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V-D-5

Control Cost Document for Mobile Source Control Measures for the California FIP

FEBRUARY, 1995

Mobile Sources

A. General Methodology

Costs were determined considering the per unit variable costs of equipment and the fixed costs attributable to the FIP requirement. Development costs and other fixed start up costs were first amortized over generally a ten year period. A seven (7) percent amortization rate was used. Then the stream of fixed and variable costs were discounted over a thirty year period to determine a present value as of 1995 of this stream of costs. A three (3) percent discount rate was used. Incremental costs to the manufacturer/producer were determined on a per unit basis, then summed over all units sold in the year. When an action was being phased in (for example as an increasing percent of sales with 100% of sales applicable to the FIP requirement in the third year), this was also reflected in the stream of variable costs; development and other fixed start up costs were assumed to all occur beginning with the start of the program (i.e., were not phased in with production).

For programs being implemented only in a FIP area, the costs attributable to the units affected in those FIP areas were determined. For programs being implemented state wide, total costs for state wide implementation were used. For programs which also have a national component (i.e., for which the Agency has or has plans to promulgate similar requirements applicable to units sold in the rest of the states), the fixed costs were distributed over total national sales to determine a per unit average fixed cost; per unit average fixed and variable costs were determined for each unit sold in California and summed to determine the California fleet costs.

Benefits were estimated in much the same way. The net present value of benefits was calculated from the stream of benefits over thirty years, discounted to 1995 using a three (3) percent discount rate. If benefits only accrued to the FIP area (i.e., the action only affected the FIP area), then only these benefits were determined. For programs having state wide benefit, state wide benefits were also calculated. The rationale behind calculating these two sets of benefits is that, in the first case, the action is being specifically mandated for the purpose of improving the air quality in these FIP area. In the second case, state wide benefits are calculated recognizing that other areas of the State of California are also benefitting from the emission reductions from this control measure. While being caused by the FIP specific to the FIP areas, other areas with air quality problems will benefit from the action. These other areas may realize this benefit through subsequent adjustments of their SIPs which may reduce the need for other individual actions, perhaps lowering the local cost impact of the SIP. At a minimum, the state wide emission reduction benefits from these FIP actions will improve the air quality compliance margin in other areas, with the attendant benefits in terms of growth potential without

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added air quality improvement costs, etc.

Cost effectiveness calculations can be made assuming either calculation of emission reduction benefits. Clearly, for the case when statewide costs are divided by FIP area-only benefits, the cost-effectiveness ratio will be considerably higher compared to the case where state wide benefits are used.

The following discusses the individual cost and benefit analyses for each measure being adopted through this FIP rule. Any deviations from the general methodology discussed above or special circumstances worthy of note are included in the individual descriptions below.

I. ENHANCED I/M

The enhanced I/M program adopted in the FIP is a biennial, centralized program with cutpoints of 0.6 for hydrocarbons (HC), 10 for CO, and 1.5 for NO_x. These cutpoints are more stringent than the cutpoints in EPA's performance standard for areas requiring enhanced I/M under the CAA. The costs associated with the FIP enhanced I/M program are based on the costs of the EPA performance standard. Costs may be underestimated, however, since all vehicles will be subject to more stringent cutpoints which may lead to an increased number of failures and therefore increased repair costs.

The total national costs and economic benefits of the enhanced I/M program (assuming a biennial program) are shown in Table 1 (EPA, 1992). Per-vehicle costs, also shown in Table 1, were derived from these total national costs by dividing by the number of vehicles subject to enhanced I/M. The nationwide cost estimates are based on an annual per-vehicle inspection cost of $9 for a biennial program. The cost to fix a transient test failure that would also fail the 2500/idle test is estimated at $75. The average cost to repair vehicles failing the transient test that do not fail the 2500/idle test is estimated at $150. The overall average repair cost for transient failures is $120.

Costs for California and the individual FIP areas were estimated by multiplying the per-vehicle costs by the estimated vehicle registrations in each area. The enhanced I/M program will apply to light-duty vehicles and trucks, as well as heavy-duty gasoline vehicles. (This is broader in scope than the EPA performance standard.) Vehicle registration data for California are shown in Table 2 (AAMA, 1993). Included are automobile registrations, light- and medium-duty truck registrations (classified here as up to 14,000 lbs) and heavy-duty trucks (classified as truck tractors). Heavy-duty trailers were not included because these vehicles operate almost exclusively on diesel. It was assumed that all truck tractors were gasoline, although a portion of these may operate on diesel fuel. Since costs for subjecting heavy-duty trucks to IM240 type tests have not been documented, the per-vehicle cost for light-duty vehicles was applied to these as well.

California registrations were allocated to each FIP area based on 1990 population: 28.8 million for the State, 1.6 million for the Sacramento FIP area, 0.7 million for the Ventura FIP area, and 13 million for the SCAQMD. Total registrations in each FIP area were multiplied by the net per-vehicle cost to estimate the total program cost. The results are shown in Table 3.

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Table 1
National Costs of Enhanced I/M

	Test Cost	Emission Test Repair Cost	Evap. Repair Cost	Emission Test Fuel Economy Savings	Evap. Fuel Economy Savings	Net Cost
Total Program Cost (million $)	451	489	221	(617)	(208)	336
Per-Vehicle Cost ($/vehicle)	9.00	9.78	4.42	(12.34)	(4.16)	6.70

Table 2
California Vehicle Registrations (thousand vehicles)[1]

	1991	1999	2005	2010
Automobiles	17,232	19,083	20,187	20,966
Light and Medium Trucks[2]	3,788	4,195	4,438	4,609
Heavy-Duty Trucks	114	126	134	139
TOTAL	21,863	23,404	24,759	25,714

[1] Vehicle registrations were grown to future years based on expected population growth in California (BEA, 1990).

[2] Includes trucks of 10,000 pounds or less gross vehicle weight.

Table 3
Enhanced I/M Program Costs

	1999	2005	2010
California			
Vehicle Registration (thousands)	23,404	24,759	25,714
Enhanced I/M Program Cost (million $)[1]	156.8	165.9	172.3
Ventura			
Vehicle Registrations (thousands)	569	602	624
Enhanced I/M Program Cost (million $)[1]	3.8	4.0	4.2
Sacramento			
Vehicle Registrations (thousands)	1,300	1,376	1,429
Enhanced I/M Program Cost (million $)[1]	8.7	9.2	9.5
South Coast			
Vehicle Registrations (thousands)	10,564	11,176	11,607
Enhanced I/M Program Cost (million $)[1]	70.8	74.9	77.8

[1] The enhanced I/M program cost was estimated by applying the net per vehicle program cost of $6.70 (see Table 4.2 to the estimated vehicle registrations subject to enhanced I/M).

The South Coast FIP relies upon a single strategy, the enhanced inspection and maintenance (I/M) program, to meet the emission reductions necessary to demonstrate attainment with the CO standard in the South Coast FIP areas. The enhanced I/M program is being promulgated as a control measure required to achieve both the ozone and CO attainment in the South Coast FIP area. The enhanced I/M program costs applicable to each FIP area are included in the costs associated with meeting ozone attainment. Incremental costs above the ozone standards are not required to meet CO attainment in the south Coast; therefore, no costs are specifically identifiable with achieving the CO standard in the South Coast. Throughout this report, estimated control costs and information collection request (ICR) costs are reported for the South Coast FIP, and these costs represent those required to meet ozone attainment and CO attainment in the South Coast.

II. HEAVY-DUTY VEHICLES

Overview and General Methodology

Statewide annual costs are calculated over a thirty-year period beginning with 2002, when the program first takes effect. Emission reductions are also calculated annually over thirty years. Total annual costs and emission reductions are converted to net present value (1995) with a three percent discount rate and compared to determine a program cost-effectiveness. Two separate technical approaches to emission reduction are analyzed, the first relying on EGR and oxidation catalyst technology, the second assuming reducing catalyst technology. Since nationwide implementation of similar requirements is anticipated, the R&D and other fixed up front costs are adjusted to reflect spreading of costs across a national fleet. However, whereas only about ten percent of heavy duty truck sales are in California, this analysis assumes twenty percent of these fixed costs are associated with this FIP in recognition of the fact that California implementation will precede nationwide implementation by a couple of years.

The cost-effectiveness calculation is made for the three FIP areas combined; no sensible way was available for determining a cost-effectiveness value for each FIP area individually. Also, since this program affects emissions statewide as well as in the FIP areas, two separate cost-effectiveness can be calculated. The numbers included in Tables I-1 and I-2 are cost-effectiveness values for the combined FIP areas only. Since FIP area vehicle miles traveled (VMT) is approximately 33 percent of statewide VMT for all trucks sold in California subject to this action, the FIP-area cost-effectiveness assumes total statewide costs but only FIP area benefits. Statewide cost-effectiveness numbers would also include benefits available from the VMT outside the FIP areas affected by this action. The statewide cost-effectiveness estimates would be $4545 per ton NOx reduction using the EGR and oxidation catalyst assumption and $10,017 per ton using the reducing catalyst technology assumption.

Methodology

Statewide costs are calculated over a thirty-year period on an annual basis. Emission reductions are also calculated annually over thirty years. Total annual costs and emission reductions are converted to net present value (1995) with a three percent discount rate and compared to determine a program cost-effectiveness.

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Basic Assumptions

1. All costs are in constant 1995 dollars.

2. Statewide HDV population in 2010 comes from EMFAC7. EMFAC's estimate for 1990 HDV population is compared with the 2010 value to derive an estimated linear growth of 2.1 percent per year.

3. Similarly, statewide VMT in 2010 comes from EMFAC7, with an estimated linear VMT growth of 2.8 percent.

4. The FIP-area VMT estimate, needed to calculate emission reductions, is from [CALI5b]. 2005 VMT from Sacramento and Ventura are added to the 2010 South Coast VMT to yield an approximate total FIP-area VMT for 2010. VMT growth in FIP areas is assumed to match statewide VMT growth (2.8 percent linear growth per year).

5. Annual sales

There were 486,080 California new-truck registrations in 1992 (MVMA, 1993).

4.82% of total California truck registration are over 14,000 lbs. GVWR (MVMA, 1993).

Grow 1992 sales to 2002 using HDV population growth estimates (#1).

486,080*0.0482=23,452 in 1992=> 28,377 in 2002

R&D

Total expenses assumed to be $150 million for whole fleet, including research, all phases of development, testing, etc. (excluding certification). This assumes 3 FTEs for two years at $125,000 per year for each of 100 engine families. The estimate is then doubled to cover costs for testing, supplies, materials and other overhead items.

Assuming EPA follows up with a comparable national program allows amortization of costs over vehicle sales nationwide (starting in 2004). Approximately 10 percent of U.S. heavy-duty vehicles are in California. Due to early start in California, EPA assumed 20 % of R&D costs are attributed to California trucks. The resulting $30 million estimate is amortized over 10 years at 7 %.

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Variable Cost

Two scenarios are developed to provide a cost range. Variable costs per vehicle are multiplied by 80 % of California's annual sales for a statewide cost estimate (20 % of heavy-duty VMT is from interstate trucks not affected by the FIP).

1. EGR & oxidation catalyst

Based on information adapted from Acurex, we estimate a total variable cost of $3000 per vehicle for initial purchase price. Engine modifications, including EGR, variable-geometry turbocharger and advanced fuel injection, cost approximately $2000 and the catalyst about $1000. Acurex lumped fixed and variable costs for an estimate of around $11,000 per engine.

2. Reducing catalyst

Based on information from Acurex, we estimate a total variable cost of $2000 per vehicle for initial purchase price, including $1250 for the catalyst and $750 for fuel system modifications. Fuel system modifications may include advanced fuel injection for the engine to meet NOx standards.

Maintenance Cost

EPA assumed a median vehicle age of 12 years, based on MOBILE5. Maintenance costs were assumed at intervals over each vehicle's lifetime, then converted to a net present value for each model year's sales. Separate maintenance estimates for the two technology scenarios are multiplied by 80 % of California's annual sales for a statewide cost estimate.

1. EGR & oxidation catalyst

General maintenance was assumed to increase by $134 per year (Acurex). In addition, we assumed a one-time $2000 incremental cost for a rebuild in the seventh year. By year seven, vehicles in classes 6-8A have accumulated 244,000 miles and class 8B vehicles have accumulated 475,000 miles. The $2000 estimate is reduced by 20 percent for those vehicles that are not rebuilt for a calculated composite cost-effectiveness of $1600 per engine. Catalyst replacement was assumed for year nine; MOBILE modeling indicates that a composite heavy-duty vehicle reaches the 350,000 mile mark in its ninth year. The cost for the catalyst replacement was assumed to be four times the initial cost, or $4000.

2. Reducing catalyst

General maintenance was again assumed to increase by $134 per year (Acurex). Catalyst replacement was assumed for year nine. The cost for the catalyst replacement was assumed to be four

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times the initial cost, or $5000.

Fuel Penalty

1. EGR & oxidation catalyst

No change in fuel consumption is estimated for incorporation of EGR or an oxidation catalyst.

2. Reducing catalyst

A 7% increase in fuel consumption is assumed for a reducing catalyst, assuming diesel fuel is used as a reducing agent. This is consistent with Acurex's estimate. Increased fuel consumption converts to 0.009 gal/mi, assuming an average baseline fuel economy of 7.7 mpg for (2000 estimate for medium and heavy HDVs from DOE Motor Fuel Consumption Model, 14th Periodical report, Dec. 1988). Increased fuel consumption is multiplied by 80 percent of statewide annual VMT (excluding unaffected interstate vehicles). Fuel is assumed to cost $1.20 per gallon. Using MOBILE5 data for turnover rates, we can estimate the fraction of VMT each year that is from 2002 and later model year vehicles.

C cost = HDV miles * FIP fraction of VMT fleet * increased fuel use (gal/mi)* fuel cost ($/gal)

Recertification Costs

EPA assumed a cost of $260,000 per engine family to certify a rebuild under the urban bus retrofit/rebuild program. The same estimate will be used for the recertification (proposed as the "rebuild program") program for the FIP. Total recertification costs are reduced by 80 percent to estimate the California portion of the cost burden, similar to the methodology for R&D costs.

Assuming three separate parties will be prepared to recertify each engine family, the per-family cost is multiplied by three, then multiplied by 100 engine families (approximate 1994 certification). This full cost of $15.6 million is assumed for the first year of production. In subsequent years, the cost is divided by three to account for the reduced compliance burden with carryover of test data.

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TABLE I-1

Cost-effectiveness for Heavy-Duty Vehicles

Calendar Year	R&D	Variable Cost	Maintenance	Fuel	Testing/ Recert.	Total cost	Em. Red. tons/yr
2002	4,271,325	68,104,800	96,174,296	0	15,600,000	184,150,421	2,070
2003	4,271,325	69,535,001	98,193,956	0	5,200,000	177,200,282	3,891
2004	4,271,325	70,965,202	100,213,616	0	5,200,000	180,650,143	5,543
2005	4,271,325	72,395,402	102,233,277	0	5,200,000	184,100,004	7,097
2006	4,271,325	73,825,603	104,252,937	0	5,200,000	187,549,865	8,593
2007	4,271,325	75,255,804	106,272,597	0	5,200,000	190,999,726	10,034
2008	4,271,325	76,686,005	108,292,257	0	5,200,000	194,449,587	11,373
2009	4,271,325	78,116,206	110,311,917	0	5,200,000	197,899,448	12,583
2010	4,271,325	79,546,406	112,331,578	0	5,200,000	201,349,309	13,691
2011	4,271,325	80,976,607	114,351,238	0	5,200,000	204,799,170	14,689
2012		82,406,808	116,370,898	0	5,200,000	203,977,706	15,601
2013		83,837,009	118,390,558	0	5,200,000	207,427,567	16,421
2014		85,267,210	120,410,219	0	5,200,000	210,877,428	17,180
2015		86,697,410	122,429,879	0	5,200,000	214,327,289	17,905
2016		88,127,611	124,449,539	0	5,200,000	217,777,150	18,608
2017		89,557,812	126,469,199	0	5,200,000	221,227,011	19,281
2018		90,988,013	128,488,859	0	5,200,000	224,676,872	19,927
2019		92,418,214	130,508,520	0	5,200,000	228,126,733	20,548
2020		93,848,414	132,528,180	0	5,200,000	231,576,594	21,155
2021		95,278,615	134,547,840	0	5,200,000	235,026,455	21,742
2022		96,708,816	136,567,500	0	5,200,000	238,476,316	22,321
2023		98,139,017	138,587,160	0	5,200,000	241,926,177	22,895
2024		99,569,218	140,606,821	0	5,200,000	245,376,038	23,474
2025		100,999,418	142,626,481	0	5,200,000	248,825,899	24,056
2026		102,429,619	144,646,141	0	5,200,000	252,275,760	24,536
2027		103,859,820	146,665,801	0	5,200,000	255,725,621	25,010
2028		105,290,021	148,685,462	0	5,200,000	259,175,482	25,485
2029		106,720,222	150,705,122	0	5,200,000	262,625,343	25,959
2030		108,150,422	152,724,782	0	5,200,000	266,075,204	26,434
2031		109,580,623	154,744,442	0	5,200,000	269,525,065	26,908
					npv (1995) =	3,415,846,490	250,514
					Cost-effectiveness =	$13,635	per ton

Assumed variable cost = $3,000

R&D amortization:

cost = 3.0E+07 (20% of total R&D cost allocated to California sales)

rate = 7%

Fuel economy penalty = 0%

Maintenance costs

age	Incremental maintenance costs
1	$134
2	$134
3	$134
4	$134
5	$134
6	$134
7	$1,734
8	$134
9	$4,134
10	$134
11	$134
12	$134
npv=	$4,236

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TABLE-I-2

Cost-effectiveness for Heavy-Duty Vehicles

Calendar Year	R&D	Variable Cost	Maintenance	Fuel	Testing/ Recert.	Total cost	Em. Red. tons/yr
2002	4,271,325	45,403,200	85,902,597	39,440,891	15,600,000	190,618,014	2,070
2003	4,271,325	46,356,667	87,706,552	74,147,160	5,200,000	217,681,705	3,891
2004	4,271,325	47,310,134	89,510,506	105,637,255	5,200,000	251,929,221	5,543
2005	4,271,325	48,263,602	91,314,461	135,240,785	5,200,000	284,290,173	7,097
2006	4,271,325	49,217,069	93,118,416	163,759,083	5,200,000	315,565,892	8,593
2007	4,271,325	50,170,536	94,922,370	191,224,826	5,200,000	345,789,057	10,034
2008	4,271,325	51,124,003	96,726,325	216,731,415	5,200,000	374,053,068	11,373
2009	4,271,325	52,077,470	98,530,279	239,794,874	5,200,000	399,873,949	12,583
2010	4,271,325	53,030,938	100,334,234	260,910,545	5,200,000	423,747,042	13,691
2011	4,271,325	53,984,405	102,138,188	279,933,895	5,200,000	445,527,813	14,689
2012		54,937,872	103,942,143	297,310,925	5,200,000	461,390,940	15,601
2013		55,891,339	105,746,097	312,929,908	5,200,000	479,767,345	16,421
2014		56,844,806	107,550,052	327,404,502	5,200,000	496,999,360	17,180
2015		57,798,274	109,354,006	341,207,057	5,200,000	513,559,337	17,905
2016		58,751,741	111,157,961	354,603,781	5,200,000	529,713,482	18,608
2017		59,705,208	112,961,916	367,429,988	5,200,000	545,297,112	19,281
2018		60,658,675	114,765,870	379,747,291	5,200,000	560,371,836	19,927
2019		61,612,142	116,569,825	391,587,721	5,200,000	574,969,688	20,548
2020		62,565,610	118,373,779	403,155,875	5,200,000	589,295,264	21,155
2021		63,519,077	120,177,734	414,340,154	5,200,000	603,236,965	21,742
2022		64,472,544	121,981,688	425,366,854	5,200,000	617,021,086	22,321
2023		65,426,011	123,785,643	436,307,789	5,200,000	630,719,443	22,895
2024		66,379,478	125,589,597	447,331,905	5,200,000	644,500,981	23,474
2025		67,332,946	127,393,552	458,439,203	5,200,000	658,365,700	24,056
2026		68,286,413	129,197,506	467,572,364	5,200,000	670,256,283	24,536
2027		69,239,880	131,001,461	476,613,818	5,200,000	682,055,159	25,010
2028		70,193,347	132,805,415	485,655,273	5,200,000	693,854,035	25,485
2029		71,146,814	134,609,370	494,696,727	5,200,000	705,652,912	25,959
2030		72,100,282	136,413,325	503,738,182	5,200,000	717,451,788	26,434
2031		73,053,749	138,217,279	512,779,636	5,200,000	729,250,664	26,908
					npv (1995) =	7,528,450,684	250,514
					Cost-effectiveness =	$30,052	per ton

Assumed variable cost = $2,000

R&D amortization:

cost = 3.0E+07 (20% of total R&D cost allocated to California sales)

rate = 7%

Fuel economy penalty = 7%

Maintenance costs

age	Incremental maintenance costs
1	$134
2	$134
3	$134
4	$134
5	$134
6	$134
7	$134
8	$134
9	$5,134
10	$134
11	$134
12	$134
npv=	$3,784

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TABLE I-3

Base mpg= 7.7
Increase in fuel consumption= 7.0%
Incr. in fuel consumption (gal/mi)= 0.00909
VMT growth = 2.80%

Cost From Increased Fuel Consumption

Calendar year*	HDV VMT Statewide**	VMT from new eng.'s	Increase in FC, gal/mi	Fuel cost, $/gal	Calendar Year Cost
2002	62,930,411	15.7%	0.00909	1.20	$39,440,891
2003	65,201,096	28.6%	0.00909	1.20	$74,147,160
2004	67,471,781	39.3%	0.00909	1.20	$105,637,255
2005	69,742,466	48.7%	0.00909	1.20	$135,240,785
2006	72,013,151	57.1%	0.00909	1.20	$163,759,083
2007	74,283,836	64.7%	0.00909	1.20	$191,224,826
2008	76,554,521	71.1%	0.00909	1.20	$216,731,415
2009	78,825,205	76.4%	0.00909	1.20	$239,794,874
2010	81,095,890	80.8%	0.00909	1.20	$260,910,545
2011	83,366,575	84.3%	0.00909	1.20	$279,933,895
2012	85,637,260	87.2%	0.00909	1.20	$297,310,925
2013	87,907,945	89.4%	0.00909	1.20	$312,929,908
2014	90,178,630	91.2%	0.00909	1.20	$327,404,502
2015	92,449,315	92.7%	0.00909	1.20	$341,207,057
2016	94,720,000	94.0%	0.00909	1.20	$354,603,781
2017	96,990,685	95.1%	0.00909	1.20	$367,429,988
2018	99,261,370	96.1%	0.00909	1.20	$379,747,291
2019	101,532,055	96.9%	0.00909	1.20	$391,587,721
2020	103,802,740	97.5%	0.00909	1.20	$403,155,875
2021	106,073,425	98.1%	0.00909	1.20	$414,340,154
2022	108,344,110	98.6%	0.00909	1.20	$425,366,854
2023	110,614,795	99.1%	0.00909	1.20	$436,307,789
2024	112,885,479	99.5%	0.00909	1.20	$447,331,905
2025	115,156,164	100.0%	0.00909	1.20	$458,439,203
2026	117,426,849	100.0%	0.00909	1.20	$467,572,364
2027	119,697,534	100.0%	0.00909	1.20	$476,613,818
2028	121,968,219	100.0%	0.00909	1.20	$485,655,273
2029	124,238,904	100.0%	0.00909	1.20	$494,696,727
2030	126,509,589	100.0%	0.00909	1.20	$503,738,182
2031	128,780,274	100.0%	0.00909	1.20	$512,779,636

*2010 is the base year for VMT estimates
**Reduced by 20% to exclude out-of-state trucks

TABLE I-4

Fuel	NOx Emission Factors 2010 base	NOx Emission Factors new eng.	Em red. g/mi
Diesel	5.53	3.80	1.73
Gasoline	4.01	2.86	1.15

EF's, from CALI5b, represent lifetime average emission level.

Emission Reductions

Calendar Year	FIP area VMT/day diesel	FIP area VMT/day gasoline	Emission red., g/mi diesel	Emission red., g/mi gasoline	VMT from New eng.'s	Em. red., tons/yr
2002	14,062,982	7,322,336	1.73	1.15	15.7%	2,070
2003	14,570,410	7,586,544	1.73	1.15	28.6%	3,891
2004	15,077,837	7,850,752	1.73	1.15	39.3%	5,543
2005	15,585,264	8,114,960	1.73	1.15	48.7%	7,097
2006	16,092,691	8,379,168	1.73	1.15	57.1%	8,593
2007	16,600,118	8,643,376	1.73	1.15	64.7%	10,034
2008	17,107,546	8,907,584	1.73	1.15	71.1%	11,373
2009	17,614,973	9,171,792	1.73	1.15	76.4%	12,583
2010	18,122,400	9,436,000	1.73	1.15	80.8%	13,691
2011	18,629,827	9,700,208	1.73	1.15	84.3%	14,689
2012	19,137,254	9,964,416	1.73	1.15	87.2%	15,601
2013	19,644,682	10,228,624	1.73	1.15	89.4%	16,421
2014	20,152,109	10,492,832	1.73	1.15	91.2%	17,180
2015	20,659,536	10,757,040	1.73	1.15	92.7%	17,905
2016	21,166,963	11,021,248	1.73	1.15	94.0%	18,608
2017	21,674,390	11,285,456	1.73	1.15	95.1%	19,281
2018	22,181,818	11,549,664	1.73	1.15	96.1%	19,927
2019	22,689,245	11,813,872	1.73	1.15	96.9%	20,548
2020	23,196,672	12,078,080	1.73	1.15	97.5%	21,155
2021	23,704,099	12,342,288	1.73	1.15	98.1%	21,742
2022	24,211,526	12,606,496	1.73	1.15	98.6%	22,321
2023	24,718,954	12,870,704	1.73	1.15	99.1%	22,895
2024	25,226,381	13,134,912	1.73	1.15	99.5%	23,474
2025	25,733,808	13,399,120	1.73	1.15	100.0%	24,056
2026	26,241,235	13,663,328	1.73	1.15	100.0%	24,536
2027	26,748,662	13,927,536	1.73	1.15	100.0%	25,010
2028	27,256,090	14,191,744	1.73	1.15	100.0%	25,485
2029	27,763,517	14,455,952	1.73	1.15	100.0%	25,959
2030	28,270,944	14,720,160	1.73	1.15	100.0%	26,434
2031	28,778,371	14,984,368	1.73	1.15	100.0%	26,908

*2010 is the base year for VMT estimates

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TABLE- I-5

VMT distribution vs. age for HDVs over 14,000 lbs. GVWR

	Gas		Diesel									
Age	All classes	Population fraction	Class 4 - 5	Population fraction	lass 6 - 8	Cumulative	Population fraction	Class 8B	Cumulative	Population fraction	Weighted VMT/yr	Cumulative Mileage
1	18,211	19.8%	23,611	0.0%	43,946	43,946	49.5%	86,375	86,375	30.7%	51,892	63,352
2	16,767	19.8%	20,947	0.0%	40,504	84,450	49.5%	79,434	165,809	30.7%	47,771	111,122
3	15,437	19.8%	18,583	0.0%	37,332	121,782	49.5%	73,051	238,860	30.7%	43,976	155,099
4	14,213	19.8%	16,486	0.0%	34,408	156,190	49.5%	67,181	306,041	30.7%	40,483	195,582
5	13,086	19.8%	14,625	0.0%	31,713	187,903	49.5%	61,782	367,823	30.7%	37,268	232,849
6	12,048	19.8%	12,975	0.0%	29,229	217,132	49.5%	56,817	424,640	30.7%	34,307	267,157
7	11,093	19.8%	11,511	0.0%	26,939	244,071	49.5%	52,252	476,892	30.7%	31,582	298,739
8	10,213	19.8%	10,212	0.0%	24,829	268,900	49.5%	48,053	524,945	30.7%	29,074	327,813
9	9,403	19.8%	9,059	0.0%	22,885	291,785	49.5%	44,191	569,136	30.7%	26,765	354,578
10	8,657	19.8%	8,037	0.0%	21,092	312,877	49.5%	40,640	609,776	30.7%	24,639	379,216
11	7,971	19.8%	7,130	0.0%	19,440	332,317	49.5%	37,374	647,150	30.7%	22,682	401,898
12	7,339	19.8%	6,325	0.0%	17,918	350,235	49.5%	34,371	681,521	30.7%	20,881	422,779
13	6,757	19.8%	5,612	0.0%	16,514	366,749	49.5%	31,609	713,130	30.7%	19,222	442,001
14	6,221	19.8%	4,978	0.0%	15,221	381,970	49.5%	29,069	742,199	30.7%	17,696	459,697
15	5,728	19.8%	4,416	0.0%	14,029	395,999	49.5%	26,733	768,932	30.7%	16,290	475,987
16	5,273	19.8%	3,918	0.0%	12,930	408,929	49.5%	24,585	793,517	30.7%	14,996	490,983
17	4,855	19.8%	3,476	0.0%	11,917	420,846	49.5%	22,609	816,126	30.7%	13,805	504,789
18	4,470	19.8%	3,084	0.0%	10,984	431,830	49.5%	20,792	836,918	30.7%	12,709	517,498
19	4,116	19.8%	2,736	0.0%	10,123	441,953	49.5%	19,121	856,039	30.7%	11,699	529,197
20	3,789	19.8%	2,427	0.0%	9,331	451,284	49.5%	17,585	873,624	30.7%	10,771	539,968
21	3,789	19.8%	2,427	0.0%	9,331	460,615	49.5%	17,585	891,209	30.7%	10,771	550,739
22	3,789	19.8%	2,427	0.0%	9,331	469,946	49.5%	17,585	908,794	30.7%	10,771	561,510
23	3,789	19.8%	2,427	0.0%	9,331	479,277	49.5%	17,585	926,379	30.7%	10,771	572,281
24	3,789	19.8%	2,427	0.0%	9,331	488,608	49.5%	17,585	943,964	30.7%	10,771	583,052
25	3,789	19.8%	2,427	0.0%	9,331	497,939	49.5%	17,585	961,549	30.7%	10,771	593,822
26	3,789	19.8%	2,427	0.0%	9,331	507,270	49.5%	17,585	979,134	30.7%	10,771	604,593
27	3,789	19.8%	2,427	0.0%	9,331	516,601	49.5%	17,585	996,719	30.7%	10,771	615,364
28	3,789	19.8%	2,427	0.0%	9,331	525,932	49.5%	17,585	1,014,304	30.7%	10,771	626,135
29	3,789	19.8%	2,427	0.0%	9,331	535,263	49.5%	17,585	1,031,889	30.7%	10,771	636,906
30	3,789	19.8%	2,427	0.0%	9,331	544,594	49.5%	17,585	1,049,474	30.7%	10,771	647,677

Vehicle stock distribution for 2000 (calendar year) --MOBILE4 Fuel Consumption Model

	Class						
	4	5	6	7	buses	8a	8b
pop. (millions)	149,000	346,000	847,000	1,771,000	789,000	578,000	1,988,000
diesel fraction	0.00	0.00	0.70	0.70	1.00	1.00	1.00
gas vehicles	149,000	346,000	254,100	531,300	0	0	0
diesel vehicles	0	0	592,900	1,239,700	789,000	578,000	1,988,000

	Gas	Diesel				
		Class				
	all classes	4-5	6-8a	8b		sum
combined pop.	1,280,400	0	3,199,600	1,988,000		6,468,000
normalized	19.8%	0.0%	49.5%	30.7%		100.0%

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III. ILEV FLEET PROGRAM

Overview and General Methodology

Estimates are made of the volume of vehicles covered by this action in each of the FIP areas. Annual costs and benefits are determined, based on estimates which are assumed to include amortized R&D costs and other fixed costs, variable costs to the manufacturer. EPA believes that operating costs to the fleet operator will not change significantly. Costs are distributed among the FIP areas in proportion to the estimate of vehicle volumes affected. Costs and benefits are determined for a thirty-year period assuming growth in the number of required ILEV fleet vehicles per year similar to that developed for the Clean Fuel Fleet program. This stream of costs and benefits is then discounted to determine a net present value of costs and benefits in each FIP area.

Basic Assumptions

Based on EPA's analysis in support of the Clean Fuel Fleet rulemakings, there will be in 1998 4.7 million LDVs, 2.8 million LDTs, and 1.0 million HDVs up to 26,000 lbs GVWR, respectively, in fleets of 10 or more nationwide (federal definitions for LDT and HDE).[1] EPA also estimated that 47 percent, 56 percent, and 80 percent of these LDVs, LDTs, and HDVs, respectively, were in fleets of 10 or more vehicles which were capable of being centrally fueled. Based on EPA's analysis for the recent Reformulated Gasoline rulemaking, gasoline consumption in the FIP nonattainment areas is 5.18 percent of nationwide gasoline consumption (South Coast, 4.93; Ventura, 0.25). Assuming no significant difference in fuel consumption per vehicle between the FIP areas and the rest of the nation, EPA estimates that 5.18 percent of nationwide fleet vehicles are operated in the FIP areas. Thus the ILEV fleet program should affect about 243,500 LDVs, 145,000 LDTs, and 52,000 HDVs. About 48 percent of federally-defined fleet LDTs and 58 percent of federally-defined HDEs fall into California's MDV class. Thus, the following numbers of covered fleet vehicles can be projected for the FIP areas in terms of California vehicle classes: 243,500 LDVs, 75,500 LDTs (CA), 99,500 MDVs, and 7,000 HDVs (CA).

Any vehicles certified to have very low or zero inherent evaporative emissions, including vehicles certified as federal ILEVs or as ZEVs, will meet the ILEV evaporative requirements of the ILEV fleet program, regardless of their fuel type. At this time, it appears that in the early years of the program, dedicated compressed natural gas (CNG) vehicles will be the predominate vehicle type purchased by fleets to comply with the program, although a small number of ZEVs and dedicated LPG

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[1]Regulatory Impact Analysis for the Clean Fuel Fleet Program, U.S. EPA, June 1994.

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vehicles may also used as compliance vehicles. Vehicles designed to operate on pure alcohols, although developed and demonstrated for heavy-duty applications, may not be available for light-duty applications in the early years of the ILEV fleet program. For gasoline MDVs and HDVs covered by the ILEV fleet program, EPA also expects CNG to predominate in the early years of the program, with small numbers of ZEVs, dedicated LPG vehicles, and pure alcohol vehicles also being purchased. California MDV and HDV diesels will probably meet the ILEV evaporative requirement and thus will not generally be replaced by alternative fuel vehicles.

EPA estimates that the incremental cost of CNG vehicles over the cost of a conventional California vehicle will be $2000 or less per vehicle for LDVs and LDTs and $2000-4000 for MDVs and HDVs in the ILEV fleet program. For this cost/effectiveness analysis, EPA used $2000 per vehicle for LDVs, LDTs and MDVs and $4000 per vehicle for HDVs. These costs are primarily due to the addition of high-pressure CNG cylinders. These costs may be lower if some gasoline vehicle exhaust emission controls can be avoided in CNG vehicles. EPA has not made separate estimates of costs for vehicles of other fuel types since their numbers in the ILEV fleet program are likely to be small, at least in the early years of the program.

While wholesale natural gas is much cheaper than gasoline, the cost of compression and distribution can result in CNG costing either more or less than gasoline on an energy equivalent basis depending on the relative prices of natural gas and crude oil at the time. Thus, the vehicle acquisition costs above provide a reasonable upper limit for the overall acquisition/ perating cost of a CNG-fueled vehicle complying with the ILEV fleet program.

Based on the vehicle turnover rates analyzed in the Clean Fuel Fleet final rule, the phasing in of ILEVs in the ILEV fleet program will be largely complete by about 2010. In subsequent years, 70 percent of covered fleet LDVs and LDTs, and 50 percent of covered fleet MDVs and HDVs will be ILEVs. For the 30-year cost analysis, EPA ramped the vehicle numbers up to these levels from 1999 to 2010, applied per-vehicle costs ($2000 for LDVs/LDTs/MDVs and $4000 for HDVs) for each of 30 years. We then calculated the net present value cost, and divided by 30 years for a thirty-year average annual cost of about $60.9 million per year for the ~~three~~ two FIP areas.

EPA calculated emission reduction estimates based on California's SIP inventory estimates for ROG. Estimating that 8 percent of VMT is in fleets covered by the ILEV fleet program, we assumed that the ILEV fleet program would eliminate all evaporative emissions from this 8 percent of the fleet once the fleet had fully turned over based on vehicle population growth figures from the EPA MOBILE4 Fuel Consumption Model. To generate 30 years of reductions, we ramped up the emission reductions over

the first 10 years of the program. This amounts to approximately 1,669 tons of pollutants per year (4.57 tons per day) for 2010 and beyond. This analysis produced a discounted average annual emission reduction of about 872 tons per year, or 2.39 tons per day total for the FIP areas.

