

**REFINEMENT OF SELECTED FUEL-CYCLE
EMISSIONS ANALYSES**

**FINAL REPORT
CONTRACT NO. 98-338
VOLUME II**

PREPARED FOR:

**CALIFORNIA AIR RESOURCES BOARD
RESEARCH DIVISION
1001 I STREET
SACRAMENTO, CA 95814**

PREPARED BY:

**STEFAN UNNASCH
LOUIS BROWNING
ERIN KASSOY**

**ARTHUR D. LITTLE, INC.
10061 BUBB ROAD
CUPERTINO, CALIFORNIA 95014**

APRIL 2001

For more information about the ARB's, Research Division's
research and activities, please visit our Website:

<http://www.arb.ca.gov/research/research.htm>



ABSTRACT

The ARB's Low-Emission Vehicle and Clean Fuels regulations give manufacturers the option of using clean alternative fuels to help their vehicles meet increasingly stringent emissions standards, with less need for control hardware than conventionally fueled vehicles. In 1996, the fuel-cycle emissions of nine vehicle fuels were evaluated, by calculating emissions from four categories of the fuel-cycle process: extraction, production, marketing, and distribution. Oxides of nitrogen, non-methane organic gas, methane, carbon monoxide, carbon dioxide, and toxics emissions were quantified for each vehicle fuel. Three fuels were estimated to have fuel-cycle emissions close to electric vehicles (EVs): diesel fuel and liquefied petroleum gas for internal-combustion vehicles, and methanol, which can be used for fuel-cell-powered vehicles.

In this study, the analysis for these three fuels was refined, and the emissions associated with EVs were reassessed, taking into consideration the post-1998 deregulated environment. The emissions data resulting from this study have been used to compare fuel-cycle emissions for these three fuels to the emissions associated with electricity generation for EVs and provide appropriate regulatory credit.



Table of Contents

Introduction	v
Appendix A — Toxics	A-1
Appendix B — Electricity System Emission Impacts of Electric Vehicle	
Recharging for the Year 2010	B-1
B.I Introduction	B-1
B.II Methodology	B-2
B.III Assumptions	B-2
B.III.1 Electric Vehicle Assumptions	B-3
B.III.2 Capacity Additions and Deletions By 2010	B-5
B.III.3 Resource Plan Scenario	B-7
B.IV Results	B-7
B.V Conclusions	B-8
Appendix C — California Power Generation Resources, Capacity Additions, and Heat Rates.....	C-1
Appendix D — Fuel Economy	D-1
Gasoline.....	D-3
Diesel.....	D-6
CNG.....	D-7
Fuel Cell Powered Vehicles	D-8
Electric Vehicles.....	D-11
Appendix E — Emission Results	E-1
E.I Marginal Emission Results in the SoCAB	E-2
E.I.1 NOx	E-2
Scenario 1a — Pre 2000, Existing subcompact	E-2
Scenario 2b — 2010 emissions, High estimate, moderate efficiency subcompact.....	E-4
Scenario 3c — 2010 emissions, Consistent with inventory, high efficiency subcompact.....	E-6
Scenario 3.2e — 2010 emissions, Consistent with inventory, high spillage, high efficiency light-weight car	E-8
E.I.2 PM	E-10
Scenario 1a — Pre 2000.....	E-10
Scenario 2b — 2010 emissions, High estimate, moderate vehicle efficiency	E-12
Scenario 3c — 2010 emissions, Consistent with inventory, high vehicle efficiency.....	E-14
Scenario 3.2e — 2010 emissions, Consistent with inventory, high spillage, high efficiency light-weight car	E-16

E.I.3	NMOG.....	E-18
	Scenario 1a — Pre 2000.....	E-18
	Scenario 2b — 2010 emissions, High estimate, moderate vehicle efficiency.....	E-20
	Scenario 3c — 2010 emissions, Consistent with inventory, high vehicle efficiency	E-22
	Scenario 3.2e — 2010 emissions, Consistent with inventory, high spillage, high efficiency light-weight car.....	E-24
E.I.4	Toxics.....	E-26
	Scenario 1a — Pre 2000.....	E-26
	Scenario 2b — 2010 emissions, High estimate, moderate vehicle efficiency.....	E-28
	Scenario 3c — 2010 emissions, Consistent with inventory, high vehicle efficiency	E-30
	Scenario 3.2e — 2010 emissions, Consistent with inventory, high spillage, high efficiency light-weight car.....	E-32
E.II	Marginal Emission Results, SoCAB plus California	E-34
E.II.1	Scenario 3c — CA2010 emissions, Consistent with inventory, high vehicle efficiency	E-34
	NOx	E-34
	PM	E-36
	NMOG.....	E-38
	Toxics	E-40
Appendix F	— Technical Advisory Committee and Stakeholder Comments	F-1
F.I	EV Energy Consumption	F-1
F.II	EV Time of Day Charging and California Power Demand	F-2
F.III	Considering Advanced Gasoline Technologies	F-2
F.IV	Outlook for Power Plant Construction in California.....	F-2
F.V	Emission Data from Power Plants.....	F-2
F.VI	Consideration of Green Power Options for EV Charging.....	F-2

Introduction

This volume provides supplementary information on the analysis of fuel cycle emissions. Data on toxic emissions from the South Coast Air Quality Management district are presented in Appendix A. An analysis of the emissions from electric power generation was performed by the CEC in 1999. This analysis is presented in Appendix B. Additional information on power generation including time of day loads, heat rates for power production, and planned generation capacity additions are presented in Appendix C. Data on fuel economy from baseline gasoline and alternative fueled vehicle technologies is presented in Appendix D. This section shows the individual vehicle data comparisons used to determine EER values in Section 5. Appendix E presents the emission results for all of the principal combinations of fuel cycle scenarios and vehicle fuel economy assumptions. Appendix F . . .

Appendix A — Toxics Data

The toxics composition of various hydrocarbon sources was determined from the emissions inventory in the SoCAB. The inventory of toxics and ROG are shown below. These data were combined to determine the inventory weighted toxics per unit of hydrocarbons (expressed as reactive organic gases (ROG) in the inventory). The weighted toxics for each source category is also shown.

Fuel-Cycle Process	Toxic Emissions (lb/day)			
	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde
Oil and Gas Production: combustion	55.57	0.02	121.01	1.10
Petroleum Refining: combustion	1.12	0.01	2.44	0.12
Electric Utilities: combustion	12.63	0.04	31.58	0.41
Oil and Gas Extraction: process, storage	318.26	0.00	0.00	0.00
Petroleum Refining: process, storage	2.44	0.00	0.01	0.00
Petroleum Marketing: storage transfer	205.15	0.00	0.00	0.00
Other process storage or transfer	8.78	0.00	0.03	0.00
Light-Duty Passenger Vehicles	14133.12	2582.24	6922.97	1610.57
Total	14737.07	2582.31	7078.04	1612.20

ToxicsInv.xls

Fuel-Cycle Process	ROG (short tons/day)	
	1999	2000
Oil and Gas Production: combustion	0.56	0.56
Petroleum Refining: combustion	1.33	1.33
Electric Utilities: combustion	1.4	0.98
Oil and Gas Extraction: process, storage	12.19	11.7
Petroleum Refining: process, storage	9.55	9.16
Petroleum Marketing: storage transfer	22.17	22.81
Other process storage or transfer	45.93	45.91
Light-Duty Passenger Vehicles	242.81	96.38
Total	335.94	188.83

ToxicsInv.xls

Fuel-Cycle Process	Toxics comparison to ROG (mg/g); Year 2000			
	Benzene/ ROG	1,3-Butadiene/ ROG	Formaldehyde/ ROG	Acetaldehyde/ ROG
Oil and Gas Production: combustion	49.61	0.018	108.045	0.982
Petroleum Refining: combustion	0.421	0.004	0.917	0.045
Electric Utilities: combustion	4.51	0.014	11.279	0.146
Oil and Gas Extraction: process, storage	13.05	0.000	0.000	0.000
Petroleum Refining: process, storage	0.128	0.000	0.001	0.000
Petroleum Marketing: storage transfer	4.62	0.000	0.000	0.000
Other process storage or transfer	0.096	0.000	0.000	0.000
Light-Duty Passenger Vehicles	29.10	5.317	14.256	3.317
Total	101.56	5.35	134.50	4.49

ToxicInv.xls

Fuel-Cycle Process	Weighted Toxics comparison to ROG (mg/g); Year 2000				
	Benzene/ ROG	1,3-Butadiene/ ROG	Formaldehyde/ ROG	Acetaldehyde/ ROG	Total Weighted Toxics
Toxic Weighting	4.83	28.33	1.00	0.45	
Oil and Gas Production: combustion	239.81	0.51	108.04	0.44	348.8
Petroleum Refining: combustion	2.04	0.11	0.92	0.02	3.1
Electric Utilities: combustion	21.80	0.40	11.28	0.07	33.6
Oil and Gas Extraction: process, storage	63.10	0.00	0.00	0.00	63.1
Petroleum Refining: process, storage	0.62	0.00	0.00	0.00	0.6
Petroleum Marketing: storage transfer	22.36	0.00	0.00	0.00	22.4
Other process storage or transfer	0.46	0.00	0.00	0.00	0.5
Light-Duty Passenger Vehicles	140.67	150.66	14.26	1.49	307.1
Total	490.85	151.68	134.50	2.02	779.0

ToxicInv.xls

Electricity System Emission Impacts of Electric Vehicle Recharging for the Year 2010

Prepared by Angela Tanghetti, California Energy Commission, September 1999

B-I. Introduction

The California Air Resources Board (CARB) is in the process of gathering information that will be used for their year 2000 Biennial Update of Zero Emission Vehicle (ZEV) credits. As part of this process, CARB asked the Commission for an update of the 1995 Electric Vehicles and Power Plant Emissions Report.¹ This update is part of a joint effort between Commission staff, CARB staff and their consultant, Stefan Unnasch of Arthur D. Little to estimate the incremental emission impacts of electric vehicles (EVs) on electric generation.

This study group is refining the estimates of fuel-cycle emissions from the use of three different fuel/vehicle systems and comparing the corresponding increase in emissions from electricity generation facilities for electric vehicle recharging loads. As part of the Commission's contribution to the analysis, the Multisym™ Model² was used to estimate incremental power plant emissions of ROG (methane), NO_x and carbon from recharging electric vehicles in the year 2010.

The scope of the Commission's effort is to analyze incremental power plant emissions from recharging electric vehicles, not a study to reflect the emissions avoided by gasoline or other fuel powered vehicles. We present incremental results for the Western System Coordinating Council (WSCC)³ region and each air basin in California. Figure B-1 shows the air basins designated in California.

As with all such studies, assumptions are numerous and uncertain. This study considered the uncertainties associated with the development of EV technologies, the potential impacts of different regulations (such as RECLAIM) and the changes related to the deregulated electric industry.

¹ A. Tanghetti et.al (6/95).

² Henwood Energy Services, Inc.

³ A regional electricity reliability council that serves the western part of the continental United States, Canada and Mexico. The council's region encompasses approximately 1.8 million square miles.



Figure B-1. Air Basins in California

B-II. Methodology

This study applied the same general methodology used for previous electric vehicle studies and is consistent with Energy Commission guidelines for estimating system benefits. The initial step in our analysis was to develop two scenarios of possible future power plant additions and retirements. In each scenario, staff added enough new power plants to have an adequate supply of resources for future demand levels. Multisym™ model runs were made for each scenario with and without EV loads to calculate the incremental emissions for the year 2010.

B-III. Assumptions

To study the impacts of electric vehicles on electricity generation systems, the study team developed several plausible assumptions regarding future electric vehicles. These assumptions are discussed in Section A. Section B presents a description of the Commission staff's two capacity expansion scenarios.

B.III.1. Electric Vehicle Assumptions

To determine the amount of electricity that electric vehicles may draw from power plants in the year 2010, several assumptions were considered regarding the potential number of EVs connected to the grid, their operational efficiency and likely annual miles traveled. The following range of assumptions were considered in this study:

- Between 50,000 and 400,000 vehicles (cumulative) were assumed grid connected by 2010. The low estimate represents the number of electric vehicles currently on the road (1,500 in 1999) increasing by 20 percent annually. The high estimate is based on the assumption that electric vehicles will represent about 2 percent of the annual California vehicle sales (gasoline and diesel) from 2002 through 2010.⁴
- Estimated vehicle efficiencies are between 0.37 and 0.47 kWh per mile. The EV fleet efficiency will vary depending on the average vehicle size that may be on the road in the future. These fuel consumption values are consistent with subcompact cars.
- Annual vehicle miles traveled ranged from 10,000 - 25,000 miles. The low range represents a vehicle driven about 300 days per year and 35 miles per day. The high estimate represents an electric vehicle driven about 300 days per year and 80 miles per day.

Various combinations of these assumptions were included in a simple probability model to calculate the most likely effects of EVs on electricity demand. As shown in Figure B-2, 1,000 GWh per year of electricity consumed by EVs is the approximate mean of various combinations of the EV assumptions. This EV demand assumption is less than half a percent of the 300,000 GWh of projected electricity demand in California for the year 2010. This power demand correspond to about 2 percent of passenger car sales as battery EVs. If many of these vehicles are city cars smaller vehicles, the power consumption would be lower.

This estimate of EV electricity consumption was distributed among the California transmission areas designated within the Multisym™ model. These areas are (1) Northern California, which is basically the entire region north of Los Banos (19.0%); (2) Southern California, which is the major part of the state south of Los Banos (65.0%); (3) San Diego area (5.0%); (4) LADWP area (10.0%); (5) San Francisco Area (1.0%); (6) IID area, which we assume has negligible EV load. See Figure 3 for a geographical depiction of these California transmission areas.

⁴ The EV fleet estimates range between one and two percent of the 27.5 million gasoline and diesel powered vehicles projected to be on the road in California by 2010.

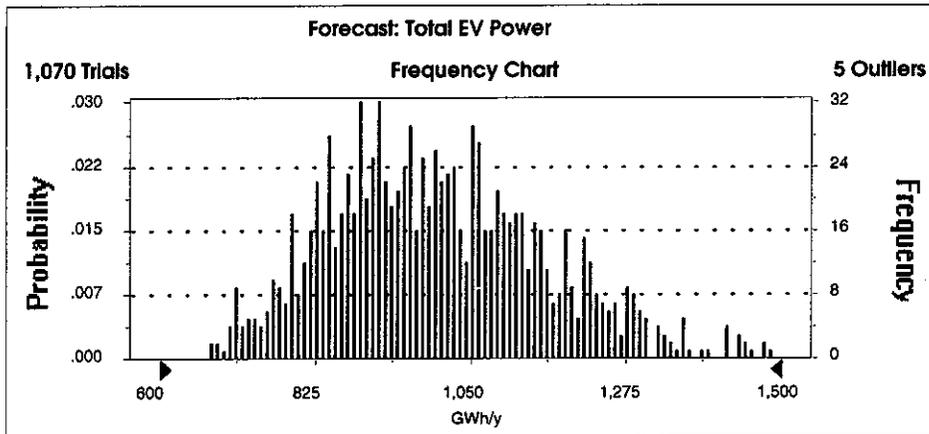


Figure B-2. Estimate of EV Power Demand (GWh/yr)

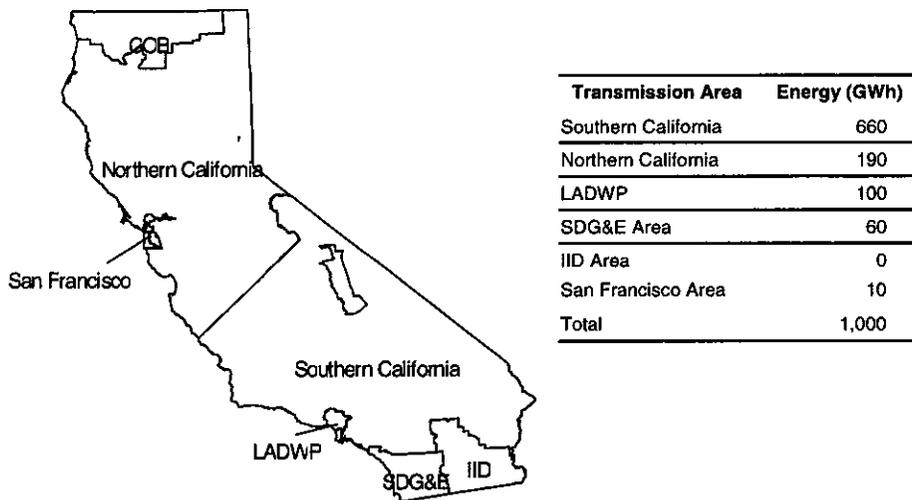


Figure B-3. EV Energy Consumption by Transmission Area

Table B-1 lists the expected time-of-day profile for EV recharging. We used a profile that allocates about 95 percent of recharging load into the off-peak periods and 5 percent into the on-peak period.⁵ This is consistent with current EV-owner data received by Commission staff; owners are taking full advantage of time-of-use metered rates and

⁵ Electricity demand in California peaks in the afternoon and in this analysis, peak hours are from 11:00 a.m. until 6:00 p.m. and all other hours are assumed off-peak.

recharging their vehicles mainly during off-peak hours. The same recharging profile was used in the Commission's 1995 EV study⁶. The results of this study

Table B-1. EV Recharging Profile

1:00 a.m.	10.772
2:00 a.m.	7.181
3:00 a.m.	6.284
4:00 a.m.	5.386
5:00 a.m.	4.488
6:00 a.m.	3.592
7:00 a.m.	1.796
8:00 a.m.	0.718
9:00 a.m.	0.718
10:00 a.m.	0.718
11:00 a.m.	0.718
12:00 p.m.	0.718
1:00 p.m.	0.718
2:00 p.m.	0.718
3:00 p.m.	0.718
4:00 p.m.	0.718
5:00 p.m.	0.718
6:00 p.m.	0.718
7:00 p.m.	0.718
8:00 p.m.	0.718
9:00 p.m.	4.488
10:00 p.m.	14.363
11:00 p.m.	17.953
12:00 a.m.	14.363
	100

B.III.2. Capacity Additions and Deletions By 2010

Assumptions regarding the future mix of generation capacity will have a significant influence on the incremental emissions attributable to EVs. Table B-2 shows a potential scenario of future generation capacity additions for the WSCC region in the year 2010. Since the quantity of EV demand assumed during 2010 is small, the composition of future resource plans is critical when trying to estimate incremental emissions.

⁶ Results are presented in Unnasch, S. "Evaluation of Fuel Cycle Emissions on a Reactivity Basis", CA ARB, 1996.

Table B-2. Capacity Additions/Retirements

Transmission Area	2010	MW
San Francisco Area	Capacity Additions	553
	Capacity Retirements	-430
	San Francisco area net additions	123
Northern California	Capacity Additions	4968
	Capacity Retirements	0
	California North net additions	4968
Southern California	Capacity Additions	9768
	Capacity Retirements	-3448
	California South net additions	6320
LADWP Area	Capacity Additions	10
	Capacity Retirements	-362
	LADWP area net additions	-352
SDG&E Area	Capacity Additions	1702
	Capacity Retirements	-430
	SDG&E area net additions	1272
IID Area	Capacity Additions	559
	Capacity Retirements	0
	IID area net additions	559
Mexico	Capacity Additions	1725
	Capacity Retirements	0
	Mexico area net additions	1725
Northwest Area	Capacity Additions	3544
	Capacity Retirements	-790
	Northwest area net additions	2754
Southwest	Capacity Additions	2393
	Capacity Retirements	0
	Southwest area net additions	2393
Rocky Mountains	Capacity Additions	1266
	Capacity Retirements	-342
	Rocky Mountain net additions	924
Nevada/Utah	Capacity Additions	3880
	Capacity Retirements	0
	Nevada/Utah net additions	3880
WSCC Region	Capacity Additions	30368
	Capacity Retirements	-5802
	WSCC Region net additions	24566

Data used to develop these resource scenarios are from three primary sources: (1) WSCC 10-Year Coordinated Plan Summary 1998-2007, (2) a draft Energy Commission staff document (January 29, 1999) of current and future power plant siting cases, and (3) an Energy Commission listing of new renewable projects that receive

Public Interest Surcharge support (conditional funding) awards. Commission staff also used various press releases, trade journals, and annual reports to enhance this data.

The system adequacy implications of each resource plan were then evaluated using the Energy Commission's RAM Model.⁷ This model determined if each scenario had enough generation to meet minimum capacity reserve requirements. If the model determined that minimum reserve requirements were not being met within a transmission area, then additional generation capacity, either combined cycle units or combustion turbines were added to the area. The following is a brief description of the scenario and how it was developed.

B.III.3. Resource Plan Scenario

This scenario includes all of the announced resource additions and retirements in the WSCC that are identified from public resources or information available in the Commission. Each unit identified in the WSCC 10-Year Coordinated Plan Summary, as a significant generation addition is included in this scenario. All current and future siting case projects outlined in the January 29, 1999 draft Energy Commission staff working document are included in this scenario. The San Onofre Nuclear Generating Station is assumed to be off-line in 2010 for refueling. Additionally, this scenario includes 311MW of renewable projects with Public Interest Surcharge support.

Table B-2 lists resource additions and retirements for California and the rest of the WSCC under this scenario. The net resource additions for the entire WSCC in 2010 are 24,566 MW; this is approximately 15 percent of the region's 167,878 MW peak demand. 12,890 MW of these net additions are located in California; this is approximately 23 percent of the estimated 56,476 MW peak demand for California in 2010.

B-IV. Results

Incremental emission results for the entire WSCC are presented by each air basin within California and for areas outside of California. We are able to provide estimates of incremental emissions from power plants located within California using the Multisym™ model.⁸ However, the emission results for regions outside of California are calculated from an estimated emission factor. These estimated emission factors depend on the fuel mix of the incremental energy produced in each area outside of California.⁹ Presently, the Energy Commission does not have adequate information on emissions factors for all resources located outside of California to provide actual model results.

⁷ Reliability Assessment Model developed by AlberBelostotsky, Ph.D of the California Energy Commission.

⁸ The majority of existing steam-boilers in California are assumed to be retrofit by 2010 with additional emission control equipment in both resource plans.

⁹ Existing generation outside of California were not assumed to be retrofit with additional emission control equipment.

The modeling results indicate that the majority of incremental electricity generated in California is from new gas-fired generation and the larger existing gas-fired power plants. The incremental emission factors shown in Table B-3 for air basins in California are for a mix of new combined cycle technologies and existing gas-fired steam-boiler power plants. The incremental electricity for areas outside of California, comes from a mix of gas-fired (73 percent) and coal-fired generation (27 percent). While the majority of this imported energy is from gas-fired generation, the majority of these emissions outside of California are from the coal-fired generation.

Table B-3. 2010 Emission Results

Area	Incremental Generation GWh/yr	Incremental NOx (tons/yr)	Incremental NOx (lb/MWh)	Incremental ROG (tons/yr)	Incremental ROG (lb/MWh)	Incremental CO (tons/yr)	Incremental CO (lb/MWh)
Mojave Desert	50.8	12.4	0.49	1.7	0.067	15.6	0.61
North Central Coast	39.2	13.4	0.68	0.6	0.031	11.9	0.61
Northeast Plateau	4.0	0.0	0.00	0.0	0.000	0.0	0.00
Sacramento Valley	26.3	2.2	0.17	0.8	0.061	6.5	0.49
Salton Sea	2.6	0.6	0.46	0.1	0.077	1.2	0.91
San Diego County	89.5	2.0	0.04	1.5	0.034	27.3	0.61
San Francisco Bay Area	148.8	46.9	0.63	3.1	0.042	50.4	0.68
San Joaquin Valley	178.2	4.7	0.05	4.0	0.045	46.9	0.54
South Central Coast	84.8	16.6	0.39	0.7	0.017	31.7	0.75
South Coast	168.0	49.7	0.59	5.3	0.063	110.1	1.31
California Total	792.1	148.5	0.37	17.8	0.04	301.7	0.77
Southwest	55.8	146.2	5.24	0.8	0.029	24.1	0.86
Northwest	9.7	13.2	2.73	0.2	0.036	4.4	0.91
Rocky Mountains	16.7	53.0	6.35	0.2	0.020	6.8	0.82
Nevada/Utah	104.8	138.3	2.64	2.1	0.040	47.7	0.91
Mexico	20.4	25.5	2.50	0.4	0.040	9.5	0.93
Outside California Total	207.4		3.63		0.04	92.5	0.89
WSCC Total	1000.5	525.3	1.05	21.5	0.043	156.5	0.793

B-V. Conclusions

Increasing energy consumption by 1,000 GWh annually throughout California in 2010 has a very small effect on incremental emissions for the entire WSCC region under either scenario. Actual emissions reported in the CARB's 1996 emissions inventory for electricity generated in California is about 94, 166, and 7 tons per day for NOx, CO and ROG respectively. When these actual emission amounts are compared to the estimated annual incremental emissions presented in Table B-3, the differences are minor. Moreover, any demand with a profile similar to EVs, whether it is as small as 50 GWh

or as large as 2,000 GWh, will have similar incremental emission results. For any relatively small amount of off-peak energy demand, the incremental power plant will most likely be gas-fired.

Differences in capacity additions other than those analyzed here would be most apparent within California air basins where new gas-fired power plants are located. Out-of-state generation is largely a function of which units the model predicts to be forced out, rather than a result of capacity additions.

Finally, these incremental results are similar to those results generated in the Energy Commission's 1995 EV Report. The only difference we noted is in the mix of incremental energy imported from areas outside of California. The majority of imported energy to meet a slight increase in off-peak demand tended to be gas-fired. Previously, the Energy Commission analysis assumed a constant mix of gas, hydro and coal-fired generation from imported energy.

Appendix C — California Power Generation Resources, Capacity Additions, and Heat Rates

This appendix includes the following:

- Example heat rates for sample power plants
- SCE service area load and generation projections for 2003
- SCE service area power plants supply curve
- SCE service area power plant identification and supply curve data
- Projected generation capacity additions in California
- Projected generation capacity additions in the WSCC

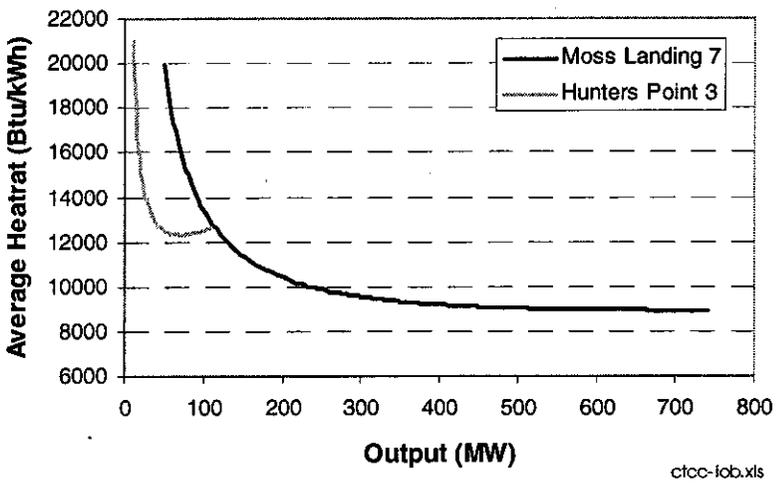
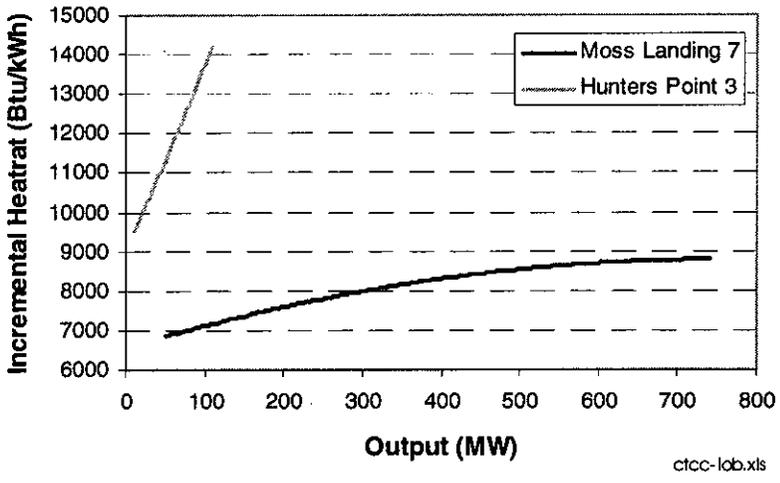
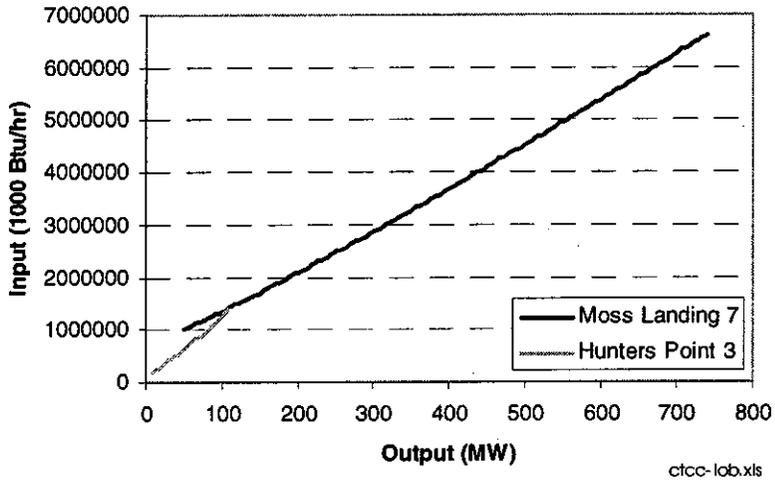
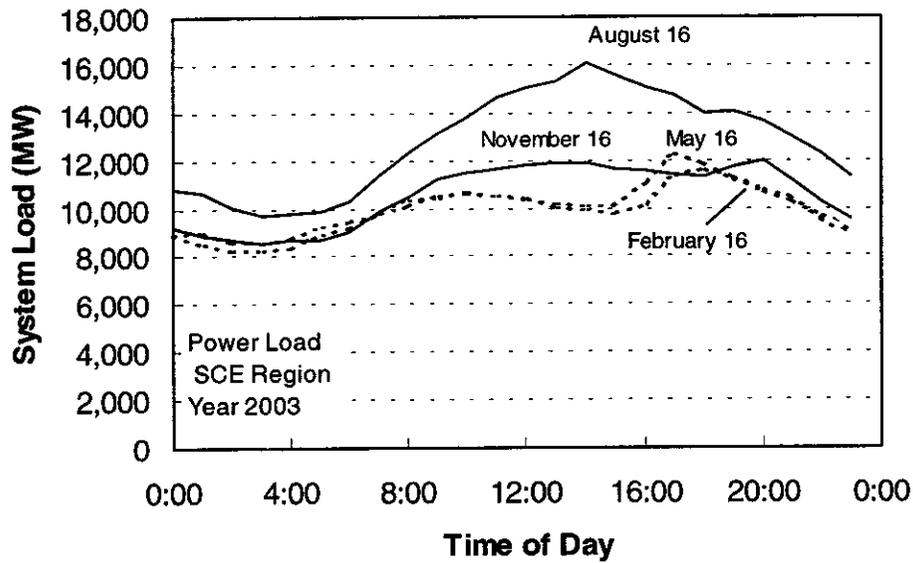
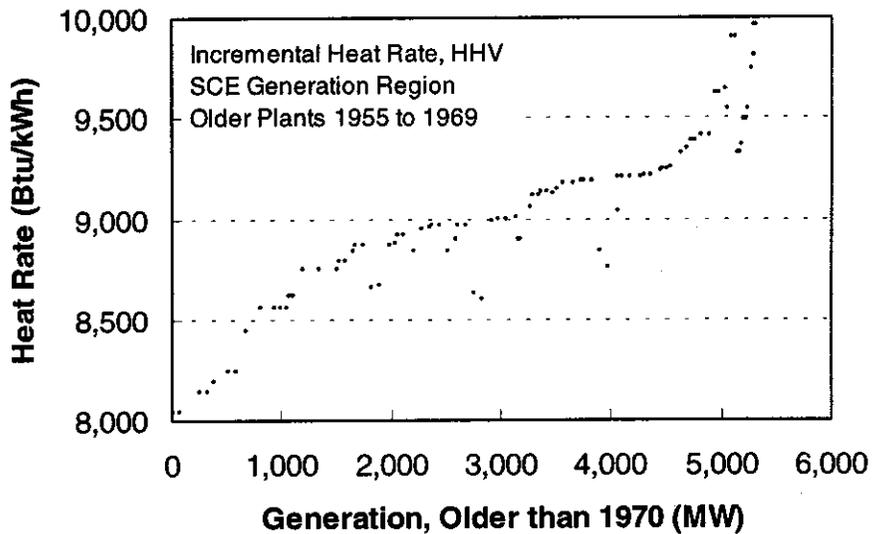


