢/kWh.

Diesel Fuel Oil (#2)----$0.54/gal (Oct.,1995, before taxes). This is equivalent to $4.00/MBtu or 1.36¢/kWh.

Unfortunately, these prices fluctuate significantly with time. Consequently, no attempt is made here or in the computer code to assign a monetary value to the energy and petroleum savings.

Perhaps the most significant benefits of diverting trips from petroleum-fueled modes arrise from the reduction in importation of crude oil since that directly impacts the U.S.'s trade balance, the cost of maintaining the U.S. strategic petroleum reserve, and the cost of protecting the foreign petroleum sources. No attempt is made here to place a monetary value on those benefits. However, it is worth noting that the cost of fossil fuels has fallen significantly behind inflation. The real cost of crude oil, and derived fuels has declined since about 1981 (Ref. 34). Prediction of future trends in petroleum price is confounded by sensitivity to international politics.

## 7. TREATMENT OF COMPLEX CORRIDORS

Complex corridors are those that contain branches and/or segments that ulitize different technologies. Up to now, it has been assumed that the mix of technologies before and after the introduction of a new mode applies to the entire corridor. Near the end of this project, it became apparent that there were cases in which one portion of a corridor would use one type of "before" mode for rail and the other portion of the corridor would use a different "before" mode for rail. Unfortunately, this situation could not be treated in a straight forward manner with the existing methodology.

Generally, to apply the methodology to a particular corridor, it is necessary to select one rail mode for the "before" case and one or more rail modes for "after" cases. Either an electric or a diesel "before" rail mode is selected depending on the location of the corridor. A distinction is also made in some locations between low-speed and high-speed corridors. The only corridor currently using an electric rail mode is the portion of the northeast (NE) corridor between New York and Washington, D.C.. An extension of the electrified line to Boston, is planned for the near future. Hence, for future projections, it may be appropriate to assume that the "before" rail mode is electric.

An example of a complex corridor that can not be readily handled by the present methodology is the combined New York (NY) and NE corridor. Current rail operations on the NY corridor are diesel, whereas electric rail is used on the NE corridor (see discussion above). This combined corridor can be handled by an approximate method discribed below:

First, it is necessary to define some symbols:

Before Case: $E_B$ = Energy before

$\mathcal{E}_B$ = Emissions before

$D_B$ = Dollar value of emissions before

$E_B(T)$, $\mathcal{E}_B(T)$, $D_B(T)$ refer to the "true" or actual before case.

$E_{B,d}(T)$, etc. refer to the diesel rail case.

$E_{B,el}(T)$, etc. refer to the electric rail case.

$E_B(NY)$, etc. refer to the NY portion of the NY-NE combined corridor.

$E_B(NE)$, etc. refer to the NE portion of the NY-NE combined corridor.

With these definitions, it follows that the true before case total energy for the rail mode in the NY-NE combined corridor is given by

$$E_B(T) = E_{B,d}(NY) + E_{B,el}(NE). \tag{28}$$

Unfortunately, the two terms on the right side of this equation are not known. However, they can be estimated as follows:

Assuming that all parameters vary directly with passenger miles (PM), we can write

$$E_{B,d}(NY) \approx \frac{PM(NY)}{PM(NY+NE)}\left[E_{B,d}(NY) + E_{B,d}(NE)\right] \tag{29}$$

$$E_{B,el}(NE) \approx \frac{PM(NE)}{PM(NY+NE)}\left[E_{B,el}(NY) + E_{B,el}(NE)\right] \tag{30}$$

Similarly, $\mathcal{E}_B(T) = \mathcal{E}_{B,d}(NY) + \mathcal{E}_{B,el}(NE)$, (31)

$$\mathcal{E}_{B,d}(NY) \approx \frac{PM(NY)}{PM(NY+NE)}\left[\mathcal{E}_{B,d}(NY) + \mathcal{E}_{B,d}(NE)\right], \quad (32)$$

$$\mathcal{E}_{B,el}(NE) \approx \frac{PM(NE)}{PM(NY+NE)}\left[\mathcal{E}_{B,el}(NY) + \mathcal{E}_{B,el}(NE)\right]. \quad (33)$$

And, $D_B(T) = D_{B,d}(NY) + D_{B,el}(NE)$, (34)

$$D_{B,d}(NY) \approx \frac{PM(NY)}{PM(NY+NE)}\left[D_{B,d}(NY) + D_{B,d}(NE)\right], \quad (35)$$

$$D_{B,el}(NE) \approx \frac{PM(NE)}{PM(NY+NE)}\left[D_{B,el}(NY) + D_{B,el}(NE)\right]. \quad (36)$$

In order to obtain the quantities of interest, it is necessary to run the SEPEC model twice. Run #1 is for all electric for NY + NE. Run #2 is for all diesel for NY + NE. Then do the following:

- From Run #1, extract the quantities PM(NE), PM(NY), $E_{B,el}(NY) + E_{B,el}(NE)$, $\mathcal{E}_{B,el}(NY) + \mathcal{E}_{B,el}(NE)$, and $D_{B,el}(NY) + D_{B,el}(NE)$.
- Calculate $E_{B,el}(NE)$ from Eqn. 30,
  $\mathcal{E}_{B,el}(NE)$ from Eqn. 33, and
  $D_{B,el}(NE)$ from Eqn. 36.
- From run #2,extract the quantities PM(NE), PM(NY), $E_{B,d}(NY) + E_{B,d}(NE)$, $\mathcal{E}_{B,d}(NY) + \mathcal{E}_{B,d}(NE)$, and $D_{B,d}(NY) + D_{B,d}(NE)$.
- Calculate $E_{B,d}(NY)$ from Eqn. 29,
  $\mathcal{E}_{B,d}(NY)$ from Eqn. 32, and
  $D_{B,d}(NY)$ from Eqn. 35.
- Calculate $E_B(T)$ from Eqn. 28,
  $\mathcal{E}_B(T)$ from Eqn. 31, and
  $D_B(T)$ from Eqn. 34.
- Calculate the savings by subtracting the true before quantities $E_B(T)$, $\mathcal{E}_B(T)$, and $D_B(T)$ from the after quantities obtained from run #1, which are all electric.

## REFERENCES


1. FAA Aviation Forecasts, Fiscal Years 1995-2006, FAA-APO-95-1, March 1995.

2. World Jet Airplane Inventory, Year-End 1993, Boeing Commercial Airplane Group, Seattle, WA, March 1993.

3. Personal Communication, letter from Richard D. Willy, Boeing Commercial Airplane Group to John Harding, Federal Railroad Administration, U.S. DOT., Sept. 30, 1993.

4. FAA Long-Range Aviation Forecasts, Fiscal Years 2005-2020, Office of Aviation Policy, Plans, and Management Analysis, July, 1994.

5. Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, U.S. EPA Report No. EPA-450/4-81-026d(Revised), 1992.

6. Mobile 5a User's Guide, U.S. EPA, Office of Mobile Sources, Ann Arbor, MI., March 26, 1993.

7. Methodology for Estimating Emissions From On-Road Motor Vehicles, Vol. I: EMFAC7F, Prepared by Technical Support Division, Mobile Source Emission Inventory Branch, California Resources Board, June 1993.

8. Intercity Transportation Environment: Socioeconomic Projections Set Selection and Nationwide Intercity Travel Estimation, Working Paper No. 3, Vyas, A.D., Y.J. Gur, and L.R. Johnson, Center for Transportation Research, Argonne National Laboratory, Draft Report prepared for the Federal Railroad Administration, April 25, 1991.

9. Forecast of Transportation Energy Demand Through the Year 2010, Mintz, M.M. and A.D. Vyas, Center for Transportation Research, Argonne National Laboratory, Report No. ANL/ESD-9, Nov. 1990, revised April 1991.

10. Intercity Transportation Environment: Future Transportation Environment: Future Transportation Characteristics, Working Paper No. 2, Vyas, A.D., M. Shockey, Y. J. Gur, and L.R. Johnson, Center for Transportation Research, Argonne National Laboratory, Draft Report prepared for the Federal Railroad Administration, August 27, 1991.

11: Transportion Energy Data Book: Edition 15, Davis, S.C., Oak Ridge National Laboratory Report No. ORNL-6856, May 1995.

12. Personal Communication, Memo from Michael Coltman to Ron Mauri, both from the Volpi National Transportation System Center, Feb. 17, 1995.

13. Personal Communication from Marijke Bekken, California Air Resources Board (CARB), to Donald M. Rote, Argonne National Laboratory, Exhibit 4-27, EMD and GE Locomotives for Which Emission Factors Are Available, and Locomotive Emission Factors, Sept. 16, 1994.

14. Personal Communication from David E. Brann, Electro-Motive Division of General Motors, to Donald M. Rote, Argonne National Laboratory, Sept. 25, 1994.

## REFERENCES (CONT'D)


15. Supplement to the Annual Energy Outlook 1994, Energy Information Administration Report DOE/EIA-0554(94), March 1994.

16. TAG-Technical Assessment Guide, Vol. 1: Electricity Supply - 1986, Electric Power Research Institute, EPRI-P-4463-SR, Dec. 1986.

17. TAG-Technical Assessment Guide, Electricity Supply-1993, Electric Power Research Institute, EPRI TR-102276-V1R7, Vol. 1, Revision 7, June 1993.

18. Emission of Greenhouse Gases from the Use of Transportation Fuels and Electricity, (Vol 1 & Vol. 2: Appendexes A-S, prepared for Argonne National Laboratory by M.A. DeLucchi, ANL Report No. ANL/ESD/TM-22, Vol. 1 & Vol. 2, Nov. 1993.

19. Staying Close to the Market, GEC Alsthom News, No. 8, Nov. 1994.

20. United Technologies Turbo Power, advertisement, 1989 Edition, Vol. 54, Diesel and Gas Turbine Catalogue, pg. 546, 1989.

21. The World's Most Efficient Steam Turbine Cycle, GEC Alsthom News, No. 4, Summer, 1993.

22. Assumptions for the Annual Energy Outlook, 1993, Energy Information Administration, 1993.

23. Introduction to the Argonne Utility Simulation (ARGUS) Model, by T.D. Veselka, et al., ANL Report No. ANL/EAIS/TM-10, March 1990.

24. Procedures for Emission Inventory Preparation, Section 3.1 Stationary Gas Turbine for Electricity Generation; Section 3.2 Heavy Duty Natural Gas-Fired Pipeline Compressor Stations; Section 3.3 Gasoline and Diesel Industrial Engines; Section 3.4 Large Stationary Diesel and All Stationary Dual Fuel Engines, U.S. EPA, Oct., 1992.

25. U.S. Travel Data Center, *1988 Travel Market Close-up: National Travel Survey Tabulations*, Washington, D.C. (1989).

26. Bureau of the Census, *1977 Census of Transportation: National Travel Survey - Travel During 1977*, U.S. Department of Commerce Report TC77-N-2, Washington, D.C. (1979).

27. American Public Transit Association, *1992 Transit fact Book*, Washington, D.C. (1993).

28. *Methods of Valuing Air Pollution and Estimated Monetary Values of Air Pollutants in Various U.S. Regions* by M.Q. Wang, D.J. Santini, and S.A. Warinner, Argonne National Laboratory Report No. ANL/ESD-26, Dec. 1994.

29 The National Air Quality and Emissions Trends Report, 1992, U.S. EPA 454/R-93-031, Oct. 1993.

30. *Integrated Analysis of Fuel, Technology, and Emission Allowance Markets: Electric Utility Responses to the Clean Air Act Amendments of 1990*, EPRI Report No. EPRI TR-102510, (see in particular pg. 6-37 to 6-39) August, 1993.

## REFERENCES (CONT'D)


31. *Increasing the Efficiency and Effectiveness of Environmental Decisions: Benefit-Cost Analysis and Effluent Fees a Critical Review*, L. Lave and H. Gruenspecht, Journal of Air Waste Management Association, Vol. 41, No. 5, pg. 680-693, May, 1991.

32. Annual Energy Outlook 1994 With Projections to 2010, Energy Information Administration, DOE/EIA-0383(94), Jan., 1994.

33. Monthly Energy Review, DOE/EIA-0035(96/01), Jan., 1996.

34. Annual Energy Review 1994, DOE/EIA-0384(94), July 1995.

# APPENDIX A: USER'S GUIDE TO SEPEC: AN EXCEL PROGRAM PACKAGE FOR SUMMARY OF ENERGY, PETROLEUM, AND EMISSION COMPUTATIONS

## ABSTRACT

SEPEC (summary of energy, petroleum, and emission computations) is a large spread sheet program (Excel with macro functions that are written in Visual Basic computer language) for calculating changes in certain quantities associated with the introduction of several new high-speed guided ground transportation modes. The program was prepared for use in the FRA's Commercial Feasibility Study and utilizes data on projected ridership from the Volpe National Transportation Systems Center (VNTSC). It also uses aircraft, highway vehicle, and rail energy and emission data and data on regional-based projections of electric power generation. This report summarizes and documents the whole package of the program, and tells users how to use it.

## 1. Introduction

As a part of the FRA's Commercial Feasibility Study, Argonne National Laboratory provides methodology and computer codes to compute projected changes in energy, petroleum use, air pollution emissions, and their monetary value after new high speed ground transportation (HSGT) modes, including diesel-fueled and all electric high-speed trains and Maglev, are introduced into the market place. Detailed methodology was described in the main text of this report. This appendix will describe the computer code.

At the request of the VNTSC, the computer code is developed in a spread sheet program called Excel. The code consists of twenty eight files. Since the code involves numerous data transactions, a macro function was written to automate the tasks. A macro function is a sequence of instructions that tells Excel what to do. The instructions are written in Visual Basic - a computer programming language.

## 2. Description of the Code

SEPEC contains a total of 30 files. Among them, there are nine input files in which passenger trips/passenger-miles are provided by the Volpe National Transportation Systems Center (VNTSC), two output files containing summaries of the results of energy and emission computation as well as present values of the emission control costs, seventeen intermediate files, and two files containing macro functions to run the whole program. Two macro functions are needed because there are two <u>before cases</u> for the rail mode: diesel or electric. The macro function "CORRIDOR.MAC" is for the diesel <u>before case</u>, and "CORID_NE.MAC" is for electric rail mode in the <u>before case</u>. A flow chart of SEPEC is shown in Fig. A.1.

Maglev new mode. The 79 diesel engine (P40) is always used for the diesel before case. ** A list of symbols representing corridors are in Table A.1.

## 2.1 Description of the Files

A list of file names and detailed descriptions of SEPEC is as follows:

**Macro Function:**

CORRIDOR.MAC -- To run the program. Note that this macro function is used when the*diesel* is for rail mode in the before case. The content of the file is listed in Appendix B

CORID_NE.MAC -- To run the program. Note that this macro function is used when the *electric* is for rail mode in the before case.

**Input Files:**

*A* -- containing 79PRE data (passenger trips etc.) from VNTSC
*B* -- containing 90PRE data (passenger trips etc.) from VNTSC
*C* -- containing 110 data (passenger trips etc.) from VNTSC
*E* -- containing 125E data (passenger trips etc.) from VNTSC
*F* -- containing 125NE data (passenger trips etc.) from VNTSC
*M* -- containing Maglev data (passenger trips etc.)
*N* -- containing TGV data (passenger trips etc.) from VNTSC
*P* -- containing 150E data (passenger trips etc.) from VNTSC
*Q* -- containing 150NE data (passenger trips etc.) from VNTSC

**Output Files:**

CS.SUM -- Summary of energy, emission, petroleum, and emission control costs for entire corridor

TOTPV.SUM-- Present values of emission control cost calculation for entire corridor.

**Intermediate Files** (users may ignore these files)

COSTS.INP -- Parameters of emission control costs by each pollutant for each corridor and for each county within that corridor (Data for twenty four corridors are stored in 24 sheets)

REGION.INP-- Information for each corridor and for each city pair within that corridor, including portions of Electricity Market Module (EMM) regions through which the corridor passes; the counties in which the city-pair are located; access/egress distance, access/egress mode shares for business and non-business purposes respectively; for corridors in California, parameters to identify the city-pair in northern or southern California; parameters for overnight idle calculations for diesel-engine trains (information for twenty four corridors is stored in 24 sheets)

ELREGION.INP -- Emission factors and efficiencies for all Electricity Market Module

| | | |
|---|---|---|
| | | (EMM) regions |
| TOTCS.CST | – | Parameters of emission control cost and access/egress for one corridor |
| CSINPUT.INP | – | Energy and Emission factors for different modes and different years; electric power generating efficiency and transmission efficiency for electric trains; Net petroleum production efficiency for various fuel products; |
| TOT.XLS | – | Data from VNTSC for an entire corridor |
| CSVNTSC.VN | – | Data from VNTSC for one city pair |
| CS.CST | – | Parameters of emission control cost and access/egress information for one city pair |
| MAIN.GEL | – | Energy, emission, petroleum, and emission control cost computations for one city-pair and one particular year. In this file, the rail mode for before case is *diesel*.. |
| MAIN_NE.GEL | – | Energy, emission, petroleum, and emission control cost computations for one city-pair and one particular year. In this file, the rail mode for before case is *electric*. |
| IDLE.GEL | – | Overnight idle energy, emission, petroleum, and emission control cost computation for diesel-engine trains |
| CS2000.GEL | – | Information for year of 2000 |
| CS2005.GEL | – | Information for year of 2005 |
| CS2010.GEL | – | Information for year of 2010 |
| CS2020.GEL | – | Information for year of 2020 |
| CS2030.GEL | – | Information for year of 2030 |
| CS2040.GEL | – | Information for year of 2040 |

## 2.2 Major Equations in "MAIN.GEL" and "MAIN_NE.GEL

In the file "MAIN.GEL", the main formulae for energy and emission computations are as follows.

Before the formulae are listed, some definitions are made for convenience:

PT = Passenger Trips PM = Passenger Miles (000)

LF = Load Factor EI = Energy Intensity (Btu / Pass. mile)

EF = Emission Factor D = Distance (mile)

MG = Mile per gallon DAE = Distance of Access/Egress (mile)

NPPE = Net Petroleum Production Efficiency (depends on type of fuel)

**Energy computations (Million Btu):**

Air Carriers:

LTO-cycle:

$$\text{Fuel (lb/plane)} \times \frac{\text{Heat content (Btu/lb)}}{\text{NPPE}} \times \frac{\text{PT}}{\text{\# of seat} \times \text{LF}} \times 10^{-6}$$

Cruising:

$$\text{Fuel (lb/mile/plane)} \times \frac{\text{Heat content (Btu/lb)}}{\text{NPPE}} \times \frac{\text{PM}}{\text{\# of seat} \times \text{LF}} \times 10^{-3}$$

Air Regional:

LTO-cycle:

$$\text{Fuel (lb/plane)} \times \frac{\text{Heat content (Btu/lb)}}{\text{NPPE}} \times \frac{\text{PT}}{\text{Avg. \# of seat} \times \text{LF}} \times 10^{-6}$$

Cruising:

$$\text{Fuel (lb/mile/plane)} \times \frac{\text{Heat content (Btu/lb)}}{\text{NPPE}} \times \frac{\text{PM}}{\text{Avg. \# of seat} \times \text{LF}} \times 10^{-3}$$

Rail: (existing, diesel-electric locomotive driven trains, 79mph max. speed)

$$(C1_{79}[D] + C2_{79} \times D) \text{ (MBtu)} \times \frac{\text{PT}}{\text{\# of seat} \times \text{LF} \times \text{NPPE}}$$

where $C1_{79}[D]$ is a parameter that depends on the city-pair distance (see main text).

Bus:

$$\left(\frac{(\text{D} - \text{MAX}[30, 0.1\text{D}]) \text{ (mile)}}{\text{D (mile)}} \times \text{EI}_{\text{intercity}} \text{(Btu/PM)} + \frac{\text{MAX}[30, 0.1\text{D}] \text{ (mile)}}{\text{D (mile)}} \times \text{EI}_{\text{transit}} \text{(Btu/PM)}\right)$$

$$\times \text{PM} \times 10^{-3}$$

Auto:

$$\left(\frac{(\text{D} - \text{MAX}[30, 0.1\text{D}]) \text{ (mile)}}{\text{D (mile)} \times \text{MG}_{\text{intercity}} \text{(mile/gal)}} + \frac{\text{MAX}[30, 0.1\text{D}] \text{ (mile)}}{\text{D (mile)} \times \text{MG}_{\text{urban-freeway}} \text{(mile/gal)}}\right)$$

$$\times \text{PM} \times \frac{\text{Fuel density (lb/gal)} \times \text{Heat content (Btu/lb)}}{\text{NPPE} \times \text{Veh. occup.}} \times 10^{-3}$$

New Mode:

Non-electric trains:

$$\frac{(C1[D] + C2 \text{ x } D \text{ (mile)) (MBtu)} \times PT}{\text{\# of seat} \times LF \times NPPE}$$

Electric trains:

$$\frac{(C1[D] + C2 \text{ x } D \text{ (mile)) (MBtu)} \times PT}{\text{\# of seat} \times \eta_G \times \eta_T \times LF}$$

where C1[D] is a parameter that depends on the city-pair distance (see main text), $\eta_G$ is electric power generating efficiency, and $\eta_T$ is transmission efficiency.

Access/Egress:

Airplanes:

$$\sum_{i=\text{auto,limo,bus}} \frac{\text{DAE(mile)} \times \text{\# of A/E veh. trips}_i}{MG_{i_{\text{urban-freeway}}}\text{(mile/gal)}} \times \frac{\text{Heat content}_i \text{ (Btu/lb)} \times \text{Fuel density}_i\text{(lb/gal)}}{NPPE_i}$$

where DAE is selected from Table 19 in main text; # of A/E vehicle trips for each mode (auto, limo, or bus) is determined by Tables 19 and 20 in main text, i.e. # of A/E vehicle trips is equal to the potion of total passenger trips.

Other modes except airplanes:

$$\sum_{i=\text{auto,limo,bus}} \frac{\text{DAE(mile)} \times \text{\# of A/E veh. trips}_i}{2 \times MG_{i_{\text{urban-freeway}}}\text{(mile/gal)}} \times \frac{\text{Heat content}_i \text{ (Btu/lb)} \times \text{Fuel density}_i\text{(lb/gal)}}{NPPE_i}$$

**Emission Computations (000 kg):**

Air Carriers:

LTO-cycle:

$$\frac{PT \times \text{EF(gram/LTO)}}{\text{\# of seat} \times LF} \times 10^{-6}$$

Cruising:

$$\frac{PM \times \text{EF(gram/mile/plane)}}{\text{\# of seat} \times LF} \times 10^{-3}$$

Air Regional

LTO-cycle:

$$\frac{PT \times EF(gram/LTO)}{Avg.\ \#\ of\ seat \times LF} \times 10^{-6}$$

Cruising:

$$\frac{PM \times EF(gram/mile/plane)}{Avg.\ \#\ of\ seat \times LF} \times 10^{-3}$$

Rail (existing, diesel-electric locomotive driven trains, 79mph max. speed) :

$$\text{Running:} \quad \frac{(EM1_{79}[D] + EM2_{79} \times D)\ (gram/train)}{\#\ of\ seat \times LF} \times PT \times 10^{-6}$$

where $EM1_{79}[D]$ is a parameter that depends on the city-pair distance.

Bus:

$$\left(\frac{(D - MAX[30, 0.1D])\ (mile)}{D\ (mile)} \times EF_{intercity} + \frac{MAX[30, 0.1D]\ (mile)}{D(mile)} \times EF_{city}\right) \times \frac{PT \times 10^{-6}}{Veh.\ occup.}$$

Auto:

$$\left(\frac{(D - MAX[30, 0.1D])\ (mile)}{D\ (mile)} \times EF_{intercity} + \frac{MAX[30, 0.1D]\ (mile)}{D(mile)} \times EF_{city}\right) \times \frac{PT \times 10^{-6}}{Veh.\ occup.}$$

New Modes:

$$\text{Running:} \quad \frac{(EM1[D] + EM2 \times D)\ (gram/train)}{\#\ of\ seat \times LF} \times PT \times 10^{-6}$$

where EM1[D] is a parameter that depends on the city-pair distance.

Access/Egress:

Airplanes:

$$\sum_{i=auto,limo,bus} DAE(mile) \times \#\ of\ A/E\ veh.\ trips_i \times EF_i\ (gram/mile) \times 10^{-6}$$

Other modes except airplanes:

$$\sum_{i=auto,limo,bus} \frac{DAE(mile)}{2} \times \#\ of\ A/E\ veh.\ trips_i \times EF_i\ (gram/mile) \times 10^{-6}$$

**Equivalent Petroleum Computations (Million Gallons):**

$$\frac{\text{Energy supplied by petroleum-based fuels (MBtu)}}{\text{Heat Content (Btu/Gal)}}$$

**Emission Control Costs (Million Dollars):**

$$\left(\text{Emiss.}_{\text{Access}} + \frac{\text{Emiss.}_{\text{(LTO/Idle)}}}{2}\right) \times C_{i1}$$

$$+ \sum_{j=1}^{n} \text{Emiss.}_{\text{Crusing}} \times f_j \times C_{ij} + \left(\text{Emiss.}_{\text{Egress}} + \frac{\text{Emiss.}_{\text{(LTO/Idle)}}}{2}\right) \times C_{in},$$

$$i = VOC, CO, SO_x, PM10, NO_x, CO_2$$

where $f_j$ = the fraction of a route length passing through county j and $C_{ij}$ = control cost for pollutant i in county j. Note that for emission control costs for airplanes, pollutants other than $CO_2$ are calculated only for access/egress and LTO-cycle operations .

## 2.3 Equations in "IDLE.GEL"

For overnight idle of diesel-engine trains, major equations for whole corridor are as follows:

<u>(a) Energy computations (Million Btu):</u>

The calculation of the energy consumed during overnight idling at each of the corridor terminal cities requires an estimate of the number of separate locomotives (not locomotive trips) needed to meet the passenger demand along the corridor. In general this is complicated by corridor operational details that are unknown here. Consequently, some simplifying assumptions are required. It is assumed that all trains travel the full length of the corridor, and that each train, i.e. locomotive, makes only one trip per day. Then the energy consumed during overnight idling at each of the corridor terminal cities is given by

$$\sum_{i=1}^{4} \text{Fuel (gal/min)} \times 600 \text{ (min)} \times \frac{\text{Idle PT}_i \times 10^{-6}}{2 \times \text{\# of seat} \times \text{LF}} \times \frac{\text{Heat Content(Btu/gal)}}{\text{NPPE}},$$

where the sum includes all passenger trips, "Idle $PT_i$", that contribute to the maximum capacity requirement on the corridor. For the present purpose, those contributions may be approximated by the summation of all passenger trips starting from the origin city plus passenger trips from other cities with non-stop service to the final destination city. For example: Passenger-trip data for the principal city pairs of one of the California corridors are given below:

| City 1 | City 2 | Newmode |
|---|---|---|
| San Diego | Los Angeles | 3,744,987 |
| San Diego | San Francisco | 202,737 |
| Los Angeles | San Francisco | 1,890,906 |
| San Diego | Bakersfield | 129,878 |
| San Diego | Visalia | 77,325 |
| San Diego | Fresno | 150,456 |
| Los Angeles | Bakersfield | 798,296 |
| Los Angeles | Visalia | 279,751 |
| Los Angeles | Fresno | 575,880 |
| Bakersfield | Visalia | 169,282 |
| Bakersfield | Fresno | 170,355 |

.
.
.

In this case, the contributions to the total number of trains departing during the day from San Diego after idling overnight are given approximately by

$$\text{Idle PT}_1 = 3{,}744{,}987 + 202{,}737 + 129{,}878 + 77{,}325 + 150{,}456 = 4{,}305{,}384$$
$$\text{Idle PT}_2 = 1{,}890{,}906$$

<u>(b) Emission Computations (000 kg):</u>

$$\sum_{i=1}^{4} \text{EF (gram/hour)} \times 10 \text{ (hour)} \times \frac{\text{Idle PT}_i \times 10^{-6}}{2 \times \text{\# of seat} \times \text{LF}}$$

**2.4 Equation in "TOTPV.SUM"**

**Present Values of Savings of Emission Control Costs:**

Base year = 1995

$$\sum_{year=2000}^{2040} \frac{\text{Savings of Emiss. Cont. Costs}_{year} \text{ (Million \$)}}{1.07^{year - 1995}}$$

Base year = 2000

$$\sum_{year=2000}^{2040} \frac{\text{Savings of Emiss. Cont. Costs}_{year} \text{ (Million \$)}}{1.07^{year - 2000}}$$

**3. Instructions for Running Program**

To run the program, the following steps should be followed:

1. Open the file "CORRIDOR.MAC" for rail mode in before case being *diesel*.; or open the file "CORID_NE.MAC" for rail mode in before case being *electric* .

2. Choose "RUN" in the menu bar.

3. Click "START" in the "RUN". (Sometimes, several procedures will show up to be selected. In this case, select "CEPES"). A dialog window will appear, and the user can check the desired new technology modes. Note that Pre79 mode must be selected as one of the modes for low-speed trains because the before case for low-speed trains (low speed trains include Pre79, Pre90, ACC110, 125Electric, 125Non-Electric, 150Electric, and 150Non-Electric) uses the data from Pre79; Maglev must be selected as one of the modes for high-speed trains (high-speed trains include TGV and Maglev) because the before case for high speed trains, which is different from that for the low-speed cases, is automatically included when Maglev is selected.

4. In a while, a little window will come out, and users are asked to input a corridor or route symbol, such as A, B, EE, EV+ DD. Table A.1 lists all symbols that represent different corridors (or routes).

5. Nine little windows (or fewer, depending upon the number of new technology modes selected) will appear sequentially on the screen and users are asked to input the file names containing passenger-trip and passenger-mile data for each mode. File sequences must be as follows: Pre79, Pre90, ACC110, 125Electric, 125Non-Electric, Maglev, TGV, 150Electric, 150Non-Electric. File formats must be the same as for the example given in Appendix C.

6. The program is running. It will take time. For example, a corridor with 6 city-pairs will take 20-25 minutes in a typical 486 PC machine.

7. The results are saved in the file "CS.SUM". Note that only SHEET 2 contains the summary of the entire corridor. The calculations of present values are in the file "TOTPV.SUM". Three charts representing savings of current values, present values in the base year of 1995, and present values in the base year of 2000 are stored in SHEET2 through SHEET4, respectively .

**Table A.1 Route Symbols and Their Descriptions**

| Symbol | Corridor | # of City Pairs |
|---|---|---|
| A | Chicago-Detroit | 10 |
| B | Chicago-Milwaukee | 1 |
| C | Chicago-St. Louis | 6 |
| D | Los Angles-San Diego Accelerail | 1 |
| F | Miami-Orlando-Tampa Accelerail | 9 |
| H | Eugene-Vancouver,BC (Northwest) Accelerail | 32 |
| I | Texas Triangle Accelerail | 19 |
| K | Empire (Northeast) Accelerail | 20 |
| BB | Texas Triangle HSGT Corridor | 19 |
| DD | Los Angles-San Diego HSGT Corridor | 1 |
| EC + D | San Diego-San Francisco Coast | 15 |
| EE + D | San Diego-San Francisco Valley Low Speeds | 14 |
| EE + DD | San Diego-San Francisco Valley High Speeds | 14 |
| EV + D | San Diego-San Francisco Valley Low Speeds | 33 |
| FF | Northeast Corridor: HSGT Corridor | 24 |
| MM | Florida High Speeds | 14 |
| FF + G | Washington D.C. - Charlotte - Northeast HSGT Corridor | 62 |
| K + G | Washington D.C. - Charlotte - Northeast Accelerail | 65 |
| FF + AA | Niagra-Northeast HSGT Corridor | 64 |
| K + AA | Niagra-Northeast Accelerail | 60 |
| A + B+ C | Chicago Hub | 36 |

