DOE/EA-0819

ENVIRONMENTAL ASSESSMENT FOR PROPOSED ENERGY CONSERVATION STANDARDS FOR EIGHT TYPES OF CONSUMER PRODUCTS: ROOM AIR CONDITIONERS, WATER HEATERS, DIRECT HEATING EQUIPMENT, MOBILE HOME FURNACES, RANGES AND OVENS, POOL HEATERS, FLUORESCENT BALLASTS, AND TELEVISIONS

1 INTRODUCTION AND NEED FOR PROPOSED ACTION

This Environmental Assessment (EA) on the candidate energy conservation standards for eight appliances (room air conditioners, water heaters, direct heating equipment, mobile home furnaces, kitchen ranges and ovens, pool heaters, fluorescent lamp ballasts, and television sets) was prepared pursuant to the National Environmental Policy Act of 1969 (NEPA), regulations of the Council on Environmental Quality, Title 40, Code of Federal Regulations, Parts 1500 through 1508. The candidate conservation standards are being proposed pursuant to the Energy Policy and Conservation Act, as amended by the National Energy Conservation Policy Act, the National Appliance Energy Conservation Act and the National Appliance Energy Conservation Amendments.

The EA presents the results of the associated environmental impacts from a range of new candidate energy conservation standards for eight types of household appliances. The results are presented for each potential standard level for each of the eight appliance types. Each measure of possible environmental change is an alternative action, and it is compared to what is expected to happen if no new standards for each product were finalized, i.e., the "no action" alternative.

The main environmental concern addressed is emissions from fossil-fueled electricity generation. Most of the design options for the eight appliances result in decreased electricity use and, therefore, a reduction of power plant emissions. The proposed efficiency standards will generally decrease air pollution by decreasing future energy demand. The greatest decreases in air pollution will be for sulfur oxides, listed in equivalent weight of sulfur dioxide, or SO_2. Reductions of nitrogen oxides and carbon dioxide also occur and are listed by weight of NO_x and CO_2, respectively. Carbon dioxide (CO_2) emissions from fossil-fuel burning is considered an environmental hazard because it contributes to the "greenhouse effect" by trapping heat energy from the earth that is emitted as infrared radiation. The "greenhouse effect" is expected to gradually raise the mean global temperature. Design options for many of the appliances (i.e. gas and oil water heaters, gas pool heaters, direct heating equipment, mobile home furnaces, and gas ranges and ovens) also reduce in-home fuel consumption, resulting in lower in-home emissions from fuel-burning appliances.

Although the quantity of raw materials used per appliance will remain relatively constant, in most scenarios increased initial cost is expected to decrease slightly the number of appliances sold, resulting in small decreases in raw materials used. The main effect of decreased appliance production is the SO_2 emitted in steel production. The decrease is small, however, in comparison to the SO_2 decreases from fuel burning avoided at power

plants. The contribution from steel production is not included in the estimates for net SO_2 decreases resulting from design changes in these products.

The effects on particulate emissions related to a standard-induced decrease in electricity generation would be minor compared to effects on decreases in SO_2, NO_2, and CO_2. For example, in 1984, power plants contributed only 7% of U.S. total particulate emissions as compared to contributions of 83% and 34% to total SO_2 and NO_2 emissions, respectively (1). Though the reduction in particulate emissions would be relatively small, any reduction would possibly be beneficial to improving the quality of surfacewater. Since the amount of particulates emitted would be decreased, it is very likely that less particulates would reach the surfacewater.

Reductions in particulate emissions accompanied by decreases in SO_2 and NO_2 would have other beneficial effects on the environment. The resultant improvement to air quality and the decreased potential of acid rain formation would help improve the quality of wetlands and fish & wildlife as well as aid in the preservation of historical and archaeological sites.

Reduced in-home fuel consumption will decrease the amount of gas or oil burned within some homes, thereby decreasing the impact of combustion on indoor air quality. Indoor air problems are usually due to a combination of factors, including a tight house envelope, insufficient ventilation for cooking appliances, presence of sources such as cigarette smokers or formaldehyde containing products, and radon diffusion from soil. In comparison to the above factors, and because fuel-burning appliances are normally vented to the outside, the projected changes in in-home fuel-burning appliance use is expected to have little effect on indoor air quality.

2 METHODS OF ESTIMATING ENVIRONMENTAL IMPACTS

The greatest impacts of the proposed standards would be a reduction in electricity demand growth. The main environmental effects of power plants on air and water quality result from emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon dioxide (CO_2). With the proposed standards lessening the need for electricity generation, power plant emissions would be reduced. A second source of these pollutants is fuel-burning household appliances. Pollutants from fuel-burning household aplliances will be termed "in-house" emissions. The proposed standards would also reduce these emissions. Since fuel-burning household appliances are normally vented to the outside, both the power plant and "in-house" emissions are reported.

2.1 Baseline Emissions

The estimates of emissions of SO_2, NO_x, and CO_2 are also expressed as a percentage of U.S. power plant emissions for the year under consideration. In a report that accompanies the 1991 National Energy Strategy (NES), the impact on power plant emissions as a result of revisions to Title V of the 1990 Clean Air Act (i.e., H.R. 3030) are estimated (2).

The legislation calls for SO_2 emissions reductions in two phases. In the first phase of the planned reductions (beginning December 31, 1995 and carrying through the year 2000), electric utilities will have several options for reducing their SO_2 emissions to comply with the allowance constraints imposed by the provisions of the Clean Air Act. The major options are 1) to decrease their use of high emission units and increase the use of their clean coal, gas, or oil units, 2) to switch units using high sulfur coal to low sulfur coal, 3) to retrofit plants emitting at a high rate with emissions reduction technologies (e.g., scrubbers), and 4) to purchase allowances from other utilities who reduce their emissions below their permitted levels, in order to sell their allowances for a profit. Most utilities will make use of a combination of these options to minimize the cost of complying with the allowance constraints. Total SO_2 emissions by utilities cannot exceed 8.9 million tons after December 31, 2000.

In the second phase of the planned reductions (beginning December 31, 2000), the options available to electric utilities for maintaining the 8.9 million-ton cap will broaden with the expected introduction of new, advanced generating technologies. However, during this period utilities are less able to reduce emissions by changing the way they utilize their plants. Since most plants will be fully utilized, there will be few opportunities for reducing emissions by decreasing the use of a high emission plant.

In the report accompanying the 1991 NES, two possible outcomes are presented, a flexible case and a restricted case, so that the effect of different levels of permitted trading of emission allowances can be evaluated. (The report does not go beyond this explanation in defining the differences between the two cases.) As presented in the report, the results for the two cases are virtually identical. Because the two cases are so similar, the U.S. power plant emission projections for the three effluents under the assumptions made in the flexible case are presented only. Table 1 summarizes the results.

Table 1 U.S. CO_2, SO_2, NO_x Power Plant Emissions

Year	CO_2 *10^6 tons*	SO_2 *10^6 tons*	NO_x *10^6 tons*
1995	2232.5	13.8	8.4
2000	2506.2	9.0	6.7
2010	3219.3	8.4	7.3
2020	3964.2	6.7	6.7
2030	4804.4	4.8	5.9

2.2 Sulfur and Nitrogen Oxide Emissions

For each of the scenarios analyzed, emissions abated from fossil fuel-burning power plants are estimated. In analyzing the impacts of design changes to each of the appliances, lower sulfur emissions resulting from decreased steel production are not considered. No changes in the amount of steel used per unit are expected. Analysis of the impacts resulting from several design options includes the consideration of SO_2 and NO_x from in-home combustion of gas and oil.

In order to capture the effects of cleaner-burning power plants in future years, emission rates (tons/Quad) for power plant fuel-burning are calculated from projected emissions and electrical generation data. The electrical generation data is translated into energy use (Quads) by multiplying the generation data by 11,500 Btu/kWh. The source of these projected emissions and electrical generation data is the report that accompanies the 1991 National Energy Strategy (data for Table 1 was extracted from the same Service Report). (2) Table 2 presents these data and the calculated emission rates for SO_2 and NO_x.