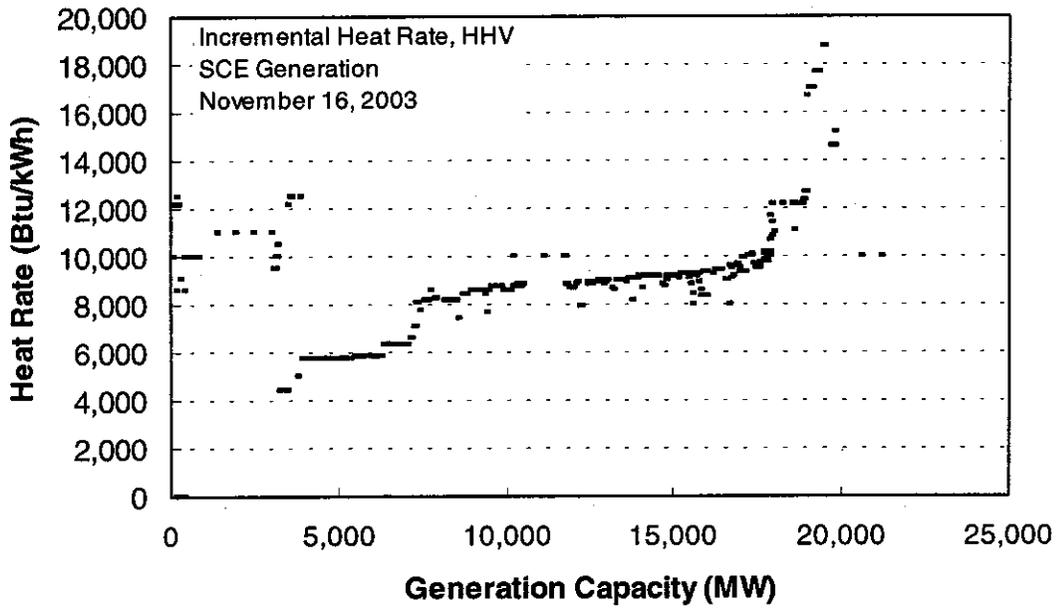
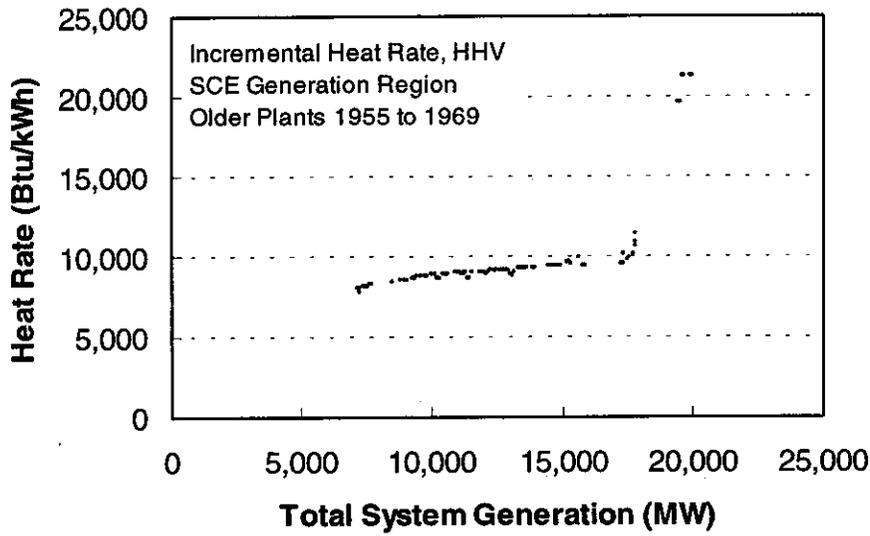
Figure C-1. Heat Rate Data for Gas-Fired Power Plants

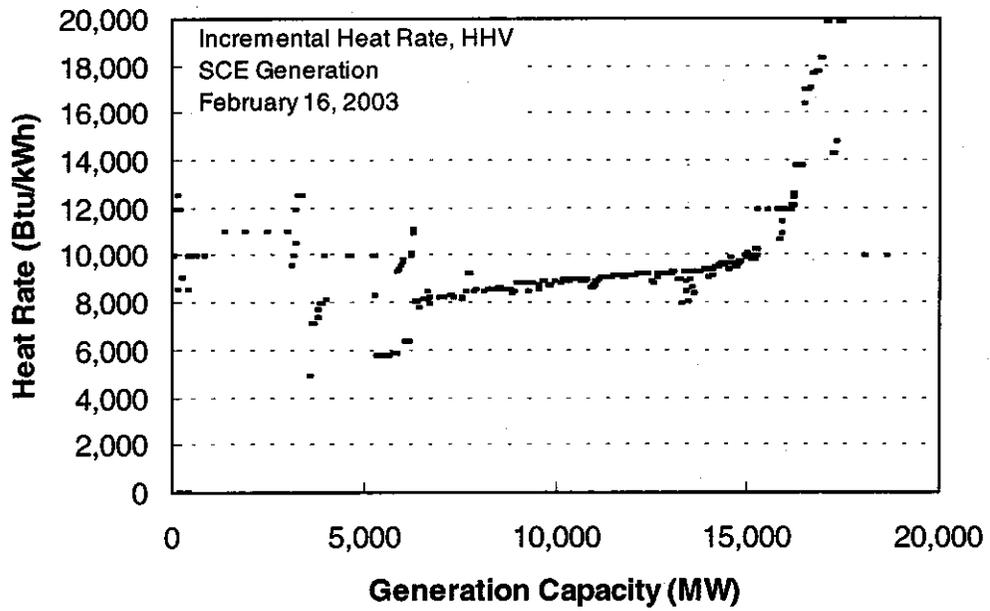
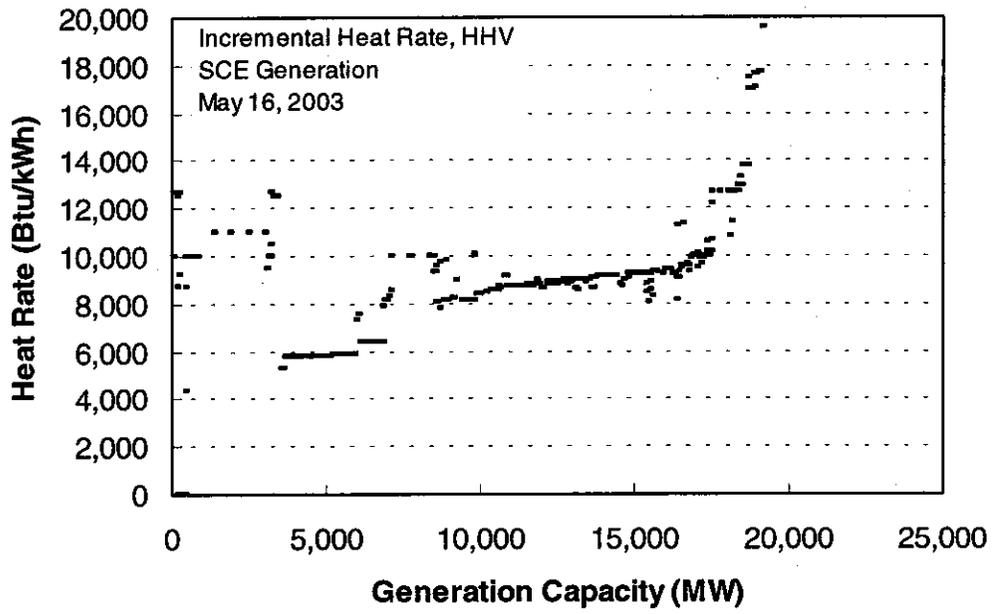


Source: CEC

Figure C-2. Heat Rates for Power Plants at Different Loads







SCE Generation Region, Power Plant Start-Up Date

ID #	Unit Name	No	Unit Type	On-Line	Off-Line	Fuel Group
903	Redondo.Beach	5	ST	01-Jan-54	31-Dec-02	NG SCG
597	Broadway	1	ST	01-Jan-55	31-Dec-26	NG SCG
877	El Segundo	1	ST	01-Jan-55	31-Dec-26	NG SCG
878	El Segundo	2	ST	01-Jan-56	31-Dec-26	NG SCG
598	Broadway	2	ST	01-Jan-57	31-Dec-26	NG SCG
904	Redondo.Beach	6	ST	01-Jan-57	31-Dec-02	NG SCG
888	Huntington Beach	2	ST	01-Jan-58	31-Dec-26	NG SCG
887	Huntington Beach	1	ST	01-Jan-58	31-Dec-26	NG SCG
894	Mandalay	2	ST	01-Jan-59	31-Dec-26	NG SCG
893	Mandalay	1	ST	01-Jan-59	31-Dec-26	NG SCG
868	Alamitos	3	ST	01-Jan-61	31-Dec-15	NG SCG
873	Coolwater	1	ST	01-Jan-61	31-Dec-26	NG SCE Coolwater
869	Alamitos	4	ST	01-Jan-62	31-Dec-15	NG SCG
882	Etiwanda	3	ST	01-Jan-63	31-Dec-26	NG SCG
883	Etiwanda	4	ST	01-Jan-63	31-Dec-26	NG SCG
874	Coolwater	2	ST	01-Jan-64	31-Dec-26	NG SCE Coolwater
879	El Segundo	3	ST	01-Jan-64	31-Dec-26	NG SCG
599	Broadway	3	ST	01-Jan-65	31-Dec-26	NG SCG
880	El Segundo	4	ST	01-Jan-65	31-Dec-26	NG SCG
871	Alamitos	6	ST	01-Jan-66	31-Dec-26	NG SCG
870	Alamitos	5	ST	01-Jan-66	31-Dec-26	NG SCG
905	Redondo.Beach	7	ST	01-Jan-67	31-Dec-26	NG SCG
906	Redondo.Beach	8	ST	01-Jan-67	31-Dec-26	NG SCG
872	Alamitos GT	7	GT	01-Jan-69	31-Dec-26	NG SCG
884	Etiwanda GT	5	GT	01-Jan-69	31-Dec-26	FO#2-WSCC
889	Huntin. Beach GT	5	GT	01-Jan-69	31-Dec-26	NG SCG
895	Mandalay GT	3	GT	01-Jan-70	31-Dec-26	FO#2-WSCC
898	Ormond.Beach	1	ST	01-Jan-71	31-Dec-26	NG SCG
899	Ormond.Beach	2	ST	01-Jan-73	31-Dec-26	NG SCG
881	Elwood GT	1	GT	01-Jan-74	31-Dec-26	FO#2-WSCC
600	Glenarm GT	1	GT	01-Jan-75	31-Dec-26	NG SCG
601	Glenarm GT	2	GT	01-Jan-75	31-Dec-26	NG SCG
891	Long Beach CC	8	CC	01-Jan-76	31-Dec-26	NG SCG
892	Long Beach CC	9	CC	01-Jan-77	31-Dec-26	NG SCG
875	Coolwater CC	3	CC	01-Jan-78	31-Dec-26	NG SCE Coolwater
876	Coolwater CC	4	CC	01-Jan-78	31-Dec-26	NG SCE Coolwater
1625	Riverside Cement	1	ST	08-Jun-79	31-Dec-28	SCE IPP Coal
1765	North Am Chem	1	GT	25-Jun-79	31-Dec-28	NG SCG
1728	Proctor & G Oxnd	1-2	CC	26-Jan-82	31-Dec-28	NG SCG
1672	FPB Cogen	1	CC	01-Jun-82	31-Dec-28	NG SCG
1628	Arco Wilmington	1	ST	22-Feb-83	31-Dec-28	NG SCG
1622	North Am Chem	2	ST	01-Apr-83	31-Dec-28	SCE IPP Coal
1721	Mobil Oil Corp	1	GT	01-May-83	31-Dec-28	NG SCG
399	San Onofre-SONGS	2	NP	01-Aug-83	31-Dec-26	Uranium
400	San Onofre-SONGS	3	NP	01-Apr-84	31-Dec-26	Uranium
1671	SUNLAW CG Partner	1	GT	01-May-84	31-Dec-28	NG SCG
1736	US Borax & Chem	1	GT	01-Jun-84	31-Dec-28	NG Mojave PL
204795215	Mammoth Pacific	1	GE	26-Nov-84	31-Dec-28	SCE IPP Geo

SCE Generation Region, Power Plant Start-Up Date

ID #	Unit Name	No	Unit Type	On-Line	Off-Line	Fuel Group
1732	Smurfit Newsprint	1	GT	01-Jun-85	31-Dec-28	NG SCG
1823	O'brien Cal Milk	1	GT	14-Jun-85	31-Dec-28	NG SCG
1764	Kern River CG	1	GT	01-Aug-85	31-Dec-28	NG TEOR Cogen
1718	Inland Container	1	GT	01-Sep-85	31-Dec-28	NG SCG
1730	SIMPSON PAPER CO	1	CC	18-Nov-85	31-Jul-00	NG SCG
1719	Jefferson Smurft	1	GT	31-Dec-85	31-Dec-28	NG SCG
1741	Williamette Indu	1	GT	14-Mar-86	31-Dec-28	NG SCG
1819	PacEn (Penrose)	1	GT	12-May-86	31-Dec-28	SCE IPP Bio
1820	PacEn (Toyon)	1	GT	12-May-86	31-Dec-28	SCE IPP Bio
1818	LA County Puente	B	GT	08-Aug-86	31-Dec-28	SCE IPP Bio
1815	Commerce Refuse	1	ST	13-Nov-86	31-Dec-28	SCE IPP Bio
1740	Wheelabrator Nor	1	CC	10-Sep-87	31-Dec-28	NG SCG
1674	Point Arguello P	1	GT	15-Dec-87	31-Dec-28	NG SCG
1724	O.L.S. Camarillo	1	CC	22-Dec-87	31-Dec-28	NG SCG
1725	O.L.S. Chino	1	CC	24-Dec-87	31-Dec-28	NG SCG
1670	Chevron El Segun	2	GT	29-Dec-87	31-Dec-28	NG SCG
1733	Sycamore Cogen	1	GT	01-Jan-88	31-Dec-28	NG TEOR Cogen
1648	Watson Cogen	1	CC	01-Apr-88	31-Dec-28	NG SCG
1663	Corona	1	CC	03-Jun-88	31-Dec-28	NG SCG
1411	AES Placerita	1	CG	01-Jul-88	31-Dec-26	NG TEOR Cogen
1812	CityofLongBeach	1	ST	04-Jul-88	31-Dec-28	SCE IPP Bio
1727	Pitchess Honor R	1	CC	24-Oct-88	31-Dec-28	NG SCG
1680	Harbor Cogen	1	GT	01-Dec-88	31-Dec-28	NG SCG
1720	Loma Linda Univ	1	GT	01-Jan-89	31-Dec-28	NG SCG
1288	Vernon GT	1	GT	01-Jan-89	31-Dec-26	NG SCG
1289	Vernon IC	2	IC	01-Jan-89	01-Jan-00	FO#2-WSCC
1817	Gas Recovery Sys	1	GT	08-Feb-89	31-Dec-28	SCE IPP Bio
1722	Midway Sunset	1	GT	24-Feb-89	31-Dec-28	NG TEOR Cogen
1655	Carson Cogen Co.	1	CC	22-Dec-89	31-Dec-28	NG SCG
1385	SCE Misc Bio QF	1	OT	01-Jan-90	31-Dec-26	SCE IPP Bio
1386	SCE Misc CG QF	1	CG	01-Jan-90	31-Dec-26	NG SCG
1389	SCE QF Solar	1	OT	01-Jan-90	31-Dec-26	SCE IPP Other
1390	SCE QF Wind	1	WT	01-Jan-90	31-Dec-26	Wind
1624	Rio Bravo Jasmin	1	ST	02-Feb-90	31-Dec-28	SCE IPP Coal
1647	Arco Placerita	1-2	GT	06-Mar-90	31-Dec-28	NG TEOR Cogen
1669	E F Oxnard	1	CC	13-Apr-90	31-Dec-28	NG SCG
1816	Delano Energy	1	ST	29-Jun-90	31-Dec-28	SCE IPP Bio
1620	Ace Cogeneration	1	ST	01-Oct-90	31-Dec-28	SCE IPP Coal
1723	Mojave	1	CC	01-Dec-90	31-Dec-28	NG SCG
1.466E+09	Mammoth Pacific	2	GE	07-Dec-90	31-Dec-28	SCE IPP Geo
182942147	Mammoth Pac L.P.	1	GE	22-Dec-90	31-Dec-28	SCE IPP Geo
9	Anaheim GT	1	GT	01-Jun-91	31-Dec-26	NG SCG
1731	EXXON Santa Ynez	1	GT	01-Jun-91	31-Dec-28	NG SCG
1814	Colmac Energy	1	ST	20-Dec-91	31-Dec-28	SCE IPP Bio
1813	OrangeCountySan	1	GT	27-Jul-93	31-Dec-28	SCE IPP Bio
1365	Alamitos	2	ST	01-Jan-95	31-Dec-15	NG SCG
1364	Alamitos	1	ST	01-Jan-95	31-Dec-15	NG SCG
1367	Etiwanda	2	ST	01-Jan-95	31-Dec-26	NG SCG
1366	Etiwanda	1	ST	01-Jan-95	31-Dec-26	NG SCG
1370	Highgrove	3	ST	01-Jan-95	30-Apr-03	NG SCG
1369	Highgrove	2	ST	01-Jan-95	30-Apr-03	NG SCG
1371	Highgrove	4	ST	01-Jan-95	30-Apr-03	NG SCG
1368	Highgrove	1	ST	01-Jan-95	30-Apr-03	NG SCG
1362	INTLD SCE	1	Inter	01-Jan-95	31-Dec-30	INTLOAD
1372	San Bernardino	1	ST	01-Jan-95	31-Dec-27	NG SCG
1373	San Bernardino	2	ST	01-Jan-95	31-Dec-27	NG SCG
1822	L A Total Energy	1	GT	12-Jun-95	31-Dec-28	NG SCG
607	PASA Gen. Fuel Cell	1	FC	01-Feb-96	31-Dec-26	Other-WSCC

SCE Generation Region, Power Plant Start-Up Date

ID #	Unit Name	No	Unit Type	On-Line	Off-Line	Fuel Group
1.253E+09	Chevron El Seg_	3	GT	04-Mar-96	31-Dec-28	NG SCG
1908	Tulare Energy	1	OT	31-Jul-98	31-Dec-26	Biomass
556840377	Tehachapi Wind	1	WT	01-Jun-99	31-Dec-39	Wind
1906	West Covina	1	OT	01-Mar-00	31-Dec-26	Biomass
1915	Wintec	1	WT	01-Mar-00	31-Dec-26	Wind
1917	Cabazon Wind	1	WT	01-Jul-00	31-Dec-26	Wind
1904	Tajiguas	1	OT	01-Jul-00	31-Dec-26	Biomass
1.43E+09	RCWMD Badlands	1	OT	30-Sep-00	31-Dec-26	Biomass
1907	Woodville Energy	1	OT	01-Jan-01	31-Dec-26	Biomass
1919	Mark Tech Corp	1	WT	01-Feb-01	31-Dec-26	Wind
1921	16 West	1-2	WT	01-Mar-01	31-Dec-26	Wind
1923	Catellus	1-5	WT	01-Mar-01	31-Dec-26	Wind
1922	Phoenix	1-5	WT	01-Mar-01	31-Dec-26	Wind
1911	Windland	1	WT	01-Mar-01	31-Dec-26	Wind
1.388E+09	Harbor Cgn (pkr)	1	CT	15-May-01	30-Sep-03	NG SCG
282087728	Colton	2	CT	01-Jun-01	30-Sep-03	NG SCG
1.86E+09	Colton	1	CT	01-Jun-01	30-Sep-03	NG SCG
1.455E+09	Devers	1	CT	01-Jun-01	30-Sep-03	NG SCG
948181079	Vista	1	CT	15-Jun-01	30-Sep-03	NG SCG
1905	Energy Dev Azusa	1	OT	01-Jul-01	31-Dec-26	Biomass
2045	RCWMD Mead Vly	1	OT	01-Jul-01	31-Dec-26	Biomass
552960291	Huntington Beach	4	ST	01-Nov-01	31-Dec-27	NG SCG
270198787	Huntington Beach	3	ST	01-Nov-01	31-Dec-27	NG SCG
1920	Alexander	1-3	WT	01-Dec-01	31-Dec-26	Wind
1902	RCW Lamb Canyon	1	OT	01-Dec-01	31-Dec-26	Biomass
1903	RCWMD Edom Hill	1	OT	01-Dec-01	31-Dec-26	Biomass
1918	CalWind	1	WT	29-Dec-01	31-Dec-26	Wind
1914	Chistensen/Lazar	1	WT	31-Dec-01	31-Dec-26	Wind
1913	Gorman	1	WT	31-Dec-01	31-Dec-26	Wind
1916	Painted Hills	1	WT	31-Dec-01	31-Dec-26	Wind
1912	Victory Garden	1	WT	31-Dec-01	31-Dec-26	Wind
1.55E+09	Pastoria	3	CC	01-Jan-03	31-Dec-31	NG SCG
1.919E+09	Pastoria	1	CC	01-Jan-03	31-Dec-31	NG SCG
1.466E+09	Pastoria	2	CC	01-Jan-03	31-Dec-31	NG SCG
1.322E+09	Blythe	2	CC	01-Apr-03	31-Dec-31	NG SCG
2.076E+09	Blythe	1	CC	01-Apr-03	31-Dec-31	NG SCG
2085	High Desert	1	CC	01-May-03	31-Dec-31	NG SCG
2087	High Desert	3	CC	01-May-03	31-Dec-31	NG SCG
2086	High Desert	2	CC	01-May-03	31-Dec-31	NG SCG
2080	Mountainview	1	CC	01-May-03	31-Dec-31	NG SCG
2081	Mountainview	2	CC	01-May-03	31-Dec-31	NG SCG
2082	Mountainview	3	CC	01-May-03	31-Dec-31	NG SCG
2083	Mountainview	4	CC	01-May-03	31-Dec-31	NG SCG
2088	Nueva Azalea	1	CG	01-Aug-03	31-Dec-31	NG SCG
2089	Nueva Azalea	2	CG	01-Aug-03	31-Dec-31	NG SCG
878859152	Teayawa	2	CC	01-Dec-03	31-Dec-31	NG SCG
443395328	Teayawa	1	CC	01-Dec-03	31-Dec-31	NG SCG

SCE Generation Region, Generation Supply Duration Curve with Heat Rates

Total Block ID	Cumulative Block (MW)	Unit Name	No	Ave. Heat (Btu/kWh)	Station Block ID	Station Block (MW)	Incremental Heat Rate
1	23	Tehachapi Wind	1	10,000	1	23	10,000
2	59	Arco Placerita	1-2	12,000	1	36	12,720
3	100	Carson Cogen Co.	1	8,500	1	41	8,755
4	129	CityofLongBeach	1	12,500	1	29	12,500
5	129	Highgrove	1	20,479	1	-	-
6	129	Highgrove	2	20,490	1	-	-
7	129	Highgrove	3	49,304	1	-	-
8	129	Highgrove	4	66,603	1	-	-
9	174	LA County Puente	B	12,000	1	45	12,720
10	174	Mobil Oil Corp	1	12,000	1	-	-
11	218	Proctor & G Oxnd	1-2	9,000	1	44	9,270
12	388	Watson Cogen	1	8,500	1	170	8,755
13	388	Teayawa	1	10,120	1	-	-
14	388	Teayawa	2	10,120	1	-	-
15	391	Energy Dev Azusa	1	10,000	1	3	10,000
16	393	RCW Lamb Canyon	1	10,000	1	2	10,000
17	394	RCWMD Badlands	1	10,000	1	1	10,000
18	395	RCWMD Edom Hill	1	10,000	1	1	10,000
19	396	RCWMD Mead Vly	1	10,000	1	1	10,000
20	398	Tajiguas	1	10,000	1	1	10,000
21	398	Tulare Energy	1	10,000	1	1	10,000
22	401	West Covina	1	10,000	1	3	10,000
23	402	Woodville Energy	1	10,000	1	0	10,000
33	605	SCE QF Solar	1	10,000	1	189	10,000
35	1,329	San Onofre-SONGS	2	10,986	1	535	10,986
36	1,869	San Onofre-SONGS	3	10,986	1	540	10,986
39	3,041	Ace Cogen	1	9,500	1	97	9,500
41	3,121	Nueva Azalea	1	11,310	1	69	4,398
42	3,190	Nueva Azalea	2	11,310	1	69	4,398
45	3,366	SCE Misc Bio QF	1	10,000	1	39	10,000
47	3,422	North Am Chem	2	10,500	1	17	10,500
48	3,422	Riverside Cement	1	10,500	1	0	10,500
51	3,604	Midway Sunset	1	4,962	1	180	5,260
53	3,669	Colmac Energy	1	12,500	1	45	12,500
54	3,678	Commerce Refuse	1	12,500	1	9	12,500
55	3,690	Delano Energy	1	12,500	1	12	12,500
60	3,740	Gas Recovery Sys	1	12,000	1	5	12,720
61	3,741	OrangeCountySan	1	12,000	1	1	12,720
62	3,750	PacEn (Penrose)	1	12,000	1	8	12,720
63	3,753	PacEn (Toyon)	1	12,000	1	3	12,720
69	3,811	Rio Bravo Jasmin	1	12,500	1	37	12,500
71	3,876	Blythe	1	10,120	1	65	5,766
72	3,941	Blythe	2	10,120	1	65	5,766
73	4,001	High Desert	1	10,120	1	60	5,766
74	4,061	High Desert	2	10,120	1	60	5,766
75	4,121	High Desert	3	10,120	1	60	5,766
76	4,187	Mountainview	1	10,120	1	66	5,766
77	4,254	Mountainview	2	10,120	1	66	5,766
78	4,320	Mountainview	3	10,120	1	66	5,766
79	4,386	Mountainview	4	10,120	1	66	5,766
80	4,449	Pastoria	1	10,120	1	63	5,766
81	4,511	Pastoria	2	10,120	1	63	5,766
82	4,574	Pastoria	3	10,120	1	63	5,766
123	7,156	Mandalay	2	17,243	1	20	8,044
126	7,386	Alamitos	5	11,433	1	130	8,136
129	7,646	Alamitos	6	11,144	1	130	8,241

SCE Generation Region, Generation Supply Duration Curve with Heat Rates

Total Block ID	Cumulative Block (MW)	Unit Name	No	Ave. Heat (Btu/kWh)	Station Block ID	Station Block (MW)	Incremental Heat Rate
131	7,976	Ormond.Beach	1	10,852	1	250	8,166
133	8,168	Coolwater CC	3	16,092	1	72	7,274
135	8,263	Ormond.Beach	2	19,877	1	50	8,190
138	8,541	O'brien Cal Milk	1	8,500	1	14	9,010
141	8,803	Redondo.Beach	7	11,220	1	130	8,552
142	8,933	Redondo.Beach	8	11,220	1	130	8,552
147	9,303	Mandalay	1	15,735	1	20	8,619
152	9,763	El Segundo	4	20,114	1	20	8,789
154	9,864	Mojave	1	8,500	1	41	8,755
158	10,088	Alamitos	3	21,217	1	20	8,861
164	10,468	Etiwanda	3	20,995	1	20	8,915
171	10,986	Etiwanda	4	20,844	1	20	8,963
175	11,226	El Segundo	3	21,575	1	20	8,964
180	11,558	Corona	1	8,500	1	32	8,755
181	11,583	O.L.S. Camarillo	1	8,500	1	25	8,755
182	11,605	Pitchess Honor R	1	8,500	1	22	8,755
183	11,631	Wheelabrator Nor	1	8,500	1	26	8,755
193	12,043	Broadway	3	13,399	1	18	8,892
196	12,176	E F Oxnard	1	8,758	1	25	9,021
198	12,199	Huntington Beach	2	15,634	1	20	9,111
200	12,339	Huntington Beach	3	11,775	1	90	9,121
202	12,389	Huntington Beach	1	15,100	1	20	9,130
205	12,579	Huntington Beach	4	11,697	1	90	9,135
211	12,899	Alamitos	4	22,209	1	20	9,182
216	13,271	Coolwater CC	4	14,469	1	72	8,127
218	13,325	El Segundo	2	27,838	1	10	9,203
222	13,527	San Bernardino	1	27,481	1	7	8,662
223	13,534	San Bernardino	2	27,481	1	7	8,662
230	13,892	El Segundo	1	27,838	1	10	9,244
233	13,987	Etiwanda	2	29,923	1	10	9,266
238	14,119	Etiwanda	1	66,603	1	10	9,281
243	14,301	AES Placerita	1	9,200	1	60	9,200
255	15,028	FPB Cogen	1	9,000	1	6	9,270
268	15,429	Long Beach CC	9	12,600	1	79	9,208
276	15,741	SCE Misc CG QF	1	10,000	1	67	10,000
278	15,825	Coolwater	1	11,944	1	17	9,322
281	15,892	Coolwater	2	12,181	1	19	9,368
284	15,961	Arco Wilmington	1	10,000	1	31	10,000
286	16,560	SCE QF Wind	1	10,000	1	595	10,000
287	16,561	PASA Gen: Fuel Cell	1	10,000	1	1	10,000
288	16,563	16 West	1-2	10,000	1	2	10,000
289	16,566	Alexander	1-3	10,000	1	3	10,000
290	16,571	Cabazon Wind	1	10,000	1	5	10,000
291	16,573	CalWind	1	10,000	1	2	10,000
292	16,581	Catellus	1-5	10,000	1	8	10,000
293	16,587	Chistensen/Lazar	1	10,000	1	6	10,000
294	16,595	Gorman	1	10,000	1	9	10,000
295	16,600	Mark Tech Corp	1	10,000	1	5	10,000
296	16,605	Painted Hills	1	10,000	1	5	10,000
297	16,607	Phoenix	1-5	10,000	1	2	10,000
298	16,614	Victory Garden	1	10,000	1	7	10,000
299	16,619	Windland	1	10,000	1	5	10,000
300	16,624	Wintec	1	10,000	1	5	10,000
318	17,323	Broadway	2	14,292	1	11	9,493
323	17,411	Long Beach CC	8	12,600	1	35	9,894
332	17,744	Broadway	1	14,994	1	11	9,958