## APPENDIX B: LISTING OF FILE "CORRIDOR.MAC"

```
Sub CEPES()
   For Each c In DialogSheets(1).CheckBoxes
      c.Value = xlOn
   Next
   DialogSheets(1).Show
End Sub

Sub cancelbtn()
   n = MsgBox("Are you sure you want to cancel?")
End Sub

Sub Run_Total_corridor()
   Dim ii As Integer, finp, tcst As String
   Input_Route_Name rn, irout, Icity
   Workbooks.Open Filename:="tot.xls"
   Input_Nine_files Icity
   Workbooks.Open Filename:="region.inp"
   Workbooks.Open Filename:="cs.cst"
   Workbooks.Open Filename:="csvntsc.vn"
   Workbooks.Open Filename:="cs.sum"
   Sheets(2).Select
   Clear_cssum_sheet
   Workbooks.Open Filename:="idle.gel"
   Calculate_Idle Icity, irout
   Cells(1, 1).Value = "Summary for Total Corridor"
   Cells(1, 4).Value = rn
   For ii = 1 To Icity
      Determine_County_along_Route irout, ii, "totcs.inp", "region.inp"
      Form_CSVN_File "tot.xls", "csvntsc.vn", (Icity + 9), ii
      Workbooks.Open Filename:="main.gel"
      Windows("cs.sum").Activate
      Run_Main_Code_for_All_Years
      Total_Corridor_Summary
      Windows("cs.sum").Activate
      ActiveWorkbook.Save
   Next ii
   Calculate_Present_Values
   Windows("csinput.inp").Activate
   ActiveWorkbook.Save
   ActiveWindow.Close
   Windows("cs.cst").Activate
   ActiveWindow.Close
   Windows("totcs.inp").Activate
   ActiveWorkbook.Save
   ActiveWindow.Close
   Windows("region.inp").Activate
   ActiveWorkbook.Save
   ActiveWindow.Close
   Windows("csvntsc.vn").Activate
   ActiveWindow.Close
End Sub
```

```
Sub Calculate_Idle(Icity, irout)
  Dim arr1(70), arr2(70) As Integer
  Workbooks.Open Filename:="COSTS.INP"
  Windows("REGION.INP").Activate
  Sheets(irout).Select
  Range(Cells(1, 6), Cells(Icity + 2, 7)).Select
  Selection.Copy
  Windows("Idle.gel").Activate
  Range("O1").Select
  ActiveSheet.Paste
  Range("A5:J12").Select
  Selection.Clear
  Range("C60:AX70").Select
  Selection.Clear
  Windows("REGION.INP").Activate
  Range(Cells(1, 24), Cells(Icity + 2, 26)).Select
  Selection.Copy
  Windows("Idle.gel").Activate
  Range("Q1").Select
  ActiveSheet.Paste
  For i = 1 To Icity
    arr1(i) = Cells(i + 2, 17)
    arr2(i) = Cells(i + 2, 18)
  Next i
  ict = 9
'Before 1
  i2 = 60
  Idle_PT i2, 8, 5, 5, 6, ict, Icity, arr1
'before 2
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 8, 5, 5, 6, ict, Icity, arr1
'Pre 79
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 4, 6, 3, 12, ict, Icity, arr1
'pre 90
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 4, 6, 3, 12, ict, Icity, arr1
'ACC 110
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 4, 6, 3, 12, ict, Icity, arr1
'ACC 125E
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 8, 6, 6, 6, ict, Icity, arr1
'ACC 125NE
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 4, 6, 3, 12, ict, Icity, arr1
```

```
'MAGLEV
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 8, 6, 6, 6, ict, Icity, arr1
'TGV
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 8, 6, 6, 6, ict, Icity, arr1
'ACC 150E
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 8, 6, 6, 6, ict, Icity, arr1
'ACC 150NE
  ict = ict + Icity + 9
  i2 = i2 + 1
  Idle_PT i2, 4, 6, 3, 12, ict, Icity, arr1
  For k = 1 To Icity
    Loc1 = arr2(k)
      Select Case Loc1
        Case 1
          JI = 5
          COPY_EMISSION_COST k, JI, irout
        Case 2
          JI = 7
          COPY_EMISSION_COST k, JI, irout
        Case 3
          JI = 9
          COPY_EMISSION_COST k, JI, irout
        Case 4
          JI = 11
          COPY_EMISSION_COST k, JI, irout
      End Select
  Next k
  Range("C5:D12").Select
  Selection.Clear
  Windows("tot.xls").Activate
  ActiveWorkbook.Save
  ActiveWindow.Close
  Windows("COSTS.INP").Activate
  ActiveWorkbook.Save
  ActiveWindow.Close
  Idle_to_Summary
End Sub

Sub COPY_EMISSION_COST(K1, JI, irout)
  count1 = Cells(K1 + 2, 15)
  count2 = Cells(K1 + 2, 16)
  Windows("costs.inp").Activate
  Sheets(irout).Select
  Range(Cells(count1 + 3, 1), Cells(count1 + 3, 10)).Select
  Selection.Copy
  Windows("Idle.gel").Activate
  Range(Cells(JI, 1), Cells(JI, 1)).Select
```

```
   ActiveSheet.Paste
   Windows("costs.inp").Activate
   Range(Cells(count2 + 3, 1), Cells(count2 + 3, 10)).Select
   Selection.Copy
   Windows("Idle.gel").Activate
   Range(Cells(JI + 1, 1), Cells(JI + 1, 1)).Select
   ActiveSheet.Paste
End Sub

Sub Idle_PT(i2, k11, j1, j11, jtot, ict, Icity, arr1)
   K1 = 3
   For j = 1 To jtot
      sum1 = 0
      sum2 = 0
      sum3 = 0
      sum4 = 0
      Windows("TOT.XLS").Activate
      For i = 1 To Icity
         Loc1 = arr1(i)
         Select Case Loc1
            Case 1
               sum1 = sum1 + Cells(ict + i, j1)
            Case 2
               sum2 = sum2 + Cells(ict + i, j1)
            Case 3
               sum3 = sum3 + Cells(ict + i, j1)
            Case 4
               sum4 = sum4 + Cells(ict + i, j1)
         End Select
      Next i
      Windows("idle.gel").Activate
      Cells(i2, K1) = sum1
      Cells(i2, K1 + 1) = sum2
      Cells(i2, K1 + 2) = sum3
      Cells(i2, K1 + 3) = sum4
      j1 = j1 + j11
      K1 = K1 + k11
   Next j
End Sub

Sub Clear_cssum_sheet()
  Windows("cs.sum").Activate
     Sheets(2).Select
   ic11 = 4
   For icl = 1 To 6
      Range(Cells(ic11, 3), Cells(ic11 + 2, 14)).Select
      Selection.Clear
      ic11 = ic11 + 4
   Next icl
   ic11 = 57
   For icl = 1 To 6
      Range(Cells(ic11, 2), Cells(ic11 + 2, 67)).Select
      Selection.Clear
```

```
      ic11 = ic11 + 2
   Next icl
   ic11 = 72
   For icl = 1 To 6
      Range(Cells(ic11, 2), Cells(ic11 + 2, 67)).Select
      Selection.Clear
      ic11 = ic11 + 2
   Next icl
End Sub

Sub Determine_County_along_Route(irout, ic, f1, f2)
'f1 is totcs.inp file
'f2 is region.inp file
   Windows("cs.cst").Activate
   Range("A5:J41").Clear
   Windows(f2).Activate
   Sheets(irout).Select
   Range(Cells(ic + 2, 1), Cells(ic + 2, 5)).Select
   Selection.Copy
   NorS1 = Cells(ic + 2, 22).Value
   NorS2 = Cells(ic + 2, 23).Value
   Windows("cs.cst").Activate
   Range("A57").Select
   ActiveSheet.Paste
   Cells(55, 2).Value = NorS1
   Cells(55, 4).Value = NorS2
   Windows(f2).Activate
   Sheets(irout).Select
   c1 = Cells(ic + 2, 6).Value + 4
   c2 = Cells(ic + 2, 7).Value + 4
   acc = Cells(ic + 2, 8).Value
   egr = Cells(ic + 2, 9).Value
   Range(Cells(ic + 2, 10), Cells(ic + 2, 21)).Select
   Selection.Copy
   Windows("CS.CST").Activate
   Range("I43").Select
   ActiveSheet.Paste
   Cells(56, 11).Value = 1
   Cells(56, 9).Value = 0
   Windows(f1).Activate
   Range(Cells(c1, 1), Cells(c2, 10)).Select
   Selection.Copy
   Windows("CS.CST").Activate
   Range(Cells(c1, 1), Cells(c1, 1)).Select
   ActiveSheet.Paste
   Range(Cells(c1, 1), Cells(c1, 10)).Select
   Selection.Cut
   Range("A5").Select
   ActiveSheet.Paste
   Range(Cells(c2, 1), Cells(c2, 10)).Select
   Selection.Cut
   Range("A41").Select
   ActiveSheet.Paste
```

```
  Range("B4").Select
  ActiveCell.FormulaR1C1 = "=SUM(R[1]C:R[37]C)"
  Selection.Copy
  Range("C4").Select
  ActiveSheet.Paste
  If c1 <> 5 Then Cells(c1, 2).Value = Cells(c1, 2).Value / 2
  Cells(41, 2).Value = Cells(41, 2).Value / 2
  Cells(50, 2).Value = acc
  Cells(50, 4).Value = egr
  Cells(50, 6).Value = acc
  Cells(50, 8).Value = egr
  For ick = 1 To 3
    Cells(ick + 51, 2).Value = Cells(43, ick + 8).Value
    Cells(ick + 51, 4).Value = Cells(43, ick + 11).Value
    Cells(ick + 51, 6).Value = Cells(43, ick + 14).Value
    Cells(ick + 51, 8).Value = Cells(43, ick + 17).Value
  Next ick
  Range("I43:T43").Select
  Selection.Clear
  Windows(f2).Activate
  If Cells(1, 22).Value = "CA" Then
    Determine_Portion_of_North_Part
  End If
  Windows("CS.CST").Activate
  ActiveWorkbook.Save
End Sub

Sub Determine_Portion_of_North_Part()
  Windows("CS.CST").Activate
  Ssum = 0
  For isn = 5 To 41
    If Cells(isn, 4).Value = 1 Then
      Ssum = Ssum + Cells(isn, 3).Value
    End If
  Next isn
  Cells(56, 11).Value = Ssum * 0.01
  Cells(56, 9).Value = 1 - Ssum * 0.01
End Sub

Sub Calculate_Present_Values()
  Workbooks.Open Filename:="totpv.sum"
  Sheets(1).Select
  i1 = 4
  For i = 1 To 6
    Windows("CS.SUM").Activate
    Sheets(2).Select
    Range(Cells(i1, 3), Cells(i1, 13)).Select
    Selection.Copy
    Windows("TOTPV.SUM").Activate
    Range(Cells(i + 4, 2), Cells(i + 4, 2)).Select
    ActiveSheet.Paste
    i1 = i1 + 4
  Next i
```

```
  i1 = 72
  For i = 1 To 6
    Windows("CS.SUM").Activate
    Sheets(2).Select
    Range(Cells(i1, 2), Cells(i1, 67)).Select
    Selection.Copy
    Windows("TOTPV.SUM").Activate
    Range(Cells(i + 4, 15), Cells(i + 4, 15)).Select
    ActiveSheet.Paste
    i1 = i1 + 2
  Next i
  PV_Charts
  ActiveWorkbook.Save
  Windows("CS.SUM").Activate
  ActiveWorkbook.Save
End Sub

Sub PV_Charts()
  Sheets("chart1").Select
  ActiveChart.ChartWizard Source:=Sheets("TOTPV").Range("C58:K59"), _
    Gallery:=xlColumn, Format:=6, PlotBy:=xlRows, CategoryLabels _
    :=1, SeriesLabels:=0, HasLegend:=1
  ActiveChart.Legend.Select
  Selection.Delete
  ActiveChart.ApplyDataLabels Type:=xlShowValue, LegendKey:=False
  Sheets("chart2").Select
  ActiveChart.ChartWizard Source:=Sheets("TOTPV").Range("C107:K108"), _
    Gallery:=xlColumn, Format:=6, PlotBy:=xlRows, CategoryLabels _
    :=1, SeriesLabels:=0, HasLegend:=1
  ActiveChart.Legend.Select
  Selection.Delete
  ActiveChart.ApplyDataLabels Type:=xlShowValue, LegendKey:=False
  Sheets("chart3").Select
  ActiveChart.ChartWizard Source:=Sheets("TOTPV").Range("C156:K157"), _
    Gallery:=xlColumn, Format:=6, PlotBy:=xlRows, CategoryLabels _
    :=1, SeriesLabels:=0, HasLegend:=1
  ActiveChart.Legend.Select
  Selection.Delete
  ActiveChart.ApplyDataLabels Type:=xlShowValue, LegendKey:=False
End Sub

Sub Idle_to_Summary()
  Windows("IDLE.GEL").Activate
  Range("B142:BO152").Select
  Selection.Copy
  Windows("CS.SUM").Activate
  Sheets(2).Select
  Range("B57").Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  Windows("IDLE.GEL").Activate
  Range("B327:BO337").Select
  Selection.Copy
```

```
   Windows("CS.SUM").Activate
   Range("B72").Select
   Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
      SkipBlanks:=False, Transpose:=False
   Windows("IDLE.GEL").Activate
   Range("C300:M322").Select
   Selection.Copy
   Windows("CS.SUM").Activate
   Range("C4").Select
   Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
      SkipBlanks:=False, Transpose:=False
   Windows("IDLE.GEL").Activate
   ActiveWorkbook.Save
   ActiveWindow.Close
End Sub

Sub Total_Corridor_Summary()
   Windows("cs.sum").Activate
   Sheets(2).Select
   i1 = 4
   For k = 1 To 6
      For i = i1 To i1 + 2
         For j = 3 To 13
            Cells(i, j).Value = Cells(i, j).Value + _
               Worksheets(1).Cells(i, j).Value
         Next j
      Next i
      i1 = i1 + 4
   Next k
   i1 = 57
   For k = 1 To 6
         For j = 2 To 67
            Cells(i1, j).Value = Cells(i1, j).Value + _
               Worksheets(1).Cells(i1, j).Value
         Next j
      i1 = i1 + 2
   Next k
   i1 = 72
   For k = 1 To 6
         For j = 2 To 67
            Cells(i1, j).Value = Cells(i1, j).Value + _
               Worksheets(1).Cells(i1, j).Value
         Next j
      i1 = i1 + 2
   Next k
   End Sub

Sub Input_Route_Name(rn, irout, Icity)
   Workbooks.Open Filename:="csinput.inp"
   Range("AH77:AR107").Select
   Selection.Copy
   Range("A77").Select
   ActiveSheet.Paste
```

```
Workbooks.Open Filename:="ELREGION.inp"
Workbooks.Open Filename:="costs.inp"
Workbooks.Open Filename:="totcs.inp"
rn = InputBox("Enter route symbol, capital letter", _
  " Enter symbol", default:="A")
irout = 0
Select Case rn
   Case "A"
      irout = 1
      Icity = 10
      Copy_region_data "ECAR", 1
      Copy_region_data "MAIN", 11
   Case "B"
      irout = 2
      Icity = 1
      Copy_region_data "MAIN", 1
   Case "C"
      irout = 3
      Icity = 6
      Copy_region_data "MAIN", 1
   Case "D"
      irout = 4
      Icity = 1
      Copy_region_data "CNV", 1
      Windows("csinput.inp").Activate
      Range("W77:AG107").Select
      Selection.Copy
      Range("A77").Select
      ActiveSheet.Paste
   Case "F"
      irout = 5
      Icity = 9
      Copy_region_data "STV", 1
   Case "G"
      irout = 6
      Copy_region_data "STV", 1
   Case "H"
      irout = 7
      Icity = 32
      Copy_region_data "NWP", 1
   Case "I"
      irout = 8
      Icity = 19
      Copy_region_data "ERCOT", 1
   Case "J"
      irout = 9
      Copy_region_data "NY", 1
   Case "K"
      irout = 10
      Icity = 20
      Copy_region_data "MAAC", 1
      Copy_region_data "NE", 11
   Case "AA"
```

```
    irout = 11
    Copy_region_data "NY", 1
  Case "BB"
    irout = 12
    Icity = 19
    Copy_region_data "ERCOT", 1
  Case "DD"
    irout = 13
    Icity = 1
    Copy_region_data "CNV", 1
    Windows("csinput.inp").Activate
    Range("W77:AG107").Select
    Selection.Copy
    Range("A77").Select
    ActiveSheet.Paste
  Case "EC+D"
    irout = 14
    Icity = 15
    Copy_region_data "CNV", 1
    Windows("csinput.inp").Activate
    Range("W77:AG107").Select
    Selection.Copy
    Range("A77").Select
    ActiveSheet.Paste
  Case "EE+D"
    irout = 15
    Icity = 14
    Copy_region_data "CNV", 1
    Windows("csinput.inp").Activate
    Range("W77:AG107").Select
    Selection.Copy
    Range("A77").Select
    ActiveSheet.Paste
  Case "EE+DD"
    irout = 16
    Icity = 14
    Copy_region_data "CNV", 1
    Windows("csinput.inp").Activate
    Range("W77:AG107").Select
    Selection.Copy
    Range("A77").Select
    ActiveSheet.Paste
  Case "EV+D"
    irout = 17
    Icity = 33
    Copy_region_data "CNV", 1
    Windows("csinput.inp").Activate
    Range("W77:AG107").Select
    Selection.Copy
    Range("A77").Select
    ActiveSheet.Paste
  Case "FF"
    irout = 18
```

```
      Icity = 24
      Copy_region_data "MAAC", 1
      Copy_region_data "NE", 11
    Case "MM"
      irout = 19
      Icity = 14
      Copy_region_data "STV", 1
    Case "FF+G"
      irout = 20
      Icity = 62
      Copy_region_data "MAAC", 1
      Copy_region_data "NE", 11
      Copy_region_data "STV", 21
    Case "K+G"
      irout = 21
      Icity = 65
      Copy_region_data "MAAC", 1
      Copy_region_data "NE", 11
      Copy_region_data "STV", 21
    Case "FF+AA"
      irout = 22
      Icity = 64
      Copy_region_data "MAAC", 1
      Copy_region_data "NE", 11
      Copy_region_data "NY", 21
    Case "K+AA"
      irout = 23
      Icity = 60
      Copy_region_data "MAAC", 1
      Copy_region_data "NE", 11
      Copy_region_data "NY", 21
    Case "A+B+C"
      irout = 24
      Icity = 36
      Copy_region_data "ECAR", 1
      Copy_region_data "MAIN", 11
  End Select
  Windows("COSTS.INP").Activate
  Sheets(irout).Select
  Range("A1:J41").Select
  Selection.Copy
  Windows("TOTCS.INP").Activate
  Range("A2").Select
  ActiveSheet.Paste
  ActiveWorkbook.Save
  Windows("ELREGION.INP").Activate
  ActiveWorkbook.Save
  ActiveWindow.Close
  Windows("COSTS.INP").Activate
  ActiveWorkbook.Save
  ActiveWindow.Close
End Sub
```

```
Sub Copy_region_data(rname1, i1)
  Windows("ELREGION.INP").Activate
  Select Case rname1
    Case "CNV"
      Range("A1:I10").Select
      Selection.Copy
    Case "ECAR"
      Range("A12:I21").Select
      Selection.Copy
    Case "ERCOT"
      Range("A23:I32").Select
      Selection.Copy
    Case "MAAC"
      Range("A34:I43").Select
      Selection.Copy
    Case "MAIN"
      Range("A45:I54").Select
      Selection.Copy
    Case "NE"
      Range("A56:I65").Select
      Selection.Copy
    Case "NY"
      Range("A67:I76").Select
      Selection.Copy
    Case "NWP"
      Range("A78:I87").Select
      Selection.Copy
    Case "STV"
      Range("A89:I98").Select
      Selection.Copy
    End Select
      Windows("CSINPUT.INP").Activate
      Range(Cells(122, i1), Cells(122, i1)).Select
      ActiveSheet.Paste
End Sub

Sub Copy_Before_Mode_Data(w1, w2 As String, ict, bv)
'w1 is a file name of input data from VNTSC,
'w2 ia a file name for instore all data
'Ict is the number of city-pair
'bv is the variable to specify before1 or before2
  i2 = 4
  i3 = 3
  Windows(w1).Activate
  Range("a1:d4").Select
  Selection.Copy
  Windows(w2).Activate
  Range(Cells(bv, 1), Cells(bv, 1)).Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  Windows(w1).Activate
  Range(Cells(8, 1), Cells(9 + ict, 2)).Select
  Selection.Copy
```

```
  Windows(w2).Activate
  Range(Cells(bv + 7, 1), Cells(bv + 7, 1)).Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  For i1 = 1 To 12
  Windows(w1).Activate
  Range(Cells(5, i2), Cells(9 + ict, i2 + 4)).Select
  Selection.Copy
  Windows(w2).Activate
  Range(Cells(bv + 4, i3), Cells(bv + 4, i3)).Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  i2 = i2 + 11
  i3 = i3 + 5
  Windows(w1).Activate
  Next i1
End Sub

Sub Copy_New_Mode_Data(w1, w2 As String, i4, ict)
'w1 is a file name of input data from VNTSC,
'w2 ia a file name for instore all data
'Ict is the number of city_pair
  i2 = 9
  i3 = 4
  Windows(w1).Activate
  Range("a1:d5").Select
  Selection.Copy
  Windows(w2).Activate
  Range(Cells(i4, 1), Cells(i4, 1)).Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  Windows(w1).Activate
  Range(Cells(8, 1), Cells(9 + ict, 3)).Select
  Selection.Copy
  Windows(w2).Activate
  Range(Cells(i4 + 7, 1), Cells(i4 + 7, 1)).Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  For i1 = 1 To 12
  Windows(w1).Activate
  Range(Cells(5, i2), Cells(9 + ict, i2 + 5)).Select
  Selection.Copy
  Windows(w2).Activate
  Range(Cells(i4 + 4, i3), Cells(i4 + 4, i3)).Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  i2 = i2 + 11
  i3 = i3 + 6
  Windows(w1).Activate
  Next i1
End Sub

Sub Open_file_To_Copy_Before_and_New_Mode _
```

```
  (s1, s2, w1 As String, ia1, ict, bf)
'w1 is a file name for instore all data
'Ict is the number of city-pair
Dim f As String
 f = InputBox(s1, _
    " File Open", default:=s2)
   Workbooks.Open Filename:=f
   Copy_Before_Mode_Data f, w1, ict, bf
   Copy_New_Mode_Data f, w1, ia1, ict
   ActiveWorkbook.Save
   ActiveWindow.Close
End Sub

Sub Open_file_To_Copy_New_Mode(s1, s2, w1 As String, ia1, ict)
'w1 is a file name for instore all data
'Ict is the number of city-pair
   Dim f As String
   f = InputBox(s1, _
    " File Open", default:=s2)
    Workbooks.Open Filename:=f
   Copy_New_Mode_Data f, w1, ia1, ict
   ActiveWorkbook.Save
   ActiveWindow.Close
End Sub

Sub buttonchecking(cka)
   n = 0
   For Each checkbtn In DialogSheets(1).CheckBoxes
   n = n + 1
   If checkbtn.Value = xlOn Then
      cka(n) = 1
      Else cka(n) = 0
   End If
   Next
End Sub

Sub Input_Nine_files(Icity)
'icity is the number of city-pair
Dim ict1 As Integer
Dim cka(9)
   Windows("CORRIDOR.mac").Activate
   buttonchecking cka
   Windows("tot.xls").Activate
   Cells.Select
   Selection.Clear
   ict = Icity + 9
   ict1 = 2 * ict + 1
   If cka(1) = 1 Then
   Open_file_To_Copy_Before_and_New_Mode _
      "Enter a file *A* in which 79PRE data are contained:", _
      "yr12a2.xls", "tot.xls", ict1, Icity, 1
      End If
   ict1 = ict1 + ict
```

```
 If cka(2) = 1 Then
Open_file_To_Copy_New_Mode _
   "Enter a file *B* in which 90PRE data are contained:", _
   "yr12b2.xls", "tot.xls", ict1, Icity
    End If
ict1 = ict1 + ict
 If cka(3) = 1 Then
Open_file_To_Copy_New_Mode _
   "Enter a file *C* in which 110E data are contained:", _
   "yr12c2.xls", "tot.xls", ict1, Icity
    End If
ict1 = ict1 + ict
If (cka(1) = 0) And (cka(4) = 1) Then
   Open_file_To_Copy_Before_and_New_Mode _
   "Enter a file *E* in which Maglev data are contained:", _
   "yr12e2.xls", "tot.xls", ict1, Icity, 1
   End If
 If (cka(4) = 1) And (cka(1) = 1) Then
   Open_file_To_Copy_New_Mode _
   "Enter a file *E* in which Maglev data are contained:", _
   "yr12e2.xls", "tot.xls", ict1, Icity
    End If
ict1 = ict1 + ict
 If cka(5) = 1 Then
Open_file_To_Copy_New_Mode _
   "Enter a file *F* in which 125NE data are contained:", _
   "yr12f2.xls", "tot.xls", ict1, Icity
    End If
ict1 = ict1 + ict
If (cka(6) = 1) Then
   Open_file_To_Copy_Before_and_New_Mode _
   "Enter a file *M* in which Maglev data are contained:", _
   "yr12m2.xls", "tot.xls", ict1, Icity, Icity + 10
   End If
ict1 = ict1 + ict
 If cka(7) = 1 Then
Open_file_To_Copy_New_Mode _
   "Enter a file *N* in which TGV data are contained:", _
   "yr12n2.xls", "tot.xls", ict1, Icity
    End If
ict1 = ict1 + ict
 If cka(8) = 1 Then
Open_file_To_Copy_New_Mode _
   "Enter a file *P* in which 150E data are contained:", _
   "yr12p2.xls", "tot.xls", ict1, Icity
    End If
ict1 = ict1 + ict
 If cka(9) = 1 Then
Open_file_To_Copy_New_Mode _
   "Enter a file *Q* in which 150NE data are contained:", _
   "yr12q2.xls", "tot.xls", ict1, Icity
    End If
Windows("tot.xls").Activate
```

```
    ActiveWorkbook.Save
'   ActiveWindow.Close
End Sub

Sub Form_CSVN_File(f1 As String, f2 As String, ict, ii As Integer)
'f1 is a file containing all city-pair data
'f2 is a CS.VN file containing only one city-pair data
'Ict is the number of city-pair plus 9
'ii is ith city-pair
    Dim j1, j2, ict1 As Integer
    ict1 = 9 + ii
    Workbooks.Open Filename:=f1
    Windows(f1).Activate
    Range(Cells(ict1, 1), Cells(ict1, 62)).Select
    Selection.Copy
    Windows(f2).Activate
    Range("A9").Select
    ActiveSheet.Paste
    ict1 = ict1 + ict
    Windows(f1).Activate
    Range(Cells(ict1, 1), Cells(ict1, 62)).Select
    Selection.Copy
    Windows(f2).Activate
    Range("A10").Select
    ActiveSheet.Paste
    j1 = 2 * ict + 9 + ii
    j2 = 15
    For j3 = 1 To 9
    Windows(f1).Activate
    Range(Cells(j1, 3), Cells(j1, 78)).Select
    Selection.Copy
    Windows(f2).Activate
    Range(Cells(j2, 3), Cells(j2, 3)).Select
    ActiveSheet.Paste
    j1 = j1 + ict
    j2 = j2 + 1
    Next j3
    ActiveWorkbook.Save
    Windows(f1).Activate
    ActiveWorkbook.Close
End Sub

Sub Run_Main_Code_for_All_Years()
    Dim ks2, ks3, ks4 As Integer
'   Workbooks.Open Filename:="main.gel"
    ks2 = 4
    ks3 = 57
    ks4 = 72
    Run_Main_Code_Per_Year "cs2000.gel", "main.gel", "cs.sum", ks2, ks3, ks4
    ks2 = ks2 + 4
    ks3 = ks3 + 2
    ks4 = ks4 + 2
    Run_Main_Code_Per_Year "cs2005.gel", "main.gel", "cs.sum", ks2, ks3, ks4
```

```
   ks2 = ks2 + 4
   ks3 = ks3 + 2
   ks4 = ks4 + 2
   Run_Main_Code_Per_Year "cs2010.gel", "main.gel", "cs.sum", ks2, ks3, ks4
   ks2 = ks2 + 4
   ks3 = ks3 + 2
   ks4 = ks4 + 2
   Run_Main_Code_Per_Year "cs2020.gel", "main.gel", "cs.sum", ks2, ks3, ks4
   ks2 = ks2 + 4
   ks3 = ks3 + 2
   ks4 = ks4 + 2
   Run_Main_Code_Per_Year "cs2030.gel", "main.gel", "cs.sum", ks2, ks3, ks4
   ks2 = ks2 + 4
   ks3 = ks3 + 2
   ks4 = ks4 + 2
   Run_Main_Code_Per_Year "cs2040.gel", "main.gel", "cs.sum", ks2, ks3, ks4
   Windows("main.gel").Activate
   ActiveWorkbook.Save
   ActiveWorkbook.Close
End Sub

Sub Run_Main_Code_Per_Year(f1, f2, f3 As String, k2, k3, k4 As Integer)
'f1 is a file a specifical year's data
'f2 is main file
'f3 is a file containing summary for one city-pair
   Workbooks.Open Filename:=f1
   Dim k As Integer
   Windows(f1).Activate
   Range("A1:DZ32").Select
   Selection.Copy
   Windows(f2).Activate
   Range("A1").Select
   ActiveSheet.Paste
   Windows(f2).Activate
   Range("B406:L408").Select
   Selection.Copy
   Windows(f3).Activate
   Sheets(1).Select
   Range(Cells(k2, 3), Cells(k2, 3)).Select
   Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
      SkipBlanks:=False, Transpose:=False
   Windows(f2).Activate
   Range("C319:BP319").Select
   Selection.Copy
   Windows(f3).Activate
   Range(Cells(k3, 2), Cells(k3, 2)).Select
   Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
      SkipBlanks:=False, Transpose:=False
   Windows(f2).Activate
   Range("B419:BO419").Select
   Selection.Copy
   Windows(f3).Activate
   Range(Cells(k4, 2), Cells(k4, 2)).Select
```

```
    Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
        SkipBlanks:=False, Transpose:=False
    Windows(f1).Activate
    ActiveWorkbook.Save
    ActiveWindow.Close
End Sub
```

## APPENDIX C

## An Example Calculation: The Chicago-St. Louis Corridor

1. An Example of The Input Data Format:
   - PreHSR 79, passenger trips and passenger miles before and after new mode
   - introduction.

2. An Example of The Output Data Format:
   - Summary for the total corridor, by projection year, of the monetary value of emissions, energy use, and petroleum use before and after the introduction of all low and high speed new modes.
   - Summary for the total corridor, by projection year, , of the monetary value of emissions savings, energy use savings, and petroleum use savings after the introduction of all low and high speed new modes.
   - Summary of emissions by pollutant and by projection year before and after each new mode is introduced.
   - Monetary value of emissions savings by pollutant and by projection year before and after each new mode is introduced.
   - File TOTPV.SUM

     Summary of monetary values of total emission by projection year, for every year, and;

     sums over all years, and total savings;
     present values of savings for base year 1995;
     present values of savings for base year 2000.

     Summary of monetary values of emissions by pollutant, by projection year, for every year, and;

     sums over all years, and total savings;
     present values of savings for base year 1995;
     present values of savings for base year 2000.

3. Charts of total and present values of total emissions savings by new mode.

An Example of Input Data Format

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AGGREGATE OUTPUT FILE | | | | Base Frequency 5.7 multistop | | | | | | | | |
| 2 | FOR COST, FUEL/EMMISIONS USE | | | | Key Fare 90% of Rail | | | | | | | | |
| 3 | June 14, 1995 | | | | | | | | | | | | |
| 4 | Chi-StL | | | | | | | | | | | | |
| 5 | PreHSR 79 | | | Passenger Trips: | | | | | | | | | |
| 6 | | | | 2000 | | | | | | | | | |
| 7 | | | New Mod | Before: | | | | | After: | | | | |
| 8 | City 1 | City 2 | Distance | Air Carrier | Air Region | Rail | Bus | Auto | Air Carrier | Air Region | Rail | Bus | Auto |
| 9 | Corridor Total | | 278 | 1273905 | 219955 | 281483 | 122663 | 8662718 | 1179409 | 152607 | 1274 | 98733 | 8353560 |
| 10 | Chicago | Bloomington | 125 | 0 | 75959 | 52932 | 7473 | 1723517 | 0 | 46513 | 573 | 6742 | 1681968 |
| 11 | Chicago | Springfield | 183 | 11154 | 96469 | 88558 | 11083 | 1081849 | 7188 | 64778 | 261 | 8878 | 1039202 |
| 12 | Chicago | Saint Louis | 278 | 1262747 | 44288 | 108708 | 95381 | 2117692 | 1172217 | 38402 | 180 | 76076 | 1990542 |
| 13 | Bloomington | Springfield | 59 | 0 | 0 | 7224 | 393 | 962908 | 0 | 0 | 127 | 352 | 947136 |
| 14 | Bloomington | Saint Louis | 153 | 0 | 1059 | 9092 | 1936 | 719556 | 0 | 1023 | 36 | 1609 | 694547 |
| 15 | Springfield | Saint Louis | 95 | 4 | 2180 | 14970 | 6398 | 2057196 | 3 | 1891 | 96 | 5077 | 2000165 |

An Example of Input Data Format

| | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | 2005 | | | | | | | | | | | 2010 |
| 7 | | Before: | | | | | After: | | | | | | Before: |
| 8 | Newmode | Air Carrier | Air Region | Rail | Bus | Auto | Air Carrier | Air Regional | Rail | Bus | Auto | Newmode | Air Carrier |
| 9 | 843401 | 1397748 | 246182 | 308658 | 133070 | 9412558 | 1284720 | 173882 | 1311 | 106579 | 9053130 | 955138 | 1533878 |
| 10 | 132638 | 0 | 84422 | 58172 | 8116 | 1871914 | 0 | 55496 | 611 | 7307 | 1822419 | 146028 | 0 |
| 11 | 182250 | 10584 | 108919 | 97354 | 12040 | 1175266 | 6612 | 72967 | 279 | 9598 | 1126011 | 203657 | 10044 |
| 12 | 385095 | 1387161 | 49235 | 118679 | 103421 | 2296218 | 1278105 | 42133 | 165 | 82086 | 2151980 | 438270 | 1523831 |
| 13 | 25023 | 0 | 0 | 7967 | 428 | 1049086 | 0 | 0 | 136 | 381 | 1029464 | 29924 | 0 |
| 14 | 37758 | 0 | 1179 | 10005 | 2105 | 782477 | 0 | 1138 | 33 | 1744 | 753254 | 43378 | 0 |
| 15 | 80637 | 3 | 2428 | 16480 | 6959 | 2237596 | 3 | 2148 | 88 | 5463 | 2170002 | 93882 | 3 |

An Example of Input Data Format

| | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK | AL | AM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | 2020 | | |
| 7 | | | | | After: | | | | | | Before: | | |
| 8 | Air Regiona | Rail | Bus | Auto | Air Carrier | Air Region | Rail | Bus | Auto | Newmode | Air Carrier | Air Region | Rail |
| 9 | 275554 | 338461 | 144359 | 10227326 | 1399642 | 198338 | 1355 | 115048 | 9811313 | 1082730 | 1806898 | 334904 | 397427 |
| 10 | 93827 | 63931 | 8815 | 2033090 | 0 | 66214 | 652 | 7919 | 1974599 | 161444 | 0 | 112745 | 75368 |
| 11 | 122975 | 107024 | 13079 | 1276750 | 6082 | 82191 | 299 | 10377 | 1220072 | 227578 | 8852 | 150679 | 125960 |
| 12 | 54735 | 129565 | 112140 | 2489795 | 1393558 | 46228 | 151 | 88572 | 2326511 | 498787 | 1798043 | 66644 | 151296 |
| 13 | 0 | 8787 | 466 | 1142976 | 0 | 0 | 144 | 414 | 1118949 | 35785 | 0 | 0 | 10379 |
| 14 | 1313 | 11011 | 2289 | 850900 | 0 | 1266 | 30 | 1889 | 816923 | 49835 | 0 | 1582 | 13016 |
| 15 | 2704 | 18142 | 7569 | 2433816 | 3 | 2439 | 80 | 5878 | 2354260 | 109301 | 2 | 3254 | 21409 |

An Example of Input Data Format

| | AN | AO | AP | AQ | AR | AS | AT | AU | AV | AW | AX | AY | AZ | BA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | | | | | | | | | 2030 | | | | | |
| 7 | | | After: | | | | | | Before: | | | | | After: |
| 8 | Bus | Auto | Air Carrier | Air Region | Rail | Bus | Auto | Newmode | Air Carrier | Air Region | Rail | Bus | Auto | Air Carrier |
| 9 | 166548 | 11809342 | 1628812 | 251782 | 1512 | 131487 | 11296605 | 1313892 | 2147779 | 409318 | 470578 | 193534 | 13729513 | 1906871 |
| 10 | 10177 | 2347084 | 0 | 86163 | 760 | 9120 | 2271183 | 191988 | 0 | 136659 | 89583 | 11828 | 2728040 | 0 |
| 11 | 15077 | 1471720 | 5533 | 106010 | 351 | 11891 | 1400919 | 267509 | 8399 | 184759 | 149579 | 17509 | 1709130 | 5391 |
| 12 | 129360 | 2872126 | 1623276 | 55046 | 135 | 101180 | 2677969 | 613737 | 2139378 | 82031 | 178096 | 150313 | 3337328 | 1901478 |
| 13 | 539 | 1321648 | 0 | 0 | 169 | 476 | 1289087 | 46871 | 0 | 0 | 12351 | 627 | 1537750 | 0 |
| 14 | 2649 | 984641 | 0 | 1524 | 26 | 2171 | 943092 | 60469 | 0 | 1921 | 15499 | 3084 | 1146287 | 0 |
| 15 | 8746 | 2812122 | 2 | 3039 | 72 | 6649 | 2714356 | 133319 | 2 | 3949 | 25470 | 10173 | 3270978 | 2 |

An Example of Input Data Format

| | BB | BC | BD | BE | BF | BG | BH | BI | BJ | BK | BL | BM | BN | BO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | | | | | | 2040 | | | | | | | | |
| 7 | | | | | | Before: | | | | | After: | | | |
| 8 | Air Region | Rail | Bus | Auto | Newmode | Air Carrier | Air Region | Rail | Bus | Auto | Air Carrier | Air Region | Rail | Bus |
| 9 | 295816 | 1708 | 151673 | 13092452 | 1637461 | 2553482 | 500286 | 557206 | 224894 | 15961907 | 2232612 | 347662 | 1941 | 174959 |
| 10 | 98863 | 884 | 10573 | 2631358 | 241570 | 0 | 165646 | 106480 | 13748 | 3170829 | 0 | 113435 | 1030 | 12257 |
| 11 | 125443 | 411 | 13729 | 1621404 | 326927 | 7969 | 226546 | 177628 | 20333 | 1984838 | 5253 | 148438 | 481 | 15851 |
| 12 | 65966 | 126 | 116691 | 3102599 | 767691 | 2545511 | 100969 | 209643 | 174659 | 3877879 | 2227358 | 79054 | 117 | 134580 |
| 13 | 0 | 197 | 552 | 1494566 | 60664 | 0 | 0 | 14698 | 730 | 1789187 | 0 | 0 | 229 | 640 |
| 14 | 1850 | 24 | 2515 | 1094511 | 74561 | 0 | 2334 | 18456 | 3590 | 1334470 | 0 | 2245 | 22 | 2914 |
| 15 | 3695 | 67 | 7613 | 3148014 | 166047 | 2 | 4791 | 30300 | 11833 | 3804704 | 2 | 4491 | 62 | 8717 |

An Example of Input Data Format

| | BP | BQ | BR | BS | BT | BU | BV | BW | BX | BY | BZ | CA | CB | CC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | Passenger Miles (000): | | | | | | | | | | | |
| 6 | | | 2000 | | | | | | | | | | | 2005 |
| 7 | | | Before: | | | | | After: | | | | | | Before: |
| 8 | Auto | Newmode | Air Carrier | Air Region | Rail | Bus | Auto | Air Carrier | Air Region | Rail | Bus | Auto | Newmode | Air Carrier |
| 9 | 15173799 | 2053482 | 322681 | 37180 | 55323 | 32431 | 1498294 | 298996 | 26725 | 185 | 25991 | 1434246 | 171791 | 354183 |
| 10 | 3048651 | 309463 | 0 | 8811 | 6316 | 1016 | 235823 | 0 | 5395 | 67 | 917 | 230044 | 16365 | 0 |
| 11 | 1876591 | 407771 | 1941 | 16786 | 15994 | 2183 | 218534 | 1251 | 11271 | 47 | 1749 | 209919 | 33410 | 1842 |
| 12 | 3594560 | 960293 | 320740 | 11249 | 29774 | 28233 | 637425 | 297745 | 9754 | 49 | 22518 | 599153 | 107110 | 352341 |
| 13 | 1732798 | 78042 | 0 | 0 | 440 | 24 | 63552 | 0 | 0 | 8 | 21 | 62511 | 1466 | 0 |
| 14 | 1270242 | 91769 | 0 | 150 | 1402 | 310 | 118727 | 0 | 145 | 6 | 257 | 114600 | 5793 | 0 |
| 15 | 3650956 | 206143 | 0 | 183 | 1397 | 665 | 224234 | 0 | 159 | 9 | 528 | 218018 | 7646 | 0 |

An Example of Input Data Format

| | CD | CE | CF | CG | CH | CI | CJ | CK | CL | CM | CN | CO | CP | CQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | 2010 | | | |
| 7 | | | | | After: | | | | | | Before: | | | |
| 8 | Air Region | Rail | Bus | Auto | Air Carrier | Air Region | Rail | Bus | Auto | Newmode | Air Carrier | Air Region | Rail | Bus |
| 9 | 41622 | 60595 | 35175 | 1626939 | 325791 | 30178 | 188 | 28052 | 1553217 | 194544 | 388803 | 46598 | 66370 | 38151 |
| 10 | 9793 | 6941 | 1104 | 256127 | 0 | 6438 | 71 | 994 | 249255 | 17999 | 0 | 10884 | 7628 | 1199 |
| 11 | 18952 | 17583 | 2372 | 237404 | 1150 | 12696 | 50 | 1891 | 227454 | 37334 | 1748 | 21398 | 19329 | 2577 |
| 12 | 12506 | 32506 | 30613 | 691162 | 324641 | 10702 | 45 | 24298 | 647746 | 121900 | 387056 | 13903 | 35487 | 33193 |
| 13 | 0 | 485 | 26 | 69240 | 0 | 0 | 8 | 23 | 67945 | 1754 | 0 | 0 | 535 | 28 |
| 14 | 167 | 1543 | 337 | 129109 | 0 | 162 | 5 | 279 | 124287 | 6655 | 0 | 186 | 1698 | 366 |
| 15 | 204 | 1537 | 724 | 243898 | 0 | 180 | 8 | 568 | 236530 | 8902 | 0 | 227 | 1692 | 787 |

An Example of Input Data Format

| | CR | CS | CT | CU | CV | CW | CX | CY | CZ | DA | DB | DC | DD | DE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | | | | | | | | 2020 | | | | | | |
| 7 | | After: | | | | | | Before: | | | | | After: | |
| 8 | Auto | Air Carrier | Air Region | Rail | Bus | Auto | Newmode | Air Carrier | Air Region | Rail | Bus | Auto | Air Carrier | Air Region |
| 9 | 1766633 | 355024 | 34109 | 192 | 30277 | 1682061 | 220436 | 458246 | 56722 | 77817 | 44011 | 2039156 | 413278 | 42894 |
| 10 | 278180 | 0 | 7681 | 76 | 1077 | 270070 | 19878 | 0 | 13078 | 8993 | 1384 | 321143 | 0 | 9995 |
| 11 | 257903 | 1058 | 14301 | 54 | 2044 | 246454 | 41720 | 1540 | 26218 | 22749 | 2970 | 297287 | 963 | 18446 |
| 12 | 749428 | 353966 | 11742 | 41 | 26217 | 700280 | 138733 | 456706 | 16928 | 41439 | 38291 | 864510 | 412315 | 13982 |
| 13 | 75436 | 0 | 0 | 9 | 25 | 73851 | 2097 | 0 | 0 | 632 | 33 | 87229 | 0 | 0 |
| 14 | 140399 | 0 | 180 | 5 | 302 | 134792 | 7646 | 0 | 225 | 2007 | 424 | 162466 | 0 | 216 |
| 15 | 265286 | 0 | 205 | 7 | 611 | 256614 | 10364 | 0 | 273 | 1997 | 910 | 306521 | 0 | 255 |