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ILEV EMISSION REDUCTIONS - TONS ROG/YEAR
LA BASIN + VENTURA

YEAR	YEAR	LDV	LDT	MDV	HDV	TOTAL	% NEW VEH	ROG EMISS <	TONS/DAY
1998	1998	1,078.61	167.21	58.28	53.32	1,357.42	0.41	560.852	1.54
1999	1999	1,095.76	171.31	59.68	54.20	1,380.95	0.60	826.916	2.26
2000	2000	1,113.19	175.50	61.11	55.09	1,404.90	0.86	1,202.994	3.29
2001	2001	1,130.89	179.80	62.58	56.00	1,429.27	0.87	1,240.984	3.40
2002	2002	1,148.87	184.21	64.08	56.93	1,454.08	0.88	1,279.941	3.50
2003	2003	1,167.14	188.72	65.62	57.87	1,479.34	0.90	1,328.749	3.64
2004	2004	1,185.69	193.34	67.19	58.82	1,505.05	0.91	1,369.867	3.75
2005	2005	1,204.55	198.08	68.81	59.79	1,531.22	0.93	1,421.196	3.89
2006	2006	1,223.70	202.93	70.46	60.78	1,557.87	0.93	1,455.253	3.98
2007	2007	1,243.15	207.91	72.15	61.78	1,584.99	0.95	1,509.062	4.13
2008	2008	1,262.92	213.00	73.88	62.80	1,612.60	0.97	1,564.319	4.28
2009	2009	1,283.00	218.22	75.65	63.84	1,640.71	0.98	1,611.235	4.41
2010	2010	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2011	2011	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2012	2012	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2013	2013	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2014	2014	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2015	2015	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2016	2016	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2017	2017	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2018	2018	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2019	2019	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2020	2020	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2021	2021	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2022	2022	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2023	2023	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2024	2024	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2025	2025	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2026	2026	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
2027	2027	1,303.40	223.56	77.47	64.89	1,669.32	1.00	1,669.323	4.57
NPV (TON	NPV (TONS) - 1995							26,156.14	
ANNUAL A	ANNUAL AVERAGE							871.87	2.39

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CALIFORNIA ILEV COST ANALYSIS - BY AREA

	L A BASIN				VENTURA				L A BASIN + VENTURA			
	COST- $K/ (NPV 1995)				COST- $K/ (NPV 1995)				COST- $K/ (NPV 1995)			
YEAR	LDV	LDT	MDV	HDV	LDV	LDT	MDV	HDV	LDV	LDT	MDV	HDV
1998	21,716	4,842	11,748	3,274	1,046	274	511	156	22,761	5,117	12,260	3,429
1999	36,806	8,429	15,551	3,412	1,772	478	677	162	38,579	8,907	16,228	3,574
2000	52,633	12,195	19,234	3,412	2,534	691	837	162	55,167	12,886	20,071	3,574
2001	53,369	12,733	19,760	3,412	2,570	721	860	162	55,939	13,455	20,620	3,574
2002	54,105	13,092	20,111	3,412	2,605	742	875	162	56,710	13,834	20,986	3,574
2003	55,210	13,809	20,812	3,412	2,658	782	906	162	57,868	14,592	21,718	3,574
2004	55,946	13,989	20,988	3,412	2,694	793	914	162	58,639	14,781	21,901	3,574
2005	57,050	14,527	21,543	3,426	2,747	823	938	163	59,797	15,350	22,481	3,589
2006	57,418	15,244	22,245	3,426	2,765	864	968	163	60,183	16,108	23,213	3,589
2007	58,522	15,782	23,067	3,564	2,818	894	1,004	169	61,340	16,676	24,071	3,733
2008	59,626	16,320	23,563	3,550	2,871	925	1,026	169	62,497	17,245	24,589	3,719
2009	60,362	17,038	24,265	3,550	2,906	965	1,056	169	63,269	18,003	25,321	3,719
2010	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2011	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2012	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2013	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2014	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2015	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2016	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2017	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2018	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2019	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2020	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2021	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2022	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2023	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2024	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2025	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2026	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
2027	61,467	17,576	24,791	3,550	2,960	996	1,079	169	64,426	18,571	25,870	3,719
NPV	$1,007,291	$272,281	$400,345	$62,601	$48,499	$15,426	$17,428	$2,974	$1,055,790	$287,706	$417,773	$65,575
TOTAL				$1,742,518				$84,326				$1,826,845
AVERAGE				$58,084				$2,811				$60,895

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IV. MEDIUM-DUTY VEHICLES

Overview and General Methodology

Annual costs and benefits for this action were determined for a thirty-year period starting in 1998, and discounted to 1995 to determine a net present value. Since this program affects medium-duty vehicles sold throughout California, costs were determined for their statewide impact. Benefits in the FIP areas were calculated based on the estimated percent of VMT in the FIP areas. The discounted stream of these costs and benefits was used to determine the cost-effectiveness value described below. A combined value for tons of NMHC and NOx reduction is used for the benefits since it is impossible to distribute costs between these two pollutants and in recognition of their combined influence on ozone NAAQS attainment. The cost-effectiveness calculation is made for the three FIP areas combined; no sensible way was available for determining a cost-effectiveness value for each FIP area individually. As with other statewide programs, a statewide cost-effectiveness value can also be calculated. It is estimated that about 48 percent of California's MDV VMT will be in the three FIP areas. Considering the emission reductions due to VMT in the rest of the state results in a cost-effectiveness value of $4,390/ton of the combined NMHC and NOx reductions.

Basic Assumptions

MDV sales in California were estimated based on nationwide sales and the fraction of vehicles registered in California. According to AAMA's Facts and Figures book, the 1993 nationwide sales of MDVs (GVWR between 6,000 and 14,000 pounds) was 1,259,332. In addition, approximately ten percent of nationwide new car and truck registrations were in California. Therefore, the number of MDVs sold in California in 1993 was estimated to be 125,933. Sales were estimated to grow at 2.1 percent per year, consistent with the estimates of sales growth used for heavy-duty vehicles. VMT per vehicle was estimated to grow at 0.7 percent per year, also consistent with the estimates of VMT growth used for heavy-duty vehicles. When combined with growth in sales, total MDV VMT was estimated to grow at 2.8 percent per year.

The fraction of California VMT in the three FIP areas was determined on the basis of 1990 MDV VMT estimates contained in CARB's EMFAC model (see below). The same fraction was assumed for all years modelled.

Area	1990 MDV VMT (1000 miles/day)
South Coast	13639
Sacramento	2426
Ventura	807

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Total FIP areas	16872
California	35187
Fraction of California MDV VMT in FIP areas	0.48

Cost

Under CARB's current regulations, manufacturers were to begin the phase in of MDVs meeting LEV and ULEV standards starting in 1998 (see below). Under the FIP, EPA is requiring manufacturers to comply with a more stringent phase in of the MDV LEV and ULEV standards (see below). Therefore, in determining the costs of the MDV FIP program, EPA estimated the cost based on the incremental difference between CARB's current requirements and the FIP requirements (i.e., the increased phase in requirements for MDV ULEVs).

Year	Current CARB Phase-in Schedule		FIP Phase-in Schedule	
	% LEVs	% ULEVs	% LEVs	% ULEVs
1998	25	2	10	10
1999	50	2	25	25
2000	75	2	50	50
2001	95	5	25	75
2002	90	10	0	100
2003	85	15	0	100

The incremental cost between a MDV meeting the LEV standards and one meeting ULEV standards was estimated based on cost information contained in CARB's staff report "1994 Low-Emission Vehicle and Zero-Emission Vehicle Program Review" and CARB's report "Proposed Regulations for Low-Emission Vehicles and Clean Fuels, Technical Support Document." As described in the technical support document for the FIP, EPA believes that the MDV ULEV standards are similar in stringency to the light-duty vehicle LEV standards. EPA also believes that similar technologies will be used on MDVs to meet the ULEV standards as will be used on light-duty vehicles to meet the LEV standards (and perhaps ULEV standards to a limited extent), with appropriate modifications. Therefore, in estimating the cost for MDVs to meet the ULEV standards EPA relied upon CARB's cost estimates for meeting the light-duty vehicle low-emission vehicle

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program standards. EPA used CARB's cost estimates for the largest light-duty vehicles (8-cylinder) because most MDVs are likely to be powered by similar engines. CARB estimated the cost for an 8-cylinder light-duty vehicle to be approximately $72 to meet the LEV standard and approximately $212 to meet the ULEV standard (both estimates are incremental to the TLEV standard). EPA weighted these light-duty vehicle cost estimates by 80 and 20 percent, respectively, to yield a cost of $100 per vehicle. In order to account for the differences between light-duty and medium-duty vehicles, EPA increased the cost by $20, the incremental cost between light-duty and medium-duty vehicles cited in CARB's technical support document noted above. Therefore, the incremental cost for MDVs to comply with the FIP requirements was estimated to be $120 per vehicle.

EPA believes that the technology used to comply with the more stringent FIP requirements, such as electrically heated catalysts, could result in a small fuel economy penalty. Therefore, EPA assumed a two percent fuel economy penalty for all vehicles subject to this action in estimating the overall cost of the program.

Combining the per vehicles costs and the fuel economy penalty over the 30-year period after which the FIP requirements take effect, yields a discounted (to 1995) cost of $599 million.

Emission Reductions

In a manner similar to the cost analysis, NOx and NMHC emission benefits were determined by comparing the incremental difference between CARB's current requirements and the FIP requirements (i.e., the increased phase in of the ULEV standards). It should be noted that CARB has five subcategories of MDVs. EPA based its analysis on the standards for the middle of the five subcategories, the subcategory in which most MDVs are expected to be certified. EPA estimated the fleetwide NOx and NMHC emission reductions taking into account annual mileage accumulation rates, emission deterioration rates, and fleet turnover statistics based on the information contained in EPA's CALI5 emissions model.

EPA's calculation of fleetwide emission reductions during the 30-year period after which the FIP requirements take effect, yields a discounted (to 1995) emission reduction of 57,029 tons of NOx and 8,439 tons of NMHC, or a total of 65,468 tons of pollutants.

Cost-Effectiveness

To calculate cost-effectiveness, EPA divided the statewide costs of the MDV program by the FIP area emission benefits (NOx and NMHC combined) of the MDV program. The resulting 30-year discounted cost-effectiveness is $9,150 per ton of pollutant reduced.

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Cost-effectiveness of MDV FIP requirements

Fraction of California MDV VMT accumulated in FIP areas (based on CARB's EMFAC/Burden output) :

Area	1990 MDV VMT
South Coast	13639
Sacramento	2426
Ventura	807
Total FIP areas	16872
California	35187

Estimated Fraction in FIP areas= 0.479

California Sales of MDVs (based on 6,000-14,000 pounds GVWR numbers from MVMA Facts and Figures) :

1993 Nationwide Sales	1259332
California Registration Fraction	0.1

Estimated California MDV Sales = 125933

Incremental Cost of ULEV compared to a LEV (based on previous CARB estimates) :

Estimated cost of ULEV compared to LEV = $120.00

30-year Discounted FIP area emission reductions (based on reductions from a ULEV incremental to a LEV) : tons (discounted to 1995)

NOx	NMHC	Total
57029	8439	65468

30-year Discounted California fleetwide costs (from a ULEV incremental to a LEV) :

Total Discounted (to 1995) Cost =5.99E+08

30-year Discounted Cost-Effectiveness :

Discounted C/E ($/ton) = 9150

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30-year Discounted Costs of MDV FIP Provisions (based on the costs of a ULEV incremental to a LEV)
(Discounted to 1995)

Discount rate =	0.03	
1993 California MDV sales =	125933	
Linear Sales growth rate =	0.021	
Incremental Cost (ULEV compared to LEV) =		$120.00
Fuel Economy Penalty =	0.02	
MDV Fuel Economy (MPG) =	14.3	
Cost of Fuel ($/gallon) =	$1.20	

Model Year	Calendar Year 1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1998	1.22E+06	1.85E+05	2.49E+05	2.04E+05	1.68E+05	1.42E+05	1.22E+05	1.02E+05	8.65E+04	7.15E+04	5.72E+04	4.72E+04	3.64E+04
1999	0.000	3.48E+06	5.27E+05	7.09E+05	5.81E+05	4.76E+05	4.04E+05	3.46E+05	2.90E+05	2.45E+05	2.03E+05	1.62E+05	1.34E+05
2000	0.000	0.000	7.18E+06	1.09E+06	1.46E+06	1.20E+06	9.82E+05	8.32E+05	7.12E+05	5.97E+05	5.05E+05	4.17E+05	3.34E+05
2001	0.000	0.000	0.000	1.03E+07	1.57E+06	2.11E+06	1.73E+06	1.41E+06	1.20E+06	1.02E+06	8.58E+05	7.27E+05	6.00E+05
2002	0.000	0.000	0.000	0.000	9.50E+06	1.44E+06	1.93E+06	1.58E+06	1.30E+06	1.10E+06	9.39E+05	7.86E+05	6.66E+05
2003	0.000	0.000	0.000	0.000	0.000	1.23E+07	1.86E+06	2.50E+06	2.04E+06	1.67E+06	1.42E+06	1.21E+06	1.01E+06
2004	0.000	0.000	0.000	0.000	0.000	0.000	1.21E+07	1.83E+06	2.46E+06	2.02E+06	1.65E+06	1.40E+06	1.19E+06
2005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.20E+07	1.81E+06	2.43E+06	1.99E+06	1.63E+06	1.38E+06
2006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.18E+07	1.79E+06	2.40E+06	1.96E+06	1.61E+06
2007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.17E+07	1.76E+06	2.37E+06	1.93E+06
2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.15E+07	1.74E+06	2.33E+06
2009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.13E+07	1.72E+06
2010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.12E+07
2011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Yearly Totals	1.22E+06	3.66E+06	7.95E+06	1.23E+07	1.33E+07	1.76E+07	1.91E+07	2.06E+07	2.17E+07	2.26E+07	2.33E+07	2.38E+07	2.41E+07

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MDV FIP Costs

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
2.92E+04	2.39E+04	1.93E+04	1.60E+04	1.19E+04	9.58E+03	7.61E+03	6.93E+03	7.09E+03	7.15E+03	7.54E+03	7.41E+03	0.00E+00	0.00E+00
1.03E+05	8.28E+04	6.76E+04	5.45E+04	4.53E+04	3.37E+04	2.71E+04	2.15E+04	1.96E+04	2.01E+04	2.02E+04	2.13E+04	2.10E+04	0.00E+00
2.75E+05	2.13E+05	1.70E+05	1.39E+05	1.12E+05	9.32E+04	6.92E+04	5.57E+04	4.42E+04	4.03E+04	4.12E+04	4.15E+04	4.38E+04	4.30E+04
4.80E+05	3.96E+05	3.05E+05	2.45E+05	2.00E+05	1.61E+05	1.34E+05	9.93E+04	8.00E+04	6.34E+04	5.78E+04	5.91E+04	5.96E+04	6.28E+04
5.50E+05	4.39E+05	3.62E+05	2.79E+05	2.24E+05	1.83E+05	1.47E+05	1.22E+05	9.07E+04	7.31E+04	5.80E+04	5.28E+04	5.40E+04	5.44E+04
8.58E+05	7.08E+05	5.66E+05	4.67E+05	3.60E+05	2.88E+05	2.35E+05	1.90E+05	1.57E+05	1.17E+05	9.41E+04	7.46E+04	6.79E+04	6.94E+04
1.00E+06	8.46E+05	6.98E+05	5.57E+05	4.60E+05	3.54E+05	2.84E+05	2.31E+05	1.87E+05	1.55E+05	1.15E+05	9.25E+04	7.33E+04	6.68E+04
1.18E+06	9.85E+05	8.34E+05	6.88E+05	5.49E+05	4.53E+05	3.49E+05	2.79E+05	2.28E+05	1.84E+05	1.52E+05	1.13E+05	9.10E+04	7.21E+04
1.36E+06	1.16E+06	9.71E+05	8.21E+05	6.77E+05	5.41E+05	4.46E+05	3.44E+05	2.75E+05	2.24E+05	1.81E+05	1.50E+05	1.11E+05	8.95E+04
1.58E+06	1.34E+06	1.14E+06	9.57E+05	8.09E+05	6.67E+05	5.32E+05	4.39E+05	3.38E+05	2.70E+05	2.21E+05	1.78E+05	1.47E+05	1.09E+05
1.91E+06	1.56E+06	1.32E+06	1.13E+06	9.42E+05	7.97E+05	6.57E+05	5.24E+05	4.32E+05	3.33E+05	2.66E+05	2.17E+05	1.75E+05	1.45E+05
2.30E+06	1.88E+06	1.54E+06	1.30E+06	1.11E+06	9.28E+05	7.84E+05	6.47E+05	5.16E+05	4.25E+05	3.27E+05	2.62E+05	2.13E+05	1.72E+05
1.69E+06	2.27E+06	1.85E+06	1.51E+06	1.28E+06	1.09E+06	9.14E+05	7.72E+05	6.36E+05	5.08E+05	4.18E+05	3.22E+05	2.57E+05	2.10E+05
1.10E+07	1.67E+06	2.23E+06	1.82E+06	1.49E+06	1.26E+06	1.08E+06	8.99E+05	7.60E+05	6.26E+05	4.99E+05	4.11E+05	3.17E+05	2.53E+05
0.000	1.09E+07	1.64E+06	2.20E+06	1.80E+06	1.47E+06	1.24E+06	1.06E+06	8.85E+05	7.48E+05	6.16E+05	4.91E+05	4.05E+05	3.11E+05
0.000	0.000	1.07E+07	1.62E+06	2.17E+06	1.77E+06	1.45E+06	1.22E+06	1.04E+06	8.71E+05	7.36E+05	6.06E+05	4.83E+05	3.98E+05
0.000	0.000	0.000	1.06E+07	1.59E+06	2.14E+06	1.74E+06	1.42E+06	1.20E+06	1.03E+06	8.57E+05	7.24E+05	5.96E+05	4.75E+05
0.000	0.000	0.000	0.000	1.04E+07	1.57E+06	2.10E+06	1.72E+06	1.40E+06	1.18E+06	1.01E+06	8.43E+05	7.12E+05	5.86E+05
0.000	0.000	0.000	0.000	0.000	1.02E+07	1.55E+06	2.07E+06	1.69E+06	1.38E+06	1.16E+06	9.93E+05	8.29E+05	7.00E+05
0.000	0.000	0.000	0.000	0.000	0.000	1.01E+07	1.52E+06	2.04E+06	1.66E+06	1.36E+06	1.15E+06	9.77E+05	8.16E+05
0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.93E+06	1.50E+06	2.00E+06	1.64E+06	1.34E+06	1.13E+06	9.60E+05
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.77E+06	1.47E+06	1.97E+06	1.61E+06	1.31E+06	1.11E+06
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.61E+06	1.45E+06	1.94E+06	1.58E+06	1.29E+06
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.46E+06	1.43E+06	1.91E+06	1.56E+06
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.30E+06	1.40E+06	1.88E+06
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.15E+06	1.38E+06
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.00E+06
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
													Total 3
2.43E+07	2.44E+07	2.44E+07	2.44E+07	2.42E+07	2.40E+07	2.38E+07	2.36E+07	2.33E+07	2.30E+07	2.27E+07	2.24E+07	2.21E+07	2.18E+07

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2025	2026	2027	Fleetwide (All of California) Costs Discounted to 1995
0.00E+00	0.00E+00	0.00E+00	2.85E+06
0.00E+00	0.00E+00	0.00E+00	8.09E+06
0.00E+00	0.00E+00	0.00E+00	1.67E+07
6.17E+04	0.00E+00	0.00E+00	2.40E+07
5.73E+04	5.63E+04	0.00E+00	2.20E+07
6.99E+04	7.37E+04	7.24E+04	2.84E+07
6.82E+04	6.87E+04	7.24E+04	2.80E+07
6.56E+04	6.71E+04	6.76E+04	2.76E+07
7.09E+04	6.45E+04	6.59E+04	2.71E+07
8.80E+04	6.97E+04	6.34E+04	2.67E+07
1.07E+05	8.65E+04	6.85E+04	2.62E+07
1.43E+05	1.06E+05	8.50E+04	2.58E+07
1.69E+05	1.40E+05	1.04E+05	2.53E+07
2.06E+05	1.66E+05	1.38E+05	2.49E+07
2.49E+05	2.03E+05	1.63E+05	2.44E+07
3.06E+05	2.45E+05	1.99E+05	2.38E+07
3.91E+05	3.01E+05	2.40E+05	2.33E+07
4.67E+05	3.85E+05	2.96E+05	2.27E+07
5.76E+05	4.59E+05	3.78E+05	2.20E+07
6.88E+05	5.67E+05	4.51E+05	2.13E+07
8.02E+05	6.77E+05	5.57E+05	2.05E+07
9.44E+05	7.88E+05	6.65E+05	1.96E+07
1.09E+06	9.28E+05	7.75E+05	1.87E+07
1.27E+06	1.07E+06	9.12E+05	1.76E+07
1.53E+06	1.25E+06	1.05E+06	1.64E+07
1.85E+06	1.50E+06	1.23E+06	1.51E+07
1.36E+06	1.81E+06	1.48E+06	1.36E+07
8.85E+06	8.85E+06	8.85E+06	2.65E+07
0-year discounted fleetwide (all of California) cost =			5.99E+08
2.15E+07	1.99E+07	1.80E+07	

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MDV FIP NOx Reductions

Age	0	1	2	3	4	5	6	7	8	9	10	11
Mileage Accum.	2201	10962	16568	15260	14056	12945	11923	10982	10115	9317	8581	7903
Survival Rate	1	1	0.9	0.81	0.73	0.68	0.64	0.59	0.55	0.5	0.44	0.4
LEV NOx	0.503	0.584	0.751	0.945	1.124	1.289	1.440	1.580	1.708	1.827	1.936	2.036
ULEV NOx	0.274	0.318	0.410	0.515	0.613	0.703	0.785	0.862	0.932	0.996	1.056	1.111

NOx Emission Reductions (discounted to 1995, incorporating survival)

	Calendar Year											
Model Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1998	4.07E-05	2.28E-04	3.87E-04	3.92E-04	3.76E-04	3.59E-04	3.37E-04	3.05E-04	2.75E-04	2.39E-04	1.99E-04	1.70E-04
1999		1.13E-04	6.36E-04	1.08E-03	1.09E-03	1.05E-03	1.00E-03	9.42E-04	8.52E-04	7.68E-04	6.67E-04	5.57E-04
2000			2.30E-04	1.29E-03	2.19E-03	2.22E-03	2.13E-03	2.03E-03	1.91E-03	1.73E-03	1.56E-03	1.35E-03
2001				3.26E-04	1.82E-03	3.10E-03	3.14E-03	3.01E-03	2.87E-03	2.70E-03	2.44E-03	2.20E-03
2002					4.06E-04	2.28E-03	3.87E-03	3.92E-03	3.76E-03	3.59E-03	3.37E-03	3.05E-03
2003						3.73E-04	2.09E-03	3.55E-03	3.59E-03	3.44E-03	3.29E-03	3.09E-03
2004							3.62E-04	2.03E-03	3.45E-03	3.49E-03	3.34E-03	3.19E-03
2005								3.51E-04	1.97E-03	3.35E-03	3.39E-03	3.25E-03
2006									3.41E-04	1.91E-03	3.25E-03	3.29E-03
2007										3.31E-04	1.86E-03	3.15E-03
2008											3.21E-04	1.80E-03
2009												3.12E-04
2010												
2011												
2012												
2013												
2014												
2015												
2016												
2017												
2018												
2019												
2020												
2021												
2022												
2023												
2024												
2025												

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MDV FIP NOx Reductions

12	13	14	15	16	17	18	19	20	21	22	23	24
7279	6704	6175	5688	5238	4825	4444	4093	3789	3939	4036	4036	4036
0.34	0.3	0.27	0.24	0.22	0.18	0.16	0.14	0.14	0.14	0.14	0.15	0.15
2.129	2.214	2.293	2.365	2.432	2.493	2.549	2.601	2.650	2.697	2.745	2.794	2.844
1.161	1.208	1.250	1.290	1.326	1.360	1.390	1.419	1.445	1.471	1.497	1.524	1.551

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1.35E-04	1.11E-04	9.26E-05	7.60E-05	6.40E-05	4.80E-05	3.90E-05	3.12E-05	2.85E-05	2.93E-05	2.97E-05	3.14E-05	3.10E-05	0.00E+00
4.76E-04	3.78E-04	3.10E-04	2.59E-04	2.12E-04	1.79E-04	1.34E-04	1.09E-04	8.70E-05	7.96E-05	8.18E-05	8.28E-05	8.77E-05	8.66E-05
1.13E-03	9.64E-04	7.66E-04	6.29E-04	5.24E-04	4.30E-04	3.62E-04	2.72E-04	2.21E-04	1.76E-04	1.61E-04	1.66E-04	1.68E-04	1.78E-04
1.91E-03	1.60E-03	1.37E-03	1.08E-03	8.90E-04	7.42E-04	6.08E-04	5.13E-04	3.84E-04	3.13E-04	2.50E-04	2.28E-04	2.35E-04	2.38E-04
2.75E-03	2.39E-03	1.99E-03	1.70E-03	1.35E-03	1.11E-03	9.26E-04	7.59E-04	6.40E-04	4.80E-04	3.90E-04	3.11E-04	2.85E-04	2.93E-04
2.80E-03	2.52E-03	2.19E-03	1.83E-03	1.56E-03	1.24E-03	1.02E-03	8.49E-04	6.96E-04	5.87E-04	4.40E-04	3.58E-04	2.86E-04	2.61E-04
3.00E-03	2.72E-03	2.45E-03	2.13E-03	1.77E-03	1.52E-03	1.21E-03	9.89E-04	8.24E-04	6.76E-04	5.70E-04	4.27E-04	3.47E-04	2.77E-04
3.10E-03	2.92E-03	2.64E-03	2.38E-03	2.07E-03	1.72E-03	1.47E-03	1.17E-03	9.60E-04	8.00E-04	6.56E-04	5.53E-04	4.15E-04	3.37E-04
3.15E-03	3.01E-03	2.83E-03	2.56E-03	2.31E-03	2.01E-03	1.67E-03	1.43E-03	1.14E-03	9.32E-04	7.77E-04	6.37E-04	5.37E-04	4.03E-04
3.19E-03	3.06E-03	2.92E-03	2.75E-03	2.48E-03	2.24E-03	1.95E-03	1.62E-03	1.39E-03	1.10E-03	9.05E-04	7.54E-04	6.19E-04	5.21E-04
3.06E-03	3.10E-03	2.97E-03	2.84E-03	2.67E-03	2.41E-03	2.17E-03	1.89E-03	1.58E-03	1.35E-03	1.07E-03	8.79E-04	7.32E-04	6.01E-04
1.75E-03	2.97E-03	3.01E-03	2.88E-03	2.75E-03	2.59E-03	2.34E-03	2.11E-03	1.84E-03	1.53E-03	1.31E-03	1.04E-03	8.53E-04	7.11E-04
3.03E-04	1.70E-03	2.89E-03	2.92E-03	2.80E-03	2.67E-03	2.51E-03	2.27E-03	2.05E-03	1.78E-03	1.49E-03	1.27E-03	1.01E-03	8.28E-04
	2.94E-04	1.65E-03	2.80E-03	2.84E-03	2.72E-03	2.60E-03	2.44E-03	2.21E-03	1.99E-03	1.73E-03	1.44E-03	1.23E-03	9.80E-04
		2.86E-04	1.60E-03	2.72E-03	2.75E-03	2.64E-03	2.52E-03	2.37E-03	2.14E-03	1.93E-03	1.68E-03	1.40E-03	1.20E-03
			2.77E-04	1.55E-03	2.64E-03	2.67E-03	2.56E-03	2.45E-03	2.30E-03	2.08E-03	1.88E-03	1.63E-03	1.36E-03
				2.69E-04	1.51E-03	2.56E-03	2.60E-03	2.49E-03	2.38E-03	2.23E-03	2.02E-03	1.82E-03	1.58E-03
					2.61E-04	1.46E-03	2.49E-03	2.52E-03	2.42E-03	2.31E-03	2.17E-03	1.96E-03	1.77E-03
						2.54E-04	1.42E-03	2.42E-03	2.45E-03	2.35E-03	2.24E-03	2.11E-03	1.90E-03
							2.46E-04	1.38E-03	2.35E-03	2.38E-03	2.28E-03	2.17E-03	2.04E-03
								2.39E-04	1.34E-03	2.28E-03	2.31E-03	2.21E-03	2.11E-03
									2.32E-04	1.30E-03	2.21E-03	2.24E-03	2.15E-03
										2.25E-04	1.26E-03	2.15E-03	2.17E-03
											2.19E-04	1.23E-03	2.09E-03
												2.13E-04	1.19E-03
													2.06E-04

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MDV FIP NOx Reductions

2024	2025	2026	2027	Per Vehicle Emission Reductions Discounted to	1995	Fleetwide (FIP Area) Reductions Discounted to	1995
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.004		286	
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.012		818	
1.76E-04	0.00E+00	0.00E+00	0.00E+00	0.025		1698	
2.52E-04	2.49E-04	0.00E+00	0.00E+00	0.035		2465	
2.97E-04	3.14E-04	3.10E-04	0.00E+00	0.044		3152	
2.69E-04	2.72E-04	2.88E-04	2.84E-04	0.041		2961	
2.54E-04	2.61E-04	2.64E-04	2.80E-04	0.039		2920	
2.69E-04	2.46E-04	2.53E-04	2.56E-04	0.038		2880	
3.27E-04	2.61E-04	2.39E-04	2.46E-04	0.037		2839	
3.91E-04	3.18E-04	2.54E-04	2.32E-04	0.036		2799	
5.06E-04	3.80E-04	3.09E-04	2.46E-04	0.035		2759	
5.83E-04	4.91E-04	3.69E-04	3.00E-04	0.034		2716	
6.90E-04	5.66E-04	4.77E-04	3.58E-04	0.033		2668	
8.04E-04	6.70E-04	5.50E-04	4.63E-04	0.031		2613	
9.52E-04	7.81E-04	6.51E-04	5.34E-04	0.030		2548	
1.16E-03	9.24E-04	7.58E-04	6.32E-04	0.029		2474	
1.32E-03	1.13E-03	8.97E-04	7.36E-04	0.027		2390	
1.54E-03	1.28E-03	1.10E-03	8.71E-04	0.026		2295	
1.72E-03	1.49E-03	1.24E-03	1.06E-03	0.024		2184	
1.85E-03	1.67E-03	1.45E-03	1.21E-03	0.023		2051	
1.99E-03	1.79E-03	1.62E-03	1.41E-03	0.021		1902	
2.05E-03	1.93E-03	1.74E-03	1.57E-03	0.019		1730	
2.08E-03	1.99E-03	1.87E-03	1.69E-03	0.016		1538	
2.11E-03	2.02E-03	1.93E-03	1.82E-03	0.014		1331	
2.02E-03	2.05E-03	1.96E-03	1.88E-03	0.011		1107	
1.16E-03	1.97E-03	1.99E-03	1.91E-03	0.009		875	
2.00E-04	1.12E-03	1.91E-03	1.93E-03	0.006		637	
	1.94E-04	1.09E-03	1.85E-03	0.004		394	

Total 30-year discounted fleetwide NOx emissions (tons) = 57029

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MDV FIP HC Reductions

Age	0	1	2	3	4	5	6	7	8	9	10	11
Mileage Accum.	2201	10962	16568	15260	14056	12945	11923	10982	10115	9317	8581	7903
Survival rate	1	1	0.9	0.81	0.73	0.68	0.64	0.59	0.55	0.5	0.44	0.4
LEV NMHC	0.116	0.126	0.146	0.170	0.192	0.212	0.231	0.248	0.264	0.279	0.292	0.304
ULEV NMHC	0.070	0.076	0.088	0.103	0.116	0.128	0.139	0.149	0.159	0.168	0.176	0.183

NMHC Emission Reductions (discounted to 1995, incorporating survival)

	Calendar Year											
Model Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1998	8.16E-06	4.29E-05	6.57E-05	6.11E-05	5.59E-05	5.14E-05	4.74E-05	4.21E-05	3.72E-05	3.20E-05	2.63E-05	2.23E-05
1999		2.28E-05	1.20E-04	1.83E-04	1.71E-04	1.56E-04	1.44E-04	1.32E-04	1.17E-04	1.04E-04	8.92E-05	7.33E-05
2000			4.62E-05	2.43E-04	3.72E-04	3.46E-04	3.16E-04	2.91E-04	2.68E-04	2.38E-04	2.10E-04	1.81E-04
2001				6.54E-05	3.44E-04	5.26E-04	4.89E-04	4.47E-04	4.12E-04	3.80E-04	3.37E-04	2.98E-04
2002					8.16E-05	4.29E-04	6.57E-04	6.11E-04	5.58E-04	5.14E-04	4.74E-04	4.20E-04
2003						7.48E-05	3.93E-04	6.02E-04	5.60E-04	5.12E-04	4.71E-04	4.34E-04
2004							7.26E-05	3.82E-04	5.85E-04	5.44E-04	4.97E-04	4.58E-04
2005								7.05E-05	3.71E-04	5.68E-04	5.28E-04	4.83E-04
2006									6.85E-05	3.60E-04	5.51E-04	5.13E-04
2007										6.65E-05	3.49E-04	5.35E-04
2008											6.45E-05	3.39E-04
2009												6.27E-05
2010												
2011												
2012												
2013												
2014												
2015												
2016												
2017												
2018												
2019												
2020												
2021												
2022												
2023												
2024												
2025												

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MDV FIP HC Reductions

12	13	14	15	16	17	18	19	20	21	22	23	24
7279	6704	6175	5688	5238	4825	4444	4093	3789	3939	4036	4036	4036
0.34	0.3	0.27	0.24	0.22	0.18	0.16	0.14	0.14	0.14	0.14	0.15	0.15
0.316	0.326	0.336	0.345	0.353	0.360	0.367	0.374	0.380	0.386	0.392	0.398	0.404
0.190	0.196	0.202	0.207	0.212	0.217	0.221	0.225	0.228	0.232	0.236	0.239	0.243

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1.76E-05	1.44E-05	1.19E-05	9.75E-06	8.16E-06	6.06E-06	4.92E-06	3.93E-06	3.60E-06	3.68E-06	3.71E-06	3.93E-06	3.87E-06
6.22E-05	4.92E-05	4.01E-05	3.32E-05	2.72E-05	2.28E-05	1.69E-05	1.37E-05	1.10E-05	1.00E-05	1.03E-05	1.04E-05	1.10E-05
1.49E-04	1.26E-04	9.97E-05	8.12E-05	6.74E-05	5.51E-05	4.62E-05	3.43E-05	2.78E-05	2.22E-05	2.04E-05	2.08E-05	2.10E-05
2.56E-04	2.10E-04	1.78E-04	1.41E-04	1.15E-04	9.54E-05	7.81E-05	6.54E-05	4.85E-05	3.94E-05	3.14E-05	2.88E-05	2.95E-05
3.72E-04	3.19E-04	2.63E-04	2.23E-04	1.76E-04	1.43E-04	1.19E-04	9.75E-05	8.16E-05	6.06E-05	4.91E-05	3.92E-05	3.60E-05
3.85E-04	3.41E-04	2.93E-04	2.41E-04	2.04E-04	1.62E-04	1.32E-04	1.09E-04	8.94E-05	7.48E-05	5.55E-05	4.51E-05	3.60E-05
4.22E-04	3.74E-04	3.31E-04	2.84E-04	2.34E-04	1.98E-04	1.57E-04	1.28E-04	1.06E-04	8.68E-05	7.26E-05	5.39E-05	4.37E-05
4.44E-04	4.10E-04	3.63E-04	3.21E-04	2.76E-04	2.27E-04	1.92E-04	1.52E-04	1.24E-04	1.03E-04	8.42E-05	7.05E-05	5.23E-05
4.69E-04	4.31E-04	3.98E-04	3.53E-04	3.12E-04	2.68E-04	2.20E-04	1.87E-04	1.48E-04	1.20E-04	9.99E-05	8.18E-05	6.85E-05
4.98E-04	4.55E-04	4.19E-04	3.86E-04	3.42E-04	3.03E-04	2.60E-04	2.14E-04	1.81E-04	1.44E-04	1.17E-04	9.70E-05	7.94E-05
5.20E-04	4.83E-04	4.42E-04	4.07E-04	3.75E-04	3.32E-04	2.94E-04	2.53E-04	2.08E-04	1.76E-04	1.39E-04	1.13E-04	9.42E-05
3.29E-04	5.05E-04	4.69E-04	4.29E-04	3.95E-04	3.64E-04	3.23E-04	2.85E-04	2.45E-04	2.02E-04	1.71E-04	1.35E-04	1.10E-04
6.08E-05	3.20E-04	4.90E-04	4.55E-04	4.16E-04	3.83E-04	3.53E-04	3.13E-04	2.77E-04	2.38E-04	1.96E-04	1.66E-04	1.31E-04
	5.91E-05	3.10E-04	4.76E-04	4.42E-04	4.04E-04	3.72E-04	3.43E-04	3.04E-04	2.69E-04	2.31E-04	1.90E-04	1.61E-04
		5.73E-05	3.01E-04	4.62E-04	4.29E-04	3.92E-04	3.61E-04	3.33E-04	2.95E-04	2.61E-04	2.24E-04	1.85E-04
			5.57E-05	2.93E-04	4.48E-04	4.17E-04	3.81E-04	3.51E-04	3.23E-04	2.87E-04	2.54E-04	2.18E-04
				5.41E-05	2.84E-04	4.35E-04	4.05E-04	3.70E-04	3.41E-04	3.14E-04	2.78E-04	2.46E-04
					5.25E-05	2.76E-04	4.23E-04	3.93E-04	3.59E-04	3.31E-04	3.05E-04	2.70E-04
						5.09E-05	2.68E-04	4.10E-04	3.81E-04	3.49E-04	3.21E-04	2.96E-04
							4.95E-05	2.60E-04	3.98E-04	3.70E-04	3.39E-04	3.12E-04
								4.80E-05	2.52E-04	3.87E-04	3.59E-04	3.29E-04
									4.66E-05	2.45E-04	3.75E-04	3.49E-04
										4.53E-05	2.38E-04	3.64E-04
											4.39E-05	2.31E-04
												4.27E-05

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MDV FIP HC Reductions

2023	2024	2025	2026	2027	Per Vehicle Emission Reductions Discounted to 1995	Fleetwide (FIP Area) Reductions Discounted to 1995
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.001	41
1.08E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.002	118
2.22E-05	2.19E-05	0.00E+00	0.00E+00	0.00E+00	0.004	246
2.97E-05	3.15E-05	3.10E-05	0.00E+00	0.00E+00	0.005	357
3.68E-05	3.71E-05	3.93E-05	3.86E-05	0.00E+00	0.006	457
3.30E-05	3.37E-05	3.40E-05	3.60E-05	3.54E-05	0.006	429
3.49E-05	3.20E-05	3.28E-05	3.30E-05	3.50E-05	0.006	424
4.25E-05	3.39E-05	3.11E-05	3.18E-05	3.20E-05	0.006	418
5.08E-05	4.12E-05	3.29E-05	3.02E-05	3.09E-05	0.005	413
6.65E-05	4.93E-05	4.00E-05	3.20E-05	2.93E-05	0.005	407
7.71E-05	6.45E-05	4.79E-05	3.89E-05	3.10E-05	0.005	402
9.14E-05	7.48E-05	6.27E-05	4.65E-05	3.77E-05	0.005	396
1.07E-04	8.87E-05	7.27E-05	6.08E-05	4.51E-05	0.005	390
1.28E-04	1.04E-04	8.62E-05	7.05E-05	5.91E-05	0.005	382
1.57E-04	1.24E-04	1.01E-04	8.37E-05	6.85E-05	0.004	374
1.79E-04	1.52E-04	1.20E-04	9.79E-05	8.12E-05	0.004	364
2.12E-04	1.74E-04	1.48E-04	1.17E-04	9.50E-05	0.004	352
2.39E-04	2.05E-04	1.69E-04	1.43E-04	1.13E-04	0.004	340
2.62E-04	2.32E-04	1.99E-04	1.64E-04	1.39E-04	0.004	325
2.87E-04	2.55E-04	2.25E-04	1.94E-04	1.59E-04	0.003	307
3.03E-04	2.79E-04	2.47E-04	2.19E-04	1.88E-04	0.003	287
3.19E-04	2.94E-04	2.71E-04	2.40E-04	2.12E-04	0.003	264
3.39E-04	3.10E-04	2.85E-04	2.63E-04	2.33E-04	0.003	238
3.54E-04	3.29E-04	3.01E-04	2.77E-04	2.55E-04	0.002	209
2.24E-04	3.44E-04	3.19E-04	2.92E-04	2.69E-04	0.002	177
4.14E-05	2.18E-04	3.34E-04	3.10E-04	2.83E-04	0.001	144
	4.02E-05	2.11E-04	3.24E-04	3.01E-04	0.001	108
		3.90E-05	2.05E-04	3.14E-04	0.001	70

Total 30 year discounted Fleetwide NMHC emisssions (tons) = 8439

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V. FIP Cost/Benefit Analysis for >50 HP Nonroad Engine Standard

The purpose of this document is to describe the methodology used by EPA to determine the cost effectiveness of a 4.0 g/hp-hr NOx standard for new nonroad engines with a rated power of 50 horsepower or greater. To allow manufacturers some flexibility in converting their product lines, the standards are phased-in by rated engine power over four years. The phase-in schedule is as follows: 175-750 hp in 2002, 100-175 hp in 2003, 50-100 hp in 2004, and 750+ hp in 2005. This cost/benefit analysis presents emission benefits in the FIP areas, technology mix of engines, costs for all of California, and a final cost/benefit result.