SCE Generation Region, Generation Supply Duration Curve with Heat Rates

Total Block ID	Cumulative Block (MW)	Unit Name	No	Ave. Heat (Btu/kWh)	Station Block ID	Station Block (MW)	Incremental Heat Rate
334	17,755	Loma Linda Univ	1	12,200	1	0	10,600
338	17,787	Mammoth Pac L.P.	1	21,000	1	12	21,000
339	17,791	Mammoth Pacific	1	21,000	1	4	21,000
340	17,802	Mammoth Pacific	2	21,000	1	11	21,000
346	17,828	L A Total Energy	1	11,500	1	4	12,190
352	17,908	EXXON Santa Ynez	1	12,000	1	3	12,720
354	18,167	Kern River CG	1	12,000	1	256	12,720
355	18,455	Sycamore Cogen	1	12,000	1	288	12,720
358	18,517	Chevron El Segundo	2	12,000	1	2	12,720
360	18,544	US Borax & Chem	1	12,000	1	27	12,720
362	18,565	Harbor Cogen	1	12,000	1	20	12,720
363	18,579	Inland Container	1	12,000	1	14	12,720
364	18,606	Jefferson Smurft	1	12,000	1	27	12,720
365	18,606	Point Arguello P	1	12,000	1	1	12,720
366	18,608	Smurfit Newsprint	1	12,000	1	1	12,720
367	18,635	SUNLAW CG Partne	1	12,000	1	27	12,720
368	18,650	Williamette Indu	1	12,000	1	15	12,720
376	18,760	O.L.S. Chino	1	12,602	1	14	12,980
378	18,779	Vernon GT	1	10,000	1	5	12,932
379	18,792	Glenarm GT	1	12,200	1	13	12,932
380	18,805	Glenarm GT	2	12,200	1	13	12,932
384	18,838	North Am Chem	1	12,500	1	2	13,250
386	18,848	Colton	1	13,760	1	10	13,760
387	18,858	Colton	2	13,760	1	10	13,760
388	18,869	Devers	1	13,760	1	11	13,760
389	18,877	Harbor Cgn (pkr)	1	13,760	1	8	13,760
390	18,887	Vista	1	13,760	1	10	13,760
401	19,043	Alamitos	2	28,854	1	10	16,975
406	19,218	Alamitos	1	49,304	1	10	17,653
411	19,406	Anaheim GT	1	16,500	1	23	17,490
413	19,503	Alamitos GT	7	18,510	1	74	19,621
415	19,636	Huntin. Beach GT	5	19,997	1	74	21,197
417	19,769	Mandalay GT	3	14,393	1	74	15,257
419	19,862	Elwood GT	1	14,950	1	27	15,847
421	19,954	Etiwanda GT	5	20,006	1	71	21,206
423	20,609	INTLD SCE	1	10,000	1	600	10,000
24	405	Energy Dev Azusa	1	-	2	3	10,000
25	407	RCW Lamb Canyon	1	-	2	2	10,000
26	408	RCWMD Badlands	1	-	2	1	10,000
27	409	RCWMD Edom Hill	1	-	2	1	10,000
28	410	RCWMD Mead Vly	1	-	2	1	10,000
29	411	Tajiguas	1	-	2	1	10,000
30	412	Tulare Energy	1	-	2	1	10,000
31	415	West Covina	1	-	2	3	10,000
32	415	Woodville Energy	1	-	2	0	10,000
34	794	SCE QF Solar	1	-	2	189	10,000
37	2,404	San Onofre-SONGS	2	-	2	535	10,986
38	2,944	San Onofre-SONGS	3	-	2	540	10,986
40	3,052	Ace Cogen	1	9,500	2	11	9,500
43	3,258	Nueva Azalea	1	7,854	2	69	4,398
44	3,327	Nueva Azalea	2	7,854	2	69	4,398
46	3,404	SCE Misc Bio QF	1	-	2	39	10,000
49	3,424	North Am Chem	2	10,500	2	2	10,500
50	3,424	Riverside Cement	1	10,500	2	0	10,500
52	3,624	Midway Sunset	1	4,962	2	20	5,260
56	3,693	City of Long Beach	1	12,500	2	3	12,500

SCE Generation Region, Generation Supply Duration Curve with Heat Rates

Total Block ID	Cumulative Block (MW)	Unit Name	No	Ave. Heat (Btu/kWh)	Station Block ID	Station Block (MW)	Incremental Heat Rate
57	3,698	Colmac Energy	1	12,500	2	5	12,500
58	3,699	Commerce Refuse	1	12,500	2	1	12,500
59	3,735	Delano Energy	1	12,500	2	36	12,500
64	3,768	Gas Recovery Sys	1	12,000	2	15	12,720
65	3,773	LA County Puente	B	12,000	2	5	12,720
66	3,773	Orange Cty Sanitation	1	12,000	2	0	12,720
67	3,774	PacEn (Penrose)	1	12,000	2	1	12,720
68	3,774	PacEn (Toyon)	1	12,000	2	0	12,720
70	3,811	Rio Bravo Jasmin	1	12,500	2	0	12,500
83	4,639	Blythe	1	7,943	2	65	5,766
84	4,704	Blythe	2	7,943	2	65	5,766
85	4,764	High Desert	1	7,943	2	60	5,766
86	4,824	High Desert	2	7,943	2	60	5,766
87	4,884	High Desert	3	7,943	2	60	5,766
88	4,950	Mountainview	1	7,943	2	66	5,766
89	5,016	Mountainview	2	7,943	2	66	5,766
90	5,082	Mountainview	3	7,943	2	66	5,766
91	5,149	Mountainview	4	7,943	2	66	5,766
92	5,211	Pastoria	1	7,943	2	63	5,766
93	5,274	Pastoria	2	7,943	2	63	5,766
94	5,336	Pastoria	3	7,943	2	63	5,766
124	7,206	Mandalay	2	10,672	2	50	8,044
127	7,466	Alamitos	5	10,177	2	80	8,136
130	7,726	Alamitos	6	10,038	2	80	8,241
132	8,096	Ormond.Beach	1	9,981	2	120	8,166
134	8,213	Coolwater CC	3	12,644	2	45	7,274
136	8,438	Ormond.Beach	2	10,787	2	175	8,190
139	8,543	O'brien Cal Milk	1	8,500	2	2	9,010
143	8,983	Redondo Beach	7	10,479	2	50	8,552
144	9,033	Redondo Beach	8	10,479	2	50	8,552
148	9,353	Mandalay	1	10,652	2	50	8,619
153	9,823	El Segundo	4	11,620	2	60	8,789
155	9,868	Mojave	1	8,500	2	5	8,755
159	10,148	Alamitos	3	11,950	2	60	8,861
165	10,528	Etiwanda	3	11,935	2	60	8,915
172	11,046	Etiwanda	4	11,933	2	60	8,963
176	11,286	El Segundo	3	12,117	2	60	8,964
184	11,632	Carson Cogen Co.	1	8,500	2	2	8,755
185	11,636	Corona	1	8,500	2	4	8,755
186	11,639	O.L.S. Camarillo	1	8,500	2	3	8,755
187	11,641	Pitchess Honor R	1	8,500	2	2	8,755
188	11,787	Watson Cogen	1	8,500	2	146	8,755
189	11,790	Wheelabrator Nor	1	8,500	2	3	8,755
194	12,061	Broadway	3	11,139	2	18	8,892
197	12,179	E F Oxnard	1	8,758	2	3	9,021
199	12,249	Huntington Beach	2	10,975	2	50	9,111
201	12,369	Huntington Beach	3	11,115	2	30	9,121
203	12,439	Huntington Beach	1	10,836	2	50	9,130
206	12,609	Huntington Beach	4	11,053	2	30	9,135
212	12,959	Alamitos	4	12,439	2	60	9,182
217	13,315	Coolwater CC	4	11,957	2	45	8,127
219	13,360	El Segundo	2	13,344	2	35	9,203
224	13,548	San Bernardino	1	14,935	2	14	8,662
225	13,562	San Bernardino	2	14,935	2	14	8,662
231	13,927	El Segundo	1	13,376	2	35	9,244
234	14,017	Etiwanda	2	20,380	2	30	9,266

SCE Generation Region, Generation Supply Duration Curve with Heat Rates

Total Block ID	Cumulative Block (MW)	Unit Name	No	Ave. Heat (Btu/kWh)	Station Block ID	Station Block (MW)	Incremental Heat Rate
239	14,149	Etiwanda	1	32,358	2	30	9,281
244	14,361	AES Placerita	1	9,200	2	60	9,200
256	15,047	FPB Cogen	1	9,000	2	19	9,270
257	15,052	Proctor & G Oxnd	1-2	9,000	2	5	9,270
269	15,508	Long Beach CC	9	10,770	2	79	9,208
277	15,808	SCE Misc CG QF	1	-	2	67	10,000
279	15,838	Coolwater	1	10,808	2	13	9,322
282	15,908	Coolwater	2	10,895	2	16	9,368
283	15,931	Tehachapi Wind	1	-	2	23	10,000
285	15,965	Arco Wilmington	1	10,000	2	3	10,000
301	17,220	SCE QF Wind	1	-	2	595	10,000
302	17,221	PASA Gen. Fuel Cell	1	-	2	1	10,000
303	17,223	16 West	1-2	-	2	2	10,000
304	17,226	Alexander	1-3	-	2	3	10,000
305	17,231	Cabazon Wind	1	-	2	5	10,000
306	17,233	CalWind	1	-	2	2	10,000
307	17,240	Catellus	1-5	-	2	8	10,000
308	17,246	Chistensen/Lazar	1	-	2	6	10,000
309	17,255	Gorman	1	-	2	9	10,000
310	17,260	Mark Tech Corp	1	-	2	5	10,000
311	17,265	Painted Hills	1	-	2	5	10,000
312	17,267	Phoenix	1-5	-	2	2	10,000
313	17,274	Victory Garden	1	-	2	7	10,000
314	17,279	Windland	1	-	2	5	10,000
315	17,284	Wintec	1	-	2	5	10,000
319	17,334	Broadway	2	11,882	2	11	9,493
324	17,466	Long Beach CC	8	10,770	2	55	9,894
333	17,755	Broadway	1	12,465	2	11	9,958
335	17,755	Loma Linda Univ	1	12,200	2	0	10,600
341	17,803	Mammoth Pac L.P.	1	21,000	2	1	21,000
342	17,804	Mammoth Pacific	1	21,000	2	1	21,000
343	17,804	Mammoth Pacific	2	21,000	2	0	21,000
347	17,840	L A Total Energy	1	11,500	2	12	12,190
350	17,879	Arco Placerita	1-2	12,000	2	4	12,720
353	17,911	EXXON Santa Ynez	1	12,000	2	3	12,720
356	18,483	Kern River CG	1	12,000	2	28	12,720
357	18,515	Sycamore Cogen	1	12,000	2	32	12,720
359	18,517	Chevron El Segun	2	12,000	2	0	12,720
361	18,545	US Borax & Chem	1	12,000	2	1	12,720
369	18,710	Harbor Cogen	1	12,000	2	60	12,720
370	18,711	Inland Container	1	12,000	2	2	12,720
371	18,714	Jefferson Smurft	1	12,000	2	3	12,720
372	18,715	Point Arguello P	1	12,000	2	1	12,720
373	18,715	Smurfit Newsprint	1	12,000	2	0	12,720
374	18,744	SUNLAW CG Partne	1	12,000	2	29	12,720
375	18,746	Williamette Indu	1	12,000	2	2	12,720
377	18,774	O.L.S. Chino	1	-	2	14	12,980
381	18,810	Vernon GT	1	10,000	2	5	12,932
382	18,823	Glenarm GT	1	12,200	2	13	12,932
383	18,836	Glenarm GT	2	12,200	2	13	12,932
385	18,838	North Am Chem	1	12,500	2	0	13,250
391	18,897	Colton	1	13,760	2	10	13,760
393	18,927	Colton	2	13,760	2	10	13,760
395	18,958	Devers	1	13,760	2	11	13,760
397	18,988	Harbor Cgn (pkr)	1	13,760	2	8	13,760
399	19,013	Vista	1	13,760	2	10	13,760

SCE Generation Region, Generation Supply Duration Curve with Heat Rates

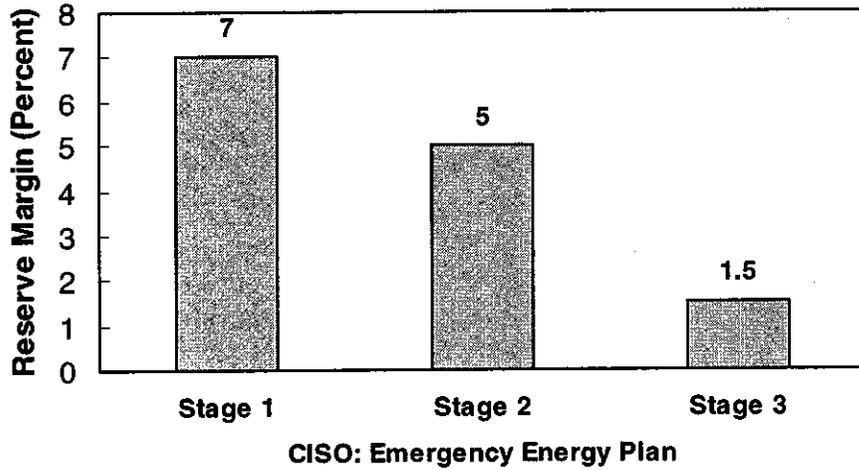
Total Block ID	Cumulative Block (MW)	Unit Name	No	Ave. Heat (Btu/kWh)	Station Block ID	Station Block (MW)	Incremental Heat Rate
402	19,078	Alamitos	2	19,615	2	35	16,975
407	19,253	Alamitos	1	26,587	2	35	17,653
412	19,429	Anaheim GT	1	16,500	2	23	17,490
414	19,562	Alamitos GT	7	18,510	2	60	19,621
416	19,695	Huntin. Beach GT	5	19,997	2	60	21,197
418	19,835	Mandalay GT	3	14,393	2	67	15,257
420	19,883	Elwood GT	1	14,950	2	22	15,847
422	20,009	Etiwanda GT	5	20,006	2	55	21,206
424	21,209	INTLD SCE	1	-	2	600	10,000
95	5,405	Nueva Azalea	1	7,183	3	69	5,841
96	5,474	Nueva Azalea	2	7,183	3	69	5,841
97	5,539	Blythe	1	7,248	3	65	5,858
98	5,604	Blythe	2	7,248	3	65	5,858
99	5,664	High Desert	1	7,248	3	60	5,858
120	6,999	Pastoria	3	7,027	4	63	6,364
121	7,067	Nueva Azalea	1	7,027	4	69	6,559
122	7,136	Nueva Azalea	2	7,027	4	69	6,559
128	7,516	Mandalay	2	9,093	4	50	8,186
149	9,443	Alamitos	5	9,445	4	90	8,745
157	10,068	Ormond.Beach	1	9,413	4	120	8,730
161	10,308	Alamitos	3	9,756	4	80	8,664
167	10,631	Coolwater CC	3	10,267	4	22	7,866
168	10,806	Ormond.Beach	2	9,475	4	175	8,805
170	10,966	El Segundo	4	9,803	4	80	8,955
174	11,206	Etiwanda	4	9,886	4	80	8,894
178	11,446	El Segundo	3	9,780	4	80	8,594
179	11,526	Etiwanda	3	9,919	4	80	8,987
190	11,860	Redondo.Beach	7	9,570	4	70	9,000
191	11,930	Redondo.Beach	8	9,570	4	70	9,000
214	13,119	Alamitos	4	10,012	4	80	8,760
226	13,612	Mandalay	1	9,707	4	50	9,213
227	13,662	Huntington Beach	1	9,856	4	50	9,213
229	13,882	Alamitos	6	9,582	4	90	9,239
232	13,977	Huntington Beach	2	9,941	4	50	9,257
100	5,724	High Desert	2	7,248	3	60	5,858
101	5,784	High Desert	3	7,248	3	60	5,858
102	5,850	Mountainview	1	7,248	3	66	5,858
103	5,916	Mountainview	2	7,248	3	66	5,858
104	5,982	Mountainview	3	7,248	3	66	5,858
105	6,049	Mountainview	4	7,248	3	66	5,858
106	6,111	Pastoria	1	7,248	3	63	5,858
107	6,174	Pastoria	2	7,248	3	63	5,858
108	6,236	Pastoria	3	7,248	3	63	5,858
125	7,256	Mandalay	2	9,471	3	50	7,790
137	8,528	Alamitos	5	9,655	3	90	8,437
140	8,673	Ormond.Beach	1	9,577	3	130	8,427
145	9,208	Ormond.Beach	2	9,768	3	175	8,458
146	9,283	Coolwater CC	3	10,572	3	75	7,583
150	9,593	Redondo.Beach	7	9,691	3	150	8,745
151	9,743	Redondo.Beach	8	9,691	3	150	8,745
156	9,948	El Segundo	4	10,227	3	80	8,834
160	10,228	Alamitos	3	10,302	3	80	8,654
162	10,398	Alamitos	6	9,685	3	90	8,861
163	10,448	Mandalay	1	9,913	3	50	8,878
166	10,608	Etiwanda	3	10,385	3	80	8,835
173	11,126	Etiwanda	4	10,382	3	80	8,831

SCE Generation Region, Generation Supply Duration Curve with Heat Rates

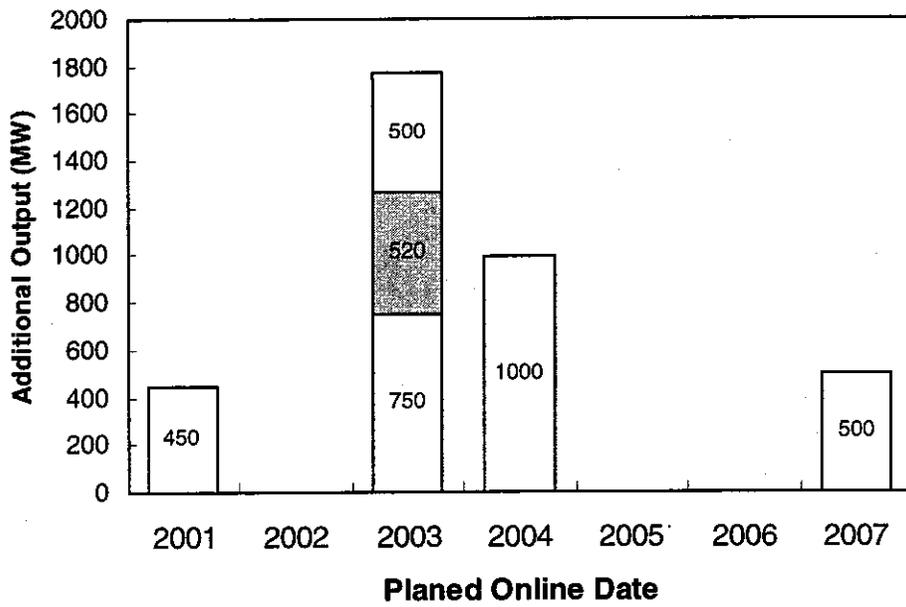
Total Block ID	Cumulative Block (MW)	Unit Name	No	Ave. Heat (Btu/kWh)	Station Block ID	Station Block (MW)	Incremental Heat Rate
177	11,366	El Segundo	3	10,373	3	80	8,629
204	12,489	Huntington Beach	1	10,124	3	50	9,127
208	12,704	Huntington Beach	2	10,226	3	50	9,177
213	13,039	Alamitos	4	10,638	3	80	8,837
235	14,047	Etiwanda	2	19,025	3	30	8,858
240	14,179	Etiwanda	1	19,742	3	30	8,924
245	14,391	Huntington Beach	3	10,771	3	30	9,318
250	14,791	El Segundo	2	11,363	3	45	9,382
251	14,821	Huntington Beach	4	10,706	3	30	9,395
252	14,866	El Segundo	1	11,393	3	45	9,410
254	15,022	Coolwater CC	4	10,447	3	75	8,351
264	15,296	San Bernardino	1	12,599	3	14	9,095
265	15,310	San Bernardino	2	12,599	3	14	9,095
267	15,350	Broadway	3	10,607	3	18	9,540
270	15,538	Long Beach CC	9	10,320	3	30	8,147
320	17,350	Coolwater	2	10,470	3	16	9,540
321	17,363	Coolwater	1	10,426	3	13	9,544
325	17,526	Long Beach CC	8	10,320	3	60	9,934
337	17,776	Broadway	2	11,314	3	11	10,173
344	17,815	Broadway	1	11,869	3	11	10,672
392	18,917	Colton	1	13,760	3	20	13,760
394	18,947	Colton	2	13,760	3	20	13,760
396	18,980	Devers	1	13,760	3	23	13,760
398	19,003	Harbor Cgn (pkr)	1	13,760	3	15	13,760
400	19,033	Vista	1	13,760	3	20	13,760
403	19,123	Alamitos	2	18,303	3	45	16,991
408	19,298	Alamitos	1	17,035	3	45	17,670
109	6,301	Blythe	1	7,027	4	65	6,364
110	6,366	Blythe	2	7,027	4	65	6,364
111	6,426	High Desert	1	7,027	4	60	6,364
112	6,486	High Desert	2	7,027	4	60	6,364
113	6,546	High Desert	3	7,027	4	60	6,364
114	6,612	Mountainview	1	7,027	4	66	6,364
115	6,679	Mountainview	2	7,027	4	66	6,364
116	6,745	Mountainview	3	7,027	4	66	6,364
117	6,811	Mountainview	4	7,027	4	66	6,364
118	6,874	Pastoria	1	7,027	4	63	6,364
119	6,936	Pastoria	2	7,027	4	63	6,364
236	14,077	Etiwanda	2	18,580	4	30	8,453
241	14,209	Etiwanda	1	15,465	4	30	8,612
258	15,082	Huntington Beach	4	10,521	4	30	9,565
260	15,147	Huntington Beach	3	10,570	4	30	9,596
262	15,237	El Segundo	2	10,783	4	45	9,623
263	15,282	El Segundo	1	10,808	4	45	9,638
266	15,332	Coolwater CC	4	10,225	4	22	8,560
271	15,566	Long Beach CC	9	10,155	4	29	9,339
272	15,580	San Bernardino	1	11,670	4	14	9,348
273	15,594	San Bernardino	2	11,670	4	14	9,348
322	17,376	Broadway	3	10,500	4	13	10,180
326	17,542	Coolwater	2	10,296	4	16	9,741
327	17,597	Long Beach CC	8	10,155	4	55	9,996
328	17,610	Coolwater	1	10,284	4	13	9,814
345	17,824	Broadway	2	11,200	4	8	10,860
348	17,848	Broadway	1	11,750	4	8	11,395
404	19,168	Alamitos	2	17,872	4	45	17,010
409	19,343	Alamitos	1	14,282	4	45	17,690

SCE Generation Region, Generation Supply Duration Curve with Heat Rates

Total Block ID	Cumulative Block (MW)	Unit Name	No	Ave. Heat (Btu/kWh)	Station Block ID	Station Block (MW)	Incremental Heat Rate
169	10,886	Alamitos	3	9,553	5	80	8,944
192	12,025	El Segundo	3	9,561	5	95	9,008
195	12,151	Alamitos	5	9,371	5	90	9,050
207	12,654	Mandalay	2	9,103	5	45	9,141
209	12,799	El Segundo	4	9,626	5	95	9,179
210	12,879	Etiwanda	4	9,710	5	80	9,182
215	13,199	Alamitos	4	9,767	5	80	9,032
220	13,440	Redondo.Beach	7	9,509	5	80	9,204
221	13,520	Redondo.Beach	8	9,509	5	80	9,204
228	13,792	Ormond.Beach	1	9,359	5	130	9,101
237	14,109	Etiwanda	2	18,380	5	32	8,041
242	14,241	Etiwanda	1	14,760	5	32	8,333
246	14,481	Alamitos	6	9,534	5	90	9,326
247	14,526	Huntington Beach	2	9,816	5	45	9,344
248	14,701	Ormond.Beach	2	9,423	5	175	9,252
249	14,746	Huntington Beach	1	9,756	5	45	9,378
253	14,946	Etiwanda	3	9,792	5	80	9,411
259	15,117	Huntington Beach	4	10,446	5	35	9,501
261	15,192	Mandalay	1	9,689	5	45	9,621
274	15,634	El Segundo	1	10,600	5	40	9,898
275	15,674	El Segundo	2	10,582	5	40	9,904
280	15,873	Huntington Beach	3	10,396	5	35	10,060
316	17,298	San Bernardino	1	11,229	5	14	9,686
317	17,312	San Bernardino	2	11,229	5	14	9,686
329	17,659	Long Beach CC	9	10,065	5	48	10,050
330	17,719	Long Beach CC	8	10,065	5	60	10,114
331	17,733	Coolwater	2	10,238	5	14	9,960
336	17,764	Coolwater	1	10,255	5	9	10,075
349	17,875	Coolwater CC	3	10,371	5	26	11,237
351	17,905	Coolwater CC	4	10,357	5	26	11,372
405	19,208	Alamitos	2	17,678	5	40	17,023
410	19,383	Alamitos	1	13,406	5	40	17,705



CAelectricityoutlook.xls



CAelectricityoutf

CA_Proposed Generation

ID	Facility	Technology	Fuel Type	Output (MW)	Est Online Date	Company	Notes	Source	Status	Est Cost (in Millions)	County	Region
120	CE Turbo	Geothermal	Geothermal	10	06/00	CalEnergy	Under Construction	CalEnergy Web	1		Imperial	Cal - Mex
117	Mountain View Power Partners	Wind	Wind	75	04/01	Seawest, Inc	Under Construction 20% complete	Website 3/13/00 news	1		Riverside	Cal - Mex
198	Procter & Gamble	Gas	Gas	44	05/01	Sacramento Municipal	Under Construction	CEC Website	3		Sacramento	Cal - Mex
162	United Golden Gate	Combustion	Gas	48	06/01	El Paso Merchant Energy	CEC Decret # 00-AFC-5 (4 month sitting)	CEC Website	1		San Mateo	Cal - Mex
119	Salton Sea V	Geothermal	Geothermal	49	06/00	CalEnergy	Under Construction	CalEnergy Web	1		Imperial	Cal - Mex
118	Fournille	Geothermal	Geothermal	50	09/03	Calpine		BLM Website	2		Siskiyou/MiDoc	Cal - Mex
156	Haynes	Combined	Gas	50	01/07	LADWP	Upgrades to existing plant	LADWP Press Release	5		Los Angeles	Cal - Mex
157	Scattergood	Combined	Gas	50	01/07	LADWP	Upgrades to existing plant	LADWP Press Release	5	60	Los Angeles	Cal - Mex
166	Woodland Generation Station	Combined	Gas	75	01/07	Modesto Irrigation	Upgrades to existing plant	Sacramento Bee	3	70	Stanislaus	Cal - Mex
144	Hanford Energy Park	Combined	Gas	150	02/03	GW Power Sys	Applied for small power plant exemption	CEC Website	5		Kern	Cal - Mex
199	Sunrise Power Phase II	Combined	Gas	240	08/03	Edison International	Convert Sunrise I to a 500MW Combined	Edison Press Release	5		Kern	Cal - Mex
155	Valley	Combined	Gas	250	12/03	LADWP	Upgrades to existing plant	LADWP Press Release	5		Los Angeles	Cal - Mex
108	Sunrise Power Phase I	Simple	Gas	320	08/01	Edison International	Upgrades to existing plant	CEC Website	1	200	Kern	Cal - Mex
196	Huntington Beach Modern	Gas	Gas	450	06/01	AES	CEC Decret # 99-AFC-4	CEC Website	3		Orange	Cal - Mex
103	Los Medanos (Pittsburg) Facility	Combined	Gas	500	07/01	Calpine	Expedited permitting process requested	CEC Website	1	300	Contra Costa	Cal - Mex
109	Sutter Power	Combined	Gas	500	07/01	Calpine	CEC Decret # 98-AFC-1 45% complete	CEC Website	1	275	Sutter	Cal - Mex
91	Elk Hills	Combined	Gas	500	09/02	Sempra/OXY	CEC Decret # 97-AFC-2 50% complete	CEC & Sempra Webs	2	300	Kern	Cal - Mex
110	Three Mountain	Combined	Gas	500	02/03	Ogden Pacific	CEC Decret # 99-AFC-1	CEC Website	3	300	Shasta	Cal - Mex
96	Midway-Sunset	Combined	Gas	500	03/03	ARCO Western Energy	CEC Decret # 99-AFC-2	CEC Website	3	250	Kern	Cal - Mex
94	Long Beach District	Combined	Gas	500	01/07	Enron	CEC Decret # 99-AFC-9	CEC Website	5	300	Los Angeles	Cal - Mex
195	Rio Linda/Elverta	Combined	Gas	500	01/07	Florida Power	AFC expected 2000	CEC Website	5		Sacramento	Cal - Mex
101	Olay Mesa	Combined	Gas	510	01/03	PG&E	CEC Decret # 99-AFC-5	CEC Website	3	350	San Diego	Cal - Mex
88	Blythe	Combined	Gas	520	04/03	Summit Energy Group	CEC Decret # 99-AFC-8	CEC Website	3	250	Riverside	Cal - Mex
104	Potrero	Combustion	Gas	520	09/03	Southern Energy	AFC expected 2000	CEC Website	3	250	Contra Costa	Cal - Mex
93	La Paloma Phase	Combined	Gas	521	12/01	PG&E	CEC Decret # 98-AFC-2 40% complete	CEC Website	1	500	Kern	Cal - Mex
167	La Paloma Phase	Combined	Gas	522	03/02	PG&E	CEC Decret # 98-AFC-2 40% complete	CEC Website	1	500	Kern	Cal - Mex
89	Contra Costa	Combined	Gas	530	05/03	Southern Energy	CEC Decret # 00-AFC-1	CEC Website	3	250	Contra Costa	Cal - Mex
107	Nueva Azalea (Sunlaw)	Combined	Gas	550	08/03	Sunlaw Cogen Partners	CEC Decret # 00-AFC-3	CEC Website	3	450	Los Angeles	Cal - Mex
106	South City	Combined	Gas	550	04/04	AES	AFC expected 2000	CEC Website	4		San Mateo	Cal - Mex
194	El Segundo	Gas	Gas	550	01/07	NRG & Dynergy		CEC Website	5		Los Angeles	Cal - Mex
95	Metcalf Energy Center	Combined	Gas	600	03/03	Calpine & Bechtel	CEC Decret # 99-AFC-3	CEC Website	3	350	Los Angeles	Cal - Mex
143	Teayawa Energy Center	Gas	Gas	600	12/03	Calpine	Located on Torrey Martinez Desert Cahuilla	Company Website	5	275	Riverside	Cal - Mex
105	Redondo Beach	Combined	Gas	700	01/03	AES	AFC expected 2000	CEC Website	5		Los Angeles	Cal - Mex
92	High Desert	Combined	Gas	720	01/03	Inland Group &	CEC Decret # 97-AFC-1, Decret sat 4/01	CEC Website	2	350	San Bernardino	Cal - Mex
102	Pastoria	Combined	Gas	750	01/03	Southern Energy	CEC Decret # 99-AFC-7	CEC Website	3	400	Kern	Cal - Mex
197	Roseville	Gas	Gas	750	01/07	Enron		CEC Website	4		Placer	Cal - Mex
90	Delta Energy Center	Combined	Gas	880	07/02	Calpine & Bechtel	CEC Decret # 99-AFC-3 15% complete	CEC Website	1	375	Contra Costa	Cal - Mex
87	Antelope	Combined	Gas	1000	02/04	Enron	CEC Decret # 98-SIT-8, up to 1000MW	CEC Website	4	500	Kern	Cal - Mex
99	Mountainview	Gas	Gas	1056	05/03	Thermo Ecotek	CEC Decret # 00-AFC-2	CEC Website	3	550	San Bernardino	Cal - Mex
98	Moss Landing	Combined	Gas	1060	06/02	Duke	CEC Decret # 99-AFC-4	CEC Website	1	475	Monterey	Cal - Mex
97	Morro Bay	Combined	Gas	1200	10/03	Duke	CEC Decret # 00-AFC-12 (Replaces 1,000MW)	CEC Website	3		San Luis Obispo	Cal - Mex