An Example of Input Data Format

| | DF | DG | DH | DI | DJ | DK | DL | DM | DN | DO | DP | DQ | DR | DS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | | | | | 2030 | | | | | | | | | |
| 7 | | | | | Before: | | | | | After: | | | | |
| 8 | Rail | Bus | Auto | Newmode | Air Carrier | Air Region | Rail | Bus | Auto | Air Carrier | Air Region | Rail | Bus | Auto |
| 9 | 210 | 34600 | 1936245 | 268014 | 544867 | 69441 | 92002 | 51140 | 2370213 | 483917 | 50624 | 233 | 39911 | 2243676 |
| 10 | 88 | 1240 | 310637 | 23604 | 0 | 15852 | 10689 | 1609 | 373268 | 0 | 11468 | 103 | 1438 | 359901 |
| 11 | 63 | 2342 | 282986 | 49040 | 1461 | 32148 | 27015 | 3449 | 345244 | 938 | 21827 | 74 | 2705 | 327524 |
| 12 | 37 | 29949 | 806069 | 170705 | 543405 | 20836 | 48780 | 44493 | 1004536 | 482978 | 16756 | 34 | 34541 | 933882 |
| 13 | 10 | 29 | 85080 | 2747 | 0 | 0 | 752 | 38 | 101492 | 0 | 0 | 12 | 34 | 98641 |
| 14 | 4 | 347 | 155610 | 9277 | 0 | 273 | 2390 | 493 | 189137 | 0 | 263 | 4 | 402 | 180594 |
| 15 | 7 | 691 | 295865 | 12641 | 0 | 332 | 2376 | 1058 | 356537 | 0 | 310 | 6 | 792 | 343134 |

An Example of Input Data Format

| | DT | DU | DV | DW | DX | DY | DZ | EA | EB | EC | ED | EE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | 2040 | | | | | | | | | | |
| 7 | | Before: | | | | | After: | | | | | |
| 8 | Newmode | Air Carrier | Air Region | Rail | Bus | Auto | Air Carrier | Air Region | Rail | Bus | Auto | Newmode |
| 9 | 333885 | 647951 | 85014 | 108774 | 59424 | 2755019 | 566667 | 59762 | 262 | 46037 | 2599921 | 416089 |
| 10 | 29688 | 0 | 19215 | 12705 | 1870 | 433853 | 0 | 13158 | 120 | 1667 | 416978 | 37441 |
| 11 | 59932 | 1387 | 39419 | 32080 | 4006 | 400937 | 914 | 25828 | 87 | 3123 | 379071 | 73244 |
| 12 | 213525 | 646564 | 25646 | 57420 | 51699 | 1167242 | 565753 | 20080 | 32 | 39836 | 1081963 | 267088 |
| 13 | 3555 | 0 | 0 | 895 | 45 | 118086 | 0 | 0 | 14 | 39 | 114365 | 4601 |
| 14 | 11439 | 0 | 331 | 2846 | 574 | 220188 | 0 | 319 | 3 | 466 | 209590 | 14105 |
| 15 | 15745 | 0 | 402 | 2827 | 1231 | 414713 | 0 | 377 | 6 | 907 | 397954 | 19610 |

An Example of Output

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Summary for Total Corridor | | | C | | | | | | | | | |
| 2 | Year | | Before1 | Before2 | After | | | | | | | | |
| 3 | | | for low speed | for high speed | PreHSR 7 | PreHSR 9 | ACC 110 | ACC 125E | ACC 125N | Maglev | TGV | ACC 150 | ACC 150N |
| 4 | 2000 | Million $ | 39.42 | 39.82 | 38.65 | 38.77 | 37.66 | 36.80 | 37.46 | 36.27 | 36.43 | 36.52 | 37.74 |
| 5 | | Energy( B. Btu) | 6799.23 | 6906.52 | 6588.42 | 6516.91 | 6487.24 | 6485.37 | 6458.16 | 6757.11 | 6483.89 | 6427.48 | 6426.69 |
| 6 | | Pet. (M Gal) | 53.42 | 54.23 | 51.73 | 51.17 | 50.92 | 48.03 | 50.68 | 44.45 | 46.54 | 47.56 | 50.43 |
| 7 | | | | | | | | | | | | | |
| 8 | 2005 | Million $ | 40.20 | 40.60 | 39.43 | 39.61 | 38.40 | 37.43 | 38.21 | 36.97 | 37.02 | 37.15 | 38.55 |
| 9 | | Energy( B. Btu) | 7032.76 | 7142.78 | 6807.02 | 6735.42 | 6710.07 | 6705.73 | 6684.63 | 7028.66 | 6708.23 | 6645.96 | 6655.26 |
| 10 | | Pet. (M Gal) | 55.25 | 56.08 | 53.44 | 52.88 | 52.65 | 49.47 | 52.44 | 45.91 | 47.85 | 48.99 | 52.20 |
| 11 | | | | | | | | | | | | | |
| 12 | 2010 | Million $ | 40.62 | 41.02 | 39.90 | 40.16 | 38.85 | 37.76 | 38.67 | 37.40 | 37.34 | 37.48 | 39.09 |
| 13 | | Energy( B. Btu) | 7310.05 | 7424.10 | 7069.75 | 6998.00 | 6976.94 | 6965.41 | 6954.96 | 7332.03 | 6966.40 | 6903.00 | 6927.23 |
| 14 | | Pet. (M Gal) | 57.41 | 58.27 | 55.49 | 54.92 | 54.73 | 51.21 | 54.54 | 47.63 | 49.42 | 50.72 | 54.31 |
| 15 | | | | | | | | | | | | | |
| 16 | 2020 | Million $ | 43.62 | 44.04 | 42.94 | 43.32 | 41.80 | 40.49 | 41.64 | 40.26 | 40.02 | 40.20 | 42.17 |
| 17 | | Energy( B. Btu) | 7683.59 | 7803.69 | 7427.89 | 7355.74 | 7344.13 | 7317.31 | 7330.21 | 7768.02 | 7322.20 | 7251.15 | 7306.89 |
| 18 | | Pet. (M Gal) | 60.30 | 61.21 | 58.24 | 57.67 | 57.54 | 53.43 | 57.41 | 49.84 | 51.38 | 52.91 | 57.21 |
| 19 | | | | | | | | | | | | | |
| 20 | 2030 | Million $ | 51.02 | 51.51 | 50.15 | 50.67 | 48.81 | 47.12 | 48.62 | 46.82 | 46.48 | 46.79 | 49.29 |
| 21 | | Energy( B. Btu) | 8258.82 | 8386.25 | 7965.33 | 7906.82 | 7905.95 | 7860.64 | 7903.14 | 8424.70 | 7884.09 | 7789.58 | 7885.68 |
| 22 | | Pet. (M Gal) | 64.80 | 65.76 | 62.43 | 61.95 | 61.90 | 56.99 | 61.85 | 53.39 | 54.74 | 56.45 | 61.69 |
| 23 | | | | | | | | | | | | | |
| 24 | 2040 | Million $ | 61.32 | 61.88 | 60.14 | 60.84 | 58.55 | 56.45 | 58.35 | 56.10 | 55.60 | 56.05 | 59.16 |
| 25 | | Energy( B. Btu) | 8671.05 | 8809.50 | 8350.56 | 8312.47 | 8323.39 | 8261.46 | 8333.30 | 8963.10 | 8307.15 | 8181.98 | 8320.31 |
| 26 | | Pet. (M Gal) | 67.95 | 68.99 | 65.35 | 65.03 | 65.06 | 59.15 | 65.09 | 55.47 | 56.62 | 58.56 | 64.97 |
| 27 | | | | | | | | | | | | | |
| 28 | Emis. Con. Cost Savings (million $), Energy Savings, and Petroleum Savings (million Gal) | | | | | | | | | | | | |
| 29 | Year | | PreHSR 79 | PreHSR 90 | ACC 110 | 125E | 125NE | Maglev | TGV | ACC 150E | ACC 150NE | | |
| 30 | 2000 | Million $ | 0.76 | 0.65 | 1.75 | 2.62 | 1.96 | 3.55 | 3.39 | 2.89 | 1.68 | | |
| 31 | | Energy( B. Btu) | 210.82 | 282.32 | 311.99 | 313.86 | 341.07 | 149.40 | 422.62 | 371.75 | 372.54 | | |
| 32 | | Pet. (M Gal) | 1.68 | 2.24 | 2.50 | 5.39 | 2.73 | 9.77 | 7.69 | 5.86 | 2.99 | | |
| 33 | | | | | | | | | | | | | |
| 34 | 2005 | Million $ | 0.76 | 0.59 | 1.79 | 2.76 | 1.99 | 3.63 | 3.58 | 3.04 | 1.65 | | |
| 35 | | Energy( B. Btu) | 225.74 | 297.34 | 322.69 | 327.03 | 348.13 | 114.12 | 434.55 | 386.80 | 377.50 | | |
| 36 | | Pet. (M Gal) | 1.80 | 2.37 | 2.59 | 5.78 | 2.81 | 10.17 | 8.22 | 6.25 | 3.04 | | |
| 37 | | | | | | | | | | | | | |
| 38 | 2010 | Million $ | 0.73 | 0.47 | 1.77 | 2.86 | 1.95 | 3.62 | 3.68 | 3.14 | 1.54 | | |
| 39 | | Energy( B. Btu) | 240.30 | 312.05 | 333.11 | 344.64 | 355.10 | 92.07 | 457.70 | 407.05 | 382.82 | | |
| 40 | | Pet. (M Gal) | 1.93 | 2.49 | 2.69 | 6.20 | 2.88 | 10.65 | 8.85 | 6.69 | 3.10 | | |
| 41 | | | | | | | | | | | | | |
| 42 | 2020 | Million $ | 0.69 | 0.30 | 1.82 | 3.14 | 1.99 | 3.77 | 4.02 | 3.42 | 1.45 | | |
| 43 | | Energy( B. Btu) | 255.70 | 327.85 | 339.46 | 366.28 | 353.38 | 35.67 | 481.49 | 432.44 | 376.70 | | |
| 44 | | Pet. (M Gal) | 2.06 | 2.63 | 2.76 | 6.87 | 2.89 | 11.37 | 9.82 | 7.39 | 3.09 | | |
| 45 | | | | | | | | | | | | | |
| 46 | 2030 | Million $ | 0.88 | 0.35 | 2.22 | 3.90 | 2.40 | 4.69 | 5.03 | 4.24 | 1.74 | | |
| 47 | | Energy( B. Btu) | 293.49 | 352.01 | 352.88 | 398.18 | 355.69 | -38.44 | 502.17 | 469.25 | 373.15 | | |
| 48 | | Pet. (M Gal) | 2.37 | 2.85 | 2.90 | 7.81 | 2.95 | 12.37 | 11.02 | 8.35 | 3.11 | | |
| 49 | | | | | | | | | | | | | |
| 50 | 2040 | Million $ | 1.18 | 0.48 | 2.76 | 4.87 | 2.97 | 5.79 | 6.29 | 5.27 | 2.16 | | |
| 51 | | Energy( B. Btu) | 320.49 | 358.58 | 347.66 | 409.59 | 337.75 | -153.60 | 502.36 | 489.07 | 350.74 | | |
| 52 | | Pet. (M Gal) | 2.60 | 2.92 | 2.89 | 8.79 | 2.86 | 13.52 | 12.37 | 9.39 | 2.98 | | |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | | Summary | | | | | | | | | |
| 54 | | Total Emissions (ton) | | | | | | | | | |
| 55 | Year | Before1 (for low speeds): | | | | | | Before2 (for high speeds): | | | |
| 56 | | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx |
| 57 | 2000 | 883.32 | 15724.03 | 2232.36 | 91.59 | 96.35 | 382733.25 | 888.57 | 15777.87 | 2255.15 | 92.76 |
| 58 | | | | | | | | | | | |
| 59 | 2005 | 901.27 | 15930.01 | 2294.14 | 99.60 | 97.67 | 396039.24 | 905.65 | 15982.17 | 2318.23 | 100.81 |
| 60 | | | | | | | | | | | |
| 61 | 2010 | 931.72 | 16045.17 | 2297.10 | 107.65 | 104.03 | 404908.09 | 936.00 | 16096.65 | 2319.56 | 108.85 |
| 62 | | | | | | | | | | | |
| 63 | 2020 | 954.54 | 16557.94 | 2671.35 | 127.68 | 123.10 | 420888.49 | 959.25 | 16613.70 | 2693.64 | 128.96 |
| 64 | | | | | | | | | | | |
| 65 | 2030 | 1126.90 | 19596.12 | 3156.95 | 150.98 | 146.04 | 459916.68 | 1132.46 | 19662.36 | 3183.16 | 152.49 |
| 66 | | | | | | | | | | | |
| 67 | 2040 | 1331.88 | 23194.46 | 3726.22 | 178.24 | 172.97 | 610118.21 | 1338.44 | 23272.86 | 3756.68 | 180.00 |
| 68 | | | | | | | | | | | |
| 69 | **Summary of Emission Control Cost (million $) by each pollutant** | | | | | | | | | | |
| 70 | Year | Before1 (for low speeds) | | | | | | Before 2 (for high speeds) | | | |
| 71 | | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx |
| 72 | 2000 | 4.550 | 17.312 | 11.592 | 0.049 | 0.173 | 5.741 | 4.593 | 17.428 | 11.730 | 0.050 |
| 73 | | | | | | | | | | | |
| 74 | 2005 | 4.604 | 17.513 | 11.904 | 0.054 | 0.181 | 5.941 | 4.641 | 17.628 | 12.049 | 0.054 |
| 75 | | | | | | | | | | | |
| 76 | 2010 | 4.739 | 17.611 | 11.949 | 0.059 | 0.191 | 6.074 | 4.775 | 17.723 | 12.088 | 0.059 |
| 77 | | | | | | | | | | | |
| 78 | 2020 | 4.874 | 18.217 | 13.925 | 0.071 | 0.225 | 6.313 | 4.914 | 18.338 | 14.068 | 0.071 |
| 79 | | | | | | | | | | | |
| 80 | 2030 | 5.750 | 21.561 | 16.464 | 0.084 | 0.266 | 6.899 | 5.796 | 21.706 | 16.634 | 0.084 |
| 81 | | | | | | | | | | | |
| 82 | 2040 | 6.792 | 25.519 | 19.443 | 0.099 | 0.315 | 9.152 | 6.847 | 25.690 | 19.641 | 0.100 |

An Example of Output

| | L | M | N | O | P | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | | | | | | | | | | | | | |
| 54 | | | | | | | | | | | | | |
| 55 | | | After PreHSR 79 | | | | | | After PreHSR 90 | | | | |
| 56 | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 |
| 57 | 98.06 | 389751.44 | 847.71 | 15115.06 | 2253.61 | 100.66 | 91.73 | 370679.33 | 838.45 | 14997.26 | 2323.24 | 104.87 | 90.82 |
| 58 | | | | | | | | | | | | | |
| 59 | 99.09 | 403236.36 | 864.99 | 15277.23 | 2324.82 | 110.10 | 93.14 | 383162.41 | 856.79 | 15163.12 | 2404.71 | 114.83 | 92.52 |
| 60 | | | | | | | | | | | | | |
| 61 | 105.44 | 411910.15 | 893.48 | 15352.03 | 2344.31 | 119.90 | 99.33 | 391902.00 | 885.71 | 15242.13 | 2438.16 | 125.26 | 98.85 |
| 62 | | | | | | | | | | | | | |
| 63 | 124.61 | 427912.10 | 917.07 | 15815.90 | 2733.10 | 142.90 | 117.89 | 407751.10 | 910.01 | 15711.30 | 2849.70 | 149.37 | 117.47 |
| 64 | | | | | | | | | | | | | |
| 65 | 147.83 | 467971.43 | 1079.74 | 18657.26 | 3234.99 | 170.22 | 138.99 | 443830.98 | 1073.92 | 18549.31 | 3378.04 | 178.01 | 139.30 |
| 66 | | | | | | | | | | | | | |
| 67 | 175.06 | 619170.55 | 1272.89 | 22014.92 | 3827.07 | 202.71 | 163.68 | 584338.68 | 1268.85 | 21907.53 | 4002.77 | 212.08 | 165.12 |
| 68 | | | | | | | | | | | | | |
| 69 | | | | | | | | | | | | | |
| 70 | | | After Pre 79 | | | | | | After Pre 90 | | | | |
| 71 | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 |
| 72 | 0.176 | 5.846 | 4.389 | 16.717 | 11.764 | 0.055 | 0.168 | 5.560 | 4.340 | 16.582 | 12.127 | 0.058 | 0.168 |
| 73 | | | | | | | | | | | | | |
| 74 | 0.185 | 6.048 | 4.445 | 16.875 | 12.127 | 0.061 | 0.177 | 5.747 | 4.403 | 16.744 | 12.543 | 0.064 | 0.177 |
| 75 | | | | | | | | | | | | | |
| 76 | 0.195 | 6.178 | 4.575 | 16.931 | 12.258 | 0.067 | 0.187 | 5.879 | 4.536 | 16.805 | 12.742 | 0.071 | 0.187 |
| 77 | | | | | | | | | | | | | |
| 78 | 0.229 | 6.418 | 4.719 | 17.488 | 14.312 | 0.081 | 0.220 | 6.116 | 4.686 | 17.364 | 14.909 | 0.085 | 0.221 |
| 79 | | | | | | | | | | | | | |
| 80 | 0.271 | 7.019 | 5.555 | 20.630 | 16.950 | 0.096 | 0.260 | 6.657 | 5.528 | 20.498 | 17.678 | 0.101 | 0.261 |
| 81 | | | | | | | | | | | | | |
| 82 | 0.320 | 9.287 | 6.548 | 24.343 | 20.064 | 0.115 | 0.306 | 8.765 | 6.531 | 24.206 | 20.953 | 0.121 | 0.309 |

An Example of Output

| | Y | Z | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | | | | | | | | | | | | | |
| 54 | | | | | | | | | | | | | |
| 55 | | After ACC 110 | | | | | | After ACC 125E | | | | | |
| 56 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 |
| 57 | 366194.85 | 825.69 | 14844.40 | 2181.27 | 97.27 | 88.12 | 359497.80 | 810.59 | 14744.92 | 2050.18 | 160.33 | 91.22 | 359757.95 |
| 58 | | | | | | | | | | | | | |
| 59 | 378654.54 | 843.93 | 15005.22 | 2245.97 | 106.29 | 89.87 | 371628.85 | 828.57 | 14905.64 | 2094.23 | 163.18 | 93.35 | 372160.54 |
| 60 | | | | | | | | | | | | | |
| 61 | 387734.28 | 872.00 | 15078.01 | 2263.06 | 115.69 | 96.02 | 380700.39 | 855.52 | 14977.51 | 2089.52 | 163.12 | 99.34 | 381837.20 |
| 62 | | | | | | | | | | | | | |
| 63 | 403840.62 | 894.65 | 15533.95 | 2641.21 | 137.83 | 114.20 | 396489.88 | 876.10 | 15429.90 | 2424.73 | 166.80 | 117.65 | 400002.85 |
| 64 | | | | | | | | | | | | | |
| 65 | 440382.65 | 1055.16 | 18337.84 | 3121.81 | 163.74 | 135.21 | 431552.38 | 1032.96 | 18216.89 | 2843.24 | 166.58 | 138.27 | 436197.42 |
| 66 | | | | | | | | | | | | | |
| 67 | 581313.05 | 1245.86 | 21655.51 | 3688.17 | 194.44 | 160.00 | 570401.08 | 1219.27 | 21515.73 | 3337.71 | 173.28 | 163.04 | 576904.08 |
| 68 | | | | | | | | | | | | | |
| 69 | | | | | | | | | | | | | |
| 70 | | After Acc 110 | | | | | | After Acc 125E | | | | | |
| 71 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 |
| 72 | 5.493 | 3.722 | 14.852 | 9.542 | 0.049 | 0.115 | 3.996 | 4.161 | 16.264 | 10.720 | 0.092 | 0.167 | 5.396 |
| 73 | | | | | | | | | | | | | |
| 74 | 5.680 | 3.866 | 15.055 | 9.807 | 0.054 | 0.125 | 4.164 | 4.222 | 16.417 | 10.944 | 0.094 | 0.175 | 5.582 |
| 75 | | | | | | | | | | | | | |
| 76 | 5.816 | 4.010 | 15.151 | 10.033 | 0.059 | 0.136 | 4.362 | 4.341 | 16.468 | 10.944 | 0.094 | 0.185 | 5.728 |
| 77 | | | | | | | | | | | | | |
| 78 | 6.058 | 4.108 | 15.606 | 12.004 | 0.072 | 0.166 | 4.634 | 4.462 | 17.000 | 12.712 | 0.096 | 0.217 | 6.000 |
| 79 | | | | | | | | | | | | | |
| 80 | 6.606 | 4.851 | 18.452 | 14.249 | 0.086 | 0.198 | 5.008 | 5.256 | 20.062 | 14.912 | 0.095 | 0.254 | 6.543 |
| 81 | | | | | | | | | | | | | |
| 82 | 8.720 | 5.738 | 21.831 | 16.929 | 0.103 | 0.235 | 6.957 | 6.200 | 23.687 | 17.513 | 0.099 | 0.299 | 8.654 |

An Example of Output

| | AL | AM | AN | AO | AP | AQ | AR | AS | AT | AU | AV | AW | AX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | | | | | | | | | | | | | |
| 54 | | | | | | | | | | | | | |
| 55 | After ACC 125NE | | | | | | After Maglev | | | | | | After TGV |
| 56 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC |
| 57 | 820.19 | 14773.49 | 2180.97 | 97.14 | 86.84 | 354362.07 | 783.45 | 14362.39 | 2026.92 | 312.06 | 101.99 | 368813.88 | 808.50 |
| 58 | | | | | | | | | | | | | |
| 59 | 839.15 | 14936.04 | 2246.58 | 106.18 | 88.81 | 366329.78 | 805.50 | 14539.51 | 2065.60 | 303.79 | 106.48 | 384420.63 | 825.63 |
| 60 | | | | | | | | | | | | | |
| 61 | 867.30 | 15010.03 | 2267.15 | 115.63 | 94.98 | 375556.74 | 832.92 | 14623.68 | 2066.19 | 287.79 | 113.09 | 399119.41 | 849.82 |
| 62 | | | | | | | | | | | | | |
| 63 | 890.05 | 15466.40 | 2649.41 | 137.81 | 113.12 | 391346.48 | 854.75 | 15092.09 | 2398.66 | 263.37 | 133.17 | 427530.11 | 867.10 |
| 64 | | | | | | | | | | | | | |
| 65 | 1049.97 | 18261.22 | 3132.21 | 163.68 | 133.95 | 425575.42 | 1009.67 | 17844.37 | 2795.90 | 226.62 | 154.87 | 470847.72 | 1019.76 |
| 66 | | | | | | | | | | | | | |
| 67 | 1240.06 | 21569.30 | 3702.20 | 194.40 | 158.56 | 563492.47 | 1193.75 | 21105.20 | 3274.03 | 205.25 | 181.79 | 620063.31 | 1200.83 |
| 68 | | | | | | | | | | | | | |
| 69 | | | | | | | | | | | | | |
| 70 | After Acc 125NE | | | | | | After Maglev | | | | | | After TGV |
| 71 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC |
| 72 | 4.212 | 16.298 | 11.416 | 0.054 | 0.160 | 5.315 | 3.997 | 15.777 | 10.604 | 0.185 | 0.185 | 5.527 | 4.143 |
| 73 | | | | | | | | | | | | | |
| 74 | 4.278 | 16.452 | 11.753 | 0.059 | 0.168 | 5.495 | 4.085 | 15.949 | 10.802 | 0.179 | 0.196 | 5.760 | 4.200 |
| 75 | | | | | | | | | | | | | |
| 76 | 4.403 | 16.505 | 11.886 | 0.065 | 0.178 | 5.633 | 4.207 | 16.016 | 10.823 | 0.170 | 0.206 | 5.979 | 4.305 |
| 77 | | | | | | | | | | | | | |
| 78 | 4.536 | 17.042 | 13.901 | 0.079 | 0.210 | 5.870 | 4.335 | 16.563 | 12.568 | 0.155 | 0.241 | 6.402 | 4.408 |
| 79 | | | | | | | | | | | | | |
| 80 | 5.347 | 20.114 | 16.438 | 0.093 | 0.248 | 6.384 | 5.117 | 19.578 | 14.658 | 0.133 | 0.280 | 7.050 | 5.180 |
| 81 | | | | | | | | | | | | | |
| 82 | 6.311 | 23.749 | 19.436 | 0.111 | 0.293 | 8.452 | 6.046 | 23.148 | 17.172 | 0.119 | 0.328 | 9.285 | 6.095 |

An Example of Output

| | AY | AZ | BA | BB | BC | BD | BE | BF | BG | BH | BI | BJ | BK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | | | | | | | | | | | | | |
| 54 | | | | | | | | | | | | | |
| 55 | | | | | | After ACC 150E | | | | | | After ACC 150NE | |
| 56 | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO |
| 57 | 14602.36 | 2021.39 | 199.52 | 94.70 | 357343.04 | 806.56 | 14675.48 | 2033.98 | 160.32 | 90.13 | 355358.43 | 819.83 | 14730.01 |
| 58 | | | | | | | | | | | | | |
| 59 | 14751.37 | 2059.54 | 200.57 | 97.72 | 369918.93 | 824.99 | 14837.58 | 2077.16 | 162.96 | 92.39 | 367611.45 | 839.80 | 14896.69 |
| 60 | | | | | | | | | | | | | |
| 61 | 14807.32 | 2056.31 | 197.25 | 103.59 | 380748.29 | 851.97 | 14910.70 | 2073.22 | 162.71 | 98.35 | 377340.12 | 868.52 | 14974.74 |
| 62 | | | | | | | | | | | | | |
| 63 | 15232.38 | 2386.71 | 194.10 | 121.79 | 401088.17 | 872.60 | 15362.22 | 2407.99 | 166.10 | 116.56 | 395467.61 | 892.37 | 15437.54 |
| 64 | | | | | | | | | | | | | |
| 65 | 17958.96 | 2788.73 | 183.10 | 142.14 | 437633.07 | 1029.00 | 18138.62 | 2823.61 | 165.55 | 136.96 | 430972.67 | 1053.11 | 18231.12 |
| 66 | | | | | | | | | | | | | |
| 67 | 21181.03 | 3265.84 | 180.88 | 166.76 | 578071.74 | 1214.56 | 21422.57 | 3314.40 | 171.98 | 161.46 | 570641.61 | 1243.96 | 21535.76 |
| 68 | | | | | | | | | | | | | |
| 69 | | | | | | | | | | | | | |
| 70 | | | | | | After Acc 150E | | | | | | After Acc 150NE | |
| 71 | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO |
| 72 | 16.075 | 10.566 | 0.116 | 0.170 | 5.360 | 4.137 | 16.167 | 10.631 | 0.092 | 0.165 | 5.330 | 4.201 | 16.236 |
| 73 | | | | | | | | | | | | | |
| 74 | 16.214 | 10.764 | 0.117 | 0.179 | 5.549 | 4.200 | 16.321 | 10.850 | 0.094 | 0.173 | 5.514 | 4.271 | 16.395 |
| 75 | | | | | | | | | | | | | |
| 76 | 16.248 | 10.771 | 0.115 | 0.189 | 5.711 | 4.319 | 16.373 | 10.853 | 0.094 | 0.183 | 5.660 | 4.399 | 16.452 |
| 77 | | | | | | | | | | | | | |
| 78 | 16.749 | 12.513 | 0.113 | 0.221 | 6.016 | 4.441 | 16.901 | 12.616 | 0.096 | 0.214 | 5.932 | 4.536 | 16.993 |
| 79 | | | | | | | | | | | | | |
| 80 | 19.742 | 14.632 | 0.106 | 0.258 | 6.564 | 5.232 | 19.947 | 14.798 | 0.095 | 0.251 | 6.465 | 5.348 | 20.060 |
| 81 | | | | | | | | | | | | | |
| 82 | 23.277 | 17.147 | 0.104 | 0.303 | 8.671 | 6.171 | 23.546 | 17.376 | 0.098 | 0.295 | 8.560 | 6.312 | 23.685 |

An Example of Output

| | BL | BM | BN | BO |
|---|---|---|---|---|
| 53 | | | | |
| 54 | | | | |
| 55 | | | | |
| 56 | NOx | SOx | PM10 | CO2 |
| 57 | 2252.83 | 104.29 | 89.07 | 355706.37 |
| 58 | | | | |
| 59 | 2327.67 | 114.16 | 91.60 | 368217.09 |
| 60 | | | | |
| 61 | 2360.50 | 124.58 | 98.21 | 378306.22 |
| 62 | | | | |
| 63 | 2763.35 | 148.53 | 117.10 | 395472.85 |
| 64 | | | | |
| 65 | 3271.15 | 176.68 | 138.84 | 430882.62 |
| 66 | | | | |
| 67 | 3870.70 | 210.08 | 164.53 | 569962.78 |
| 68 | | | | |
| 69 | | | | |
| 70 | | | | |
| 71 | NOx | SOx | PM10 | CO2 |
| 72 | 11.742 | 0.059 | 0.163 | 5.336 |
| 73 | | | | |
| 74 | 12.120 | 0.064 | 0.172 | 5.523 |
| 75 | | | | |
| 76 | 12.307 | 0.071 | 0.183 | 5.675 |
| 77 | | | | |
| 78 | 14.413 | 0.085 | 0.216 | 5.932 |
| 79 | | | | |
| 80 | 17.061 | 0.101 | 0.255 | 6.463 |
| 81 | | | | |
| 82 | 20.187 | 0.121 | 0.301 | 8.549 |

An Example of Output

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 84 | **Savings of Emission Control Cost (million $) by each pollutant** | | | | | | | | | | |
| 85 | Year | After Pre 79 | | | | | | After Pre 90 | | | |
| 86 | | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx |
| 87 | 2000 | 0.1611 | 0.5950 | -0.1720 | -0.0060 | 0.0042 | 0.1808 | 0.2098 | 0.7292 | -0.5356 | -0.0089 |
| 88 | | | | | | | | | | | |
| 89 | 2005 | 0.1589 | 0.6389 | -0.2235 | -0.0070 | 0.0042 | 0.1932 | 0.2003 | 0.7697 | -0.6388 | -0.0101 |
| 90 | | | | | | | | | | | |
| 91 | 2010 | 0.1647 | 0.6795 | -0.3087 | -0.0081 | 0.0042 | 0.1951 | 0.2031 | 0.8061 | -0.7929 | -0.0116 |
| 92 | | | | | | | | | | | |
| 93 | 2020 | 0.1545 | 0.7289 | -0.3871 | -0.0099 | 0.0046 | 0.1971 | 0.1883 | 0.8520 | -0.9845 | -0.0142 |
| 94 | | | | | | | | | | | |
| 95 | 2030 | 0.1951 | 0.9307 | -0.4853 | -0.0126 | 0.0066 | 0.2413 | 0.2215 | 1.0623 | -1.2132 | -0.0177 |
| 96 | | | | | | | | | | | |
| 97 | 2040 | 0.2440 | 1.1757 | -0.6217 | -0.0160 | 0.0089 | 0.3867 | 0.2603 | 1.3127 | -1.5102 | -0.0221 |

An Example of Output

| | L | M | N | O | P | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 84 | | | | | | | | | | | | | |
| 85 | | | After Acc 110 | | | | | | After Acc 125E | | | | |
| 86 | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 |
| 87 | 0.0046 | 0.2481 | 0.8278 | 2.4592 | 2.0494 | 0.0008 | 0.0578 | 1.7453 | 0.3886 | 1.0472 | 0.8717 | -0.0427 | 0.0058 |
| 88 | | | | | | | | | | | | | |
| 89 | 0.0044 | 0.2608 | 0.7373 | 2.4580 | 2.0970 | 0.0003 | 0.0562 | 1.7766 | 0.3821 | 1.0962 | 0.9603 | -0.0397 | 0.0059 |
| 90 | | | | | | | | | | | | | |
| 91 | 0.0040 | 0.2576 | 0.7297 | 2.4595 | 1.9166 | -0.0005 | 0.0553 | 1.7113 | 0.3986 | 1.1431 | 1.0054 | -0.0349 | 0.0065 |
| 92 | | | | | | | | | | | | | |
| 93 | 0.0041 | 0.2557 | 0.7660 | 2.6102 | 1.9212 | -0.0016 | 0.0587 | 1.6791 | 0.4119 | 1.2169 | 1.2125 | -0.0252 | 0.0078 |
| 94 | | | | | | | | | | | | | |
| 95 | 0.0051 | 0.2930 | 0.8988 | 3.1084 | 2.2149 | -0.0026 | 0.0686 | 1.8907 | 0.4933 | 1.4983 | 1.5520 | -0.0115 | 0.0119 |
| 96 | | | | | | | | | | | | | |
| 97 | 0.0060 | 0.4321 | 1.0533 | 3.6872 | 2.5133 | -0.0041 | 0.0792 | 2.1952 | 0.5914 | 1.8317 | 1.9293 | 0.0004 | 0.0157 |

An Example of Output

| | Y | Z | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 84 | | | | | | | | | | | | | |
| 85 | | After Acc 125NE | | | | | | After Maglev | | | | | |
| 86 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 |
| 87 | 0.3446 | 0.3375 | 1.0141 | 0.1754 | -0.0048 | 0.0128 | 0.4256 | 0.5957 | 1.6510 | 1.1260 | -0.1347 | -0.0085 | 0.3193 |
| 88 | | | | | | | | | | | | | |
| 89 | 0.3582 | 0.3259 | 1.0610 | 0.1511 | -0.0055 | 0.0130 | 0.4456 | 0.5561 | 1.6784 | 1.2463 | -0.1251 | -0.0108 | 0.2885 |
| 90 | | | | | | | | | | | | | |
| 91 | 0.3461 | 0.3361 | 1.1054 | 0.0638 | -0.0064 | 0.0132 | 0.4403 | 0.5679 | 1.7073 | 1.2649 | -0.1106 | -0.0114 | 0.1993 |
| 92 | | | | | | | | | | | | | |
| 93 | 0.3133 | 0.3378 | 1.1745 | 0.0241 | -0.0078 | 0.0147 | 0.4431 | 0.5790 | 1.7756 | 1.5006 | -0.0840 | -0.0128 | 0.0157 |
| 94 | | | | | | | | | | | | | |
| 95 | 0.3558 | 0.4029 | 1.4467 | 0.0266 | -0.0098 | 0.0182 | 0.5151 | 0.6795 | 2.1273 | 1.9754 | -0.0484 | -0.0096 | -0.0308 |
| 96 | | | | | | | | | | | | | |
| 97 | 0.4982 | 0.4808 | 1.7692 | 0.0072 | -0.0123 | 0.0219 | 0.6994 | 0.8003 | 2.5419 | 2.4688 | -0.0197 | -0.0084 | 0.0022 |

An Example of Output

| | AL | AM | AN | AO | AP | AQ | AR | AS | AT | AU | AV | AW | AX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 84 | | | | | | | | | | | | | |
| 85 | After TGV | | | | | | After Acc 150E | | | | | | After Acc |
| 86 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC | CO | NOx | SOx | PM10 | CO2 | VOC |
| 87 | 0.4499 | 1.3528 | 1.1634 | -0.0664 | 0.0060 | 0.4858 | 0.4131 | 1.1450 | 0.9607 | -0.0429 | 0.0079 | 0.4106 | 0.3493 |
| 88 | | | | | | | | | | | | | |
| 89 | 0.4402 | 1.4136 | 1.2844 | -0.0624 | 0.0054 | 0.4994 | 0.4036 | 1.1927 | 1.0541 | -0.0398 | 0.0079 | 0.4264 | 0.3325 |
| 90 | | | | | | | | | | | | | |
| 91 | 0.4705 | 1.4757 | 1.3171 | -0.0556 | 0.0058 | 0.4670 | 0.4199 | 1.2381 | 1.0967 | -0.0348 | 0.0086 | 0.4135 | 0.3404 |
| 92 | | | | | | | | | | | | | |
| 93 | 0.5055 | 1.5893 | 1.5550 | -0.0418 | 0.0072 | 0.4019 | 0.4332 | 1.3155 | 1.3089 | -0.0250 | 0.0102 | 0.3813 | 0.3384 |
| 94 | | | | | | | | | | | | | |
| 95 | 0.6167 | 1.9637 | 2.0017 | -0.0217 | 0.0125 | 0.4545 | 0.5177 | 1.6142 | 1.6660 | -0.0111 | 0.0148 | 0.4342 | 0.4021 |
| 96 | | | | | | | | | | | | | |
| 97 | 0.7512 | 2.4129 | 2.4943 | -0.0046 | 0.0173 | 0.6158 | 0.6209 | 1.9727 | 2.0671 | 0.0009 | 0.0192 | 0.5921 | 0.4800 |

An Example of Output

| | AY | AZ | BA | BB | BC |
|---|---|---|---|---|---|
| 84 | | | | | |
| 85 | 50NE | | | | |
| 86 | CO | NOx | SOx | PM10 | CO2 |
| 87 | 1.0756 | -0.1500 | -0.0093 | 0.0096 | 0.4054 |
| 88 | | | | | |
| 89 | 1.1185 | -0.2156 | -0.0105 | 0.0092 | 0.4173 |
| 90 | | | | | |
| 91 | 1.1589 | -0.3575 | -0.0120 | 0.0087 | 0.3990 |
| 92 | | | | | |
| 93 | 1.2232 | -0.4879 | -0.0144 | 0.0091 | 0.3812 |
| 94 | | | | | |
| 95 | 1.5008 | -0.5963 | -0.0178 | 0.0113 | 0.4355 |
| 96 | | | | | |
| 97 | 1.8338 | -0.7445 | -0.0220 | 0.0136 | 0.6023 |

An Example of Output (TOTPV.SUM)