Emission Benefits

This section presents the methodology used to determine the FIP area benefits of a 4.0 g/hp-hr standard on large nonroad engines. Emission benefits are presented both as per-engine benefits and total FIP area benefits. Per-engine benefits are the tons of NOx reduced from an engine over the lifetime of that engine. Total FIP area benefits show the yearly reduction of NOx in the FIP areas as the result of the turnover from old engines to new engines certified to a 4.0 g/hp-hr NOx level. The key parts of this analysis are engine population, aggregate source NOx reductions, and per-engine NOx reductions.

Engine Population

The three California FIP areas are South Coast, Sacramento, and Ventura. California's Air Resources Board (ARB) supplied EPA with 1990 NOx (tpsd) estimates and linear growth rates for each of these three areas. By using data from the *Nonroad Engine and Vehicle Emissions Study,*[1] EPA was able to determine a 1990 engine population for South Coast. By coupling this data with the data supplied by ARB, annual populations were determined. The 1990 large nonroad engine populations and linear growth rates are presented in the following table:

Table 1
FIP Area 1990 Engine Populations and Linear Growth Rates

FIP Area	1990 Population	Linear Growth
South Coast	64,500	2.89%
Sacramento	4,500	1.70%
Ventura	1,900	1.39%
Total	70,900	--

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Aggregate Source NOx Reductions

The following information is needed for each engine category affected by this rule to calculate annual tons of NOx emitted: rated power, load factor, annual hours of operation, emission factor, and engine population. For this analysis 35 engine categories were used. Each category was further divided into spark-ignition and compression-ignition engines due to the differences in operation and emissions between these engine types. Due to the phase-in of the standards by power ranges, the categories were further divided into four power groupings.

The engine operation information above was taken from the nonroad study.[1] To calculate 1990 baseline NOx emissions for each category, the following formula was used (the total NOx inventory was determined by summing up the NOx emissions from each category):

$$MASS = POP \times HP \times LOAD \times HOURS \times EF$$

where:

MASS	=	FIP area NOx emissions (grams) for that category
POP	=	category population
HP	=	category average rated power (horsepower)
LOAD	=	ratio (%) between average operational power and rated power
HOURS	=	average annual hours of engine operation
EF	=	category average NOx emission factor (g/hp-hr)

The above equation was used to calculate emissions for each of the years following the baseline years. Changes in population due to engine sales and survival rates were accounted for. Linear growth rates supplied by ARB were applied to sales. Survival probability was based on a 16 year average useful life which resulted in maximum survivability of 30 years for this analysis.[2]

Changes in emission factors due to emission control technologies were applied to new engine sales. Emission factors were affected by a national 6.9 g/hp-hr NOx standard for compression-ignition engines phased-in from 1996 to 2000 and a California 5.8 g/hp-hr NOx standard for compression-ignition engines from 175 to 750 hp beginning in 2001. The 4.0 g/hp-hr NOx standard was phased-in from 2002 to 2005. California engines were assumed to emit seven percent lower NOx than a national standard would require due to the reformulated fuel used in California. Annual NOx emissions for the FIP areas are presented in Figure 1:

Per-Engine NOx Reductions

EPA also calculated NOx benefits as a per-engine emission reduction. Per-engine reductions are presented both as annual and lifetime NOx reductions. Benefits described in this section

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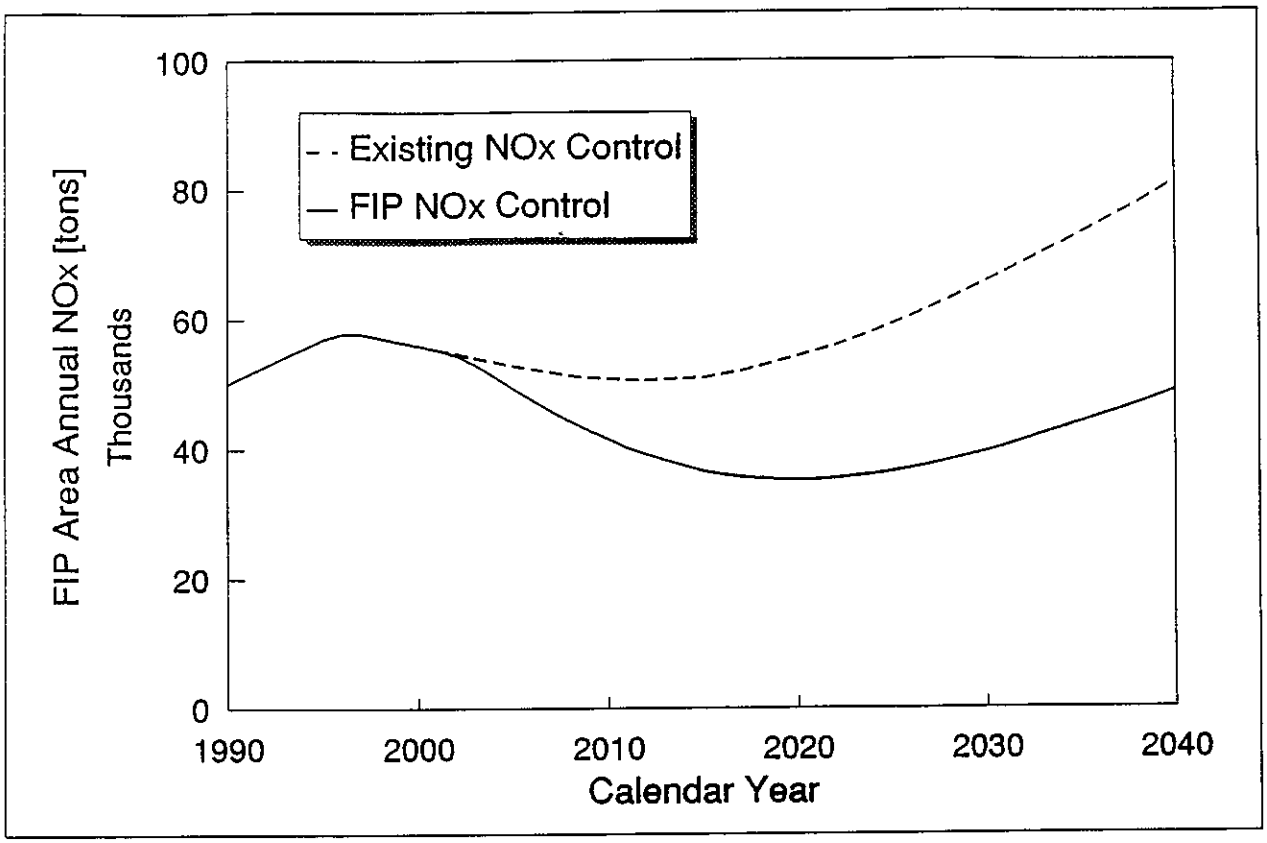

Figure 1: Projected FIP Area NOx Emissions from Nonroad Engines with Rated Power of 50 Horsepower or Greater

are presented as NOx reductions in the FIP areas divided by the number of engines sold in California.

Annual per-engine NOx was calculated by dividing the annual NOx from the total FIP area engine inventory by the number of engines in operation in California. NOx reduction was calculated as the difference between per-engine NOx with and without a 4.0 g/hp-hr NOx standard. The annual per-engine NOx levels with and without this standard were 0.07 and 0.04 tons, respectively. Therefore, the annual per-engine NOx reduction is 0.03 tons.

To determine the **lifetime per-engine NOx** reduction, an estimate for survival rate was needed. Survival rates from the nonroad compression-ignition engine rulemaking[2] were used. As annual emissions are directly related to annual usage, EPA calculated lifetime per-engine NOx reductions using the following formula:

$$LR_{NOx} = AR_{NOx,avg} X \sum_{j=1}^{j=30} (S_j X AU_{rel,j})$$

j	=	the age of the engine
S_j	=	the likelihood than an engine of age j remains in service

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$AR_{NOx,avg}$	=	the average annual reduction in per-engine NOx emissions
$AU_{rel,j}$	=	relative annual usage of an engine of age j
LR_{NOx}	=	lifetime per-source reduction in NOx

Because the reductions calculated above occur as a stream of annual reductions occurring over the lifetime of the engine, EPA also calculated the discounted value of the emissions using

$$LR_{NOx,disc} = AR_{NOx,avg} X \sum_{j=1}^{j=t} \frac{S_j X AU_{rel,j}}{(1+r)^{j-0.5}}$$

Here, the interest rate used for discounting is indicated by r. A three percent discount rate was used. The final lifetime NOx reduction is 0.43 tons without discounting. This amounts to a lifetime NOx reduction of 0.33 tons with discounting.

Technology Mix

This section presents the anticipated technology mix of California engines complying to a 4.0 g/hp-hr NOx new engine standard. Both compression-ignition (CI) and spark-ignition (SI) nonroad engines with a rated power of 50 horsepower or above are assumed to need modifications to meet the NOx standard.

Compression-Ignition Engines

Compression-ignition nonroad engines that are affected by this FIP will have already complied to national standards. These standards will be phased in from 1996 to 2000 and will include a 6.9 g/hp-hr NOx requirement. FIP area compression-ignition engines ranging from 175 to 750 horsepower will be designed to meet a California 5.8 g/hp-hr NOx standard which goes into effect in 2001.

EPA believes that compression-ignition nonroad engines can meet the 4.0 g/hp-hr NOx standard through enhanced aftercooling, combustion chamber design and calibration changes, and fuel system improvements. Exhaust gas recirculation and aftertreatment should not be necessary for this action. In the following table, the baseline (1990), existing (2001), and anticipated (2005) technology mixes for CI engines are presented for California:

Table 2
Effect of Emission Standards on
Technology Mix for CI Engines

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Technology Package	Pre-Control (1990 Market)	Existing Control (2001 Market)	FIP Control (2005 Market)
Naturally Aspirated	35%	28%	0%
Turbocharged	65%	72%	100%
Air to Water Aftercooling	15%	24%	24%
Air to Air Aftercooling	5%	9%	69%
Mechanical Fuel Injection	0%	99%	50%
Electronic Fuel Injection	0%	1%	50%
Timing Retard/Calibration	0%	100%	100%
Improved Fuel System	0%	55%	45%
Sophisticated Fuel Injectors	0%	0%	55%

Spark-Ignition Engines

Spark-ignition nonroad engines over 50 horsepower have not been required to meet any exhaust emission standards. However, these engines have baseline NOx levels much lower than the baseline NOx levels of the compression-ignition nonroad engines. EPA anticipates that these engines will meet the NOx standard through calibration changes and through the use of fuel injection systems. This analysis conservatively assumes that no SI nonroad engines have been upgraded to fuel injection prior to the FIP NOx standard. In the following table, the baseline (1990), existing (2001), and anticipated (2005) technology mixes for SI engines are presented for California:

Table 3
Effect of Emission Standards on
Technology Mix for SI Engines

Technology Package	Pre-Control (1990 Market)	Existing Control (2001 Market)	FIP Control (2005 Market)
Carburetion	100%	100%	40%
Throttle Body Fuel Injection	0%	0%	15%
Electronic Fuel Injection	0%	0%	45%

Cost Analysis

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This section estimates the costs of California engines complying to a 4.0 g/hp-hr NOx new engine standard with a rebuild program. In this analysis, the NOx standard is assumed to be implemented as a national rule with a phase-in by rated power from 2002 to 2005. Costs are calculated for all of California.

The methodology used in this cost analysis is similar to that used in the national rulemaking for nonroad compression-ignition engines.[2] Four main types of cost are analyzed: 1) variable hardware costs, 2) production life fixed costs, 3) annual fixed costs, and 4) consumer costs.

Major assumptions for the cost analysis are as follows:

- All engines comply in model year 2002.
- Inflation is three percent.
- Manufacturers will amortize fixed costs over ten years (assumed production life) with an amortization rate of seven percent.
- Annual sales growth is two percent.
- Future sales distribution is equivalent to the current engine family distribution.

Variable Hardware Costs

Variable hardware costs are those costs for hardware changes made to engines for compliance with new emission standards. Hardware costs are variable since they depend on production volumes.

EPA developed two variable hardware cost figures; one is representative of CI engines, and the another is representative of SI engines. These costs were developed directly from the incremental changes in the technology mixes of CI and SI engines (explained in the previous section). Costs of various technologies were weighted by the number of engines converting to those technologies. The following table presents the results of the weighted cost methodology:

Table 4
Weighted Average Variable Hardware Cost

Technology	Cost (1994 $)	Change in Market (%)	Weighted Cost (1994 $)
Compression-Ignition Engines			
Turbocharger	424	28	119
Air to Water	106	0	0
Air to Air	159	60	95
Electronics	318	49	156
Fuel System	164	-10	-16
New Injectors	255	55	140

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Average Per-Engine Weighted Cost			**494**
Spark-Ignition Engines			
Carburetor	212	-60	-127
TBI	265	15	40
EFI	530	45	239
Average Per-Engine Weighted Cost			**151**

Total annual variable hardware costs are calculated by multiplying engine sales for that year by the appropriate weighted variable costs in the above table.

Production Life Fixed Costs

Production life fixed costs are the calibration, development, test facility, and mechanical integrity costs required to develop a new product line. Production cycles for the engines included in this rule appear to be about ten years. Therefore, production life fixed costs are amortized over ten years for this cost analysis. EPA uses an amortization rate of seven percent.

Calibration Costs:

Calibration costs represent the costs associated with recalibrating the injection (or spark) timing system to achieve optimized emissions and performance under the constraints of the NOx emission standard. This analysis assumes that all of the engines (224 engine families) affected by the NOx standard will require some sort of recalibration. It is estimated that each recalibration would require 20 person-days, 15 for the technician and 5 for the engineer. The cost estimate assumes an eight hour day and a cost of $64/hour including labor and overhead. Because these recalibration costs are assumed to occur for every production cycle, EPA accounted for these costs three times over the 30 years that it takes the fleet to turn over.

Development Costs:

Development costs are those costs incurred by the engine manufacturers in modifying their engines to meet the NOx standard. Design costs for the components are included in the variable hardware costs. Therefore, the development costs are the result of days of personnel effort required to modify the engines. It is assumed that manufacturers would undertake two redesigns for each modification to an engine family and pick the one which best met their objectives. The following modifications are expected to be made to the engines affected by this rule:

1. **combustion chamber design**--EPA assumes that CI engines

requiring the addition of turbocharging or aftercooling, or fuel system redesign will undergo combustion chamber changes. These changes include changes to bore and stroke, combustion bowl redesign, and adjustments to the fuel injectors.

2. **aftercooler/intercooler system**--In adding this hardware to CI engines, the manufactures must determine the proper air supply, placement of the system, connecting hardware, etc.
3. **electronic control**--This refers to adding electronic control to CI engines. Incremental calibration costs between satisfactory operation and fine tuning for the NOx standard are not included.
4. **throttle body fuel injection**--These costs are associated with fitting a TBI system on a SI engine in place of a carburetor. Some modification of the inlet manifold may be necessary.
5. **electronic fuel injection**--SI engine manufacturers are assumed to use port fuel injection in an EFI system. The inlet manifold must be modified for positioning the fuel injectors. Some combustion chamber redesign may be necessary.

The following table presents the estimate number of days of personnel effort required to address the system design on average:

Table 5
Development Person-Days

System Categories	1	2	3	4	5
# Redesigns	2	2	2	2	2
	Person-Days per Redesign				
Machinist's Days	9	0	0	7	15
Mechanic's Days	5	9	12	7	5
Technician's Days	58	87	68	58	80
Engineer's Days	58	35	50	58	60
Total Person-days	260	262	260	260	320

Development costs for these engines are based on the total person-days for each modification and a rate of $509/day (based on eight hour days) including labor and overhead. These costs are applied to the percentage of engine families incorporating each technology. The total unamortized and undiscounted development cost estimate for a national NOx standard of 4.0 g/hp-hr is presented in the following table:

Table 6
National Development Costs

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Design	Full-Time Person-Days	% Engine Families	$/Day	Total ($ Million)
Compression-Ignition Engines				
Combustion Chamber	260	75	509	21.1
Aftercooler	262	72	509	20.3
Electronic Control	260	49	509	13.8
Spark-Ignition Engines				
TBI	260	15	509	0.22
EFI	320	45	509	0.75
Approximate Total Development Costs				56.2

Test Facility Costs:

These are the costs for construction and/or expansion of certification quality test facilities. EPA assumes that all of the test facilities necessary for this rule due to the existing national nonroad CI emission standards. In addition, most SI engine manufacturers already have test facilities for their engines. This analysis assumes that three new test cells will have to be built as a result of this rule.

The estimated cost of each cell is about $212,500. This total cost consists of approximately $80,000 for a water brake or eddy dynamometer, $106,000 for basic instrumentation and analyzers, and $26,500 for automated data processing and wiring. EPA estimates that the dynamometer can be amortized over 30 years, the basic instrumentation and analyzers can be amortized over 10 years, and the automated data processing and wiring can be amortized over 5 years. At the end of its amortization life, each component is assumed to be replaced. This results in an annual cost of approximately $84,000 when amortized at seven percent.

Mechanical Integrity Costs:

Mechanical integrity costs are those costs associated with useful life accumulation and testing to insure the performance and durability of the new engine designs. EPA assumes that manufacturers will perform these tests on engines that have added turbocharging, aftercooling, electronic control, or new fuel injection systems to their engines. This constitutes about 85% of the compression-ignition engine families and about 60% of the spark-ignition engine families. The mechanical integrity testing is assumed to take 1000 hours at $64/hour. The annual cost would be approximately 2.6 million dollars which represents the total mechanical integrity cost amortized over the expected 10 year

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production life at seven percent.

Annual Fixed Costs

This section describes annual fixed costs that result from the certification and enforcement programs in this rule. Annual fixed costs associated with hardware were included in a previous section. The annual fixed costs are made up of new engine certification, emission defect reporting, selective enforcement auditing, and rebuild certification costs. All of the costs reported in this analysis are based on the cost analysis for the existing national nonroad compression-ignition rule.[2]

New Engine Certification:

Manufacturers must certify each engine family to prove to EPA that the engines will be built to meet the emission standards. Certification costs are a combination of emission testing, record keeping, and reporting costs. New compression-engines are assumed to have no incremental certification or enforcement costs because of the existing national rule. However, because spark-ignition land-based nonroad engines have not previously been regulated, certification costs are added for these engines. Incremental annual certification costs are estimated to be about half of a million dollars per year.

Emission Defect Reporting:

Emission defect warranty reporting is required under EPA's enforcement program for these engines. Based on a cost estimate for existing nonroad CI engine manufacturers of about $13,800/year, EPA estimates that the cost to SI engine manufacturers would be about $710/year.

Selective Enforcement Auditing (SEA):

SEA testing refers to assembly line testing performed to verify that production engines meet the family certification levels. This program is similar to the program used for on-highway heavy-duty engines. EPA estimates that more than half of the nonroad engine manufacturers will voluntarily collect assembly line emission test data. Again, CI engine manufacturers are already incurring this cost due to the existing national rule. SEA costs include testing, record keeping, and reporting costs.

Consumer Costs

Consumer costs include the increase in retail price and engine operating costs. The increase in retail price is due to profit and overhead for both the manufacturer and the dealer. Variable hardware costs are multiplied by a manufacturer factor.

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Recalibration, design, mechanical integrity, certification, emission defect reporting, and SEA costs are added to this figure. This result is then multiplied by a dealer factor. The manufacturer and dealer factors are 1.282 and 1.062 respectively. These factors are taken from the cost analysis for the existing national nonroad CI rule.[2]

Engine operating costs are made up of fuel and maintenance costs. EPA assumed that any emission control strategy used by the engine manufacturers for this rule would include the necessary technology for maintaining or improving fuel economy from the regulated engines. These costs have been included under variable hardware costs. EPA also has not seen evidence that the addition of turbochargers, aftercoolers, or electronic fuel injection will affect the maintenance schedules for these engines. Therefore, EPA is not including any engine operating cost impact.

Presentation of Costs

The cost estimates in this analysis are for engines sold in California only. Variable hardware costs are calculated for the estimated California sales only. Fixed costs are first calculated for nationwide sales, but EPA assumes that these costs will be distributed evenly over nationwide sales. Only the fixed costs assumed to be distributed over California sales are included in this cost analysis.

EPA's cost analysis is presented in terms of annualized costs as recovered over the 30 years necessary for a full turnover. This means that costs which occur in years preceding production are assumed to be recovered over sales throughout the production cycle. In other words, the methodology attributes the first year of amortized costs to the first year of sales, the second year of amortized costs to the second year of sales, etc. These costs are shown in year of recovery in future value.

Corresponding present values for the annualized total costs and cost effectiveness are also presented in this analysis. The present values are stated in 1994 dollars. The total cost and benefit streams are discounted at three percent.

Annualized costs as recovered for California are presented in Table 7. Corresponding present values to the annualized costs are presented in Table 8.

Cost/Benefit Analysis

When EPA evaluates the effectiveness of various emission control strategies, EPA looks at the costs incurred per benefits achieved. Typically, this cost effectiveness is presented as dollars per ton of pollutant reduced. All other things being equal, EPA will follow through on the control strategy with the lowest cost per benefit.

To calculate the cost effectiveness for the FIP areas only, EPA used the total California costs, but only the FIP area

benefits. The NOx standard for nonroad engines with rated power of 50 horsepower or greater is estimated to have a cost effectiveness of $2,510 per ton of NOx reduced. This cost per ton of NOx reduction is based on the ratio of the net present value of the stream of costs divided by the net present value of the stream of benefits. The cost and benefit stream are calculated over the 30 years it takes the fleet to turn over.

Although the FIP measures were initiated specifically for the three FIP areas, the nature of this new engine standard creates NOx benefits throughout all of California. If total California benefits are used in calculating the cost effectiveness, the result is $604 per ton of NOx reduced. In either case, the cost per engine is $828.

References

1. Environmental Protection Agency, *Nonroad Engine and Vehicle Emission Study*, EPA Report Number 21A-2001, Washington, DC, November 1991.

2. Environmental Protection Agency, Regulatory Impact Analysis and Regulatory Support Document, *Control of Air Pollution; Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts (50 Horsepower)*, May 27, 1994.

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Table 7

California Annualized Costs as Recovered

Year	Variable Hardware Cost	Recali-bration	Design	Test Facility	Mechanical Integrity Testing	Certifi-cation	Emission Defect Reporting	Selective Enforcement Auditing	ANNUALIZED TOTAL
2002	18,125,091	273,038	875,709	9,089	178,711	49,341	70	8,657	19,519,706
2003	18,487,593	273,038	875,709	9,089	178,711	49,696	70	8,657	19,882,563
2004	18,857,344	273,038	875,709	9,089	178,711	49,696	70	8,657	20,252,315
2005	19,234,491	273,038	875,709	9,089	178,711	49,696	70	2,309	20,623,113
2006	19,619,181	273,038	875,709	9,089	178,711	49,696	70	2,309	21,007,803
2007	20,011,565	273,038	875,709	9,089	178,711	49,696	70	2,309	21,400,187
2008	20,411,796	273,038	875,709	9,089	178,711	49,696	70	2,309	21,800,418
2009	20,820,032	273,038	875,709	9,089	178,711	49,696	70	2,309	22,208,654
2010	21,236,433	273,038	875,709	9,089	178,711	49,696	70	2,309	22,625,055
2011	21,661,161	273,038	875,709	9,089	178,711	49,696	70	2,309	23,049,783
2012	22,094,385	273,038	0	9,089	0	49,696	70	2,309	22,428,586
2013	22,536,272	273,038	0	9,089	0	49,696	70	2,309	22,870,474
2014	22,986,998	273,038	0	9,089	0	49,696	70	2,309	23,321,199
2015	23,446,738	273,038	0	9,089	0	49,696	70	2,309	23,780,939
2016	23,915,672	273,038	0	9,089	0	49,696	70	2,309	24,249,874
2017	24,393,986	273,038	0	9,089	0	49,696	70	2,309	24,728,188
2018	24,881,866	273,038	0	9,089	0	49,696	70	2,309	25,216,067
2019	25,379,503	273,038	0	9,089	0	49,696	70	2,309	25,713,705
2020	25,887,093	273,038	0	9,089	0	49,696	70	2,309	26,221,295
2021	26,404,835	273,038	0	9,089	0	49,696	70	2,309	26,739,036
2022	26,932,931	273,038	0	9,089	0	49,696	70	2,309	27,267,133
2023	27,471,590	273,038	0	9,089	0	49,696	70	2,309	27,805,792
2024	28,021,022	273,038	0	9,089	0	49,696	70	2,309	28,355,224
2025	28,581,442	273,038	0	9,089	0	49,696	70	2,309	28,915,644
2026	29,153,071	273,038	0	9,089	0	49,696	70	2,309	29,487,273
2027	29,736,133	273,038	0	9,089	0	49,696	70	2,309	30,070,334
2028	30,330,855	273,038	0	9,089	0	49,696	70	2,309	30,665,057
2029	30,937,472	273,038	0	9,089	0	49,696	70	2,309	31,271,674
2030	31,556,222	273,038	0	9,089	0	49,696	70	2,309	31,890,424
2031	32,187,346	273,038	0	9,089	0	49,696	70	2,309	32,521,548
2032	32,831,093	0	0	9,089	0	49,696	70	2,309	32,892,257

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Table 8

Annualized Costs and Corresponding Present Values

(1) Year	(2) Annualized Total [1994 $]	(3) Present Value of (2) [1994 $]	(4) Total Increase in Retail Cost [1994 $]	(5) Present Value of (4) [1994 $]	(6) Present Value Per-Engine (4) [1994 $]	(7) Present Value Per-Engine Cost-Effectiveness ($/ton of NOx reduced) [1994 $]
2002	19,519,706	15,409,036	26,158,102	20,649,448	542	501
2003	19,882,563	15,238,329	26,652,020	20,426,554	526	501
2004	20,252,315	15,069,624	27,155,432	20,206,191	510	500
2005	20,623,113	14,898,576	27,662,169	19,983,739	495	500
2006	21,007,803	14,734,451	28,185,918	19,769,036	480	499
2007	21,400,187	14,572,486	28,720,142	19,557,019	465	499
2008	21,800,418	14,412,645	29,265,050	19,347,646	451	498
2009	22,208,654	14,254,890	29,820,857	19,140,873	438	498
2010	22,625,055	14,099,186	30,387,780	18,936,660	424	497
2011	23,049,783	13,945,498	30,966,041	18,734,964	412	497
2012	22,428,586	13,174,431	30,436,073	17,877,985	385	479
2013	22,870,474	13,042,712	31,037,696	17,700,364	374	479
2014	23,321,199	12,912,383	31,651,352	17,524,586	363	478
2015	23,780,939	12,783,427	32,277,280	17,350,629	352	478
2016	24,249,874	12,655,827	32,915,728	17,178,471	342	478
2017	24,728,188	12,529,569	33,566,944	17,008,093	332	478
2018	25,216,067	12,404,634	34,231,184	16,839,474	322	478
2019	25,713,705	12,281,009	34,908,709	16,672,594	313	478
2020	26,221,295	12,158,676	35,599,785	16,507,433	304	478
2021	26,739,036	12,037,622	36,304,682	16,343,971	295	478
2022	27,267,133	11,917,830	37,023,677	16,182,189	286	478
2023	27,805,792	11,799,287	37,757,053	16,022,068	278	478
2024	28,355,224	11,681,977	38,505,095	15,863,589	269	477
2025	28,915,644	11,565,886	39,268,099	15,706,735	262	477
2026	29,487,273	11,451,000	40,046,362	15,551,486	254	477
2027	30,070,334	11,337,305	40,840,191	15,397,824	246	477
2028	30,665,057	11,224,788	41,649,896	15,245,732	239	477
2029	31,271,674	11,113,434	42,475,796	15,095,193	232	477
2030	31,890,424	11,003,230	43,318,213	14,946,188	225	477
2031	32,521,548	10,894,164	44,177,479	14,798,702	219	477
2032	32,892,257	10,697,422	44,763,964	14,558,412	211	474

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VI. AIRPORT GROUND SUPPORT EQUIPMENT and AIRCRAFT AUXILIARY POWER UNITS

Overview and General Methodology

Ground Support Equipment - For each airport located in the FIP areas which serviced commercial airplanes, the existing ground support equipment was surveyed. For each type of ground support equipment, a cost of conversion to electric equipment was determined. Replacement of existing equipment was based on assumption of turnover; existing equipment was phased out (either retired or moved to a new location to replace existing equipment being retired or to satisfy growth demands). Anticipated growth at each airport was also reflected through the growth in ground support equipment. The incremental cost of electrically-powered ground support equipment over traditional equipment was applied to this growth in equipment needs. Emission benefits per piece of equipment were also determined and accumulated according to the same phase-in schedule for the equipment. Thus airport-specific streams of costs and emission benefits were determined. These were then discounted over time to determine present values and a cost-effectiveness number was calculated for conversion of ground equipment at each airport. These can then be merged to determine a FIP area cost-effectiveness value for this action.

Auxiliary Power Units - Much the same methodology was followed for auxiliary power units. At each affected airport, the use of auxiliary power would diminish as the aircraft is attached to electric power at the gate as soon as possible after arriving. Likewise, the aircraft would remain attached to electrical service as long as possible prior to departure. The emission benefits are due to the lesser use of APU's. The costs include any additional cost to bring necessary electrical supply to the aircraft, cost of the electrically used, and the impact on annual cost of the APU (including less maintenance due to less use) due to greater reliance on electrical service.

Both the ground support equipment and auxiliary power unit impacts are considered in the following analyses and tables.

Assumptions and analyses

The following tables detail the analyses. Included are values for the incremental cost of equipment, the cost of converting the infrastructure of the airport to support electrified ground support equipment and the difference in operating costs (including energy and maintenance costs) between the electrically-powered equipment and traditional equipment.

This analysis indicates that conversion to electrically-powered ground support equipment has a net economic benefit due to the lower operating costs. Cost streams were determined through 2010. Analyses beyond 2010 were not performed due to the potentially large impact of growth assumptions and since the cost

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stream would continue to indicate a net cost advantage of the conversions. In fact, the cost advantage should continue to grow as the number of electrically-powered units grow and because the initial costs of infrastructure conversion is already taken into account.

Table V-1 summarizes the cost-effectiveness calculations for each airport and FIP area.

Table V-1
Cost Effectiveness Table

	Ground Support Equipment		
	Cost (present value)	NOx Benefits - Tons (present value)	HC Benefits - Tons (present value)
South Coast	($11,436,016)*	6,567	2431
Sacramento	($1,044,071)	590	298
	Auxiliary Power Units		
South Coast	($224,034,607)	7,165	232
Sacramento	($1,533,420)	58	3

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APU ANALYSIS (Summary of Cost and Emission Outputs)
Net Present Value of APU Mitigation Costs and Benefits

Airport	Costs ($)*	HC Emissions Benefit (lbs)	NOx Emissions Benefit (lbs)
Burbank	($2,029,742)	13,905	275,030
John Wayne	$1,269,301	6,076	125,570
Long Beach	($5,120,525)	23,210	371,399
Los Angeles Intl	($188,406,839)	338,268	11,740,136
Ontario	($29,746,802)	83,445	1,818,236
Sacramento Metro	($1,533,420)	5,969	115,406

* Some costs are negative and, therefore, a savings

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Net Present Value of APU Mitigation Costs

Airport	COST ($)*
Burbank	($2,029,742)
John Wayne	$1,269,301
Long Beach	($5,120,525)
Los Angeles Intl	($188,406,839)
Ontario	($29,746,802)
Sacramento Metro	($1,533,420)

* Some costs are negative and, therefore, a savings

JAN 27 1995

APU COST ANALYSIS (Inputs)*

Airport	APU Operation** (hrs/LTO)	Air Carrier LTOs (LTOs/yr) 1990	2000	2005	2010	APU O&M COST*** ($/hr)	No. of Gates	Current Gate Status (Power/PCA)	Gate Requirements (Power/PCA)	Power Cost per Gate: Installed Capital ($000)	Power Cost per Gate: Energy ($/month)	PCA Cost per Gate: Installed Capital ($000)	PCA Cost per Gate: Energy ($/month)
Burbank	0.736	30,517	42,800	48,942	55,083	$36.65	14 *3*	- -	Power/PCA *Power*	$40 *$110*	$430	$130	$1,250
John Wayne	0.658	37,424	52,487	60,018	67,550	$36.65	14 *3*	Power -	PCA *Power*	$40 *$110*	$430	$130	$1,250
Long Beach	1.650	14,586	20,460	23,396	26,331	$36.65	15 *3*	- -	Power/PCA *Power*	$40 *$110*	$430	$130	$1,250
Los Angeles Intl	1.756	240,580	337,411	385,828	434,246	$47.60	45 60 *21*	Power/PCA Power -	- PCA *Power*	$40 $40 *$110*	$430	$130	$1,416
Ontario	1.927	45,817	64,258	73,479	82,700	$39.99	30 *6*	- -	Power/PCA *Power*	$40 *$110*	$430	$130	$1,275
		1990	1999	2000	2005								
Sacramento Metro****	0.428	39,722	46,145	48,802	52,913	$36.65	3 11 *3*	Power/PCA - -	- Power/PCA *Power*	$40 $40 *$110*	$430	$130	$1,250

* Sources: APU Operation - ATA Comments on the Proposed FIP and 1994 TSD (Sacramento Metro)
Air Carrier LTOs - Technical Support Document Errata memo (1990) and South Coast Aviation Growth Rates memo
APU O&M Cost - ASSI study
No. of Gates - 1994 TSD (additional information was obtained for Los Angeles Intl)
Current Gate Status - 1994 TSD
Power Cost per Gate - AA (Installed Capital) and Washington National Airport study (Energy). Capital cost includes $5,000 per gate for mobile back-up to fixed ground power.
PCA Cost per Gate - AA (Installed Capital) and Aviation Systems, Inc. (Energy). Capital costs includes $5,000 per gate for mobile back-up to PCA.

** For all airports except Sacramento Metro, the APU operational time includes APU operation during aircraft taxi.

*** APU O&M Costs were estimated from narrow body and wide body O&M costs weighted by percentage of airport's LTOs. O&M costs were calculated using maintenance costs ($14.60/hour maintenance for narrow body aircraft, $50.90/hour maintenance for wide body aircraft) and fuel consumption data (37 gallons/hour fuel for narrow body aircraft, 50 gallons/hour fuel for wide body aircraft) from ASSI study and $0.65/gallon fuel cost. Percentage of airport's LTOs were calculated using airport LTO data by aircraft class contained in the South Coast Aviation Growth Rates memo. The following equations were used:

Narrow Body = [$14.60 + (37gal x $0.65/gal)] x % of airport LTOs
Wide Body = [$50.90 + (50gal x $0.65/gal)] x % of airport LTOs

**** Sacramento Metro APU operational time reduces to 0.167 hours/LTO beginning in 2005 due to planned facility modifications.

NOTE: Italicized information refers to remote and maintenance gates. The number of remote and maintenance gates was estimated to be 20% of the total number of airport gates. It was assumed that these gates only would require fixed power. It also was assumed that the installation cost would be 3 times higher than for a permanent facility gate installation, but that the energy costs would be the same.

JAN 27 1995

APU COST ANALYSIS
- Fixed System Costs -
($/gate)

Airport	Power Cost		PCA Cost	
	Installed Capital* ($/gate)	Energy ($/year/gate)	Installed Capital** ($)	Energy ($/year/gate)
Burbank (remote)	$40,000 $110,000	$5,160	$130,000	$15,000
John Wayne (remote)	$40,000 $110,000	$5,160	$130,000	$15,000
Long Beach (remote)	$40,000 $110,000	$5,160	$130,000	$15,000
Los Angeles Intl (remote)	$40,000 $110,000	$5,160	$130,000	$16,992
Ontario (remote)	$40,000 $110,000	$5,160	$130,000	$15,300
Sacramento Metro (remote)	$40,000 $110,000	$5,160	$130,000	$15,000

* Includes $5,000/gate for mobile back-up unit for ground power system.
** Includes $5,000/gate for mobile back-up unit for PCA equipment.