WSCC Planned Capacity Additions

ID	Facility	Location	Technology	Fuel Type	Output (MW)	Est Online Date
56	Wygen I	Wyoming		Coal	80	1/1/03
36	Carbon County	Montana		Coal	2000	12/1/03
26	Manchief	Colorado		Gas	265	5/1/00
40	El Dorado Energy Project	Nevada	Combined	Gas	492	5/1/00
25	Arapahoe	Colorado		Gas	74	6/1/00
171	Fountain	Colorado		Gas	215	6/1/00
37	Cobisa-Person	New Mexico	Combustion	Gas	132	7/1/00
192	Albany Cogeneration	Oregon	Cogeneration	Gas	85	7/1/00
1	Poplar Creek Ph 1	Canada - Alberta	Combined	Gas	290	9/1/00
2	Joffre	Canada - Alberta	Combined	Gas	416	9/1/00
179	Air Liquide - Scotford	Canada - Alberta		Gas	80	9/1/00
21	Island Cogeneration	Canada - British Columbia	Combined	Gas	250	10/1/00
4	Poplar Creek Ph 2	Canada - Alberta	Combined	Gas	70	1/1/01
27	Front Range (Ft Lupton)	Colorado	Combined	Gas	164	5/1/01
32	Presidente Juarez	Mexico - Baja California	Combined	Gas	540	5/1/01
198	Procter & Gamble	California		Gas	44	5/1/01
6	South Point	Arizona		Gas	500	6/1/01
8	Desert Basin Generating	Arizona		Gas	500	6/1/01
29	Fort St. Vrain (Phase 3)	Colorado		Gas	235	6/1/01
162	United Golden Gate Peaking	California	Combustion	Gas	48	6/1/01
184	Gillette Upgrade	Wyoming		Gas	40	6/1/01
196	Huntington Beach Modern.	California		Gas	450	6/1/01
103	Los Medanos (Pittsburg) Facility	California	Combined	Gas	500	7/1/01
109	Sutter Power	California	Combined	Gas	500	7/1/01
7	Griffith Energy Project	Arizona	Combined	Gas	520	7/1/01
46	Klamath Falls Cogeneration	Oregon	Combined	Gas	500	7/1/01
108	Sunrise Power Phase I	California	Simple	Gas	320	8/1/01
9	West Phoenix (Phase 1)	Arizona	Combined	Gas	120	8/1/01
30	Rathdrum	Idaho		Gas	270	9/1/01
187	Cavaller	Canada - Alberta		Gas	106	9/1/01
139	Carseland Cogeneration	Canada - Alberta		Gas	80	11/1/01
140	Redwater Cogeneration	Canada - Alberta		Gas	40	11/1/01
93	La Paloma Phase I	California	Combined	Gas	521	12/1/01
49	Everett Delta	Washington		Gas	248	12/1/01
188	Balzac	Canada - Alberta		Gas	106	12/1/01
35	Blackfeet	Montana		Gas	160	1/1/02
41	Next Generation II	Nevada		Gas	30	1/1/02
167	La Paloma Phase II	California	Combined	Gas	522	3/1/02
130	Coyote Springs II	Oregon	Combined	Gas	280	6/1/02
98	Moss Landing	California	Combined	Gas	1060	6/1/02
47	Hermiston	Oregon	Combined	Gas	546	6/1/02
149	Frederickson (Tenaska)	Washington		Gas	249	6/1/02
173	Sundance Energy Project	Arizona		Gas	600	6/1/02
90	Delta Energy Center	California	Combined	Gas	880	7/1/02
132	Caithness Big Sandy (Phase I)	Arizona	Combined	Gas	500	8/1/02
17	Arlington Valley	Arizona		Gas	500	8/1/02
10	West Phoenix (Phase 2)	Arizona	Combined	Gas	500	9/1/02
91	Elk Hills	California	Combined	Gas	500	9/1/02
125	Rossdale Unit 11 Repower	Canada - Alberta	Combined	Gas	170	9/1/02
127	Cold Lake	Canada - Alberta	Cogeneration	Gas	220	10/1/02
5	Muskeg River	Canada - Alberta	Cogeneration	Gas	170	12/1/02
18	Gila River	Arizona	Combined	Gas	2000	12/1/02
28	Ray D. Nixon (Phase 2)	Colorado	Combined	Gas	400	12/1/02
50	Chehalis Generation	Washington	Combined	Gas	460	12/1/02
153	Deming	New Mexico		Gas	550	12/1/02
101	Otay Mesa	California	Combined	Gas	510	1/1/03

WSCC Planned Capacity Additions

ID	Facility	Location	Technology	Fuel Type	Output (MW)	Est Online Date
102	Pastoria	California	Combined	Gas	750	1/1/03
105	Redondo Beach	California		Gas	700	1/1/03
11	Redhawk 1	Arizona	Combined	Gas	530	1/1/03
12	Redhawk 2	Arizona	Combined	Gas	530	1/1/03
92	High Desert	California	Combined	Gas	720	1/1/03
116	Scotford	Canada - Alberta	Cogeneration	Gas	150	1/1/03
122	Goldendale	Washington	Combined	Gas	248	1/1/03
110	Three Mountain	California	Combined	Gas	500	2/1/03
144	Hanford Energy Park	California	Combined	Gas	150	2/1/03
95	Metcalfe Energy Center	California	Combined	Gas	600	3/1/03
96	Midway-Sunset	California	Combined	Gas	500	3/1/03
43	Apex Industrial	Nevada	Combined	Gas	1000	3/1/03
174	Mesquite Power	Arizona		Gas	1000	3/1/03
134	La Rosita	Mexico - Baja California	Combined	Gas	750	4/1/03
88	Blythe	California	Combined	Gas	520	4/1/03
99	Mountainview	California		Gas	1056	5/1/03
89	Contra Costa	California	Combined	Gas	530	5/1/03
176	Arrow Canyon	Nevada		Gas	500	6/1/03
53	Satsop	Washington	Combined	Gas	500	6/1/03
107	Nueva Azalea (Sunlaw)	California	Combined	Gas	550	8/1/03
199	Sunrise Power Phase II	California	Combined	Gas	240	8/1/03
104	Potrero	California	Combustion	Gas	520	9/1/03
15	Harquahala Generating Station	Arizona	Combined	Gas	1040	9/1/03
168	Silicon Mountain	Montana	Combined	Gas	500	9/1/03
190	Edmonton	Canada - Alberta	Cogeneration	Gas	30	9/1/03
97	Morro Bay	California	Combined	Gas	1200	10/1/03
133	Caithness Big Sandy (Phase II)	Arizona	Combined	Gas	220	12/1/03
136	El Dorado II	Nevada	Combined	Gas	480	12/1/03
137	Umatilla	Oregon		Gas	550	12/1/03
143	Teayawa Energy Center	California		Gas	600	12/1/03
52	Sumas 2 Generating Facility	Washington	Combined	Gas	660	12/1/03
86	Calgary Energy Centre	Canada - Alberta	Combined	Gas	250	12/1/03
148	Washoe Energy Facility	Nevada	Combined	Gas	600	12/1/03
155	Valley	California	Combined	Gas	250	12/1/03
16	Kyrene (Oasis)	Arizona	Combined	Gas	250	1/1/04
38	Belen	New Mexico		Gas	140	1/1/04
54	Starbuck	Washington	Combined	Gas	1100	1/1/04
51	Cowlitz Cogeneration project	Washington	Combined	Gas	250	2/1/04
87	Antelope	California	Combined	Gas	1000	2/1/04
170	Meadow Valley	Nevada	Combined	Gas	1000	3/1/04
106	South City	California	Combined	Gas	550	4/1/04
19	Gila Bend	Arizona	Combined	Gas	750	6/1/04
142	Garnet Energy Facility	Idaho	Combined	Gas	250	7/1/04
145	Wallula	Washington		Gas	1300	1/1/05
178	La Paz	Arizona	Combined	Gas	1080	8/1/05
20	Santan	Arizona	Combined	Gas	825	12/1/05
13	Redhawk 3	Arizona	Combined	Gas	530	6/1/06
94	Long Beach District	California		Gas	500	1/1/07
111	Northwest Regional Power	Washington	Combined	Gas	838	1/1/07
112	Reliant/Pinnacle JDA (1)	Nevada		Gas	1400	1/1/07
23	Port Alberni	Canada - British Columbia	Combined	Gas	240	1/1/07
44	Carlin	Nevada		Gas	500	1/1/07
114	Mexicali	Mexico - Baja California		Gas	257	1/1/07
183	Mercer Ranch	Washington	Combined	Gas	850	1/1/07
156	Haynes	California	Combined	Gas	50	1/1/07
157	Scattergood	California	Combined	Gas	50	1/1/07
181	Toltec Power Station	Arizona		Gas	2000	1/1/07

WSCC Planned Capacity Additions

ID	Facility	Location	Technology	Fuel Type	Output (MW)	Est Online Date
194	El Segundo	California		Gas	550	1/1/07
195	Rio Linda/Elverta	California	Combined	Gas	500	1/1/07
166	Woodland Generation Station	California		Gas	75	1/1/07
172	Moapa Paiute Generating Station	Nevada	Combined	Gas	760	1/1/07
191	Syncrude - Ft McMurray	Canada - Alberta	Cogeneration	Gas	238	1/1/07
197	Roseville	California		Gas	750	1/1/07
14	Redhawk 4	Arizona	Combined	Gas	530	12/1/07
24	Valmont	Colorado		Gas/Coal	37	6/1/00
31	Cerro Prieto IV	Mexico - Baja California	Geothermal	Geothermal	100	6/1/00
119	Salton Sea V	California		Geothermal	49	6/1/00
120	CE Turbo	California		Geothermal	10	6/1/00
118	Fourmile Hill	California		Geothermal	50	9/1/03
3	Taylor Coulee Shute	Canada - Alberta	Hydro	Hydro	13	5/1/00
22	Stave Falls	Canada - British Columbia	Hydro	Hydro	90	12/1/00
45	Little Sandy Dam	Oregon	Hydro	Hydro	-11	5/1/01
146	Oldman	Canada - Alberta	Hydro	Hydro	25	6/1/02
147	Dunvegan	Canada - Alberta	Hydro	Hydro	40	12/1/02
185	Miller Creek	Canada - British Columbia	Hydro	Hydro	25	4/1/03
150	Mamquam	Canada - British Columbia	Hydro	Hydro	25	1/1/07
151	Ashlu	Canada - British Columbia	Hydro	Hydro	25	1/1/07
152	Pingston	Canada - British Columbia	Hydro	Hydro	25	1/1/07
180	White Tank Mountain	Arizona	Pump Storage	Hydro	1250	1/1/07
42	Nevada Green Energy Project	Nevada		Renew	150	12/1/02
126	Cowley Ridge	Canada - Alberta	Wind	Wind	2	8/1/00
129	Foot Creek Wind IV	Wyoming	Wind	Wind	17	10/1/00
55	Foot Creek Wind III	Wyoming	Wind	Wind	25	10/1/00
177	Simpson Ridge	Wyoming	Wind	Wind	10	12/1/00
117	Mountain View Power Partners	California	Wind	Wind	44	4/1/01
135	Gilliam County Wind	Oregon	Wind	Wind	25	9/1/01
169	Blackfoot I Wind	Montana	Wind	Wind	22	10/1/01
131	State Line Project	Oregon	Wind	Wind	99	12/1/01
141	State Line Project	Washington	Wind	Wind	99	12/1/01
189	Grande Prairie	Canada - Alberta		WoodWaste	20	3/1/02
186	Lytton	Canada - British Columbia		WoodWaste	25	1/1/07
138	Cancarb Cogeneration	Canada - Alberta			47	12/1/00
154	Ensenada	Mexico - Baja California			40	1/1/07
182	Mobile	Arizona			600	1/1/07

WSCC Capacity Additions (Concluded)

ID	Company	Source	County	Region	Notes
56	Black Hills	Corp Website	Campbell	Rocky Mountain	Under Construction
36	Composite	WEU/PMW	Carbon	Rocky Mountain	Transmission to Wisconsin
26	Fulton/Coastal	EIA	Morgan	Rocky Mountain	complete
40	Sempra/Reliant	Website		Southwest	Complete/Merchant Plant/246mw to sempra
25	Black Hills	WEU	Cheyenne	Rocky Mountain	Complete
171	Enron	PMW		Rocky Mountain	
37	Delta Power	WEU/CEM	Bernalillo	Southwest	Complete
192	Williamette	EIA		Northwest	Complete
1	TransAlta	Website		Northwest	Complete - Cogeneration Project/Suncor
2	ATCO	PMW		Northwest	Complete
179	Air Liquide	Alberta resource		Northwest	Complete
21	Westcoast nrg	Website		Northwest	Under Construction
4	TransAlta	Website		Northwest	Cogeneration Project/Suncor (Poplar Creek)
27	KN Power	WEU	Weld	Rocky Mountain	Joint with Quixx (Peaker Unit)
32	Alstrom Power	CFE		Cal - Mex	Under Construction
198	Sacramento Municipal	CEC	Sacramento	Cal - Mex	Under Construction 20% complete
6	Calpine	WEU	Mohave	Southwest	Under Construction
8	Reliant	WEU/CEM	Pinal	Southwest	Under Construction
29	PSC CO	PSC IRP 1999	Weld	Rocky Mountain	Expand existing plant
162	EI Paso Merchant Energy	CEC Website	San Mateo	Cal - Mex	CEC Docket # 00-AFC-5 (4 month siting)
184	Black Hills	Corp Website/EIA	Campbell	Rocky Mountain	Complete
196	AES	CEC	Orange	Cal - Mex	Expedited permitting process requested
103	Calpine	CEC Website	Contra Costa	Cal - Mex	CEC Docket # 98-AFC-1 45% complete
109	Calpine	CEC Website	Sutter	Cal - Mex	CEC Docket # 97-AFC-2 50% complete
7	Griffith Energy (PPL & Duke)	WEU/CEM	Mohave	Southwest	Under Construction
46	PacifiCorp	www.klamathcogen.com/	Klamath	Northwest	Under Construction
108	Edison International	CEC Website	Kern	Cal - Mex	CEC Docket # 98-AFC-4
9	APS/Calpine	WEU/PMW/CEM	Maricopa	Southwest	Upgrade existing units
30	Avista	WEU	Kootenai	Northwest	w/Cogentrix - under construction
187	PanCanadian	Alberta Resource Dev		Northwest	www.resdev.gov.ab.ca/electric/rgeneral
139	TransCanada	Corporate Website		Northwest	
140	TransCanada	Corporate Website		Northwest	
93	PG&E NEG	CEC Website	Kern	Cal - Mex	CEC Docket # 98-AFC-2 40% complete
49	FPL Energy	WEU	Snohomish	Northwest	Purchased rights from NW Power
188	PanCanadian/CanOxy	Alberta Resource Dev		Northwest	www.resdev.gov.ab.ca/electric/rgeneral
35	Adair	PMW	Glacier	Rocky Mountain	Merchant
41	Next Generation	CEM		Southwest	Will add 90 MW later
167	PG&E NEG	CEC Website	Kern	Cal - Mex	CEC Docket # 98-AFC-2 40% complete
130	Avista	Oregon Reg	Morrow	Northwest	
98	Duke	CEC Website	Monterey	Cal - Mex	CEC Docket # 99-AFC-4
47	Calpine	Oregon Reg	Umatilla	Northwest	Purchased from Ida Corp & Trans Alta
149	Frederickson Power	PMA	Pierce	Northwest	Joint venture EPCOR and Westcoast energyr
173	PPL Global	EPA Federal Register	Pinal	Southwest	Merchant Peaker
90	Calpine & Bechtel	CEC Website	Contra Costa	Cal - Mex	CEC Docket # 98-AFC-3 15% complete

WSCC Capacity Additions (Concluded)

ID	Company	Source	County	Region	Notes
132	Caithness	ACC Website	Mohave	Southwest	ACC Docket # L-00000R-00-0100
17	Duke	CEM	Maricopa	Southwest	
10	APS/Calpine	Website	Maricopa	Southwest	
91	Sempra/OXY	CEC & Sempra Webs	Kern	Cal - Mex	CEC Docket # 99-AFC-1
125	Epcor	Epcor Website		Northwest	*Will use existing steam turbine
127	Imperial Oil/?	Alberta Resource		Northwest	
5	ATCO	Atco Website		Northwest	Part of Athabasca Oil Sands Project
18	Panda Energy	AZ Republic	Maricopa	Southwest	ACC will consider at Jun 27-28 meeting
28	Coastal/CSU	Website	El Paso	Rocky Mountain	Turbines purchased
50	Tractebel	WA State Web	Lewis	Northwest	
153	Duke Energy Luna LLC	NM PRC Utility Division	Luna	Southwest	
101	PG&E NEG	CEC Website	San Diego	Cal - Mex	CEC Docket # 99-AFC-5
102	Southern Energy	CEC Website	Kern	Cal - Mex	CEC Docket # 99-AFC-7
105	AES	CEC Website	Los Angeles	Cal - Mex	AFC expected 2000
11	APS/Reliant	PMW	Maricopa	Southwest	Merchant/Est Groundbreaking 12/19/00
12	APS/Reliant	PMW	Maricopa	Southwest	Merchant/Est Groundbreaking 12/19/00
92	Inland Group & Constellation	CEC Website	San Bernardino	Cal - Mex	CEC Docket # 97-AFC-1; Const est 4/01
116	ATCO	Atco Website		Northwest	
122	Nat. Energy Sys.	Oregonian	Klickitat	Northwest	
110	Ogden Pacific	CEC Website	Shasta	Cal - Mex	CEC Docket # 99-AFC-2
144	GWF Power Sys	CEC Website	Kings	Cal - Mex	Applied for small power plant exemption
95	Calpine & Bechtel	CEC Website	Santa Clara	Cal - Mex	CEC Docket # 99-AFC-3
96	ARCO Western Energy	CEC Website	Kern	Cal - Mex	CEC Docket # 99-AFC-9
43	Southern Energ	Website		Southwest	
174	Sempra Energy Resources	Maricopa County Web	Maricopa	Southwest	
134	Intergen	Corp Press Rel		Cal - Mex	34% available for sale in US
88	Summit Energy Group	CEC Website	Riverside	Cal - Mex	CEC Docket # 99-AFC-8
99	Thermo Ecotek	CEC Website	San Bernardino	Cal - Mex	CEC Docket # 00-AFC-2
89	Southern Energy	CEC Website	Contra Costa	Cal - Mex	CEC Docket # 00-AFC-1
176	Reliant	Reliant website	Clark	Southwest	
53	Duke	WA State Web	Mason	Northwest	
107	Sunlaw Cogen Partners	CEC Website	Los Angeles	Cal - Mex	CEC Docket # 00-AFC-3
199	Edison International	Edison Press Release	Kern	Cal - Mex	Convert Sunrise I to a 560MW Combined
104	Southern Energy	CEC Website	Contra Costa	Cal - Mex	AFC expected 2000
15	PG&E NEG	PMA	Maricopa	Southwest	Merchant
168	BBI Power		Silver Bow	Rocky Mountain	
190	Confidential	Alberta Resource Dev		Northwest	www.resdev.gov.ab.ca/electric/rgeneral
97	Duke	CEC Website	San Luis Obispo	Cal - Mex	CEC Docket # 00-AFC-12 (Replaces 1,000MW)
133	Caithness	ACC Website	Mohave	Southwest	ACC Docket # L-00000R-00-0100
136	Sempra/Reliant	CEM		Southwest	
137	PG&E Natl Energy	Oregon Reg	Umatilla	Northwest	Adjacent to existing Hermiston plant
143	Calpine	Company Website	Riverside	Cal - Mex	Located on Torres Martinez Desert Cahuilla
52	National Energy	WEU/State Reg	Whatcom	Northwest	Application No 99-1
86	Calpine	Reuters		Northwest	Name unknown - Plant is near Calgary
148	Duke Energy NA	CEM 7/28/00	Washoe	Northwest	

WSCC Capacity Additions (Concluded)

ID	Company	Source	County	Region	Notes
155	LADWP	LADWP Press Release	Los Angeles	Cal - Mex	Upgrades to existing plant
16	Oasis LLC	PMW	Maricopa	Southwest	
38	Cobisa	www.cobisa.com/projects.htm	Valencia	Southwest	Merchant
54	PPL Global	WA State Web	Columbia	Northwest	
51	Weyerhaeuser	WA State Web	Cowlitz	Northwest	
87	Enron	CEC Website	Kern	Cal - Mex	CEC Docket # 98-SIT-8; up to 1000MW
170	PG&E NEG	PMA Online	Clark	Southwest	
106	AES	CEC Website	San Mateo	Cal - Mex	AFC expected 2000
19	Power Dev Ent	AZ Republic	Maricopa	Southwest	Merchant/With Industrial Power Technology
142	Ida-West	www.ida-west.com/projects.htm		Northwest	Proposed to meet RFP from Idaho Power
145	Newport Generation		Walla Walla	Northwest	
178	Allegheny	Allegheny website	La Paz	Southwest	
20	SRP	www.santanfacts.org	Maricopa	Southwest	Environmental Cert App submitted 7/17
13	APS	PMW	Maricopa	Southwest	Merchant
94	Enron	CEC Website	Los Angeles	Cal - Mex	AFC expected 2000
111	Northwest Power Ent	WA Website	Lincoln	Northwest	Reg approval 9/96.
112	Reliant/Pinnacle	Reliant Website		Southwest	Announced 3/14/00
23	ATCO	WEU		Northwest	Delayed Indef
44	Coastal Power	WEU	Elko	Northwest	Being considered
114	AES	Energy insight		Cal - Mex	Announced 3/20/00
183	Cogentrix	http://www.efsec.wa.gov	Benton	Northwest	
156	LADWP	LADWP Press Release	Los Angeles	Cal - Mex	Upgrades to existing plant
157	LADWP	LADWP Press Release	Los Angeles	Cal - Mex	Upgrades to existing plant
181	SW Power Group II	PMA	Pinal	Southwest	1st phase estimated online in 2003
194	NRG & Dynergy	CEC	Los Angeles	Cal - Mex	
195	Florida Power	CEC	Sacramento	Cal - Mex	
166	Modesto Irrigation	Sacramento Bee	Stanislaus	Cal - Mex	
172	Calpine	EPA Federal Register	Clark	Southwest	
191	Syncrude Aurora	Alberta Resource Dev		Northwest	www.resdev.gov.ab.ca/electric/rgeneral
197	Enron	CEC	Placer	Cal - Mex	
14	APS	PMW	Maricopa	Southwest	Merchant
24	Black Hills	WEU	Boulder	Rocky Mountain	Complete
31	Mitsubishi	CFE		Cal - Mex	Under Construction
119	CalEnergy	CalEnergy Web	Imperial	Cal - Mex	Under Construction
120	CalEnergy	CalEnergy Web	Imperial	Cal - Mex	Under Construction
118	Calpine	BLM Website	Siskiyou/Mo doc	Cal - Mex	
3	Canadian Hydro	WEU		Northwest	Completed 4/27/00
22	BC Hydro	Website		Northwest	*90 MW plant nets 38. Complete
45	Portland GE	WEU		Northwest	Demolition in progress
146	Atco Energen	Alberta Resource		Northwest	
147	Canadian Hydro	Alberta Resource		Northwest	
185	Miller Creek Power Ltd	BC Hydro Website		Northwest	RFP for BC Hydro
150	Canadian Hydro	Canadian Hydro Website		Northwest	
151	Canadian Hydro	Canadian Hydro Website		Northwest	
152	Canadian Hydro	Canadian Hydro Website		Northwest	Joint with Great Lakes Power
180	Arizona Independent Pwr	CEM	Maricopa	Southwest	
42	Composite	WEU		Southwest	Up to 1000 MW.Wind/Solar/Geo
126	Canadian Hydro	Website		Northwest	Complete
129	Seawest, Inc	WEU/Seawest website	Carbon	Rocky Mountain	Complete
55	Seawest, Inc	Seawest Website	Carbon	Rocky Mountain	25 MW to PSC CO - Project Complete

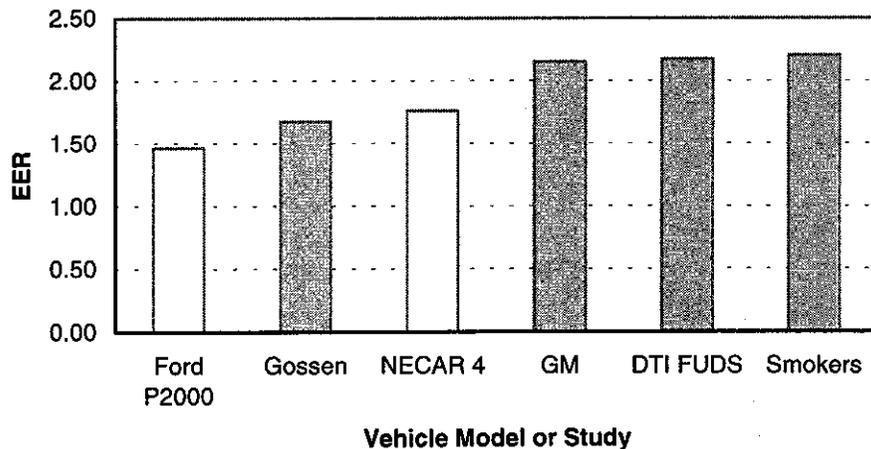
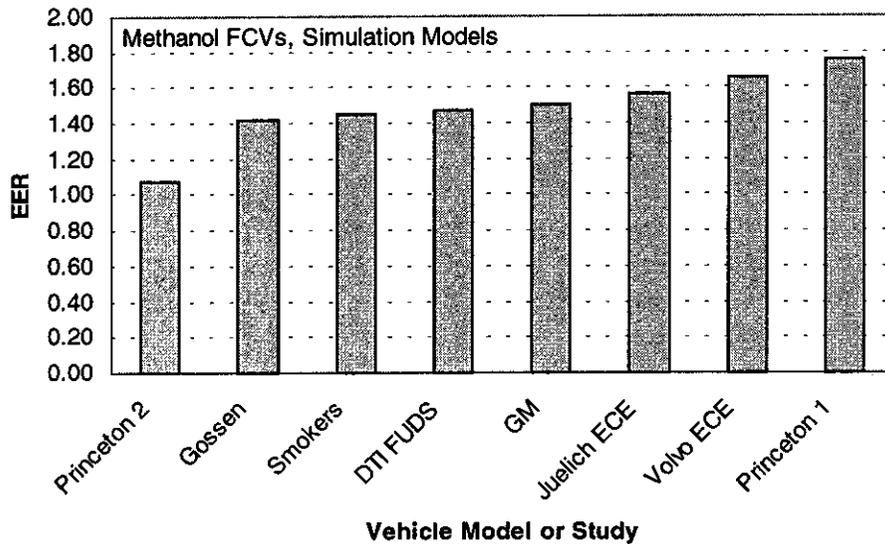
WSCC Capacity Additions (Concluded)

ID	Company	Source	County	Region	Notes
177	Terra Moya	Energy Insight	Carbon	Rocky Mountain	
117	Seawest, Inc	Website 3/13/00 news	Riverside	Cal - Mex	
135	Seawest, Inc	WEU	Gilliam	Northwest	
169	Seawest Wind	Seawest Website	Glacier	Rocky Mountain	
131	FPL Energy	Oregon Reg	Umatilla	Northwest	Full application expected by Aug 2000
141	FPL Energy	PMW 6/26/00		Northwest	See Oregon Stateline project
189	Canadian Gas & Elec	Alberta Resource Dev		Northwest	www.resdev.gov.ab.ca/electric/rgeneral
186	Lytton power Inc	BC Hydro Website		Northwest	RFP for BC Hydro
138	TransCanada	Corporate Website		Northwest	
154		San Diego Union		Cal - Mex	Expansion of existing plant
182	American Energy	County Website	Maricopa	Southwest	www.maricopa.gov/envsvc/AIR/pwrplant.asp



Appendix D — Fuel Economy

Representatives from the electric utility industry participated in the TAC discussion of EV energy consumption and EERs. They indicated that EVs should be assigned a higher EER based on utility fleet operation data. SCE's on-road data for EVs operating on the "Pomona Loop" is summarized in Appendix D. A significant conclusion from this data was the EVs operating over the Pomona loop achieved fuel economy that was directionally consistent with certification data. The same vehicles had low energy consumption on both the certification driving cycle and the on-road test. However, the estimated EERs for the NiMH battery vehicles were closer to other EVs for the on-road testing.