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **CHICAGO-ST.LOUIS CORRIDOR** | | | | | | | | | | | |
| 2 | **Summary of Emis. Con. Cost (million $)** | | | | | | | | | | | |
| 3 | Year | Before1 | Before2 | After | After | After | After | After | After | After | After | After |
| 4 | | for low speed | for high speed | PreHSR 79 | PreHSR | ACC 110 | ACC 125E | ACC 125 | Maglev | TGV | ACC 150 | ACC 150 |
| 5 | 2000 | 39.416 | 39.822 | 38.653 | 38.769 | 37.663 | 36.801 | 37.456 | 36.274 | 36.431 | 36.522 | 37.736 |
| 6 | 2005 | 40.197 | 40.605 | 39.432 | 39.611 | 38.405 | 37.434 | 38.206 | 36.971 | 37.024 | 37.152 | 38.546 |
| 7 | 2010 | 40.623 | 41.019 | 39.897 | 40.157 | 38.850 | 37.759 | 38.671 | 37.402 | 37.339 | 37.482 | 39.086 |
| 8 | 2020 | 43.624 | 44.038 | 42.936 | 43.322 | 41.800 | 40.487 | 41.638 | 40.264 | 40.021 | 40.200 | 42.174 |
| 9 | 2030 | 51.023 | 51.510 | 50.148 | 50.672 | 48.808 | 47.123 | 48.624 | 46.816 | 46.482 | 46.788 | 49.288 |
| 10 | 2040 | 61.318 | 61.884 | 60.141 | 60.839 | 58.554 | 56.452 | 58.352 | 56.099 | 55.597 | 56.045 | 59.155 |
| 11 | **EMISSION CONTROL COSTS BASED ON CURRENT DOLLAR VALUES** | | | | | | | | | | | |
| 12 | Year\Mill | Before1 | Before2 | After | After | After | After | After | After | After | After | After |
| 13 | | for low speed | for high speed | PreHSR 79 | PreHSR | ACC 110 | ACC 125E | ACC 125 | Maglev | TGV | ACC 150 | ACC 150 |
| 14 | 2000 | 39.42 | 39.82 | 38.65 | 38.77 | 37.66 | 36.80 | 37.46 | 36.27 | 36.43 | 36.52 | 37.74 |
| 15 | 2001 | 39.57 | 39.98 | 38.81 | 38.94 | 37.81 | 36.93 | 37.61 | 36.41 | 36.55 | 36.65 | 37.90 |
| 16 | 2002 | 39.73 | 40.14 | 38.96 | 39.11 | 37.96 | 37.05 | 37.76 | 36.55 | 36.67 | 36.77 | 38.06 |
| 17 | 2003 | 39.88 | 40.29 | 39.12 | 39.27 | 38.11 | 37.18 | 37.91 | 36.69 | 36.79 | 36.90 | 38.22 |
| 18 | 2004 | 40.04 | 40.45 | 39.28 | 39.44 | 38.26 | 37.31 | 38.06 | 36.83 | 36.91 | 37.03 | 38.38 |
| 19 | 2005 | 40.20 | 40.60 | 39.43 | 39.61 | 38.40 | 37.43 | 38.21 | 36.97 | 37.02 | 37.15 | 38.55 |
| 20 | 2006 | 40.28 | 40.69 | 39.53 | 39.72 | 38.49 | 37.50 | 38.30 | 37.06 | 37.09 | 37.22 | 38.65 |
| 21 | 2007 | 40.37 | 40.77 | 39.62 | 39.83 | 38.58 | 37.56 | 38.39 | 37.14 | 37.15 | 37.28 | 38.76 |
| 22 | 2008 | 40.45 | 40.85 | 39.71 | 39.94 | 38.67 | 37.63 | 38.48 | 37.23 | 37.21 | 37.35 | 38.87 |
| 23 | 2009 | 40.54 | 40.94 | 39.80 | 40.05 | 38.76 | 37.69 | 38.58 | 37.32 | 37.28 | 37.42 | 38.98 |
| 24 | 2010 | 40.62 | 41.02 | 39.90 | 40.16 | 38.85 | 37.76 | 38.67 | 37.40 | 37.34 | 37.48 | 39.09 |
| 25 | 2011 | 40.92 | 41.32 | 40.20 | 40.47 | 39.14 | 38.03 | 38.97 | 37.69 | 37.61 | 37.75 | 39.39 |
| 26 | 2012 | 41.22 | 41.62 | 40.50 | 40.79 | 39.44 | 38.30 | 39.26 | 37.97 | 37.88 | 38.03 | 39.70 |
| 27 | 2013 | 41.52 | 41.92 | 40.81 | 41.11 | 39.73 | 38.58 | 39.56 | 38.26 | 38.14 | 38.30 | 40.01 |
| 28 | 2014 | 41.82 | 42.23 | 41.11 | 41.42 | 40.03 | 38.85 | 39.86 | 38.55 | 38.41 | 38.57 | 40.32 |
| 29 | 2015 | 42.12 | 42.53 | 41.42 | 41.74 | 40.32 | 39.12 | 40.15 | 38.83 | 38.68 | 38.84 | 40.63 |
| 30 | 2016 | 42.42 | 42.83 | 41.72 | 42.06 | 40.62 | 39.40 | 40.45 | 39.12 | 38.95 | 39.11 | 40.94 |
| 31 | 2017 | 42.72 | 43.13 | 42.02 | 42.37 | 40.92 | 39.67 | 40.75 | 39.41 | 39.22 | 39.38 | 41.25 |
| 32 | 2018 | 43.02 | 43.43 | 42.33 | 42.69 | 41.21 | 39.94 | 41.04 | 39.69 | 39.48 | 39.66 | 41.56 |
| 33 | 2019 | 43.32 | 43.74 | 42.63 | 43.01 | 41.51 | 40.21 | 41.34 | 39.98 | 39.75 | 39.93 | 41.87 |
| 34 | 2020 | 43.62 | 44.04 | 42.94 | 43.32 | 41.80 | 40.49 | 41.64 | 40.26 | 40.02 | 40.20 | 42.17 |
| 35 | 2021 | 44.36 | 44.79 | 43.66 | 44.06 | 42.50 | 41.15 | 42.34 | 40.92 | 40.67 | 40.86 | 42.89 |
| 36 | 2022 | 45.10 | 45.53 | 44.38 | 44.79 | 43.20 | 41.81 | 43.03 | 41.57 | 41.31 | 41.52 | 43.60 |
| 37 | 2023 | 45.84 | 46.28 | 45.10 | 45.53 | 43.90 | 42.48 | 43.73 | 42.23 | 41.96 | 42.18 | 44.31 |
| 38 | 2024 | 46.58 | 47.03 | 45.82 | 46.26 | 44.60 | 43.14 | 44.43 | 42.88 | 42.61 | 42.83 | 45.02 |
| 39 | 2025 | 47.32 | 47.77 | 46.54 | 47.00 | 45.30 | 43.81 | 45.13 | 43.54 | 43.25 | 43.49 | 45.73 |
| 40 | 2026 | 48.06 | 48.52 | 47.26 | 47.73 | 46.00 | 44.47 | 45.83 | 44.20 | 43.90 | 44.15 | 46.44 |
| 41 | 2027 | 48.80 | 49.27 | 47.98 | 48.47 | 46.71 | 45.13 | 46.53 | 44.85 | 44.54 | 44.81 | 47.15 |
| 42 | 2028 | 49.54 | 50.02 | 48.71 | 49.20 | 47.41 | 45.80 | 47.23 | 45.51 | 45.19 | 45.47 | 47.86 |
| 43 | 2029 | 50.28 | 50.76 | 49.43 | 49.94 | 48.11 | 46.46 | 47.92 | 46.16 | 45.84 | 46.13 | 48.58 |
| 44 | 2030 | 51.02 | 51.51 | 50.15 | 50.67 | 48.81 | 47.12 | 48.62 | 46.82 | 46.48 | 46.79 | 49.29 |
| 45 | 2031 | 52.05 | 52.55 | 51.15 | 51.69 | 49.78 | 48.06 | 49.60 | 47.74 | 47.39 | 47.71 | 50.27 |
| 46 | 2032 | 53.08 | 53.58 | 52.15 | 52.71 | 50.76 | 48.99 | 50.57 | 48.67 | 48.31 | 48.64 | 51.26 |
| 47 | 2033 | 54.11 | 54.62 | 53.15 | 53.72 | 51.73 | 49.92 | 51.54 | 49.60 | 49.22 | 49.56 | 52.25 |
| 48 | 2034 | 55.14 | 55.66 | 54.14 | 54.74 | 52.71 | 50.85 | 52.51 | 50.53 | 50.13 | 50.49 | 53.23 |
| 49 | 2035 | 56.17 | 56.70 | 55.14 | 55.76 | 53.68 | 51.79 | 53.49 | 51.46 | 51.04 | 51.42 | 54.22 |
| 50 | 2036 | 57.20 | 57.73 | 56.14 | 56.77 | 54.66 | 52.72 | 54.46 | 52.39 | 51.95 | 52.34 | 55.21 |
| 51 | 2037 | 58.23 | 58.77 | 57.14 | 57.79 | 55.63 | 53.65 | 55.43 | 53.31 | 52.86 | 53.27 | 56.19 |
| 52 | 2038 | 59.26 | 59.81 | 58.14 | 58.81 | 56.60 | 54.59 | 56.41 | 54.24 | 53.77 | 54.19 | 57.18 |
| 53 | 2039 | 60.29 | 60.85 | 59.14 | 59.82 | 57.58 | 55.52 | 57.38 | 55.17 | 54.69 | 55.12 | 58.17 |
| 54 | 2040 | 61.32 | 61.88 | 60.14 | 60.84 | 58.55 | 56.45 | 58.35 | 56.10 | 55.60 | 56.05 | 59.16 |
| 55 | TOTAL | 1907.63 | 1925.98 | 1873.95 | 1890.10 | 1824.52 | 1767.35 | 1816.98 | 1753.54 | 1745.27 | 1754.56 | 1839.05 |
| 56 | | | | | | | | | | | | |
| 57 | **SAVINGS** | | | | | | | | | | | |
| 58 | | | **PreHSR 79** | **PreHSR 90** | **ACC 110** | **ACC 125E** | **ACC 125N** | **Maglev** | **TGV** | **ACC 150E** | **ACC 150NE** | |
| 59 | **Millions $** | | **33.6789** | **17.5285** | **83.1157** | **140.2828** | **90.6557** | **172.4391** | **180.7036** | **153.0729** | **68.5819** | |

An Example of Output (TOTPV.SUM)

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | **PRESENT VALUES, BASE YEAR = 1995** | | | | | | | | | | | |
| 61 | Year\Mill | Before1 | Before2 | After | After | After | After | After | After | After | After | After |
| 62 | | for low speed | for high speed | PreHSR 79 | PreHSR | ACC 110 | ACC 125E | ACC 125 | Maglev | TGV | ACC 150 | ACC 150 |
| 63 | 2000 | 28.10 | 28.39 | 27.56 | 27.64 | 26.85 | 26.24 | 26.71 | 25.86 | 25.97 | 26.04 | 26.90 |
| 64 | 2001 | 26.37 | 26.64 | 25.86 | 25.95 | 25.20 | 24.61 | 25.06 | 24.26 | 24.35 | 24.42 | 25.25 |
| 65 | 2002 | 24.74 | 24.99 | 24.27 | 24.35 | 23.64 | 23.08 | 23.51 | 22.76 | 22.84 | 22.90 | 23.70 |
| 66 | 2003 | 23.21 | 23.45 | 22.77 | 22.86 | 22.18 | 21.64 | 22.06 | 21.36 | 21.41 | 21.48 | 22.25 |
| 67 | 2004 | 21.78 | 22.00 | 21.36 | 21.45 | 20.81 | 20.29 | 20.70 | 20.03 | 20.07 | 20.14 | 20.88 |
| 68 | 2005 | 20.43 | 20.64 | 20.05 | 20.14 | 19.52 | 19.03 | 19.42 | 18.79 | 18.82 | 18.89 | 19.59 |
| 69 | 2006 | 19.14 | 19.33 | 18.78 | 18.87 | 18.29 | 17.82 | 18.20 | 17.61 | 17.62 | 17.68 | 18.36 |
| 70 | 2007 | 17.92 | 18.10 | 17.59 | 17.68 | 17.13 | 16.68 | 17.05 | 16.49 | 16.49 | 16.55 | 17.21 |
| 71 | 2008 | 16.79 | 16.95 | 16.48 | 16.57 | 16.05 | 15.61 | 15.97 | 15.45 | 15.44 | 15.50 | 16.13 |
| 72 | 2009 | 15.72 | 15.88 | 15.44 | 15.53 | 15.03 | 14.62 | 14.96 | 14.47 | 14.46 | 14.51 | 15.12 |
| 73 | 2010 | 14.72 | 14.87 | 14.46 | 14.55 | 14.08 | 13.69 | 14.02 | 13.56 | 13.53 | 13.59 | 14.17 |
| 74 | 2011 | 13.86 | 14.00 | 13.62 | 13.71 | 13.26 | 12.88 | 13.20 | 12.77 | 12.74 | 12.79 | 13.34 |
| 75 | 2012 | 13.05 | 13.18 | 12.82 | 12.91 | 12.49 | 12.13 | 12.43 | 12.02 | 11.99 | 12.04 | 12.57 |
| 76 | 2013 | 12.29 | 12.40 | 12.07 | 12.16 | 11.76 | 11.41 | 11.70 | 11.32 | 11.29 | 11.33 | 11.84 |
| 77 | 2014 | 11.56 | 11.68 | 11.37 | 11.45 | 11.07 | 10.74 | 11.02 | 10.66 | 10.62 | 10.66 | 11.15 |
| 78 | 2015 | 10.89 | 10.99 | 10.70 | 10.79 | 10.42 | 10.11 | 10.38 | 10.04 | 10.00 | 10.04 | 10.50 |
| 79 | 2016 | 10.25 | 10.34 | 10.08 | 10.16 | 9.81 | 9.51 | 9.77 | 9.45 | 9.41 | 9.45 | 9.89 |
| 80 | 2017 | 9.64 | 9.74 | 9.49 | 9.56 | 9.24 | 8.95 | 9.20 | 8.89 | 8.85 | 8.89 | 9.31 |
| 81 | 2018 | 9.08 | 9.16 | 8.93 | 9.01 | 8.69 | 8.43 | 8.66 | 8.37 | 8.33 | 8.37 | 8.77 |
| 82 | 2019 | 8.54 | 8.62 | 8.40 | 8.48 | 8.18 | 7.93 | 8.15 | 7.88 | 7.84 | 7.87 | 8.25 |
| 83 | 2020 | 8.04 | 8.11 | 7.91 | 7.98 | 7.70 | 7.46 | 7.67 | 7.42 | 7.37 | 7.41 | 7.77 |
| 84 | 2021 | 7.64 | 7.71 | 7.52 | 7.59 | 7.32 | 7.09 | 7.29 | 7.05 | 7.00 | 7.04 | 7.38 |
| 85 | 2022 | 7.26 | 7.33 | 7.14 | 7.21 | 6.95 | 6.73 | 6.93 | 6.69 | 6.65 | 6.68 | 7.02 |
| 86 | 2023 | 6.89 | 6.96 | 6.78 | 6.85 | 6.60 | 6.39 | 6.58 | 6.35 | 6.31 | 6.34 | 6.66 |
| 87 | 2024 | 6.55 | 6.61 | 6.44 | 6.50 | 6.27 | 6.06 | 6.25 | 6.03 | 5.99 | 6.02 | 6.33 |
| 88 | 2025 | 6.22 | 6.28 | 6.11 | 6.17 | 5.95 | 5.75 | 5.93 | 5.72 | 5.68 | 5.71 | 6.01 |
| 89 | 2026 | 5.90 | 5.96 | 5.80 | 5.86 | 5.65 | 5.46 | 5.63 | 5.43 | 5.39 | 5.42 | 5.70 |
| 90 | 2027 | 5.60 | 5.65 | 5.51 | 5.56 | 5.36 | 5.18 | 5.34 | 5.15 | 5.11 | 5.14 | 5.41 |
| 91 | 2028 | 5.31 | 5.36 | 5.22 | 5.28 | 5.08 | 4.91 | 5.06 | 4.88 | 4.85 | 4.88 | 5.13 |
| 92 | 2029 | 5.04 | 5.09 | 4.95 | 5.00 | 4.82 | 4.66 | 4.80 | 4.63 | 4.59 | 4.62 | 4.87 |
| 93 | 2030 | 4.78 | 4.82 | 4.70 | 4.75 | 4.57 | 4.41 | 4.55 | 4.38 | 4.35 | 4.38 | 4.62 |
| 94 | 2031 | 4.56 | 4.60 | 4.48 | 4.52 | 4.36 | 4.21 | 4.34 | 4.18 | 4.15 | 4.18 | 4.40 |
| 95 | 2032 | 4.34 | 4.38 | 4.27 | 4.31 | 4.15 | 4.01 | 4.14 | 3.98 | 3.95 | 3.98 | 4.19 |
| 96 | 2033 | 4.14 | 4.18 | 4.06 | 4.11 | 3.96 | 3.82 | 3.94 | 3.79 | 3.76 | 3.79 | 3.99 |
| 97 | 2034 | 3.94 | 3.98 | 3.87 | 3.91 | 3.77 | 3.63 | 3.75 | 3.61 | 3.58 | 3.61 | 3.80 |
| 98 | 2035 | 3.75 | 3.79 | 3.68 | 3.72 | 3.58 | 3.46 | 3.57 | 3.44 | 3.41 | 3.43 | 3.62 |
| 99 | 2036 | 3.57 | 3.60 | 3.50 | 3.54 | 3.41 | 3.29 | 3.40 | 3.27 | 3.24 | 3.27 | 3.45 |
| 100 | 2037 | 3.40 | 3.43 | 3.33 | 3.37 | 3.24 | 3.13 | 3.23 | 3.11 | 3.08 | 3.11 | 3.28 |
| 101 | 2038 | 3.23 | 3.26 | 3.17 | 3.21 | 3.09 | 2.98 | 3.07 | 2.96 | 2.93 | 2.95 | 3.12 |
| 102 | 2039 | 3.07 | 3.10 | 3.01 | 3.05 | 2.93 | 2.83 | 2.92 | 2.81 | 2.79 | 2.81 | 2.96 |
| 103 | 2040 | 2.92 | 2.95 | 2.86 | 2.90 | 2.79 | 2.69 | 2.78 | 2.67 | 2.65 | 2.67 | 2.82 |
| 104 | TOTAL | 434.23 | 438.50 | 426.42 | 429.23 | 415.25 | 403.53 | 413.33 | 399.58 | 398.92 | 400.56 | 417.72 |
| 105 | | | | | | | | | | | | |
| 106 | **SAVINGS OF PRESENT VALUES, BASE YEAR = 1995** | | | | | | | | | | | |
| 107 | | | **PreHSR 79** | **PreHSR 90** | **ACC 110** | **ACC 125E** | **ACC 125N** | **Maglev** | **TGV** | **ACC 150E** | **ACC 150NE** | |
| 108 | **Million $** | | **7.8125** | **5.0034** | **18.9782** | **30.7016** | **20.8955** | **38.9223** | **39.5874** | **33.6683** | **16.5119** | |

An Example of Output (TOTPV.SUM)

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 109 | **PRESENT VALUES, BASE YEAR = 2000** | | | | | | | | | | | |
| 110 | Year\Mill | Before1 | Before2 | After | After | After | After | After | After | After | After | After |
| 111 | | for low speed | for high speed | PreHSR 79 | PreHSR | ACC 110 | ACC 125E | ACC 125 | Maglev | TGV | ACC 150 | ACC 150 |
| 112 | 2000 | 39.42 | 39.82 | 38.65 | 38.77 | 37.66 | 36.80 | 37.46 | 36.27 | 36.43 | 36.52 | 37.74 |
| 113 | 2001 | 36.98 | 37.36 | 36.27 | 36.39 | 35.34 | 34.51 | 35.15 | 34.03 | 34.16 | 34.25 | 35.42 |
| 114 | 2002 | 34.70 | 35.06 | 34.03 | 34.16 | 33.16 | 32.36 | 32.98 | 31.93 | 32.03 | 32.12 | 33.24 |
| 115 | 2003 | 32.56 | 32.89 | 31.93 | 32.06 | 31.11 | 30.35 | 30.94 | 29.95 | 30.03 | 30.12 | 31.20 |
| 116 | 2004 | 30.55 | 30.86 | 29.96 | 30.09 | 29.19 | 28.46 | 29.03 | 28.10 | 28.15 | 28.25 | 29.28 |
| 117 | 2005 | 28.66 | 28.95 | 28.11 | 28.24 | 27.38 | 26.69 | 27.24 | 26.36 | 26.40 | 26.49 | 27.48 |
| 118 | 2006 | 26.84 | 27.11 | 26.34 | 26.47 | 25.65 | 24.99 | 25.52 | 24.69 | 24.71 | 24.80 | 25.76 |
| 119 | 2007 | 25.14 | 25.39 | 24.67 | 24.80 | 24.03 | 23.39 | 23.91 | 23.13 | 23.14 | 23.22 | 24.14 |
| 120 | 2008 | 23.54 | 23.78 | 23.11 | 23.24 | 22.51 | 21.90 | 22.40 | 21.67 | 21.66 | 21.74 | 22.62 |
| 121 | 2009 | 22.05 | 22.27 | 21.65 | 21.78 | 21.08 | 20.50 | 20.98 | 20.30 | 20.28 | 20.35 | 21.20 |
| 122 | 2010 | 20.65 | 20.85 | 20.28 | 20.41 | 19.75 | 19.19 | 19.66 | 19.01 | 18.98 | 19.05 | 19.87 |
| 123 | 2011 | 19.44 | 19.63 | 19.10 | 19.23 | 18.60 | 18.07 | 18.51 | 17.91 | 17.87 | 17.94 | 18.72 |
| 124 | 2012 | 18.30 | 18.48 | 17.98 | 18.11 | 17.51 | 17.01 | 17.43 | 16.86 | 16.82 | 16.88 | 17.63 |
| 125 | 2013 | 17.23 | 17.40 | 16.93 | 17.06 | 16.49 | 16.01 | 16.42 | 15.88 | 15.83 | 15.89 | 16.60 |
| 126 | 2014 | 16.22 | 16.38 | 15.94 | 16.06 | 15.52 | 15.07 | 15.46 | 14.95 | 14.90 | 14.96 | 15.64 |
| 127 | 2015 | 15.27 | 15.41 | 15.01 | 15.13 | 14.62 | 14.18 | 14.55 | 14.07 | 14.02 | 14.08 | 14.73 |
| 128 | 2016 | 14.37 | 14.51 | 14.13 | 14.25 | 13.76 | 13.34 | 13.70 | 13.25 | 13.19 | 13.25 | 13.87 |
| 129 | 2017 | 13.53 | 13.65 | 13.30 | 13.41 | 12.95 | 12.56 | 12.90 | 12.47 | 12.41 | 12.47 | 13.06 |
| 130 | 2018 | 12.73 | 12.85 | 12.52 | 12.63 | 12.19 | 11.82 | 12.14 | 11.74 | 11.68 | 11.73 | 12.30 |
| 131 | 2019 | 11.98 | 12.09 | 11.79 | 11.89 | 11.48 | 11.12 | 11.43 | 11.05 | 10.99 | 11.04 | 11.58 |
| 132 | 2020 | 11.27 | 11.38 | 11.10 | 11.20 | 10.80 | 10.46 | 10.76 | 10.40 | 10.34 | 10.39 | 10.90 |
| 133 | 2021 | 10.71 | 10.82 | 10.54 | 10.64 | 10.26 | 9.94 | 10.22 | 9.88 | 9.82 | 9.87 | 10.36 |
| 134 | 2022 | 10.18 | 10.28 | 10.02 | 10.11 | 9.75 | 9.44 | 9.71 | 9.38 | 9.32 | 9.37 | 9.84 |
| 135 | 2023 | 9.67 | 9.76 | 9.51 | 9.60 | 9.26 | 8.96 | 9.23 | 8.91 | 8.85 | 8.90 | 9.35 |
| 136 | 2024 | 9.18 | 9.27 | 9.03 | 9.12 | 8.79 | 8.51 | 8.76 | 8.45 | 8.40 | 8.44 | 8.88 |
| 137 | 2025 | 8.72 | 8.80 | 8.58 | 8.66 | 8.35 | 8.07 | 8.32 | 8.02 | 7.97 | 8.01 | 8.43 |
| 138 | 2026 | 8.28 | 8.36 | 8.14 | 8.22 | 7.92 | 7.66 | 7.89 | 7.61 | 7.56 | 7.60 | 8.00 |
| 139 | 2027 | 7.85 | 7.93 | 7.72 | 7.80 | 7.52 | 7.26 | 7.49 | 7.22 | 7.17 | 7.21 | 7.59 |
| 140 | 2028 | 7.45 | 7.52 | 7.33 | 7.40 | 7.13 | 6.89 | 7.10 | 6.84 | 6.80 | 6.84 | 7.20 |
| 141 | 2029 | 7.07 | 7.14 | 6.95 | 7.02 | 6.76 | 6.53 | 6.74 | 6.49 | 6.44 | 6.48 | 6.83 |
| 142 | 2030 | 6.70 | 6.77 | 6.59 | 6.66 | 6.41 | 6.19 | 6.39 | 6.15 | 6.11 | 6.15 | 6.47 |
| 143 | 2031 | 6.39 | 6.45 | 6.28 | 6.35 | 6.11 | 5.90 | 6.09 | 5.86 | 5.82 | 5.86 | 6.17 |
| 144 | 2032 | 6.09 | 6.15 | 5.98 | 6.05 | 5.82 | 5.62 | 5.80 | 5.58 | 5.54 | 5.58 | 5.88 |
| 145 | 2033 | 5.80 | 5.86 | 5.70 | 5.76 | 5.55 | 5.35 | 5.53 | 5.32 | 5.28 | 5.32 | 5.60 |
| 146 | 2034 | 5.53 | 5.58 | 5.43 | 5.49 | 5.28 | 5.10 | 5.26 | 5.06 | 5.02 | 5.06 | 5.34 |
| 147 | 2035 | 5.26 | 5.31 | 5.16 | 5.22 | 5.03 | 4.85 | 5.01 | 4.82 | 4.78 | 4.82 | 5.08 |
| 148 | 2036 | 5.01 | 5.05 | 4.91 | 4.97 | 4.78 | 4.61 | 4.77 | 4.59 | 4.55 | 4.58 | 4.83 |
| 149 | 2037 | 4.76 | 4.81 | 4.67 | 4.73 | 4.55 | 4.39 | 4.53 | 4.36 | 4.32 | 4.36 | 4.60 |
| 150 | 2038 | 4.53 | 4.57 | 4.45 | 4.50 | 4.33 | 4.17 | 4.31 | 4.15 | 4.11 | 4.14 | 4.37 |
| 151 | 2039 | 4.31 | 4.35 | 4.23 | 4.27 | 4.11 | 3.97 | 4.10 | 3.94 | 3.91 | 3.94 | 4.16 |
| 152 | 2040 | 4.09 | 4.13 | 4.02 | 4.06 | 3.91 | 3.77 | 3.90 | 3.75 | 3.71 | 3.74 | 3.95 |
| 153 | TOTAL | 609.03 | 615.02 | 598.07 | 602.01 | 582.41 | 565.97 | 579.72 | 560.43 | 559.50 | 561.81 | 585.87 |
| 154 | | | | | | | | | | | | |
| 155 | **SAVINGS OF PRESENT VALUES, BASE YEAR = 2000** | | | | | | | | | | | |
| 156 | | | PreHSR 79 | PreHSR 90 | ACC 110 | ACC 125E | ACC 125N | Maglev | TGV | ACC 150E | ACC 150NE | |
| 157 | **Million $** | | **10.9575** | **7.0176** | **26.6179** | **43.0606** | **29.3070** | **54.5906** | **55.5234** | **47.2216** | **23.1588** | |

An Example of Output (TOTPV.SUM)

| | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | **Summary of Emission Control Cost (million $) by each pollutant** | | | | | | | | |
| 3 | Year | Before1 (for low speeds) | | | | | | Before 2 (for high speeds) | |
| 4 | | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| 5 | 2000 | 4.550 | 17.312 | 11.592 | 0.049 | 0.173 | 5.741 | 4.593 | 17.428 |
| 6 | 2005 | 4.604 | 17.513 | 11.904 | 0.054 | 0.181 | 5.941 | 4.641 | 17.628 |
| 7 | 2010 | 4.739 | 17.611 | 11.949 | 0.059 | 0.191 | 6.074 | 4.775 | 17.723 |
| 8 | 2020 | 4.874 | 18.217 | 13.925 | 0.071 | 0.225 | 6.313 | 4.914 | 18.338 |
| 9 | 2030 | 5.750 | 21.561 | 16.464 | 0.084 | 0.266 | 6.899 | 5.796 | 21.706 |
| 10 | 2040 | 6.792 | 25.519 | 19.443 | 0.099 | 0.315 | 9.152 | 6.847 | 25.690 |
| 11 | **EMISSION CONTROL COSTS BASED ON CURRENT DOLLAR VALUES BY EACH POLLUTANT** | | | | | | | | |
| 12 | Year | Before1 (for low speeds) | | | | | | Before 2 (for high speeds) | |
| 13 | | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| 14 | 2000 | 4.55 | 17.31 | 11.59 | 0.05 | 0.17 | 5.74 | 4.59 | 17.43 |
| 15 | 2001 | 4.56 | 17.35 | 11.65 | 0.05 | 0.17 | 5.78 | 4.60 | 17.47 |
| 16 | 2002 | 4.57 | 17.39 | 11.72 | 0.05 | 0.18 | 5.82 | 4.61 | 17.51 |
| 17 | 2003 | 4.58 | 17.43 | 11.78 | 0.05 | 0.18 | 5.86 | 4.62 | 17.55 |
| 18 | 2004 | 4.59 | 17.47 | 11.84 | 0.05 | 0.18 | 5.90 | 4.63 | 17.59 |
| 19 | 2005 | 4.60 | 17.51 | 11.90 | 0.05 | 0.18 | 5.94 | 4.64 | 17.63 |
| 20 | 2006 | 4.63 | 17.53 | 11.91 | 0.05 | 0.18 | 5.97 | 4.67 | 17.65 |
| 21 | 2007 | 4.66 | 17.55 | 11.92 | 0.06 | 0.19 | 5.99 | 4.69 | 17.67 |
| 22 | 2008 | 4.69 | 17.57 | 11.93 | 0.06 | 0.19 | 6.02 | 4.72 | 17.69 |
| 23 | 2009 | 4.71 | 17.59 | 11.94 | 0.06 | 0.19 | 6.05 | 4.75 | 17.70 |
| 24 | 2010 | 4.74 | 17.61 | 11.95 | 0.06 | 0.19 | 6.07 | 4.78 | 17.72 |
| 25 | 2011 | 4.75 | 17.67 | 12.15 | 0.06 | 0.19 | 6.10 | 4.79 | 17.78 |
| 26 | 2012 | 4.77 | 17.73 | 12.34 | 0.06 | 0.20 | 6.12 | 4.80 | 17.85 |
| 27 | 2013 | 4.78 | 17.79 | 12.54 | 0.06 | 0.20 | 6.15 | 4.82 | 17.91 |
| 28 | 2014 | 4.79 | 17.85 | 12.74 | 0.06 | 0.20 | 6.17 | 4.83 | 17.97 |
| 29 | 2015 | 4.81 | 17.91 | 12.94 | 0.06 | 0.21 | 6.19 | 4.84 | 18.03 |
| 30 | 2016 | 4.82 | 17.97 | 13.13 | 0.07 | 0.21 | 6.22 | 4.86 | 18.09 |
| 31 | 2017 | 4.83 | 18.03 | 13.33 | 0.07 | 0.21 | 6.24 | 4.87 | 18.15 |
| 32 | 2018 | 4.85 | 18.10 | 13.53 | 0.07 | 0.22 | 6.27 | 4.89 | 18.22 |
| 33 | 2019 | 4.86 | 18.16 | 13.73 | 0.07 | 0.22 | 6.29 | 4.90 | 18.28 |
| 34 | 2020 | 4.87 | 18.22 | 13.92 | 0.07 | 0.22 | 6.31 | 4.91 | 18.34 |
| 35 | 2021 | 4.96 | 18.55 | 14.18 | 0.07 | 0.23 | 6.37 | 5.00 | 18.68 |
| 36 | 2022 | 5.05 | 18.89 | 14.43 | 0.07 | 0.23 | 6.43 | 5.09 | 19.01 |
| 37 | 2023 | 5.14 | 19.22 | 14.69 | 0.07 | 0.24 | 6.49 | 5.18 | 19.35 |
| 38 | 2024 | 5.22 | 19.55 | 14.94 | 0.08 | 0.24 | 6.55 | 5.27 | 19.69 |
| 39 | 2025 | 5.31 | 19.89 | 15.19 | 0.08 | 0.25 | 6.61 | 5.35 | 20.02 |
| 40 | 2026 | 5.40 | 20.22 | 15.45 | 0.08 | 0.25 | 6.66 | 5.44 | 20.36 |
| 41 | 2027 | 5.49 | 20.56 | 15.70 | 0.08 | 0.25 | 6.72 | 5.53 | 20.70 |
| 42 | 2028 | 5.57 | 20.89 | 15.96 | 0.08 | 0.26 | 6.78 | 5.62 | 21.03 |
| 43 | 2029 | 5.66 | 21.23 | 16.21 | 0.08 | 0.26 | 6.84 | 5.71 | 21.37 |
| 44 | 2030 | 5.75 | 21.56 | 16.46 | 0.08 | 0.27 | 6.90 | 5.80 | 21.71 |
| 45 | 2031 | 5.85 | 21.96 | 16.76 | 0.09 | 0.27 | 7.12 | 5.90 | 22.10 |
| 46 | 2032 | 5.96 | 22.35 | 17.06 | 0.09 | 0.28 | 7.35 | 6.01 | 22.50 |
| 47 | 2033 | 6.06 | 22.75 | 17.36 | 0.09 | 0.28 | 7.57 | 6.11 | 22.90 |
| 48 | 2034 | 6.17 | 23.14 | 17.66 | 0.09 | 0.29 | 7.80 | 6.22 | 23.30 |
| 49 | 2035 | 6.27 | 23.54 | 17.95 | 0.09 | 0.29 | 8.03 | 6.32 | 23.70 |
| 50 | 2036 | 6.37 | 23.94 | 18.25 | 0.09 | 0.30 | 8.25 | 6.43 | 24.10 |
| 51 | 2037 | 6.48 | 24.33 | 18.55 | 0.09 | 0.30 | 8.48 | 6.53 | 24.49 |
| 52 | 2038 | 6.58 | 24.73 | 18.85 | 0.10 | 0.30 | 8.70 | 6.64 | 24.89 |
| 53 | 2039 | 6.69 | 25.12 | 19.14 | 0.10 | 0.31 | 8.93 | 6.74 | 25.29 |
| 54 | 2040 | 6.79 | 25.52 | 19.44 | 0.10 | 0.31 | 9.15 | 6.85 | 25.69 |
| 55 | TOTAL | 215.80 | 809.71 | 594.74 | 2.95 | 9.50 | 274.93 | 217.55 | 815.08 |
| 56 | **SAVINGS (million $)** | | | | | | | | |
| 57 | After Pre 79 | | | | | | After Pre 90 | | |
| 58 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 59 | **7.3510** | **33.1382** | **-16.0918** | **-0.4267** | **0.2266** | **9.4816** | **8.6835** | **38.4454** | **-41.0313** |

An Example of Output (TOTPV.SUM)

| | W | X | Y | Z | AA | AB | AC | AD | AE |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | After Pre 79 | | | | |
| 4 | NOx | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 5 | 11.730 | 0.050 | 0.176 | 5.846 | 4.389 | 16.717 | 11.764 | 0.055 | 0.168 |
| 6 | 12.049 | 0.054 | 0.185 | 6.048 | 4.445 | 16.875 | 12.127 | 0.061 | 0.177 |
| 7 | 12.088 | 0.059 | 0.195 | 6.178 | 4.575 | 16.931 | 12.258 | 0.067 | 0.187 |
| 8 | 14.068 | 0.071 | 0.229 | 6.418 | 4.719 | 17.488 | 14.312 | 0.081 | 0.220 |
| 9 | 16.634 | 0.084 | 0.271 | 7.019 | 5.555 | 20.630 | 16.950 | 0.096 | 0.260 |
| 10 | 19.641 | 0.100 | 0.320 | 9.287 | 6.548 | 24.343 | 20.064 | 0.115 | 0.306 |
| 11 | | | | | | | | | |
| 12 | | | | | After Pre 79 | | | | |
| 13 | NOx | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 14 | 11.73 | 0.05 | 0.18 | 5.85 | 4.39 | 16.72 | 11.76 | 0.06 | 0.17 |
| 15 | 11.79 | 0.05 | 0.18 | 5.89 | 4.40 | 16.75 | 11.84 | 0.06 | 0.17 |
| 16 | 11.86 | 0.05 | 0.18 | 5.93 | 4.41 | 16.78 | 11.91 | 0.06 | 0.17 |
| 17 | 11.92 | 0.05 | 0.18 | 5.97 | 4.42 | 16.81 | 11.98 | 0.06 | 0.17 |
| 18 | 11.98 | 0.05 | 0.18 | 6.01 | 4.43 | 16.84 | 12.05 | 0.06 | 0.18 |
| 19 | 12.05 | 0.05 | 0.18 | 6.05 | 4.44 | 16.87 | 12.13 | 0.06 | 0.18 |
| 20 | 12.06 | 0.06 | 0.19 | 6.07 | 4.47 | 16.89 | 12.15 | 0.06 | 0.18 |
| 21 | 12.06 | 0.06 | 0.19 | 6.10 | 4.50 | 16.90 | 12.18 | 0.06 | 0.18 |
| 22 | 12.07 | 0.06 | 0.19 | 6.13 | 4.52 | 16.91 | 12.21 | 0.06 | 0.18 |
| 23 | 12.08 | 0.06 | 0.19 | 6.15 | 4.55 | 16.92 | 12.23 | 0.07 | 0.19 |
| 24 | 12.09 | 0.06 | 0.20 | 6.18 | 4.57 | 16.93 | 12.26 | 0.07 | 0.19 |
| 25 | 12.29 | 0.06 | 0.20 | 6.20 | 4.59 | 16.99 | 12.46 | 0.07 | 0.19 |
| 26 | 12.48 | 0.06 | 0.20 | 6.23 | 4.60 | 17.04 | 12.67 | 0.07 | 0.19 |
| 27 | 12.68 | 0.06 | 0.21 | 6.25 | 4.62 | 17.10 | 12.87 | 0.07 | 0.20 |
| 28 | 12.88 | 0.06 | 0.21 | 6.27 | 4.63 | 17.15 | 13.08 | 0.07 | 0.20 |
| 29 | 13.08 | 0.07 | 0.21 | 6.30 | 4.65 | 17.21 | 13.28 | 0.07 | 0.20 |
| 30 | 13.28 | 0.07 | 0.22 | 6.32 | 4.66 | 17.27 | 13.49 | 0.08 | 0.21 |
| 31 | 13.47 | 0.07 | 0.22 | 6.35 | 4.68 | 17.32 | 13.70 | 0.08 | 0.21 |
| 32 | 13.67 | 0.07 | 0.22 | 6.37 | 4.69 | 17.38 | 13.90 | 0.08 | 0.21 |
| 33 | 13.87 | 0.07 | 0.23 | 6.39 | 4.71 | 17.43 | 14.11 | 0.08 | 0.22 |
| 34 | 14.07 | 0.07 | 0.23 | 6.42 | 4.72 | 17.49 | 14.31 | 0.08 | 0.22 |
| 35 | 14.32 | 0.07 | 0.23 | 6.48 | 4.80 | 17.80 | 14.58 | 0.08 | 0.22 |
| 36 | 14.58 | 0.07 | 0.24 | 6.54 | 4.89 | 18.12 | 14.84 | 0.08 | 0.23 |
| 37 | 14.84 | 0.08 | 0.24 | 6.60 | 4.97 | 18.43 | 15.10 | 0.09 | 0.23 |
| 38 | 15.09 | 0.08 | 0.25 | 6.66 | 5.05 | 18.74 | 15.37 | 0.09 | 0.24 |
| 39 | 15.35 | 0.08 | 0.25 | 6.72 | 5.14 | 19.06 | 15.63 | 0.09 | 0.24 |
| 40 | 15.61 | 0.08 | 0.25 | 6.78 | 5.22 | 19.37 | 15.89 | 0.09 | 0.24 |
| 41 | 15.86 | 0.08 | 0.26 | 6.84 | 5.30 | 19.69 | 16.16 | 0.09 | 0.25 |
| 42 | 16.12 | 0.08 | 0.26 | 6.90 | 5.39 | 20.00 | 16.42 | 0.09 | 0.25 |
| 43 | 16.38 | 0.08 | 0.27 | 6.96 | 5.47 | 20.32 | 16.69 | 0.09 | 0.26 |
| 44 | 16.63 | 0.08 | 0.27 | 7.02 | 5.55 | 20.63 | 16.95 | 0.10 | 0.26 |
| 45 | 16.93 | 0.09 | 0.28 | 7.25 | 5.65 | 21.00 | 17.26 | 0.10 | 0.26 |
| 46 | 17.24 | 0.09 | 0.28 | 7.47 | 5.75 | 21.37 | 17.57 | 0.10 | 0.27 |
| 47 | 17.54 | 0.09 | 0.29 | 7.70 | 5.85 | 21.74 | 17.88 | 0.10 | 0.27 |
| 48 | 17.84 | 0.09 | 0.29 | 7.93 | 5.95 | 22.12 | 18.20 | 0.10 | 0.28 |
| 49 | 18.14 | 0.09 | 0.30 | 8.15 | 6.05 | 22.49 | 18.51 | 0.11 | 0.28 |
| 50 | 18.44 | 0.09 | 0.30 | 8.38 | 6.15 | 22.86 | 18.82 | 0.11 | 0.29 |
| 51 | 18.74 | 0.09 | 0.31 | 8.61 | 6.25 | 23.23 | 19.13 | 0.11 | 0.29 |
| 52 | 19.04 | 0.10 | 0.31 | 8.83 | 6.35 | 23.60 | 19.44 | 0.11 | 0.30 |
| 53 | 19.34 | 0.10 | 0.32 | 9.06 | 6.45 | 23.97 | 19.75 | 0.11 | 0.30 |
| 54 | 19.64 | 0.10 | 0.32 | 9.29 | 6.55 | 24.34 | 20.06 | 0.11 | 0.31 |
| 55 | 601.14 | 2.97 | 9.67 | 279.56 | 208.45 | 776.57 | 610.83 | 3.37 | 9.27 |
| 56 | | | | | | | | | |
| 57 | | | | After Acc 110 | | | | | |
| 58 | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM | CO2 |
| 59 | **-0.6043** | **0.1914** | **11.8438** | **34.0841** | **115.5797** | **86.1912** | **-0.0640** | **2.5773** | **74.7254** |