JAN 27 1995

APU COST ANALYSIS (Outputs)
AIRPORT: Burbank

Year	Total LTOs (LTOs/year)	Passenger LTOs (LTOs/year)	All Cargo LTOs* (LTOs/year)	Passenger LTO APU O&M Cost ($/year)	All Cargo LTO* APU O&M Cost ($/year)	Net Present Value of APU Mitigation Costs ($)**	
1990	30,517	30,268	249				
1991	31,745	31,487	259				
1992	32,974	32,705	269				
1993	34,202	33,923	279				
1994	35,430	35,142	289				
1995	36,659	36,360	299	$591,635	$4,859	$0	
1996	37,887	37,578	309	$611,459	$5,022	$0	
1997	39,115	38,796	319	$631,283	$5,185	$0	
1998	40,343	40,015	329	$651,106	$5,347	$0	
1999	41,572	41,233	339	$670,930	$5,510	($2,355,849)	Note: 1995 Present Value for 1999 Requirement
2000	42,800	42,451	349	$690,754	$5,673	$0	
2001	44,028	43,670	359	$710,579	$5,836	$0	
2002	45,257	44,888	369	$730,404	$5,999	$326,107	Note: 1995 Present Value for 2002 Requirement
2003	46,485	46,107	379	$750,229	$6,162	$0	
2004	47,714	47,325	389	$770,055	$6,324	$0	
2005	48,942	48,543	399	$789,880	$6,487	$0	
2006	50,170	49,762	409	$809,702	$6,650	$0	
2007	51,398	50,980	419	$829,524	$6,813	$0	
2008	52,627	52,198	429	$849,346	$6,976	$0	
2009	53,855	53,416	439	$869,168	$7,138	$0	
2010	55,083	54,634	449	$888,990	$7,301	$0	
	APU operation (hrs/LTO)*** =		0.421			($2,029,742)	
	APU O&M cost ($/hr) =		38.65				

* 0.8146% of the airport's total LTOs, based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990.

** Some costs are negative and, therefore, a savings

*** Excludes 5.5 min/LTO (0.092 hrs/LTO) for gate operation and 13.5 min/LTO (0.225 hrs/LTO) for taxi operation, which are allowed APU operations.
The time allowed for APU operation during aircraft taxi is equivalent to the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU COST ANALYSIS (Calculations)*
AIRPORT: Burbank

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1991310	-408514	-428339	-448164	-467989	-487815	-507640	-527462	-547284	-567106	-586928	-606750
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	339481	9318	9156	8993	8830	8667	8504	8342	8179
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Some costs are negative and, therefore, a savings

Discount Rate = 3%

APU COST ANALYSIS (Outputs)
AIRPORT: John Wayne

Year	Total LTOs (LTOs/year)	Passenger LTOs (LTOs/year)	All Cargo LTOs* (LTOs/year)	Passenger LTO APU O&M Cost ($/year)	All Cargo LTO* APU O&M Cost ($/year)	Net Present Value of APU Mitigation Costs ($)**	
1990	37,424	37,424	0				
1991	38,930	38,930	0				
1992	40,437	40,437	0				
1993	41,943	41,943	0				
1994	43,449	43,449	0				
1995	44,956	44,956	0	$276,267	$0	$0	
1996	46,462	46,462	0	$285,524	$0	$0	
1997	47,968	47,968	0	$294,781	$0	$0	
1998	49,474	49,474	0	$304,038	$0	$0	
1999	50,981	50,981	0	$313,294	$0	$900,040	Note: 1995 Present Value for 1999 Requirement
2000	52,487	52,487	0	$322,551	$0	$0	
2001	53,993	53,993	0	$331,807	$0	$0	
2002	55,499	55,499	0	$341,063	$0	$369,261	Note: 1995 Present Value for 2002 Requirement
2003	57,006	57,006	0	$350,319	$0	$0	
2004	58,512	58,512	0	$359,575	$0	$0	
2005	60,018	60,018	0	$368,832	$0	$0	
2006	61,524	61,524	0	$378,089	$0	$0	
2007	63,031	63,031	0	$387,346	$0	$0	
2008	64,537	64,537	0	$396,604	$0	$0	
2009	66,044	66,044	0	$405,861	$0	$0	
2010	67,550	67,550	0	$415,118	$0	$0	
	APU operation (hrs/LTO)*** =		0.159			$1,269,301	
	APU O&M cost ($/hr) =		38.65				

* No all cargo LTOs reported in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990. Assumes no future all cargo operations in future years.
Analysis assumes all remote gates at John Wayne Airport are used for maintenance only.
** Some costs are negative and, therefore, a savings
*** Excludes 5.5 min/LTO (0.092 hrs/LTO) for gate operation and 18.4 min/LTO (0.307 hrs/LTO) for taxi operation, which are allowed APU operations.
The time allowed for APU operation during aircraft taxi is equivalent to the FAA airport average taxi time.
NOTE: Discount Rate = 3%

JAN 27 1995

APU COST ANALYSIS (Calculations)*
AIRPORT: John Wayne

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1788946	-40311	-49567	-58823	-68079	-77335	-86592	-95849	-105106	-114364	-123621	-132878
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	345480	15480	15480	15480	15480	15480	15480	15480	15480
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Some costs are negative and, therefore, a savings

Discount Rate = 3%

APU COST ANALYSIS (Outputs)
AIRPORT: Long Beach

Year	Total LTOs (LTOs/year)	Passenger LTOs (LTOs/year)	All Cargo LTOs* (LTOs/year)	Passenger LTO APU O&M Cost ($/year)	All Cargo LTO* APU O&M Cost ($/year)	Net Present Value of APU Mitigation Costs ($)**	
1990	14,588	14,056	532				
1991	15,175	14,621	554				
1992	15,762	15,187	575				
1993	16,350	15,753	597				
1994	16,937	16,319	618				
1995	17,524	16,885	639	$858,806	$32,524	$0	
1996	18,111	17,450	661	$887,584	$33,614	$0	
1997	18,698	18,016	682	$916,361	$34,703	$0	
1998	19,286	18,582	704	$945,138	$35,793	$0	
1999	19,873	19,148	725	$973,915	$36,883	($5,200,939)	Note: 1995 Present Value for 1999 Requirement
2000	20,460	19,713	747	$1,002,692	$37,973	$0	
2001	21,047	20,279	768	$1,031,470	$39,063	$0	
2002	21,634	20,845	789	$1,060,247	$40,152	$60,414	Note: 1995 Present Value for 2002 Requirement
2003	22,222	21,411	811	$1,089,024	$41,242	$0	
2004	22,809	21,977	832	$1,117,801	$42,332	$0	
2005	23,396	22,542	854	$1,146,578	$43,422	$0	
2006	23,983	23,108	875	$1,175,346	$44,511	$0	
2007	24,570	23,673	897	$1,204,113	$45,601	$0	
2008	25,157	24,239	918	$1,232,880	$46,690	$0	
2009	25,744	24,805	939	$1,261,648	$47,780	$0	
2010	26,331	25,370	961	$1,290,415	$48,869	$0	
	APU operation (hrs/LTO)*** =		1.316			($5,120,525)	
	APU O&M cost ($/hr) =		38.65				

* 3.6489% of the airport's total LTOs, based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

** Some costs are negative and, therefore, a savings

*** Excludes 5.5 min/LTO (0.092 hrs/LTO) for gate operation and 14.5 min/LTO (0.242 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is equivalent to the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU COST ANALYSIS (Calculations)*
AIRPORT: Long Beach

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1878485	-700292	-729070	-757847	-786624	-815401	-844178	-872946	-901713	-930480	-959248	-988015
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	305328	-25762	-26652	-27942	-29031	-30121	-31210	-32300	-33389
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Some costs are negative and, therefore, a savings

Discount Rate = 3%

APU COST ANALYSIS (Outputs)
AIRPORT: Los Angeles Intl

Year	Total LTOs (LTOs/year)	Passenger LTOs (LTOs/year)	All Cargo LTOs* (LTOs/year)	Passenger LTO APU O&M Cost ($/year)	All Cargo LTO* APU O&M Cost ($/year)	Net Present Value of APU Mitigation Costs ($)**	
1990	240,580	235,217	5,363				
1991	250,263	244,684	5,579				
1992	259,946	254,151	5,795				
1993	269,629	263,618	6,011				
1994	279,312	273,086	6,227				
1995	288,995	282,553	6,443	$17,040,541	$388,547	$0	
1996	298,679	292,020	6,658	$17,611,502	$401,565	$0	
1997	308,362	301,487	6,874	$18,182,463	$414,584	($90,686,749)	Note: 1995 Present Value for 1997 Requirement
1998	318,045	310,955	7,090	$18,753,425	$427,603	$0	
1999	327,728	320,422	7,306	$19,324,386	$440,621	($96,854,191)	Note: 1995 Present Value for 1999 Requirement
2000	337,411	329,889	7,522	$19,895,348	$453,640	$0	
2001	347,094	339,357	7,738	$20,466,327	$466,659	$0	
2002	356,778	348,824	7,954	$21,037,306	$479,678	($865,898)	Note: 1995 Present Value for 2002 Requirement
2003	366,461	358,292	8,170	$21,608,285	$492,697	$0	
2004	376,145	367,759	8,385	$22,179,264	$505,716	$0	
2005	385,828	377,227	8,601	$22,750,243	$518,735	$0	
2006	395,512	386,694	8,817	$23,321,234	$531,755	$0	
2007	405,195	396,162	9,033	$23,892,224	$544,774	$0	
2008	414,879	405,630	9,249	$24,463,215	$557,793	$0	
2009	424,562	415,098	9,465	$25,034,206	$570,813	$0	
2010	434,246	424,565	9,681	$25,605,197	$583,832	$0	
	APU operation (hrs/LTO)*** =		1.267			($188,406,839)	
	APU O&M cost ($/hr) =		47.60				

* 2.2293% of the airport's total LTOs, based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

** Some costs are negative and, therefore, a savings

*** Excludes 5.5 min/LTO (0.092 hrs/LTO) for gate operation and 23.8 min/LTO (0.397 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is equivalent to the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU COST ANALYSIS (Calculations)*
AIRPORT: Los Angeles Intl

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	-6795644	-7040342	-7285040	-7529738	-7774443	-8019148	-8263853	-8508559	-8753264	-8997974	-9242685	-9487395	-9732105	-9976816
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	-1913386	-10039650	-10365924	-10692197	-11018471	-11344745	-11671019	-11997299	-12323580	-12649860	-12976141	-13302421
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1938662	-364337	-397356	-410375	-423395	-436414	-449433	-462453	-475472
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Some costs are negative and, therefore, a savings

Discount Rate = 3%

APU COST ANALYSIS (Outputs)
AIRPORT: Ontario Intl

Year	Total LTOs (LTOs/year)	Passenger LTOs (LTOs/year)	All Cargo LTOs* (LTOs/year)	Passenger LTO APU O&M Cost ($/year)	All Cargo LTO* APU O&M Cost ($/year)	Net Present Value of APU Mitigation Costs ($)**	
1990	45,817	42,190	3,627				
1991	47,661	43,888	3,773				
1992	49,505	45,586	3,919				
1993	51,349	47,284	4,065				
1994	53,193	48,982	4,211				
1995	55,037	50,680	4,357	$3,206,251	$275,652	$0	
1996	56,882	52,378	4,503	$3,313,680	$284,888	$0	
1997	58,726	54,077	4,649	$3,421,109	$294,124	$0	
1998	60,570	55,775	4,795	$3,528,539	$303,360	$0	
1999	62,414	57,473	4,941	$3,635,968	$312,596	($28,037,220)	Note: 1995 Present Value for 1999 Requirement
2000	64,258	59,171	5,087	$3,743,398	$321,832	$0	
2001	66,102	60,869	5,233	$3,850,833	$331,069	$0	
2002	67,946	62,567	5,379	$3,958,268	$340,305	($1,709,582)	Note: 1995 Present Value for 2002 Requirement
2003	69,791	64,265	5,525	$4,065,703	$349,542	$0	
2004	71,635	65,964	5,671	$4,173,139	$358,778	$0	
2005	73,479	67,662	5,817	$4,280,574	$368,015	$0	
2006	75,323	69,360	5,963	$4,388,009	$377,251	$0	
2007	77,167	71,058	6,109	$4,495,444	$386,488	$0	
2008	79,012	72,756	6,255	$4,602,880	$395,724	$0	
2009	80,856	74,455	6,401	$4,710,315	$404,961	$0	
2010	82,700	76,153	6,547	$4,817,750	$414,196	$0	
	APU operation (hrs/LTO)*** =		1.582			($29,746,802)	
	APU O&M cost ($/hr) =		39.99				

* 7.9167% of the airport's total LTOs, based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

** Some costs are negative and, therefore, a savings

*** Excludes 5.5 min/LTO (0.092 hrs/LTO) for gate operation and 15.2 min/LTO (0.253 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is equivalent to the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU COST ANALYSIS (Calculations)*
AIRPORT: Ontario Intl

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	2077832	-3129598	-3237033	-3344468	-3451903	-3559339	-3666774	-3774209	-3881644	-3989080	-4096515	-4203950
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	350655	-318582	-327818	-337055	-346291	-355528	-364764	-374001	-383238
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Some costs are negative and, therefore, a savings

Discount Rate = 3%

APU COST ANALYSIS (Outputs)
AIRPORT: Sacramento Metro

Year	Total LTOs (LTOs/year)	Passenger LTOs (LTOs/year)	All Cargo LTOs* (LTOs/year)	Passenger LTO APU O&M Cost ($/year)	All Cargo LTO* APU O&M Cost ($/year)	Net Present Value of APU Mitigation Costs ($)**	
1990	39,722	38,338	1,384				
1991	40,658	39,241	1,417				
1992	41,594	40,145	1,449				
1993	42,530	41,048	1,482				
1994	43,466	41,951	1,514				
1995	44,401	42,854	1,547	$556,525	$20,090	$0	
1996	45,337	43,758	1,580	$568,255	$20,513	$0	
1997	46,273	44,661	1,612	$579,986	$20,937	($825,613)	Note: 1995 Present Value for 1997 Requirement
1998	47,209	45,564	1,645	$591,716	$21,360	$0	
1999	48,145	46,468	1,677	$603,447	$21,784	($922,736)	Note: 1995 Present Value for 1999 Requirement
2000	48,802	47,102	1,700	$611,681	$22,081	$0	
2001	49,624	47,895	1,729	$621,967	$22,453	$0	
2002	50,446	48,689	1,758	$632,292	$22,825	$214,928	Note: 1995 Present Value for 2002 Requirement
2003	51,269	49,482	1,786	$642,596	$23,197	$0	
2004	52,091	50,276	1,815	$652,903	$23,569	$0	
2005	52,913	51,069	1,844	$663,206	$23,941	$0	
2006	52,913	51,069	1,844	$663,206	$23,941	$0	
2007	52,913	51,069	1,844	$663,206	$23,941	$0	
2008	52,913	51,069	1,844	$663,206	$23,941	$0	
2009	52,913	51,069	1,844	$663,206	$23,941	$0	
2010	52,913	51,069	1,844	$663,206	$23,941	$0	
	APU operation (hrs/LTO)*** =		0.336			($1,533,420)	
	APU O&M cost ($/hr) =		38.65				

* 3.4841% of the airport's total LTOs, based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990.

** Some costs are negative and, therefore, a savings

** Excludes 5.5 min/LTO (0.092 hrs/LTO) allowed for APU operation at the gate. APU operation reduces to 4.5 min/LTO (0.075 hrs/LTO) beginning in 2005 due to planned facility modifications.

NOTE: Discount Rate = 3%

JAN 27 1995

APU COST ANALYSIS (Calculations)*
AIRPORT: Sacramento Metro

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	-63803	-66316	-68830	-70595	-72803	-75011	-77219	-79428	-81636	-81636	-81636	-81636	-81636	-81636
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1617623	-258847	-266944	-275041	-283138	-291235	-299332	-299332	-299332	-299332	-299332	-299332
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	322655	-7717	-8069	-8461	-8461	-8461	-8461	-8461	-8461
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Some costs are negative and, therefore, a savings

Discount Rate = 3%

APU HC EMISSIONS BENEFIT ANALYSIS (Summary of Outputs)

Airport	HC Emissions Benefit (lbs)
Burbank	13,905
John Wayne	6,076
Long Beach	23,210
Los Angeles Intl	338,268
Ontario	83,445
Sacramento Metro	5,969

JAN 27 1995

APU EMISSIONS BENEFIT ANALYSIS (Inputs)*

JAN 27 1995

Airport	APU Operation** (hrs/LTO)	APU Operation** (min/LTO)	Air Carrier LTOs (LTOs/yr)				No. of Gates	Current Gate Status (Power/PCA)	Gate Requirements (Power/PCA)
			1990	2000	2005	2010			
Burbank	0.738	44.28	30,517	42,800	48,942	55,083	14 *3*	- -	Power/PCA *Power*
John Wayne	0.558	33.48	37,424	52,487	60,018	67,550	14 *3*	Power -	PCA *Power*
Long Beach	1.650	99.00	14,588	20,460	23,396	26,331	15 *3*	- -	Power/PCA *Power*
Los Angeles Intl (Domestic Carriers)	1.756	105.36	216,316	303,381	346,915	390,449	33 60 *19*	Power/PCA Power -	- PCA *Power*
Los Angeles Intl (Foreign Carriers)	1.756	105.36	24,264	34,030	38,913	43,797	12 *2*	Power/PCA -	- *Power*
Ontario	1.927	115.62	45,817	64,258	73,479	82,700	30 *6*	- -	Power/PCA *Power*
			1990	1999	2000	2005			
Sacramento Metro	0.428	25.68	39,722	48,145	48,802	52,913	3 11 *3*	Power/PCA - -	- Power/PCA *Power*

* Sources: APU Operation - ATA Comments on the Proposed FIP and 1994 TSD (Sacramento Metro)
Air Carrier LTOs - Technical Support Document Errata memo (1990) and South Coast Aviation Growth Rates memo
No. of Gates - 1994 TSD (additional information was obtained for Los Angeles Intl)
Current Gate Status - 1994 TSD

** For all airports except Sacremento Metro, the APU operational time includes APU operation during aircraft taxi. Sacramento Metro APU operational time reduces to 0.167 hrs/LTO beginning in 2005 due to planned facility modifications.

NOTE: Italicized information refers to remote and maintenance gates. The number of remote and maintenance gates was estimated to be 20% of the total number of airport gates. It was assumed that these gates only would require fixed power.

APU HC EMISSIONS BENEFIT ANALYSIS (Outputs)

AIRPORT: Burbank

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU HC Emissions Benefit (LBS)	
1990	30,517					
1991	31,745					
1992	32,974					
1993	34,202					
1994	35,430					
1995	36,659					
1996	37,887					
1997	39,115	0			0	Note: 1995 Present Value for 1997 Requirement
1998	40,343	0			0	
1999	41,572	0	41,233		13,821	Note: 1995 Present Value for 1999 Requirement
2000	42,800	0	42,451		0	
2001	44,028	0	43,670		0	
2002	45,257	0	44,888	369	65	Note: 1995 Present Value for 2002 Requirement
2003	46,485	0	46,107	379	0	
2004	47,714	0	47,325	389	0	
2005	48,942	0	48,543	399	0	
2006	50,170	0	49,762	409	0	
2007	51,398	0	50,980	419	0	
2008	52,627	0	52,198	429	0	
2009	53,855	0	53,416	439	0	
2010	55,083	0	54,634	449	0	
	APU operation (min/LTO)*** =		25.28		13,905	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirement: 0%

** Refers to all cargo LTOs. All cargo LTOs are 0.8146% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 13.5 min/LTO (0.225 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU HC EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Burbank

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1,354	1,341	1,379	1,418	1,456	1,506	1,558	1,597	1,636	1,675	1,714	1,738
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	12	12	12	13	13	13	14	14	14
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU HC EMISSIONS BENEFIT ANALYSIS (Outputs)

AIRPORT: John Wayne

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU HC Emissions Benefit (LBS)	
1990	37,424					
1991	38,930					
1992	40,437					
1993	41,943					
1994	43,449					
1995	44,956					
1996	46,462					
1997	47,968	0			0	Note: 1995 Present Value for 1997 Requirement
1998	49,474	0			0	
1999	50,981	0	50,981		6,076	Note: 1995 Present Value for 1999 Requirement
2000	52,487	0	52,487		0	
2001	53,993	0	53,993		0	
2002	55,499	0	55,499	0	0	Note: 1995 Present Value for 2002 Requirement
2003	57,006	0	57,006	0	0	
2004	58,512	0	58,512	0	0	
2005	60,018	0	60,018	0	0	
2006	61,524	0	61,524	0	0	
2007	63,031	0	63,031	0	0	
2008	64,537	0	64,537	0	0	
2009	66,044	0	66,044	0	0	
2010	67,550	0	67,550	0	0	
	APU operation (min/LTO)*** =		9.58		6,076	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirement: 0%

** Refers to all cargo LTOs. All cargo LTOs are 0% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 18.4 min/LTO (0.307 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU HC EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: John Wayne

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	572	589	606	622	639	666	689	707	724	741	759	769
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU HC EMISSIONS BENEFIT ANALYSIS (Outputs)
AIRPORT: Long Beach

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU HC Emissions Benefit (LBS)	
1990	14,588					
1991	15,175					
1992	15,762					
1993	16,350					
1994	16,937					
1995	17,524					
1996	18,111					
1997	18,698	0			0	Note: 1995 Present Value for 1997 Requirement
1998	19,286	0			0	
1999	19,873	0	19,148		22,569	Note: 1995 Present Value for 1999 Requirement
2000	20,460	0	19,713		0	
2001	21,047	0	20,279		0	
2002	21,634	0	20,845	789	641	Note: 1995 Present Value for 2002 Requirement
2003	22,222	0	21,411	811	0	
2004	22,809	0	21,977	832	0	
2005	23,396	0	22,542	854	0	
2006	23,983	0	23,108	875	0	
2007	24,570	0	23,673	897	0	
2008	25,157	0	24,239	918	0	
2009	25,744	0	24,805	939	0	
2010	26,331	0	25,370	961	0	
	APU operation (min/LTO)*** =		79.00		23,210	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirement: 0%

** Refers to all cargo LTOs. All cargo LTOs are 3.6489% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 14.5 min/LTO (0.242 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

JAN 2 7 1995

APU HC EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Long Beach

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	2,117	2,180	2,242	2,305	2,367	2,463	2,566	2,630	2,695	2,759	2,823	2,866
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	87	90	94	97	100	102	104	107	109
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

JAN 27 1995

APU HC EMISSIONS BENEFIT ANALYSIS (Outputs)

AIRPORT: Los Angeles Intl (Domestic Carriers)

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU HC Emissions Benefit (LBS)	
1990	216,316					
1991	225,023					
1992	233,729					
1993	242,436					
1994	251,142					
1995	259,849					
1996	268,555					
1997	277,262	96,190			17,713	Note: 1995 Present Value for 1997 Requirement***
1998	285,968	99,210			0	
1999	294,675	102,231	185,874		282,099	Note: 1995 Present Value for 1999 Requirement
2000	303,381	105,251	191,366		0	
2001	312,088	108,272	196,858		0	
2002	320,795	111,293	202,350	7,151	4,765	Note: 1995 Present Value for 2002 Requirement
2003	329,501	114,313	207,842	7,346	0	
2004	338,208	117,334	213,335	7,540	0	
2005	346,915	120,355	218,827	7,734	0	
2006	355,622	123,375	224,319	7,928	0	
2007	364,329	126,396	229,811	8,122	0	
2008	373,035	129,417	235,303	8,316	0	
2009	381,742	132,437	240,795	8,510	0	
2010	390,449	135,458	246,287	8,704	0	
	APU operation (min/LTO)**** =		76.06		304,577	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirement: 35%

** Refers to all cargo LTOs. All cargo LTOs are 2.2293% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

*** Represents value through 1998. Value from 1999 through 2010 included in 1999 requirement value.

**** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 23.8 min/LTO (0.397 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

APU HC EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Los Angeles Intl (Domestic Carriers)

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	9,390	9,684	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	28,124	27,918	28,719	29,520	30,321	31,123	31,259	32,043	32,828	33,612	34,397	34,470
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	673	691	710	713	731	749	766	784	786
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU HC EMISSIONS BENEFIT ANALYSIS (Outputs)
AIRPORT: Los Angeles Intl (Foreign Carriers)

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU HC Emissions Benefit (LBS)	
1990	24,264					
1991	25,241					
1992	26,217					
1993	27,194					
1994	28,170					
1995	29,147					
1996	30,124					
1997	31,100	30,407			33,207	Note: 1995 Present Value for 1997 Requirement
1998	32,077	31,362			0	
1999	33,053	32,317	0		0	Note: 1995 Present Value for 1999 Requirement
2000	34,030	33,271	0		0	
2001	35,007	34,226	0		0	
2002	35,983	35,181	0	802	483	Note: 1995 Present Value for 2002 Requirement
2003	36,960	36,136	0	824	0	
2004	37,936	37,091	0	846	0	
2005	38,913	38,046	0	867	0	
2006	39,890	39,001	0	889	0	
2007	40,867	39,956	0	911	0	
2008	41,843	40,911	0	933	0	
2009	42,820	41,866	0	955	0	
2010	43,797	42,821	0	976	0	
	APU operation (min/LTO)*** =		76.06		33,690	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirement: 100%

** Refers to all cargo LTOs. All cargo LTOs are 2.2293% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 23.8 min/LTO (0.397 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU HC EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Los Angeles Intl (Foreign Carriers)

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	2,546	2,626	2,706	2,786	2,866	2,946	3,026	3,106	3,186	3,266	3,346	3,426	3,506	3,586
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	67	69	71	73	74	76	78	80	82
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU HC EMISSIONS BENEFIT ANALYSIS (Outputs)
AIRPORT: Ontario Intl

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU HC Emissions Benefit (LBS)	
1990	45,817					
1991	47,661					
1992	49,505					
1993	51,349					
1994	53,193					
1995	55,037					
1996	56,882					
1997	58,726	0			0	Note: 1995 Present Value for 1997 Requirement
1998	60,570	0			0	
1999	62,414	0	57,473		78,408	Note: 1995 Present Value for 1999 Requirement
2000	64,258	0	59,171		0	
2001	66,102	0	60,869		0	
2002	67,946	0	62,567	5,379	5,037	Note: 1995 Present Value for 2002 Requirement
2003	69,791	0	64,265	5,525	0	
2004	71,635	0	65,964	5,671	0	
2005	73,479	0	67,662	5,817	0	
2006	75,323	0	69,360	5,963	0	
2007	77,167	0	71,058	6,109	0	
2008	79,012	0	72,756	6,255	0	
2009	80,856	0	74,455	6,401	0	
2010	82,700	0	76,153	6,547	0	
	APU operation (min/LTO)*** =		94.92		83,445	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirement: 0%

** Refers to all cargo LTOs. All cargo LTOs are 7.9167% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 15.2 min/LTO (0.253 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU HC EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Ontario Intl

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	7,503	7,628	7,847	8,066	8,285	8,544	8,859	9,062	9,304	9,527	9,749	9,864
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	693	712	735	762	781	800	819	838	848
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU HC EMISSIONS BENEFIT ANALYSIS (Outputs)

AIRPORT: Sacramento Metro

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU HC Emissions Benefit (LBS)	
1990	39,722					
1991	40,658					
1992	41,594					
1993	42,530					
1994	43,466					
1995	44,401					
1996	45,337					
1997	46,273	9,570			359	Note: 1995 Present Value for 1997 Requirement***
1998	47,209	9,764			0	
1999	48,145	9,957	36,510		5,496	Note: 1995 Present Value for 1999 Requirement
2000	48,802	10,093	37,008		0	
2001	49,624	10,263	37,632		0	
2002	50,446	10,433	38,255	1,758	114	Note: 1995 Present Value for 2002 Requirement
2003	51,269	10,603	38,879	1,786	0	
2004	52,091	10,773	39,502	1,815	0	
2005	52,913	10,943	40,126	1,844	0	
2006	52,913	10,943	40,126	1,844	0	
2007	52,913	10,943	40,126	1,844	0	
2008	52,913	10,943	40,126	1,844	0	
2009	52,913	10,943	40,126	1,844	0	
2010	52,913	10,943	40,126	1,844	0	
	APU operation (min/LTO)**** =		20.18		5,969	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirement: 21%

** Refers to all cargo LTOs. All cargo LTOs are 3.4841% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990.

*** Represents value through 1996. Value from 1999 through 2010 included in 1999 requirement value.

**** Excludes 5.5 min/LTO (.092 hrs/LTO) allowed for APU operation at the gate. APU operation reduces to 4.5 min/LTO (0.075 hrs/LTO) beginning in 2005 due to planned facility modifications.

NOTE: Discount Rate = 3%

JAN 2 7 1995

APU HC EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Sacramento Metro

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	191	195	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	890	900	915	931	946	961	222	222	222	222	222	222
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	34	34	35	8	8	8	8	8	8
0	0	0	0	0	0	0	0	0	-0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU NOx EMISSIONS BENEFIT ANALYSIS (Summary of Outputs)

JAN 27 1995

Airport	NOx Emissions Benefit (lbs)
Burbank	275,030
John Wayne	125,570
Long Beach	371,399
Los Angeles Intl	11,740,136
Ontario	1,818,236
Sacramento Metro	115,406

APU NOx EMISSIONS BENEFIT ANALYSIS (Outputs)
AIRPORT: Burbank

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU NOx Emissions Benefit (LBS)	
1990	30,517					
1991	31,745					
1992	32,974					
1993	34,202					
1994	35,430					
1995	36,659					
1996	37,887					
1997	39,115	0			0	Note: 1995 Present Value of 1997 Requirement
1998	40,343	0			0	
1999	41,572	0	41,233		273,319	Note: 1995 Present Value of 1999 Requirement
2000	42,800	0	42,451		0	
2001	44,028	0	43,670		0	
2002	45,257	0	44,888	369	1,711	Note: 1995 Present Value of 2002 Requirement
2003	46,485	0	46,107	379	0	
2004	47,714	0	47,325	389	0	
2005	48,942	0	48,543	399	0	
2006	50,170	0	49,762	409	0	
2007	51,398	0	50,980	419	0	
2008	52,627	0	52,198	429	0	
2009	53,855	0	53,416	439	0	
2010	55,083	0	54,634	449	0	
	APU operation (min/LTO)*** =		25.28		275,030	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirements: 0%

** Refers to all cargo LTOs. All cargo LTOs are 0.8146% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 13.5 min/LTO (0.225 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU NOx EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Burbank

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	20,684	27,029	27,803	28,580	29,356	30,841	31,361	32,149	32,937	33,723	34,510	35,604
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	235	241	253	258	264	271	277	283	292
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU NOx EMISSIONS BENEFIT ANALYSIS (Outputs)

AIRPORT: John Wayne

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU NOx Emissions Benefit (LBS)	
1990	37,424					
1991	38,930					
1992	40,437					
1993	41,943					
1994	43,449					
1995	44,956					
1996	46,462					
1997	47,968	0			0	Note: 1995 Present Value of 1997 Requirement
1998	49,474	0			0	
1999	50,981	0	50,981		125,570	Note: 1995 Present Value of 1999 Requirement
2000	52,487	0	52,487		0	
2001	53,993	0	53,993		0	
2002	55,499	0	55,499	0	0	Note: 1995 Present Value of 2002 Requirement
2003	57,006	0	57,006	0	0	
2004	58,512	0	58,512	0	0	
2005	60,018	0	60,018	0	0	
2006	61,524	0	61,524	0	0	
2007	63,031	0	63,031	0	0	
2008	64,537	0	64,537	0	0	
2009	66,044	0	66,044	0	0	
2010	67,550	0	67,550	0	0	
	APU operation (min/LTO)*** =		9.58		125,570	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirements: 0%

** Refers to all cargo LTOs. All cargo LTOs are 0% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 18.4 min/LTO (0.307 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU NOx EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: John Wayne

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	11,623	11,966	12,309	12,653	12,996	14,105	14,344	14,705	15,065	15,425	15,785	16,285
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU NOx EMISSIONS BENEFIT ANALYSIS (Outputs)
AIRPORT: Long Beach

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU NOx Emissions Benefit (LBS)	
1990	14,588					
1991	15,175					
1992	15,762					
1993	16,350					
1994	16,937					
1995	17,524					
1996	18,111					
1997	18,698	0			0	Note: 1995 Present Value of 1997 Requirement
1998	19,286	0			0	
1999	19,873	0	19,148		361,063	Note: 1995 Present Value of 1999 Requirement
2000	20,460	0	19,713		0	
2001	21,047	0	20,279		0	
2002	21,634	0	20,845	789	10,336	Note: 1995 Present Value of 2002 Requirement
2003	22,222	0	21,411	811	0	
2004	22,809	0	21,977	832	0	
2005	23,396	0	22,542	854	0	
2006	23,983	0	23,108	875	0	
2007	24,570	0	23,673	897	0	
2008	25,157	0	24,239	918	0	
2009	25,744	0	24,805	939	0	
2010	26,331	0	25,370	961	0	
	APU operation (min/LTO)*** =		79.00		371,399	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirements: 0%

** Refers to all cargo LTOs. All cargo LTOs are 3.6489% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 14.5 min/LTO (0.242 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU NOx EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Long Beach

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	33,088	34,066	35,044	36,022	36,999	40,851	41,528	42,570	43,613	44,653	45,696	47,150
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1,364	1,401	1,547	1,573	1,612	1,652	1,691	1,731	1,786
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

JAN 27 1995

APU NOx EMISSIONS BENEFIT ANALYSIS (Outputs)
AIRPORT: Los Angeles Intl (Domestic Carriers)

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU NOx Emissions Benefit (LBS)	
1990	216,316					
1991	225,023					
1992	233,729					
1993	242,436					
1994	251,142					
1995	259,849					
1996	268,555					
1997	277,262	96,190			483,101	Note: 1995 Present Value of 1997 Requirement***
1998	285,968	99,210			0	
1999	294,675	102,231	185,874		9,248,797	Note: 1995 Present Value of 1999 Requirement
2000	303,381	105,251	191,366		0	
2001	312,088	108,272	196,858		0	
2002	320,795	111,293	202,350	7,151	159,631	Note: 1995 Present Value of 2002 Requirement
2003	329,501	114,313	207,842	7,346	0	
2004	338,208	117,334	213,335	7,540	0	
2005	346,915	120,355	218,827	7,734	0	
2006	355,622	123,375	224,319	7,928	0	
2007	364,329	126,396	229,811	8,122	0	
2008	373,035	129,417	235,303	8,316	0	
2009	381,742	132,437	240,795	8,510	0	
2010	390,449	135,458	246,287	8,704	0	
	APU operation (min/LTO)**** =		76.06		9,891,529	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirements: 35%

** Refers to all cargo LTOs. All cargo LTOs are 2.2293% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

*** Represents value through 1998. Value from 1999 through 2010 included in 1999 requirement value.

**** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 23.8 min/LTO (0.397 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

APU NOx EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Los Angeles Intl (Domestic Carriers)

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	256,067	264,128	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	767,024	906,494	934,568	960,640	986,715	1,012,787	1,058,660	1,085,229	1,111,800	1,138,370	1,164,941	1,196,268
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	21,904	22,498	23,093	24,139	24,745	25,350	25,956	26,562	27,277
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU NOx EMISSIONS BENEFIT ANALYSIS (Outputs)
AIRPORT: Los Angeles Intl (Foreign Carriers)

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU NOx Emissions Benefit (LBS)	
1990	24,264					
1991	25,241					
1992	26,217					
1993	27,194					
1994	28,170					
1995	29,147					
1996	30,124					
1997	31,100	30,407			1,822,090	Note: 1995 Present Value of 1997 Requirement
1998	32,077	31,362			0	
1999	33,053	32,317	0		0	Note: 1995 Present Value of 1999 Requirement
2000	34,030	33,271	0		0	
2001	35,007	34,226	0		0	
2002	35,983	35,181	0	802	26,517	Note: 1995 Present Value of 2002 Requirement
2003	36,960	36,136	0	824	0	
2004	37,936	37,091	0	846	0	
2005	38,913	38,046	0	867	0	
2006	39,890	39,001	0	889	0	
2007	40,867	39,956	0	911	0	
2008	41,843	40,911	0	933	0	
2009	42,820	41,866	0	955	0	
2010	43,797	42,821	0	976	0	
	APU operation (min/LTO)*** =		76.06		1,848,607	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirements: 100%

** Refers to all cargo LTOs. All cargo LTOs are 2.2293% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 23.8 min/LTO (0.397 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU NOx EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Los Angeles Intl (Foreign Carriers)

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	139,723	144,112	148,497	152,886	157,276	161,661	166,050	170,435	174,824	179,214	183,603	187,988	192,377	196,766
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	3,686	3,786	3,886	3,986	4,086	4,186	4,286	4,386	4,487
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU NOx EMISSIONS BENEFIT ANALYSIS (Outputs)
AIRPORT: Ontario Intl

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU NOx Emissions Benefit (LBS)	
1990	45,817					
1991	47,661					
1992	49,505					
1993	51,349					
1994	53,193					
1995	55,037					
1996	56,882					
1997	58,726	0			0	Note: 1995 Present Value of 1997 Requirement
1998	60,570	0			0	
1999	62,414	0	57,473		1,707,084	Note: 1995 Present Value of 1999 Requirement
2000	64,258	0	59,171		0	
2001	66,102	0	60,869		0	
2002	67,946	0	62,567	5,379	111,152	Note: 1995 Present Value of 2002 Requirement
2003	69,791	0	64,265	5,525	0	
2004	71,635	0	65,964	5,671	0	
2005	73,479	0	67,662	5,817	0	
2006	75,323	0	69,360	5,963	0	
2007	77,167	0	71,058	6,109	0	
2008	79,012	0	72,756	6,255	0	
2009	80,856	0	74,455	6,401	0	
2010	82,700	0	76,153	6,547	0	
	APU operation (min/LTO)*** =		94.92		1,818,236	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirements: 0%

** Refers to all cargo LTOs. All cargo LTOs are 7.9167% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990, supplemented with UPS data provided in August 12, 1993 letter from Daniel Tenfelde, UPS, to Don Collier, ATA.

*** Excludes 5.5 min/LTO (.092 hrs/LTO) for gate operation and 15.2 min/LTO (0.253 hrs/LTO) for taxi operation, which are allowed APU operations. The time allowed for APU operation during aircraft taxi is the FAA airport average taxi time.