Table 2 Electrical Generation and Emissions Data and Emission Rates for SO_2 and NO_x at Fossil Fuel-Burning Power Plants

	Electrical Generation			Energy Use	Emissions		Emissions Rates	
	Coal	Oil	Gas	Total	SO_2	NO_x	SO_2	NO_x
Year	*10^9 kWh*	*10^9 kWh*	*10^9 kWh*	*Quads*	*10^6 tons*	*10^6 tons*	*10^3 tons/Quad*	*10^3 tons/Quad*
1995	1602.2	193.7	442.0	25.74	13.8	8.4	552.5	336.3
2000	1814.0	179.8	605.0	29.89	9.0	6.7	310.3	231.0
2010	2660.6	149.9	482.5	37.88	8.4	7.3	228.6	198.6
2020	3727.8	67.2	292.3	47.01	6.7	6.7	146.9	146.9
2030	4837.3	29.0	179.2	58.03	4.8	5.9	85.2	104.8

The calculated emissions rate data listed in Table 2 represent the average SO_2 and NO_x emissions rates for all fossil fuel-burning power plants in the United States. Emissions rates were not calculated for each fuel-burning source as the emissions data supplied by the Service Report were not disaggregated according to power plant type (i.e. coal, oil, gas). To obtain emission rate values, the amount of emissions were divided by the total energy use of fossil fuel-burning power plants. The total energy use by fossil fuel-burning power plants was calculated from the electrical generation data supplied by the report accompanying the 1991 NES. The electrical generation data was disaggregated by fuel source. To obtain the total energy use (input), the electrical generation data from each fossil fuel source was summed and then divided by the assumed efficiency of fossil fuel-burning power plants (30.6%). This fossil fuel-burning power plant efficiency is consistent with that used by the LBL Residential Energy Model (REM). For further information on the assumed efficiency of fossil fuel-burning power plants, refer to Appendix B of volume A of the Technical Support Document (TSD).

The amount of SO_2 and NO_x emissions abated for any particular year is determined by multiplying the estimates of energy saved through reduced electricity generation in that year by the emission rate for that particular year. For years not covered in the Service Report, linear interpolation was used to derive emission rates and, in turn, the corresponding abated emissions.

Table 3 presents the emission factors (rates) that were used for SO_2 and NO_x for in-home gas and oil combustion. The values for reduction of SO_2 and NO_x emissions from in-home gas and oil combustion are produced by multiplying in-home fuel savings for gas and oil by the corresponding emission rates. Emission factors that appear in Table 3 are from a Lawrence Berkeley Laboratory report. (3) Emission factors for gas in-home combustion were assumed to equal the average of those for residential gas space heaters and water heaters. Emission factors

for oil in-home combustion were assumed to equal those associated with a residential #2 oil boiler.

Table 3 Emission Rates for SO_2 and NO_x for In-Home Combustion

SO_2 Gas Emission *10^3 tons/Quad*	SO_2 Oil Emission *10^3 tons/Quad*	NO_x Gas Emission *10^3 tons/Quad*	NO_x Oil Emission *10^3 tons/Quad*
0.0	156.5	52.5	65.0

2.3 Carbon Dioxide Emissions

Emission rates for carbon dioxide were derived in the same manner as those derived for SO_2 and NO_x. As presented in Table 1, the report accompanying the 1991 National Energy Strategy (NES) also provided emissions data with regard to CO_2.[8] Table 4 presents the CO_2 emission rate data as derived from the electrical generation data and emissions data supplied by the 1991 NES report.

Table 4 Electrical Generation Data, Emissions Data and Emissions Rates for CO_2 at Fossil Fuel-Burning Power Plants

Year	Electrical Generation			Energy Use Total	Emission CO_2	Emission Rate CO_2
	Coal *10^9 kWh*	Oil *10^9 kWh*	Gas *10^9 kWh*	*Quads*	*10^6 tons*	*10^6 tons/Quad*
1995	1602.2	193.7	442.0	25.74	2232.5	89.39
2000	1814.0	179.8	605.0	29.89	2506.2	86.41
2010	2660.6	149.9	482.5	37.88	3219.3	87.60
2020	3727.8	67.2	292.3	47.01	3964.2	86.90
2030	4837.3	29.0	179.2	58.03	4804.4	85.32

As with the SO_2 and NO_x emissions, the amount of CO_2 emissions abated for any particular year is determined by multiplying the estimates of energy saved through reduced electricity generation by the emission rate for that particular year. For years not covered in the Service Report, linear interpolation was used to derive emission rates and, in turn, the corresponding abated emissions.

[8] Upon phone conversations with David Streets at Argonne National Laboratory (February 1992), it was determined that the carbon emissions data provided in the report accompanying the 1991 NES were mistakenly reported as tons of carbon emitted. David Streets was one of authors at Argonne who contributed to the 1991 NES report.

Table 5 presents the emission factors (rates) that were used for CO_2 for in-home gas and oil combustion. The values for the reduction of CO_2 emissions from in-home gas and oil combustion are produced by multiplying in-home fuel savings for gas and oil by the corresponding emission rates. Emission factors that appear in Table 5 are from a Lawrence Berkeley Laboratory report(3). The emission factor for gas in-home combustion was assumed to equal the average of those for residential gas space heaters and water heaters. The emission factor for oil in-home combustion was assumed to equal the one associated with a residential #2 oil boiler.

Table 5 Emission Rates for CO_2 for In-Home Combustion

CO_2 Gas Emission *10^3 tons/Quad*	CO_2 Oil Emission *10^3 tons/Quad*
55,000	84,300

3 RESULTS

The following tabular results indicate what changes can be brought about in the amounts of emitted CO_2, SO_2, and NO_x by imposing efficiency standards for each of the eight appliances considered in this analysis. A table is presented for each of the appliances' trial standard levels. Each appliance has been analyzed separately in order to determine the emission changes resulting from each of their prospective trial standards levels. Each table details the changes that occur to each of the three pollutants (i.e. CO_2, SO_2, and NO_x) through the imposition of an appliance's specific trial standard level. Each table includes the following information for a specific year between 1996 and 2030: the amount of pollutant abated from power plant generation, the amount abated from in-home generation, the net change in the pollutant emitted, and the percent the net change comprises of total U.S. power plant emissions. Also included are the cumulative changes of each pollutant (between the years 1996 and 2030).

For each section that follows, only the results from the last standard level are discussed for each appliance. In order to view the results for each standard level, tables for each level are provided after the discussion.

It should be noted that the standard levels studied for each appliance are not consistent between the eight appliances. The number of standard levels that are analyzed for a particular appliance depends on the number and type of technologies that were considered for it. For a detailed explanation of the specific technologies considered for each appliance, please refer to the appropriate sections and appendices of the Technical Support Document.

3.1 ROOM AIR CONDITIONERS

Decreases in the amounts of CO_2, SO_2, and NO_x emitted at trial standards levels 1 through 7 are summarized in Tables 6 through 12.

3.1.1 Sulfur and Nitrogen Oxide Emissions

Sulfur dioxide emissions would be decreased by a cumulative total of 0.78 million tons between 1996 and 2030 in the level 7 scenario. In the year 1996, decreases in sulfur dioxide will represent about 0.11% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, decreases in SO_2 emissions will represent about 0.26% of the SO_2 emissions estimated to come from power plants in that year. Because of provisions in the Clean Air Act Amendments (Pub. L. 101-549, November 15, 1990), the possible reductions of SO_2 that are caused by standards can be earned as credits by the utility realizing the reductions. To the extent SO_2 credits are used for future emissions, the net effect on SO_2 emissions from standards would be only a postponement of those SO_2 emissions.

Level 7 design changes to room air conditioners would result in an estimated decrease in NO_x emissions of 0.70 million tons between 1996 and 2030. NO_x decreases would represent 0.11% and 0.26% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

3.1.2 Carbon Dioxide Emissions

The cumulative reduction in CO_2 emissions from level 7 design changes is 360 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 2496 thousand tons of CO_2 or about 0.11% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 reduction is 12,253 thousand tons of CO_2 or about 0.26% of estimated U.S.power plant CO_2 emissions in 2030.