An Example of Output (TOTPV.SUM)

| | AF | AG | AH | AI | AJ | AK | AL | AM | AN |
|---|---|---|---|---|---|---|---|---|---|
| **1** | | | | | | | | | |
| **2** | | | | | | | | | |
| **3** | | After Pre 90 | | | | | | After Acc 110 | |
| **4** | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| **5** | 5.560 | 4.340 | 16.582 | 12.127 | 0.058 | 0.168 | 5.493 | 3.722 | 14.852 |
| **6** | 5.747 | 4.403 | 16.744 | 12.543 | 0.064 | 0.177 | 5.680 | 3.866 | 15.055 |
| **7** | 5.879 | 4.536 | 16.805 | 12.742 | 0.071 | 0.187 | 5.816 | 4.010 | 15.151 |
| **8** | 6.116 | 4.686 | 17.364 | 14.909 | 0.085 | 0.221 | 6.058 | 4.108 | 15.606 |
| **9** | 6.657 | 5.528 | 20.498 | 17.678 | 0.101 | 0.261 | 6.606 | 4.851 | 18.452 |
| **10** | 8.765 | 6.531 | 24.206 | 20.953 | 0.121 | 0.309 | 8.720 | 5.738 | 21.831 |
| **11** | | | | | | | | | |
| **12** | | After Pre 90 | | | | | | After Acc 110 | |
| **13** | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| **14** | 5.56 | 4.34 | 16.58 | 12.13 | 0.06 | 0.17 | 5.49 | 3.72 | 14.85 |
| **15** | 5.60 | 4.35 | 16.61 | 12.21 | 0.06 | 0.17 | 5.53 | 3.75 | 14.89 |
| **16** | 5.64 | 4.37 | 16.65 | 12.29 | 0.06 | 0.17 | 5.57 | 3.78 | 14.93 |
| **17** | 5.67 | 4.38 | 16.68 | 12.38 | 0.06 | 0.17 | 5.61 | 3.81 | 14.97 |
| **18** | 5.71 | 4.39 | 16.71 | 12.46 | 0.06 | 0.18 | 5.64 | 3.84 | 15.01 |
| **19** | 5.75 | 4.40 | 16.74 | 12.54 | 0.06 | 0.18 | 5.68 | 3.87 | 15.06 |
| **20** | 5.77 | 4.43 | 16.76 | 12.58 | 0.07 | 0.18 | 5.71 | 3.90 | 15.07 |
| **21** | 5.80 | 4.46 | 16.77 | 12.62 | 0.07 | 0.18 | 5.73 | 3.92 | 15.09 |
| **22** | 5.83 | 4.48 | 16.78 | 12.66 | 0.07 | 0.18 | 5.76 | 3.95 | 15.11 |
| **23** | 5.85 | 4.51 | 16.79 | 12.70 | 0.07 | 0.19 | 5.79 | 3.98 | 15.13 |
| **24** | 5.88 | 4.54 | 16.80 | 12.74 | 0.07 | 0.19 | 5.82 | 4.01 | 15.15 |
| **25** | 5.90 | 4.55 | 16.86 | 12.96 | 0.07 | 0.19 | 5.84 | 4.02 | 15.20 |
| **26** | 5.93 | 4.57 | 16.92 | 13.18 | 0.07 | 0.19 | 5.86 | 4.03 | 15.24 |
| **27** | 5.95 | 4.58 | 16.97 | 13.39 | 0.07 | 0.20 | 5.89 | 4.04 | 15.29 |
| **28** | 5.97 | 4.60 | 17.03 | 13.61 | 0.08 | 0.20 | 5.91 | 4.05 | 15.33 |
| **29** | 6.00 | 4.61 | 17.08 | 13.83 | 0.08 | 0.20 | 5.94 | 4.06 | 15.38 |
| **30** | 6.02 | 4.63 | 17.14 | 14.04 | 0.08 | 0.21 | 5.96 | 4.07 | 15.42 |
| **31** | 6.04 | 4.64 | 17.20 | 14.26 | 0.08 | 0.21 | 5.99 | 4.08 | 15.47 |
| **32** | 6.07 | 4.66 | 17.25 | 14.48 | 0.08 | 0.21 | 6.01 | 4.09 | 15.52 |
| **33** | 6.09 | 4.67 | 17.31 | 14.69 | 0.08 | 0.22 | 6.03 | 4.10 | 15.56 |
| **34** | 6.12 | 4.69 | 17.36 | 14.91 | 0.08 | 0.22 | 6.06 | 4.11 | 15.61 |
| **35** | 6.17 | 4.77 | 17.68 | 15.19 | 0.09 | 0.22 | 6.11 | 4.18 | 15.89 |
| **36** | 6.22 | 4.85 | 17.99 | 15.46 | 0.09 | 0.23 | 6.17 | 4.26 | 16.18 |
| **37** | 6.28 | 4.94 | 18.30 | 15.74 | 0.09 | 0.23 | 6.22 | 4.33 | 16.46 |
| **38** | 6.33 | 5.02 | 18.62 | 16.02 | 0.09 | 0.24 | 6.28 | 4.41 | 16.74 |
| **39** | 6.39 | 5.11 | 18.93 | 16.29 | 0.09 | 0.24 | 6.33 | 4.48 | 17.03 |
| **40** | 6.44 | 5.19 | 19.24 | 16.57 | 0.09 | 0.24 | 6.39 | 4.55 | 17.31 |
| **41** | 6.50 | 5.28 | 19.56 | 16.85 | 0.10 | 0.25 | 6.44 | 4.63 | 17.60 |
| **42** | 6.55 | 5.36 | 19.87 | 17.12 | 0.10 | 0.25 | 6.50 | 4.70 | 17.88 |
| **43** | 6.60 | 5.44 | 20.19 | 17.40 | 0.10 | 0.26 | 6.55 | 4.78 | 18.17 |
| **44** | 6.66 | 5.53 | 20.50 | 17.68 | 0.10 | 0.26 | 6.61 | 4.85 | 18.45 |
| **45** | 6.87 | 5.63 | 20.87 | 18.01 | 0.10 | 0.27 | 6.82 | 4.94 | 18.79 |
| **46** | 7.08 | 5.73 | 21.24 | 18.33 | 0.11 | 0.27 | 7.03 | 5.03 | 19.13 |
| **47** | 7.29 | 5.83 | 21.61 | 18.66 | 0.11 | 0.28 | 7.24 | 5.12 | 19.47 |
| **48** | 7.50 | 5.93 | 21.98 | 18.99 | 0.11 | 0.28 | 7.45 | 5.21 | 19.80 |
| **49** | 7.71 | 6.03 | 22.35 | 19.32 | 0.11 | 0.28 | 7.66 | 5.29 | 20.14 |
| **50** | 7.92 | 6.13 | 22.72 | 19.64 | 0.11 | 0.29 | 7.87 | 5.38 | 20.48 |
| **51** | 8.13 | 6.23 | 23.09 | 19.97 | 0.12 | 0.29 | 8.09 | 5.47 | 20.82 |
| **52** | 8.34 | 6.33 | 23.46 | 20.30 | 0.12 | 0.30 | 8.30 | 5.56 | 21.16 |
| **53** | 8.55 | 6.43 | 23.84 | 20.63 | 0.12 | 0.30 | 8.51 | 5.65 | 21.49 |
| **54** | 8.77 | 6.53 | 24.21 | 20.95 | 0.12 | 0.31 | 8.72 | 5.74 | 21.83 |
| **55** | 265.45 | 207.12 | 771.26 | 635.77 | 3.55 | 9.31 | 263.09 | 181.72 | 694.13 |
| **56** | | | | | | | | | |
| **57** | After Acc 125E | | | | | | After Acc 125NE | | |
| **58** | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| **59** | **18.3707** | **54.4222** | **53.2138** | **-0.9545** | **0.3794** | **14.8512** | **15.2144** | **52.5795** | **2.3071** |

An Example of Output (TOTPV.SUM)

| | AO | AP | AQ | AR | AS | AT | AU | AV | AW |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | After Acc 125E | | | | |
| 4 | NOx | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 5 | 9.542 | 0.049 | 0.115 | 3.996 | 4.161 | 16.264 | 10.720 | 0.092 | 0.167 |
| 6 | 9.807 | 0.054 | 0.125 | 4.164 | 4.222 | 16.417 | 10.944 | 0.094 | 0.175 |
| 7 | 10.033 | 0.059 | 0.136 | 4.362 | 4.341 | 16.468 | 10.944 | 0.094 | 0.185 |
| 8 | 12.004 | 0.072 | 0.166 | 4.634 | 4.462 | 17.000 | 12.712 | 0.096 | 0.217 |
| 9 | 14.249 | 0.086 | 0.198 | 5.008 | 5.256 | 20.062 | 14.912 | 0.095 | 0.254 |
| 10 | 16.929 | 0.103 | 0.235 | 6.957 | 6.200 | 23.687 | 17.513 | 0.099 | 0.299 |
| 11 | | | | | | | | | |
| 12 | | | | | After Acc 125E | | | | |
| 13 | NOx | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 14 | 9.54 | 0.05 | 0.11 | 4.00 | 4.16 | 16.26 | 10.72 | 0.09 | 0.17 |
| 15 | 9.60 | 0.05 | 0.12 | 4.03 | 4.17 | 16.29 | 10.76 | 0.09 | 0.17 |
| 16 | 9.65 | 0.05 | 0.12 | 4.06 | 4.19 | 16.33 | 10.81 | 0.09 | 0.17 |
| 17 | 9.70 | 0.05 | 0.12 | 4.10 | 4.20 | 16.36 | 10.85 | 0.09 | 0.17 |
| 18 | 9.75 | 0.05 | 0.12 | 4.13 | 4.21 | 16.39 | 10.90 | 0.09 | 0.17 |
| 19 | 9.81 | 0.05 | 0.12 | 4.16 | 4.22 | 16.42 | 10.94 | 0.09 | 0.18 |
| 20 | 9.85 | 0.05 | 0.13 | 4.20 | 4.25 | 16.43 | 10.94 | 0.09 | 0.18 |
| 21 | 9.90 | 0.06 | 0.13 | 4.24 | 4.27 | 16.44 | 10.94 | 0.09 | 0.18 |
| 22 | 9.94 | 0.06 | 0.13 | 4.28 | 4.29 | 16.45 | 10.94 | 0.09 | 0.18 |
| 23 | 9.99 | 0.06 | 0.13 | 4.32 | 4.32 | 16.46 | 10.94 | 0.09 | 0.18 |
| 24 | 10.03 | 0.06 | 0.14 | 4.36 | 4.34 | 16.47 | 10.94 | 0.09 | 0.18 |
| 25 | 10.23 | 0.06 | 0.14 | 4.39 | 4.35 | 16.52 | 11.12 | 0.09 | 0.19 |
| 26 | 10.43 | 0.06 | 0.14 | 4.42 | 4.37 | 16.57 | 11.30 | 0.09 | 0.19 |
| 27 | 10.62 | 0.06 | 0.15 | 4.44 | 4.38 | 16.63 | 11.47 | 0.09 | 0.19 |
| 28 | 10.82 | 0.06 | 0.15 | 4.47 | 4.39 | 16.68 | 11.65 | 0.09 | 0.20 |
| 29 | 11.02 | 0.07 | 0.15 | 4.50 | 4.40 | 16.73 | 11.83 | 0.09 | 0.20 |
| 30 | 11.22 | 0.07 | 0.15 | 4.53 | 4.41 | 16.79 | 12.00 | 0.10 | 0.20 |
| 31 | 11.41 | 0.07 | 0.16 | 4.55 | 4.43 | 16.84 | 12.18 | 0.10 | 0.21 |
| 32 | 11.61 | 0.07 | 0.16 | 4.58 | 4.44 | 16.89 | 12.36 | 0.10 | 0.21 |
| 33 | 11.81 | 0.07 | 0.16 | 4.61 | 4.45 | 16.95 | 12.54 | 0.10 | 0.21 |
| 34 | 12.00 | 0.07 | 0.17 | 4.63 | 4.46 | 17.00 | 12.71 | 0.10 | 0.22 |
| 35 | 12.23 | 0.07 | 0.17 | 4.67 | 4.54 | 17.31 | 12.93 | 0.10 | 0.22 |
| 36 | 12.45 | 0.08 | 0.17 | 4.71 | 4.62 | 17.61 | 13.15 | 0.10 | 0.22 |
| 37 | 12.68 | 0.08 | 0.18 | 4.75 | 4.70 | 17.92 | 13.37 | 0.10 | 0.23 |
| 38 | 12.90 | 0.08 | 0.18 | 4.78 | 4.78 | 18.22 | 13.59 | 0.10 | 0.23 |
| 39 | 13.13 | 0.08 | 0.18 | 4.82 | 4.86 | 18.53 | 13.81 | 0.10 | 0.24 |
| 40 | 13.35 | 0.08 | 0.18 | 4.86 | 4.94 | 18.84 | 14.03 | 0.10 | 0.24 |
| 41 | 13.58 | 0.08 | 0.19 | 4.90 | 5.02 | 19.14 | 14.25 | 0.10 | 0.24 |
| 42 | 13.80 | 0.08 | 0.19 | 4.93 | 5.10 | 19.45 | 14.47 | 0.10 | 0.25 |
| 43 | 14.02 | 0.08 | 0.19 | 4.97 | 5.18 | 19.76 | 14.69 | 0.10 | 0.25 |
| 44 | 14.25 | 0.09 | 0.20 | 5.01 | 5.26 | 20.06 | 14.91 | 0.10 | 0.25 |
| 45 | 14.52 | 0.09 | 0.20 | 5.20 | 5.35 | 20.42 | 15.17 | 0.10 | 0.26 |
| 46 | 14.79 | 0.09 | 0.21 | 5.40 | 5.45 | 20.79 | 15.43 | 0.10 | 0.26 |
| 47 | 15.05 | 0.09 | 0.21 | 5.59 | 5.54 | 21.15 | 15.69 | 0.10 | 0.27 |
| 48 | 15.32 | 0.09 | 0.21 | 5.79 | 5.63 | 21.51 | 15.95 | 0.10 | 0.27 |
| 49 | 15.59 | 0.09 | 0.22 | 5.98 | 5.73 | 21.87 | 16.21 | 0.10 | 0.28 |
| 50 | 15.86 | 0.10 | 0.22 | 6.18 | 5.82 | 22.24 | 16.47 | 0.10 | 0.28 |
| 51 | 16.13 | 0.10 | 0.22 | 6.37 | 5.92 | 22.60 | 16.73 | 0.10 | 0.29 |
| 52 | 16.39 | 0.10 | 0.23 | 6.57 | 6.01 | 22.96 | 16.99 | 0.10 | 0.29 |
| 53 | 16.66 | 0.10 | 0.23 | 6.76 | 6.11 | 23.32 | 17.25 | 0.10 | 0.29 |
| 54 | 16.93 | 0.10 | 0.24 | 6.96 | 6.20 | 23.69 | 17.51 | 0.10 | 0.30 |
| 55 | 508.55 | 3.01 | 6.92 | 200.21 | 197.43 | 755.29 | 541.53 | 3.90 | 9.12 |
| 56 | | | | | | | | | |
| 57 | | | | After Maglev | | | | | |
| 58 | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM | CO2 |
| 59 | **-0.3329** | **0.6515** | **20.2361** | **25.8137** | **79.1594** | **67.4353** | **-3.2906** | **-0.4347** | **3.7560** |

An Example of Output (TOTPV.SUM)

| | AX | AY | AZ | BA | BB | BC | BD | BE | BF |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | After Acc 125NE | | | | | | After Maglev | |
| 4 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| 5 | 5.396 | 4.212 | 16.298 | 11.416 | 0.054 | 0.160 | 5.315 | 3.997 | 15.777 |
| 6 | 5.582 | 4.278 | 16.452 | 11.753 | 0.059 | 0.168 | 5.495 | 4.085 | 15.949 |
| 7 | 5.728 | 4.403 | 16.505 | 11.886 | 0.065 | 0.178 | 5.633 | 4.207 | 16.016 |
| 8 | 6.000 | 4.536 | 17.042 | 13.901 | 0.079 | 0.210 | 5.870 | 4.335 | 16.563 |
| 9 | 6.543 | 5.347 | 20.114 | 16.438 | 0.093 | 0.248 | 6.384 | 5.117 | 19.578 |
| 10 | 8.654 | 6.311 | 23.749 | 19.436 | 0.111 | 0.293 | 8.452 | 6.046 | 23.148 |
| 11 | | | | | | | | | |
| 12 | | After Acc 125NE | | | | | | After Maglev | |
| 13 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| 14 | 5.40 | 4.21 | 16.30 | 11.42 | 0.05 | 0.16 | 5.32 | 4.00 | 15.78 |
| 15 | 5.43 | 4.23 | 16.33 | 11.48 | 0.06 | 0.16 | 5.35 | 4.01 | 15.81 |
| 16 | 5.47 | 4.24 | 16.36 | 11.55 | 0.06 | 0.16 | 5.39 | 4.03 | 15.85 |
| 17 | 5.51 | 4.25 | 16.39 | 11.62 | 0.06 | 0.16 | 5.42 | 4.05 | 15.88 |
| 18 | 5.55 | 4.26 | 16.42 | 11.69 | 0.06 | 0.17 | 5.46 | 4.07 | 15.91 |
| 19 | 5.58 | 4.28 | 16.45 | 11.75 | 0.06 | 0.17 | 5.49 | 4.08 | 15.95 |
| 20 | 5.61 | 4.30 | 16.46 | 11.78 | 0.06 | 0.17 | 5.52 | 4.11 | 15.96 |
| 21 | 5.64 | 4.33 | 16.47 | 11.81 | 0.06 | 0.17 | 5.55 | 4.13 | 15.98 |
| 22 | 5.67 | 4.35 | 16.48 | 11.83 | 0.06 | 0.17 | 5.58 | 4.16 | 15.99 |
| 23 | 5.70 | 4.38 | 16.49 | 11.86 | 0.06 | 0.18 | 5.61 | 4.18 | 16.00 |
| 24 | 5.73 | 4.40 | 16.51 | 11.89 | 0.07 | 0.18 | 5.63 | 4.21 | 16.02 |
| 25 | 5.75 | 4.42 | 16.56 | 12.09 | 0.07 | 0.18 | 5.66 | 4.22 | 16.07 |
| 26 | 5.78 | 4.43 | 16.61 | 12.29 | 0.07 | 0.18 | 5.68 | 4.23 | 16.13 |
| 27 | 5.81 | 4.44 | 16.67 | 12.49 | 0.07 | 0.19 | 5.70 | 4.25 | 16.18 |
| 28 | 5.84 | 4.46 | 16.72 | 12.69 | 0.07 | 0.19 | 5.73 | 4.26 | 16.23 |
| 29 | 5.86 | 4.47 | 16.77 | 12.89 | 0.07 | 0.19 | 5.75 | 4.27 | 16.29 |
| 30 | 5.89 | 4.48 | 16.83 | 13.09 | 0.07 | 0.20 | 5.78 | 4.28 | 16.34 |
| 31 | 5.92 | 4.50 | 16.88 | 13.30 | 0.07 | 0.20 | 5.80 | 4.30 | 16.40 |
| 32 | 5.95 | 4.51 | 16.93 | 13.50 | 0.08 | 0.20 | 5.82 | 4.31 | 16.45 |
| 33 | 5.97 | 4.52 | 16.99 | 13.70 | 0.08 | 0.21 | 5.85 | 4.32 | 16.51 |
| 34 | 6.00 | 4.54 | 17.04 | 13.90 | 0.08 | 0.21 | 5.87 | 4.33 | 16.56 |
| 35 | 6.05 | 4.62 | 17.35 | 14.15 | 0.08 | 0.21 | 5.92 | 4.41 | 16.86 |
| 36 | 6.11 | 4.70 | 17.66 | 14.41 | 0.08 | 0.22 | 5.97 | 4.49 | 17.17 |
| 37 | 6.16 | 4.78 | 17.96 | 14.66 | 0.08 | 0.22 | 6.02 | 4.57 | 17.47 |
| 38 | 6.22 | 4.86 | 18.27 | 14.92 | 0.08 | 0.23 | 6.08 | 4.65 | 17.77 |
| 39 | 6.27 | 4.94 | 18.58 | 15.17 | 0.09 | 0.23 | 6.13 | 4.73 | 18.07 |
| 40 | 6.33 | 5.02 | 18.89 | 15.42 | 0.09 | 0.23 | 6.18 | 4.80 | 18.37 |
| 41 | 6.38 | 5.10 | 19.19 | 15.68 | 0.09 | 0.24 | 6.23 | 4.88 | 18.67 |
| 42 | 6.43 | 5.18 | 19.50 | 15.93 | 0.09 | 0.24 | 6.28 | 4.96 | 18.98 |
| 43 | 6.49 | 5.27 | 19.81 | 16.18 | 0.09 | 0.24 | 6.33 | 5.04 | 19.28 |
| 44 | 6.54 | 5.35 | 20.11 | 16.44 | 0.09 | 0.25 | 6.38 | 5.12 | 19.58 |
| 45 | 6.75 | 5.44 | 20.48 | 16.74 | 0.10 | 0.25 | 6.59 | 5.21 | 19.94 |
| 46 | 6.97 | 5.54 | 20.84 | 17.04 | 0.10 | 0.26 | 6.80 | 5.30 | 20.29 |
| 47 | 7.18 | 5.64 | 21.20 | 17.34 | 0.10 | 0.26 | 7.00 | 5.40 | 20.65 |
| 48 | 7.39 | 5.73 | 21.57 | 17.64 | 0.10 | 0.27 | 7.21 | 5.49 | 21.01 |
| 49 | 7.60 | 5.83 | 21.93 | 17.94 | 0.10 | 0.27 | 7.42 | 5.58 | 21.36 |
| 50 | 7.81 | 5.93 | 22.30 | 18.24 | 0.10 | 0.27 | 7.62 | 5.67 | 21.72 |
| 51 | 8.02 | 6.02 | 22.66 | 18.54 | 0.11 | 0.28 | 7.83 | 5.77 | 22.08 |
| 52 | 8.23 | 6.12 | 23.02 | 18.84 | 0.11 | 0.28 | 8.04 | 5.86 | 22.43 |
| 53 | 8.44 | 6.21 | 23.39 | 19.14 | 0.11 | 0.29 | 8.25 | 5.95 | 22.79 |
| 54 | 8.65 | 6.31 | 23.75 | 19.44 | 0.11 | 0.29 | 8.45 | 6.05 | 23.15 |
| 55 | 260.08 | 200.59 | 757.13 | 592.43 | 3.28 | 8.85 | 254.70 | 191.74 | 735.93 |
| 56 | | | | | | | | | |
| 57 | After TGV | | | | | | After Acc 150E | | |
| 58 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 59 | **22.4335** | **70.9951** | **69.0763** | **-1.5889** | **0.3807** | **19.4069** | **19.3300** | **58.8314** | **57.4959** |

An Example of Output (TOTPV.SUM)

| | BG | BH | BI | BJ | BK | BL | BM | BN | BO |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | After TGV | | | | |
| 4 | NOx | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 5 | 10.604 | 0.185 | 0.185 | 5.527 | 4.143 | 16.075 | 10.566 | 0.116 | 0.170 |
| 6 | 10.802 | 0.179 | 0.196 | 5.760 | 4.200 | 16.214 | 10.764 | 0.117 | 0.179 |
| 7 | 10.823 | 0.170 | 0.206 | 5.979 | 4.305 | 16.248 | 10.771 | 0.115 | 0.189 |
| 8 | 12.568 | 0.155 | 0.241 | 6.402 | 4.408 | 16.749 | 12.513 | 0.113 | 0.221 |
| 9 | 14.658 | 0.133 | 0.280 | 7.050 | 5.180 | 19.742 | 14.632 | 0.106 | 0.258 |
| 10 | 17.172 | 0.119 | 0.328 | 9.285 | 6.095 | 23.277 | 17.147 | 0.104 | 0.303 |
| 11 | | | | | | | | | |
| 12 | | | | | After TGV | | | | |
| 13 | NOx | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 14 | 10.60 | 0.18 | 0.18 | 5.53 | 4.14 | 16.08 | 10.57 | 0.12 | 0.17 |
| 15 | 10.64 | 0.18 | 0.19 | 5.57 | 4.15 | 16.10 | 10.61 | 0.12 | 0.17 |
| 16 | 10.68 | 0.18 | 0.19 | 5.62 | 4.17 | 16.13 | 10.65 | 0.12 | 0.17 |
| 17 | 10.72 | 0.18 | 0.19 | 5.67 | 4.18 | 16.16 | 10.69 | 0.12 | 0.18 |
| 18 | 10.76 | 0.18 | 0.19 | 5.71 | 4.19 | 16.19 | 10.72 | 0.12 | 0.18 |
| 19 | 10.80 | 0.18 | 0.20 | 5.76 | 4.20 | 16.21 | 10.76 | 0.12 | 0.18 |
| 20 | 10.81 | 0.18 | 0.20 | 5.80 | 4.22 | 16.22 | 10.77 | 0.12 | 0.18 |
| 21 | 10.81 | 0.18 | 0.20 | 5.85 | 4.24 | 16.23 | 10.77 | 0.12 | 0.18 |
| 22 | 10.81 | 0.17 | 0.20 | 5.89 | 4.26 | 16.23 | 10.77 | 0.12 | 0.19 |
| 23 | 10.82 | 0.17 | 0.20 | 5.94 | 4.28 | 16.24 | 10.77 | 0.12 | 0.19 |
| 24 | 10.82 | 0.17 | 0.21 | 5.98 | 4.30 | 16.25 | 10.77 | 0.11 | 0.19 |
| 25 | 11.00 | 0.17 | 0.21 | 6.02 | 4.32 | 16.30 | 10.95 | 0.11 | 0.19 |
| 26 | 11.17 | 0.17 | 0.21 | 6.06 | 4.33 | 16.35 | 11.12 | 0.11 | 0.20 |
| 27 | 11.35 | 0.17 | 0.22 | 6.11 | 4.34 | 16.40 | 11.29 | 0.11 | 0.20 |
| 28 | 11.52 | 0.16 | 0.22 | 6.15 | 4.35 | 16.45 | 11.47 | 0.11 | 0.20 |
| 29 | 11.70 | 0.16 | 0.22 | 6.19 | 4.36 | 16.50 | 11.64 | 0.11 | 0.21 |
| 30 | 11.87 | 0.16 | 0.23 | 6.23 | 4.37 | 16.55 | 11.82 | 0.11 | 0.21 |
| 31 | 12.04 | 0.16 | 0.23 | 6.28 | 4.38 | 16.60 | 11.99 | 0.11 | 0.21 |
| 32 | 12.22 | 0.16 | 0.23 | 6.32 | 4.39 | 16.65 | 12.16 | 0.11 | 0.21 |
| 33 | 12.39 | 0.16 | 0.24 | 6.36 | 4.40 | 16.70 | 12.34 | 0.11 | 0.22 |
| 34 | 12.57 | 0.16 | 0.24 | 6.40 | 4.41 | 16.75 | 12.51 | 0.11 | 0.22 |
| 35 | 12.78 | 0.15 | 0.25 | 6.47 | 4.49 | 17.05 | 12.73 | 0.11 | 0.23 |
| 36 | 12.99 | 0.15 | 0.25 | 6.53 | 4.56 | 17.35 | 12.94 | 0.11 | 0.23 |
| 37 | 13.19 | 0.15 | 0.25 | 6.60 | 4.64 | 17.65 | 13.15 | 0.11 | 0.23 |
| 38 | 13.40 | 0.15 | 0.26 | 6.66 | 4.72 | 17.95 | 13.36 | 0.11 | 0.24 |
| 39 | 13.61 | 0.14 | 0.26 | 6.73 | 4.79 | 18.25 | 13.57 | 0.11 | 0.24 |
| 40 | 13.82 | 0.14 | 0.26 | 6.79 | 4.87 | 18.54 | 13.78 | 0.11 | 0.24 |
| 41 | 14.03 | 0.14 | 0.27 | 6.86 | 4.95 | 18.84 | 14.00 | 0.11 | 0.25 |
| 42 | 14.24 | 0.14 | 0.27 | 6.92 | 5.03 | 19.14 | 14.21 | 0.11 | 0.25 |
| 43 | 14.45 | 0.13 | 0.28 | 6.99 | 5.10 | 19.44 | 14.42 | 0.11 | 0.25 |
| 44 | 14.66 | 0.13 | 0.28 | 7.05 | 5.18 | 19.74 | 14.63 | 0.11 | 0.26 |
| 45 | 14.91 | 0.13 | 0.29 | 7.27 | 5.27 | 20.10 | 14.88 | 0.11 | 0.26 |
| 46 | 15.16 | 0.13 | 0.29 | 7.50 | 5.36 | 20.45 | 15.13 | 0.11 | 0.27 |
| 47 | 15.41 | 0.13 | 0.29 | 7.72 | 5.45 | 20.80 | 15.39 | 0.11 | 0.27 |
| 48 | 15.66 | 0.13 | 0.30 | 7.94 | 5.55 | 21.16 | 15.64 | 0.11 | 0.28 |
| 49 | 15.92 | 0.13 | 0.30 | 8.17 | 5.64 | 21.51 | 15.89 | 0.11 | 0.28 |
| 50 | 16.17 | 0.12 | 0.31 | 8.39 | 5.73 | 21.86 | 16.14 | 0.10 | 0.29 |
| 51 | 16.42 | 0.12 | 0.31 | 8.61 | 5.82 | 22.22 | 16.39 | 0.10 | 0.29 |
| 52 | 16.67 | 0.12 | 0.32 | 8.84 | 5.91 | 22.57 | 16.64 | 0.10 | 0.29 |
| 53 | 16.92 | 0.12 | 0.32 | 9.06 | 6.00 | 22.92 | 16.90 | 0.10 | 0.30 |
| 54 | 17.17 | 0.12 | 0.33 | 9.28 | 6.10 | 23.28 | 17.15 | 0.10 | 0.30 |
| 55 | 533.70 | 6.26 | 10.10 | 275.81 | 195.12 | 744.09 | 532.06 | 4.56 | 9.29 |
| 56 | | | | | | | | | |
| 57 | | | | After Acc 150NE | | | | | |
| 58 | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM | CO2 |
| 59 | **-0.9450** | **0.4837** | **17.8769** | **15.3088** | **54.8371** | **-19.1462** | **-0.6130** | **0.4195** | **17.7759** |

An Example of Output (TOTPV.SUM)

| | BP | BQ | BR | BS | BT | BU | BV | BW | BX |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | After Acc 150E | | | | | | After Acc 150NE | |
| 4 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| 5 | 5.360 | 4.137 | 16.167 | 10.631 | 0.092 | 0.165 | 5.330 | 4.201 | 16.236 |
| 6 | 5.549 | 4.200 | 16.321 | 10.850 | 0.094 | 0.173 | 5.514 | 4.271 | 16.395 |
| 7 | 5.711 | 4.319 | 16.373 | 10.853 | 0.094 | 0.183 | 5.660 | 4.399 | 16.452 |
| 8 | 6.016 | 4.441 | 16.901 | 12.616 | 0.096 | 0.214 | 5.932 | 4.536 | 16.993 |
| 9 | 6.564 | 5.232 | 19.947 | 14.798 | 0.095 | 0.251 | 6.465 | 5.348 | 20.060 |
| 10 | 8.671 | 6.171 | 23.546 | 17.376 | 0.098 | 0.295 | 8.560 | 6.312 | 23.685 |
| 11 | | | | | | | | | |
| 12 | | After Acc 150E | | | | | | After Acc 150NE | |
| 13 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| 14 | 5.36 | 4.14 | 16.17 | 10.63 | 0.09 | 0.16 | 5.33 | 4.20 | 16.24 |
| 15 | 5.40 | 4.15 | 16.20 | 10.67 | 0.09 | 0.17 | 5.37 | 4.21 | 16.27 |
| 16 | 5.44 | 4.16 | 16.23 | 10.72 | 0.09 | 0.17 | 5.40 | 4.23 | 16.30 |
| 17 | 5.47 | 4.17 | 16.26 | 10.76 | 0.09 | 0.17 | 5.44 | 4.24 | 16.33 |
| 18 | 5.51 | 4.19 | 16.29 | 10.81 | 0.09 | 0.17 | 5.48 | 4.26 | 16.36 |
| 19 | 5.55 | 4.20 | 16.32 | 10.85 | 0.09 | 0.17 | 5.51 | 4.27 | 16.39 |
| 20 | 5.58 | 4.22 | 16.33 | 10.85 | 0.09 | 0.18 | 5.54 | 4.30 | 16.41 |
| 21 | 5.61 | 4.25 | 16.34 | 10.85 | 0.09 | 0.18 | 5.57 | 4.32 | 16.42 |
| 22 | 5.65 | 4.27 | 16.35 | 10.85 | 0.09 | 0.18 | 5.60 | 4.35 | 16.43 |
| 23 | 5.68 | 4.30 | 16.36 | 10.85 | 0.09 | 0.18 | 5.63 | 4.37 | 16.44 |
| 24 | 5.71 | 4.32 | 16.37 | 10.85 | 0.09 | 0.18 | 5.66 | 4.40 | 16.45 |
| 25 | 5.74 | 4.33 | 16.43 | 11.03 | 0.09 | 0.19 | 5.69 | 4.41 | 16.51 |
| 26 | 5.77 | 4.34 | 16.48 | 11.21 | 0.09 | 0.19 | 5.71 | 4.43 | 16.56 |
| 27 | 5.80 | 4.36 | 16.53 | 11.38 | 0.09 | 0.19 | 5.74 | 4.44 | 16.61 |
| 28 | 5.83 | 4.37 | 16.58 | 11.56 | 0.09 | 0.20 | 5.77 | 4.45 | 16.67 |
| 29 | 5.86 | 4.38 | 16.64 | 11.73 | 0.09 | 0.20 | 5.80 | 4.47 | 16.72 |
| 30 | 5.89 | 4.39 | 16.69 | 11.91 | 0.09 | 0.20 | 5.82 | 4.48 | 16.78 |
| 31 | 5.92 | 4.40 | 16.74 | 12.09 | 0.10 | 0.20 | 5.85 | 4.49 | 16.83 |
| 32 | 5.96 | 4.42 | 16.80 | 12.26 | 0.10 | 0.21 | 5.88 | 4.51 | 16.89 |
| 33 | 5.99 | 4.43 | 16.85 | 12.44 | 0.10 | 0.21 | 5.90 | 4.52 | 16.94 |
| 34 | 6.02 | 4.44 | 16.90 | 12.62 | 0.10 | 0.21 | 5.93 | 4.54 | 16.99 |
| 35 | 6.07 | 4.52 | 17.21 | 12.83 | 0.10 | 0.22 | 5.99 | 4.62 | 17.30 |
| 36 | 6.13 | 4.60 | 17.51 | 13.05 | 0.10 | 0.22 | 6.04 | 4.70 | 17.61 |
| 37 | 6.18 | 4.68 | 17.81 | 13.27 | 0.10 | 0.23 | 6.09 | 4.78 | 17.91 |
| 38 | 6.24 | 4.76 | 18.12 | 13.49 | 0.10 | 0.23 | 6.15 | 4.86 | 18.22 |
| 39 | 6.29 | 4.84 | 18.42 | 13.71 | 0.10 | 0.23 | 6.20 | 4.94 | 18.53 |
| 40 | 6.35 | 4.92 | 18.73 | 13.93 | 0.10 | 0.24 | 6.25 | 5.02 | 18.83 |
| 41 | 6.40 | 4.99 | 19.03 | 14.14 | 0.10 | 0.24 | 6.30 | 5.10 | 19.14 |
| 42 | 6.45 | 5.07 | 19.34 | 14.36 | 0.09 | 0.24 | 6.36 | 5.19 | 19.45 |
| 43 | 6.51 | 5.15 | 19.64 | 14.58 | 0.09 | 0.25 | 6.41 | 5.27 | 19.75 |
| 44 | 6.56 | 5.23 | 19.95 | 14.80 | 0.09 | 0.25 | 6.46 | 5.35 | 20.06 |
| 45 | 6.78 | 5.33 | 20.31 | 15.06 | 0.10 | 0.26 | 6.67 | 5.44 | 20.42 |
| 46 | 6.99 | 5.42 | 20.67 | 15.31 | 0.10 | 0.26 | 6.88 | 5.54 | 20.78 |
| 47 | 7.20 | 5.51 | 21.03 | 15.57 | 0.10 | 0.26 | 7.09 | 5.64 | 21.15 |
| 48 | 7.41 | 5.61 | 21.39 | 15.83 | 0.10 | 0.27 | 7.30 | 5.73 | 21.51 |
| 49 | 7.62 | 5.70 | 21.75 | 16.09 | 0.10 | 0.27 | 7.51 | 5.83 | 21.87 |
| 50 | 7.83 | 5.80 | 22.11 | 16.34 | 0.10 | 0.28 | 7.72 | 5.93 | 22.23 |
| 51 | 8.04 | 5.89 | 22.47 | 16.60 | 0.10 | 0.28 | 7.93 | 6.02 | 22.60 |
| 52 | 8.25 | 5.98 | 22.83 | 16.86 | 0.10 | 0.29 | 8.14 | 6.12 | 22.96 |
| 53 | 8.46 | 6.08 | 23.19 | 17.12 | 0.10 | 0.29 | 8.35 | 6.22 | 23.32 |
| 54 | 8.67 | 6.17 | 23.55 | 17.38 | 0.10 | 0.30 | 8.56 | 6.31 | 23.68 |
| 55 | 260.16 | 196.47 | 750.88 | 537.25 | 3.89 | 9.02 | 257.06 | 200.49 | 754.87 |
| 56 | | | | | | | | | |
| 57 | | | | | | | | | |
| 58 | | | | | | | | | |
| 59 | | | | | | | | | |