NOTE: Discount Rate = 3%

JAN 27 1995

APU NOx EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Ontario Intl

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	147,436	164,268	168,966	173,703	178,413	192,307	195,846	200,767	205,679	210,592	215,515	221,997
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	14,934	15,339	16,533	16,838	17,261	17,683	18,105	18,529	19,066
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

APU NOx EMISSIONS BENEFIT ANALYSIS (Outputs)

AIRPORT: Sacramento Metro

Year	Total LTOs (LTOs/year)	1997 Requirement No. of LTOs* (LTOs/year)	1999 Requirement No. of LTOs* (LTOs/year)	2002 Requirement No. of LTOs** (LTOs/year)	Net Present Value of APU NOx Emissions Benefit (LBS)	
1990	39,722					
1991	40,658					
1992	41,594					
1993	42,530					
1994	43,466					
1995	44,401					
1996	45,337					
1997	46,273	9,570			5,517	Note: 1995 Present Value of 1997 Requirement***
1998	47,209	9,764			0	
1999	48,145	9,957	36,510		107,638	Note: 1995 Present Value of 1999 Requirement
2000	48,802	10,093	37,008		0	
2001	49,624	10,263	37,632		0	
2002	50,446	10,433	38,255	1,758	2,250	Note: 1995 Present Value of 2002 Requirement
2003	51,269	10,603	38,879	1,786	0	
2004	52,091	10,773	39,502	1,815	0	
2005	52,913	10,943	40,126	1,844	0	
2006	52,913	10,943	40,126	1,844	0	
2007	52,913	10,943	40,126	1,844	0	
2008	52,913	10,943	40,126	1,844	0	
2009	52,913	10,943	40,126	1,844	0	
2010	52,913	10,943	40,126	1,844	0	
	APU operation (min/LTO)**** =		20.18		115,406	

* Refers to passenger LTOs. The 1996 requirement's % of passenger LTOs is assumed to be directly proportional to the % of fixed gates affected by the 1996 requirements: 21%

** Refers to all cargo LTOs. All cargo LTOs are 3.4841% of the airport's total LTOs based on all cargo LTOs in FAA's Airport Activity Statistics of Certificated Route Air Carriers, 1990.

*** Represents value through 1996. Value from 1999 through 2010 included in 1999 requirement value.

**** Excludes 5.5 min/LTO (.092 hrs/LTO) allowed for APU operation at the gate. APU operation reduces to 4.5 min/LTO (0.075 hrs/LTO) beginning in 2005 due to planned facility modification.

NOTE: Discount Rate = 3%

JAN 27 1995

APU NOx EMISSIONS BENEFIT ANALYSIS (Calculations)
AIRPORT: Sacramento Metro

JAN 27 1995

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	2,941	3,000	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	17,166	17,527	17,822	18,119	18,414	18,709	4,512	4,512	4,512	4,512	4,512	4,512
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	654	665	675	163	163	163	163	163	163
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discount Rate = 3%

JAN 27 1995

GSE ANALYSIS (Summary of Cost and Emission Outputs)
Net Present Value of GSE Conversion Costs and Benefits

Airport	Costs ($)*	HC Emissions Benefit (lbs)	NOx Emissions Benefit (lbs)
Burbank	($1,029,232)	413,351	1,144,048
John Wayne	($1,228,413)	489,126	1,377,033
Long Beach	($570,268)	218,401	584,124
Los Angeles Intl	($7,231,815)	3,169,737	8,546,048
Ontario Intl	($1,376,288)	571,476	1,483,453
Sacramento Metro	($1,044,071)	415,240	1,179,816

* All costs are negative and, therefore, a savings

GSE COST ANALYSIS (Summary of Outputs)
Net Present Value of GSE Conversion Costs

Airport	COST ($)*
Burbank	($1,029,232)
John Wayne	($1,228,413)
Long Beach	($570,268)
Los Angeles Intl	($7,231,815)
Ontario Intl	($1,376,288)
Sacramento Metro	($1,044,071)

* All costs are negative and, therefore, a savings.

JAN 27 1995

GSE COST ANALYSIS

Conversion Schedule (% of population converted to electric)

JAN 27 1995

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
: Tug NB - base				25%			75%										
owth							100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
: Tug WB																	100%
owth																	100%
Cond				0%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
owth																	
Start				0%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
owth																	
g Tug				100%													
owth				100%		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
lt Load							100%										
owth							100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
btail												100%					
owth												100%	100%	100%	100%	100%	100%
s				0%		0%	30%	0%	0%	0%	0%	70%	0%	0%	0%	0%	0%
owth												100%	100%	100%	100%	100%	100%
r				0%		50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	0%	0%
owth												100%	100%	100%	100%	100%	100%
rgo loader							100%										
owth							100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
rt				100%													
owth				100%		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ioer							100%										
owth							100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ridlift				100%													
owth				100%		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
el Truck							30%					70%					
owth												100%	100%	100%	100%	100%	100%
U				0%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
owth												0%					
v Cart							100%										
owth							100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
v Truck												50%					50%
owth												100%	100%	100%	100%	100%	100%
t							100%										
owth							100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
int Truck												100%					
owth												100%	100%	100%	100%	100%	100%
her							50%					50%					
owth												100%	100%	100%	100%	100%	100%
ckup												100%					
owth												100%	100%	100%	100%	100%	100%
rvice Truck												100%					
owth												100%	100%	100%	100%	100%	100%
in				0%		50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	0%	0%
owth												100%	100%	100%	100%	100%	100%
ater Truck												100%					
owth												100%	100%	100%	100%	100%	100%

GSE COST ANALYSIS (Inputs)*
AIRPORT: Burbank

JAN 27 1995

Equipment Type	Average Operation** (hours/year)	Useful Life (years)	Population				Conventional GSE Cost		Electric GSE Cost		Recharger Cost
			1990	2000	2005	2010	Capital ($000)	O&M ($/hr)	Capital*** ($000)	O&M ($/hr)	Installed Capital ($/electric unit)
A/C TUG NB	1,721	10	8	10	12	14	$100.0	$16.67	$126.0	$12.50	$2,500
A/C TUG WB	1,721	10	0	0	0	0	$190.0	$26.41	$262.5	$19.71	$2,500
AIR COND	271	8	0	2	4	4	$60.0	$12.15	N/A	N/A	N/A
AIR START	181	8	2	4	4	4	$80.0	$33.76	N/A	N/A	N/A
BAG TUG	1,021	8	38	48	56	62	$15.5	$8.06	$29.4	$6.04	$2,500
BELT LOADER	887	8	16	22	24	26	$23.0	$6.63	$36.8	$4.97	$2,500
BOBTAIL	434	8	4	4	6	6	$24.0	$13.82	$36.8	$10.37	$2,500
BUS****	1,678	8	2	2	2	2	$110.0	$9.58	$114.0	$9.58	N/A
CAR****	466	8	2	2	2	4	$15.0	$2.10	$17.0	$2.10	N/A
CARGO LOADER	1,250	10	6	8	12	12	$150.0	$9.84	$189.0	$7.38	$2,500
CART	340	8	6	8	10	10	$6.0	$1.69	$6.0	$1.27	$2,500
DEICER	156	8	2	2	2	2	$5.0	$4.63	$5.0	$3.47	$2,500
FORKLIFT	1,028	8	14	22	24	24	$18.0	$10.32	$21.0	$7.74	$2,500
FUEL TRUCK****	1,117	8	4	4	6	6	$65.0	$16.83	$69.0	$16.83	N/A
GPU	2,240	8	6	8	12	12	$32.0	$10.44	N/A	N/A	N/A
LAV CART	725	8	0	2	2	2	$7.0	$2.44	$7.0	$2.44	N/A
LAV TRUCK	735	8	2	4	4	4	$35.0	$12.15	$44.1	$9.11	$2,500
LIFT	1,357	8	4	8	8	8	$45.0	$13.73	$56.7	$10.30	$2,500
MAINT TRUCK	563	8	8	12	14	16	$25.0	$12.82	$31.5	$9.62	$2,500
OTHER	771	8	6	8	10	12	$20.0	$10.97	$31.5	$8.23	$2,500
PICKUP	1,722	8	8	12	12	14	$18.0	$9.65	$28.4	$7.24	$2,500
SERVICE TRUCK	563	8	6	6	8	8	$25.0	$12.82	$31.5	$9.62	$2,500
VAN****	1,987	8	6	8	8	8	$22.0	$10.09	$24.0	$10.09	N/A
WATER TRUCK	567	8	0	0	0	0	$32.0	$14.04	$40.4	$10.53	$2,500
Total:			150	206	242	260					

* Sources: Average Operation - ATA Comments on Proposed FIP
Useful Life - AA estimate
Population - Technical Support Document Errata memo (1990) and South Coast Aviation Growth Rates memo
GSE Cost - AA estimate
Recharger Cost - AA estimate

** Refers to average operation per unit (hours/year)

*** 5% added to all electric GSE capital costs (per unit) for shipping to a station outside of the FIP area for reuse. This does not apply to carts, deicers, lav carts, or on-road vehicles.

**** Capital and O&M costs are for ILEVs.

GSE COST ANALYSIS (Outputs)
AIRPORT: Burbank
Cost of Purchasing an Electric GSE
Instead of a Conventional GSE

JAN 27 1995

Ipment	- Cost Differential - Capital Cost* ($/unit)	O&M Cost** ($/yr/unit)	Net Present Value of GSE Conversion Costs ($)
TUG NB	28,500	(7,177)	($461,096)
TUG WB	75,000	(11,531)	$0
COND	N/A	N/A	N/A
START	N/A	N/A	N/A
TUG	16,400	(2,062)	($7,593)
T LOADER	16,250	(1,472)	$96,603
TAIL	15,250	(1,497)	$14,475
	4,000	0	$6,427
	2,000	0	$5,833
GO LOADER	41,500	(3,075)	$120,449
T	2,500	(143)	$12,016
CER	2,500	(181)	$1,809
KLIFT	5,500	(2,652)	($340,405)
L TRUCK	4,000	0	$18,806
	N/A	N/A	N/A
CART	N/A	N/A	N/A
TRUCK	11,600	(2,234)	($18,162)
T	14,200	(4,655)	($159,602)
NT TRUCK	9,000	(1,802)	($63,751)
ER	14,000	(2,113)	($26,713)
KUP	12,850	(4,150)	($208,668)
VICE TRUCK	9,000	(1,802)	($32,432)
	2,000	0	$12,772
ER TRUCK	10,925	(1,990)	$0
al:			($1,029,232)

apital cost incurred during first year of equipment purchase only.
O&M refers to Operating and Maintenance

TE: Some costs are negative and, therefore, a savings.
TE: Discount Rate = 3%

GSE COST ANALYSIS (Calculations)
AIRPORT: Burbank

JAN 27 1995

Equipment Type	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A/C TUG NB	0	0	42,647	(14,353)	(14,353)	156,234	(71,766)	(71,766)	(71,766)	(71,766)	(29,119)	(66,119)	(66,119)	(71,766)	(71,766)	(29,119)	(28,706)	(28,706)	(28,706)	(28,706)	(28,706)	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)
A/C TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIR COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIR START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAG TUG	0	0	544,826	(78,372)	(78,372)	66,004	(66,996)	(66,996)	(66,996)	(66,996)	15,704	(37,124)	(37,124)	(37,124)	(18,499)	89,528	(28,874)	(28,874)	(28,874)	(12,375)	(12,375)	(12,375)	(12,375)	(12,375)	0	0
BELT LOADER	0	0	0	0	0	365,107	(32,393)	(32,393)	(32,393)	(32,393)	(2,636)	(35,336)	(35,336)	(35,336)	(2,945)	28,610	(5,890)	(5,890)	(5,890)	(2,945)	(2,945)	(2,945)	(2,945)	(2,945)	0	0
BOBTAIL	0	0	0	0	0	0	0	0	0	0	82,516	(8,964)	(8,964)	(8,964)	(8,964)	(8,964)	(8,964)	(8,964)	(8,964)	0	0	0	0	0	0	0
BUS	0	0	0	0	0	4,000	0	0	0	0	4,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAR	0	0	0	0	2,000	0	0	0	0	0	2,000	0	0	0	0	4,000	0	0	0	0	0	0	0	0	0	0
CARGO LOADER	0	0	0	0	0	307,400	(34,600)	(34,600)	(34,600)	(34,600)	129,100	(36,900)	(36,900)	(36,900)	(36,900)	(36,900)	(12,300)	(12,300)	(12,300)	(12,300)	(12,300)	0	0	0	0	0
CART	0	0	14,143	(857)	(857)	3,866	(1,142)	(1,142)	(1,142)	(1,142)	3,572	(571)	(571)	(571)	(286)	(286)	(286)	(286)	(286)	0	0	0	0	0	0	0
DEICER	0	0	0	0	0	4,636	(362)	(362)	(362)	(362)	(362)	(362)	(362)	(362)	0	0	0	0	0	0	0	0	0	0	0	0
FORKLIFT	0	0	39,866	(37,131)	(37,131)	(14,349)	(56,349)	(56,349)	(56,349)	(56,349)	(52,654)	(26,522)	(26,522)	(26,522)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	0	0	0	0	0	0	0
FUEL TRUCK	0	0	0	0	0	8,000	0	0	0	0	16,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAV CART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAV TRUCK	0	0	0	0	0	0	0	0	0	0	28,087	(6,703)	(6,703)	(6,703)	(6,703)	2,662	(8,936)	(8,936)	(8,936)	(2,234)	(2,234)	(2,234)	(2,234)	(2,234)	0	0
LIFT	0	0	0	0	0	76,364	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	0	0	0	0	0	0	0	0	0	0	0	0
MAINT TRUCK	0	0	0	0	0	0	0	0	0	0	100,778	(25,222)	(25,222)	(25,222)	(25,222)	(10,826)	(28,826)	(28,826)	(28,826)	(3,603)	(3,603)	(3,603)	(3,603)	(3,603)	0	0
OTHER	0	0	0	0	0	36,662	(9,336)	(9,336)	(9,336)	(9,336)	76,875	(21,125)	(21,125)	(21,125)	(14,788)	8,987	(19,013)	(19,013)	(19,013)	(4,225)	(4,225)	(4,225)	(4,225)	(4,225)	0	0
PICKUP	0	0	0	0	0	0	0	0	0	0	104,400	(49,600)	(49,600)	(49,600)	(49,600)	(32,400)	(56,100)	(56,100)	(56,100)	(9,300)	(9,300)	(9,300)	(9,300)	(9,300)	0	0
SERVICE TRUCK	0	0	0	0	0	0	0	0	0	0	57,587	(14,413)	(14,413)	(14,413)	(14,413)	(14,413)	(14,413)	(14,413)	(14,413)	0	0	0	0	0	0	0
VAN	0	0	0	0	6,000	0	0	0	0	0	10,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WATER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: Some costs are negative and, therefore, a savings.
NOTE: Discount Rate 3%

GSE COST ANALYSIS (Conversion Schedule)
AIRPORT: Burbank

JAN 27 1995

	Useful Life (years)	Forecast Population 1990	2000	2005	2010	Conversion Population* 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A/C Tug NB - base	10	6	10	12	14			2	2	2	6	6	6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0
Growth	10		2	2	2						2	2	2	2	2	4	4	4	4	4	6	4	4	4	4	4	2	2	2	2	2
A/C Tug WB	10	0	0	0	0																0	0	0	0	0	0	0	0	0	0	0
Growth	10				0																0	0	0	0	0	0	0	0	0	0	0
Air Cond	6	0	2	4	4																										
Growth	6		2	2	0																										
Air Start	6	2	4	4	4																										
Growth	6		2	0	0																										
Bag Tug	6	36	48	56	62			36	36	36	36	36	36	36	36	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Growth	6		10	8	6						10	10	10	10	10	18	18	18	18	8	14	14	14	14	6	6	6	6	6	0	0
Belt Load	6	16	22	24	26						16	16	16	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	0	0	0
Growth	6		6	2	2						6	6	6	6	6	6	6	6	6	2	4	4	4	4	2	2	2	2	2	0	0
Bobtail	6	4	4	6	6											4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
Growth	6			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
Bus	6	2	2	2	2						1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0
Growth	6			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Car	6	2	2	2	4					1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0
Growth	6			0	2											0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0
Cargo loader	10	6	6	12	12						6	6	6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0
Growth	10		2	4	0						2	2	2	2	2	6	6	6	6	6	6	4	4	4	4	4	0	0	0	0	0
Cart	6	6	6	10	10			6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Growth	6		2	2	0						2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0	0	0	0	0	0
Deicer	6	2	2	2	2						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
Growth	6		0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forklift	6	14	22	24	24			14	14	14	14	14	14	14	14	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Growth	6		8	2	0						8	8	8	8	8	10	10	10	10	2	2	2	2	2	0	0	0	0	0	0	0
Fuel Truck	6	4	4	6	6						2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0	0	0	0	0	0
Growth	6			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
GPU	6	6	6	12	12																										
Growth	6			6	0																										
Lav Cart	6	0	2	2	2						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Growth	6		2	0	0						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
Lav Truck	6	2	4	4	4											1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0
Growth	6			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
Lift	6	4	6	6	6						4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0
Growth	6		4	0	0						4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0
Maint Truck	6	6	12	14	16											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
Growth	6			6	2											6	6	6	6	6	6	6	6	6	2	2	2	2	2	0	0
Other	6	6	6	10	12						3	3	3	3	3	6	6	6	6	3	3	3	3	3	0	0	0	0	0	0	0
Growth	6			4	2											4	4	4	4	4	6	6	6	6	2	2	2	2	2	0	0
Pickup	6	6	12	12	14											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
Growth	6			4	2											4	4	4	4	4	6	6	6	6	2	2	2	2	2	0	0
Service Truck	6	6	6	6	6											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
Growth	6			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
Van	6	6	6	6	6					3	3	3	3	3	3	6	6	6	3	3	3	3	3	3	0	0	0	0	0	0	0
Growth	6			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
Water Truck	6	0	0	0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Growth	6			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

JAN 27 1995

GSE COST ANALYSIS (Conversion Schedule Summary)
AIRPORT: Burbank

Conversion Population*

quipment ype	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
/C TUG NB			2	2	2	10	10	10	10	10	12	12	12	10	10	12	4	4	4	4	4	2	2	2	2	2
/C TUG WB																0	0	0	0	0	0	0	0	0	0	0
IR COND																										
IR START																										
AG TUG			38	38	38	48	48	48	48	48	56	18	18	18	8	14	14	14	14	6	6	6	6	6	0	0
ELT LOADER						22	22	22	22	22	24	24	24	24	2	4	4	4	4	2	2	2	2	2	0	0
OBTAIL											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
US						1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0
AR					1	1	1	1	1	1	2	2	2	1	1	3	3	3	3	2	2	2	2	2	0	0
ARGO LOADER						8	8	8	8	8	12	12	12	12	12	12	4	4	4	4	4	0	0	0	0	0
ART			6	6	6	8	8	8	8	8	10	4	4	4	2	2	2	2	2	0	0	0	0	0	0	0
EICER						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
ORKLIFT			14	14	14	22	22	22	22	22	24	10	10	10	2	2	2	2	2	0	0	0	0	0	0	0
UEL TRUCK						2	2	2	2	2	6	6	6	6	4	4	4	4	4	0	0	0	0	0	0	0
PU																										
AV CART						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
AV TRUCK											3	3	3	3	3	4	4	4	4	1	1	1	1	1	0	0
JFT						8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0
AINT TRUCK											14	14	14	14	14	16	16	16	16	2	2	2	2	2	0	0
THER						3	3	3	3	3	10	10	10	10	7	9	9	9	9	2	2	2	2	2	0	0
ICKUP											12	12	12	12	12	14	14	14	14	2	2	2	2	2	0	0
ERVICE TRUCK											8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0
AN					3	3	3	3	3	3	8	8	8	5	5	5	5	5	5	0	0	0	0	0	0	0
ATER TRUCK											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

JAN 27 1995

GSE COST ANALYSIS (Inputs)*
AIRPORT: John Wayne

ment	Average Operation** (hours/year)	Useful Life (years)	Population				Conventional GSE Cost		Electric GSE Cost		Recharger Cost
			1990	2000	2005	2010	Capital ($000)	O&M ($/hr)	Capital*** ($000)	O&M ($/hr)	Installed Capital ($/electric unit)
UG NB	1,721	10	10	14	16	16	$100.0	$16.67	$126.0	$12.50	$2,500
UG WB	1,721	10	0	0	0	0	$190.0	$26.41	$262.5	$19.71	$2,500
OND	271	8	0	4	4	4	$60.0	$12.15	N/A	N/A	N/A
TART	181	8	2	4	4	4	$80.0	$33.76	N/A	N/A	N/A
TUG	1,021	8	44	60	70	76	$15.5	$8.06	$29.4	$6.04	$2,500
LOADER	887	8	20	26	30	32	$23.0	$6.63	$36.8	$4.97	$2,500
TAIL	434	8	4	6	6	8	$24.0	$13.82	$36.8	$10.37	$2,500
***	1,678	8	2	2	2	2	$110.0	$9.58	$114.0	$9.58	N/A
***	486	8	2	4	4	4	$15.0	$2.10	$17.0	$2.10	N/A
GO LOADER	1,250	10	6	12	14	14	$150.0	$9.84	$189.0	$7.38	$2,500
-	340	8	8	10	10	12	$6.0	$1.69	$6.0	$1.27	$2,500
ER	156	8	2	2	2	2	$5.0	$4.63	$5.0	$3.47	$2,500
KLIFT	1,028	8	16	24	28	28	$18.0	$10.32	$21.0	$7.74	$2,500
. TRUCK****	1,117	8	4	6	6	8	$65.0	$16.83	$69.0	$16.83	N/A
	2,240	8	8	12	14	14	$32.0	$10.44	N/A	N/A	N/A
CART	725	8	0	2	2	2	$7.0	$2.44	$7.0	$2.44	N/A
TRUCK	735	8	4	4	4	6	$35.0	$12.15	$44.1	$9.11	$2,500
	1,357	8	6	8	8	8	$45.0	$13.73	$56.7	$10.30	$2,500
IT TRUCK	563	8	10	14	16	18	$25.0	$12.82	$31.5	$9.62	$2,500
ER	771	8	8	10	12	14	$20.0	$10.97	$31.5	$8.23	$2,500
UP	1,722	8	10	14	16	20	$18.0	$9.65	$28.4	$7.24	$2,500
VICE TRUCK	563	8	6	8	10	10	$25.0	$12.82	$31.5	$9.62	$2,500
****	1,987	8	6	8	10	10	$22.0	$10.09	$24.0	$10.09	N/A
ER TRUCK	567	8	0	0	0	0	$32.0	$14.04	$40.4	$10.53	$2,500
l:			178	254	288	312					

urces: Average Operation - ATA Comments on Proposed FIP
Useful Life - AA estimate
Population - Technical Support Document Errata memo (1990) and South Coast Aviation Growth Rates memo
GSE Cost - AA estimate
Recharger Cost - AA estimate

efers to average operation per unit (hours/year)
5% added to all electric GSE capital costs (per unit) for shipping to a station outside of the FIP area for reuse.
does not apply to carts, deicers, lav carts, or on-road vehicles.
' Capital and O&M costs are for ILEVs.

GSE COST ANALYSIS (Outputs)
AIRPORT: John Wayne
Cost of Purchasing an Electric GSE
Instead of a Conventional GSE

JAN 27 1995

Equipment Type	- Cost Differential - Capital Cost* ($/unit)	O&M Cost** ($/yr/unit)	Net Present Value of GSE Conversion Costs ($)
A/C TUG NB	28,500	(7,177)	($550,726)
A/C TUG WB	75,000	(11,531)	$0
AIR COND	N/A	N/A	N/A
AIR START	N/A	N/A	N/A
BAG TUG	16,400	(2,062)	($9,318)
BELT LOADER	16,250	(1,472)	$118,538
BOBTAIL	15,250	(1,497)	$18,637
BUS	4,000	0	$6,427
CAR	2,000	0	$6,242
CARGO LOADER	41,500	(3,075)	$144,378
CART	2,500	(143)	$14,293
DEICER	2,500	(181)	$1,809
FORKLIFT	5,500	(2,652)	($393,604)
FUEL TRUCK	4,000	0	$23,941
GPU	N/A	N/A	N/A
LAV CART	N/A	N/A	N/A
LAV TRUCK	11,600	(2,234)	($25,628)
LIFT	14,200	(4,655)	($159,602)
MAINT TRUCK	9,000	(1,802)	($71,859)
OTHER	14,000	(2,113)	($31,440)
PICKUP	12,850	(4,150)	($295,710)
SERVICE TRUCK	9,000	(1,802)	($40,540)
VAN	2,000	0	$15,748
WATER TRUCK	10,925	(1,990)	$0
Total:			($1,228,413)

* Capital cost incurred during first year of equipment purchase only.
** O&M refers to Operating and Maintenance

NOTE: Some costs are negative and, therefore, a savings.
NOTE: Discount Rate = 3%

GSE COST ANALYSIS (Calculations)
AIRPORT: John Wayne

JAN 27 1995

ulpment pe	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
: TUG NB	0	0	83,970	(21,530)	(21,530)	213,026	(100,472)	(100,472)	(100,472)	(100,472)	(57,825)	(114,825)	(114,825)	(93,295)	(93,295)	(93,295)	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)	0	0	0	0	0
: TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G TUG	0	0	630,954	(90,746)	(90,746)	139,666	(123,745)	(123,745)	(123,745)	(123,745)	19,831	(53,623)	(53,623)	(53,623)	(20,624)	95,401	(32,999)	(32,999)	(32,999)	(12,375)	(12,375)	(12,375)	(12,375)	(12,375)	0	0
LT LOADER	0	0	0	0	0	364,217	(36,263)	(36,263)	(36,263)	(36,263)	20,827	(44,173)	(44,173)	(44,173)	(5,890)	29,665	(8,835)	(8,835)	(8,835)	(2,946)	(2,946)	(2,946)	(2,946)	(2,946)	0	0
BTAIL	0	0	0	0	0	0	0	0	0	0	82,516	(9,964)	(9,964)	(9,964)	(9,964)	18,522	(11,978)	(11,978)	(11,978)	(2,995)	(2,995)	(2,995)	(2,995)	(2,995)	0	0
S	0	0	0	0	0	4,000	0	0	0	0	4,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R	0	0	0	0	2,000	0	0	0	0	0	6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RGO LOADER	0	0	0	0	0	461,100	(39,900)	(39,900)	(39,900)	(39,900)	39,950	(43,050)	(43,050)	(43,050)	(43,050)	(43,050)	(9,150)	(9,150)	(9,150)	(9,150)	(9,150)	0	0	0	0	0
RT	0	0	19,859	(1,142)	(1,142)	3,572	(1,426)	(1,426)	(1,426)	(1,426)	(1,426)	(266)	(266)	(266)	0	4,714	(266)	(266)	(266)	(266)	(266)	(266)	(266)	(266)	0	0
ICER	0	0	0	0	0	4,636	(362)	(362)	(362)	(362)	(362)	(362)	(362)	(362)	0	0	0	0	0	0	0	0	0	0	0	0
RKLIFT	0	0	45,564	(42,436)	(42,436)	(19,654)	(63,654)	(63,654)	(63,654)	(63,654)	(52,293)	(31,827)	(31,827)	(31,827)	(10,609)	(10,609)	(10,609)	(10,609)	(10,609)	0	0	0	0	0	0	0
EL TRUCK	0	0	0	0	0	6,000	0	0	0	0	18,000	0	0	0	0	6,000	0	0	0	0	0	0	0	0	0	0
U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V CART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V TRUCK	0	0	0	0	0	0	0	0	0	0	18,731	(4,469)	(4,469)	(4,469)	(4,469)	32,994	(13,406)	(13,406)	(13,406)	(8,936)	(8,936)	(8,936)	(8,936)	(8,936)	0	0
T	0	0	0	0	0	78,364	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	0	0	0	0	0	0	0	0	0	0	0	0
INT TRUCK	0	0	0	0	0	0	0	0	0	0	115,174	(28,826)	(28,826)	(28,826)	(28,826)	(14,429)	(32,429)	(32,429)	(32,429)	(3,603)	(3,603)	(3,603)	(3,603)	(3,603)	0	0
HER	0	0	0	0	0	47,550	(9,450)	(9,450)	(9,450)	(9,450)	66,650	(25,350)	(25,350)	(25,350)	(18,900)	6,875	(21,125)	(21,125)	(21,125)	(4,225)	(4,225)	(4,225)	(4,225)	(4,225)	0	0
CKUP	0	0	0	0	0	0	0	0	0	0	139,200	(66,400)	(66,400)	(66,400)	(66,400)	(31,600)	(83,000)	(83,000)	(83,000)	(19,600)	(19,600)	(19,600)	(19,600)	(19,600)	0	0
RVICE TRUCK	0	0	0	0	0	0	0	0	0	0	71,984	(18,016)	(18,016)	(18,016)	(18,016)	(18,016)	(18,016)	(18,016)	(18,016)	0	0	0	0	0	0	0
N	0	0	0	0	6,000	0	0	0	0	0	14,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TE: Some costs are negative and, therefore, a savings.
TE: Discount Rate 3%

GSE COST ANALYSIS (Conversion Schedule)
AIRPORT: John Wayne

JAN 27 1995

	Useful Life (years)	Forecast Population 1990	2000	2005	2010	Conversion Population* 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C Tug NB - base	10	10	14	16	16			3	3	3	10	10	10	10	10	10	10	10	7	7	7	0	0	0	0	0	0	0	0	0	0
owth	10		4	2	0						4	4	4	4	4	6	6	6	6	6	6	2	2	2	2	2	0	0	0	0	0
C Tug WB	10	0	0	0	0																0	0	0	0	0	0	0	0	0	0	0
owth	10				0																0	0	0	0	0	0	0	0	0	0	0
r Cond	8	0	4	4	4																										
owth	8		4	0	0																										
r Start	8	2	4	4	4																										
owth	8		2	0	0																										
g Tug	8	44	60	70	76			44	44	44	44	44	44	44	44	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
owth	8		16	10	6						16	16	16	16	16	26	26	26	26	10	16	16	16	16	6	6	6	6	6	0	0
lt Load	8	20	26	30	32						20	20	20	20	20	20	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0
owth	8		6	4	2						6	6	6	6	6	10	10	10	10	4	6	6	6	6	2	2	2	2	2	0	0
obtail	8	4	6	6	8											4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
owth	8			2	2											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
us	8	2	2	2	2						1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0
owth	8			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
r	8	2	4	4	4					1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0
owth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
argo loader	10	6	12	14	14						6	6	6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0
owth	10		6	2	0						6	6	6	6	6	8	8	8	8	8	8	2	2	2	2	2	0	0	0	0	0
rt	8	8	10	10	12			8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
owth	8		2	0	2						2	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	0	0
icer	8	2	2	2	2						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
owth	8		0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
orklift	8	16	24	26	26			16	16	16	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
owth	8		8	4	0						8	8	8	8	8	12	12	12	12	4	4	4	4	4	0	0	0	0	0	0	0
uel Truck	8	4	6	6	8						2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0	0	0	0	0	0
owth	8			2	2											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
PU	8	8	12	14	14																										
owth	8			6	0																										
av Cart	8	0	2	2	2						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
owth	8		2	0	0						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
av Truck	8	4	4	4	6											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
owth	8			0	2											0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0
lt	8	6	8	8	8						6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0
owth	8		2	0	0						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
aint Truck	8	10	14	16	18											10	10	10	10	10	10	10	10	10	0	0	0	0	0	0	0
owth	8			6	2											6	6	6	6	6	6	6	6	6	2	2	2	2	2	0	0
ther	8	8	10	12	14						4	4	4	4	4	8	8	8	8	4	4	4	4	4	0	0	0	0	0	0	0
owth	8			4	2											4	4	4	4	4	6	6	6	6	2	2	2	2	2	0	0
ickup	8	10	14	16	20											10	10	10	10	10	10	10	10	10	0	0	0	0	0	0	0
owth	8			6	4											6	6	6	6	6	10	10	10	10	4	4	4	4	4	0	0
ervice Truck	8	6	6	10	10											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
rowth	8			4	0											4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
an	8	6	8	10	10					3	3	3	3	3	3	6	6	6	3	3	3	3	3	3	0	0	0	0	0	0	0
rowth	8			4	0											4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
ater Truck	8	0	0	0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
rowth	8			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

JAN 27 1995

GSE COST ANALYSIS (Conversion Schedule Summary)
AIRPORT: John Wayne

Conversion Population*

Equipment Type	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A/C TUG NB			3	3	3	14	14	14	14	14	16	16	16	13	13	13	2	2	2	2	2	0	0	0	0	0
A/C TUG WB																0	0	0	0	0	0	0	0	0	0	0
AIR COND																										
AIR START																										
BAG TUG			44	44	44	60	60	60	60	60	70	26	26	26	10	16	16	16	16	6	6	6	6	6	0	0
BELT LOADER						26	26	26	26	26	30	30	30	30	4	6	6	6	6	2	2	2	2	2	0	0
BOBTAIL											6	6	6	6	6	8	8	8	8	2	2	2	2	2	0	0
BUS						1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0
CAR					1	1	1	1	1	1	4	4	4	3	3	3	3	3	3	0	0	0	0	0	0	0
CARGO LOADER						12	12	12	12	12	14	14	14	14	14	14	2	2	2	2	2	0	0	0	0	0
CART			8	8	8	10	10	10	10	10	10	2	2	2	0	2	2	2	2	2	2	2	2	2	0	0
DEICER						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
FORKLIFT			16	16	16	24	24	24	24	24	28	12	12	12	4	4	4	4	4	0	0	0	0	0	0	0
FUEL TRUCK						2	2	2	2	2	6	6	6	6	4	6	6	6	6	2	2	2	2	2	0	0
GPU																										
LAV CART						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
LAV TRUCK											2	2	2	2	2	6	6	6	6	4	4	4	4	4	0	0
LIFT						8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0
MAINT TRUCK											16	16	16	16	16	18	18	18	18	2	2	2	2	2	0	0
OTHER						4	4	4	4	4	12	12	12	12	8	10	10	10	10	2	2	2	2	2	0	0
PICKUP											16	16	16	16	16	20	20	20	20	4	4	4	4	4	0	0
SERVICE TRUCK											10	10	10	10	10	10	10	10	10	0	0	0	0	0	0	0
VAN					3	3	3	3	3	3	10	10	10	7	7	7	7	7	7	0	0	0	0	0	0	0
WATER TRUCK											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

JAN 2 7 1995

GSE COST ANALYSIS (Inputs)*
AIRPORT: Long Beach

ipment e	Average Operation** (hours/year)	Useful Life (years)	Population 1990	2000	2005	2010	Conventional GSE Cost Capital ($000)	O&M ($/hr)	Electric GSE Cost Capital*** ($000)	O&M ($/hr)	Recharger Cost Installed Capital ($/electric unit)
TUG NB	1,721	10	4	6	6	8	$100.0	$16.67	$126.0	$12.50	$2,500
TUG WB	1,721	10	0	0	0	0	$190.0	$26.41	$262.5	$19.71	$2,500
COND	271	8	0	0	0	0	$60.0	$12.15	N/A	N/A	N/A
START	181	8	2	2	2	2	$80.0	$33.76	N/A	N/A	N/A
G TUG	1,021	8	20	26	28	34	$15.5	$8.06	$29.4	$6.04	$2,500
LT LOADER	887	8	8	10	10	14	$23.0	$6.63	$36.8	$4.97	$2,500
BTAIL	434	8	2	2	2	4	$24.0	$13.82	$36.8	$10.37	$2,500
S****	1,678	8	0	0	0	0	$110.0	$9.58	$114.0	$9.58	N/A
R****	486	8	0	2	2	2	$15.0	$2.10	$17.0	$2.10	N/A
RGO LOADER	1,250	10	2	4	4	4	$150.0	$9.84	$189.0	$7.38	$2,500
RT	340	8	2	4	6	6	$6.0	$1.69	$6.0	$1.27	$2,500
ICER	156	8	0	0	0	0	$5.0	$4.63	$5.0	$3.47	$2,500
RKLIFT	1,028	8	8	10	10	12	$18.0	$10.32	$21.0	$7.74	$2,500
EL TRUCK****	1,117	8	2	2	2	4	$65.0	$16.83	$69.0	$16.83	N/A
U	2,240	8	4	4	4	6	$32.0	$10.44	N/A	N/A	N/A
V CART	725	8	0	0	0	0	$7.0	$2.44	$7.0	$2.44	N/A
V TRUCK	735	8	2	2	2	2	$35.0	$12.15	$44.1	$9.11	$2,500
T	1,357	8	2	4	4	4	$45.0	$13.73	$56.7	$10.30	$2,500
INT TRUCK	563	8	4	6	6	8	$25.0	$12.82	$31.5	$9.62	$2,500
HER	771	8	4	4	6	6	$20.0	$10.97	$31.5	$8.23	$2,500
CKUP	1,722	8	4	6	6	8	$18.0	$9.65	$28.4	$7.24	$2,500
RVICE TRUCK	563	8	2	4	4	4	$25.0	$12.82	$31.5	$9.62	$2,500
N****	1,987	8	2	4	4	4	$22.0	$10.09	$24.0	$10.09	N/A
ATER TRUCK	567	8	0	0	0	0	$32.0	$14.04	$40.4	$10.53	$2,500
tal:			74	102	108	132					

Sources: Average Operation - ATA Comments on Proposed FIP
Useful Life - AA estimate
Population - Technical Support Document Errata memo (1990) and South Coast Aviation Growth Rates memo
GSE Cost - AA estimate
Recharger Cost - AA estimate

Refers to average operation per unit (hours/year)
* 5% added to all electric GSE capital costs (per unit) for shipping to a station outside of the FIP area for reuse.
is does not apply to carts, deicers, lav carts, or on-road vehicles.
** Capital and O&M costs are for ILEVs.