Table 6
Reduction of Pollutants for Room Air Conditioners - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	172	0	172	0.01%
2000	419	0	419	0.02%
2005	676	0	676	0.02%
2010	765	0	765	0.02%
2015	931	0	931	0.03%
2020	928	0	928	0.02%
2025	835	0	835	0.02%
2030	580	0	580	0.01%

Cumulative CO2 reduction, 1996-2030 = 24 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	966	0	966	0.01%
2000	1,505	0	1,505	0.02%
2005	2,054	0	2,054	0.02%
2010	1,996	0	1,996	0.02%
2015	1,957	0	1,957	0.03%
2020	1,568	0	1,568	0.02%
2025	1,095	0	1,095	0.02%
2030	579	0	579	0.01%

Cumulative SO2 reduction, 1996-2030 = 52,274 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	607	0	607	0.01%
2000	1,121	0	1,121	0.02%
2005	1,653	0	1,653	0.02%
2010	1,735	0	1,735	0.02%
2015	1,814	0	1,814	0.03%
2020	1,568	0	1,568	0.02%
2025	1,200	0	1,200	0.02%
2030	712	0	712	0.01%

Cumulative NOx reduction, 1996-2030 = 46,839 tons

Table 7
Reduction of Pollutants for Room Air Conditioners - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	344	0	344	0.02%
2000	838	0	838	0.03%
2005	1,436	0	1,436	0.05%
2010	1,785	0	1,785	0.06%
2015	1,946	0	1,946	0.05%
2020	1,939	0	1,939	0.05%
2025	1,670	0	1,670	0.04%
2030	1,325	0	1,325	0.03%

Cumulative CO2 reduction, 1996-2030 = 53 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	1,933	0	1,933	0.02%
2000	3,011	0	3,011	0.03%
2005	4,365	0	4,365	0.05%
2010	4,657	0	4,657	0.06%
2015	4,091	0	4,091	0.05%
2020	3,278	0	3,278	0.05%
2025	2,190	0	2,190	0.04%
2030	1,323	0	1,323	0.03%

Cumulative SO2 reduction, 1996-2030 = 115,744 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	1,213	0	1,213	0.01%
2000	2,241	0	2,241	0.03%
2005	3,512	0	3,512	0.05%
2010	4,047	0	4,047	0.06%
2015	3,793	0	3,793	0.05%
2020	3,278	0	3,278	0.05%
2025	2,399	0	2,399	0.04%
2030	1,627	0	1,627	0.03%

Cumulative NOx reduction, 1996-2030 = 103,365 tons

Table 8
Reduction of Pollutants for Room Air Conditioners - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	689	0	689	0.03%
2000	1,677	0	1,677	0.07%
2005	2,788	0	2,788	0.10%
2010	3,485	0	3,485	0.11%
2015	3,808	0	3,808	0.11%
2020	3,795	0	3,795	0.10%
2025	3,506	0	3,506	0.08%
2030	2,980	0	2,980	0.06%

Cumulative CO2 reduction, 1996-2030 = 105 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	3,866	0	3,866	0.03%
2000	6,022	0	6,022	0.07%
2005	8,473	0	8,473	0.10%
2010	9,093	0	9,093	0.11%
2015	8,005	0	8,005	0.11%
2020	6,413	0	6,413	0.10%
2025	4,598	0	4,598	0.08%
2030	2,978	0	2,978	0.06%

Cumulative SO2 reduction, 1996-2030 = 229,357 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	2,427	0	2,427	0.03%
2000	4,483	0	4,483	0.07%
2005	6,818	0	6,818	0.10%
2010	7,902	0	7,902	0.11%
2015	7,422	0	7,422	0.11%
2020	6,413	0	6,413	0.10%
2025	5,038	0	5,038	0.08%
2030	3,660	0	3,660	0.06%

Cumulative NOx reduction, 1996-2030 = 205,243 tons

Table 9
Reduction of Pollutants for Room Air Conditioners - Level Four

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	861	0	861	0.04%
2000	1,928	0	1,928	0.08%
2005	3,126	0	3,126	0.11%
2010	3,995	0	3,995	0.12%
2015	4,231	0	4,231	0.12%
2020	4,301	0	4,301	0.11%
2025	4,007	0	4,007	0.09%
2030	3,312	0	3,312	0.07%

Cumulative CO2 reduction, 1996-2030 = 119 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	4,832	0	4,832	0.04%
2000	6,925	0	6,925	0.08%
2005	9,500	0	9,500	0.11%
2010	10,424	0	10,424	0.12%
2015	8,894	0	8,894	0.12%
2020	7,268	0	7,268	0.11%
2025	5,255	0	5,255	0.09%
2030	3,308	0	3,308	0.07%

Cumulative SO2 reduction, 1996-2030 = 261,109 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	3,033	0	3,033	0.04%
2000	5,155	0	5,155	0.08%
2005	7,644	0	7,644	0.11%
2010	9,059	0	9,059	0.12%
2015	8,246	0	8,246	0.12%
2020	7,268	0	7,268	0.11%
2025	5,758	0	5,758	0.09%
2030	4,067	0	4,067	0.07%

Cumulative NOx reduction, 1996-2030 = 233,507 tons

Table 10
Reduction of Pollutants for Room Air Conditioners - Level Five

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,291	0	1,291	0.06%
2000	2,935	0	2,935	0.12%
2005	4,731	0	4,731	0.17%
2010	5,950	0	5,950	0.18%
2015	6,262	0	6,262	0.17%
2020	6,409	0	6,409	0.16%
2025	6,261	0	6,261	0.14%
2030	5,630	0	5,630	0.12%

Cumulative CO2 reduction, 1996-2030 = 181 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	7,249	0	7,249	0.06%
2000	10,538	0	10,538	0.12%
2005	14,379	0	14,379	0.17%
2010	15,525	0	15,525	0.18%
2015	13,163	0	13,163	0.17%
2020	10,831	0	10,831	0.16%
2025	8,211	0	8,211	0.14%
2030	5,624	0	5,624	0.12%

Cumulative SO2 reduction, 1996-2030 = 394,176 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	4,550	0	4,550	0.06%
2000	7,845	0	7,845	0.12%
2005	11,569	0	11,569	0.17%
2010	13,492	0	13,492	0.18%
2015	12,204	0	12,204	0.17%
2020	10,831	0	10,831	0.16%
2025	8,996	0	8,996	0.14%
2030	6,913	0	6,913	0.12%

Cumulative NOx reduction, 1996-2030 = 353,124 tons

Table 11
Reduction of Pollutants for Room Air Conditioners - Level Six

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,636	0	1,636	0.07%
2000	3,689	0	3,689	0.15%
2005	6,168	0	6,168	0.22%
2010	7,820	0	7,820	0.24%
2015	8,293	0	8,293	0.23%
2020	8,432	0	8,432	0.21%
2025	8,348	0	8,348	0.19%
2030	7,865	0	7,865	0.16%

Cumulative CO2 reduction, 1996-2030 = 240 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	9,182	0	9,182	0.07%
2000	13,248	0	13,248	0.15%
2005	18,744	0	18,744	0.22%
2010	20,404	0	20,404	0.24%
2015	17,433	0	17,433	0.23%
2020	14,252	0	14,252	0.21%
2025	10,948	0	10,948	0.19%
2030	7,858	0	7,858	0.16%

Cumulative SO2 reduction, 1996-2030 = 520,335 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	5,764	0	5,764	0.07%
2000	9,863	0	9,863	0.15%
2005	15,081	0	15,081	0.22%
2010	17,732	0	17,732	0.24%
2015	16,163	0	16,163	0.23%
2020	14,252	0	14,252	0.21%
2025	11,995	0	11,995	0.19%
2030	9,658	0	9,658	0.16%

Cumulative NOx reduction, 1996-2030 = 466,729 tons

Table 12
Reduction of Pollutants for Room Air Conditioners - Level Seven

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	2,496	0	2,496	0.11%
2000	5,785	0	5,785	0.23%
2005	9,125	0	9,125	0.32%
2010	11,390	0	11,390	0.35%
2015	12,101	0	12,101	0.34%
2020	12,564	0	12,564	0.32%
2025	12,688	0	12,688	0.29%
2030	12,253	0	12,253	0.26%

Cumulative CO2 reduction, 1996-2030 = 360 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	14,014	0	14,014	0.11%
2000	20,776	0	20,776	0.23%
2005	27,731	0	27,731	0.32%
2010	29,718	0	29,718	0.35%
2015	25,437	0	25,437	0.33%
2020	21,235	0	21,235	0.32%
2025	16,641	0	16,641	0.29%
2030	12,241	0	12,241	0.26%

Cumulative SO2 reduction, 1996-2030 = 777,408 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	8,797	0	8,797	0.11%
2000	15,466	0	15,466	0.23%
2005	22,312	0	22,312	0.32%
2010	25,827	0	25,827	0.35%
2015	23,584	0	23,584	0.34%
2020	21,235	0	21,235	0.32%
2025	18,232	0	18,232	0.29%
2030	15,047	0	15,047	0.26%

Cumulative NOx reduction, 1996-2030 = 697,544 tons

3.2 WATER HEATERS

Decreases in the amounts of CO_2, SO_2, and NO_x emitted at trial standards levels 1 through 8 are summarized in Tables 13 through 20.