An Example of Output (TOTPV.SUM)

| | BY | BZ | CA | CB |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | NOx | SOx | PTM | CO2 |
| 5 | 11.742 | 0.059 | 0.163 | 5.336 |
| 6 | 12.120 | 0.064 | 0.172 | 5.523 |
| 7 | 12.307 | 0.071 | 0.183 | 5.675 |
| 8 | 14.413 | 0.085 | 0.216 | 5.932 |
| 9 | 17.061 | 0.101 | 0.255 | 6.463 |
| 10 | 20.187 | 0.121 | 0.301 | 8.549 |
| 11 | | | | |
| 12 | | | | |
| 13 | NOx | SOx | PTM | CO2 |
| 14 | 11.74 | 0.06 | 0.16 | 5.34 |
| 15 | 11.82 | 0.06 | 0.16 | 5.37 |
| 16 | 11.89 | 0.06 | 0.17 | 5.41 |
| 17 | 11.97 | 0.06 | 0.17 | 5.45 |
| 18 | 12.04 | 0.06 | 0.17 | 5.49 |
| 19 | 12.12 | 0.06 | 0.17 | 5.52 |
| 20 | 12.16 | 0.07 | 0.17 | 5.55 |
| 21 | 12.19 | 0.07 | 0.18 | 5.58 |
| 22 | 12.23 | 0.07 | 0.18 | 5.61 |
| 23 | 12.27 | 0.07 | 0.18 | 5.64 |
| 24 | 12.31 | 0.07 | 0.18 | 5.67 |
| 25 | 12.52 | 0.07 | 0.19 | 5.70 |
| 26 | 12.73 | 0.07 | 0.19 | 5.73 |
| 27 | 12.94 | 0.08 | 0.19 | 5.75 |
| 28 | 13.15 | 0.08 | 0.20 | 5.78 |
| 29 | 13.36 | 0.08 | 0.20 | 5.80 |
| 30 | 13.57 | 0.08 | 0.20 | 5.83 |
| 31 | 13.78 | 0.08 | 0.21 | 5.85 |
| 32 | 13.99 | 0.08 | 0.21 | 5.88 |
| 33 | 14.20 | 0.08 | 0.21 | 5.91 |
| 34 | 14.41 | 0.09 | 0.22 | 5.93 |
| 35 | 14.68 | 0.09 | 0.22 | 5.99 |
| 36 | 14.94 | 0.09 | 0.22 | 6.04 |
| 37 | 15.21 | 0.09 | 0.23 | 6.09 |
| 38 | 15.47 | 0.09 | 0.23 | 6.14 |
| 39 | 15.74 | 0.09 | 0.24 | 6.20 |
| 40 | 16.00 | 0.09 | 0.24 | 6.25 |
| 41 | 16.27 | 0.10 | 0.24 | 6.30 |
| 42 | 16.53 | 0.10 | 0.25 | 6.36 |
| 43 | 16.80 | 0.10 | 0.25 | 6.41 |
| 44 | 17.06 | 0.10 | 0.25 | 6.46 |
| 45 | 17.37 | 0.10 | 0.26 | 6.67 |
| 46 | 17.69 | 0.11 | 0.26 | 6.88 |
| 47 | 18.00 | 0.11 | 0.27 | 7.09 |
| 48 | 18.31 | 0.11 | 0.27 | 7.30 |
| 49 | 18.62 | 0.11 | 0.28 | 7.51 |
| 50 | 18.94 | 0.11 | 0.28 | 7.71 |
| 51 | 19.25 | 0.12 | 0.29 | 7.92 |
| 52 | 19.56 | 0.12 | 0.29 | 8.13 |
| 53 | 19.87 | 0.12 | 0.30 | 8.34 |
| 54 | 20.19 | 0.12 | 0.30 | 8.55 |
| 55 | 613.89 | 3.56 | 9.08 | 257.16 |
| 56 | | | | |
| 57 | | | | |
| 58 | | | | |
| 59 | | | | |

An Example of Output (TOTPV.SUM)

| | N | O | P | Q | R | S | T | U |
|---|---|---|---|---|---|---|---|---|
| 60 | **PRESENT VALUES BY EACH POLLUTANT, BASE YEAR = 1995** | | | | | | | |
| 61 | Year | Before1 (for low speeds) | | | | | | Before 2 (for |
| 62 | | VOC | CO | NOx | SOx | PTM | CO2 | VOC |
| 63 | 2000 | 3.24 | 12.34 | 8.26 | 0.04 | 0.12 | 4.09 | 3.27 |
| 64 | 2001 | 3.04 | 11.56 | 7.77 | 0.03 | 0.12 | 3.85 | 3.07 |
| 65 | 2002 | 2.85 | 10.83 | 7.30 | 0.03 | 0.11 | 3.62 | 2.87 |
| 66 | 2003 | 2.67 | 10.15 | 6.86 | 0.03 | 0.10 | 3.41 | 2.69 |
| 67 | 2004 | 2.50 | 9.50 | 6.44 | 0.03 | 0.10 | 3.21 | 2.52 |
| 68 | 2005 | 2.34 | 8.90 | 6.05 | 0.03 | 0.09 | 3.02 | 2.36 |
| 69 | 2006 | 2.20 | 8.33 | 5.66 | 0.03 | 0.09 | 2.83 | 2.22 |
| 70 | 2007 | 2.07 | 7.79 | 5.29 | 0.02 | 0.08 | 2.66 | 2.08 |
| 71 | 2008 | 1.94 | 7.29 | 4.95 | 0.02 | 0.08 | 2.50 | 1.96 |
| 72 | 2009 | 1.83 | 6.82 | 4.63 | 0.02 | 0.07 | 2.35 | 1.84 |
| 73 | 2010 | 1.72 | 6.38 | 4.33 | 0.02 | 0.07 | 2.20 | 1.73 |
| 74 | 2011 | 1.61 | 5.99 | 4.11 | 0.02 | 0.07 | 2.07 | 1.62 |
| 75 | 2012 | 1.51 | 5.61 | 3.91 | 0.02 | 0.06 | 1.94 | 1.52 |
| 76 | 2013 | 1.41 | 5.26 | 3.71 | 0.02 | 0.06 | 1.82 | 1.43 |
| 77 | 2014 | 1.33 | 4.94 | 3.52 | 0.02 | 0.06 | 1.71 | 1.34 |
| 78 | 2015 | 1.24 | 4.63 | 3.34 | 0.02 | 0.05 | 1.60 | 1.25 |
| 79 | 2016 | 1.16 | 4.34 | 3.17 | 0.02 | 0.05 | 1.50 | 1.17 |
| 80 | 2017 | 1.09 | 4.07 | 3.01 | 0.02 | 0.05 | 1.41 | 1.10 |
| 81 | 2018 | 1.02 | 3.82 | 2.85 | 0.01 | 0.05 | 1.32 | 1.03 |
| 82 | 2019 | 0.96 | 3.58 | 2.71 | 0.01 | 0.04 | 1.24 | 0.97 |
| 83 | 2020 | 0.90 | 3.36 | 2.57 | 0.01 | 0.04 | 1.16 | 0.91 |
| 84 | 2021 | 0.85 | 3.19 | 2.44 | 0.01 | 0.04 | 1.10 | 0.86 |
| 85 | 2022 | 0.81 | 3.04 | 2.32 | 0.01 | 0.04 | 1.03 | 0.82 |
| 86 | 2023 | 0.77 | 2.89 | 2.21 | 0.01 | 0.04 | 0.98 | 0.78 |
| 87 | 2024 | 0.73 | 2.75 | 2.10 | 0.01 | 0.03 | 0.92 | 0.74 |
| 88 | 2025 | 0.70 | 2.61 | 2.00 | 0.01 | 0.03 | 0.87 | 0.70 |
| 89 | 2026 | 0.66 | 2.48 | 1.90 | 0.01 | 0.03 | 0.82 | 0.67 |
| 90 | 2027 | 0.63 | 2.36 | 1.80 | 0.01 | 0.03 | 0.77 | 0.63 |
| 91 | 2028 | 0.60 | 2.24 | 1.71 | 0.01 | 0.03 | 0.73 | 0.60 |
| 92 | 2029 | 0.57 | 2.13 | 1.62 | 0.01 | 0.03 | 0.69 | 0.57 |
| 93 | 2030 | 0.54 | 2.02 | 1.54 | 0.01 | 0.02 | 0.65 | 0.54 |
| 94 | 2031 | 0.51 | 1.92 | 1.47 | 0.01 | 0.02 | 0.62 | 0.52 |
| 95 | 2032 | 0.49 | 1.83 | 1.40 | 0.01 | 0.02 | 0.60 | 0.49 |
| 96 | 2033 | 0.46 | 1.74 | 1.33 | 0.01 | 0.02 | 0.58 | 0.47 |
| 97 | 2034 | 0.44 | 1.65 | 1.26 | 0.01 | 0.02 | 0.56 | 0.44 |
| 98 | 2035 | 0.42 | 1.57 | 1.20 | 0.01 | 0.02 | 0.54 | 0.42 |
| 99 | 2036 | 0.40 | 1.49 | 1.14 | 0.01 | 0.02 | 0.51 | 0.40 |
| 100 | 2037 | 0.38 | 1.42 | 1.08 | 0.01 | 0.02 | 0.49 | 0.38 |
| 101 | 2038 | 0.36 | 1.35 | 1.03 | 0.01 | 0.02 | 0.47 | 0.36 |
| 102 | 2039 | 0.34 | 1.28 | 0.98 | 0.00 | 0.02 | 0.45 | 0.34 |
| 103 | 2040 | 0.32 | 1.22 | 0.93 | 0.00 | 0.01 | 0.44 | 0.33 |
| 104 | TOTAL | 49.62 | 186.69 | 131.89 | 0.63 | 2.07 | 63.33 | 50.02 |
| 105 | **SAVINGS OF PRESENT VALUES, BASE YEAR = 1995** | | | | | | | |
| 106 | | After Pre 79 | | | | | | After Pre 90 |
| 107 | | VOC | CO | NOx | SOx | PTM | CO2 | VOC |
| 108 | | **1.6969** | **7.1737** | **-3.0913** | **-0.0862** | **0.0478** | **2.0716** | **2.0893** |

An Example of Output (TOTPV.SUM)

| | V | W | X | Y | Z | AA | AB | AC |
|---|---|---|---|---|---|---|---|---|
| 60 | | | | | | | | |
| 61 | igh speeds) | | | | | After Pre 79 | | |
| 62 | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 63 | 12.43 | 8.36 | 0.04 | 0.13 | 4.17 | 3.13 | 11.92 | 8.39 |
| 64 | 11.64 | 7.86 | 0.03 | 0.12 | 3.92 | 2.93 | 11.16 | 7.89 |
| 65 | 10.90 | 7.38 | 0.03 | 0.11 | 3.69 | 2.75 | 10.45 | 7.42 |
| 66 | 10.21 | 6.94 | 0.03 | 0.11 | 3.47 | 2.57 | 9.78 | 6.97 |
| 67 | 9.57 | 6.52 | 0.03 | 0.10 | 3.27 | 2.41 | 9.16 | 6.56 |
| 68 | 8.96 | 6.12 | 0.03 | 0.09 | 3.07 | 2.26 | 8.58 | 6.16 |
| 69 | 8.38 | 5.73 | 0.03 | 0.09 | 2.89 | 2.12 | 8.02 | 5.77 |
| 70 | 7.84 | 5.36 | 0.03 | 0.08 | 2.71 | 2.00 | 7.50 | 5.41 |
| 71 | 7.34 | 5.01 | 0.02 | 0.08 | 2.54 | 1.88 | 7.02 | 5.07 |
| 72 | 6.87 | 4.68 | 0.02 | 0.07 | 2.39 | 1.76 | 6.56 | 4.74 |
| 73 | 6.42 | 4.38 | 0.02 | 0.07 | 2.24 | 1.66 | 6.14 | 4.44 |
| 74 | 6.02 | 4.16 | 0.02 | 0.07 | 2.10 | 1.55 | 5.75 | 4.22 |
| 75 | 5.65 | 3.95 | 0.02 | 0.06 | 1.97 | 1.46 | 5.40 | 4.01 |
| 76 | 5.30 | 3.75 | 0.02 | 0.06 | 1.85 | 1.37 | 5.06 | 3.81 |
| 77 | 4.97 | 3.56 | 0.02 | 0.06 | 1.73 | 1.28 | 4.74 | 3.62 |
| 78 | 4.66 | 3.38 | 0.02 | 0.05 | 1.63 | 1.20 | 4.45 | 3.43 |
| 79 | 4.37 | 3.21 | 0.02 | 0.05 | 1.53 | 1.13 | 4.17 | 3.26 |
| 80 | 4.10 | 3.04 | 0.02 | 0.05 | 1.43 | 1.06 | 3.91 | 3.09 |
| 81 | 3.84 | 2.88 | 0.01 | 0.05 | 1.34 | 0.99 | 3.67 | 2.93 |
| 82 | 3.60 | 2.73 | 0.01 | 0.04 | 1.26 | 0.93 | 3.44 | 2.78 |
| 83 | 3.38 | 2.59 | 0.01 | 0.04 | 1.18 | 0.87 | 3.22 | 2.64 |
| 84 | 3.22 | 2.47 | 0.01 | 0.04 | 1.12 | 0.83 | 3.07 | 2.51 |
| 85 | 3.06 | 2.35 | 0.01 | 0.04 | 1.05 | 0.79 | 2.92 | 2.39 |
| 86 | 2.91 | 2.23 | 0.01 | 0.04 | 0.99 | 0.75 | 2.77 | 2.27 |
| 87 | 2.77 | 2.12 | 0.01 | 0.03 | 0.94 | 0.71 | 2.63 | 2.16 |
| 88 | 2.63 | 2.02 | 0.01 | 0.03 | 0.88 | 0.67 | 2.50 | 2.05 |
| 89 | 2.50 | 1.92 | 0.01 | 0.03 | 0.83 | 0.64 | 2.38 | 1.95 |
| 90 | 2.37 | 1.82 | 0.01 | 0.03 | 0.78 | 0.61 | 2.26 | 1.85 |
| 91 | 2.26 | 1.73 | 0.01 | 0.03 | 0.74 | 0.58 | 2.14 | 1.76 |
| 92 | 2.14 | 1.64 | 0.01 | 0.03 | 0.70 | 0.55 | 2.04 | 1.67 |
| 93 | 2.03 | 1.56 | 0.01 | 0.03 | 0.66 | 0.52 | 1.93 | 1.59 |
| 94 | 1.93 | 1.48 | 0.01 | 0.02 | 0.63 | 0.49 | 1.84 | 1.51 |
| 95 | 1.84 | 1.41 | 0.01 | 0.02 | 0.61 | 0.47 | 1.75 | 1.44 |
| 96 | 1.75 | 1.34 | 0.01 | 0.02 | 0.59 | 0.45 | 1.66 | 1.37 |
| 97 | 1.66 | 1.27 | 0.01 | 0.02 | 0.57 | 0.43 | 1.58 | 1.30 |
| 98 | 1.58 | 1.21 | 0.01 | 0.02 | 0.54 | 0.40 | 1.50 | 1.24 |
| 99 | 1.50 | 1.15 | 0.01 | 0.02 | 0.52 | 0.38 | 1.43 | 1.17 |
| 100 | 1.43 | 1.09 | 0.01 | 0.02 | 0.50 | 0.36 | 1.35 | 1.12 |
| 101 | 1.36 | 1.04 | 0.01 | 0.02 | 0.48 | 0.35 | 1.29 | 1.06 |
| 102 | 1.29 | 0.99 | 0.00 | 0.02 | 0.46 | 0.33 | 1.22 | 1.01 |
| 103 | 1.22 | 0.94 | 0.00 | 0.02 | 0.44 | 0.31 | 1.16 | 0.96 |
| 104 | 187.92 | 133.38 | 0.63 | 2.11 | 64.43 | 47.92 | 179.52 | 134.98 |
| 105 | | | | | | | | |
| 106 | | | | | | After Acc 110 | | |
| 107 | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 108 | **8.4946** | **-8.2110** | **-0.1238** | **0.0450** | **2.7093** | **8.0074** | **26.4465** | **20.8005** |

An Example of Output (TOTPV.SUM)

| | AD | AE | AF | AG | AH | AI | AJ | AK |
|---|---|---|---|---|---|---|---|---|
| 60 | | | | | | | | |
| 61 | | | | After Pre 90 | | | | |
| 62 | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 63 | 0.04 | 0.12 | 3.96 | 3.09 | 11.82 | 8.65 | 0.04 | 0.12 |
| 64 | 0.04 | 0.11 | 3.73 | 2.90 | 11.07 | 8.14 | 0.04 | 0.11 |
| 65 | 0.04 | 0.11 | 3.51 | 2.72 | 10.37 | 7.66 | 0.04 | 0.11 |
| 66 | 0.03 | 0.10 | 3.30 | 2.55 | 9.71 | 7.20 | 0.04 | 0.10 |
| 67 | 0.03 | 0.10 | 3.11 | 2.39 | 9.09 | 6.78 | 0.03 | 0.10 |
| 68 | 0.03 | 0.09 | 2.92 | 2.24 | 8.51 | 6.38 | 0.03 | 0.09 |
| 69 | 0.03 | 0.09 | 2.74 | 2.10 | 7.96 | 5.98 | 0.03 | 0.09 |
| 70 | 0.03 | 0.08 | 2.58 | 1.98 | 7.45 | 5.60 | 0.03 | 0.08 |
| 71 | 0.03 | 0.08 | 2.42 | 1.86 | 6.96 | 5.25 | 0.03 | 0.08 |
| 72 | 0.03 | 0.07 | 2.27 | 1.75 | 6.51 | 4.93 | 0.03 | 0.07 |
| 73 | 0.02 | 0.07 | 2.13 | 1.64 | 6.09 | 4.62 | 0.03 | 0.07 |
| 74 | 0.02 | 0.06 | 2.00 | 1.54 | 5.71 | 4.39 | 0.02 | 0.06 |
| 75 | 0.02 | 0.06 | 1.88 | 1.45 | 5.36 | 4.17 | 0.02 | 0.06 |
| 76 | 0.02 | 0.06 | 1.76 | 1.36 | 5.02 | 3.96 | 0.02 | 0.06 |
| 77 | 0.02 | 0.06 | 1.65 | 1.27 | 4.71 | 3.76 | 0.02 | 0.06 |
| 78 | 0.02 | 0.05 | 1.55 | 1.19 | 4.41 | 3.57 | 0.02 | 0.05 |
| 79 | 0.02 | 0.05 | 1.45 | 1.12 | 4.14 | 3.39 | 0.02 | 0.05 |
| 80 | 0.02 | 0.05 | 1.36 | 1.05 | 3.88 | 3.22 | 0.02 | 0.05 |
| 81 | 0.02 | 0.05 | 1.28 | 0.98 | 3.64 | 3.05 | 0.02 | 0.05 |
| 82 | 0.02 | 0.04 | 1.20 | 0.92 | 3.41 | 2.90 | 0.02 | 0.04 |
| 83 | 0.01 | 0.04 | 1.13 | 0.86 | 3.20 | 2.75 | 0.02 | 0.04 |
| 84 | 0.01 | 0.04 | 1.06 | 0.82 | 3.04 | 2.61 | 0.01 | 0.04 |
| 85 | 0.01 | 0.04 | 1.00 | 0.78 | 2.90 | 2.49 | 0.01 | 0.04 |
| 86 | 0.01 | 0.03 | 0.94 | 0.74 | 2.75 | 2.37 | 0.01 | 0.04 |
| 87 | 0.01 | 0.03 | 0.89 | 0.71 | 2.62 | 2.25 | 0.01 | 0.03 |
| 88 | 0.01 | 0.03 | 0.84 | 0.67 | 2.49 | 2.14 | 0.01 | 0.03 |
| 89 | 0.01 | 0.03 | 0.79 | 0.64 | 2.36 | 2.03 | 0.01 | 0.03 |
| 90 | 0.01 | 0.03 | 0.75 | 0.61 | 2.24 | 1.93 | 0.01 | 0.03 |
| 91 | 0.01 | 0.03 | 0.70 | 0.57 | 2.13 | 1.84 | 0.01 | 0.03 |
| 92 | 0.01 | 0.03 | 0.66 | 0.55 | 2.02 | 1.74 | 0.01 | 0.03 |
| 93 | 0.01 | 0.02 | 0.62 | 0.52 | 1.92 | 1.66 | 0.01 | 0.02 |
| 94 | 0.01 | 0.02 | 0.60 | 0.49 | 1.83 | 1.58 | 0.01 | 0.02 |
| 95 | 0.01 | 0.02 | 0.58 | 0.47 | 1.74 | 1.50 | 0.01 | 0.02 |
| 96 | 0.01 | 0.02 | 0.56 | 0.45 | 1.65 | 1.43 | 0.01 | 0.02 |
| 97 | 0.01 | 0.02 | 0.54 | 0.42 | 1.57 | 1.36 | 0.01 | 0.02 |
| 98 | 0.01 | 0.02 | 0.51 | 0.40 | 1.49 | 1.29 | 0.01 | 0.02 |
| 99 | 0.01 | 0.02 | 0.49 | 0.38 | 1.42 | 1.23 | 0.01 | 0.02 |
| 100 | 0.01 | 0.02 | 0.47 | 0.36 | 1.35 | 1.16 | 0.01 | 0.02 |
| 101 | 0.01 | 0.02 | 0.45 | 0.35 | 1.28 | 1.11 | 0.01 | 0.02 |
| 102 | 0.01 | 0.02 | 0.44 | 0.33 | 1.21 | 1.05 | 0.01 | 0.02 |
| 103 | 0.01 | 0.01 | 0.42 | 0.31 | 1.15 | 1.00 | 0.01 | 0.01 |
| 104 | 0.72 | 2.02 | 61.26 | 47.53 | 178.19 | 140.10 | 0.75 | 2.02 |
| 105 | | | | | | | | |
| 106 | | | | After Acc 125E | | | | |
| 107 | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 108 | **-0.0058** | **0.5994** | **17.9911** | **4.1913** | **12.0829** | **11.1242** | **-0.3317** | **0.0743** |

An Example of Output (TOTPV.SUM)

| | AL | AM | AN | AO | AP | AQ | AR | AS |
|---|---|---|---|---|---|---|---|---|
| 60 | | | | | | | | |
| 61 | | After Acc 110 | | | | | | After Acc 125 |
| 62 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC |
| 63 | 3.92 | 2.65 | 10.59 | 6.80 | 0.03 | 0.08 | 2.85 | 2.97 |
| 64 | 3.69 | 2.50 | 9.92 | 6.39 | 0.03 | 0.08 | 2.68 | 2.78 |
| 65 | 3.47 | 2.35 | 9.30 | 6.01 | 0.03 | 0.07 | 2.53 | 2.61 |
| 66 | 3.26 | 2.22 | 8.72 | 5.65 | 0.03 | 0.07 | 2.38 | 2.44 |
| 67 | 3.07 | 2.09 | 8.17 | 5.31 | 0.03 | 0.07 | 2.25 | 2.29 |
| 68 | 2.89 | 1.97 | 7.65 | 4.99 | 0.03 | 0.06 | 2.12 | 2.15 |
| 69 | 2.71 | 1.85 | 7.16 | 4.68 | 0.03 | 0.06 | 2.00 | 2.02 |
| 70 | 2.55 | 1.74 | 6.70 | 4.39 | 0.02 | 0.06 | 1.88 | 1.90 |
| 71 | 2.39 | 1.64 | 6.27 | 4.13 | 0.02 | 0.05 | 1.78 | 1.78 |
| 72 | 2.24 | 1.54 | 5.87 | 3.87 | 0.02 | 0.05 | 1.68 | 1.67 |
| 73 | 2.11 | 1.45 | 5.49 | 3.64 | 0.02 | 0.05 | 1.58 | 1.57 |
| 74 | 1.98 | 1.36 | 5.15 | 3.47 | 0.02 | 0.05 | 1.49 | 1.47 |
| 75 | 1.86 | 1.28 | 4.83 | 3.30 | 0.02 | 0.04 | 1.40 | 1.38 |
| 76 | 1.74 | 1.20 | 4.52 | 3.14 | 0.02 | 0.04 | 1.31 | 1.30 |
| 77 | 1.63 | 1.12 | 4.24 | 2.99 | 0.02 | 0.04 | 1.24 | 1.21 |
| 78 | 1.53 | 1.05 | 3.97 | 2.85 | 0.02 | 0.04 | 1.16 | 1.14 |
| 79 | 1.44 | 0.98 | 3.73 | 2.71 | 0.02 | 0.04 | 1.09 | 1.07 |
| 80 | 1.35 | 0.92 | 3.49 | 2.58 | 0.02 | 0.04 | 1.03 | 1.00 |
| 81 | 1.27 | 0.86 | 3.27 | 2.45 | 0.01 | 0.03 | 0.97 | 0.94 |
| 82 | 1.19 | 0.81 | 3.07 | 2.33 | 0.01 | 0.03 | 0.91 | 0.88 |
| 83 | 1.12 | 0.76 | 2.88 | 2.21 | 0.01 | 0.03 | 0.85 | 0.82 |
| 84 | 1.05 | 0.72 | 2.74 | 2.11 | 0.01 | 0.03 | 0.80 | 0.78 |
| 85 | 0.99 | 0.69 | 2.60 | 2.00 | 0.01 | 0.03 | 0.76 | 0.74 |
| 86 | 0.94 | 0.65 | 2.48 | 1.91 | 0.01 | 0.03 | 0.71 | 0.71 |
| 87 | 0.88 | 0.62 | 2.35 | 1.81 | 0.01 | 0.03 | 0.67 | 0.67 |
| 88 | 0.83 | 0.59 | 2.24 | 1.72 | 0.01 | 0.02 | 0.63 | 0.64 |
| 89 | 0.78 | 0.56 | 2.13 | 1.64 | 0.01 | 0.02 | 0.60 | 0.61 |
| 90 | 0.74 | 0.53 | 2.02 | 1.56 | 0.01 | 0.02 | 0.56 | 0.58 |
| 91 | 0.70 | 0.50 | 1.92 | 1.48 | 0.01 | 0.02 | 0.53 | 0.55 |
| 92 | 0.66 | 0.48 | 1.82 | 1.41 | 0.01 | 0.02 | 0.50 | 0.52 |
| 93 | 0.62 | 0.45 | 1.73 | 1.33 | 0.01 | 0.02 | 0.47 | 0.49 |
| 94 | 0.60 | 0.43 | 1.64 | 1.27 | 0.01 | 0.02 | 0.46 | 0.47 |
| 95 | 0.57 | 0.41 | 1.56 | 1.21 | 0.01 | 0.02 | 0.44 | 0.45 |
| 96 | 0.55 | 0.39 | 1.49 | 1.15 | 0.01 | 0.02 | 0.43 | 0.42 |
| 97 | 0.53 | 0.37 | 1.42 | 1.09 | 0.01 | 0.02 | 0.41 | 0.40 |
| 98 | 0.51 | 0.35 | 1.35 | 1.04 | 0.01 | 0.01 | 0.40 | 0.38 |
| 99 | 0.49 | 0.34 | 1.28 | 0.99 | 0.01 | 0.01 | 0.39 | 0.36 |
| 100 | 0.47 | 0.32 | 1.21 | 0.94 | 0.01 | 0.01 | 0.37 | 0.35 |
| 101 | 0.45 | 0.30 | 1.15 | 0.89 | 0.01 | 0.01 | 0.36 | 0.33 |
| 102 | 0.43 | 0.29 | 1.10 | 0.85 | 0.01 | 0.01 | 0.34 | 0.31 |
| 103 | 0.42 | 0.27 | 1.04 | 0.81 | 0.00 | 0.01 | 0.33 | 0.30 |
| 104 | 60.62 | 41.61 | 160.24 | 111.09 | 0.64 | 1.47 | 45.34 | 45.43 |
| 105 | | | | | | | | |
| 106 | | After Acc 125NE | | | | | | After Maglev |
| 107 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC |
| 108 | **3.5607** | **3.5262** | **11.6823** | **0.9643** | **-0.0678** | **0.1441** | **4.6463** | **6.0328** |

An Example of Output (TOTPV.SUM)

| | AT | AU | AV | AW | AX | AY | AZ | BA |
|---|---|---|---|---|---|---|---|---|
| 60 | | | | | | | | |
| 61 | | | | | | After Acc 125NE | | |
| 62 | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 63 | 11.60 | 7.64 | 0.07 | 0.12 | 3.85 | 3.00 | 11.62 | 8.14 |
| 64 | 10.86 | 7.17 | 0.06 | 0.11 | 3.62 | 2.82 | 10.88 | 7.65 |
| 65 | 10.17 | 6.73 | 0.06 | 0.11 | 3.41 | 2.64 | 10.19 | 7.19 |
| 66 | 9.52 | 6.32 | 0.05 | 0.10 | 3.21 | 2.47 | 9.54 | 6.76 |
| 67 | 8.91 | 5.93 | 0.05 | 0.09 | 3.02 | 2.32 | 8.93 | 6.36 |
| 68 | 8.35 | 5.56 | 0.05 | 0.09 | 2.84 | 2.17 | 8.36 | 5.97 |
| 69 | 7.80 | 5.20 | 0.04 | 0.08 | 2.67 | 2.04 | 7.82 | 5.60 |
| 70 | 7.30 | 4.86 | 0.04 | 0.08 | 2.50 | 1.92 | 7.31 | 5.24 |
| 71 | 6.83 | 4.54 | 0.04 | 0.08 | 2.35 | 1.81 | 6.84 | 4.91 |
| 72 | 6.38 | 4.24 | 0.04 | 0.07 | 2.21 | 1.70 | 6.40 | 4.60 |
| 73 | 5.97 | 3.97 | 0.03 | 0.07 | 2.08 | 1.60 | 5.98 | 4.31 |
| 74 | 5.60 | 3.77 | 0.03 | 0.06 | 1.95 | 1.50 | 5.61 | 4.09 |
| 75 | 5.25 | 3.58 | 0.03 | 0.06 | 1.83 | 1.40 | 5.26 | 3.89 |
| 76 | 4.92 | 3.39 | 0.03 | 0.06 | 1.72 | 1.31 | 4.93 | 3.70 |
| 77 | 4.61 | 3.22 | 0.03 | 0.05 | 1.61 | 1.23 | 4.62 | 3.51 |
| 78 | 4.32 | 3.06 | 0.02 | 0.05 | 1.52 | 1.16 | 4.33 | 3.33 |
| 79 | 4.05 | 2.90 | 0.02 | 0.05 | 1.42 | 1.08 | 4.06 | 3.16 |
| 80 | 3.80 | 2.75 | 0.02 | 0.05 | 1.34 | 1.01 | 3.81 | 3.00 |
| 81 | 3.56 | 2.61 | 0.02 | 0.04 | 1.25 | 0.95 | 3.57 | 2.85 |
| 82 | 3.34 | 2.47 | 0.02 | 0.04 | 1.18 | 0.89 | 3.35 | 2.70 |
| 83 | 3.13 | 2.34 | 0.02 | 0.04 | 1.11 | 0.84 | 3.14 | 2.56 |
| 84 | 2.98 | 2.23 | 0.02 | 0.04 | 1.04 | 0.80 | 2.99 | 2.44 |
| 85 | 2.83 | 2.12 | 0.02 | 0.04 | 0.98 | 0.76 | 2.84 | 2.32 |
| 86 | 2.69 | 2.01 | 0.01 | 0.03 | 0.93 | 0.72 | 2.70 | 2.21 |
| 87 | 2.56 | 1.91 | 0.01 | 0.03 | 0.87 | 0.68 | 2.57 | 2.10 |
| 88 | 2.43 | 1.81 | 0.01 | 0.03 | 0.82 | 0.65 | 2.44 | 1.99 |
| 89 | 2.31 | 1.72 | 0.01 | 0.03 | 0.78 | 0.62 | 2.32 | 1.89 |
| 90 | 2.20 | 1.64 | 0.01 | 0.03 | 0.73 | 0.59 | 2.20 | 1.80 |
| 91 | 2.09 | 1.55 | 0.01 | 0.03 | 0.69 | 0.56 | 2.09 | 1.71 |
| 92 | 1.98 | 1.47 | 0.01 | 0.03 | 0.65 | 0.53 | 1.99 | 1.62 |
| 93 | 1.88 | 1.40 | 0.01 | 0.02 | 0.61 | 0.50 | 1.88 | 1.54 |
| 94 | 1.79 | 1.33 | 0.01 | 0.02 | 0.59 | 0.48 | 1.79 | 1.47 |
| 95 | 1.70 | 1.26 | 0.01 | 0.02 | 0.57 | 0.45 | 1.70 | 1.39 |
| 96 | 1.62 | 1.20 | 0.01 | 0.02 | 0.55 | 0.43 | 1.62 | 1.33 |
| 97 | 1.54 | 1.14 | 0.01 | 0.02 | 0.53 | 0.41 | 1.54 | 1.26 |
| 98 | 1.46 | 1.08 | 0.01 | 0.02 | 0.51 | 0.39 | 1.46 | 1.20 |
| 99 | 1.39 | 1.03 | 0.01 | 0.02 | 0.49 | 0.37 | 1.39 | 1.14 |
| 100 | 1.32 | 0.98 | 0.01 | 0.02 | 0.47 | 0.35 | 1.32 | 1.08 |
| 101 | 1.25 | 0.93 | 0.01 | 0.02 | 0.45 | 0.33 | 1.26 | 1.03 |
| 102 | 1.19 | 0.88 | 0.01 | 0.02 | 0.43 | 0.32 | 1.19 | 0.97 |
| 103 | 1.13 | 0.83 | 0.00 | 0.01 | 0.41 | 0.30 | 1.13 | 0.93 |
| 104 | 174.61 | 120.77 | 0.96 | 1.99 | 59.77 | 46.09 | 175.01 | 130.93 |
| 105 | | | | | | | | |
| 106 | | | | | | After TGV | | |
| 107 | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 108 | **18.0718** | **14.1388** | **-1.0735** | **-0.1090** | **1.8615** | **4.9902** | **15.6758** | **14.5773** |