GSE COST ANALYSIS (Outputs)
AIRPORT: Long Beach
Cost of Purchasing an Electric GSE
Instead of a Conventional GSE

JAN 27 1995

ulpment pe	- Cost Differential - Capital Cost* ($/unit)	O&M Cost** ($/yr/unit)	Net Present Value of GSE Conversion Costs ($)
C TUG NB	28,500	(7,177)	($260,882)
C TUG WB	75,000	(11,531)	$0
R COND	N/A	N/A	N/A
R START	N/A	N/A	N/A
G TUG	16,400	(2,062)	($4,111)
LT LOADER	16,250	(1,472)	$49,718
BTAIL	15,250	(1,497)	$8,987
S	4,000	0	$0
R	2,000	0	$2,976
RGO LOADER	41,500	(3,075)	$42,077
RT	2,500	(143)	$6,908
ICER	2,500	(181)	$0
RKLIFT	5,500	(2,652)	($166,370)
EL TRUCK	4,000	0	$11,562
U	N/A	N/A	N/A
V CART	N/A	N/A	N/A
V TRUCK	11,600	(2,234)	($8,758)
FT	14,200	(4,655)	($79,801)
INT TRUCK	9,000	(1,802)	($31,318)
HER	14,000	(2,113)	($13,832)
CKUP	12,850	(4,150)	($117,448)
RVICE TRUCK	9,000	(1,802)	($16,216)
N	2,000	0	$6,242
ATER TRUCK	10,925	(1,990)	$0
tal:			($570,268)

Capital cost incurred during first year of equipment purchase only.
' O&M refers to Operating and Maintenance

TE: Some costs are negative and, therefore, a savings.
TE: Discount Rate = 3%

JAN 27 1995

GSE COST ANALYSIS (Calculations)
AIRPORT: Long Beach

Equipment Type	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A/C TUG NB	0	0	21,323	(7,177)	(7,177)	99,441	(43,059)	(43,059)	(43,059)	(43,059)	(43,059)	(43,059)	(43,059)	(35,883)	(35,883)	6,764	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)
A/C TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIR COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIR START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAG TUG	0	0	286,752	(41,248)	(41,248)	44,777	(53,623)	(53,623)	(53,623)	(53,623)	(24,948)	(16,499)	(16,499)	(16,499)	(4,125)	81,901	(16,499)	(16,499)	(16,499)	(12,375)	(12,375)	(12,375)	(12,375)	(12,375)	0	0
BELT LOADER	0	0	0	0	0	147,778	(14,724)	(14,724)	(14,724)	(14,724)	(14,724)	(14,724)	(14,724)	(14,724)	0	59,110	(5,890)	(5,890)	(5,890)	(5,890)	(5,890)	(5,890)	(5,890)	(5,890)	0	0
BOBTAIL	0	0	0	0	0	0	0	0	0	0	27,505	(2,995)	(2,995)	(2,995)	(2,995)	24,511	(5,990)	(5,990)	(5,990)	(2,995)	(2,995)	(2,995)	(2,995)	(2,995)	0	0
BUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAR	0	0	0	0	0	0	0	0	0	0	4,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CARGO LOADER	0	0	0	0	0	188,700	(12,300)	(12,300)	(12,300)	(12,300)	(12,300)	(12,300)	(12,300)	(12,300)	(12,300)	(12,300)	0	0	0	0	0	0	0	0	0	0
CART	0	0	4,714	(286)	(286)	4,428	(571)	(571)	(571)	(571)	4,143	(571)	(571)	(571)	(286)	(286)	(286)	(286)	(286)	0	0	0	0	0	0	0
DEICER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FORKLIFT	0	0	22,782	(21,218)	(21,218)	(15,522)	(26,522)	(26,522)	(26,522)	(26,522)	(26,522)	(5,304)	(5,304)	(5,304)	0	5,696	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	0	0
FUEL TRUCK	0	0	0	0	0	4,000	0	0	0	0	4,000	0	0	0	0	8,000	0	0	0	0	0	0	0	0	0	0
GPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAV CART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAV TRUCK	0	0	0	0	0	0	0	0	0	0	9,366	(2,234)	(2,234)	(2,234)	(2,234)	7,131	(4,469)	(4,469)	(4,469)	(2,234)	(2,234)	(2,234)	(2,234)	(2,234)	0	0
LIFT	0	0	0	0	0	36,182	(18,618)	(18,618)	(18,618)	(18,618)	(18,618)	(18,618)	(18,618)	(18,618)	0	0	0	0	0	0	0	0	0	0	0	0
MAINT TRUCK	0	0	0	0	0	0	0	0	0	0	43,190	(10,810)	(10,810)	(10,810)	(10,810)	3,587	(14,413)	(14,413)	(14,413)	(3,603)	(3,603)	(3,603)	(3,603)	(3,603)	0	0
OTHER	0	0	0	0	0	23,775	(4,225)	(4,225)	(4,225)	(4,225)	43,325	(12,675)	(12,675)	(12,675)	(8,450)	(8,450)	(8,450)	(8,450)	(8,450)	0	0	0	0	0	0	0
PICKUP	0	0	0	0	0	0	0	0	0	0	52,200	(24,900)	(24,900)	(24,900)	(24,900)	(7,500)	(33,200)	(33,200)	(33,200)	(8,300)	(8,300)	(8,300)	(8,300)	(8,300)	0	0
SERVICE TRUCK	0	0	0	0	0	0	0	0	0	0	28,794	(7,206)	(7,206)	(7,206)	(7,206)	(7,206)	(7,206)	(7,206)	(7,206)	0	0	0	0	0	0	0
VAN	0	0	0	0	2,000	0	0	0	0	0	6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WATER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: Some costs are negative and, therefore, a savings.
NOTE: Discount Rate 3%

GSE COST ANALYSIS (Conversion Schedule)
AIRPORT: Long Beach

JAN 27 1995

	Useful Life (years)	Forecast Population 1990	2000	2005	2010	Conversion Population* 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tug NB - base	10	4	6	6	8			1	1	1	4	4	4	4	4	4	4	4	3	3	3	0	0	0	0	0	0	0	0	0	0
vith	10		2	0	2						2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	2	2	2	2	2	2
Tug WB	10	0	0	0	0																0	0	0	0	0	0	0	0	0	0	0
vith	10				0																0	0	0	0	0	0	0	0	0	0	0
Cond	8	0	0	0	0																										
vith	8		0	0	0																										
Start	8	2	2	2	2																										
vith	8		0	0	0																										
Tug	8	20	26	26	34			20	20	20	20	20	20	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vith	8		6	2	6						6	6	6	6	6	6	6	6	6	2	6	6	6	6	6	6	6	6	6	0	0
Load	8	6	10	10	14						6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0
vith	8		2	0	4						2	2	2	2	2	2	2	2	2	0	4	4	4	4	4	4	4	4	4	0	0
tail	8	2	2	2	4											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
vith	8			0	2											0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0
	8	0	0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vith	8			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8	0	2	2	2					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vith	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
go loader	10	2	4	4	4						2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0
vith	10		2	0	0						2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0
t	8	2	4	6	6			2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vith	8		2	2	0						2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0	0	0	0	0	0
ser	8	0	0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vith	8		0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
idift	8	8	10	10	12			8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vith	8		2	0	2						2	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	0	0
l Truck	8	2	2	2	4						1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0
vith	8			0	2											0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0
J	8	4	4	4	6																										
vith	8			0	2																										
Cart	8	0	0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vith	8		0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck	8	2	2	2	2											1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0
vith	8			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8	2	4	4	4						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
vith	8		2	0	0						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
nt Truck	8	4	6	6	8											4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
vith	8			2	2											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
er	8	4	4	6	6						2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0	0	0	0	0	0
vith	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
oup	8	4	6	6	8											4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
vith	8			2	2											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
vice Truck	8	2	4	4	4											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
vith	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
	8	2	4	4	4					1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0
vith	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
er Truck	8	0	0	0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vith	8			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

opulation in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

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GSE COST ANALYSIS (Conversion Schedule Summary)
AIRPORT: Long Beach

Conversion Population*

Equipment Type	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A/C TUG NB			1	1	1	6	6	6	6	6	6	6	6	5	5	7	2	2	2	2	2	2	2	2	2	2
A/C TUG WB																0	0	0	0	0	0	0	0	0	0	0
AIR COND																										
AIR START																										
BAG TUG			20	20	20	26	26	26	26	26	28	8	8	8	2	8	8	8	8	6	6	6	6	6	0	0
BELT LOADER						10	10	10	10	10	10	10	10	10	0	4	4	4	4	4	4	4	4	4	0	0
BOBTAIL											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
BUS						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAR					0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
CARGO LOADER						4	4	4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0
CART			2	2	2	4	4	4	4	4	6	4	4	4	2	2	2	2	2	0	0	0	0	0	0	0
DEICER						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FORKLIFT			8	8	8	10	10	10	10	10	10	2	2	2	0	2	2	2	2	2	2	2	2	2	0	0
FUEL TRUCK						1	1	1	1	1	2	2	2	2	1	3	3	3	3	2	2	2	2	2	0	0
GPU																										
LAV CART						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAV TRUCK											1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0
LIFT						4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0
MAINT TRUCK											6	6	6	6	6	8	8	8	8	2	2	2	2	2	0	0
OTHER						2	2	2	2	2	6	6	6	6	4	4	4	4	4	0	0	0	0	0	0	0
PICKUP											6	6	6	6	6	8	8	8	8	2	2	2	2	2	0	0
SERVICE TRUCK											4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
VAN					1	1	1	1	1	1	4	4	4	3	3	3	3	3	3	0	0	0	0	0	0	0
WATER TRUCK											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

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GSE COST ANALYSIS (Inputs)*
AIRPORT: Los Angeles Intl

lpment	Average Operation** (hours/year)	Useful Life (years)	Population				Conventional GSE Cost		Electric GSE Cost		Recharger Cost
			1990	2000	2005	2010	Capital ($000)	O&M ($/hr)	Capital*** ($000)	O&M ($/hr)	Installed Capital ($/electric unit)
TUG NB	1,721	10	44	58	61	67	$100.0	$16.67	$126.0	$12.50	$2,500
TUG WB	1,721	10	3	6	7	8	$190.0	$26.41	$262.5	$19.71	$2,500
COND	271	8	13	17	19	21	$60.0	$12.15	N/A	N/A	N/A
START	181	8	23	33	36	39	$80.0	$33.76	N/A	N/A	N/A
I TUG	1,021	8	296	426	454	507	$15.5	$8.06	$29.4	$6.04	$2,500
T LOADER	887	8	127	183	195	217	$23.0	$6.63	$36.8	$4.97	$2,500
STAIL	434	8	28	40	43	48	$24.0	$13.82	$36.8	$10.37	$2,500
;****	1,678	8	11	17	18	20	$110.0	$9.58	$114.0	$9.58	N/A
]****	486	8	16	22	24	26	$15.0	$2.10	$17.0	$2.10	N/A
IGO LOADER	1,250	10	54	76	82	92	$150.0	$9.84	$189.0	$7.38	$2,500
IT	340	8	49	69	74	82	$6.0	$1.69	$6.0	$1.27	$2,500
CER	156	8	9	13	14	15	$5.0	$4.63	$5.0	$3.47	$2,500
RKLIFT	1,028	8	117	167	178	199	$18.0	$10.32	$21.0	$7.74	$2,500
EL TRUCK****	1,117	8	32	45	49	54	$65.0	$16.83	$69.0	$16.83	N/A
J	2,240	8	56	80	85	95	$32.0	$10.44	N/A	N/A	N/A
/ CART	725	8	7	9	10	11	$7.0	$2.44	$7.0	$2.44	N/A
/ TRUCK	735	8	20	29	31	35	$35.0	$12.15	$44.1	$9.11	$2,500
T	1,357	8	37	54	58	65	$45.0	$13.73	$56.7	$10.30	$2,500
NT TRUCK	563	8	75	108	116	130	$25.0	$12.82	$31.5	$9.62	$2,500
IER	771	8	58	85	91	101	$20.0	$10.97	$31.5	$8.23	$2,500
KUP	1,722	8	72	104	110	123	$18.0	$9.65	$28.4	$7.24	$2,500
RVICE TRUCK	563	8	43	63	66	74	$25.0	$12.82	$31.5	$9.62	$2,500
J****	1,987	8	42	60	64	72	$22.0	$10.09	$24.0	$10.09	N/A
TER TRUCK	567	8	3	5	5	6	$32.0	$14.04	$40.4	$10.53	$2,500
al:			1,235	1,769	1,890	2,107					

ources: Average Operation - ATA Comments on Proposed FIP
Useful Life - AA estimate
Population - Technical Support Document Errata memo (1990) and South Coast Aviation Growth Rates memo
GSE Cost - AA estimate
Recharger Cost - AA estimate

Refers to average operation per unit (hours/year)
' 5% added to all electric GSE capital costs (per unit) for shipping to a station outside of the FIP area for reuse.
s does not apply to carts, deicers, lav carts, or on-road vehicles.
'* Capital and O&M costs are for ILEVs.

GSE COST ANALYSIS (Outputs)
AIRPORT: Los Angeles Intl
Cost of Purchasing an Electric GSE
Instead of a Conventional GSE

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ıIpment	- Cost Differential - Capital Cost* ($/unit)	O&M Cost** ($/yr/unit)	Net Present Value of GSE Conversion Costs ($)
TUG NB	28,500	(7,177)	($2,273,753)
TUG WB	75,000	(11,531)	($179,156)
COND	N/A	N/A	N/A
START	N/A	N/A	N/A
ɜ TUG	16,400	(2,062)	($62,428)
.T LOADER	16,250	(1,472)	$803,527
ƷTAIL	15,250	(1,497)	$114,140
ɜ	4,000	0	$67,507
ɜ	2,000	0	$40,594
ƷGO LOADER	41,500	(3,075)	$932,175
ƷT	2,500	(143)	$97,944
CER	2,500	(181)	$13,214
ƷKLIFT	5,500	(2,652)	($2,761,011)
ƷL TRUCK	4,000	0	$177,222
J	N/A	N/A	N/A
/ CART	N/A	N/A	N/A
/ TRUCK	11,600	(2,234)	($155,528)
T	14,200	(4,655)	($1,250,061)
NT TRUCK	9,000	(1,802)	($519,226)
ƷER	14,000	(2,113)	($228,199)
ƷKUP	12,850	(4,150)	($1,842,844)
ƷVICE TRUCK	9,000	(1,802)	($295,542)
N	2,000	0	$111,578
TER TRUCK	10,925	(1,990)	($21,967)
al:			
			($7,231,815)

apital cost incurred during first year of equipment purchase only.
O&M refers to Operating and Maintenance

TE: Some costs are negative and, therefore, a savings.
TE: Discount Rate = 3%

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GSE COST ANALYSIS (Calculations)
AIRPORT: Los Angeles Intl

Equipment Type	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A/C TUG NB	0	0	234,558	(78,942)	(78,942)	923,259	(416,241)	(416,241)	(416,241)	(416,241)	(352,271)	(437,771)	(437,771)	(358,829)	(358,829)	(230,866)	(84,589)	(84,589)	(84,589)	(84,589)	(84,589)	(43,059)	(43,059)	(43,059)	(43,059)	(43,059)
A/C TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	507,754	(92,246)	(92,246)	(92,246)	(92,246)	(92,246)	(92,246)	(92,246)	(92,246)	(92,246)	(92,246)
AIR COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIR START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAG TUG	0	0	4,243,924	(810,476)	(810,476)	1,253,409	(878,591)	(878,591)	(878,591)	(878,591)	(477,139)	(325,862)	(325,862)	(325,862)	(57,748)	702,144	(167,056)	(167,056)	(167,056)	(109,306)	(109,306)	(109,306)	(109,306)	(109,306)	0	0
BELT LOADER	0	0	0	0	0	2,764,287	(289,453)	(289,453)	(289,453)	(289,453)	(92,122)	(287,122)	(287,122)	(287,122)	(17,869)	307,436	(50,062)	(50,062)	(50,062)	(32,393)	(32,393)	(32,393)	(32,393)	(32,393)	0	0
BOBTAIL	0	0	0	0	0	0	0	0	0	0	591,366	(84,364)	(84,364)	(84,364)	(84,364)	4,360	(71,870)	(71,870)	(71,870)	(7,467)	(7,467)	(7,467)	(7,467)	(7,467)	0	0
BUS	0	0	0	0	0	84,000	0	0	0	0	56,000	0	0	0	0	8,000	0	0	0	0	0	0	0	0	0	0
CAR	0	0	0	0	16,000	0	0	0	0	0	32,000	0	0	0	0	4,000	0	0	0	0	0	0	0	0	0	0
CARGO LOADER	0	0	0	0	0	2,920,300	(233,700)	(233,700)	(233,700)	(233,700)	(3,150)	(252,150)	(252,150)	(252,150)	(252,150)	132,100	(49,200)	(49,200)	(49,200)	(49,200)	(49,200)	(30,750)	(30,750)	(30,750)	(30,750)	(30,750)
CART	0	0	115,503	(9,997)	(9,997)	40,147	(9,853)	(9,853)	(9,853)	(9,853)	1,833	(3,570)	(3,570)	(3,570)	(714)	18,144	(1,856)	(1,856)	(1,856)	(1,142)	(1,142)	(1,142)	(1,142)	(1,142)	0	0
DEICER	0	0	0	0	0	30,148	(2,352)	(2,352)	(2,352)	(2,352)	(33)	(2,533)	(2,533)	(2,533)	(181)	2,136	(362)	(362)	(362)	(181)	(181)	(181)	(181)	(181)	0	0
FORKLIFT	0	0	333,186	(310,312)	(310,312)	(167,894)	(442,924)	(442,924)	(442,924)	(442,924)	(411,898)	(181,787)	(181,787)	(181,787)	(29,175)	30,828	(84,872)	(84,872)	(84,872)	(55,697)	(55,697)	(55,697)	(55,697)	(55,697)	0	0
FUEL TRUCK	0	0	0	0	0	56,000	0	0	0	0	156,000	0	0	0	0	20,000	0	0	0	0	0	0	0	0	0	0
GPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAV CART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAV TRUCK	0	0	0	0	0	0	0	0	0	0	196,678	(46,922)	(46,922)	(46,922)	(46,922)	84,196	(78,204)	(78,204)	(78,204)	(31,282)	(31,282)	(31,282)	(31,282)	(31,282)	0	0
LIFT	0	0	0	0	0	515,456	(251,344)	(251,344)	(251,344)	(251,344)	(213,162)	(289,962)	(289,962)	(289,962)	(18,618)	46,200	(51,200)	(51,200)	(51,200)	(32,562)	(32,562)	(32,562)	(32,562)	(32,562)	0	0
MAINT TRUCK	0	0	0	0	0	0	0	0	0	0	635,014	(208,966)	(208,966)	(208,966)	(208,966)	(109,208)	(234,208)	(234,208)	(234,208)	(25,222)	(25,222)	(25,222)	(25,222)	(25,222)	0	0
OTHER	0	0	0	0	0	344,736	(61,284)	(61,284)	(61,284)	(61,284)	675,759	(192,241)	(192,241)	(192,241)	(130,977)	(12,103)	(152,103)	(152,103)	(152,103)	(21,125)	(21,125)	(21,125)	(21,125)	(21,125)	0	0
PICKUP	0	0	0	0	0	0	0	0	0	0	956,998	(456,502)	(456,502)	(456,502)	(456,502)	(343,402)	(510,452)	(510,452)	(510,452)	(53,950)	(53,950)	(53,950)	(53,950)	(53,950)	0	0
SERVICE TRUCK	0	0	0	0	0	0	0	0	0	0	475,094	(118,906)	(118,906)	(118,906)	(118,906)	(61,318)	(133,318)	(133,318)	(133,318)	(14,413)	(14,413)	(14,413)	(14,413)	(14,413)	0	0
VAN	0	0	0	0	42,000	0	0	0	0	0	86,000	0	0	0	0	16,000	0	0	0	0	0	0	0	0	0	0
WATER TRUCK	0	0	0	0	0	0	0	0	0	0	44,674	(9,951)	(9,951)	(9,951)	(9,951)	(1,016)	(11,941)	(11,941)	(11,941)	(1,990)	(1,990)	(1,990)	(1,990)	(1,990)	0	0

NOTE: Some costs are negative and, therefore, a savings.
NOTE: Discount Rate 3%

GSE COST ANALYSIS (Conversion Schedule)
AIRPORT: Los Angeles Intl

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	Useful Life (years)	Forecast Population 1990	2000	2005	2010	Conversion Population* 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tug NB - base	10	44	58	61	67			11	11	11	44	44	44	44	44	44	44	44	33	33	33	0	0	0	0	0	0	0	0	0	0
th	10		14	3	6						14	14	14	14	14	17	17	17	17	17	23	9	9	9	9	9	6	6	6	6	6
Tug WB	10	3	6	7	8																3	3	3	3	3	3	3	3	3	3	3
th	10				5																5	5	5	5	5	5	5	5	5	5	5
ond	8	13	17	19	21																										
th	8		4	2	2																										
tart	8	23	33	36	39																										
th	8		10	3	3																										
Tug	8	296	426	454	507			296	296	296	296	296	296	296	296	296	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
th	8		130	28	53						130	130	130	130	130	156	156	156	156	26	81	81	81	81	53	53	53	53	53	0	0
Load	8	127	183	195	217						127	127	127	127	127	127	127	127	127	0	0	0	0	0	0	0	0	0	0	0	0
th	8		56	12	22						56	56	56	56	56	66	66	66	66	12	34	34	34	34	22	22	22	22	22	0	0
all	8	26	40	43	48											26	26	26	26	26	26	26	26	26	0	0	0	0	0	0	0
th	8			15	5											15	15	15	15	15	20	20	20	20	5	5	5	5	5	0	0
	8	11	17	18	20						6	6	6	6	6	13	13	13	13	7	7	7	7	7	0	0	0	0	0	0	0
th	8			7	2											7	7	7	7	7	9	9	9	9	2	2	2	2	2	0	0
	8	16	22	24	26					8	8	8	8	8	8	16	16	16	8	8	8	8	8	8	0	0	0	0	0	0	0
th	8			8	2											8	8	8	8	8	10	10	10	10	2	2	2	2	2	0	0
jo loader	10	54	76	82	92						54	54	54	54	54	54	54	54	54	54	54	0	0	0	0	0	0	0	0	0	0
th	10		22	6	10						22	22	22	22	22	26	26	26	26	26	36	16	16	16	16	16	10	10	10	10	10
	8	49	69	74	82			49	49	49	49	49	49	49	49	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
th	8		20	5	8						20	20	20	20	20	25	25	25	25	5	13	13	13	13	8	8	8	8	8	0	0
er	8	9	13	14	15						9	9	9	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0
th	8		4	1	1						4	4	4	4	4	5	5	5	5	1	2	2	2	2	1	1	1	1	1	0	0
lift	8	117	167	178	199			117	117	117	117	117	117	117	117	117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
th	8		50	11	21						50	50	50	50	50	61	61	61	61	11	32	32	32	32	21	21	21	21	21	0	0
Truck	8	32	45	49	54						14	14	14	14	14	36	36	36	36	22	22	22	22	22	0	0	0	0	0	0	0
th	8			17	5											17	17	17	17	17	22	22	22	22	5	5	5	5	5	0	0
	8	56	60	85	95																										
th	8			29	10																										
Cart	8	7	9	10	11						7	7	7	7	7	7	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0
th	8		2	1	1						2	2	2	2	2	3	3	3	3	1	2	2	2	2	1	1	1	1	1	0	0
Truck	8	20	29	31	35											10	10	10	10	10	20	20	20	20	10	10	10	10	10	0	0
th	8			11	4											11	11	11	11	11	15	15	15	15	4	4	4	4	4	0	0
	8	37	54	58	66						37	37	37	37	37	37	37	37	37	0	0	0	0	0	0	0	0	0	0	0	0
th	8		17	4	7						17	17	17	17	17	21	21	21	21	4	11	11	11	11	7	7	7	7	7	0	0
t Truck	8	75	108	116	130											75	75	75	75	75	75	75	75	75	0	0	0	0	0	0	0
th	8			41	14											41	41	41	41	41	55	55	55	55	14	14	14	14	14	0	0
r	8	58	85	91	101						29	29	29	29	29	58	58	58	58	29	29	29	29	29	0	0	0	0	0	0	0
th	8			33	10											33	33	33	33	33	43	43	43	43	10	10	10	10	10	0	0
up	8	72	104	110	123											72	72	72	72	72	72	72	72	72	0	0	0	0	0	0	0
th	8			38	13											38	38	38	38	38	51	51	51	51	13	13	13	13	13	0	0
Ace Truck	8	43	63	66	74											43	43	43	43	43	43	43	43	43	0	0	0	0	0	0	0
th	8			23	8											23	23	23	23	23	31	31	31	31	8	8	8	8	8	0	0
	8	42	60	64	72					21	21	21	21	21	21	42	42	42	21	21	21	21	21	21	0	0	0	0	0	0	0
th	8			22	8											22	22	22	22	22	30	30	30	30	8	8	8	8	8	0	0
r Truck	8	3	5	5	6											3	3	3	3	3	3	3	3	3	0	0	0	0	0	0	0
th	8			2	1											2	2	2	2	2	3	3	3	3	1	1	1	1	1	0	0

opulation in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

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GSE COST ANALYSIS (Conversion Schedule Summary)
AIRPORT: Los Angeles Intl

Conversion Population*

uipment pe	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C TUG NB			11	11	11	58	58	58	58	58	61	61	61	50	50	56	9	9	9	9	9	6	6	6	6	6
C TUG WB																8	8	8	8	8	8	8	8	8	8	8
R COND																										
R START																										
G TUG			296	296	296	426	426	426	426	426	454	158	158	158	28	81	81	81	81	53	53	53	53	53	0	0
LT LOADER						183	183	183	183	183	195	195	195	195	12	34	34	34	34	22	22	22	22	22	0	0
BTAIL											43	43	43	43	43	48	48	48	48	5	5	5	5	5	0	0
JS						6	6	6	6	6	20	20	20	20	14	16	16	16	16	2	2	2	2	2	0	0
R					6	8	8	8	8	8	24	24	24	16	16	18	18	18	18	2	2	2	2	2	0	0
RGO LOADER						76	76	76	76	76	82	82	82	82	82	92	16	16	16	16	16	10	10	10	10	10
RT			49	49	49	69	69	69	69	69	74	25	25	25	5	13	13	13	13	8	8	8	8	8	0	0
ICER						13	13	13	13	13	14	14	14	14	1	2	2	2	2	1	1	1	1	1	0	0
RKLIFT			117	117	117	167	167	167	167	167	178	61	61	61	11	32	32	32	32	21	21	21	21	21	0	0
EL TRUCK						14	14	14	14	14	53	53	53	53	39	44	44	44	44	5	5	5	5	5	0	0
U																										
V CART						9	9	9	9	9	10	10	10	10	1	2	2	2	2	1	1	1	1	1	0	0
V TRUCK											21	21	21	21	21	35	35	35	35	14	14	14	14	14	0	0
FT						54	54	54	54	54	58	58	58	58	4	11	11	11	11	7	7	7	7	7	0	0
INT TRUCK											116	116	116	116	116	130	130	130	130	14	14	14	14	14	0	0
THER						29	29	29	29	29	91	91	91	91	62	72	72	72	72	10	10	10	10	10	0	0
CKUP											110	110	110	110	110	123	123	123	123	13	13	13	13	13	0	0
ERVICE TRUCK											66	66	66	66	66	74	74	74	74	8	8	8	8	8	0	0
AN					21	21	21	21	21	21	64	64	64	43	43	51	51	51	51	8	8	8	8	8	0	0
ATER TRUCK											5	5	5	5	5	6	6	6	6	1	1	1	1	1	0	0

Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

JAN 27 1995

GSE COST ANALYSIS (Inputs)*
AIRPORT: Ontario Intl

Equipment Type	Average Operation** (hours/year)	Useful Life (years)	Population				Conventional GSE Cost		Electric GSE Cost		Recharger Cost
			1990	2000	2005	2010	Capital ($000)	O&M ($/hr)	Capital*** ($000)	O&M ($/hr)	Installed Capital ($/electric unit)
VC TUG NB	1,721	10	8	12	14	14	$100.0	$16.67	$126.0	$12.50	$2,500
VC TUG WB	1,721	10	0	0	0	0	$190.0	$26.41	$262.5	$19.71	$2,500
IR COND	271	8	4	4	4	4	$60.0	$12.15	N/A	N/A	N/A
IR START	181	8	4	4	6	6	$80.0	$33.76	N/A	N/A	N/A
AG TUG	1,021	8	54	76	82	92	$15.5	$8.06	$29.4	$6.04	$2,500
ELT LOADER	887	8	22	30	36	40	$23.0	$6.63	$36.8	$4.97	$2,500
OBTAIL	434	8	6	6	8	8	$24.0	$13.82	$36.8	$10.37	$2,500
US****	1,678	8	2	2	2	4	$110.0	$9.58	$114.0	$9.58	N/A
AR****	486	8	2	4	4	4	$15.0	$2.10	$17.0	$2.10	N/A
ARGO LOADER	1,250	10	12	14	16	18	$150.0	$9.84	$189.0	$7.38	$2,500
ART	340	8	8	12	12	16	$6.0	$1.69	$6.0	$1.27	$2,500
EICER	156	8	2	2	2	2	$5.0	$4.63	$5.0	$3.47	$2,500
ORKLIFT	1,028	8	22	28	34	38	$18.0	$10.32	$21.0	$7.74	$2,500
UEL TRUCK****	1,117	8	6	8	8	10	$65.0	$16.83	$69.0	$16.83	N/A
PU	2,240	8	10	14	16	18	$32.0	$10.44	N/A	N/A	N/A
AV CART	725	8	2	2	2	2	$7.0	$2.44	$7.0	$2.44	N/A
AV TRUCK	735	8	4	6	6	6	$35.0	$12.15	$44.1	$9.11	$2,500
IFT	1,357	8	8	8	12	12	$45.0	$13.73	$56.7	$10.30	$2,500
AINT TRUCK	563	8	12	18	20	24	$25.0	$12.82	$31.5	$9.62	$2,500
THER	771	8	10	14	14	18	$20.0	$10.97	$31.5	$8.23	$2,500
ICKUP	1,722	8	12	18	22	24	$18.0	$9.65	$28.4	$7.24	$2,500
ERVICE TRUCK	563	8	6	10	12	12	$25.0	$12.82	$31.5	$9.62	$2,500
AN****	1,987	8	8	10	12	14	$22.0	$10.09	$24.0	$10.09	N/A
ATER TRUCK	567	8	0	0	0	2	$32.0	$14.04	$40.4	$10.53	$2,500
Total:			224	302	344	388					

* Sources: Average Operation - ATA Comments on Proposed FIP
Useful Life - AA estimate
Population - Technical Support Document Errata memo (1990) and South Coast Aviation Growth Rates memo
GSE Cost - AA estimate
Recharger Cost - AA estimate

** Refers to average operation per unit (hours/year)

*** 5% added to all electric GSE capital costs (per unit) for shipping to a station outside of the FIP area for reuse. This does not apply to carts, deicers, lav carts, or on-road vehicles.

**** Capital and O&M costs are for ILEVs.

GSE COST ANALYSIS (Outputs)
AIRPORT: Ontario Intl
Cost of Purchasing an Electric GSE
Instead of a Conventional GSE

JAN 2 7 1995

uipment ype	- Cost Differential - Capital Cost* ($/unit)	O&M Cost** ($/yr/unit)	Net Present Value of GSE Conversion Costs ($)
C TUG NB	28,500	(7,177)	($478,709)
C TUG WB	75,000	(11,531)	$0
R COND	N/A	N/A	N/A
R START	N/A	N/A	N/A
AG TUG	16,400	(2,062)	($11,304)
ELT LOADER	16,250	(1,472)	$146,176
OBTAIL	15,250	(1,497)	$19,300
US	4,000	0	$11,562
AR	2,000	0	$6,242
ARGO LOADER	41,500	(3,075)	$181,071
ART	2,500	(143)	$18,369
EICER	2,500	(181)	$1,809
ORKLIFT	5,500	(2,652)	($519,544)
UEL TRUCK	4,000	0	$33,344
PU	N/A	N/A	N/A
AV CART	N/A	N/A	N/A
AV TRUCK	11,600	(2,234)	($26,920)
FT	14,200	(4,655)	($228,438)
AINT TRUCK	9,000	(1,802)	($95,069)
THER	14,000	(2,113)	($39,943)
CKUP	12,850	(4,150)	($360,700)
ERVICE TRUCK	9,000	(1,802)	($48,648)
AN	2,000	0	$21,581
ATER TRUCK	10,925	(1,990)	($6,464)
otal:			
			($1,376,288)

Capital cost incurred during first year of equipment purchase only.
* O&M refers to Operating and Maintenance

OTE: Some costs are negative and, therefore, a savings.
OTE: Discount Rate = 3%

GSE COST ANALYSIS (Calculations)
AIRPORT: Ontario Intl

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ment	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
UG NB	0	0	42,847	(14,353)	(14,353)	198,861	(86,119)	(86,119)	(86,119)	(86,119)	(43,472)	(100,472)	(100,472)	(86,119)	(86,119)	(86,119)	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)	0	0	0	0	0
UG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG	0	0	774,229	(111,371)	(111,371)	204,089	(156,744)	(156,744)	(156,744)	(156,744)	(70,718)	(57,748)	(57,748)	(57,748)	(12,375)	131,001	(32,999)	(32,999)	(32,999)	(20,624)	(20,624)	(20,624)	(20,624)	(20,624)	0	0
LOADER	0	0	0	0	0	443,327	(44,173)	(44,173)	(44,173)	(44,173)	44,493	(53,007)	(53,007)	(53,007)	(8,835)	50,276	(14,724)	(14,724)	(14,724)	(5,890)	(5,890)	(5,890)	(5,890)	(5,890)	0	0
AIL	0	0	0	0	0	0	0	0	0	0	110,022	(11,978)	(11,978)	(11,978)	(11,978)	(11,978)	(11,978)	(11,978)	(11,978)	0	0	0	0	0	0	0
	0	0	0	0	0	4,000	0	0	0	0	4,000	0	0	0	0	8,000	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	2,000	0	0	0	0	0	6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IO LOADER	0	0	0	0	0	537,950	(43,050)	(43,050)	(43,050)	(43,050)	33,900	(49,200)	(49,200)	(49,200)	(49,200)	27,650	(12,300)	(12,300)	(12,300)	(12,300)	(12,300)	(6,150)	(6,150)	(6,150)	(6,150)	(6,150)
	0	0	19,858	(1,142)	(1,142)	8,286	(1,714)	(1,714)	(1,714)	(1,714)	(1,714)	(571)	(571)	(571)	0	9,429	(571)	(571)	(571)	(571)	(571)	(571)	(571)	(571)	0	0
ER	0	0	0	0	0	4,636	(362)	(362)	(362)	(362)	(362)	(362)	(362)	(362)	0	0	0	0	0	0	0	0	0	0	0	0
LIFT	0	0	82,651	(58,349)	(58,349)	(41,283)	(74,283)	(74,283)	(74,283)	(74,283)	(57,176)	(31,627)	(31,627)	(31,627)	(15,913)	(4,522)	(28,522)	(28,522)	(28,522)	(10,608)	(10,608)	(10,608)	(10,608)	(10,608)	0	0
TRUCK	0	0	0	0	0	12,000	0	0	0	0	24,000	0	0	0	0	8,000	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK	0	0	0	0	0	0	0	0	0	0	37,462	(8,938)	(8,938)	(8,938)	(8,938)	9,794	(13,406)	(13,406)	(13,406)	(4,469)	(4,469)	(4,469)	(4,469)	(4,469)	0	0
	0	0	0	0	0	76,364	(37,236)	(37,236)	(37,236)	(37,236)	946	(55,854)	(55,854)	(55,854)	(18,618)	(18,618)	(18,618)	(18,618)	(18,618)	0	0	0	0	0	0	0
T TRUCK	0	0	0	0	0	0	0	0	0	0	143,866	(36,032)	(36,032)	(36,032)	(36,032)	(7,236)	(43,236)	(43,236)	(43,236)	(7,206)	(7,206)	(7,206)	(7,206)	(7,206)	0	0
R	0	0	0	0	0	58,437	(10,563)	(10,563)	(10,563)	(10,563)	96,424	(28,578)	(28,578)	(28,578)	(19,013)	28,537	(27,463)	(27,463)	(27,463)	(8,460)	(8,460)	(8,460)	(8,460)	(8,460)	0	0
JP	0	0	0	0	0	0	0	0	0	0	181,400	(91,300)	(91,300)	(91,300)	(91,300)	(73,900)	(99,600)	(99,600)	(99,600)	(8,300)	(8,300)	(8,300)	(8,300)	(8,300)	0	0
ICE TRUCK	0	0	0	0	0	0	0	0	0	0	86,381	(21,619)	(21,619)	(21,619)	(21,619)	(21,619)	(21,619)	(21,619)	(21,619)	0	0	0	0	0	0	0
	0	0	0	0	8,000	0	0	0	0	0	16,000	0	0	0	0	4,000	0	0	0	0	0	0	0	0	0	0
R TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,870	(3,960)	(3,960)	(3,960)	(3,960)	(3,960)	(3,960)	(3,960)	(3,960)	0	0

:: Some costs are negative and, therefore, a savings.
:: Discount Rate 3%

GSE COST ANALYSIS (Conversion Schedule)
AIRPORT: Ontario Intl

JAN 27 1995

	Useful Life (years)	Forecast Population 1990	2000	2005	2010	Conversion Population* 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tug NB - base	10	8	12	14	14			2	2	2	6	6	8	8	8	8	8	8	6	6	6	0	0	0	0	0	0	0	0	0	0
vth	10		4	2	0						4	4	4	4	4	6	6	6	6	6	6	2	2	2	2	2	0	0	0	0	0
Tug WB	10	0	0	0	0																0	0	0	0	0	0	0	0	0	0	0
vth	10				0																0	0	0	0	0	0	0	0	0	0	0
Cond	8	4	4	4	4																										
vth	8		0	0	0																										
Start	8	4	4	6	6																										
vth	8		0	2	0																										
Tug	8	54	76	82	92			54	54	54	54	54	54	54	54	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vth	8		22	6	10						22	22	22	22	22	26	26	26	26	6	16	16	16	16	10	10	10	10	10	0	0
Load	8	22	30	36	40						22	22	22	22	22	22	22	22	22	0	0	0	0	0	0	0	0	0	0	0	0
vth	8		8	6	4						8	8	8	8	8	14	14	14	14	6	10	10	10	10	4	4	4	4	4	0	0
tail	8	6	6	8	8											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
vth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
	8	2	2	2	4						1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0
vth	8			0	2											0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0
	8	2	4	4	4					1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0
vth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
go loader	10	12	14	16	18						12	12	12	12	12	12	12	12	12	12	12	0	0	0	0	0	0	0	0	0	0
vth	10		2	2	2						2	2	2	2	2	4	4	4	4	4	6	4	4	4	4	4	2	2	2	2	2
	8	8	12	12	16			8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vth	8		4	0	4						4	4	4	4	4	4	4	4	4	0	4	4	4	4	4	4	4	4	4	0	0
ser	8	2	2	2	2						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
vth	8		0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
idlift	8	22	26	34	38			22	22	22	22	22	22	22	22	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vth	8		6	6	4						6	6	6	6	6	12	12	12	12	6	10	10	10	10	4	4	4	4	4	0	0
l Truck	8	6	8	8	10						3	3	3	3	3	7	7	7	7	4	4	4	4	4	0	0	0	0	0	0	0
vth	8			2	2											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
J	8	10	14	16	18																										
vth	8			6	2																										
Cart	8	2	2	2	2						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
vth	8		0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck	8	4	6	6	6											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
vth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
	8	8	8	12	12						8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0
vth	8		0	4	0						0	0	0	0	0	4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
nt Truck	8	12	16	20	24											12	12	12	12	12	12	12	12	12	0	0	0	0	0	0	0
vth	8			8	4											8	8	8	8	8	12	12	12	12	4	4	4	4	4	0	0
er	8	10	14	14	18						5	5	5	5	5	10	10	10	10	5	5	5	5	5	0	0	0	0	0	0	0
vth	8			4	4											4	4	4	4	4	8	8	8	8	4	4	4	4	4	0	0
kup	8	12	16	22	24											12	12	12	12	12	12	12	12	12	0	0	0	0	0	0	0
vth	8			10	2											10	10	10	10	10	12	12	12	12	2	2	2	2	2	0	0
vice Truck	8	6	10	12	12											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
vth	8			6	0											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
	8	6	10	12	14					4	4	4	4	4	4	8	8	8	4	4	4	4	4	4	0	0	0	0	0	0	0
vth	8			4	2											4	4	4	4	4	6	6	6	6	2	2	2	2	2	0	0
er Truck	8	0	0	0	2											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
vth	8			0	2											0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0

*Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

GSE COST ANALYSIS (Conversion Schedule Summary)
AIRPORT: Ontario Intl

JAN 27 1995

Conversion Population*

ipment	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
e																										
TUG NB			2	2	2	12	12	12	12	12	14	14	14	12	12	12	2	2	2	2	2	0	0	0	0	0
TUG WB																0	0	0	0	0	0	0	0	0	0	0
COND																										
START																										
G TUG			54	54	54	76	76	76	76	76	82	28	28	28	6	16	16	16	16	10	10	10	10	10	0	0
LT LOADER						30	30	30	30	30	36	36	36	36	6	10	10	10	10	4	4	4	4	4	0	0
BTAIL											8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0
S						1	1	1	1	1	2	2	2	2	1	3	3	3	3	2	2	2	2	2	0	0
R					1	1	1	1	1	1	4	4	4	3	3	3	3	3	3	0	0	0	0	0	0	0
RGO LOADER						14	14	14	14	14	16	16	16	16	16	18	4	4	4	4	4	2	2	2	2	2
RT			8	8	8	12	12	12	12	12	12	4	4	4	0	4	4	4	4	4	4	4	4	4	0	0
ICER						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
RKLIFT			22	22	22	28	28	28	28	28	34	12	12	12	6	10	10	10	10	4	4	4	4	4	0	0
EL TRUCK						3	3	3	3	3	9	9	9	9	6	8	8	8	8	2	2	2	2	2	0	0
U																										
V CART						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
V TRUCK											4	4	4	4	4	6	6	6	6	2	2	2	2	2	0	0
T						8	8	8	8	8	12	12	12	12	4	4	4	4	4	0	0	0	0	0	0	0
INT TRUCK											20	20	20	20	20	24	24	24	24	4	4	4	4	4	0	0
HER						5	5	5	5	5	14	14	14	14	9	13	13	13	13	4	4	4	4	4	0	0
CKUP											22	22	22	22	22	24	24	24	24	2	2	2	2	2	0	0
RVICE TRUCK											12	12	12	12	12	12	12	12	12	0	0	0	0	0	0	0
N					4	4	4	4	4	4	12	12	12	8	8	10	10	10	10	2	2	2	2	2	0	0
TER TRUCK											0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0

Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

JAN 27 1995

GSE COST ANALYSIS (Inputs)*
AIRPORT: Sacramento Metro

ipment e	Average Operation** (hours/year)	Useful Life (years)	Population 1990	1999	2000	2005	Conventional GSE Cost Capital ($000)	O&M ($/hr)	Electric GSE Cost Capital*** ($000)	O&M ($/hr)	Recharger Cost Installed Capital ($/electric unit)
TUG NB	1,721	10	10	12	12	14	$100.0	$16.67	$126.0	$12.50	$2,500
TUG WB	1,721	10	0	0	0	0	$190.0	$26.41	$262.5	$19.71	$2,500
COND	271	8	2	4	4	4	$60.0	$12.15	N/A	N/A	N/A
START	181	8	2	4	4	4	$80.0	$33.76	N/A	N/A	N/A
TUG	1,021	8	46	54	56	60	$15.5	$8.06	$29.4	$6.04	$2,500
T LOADER	887	8	20	24	24	26	$23.0	$6.63	$36.8	$4.97	$2,500
STAIL	434	8	4	6	6	6	$24.0	$13.82	$36.8	$10.37	$2,500
******	1,678	8	2	2	2	2	$110.0	$9.58	$114.0	$9.58	N/A
******	486	8	2	2	2	4	$15.0	$2.10	$17.0	$2.10	N/A
GO LOADER	1,250	10	6	12	12	12	$150.0	$9.84	$189.0	$7.38	$2,500
IT	340	8	8	8	8	10	$6.0	$1.69	$6.0	$1.27	$2,500
CER	156	8	2	2	2	2	$5.0	$4.63	$5.0	$3.47	$2,500
KLIFT	1,028	8	18	24	24	24	$18.0	$10.32	$21.0	$7.74	$2,500
L TRUCK****	1,117	8	4	6	6	6	$65.0	$16.83	$69.0	$16.83	N/A
	2,240	8	8	12	12	12	$32.0	$10.44	N/A	N/A	N/A
/ CART	725	8	2	2	2	2	$7.0	$2.44	$7.0	$2.44	N/A
/ TRUCK	735	8	4	4	4	4	$35.0	$12.15	$44.1	$9.11	$2,500
	1,357	8	6	8	8	8	$45.0	$13.73	$56.7	$10.30	$2,500
NT TRUCK	563	8	12	14	14	14	$25.0	$12.82	$31.5	$9.62	$2,500
IER	771	8	8	10	10	10	$20.0	$10.97	$31.5	$8.23	$2,500
KUP	1,722	8	10	12	12	14	$18.0	$9.65	$28.4	$7.24	$2,500
VICE TRUCK	563	8	6	8	8	8	$25.0	$12.82	$31.5	$9.62	$2,500
******	1,987	8	6	8	8	8	$22.0	$10.09	$24.0	$10.09	N/A
TER TRUCK	567	8	0	0	0	0	$32.0	$14.04	$40.4	$10.53	$2,500
al:			188	238	240	254					

ources: Average Operation - ATA Comments on Proposed FIP
Useful Life - AA estimate
Population - Technical Support Document Errata memo (1990) and South Coast Aviation Growth Rates memo
GSE Cost - AA estimate
Recharger Cost - AA estimate

Refers to average operation per unit (hours/year)
5% added to all electric GSE capital costs (per unit) for shipping to a station outside of the FIP area for reuse.
s does not apply to carts, deicers, lav carts, or on-road vehicles.
** Capital and O&M costs are for ILEVs.

GSE COST ANALYSIS (Outputs)
AIRPORT: Sacramento Metro
Cost of Purchasing an Electric GSE
Instead of a Conventional GSE

JAN 27 1995

Equipment Type	- Cost Differential - Capital Cost* ($/unit)	O&M Cost** ($/yr/unit)	Net Present Value of GSE Conversion Costs ($)
VC TUG NB	28,500	(7,177)	($481,900)
VC TUG WB	75,000	(11,531)	$0
IR COND	N/A	N/A	N/A
IR START	N/A	N/A	N/A
AG TUG	16,400	(2,062)	($7,693)
ELT LOADER	16,250	(1,472)	$98,564
OBTAIL	15,250	(1,497)	$14,475
US	4,000	0	$6,427
AR	2,000	0	$5,833
ARGO LOADER	41,500	(3,075)	$126,230
ART	2,500	(143)	$12,232
EICER	2,500	(181)	$1,809
ORKLIFT	5,500	(2,652)	($349,189)
UEL TRUCK	4,000	0	$18,806
PU	N/A	N/A	N/A
AV CART	N/A	N/A	N/A
AV TRUCK	11,600	(2,234)	($17,516)
IFT	14,200	(4,655)	($159,602)
AINT TRUCK	9,000	(1,802)	($56,756)
THER	14,000	(2,113)	($23,285)
ICKUP	12,850	(4,150)	($212,845)
ERVICE TRUCK	9,000	(1,802)	($32,432)
AN	2,000	0	$12,772
ATER TRUCK	10,925	(1,990)	$0
Total:			($1,044,071)

* Capital cost incurred during first year of equipment purchase only.
** O&M refers to Operating and Maintenance

NOTE: Some costs are negative and, therefore, a savings.
NOTE: Discount Rate = 3%

GSE COST ANALYSIS (Calculations)
AIRPORT: Sacramento Metro

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ment	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
UG NB	0	0	63,970	(21,530)	(21,530)	170,361	(86,119)	(86,119)	(86,119)	(86,119)	(43,472)	(100,472)	(100,472)	(78,942)	(78,942)	(78,942)	(14,353)	(14,353)	(14,353)	(14,353)	(14,353)	0	0	0	0	0
UG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG	0	0	659,528	(94,871)	(94,871)	48,504	(115,496)	(115,496)	(115,496)	(115,496)	(58,145)	(28,874)	(28,874)	(28,874)	(9,250)	(9,250)	(9,250)	(9,250)	(9,250)	0	0	0	0	0	0	0
LOADER	0	0	0	0	0	364,882	(36,336)	(36,336)	(36,336)	(36,336)	(5,783)	(38,283)	(38,283)	(38,283)	(2,946)	(2,946)	(2,946)	(2,946)	(2,946)	0	0	0	0	0	0	0
AIL	0	0	0	0	0	0	0	0	0	0	82,516	(8,964)	(8,964)	(8,964)	(8,964)	(8,964)	(8,964)	(8,964)	(8,964)	0	0	0	0	0	0	0
	0	0	0	0	0	4,000	0	0	0	0	4,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	2,000	0	0	0	0	0	2,000	0	0	0	0	4,000	0	0	0	0	0	0	0	0	0	0
O LOADER	0	0	0	0	0	461,100	(36,900)	(36,900)	(36,900)	(36,900)	(36,900)	(36,900)	(36,900)	(36,900)	(36,900)	(36,900)	0	0	0	0	0	0	0	0	0	0
	0	0	18,856	(1,142)	(1,142)	(1,142)	(1,142)	(1,142)	(1,142)	(1,142)	3,572	(266)	(266)	(266)	(266)	(266)	(266)	(266)	(266)	0	0	0	0	0	0	0
ER	0	0	0	0	0	4,836	(362)	(362)	(362)	(362)	(362)	(362)	(362)	(362)	0	0	0	0	0	0	0	0	0	0	0	0
LIFT	0	0	51,380	(47,740)	(47,740)	(30,654)	(63,654)	(63,654)	(63,654)	(63,654)	(63,654)	(15,913)	(15,913)	(15,913)	0	0	0	0	0	0	0	0	0	0	0	0
. TRUCK	0	0	0	0	0	6,000	0	0	0	0	16,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK	0	0	0	0	0	0	0	0	0	0	18,731	(4,469)	(4,469)	(4,469)	(4,469)	14,262	(8,938)	(8,938)	(8,938)	(4,469)	(4,469)	(4,469)	(4,469)	(4,469)	0	0
	0	0	0	0	0	76,364	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	(37,236)	0	0	0	0	0	0	0	0	0	0	0	0
T TRUCK	0	0	0	0	0	0	0	0	0	0	100,778	(25,222)	(25,222)	(25,222)	(25,222)	(25,222)	(25,222)	(25,222)	(25,222)	0	0	0	0	0	0	0
ER	0	0	0	0	0	47,560	(8,460)	(8,460)	(8,460)	(8,460)	62,875	(21,125)	(21,125)	(21,125)	(12,675)	(12,675)	(12,675)	(12,675)	(12,675)	0	0	0	0	0	0	0
UP	0	0	0	0	0	0	0	0	0	0	121,900	(56,100)	(56,100)	(56,100)	(56,100)	(56,100)	(56,100)	(56,100)	(56,100)	0	0	0	0	0	0	0
ACE TRUCK	0	0	0	0	0	0	0	0	0	0	57,587	(14,413)	(14,413)	(14,413)	(14,413)	(14,413)	(14,413)	(14,413)	(14,413)	0	0	0	0	0	0	0
	0	0	0	0	6,000	0	0	0	0	0	10,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

E: Some costs are negative and, therefore, a savings.
E: Discount Rate 3%

GSE COST ANALYSIS (Conversion Schedule)
AIRPORT: Sacramento Metro

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	Useful Life (years)	Forecast Population 1990	2000	2005	2010	Conversion Population* 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
: Tug NB - base	10	10	12	14	14			3	3	3	10	10	10	10	10	10	10	10	7	7	7	0	0	0	0	0	0	0	0	0	0
wth	10		2	2	0						2	2	2	2	2	4	4	4	4	4	4	2	2	2	2	2	0	0	0	0	0
: Tug WB	10	0	0	0	0																0	0	0	0	0	0	0	0	0	0	0
wth	10				0																0	0	0	0	0	0	0	0	0	0	0
Cond	8	2	4	4	4																										
wth	8		2	0	0																										
Start	8	2	4	4	4																										
wth	8		2	0	0																										
g Tug	8	46	56	60	60			46	46	46	46	46	46	46	46	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wth	8		10	4	0						10	10	10	10	10	14	14	14	14	4	4	4	4	4	0	0	0	0	0	0	0
t Load	8	20	24	26	26						20	20	20	20	20	20	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0
wth	8		4	2	0						4	4	4	4	4	6	6	6	6	2	2	2	2	2	0	0	0	0	0	0	0
tail	8	4	6	8	8											4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
wth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
s	8	2	2	2	2						1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0
wth	8			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8	2	2	2	4					1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0
wth	8			0	2											0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0
go loader	10	6	12	12	12						6	6	6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0
wth	10		6	0	0						6	6	6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0
t	8	8	8	10	10			8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wth	8		0	2	0						0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
ioer	8	2	2	2	2						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
wth	8		0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ridlift	8	18	24	24	24			18	18	18	18	18	18	18	18	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wth	8		6	0	0						6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0
el Truck	8	4	6	6	6						2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0	0	0	0	0	0
wth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
U	8	8	12	12	12																										
wth	8			4	0																										
v Cart	8	2	2	2	2						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
wth	8		0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
v Truck	8	4	4	4	4											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
wth	8			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
t	8	6	8	8	8						6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0
wth	8		2	0	0						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
int Truck	8	12	14	14	14											12	12	12	12	12	12	12	12	12	0	0	0	0	0	0	0
wth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
ner	8	8	10	10	10						4	4	4	4	4	8	8	8	8	4	4	4	4	4	0	0	0	0	0	0	0
wth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
kup	8	10	12	14	14											10	10	10	10	10	10	10	10	10	0	0	0	0	0	0	0
wth	8			4	0											4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0
rvice Truck	8	6	8	8	8											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
wth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
n	8	6	8	8	8					3	3	3	3	3	3	6	6	6	3	3	3	3	3	3	0	0	0	0	0	0	0
wth	8			2	0											2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
ter Truck	8	0	0	0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wth	8			0	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

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GSE COST ANALYSIS (Conversion Schedule Summary)
AIRPORT: Sacramento Metro

Conversion Population*

uipment pe	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C TUG NB			3	3	3	12	12	12	12	12	14	14	14	11	11	11	2	2	2	2	2	0	0	0	0	0
C TUG WB																0	0	0	0	0	0	0	0	0	0	0
R COND																										
R START																										
G TUG			46	46	46	56	56	56	56	56	60	14	14	14	4	4	4	4	4	0	0	0	0	0	0	0
LT LOADER						24	24	24	24	24	26	26	26	26	2	2	2	2	2	0	0	0	0	0	0	0
BTAIL											6	6	6	6	6	6	6	6	6	0	0	0	0	0	0	0
S						1	1	1	1	1	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0
R					1	1	1	1	1	1	2	2	2	1	1	3	3	3	3	2	2	2	2	2	0	0
RGO LOADER						12	12	12	12	12	12	12	12	12	12	12	0	0	0	0	0	0	0	0	0	0
RT			8	8	8	8	8	8	8	8	10	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
ICER						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
RKLIFT			18	18	18	24	24	24	24	24	24	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0
JEL TRUCK						2	2	2	2	2	6	6	6	6	4	4	4	4	4	0	0	0	0	0	0	0
U																										
V CART						2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
V TRUCK											2	2	2	2	2	4	4	4	4	2	2	2	2	2	0	0
FT						8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0
INT TRUCK											14	14	14	14	14	14	14	14	14	0	0	0	0	0	0	0
HER						4	4	4	4	4	10	10	10	10	6	6	6	6	6	0	0	0	0	0	0	0
CKUP											14	14	14	14	14	14	14	14	14	0	0	0	0	0	0	0
ERVICE TRUCK											8	8	8	8	8	8	8	8	8	0	0	0	0	0	0	0
N					3	3	3	3	3	3	8	8	8	5	5	5	5	5	5	0	0	0	0	0	0	0
ATER TRUCK											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Population in a given year is the number of alternative fuelled vehicles in operation as a result of this rule. This analysis includes only one life cycle for converted equipment.

GSE HC EMISSIONS BENEFIT ANALYSIS (Summary of Outputs)

Airports	HC Emissions Benefit (lbs)
Burbank	413,351
John Wayne	489,126
Long Beach	218,401
Los Angeles Intl	3,169,737
Ontario Intl	571,476
Sacramento Metro	415,240

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GSE HC EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Burbank

uipment pe	Net Present Value of GSE HC Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C TUG NB	101,062	0	0	2214	2214	2214	9189	9189	9189	9189	9189	10462	10462	10462	9189	9189	10462	3487	3487	3487	3487	3487	2214	2214	2214	2214	2214
C TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G TUG	143,666	0	0	12737	12737	12737	15790	15790	15790	15790	15790	18611	5874	5874	5874	2821	4653	4653	4653	4653	1832	1832	1832	1832	1832	0	0
LT LOADER	28,913	0	0	0	0	0	3443	3443	3443	3443	3443	3722	3722	3722	3722	278	557	557	557	557	278	278	278	278	278	0	0
STAIL	7,531	0	0	0	0	0	0	0	0	0	0	1282	1282	1282	1282	1282	1282	1282	1282	1282	0	0	0	0	0	0	0
S	3,806	0	0	0	0	0	274	274	274	274	274	611	611	611	611	305	305	305	305	305	0	0	0	0	0	0	0
R	380	0	0	0	0	19	19	19	19	19	19	31	31	31	15	15	46	46	46	46	31	31	31	31	31	0	0
RGO LOADER	13,955	0	0	0	0	0	1284	1284	1284	1284	1284	1767	1767	1767	1767	1767	1767	502	502	502	502	502	0	0	0	0	0
RT	3,196	0	0	270	270	270	359	359	359	359	359	449	180	180	180	90	90	90	90	90	0	0	0	0	0	0	0
CER	1,661	0	0	0	0	0	243	243	243	243	243	243	243	243	243	0	0	0	0	0	0	0	0	0	0	0	0
NKLIFT	21,457	0	0	1715	1715	1715	2706	2706	2706	2706	2706	2960	1285	1285	1285	272	272	272	272	272	0	0	0	0	0	0	0
EL TRUCK	1,992	0	0	0	0	0	129	129	129	129	129	296	296	296	296	196	196	196	196	196	0	0	0	0	0	0	0
U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V CART	1,328	0	0	0	0	0	192	192	192	192	192	192	192	192	192	0	0	0	0	0	0	0	0	0	0	0	0
V TRUCK	4,849	0	0	0	0	0	0	0	0	0	0	631	631	631	631	631	842	842	842	842	210	210	210	210	210	0	0
FT	33,081	0	0	0	0	0	4782	4782	4782	4782	4782	4782	4782	4782	4782	0	0	0	0	0	0	0	0	0	0	0	0
NT TRUCK	28,906	0	0	0	0	0	0	0	0	0	0	4286	4286	4286	4286	4286	4933	4933	4933	4933	645	645	645	645	645	0	0
HER	11,890	0	0	0	0	0	509	509	509	509	509	1571	1571	1571	1571	1189	1401	1401	1401	1401	340	340	340	340	340	0	0
CKUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ERVICE TRUCK	8,236	0	0	0	0	0	0	0	0	0	0	1045	1045	1045	1045	1045	1045	1045	1045	1045	0	0	0	0	0	0	0
N	1,618	0	0	0	0	114	114	114	114	114	114	232	232	232	145	145	145	145	145	145	0	0	0	0	0	0	0
ATER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	413,351																										

ote: Discount Rate = 3%

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GSE HC EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: John Wayne

ipment e	Net Present Value of GSE HC Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
TUG NB	118,176	0	0	2851	2851	2851	12876	12876	12876	12876	12876	13950	13950	13950	11099	11099	11099	2214	2214	2214	2214	2214	0	0	0	0	0
TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G TUG	176,448	0	0	14569	14569	14569	19832	19832	19832	19832	19832	23283	8695	8695	8695	3432	5283	5283	5283	5283	1832	1832	1832	1832	1832	0	0
T LOADER	32,428	0	0	0	0	0	4000	4000	4000	4000	4000	4557	4557	4557	4557	567	836	836	836	836	278	278	278	278	278	0	0
BTAIL	9,066	0	0	0	0	0	0	0	0	0	0	1262	1262	1262	1262	1262	1662	1662	1662	1662	421	421	421	421	421	0	0
	3,805	0	0	0	0	0	274	274	274	274	274	611	611	611	611	305	305	305	305	305	0	0	0	0	0	0	0
R	405	0	0	0	0	19	19	19	19	19	19	62	62	62	46	46	46	46	46	46	0	0	0	0	0	0	0
RGO LOADER	17,366	0	0	0	0	0	1767	1767	1767	1767	1767	2278	2278	2278	2278	2278	2278	251	251	251	251	251	0	0	0	0	0
RT	3,800	0	0	360	360	360	449	449	449	449	449	449	90	90	90	0	90	90	90	90	90	90	90	90	90	0	0
CER	1,061	0	0	0	0	0	243	243	243	243	243	243	243	243	243	0	0	0	0	0	0	0	0	0	0	0	0
RKLIFT	24,575	0	0	1987	1987	1987	2980	2980	2980	2980	2980	3430	1443	1443	1443	450	450	450	450	450	0	0	0	0	0	0	0
EL TRUCK	2,503	0	0	0	0	0	129	129	129	129	129	296	296	296	296	196	296	296	296	296	99	99	99	99	99	0	0
U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V CART	1,328	0	0	0	0	0	192	192	192	192	192	192	192	192	192	0	0	0	0	0	0	0	0	0	0	0	0
V TRUCK	6,847	0	0	0	0	0	0	0	0	0	0	421	421	421	421	421	1263	1263	1263	1263	842	842	842	842	842	0	0
T	39,061	0	0	0	0	0	4782	4782	4782	4782	4782	4782	4782	4782	4782	0	0	0	0	0	0	0	0	0	0	0	0
NT TRUCK	32,757	0	0	0	0	0	0	0	0	0	0	4933	4933	4933	4933	4933	5578	5578	5578	5578	645	645	645	645	645	0	0
HER	13,861	0	0	0	0	0	679	679	679	679	679	1911	1911	1911	1911	1359	1571	1571	1571	1571	340	340	340	340	340	0	0
KUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RVICE TRUCK	8,366	0	0	0	0	0	0	0	0	0	0	1402	1402	1402	1402	1402	1402	1402	1402	1402	0	0	0	0	0	0	0
N	1,964	0	0	0	0	114	114	114	114	114	114	290	290	290	203	203	203	203	203	203	0	0	0	0	0	0	0
TER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	488,128																										

te: Discount Rate = 3%

JAN 27 1995

GSE HC EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Long Beach

uipment pe	Net Present Value of GSE HC Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C TUG NB	59,031	0	0	637	637	637	5701	5701	5701	5701	5701	5701	5701	5701	4124	4124	6336	2214	2214	2214	2214	2214	2214	2214	2214	2214	2214
C TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AG TUG	78,313	0	0	6484	6484	6484	8695	8695	8695	8695	8695	9305	2821	2821	2821	611	2821	2821	2821	2821	1832	1832	1832	1832	1832	0	0
ELT LOADER	13,818	0	0	0	0	0	1563	1563	1563	1563	1563	1563	1563	1563	1563	0	557	557	557	557	557	557	557	557	557	0	0
OBTAIL	4,677	0	0	0	0	0	0	0	0	0	0	421	421	421	421	421	841	841	841	841	421	421	421	421	421	0	0
JS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NR	184	0	0	0	0	0	0	0	0	0	0	31	31	31	31	31	31	31	31	31	0	0	0	0	0	0	0
ARGO LOADER	4,127	0	0	0	0	0	502	502	502	502	502	502	502	502	502	502	502	0	0	0	0	0	0	0	0	0	0
ART	1,840	0	0	90	90	90	180	180	180	180	180	270	180	180	180	90	90	90	90	90	0	0	0	0	0	0	0
EICER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ORKLIFT	10,798	0	0	993	993	993	1265	1265	1265	1265	1265	1265	272	272	272	0	272	272	272	272	272	272	272	272	272	0	0
UEL TRUCK	1,211	0	0	0	0	0	65	65	65	65	65	99	99	99	99	50	149	149	149	149	99	99	99	99	99	0	0
PU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AV CART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AV TRUCK	2,337	0	0	0	0	0	0	0	0	0	0	210	210	210	210	210	421	421	421	421	210	210	210	210	210	0	0
FT	16,541	0	0	0	0	0	2391	2391	2391	2391	2391	2391	2391	2391	2391	0	0	0	0	0	0	0	0	0	0	0	0
AINT TRUCK	14,886	0	0	0	0	0	0	0	0	0	0	1936	1936	1936	1936	1936	2579	2579	2579	2579	646	646	646	646	646	0	0
THER	6,404	0	0	0	0	0	340	340	340	340	340	1019	1019	1019	1019	679	679	679	679	679	0	0	0	0	0	0	0
ICKUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ERVICE TRUCK	3,497	0	0	0	0	0	0	0	0	0	0	586	586	586	586	586	586	586	586	586	0	0	0	0	0	0	0
AN	770	0	0	0	0	36	36	36	36	36	36	116	116	116	87	87	87	87	87	87	0	0	0	0	0	0	0
ATER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	218,401																										

ote: Discount Rate = 3%

JAN 27 1995

GSE HC EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Los Angeles Intl

Equipment Type	Net Present Value of GSE HC Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
VC TUG NB	479,399	0	0	9626	9626	9626	51039	51039	51039	51039	51039	53869	53869	53869	44064	44064	49765	7812	7812	7812	7812	7812	5701	5701	5701	5701	5701
VC TUG WB	115,013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18602	18602	18602	18602	18602	18602	18602	18602	18602	18602	18602
NR COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NR START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AG TUG	1,181,488	0	0	97936	97936	97936	140654	140654	140654	140654	140654	149980	52022	52022	52022	9305	26811	26811	26811	26811	17505	17505	17505	17505	17505	0	0
ELT LOADER	222,847	0	0	0	0	0	28046	28046	28046	28046	28046	29907	29907	29907	29907	1861	5304	5304	5304	5304	3443	3443	3443	3443	3443	0	0
OBTAIL	59,378	0	0	0	0	0	0	0	0	0	0	9043	9043	9043	9043	9043	10095	10095	10095	10095	1052	1052	1052	1052	1052	0	0
US	40,547	0	0	0	0	0	1,642	1,642	1,642	1,642	1,642	6106	6106	6106	6106	4274	4885	4885	4885	4885	611	611	611	611	611	0	0
AR	2,865	0	0	0	0	155	155	155	155	155	155	370	370	370	246	246	277	277	277	277	31	31	31	31	31	0	0
ARGO LOADER	114,126	0	0	0	0	0	11881	11881	11881	11881	11881	12894	12894	12894	12894	12894	14410	2529	2529	2529	2529	2529	1515	1515	1515	1515	1515
ART	28,049	0	0	2202	2202	2202	3100	3100	3100	3100	3100	3325	1123	1123	1123	225	564	564	564	564	339	339	339	339	339	0	0
EICER	11,883	0	0	0	0	0	1494	1494	1494	1494	1494	1615	1615	1615	1615	121	243	243	243	243	121	121	121	121	121	0	0
ORKLIFT	172,928	0	0	14400	14400	14400	20539	20539	20539	20539	20539	21940	7540	7540	7540	1401	3974	3974	3974	3974	2573	2573	2573	2573	2573	0	0
UEL TRUCK	18,476	0	0	0	0	0	904	904	904	904	904	2829	2829	2829	2829	1934	2162	2162	2162	2162	248	248	248	248	248	0	0
PU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AV CART	7,030	0	0	0	0	0	862	862	862	862	862	958	958	958	958	96	192	192	192	192	96	96	96	96	96	0	0
AV TRUCK	41,541	0	0	0	0	0	0	0	0	0	0	4420	4420	4420	4420	4420	7366	7366	7366	7366	2946	2946	2946	2946	2946	0	0
JET	259,128	0	0	0	0	0	32281	32281	32281	32281	32281	34672	34672	34672	34672	2391	6576	6576	6576	6576	4185	4185	4185	4185	4185	0	0
AINT TRUCK	238,528	0	0	0	0	0	0	0	0	0	0	36273	36273	36273	36273	36273	40561	40561	40561	40561	4288	4288	4288	4288	4288	0	0
THER	100,860	0	0	0	0	0	4670	4670	4670	4670	4670	14817	14817	14817	14817	10020	11718	11718	11718	11718	1571	1571	1571	1571	1571	0	0
CKUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ERVICE TRUCK	58,907	0	0	0	0	0	0	0	0	0	0	8970	8970	8970	8970	8970	10015	10015	10015	10015	1045	1045	1045	1045	1045	0	0
AN	13,902	0	0	0	0	796	796	796	796	796	796	1856	1856	1856	1247	1247	1479	1479	1479	1479	232	232	232	232	232	0	0
ATER TRUCK	5,242	0	0	0	0	0	0	0	0	0	0	749	749	749	749	749	899	899	899	899	150	150	150	150	150	0	0
	3,169,737																										

Note: Discount Rate = 3%

JAN 27 1995

GSE HC EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Ontario Intl

uipment pe	Net Present Value of GSE HC Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C TUG NB	103,394	0	0	2214	2214	2214	10462	10462	10462	10462	10462	12878	12878	12878	10462	10462	10462	2214	2214	2214	2214	2214	0	0	0	0	0
C TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AG TUG	214,542	0	0	18000	18000	18000	25095	25095	25095	25095	25095	28927	9305	9305	9305	1832	5283	5283	5283	5283	3432	3432	3432	3432	3432	0	0
ELT LOADER	40,366	0	0	0	0	0	4557	4557	4557	4557	4557	5583	5583	5583	5583	835	1563	1563	1563	1563	557	557	557	557	557	0	0
OBTAIL	10,037	0	0	0	0	0	0	0	0	0	0	1662	1662	1662	1662	1662	1662	1662	1662	1662	0	0	0	0	0	0	0
NS	8,848	0	0	0	0	0	274	274	274	274	274	611	611	611	611	305	916	916	916	916	611	611	611	611	611	0	0
VR	406	0	0	0	0	19	19	19	19	19	19	62	62	62	46	46	46	46	46	46	0	0	0	0	0	0	0
ARGO LOADER	22,042	0	0	0	0	0	2278	2278	2278	2278	2278	2529	2529	2529	2529	2529	2780	502	502	502	502	502	251	251	251	251	251
ART	4,866	0	0	359	359	359	539	539	539	539	539	539	180	180	180	0	180	180	180	180	180	180	180	180	180	0	0
ECER	1,661	0	0	0	0	0	243	243	243	243	243	243	243	243	243	0	0	0	0	0	0	0	0	0	0	0	0
ORKLIFT	32,317	0	0	2708	2708	2708	3430	3430	3430	3430	3430	4152	1443	1443	1443	722	1285	1285	1285	1285	460	460	460	460	460	0	0
UEL TRUCK	3,499	0	0	0	0	0	194	194	194	194	194	446	446	446	446	296	397	397	397	397	99	99	99	99	99	0	0
PU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AV CART	1,328	0	0	0	0	0	192	192	192	192	192	192	192	192	192	0	0	0	0	0	0	0	0	0	0	0	0
AV TRUCK	7,192	0	0	0	0	0	0	0	0	0	0	842	842	842	842	842	1263	1263	1263	1263	421	421	421	421	421	0	0
FT	47,952	0	0	0	0	0	4782	4782	4782	4782	4782	7174	7174	7174	7174	2391	2391	2391	2391	2391	0	0	0	0	0	0	0
AINT TRUCK	43,773	0	0	0	0	0	0	0	0	0	0	6223	6223	6223	6223	6223	7512	7512	7512	7512	1290	1290	1290	1290	1290	0	0
THER	17,729	0	0	0	0	0	849	849	849	849	849	2250	2250	2250	2250	1401	2080	2080	2080	2080	679	679	679	679	679	0	0
CKUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ERVICE TRUCK	9,733	0	0	0	0	0	0	0	0	0	0	1631	1631	1631	1631	1631	1631	1631	1631	1631	0	0	0	0	0	0	0
AN	2,666	0	0	0	0	152	152	152	152	152	152	348	348	348	252	252	250	250	250	250	56	56	56	56	56	0	0
ATER TRUCK	1,544	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	300	300	300	300	300	300	300	300	0	0
	571,476																										

ote: Discount Rate = 3%

JAN 27 1995

GSE HC EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Sacramento Metropolitan

ipment	Net Present Value of GSE HC Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
TUG NB	103,862	0	0	2851	2851	2851	10462	10462	10462	10462	10462	12676	12676	12676	9626	9626	9626	2214	2214	2214	2214	2214	0	0	0	0	0
TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I TUG	145,771	0	0	15179	15179	15179	18611	18611	18611	18611	18611	19832	4653	4653	4653	1221	1221	1221	1221	1221	0	0	0	0	0	0	0
T LOADER	27,407	0	0	0	0	0	3722	3722	3722	3722	3722	4000	4000	4000	4000	278	278	278	278	278	0	0	0	0	0	0	0
ITAIL	7,531	0	0	0	0	0	0	0	0	0	0	1262	1262	1262	1262	1262	1262	1262	1262	1262	0	0	0	0	0	0	0
	3,805	0	0	0	0	0	274	274	274	274	274	611	611	611	611	305	305	305	305	305	0	0	0	0	0	0	0
	360	0	0	0	0	18	18	19	19	19	19	31	31	31	15	15	46	46	46	46	31	31	31	31	31	0	0
IGO LOADER	14,526	0	0	0	0	0	1767	1767	1767	1767	1767	1767	1767	1767	1767	1767	1767	0	0	0	0	0	0	0	0	0	0
IT	3,251	0	0	358	358	358	358	358	358	358	358	449	90	90	90	90	90	90	90	90	0	0	0	0	0	0	0
CER	1,881	0	0	0	0	0	243	243	243	243	243	243	243	243	243	0	0	0	0	0	0	0	0	0	0	0	0
KLIFT	22,066	0	0	2259	2259	2259	2960	2960	2960	2960	2960	2960	722	722	722	0	0	0	0	0	0	0	0	0	0	0	0
L TRUCK	1,892	0	0	0	0	0	129	129	129	129	129	296	296	296	296	196	196	196	196	196	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
/ CART	1,328	0	0	0	0	0	192	192	192	192	192	192	192	192	192	0	0	0	0	0	0	0	0	0	0	0	0
/ TRUCK	4,679	0	0	0	0	0	0	0	0	0	0	421	421	421	421	421	842	842	842	842	421	421	421	421	421	0	0
	33,081	0	0	0	0	0	4782	4782	4782	4782	4782	4782	4782	4782	4782	0	0	0	0	0	0	0	0	0	0	0	0
NT TRUCK	25,586	0	0	0	0	0	0	0	0	0	0	4286	4286	4286	4286	4286	4286	4286	4286	4286	0	0	0	0	0	0	0
IER	10,416	0	0	0	0	0	679	679	679	679	679	1571	1571	1571	1571	1019	1019	1019	1019	1019	0	0	0	0	0	0	0
KUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VICE TRUCK	6,236	0	0	0	0	0	0	0	0	0	0	1046	1046	1046	1046	1046	1046	1046	1046	1046	0	0	0	0	0	0	0
	1,616	0	0	0	0	114	114	114	114	114	114	232	232	232	146	146	146	146	146	146	0	0	0	0	0	0	0
TER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	415,240																										

e: Discount Rate = 3%

JAN 2 7 1995

ISE NOx EMISSIONS BENEFIT ANALYSIS (Summary of Outputs)

Airports	NOx Emissions Benefit (lbs)
Burbank	1,144,048
John Wayne	1,377,033
Long Beach	584,124
Los Angeles Intl	8,546,048
Ontario Intl	1,483,453
Sacramento Metro	1,179,816