3.2.1 Sulfur and Nitrogen Oxide Emissions

Sulfur dioxide emissions would be decreased by a cumulative total of 7.12 million tons between 1996 and 2030 in the level 8 scenario. In the year 1996, decreases in sulfur dioxide will represent about 1.14% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, decreases in SO_2 emissions will represent about 2.44% of the SO_2 emissions estimated to come from power plants in that year. As discussed earlier, the possible reductions of SO_2 emissions caused by standards can be earned as credits. To the extent credits are used for future emissions, the standards' net effect on those SO_2 emissions would be only a postponement.

Level 8 design changes to water heaters would result in an estimated decrease in NO_x emissions of 7.11 million tons between 1996 and 2030. NO_x decreases would represent 1.21% and 2.81% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

3.2.2 Carbon Dioxide Emissions

The cumulative reduction in CO_2 emissions from level 8 design changes is 4113 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 33,450 thousand tons of CO_2 or about 1.46% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 reduction is 142,630 thousand tons of CO_2 or about 2.97% of estimated U.S. power plant CO_2 emissions in 2030.

Table 13
Reduction of Pollutants for Water Heaters - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	86	0	86	0.00%
2000	252	0	252	0.01%
2005	338	139	477	0.02%
2010	170	0	170	0.01%
2015	85	0	85	0.00%
2020	169	55	224	0.01%
2025	83	55	138	0.00%
2030	166	0	166	0.00%

Cumulative CO2 reduction, 1996-2030 = 7 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	483	0	483	0.00%
2000	903	0	903	0.01%
2005	1,027	157	1,184	0.01%
2010	444	0	444	0.01%
2015	178	0	178	0.00%
2020	285	0	285	0.00%
2025	109	0	109	0.00%
2030	165	0	165	0.00%

Cumulative SO2 reduction, 1996-2030 = 16,662 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	303	0	303	0.00%
2000	672	0	672	0.01%
2005	826	117	944	0.01%
2010	385	0	385	0.01%
2015	165	0	165	0.00%
2020	285	52	338	0.01%
2025	120	53	172	0.00%
2030	203	0	203	0.00%

Cumulative NOx reduction, 1996-2030 = 14,405 tons

Table 14
Reduction of Pollutants for Water Heaters - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	689	84	773	0.03%
2000	1,845	224	2,068	0.08%
2005	2,619	418	3,037	0.11%
2010	1,955	334	2,289	0.07%
2015	1,269	418	1,687	0.05%
2020	928	334	1,261	0.03%
2025	584	279	863	0.02%
2030	497	363	860	0.02%

Cumulative CO2 reduction, 1996-2030 = 59 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	3,866	157	4,022	0.03%
2000	6,624	313	6,937	0.08%
2005	7,960	470	8,429	0.10%
2010	5,101	313	5,414	0.06%
2015	2,668	470	3,138	0.04%
2020	1,568	313	1,881	0.03%
2025	766	313	1,079	0.02%
2030	496	470	966	0.02%

Cumulative SO2 reduction, 1996-2030 = 145,477 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	2,427	65	2,492	0.03%
2000	4,931	182	5,114	0.08%
2005	6,404	352	6,757	0.10%
2010	4,433	287	4,720	0.06%
2015	2,474	352	2,826	0.04%
2020	1,568	287	1,855	0.03%
2025	840	235	1,075	0.02%
2030	610	300	910	0.02%

Cumulative NOx reduction, 1996-2030 = 118,434 tons

Table 15
Reduction of Pollutants for Water Heaters - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	18,077	1,991	20,068	0.88%
2000	44,857	4,286	49,143	1.96%
2005	70,802	6,500	77,302	2.70%
2010	73,607	6,911	80,518	2.50%
2015	74,385	7,520	81,904	2.28%
2020	76,651	7,824	84,475	2.13%
2025	78,634	8,128	86,762	1.98%
2030	81,381	8,517	89,898	1.87%

Cumulative CO2 reduction, 1996-2030 = 2,607 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	101,482	939	102,421	0.80%
2000	161,086	2,035	163,120	1.81%
2005	215,169	3,287	218,455	2.51%
2010	192,061	3,130	195,191	2.32%
2015	156,360	3,443	159,803	2.10%
2020	129,550	3,600	133,149	1.99%
2025	103,128	3,756	106,884	1.84%
2030	81,306	4,069	85,375	1.78%

Cumulative SO2 reduction, 1996-2030 = 5,381,123 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	63,703	1,808	65,511	0.81%
2000	119,919	3,890	123,809	1.85%
2005	173,124	5,880	179,004	2.56%
2010	166,910	6,288	173,198	2.37%
2015	144,970	6,838	151,807	2.17%
2020	129,550	7,113	136,662	2.04%
2025	112,993	7,388	120,380	1.91%
2030	99,939	7,728	107,667	1.82%

Cumulative NOx reduction, 1996-2030 = 4,890,115 tons

Table 16
Reduction of Pollutants for Water Heaters - Level Four

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	21,263	2,156	23,418	1.02%
2000	50,139	4,645	54,784	2.19%
2005	76,885	6,775	83,660	2.92%
2010	79,727	7,270	86,997	2.70%
2015	80,732	7,850	88,581	2.47%
2020	83,312	8,154	91,466	2.31%
2025	85,563	8,598	94,160	2.15%
2030	88,666	8,986	97,652	2.03%

Cumulative CO2 reduction, 1996-2030 = 2,837 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	119,363	939	120,302	0.94%
2000	180,055	2,191	182,246	2.02%
2005	233,656	3,287	236,942	2.72%
2010	208,029	3,287	211,316	2.52%
2015	169,701	3,443	173,144	2.28%
2020	140,809	3,600	144,408	2.16%
2025	112,215	3,913	116,128	2.00%
2030	88,585	4,226	92,811	1.93%

Cumulative SO2 reduction, 1996-2030 = 5,885,240 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	74,927	1,965	76,892	0.95%
2000	134,041	4,218	138,258	2.06%
2005	187,999	6,143	194,141	2.77%
2010	180,787	6,615	187,402	2.57%
2015	157,339	7,153	164,491	2.35%
2020	140,809	7,428	148,236	2.21%
2025	122,949	7,820	130,769	2.08%
2030	108,886	8,160	117,046	1.98%

Cumulative NOx reduction, 1996-2030 = 5,337,547 tons

Table 17
Reduction of Pollutants for Water Heaters - Level Five

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	21,176	2,350	23,527	1.03%
2000	49,972	5,034	55,005	2.19%
2005	76,631	7,278	83,909	2.93%
2010	79,472	7,717	87,190	2.71%
2015	80,562	8,271	88,834	2.47%
2020	83,144	8,575	91,719	2.31%
2025	85,479	8,964	94,443	2.15%
2030	88,583	9,408	97,991	2.04%

Cumulative CO2 reduction, 1996-2030 = 2,845 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	118,879	1,096	119,975	0.94%
2000	179,453	2,504	181,957	2.02%
2005	232,885	3,913	236,798	2.72%
2010	207,364	3,913	211,276	2.52%
2015	169,346	4,226	173,571	2.28%
2020	140,524	4,382	144,906	2.16%
2025	112,106	4,695	116,801	2.01%
2030	88,502	5,008	93,510	1.95%

Cumulative SO2 reduction, 1996-2030 = 5,890,278 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	74,624	2,135	76,759	0.95%
2000	133,592	4,558	138,150	2.06%
2005	187,379	6,560	193,939	2.77%
2010	180,209	6,980	187,189	2.56%
2015	157,009	7,478	164,487	2.35%
2020	140,524	7,753	148,276	2.21%
2025	122,829	8,093	130,921	2.08%
2030	108,784	8,485	117,269	1.99%