Project Objective: The primary objective of this study is to determine the fuel cycle energy conversion efficiency and associated energy impacts of fuel and vehicle technology combinations being pursued over the next ten years.

EER Approach: Where possible, use EPA fuel economy data on commercial vehicles with reasonably equitable vehicle comparisons. Where insufficient commercial vehicle fuel economy data is unavailable, use prototype and modeling data that is scientifically sound.

Data Set for Fuel Cycle Analysis						
Technology	AD Little Estimates*					
	2000			2010		
	EER	Wgt Ratio	EER High	EER Low	Wgt Ratio	
Gasoline, RFG ICE	1.00	1.00	1.00	1.00	1.00	1.00
Diesel, FTD DI CI	1.37	1.02	1.37	1.21	1.02	1.02
RFG HEV	1.53	1.00	1.45	1.30	1.00	1.00
CNG ICE	0.98	1.07	1.08	0.98	1.07	1.07
LPG ICE			1.08	0.98		1.05
E85 ICE FFV	1.09	1.00	1.09	1.03	1.00	1.00
RFG, Naptha ATR/PEMFC			1.35	0.97		1.50
Methanol SR/PEMFC			1.54	1.39		1.50
Hydrogen PEMFC	1.57		1.74	1.50		1.50
Battery EV	2.85	1.29	2.90	2.40		1.25

Values used in Section 5 and CEC, "Fuel Cycle Energy Conversion Efficiency Analysis, Status Report," May 2000.

2010 Estimated Fuel Economy - Average Subcompact						
Fuel	Technology	LHV	High	Low	Units	
Gasoline	Conventional ICE	114,244	30.16	30.16	mi/gal	
RFG2	Conventional ICE	113,000	29.83	29.83	mi/gal	
RFG3	Conventional ICE	113,500	29.97	29.97	mi/gal	
RFG3	Motor Assist HEV	113,500	43.45	38.96	mi/gal	
RFG3	POX/PEM Fuel Cell	113,500	40.45	29.07	mi/gal	
Diesel	DI CI	130,800	47.31	41.79	mi/gal	
Naptha	POX/PEM Fuel Cell	116,000	41.35	29.71	mi/gal	
FT Diesel	DI CI	118,800	42.97	37.95	mi/gal	
CNG	Conventional ICE	92,800	26.46	24.01	mi/100 scf	
LPG	Conventional ICE	83,200	23.72	21.53	mi/gal	
Ethanol	Conventional ICE, FFV	76,200	21.93	20.72	mi/gal	
Methanol	SR/PEM Fuel Cell	57,000	23.18	20.92	mi/gal	
Hydrogen	PEM Fuel Cell	51,600	23.70	20.43	mi/lb	
Electric	Battery EV	3,412	0.38	0.46	kWh/mi	

LHV in Btus per unit of fuel

Gasoline Subcompact Cars

Class	Manufacturer	Carline Name	Displ	Cylinder	Transmission	Drv	Cty	Hwy	Combined	Fuel
SUBCOMPACT CARS	ACURA	INTEGRA	1.8	4	Auto(L4)	F	26.1883	38.9626	30.7208	R
SUBCOMPACT CARS	ACURA	INTEGRA	1.8	4	Manual(M5)	F	28.0294	39.7852	32.3279	R
SUBCOMPACT CARS	CHEVROLET	CAMARO	3.8	6	Auto(L4)	R	21.0237	36.9159	26.0750	R
SUBCOMPACT CARS	CHEVROLET	CAMARO	3.8	6	Manual(M5)	R	21.3912	38.8618	26.8161	R
SUBCOMPACT CARS	CHEVROLET	CAVALIER	2.2	4	Auto(L3)	F	25.1000	36.9000	29.3191	R
SUBCOMPACT CARS	CHEVROLET	CAVALIER	2.2	4	Auto(L4)	F	25.7476	40.0000	30.6643	R
SUBCOMPACT CARS	CHEVROLET	CAVALIER	2.2	4	Manual(M5)	F	26.5000	43.4000	32.1302	R
SUBCOMPACT CARS	CHEVROLET	CAVALIER	2.4	4	Auto(L4)	F	24.5000	39.1000	29.4482	R
SUBCOMPACT CARS	CHEVROLET	CAVALIER	2.4	4	Manual(M5)	F	25.1000	42.5000	30.7687	R
SUBCOMPACT CARS	CHEVROLET	METRO	1.0	3	Manual(M5)	F	42.9000	59.0000	48.9054	R
SUBCOMPACT CARS	CHEVROLET	METRO	1.3	4	Auto(A3)	F	33.5415	44.0995	37.5914	R
SUBCOMPACT CARS	CHEVROLET	METRO	1.3	4	Manual(M5)	F	40.2830	54.2000	45.5456	R
SUBCOMPACT CARS	FORD	ESCORT ZX2	2.0	4	Auto(L4)	F	28.2000	42.0000	33.0930	R
SUBCOMPACT CARS	FORD	ESCORT ZX2	2.0	4	Manual(M5)	F	28.1308	41.8706	33.0045	R
SUBCOMPACT CARS	FORD	MUSTANG	3.8	6	Auto(L4)	R	22.1156	35.1066	26.5341	R
SUBCOMPACT CARS	FORD	MUSTANG	3.8	6	Manual(M5)	R	21.7684	36.8187	26.6752	R
SUBCOMPACT CARS	FORD	MUSTANG	4.6	8	Auto(L4)	R	19.3656	30.3974	23.1456	R
SUBCOMPACT CARS	FORD	MUSTANG	4.6	8	Manual(M5)	R	19.0000	31.6000	23.1546	R
SUBCOMPACT CARS	HONDA	CIVIC	1.6	4	Auto(L4)	F	30.6000	44.4000	35.5758	R
SUBCOMPACT CARS	HONDA	CIVIC	1.6	4	Auto(L4)	F	30.8000	44.6000	35.7822	R
SUBCOMPACT CARS	HONDA	CIVIC	1.6	4	Manual(M5)	F	35.0600	46.9023	39.5540	R
SUBCOMPACT CARS	HONDA	CIVIC	1.6	4	Manual(M5)	F	32.8000	44.6000	37.2329	R
SUBCOMPACT CARS	HONDA	CIVIC HX	1.6	4	Auto(AV)	F	37.4895	48.9549	41.9061	R
SUBCOMPACT CARS	HONDA	CIVIC HX	1.6	4	Manual(M5)	F	38.6946	55.0218	44.6580	R
SUBCOMPACT CARS	HYUNDAI	TIBURON	2.0	4	Auto(L4)	F	23.9608	38.6472	28.9035	R
SUBCOMPACT CARS	HYUNDAI	TIBURON	2.0	4	Manual(M5)	F	26.1050	40.6658	31.1191	R
SUBCOMPACT CARS	IMPCO	CAVALIER DUAL-FUEL	2.2	4	Auto(A3)	F	24.5984	35.3000	28.4843	R
SUBCOMPACT CARS	MINI	MINI COOPER	2.4	4	Auto(L4)	F	23.1869	35.4732	27.4680	R
SUBCOMPACT CARS	MINI	MINI COOPER	2.4	4	Auto(L4)	F	22.7277	35.2404	27.0497	R
SUBCOMPACT CARS	MINI	MINI COOPER	2.4	4	Manual(M5)	F	25.3493	39.1209	30.1208	R
SUBCOMPACT CARS	MINI	MINI COOPER	1.5	4	Auto(L4)	F	31.6232	45.6697	36.7031	R
SUBCOMPACT CARS	MINI	MINI COOPER	1.5	4	Manual(M5)	F	36.3310	50.7772	41.6652	R
SUBCOMPACT CARS	MINI	MINI COOPER	1.8	4	Auto(L4)	F	28.4734	41.6734	33.2066	R
SUBCOMPACT CARS	MINI	MINI COOPER	1.8	4	Manual(M5)	F	30.9093	46.1139	36.2944	R
SUBCOMPACT CARS	PONTIAC	FIREBIRD/TRANSAM	3.8	6	Auto(L4)	R	21.0139	36.9093	26.0652	R
SUBCOMPACT CARS	PONTIAC	FIREBIRD/TRANSAM	3.8	6	Manual(M5)	R	21.3894	38.8537	26.8128	R
SUBCOMPACT CARS	PONTIAC	SUNFIRE	2.2	4	Auto(L3)	F	25.1000	36.9000	29.3191	R
SUBCOMPACT CARS	PONTIAC	SUNFIRE	2.2	4	Auto(L4)	F	25.7476	40.0000	30.6643	R
SUBCOMPACT CARS	PONTIAC	SUNFIRE	2.2	4	Manual(M5)	F	26.5000	43.4000	32.1302	R
SUBCOMPACT CARS	PONTIAC	SUNFIRE	2.4	4	Auto(L4)	F	24.5000	39.1000	29.4482	R

Gasoline Subcompact Cars

Class	Manufacturer	Carline Name	Displ	Cylinder	Transmission	Drv	Cty	Hwy	Combined	Fuel
SUBCOMPACT CARS	PONTIAC	SUNFIRE	2.4	4	Manual(M5)	F	25,1000	42,5000	30,7687	R
SUBCOMPACT CARS	SAAB	SAAB 9-3 CONVERTIBLE	2.0	4	Auto(L4)	F	22,0000	32,6000	25,7708	R
SUBCOMPACT CARS	SAAB	SAAB 9-3 CONVERTIBLE	2.0	4	Manual(M5)	F	23,9000	37,5000	28,5612	R
SUBCOMPACT CARS	SATURN	SC	1.9	4	Auto(L4)	F	29,6014	46,6121	35,4178	R
SUBCOMPACT CARS	SATURN	SC	1.9	4	Auto(L4)	F	27,8917	45,8399	33,8571	R
SUBCOMPACT CARS	SATURN	SC	1.9	4	Manual(M5)	F	31,5068	51,3020	38,1270	R
SUBCOMPACT CARS	SATURN	SC	1.9	4	Manual(M5)	F	29,9000	48,4000	36,1113	R
SUBCOMPACT CARS	SUZUKI	ESTEEM	1.6	4	Auto(L4)	F	30,2000	43,4000	34,9888	R
SUBCOMPACT CARS	SUZUKI	ESTEEM	1.6	4	Manual(M5)	F	33,6000	47,1000	38,5755	R
SUBCOMPACT CARS	SUZUKI	ESTEEM	1.8	4	Auto(L4)	F	28,8000	42,5000	33,6865	R
SUBCOMPACT CARS	SUZUKI	ESTEEM	1.8	4	Manual(M5)	F	31,4000	44,4000	36,1650	R
SUBCOMPACT CARS	SUZUKI	SWIFT	1.3	4	Auto(A3)	F	33,5415	44,0995	37,5914	R
SUBCOMPACT CARS	SUZUKI	SWIFT	1.3	4	Manual(M5)	F	40,2830	54,2000	45,5456	R
SUBCOMPACT CARS	TOYOTA	CAMRY SOLARA CONVERTIBLE	2.2	4	Auto(L4)	F	25,2733	39,0956	30,0550	R
SUBCOMPACT CARS	TOYOTA	CAMRY SOLARA CONVERTIBLE	3.0	6	Auto(L4)	F	20,9000	33,4673	25,1498	R
SUBCOMPACT CARS	TOYOTA	CELICA	1.8	4	Auto(L4)	F	25,6335	38,0990	30,0592	P
SUBCOMPACT CARS	TOYOTA	CELICA	1.8	4	Auto(L4)	F	29,8000	44,2000	34,9194	R
SUBCOMPACT CARS	TOYOTA	CELICA	1.8	4	Manual(M5)	F	30,6000	43,2000	35,2230	R
SUBCOMPACT CARS	TOYOTA	CELICA	1.8	4	Manual(M6)	F	25,7000	40,5000	30,7580	P
SUBCOMPACT CARS	VOLKSWAGEN	CABRIO	2.0	4	Auto(L4)	F	24,4999	35,6731	28,5196	R
SUBCOMPACT CARS	VOLKSWAGEN	CABRIO	2.0	4	Manual(M5)	F	26,7103	39,2215	31,1870	R
SUBCOMPACT CARS	VOLKSWAGEN	NEW BEETLE	1.8	4	Auto(L4)	F	25,0000	35,1000	28,7187	P
SUBCOMPACT CARS	VOLKSWAGEN	NEW BEETLE	1.8	4	Manual(M5)	F	28,2000	39,2000	32,2756	P
SUBCOMPACT CARS	VOLKSWAGEN	NEW BEETLE	2.0	4	Auto(L4)	F	24,4999	35,6731	28,5196	R
SUBCOMPACT CARS	VOLKSWAGEN	NEW BEETLE	2.0	4	Manual(M5)	F	26,7103	39,2215	31,1870	R
SUBCOMPACT CARS	VOLVO	C70 CONVERTIBLE	2.3	5	Auto(L4)	F	20,6627	31,8843	24,5510	P
SUBCOMPACT CARS	VOLVO	C70 CONVERTIBLE	2.3	5	Manual(M5)	F	22,0837	33,3974	26,0557	P
SUBCOMPACT CARS	VOLVO	C70 CONVERTIBLE	2.4	5	Auto(L4)	F	21,0033	33,3517	25,2023	P
Averages							27.5	41.2	32.3	

Ferrari, 8 cylinder, and 4-wheel drive cars removed

Data Source: EPA Fuel Economy Guide 2000 Model Year

Fuel	LHV Btu/gal	FE mpg	Discounted mpg
Gasoline (Indolene)	114,244	32.26	27.42
California Phase 2 RFG	113,000	31.91	27.12
California Phase 3 RFG	113,500	32.05	27.24

2010 Estimate increase by 10%

30.16

Diesel Cars

Class	Manufacturer	Carline Name	Displacement	Cylinders	Trans	Drv	Cty	Hwy	Combined	Fuel	Curb Wgt
SUBCOMPACT CARS	VOLKSWAGEN	NEW BEETLE	1.9	4	Auto(L4)	F	37.8549	57.4406	44.7160	D	2,867
SUBCOMPACT CARS	VOLKSWAGEN	NEW BEETLE	2	4	Auto(L4)	F	24.4999	35.6731	28.5196	R	2,785
COMPACT CARS	VOLKSWAGEN	GOLF	1.9	4	Auto(L4)	F	37.8549	57.4406	44.7160	D	2,875
COMPACT CARS	VOLKSWAGEN	GOLF	2	4	Auto(L4)	F	24.4999	35.6731	28.5196	R	2,820
COMPACT CARS	VOLKSWAGEN	JETTA	1.9	4	Auto(L4)	F	37.8549	57.4406	44.7160	D	2,891
COMPACT CARS	VOLKSWAGEN	JETTA	2	4	Auto(L4)	F	24.4999	35.6731	28.5196	R	2,862

	LHV	MPG	MPEG	Curb Weight
Gasoline	114,244	28.5	28.5	2,822
Diesel	130,800	44.7	39.1	2,878

EER	1.37
Weight Ratio	1.02

Data Source: EPA Fuel Economy Guide 2000 Model Year

European Diesels versus Gasoline vehicles (DI Diesel Technology only)			
	LHV	MPG	MPEG
Gasoline	114244	25.66293	25.7
Diesel	130800	35.51923	31
EER			1.21

CEC Comments: Sorted data for DI models vs all gasoline vehicles, since we anticipate only DI technology for light-duty US 2010 case. Averaged only the DI diesels (176 diesels) to the gasoline vehicles (830 vehicles), ignored the IDI vehicles. Suspect European data has significant IDI technologies that would not be appropriate for the US market in 2010. Conclusion: Recommend we set the lower bound for the diesel case at 1.21. EER.

CNG Cars										
Class	Manufacturer	carline name	displaceme	cylinders	trans	drv	cty	hwy	cmb	fi
SUBCOMPACT CARS	IMPACO	CAVALIER DUAL-FUEL	2.2	4	Auto(A3)	F	22.0000	28.0000	24.3478	R
SUBCOMPACT CARS	IMPACO	CAVALIER DUAL-FUEL	2.2	4	Auto(A3)	F	20.0000	27.0000	22.6415	C
SUBCOMPACT CARS	HONDA	CIVIC	1.6	4	Auto(L4)	F	28.0000	35.0000	30.7692	R
SUBCOMPACT CARS	HONDA	CIVIC GX	1.6	4	Auto(L4)	F	28.0000	34.0000	30.4153	C
COMPACT CARS	TOYOTA	CAMRY SOLARA	2.2	4	Auto(L4)	F	23.0000	30.0000	25.6983	R
COMPACT CARS	TOYOTA	CAMRY CNG	2.2	4	Auto(L4)	F	22.0000	30.0000	25.0000	C
COMPACT CARS	FORD	CONTOUR	2.0	4	Auto(L4)	F	20.0000	28.0000	22.9508	R
COMPACT CARS	FORD	CONTOUR	2.0	4	Auto(L4)	F	20.0000	27.0000	22.6415	C
			LHV	FE			MPEG			
			114244.0	25.94155	mpg	25.9416				
			92800.0	20.719826	mi/100 scf	25.5077				
			EER				0.98328			

TAC Comments
 EER can be as high as 1.08 if fuel injection technology is used.
 Efficiency of LPG cars can be similar to CNG models
 CNG has higher octane and lean burn potential but LPG has lighter weight

Fuel Cell Powered Vehicles

Gossen, 1999		Efficiency KJ/Km		55/45 Average Mpg		EER Rel FI	
Compact Class Vehicles	Weight kg	Max Power kw	Urban	Hwy	55/45 Average Mpg	EER Rel DI	EER Rel FI
gas DI*	957	63	2022	1648	1854	1.000	1.128
diesel DI**	1042	69	1814	1492	1669	1.111	1.253
IDM FCV	1142	60	1451	1492	1469	1.261	1.423
DH FCV	1042	60	1213	1290	1248	1.486	1.676
PHEV D	1092	na	1388	1296	1347	1.377	1.553
Conventional Gasoline Estimate			2346	1780	2091		1.000

Source: Frank Gossen, Jan-Weim Bierman, Comparison of Fuel Cell Systems and Other Future Powertrains Concerning Energy Efficiency, September 1999, International Energy Agency, Implementing Agreement 026; Final Report 1997-1999; Institut für Kraftfahrwesen, Aachen, Germany

Schmitz, 2000	Efficiency Gas Equiv Liters/100 km		
Vehicle	Weight kg	Max Power kw	Combined
Ford P2000	1514	75	3.64
			Urban
			Hwy
			Combined
			55/45
			3.64

Source: Peter Schmitz, Ford's Fuel Cell Activities, March 2000, Ford Forschungszentrum Aachen

Friedlmeier '99	Average Efficiency (urban/hwy not reported)			EER	
vehicle	weight kg	max power kw	kg H2/100 km	gasoline L/100km	diesel L/100 km
NECAR 4	1750	70	37	1.07	3.7
A Class Gas	1450	60		7.1	
A Class Diesel	1450	44			4.5
					1.22

* ICE efficiency numbers given for gasoline and diesel vehicles in general, but not A Class' in particular. Driving Cycle: NEDC comprised of 4 city cycles (ECE) and one extra-urban driving cycle (EUDC)

Fuel Cell Powered Vehicles

Ford Data	Hydrogen FC vehicle	gasoline equivalent FE		
		Urban	Highway	Combined
P2000	5 Passenger 1520 kg 3351 lbs	4.22	2.92	3.51 l/100 km 67.11 mpeg
Comparable Gasoline Vehicles				
P2000	2000			44.20 mpg
		1.6755	EER	1.52

Daimler-Chrysler Hydrogen Fuel Cell Vehicles				
	H₂ FE	Gasoline Equivalent		
NECAR IV	1750 kg	1.1	4.4 l/100 km 53.46 mpeg	
Gasoline equivalent vehicle per Daimler-Chrysler			7.1 l/100 km 33.13 mpeg	
			EER	1.61

Existing Hydrogen Fuel Cell Vehicles
Average EER 1.57

Vehicle	FC Fuel	Fuel Cell		Gasoline		EER	Wt Ratio	kJ/kg	Btu/mi	mpeg
		mpeg	mpeg	mpeg	mpeg					
ARB Reformer Report	M100, FUDS	46.3	24.6	1.88	1.14	1800	2746.9	41.1		
Volvo	M100. ECE	41.1	25	1.65	--	1200	1831.3	61.7		
Princeton	M100	61.7	35	1.76	1.57	2490	3799.9	29.7		
Princeton	M100	29.7	27.5	1.08	1.71	1140	1739.7	65.0		
Princeton	Gasoline, FUDS	65	35	1.86	1.47	2000	3052.1	37.0		
Princeton	Gasoline, FUDS	37	27.5	1.35	1.76	--	--	--		
FZ Juelich	M100 ECE	74.1	47.4	1.56	--	--	--	--		
Kreutz	Gasoline, FUDS	40.9	33.4	1.22	1.28	--	--	--		
DTI NREL Report	Hydrogen, FUDS	65	30	2.17	--	--	--	--		
DTI NREL Report	M100 FUDS	44	30	1.47	--	--	--	--		
DTI NREL Report	Gasoline, FUDS	29	30	0.97	--	--	--	--		

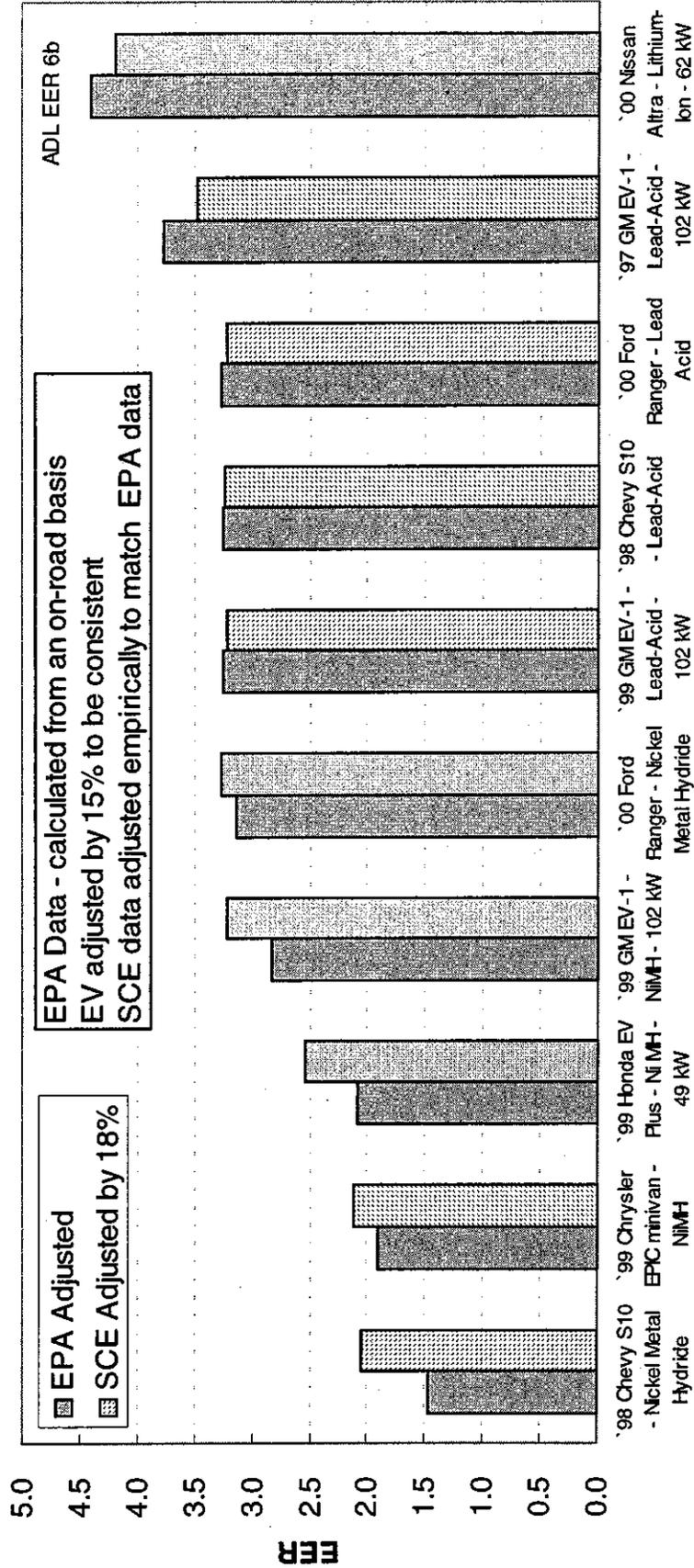
Technology	Estimated EER	Wgt Ratio	
		Low	High
Hydrogen PEMFC	2.09	1.61	2.48
M100 SR/PEMFC	1.57	1.08	1.88
Gasoline ATR/PEMFC	1.35	0.97	1.86
IKA Hydrogen FC estimates		1.63	1.74
IKA M100 FC estimates		1.39	1.54

Electric Vehicle	Adj SCE* FE (kWh/mi)	Gas Equiv FE (mpg)	Gasoline Vehicle	Gasoline UnAdj EPA FE (mpg)	EER
'99 Toyota RAV4 - NIMH	0.382	87.7	'99 Toyota RAV4 - 2WD - Auto 2.0L	27.9	3.15
'99 GM EV-1 - NIMH - 102 kW	0.299	112.1	'99 Acura Integra - Auto - 1.8L	31.9	3.51
'99 GM EV-1 - PbA - 102 kW	0.283	118.3	'99 Acura Integra - Auto - 1.8L	31.9	3.71
'99 Honda EV Plus - NIMH - 49 kW	0.434	77.1	'99 Honda Civic/accord - Auto	32.7	2.36
'00 Ford Ranger - PbA	0.434	77.1	'00 Ford Ranger - 2WD - Auto 2.5L	25.5	3.03
'00 Ford Ranger - NIMH	0.428	78.2	'00 Ford Ranger - 2WD - Auto 2.5L	25.5	3.07
'98 Chevy S10 - PbA	0.430	77.8	'98 Chevy S10 -Auto L4-2.2L	25.3	3.08
'98 Chevy S10 - NIMH	0.677	49.5	'98 Chevy S10 -Auto L4-2.2L	25.3	1.96
'99 Nissan Altra - Li-Ion	0.303	110.6	'99 Saturn SW/VW Passat SW - Auto	31.2	3.54
'99 Chrysler EPIC minivan - PbA	0.604	55.5	'99 Dodge Minivan - Auto L3 -2.4L	25.9	2.14
'99 Chrysler EPIC minivan - NIMH	0.654	51.2	'99 Dodge Minivan - Auto L3 -2.4L	25.9	1.97
			Average		2.86

SCE data adjusted upward by 8.5% to simulate EPA Unadjusted FE (average of difference between comparable vehicles on the two cycles)

Current	2.85
2010	2.40
	2.9

EER Comparisons, Adjusted SCE and EPA Data



Appendix E — Emission Results

This appendix presents the detailed emission calculations for all of the scenarios analyzed in this study. The marginal emissions in the SoCAB are presented in Appendix E.1. The results are provided for NO_x, particulate matter (PM), NMOG, and toxics. For each pollutant category, the results are shown for emissions in the SoCAB for the following scenarios.

- 1996 subcompacts, Scenario 1a;
- High fuel cycle emissions, less efficient subcompacts, Scenario 2b;
- Fuel cycle emissions consistent with the inventory; efficient subcompacts, Scenario 3c
- Lightweight efficient vehicles with fuel cycle assumptions for Scenario 3, but higher spillage (Scenario 3.2e).

For NO_x, PM, and NMOG, the well to pump (g/gal) results are shown by emission source category, followed by the g/mi emissions with corresponding fuel economy assumptions. These results are categorized by extraction, production, marketing, and distribution and presented in a chart.

Toxics are calculated from NMOG based on the toxics fraction of hydrocarbons for each source. Therefore, the toxics fraction in diesel exhaust (for example, mg benzene/ g NMOG) are multiplied by the NMOG portion. All of the toxics are summed and presented by component. The results are weighted by the toxics risk factor, normalized to formaldehyde as 1.0. The weighted toxics are also presented in a chart.

Emissions in California plus the SoCAB are presented in Appendix E.2. These results reflect the additional sources of marginal fuel cycle emissions outside the SoCAB in California; primarily rail car emissions from LPG transport and power plants. Scenario 3cCA shows the emissions for subcompact cars. The results would be proportional to fuel economy for lighter weight vehicles.