An Example of Output (TOTPV.SUM)

| | BB | BC | BD | BE | BF | BG | BH | BI |
|---|---|---|---|---|---|---|---|---|
| 60 | | | | | | | | |
| 61 | | | | After Maglev | | | | |
| 62 | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 63 | 0.04 | 0.11 | 3.79 | 2.85 | 11.25 | 7.56 | 0.13 | 0.13 |
| 64 | 0.04 | 0.11 | 3.57 | 2.67 | 10.54 | 7.09 | 0.12 | 0.12 |
| 65 | 0.04 | 0.10 | 3.35 | 2.51 | 9.87 | 6.65 | 0.11 | 0.12 |
| 66 | 0.03 | 0.10 | 3.16 | 2.36 | 9.24 | 6.24 | 0.11 | 0.11 |
| 67 | 0.03 | 0.09 | 2.97 | 2.21 | 8.66 | 5.85 | 0.10 | 0.11 |
| 68 | 0.03 | 0.09 | 2.79 | 2.08 | 8.11 | 5.49 | 0.09 | 0.10 |
| 69 | 0.03 | 0.08 | 2.62 | 1.95 | 7.58 | 5.13 | 0.08 | 0.09 |
| 70 | 0.03 | 0.08 | 2.46 | 1.84 | 7.09 | 4.80 | 0.08 | 0.09 |
| 71 | 0.03 | 0.07 | 2.31 | 1.73 | 6.64 | 4.49 | 0.07 | 0.08 |
| 72 | 0.02 | 0.07 | 2.17 | 1.62 | 6.21 | 4.20 | 0.07 | 0.08 |
| 73 | 0.02 | 0.06 | 2.04 | 1.52 | 5.80 | 3.92 | 0.06 | 0.07 |
| 74 | 0.02 | 0.06 | 1.92 | 1.43 | 5.44 | 3.73 | 0.06 | 0.07 |
| 75 | 0.02 | 0.06 | 1.80 | 1.34 | 5.10 | 3.54 | 0.05 | 0.07 |
| 76 | 0.02 | 0.06 | 1.69 | 1.26 | 4.79 | 3.36 | 0.05 | 0.06 |
| 77 | 0.02 | 0.05 | 1.58 | 1.18 | 4.49 | 3.19 | 0.05 | 0.06 |
| 78 | 0.02 | 0.05 | 1.49 | 1.10 | 4.21 | 3.02 | 0.04 | 0.06 |
| 79 | 0.02 | 0.05 | 1.39 | 1.03 | 3.95 | 2.87 | 0.04 | 0.05 |
| 80 | 0.02 | 0.05 | 1.31 | 0.97 | 3.70 | 2.72 | 0.04 | 0.05 |
| 81 | 0.02 | 0.04 | 1.23 | 0.91 | 3.47 | 2.58 | 0.03 | 0.05 |
| 82 | 0.02 | 0.04 | 1.15 | 0.85 | 3.25 | 2.44 | 0.03 | 0.05 |
| 83 | 0.01 | 0.04 | 1.08 | 0.80 | 3.05 | 2.32 | 0.03 | 0.04 |
| 84 | 0.01 | 0.04 | 1.02 | 0.76 | 2.90 | 2.20 | 0.03 | 0.04 |
| 85 | 0.01 | 0.04 | 0.96 | 0.72 | 2.76 | 2.09 | 0.02 | 0.04 |
| 86 | 0.01 | 0.03 | 0.91 | 0.69 | 2.63 | 1.98 | 0.02 | 0.04 |
| 87 | 0.01 | 0.03 | 0.85 | 0.65 | 2.50 | 1.88 | 0.02 | 0.04 |
| 88 | 0.01 | 0.03 | 0.80 | 0.62 | 2.37 | 1.79 | 0.02 | 0.03 |
| 89 | 0.01 | 0.03 | 0.76 | 0.59 | 2.26 | 1.70 | 0.02 | 0.03 |
| 90 | 0.01 | 0.03 | 0.71 | 0.56 | 2.14 | 1.61 | 0.02 | 0.03 |
| 91 | 0.01 | 0.03 | 0.67 | 0.53 | 2.03 | 1.53 | 0.01 | 0.03 |
| 92 | 0.01 | 0.02 | 0.63 | 0.50 | 1.93 | 1.45 | 0.01 | 0.03 |
| 93 | 0.01 | 0.02 | 0.60 | 0.48 | 1.83 | 1.37 | 0.01 | 0.03 |
| 94 | 0.01 | 0.02 | 0.58 | 0.46 | 1.75 | 1.31 | 0.01 | 0.02 |
| 95 | 0.01 | 0.02 | 0.56 | 0.43 | 1.66 | 1.24 | 0.01 | 0.02 |
| 96 | 0.01 | 0.02 | 0.54 | 0.41 | 1.58 | 1.18 | 0.01 | 0.02 |
| 97 | 0.01 | 0.02 | 0.52 | 0.39 | 1.50 | 1.12 | 0.01 | 0.02 |
| 98 | 0.01 | 0.02 | 0.50 | 0.37 | 1.43 | 1.06 | 0.01 | 0.02 |
| 99 | 0.01 | 0.02 | 0.48 | 0.35 | 1.36 | 1.01 | 0.01 | 0.02 |
| 100 | 0.01 | 0.02 | 0.46 | 0.34 | 1.29 | 0.96 | 0.01 | 0.02 |
| 101 | 0.01 | 0.02 | 0.44 | 0.32 | 1.22 | 0.91 | 0.01 | 0.02 |
| 102 | 0.01 | 0.01 | 0.42 | 0.30 | 1.16 | 0.86 | 0.01 | 0.02 |
| 103 | 0.01 | 0.01 | 0.40 | 0.29 | 1.10 | 0.82 | 0.01 | 0.02 |
| 104 | 0.70 | 1.93 | 58.68 | 43.99 | 169.85 | 119.24 | 1.71 | 2.22 |
| 105 | | | | | | | | |
| 106 | | | | After Acc 150E | | | | |
| 107 | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 108 | **-0.5309** | **0.0716** | **4.8035** | **4.4214** | **13.1052** | **12.1057** | **-0.3310** | **0.0974** |

An Example of Output (TOTPV.SUM)

| | BJ | BK | BL | BM | BN | BO | BP | BQ |
|---|---|---|---|---|---|---|---|---|
| 60 | | | | | | | | |
| 61 | | After TGV | | | | | | After Acc 150 |
| 62 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC |
| 63 | 3.94 | 2.95 | 11.46 | 7.53 | 0.08 | 0.12 | 3.82 | 2.95 |
| 64 | 3.71 | 2.77 | 10.73 | 7.07 | 0.08 | 0.11 | 3.60 | 2.76 |
| 65 | 3.50 | 2.59 | 10.05 | 6.63 | 0.07 | 0.11 | 3.39 | 2.59 |
| 66 | 3.30 | 2.43 | 9.40 | 6.22 | 0.07 | 0.10 | 3.19 | 2.43 |
| 67 | 3.11 | 2.28 | 8.80 | 5.83 | 0.06 | 0.10 | 3.00 | 2.28 |
| 68 | 2.93 | 2.14 | 8.24 | 5.47 | 0.06 | 0.09 | 2.82 | 2.14 |
| 69 | 2.76 | 2.01 | 7.71 | 5.11 | 0.06 | 0.09 | 2.65 | 2.01 |
| 70 | 2.60 | 1.88 | 7.21 | 4.78 | 0.05 | 0.08 | 2.49 | 1.89 |
| 71 | 2.44 | 1.77 | 6.74 | 4.47 | 0.05 | 0.08 | 2.34 | 1.77 |
| 72 | 2.30 | 1.66 | 6.30 | 4.18 | 0.04 | 0.07 | 2.20 | 1.67 |
| 73 | 2.17 | 1.56 | 5.89 | 3.90 | 0.04 | 0.07 | 2.07 | 1.57 |
| 74 | 2.04 | 1.46 | 5.52 | 3.71 | 0.04 | 0.07 | 1.94 | 1.47 |
| 75 | 1.92 | 1.37 | 5.18 | 3.52 | 0.04 | 0.06 | 1.83 | 1.38 |
| 76 | 1.81 | 1.28 | 4.85 | 3.34 | 0.03 | 0.06 | 1.72 | 1.29 |
| 77 | 1.70 | 1.20 | 4.55 | 3.17 | 0.03 | 0.06 | 1.61 | 1.21 |
| 78 | 1.60 | 1.13 | 4.26 | 3.01 | 0.03 | 0.05 | 1.52 | 1.13 |
| 79 | 1.51 | 1.05 | 4.00 | 2.85 | 0.03 | 0.05 | 1.42 | 1.06 |
| 80 | 1.42 | 0.99 | 3.75 | 2.71 | 0.03 | 0.05 | 1.34 | 0.99 |
| 81 | 1.33 | 0.93 | 3.51 | 2.57 | 0.02 | 0.05 | 1.26 | 0.93 |
| 82 | 1.25 | 0.87 | 3.29 | 2.43 | 0.02 | 0.04 | 1.18 | 0.87 |
| 83 | 1.18 | 0.81 | 3.09 | 2.31 | 0.02 | 0.04 | 1.11 | 0.82 |
| 84 | 1.11 | 0.77 | 2.94 | 2.19 | 0.02 | 0.04 | 1.05 | 0.78 |
| 85 | 1.05 | 0.73 | 2.79 | 2.08 | 0.02 | 0.04 | 0.99 | 0.74 |
| 86 | 0.99 | 0.70 | 2.65 | 1.98 | 0.02 | 0.03 | 0.93 | 0.70 |
| 87 | 0.94 | 0.66 | 2.52 | 1.88 | 0.02 | 0.03 | 0.88 | 0.67 |
| 88 | 0.88 | 0.63 | 2.40 | 1.78 | 0.01 | 0.03 | 0.83 | 0.64 |
| 89 | 0.83 | 0.60 | 2.28 | 1.69 | 0.01 | 0.03 | 0.78 | 0.60 |
| 90 | 0.79 | 0.57 | 2.16 | 1.61 | 0.01 | 0.03 | 0.73 | 0.57 |
| 91 | 0.74 | 0.54 | 2.05 | 1.52 | 0.01 | 0.03 | 0.69 | 0.54 |
| 92 | 0.70 | 0.51 | 1.95 | 1.45 | 0.01 | 0.03 | 0.65 | 0.52 |
| 93 | 0.66 | 0.49 | 1.85 | 1.37 | 0.01 | 0.02 | 0.61 | 0.49 |
| 94 | 0.64 | 0.46 | 1.76 | 1.30 | 0.01 | 0.02 | 0.59 | 0.47 |
| 95 | 0.61 | 0.44 | 1.67 | 1.24 | 0.01 | 0.02 | 0.57 | 0.44 |
| 96 | 0.59 | 0.42 | 1.59 | 1.18 | 0.01 | 0.02 | 0.55 | 0.42 |
| 97 | 0.57 | 0.40 | 1.51 | 1.12 | 0.01 | 0.02 | 0.53 | 0.40 |
| 98 | 0.55 | 0.38 | 1.44 | 1.06 | 0.01 | 0.02 | 0.51 | 0.38 |
| 99 | 0.52 | 0.36 | 1.36 | 1.01 | 0.01 | 0.02 | 0.49 | 0.36 |
| 100 | 0.50 | 0.34 | 1.30 | 0.96 | 0.01 | 0.02 | 0.47 | 0.34 |
| 101 | 0.48 | 0.32 | 1.23 | 0.91 | 0.01 | 0.02 | 0.45 | 0.33 |
| 102 | 0.46 | 0.31 | 1.17 | 0.86 | 0.01 | 0.02 | 0.43 | 0.31 |
| 103 | 0.44 | 0.29 | 1.11 | 0.82 | 0.00 | 0.01 | 0.41 | 0.29 |
| 104 | 62.57 | 45.03 | 172.24 | 118.81 | 1.17 | 2.04 | 59.63 | 45.20 |
| 105 | | | | | | | | |
| 106 | | After Acc 150NE | | | | | | |
| 107 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | |
| 108 | **4.2695** | **3.5771** | **12.2502** | **-3.4899** | **-0.1269** | **0.0969** | **4.2044** | |

An Example of Output (TOTPV.SUM)

| | BR | BS | BT | BU | BV | BW | BX | BY |
|---|---|---|---|---|---|---|---|---|
| 60 | | | | | | | | |
| 61 | | | | | | After Acc 150NE | | |
| 62 | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 63 | 11.53 | 7.58 | 0.07 | 0.12 | 3.80 | 2.99 | 11.58 | 8.37 |
| 64 | 10.79 | 7.11 | 0.06 | 0.11 | 3.58 | 2.81 | 10.84 | 7.87 |
| 65 | 10.11 | 6.68 | 0.06 | 0.10 | 3.37 | 2.63 | 10.15 | 7.41 |
| 66 | 9.46 | 6.26 | 0.05 | 0.10 | 3.17 | 2.47 | 9.51 | 6.97 |
| 67 | 8.86 | 5.88 | 0.05 | 0.09 | 2.98 | 2.32 | 8.90 | 6.55 |
| 68 | 8.30 | 5.52 | 0.05 | 0.09 | 2.80 | 2.17 | 8.33 | 6.16 |
| 69 | 7.76 | 5.15 | 0.04 | 0.08 | 2.63 | 2.04 | 7.79 | 5.78 |
| 70 | 7.26 | 4.82 | 0.04 | 0.08 | 2.47 | 1.92 | 7.29 | 5.41 |
| 71 | 6.79 | 4.50 | 0.04 | 0.07 | 2.32 | 1.80 | 6.82 | 5.08 |
| 72 | 6.35 | 4.21 | 0.04 | 0.07 | 2.18 | 1.70 | 6.38 | 4.76 |
| 73 | 5.93 | 3.93 | 0.03 | 0.07 | 2.05 | 1.59 | 5.96 | 4.46 |
| 74 | 5.56 | 3.74 | 0.03 | 0.06 | 1.93 | 1.49 | 5.59 | 4.24 |
| 75 | 5.22 | 3.55 | 0.03 | 0.06 | 1.81 | 1.40 | 5.24 | 4.03 |
| 76 | 4.89 | 3.37 | 0.03 | 0.06 | 1.70 | 1.31 | 4.92 | 3.83 |
| 77 | 4.59 | 3.20 | 0.03 | 0.05 | 1.60 | 1.23 | 4.61 | 3.64 |
| 78 | 4.30 | 3.03 | 0.02 | 0.05 | 1.50 | 1.15 | 4.32 | 3.45 |
| 79 | 4.03 | 2.88 | 0.02 | 0.05 | 1.41 | 1.08 | 4.05 | 3.28 |
| 80 | 3.78 | 2.73 | 0.02 | 0.05 | 1.32 | 1.01 | 3.80 | 3.11 |
| 81 | 3.54 | 2.59 | 0.02 | 0.04 | 1.24 | 0.95 | 3.56 | 2.95 |
| 82 | 3.32 | 2.45 | 0.02 | 0.04 | 1.16 | 0.89 | 3.34 | 2.80 |
| 83 | 3.11 | 2.32 | 0.02 | 0.04 | 1.09 | 0.84 | 3.13 | 2.66 |
| 84 | 2.96 | 2.21 | 0.02 | 0.04 | 1.03 | 0.79 | 2.98 | 2.53 |
| 85 | 2.82 | 2.10 | 0.02 | 0.04 | 0.97 | 0.76 | 2.83 | 2.40 |
| 86 | 2.68 | 2.00 | 0.01 | 0.03 | 0.92 | 0.72 | 2.69 | 2.29 |
| 87 | 2.55 | 1.90 | 0.01 | 0.03 | 0.86 | 0.68 | 2.56 | 2.17 |
| 88 | 2.42 | 1.80 | 0.01 | 0.03 | 0.81 | 0.65 | 2.43 | 2.07 |
| 89 | 2.30 | 1.71 | 0.01 | 0.03 | 0.77 | 0.62 | 2.31 | 1.96 |
| 90 | 2.18 | 1.62 | 0.01 | 0.03 | 0.72 | 0.59 | 2.20 | 1.87 |
| 91 | 2.07 | 1.54 | 0.01 | 0.03 | 0.68 | 0.56 | 2.09 | 1.77 |
| 92 | 1.97 | 1.46 | 0.01 | 0.02 | 0.64 | 0.53 | 1.98 | 1.68 |
| 93 | 1.87 | 1.39 | 0.01 | 0.02 | 0.61 | 0.50 | 1.88 | 1.60 |
| 94 | 1.78 | 1.32 | 0.01 | 0.02 | 0.58 | 0.48 | 1.79 | 1.52 |
| 95 | 1.69 | 1.25 | 0.01 | 0.02 | 0.56 | 0.45 | 1.70 | 1.45 |
| 96 | 1.61 | 1.19 | 0.01 | 0.02 | 0.54 | 0.43 | 1.62 | 1.38 |
| 97 | 1.53 | 1.13 | 0.01 | 0.02 | 0.52 | 0.41 | 1.54 | 1.31 |
| 98 | 1.45 | 1.07 | 0.01 | 0.02 | 0.50 | 0.39 | 1.46 | 1.24 |
| 99 | 1.38 | 1.02 | 0.01 | 0.02 | 0.48 | 0.37 | 1.39 | 1.18 |
| 100 | 1.31 | 0.97 | 0.01 | 0.02 | 0.46 | 0.35 | 1.32 | 1.12 |
| 101 | 1.24 | 0.92 | 0.01 | 0.02 | 0.44 | 0.33 | 1.25 | 1.07 |
| 102 | 1.18 | 0.87 | 0.00 | 0.01 | 0.43 | 0.32 | 1.19 | 1.01 |
| 103 | 1.12 | 0.83 | 0.00 | 0.01 | 0.41 | 0.30 | 1.13 | 0.96 |
| 104 | 173.58 | 119.79 | 0.96 | 1.97 | 59.06 | 46.04 | 174.44 | 135.38 |
| 105 | | | | | | | | |
| 106 | | | | | | | | |
| 107 | | | | | | | | |
| 108 | | | | | | | | |

An Example of Output (TOTPV.SUM)

| | BZ | CA | CB |
|---|---|---|---|
| 60 | | | |
| 61 | | | |
| 62 | SOx | PTM | CO2 |
| 63 | 0.04 | 0.12 | 3.80 |
| 64 | 0.04 | 0.11 | 3.58 |
| 65 | 0.04 | 0.10 | 3.37 |
| 66 | 0.04 | 0.10 | 3.17 |
| 67 | 0.03 | 0.09 | 2.98 |
| 68 | 0.03 | 0.09 | 2.81 |
| 69 | 0.03 | 0.08 | 2.64 |
| 70 | 0.03 | 0.08 | 2.48 |
| 71 | 0.03 | 0.07 | 2.33 |
| 72 | 0.03 | 0.07 | 2.19 |
| 73 | 0.03 | 0.07 | 2.06 |
| 74 | 0.02 | 0.06 | 1.93 |
| 75 | 0.02 | 0.06 | 1.81 |
| 76 | 0.02 | 0.06 | 1.70 |
| 77 | 0.02 | 0.05 | 1.60 |
| 78 | 0.02 | 0.05 | 1.50 |
| 79 | 0.02 | 0.05 | 1.41 |
| 80 | 0.02 | 0.05 | 1.32 |
| 81 | 0.02 | 0.04 | 1.24 |
| 82 | 0.02 | 0.04 | 1.16 |
| 83 | 0.02 | 0.04 | 1.09 |
| 84 | 0.01 | 0.04 | 1.03 |
| 85 | 0.01 | 0.04 | 0.97 |
| 86 | 0.01 | 0.03 | 0.92 |
| 87 | 0.01 | 0.03 | 0.86 |
| 88 | 0.01 | 0.03 | 0.81 |
| 89 | 0.01 | 0.03 | 0.77 |
| 90 | 0.01 | 0.03 | 0.72 |
| 91 | 0.01 | 0.03 | 0.68 |
| 92 | 0.01 | 0.03 | 0.64 |
| 93 | 0.01 | 0.02 | 0.61 |
| 94 | 0.01 | 0.02 | 0.58 |
| 95 | 0.01 | 0.02 | 0.56 |
| 96 | 0.01 | 0.02 | 0.54 |
| 97 | 0.01 | 0.02 | 0.52 |
| 98 | 0.01 | 0.02 | 0.50 |
| 99 | 0.01 | 0.02 | 0.48 |
| 100 | 0.01 | 0.02 | 0.46 |
| 101 | 0.01 | 0.02 | 0.44 |
| 102 | 0.01 | 0.02 | 0.42 |
| 103 | 0.01 | 0.01 | 0.41 |
| 104 | 0.76 | 1.97 | 59.13 |
| 105 | | | |
| 106 | | | |
| 107 | | | |
| 108 | | | |

An Example of Output (TOTPV.SUM)

| | N | O | P | Q | R | S | T | U |
|---|---|---|---|---|---|---|---|---|
| 109 | **PRESENT VALUES BY EACH POLLUTANT, BASE YEAR = 2000** | | | | | | | |
| 110 | Year | Before1 (for low speeds) | | | | | | Before 2 (for |
| 111 | | VOC | CO | NOx | SOx | PTM | CO2 | VOC |
| 112 | 2000 | 4.55 | 17.31 | 11.59 | 0.05 | 0.17 | 5.74 | 4.59 |
| 113 | 2001 | 4.26 | 16.22 | 10.89 | 0.05 | 0.16 | 5.40 | 4.30 |
| 114 | 2002 | 3.99 | 15.19 | 10.23 | 0.04 | 0.15 | 5.08 | 4.03 |
| 115 | 2003 | 3.74 | 14.23 | 9.62 | 0.04 | 0.15 | 4.78 | 3.77 |
| 116 | 2004 | 3.50 | 13.33 | 9.03 | 0.04 | 0.14 | 4.50 | 3.53 |
| 117 | 2005 | 3.28 | 12.49 | 8.49 | 0.04 | 0.13 | 4.24 | 3.31 |
| 118 | 2006 | 3.09 | 11.68 | 7.94 | 0.04 | 0.12 | 3.98 | 3.11 |
| 119 | 2007 | 2.90 | 10.93 | 7.42 | 0.03 | 0.12 | 3.73 | 2.92 |
| 120 | 2008 | 2.73 | 10.23 | 6.94 | 0.03 | 0.11 | 3.50 | 2.75 |
| 121 | 2009 | 2.56 | 9.57 | 6.49 | 0.03 | 0.10 | 3.29 | 2.58 |
| 122 | 2010 | 2.41 | 8.95 | 6.07 | 0.03 | 0.10 | 3.09 | 2.43 |
| 123 | 2011 | 2.26 | 8.40 | 5.77 | 0.03 | 0.09 | 2.90 | 2.28 |
| 124 | 2012 | 2.12 | 7.87 | 5.48 | 0.03 | 0.09 | 2.72 | 2.13 |
| 125 | 2013 | 1.98 | 7.38 | 5.20 | 0.03 | 0.08 | 2.55 | 2.00 |
| 126 | 2014 | 1.86 | 6.92 | 4.94 | 0.02 | 0.08 | 2.39 | 1.87 |
| 127 | 2015 | 1.74 | 6.49 | 4.69 | 0.02 | 0.08 | 2.24 | 1.76 |
| 128 | 2016 | 1.63 | 6.09 | 4.45 | 0.02 | 0.07 | 2.11 | 1.65 |
| 129 | 2017 | 1.53 | 5.71 | 4.22 | 0.02 | 0.07 | 1.98 | 1.54 |
| 130 | 2018 | 1.43 | 5.35 | 4.00 | 0.02 | 0.06 | 1.85 | 1.45 |
| 131 | 2019 | 1.34 | 5.02 | 3.80 | 0.02 | 0.06 | 1.74 | 1.35 |
| 132 | 2020 | 1.26 | 4.71 | 3.60 | 0.02 | 0.06 | 1.63 | 1.27 |
| 133 | 2021 | 1.20 | 4.48 | 3.42 | 0.02 | 0.06 | 1.54 | 1.21 |
| 134 | 2022 | 1.14 | 4.26 | 3.26 | 0.02 | 0.05 | 1.45 | 1.15 |
| 135 | 2023 | 1.08 | 4.05 | 3.10 | 0.02 | 0.05 | 1.37 | 1.09 |
| 136 | 2024 | 1.03 | 3.86 | 2.95 | 0.01 | 0.05 | 1.29 | 1.04 |
| 137 | 2025 | 0.98 | 3.66 | 2.80 | 0.01 | 0.05 | 1.22 | 0.99 |
| 138 | 2026 | 0.93 | 3.48 | 2.66 | 0.01 | 0.04 | 1.15 | 0.94 |
| 139 | 2027 | 0.88 | 3.31 | 2.53 | 0.01 | 0.04 | 1.08 | 0.89 |
| 140 | 2028 | 0.84 | 3.14 | 2.40 | 0.01 | 0.04 | 1.02 | 0.85 |
| 141 | 2029 | 0.80 | 2.98 | 2.28 | 0.01 | 0.04 | 0.96 | 0.80 |
| 142 | 2030 | 0.76 | 2.83 | 2.16 | 0.01 | 0.03 | 0.91 | 0.76 |
| 143 | 2031 | 0.72 | 2.70 | 2.06 | 0.01 | 0.03 | 0.87 | 0.72 |
| 144 | 2032 | 0.68 | 2.56 | 1.96 | 0.01 | 0.03 | 0.84 | 0.69 |
| 145 | 2033 | 0.65 | 2.44 | 1.86 | 0.01 | 0.03 | 0.81 | 0.66 |
| 146 | 2034 | 0.62 | 2.32 | 1.77 | 0.01 | 0.03 | 0.78 | 0.62 |
| 147 | 2035 | 0.59 | 2.20 | 1.68 | 0.01 | 0.03 | 0.75 | 0.59 |
| 148 | 2036 | 0.56 | 2.10 | 1.60 | 0.01 | 0.03 | 0.72 | 0.56 |
| 149 | 2037 | 0.53 | 1.99 | 1.52 | 0.01 | 0.02 | 0.69 | 0.53 |
| 150 | 2038 | 0.50 | 1.89 | 1.44 | 0.01 | 0.02 | 0.67 | 0.51 |
| 151 | 2039 | 0.48 | 1.80 | 1.37 | 0.01 | 0.02 | 0.64 | 0.48 |
| 152 | 2040 | 0.45 | 1.70 | 1.30 | 0.01 | 0.02 | 0.61 | 0.46 |
| 153 | TOTAL | 69.59 | 261.84 | 184.99 | 0.88 | 2.90 | 88.83 | 70.16 |
| 154 | **SAVINGS OF PRESENT VALUES BY EACH POLLUTANT, BASE YEAR = 2000** | | | | | | | |
| 155 | After Pre 79 | | | | | | After Pre 90 | |
| 156 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| 157 | **2.3800** | **10.0615** | **-4.3356** | **-0.1208** | **0.0670** | **2.9055** | **2.9303** | **11.9141** |

An Example of Output (TOTPV.SUM)

| | V | W | X | Y | Z | AA | AB | AC |
|---|---|---|---|---|---|---|---|---|
| 109 | | | | | | | | |
| 110 | igh speeds) | | | | | After Pre 79 | | |
| 111 | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 112 | 17.43 | 11.73 | 0.05 | 0.18 | 5.85 | 4.39 | 16.72 | 11.76 |
| 113 | 16.33 | 11.02 | 0.05 | 0.17 | 5.50 | 4.11 | 15.65 | 11.06 |
| 114 | 15.29 | 10.36 | 0.05 | 0.16 | 5.18 | 3.85 | 14.66 | 10.40 |
| 115 | 14.32 | 9.73 | 0.04 | 0.15 | 4.87 | 3.61 | 13.72 | 9.78 |
| 116 | 13.42 | 9.14 | 0.04 | 0.14 | 4.58 | 3.38 | 12.85 | 9.20 |
| 117 | 12.57 | 8.59 | 0.04 | 0.13 | 4.31 | 3.17 | 12.03 | 8.65 |
| 118 | 11.76 | 8.03 | 0.04 | 0.12 | 4.05 | 2.98 | 11.25 | 8.10 |
| 119 | 11.00 | 7.51 | 0.04 | 0.12 | 3.80 | 2.80 | 10.52 | 7.58 |
| 120 | 10.29 | 7.03 | 0.03 | 0.11 | 3.57 | 2.63 | 9.84 | 7.10 |
| 121 | 9.63 | 6.57 | 0.03 | 0.10 | 3.35 | 2.47 | 9.20 | 6.65 |
| 122 | 9.01 | 6.14 | 0.03 | 0.10 | 3.14 | 2.33 | 8.61 | 6.23 |
| 123 | 8.45 | 5.84 | 0.03 | 0.09 | 2.95 | 2.18 | 8.07 | 5.92 |
| 124 | 7.92 | 5.54 | 0.03 | 0.09 | 2.76 | 2.04 | 7.57 | 5.63 |
| 125 | 7.43 | 5.26 | 0.03 | 0.09 | 2.59 | 1.92 | 7.10 | 5.34 |
| 126 | 6.97 | 5.00 | 0.02 | 0.08 | 2.43 | 1.80 | 6.65 | 5.07 |
| 127 | 6.54 | 4.74 | 0.02 | 0.08 | 2.28 | 1.68 | 6.24 | 4.82 |
| 128 | 6.13 | 4.50 | 0.02 | 0.07 | 2.14 | 1.58 | 5.85 | 4.57 |
| 129 | 5.75 | 4.27 | 0.02 | 0.07 | 2.01 | 1.48 | 5.48 | 4.34 |
| 130 | 5.39 | 4.05 | 0.02 | 0.07 | 1.88 | 1.39 | 5.14 | 4.11 |
| 131 | 5.05 | 3.84 | 0.02 | 0.06 | 1.77 | 1.30 | 4.82 | 3.90 |
| 132 | 4.74 | 3.64 | 0.02 | 0.06 | 1.66 | 1.22 | 4.52 | 3.70 |
| 133 | 4.51 | 3.46 | 0.02 | 0.06 | 1.56 | 1.16 | 4.30 | 3.52 |
| 134 | 4.29 | 3.29 | 0.02 | 0.05 | 1.48 | 1.10 | 4.09 | 3.35 |
| 135 | 4.08 | 3.13 | 0.02 | 0.05 | 1.39 | 1.05 | 3.89 | 3.19 |
| 136 | 3.88 | 2.98 | 0.02 | 0.05 | 1.31 | 1.00 | 3.70 | 3.03 |
| 137 | 3.69 | 2.83 | 0.01 | 0.05 | 1.24 | 0.95 | 3.51 | 2.88 |
| 138 | 3.51 | 2.69 | 0.01 | 0.04 | 1.17 | 0.90 | 3.34 | 2.74 |
| 139 | 3.33 | 2.55 | 0.01 | 0.04 | 1.10 | 0.85 | 3.17 | 2.60 |
| 140 | 3.16 | 2.42 | 0.01 | 0.04 | 1.04 | 0.81 | 3.01 | 2.47 |
| 141 | 3.00 | 2.30 | 0.01 | 0.04 | 0.98 | 0.77 | 2.86 | 2.35 |
| 142 | 2.85 | 2.19 | 0.01 | 0.04 | 0.92 | 0.73 | 2.71 | 2.23 |
| 143 | 2.71 | 2.08 | 0.01 | 0.03 | 0.89 | 0.69 | 2.58 | 2.12 |
| 144 | 2.58 | 1.98 | 0.01 | 0.03 | 0.86 | 0.66 | 2.45 | 2.02 |
| 145 | 2.46 | 1.88 | 0.01 | 0.03 | 0.83 | 0.63 | 2.33 | 1.92 |
| 146 | 2.34 | 1.79 | 0.01 | 0.03 | 0.79 | 0.60 | 2.22 | 1.82 |
| 147 | 2.22 | 1.70 | 0.01 | 0.03 | 0.76 | 0.57 | 2.11 | 1.73 |
| 148 | 2.11 | 1.61 | 0.01 | 0.03 | 0.73 | 0.54 | 2.00 | 1.65 |
| 149 | 2.00 | 1.53 | 0.01 | 0.02 | 0.70 | 0.51 | 1.90 | 1.57 |
| 150 | 1.90 | 1.46 | 0.01 | 0.02 | 0.68 | 0.49 | 1.80 | 1.49 |
| 151 | 1.81 | 1.38 | 0.01 | 0.02 | 0.65 | 0.46 | 1.71 | 1.41 |
| 152 | 1.72 | 1.31 | 0.01 | 0.02 | 0.62 | 0.44 | 1.63 | 1.34 |
| 153 | 263.57 | 187.08 | 0.89 | 2.96 | 90.37 | 67.21 | 251.78 | 189.32 |
| 154 | | | | | | | | |
| 155 | | | | | After Acc 110 | | | |
| 156 | NOx | SOx | PTM | CO2 | VOC | CO | NOx | SOx |
| 157 | -11.5163 | -0.1736 | 0.0631 | 3.8000 | 11.2309 | 37.0925 | 29.1738 | -0.0081 |

An Example of Output (TOTPV.SUM)

| | AD | AE | AF | AG | AH | AI | AJ | AK |
|---|---|---|---|---|---|---|---|---|
| 109 | | | | | | | | |
| 110 | | | | After Pre 90 | | | | |
| 111 | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 112 | 0.06 | 0.17 | 5.56 | 4.34 | 16.58 | 12.13 | 0.06 | 0.17 |
| 113 | 0.05 | 0.16 | 5.23 | 4.07 | 15.53 | 11.41 | 0.06 | 0.16 |
| 114 | 0.05 | 0.15 | 4.92 | 3.81 | 14.54 | 10.74 | 0.05 | 0.15 |
| 115 | 0.05 | 0.14 | 4.63 | 3.57 | 13.62 | 10.10 | 0.05 | 0.14 |
| 116 | 0.05 | 0.13 | 4.36 | 3.35 | 12.75 | 9.51 | 0.05 | 0.13 |
| 117 | 0.04 | 0.13 | 4.10 | 3.14 | 11.94 | 8.94 | 0.05 | 0.13 |
| 118 | 0.04 | 0.12 | 3.85 | 2.95 | 11.17 | 8.38 | 0.04 | 0.12 |
| 119 | 0.04 | 0.11 | 3.61 | 2.78 | 10.44 | 7.86 | 0.04 | 0.11 |
| 120 | 0.04 | 0.11 | 3.39 | 2.61 | 9.77 | 7.37 | 0.04 | 0.11 |
| 121 | 0.04 | 0.10 | 3.18 | 2.45 | 9.13 | 6.91 | 0.04 | 0.10 |
| 122 | 0.03 | 0.10 | 2.99 | 2.31 | 8.54 | 6.48 | 0.04 | 0.10 |
| 123 | 0.03 | 0.09 | 2.80 | 2.16 | 8.01 | 6.16 | 0.03 | 0.09 |
| 124 | 0.03 | 0.09 | 2.63 | 2.03 | 7.51 | 5.85 | 0.03 | 0.09 |
| 125 | 0.03 | 0.08 | 2.47 | 1.90 | 7.04 | 5.56 | 0.03 | 0.08 |
| 126 | 0.03 | 0.08 | 2.32 | 1.78 | 6.60 | 5.28 | 0.03 | 0.08 |
| 127 | 0.03 | 0.07 | 2.17 | 1.67 | 6.19 | 5.01 | 0.03 | 0.07 |
| 128 | 0.03 | 0.07 | 2.04 | 1.57 | 5.81 | 4.76 | 0.03 | 0.07 |
| 129 | 0.02 | 0.07 | 1.91 | 1.47 | 5.44 | 4.51 | 0.03 | 0.07 |
| 130 | 0.02 | 0.06 | 1.80 | 1.38 | 5.10 | 4.28 | 0.02 | 0.06 |
| 131 | 0.02 | 0.06 | 1.68 | 1.29 | 4.79 | 4.06 | 0.02 | 0.06 |
| 132 | 0.02 | 0.06 | 1.58 | 1.21 | 4.49 | 3.85 | 0.02 | 0.06 |
| 133 | 0.02 | 0.05 | 1.49 | 1.15 | 4.27 | 3.67 | 0.02 | 0.05 |
| 134 | 0.02 | 0.05 | 1.40 | 1.10 | 4.06 | 3.49 | 0.02 | 0.05 |
| 135 | 0.02 | 0.05 | 1.32 | 1.04 | 3.86 | 3.32 | 0.02 | 0.05 |
| 136 | 0.02 | 0.05 | 1.25 | 0.99 | 3.67 | 3.16 | 0.02 | 0.05 |
| 137 | 0.02 | 0.04 | 1.18 | 0.94 | 3.49 | 3.00 | 0.02 | 0.04 |
| 138 | 0.02 | 0.04 | 1.11 | 0.89 | 3.31 | 2.85 | 0.02 | 0.04 |
| 139 | 0.01 | 0.04 | 1.05 | 0.85 | 3.15 | 2.71 | 0.02 | 0.04 |
| 140 | 0.01 | 0.04 | 0.99 | 0.81 | 2.99 | 2.58 | 0.01 | 0.04 |
| 141 | 0.01 | 0.04 | 0.93 | 0.77 | 2.84 | 2.45 | 0.01 | 0.04 |
| 142 | 0.01 | 0.03 | 0.87 | 0.73 | 2.69 | 2.32 | 0.01 | 0.03 |
| 143 | 0.01 | 0.03 | 0.84 | 0.69 | 2.56 | 2.21 | 0.01 | 0.03 |
| 144 | 0.01 | 0.03 | 0.81 | 0.66 | 2.44 | 2.10 | 0.01 | 0.03 |
| 145 | 0.01 | 0.03 | 0.78 | 0.63 | 2.32 | 2.00 | 0.01 | 0.03 |
| 146 | 0.01 | 0.03 | 0.75 | 0.59 | 2.20 | 1.90 | 0.01 | 0.03 |
| 147 | 0.01 | 0.03 | 0.72 | 0.56 | 2.09 | 1.81 | 0.01 | 0.03 |
| 148 | 0.01 | 0.03 | 0.69 | 0.54 | 1.99 | 1.72 | 0.01 | 0.03 |
| 149 | 0.01 | 0.02 | 0.67 | 0.51 | 1.89 | 1.63 | 0.01 | 0.02 |
| 150 | 0.01 | 0.02 | 0.64 | 0.48 | 1.79 | 1.55 | 0.01 | 0.02 |
| 151 | 0.01 | 0.02 | 0.61 | 0.46 | 1.70 | 1.47 | 0.01 | 0.02 |
| 152 | 0.01 | 0.02 | 0.59 | 0.44 | 1.62 | 1.40 | 0.01 | 0.02 |
| 153 | 1.00 | 2.84 | 85.92 | 66.66 | 249.93 | 196.50 | 1.06 | 2.84 |
| 154 | | | | | | | | |
| 155 | | | After Acc 125E | | | | | |
| 156 | PTM | CO2 | VOC | CO | NOx | SOx | PTM | CO2 |
| 157 | **0.8407** | **25.2335** | **5.8785** | **16.9469** | **15.6022** | **-0.4653** | **0.1041** | **4.9941** |