Cumulative NOx reduction, 1996-2030 = 5,335,580 tons

Table 18
Reduction of Pollutants for Water Heaters - Level Six

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	28,063	2,211	30,274	1.32%
2000	65,986	4,205	70,191	2.80%
2005	101,218	5,620	106,838	3.73%
2010	105,906	5,785	111,692	3.47%
2015	108,235	6,284	114,519	3.19%
2020	112,067	6,588	118,655	2.99%
2025	115,530	6,977	122,507	2.79%
2030	119,960	7,475	127,436	2.65%

Cumulative CO2 reduction, 1996-2030 = 3,662 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	157,539	939	158,478	1.24%
2000	236,962	2,191	239,153	2.66%
2005	307,604	3,287	310,890	3.57%
2010	276,337	3,287	279,624	3.33%
2015	227,514	3,600	231,113	3.04%
2020	189,407	3,756	193,163	2.88%
2025	151,518	4,069	155,587	2.68%
2030	119,850	4,382	124,232	2.59%

Cumulative SO2 reduction, 1996-2030 = 7,795,782 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	98,892	2,018	100,909	1.25%
2000	176,405	3,798	180,202	2.69%
2005	247,497	5,040	252,537	3.61%
2010	240,150	5,198	245,348	3.36%
2015	210,940	5,643	216,582	3.09%
2020	189,407	5,918	195,325	2.92%
2025	166,011	6,258	172,268	2.73%
2030	147,316	6,703	154,019	2.61%

Cumulative NOx reduction, 1996-2030 = 6,995,324 tons

Table 19
Reduction of Pollutants for Water Heaters - Level Seven

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	28,149	3,175	31,324	1.37%
2000	66,154	6,215	72,368	2.89%
2005	101,471	8,400	109,871	3.84%
2010	106,246	8,620	114,866	3.57%
2015	108,573	8,788	117,361	3.27%
2020	112,404	8,597	121,002	3.05%
2025	115,864	8,546	124,410	2.84%
2030	120,291	8,605	128,896	2.68%

Cumulative CO2 reduction, 1996-2030 = 3,747 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	158,023	1,096	159,118	1.24%
2000	237,564	2,348	239,911	2.67%
2005	308,374	3,443	311,817	3.58%
2010	277,224	3,443	280,667	3.34%
2015	228,225	3,756	231,981	3.05%
2020	189,978	3,913	193,890	2.89%
2025	151,956	4,226	156,181	2.69%
2030	120,181	4,539	124,720	2.60%

Cumulative SO2 reduction, 1996-2030 = 7,823,000 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	99,195	2,923	102,117	1.26%
2000	176,853	5,700	182,553	2.72%
2005	248,117	7,678	255,795	3.65%
2010	240,921	7,888	248,809	3.41%
2015	211,599	8,018	219,617	3.14%
2020	189,978	7,820	197,798	2.95%
2025	166,491	7,740	174,231	2.77%
2030	147,723	7,765	155,488	2.64%

Cumulative NOx reduction, 1996-2030 = 7,085,801 tons

Table 20
Reduction of Pollutants for Water Heaters - Level Eight

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	25,739	7,711	33,450	1.46%
2000	60,117	17,651	77,768	3.10%
2005	92,008	26,630	118,639	4.14%
2010	95,877	30,070	125,946	3.91%
2015	97,910	31,723	129,634	3.61%
2020	102,201	31,866	134,067	3.38%
2025	106,265	31,573	137,837	3.14%
2030	111,516	31,114	142,630	2.97%

Cumulative CO2 reduction, 1996-2030 = 4,113 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	144,492	939	145,431	1.14%
2000	215,885	2,035	217,920	2.42%
2005	279,617	3,287	282,903	3.25%
2010	250,167	3,443	253,610	3.02%
2015	205,812	3,756	209,568	2.76%
2020	172,733	4,226	176,958	2.64%
2025	139,366	5,008	144,374	2.49%
2030	111,414	5,791	117,204	2.44%

Cumulative SO2 reduction, 1996-2030 = 7,124,332 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	90,701	7,268	97,969	1.21%
2000	160,714	16,648	177,362	2.65%
2005	224,979	25,095	250,074	3.57%
2010	217,407	28,363	245,770	3.37%
2015	190,819	29,910	220,729	3.15%
2020	172,733	30,000	202,733	3.03%
2025	152,696	29,643	182,339	2.89%
2030	136,946	29,128	166,073	2.81%

Cumulative NOx reduction, 1996-2030 = 7,109,299 tons

3.3 DIRECT HEATING EQUIPMENT

Changes in the amount of CO_2, SO_2, and NO_x emitted at trial standards levels 1 through 5 are summarized in Tables 21 through 25.

3.3.1 Sulfur and Nitrogen Oxide Emissions

Sulfur dioxide emissions would be increased by a cumulative total of 0.32 million tons between 1996 and 2030 in the level 5 scenario. In the year 1996, increases in sulfur dioxide will represent about 0.04% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, increases in SO_2 emissions will represent about 0.04% of the SO_2 emissions estimated to come from power plants in that year. Although increased in the level 5 scenario, SO_2 emissions would be decreased between 1996 and 2030 in the level 1, 2, and 3 scenarios. However, as discussed earlier, the possible reductions of SO_2 emissions caused by standards can be earned as credits. To the extent credits are used for future emissions, the standards' net effect on those SO_2 emissions would be only a postponement.

Level 5 design changes to direct heating equipment would result in an estimated increase in NO_x emissions of 0.18 million tons between 1996 and 2030. NO_x increases would represent 0.03% and 0.01% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

It should be noted that, although direct heating equipment consists entirely of fuel-burning space conditioning appliances, design options for direct heaters have the effect of impacting the sales of electric space heating equipment. In the trial standard level cases where SO_2 and NO_x emissions have increased, design options for direct heating equipment have actually increased the sales of electric space heating equipment. This ultimately results in increased electricity use and, therefore, increases in the amount of power plant emissions.

3.3.2 Carbon Dioxide Emissions

The cumulative increase in CO_2 emissions from level 5 design changes is 60 million tons of CO_2. For the year 1996, the estimated CO_2 increase is 173 thousand tons of CO_2 or about 0.01% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 increase is 285 thousand tons of CO_2 or about 0.01% of estimated U.S. power plant CO_2 emissions in 2030.

The reasons that were given for increased SO_2 and NO_x emissions (namely, increased sales of electric space heating equipment) also serve to explain why CO_2 emissions have increased in some trial standard level cases.

Table 21
Reduction of Pollutants for Direct Heating Equipment - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	0	84	84	0.00%
2000	84	55	139	0.01%
2005	84	0	84	0.00%
2010	0	0	0	0.00%
2015	85	0	85	0.00%
2020	0	0	0	0.00%
2025	0	84	84	0.00%
2030	83	-55	28	0.00%

Cumulative CO2 reduction, 1996-2030 = 2 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	0	157	157	0.00%
2000	301	0	301	0.00%
2005	257	0	257	0.00%
2010	0	0	0	0.00%
2015	178	0	178	0.00%
2020	0	0	0	0.00%
2025	0	157	157	0.00%
2030	83	0	83	0.00%

Cumulative SO2 reduction, 1996-2030 = 5,474 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	0	65	65	0.00%
2000	224	53	277	0.00%
2005	207	0	207	0.00%
2010	0	0	0	0.00%
2015	165	0	165	0.00%
2020	0	0	0	0.00%
2025	0	65	65	0.00%
2030	102	-53	49	0.00%

Cumulative NOx reduction, 1996-2030 = 4,477 tons

Table 22
Reduction of Pollutants for Direct Heating Equipment - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	86	194	280	0.01%
2000	84	220	304	0.01%
2005	169	220	389	0.01%
2010	170	220	390	0.01%
2015	338	194	533	0.01%
2020	337	55	392	0.01%
2025	334	84	418	0.01%
2030	331	-55	276	0.01%

Cumulative CO2 reduction, 1996-2030 = 14 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	483	157	640	0.00%
2000	301	0	301	0.00%
2005	514	0	514	0.01%
2010	444	0	444	0.01%
2015	712	157	868	0.01%
2020	570	0	570	0.01%
2025	438	157	594	0.01%
2030	331	0	331	0.01%

Cumulative SO2 reduction, 1996-2030 = 19,780 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	303	170	473	0.01%
2000	224	210	434	0.01%
2005	413	210	623	0.01%
2010	385	210	595	0.01%
2015	660	170	830	0.01%
2020	570	53	623	0.01%
2025	480	65	545	0.01%
2030	407	-53	354	0.01%