JAN 27 1995

GSE NOx EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Burbank

uipment pe	Net Present Value of GSE NOx Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C TUG NB	502,917	0	0	7415	7415	7415	45595	45595	45595	45595	45595	57271	57271	57271	45595	45595	57271	19090	19090	19090	19090	19090	7415	7415	7415	7415	7415
C TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NG TUG	322,289	0	0	27865	27865	27865	35645	35645	35645	35645	35645	41302	13436	13436	13436	5658	10328	10328	10328	10328	4866	4866	4866	4866	4866	0	0
ELT LOADER	59,173	0	0	0	0	0	7400	7400	7400	7400	7400	8118	8118	8118	8118	718	1436	1436	1436	1436	718	718	718	718	718	0	0
OBTAIL	7,591	0	0	0	0	0	0	0	0	0	0	1262	1262	1262	1262	1262	1262	1262	1262	1262	0	0	0	0	0	0	0
JS	16,817	0	0	0	0	0	1738	1738	1738	1738	1738	2211	2211	2211	2211	1105	1105	1105	1105	1105	0	0	0	0	0	0	0
MI	291	0	0	0	0	10	10	10	10	10	10	20	20	20	10	10	30	30	30	30	20	20	20	20	20	0	0
ARGO LOADER	102,046	0	0	0	0	0	8442	8442	8442	8442	8442	13045	13045	13045	13045	13045	13045	4604	4604	4604	4604	4604	0	0	0	0	0
ART	940	0	0	54	54	54	72	72	72	72	72	90	36	36	36	18	18	18	18	18	0	0	0	0	0	0	0
EICER	1,691	0	0	0	0	0	243	243	243	243	243	243	243	243	243	0	0	0	0	0	0	0	0	0	0	0	0
ORKLIFT	29,086	0	0	2407	2407	2407	3747	3747	3747	3747	3747	4019	1611	1611	1611	272	272	272	272	272	0	0	0	0	0	0	0
UEL TRUCK	1,293	0	0	0	0	0	59	59	59	59	59	212	212	212	212	141	141	141	141	141	0	0	0	0	0	0	0
PU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AV CART	289	0	0	0	0	0	36	36	36	36	36	36	36	36	36	0	0	0	0	0	0	0	0	0	0	0	0
AV TRUCK	4,849	0	0	0	0	0	0	0	0	0	0	631	631	631	631	631	842	842	842	842	210	210	210	210	210	0	0
IFT	33,091	0	0	0	0	0	4782	4782	4782	4782	4782	4782	4782	4782	4782	0	0	0	0	0	0	0	0	0	0	0	0
AINT TRUCK	33,629	0	0	0	0	0	0	0	0	0	0	5078	5078	5078	5078	5078	5723	5723	5723	5723	645	645	645	645	645	0	0
THER	13,943	0	0	0	0	0	509	509	509	509	509	1995	1995	1995	1995	1169	1828	1828	1828	1828	340	340	340	340	340	0	0
ICKUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ERVICE TRUCK	13,630	0	0	0	0	0	0	0	0	0	0	2284	2284	2284	2284	2284	2284	2284	2284	2284	0	0	0	0	0	0	0
AN	1,004	0	0	0	0	52	52	52	52	52	52	166	166	166	103	103	103	103	103	103	0	0	0	0	0	0	0
ATER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1,144,046																										

ote: Discount Rate = 3%

JAN 27 1995

GSE NOx EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: John Wayne

Equipment Type	Net Present Value of GSE NOx Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A/C TUG NB	612,136	0	0	13252	13252	13252	64665	64665	64665	64665	64665	76361	76361	76361	63106	63106	63106	7415	7415	7415	7415	7415	0	0	0	0	0
A/C TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIR COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIR START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAG TUG	395,196	0	0	32533	32533	32533	44414	44414	44414	44414	44414	51628	19095	19095	19095	7214	11882	11882	11882	11882	4666	4666	4666	4666	4666	0	0
BELT LOADER	73,391	0	0	0	0	0	8636	8636	8636	8636	8636	10272	10272	10272	10272	1436	2154	2154	2154	2154	716	716	716	716	716	0	0
BOBTAIL	9,898	0	0	0	0	0	0	0	0	0	0	1262	1262	1262	1262	1262	1662	1662	1662	1662	421	421	421	421	421	0	0
BUS	16,617	0	0	0	0	0	1736	1736	1736	1736	1736	2211	2211	2211	2211	1105	1105	1105	1105	1105	0	0	0	0	0	0	0
CAR	247	0	0	0	0	10	10	10	10	10	10	40	40	40	30	30	30	30	30	30	0	0	0	0	0	0	0
CARGO LOADER	120,365	0	0	0	0	0	13045	13045	13045	13045	13045	14561	14561	14561	14561	14561	14561	2302	2302	2302	2302	2302	0	0	0	0	0
CART	761	0	0	72	72	72	90	90	90	90	90	90	18	18	18	0	18	18	18	18	18	18	18	18	18	0	0
DEICER	1,661	0	0	0	0	0	243	243	243	243	243	243	243	243	243	0	0	0	0	0	0	0	0	0	0	0	0
FORKLIFT	34,271	0	0	2879	2879	2879	4019	4019	4019	4019	4019	4815	2136	2136	2136	796	796	796	796	796	0	0	0	0	0	0	0
FUEL TRUCK	1,646	0	0	0	0	0	59	59	59	59	59	212	212	212	212	141	212	212	212	212	71	71	71	71	71	0	0
GPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAV CART	283	0	0	0	0	0	36	36	36	36	36	36	36	36	36	0	0	0	0	0	0	0	0	0	0	0	0
LAV TRUCK	6,847	0	0	0	0	0	0	0	0	0	0	421	421	421	421	421	1263	1263	1263	1263	842	842	842	842	842	0	0
LIFT	33,081	0	0	0	0	0	4782	4782	4782	4782	4782	4782	4782	4782	4782	0	0	0	0	0	0	0	0	0	0	0	0
MAINT TRUCK	37,472	0	0	0	0	0	0	0	0	0	0	5723	5723	5723	5723	5723	6366	6366	6366	6366	645	645	645	645	645	0	0
OTHER	16,131	0	0	0	0	0	679	679	679	679	679	2336	2336	2336	2336	1356	1996	1996	1996	1996	340	340	340	340	340	0	0
PICKUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SERVICE TRUCK	15,760	0	0	0	0	0	0	0	0	0	0	2841	2841	2841	2841	2841	2841	2841	2841	2841	0	0	0	0	0	0	0
VAN	1,250	0	0	0	0	52	52	52	52	52	52	206	206	206	144	144	144	144	144	144	0	0	0	0	0	0	0
WATER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1,377,033																										

Note: Discount Rate = 3%

JAN 27 1995

GSE NOx EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Long Beach

lpment e	Net Present Value of GSE NOx Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
TUG NB	276,155	0	0	5636	5636	5636	28505	28505	28505	28505	28505	28505	28505	28505	24928	24928	32343	7415	7415	7415	7415	7415	7415	7415	7415	7415	7415
TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG	173,640	0	0	14994	14994	14994	19095	19095	19095	19095	19095	20651	5658	5658	5658	1556	5658	5658	5658	5658	4666	4666	4666	4666	4666	0	0
T LOADER	30,804	0	0	0	0	0	3341	3341	3341	3341	3341	3341	3341	3341	3341	0	1436	1436	1436	1436	1436	1436	1436	1436	1436	0	0
STAIL	4,677	0	0	0	0	0	0	0	0	0	0	421	421	421	421	421	841	841	841	841	421	421	421	421	421	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	118	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	0	0	0	0	0	0	0
GO LOADER	37,849	0	0	0	0	0	4604	4604	4604	4604	4604	4604	4604	4604	4604	4604	4604	0	0	0	0	0	0	0	0	0	0
T	366	0	0	18	18	18	36	36	36	36	36	54	36	36	36	18	18	18	18	18	0	0	0	0	0	0	0
CER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KLIFT	13,406	0	0	1340	1340	1340	1611	1611	1611	1611	1611	1611	272	272	272	0	272	272	272	272	272	272	272	272	272	0	0
L TRUCK	794	0	0	0	0	0	29	29	29	29	29	71	71	71	71	36	106	106	106	106	71	71	71	71	71	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK	2,337	0	0	0	0	0	0	0	0	0	0	210	210	210	210	210	421	421	421	421	210	210	210	210	210	0	0
T	16,541	0	0	0	0	0	2391	2391	2391	2391	2391	2391	2391	2391	2391	0	0	0	0	0	0	0	0	0	0	0	0
NT TRUCK	14,865	0	0	0	0	0	0	0	0	0	0	1935	1935	1935	1935	1935	2579	2579	2579	2579	645	645	645	645	645	0	0
HER	8,404	0	0	0	0	0	340	340	340	340	340	1019	1019	1019	1019	679	679	679	679	679	0	0	0	0	0	0	0
KUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RVICE TRUCK	5,967	0	0	0	0	0	0	0	0	0	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	0	0	0	0	0	0	0
N	499	0	0	0	0	17	17	17	17	17	17	82	82	82	82	82	82	82	82	82	0	0	0	0	0	0	0
TER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	584,124																										

e: Discount Rate = 3%

JAN 27 1995

GSE NOx EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Los Angeles

ulpment pe	Net Present Value of GSE NOx Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C TUG NB	2,565,919	0	0	51433	51433	51433	274677	274677	274677	274677	274677	287930	287930	287930	236497	236497	263002	44016	44016	44016	44016	44016	28505	28505	28505	28505	28505
C TUG WB	751,299	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122820	122820	122820	122820	122820	122820	122820	122820	122820	122820	122820
I COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G TUG	2,646,796	0	0	218960	218960	218960	315566	315566	315566	315566	315566	336220	117280	117280	117280	20651	50903	50903	50903	50903	39252	39252	39252	39252	39252	0	0
LT LOADER	493,531	0	0	0	0	0	62334	62334	62334	62334	62334	66393	66393	66393	66393	4059	11459	11459	11459	11459	7400	7400	7400	7400	7400	0	0
BTAIL	59,378	0	0	0	0	0	0	0	0	0	0	9043	9043	9043	9043	9043	10095	10095	10095	10095	1052	1052	1052	1052	1052	0	0
S	165,053	0	0	0	0	0	10427	10427	10427	10427	10427	22108	22108	22108	22108	15476	17686	17686	17686	17686	2211	2211	2211	2211	2211	0	0
R	1,604	0	0	0	0	78	78	78	78	78	78	236	236	236	156	156	176	176	176	176	20	20	20	20	20	0	0
RGO LOADER	771,875	0	0	0	0	0	80678	80678	80678	80678	80678	86716	86716	86716	86716	86716	97461	10883	10883	10883	10883	10883	10743	10743	10743	10743	10743
RT	5,210	0	0	440	440	440	620	620	620	620	620	665	225	225	225	45	117	117	117	117	72	72	72	72	72	0	0
CER	13,740	0	0	0	0	0	1791	1791	1791	1791	1791	1913	1913	1913	1913	121	243	243	243	243	121	121	121	121	121	0	0
RKLIFT	239,965	0	0	19939	19939	19939	28500	28500	28500	28500	28500	30248	10309	10309	10309	1747	5356	5356	5356	5356	3611	3611	3611	3611	3611	0	0
EL TRUCK	12,207	0	0	0	0	0	412	412	412	412	412	1871	1871	1871	1871	1377	1553	1553	1553	1553	177	177	177	177	177	0	0
U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V CART	1,404	0	0	0	0	0	172	172	172	172	172	192	192	192	192	19	36	36	36	36	19	19	19	19	19	0	0
V TRUCK	41,541	0	0	0	0	0	0	0	0	0	0	4420	4420	4420	4420	4420	7366	7366	7366	7366	2946	2946	2946	2946	2946	0	0
T	259,128	0	0	0	0	0	32281	32281	32281	32281	32281	34672	34672	34672	34672	2391	6576	6576	6576	6576	4185	4185	4185	4185	4185	0	0
NT TRUCK	286,160	0	0	0	0	0	0	0	0	0	0	40222	40222	40222	40222	40222	45300	45300	45300	45300	5078	5078	5078	5078	5078	0	0
HER	116,799	0	0	0	0	0	5519	5519	5519	5519	5519	16940	16940	16940	16940	11718	13416	13416	13416	13416	1995	1995	1995	1995	1995	0	0
CKUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RVICE TRUCK	119,534	0	0	0	0	0	0	0	0	0	0	18061	18061	18061	18061	18061	20345	20345	20345	20345	2284	2284	2284	2284	2284	0	0
N	8,863	0	0	0	0	361	361	361	361	361	361	1318	1318	1318	866	866	1051	1051	1051	1051	185	185	185	185	185	0	0
TER TRUCK	5,242	0	0	0	0	0	0	0	0	0	0	749	749	749	749	749	899	899	899	899	150	150	150	150	150	0	0
	8,546,048																										

te: Discount Rate = 3%

JAN 27 1995

GSE NOx EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Ontario

ipment e	Net Present Value of GSE NOx Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
TUG NB	529,048	0	0	7415	7415	7415	57271	57271	57271	57271	57271	64665	64665	64665	57271	57271	57271	7415	7415	7415	7415	7415	0	0	0	0	0
TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG	478,740	0	0	39746	39746	39746	56296	56296	56296	56296	56296	60964	20651	20651	20651	4666	11662	11662	11662	11662	7214	7214	7214	7214	7214	0	0
T LOADER	89,985	0	0	0	0	0	10272	10272	10272	10272	10272	12177	12177	12177	12177	2154	3341	3341	3341	3341	1436	1436	1436	1436	1436	0	0
TAIL	10,097	0	0	0	0	0	0	0	0	0	0	1662	1662	1662	1662	1662	1662	1662	1662	1662	0	0	0	0	0	0	0
	26,197	0	0	0	0	0	1736	1736	1736	1736	1736	2211	2211	2211	2211	1105	3316	3316	3316	3316	2211	2211	2211	2211	2211	0	0
	247	0	0	0	0	10	10	10	10	10	10	40	40	40	30	30	30	30	30	30	0	0	0	0	0	0	0
GO LOADER	150,274	0	0	0	0	0	14681	14681	14681	14681	14681	16663	16663	16663	16663	16663	19185	4604	4604	4604	4604	4604	2302	2302	2302	2302	2302
T	979	0	0	72	72	72	106	106	106	106	106	106	36	36	36	0	36	36	36	36	36	36	36	36	36	0	0
CER	1,661	0	0	0	0	0	243	243	243	243	243	243	243	243	243	0	0	0	0	0	0	0	0	0	0	0	0
KLIFT	45,582	0	0	3747	3747	3747	4815	4815	4815	4815	4815	5863	2136	2136	2136	1068	1611	1611	1611	1611	786	786	786	786	786	0	0
EL TRUCK	2,286	0	0	0	0	0	88	88	88	88	88	318	318	318	318	212	282	282	282	282	71	71	71	71	71	0	0
U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V CART	283	0	0	0	0	0	36	36	36	36	36	36	36	36	36	0	0	0	0	0	0	0	0	0	0	0	0
V TRUCK	7,192	0	0	0	0	0	0	0	0	0	0	842	842	842	842	842	1263	1263	1263	1263	421	421	421	421	421	0	0
T	47,352	0	0	0	0	0	4782	4782	4782	4782	4782	7174	7174	7174	7174	2391	2391	2391	2391	2391	0	0	0	0	0	0	0
NT TRUCK	48,487	0	0	0	0	0	0	0	0	0	0	7013	7013	7013	7013	7013	8302	8302	8302	8302	1290	1290	1290	1290	1290	0	0
HER	20,286	0	0	0	0	0	849	849	849	849	849	2675	2675	2675	2675	1838	2505	2505	2505	2505	679	679	679	679	679	0	0
KUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RVICE TRUCK	19,597	0	0	0	0	0	0	0	0	0	0	3284	3284	3284	3284	3284	3284	3284	3284	3284	0	0	0	0	0	0	0
N	1,715	0	0	0	0	68	68	68	68	68	68	247	247	247	166	166	206	206	206	206	41	41	41	41	41	0	0
TER TRUCK	1,544	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	300	300	300	300	300	300	300	300	0	0
	1,483,463																										

te: Discount Rate = 3%

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GSE NOx EMISSIONS BENEFIT ANALYSIS (Outputs and Calculations)
AIRPORT: Sacramento Metro

quipment ype	Net Present Value of GSE NOx Emissions Benefit (lbs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
/C TUG NB	533,496	0	0	13252	13252	13252	57271	57271	57271	57271	57271	64666	64666	64666	51433	51433	51433	7415	7415	7415	7415	7415	0	0	0	0	0
/C TUG WB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IR COND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IR START	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AG TUG	326,161	0	0	34069	34069	34069	41302	41302	41302	41302	41302	44414	10326	10326	10326	3112	3112	3112	3112	3112	0	0	0	0	0	0	0
ELT LOADER	60,444	0	0	0	0	0	8116	8116	8116	8116	8116	8636	8636	8636	8636	716	716	716	716	716	0	0	0	0	0	0	0
OBTAIL	7,531	0	0	0	0	0	0	0	0	0	0	1262	1262	1262	1262	1262	1262	1262	1262	1262	0	0	0	0	0	0	0
US	16,817	0	0	0	0	0	1736	1736	1736	1736	1736	2211	2211	2211	2211	1105	1105	1105	1105	1105	0	0	0	0	0	0	0
AR	281	0	0	0	0	10	10	10	10	10	10	20	20	20	10	10	30	30	30	30	20	20	20	20	20	0	0
ARGO LOADER	107,241	0	0	0	0	0	13046	13046	13046	13046	13046	13046	13046	13046	13046	13046	13046	0	0	0	0	0	0	0	0	0	0
ART	652	0	0	72	72	72	72	72	72	72	72	90	18	18	18	18	18	18	18	18	0	0	0	0	0	0	0
EICER	1,661	0	0	0	0	0	243	243	243	243	243	243	243	243	243	0	0	0	0	0	0	0	0	0	0	0	0
ORKLIFT	29,666	0	0	2861	2861	2861	4019	4019	4019	4019	4019	4019	1066	1066	1066	0	0	0	0	0	0	0	0	0	0	0	0
UEL TRUCK	1,263	0	0	0	0	0	59	59	59	59	59	212	212	212	212	141	141	141	141	141	0	0	0	0	0	0	0
PU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AV CART	285	0	0	0	0	0	36	36	36	36	36	36	36	36	36	0	0	0	0	0	0	0	0	0	0	0	0
AV TRUCK	4,678	0	0	0	0	0	0	0	0	0	0	421	421	421	421	421	842	842	842	842	421	421	421	421	421	0	0
IFT	33,061	0	0	0	0	0	4782	4782	4782	4782	4782	4782	4782	4782	4782	0	0	0	0	0	0	0	0	0	0	0	0
AINT TRUCK	30,302	0	0	0	0	0	0	0	0	0	0	5078	5078	5078	5078	5078	5078	5078	5078	5078	0	0	0	0	0	0	0
THER	11,624	0	0	0	0	0	679	679	679	679	679	1995	1995	1995	1995	1019	1019	1019	1019	1019	0	0	0	0	0	0	0
ICKUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ERVICE TRUCK	13,630	0	0	0	0	0	0	0	0	0	0	2284	2284	2284	2284	2284	2284	2284	2284	2284	0	0	0	0	0	0	0
AN	1,004	0	0	0	0	52	52	52	52	52	52	166	166	166	109	109	109	109	109	109	0	0	0	0	0	0	0
ATER TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1,179,816																										

ote: Discount Rate = 3%

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VII. Locomotives

Introduction

This section contains EPA's estimates of the costs and benefits associated with the locomotive provisions for the Sacramento, Ventura and South Coast FIP areas. The results of the evaluations are presented in Figure 1 and in Tables 1 and 2. Figure 1 and Table 1 show the rates at which benefits accrue, and Table 2 shows costs and cost-effectiveness. A forty (40) year period is analyzed, reflecting the longer useful like of locomotives.

Sacramento and Ventura

The Sacramento and Ventura FIP areas require no additional measures beyond those required under the national locomotive rule currently under development. For these areas EPA employed its current estimates for the national locomotive rule as the basis for the estimates. It should be noted that the national rule has yet to be proposed and the benefits and costs presented here are preliminary and are contingent upon finalization of the national locomotive rule.

Total locomotive costs for Sacramento and Ventura areas in combination may be allocated to these areas based on the average number of locomotives operating in Sacramento and Ventura on any given day. EPA estimated this number from the 11.3 tons per day NOx value contained in the FIP estimate for locomotive emissions in 1990 in Sacramento and Ventura. Factoring in duty cycles, average rated power, and percent of rated power per notch, and assuming locomotives operate 23 hours per day, indicates that approximately 35 locomotives operate on an average day in the two areas. This value represents approximately 0.2% of the national locomotive fleet. Costs allocatable for Sacramento and Ventura would be $5.3 million over a 40 year program cycle, with a 40 year program cost-effectiveness of $300 per ton of NOx.

South Coast

The need for additional emission reductions in the South Coast necessitated an additional measure beyond that contained in the national locomotive rule. A comparison of the emissions reductions required in the South Coast relative to those required under the national program are shown in Figure 1, with a numerical tabulation shown in Table 1. In developing an estimate of costs associated with the South Coast requirements, EPA started with an estimate of the number of locomotives in operation in the South Coast on an average day (approach used for Sacramento and Ventura). Using the daily NOx emission rate for 1990 of 31.5 tons and employing the same parameters as were used previously, indicates that approximately 100 locomotives operate on an average day in the South Coast. This value represents approximately 0.6% of the national locomotive fleet. Since the

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South Coast program is an addition to the national rule, the number of locomotives in operation in the South Coast during any day does not represent the total number of locomotives required to service the South Coast. To arrive at an estimate of the total number of locomotives required, and as a result the total cost, EPA evaluated two possible scenarios. Under one scenario, railroad companies could change their operational practices significantly but would have to purchase a limited number of locomotives beyond that required under the national rule. Under the other scenario, railroads would not change their operational practices, but would buy significantly more Tier I and Tier II locomotives than they otherwise would have purchased under the national rule, in the years immediately preceding the implementation of the South Coast program. Each of these scenarios are discussed below.

Under the first scenario, railroads would modify operations and thereby limit additional purchases of Tier I and Tier II locomotives. The result would be a fleet of locomotives dedicated to the South Coast. The size of this fleet would depend on the closest points[2] outside of the South Coast where trains could be repowered. EPA assumed that the points would be existing facilities close to the border of the South Coast, but not in the South Coast. To accommodate this approach, EPA estimates that for each locomotive which is in operation in the South Coast, two additional locomotives would be in transit between the South Coast and the train repowering sites; i.e. 300 locomotives in total. Under this scenario, the total 40 year cost for the South Coast program is estimated to be $45.6 million with a corresponding cost-effectiveness of $900 per ton NOx.

Under the second scenario, where railroads would avoid schedule changes by purchasing a greater number of locomotives, EPA estimates that for each locomotive in operation in the South Coast, 13 locomotives would be in transit between widely dispersed points in the nation; e.g., Chicago, New York, Houston, Seattle. This number is based on a turnaround time of two weeks from the time a locomotive leaves the South Coast and returns. Under this scenario the three railroads which service the South Coast (Atchison, Topeka and Santa Fe, Union Pacific and Southern Pacific) would require a fleet of approximately 1400 locomotives that could meet the South Coast requirements. Even with this number of South Coast locomotives, care will have to be taken in scheduling the usage of these locomotives in order to comply with the South Coast requirements. Under this scenario, the total 40 year cost of the South Coast program is estimated to be $213 million, with a cost-effectiveness of $4,200 per ton NOx.

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[2] The concept of constructing new train repowering facilities at the borders of the South Coast was not considered to be viable because of such concerns as availability of land, building permits, etc.

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TABLE 1
PERCENT EMISSION REDUCTIONS

YEAR	NATIONAL RULE, SACRAMENTO AND VENTURA FIP AREAS	SOUTH COAST FIP AREA
1999	0%	0%
2000	8%	8%
2001	16%	16%
2002	24%	24%
2003	32%	32%
2004	39%	39%
2005	42%	53%
2006	42%	53%
2007	43%	53%
2008	44%	53%
2009	44%	53%
2010	45%	64%
2011	46%	64%
2012	46%	64%
2013	47%	64%
2014	48%	64%
2015	48%	64%
2016	49%	64%
2017	50%	64%
2018	50%	64%
2019	51%	64%
2020	52%	64%
2021	52%	64%
2022	53%	64%
2023	54%	64%
2024	54%	64%
2025	55%	64%
2026	56%	64%
2027	56%	64%
2028	57%	64%
2029	58%	64%
2030	58%	64%
2031	59%	64%
2032	60%	64%
2033	60%	64%
2034	61%	64%
2035	61%	64%
2036	62%	64%
2037	63%	64%
2038	63%	64%
2039	64%	64%
2040	64%	64%

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FIGURE 1

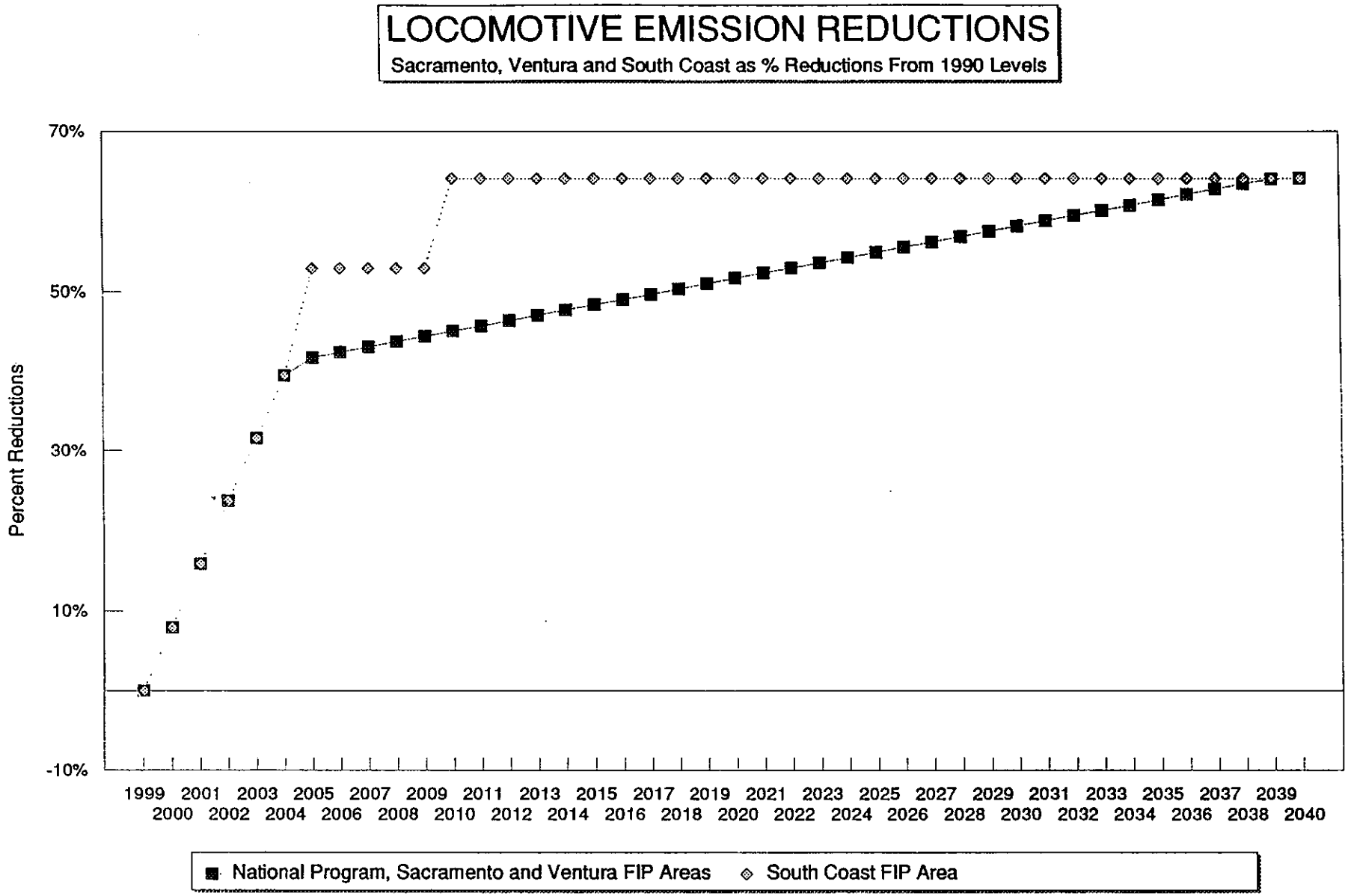

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TABLE 2

SACRAMENTO/VENTURA and SOUTH COAST COSTS, BENEFITS and COST/BENEFIT ANALYSIS

	SACRAMENTO/VENTURA			SOUTH COAST (Lowest Cost Option)			SOUTH COAST (High Cost Option)		
YEARS	COSTS	BENEFITS	COST/ BENEFIT (DOLLARS/TON)	COSTS	BENEFITS	COST/ BENEFIT (DOLLARS/TON)	COSTS	BENEFITS	COST/ BENEFIT (DOLLARS/TON)
40 Year Program Total	$5,317,104 (Y2000 Dollars)	17,701 (Y2000 Tons)	$300 (Y2000 Dollars)	$45,575,179 (Y2000 Dollars)	50,573 (Y2000 Tons)	$901 (Y2000 Dollars)	$212,684,167 (Y2000 Dollars)	50,573 (Y2000 Tons)	$4,205 (Y2000 Dollars)
1999	$0	0	$0	0	0	$0	$0	0	$0
2000	$653,549	326	$2,003	$5,601,849	932	$6,009	$26,141,961	932	$28,040
2001	$661,163	653	$1,013	$5,667,115	1,865	$3,039	$26,446,536	1,865	$14,183
2002	$668,778	979	$683	$5,732,381	2,797	$2,050	$26,751,111	2,797	$9,564
2003	$676,392	1,305	$518	$5,797,647	3,729	$1,555	$27,055,686	3,729	$7,255
2004	$684,007	1,632	$419	$5,862,913	4,662	$1,258	$27,360,261	4,662	$5,869
2005	$784,980	1,727	$455	$6,728,401	4,933	$1,364	$31,399,205	4,933	$6,365
2006	$313,440	1,754	$179	$2,686,630	5,011	$536	$12,537,606	5,011	$2,502
2007	$314,433	1,781	$177	$2,695,143	5,088	$530	$12,577,333	5,088	$2,472
2008	$315,427	1,808	$174	$2,703,656	5,166	$523	$12,617,060	5,166	$2,442
2009	$316,420	1,835	$172	$2,712,169	5,243	$517	$12,656,788	5,243	$2,414
2010	$317,413	1,862	$170	$2,720,682	5,321	$511	$12,696,515	5,321	$2,386
2011	$317,523	1,890	$168	$2,721,628	5,399	$504	$12,700,931	5,399	$2,353
2012	$321,018	1,917	$167	$2,751,581	5,476	$502	$12,840,712	5,476	$2,345
2013	$321,864	1,944	$166	$2,758,833	5,554	$497	$12,874,554	5,554	$2,318
2014	$322,710	1,971	$164	$2,766,085	5,632	$491	$12,908,396	5,632	$2,292
2015	$323,556	1,998	$162	$2,773,337	5,709	$486	$12,942,238	5,709	$2,267
2016	$324,402	2,025	$160	$2,780,589	5,787	$481	$12,976,080	5,787	$2,242
2017	$325,248	2,053	$158	$2,787,840	5,864	$475	$13,009,922	5,864	$2,218
2018	$328,743	2,080	$158	$2,817,794	5,942	$474	$13,149,703	5,942	$2,213
2019	$329,589	2,107	$156	$2,825,045	6,020	$469	$13,183,545	6,020	$2,190
2020	$330,435	2,134	$155	$2,832,297	6,097	$465	$13,217,387	6,097	$2,168
2021	$331,281	2,161	$153	$2,839,549	6,175	$460	$13,251,229	6,175	$2,146
2022	$332,127	2,188	$152	$2,846,801	6,253	$455	$13,285,071	6,253	$2,125
2023	$332,973	2,216	$150	$2,854,053	6,330	$451	$13,318,913	6,330	$2,104
2024	$336,467	2,243	$150	$2,884,006	6,408	$450	$13,458,694	6,408	$2,100
2025	$337,313	2,270	$149	$2,891,258	6,486	$446	$13,492,536	6,486	$2,080
2026	$338,159	2,297	$147	$2,898,507	6,563	$442	$13,526,365	6,563	$2,061
2027	$339,005	2,324	$146	$2,905,759	6,641	$438	$13,560,207	6,641	$2,042
2028	$339,851	2,351	$145	$2,913,011	6,718	$434	$13,594,050	6,718	$2,023
2029	$340,697	2,379	$143	$2,920,262	6,796	$430	$13,627,892	6,796	$2,005
2030	$344,192	2,406	$143	$2,950,216	6,874	$429	$13,767,673	6,874	$2,003
2031	$345,038	2,433	$142	$2,957,467	6,951	$425	$13,801,515	6,951	$1,985
2032	$345,884	2,460	$141	$2,964,719	7,029	$422	$13,835,357	7,029	$1,968
2033	$346,730	2,487	$139	$2,971,971	7,107	$418	$13,869,199	7,107	$1,952
2034	$347,576	2,514	$138	$2,979,223	7,184	$415	$13,903,041	7,184	$1,935
2035	$348,422	2,542	$137	$2,986,475	7,262	$411	$13,936,883	7,262	$1,919
2036	$351,917	2,569	$137	$3,016,428	7,339	$411	$14,076,664	7,339	$1,918
2037	$352,763	2,596	$136	$3,023,680	7,417	$408	$14,110,506	7,417	$1,902
2038	$353,609	2,623	$135	$3,030,932	7,495	$404	$14,144,348	7,495	$1,887
2039	$354,455	2,650	$134	$3,038,184	7,572	$401	$14,178,190	7,572	$1,872
2040	$355,301	2,652	$134	$3,045,435	7,577	$402	$14,212,032	7,577	$1,876

VIII. Ships and Ports Measure

Overview and General Methodology

The majority of emissions reductions from this measure come from a commitment to develop a program to reduce emissions within 25 miles of the coast by 30% in the South Coast and to no more than 4 tons in Ventura, in combination with other provisions. The other requirements and recommendations finalized today should result in cost savings. These savings were not estimated due to time considerations.

In order to estimate the cost of reducing emissions within 25 miles of the coast, EPA estimated the increased fuel costs necessary to reroute shipping to outside 25 miles. This is a simplistic assumption of how the reductions might eventually be made, but was the approach recommended by several commenters. No estimate is made for increased operational time due to the rerouting because the time, approximately 1 hour, is a period of time which is vastly overshadowed by the entire time it takes to make any trip from the San Pedro Ports north (or vice versa) and other things which may change shipping schedules (traffic, weather, tides). Further because people (the other variable cost in addition to fuel) are employed generally full time, there would not be an increase in variable costs. In the process to develop a program to achieve the necessary reductions, all costs including increased time, labor, hardware, fuel changes and others, will be considered.

Assumptions

The analysis was largely based on the 1990 inventory of ships using the Ports of Los Angeles and Long Beach which was prepared by the Merchant Exchange for the Ports. This data was used because it was the only real inventory of types of ships using the Ports based on data for a full year.

The Marine Exchange broke out ships by method of propulsion, use and size. The report also included ships, without description of their type, which used the Ports only for fueling in its inventory. These ships were allocated to the other categories assuming that the fueling ships were perfectly representative of the ships using the Ports for other reasons.

Costs to tankers were not included because almost all of them currently use a shipping lane which is further than 25 miles from shore. The Merchant Exchange also provided data on where ships were traveling for the month of November 1994. The breakout of ships for that month was applied to the yearly totals for 1990. Onl;y ships headed to or from the north were assumed to have increased costs.

The 1994 cost of bunker fuel was used for 1990. This assumption likely overestimates costs.

Lloyd's Register data was used for cruising speed and fuel consumption on average for each ship type. The fuel consumption estimate used was at 70% of full load cruise since some of the operation is near port and in a reasonably high density area. This assumption is also

the assumption that the Ports used in making their analysis of the inventory of ship emissions.

The most important assumption made was of how many miles out of their way the ships would be required to go. It was assumed that ships traveled 15 miles out of their way to reach 25 miles from shore rather than 10 miles. This assumption may exaggerate the costs applicable to shippers because ships heading north already have a substantial distance west to travel. An assumption that ships do have to detour at least slightly is appropriate because a revised ship access route could lead ships slightly south (which would be unnecessary) and to a small extent the ships might be traveling two sides of a triangle rather than the third side. These issues will be resolved by the Coast Guard when it develops its California coastal plan, but some assumption was necessary here.

SHIPS and PORTS

COST ESTIMATES

	me#	fuel	%NO-BD	fcons	avcsp		affected	cost	cost/sh
dc0-25	1919	585.8158		468	20	2504.815	1575.316	210115.6	133.3
dc26-50	69	21.06372		781	20	90.06372	56.64243	12607.75	222.58
sc0-25	102	31.13768	0.628915	442	18	133.1376	83.73228	11719.72	139.966
dbulk0-25	383	116.9189		120	10	499.9189	314.4065	21505.40	68.
dbulk26-5	3	0.915814		461	14	3.915814	2.462714	462.2338	187.692
sbulk26-5	4	1.221085		726	14	5.221085	3.283619	970.5909	295.585
sbulk51-7	3	0.915814	0.628915	1386	14	3.915814	2.462714	1389.709	564.
roro0-25	517	157.8253	0.628915	328	18	674.8253	424.4077	44081.82	103.866
dpas0-25	246	75.09677		332	18	321.0967	201.9425	21230.89	105.1333
dpas26-50	37	11.29504		450	18	48.29504	30.37347	4328.220	142.5
spas0-25	125	38.15892	0.628915	410	18	163.1589	102.6130	13322.60	129.8333
dmisc0-25	603	184.0786	0.628915	308	18	787.0786	495.0055	48279.54	97.53333
	4011				Total Affected Ships		3292.649	390014.1 Total Costs	
								23215.13 Costs/Ton	

NOTES:

Column 1

Numbers are dead weight tons, in thousands.
"dc" means diesel-powered container ship.
"sc" means steam-engine powered container ship
"dbulk" means diesel-powered dry bulk ship.
"sbulk" means steam-engine powered dry bulk ship.
"roro" means diesel engine-powered rollon-roll automobile ship.
"dpas" means diesel engine-powered passenger ship.
"spas" means steam engine-powered passenger ship.
"dmisc" means other types of diesel-powered ships; data used is for refrigerator ship because, of the miscellaneous ships entering the ports of Los Angeles and Long Beach, these are least likely to have business in the Santa Barbara shipping channel.

Column 2

These are the numbers of each type of ship which visited the ports of Los Angeles and Long Beach, as reported by the Marine Exchange, for 1990.

Column 3

This column allocates the ships that visited the Ports of Los Angeles and Long Beach only for fueling (about which we have no data) into the other categories. I assumed the range was similar to other uses of the Ports, this assumption probably exaggerates costs. Although the number of such ships declined after a tax was put in, the tax has been removed. Eventually, these ships will likely return.

Column 4

This column lists the percentage of all non-tanker ships which travelled north from (or to) the ports of Los Angeles and Long Beach in November 1994 as reported by the Merchant Exchange.

Column 5

This column describes fuel consumption in gallons per hour. This data is from the Ports' inventory of ship emissions.

Column 6

This column describes average cruising speed in knots per hour. This data is from the Ports' inventory of ship emissions.

Column 7

This column is the sum of Columns 2 and 3.

Column 8

This column is an estimate of the number of trips which would have been within the channel and would now be outside of it.

Column 9

This column estimates the total costs for each type of ship in dollars. The equation is (total ships affected - Column 8) * (cost of fuel)* (1/speed traveled - Column 6)* (# of nautical miles out of the way ships must travel)* (fuel consumption - Column 5).

1994 fuel costs were estimated by Kenny Levin of Sea Worthy Systems as 37-38 cents/gallon. Number of nautical miles out of the way is estimated at 15. This number could be as low as 0 given that San Francisco is 100 miles west of Los Angeles and thus most of the distance traveled would need to be traveled anyway.

The costs are totalled just below the individual costs. Dollars per ton were calculated by dividing by 16.8 (12 tons in Ventura and 4.8 tons (20% of the total ship inventory) in the South Coast).

Column 10

This column estimates costs per ship by dividing Column 9 by Column 8.