Emissions per fuel unit: SCENARIO 1

Fuel	NOx (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Feedstock transport	0.0285	0.0285	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0100	0.0000	0.0000	
Fuel Transport	0.0000	0.0000	0.0207	0.0897	0.0263	0.0237	0.0000	0.1410	0.0000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.1660	0.1660	0.3917	0.3917	0.1469	0.1506	0.1506	0.1506	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.194	0.194	0.412	0.481	0.173	0.174	0.141	0.292	0.001	

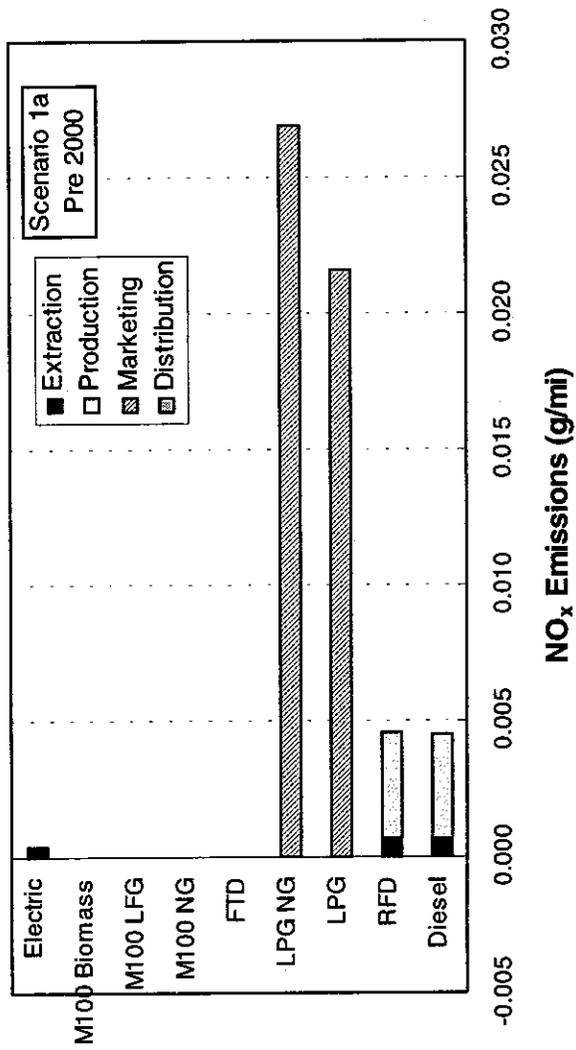
Emissions per mile driven: SCENARIO 1a

Fuel	NOx Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel Economy (mi/gal)	43.01	42.86	19.57	19.57	99999	99999	99999	99999	2.33	
Feedstock transport	0.00066	0.00066	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00039	
Refinery	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Fuel Transport	0.00000	0.00000	0.00159	0.00688	0.00000	0.00000	0.00000	0.00000	0.00000	
Fuel Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Bulk Terminal	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Exhaust	0.00386	0.00387	0.02001	0.02001	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Storage Tank Breathing	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Vehicle Working Loss	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Total	0.00386	0.00387	0.02160	0.02689	0.00000	0.00000	0.00000	0.00000	0.00000	

Emissions per mile driven: SCENARIO 1a

Fuel cycle process	NOx Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Extraction	0.00066	0.00066	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00039	
Production	0.00000	0.00000	0	0	0	0	0.00000	0.00000	0.00000	
Marketing	0.00386	0.00387	0.02160	0.02689	0.00000	0.00000	0.00000	0.00000	0.00000	
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	
Total	0.00452	0.00454	0.02160	0.02689	0.00000	0.00000	0.00000	0.00000	0.00039	

gagSumCharts-f.xls



gagSumCharts-f.xls

Methanol in fuel cell vehicles and FTD were not analyzed in Scenario 1.

Emissions per fuel unit: SCENARIO 2

Fuel cycle process	NOx (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FD	M100 NG	M100 LFG	M100 Biomass	Electric	
Feedstock transport	0.0285	0.0285	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0100	0.0000	0.0000	
Fuel Transport	0.0000	0.0000	0.0207	0.0897	0.0263	0.0237	0.0000	0.2820	0.0000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.0494	0.0494	0.1167	0.1167	0.0438	0.0449	0.0449	0.0449	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.078	0.078	0.137	0.206	0.070	0.069	0.035	0.327	0.001	

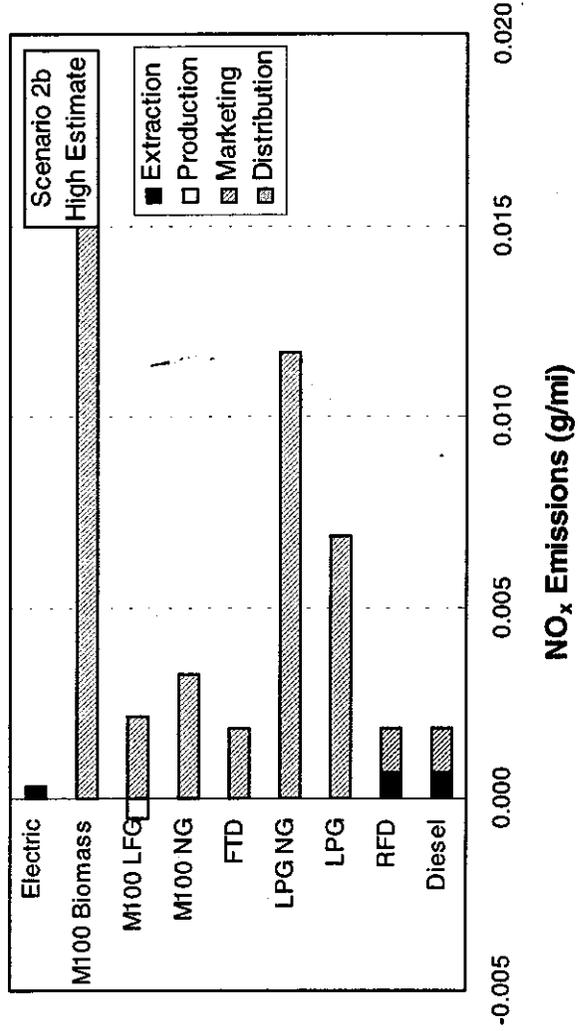
Emissions per mile driven: SCENARIO 2b 0.3448276

Fuel cycle process	NOx Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel Economy (mi/gal)	41.79	41.64	21.53	21.53	37.95	20.92	20.92	20.92	2.16	
Feedstock transport	0.00068	0.00068	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00034	
Refinery	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00048	0.00000	0.00000	
Fuel Transport	0.00000	0.00000	0.00144	0.00625	0.00069	0.00113	0.00000	0.01348	0.00000	
Fuel Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Bulk Terminal	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Exhaust	0.00118	0.00119	0.00542	0.00542	0.00115	0.00214	0.00214	0.00214	0.00000	
Truck Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Storage Tank Breathing	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Vehicle Working Loss	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Total	0.00118	0.00119	0.00686	0.01167	0.00184	0.00328	0.00167	0.01563	0.0000	

Emissions per mile driven: **SCENARIO 2b**

Fuel cycle process	NOx Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FID	M100 NG	M100 LFG	M100 Biomass	Electric	
Extraction	0.00068	0.00068	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00034	
Production	0.00000	0.00000	0	0	0	0	-0.00048	0.00000	0.00000	
Marketing	0.00118	0.00119	0.00686	0.01167	0.00184	0.00328	0.00214	0.01563	0.00000	
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	
Total	0.00186	0.00187	0.00686	0.01167	0.00184	0.00328	0.00167	0.01563	0.00034	

gggSumCharts.f.xls



gggSumCharts.f.xls

Emissions per fuel unit: SCENARIO 3

Fuel cycle process	NOx (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FID	M100 NG	M100 LFG	M100 Biomass	Electric	
Feedstock transport	0.0285	0.0285	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0100	0.0000	0.0000	
Fuel Transport	0.0000	0.0000	0.0207	0.0897	0.0263	0.0237	0.0000	0.0239	0.0000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.0494	0.0494	0.0350	0.0350	0.0438	0.0449	0.0449	0.0449	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.078	0.078	0.056	0.125	0.070	0.069	0.035	0.069	0.001	

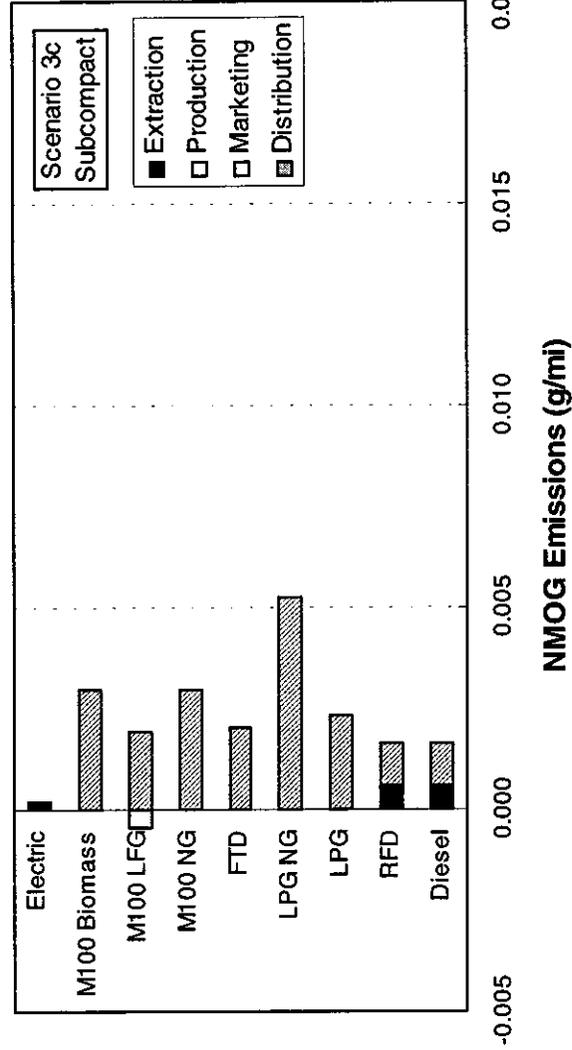
Emissions per mile driven: SCENARIO 3c

Fuel cycle process	NOx Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel Economy (mi/gal)	47.31	47.15	23.72	23.72	34.46	23.18	23.18	23.18	2.61	
Feedstock transport	0.00060	0.00060	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00019	
Refinery	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00043	0.00000	0.00000	
Fuel Transport	0.00000	0.00000	0.00087	0.00378	0.00076	0.00102	0.00000	0.00103	0.00000	
Fuel Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Bulk Terminal	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Exhaust	0.00104	0.00105	0.00148	0.00148	0.00127	0.00194	0.00194	0.00194	0.00000	
Truck Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Storage Tank Breathing	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Vehicle Working Loss	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Total	0.00104	0.00105	0.00148	0.00148	0.00127	0.00194	0.00194	0.00194	0.00000	

Emissions per mile driven: SCENARIO 3c

Fuel cycle process		NOx Emissions (g/mi)									
Fuel	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric		
Extraction	0.00060	0.00060	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00019		
Production	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00043	0.00000	0.00000		
Marketing	0.00104	0.00105	0.00235	0.00526	0.00203	0.00296	0.00194	0.00297	0.00000		
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Total	0.00165	0.00165	0.00235	0.00526	0.00203	0.00296	0.00150	0.00297	0.00019		

gpcgSumCharts-f.xls



gpcgSumCharts-f.xls

Emissions per fuel unit: SCENARIO 3

Fuel cycle process	NOx (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Feedstock transport	0.0285	0.0285	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0100	0.0000	0.0000	
Fuel Transport	0.0000	0.0000	0.0207	0.0897	0.0263	0.0237	0.0000	0.1410	0.0000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.0494	0.0494	0.0350	0.0350	0.0438	0.0449	0.0449	0.0449	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.078	0.078	0.056	0.125	0.070	0.069	0.035	0.186	0.001	

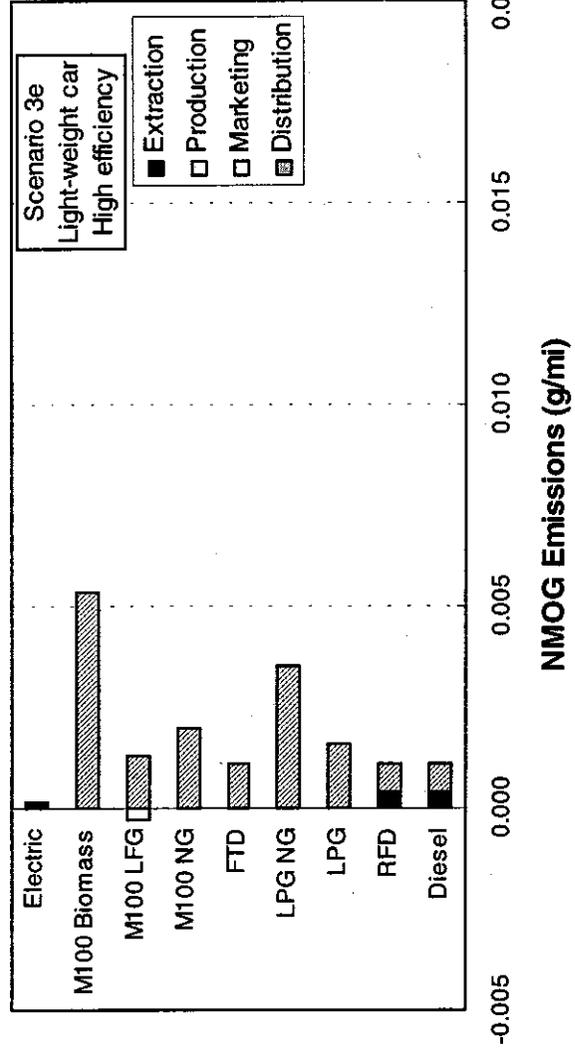
Emissions per mile driven: SCENARIO 3.2e

Fuel cycle process	NOx Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel Economy (mi/gal)	70.97	70.72	35.59	35.59	64.46	34.76	34.76	34.76	3.92	
Feedstock transport	0.0040	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00013	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.00029	0.0000	0.00000	
Fuel Transport	0.0000	0.0000	0.00058	0.00252	0.00041	0.00068	0.0000	0.00406	0.00000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.00070	0.00070	0.00098	0.00098	0.00068	0.00129	0.00129	0.00129	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.00070	0.00070	0.00098	0.00098	0.00068	0.00129	0.00129	0.00129	0.0000	

Emissions per mile driven: SCENARIO 3.2e

Fuel cycle process	NOx Emissions (g/mi)										
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric		
Extraction	0.00040	0.00040	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00013		
Production	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00029	0.00000	0.00000		
Marketing	0.00070	0.00070	0.00157	0.00350	0.00109	0.00197	0.00129	0.00535	0.00000		
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Total	0.00110	0.00110	0.00157	0.00350	0.00109	0.00197	0.00100	0.00535	0.00013		

gpgSumCharts.f.xls



gpgSumCharts.f.xls

Emissions per fuel unit: SCENARIO 1

Fuel cycle process	PM (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric	
Feedstock transport	0.0022	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0049	
Fuel Transport	0.0000	0.0000	0.0016	0.0013	0.0020	0.0020	0.0000	0.0020	0.0000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.0085	0.0085	0.0200	0.0200	0.0075	0.0077	0.0077	0.0077	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.011	0.011	0.022	0.021	0.010	0.010	0.008	0.010	0.005	

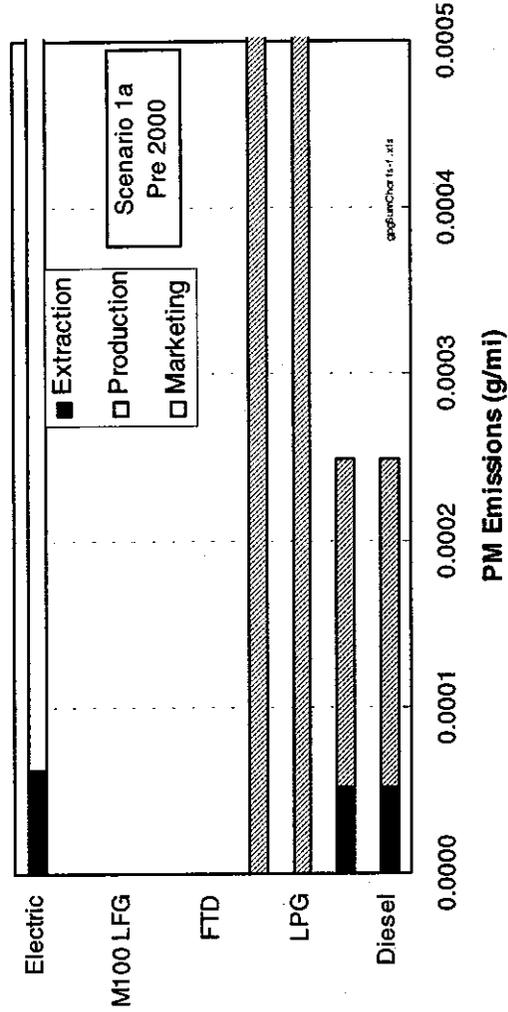
Emissions per mile driven: SCENARIO 1a

Fuel cycle process	PM Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric	
Fuel Economy (mi/gal)	43.01	42.86	19.57	19.57	99999	99999	99999	99999	2.33	
Feedstock transport	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00210	
Fuel Transport	0.0000	0.0000	0.0012	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.0020	0.0020	0.00102	0.00102	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.0002	0.0002	0.0011	0.0011	0.0000	0.0000	0.0000	0.0000	0.0022	

Emissions per mile driven: SCENARIO 1a

Fuel cycle process		PM Emissions (g/mi)									
Fuel	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric		
Extraction	0.00005	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00006		
Production	0.00000	0.00000	0	0	0	0	0.00000	0.00000	0.00210		
Marketing	0.00020	0.00020	0.00115	0.00112	0.00000	0.00000	0.00000	0.00000	0.00000		
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0		
Total	0.00025	0.00025	0.00115	0.00112	0.00000	0.00000	0.00000	0.00000	0.00216		

gpgSumCharts.xls



Emissions per fuel unit: SCENARIO 2

Fuel cycle process	PM (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric	
Feedstock transport	0.0022	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0038
Fuel Transport	0.0000	0.0000	0.0016	0.0013	0.0020	0.0020	0.0000	0.0040	0.0000	0.0000
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Truck Exhaust	0.0026	0.0026	0.0062	0.0062	0.0023	0.0024	0.0024	0.0024	0.0024	0.0000
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.005	0.005	0.008	0.007	0.004	0.004	0.002	0.006	0.004	0.004

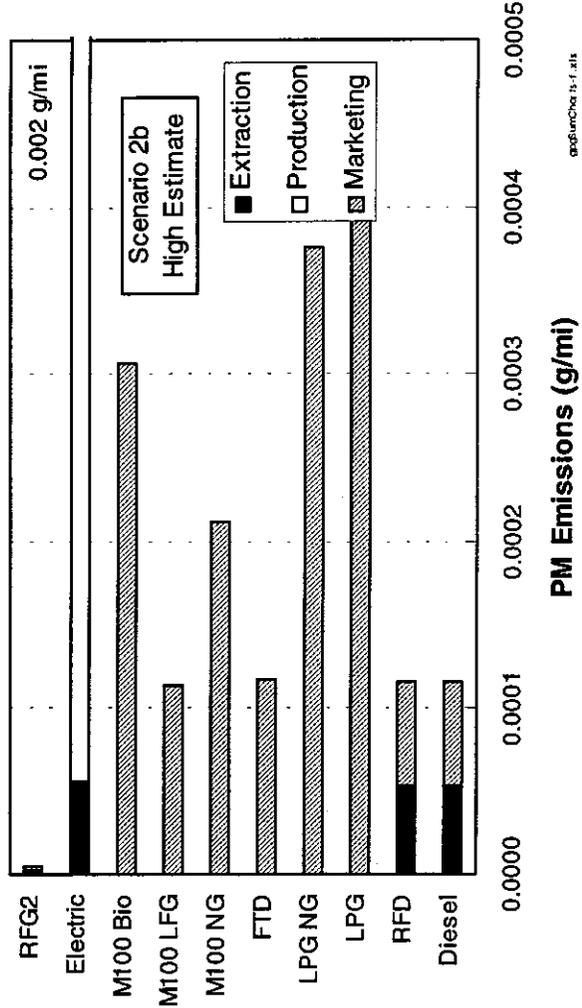
Emissions per mile driven: SCENARIO 2b

Fuel cycle process	PM Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric	
Fuel Economy (mi/gal)	41.79	41.64	21.53	21.53	37.95	20.92	20.92	20.92	2.16	
Feedstock transport	0.00005	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00006	
Refinery	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00174	
Fuel Transport	0.00000	0.00000	0.00011	0.00009	0.00005	0.00010	0.00000	0.00019	0.00000	
Fuel Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Bulk Terminal	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Exhaust	0.00006	0.00006	0.00029	0.00029	0.00006	0.00011	0.00011	0.00011	0.00000	
Truck Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Storage Tank Breathing	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Vehicle Working Loss	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Total	0.0001	0.0001	0.0004	0.0004	0.0001	0.0002	0.0001	0.0003	0.0018	

Emissions per mile driven: SCENARIO 2b

	PM Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric	
Extraction	0.00005	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00006	0.00006
Production	0.00000	0.00000	0	0	0	0	0.00000	0.00000	0.00174	0.00174
Marketing	0.00006	0.00006	0.00040	0.00038	0.00011	0.00021	0.00011	0.00031	0.00000	0.00000
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
Total	0.00012	0.00012	0.00040	0.00038	0.00011	0.00021	0.00011	0.00031	0.00180	

gpgSumCharts.xls



gpgSumCharts.xls

Emissions per fuel unit: SCENARIO 3

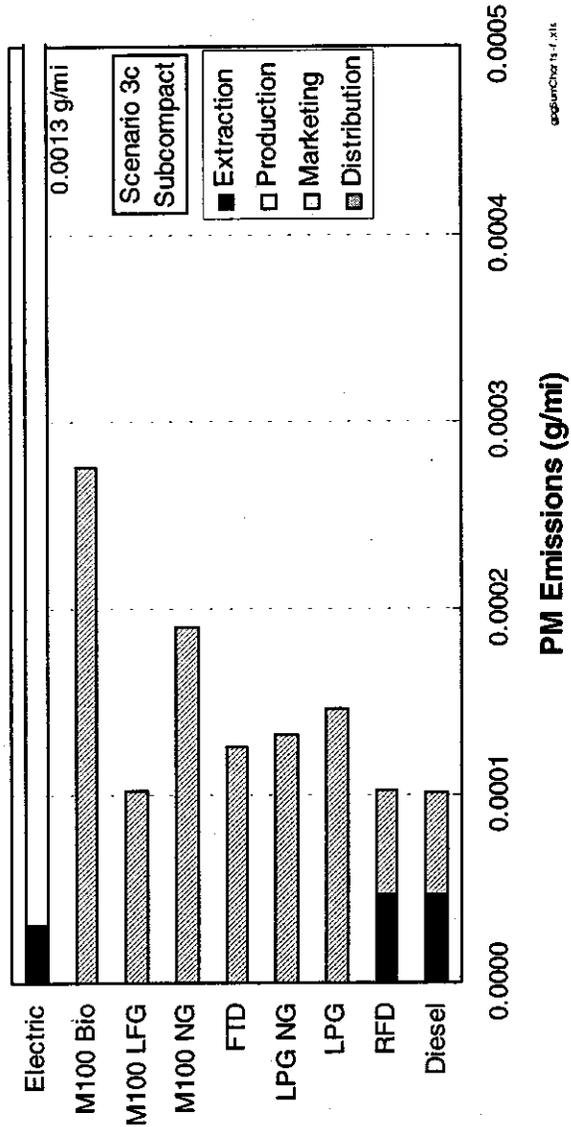
Fuel cycle process	PM (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FID	M100 NG	M100 LFG	M100 Bio	Electric	
Feedstock transport	0.0022	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0032	
Fuel Transport	0.0000	0.0000	0.0016	0.0013	0.0020	0.0020	0.0000	0.0040	0.0000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.0026	0.0026	0.0019	0.0019	0.0023	0.0024	0.0024	0.0024	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.005	0.005	0.003	0.003	0.004	0.004	0.002	0.006	0.003	

Emissions per mile driven: SCENARIO 3c

Fuel cycle process	PM Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric	
Fuel Economy (mi/gal)	47.31	47.15	23.72	23.72	34.46	23.18	23.18	23.18	2.61	
Feedstock transport	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00124	
Fuel Transport	0.0000	0.0000	0.0007	0.0005	0.0006	0.0009	0.0000	0.0017	0.00000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.0006	0.0006	0.0008	0.0008	0.0007	0.0010	0.0010	0.0010	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.0013	

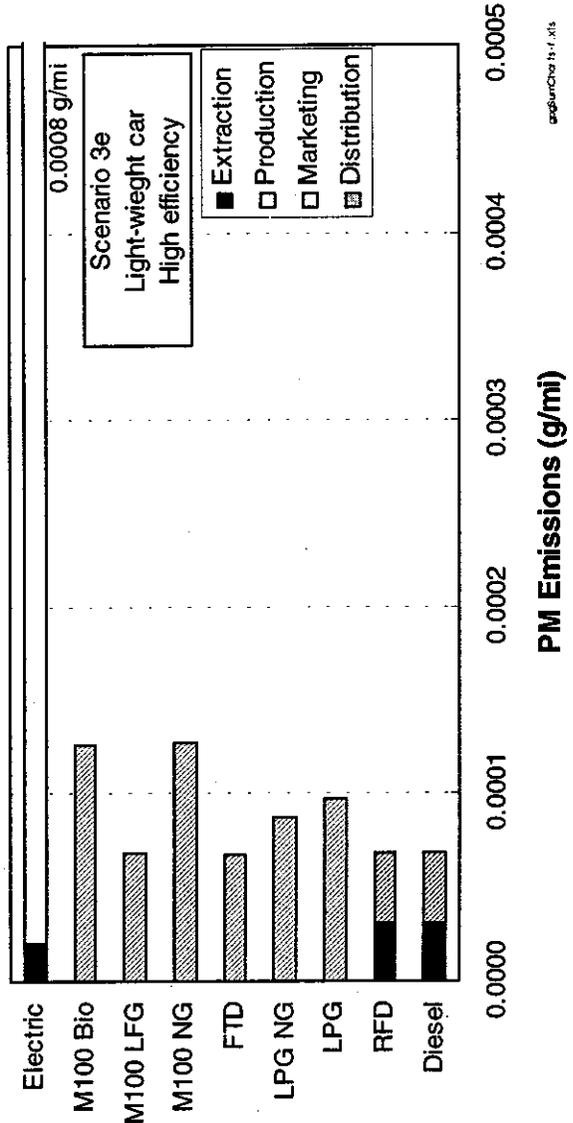
Emissions per mile driven: SCENARIO 3c

	PM Emissions (g/mi)										
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric		
Extraction	0.00005	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00003		
Production	0.00000	0.00000	0	0	0	0	0.00000	0.00000	0.00124		
Marketing	0.00006	0.00006	0.00015	0.00013	0.00013	0.00019	0.00010	0.00028	0.00000		
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0		
Total	0.00010	0.00010	0.00015	0.00013	0.00013	0.00019	0.00010	0.00028	0.00127		



Emissions per mile driven: SCENARIO 3.2e

Fuel cycle process	PM Emissions (g/mi)										
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric		
Extraction	0.00003	0.00003	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002		
Production	0.00000	0.00000	0	0	0	0	0.00000	0.00000	0.00082		
Marketing	0.00004	0.00004	0.00010	0.00009	0.00007	0.00013	0.00007	0.00013	0.00000		
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0		
Total	0.00007	0.00007	0.00010	0.00009	0.00007	0.00013	0.00007	0.00013	0.00084		



engruncho 11.1.115

Emissions per fuel unit: SCENARIO 1

Fuel cycle process	NMOG (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Feedstock transport	0.0025	0.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	
Refinery	0.0000	0.0438	0.0000	0.0000	0.0000	0.0000	-0.3000	0.0020	0.0070	
Fuel Transport	0.0000	0.0000	0.0018	0.0103	0.0020	0.0020	0.0000	0.0161	0.0000	
Fuel unloading	0.0055	0.0055	0.5000	1.5000	0.0070	0.0080	0.0080	0.0080	0.0000	
Bulk Terminal	0.0036	0.0036	0.0017	0.0017	0.0036	0.0063	0.0063	0.0063	0.0000	
Truck Loading	0.0110	0.0110	2.0780	2.0780	0.0140	0.0160	0.0160	0.0160	0.0000	
Truck Spillage	0.0200	0.0200	0.0008	0.0008	0.0200	0.0200	0.0200	0.0200	0.0000	
Truck Exhaust	0.0120	0.0120	0.0283	0.0283	0.0106	0.0109	0.0109	0.0109	0.0000	
Truck Unloading	0.0110	0.0110	5.0000	5.0000	0.0140	0.0160	0.0160	0.0160	0.0000	
Storage Tank Breathing	0.0010	0.0010	0.0000	0.0000	0.0010	0.0070	0.0070	0.0070	0.0000	
Vehicle Working Loss	0.017	0.017	7.000	7.000	0.021	0.155	0.155	0.155	0.000	
Spillage	0.383	0.383	0.091	0.091	0.313	0.182	0.182	0.182	0.000	
Total	0.467	0.510	14.702	15.710	0.406	0.423	0.113	0.439	0.008	

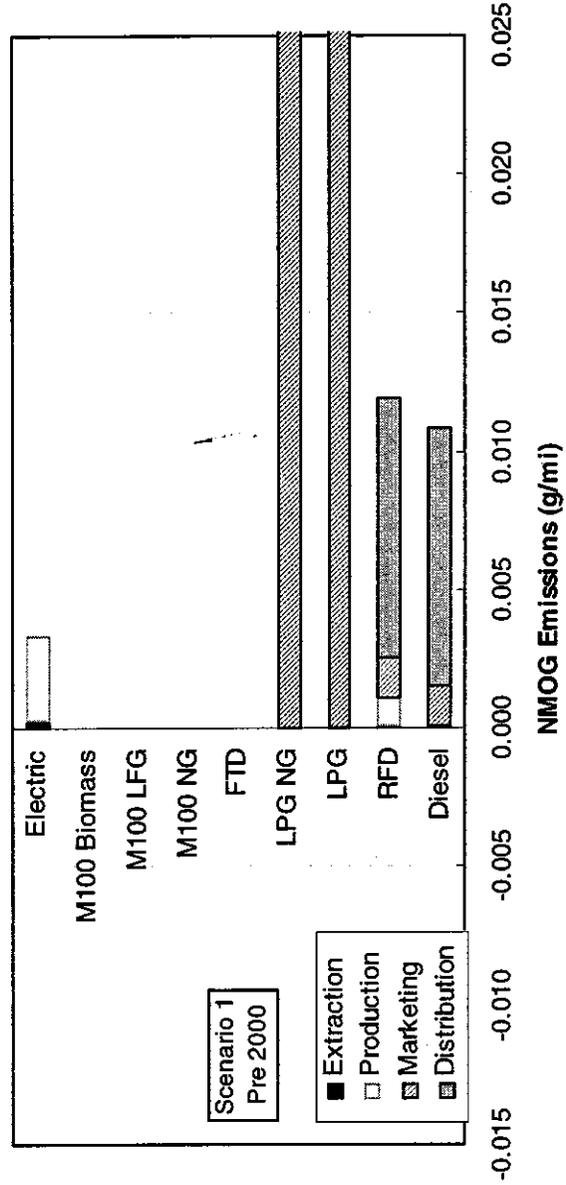
Emissions per mile driven: SCENARIO 1a

Fuel cycle process	NMOG Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel Economy (mi/gal)	43.01	42.86	19.57	19.57	99999	99999	99999	99999	2.33	
Feedstock transport	0.0006	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00032	
Refinery	0.0000	0.0102	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00300	
Fuel Transport	0.0000	0.0000	0.00014	0.00079	0.0000	0.0000	0.0000	0.0000	0.00000	
Ship/Truck Loading	0.0038	0.0038	0.13173	0.18283	0.0000	0.0000	0.0000	0.0000	0.00000	
Bulk Terminal	0.0008	0.0008	0.00009	0.00009	0.0000	0.0000	0.0000	0.0000	0.00000	
Truck Spillage	0.0047	0.0047	0.00004	0.00004	0.0000	0.0000	0.0000	0.0000	0.00000	
Truck Exhaust	0.0028	0.0028	0.00145	0.00145	0.0000	0.0000	0.0000	0.0000	0.00000	
Truck Unloading	0.0026	0.0026	0.25549	0.25549	0.0000	0.0000	0.0000	0.0000	0.00000	
Storage Tank Breathing	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00000	
Vehicle Working Loss	0.0040	0.0040	0.35769	0.35769	0.0000	0.0000	0.0000	0.0000	0.00000	
Spillage	0.0890	0.0894	0.00465	0.00465	0.0000	0.0000	0.0000	0.0000	0.00000	
Total	0.01085	0.01191	0.75128	0.8030	0.00000	0.00000	0.00000	0.00000	0.00332	