Cumulative NOx reduction, 1996-2030 = 21,442 tons

Table 23
Reduction of Pollutants for Direct Heating Equipment - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	86	165	251	0.01%
2000	84	385	469	0.02%
2005	253	495	748	0.03%
2010	340	440	780	0.02%
2015	508	359	867	0.02%
2020	675	249	924	0.02%
2025	668	224	891	0.02%
2030	662	84	747	0.02%

Cumulative CO2 reduction, 1996-2030 = 26 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	483	0	483	0.00%
2000	301	0	301	0.00%
2005	770	0	770	0.01%
2010	887	0	887	0.01%
2015	1,067	157	1,224	0.02%
2020	1,140	157	1,297	0.02%
2025	876	313	1,189	0.02%
2030	662	157	818	0.02%

Cumulative SO2 reduction, 1996-2030 = 31,644 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	303	158	461	0.01%
2000	224	368	592	0.01%
2005	620	473	1,092	0.02%
2010	771	420	1,191	0.02%
2015	990	327	1,317	0.02%
2020	1,140	222	1,363	0.02%
2025	960	183	1,142	0.02%
2030	813	65	878	0.01%

Cumulative NOx reduction, 1996-2030 = 37,241 tons

Table 24
Reduction of Pollutants for Direct Heating Equipment - Level Four

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	-172	385	213	0.01%
2000	-671	766	96	0.00%
2005	-1,183	1,012	-171	-0.01%
2010	-1,275	928	-347	-0.01%
2015	-846	821	-25	0.00%
2020	-422	686	264	0.01%
2025	-167	550	383	0.01%
2030	0	301	301	0.01%

Cumulative CO2 reduction, 1996-2030 = 2 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	-966	0	-966	-0.01%
2000	-2,409	-313	-2,722	-0.03%
2005	-3,595	-469	-4,064	-0.05%
2010	-3,327	-626	-3,953	-0.05%
2015	-1,779	-313	-2,092	-0.03%
2020	-713	-157	-869	-0.01%
2025	-219	0	-219	0.00%
2030	0	-157	-157	0.00%

Cumulative SO2 reduction, 1996-2030 = -72,413 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	-607	368	-239	0.00%
2000	-1,793	763	-1,031	-0.02%
2005	-2,892	1,013	-1,880	-0.03%
2010	-2,891	948	-1,944	-0.03%
2015	-1,649	815	-834	-0.01%
2020	-713	670	-43	0.00%
2025	-240	525	285	0.00%
2030	0	303	303	0.01%

Cumulative NOx reduction, 1996-2030 = -26,942 tons

Table 25
Reduction of Pollutants for Direct Heating Equipment - Level Five

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	-775	601	-173	-0.01%
2000	-2,599	1,390	-1,209	-0.05%
2005	-4,478	1,933	-2,545	-0.09%
2010	-5,100	2,013	-3,086	-0.10%
2015	-4,147	1,687	-2,460	-0.07%
2020	-3,036	1,445	-1,591	-0.04%
2025	-2,087	1,258	-829	-0.02%
2030	-1,242	957	-285	-0.01%

Cumulative CO2 reduction, 1996-2030 = -60 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	-4,349	-313	-4,662	-0.04%
2000	-9,334	-1,096	-10,429	-0.12%
2005	-13,609	-1,722	-15,330	-0.18%
2010	-13,307	-1,878	-15,185	-0.18%
2015	-8,716	-1,565	-10,281	-0.14%
2020	-5,131	-1,096	-6,226	-0.09%
2025	-2,737	-626	-3,363	-0.06%
2030	-1,241	-470	-1,710	-0.04%

Cumulative SO2 reduction, 1996-2030 = -319,957 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	-2,730	605	-2,125	-0.03%
2000	-6,949	1,435	-5,514	-0.08%
2005	-10,949	2,015	-8,934	-0.13%
2010	-11,564	2,108	-9,457	-0.13%
2015	-8,081	1,765	-6,316	-0.09%
2020	-5,131	1,488	-3,643	-0.05%
2025	-2,999	1,263	-1,736	-0.03%
2030	-1,525	960	-565	-0.01%

Cumulative NOx reduction, 1996-2030 = -183,878 tons

3.4 MOBILE HOME FURNACES

Changes in the amount of CO_2, SO_2, and NO_x emitted at trial standards levels 1 through 6 are summarized in Tables 26 through 31.

3.4.1 Sulfur and Nitrogen Oxide Emissions

Sulfur dioxide emissions would be increased by a cumulative total of 0.27 million tons between 1996 and 2030 in the level 6 scenario. In the year 1996, increases in sulfur dioxide will represent about 0.01% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, increases in SO_2 emissions will represent about 0.18% of the SO_2 emissions estimated to come from power plants in that year. Although increased in the level 6 scenario, SO_2 emissions would be decreased between 1996 and 2030 in the level 1 scenario. However, as discussed earlier, the possible reductions of SO_2 emissions caused by standards can be earned as credits. To the extent credits are used for future emissions, the standards' net effect on those SO_2 emissions would be only a postponement.

Level 6 design changes to mobile home furnaces would result in an estimated increase in NO_x emissions of 0.087 million tons between 1996 and 2030. NO_x increases would represent 0.005% and 0.04% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

It should be noted that, although mobile home furnaces consist entirely of fuel-burning space conditioning appliances, design options for mobile home furnaces have the effect of impacting the sales of electric space heating equipment. In the trial standard level cases where SO_2 and NO_x emissions have increased, design options for mobile home furnaces have actually increased the sales of electric space heating equipment. This ultimately results in increased electricity use and, therefore, increases in the amount of power plant emissions.

3.4.2 Carbon Dioxide Emissions

The cumulative increase in CO_2 emissions from level 6 design changes is 49 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 5 thousand tons of CO_2 or about 0.001% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 increase is 2464 thousand tons of CO_2 or about 0.05% of estimated U.S. power plant CO_2 emissions in 2030.

The reasons that were given for increased SO_2 and NO_x emissions (namely, increased sales of electric space heating equipment) also serve to explain why CO_2 emissions have increased in some trial standard level cases.

Table 26
Reduction of Pollutants for Mobile Home Furnaces - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	0	0	0	0.00%
2000	8	11	19	0.00%
2005	8	25	33	0.00%
2010	8	30	39	0.00%
2015	8	39	47	0.00%
2020	0	44	44	0.00%
2025	0	30	30	0.00%
2030	0	25	25	0.00%

Cumulative CO2 reduction, 1996-2030 = 1 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	0	0	0	0.00%
2000	30	0	30	0.00%
2005	26	16	41	0.00%
2010	22	16	38	0.00%
2015	18	31	49	0.00%
2020	0	31	31	0.00%
2025	0	16	16	0.00%
2030	0	16	16	0.00%

Cumulative SO2 reduction, 1996-2030 = 992 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	0	0	0	0.00%
2000	22	11	33	0.00%
2005	21	22	43	0.00%
2010	19	28	47	0.00%
2015	16	34	50	0.00%
2020	0	39	39	0.00%
2025	0	28	28	0.00%
2030	0	22	22	0.00%

Cumulative NOx reduction, 1996-2030 = 1,151 tons

Table 27
Reduction of Pollutants for Mobile Home Furnaces - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	0	11	11	0.00%
2000	-8	47	38	0.00%
2005	-17	68	51	0.00%
2010	-34	87	53	0.00%
2015	-42	101	59	0.00%
2020	-51	98	47	0.00%
2025	-50	78	28	0.00%
2030	-58	67	10	0.00%

Cumulative CO2 reduction, 1996-2030 = 1 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	0	0	0	0.00%
2000	-30	-16	-46	0.00%
2005	-51	-47	-98	0.00%
2010	-89	-63	-151	0.00%
2015	-89	-78	-167	0.00%
2020	-86	-94	-179	0.00%
2025	-66	-110	-175	0.00%
2030	-58	-110	-167	0.00%

Cumulative SO2 reduction, 1996-2030 = -4,696 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	0	10	10	0.00%
2000	-22	46	24	0.00%
2005	-41	70	28	0.00%
2010	-77	90	12	0.00%
2015	-82	104	22	0.00%
2020	-86	103	17	0.00%
2025	-72	86	14	0.00%
2030	-71	75	4	0.00%