An Example of Output (TOTPV.SUM)

| | AL | AM | AN | AO | AP | AQ | AR | AS |
|---|---|---|---|---|---|---|---|---|
| 109 | | | | | | | | |
| 110 | | After Acc 110 | | | | | | After Acc 125 |
| 111 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC |
| 112 | 5.49 | 3.72 | 14.85 | 9.54 | 0.05 | 0.11 | 4.00 | 4.16 |
| 113 | 5.17 | 3.51 | 13.92 | 8.97 | 0.05 | 0.11 | 3.77 | 3.90 |
| 114 | 4.86 | 3.30 | 13.04 | 8.43 | 0.04 | 0.10 | 3.55 | 3.66 |
| 115 | 4.58 | 3.11 | 12.22 | 7.92 | 0.04 | 0.10 | 3.34 | 3.43 |
| 116 | 4.30 | 2.93 | 11.45 | 7.44 | 0.04 | 0.09 | 3.15 | 3.21 |
| 117 | 4.05 | 2.76 | 10.73 | 6.99 | 0.04 | 0.09 | 2.97 | 3.01 |
| 118 | 3.80 | 2.60 | 10.04 | 6.56 | 0.04 | 0.08 | 2.80 | 2.83 |
| 119 | 3.57 | 2.44 | 9.40 | 6.16 | 0.03 | 0.08 | 2.64 | 2.66 |
| 120 | 3.35 | 2.30 | 8.80 | 5.79 | 0.03 | 0.08 | 2.49 | 2.50 |
| 121 | 3.15 | 2.17 | 8.23 | 5.43 | 0.03 | 0.07 | 2.35 | 2.35 |
| 122 | 2.96 | 2.04 | 7.70 | 5.10 | 0.03 | 0.07 | 2.22 | 2.21 |
| 123 | 2.77 | 1.91 | 7.22 | 4.86 | 0.03 | 0.07 | 2.09 | 2.07 |
| 124 | 2.60 | 1.79 | 6.77 | 4.63 | 0.03 | 0.06 | 1.96 | 1.94 |
| 125 | 2.44 | 1.68 | 6.34 | 4.41 | 0.03 | 0.06 | 1.84 | 1.82 |
| 126 | 2.29 | 1.57 | 5.95 | 4.20 | 0.03 | 0.06 | 1.73 | 1.70 |
| 127 | 2.15 | 1.47 | 5.57 | 3.99 | 0.02 | 0.05 | 1.63 | 1.60 |
| 128 | 2.02 | 1.38 | 5.22 | 3.80 | 0.02 | 0.05 | 1.53 | 1.50 |
| 129 | 1.89 | 1.29 | 4.90 | 3.61 | 0.02 | 0.05 | 1.44 | 1.40 |
| 130 | 1.78 | 1.21 | 4.59 | 3.43 | 0.02 | 0.05 | 1.36 | 1.31 |
| 131 | 1.67 | 1.13 | 4.30 | 3.26 | 0.02 | 0.05 | 1.27 | 1.23 |
| 132 | 1.57 | 1.06 | 4.03 | 3.10 | 0.02 | 0.04 | 1.20 | 1.15 |
| 133 | 1.48 | 1.01 | 3.84 | 2.95 | 0.02 | 0.04 | 1.13 | 1.10 |
| 134 | 1.39 | 0.96 | 3.65 | 2.81 | 0.02 | 0.04 | 1.06 | 1.04 |
| 135 | 1.31 | 0.91 | 3.47 | 2.67 | 0.02 | 0.04 | 1.00 | 0.99 |
| 136 | 1.24 | 0.87 | 3.30 | 2.54 | 0.02 | 0.04 | 0.94 | 0.94 |
| 137 | 1.17 | 0.83 | 3.14 | 2.42 | 0.01 | 0.03 | 0.89 | 0.90 |
| 138 | 1.10 | 0.78 | 2.98 | 2.30 | 0.01 | 0.03 | 0.84 | 0.85 |
| 139 | 1.04 | 0.74 | 2.83 | 2.18 | 0.01 | 0.03 | 0.79 | 0.81 |
| 140 | 0.98 | 0.71 | 2.69 | 2.08 | 0.01 | 0.03 | 0.74 | 0.77 |
| 141 | 0.92 | 0.67 | 2.55 | 1.97 | 0.01 | 0.03 | 0.70 | 0.73 |
| 142 | 0.87 | 0.64 | 2.42 | 1.87 | 0.01 | 0.03 | 0.66 | 0.69 |
| 143 | 0.84 | 0.61 | 2.31 | 1.78 | 0.01 | 0.02 | 0.64 | 0.66 |
| 144 | 0.81 | 0.58 | 2.19 | 1.70 | 0.01 | 0.02 | 0.62 | 0.62 |
| 145 | 0.78 | 0.55 | 2.09 | 1.61 | 0.01 | 0.02 | 0.60 | 0.59 |
| 146 | 0.75 | 0.52 | 1.98 | 1.54 | 0.01 | 0.02 | 0.58 | 0.56 |
| 147 | 0.72 | 0.50 | 1.89 | 1.46 | 0.01 | 0.02 | 0.56 | 0.54 |
| 148 | 0.69 | 0.47 | 1.79 | 1.39 | 0.01 | 0.02 | 0.54 | 0.51 |
| 149 | 0.66 | 0.45 | 1.70 | 1.32 | 0.01 | 0.02 | 0.52 | 0.48 |
| 150 | 0.63 | 0.43 | 1.62 | 1.25 | 0.01 | 0.02 | 0.50 | 0.46 |
| 151 | 0.61 | 0.40 | 1.54 | 1.19 | 0.01 | 0.02 | 0.48 | 0.44 |
| 152 | 0.58 | 0.38 | 1.46 | 1.13 | 0.01 | 0.02 | 0.46 | 0.41 |
| 153 | 85.03 | 58.36 | 224.75 | 155.81 | 0.89 | 2.06 | 63.59 | 63.71 |
| 154 | | | | | | | | |
| 155 | After Acc 125NE | | | | | | After Maglev | |
| 156 | VOC | CO | NOx | SOx | PTM | CO2 | VOC | CO |
| 157 | **4.9457** | **16.3850** | **1.3524** | **-0.0950** | **0.2021** | **6.5167** | **8.4613** | **25.3467** |

An Example of Output (TOTPV.SUM)

| | AT | AU | AV | AW | AX | AY | AZ | BA |
|---|---|---|---|---|---|---|---|---|
| 109 | | | | | | | | |
| 110 | | | | | | After Acc 125NE | | |
| 111 | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 112 | 16.26 | 10.72 | 0.09 | 0.17 | 5.40 | 4.21 | 16.30 | 11.42 |
| 113 | 15.23 | 10.06 | 0.09 | 0.16 | 5.08 | 3.95 | 15.26 | 10.73 |
| 114 | 14.26 | 9.44 | 0.08 | 0.15 | 4.78 | 3.70 | 14.29 | 10.09 |
| 115 | 13.35 | 8.86 | 0.08 | 0.14 | 4.50 | 3.47 | 13.38 | 9.48 |
| 116 | 12.50 | 8.31 | 0.07 | 0.13 | 4.23 | 3.25 | 12.53 | 8.91 |
| 117 | 11.71 | 7.80 | 0.07 | 0.12 | 3.98 | 3.05 | 11.73 | 8.38 |
| 118 | 10.95 | 7.29 | 0.06 | 0.12 | 3.74 | 2.87 | 10.97 | 7.85 |
| 119 | 10.24 | 6.82 | 0.06 | 0.11 | 3.51 | 2.70 | 10.26 | 7.35 |
| 120 | 9.57 | 6.37 | 0.05 | 0.11 | 3.30 | 2.53 | 9.59 | 6.89 |
| 121 | 8.95 | 5.95 | 0.05 | 0.10 | 3.10 | 2.38 | 8.97 | 6.45 |
| 122 | 8.37 | 5.56 | 0.05 | 0.09 | 2.91 | 2.24 | 8.39 | 6.04 |
| 123 | 7.85 | 5.28 | 0.04 | 0.09 | 2.73 | 2.10 | 7.87 | 5.74 |
| 124 | 7.36 | 5.02 | 0.04 | 0.08 | 2.57 | 1.97 | 7.38 | 5.46 |
| 125 | 6.90 | 4.76 | 0.04 | 0.08 | 2.41 | 1.84 | 6.92 | 5.18 |
| 126 | 6.47 | 4.52 | 0.04 | 0.08 | 2.26 | 1.73 | 6.48 | 4.92 |
| 127 | 6.07 | 4.29 | 0.03 | 0.07 | 2.13 | 1.62 | 6.08 | 4.67 |
| 128 | 5.69 | 4.07 | 0.03 | 0.07 | 2.00 | 1.52 | 5.70 | 4.44 |
| 129 | 5.33 | 3.86 | 0.03 | 0.07 | 1.87 | 1.42 | 5.34 | 4.21 |
| 130 | 5.00 | 3.66 | 0.03 | 0.06 | 1.76 | 1.33 | 5.01 | 3.99 |
| 131 | 4.69 | 3.47 | 0.03 | 0.06 | 1.65 | 1.25 | 4.70 | 3.79 |
| 132 | 4.39 | 3.29 | 0.02 | 0.06 | 1.55 | 1.17 | 4.40 | 3.59 |
| 133 | 4.18 | 3.12 | 0.02 | 0.05 | 1.46 | 1.12 | 4.19 | 3.42 |
| 134 | 3.98 | 2.97 | 0.02 | 0.05 | 1.38 | 1.06 | 3.99 | 3.25 |
| 135 | 3.78 | 2.82 | 0.02 | 0.05 | 1.30 | 1.01 | 3.79 | 3.09 |
| 136 | 3.59 | 2.68 | 0.02 | 0.05 | 1.23 | 0.96 | 3.60 | 2.94 |
| 137 | 3.41 | 2.54 | 0.02 | 0.04 | 1.16 | 0.91 | 3.42 | 2.79 |
| 138 | 3.24 | 2.42 | 0.02 | 0.04 | 1.09 | 0.86 | 3.25 | 2.66 |
| 139 | 3.08 | 2.29 | 0.02 | 0.04 | 1.03 | 0.82 | 3.09 | 2.52 |
| 140 | 2.93 | 2.18 | 0.01 | 0.04 | 0.97 | 0.78 | 2.93 | 2.40 |
| 141 | 2.78 | 2.07 | 0.01 | 0.04 | 0.91 | 0.74 | 2.78 | 2.27 |
| 142 | 2.64 | 1.96 | 0.01 | 0.03 | 0.86 | 0.70 | 2.64 | 2.16 |
| 143 | 2.51 | 1.86 | 0.01 | 0.03 | 0.83 | 0.67 | 2.51 | 2.05 |
| 144 | 2.39 | 1.77 | 0.01 | 0.03 | 0.80 | 0.64 | 2.39 | 1.95 |
| 145 | 2.27 | 1.68 | 0.01 | 0.03 | 0.77 | 0.60 | 2.27 | 1.86 |
| 146 | 2.16 | 1.60 | 0.01 | 0.03 | 0.74 | 0.57 | 2.16 | 1.77 |
| 147 | 2.05 | 1.52 | 0.01 | 0.03 | 0.71 | 0.55 | 2.05 | 1.68 |
| 148 | 1.95 | 1.44 | 0.01 | 0.02 | 0.68 | 0.52 | 1.95 | 1.60 |
| 149 | 1.85 | 1.37 | 0.01 | 0.02 | 0.66 | 0.49 | 1.85 | 1.52 |
| 150 | 1.76 | 1.30 | 0.01 | 0.02 | 0.63 | 0.47 | 1.76 | 1.44 |
| 151 | 1.67 | 1.23 | 0.01 | 0.02 | 0.60 | 0.44 | 1.67 | 1.37 |
| 152 | 1.58 | 1.17 | 0.01 | 0.02 | 0.58 | 0.42 | 1.59 | 1.30 |
| 153 | 244.89 | 169.38 | 1.35 | 2.80 | 83.83 | 64.64 | 245.46 | 183.63 |
| 154 | | | | | | | | |
| 155 | | | | | After TGV | | | |
| 156 | NOx | SOx | PTM | CO2 | VOC | CO | NOx | SOx |
| 157 | **19.8303** | **-1.5056** | **-0.1529** | **2.6108** | **6.9990** | **21.9861** | **20.4454** | **-0.7446** |

An Example of Output (TOTPV.SUM)

| | BB | BC | BD | BE | BF | BG | BH | BI |
|---|---|---|---|---|---|---|---|---|
| 109 | | | | | | | | |
| 110 | | | | After Maglev | | | | |
| 111 | SOx | PTM | CO2 | VOC | CO | NOx | SOx | PTM |
| 112 | 0.05 | 0.16 | 5.32 | 4.00 | 15.78 | 10.60 | 0.18 | 0.18 |
| 113 | 0.05 | 0.15 | 5.00 | 3.75 | 14.78 | 9.95 | 0.17 | 0.17 |
| 114 | 0.05 | 0.14 | 4.71 | 3.52 | 13.84 | 9.33 | 0.16 | 0.17 |
| 115 | 0.05 | 0.13 | 4.43 | 3.31 | 12.96 | 8.75 | 0.15 | 0.16 |
| 116 | 0.04 | 0.13 | 4.16 | 3.10 | 12.14 | 8.21 | 0.14 | 0.15 |
| 117 | 0.04 | 0.12 | 3.92 | 2.91 | 11.37 | 7.70 | 0.13 | 0.14 |
| 118 | 0.04 | 0.11 | 3.68 | 2.74 | 10.64 | 7.20 | 0.12 | 0.13 |
| 119 | 0.04 | 0.11 | 3.46 | 2.57 | 9.95 | 6.73 | 0.11 | 0.12 |
| 120 | 0.04 | 0.10 | 3.25 | 2.42 | 9.31 | 6.29 | 0.10 | 0.12 |
| 121 | 0.03 | 0.10 | 3.05 | 2.28 | 8.70 | 5.88 | 0.09 | 0.11 |
| 122 | 0.03 | 0.09 | 2.86 | 2.14 | 8.14 | 5.50 | 0.09 | 0.10 |
| 123 | 0.03 | 0.09 | 2.69 | 2.00 | 7.64 | 5.22 | 0.08 | 0.10 |
| 124 | 0.03 | 0.08 | 2.52 | 1.88 | 7.16 | 4.96 | 0.07 | 0.09 |
| 125 | 0.03 | 0.08 | 2.37 | 1.76 | 6.71 | 4.71 | 0.07 | 0.09 |
| 126 | 0.03 | 0.07 | 2.22 | 1.65 | 6.30 | 4.47 | 0.06 | 0.09 |
| 127 | 0.03 | 0.07 | 2.08 | 1.55 | 5.90 | 4.24 | 0.06 | 0.08 |
| 128 | 0.02 | 0.07 | 1.96 | 1.45 | 5.54 | 4.02 | 0.05 | 0.08 |
| 129 | 0.02 | 0.06 | 1.84 | 1.36 | 5.19 | 3.81 | 0.05 | 0.07 |
| 130 | 0.02 | 0.06 | 1.72 | 1.27 | 4.87 | 3.62 | 0.05 | 0.07 |
| 131 | 0.02 | 0.06 | 1.62 | 1.20 | 4.56 | 3.43 | 0.04 | 0.07 |
| 132 | 0.02 | 0.05 | 1.52 | 1.12 | 4.28 | 3.25 | 0.04 | 0.06 |
| 133 | 0.02 | 0.05 | 1.43 | 1.07 | 4.07 | 3.09 | 0.04 | 0.06 |
| 134 | 0.02 | 0.05 | 1.35 | 1.01 | 3.87 | 2.93 | 0.03 | 0.06 |
| 135 | 0.02 | 0.05 | 1.27 | 0.96 | 3.68 | 2.78 | 0.03 | 0.05 |
| 136 | 0.02 | 0.04 | 1.20 | 0.92 | 3.50 | 2.64 | 0.03 | 0.05 |
| 137 | 0.02 | 0.04 | 1.13 | 0.87 | 3.33 | 2.51 | 0.03 | 0.05 |
| 138 | 0.02 | 0.04 | 1.06 | 0.83 | 3.16 | 2.38 | 0.02 | 0.05 |
| 139 | 0.01 | 0.04 | 1.00 | 0.79 | 3.01 | 2.26 | 0.02 | 0.04 |
| 140 | 0.01 | 0.04 | 0.94 | 0.75 | 2.85 | 2.14 | 0.02 | 0.04 |
| 141 | 0.01 | 0.03 | 0.89 | 0.71 | 2.71 | 2.03 | 0.02 | 0.04 |
| 142 | 0.01 | 0.03 | 0.84 | 0.67 | 2.57 | 1.93 | 0.02 | 0.04 |
| 143 | 0.01 | 0.03 | 0.81 | 0.64 | 2.45 | 1.83 | 0.02 | 0.04 |
| 144 | 0.01 | 0.03 | 0.78 | 0.61 | 2.33 | 1.74 | 0.01 | 0.03 |
| 145 | 0.01 | 0.03 | 0.75 | 0.58 | 2.21 | 1.65 | 0.01 | 0.03 |
| 146 | 0.01 | 0.03 | 0.72 | 0.55 | 2.11 | 1.57 | 0.01 | 0.03 |
| 147 | 0.01 | 0.03 | 0.69 | 0.52 | 2.00 | 1.49 | 0.01 | 0.03 |
| 148 | 0.01 | 0.02 | 0.67 | 0.50 | 1.90 | 1.42 | 0.01 | 0.03 |
| 149 | 0.01 | 0.02 | 0.64 | 0.47 | 1.81 | 1.34 | 0.01 | 0.03 |
| 150 | 0.01 | 0.02 | 0.61 | 0.45 | 1.72 | 1.27 | 0.01 | 0.02 |
| 151 | 0.01 | 0.02 | 0.59 | 0.43 | 1.63 | 1.21 | 0.01 | 0.02 |
| 152 | 0.01 | 0.02 | 0.56 | 0.40 | 1.55 | 1.15 | 0.01 | 0.02 |
| 153 | 0.98 | 2.70 | 82.31 | 61.70 | 238.22 | 167.25 | 2.40 | 3.11 |
| 154 | | | | | | | | |
| 155 | | | After Acc 150E | | | | | |
| 156 | PTM | CO2 | VOC | CO | NOx | SOx | PTM | CO2 |
| 157 | **0.1004** | **6.7371** | **6.2013** | **18.3808** | **16.9789** | **-0.4642** | **0.1366** | **5.9881** |

An Example of Output (TOTPV.SUM)

| | BJ | BK | BL | BM | BN | BO | BP | BQ |
|---|---|---|---|---|---|---|---|---|
| 109 | | | | | | | | |
| 110 | | After TGV | | | | | | After Acc 150 |
| 111 | CO2 | VOC | CO | NOx | SOx | PTM | CO2 | VOC |
| 112 | 5.53 | 4.14 | 16.08 | 10.57 | 0.12 | 0.17 | 5.36 | 4.14 |
| 113 | 5.21 | 3.88 | 15.05 | 9.91 | 0.11 | 0.16 | 5.04 | 3.88 |
| 114 | 4.91 | 3.64 | 14.09 | 9.30 | 0.10 | 0.15 | 4.75 | 3.64 |
| 115 | 4.63 | 3.41 | 13.19 | 8.72 | 0.10 | 0.14 | 4.47 | 3.41 |
| 116 | 4.36 | 3.20 | 12.35 | 8.18 | 0.09 | 0.14 | 4.20 | 3.19 |
| 117 | 4.11 | 2.99 | 11.56 | 7.67 | 0.08 | 0.13 | 3.96 | 2.99 |
| 118 | 3.87 | 2.81 | 10.81 | 7.17 | 0.08 | 0.12 | 3.72 | 2.81 |
| 119 | 3.64 | 2.64 | 10.11 | 6.71 | 0.07 | 0.11 | 3.50 | 2.65 |
| 120 | 3.43 | 2.48 | 9.45 | 6.27 | 0.07 | 0.11 | 3.29 | 2.49 |
| 121 | 3.23 | 2.33 | 8.83 | 5.86 | 0.06 | 0.10 | 3.09 | 2.34 |
| 122 | 3.04 | 2.19 | 8.26 | 5.48 | 0.06 | 0.10 | 2.90 | 2.20 |
| 123 | 2.86 | 2.05 | 7.74 | 5.20 | 0.05 | 0.09 | 2.73 | 2.06 |
| 124 | 2.69 | 1.92 | 7.26 | 4.94 | 0.05 | 0.09 | 2.56 | 1.93 |
| 125 | 2.53 | 1.80 | 6.80 | 4.69 | 0.05 | 0.08 | 2.41 | 1.81 |
| 126 | 2.38 | 1.69 | 6.38 | 4.45 | 0.04 | 0.08 | 2.26 | 1.69 |
| 127 | 2.24 | 1.58 | 5.98 | 4.22 | 0.04 | 0.07 | 2.13 | 1.59 |
| 128 | 2.11 | 1.48 | 5.61 | 4.00 | 0.04 | 0.07 | 2.00 | 1.49 |
| 129 | 1.99 | 1.39 | 5.25 | 3.80 | 0.04 | 0.07 | 1.88 | 1.39 |
| 130 | 1.87 | 1.30 | 4.93 | 3.60 | 0.03 | 0.06 | 1.76 | 1.31 |
| 131 | 1.76 | 1.22 | 4.62 | 3.41 | 0.03 | 0.06 | 1.66 | 1.22 |
| 132 | 1.65 | 1.14 | 4.33 | 3.23 | 0.03 | 0.06 | 1.55 | 1.15 |
| 133 | 1.56 | 1.08 | 4.12 | 3.07 | 0.03 | 0.05 | 1.47 | 1.09 |
| 134 | 1.47 | 1.03 | 3.92 | 2.92 | 0.03 | 0.05 | 1.38 | 1.04 |
| 135 | 1.39 | 0.98 | 3.72 | 2.77 | 0.02 | 0.05 | 1.30 | 0.99 |
| 136 | 1.31 | 0.93 | 3.54 | 2.63 | 0.02 | 0.05 | 1.23 | 0.94 |
| 137 | 1.24 | 0.88 | 3.36 | 2.50 | 0.02 | 0.04 | 1.16 | 0.89 |
| 138 | 1.17 | 0.84 | 3.19 | 2.37 | 0.02 | 0.04 | 1.09 | 0.85 |
| 139 | 1.10 | 0.80 | 3.03 | 2.25 | 0.02 | 0.04 | 1.03 | 0.80 |
| 140 | 1.04 | 0.76 | 2.88 | 2.14 | 0.02 | 0.04 | 0.97 | 0.76 |
| 141 | 0.98 | 0.72 | 2.73 | 2.03 | 0.01 | 0.04 | 0.92 | 0.72 |
| 142 | 0.93 | 0.68 | 2.59 | 1.92 | 0.01 | 0.03 | 0.86 | 0.69 |
| 143 | 0.89 | 0.65 | 2.47 | 1.83 | 0.01 | 0.03 | 0.83 | 0.65 |
| 144 | 0.86 | 0.62 | 2.35 | 1.74 | 0.01 | 0.03 | 0.80 | 0.62 |
| 145 | 0.83 | 0.58 | 2.23 | 1.65 | 0.01 | 0.03 | 0.77 | 0.59 |
| 146 | 0.80 | 0.56 | 2.12 | 1.57 | 0.01 | 0.03 | 0.74 | 0.56 |
| 147 | 0.76 | 0.53 | 2.01 | 1.49 | 0.01 | 0.03 | 0.71 | 0.53 |
| 148 | 0.73 | 0.50 | 1.91 | 1.41 | 0.01 | 0.02 | 0.69 | 0.51 |
| 149 | 0.70 | 0.48 | 1.82 | 1.34 | 0.01 | 0.02 | 0.66 | 0.48 |
| 150 | 0.68 | 0.45 | 1.73 | 1.27 | 0.01 | 0.02 | 0.63 | 0.46 |
| 151 | 0.65 | 0.43 | 1.64 | 1.21 | 0.01 | 0.02 | 0.60 | 0.43 |
| 152 | 0.62 | 0.41 | 1.55 | 1.15 | 0.01 | 0.02 | 0.58 | 0.41 |
| 153 | 87.76 | 63.16 | 241.58 | 166.63 | 1.64 | 2.86 | 83.63 | 63.39 |
| 154 | | | | | | | | |
| 155 | After Acc 150NE | | | | | | | |
| 156 | VOC | CO | NOx | SOx | PTM | CO2 | | |
| 157 | **5.0171** | **17.1815** | **-4.8947** | **-0.1779** | **0.1359** | **5.8969** | | |

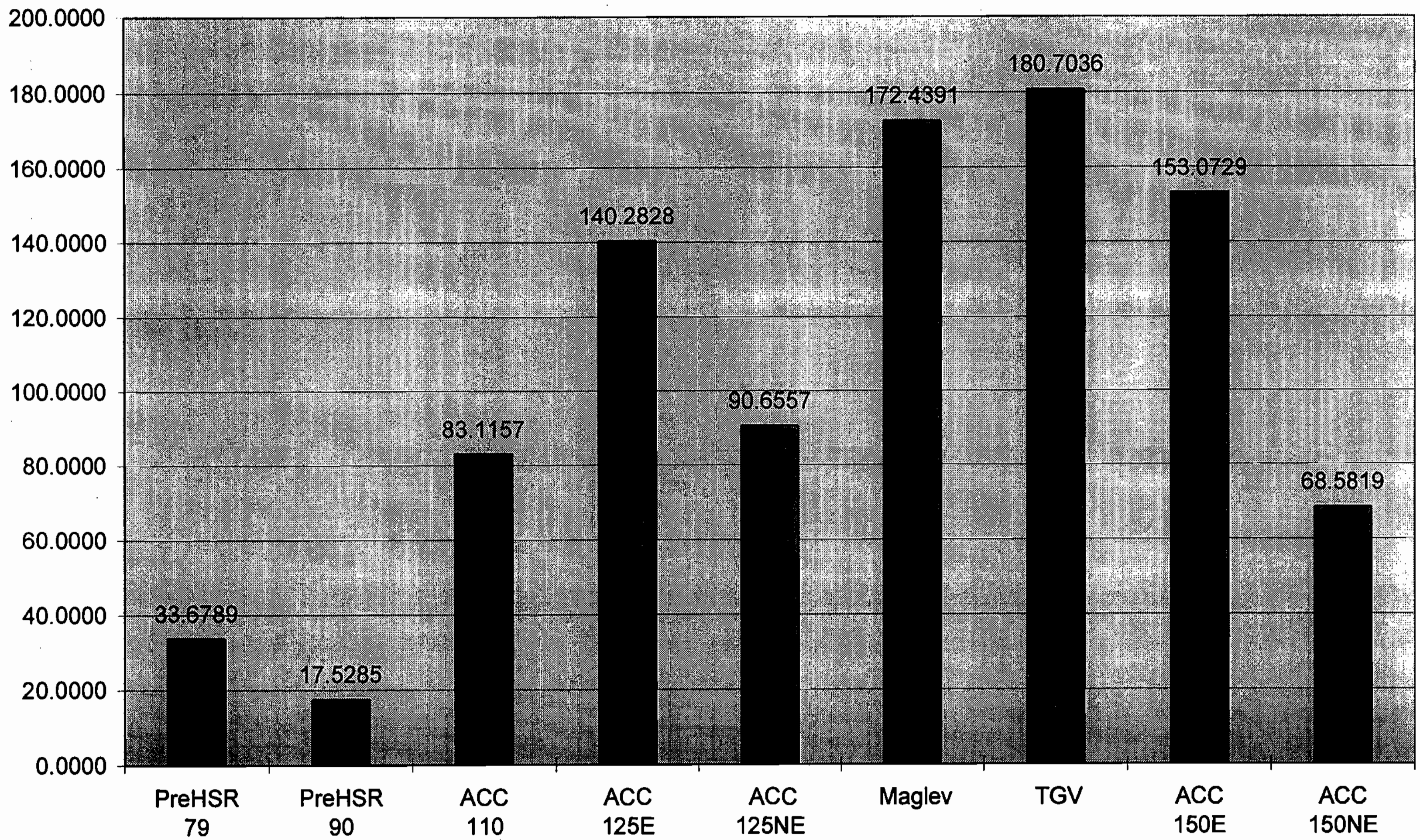
An Example of Output (TOTPV.SUM)

| | BR | BS | BT | BU | BV | BW | BX | BY |
|---|---|---|---|---|---|---|---|---|
| 109 | | | | | | | | |
| 110 | | | | | | After Acc 150NE | | |
| 111 | CO | NOx | SOx | PTM | CO2 | VOC | CO | NOx |
| 112 | 16.17 | 10.63 | 0.09 | 0.16 | 5.33 | 4.20 | 16.24 | 11.74 |
| 113 | 15.14 | 9.98 | 0.09 | 0.16 | 5.02 | 3.94 | 15.20 | 11.04 |
| 114 | 14.17 | 9.36 | 0.08 | 0.15 | 4.72 | 3.69 | 14.24 | 10.39 |
| 115 | 13.27 | 8.79 | 0.08 | 0.14 | 4.44 | 3.46 | 13.33 | 9.77 |
| 116 | 12.43 | 8.24 | 0.07 | 0.13 | 4.18 | 3.25 | 12.48 | 9.19 |
| 117 | 11.64 | 7.74 | 0.07 | 0.12 | 3.93 | 3.05 | 11.69 | 8.64 |
| 118 | 10.88 | 7.23 | 0.06 | 0.12 | 3.69 | 2.86 | 10.93 | 8.10 |
| 119 | 10.18 | 6.76 | 0.06 | 0.11 | 3.47 | 2.69 | 10.22 | 7.59 |
| 120 | 9.52 | 6.32 | 0.05 | 0.10 | 3.26 | 2.53 | 9.56 | 7.12 |
| 121 | 8.90 | 5.90 | 0.05 | 0.10 | 3.06 | 2.38 | 8.94 | 6.67 |
| 122 | 8.32 | 5.52 | 0.05 | 0.09 | 2.88 | 2.24 | 8.36 | 6.26 |
| 123 | 7.80 | 5.24 | 0.04 | 0.09 | 2.70 | 2.10 | 7.84 | 5.95 |
| 124 | 7.32 | 4.98 | 0.04 | 0.08 | 2.54 | 1.97 | 7.35 | 5.65 |
| 125 | 6.86 | 4.72 | 0.04 | 0.08 | 2.38 | 1.84 | 6.89 | 5.37 |
| 126 | 6.43 | 4.48 | 0.04 | 0.08 | 2.24 | 1.73 | 6.46 | 5.10 |
| 127 | 6.03 | 4.25 | 0.03 | 0.07 | 2.10 | 1.62 | 6.06 | 4.84 |
| 128 | 5.65 | 4.03 | 0.03 | 0.07 | 1.97 | 1.52 | 5.68 | 4.60 |
| 129 | 5.30 | 3.83 | 0.03 | 0.06 | 1.85 | 1.42 | 5.33 | 4.36 |
| 130 | 4.97 | 3.63 | 0.03 | 0.06 | 1.74 | 1.33 | 5.00 | 4.14 |
| 131 | 4.66 | 3.44 | 0.03 | 0.06 | 1.63 | 1.25 | 4.68 | 3.93 |
| 132 | 4.37 | 3.26 | 0.02 | 0.06 | 1.53 | 1.17 | 4.39 | 3.72 |
| 133 | 4.16 | 3.10 | 0.02 | 0.05 | 1.45 | 1.12 | 4.18 | 3.54 |
| 134 | 3.95 | 2.95 | 0.02 | 0.05 | 1.36 | 1.06 | 3.97 | 3.37 |
| 135 | 3.76 | 2.80 | 0.02 | 0.05 | 1.29 | 1.01 | 3.78 | 3.21 |
| 136 | 3.57 | 2.66 | 0.02 | 0.05 | 1.21 | 0.96 | 3.59 | 3.05 |
| 137 | 3.39 | 2.53 | 0.02 | 0.04 | 1.14 | 0.91 | 3.41 | 2.90 |
| 138 | 3.22 | 2.40 | 0.02 | 0.04 | 1.08 | 0.86 | 3.24 | 2.76 |
| 139 | 3.06 | 2.28 | 0.02 | 0.04 | 1.01 | 0.82 | 3.08 | 2.62 |
| 140 | 2.91 | 2.16 | 0.01 | 0.04 | 0.96 | 0.78 | 2.92 | 2.49 |
| 141 | 2.76 | 2.05 | 0.01 | 0.03 | 0.90 | 0.74 | 2.78 | 2.36 |
| 142 | 2.62 | 1.94 | 0.01 | 0.03 | 0.85 | 0.70 | 2.64 | 2.24 |
| 143 | 2.49 | 1.85 | 0.01 | 0.03 | 0.82 | 0.67 | 2.51 | 2.13 |
| 144 | 2.37 | 1.76 | 0.01 | 0.03 | 0.79 | 0.64 | 2.38 | 2.03 |
| 145 | 2.25 | 1.67 | 0.01 | 0.03 | 0.76 | 0.60 | 2.27 | 1.93 |
| 146 | 2.14 | 1.59 | 0.01 | 0.03 | 0.73 | 0.57 | 2.16 | 1.84 |
| 147 | 2.04 | 1.51 | 0.01 | 0.03 | 0.70 | 0.55 | 2.05 | 1.74 |
| 148 | 1.94 | 1.43 | 0.01 | 0.02 | 0.68 | 0.52 | 1.95 | 1.66 |
| 149 | 1.84 | 1.36 | 0.01 | 0.02 | 0.65 | 0.49 | 1.85 | 1.57 |
| 150 | 1.75 | 1.29 | 0.01 | 0.02 | 0.62 | 0.47 | 1.76 | 1.50 |
| 151 | 1.66 | 1.22 | 0.01 | 0.02 | 0.60 | 0.44 | 1.67 | 1.42 |
| 152 | 1.57 | 1.16 | 0.01 | 0.02 | 0.57 | 0.42 | 1.58 | 1.35 |
| 153 | 243.46 | 168.01 | 1.35 | 2.77 | 82.84 | 64.57 | 244.66 | 189.88 |
| 154 | | | | | | | | |
| 155 | | | | | | | | |
| 156 | | | | | | | | |
| 157 | | | | | | | | |

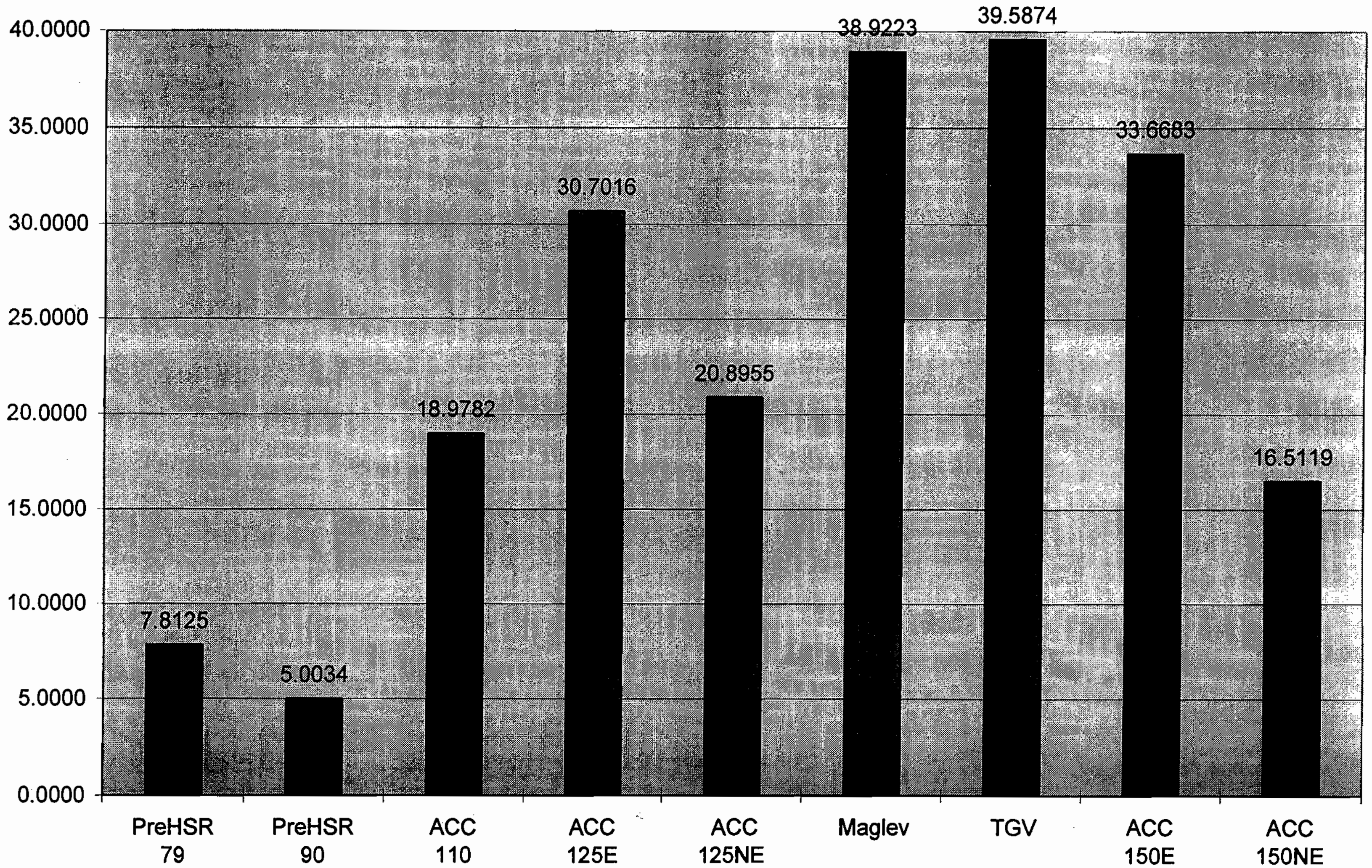
An Example of Output (TOTPV.SUM)

| | BZ | CA | CB |
|---|---|---|---|
| 109 | | | |
| 110 | | | |
| 111 | SOx | PTM | CO2 |
| 112 | 0.06 | 0.16 | 5.34 |
| 113 | 0.06 | 0.15 | 5.02 |
| 114 | 0.05 | 0.15 | 4.73 |
| 115 | 0.05 | 0.14 | 4.45 |
| 116 | 0.05 | 0.13 | 4.19 |
| 117 | 0.05 | 0.12 | 3.94 |
| 118 | 0.04 | 0.12 | 3.70 |
| 119 | 0.04 | 0.11 | 3.48 |
| 120 | 0.04 | 0.10 | 3.27 |
| 121 | 0.04 | 0.10 | 3.07 |
| 122 | 0.04 | 0.09 | 2.88 |
| 123 | 0.03 | 0.09 | 2.71 |
| 124 | 0.03 | 0.08 | 2.54 |
| 125 | 0.03 | 0.08 | 2.39 |
| 126 | 0.03 | 0.08 | 2.24 |
| 127 | 0.03 | 0.07 | 2.10 |
| 128 | 0.03 | 0.07 | 1.97 |
| 129 | 0.03 | 0.07 | 1.85 |
| 130 | 0.02 | 0.06 | 1.74 |
| 131 | 0.02 | 0.06 | 1.63 |
| 132 | 0.02 | 0.06 | 1.53 |
| 133 | 0.02 | 0.05 | 1.45 |
| 134 | 0.02 | 0.05 | 1.36 |
| 135 | 0.02 | 0.05 | 1.28 |
| 136 | 0.02 | 0.05 | 1.21 |
| 137 | 0.02 | 0.04 | 1.14 |
| 138 | 0.02 | 0.04 | 1.08 |
| 139 | 0.02 | 0.04 | 1.01 |
| 140 | 0.01 | 0.04 | 0.96 |
| 141 | 0.01 | 0.04 | 0.90 |
| 142 | 0.01 | 0.03 | 0.85 |
| 143 | 0.01 | 0.03 | 0.82 |
| 144 | 0.01 | 0.03 | 0.79 |
| 145 | 0.01 | 0.03 | 0.76 |
| 146 | 0.01 | 0.03 | 0.73 |
| 147 | 0.01 | 0.03 | 0.70 |
| 148 | 0.01 | 0.02 | 0.68 |
| 149 | 0.01 | 0.02 | 0.65 |
| 150 | 0.01 | 0.02 | 0.62 |
| 151 | 0.01 | 0.02 | 0.60 |
| 152 | 0.01 | 0.02 | 0.57 |
| 153 | 1.06 | 2.77 | 82.93 |
| 154 | | | |
| 155 | | | |
| 156 | | | |
| 157 | | | |

## SAVINGS OF EMISSION CONTROL COSTS BASED ON CURRENT DOLLAR VALUES (MILLION DOLLARS)



## SAVINGS OF EMISSION CONTROL COSTS BASED ON PRESENT DOLLAR VALUES, BASE YEAR = 1995 (MILLION DOLLARS)



## SAVINGS OF EMISSION CONTROL COSTS BASED ON PRESENT DOLLAR VALUES, BASE YEAR = 2000 (MILLION DOLLARS)