Emissions per mile driven: SCENARIO 2b

Fuel cycle process	NMOG Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel										
Extraction	0.00006	0.00006	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00032	
Production	0.00000	0.00102	0	0	0	0	0.00000	0.00000	0.00300	
Marketing	0.00147	0.00147	0.38894	0.44069	0.00000	0.00000	0.00000	0.00000	0.00000	
Distribution	0.00932	0.00936	0.36234	0.36234	0.00000	0.00000	0.00000	0.00000	0	
Total	0.01085	0.01191	0.75128	0.8030	0.00000	0.00000	0.00000	0.00000	0.00332	

gpgSumCharts.xls

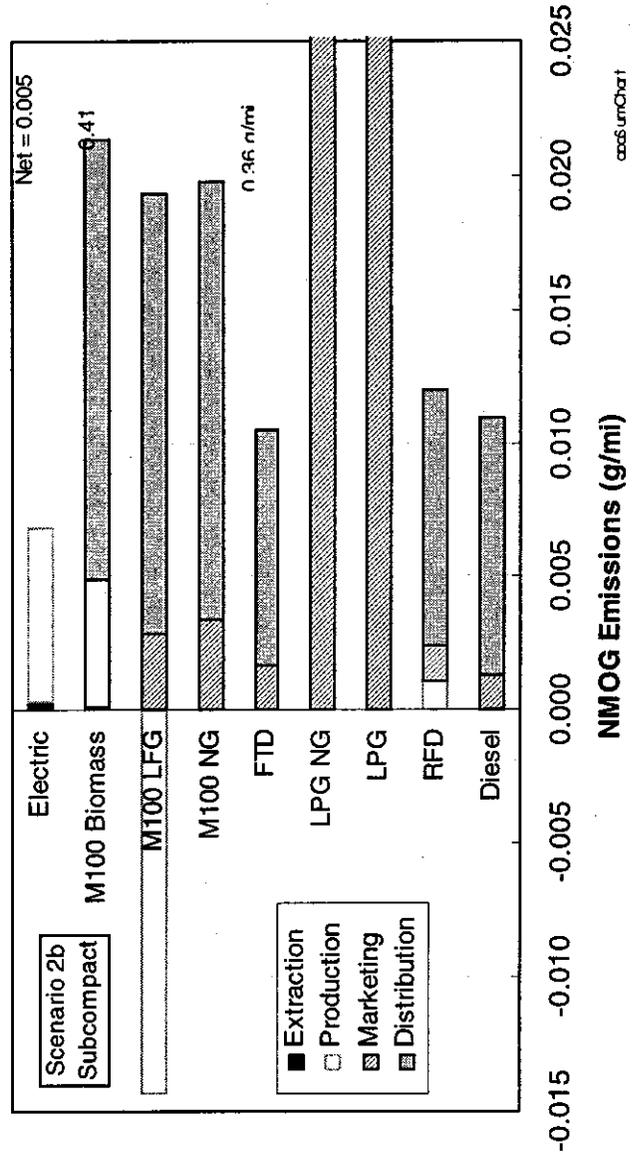


gpgSumCharts.xls

Emissions per mile driven: SCENARIO 2b

Fuel cycle process	NMOG Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Extraction	0.00006	0.00006	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00034	
Production	0.00000	0.00105	0	0	0	0	-0.01434	0.00010	0.00648	
Marketing	0.00127	0.00128	0.35244	0.39948	0.00165	0.00336	0.00288	0.00480	0.00000	
Distribution	0.00960	0.00963	0.00794	0.00794	0.00883	0.01644	0.01644	0.01644	0	
Total	0.01093	0.01202	0.36038	0.4074	0.01047	0.01980	0.00498	0.02134	0.00683	

gpgSumCharts.xls



Emissions per fuel unit: SCENARIO 3

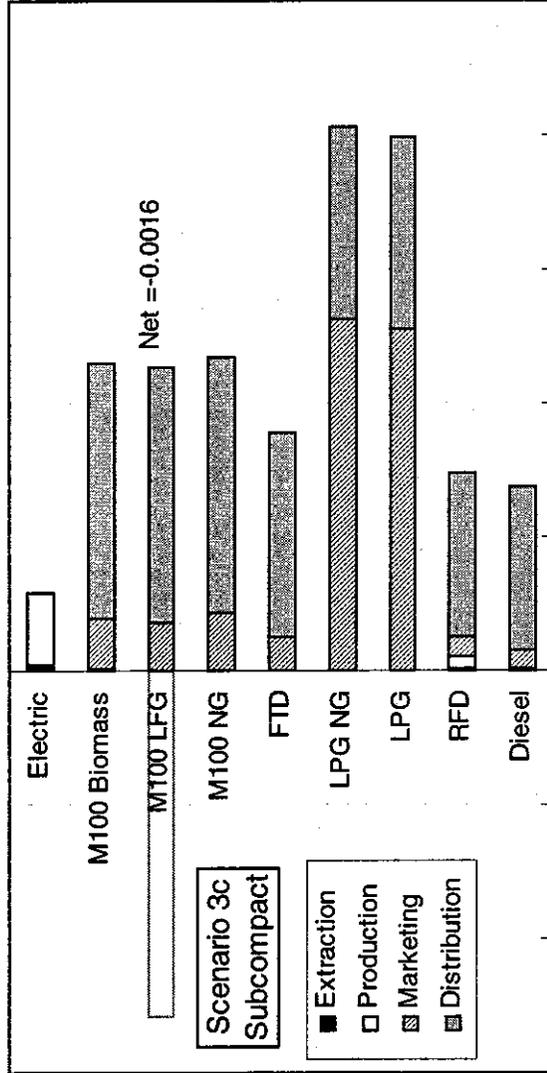
Fuel cycle process	NMOG (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Feedstock transport	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.0005	
Refinery	0.000	0.0219	0.000	0.000	0.000	0.000	-0.300	0.001	0.0070	
Fuel Transport	0.0000	0.0000	0.0018	0.0103	0.0020	0.0020	0.0000	0.0032	0.000	
Fuel unloading	0.0045	0.0045	0.2000	0.2000	0.0060	0.0070				
Bulk terminal	0.0014	0.0014	0.0007	0.0007	0.0014	0.0030	0.0030	0.0030	0.000	
Truck loading	0.0090	0.0090	0.0780	0.0780	0.0120	0.0140	0.0140	0.0140	0.000	
Truck Spillage	0.0080	0.0080	0.0003	0.0003	0.0080	0.0080	0.0080	0.0080	0.000	
Truck Exhaust	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.000	
Truck Unloading	0.0090	0.0090	0.0200	0.0200	0.0120	0.0140	0.0140	0.0140	0.000	
Storage Tank Breathing	0.0010	0.0010	0.0000	0.0000	0.0010	0.0070	0.0070	0.0070	0.000	
Vehicle Working Loss	0.011	0.011	0.080	0.080	0.014	0.077	0.077	0.077	0.000	
Spillage	0.277	0.277	0.090	0.090	0.249	0.138	0.138	0.138	0.000	
Total	0.325	0.347	0.472	0.481	0.307	0.272	-0.037	0.257	0.008	

Emissions per mile driven: SCENARIO 3c

Fuel cycle process	NMOG Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel Economy (mi/gal)	47.31	47.15	23.72	23.72	34.46	23.18	23.18	23.18	2.61	
Feedstock transport	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00019	
Refinery	0.0000	0.0046	0.0000	0.0000	0.0000	0.0000	-0.01294	0.0004	0.0027	
Fuel Transport	0.0000	0.0000	0.00008	0.00043	0.00006	0.00009	0.00000	0.00014	0.0000	
Ship/Truck Loading	0.0029	0.0029	0.01172	0.01172	0.0052	0.0091	0.00060	0.00060	0.00000	
Bulk Terminal	0.0003	0.0003	0.00003	0.00003	0.00004	0.00013	0.00013	0.00013	0.0000	
Truck Spillage	0.0017	0.0017	0.00001	0.00001	0.00023	0.00035	0.00035	0.00035	0.0000	
Truck Exhaust	0.0004	0.0004	0.00006	0.00006	0.00005	0.00008	0.00008	0.00008	0.0000	
Truck Unloading	0.0019	0.0019	0.00084	0.00084	0.00035	0.00060	0.00060	0.00060	0.0000	
Storage Tank Breathing	0.0002	0.0002	0.00000	0.00000	0.00003	0.00030	0.00030	0.00030	0.0000	
Vehicle Working Loss	0.0023	0.0023	0.0034	0.0034	0.0004	0.0033	0.0033	0.0033	0.0000	
Spillage	0.0059	0.0059	0.0038	0.0038	0.0072	0.0060	0.0060	0.0060	0.0000	
Total	0.00688	0.00737	0.01991	0.02027	0.00892	0.01173	-0.00160	0.01152	0.00287	

Emissions per mile driven: SCENARIO 3c

Fuel cycle process	NMOG Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel										
Extraction	0.00005	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00019	
Production	0.00000	0.00046	0	0	0	0	-0.01294	0.00004	0.00268	
Marketing	0.00072	0.00072	0.01274	0.01310	0.00126	0.00215	0.00176	0.00190	0.00000	
Distribution	0.00611	0.00613	0.00717	0.00717	0.00766	0.00958	0.00958	0.00958	0	
Total	0.00688	0.00737	0.01991	0.02027	0.00892	0.01173	-0.00160	0.01152	0.00287	



NMOG Emissions (g/mi)

gag5 umCharts

Emissions per fuel unit: SCENARIO 3

Fuel cycle process	NMOG (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Feedstock transport	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.0005	
Refinery	0.000	0.0219	0.000	0.000	0.000	0.000	-0.300	0.001	0.0070	
Fuel Transport	0.0000	0.0000	0.0018	0.0103	0.0020	0.0020	0.0000	0.0016	0.000	
Fuel unloading	0.0045	0.0045	0.2000	0.2000	0.0060	0.0070	0.0030	0.0030	0.000	
Bulk terminal	0.0014	0.0014	0.0007	0.0007	0.0014	0.0030	0.0140	0.0140	0.000	
Truck loading	0.0090	0.0090	0.0780	0.0780	0.0120	0.0140	0.0080	0.0080	0.000	
Truck Spillage	0.0080	0.0080	0.0003	0.0003	0.0080	0.0080	0.002	0.002	0.000	
Truck Exhaust	0.002	0.002	0.001	0.001	0.002	0.002	0.0140	0.0140	0.000	
Truck Unloading	0.0090	0.0090	0.0200	0.0200	0.0120	0.0140	0.0070	0.0070	0.000	
Storage Tank Breathing	0.0010	0.0010	0.0000	0.0000	0.0010	0.0070	0.077	0.077	0.000	
Vehicle Working Loss	0.011	0.011	0.080	0.080	0.014	0.077	0.182	0.182	0.000	
Spillage ^a	0.383	0.383	0.091	0.091	0.313	0.316	0.007	0.007	0.000	
Total	0.431	0.453	0.473	0.482	0.371	0.316	0.007	0.309	0.008	

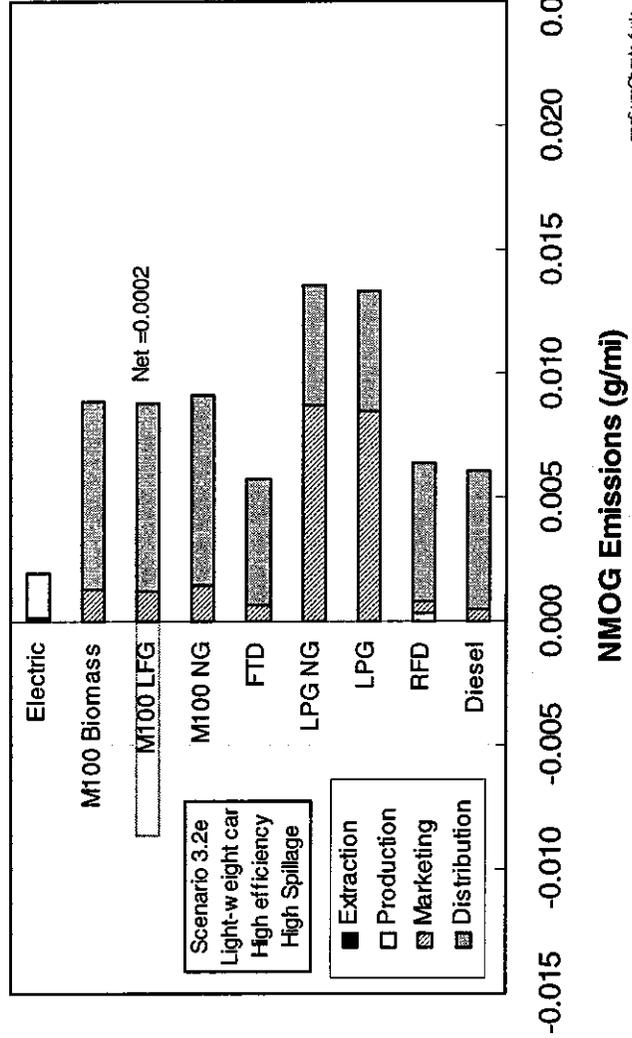
^a Spillage assumptions for Scenario 2 since fuel tanks will get smaller

Emissions per mile driven: SCENARIO 3.2e

Fuel cycle process	NMOG Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel Economy (mi/gal)	70.97	70.72	35.59	35.59	64.46	34.76	34.76	34.76	3.92	
Feedstock transport	0.00003	0.00003	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00013	
Refinery	0.00000	0.00031	0.00000	0.00000	0.00000	0.00000	-0.00863	0.00003	0.0018	
Fuel Transport	0.00000	0.00000	0.00005	0.00029	0.00003	0.00006	0.00000	0.00005	0.0000	
Ship/Truck Loading	0.00019	0.00019	0.00781	0.00781	0.00028	0.00060	0.00040	0.00040	0.00000	
Bulk Terminal	0.00002	0.00002	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009	0.0000	
Truck Spillage	0.00011	0.00011	0.00001	0.00001	0.00012	0.00023	0.00023	0.00023	0.0000	
Truck Exhaust	0.00003	0.00003	0.00004	0.00004	0.00003	0.00005	0.00005	0.00005	0.0000	
Truck Unloading	0.00013	0.00013	0.00056	0.00056	0.00019	0.00040	0.00040	0.00040	0.0000	
Storage Tank Breathing	0.00001	0.00001	0.00000	0.00000	0.00002	0.00020	0.00020	0.00020	0.0000	
Vehicle Working Loss	0.00015	0.00016	0.0022	0.0022	0.0002	0.0022	0.0022	0.0022	0.0000	
Spillage	0.0054	0.0054	0.0026	0.0026	0.0049	0.0052	0.0052	0.0052	0.0000	
Total	0.00608	0.00641	0.01330	0.01353	0.00576	0.00909	0.00020	0.00890	0.00191	

Emissions per mile driven: SCENARIO 3.2e

Fuel cycle process	NMOG Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Extraction	0.00003	0.00003	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00013	
Production	0.00000	0.00031	0	0	0	0	-0.00863	0.00003	0.00179	
Marketing	0.00048	0.00048	0.00849	0.00873	0.00067	0.00144	0.00118	0.00122	0.00000	
Distribution	0.00557	0.00559	0.00480	0.00480	0.00509	0.00765	0.00765	0.00765	0	
Total	0.00608	0.00641	0.01330	0.01353	0.00576	0.00909	0.00020	0.00890	0.00191	



g06.umChart3-f.xls

Toxics (mg/mi)

Compound	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric
Benzene	0.0060	0.0060	0.02818	0.03972	0.00000	0.00000	0.0000	0.00000	0.01450
Carbon Chlorides	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	0.00000	0.00000
1,3- Butadiene	0.0018	0.0018	0.02818	0.01215	0.00000	0.00000	0.00000	0.00000	0.00042
Formaldehyde	0.0060	0.0439	0.20629	0.29073	0.00002	0.00002	0.00001	0.00004	0.07525
Acetaldehyde	0.0142	0.0143	0.06706	0.09451	0.00001	0.00001	0.00000	0.00001	0.00139
PAHs	0.0989	0.0993	0.00266	0.00374	0.00000	0.00000	0.00000	0.00000	0.00000
Diesel PM	0.0002	0.0002	0.0011	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.127	0.165	0.332	0.441	0.000	0.000	0.000	0.000	0.092

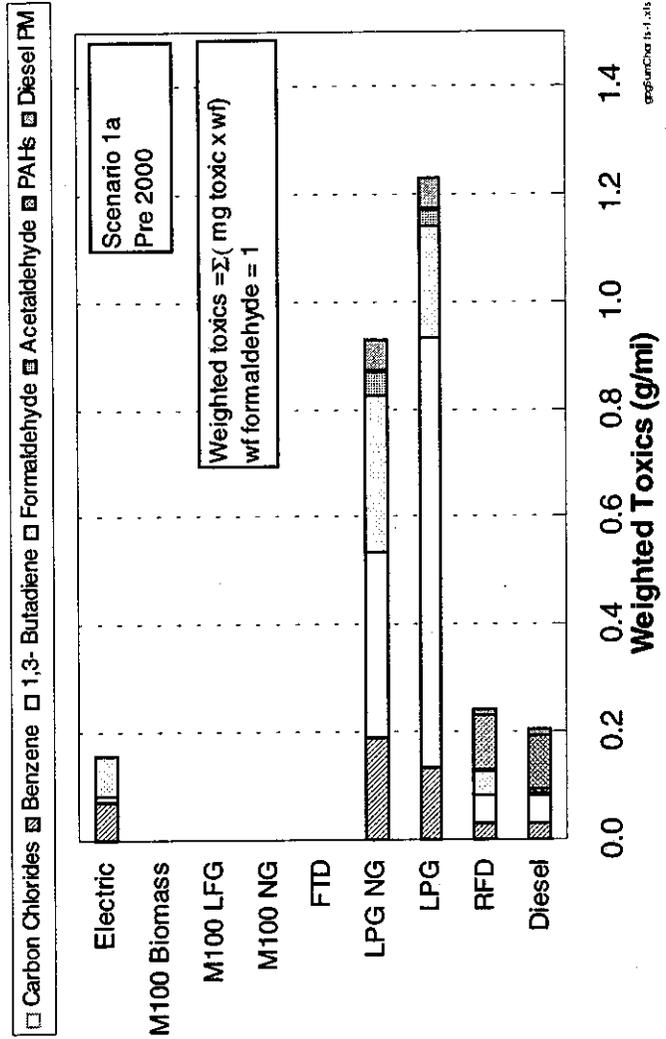
gpgSumCharts-e.xls

**Emissions per mile driven: SCENARIO 1a
Weighted Toxics (mg/mi)**

Compound	Weighting	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric
Benzene	4.8	0.0287	0.0288	0.1353	0.1907	0.0000	0.0000	0.0000	0.0000	0.0696
Carbon Chlorides	3.4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1,3- Butadiene	28.3	0.0518	0.0520	0.7976	0.3439	0.0000	0.0000	0.0000	0.0000	0.0120
Formaldehyde	1.0	0.0060	0.0439	0.2063	0.2907	0.0000	0.0000	0.0000	0.0000	0.0752
Acetaldehyde	0.5	0.0064	0.0064	0.0302	0.0425	0.0000	0.0000	0.0000	0.0000	0.0006
PAHs	1.0	0.0989	0.0993	0.0027	0.0037	0.0000	0.0000	0.0000	0.0000	0.0000
Diesel PM	50.0	0.0124	0.0125	0.0573	0.0560	0.0000	0.0000	0.0000	0.0000	0.0000
Total		0.204	0.243	1.229	0.928	0.000	0.000	0.000	0.000	0.157

° Power plant PM is not diesel PM. If power plant PM were counted as diesel PM, weighted toxics would be 0.05 mg/mi higher

gpgSumCharts-f.xls



Toxics (mg/mi)

Compound	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric
Benzene	0.0019	0.0019	0.00621	0.01670	0.00181	0.00332	-0.0006	0.02897	0.03026
Carbon Chlorides	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.0155	0.00000	0.00000
1,3- Butadiene	0.0006	0.0006	0.00621	0.00511	0.00055	0.00102	0.00048	0.00886	0.00050
Formaldehyde	0.0019	0.0141	0.04545	0.12220	0.01322	0.02430	0.01157	0.21207	0.11772
Acetaldehyde	0.0046	0.0046	0.01478	0.03973	0.00430	0.00790	0.00376	0.06894	0.00197
PAHs	0.1014	0.1017	0.00059	0.00157	0.00017	0.00031	0.00015	0.00273	0.00000
Diesel PM	0.0001	0.0001	0.0004	0.0004	0.0001	0.0002	0.0001	0.0003	0.00 ^a
Total	0.110	0.123	0.073	0.185	0.020	0.037	0.000	0.322	0.150

^a Power plant PM is not diesel PM and not counted in this category.

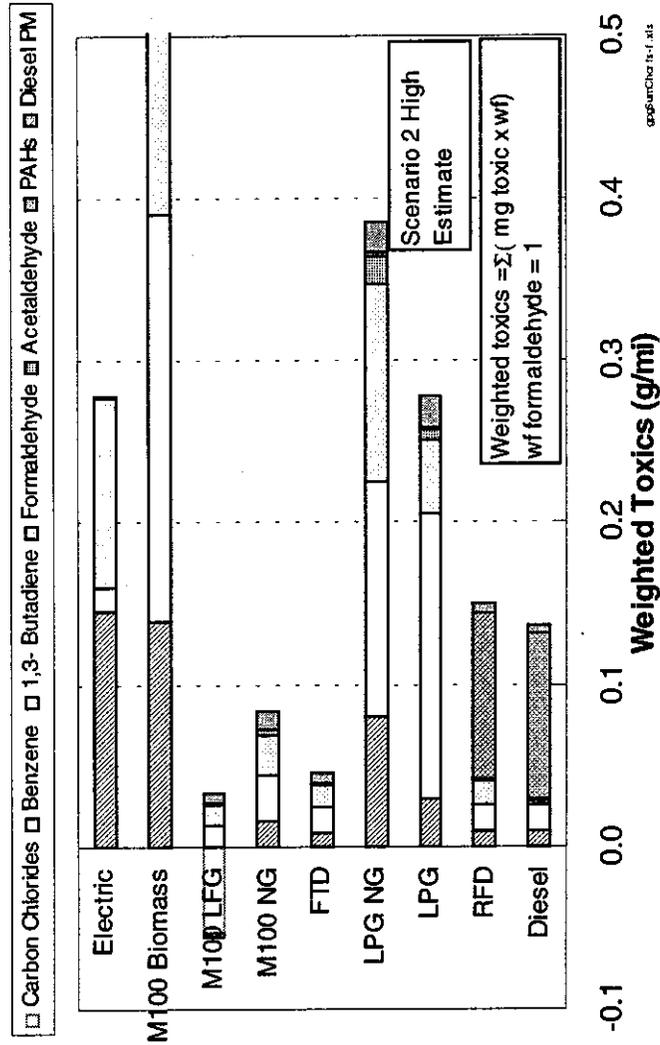
gpgSumCharts-e.xls

**Emissions per mile driven: SCENARIO 2b
Weighted Toxics (mg/mi)**

Compound	Weighting	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric
Benzene	4.8	0.0092	0.0092	0.0298	0.0801	0.0087	0.0159	-0.0027	0.1391	0.1453
Carbon Chlorides	3.4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0526	0.0000	0.0000
1,3- Butadiene	28.3	0.0166	0.0167	0.1757	0.1445	0.0156	0.0287	0.0137	0.2509	0.0142
Formaldehyde	1.0	0.0019	0.0141	0.0455	0.1222	0.0132	0.0243	0.0116	0.2121	0.1177
Acetaldehyde	0.5	0.0021	0.0021	0.0066	0.0179	0.0019	0.0036	0.0017	0.0310	0.0009
PAHs	1.0	0.1014	0.1017	0.0006	0.0016	0.0002	0.0003	0.0001	0.0027	0.0000
Diesel PM	50.0	0.0058	0.0058	0.0199	0.0188	0.0057	0.0106	0.0057	0.0153	0.000 ^a
Total		0.137	0.150	0.278	0.385	0.045	0.083	-0.023	0.651	0.278

^a Power plant PM is not diesel PM. If power plant PM were counted as diesel PM, weighted toxics would be 0.05 mg/mi higher

gpgSumCharts-f.xls



gpgSumCharts-f.xls

Toxics (mg/mi)									
Compound	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric
Benzene	0.0017	0.0017	0.0024	0.0088	0.0020	0.0030	-0.0005	0.0039	0.0127
Carbon Chlorides	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0140	0.0000	0.0000
1,3- Butadiene	0.0005	0.0005	0.0024	0.0027	0.0006	0.0009	0.0004	0.0012	0.0003
Formaldehyde	0.0017	0.0124	0.0178	0.0642	0.0146	0.0219	0.0104	0.0285	0.0551
Acetaldehyde	0.0040	0.0040	0.0058	0.0209	0.0047	0.0071	0.0034	0.0093	0.0010
PAHs	0.0636	0.0638	0.0002	0.0008	0.0002	0.0003	0.0001	0.0004	0.0000
Diesel PM	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0003	0.00 ^a
Total	0.072	0.083	0.029	0.098	0.022	0.033	0.000	0.044	0.069

gpgSumCharts-e.xls

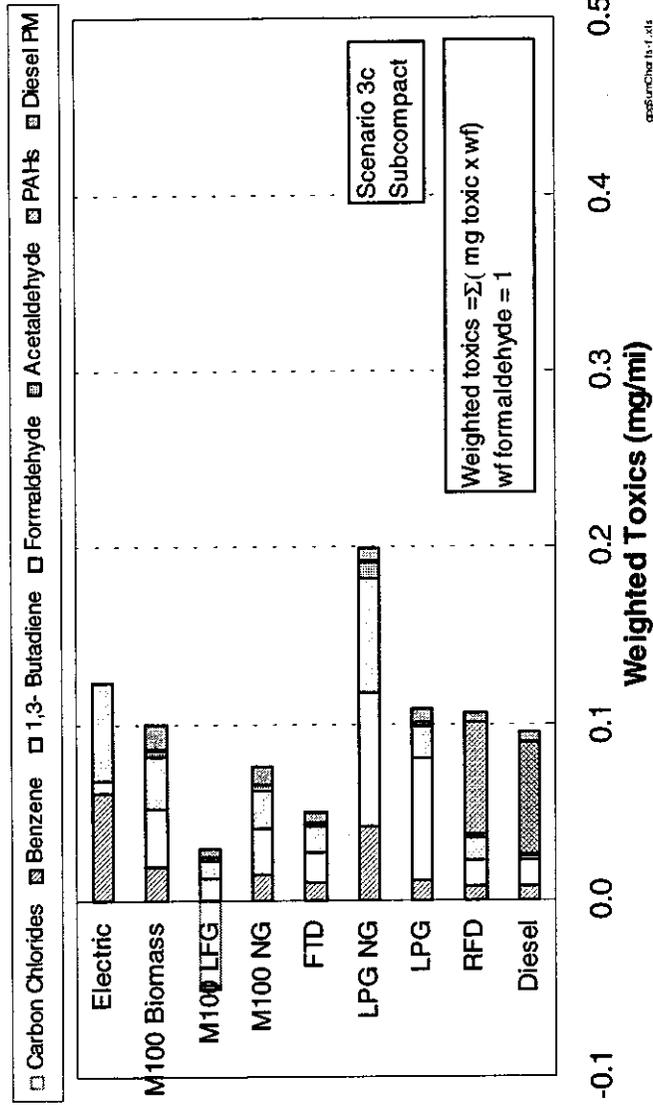
^a Power plant PM is not diesel PM and not counted in this category.