Cumulative NOx reduction, 1996-2030 = 541 tons

Table 28
Reduction of Pollutants for Mobile Home Furnaces - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	-17	30	12	0.00%
2000	-59	92	33	0.00%
2005	-127	137	10	0.00%
2010	-204	174	-30	0.00%
2015	-254	183	-70	0.00%
2020	-278	169	-109	0.00%
2025	-267	125	-142	0.00%
2030	-240	90	-150	0.00%

Cumulative CO2 reduction, 1996-2030 = -2 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	-97	-47	-144	0.00%
2000	-211	-157	-367	0.00%
2005	-385	-297	-682	-0.01%
2010	-532	-423	-955	-0.01%
2015	-534	-548	-1,081	-0.01%
2020	-470	-626	-1,096	-0.02%
2025	-350	-626	-976	-0.02%
2030	-240	-579	-819	-0.02%

Cumulative SO2 reduction, 1996-2030 = -28,747 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	-61	33	-28	0.00%
2000	-157	103	-54	0.00%
2005	-310	160	-150	0.00%
2010	-463	208	-255	0.00%
2015	-495	229	-266	0.00%
2020	-470	223	-247	0.00%
2025	-384	181	-203	0.00%
2030	-295	143	-152	0.00%

Cumulative NOx reduction, 1996-2030 = -6,507 tons

Table 29
Reduction of Pollutants for Mobile Home Furnaces - Level Four

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	-34	37	3	0.00%
2000	-117	95	-22	0.00%
2005	-245	153	-92	0.00%
2010	-365	172	-194	-0.01%
2015	-465	172	-294	-0.01%
2020	-506	140	-366	-0.01%
2025	-476	82	-393	-0.01%
2030	-414	37	-377	-0.01%

Cumulative CO2 reduction, 1996-2030 = -8 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	-193	-94	-287	0.00%
2000	-422	-313	-735	-0.01%
2005	-745	-563	-1,308	-0.02%
2010	-954	-845	-1,799	-0.02%
2015	-978	-1,080	-2,058	-0.03%
2020	-855	-1,221	-2,076	-0.03%
2025	-624	-1,205	-1,829	-0.03%
2030	-414	-1,096	-1,509	-0.03%

Cumulative SO2 reduction, 1996-2030 = -54,358 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	-121	45	-76	0.00%
2000	-314	122	-192	0.00%
2005	-599	202	-397	-0.01%
2010	-829	248	-581	-0.01%
2015	-907	271	-636	-0.01%
2020	-855	254	-601	-0.01%
2025	-684	198	-486	-0.01%
2030	-508	144	-365	-0.01%

Cumulative NOx reduction, 1996-2030 = -15,781 tons

Table 30
Reduction of Pollutants for Mobile Home Furnaces - Level Five

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	-77	111	34	0.00%
2000	-268	293	25	0.00%
2005	-558	449	-109	0.00%
2010	-841	527	-314	-0.01%
2015	-1,075	537	-537	-0.01%
2020	-1,164	420	-744	-0.02%
2025	-1,119	264	-854	-0.02%
2030	-1,035	147	-888	-0.02%

Cumulative CO2 reduction, 1996-2030 = -15 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	-435	-141	-576	0.00%
2000	-964	-579	-1,543	-0.02%
2005	-1,695	-1,158	-2,853	-0.03%
2010	-2,196	-1,737	-3,933	-0.05%
2015	-2,259	-2,301	-4,560	-0.06%
2020	-1,967	-2,723	-4,690	-0.07%
2025	-1,467	-2,848	-4,315	-0.07%
2030	-1,034	-2,801	-3,835	-0.08%

Cumulative SO2 reduction, 1996-2030 = -122,401 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	-273	120	-153	0.00%
2000	-717	337	-380	-0.01%
2005	-1,364	543	-821	-0.01%
2010	-1,908	675	-1,233	-0.02%
2015	-2,095	740	-1,354	-0.02%
2020	-1,967	670	-1,297	-0.02%
2025	-1,607	534	-1,074	-0.02%
2030	-1,271	417	-854	-0.01%

Cumulative NOx reduction, 1996-2030 = -33,753 tons

Table 31
Reduction of Pollutants for Mobile Home Furnaces - Level Six

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	-164	159	-5	0.00%
2000	-595	372	-223	-0.01%
2005	-1,217	544	-673	-0.02%
2010	-1,827	637	-1,190	-0.04%
2015	-2,310	607	-1,703	-0.05%
2020	-2,462	335	-2,127	-0.05%
2025	-2,379	45	-2,334	-0.05%
2030	-2,268	-196	-2,464	-0.05%

Cumulative CO2 reduction, 1996-2030 = -49 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	-918	-297	-1,216	-0.01%
2000	-2,138	-1,330	-3,468	-0.04%
2005	-3,697	-2,676	-6,374	-0.07%
2010	-4,768	-3,881	-8,649	-0.10%
2015	-4,856	-5,071	-9,927	-0.13%
2020	-4,162	-6,025	-10,187	-0.15%
2025	-3,120	-6,370	-9,490	-0.16%
2030	-2,266	-6,479	-8,745	-0.18%

Cumulative SO2 reduction, 1996-2030 = -269,787 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	-576	181	-395	0.00%
2000	-1,591	487	-1,104	-0.02%
2005	-2,975	784	-2,191	-0.03%
2010	-4,144	992	-3,152	-0.04%
2015	-4,502	1,081	-3,422	-0.05%
2020	-4,162	915	-3,246	-0.05%
2025	-3,419	673	-2,746	-0.04%
2030	-2,786	454	-2,332	-0.04%

Cumulative NOx reduction, 1996-2030 = -87,340 tons

3.5 RANGES AND OVENS

Decreases in the amounts of CO_2, SO_2, and NO_x are presented for cooktops, conventional ovens and microwave ovens. Trial standards levels 1 through 5 for cooktops are summarized in Tables 32 through 36, trial standards levels 1 through 5 for conventional ovens are summarized in Tables 37 through 41, and trial standards levels 1 through 5 for microwave ovens are summarized in Tables 42 through 46.

3.5.1 Sulfur and Nitrogen Oxide Emissions

Cooktops

Sulfur dioxide emissions would be decreased by a cumulative total of 0.09 million tons between 1996 and 2030 in the level 5 scenario. In the year 1996, decreases in sulfur dioxide will represent about 0.01% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, decreases in SO_2 emissions will represent about 0.04% of the SO_2 emissions estimated to come from power plants in that year. As discussed earlier, the possible reductions of SO_2 emissions caused by standards can be earned as credits. To the extent credits are used for future emissions, the standards' net effect on those SO_2 emissions would be only a postponement.

Level 5 design changes to cooktops would result in an estimated decrease in NO_x emissions of 0.21 million tons between 1996 and 2030. NO_x decreases would represent 0.02% and 0.11% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

Conventional Ovens

Sulfur dioxide emissions would be decreased by a cumulative total of 0.40 million tons between 1996 and 2030 in the level 5 scenario. In the year 1996, decreases in sulfur dioxide will represent about 0.04% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, decreases in SO_2 emissions will represent about 0.15% of the SO_2 emissions estimated to come from power plants in that year. As discussed above, the possible reductions of SO_2 emissions caused by standards can be earned as credits. To the extent credits are used for future emissions, the standards' net effect on those SO_2 emissions would be only a postponement.

Level 5 design changes to conventional ovens would result in an estimated decrease in NO_x emissions of 0.45 million tons between 1996 and 2030. NO_x decreases would represent 0.05% and 0.19% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

Microwave Ovens

Sulfur dioxide emissions would be decreased by a cumulative total of 0.19 million tons between 1996 and 2030 in the level 5 scenario. In the year 1996, decreases in sulfur dioxide will represent about 0.05% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, decreases in SO_2 emissions will represent about 0.02% of the SO_2 emissions estimated to come from power plants in that year. As discussed above, the possible reductions of SO_2 emissions caused by standards can be earned as credits. To the extent credits are used for future emissions, the standards' net effect on those SO_2 emissions would be only a postponement.

Level 5 design changes to microwave ovens would result in an estimated decrease in NO_x emissions of 0.16 million tons between 1996 and 2030. NO_x decreases would represent 0.05% and 0.02% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

3.5.2 Carbon Dioxide Emissions

Cooktops

The cumulative reduction in CO_2 emissions from level 5 design changes is 172 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 1028 thousand tons of CO_2 or about 0.04% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 reduction is 6139 thousand tons of CO_2 or about 0.13% of estimated U.S. power plant CO_2 emissions in 2030.