Emissions per mile driven: SCENARIO 3c

Weighted Toxics (mg/mi)										
Compound	Weighting	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric
Benzene	4.8	0.0081	0.0082	0.0117	0.0421	0.0095	0.0144	-0.0024	0.0187	0.0608
Carbon Chlorides	3.4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0475	0.0000	0.0000
1,3- Butadiene	28.3	0.0147	0.0147	0.0687	0.0760	0.0172	0.0259	0.0123	0.0338	0.0075
Formaldehyde	1.0	0.0017	0.0124	0.0178	0.0642	0.0146	0.0219	0.0104	0.0285	0.0551
Acetaldehyde	0.5	0.0018	0.0018	0.0026	0.0094	0.0021	0.0032	0.0015	0.0042	0.0004
PAHs	1.0	0.0636	0.0638	0.0002	0.0008	0.0002	0.0003	0.0001	0.0004	0.0000
Diesel PM	50.0	0.0051	0.0051	0.0073	0.0066	0.0063	0.0095	0.0051	0.0138	0.000 ^a
Total	0.095	0.106	0.106	0.108	0.199	0.050	0.075	-0.020	0.099	0.124

^a Power plant PM is not diesel PM. If power plant PM were counted as diesel PM, weighted toxics would be 0.05 mg/mi higher

gpgSumCharts-f.xls



gpgSumCharts-f.xls

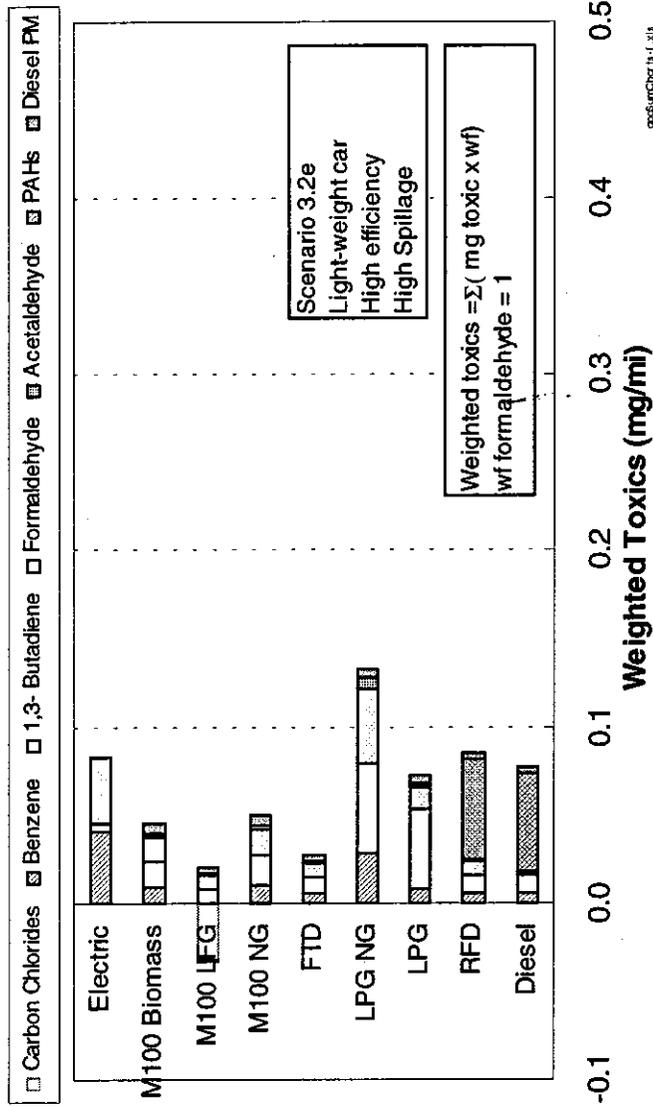
Toxics (mg/mi)										
Compound	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Benzene	0.00113	0.00113	0.00162	0.00585	0.00106	0.00200	-0.00034	0.00178	0.00843	
Carbon Chlorides	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00931	0.00000	0.00000	
1,3- Butadiene	0.00035	0.00035	0.00162	0.00179	0.00033	0.00061	0.00029	0.00054	0.00018	
Formaldehyde	0.00113	0.00829	0.01185	0.04280	0.00778	0.01463	0.00696	0.01299	0.03668	
Acetaldehyde	0.00269	0.00270	0.00385	0.01391	0.00253	0.00475	0.00226	0.00422	0.00064	
PAHs	0.05639	0.05659	0.00015	0.00055	0.00010	0.00019	0.00009	0.00017	0.00000	
Diesel PM	0.00007	0.00007	0.00010	0.00009	0.00007	0.00013	0.00007	0.00013	0.00 ^a	
Total	0.062	0.069	0.019	0.065	0.012	0.022	0.000	0.020	0.046	

^a Power plant PM is not diesel PM and not counted in this category. gpgSumCharts-e.xls

Emissions per mile driven: SCENARIO 3.2e
Weighted Toxics (mg/mi)

Compound	Weighting	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric
Benzene	4.8	0.0054	0.0054	0.0078	0.0281	0.0051	0.0096	-0.0016	0.0085	0.0405
Carbon Chlorides	3.4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0317	0.0000	0.0000
1,3- Butadiene	28.3	0.0098	0.0098	0.0458	0.0506	0.0092	0.0173	0.0082	0.0154	0.0050
Formaldehyde	1.0	0.0011	0.0083	0.0118	0.0428	0.0078	0.0146	0.0070	0.0130	0.0367
Acetaldehyde	0.5	0.0012	0.0012	0.0017	0.0063	0.0011	0.0021	0.0010	0.0019	0.0003
PAHs	1.0	0.0564	0.0566	0.0002	0.0006	0.0001	0.0002	0.0001	0.0002	0.0000
Diesel PM	50.0	0.0034	0.0034	0.0049	0.0044	0.0034	0.0064	0.0034	0.0063	0.000 ^a
Total		0.077	0.085	0.072	0.133	0.027	0.050	-0.014	0.045	0.082

^a Power plant PM is not diesel PM. If power plant PM were counted as diesel PM, weighted toxics would be 0.05 mg/mi higher. gpgSumCharts-f.xls



Emissions per fuel unit: SCENARIO 3 CA, SoCAB plus CA emissions

Fuel cycle process	NOx (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Feedstock transport	0.0285	0.0285	0.0000	0.0000	0.0000	0.0000	0.0000	-0.6418	0.0010	
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0100	0.0454	0.0000	
Fuel Transport	0.0000	0.0000	0.0207	0.1795	0.0263	0.0237	0.0000	0.2820	0.0000	
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Truck Exhaust	0.0494	0.0494	0.0350	0.0350	0.0438	0.0449	0.0449	0.0449	0.0000	
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.078	0.078	0.056	0.214	0.070	0.069	0.035	-0.270	0.001	

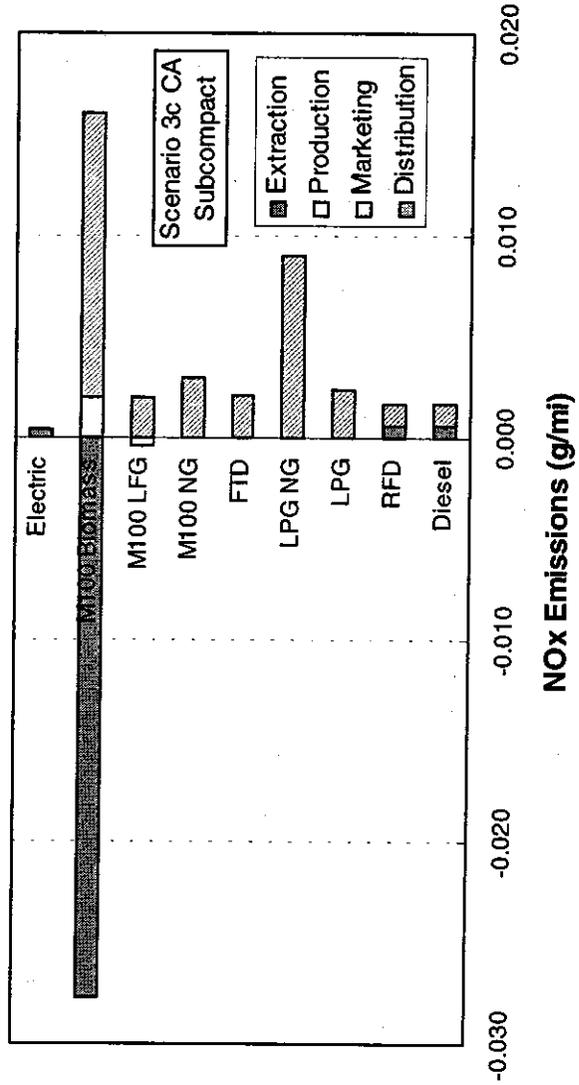
Emissions per mile driven: SCENARIO 3c CA, SoCAB plus CA emissions

Fuel cycle process	NOx Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel Economy (mi/gal)	47.31	47.15	23.72	23.72	34.46	23.18	23.18	23.18	2.61	
Feedstock transport	0.00060	0.00060	0.00000	0.00000	0.00000	0.00000	0.00000	-0.02769	0.00038	
Refinery	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00043	0.00196	0.00000	
Fuel Transport	0.00000	0.00000	0.00087	0.00757	0.00076	0.00102	0.00000	0.01217	0.00000	
Fuel Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Bulk Terminal	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Truck Exhaust	0.00104	0.00105	0.00148	0.00148	0.00127	0.00194	0.00194	0.00194	0.00000	
Truck Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Storage Tank Breathing	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Vehicle Working Loss	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Total	0.00104	0.00105	0.00148	0.00148	0.00127	0.00194	0.00194	0.00194	0.00000	

Emissions per mile driven: SCENARIO 3c CA, SoCAB plus CA emissions

Fuel cycle process	NOx Emissions (g/mi)										
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric		
Extraction	0.00060	0.00060	0.00000	0.00000	0.00000	0.00000	0.00000	-0.02769	0.00038		
Production	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00043	0.00196	0.00000		
Marketing	0.00104	0.00105	0.00235	0.00904	0.00203	0.00296	0.00194	0.01410	0.00000		
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Total	0.00165	0.00165	0.00235	0.00904	0.00203	0.00296	0.00150	(0.01163)	0.00038		

gpgSumCharts-f.xls



gpgSumCharts-f.xls

Emissions per fuel unit: SCENARIO 3 CA, SoCAB plus CA emissions

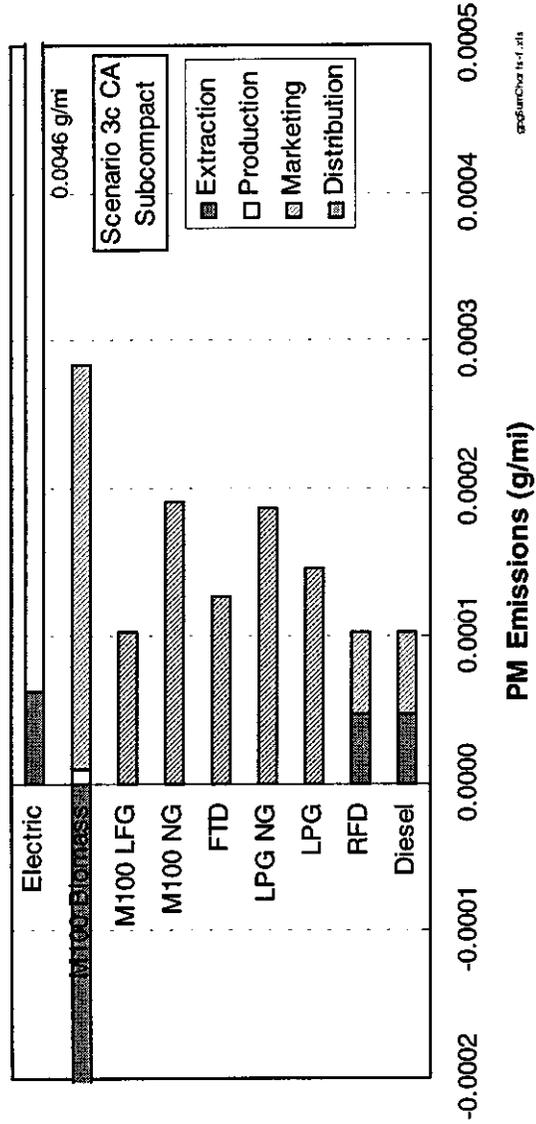
Fuel cycle process	PM (g/gal or g/kWh for electric)										
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Bio	Electric		
Feedstock transport	0.0022	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0166	0.0002		
Refinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0120		
Fuel Transport	0.0000	0.0000	0.0016	0.0026	0.0020	0.0020	0.0000	0.0040	0.0000		
Fuel Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Bulk Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Truck Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Truck Exhaust	0.0026	0.0026	0.0019	0.0019	0.0023	0.0024	0.0024	0.0024	0.0000		
Truck Unloading	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Storage Tank Breathing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Vehicle Working Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Spillage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Total	0.005	0.005	0.003	0.004	0.004	0.004	0.002	-0.010	0.012		

Emissions per mile driven: SCENARIO 3c CA, SoCAB plus CA emissions

Fuel cycle process	PM Emissions (g/mi)										
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric		
Fuel Economy (mi/gal)	47.31	47.15	23.72	23.72	34.46	23.18	23.18	23.18	2.61		
Feedstock transport	0.00005	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00007	0.00006		
Refinery	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00458		
Fuel Transport	0.00000	0.00000	0.00007	0.00011	0.00006	0.00009	0.00000	0.00017	0.00000		
Fuel Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Bulk Terminal	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Truck Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Truck Exhaust	0.00006	0.00006	0.00008	0.00008	0.00007	0.00010	0.00010	0.00010	0.00000		
Truck Unloading	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Storage Tank Breathing	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Vehicle Working Loss	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Spillage	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
Total	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	0.0001	-0.0004	0.0046		

Emissions per mile driven: SCENARIO 3c CA, SoCAB plus CA emissions

Fuel cycle process	PM Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Extraction	0.00005	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00007	0.00006	
Production	0.00000	0.00000	0	0	0	0	0.00000	0.00001	0.00458	
Marketing	0.00006	0.00006	0.00015	0.00019	0.00013	0.00019	0.00010	0.00028	0.00000	
Distribution	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	
Total	0.00010	0.00010	0.00015	0.00019	0.00013	0.00019	0.00010	-0.00004	0.00464	



Emissions per fuel unit: SCENARIO 3 CA, SoCAB plus CA emissions

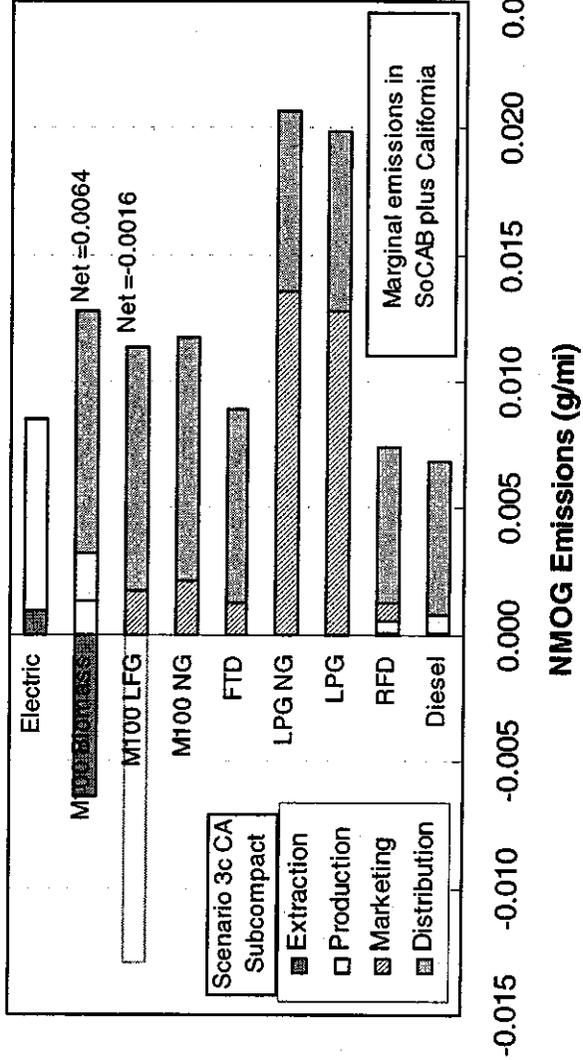
Fuel cycle process	NMOG (g/gal or g/kWh for electric)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Feedstock transport	0.002	0.002	0.000	0.000	0.000	0.000	0.000	-0.148	0.0024	
Refinery	0.000	0.0219	0.000	0.000	0.000	0.000	-0.300	0.030	0.0200	
Fuel Transport	0.0000	0.0000	0.0018	0.0205	0.0020	0.0020	0.0000	0.0032	0.0000	
Fuel unloading	0.0045	0.0045	0.2000	0.2000	0.0060	0.0070				
Bulk terminal	0.0014	0.0014	0.0007	0.0007	0.0014	0.0030	0.0030	0.0030	0.0000	
Truck loading	0.0090	0.0090	0.0780	0.0780	0.0120	0.0140	0.0140	0.0140	0.0000	
Truck Spillage	0.0080	0.0080	0.0003	0.0003	0.0080	0.0080	0.0080	0.0080	0.0000	
Truck Exhaust	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.0000	
Truck Unloading	0.0090	0.0090	0.0200	0.0200	0.0120	0.0140	0.0140	0.0140	0.0000	
Storage Tank Breathing	0.0010	0.0010	0.0000	0.0000	0.0010	0.0070	0.0070	0.0070	0.0000	
Vehicle Working Loss	0.011	0.011	0.080	0.080	0.014	0.077	0.077	0.077	0.0000	
Spillage	0.277	0.277	0.090	0.090	0.249	0.138	0.138	0.138	0.0000	
Total	0.325	0.347	0.472	0.491	0.307	0.272	-0.037	0.148	0.022	

Emissions per mile driven: SCENARIO 3c CA, SoCAB plus CA emissions

Fuel cycle process	NMOG Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Fuel Economy (mi/gal)	47.31	47.15	23.72	23.72	34.46	23.18	23.18	23.18	2.61	
Feedstock transport	0.00005	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	-0.0006	0.00090	
Refinery	0.00000	0.00046	0.00000	0.00000	0.00000	0.00000	-0.01294	0.00129	0.0076	
Fuel Transport	0.00000	0.00000	0.00008	0.00086	0.00006	0.00009	0.00000	0.00014	0.0000	
Ship/Truck Loading	0.00029	0.00029	0.01172	0.01172	0.00052	0.00091	0.00060	0.00060	0.00000	
Bulk Terminal	0.00003	0.00003	0.00003	0.00003	0.00004	0.00013	0.00013	0.00013	0.00000	
Truck Spillage	0.00017	0.00017	0.00001	0.00001	0.00023	0.00035	0.00035	0.00035	0.0000	
Truck Exhaust	0.00004	0.00004	0.00006	0.00006	0.00005	0.00008	0.00008	0.00008	0.0000	
Truck Unloading	0.00019	0.00019	0.00084	0.00084	0.00035	0.00060	0.00060	0.00060	0.0000	
Storage Tank Breathing	0.00002	0.00002	0.00000	0.00000	0.00003	0.00030	0.00030	0.00030	0.0000	
Vehicle Working Loss	0.00023	0.00023	0.0034	0.0034	0.0004	0.0033	0.0033	0.0033	0.0000	
Spillage	0.0059	0.0059	0.0038	0.0038	0.0072	0.0060	0.0060	0.0060	0.0000	
Total	0.00688	0.00737	0.01991	0.02070	0.00892	0.01173	-0.00160	0.00640	0.00855	

Emissions per mile driven: SCENARIO 3c CA, SoCAB plus CA emissions

Fuel cycle process	NMOG Emissions (g/mi)									
	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Extraction	0.00005	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	-0.0006	0.00090	
Production	0.00000	0.00046	0	0	0	0	-0.01294	0.00129	0.00764	
Marketing	0.00072	0.00072	0.01274	0.01353	0.00126	0.00215	0.00176	0.00190	0.00000	
Distribution	0.00611	0.00613	0.00717	0.00717	0.00766	0.00958	0.00958	0.00958	0	
Total	0.00688	0.00737	0.01991	0.02070	0.00892	0.01173	-0.00160	0.00640	0.00855	



gpgSumCharts-f.xls

Toxics (mg/mi)										
Compound	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	M100 Biomass	Electric	
Benzene	0.00169	0.00170	0.00243	0.01646	0.00199	0.00300	-0.00050		0.03716	
Carbon Chlorides	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.01396		0.00000	
1,3- Butadiene	0.00052	0.00052	0.00243	0.00504	0.00061	0.00092	0.00044		0.00118	
Formaldehyde	0.00169	0.01244	0.01778	0.12049	0.01456	0.02193	0.01044		0.20314	
Acetaldehyde	0.00403	0.00404	0.00578	0.03917	0.00473	0.00713	0.00339		0.00381	
PAHs	0.06363	0.06385	0.00023	0.00155	0.00019	0.00028	0.00013		0.00000	
Diesel PM	0.00010	0.00010	0.00015	0.00019	0.00013	0.00019	0.00010		0.00 ^a	
Total	0.072	0.083	0.029	0.183	0.022	0.033	0.000		0.245	

^a Power plant PM is not diesel PM and not counted in this category.

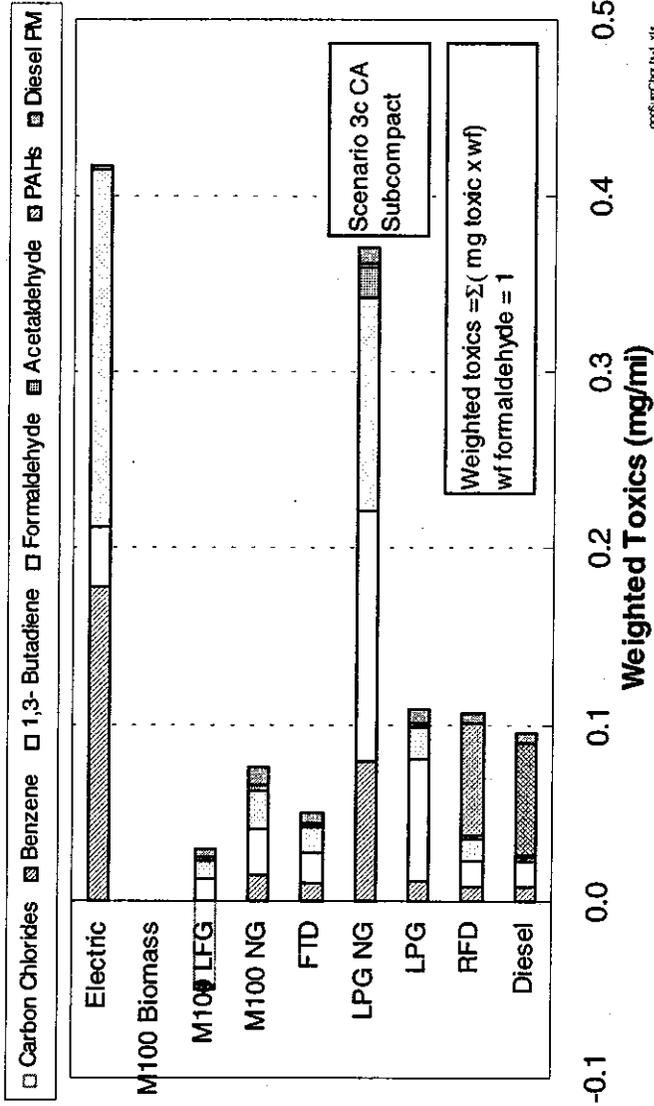
^b Reductions in toxic components for forest material and ag residue not analyzed

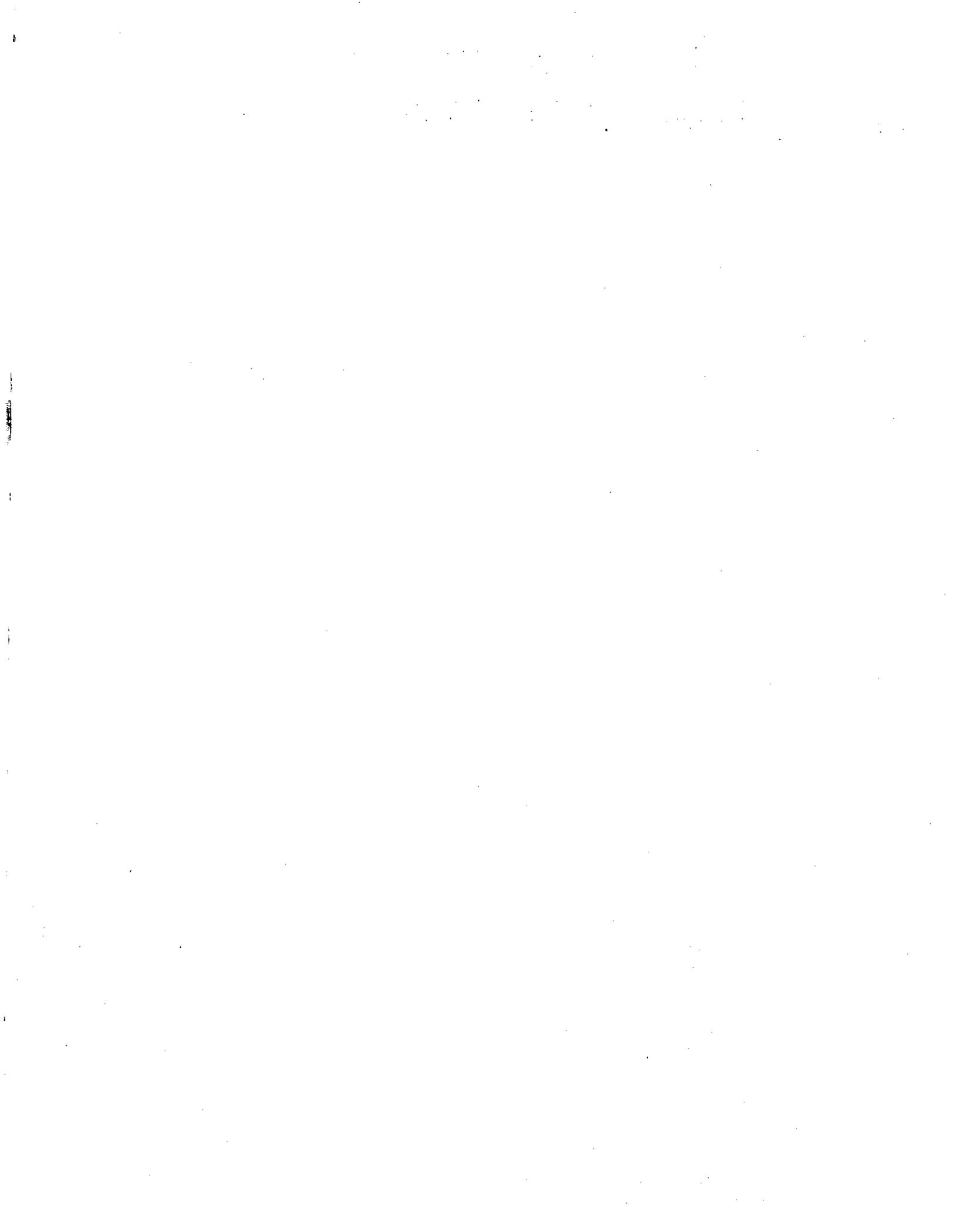
Emissions per mile driven: SCENARIO 3c CA, SoCAB plus CA emissions

gpgSumCharts-e.xls

Weighted Toxics (mg/mi)										
Compound	Weighting	Diesel	RFD	LPG	LPG NG	FTD	M100 NG	M100 LFG	#100 Biomass	Electric
Benzene	4.8	0.0081	0.0082	0.0117	0.0790	0.0095	0.0144	-0.0024	0.0000	0.1784
Carbon Chlorides	3.4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0475	0.0000	0.0000
1,3- Butadiene	28.3	0.0147	0.0147	0.0687	0.1425	0.0172	0.0259	0.0123	0.0000	0.0335
Formaldehyde	1.0	0.0017	0.0124	0.0178	0.1205	0.0146	0.0219	0.0104	0.0000	0.2031
Acetaldehyde	0.5	0.0018	0.0018	0.0026	0.0176	0.0021	0.0032	0.0015	0.0000	0.0017
PAHs	1.0	0.0636	0.0638	0.0002	0.0016	0.0002	0.0003	0.0001	0.0000	0.0000
Diesel PM	50.0	0.0051	0.0051	0.0073	0.0093	0.0063	0.0095	0.0051	0.0000	0.000 ^a
Total		0.095	0.106	0.108	0.371	0.050	0.075	-0.020	0.000	0.417

^a Power plant PM is not diesel PM. If power plant PM were counted as diesel PM, weighted toxics would be 0.05 mg/mi higher





Appendix F — Technical Advisory Committee and Stakeholder Comments

Numerous comments were received from members of the Technical Advisory Committee and other stakeholders on this report. The comments related largely to the following categories:

1. EV energy consumption
2. EV time of day charging and California power demand
3. Considering advanced gasoline technologies
4. Outlook for power plant construction in California
5. Emission data from power plants
6. Consideration of green power options for EV charging

A summary of these comments and responses is included in the following.

F-I. EV Energy Consumption

Comment: Energy consumption from various vehicle technologies was reviewed by the TAC to provide the basis for energy consumption estimates used in this study. Some EV operators believe that more data should be collected from in-use EV operation and on-road performance testing.

Response: More extensive data from EVs is included in Appendix D to illustrate the variability in EV energy consumption. It is acknowledged that more extensive on-road data from EV operation would be helpful in assessing the relative fuel economy of EVs and gasoline vehicles. The evaluation of fuel economy from the TAC was limited primarily to EPA certification data. As on-road data from EVs was limited and the analysis of EV energy consumption was consistent with the experience of TAC members, no further analysis was performed.

F-II. EV Time of Day Charging and California Power Demand

Comment: Several stakeholders expressed interest in further analysis of the time of day charging assumptions for EVs. If the 95/5 case continues to be used in this way, a parallel analysis needs to be done for the 60/40 case and included in this report to provide a realistic and balanced view. Complete results for both cases need to be presented together—including a full, updated analysis of case-specific emissions results. In addition, an evaluation of the emissions on a time of day basis would be helpful.

In addition to the question of vehicle load, the analysis of generation emissions is based on projections of future power plant construction. They do not include consideration of the “electricity crisis” situation in California or its effects on future electricity supplies or emissions.

Response: A further evaluation of EV charging patterns was included in the recommendations for this study. Discussions with the California Energy Commission staff indicated that the emission estimates were consistent with their best estimates for the power generation mix in California. Currently the number of EVs is small and more

generation capacity is expected to be constructed in the future. In any event, EVs will remain a small fraction of the electricity demand.

F-III. Considering Advanced Gasoline Technologies

Comment: This study did not include an analysis of gasoline vehicles. This resulted in a perception of "Apples and oranges" comparisons remain between gasoline vehicles and those operating on other fuels. A commitment to a high priority updating of the 1996 fuel cycle emissions analysis seems very appropriate--so basic assumptions and methodology for gasoline are consistent with those for other fuels in the present report. Including hybrid-electric gasoline, diesel, and other-fueled vehicles in comparisons in the update seems essential.

Response: An analysis of gasoline vehicles is not in the scope of the study. The study was intended to provide an evaluation of vehicles and fuels that were close to the 0.01 g/mi low fuel cycle NMOG emission threshold and not as a comparison among fuel options. Methanol, LPG, and diesel were selected from the 1996 fuel cycle study as the fuel cycle NMOG was very close to the 0.01 g/mi level. As gasoline technologies have evolved with some promising high fuel economy options, and refueling emission standards have become more stringent, evaluating gasoline in the context of the low fuel cycle emissions level would provide useful information. Furthermore, data on fuel cycle emissions for gasoline vehicles is important for emission policy evaluations beyond the "low fuel cycle emission" PZEV allowance issue. Evaluating gasoline fuel cycle emissions was included in the recommendations for this study.

F-IV. Outlook for Power Plant Construction in California

Comment: The results of this study are based on CEC projections of power plant repowering. Some stakeholders indicated that all of the older (over 40 year old by 2010) Rankine cycle power plants in California would be repowered to more efficient low emission technologies.

Response: More information is needed from power plant developers; however, the trends in power plant modifications depend on many factors that cannot be predicted. An assessment of status of several Rankine cycle plants would be helpful.

F-V. Emission Data from Power Plants

Comment: Power plant emission data on particulate and NMOG are limited. The AP-42 emission factor for combined cycle power plants is a composite value based on combustion turbines and steam turbines.

Response: More data are needed and new combined cycle natural gas facilities as well as peaking turbines and repowered facilities should be tested with the goal of providing data on the speciation of hydrocarbons and particulate. This quantification should include an investigation of background and power plant emissions.

F-VI. Consideration of Green Power Options for EV Charging

Several stakeholders provided comments indicating that green power should be considered for EV charging. The mix and baseload considerations for hydroelectric power are discussed in Section 4.8 of the main report.

In principal, green power agreements that result in the construction of new generation capacity that results in additional zero emission power being generated is an option. Such arrangements should be considered in a future study.