Conventional Ovens

The cumulative reduction in CO_2 emissions from level 5 design changes is 280 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 1442 thousand tons of CO_2 or about 0.06% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 reduction is 9897 thousand tons of CO_2 or about 0.21% of estimated U.S. power plant CO_2 emissions in 2030.

Microwave Ovens

The cumulative reduction in CO_2 emissions from level 5 design changes is 71 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 1085 thousand tons of CO_2 or about 0.05% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 reduction is 1076 thousand tons of CO_2 or about 0.02% of estimated U.S. power plant CO_2 emissions in 2030.

Table 32
Reduction of Pollutants for Cooktops - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	0	55	55	0.00%
2000	0	55	55	0.00%
2005	0	55	55	0.00%
2010	0	55	55	0.00%
2015	0	0	0	0.00%
2020	0	0	0	0.00%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative CO2 reduction, 1996-2030 = 1 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	0	0	0	0.00%
2000	0	0	0	0.00%
2005	0	0	0	0.00%
2010	0	0	0	0.00%
2015	0	0	0	0.00%
2020	0	0	0	0.00%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative SO2 reduction, 1996-2030 = 265 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	0	53	53	0.00%
2000	0	53	53	0.00%
2005	0	53	53	0.00%
2010	0	53	53	0.00%
2015	0	0	0	0.00%
2020	0	0	0	0.00%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative NOx reduction, 1996-2030 = 997 tons

Table 33
Reduction of Pollutants for Cooktops - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	86	715	801	0.04%
2000	168	1,760	1,928	0.08%
2005	338	3,080	3,418	0.12%
2010	510	4,290	4,800	0.15%
2015	508	4,675	5,183	0.14%
2020	422	4,675	5,097	0.13%
2025	417	4,675	5,092	0.12%
2030	580	4,565	5,145	0.11%

Cumulative CO2 reduction, 1996-2030 = 144 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	483	0	483	0.00%
2000	602	0	602	0.01%
2005	1,027	0	1,027	0.01%
2010	1,331	0	1,331	0.02%
2015	1,067	0	1,067	0.01%
2020	713	0	713	0.01%
2025	547	0	547	0.01%
2030	579	0	579	0.01%

Cumulative SO2 reduction, 1996-2030 = 29,529 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	303	682	986	0.01%
2000	448	1,680	2,128	0.03%
2005	826	2,940	3,766	0.05%
2010	1,156	4,095	5,251	0.07%
2015	990	4,463	5,452	0.08%
2020	713	4,463	5,175	0.08%
2025	600	4,463	5,062	0.08%
2030	712	4,358	5,069	0.09%

Cumulative NOx reduction, 1996-2030 = 151,231 tons

Table 34
Reduction of Pollutants for Cooktops - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	0	880	880	0.04%
2000	84	2,035	2,119	0.08%
2005	253	3,410	3,663	0.13%
2010	255	4,675	4,930	0.15%
2015	338	5,005	5,343	0.15%
2020	253	5,005	5,258	0.13%
2025	250	5,005	5,255	0.12%
2030	331	4,895	5,226	0.11%

Cumulative CO2 reduction, 1996-2030 = 150 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	0	0	0	0.00%
2000	301	0	301	0.00%
2005	770	0	770	0.01%
2010	665	0	665	0.01%
2015	712	0	712	0.01%
2020	428	0	428	0.01%
2025	328	0	328	0.01%
2030	331	0	331	0.01%

Cumulative SO2 reduction, 1996-2030 = 17,264 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	0	840	840	0.01%
2000	224	1,943	2,167	0.03%
2005	620	3,255	3,875	0.06%
2010	578	4,463	5,041	0.07%
2015	660	4,778	5,437	0.08%
2020	428	4,778	5,205	0.08%
2025	360	4,778	5,137	0.08%
2030	407	4,673	5,079	0.09%

Cumulative NOx reduction, 1996-2030 = 150,971 tons

Table 35
Reduction of Pollutants for Cooktops - Level Four

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	430	715	1,145	0.05%
2000	922	1,705	2,627	0.10%
2005	1,690	2,860	4,550	0.16%
2010	2,380	3,905	6,285	0.20%
2015	2,708	4,180	6,888	0.19%
2020	2,698	4,180	6,878	0.17%
2025	2,671	4,125	6,796	0.16%
2030	2,898	4,070	6,968	0.15%

Cumulative CO2 reduction, 1996-2030 = 193 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	2,416	0	2,416	0.02%
2000	3,312	0	3,312	0.04%
2005	5,135	0	5,135	0.06%
2010	6,210	0	6,210	0.07%
2015	5,692	0	5,692	0.07%
2020	4,561	0	4,561	0.07%
2025	3,503	0	3,503	0.06%
2030	2,895	0	2,895	0.06%

Cumulative SO2 reduction, 1996-2030 = 156,128 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	1,517	682	2,199	0.03%
2000	2,466	1,628	4,093	0.06%
2005	4,132	2,730	6,862	0.10%
2010	5,397	3,728	9,124	0.12%
2015	5,278	3,990	9,268	0.13%
2020	4,561	3,990	8,551	0.13%
2025	3,838	3,938	7,776	0.12%
2030	3,558	3,885	7,443	0.13%

Cumulative NOx reduction, 1996-2030 = 254,836 tons

Table 36
Reduction of Pollutants for Cooktops - Level Five

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	258	770	1,028	0.04%
2000	503	1,815	2,318	0.09%
2005	1,014	3,080	4,094	0.14%
2010	1,445	4,235	5,680	0.18%
2015	1,608	4,510	6,118	0.17%
2020	1,602	4,510	6,112	0.15%
2025	1,586	4,510	6,096	0.14%
2030	1,739	4,400	6,139	0.13%

Cumulative CO2 reduction, 1996-2030 = 172 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	1,450	0	1,450	0.01%
2000	1,807	0	1,807	0.02%
2005	3,081	0	3,081	0.04%
2010	3,770	0	3,770	0.04%
2015	3,380	0	3,380	0.04%
2020	2,708	0	2,708	0.04%
2025	2,080	0	2,080	0.04%
2030	1,737	0	1,737	0.04%

Cumulative SO2 reduction, 1996-2030 = 92,421 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	910	735	1,645	0.02%
2000	1,345	1,733	3,077	0.05%
2005	2,479	2,940	5,419	0.08%
2010	3,277	4,043	7,319	0.10%
2015	3,134	4,305	7,439	0.11%
2020	2,708	4,305	7,013	0.10%
2025	2,279	4,305	6,584	0.10%
2030	2,135	4,200	6,335	0.11%

Cumulative NOx reduction, 1996-2030 = 206,040 tons

Table 37
Reduction of Pollutants for Overs - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	86	110	196	0.01%
2000	335	275	610	0.02%
2005	676	550	1,226	0.04%
2010	850	770	1,620	0.05%
2015	846	880	1,726	0.05%
2020	843	825	1,668	0.04%
2025	668	770	1,438	0.03%
2030	745	715	1,460	0.03%

Cumulative CO2 reduction, 1996-2030 = 46 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	483	0	483	0.00%
2000	1,204	0	1,204	0.01%
2005	2,054	0	2,054	0.02%
2010	2,218	0	2,218	0.03%
2015	1,779	0	1,779	0.02%
2020	1,425	0	1,425	0.02%
2025	876	0	876	0.02%
2030	744	0	744	0.02%

Cumulative SO2 reduction, 1996-2030 = 51,111 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	303	105	408	0.01%
2000	897	262	1,159	0.02%
2005	1,653	525	2,178	0.03%
2010	1,927	735	2,662	0.04%
2015	1,649	840	2,489	0.04%
2020	1,425	788	2,213	0.03%
2025	960	735	1,695	0.03%
2030	915	683	1,598	0.03%

Cumulative NOx reduction, 1996-2030 = 67,149 tons

Table 38
Reduction of Pollutants for Ovens - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	172	275	447	0.02%
2000	587	660	1,247	0.05%
2005	1,098	1,265	2,363	0.08%
2010	1,530	1,705	3,235	0.10%
2015	1,608	1,925	3,533	0.10%
2020	1,518	1,815	3,333	0.08%
2025	1,336	1,705	3,041	0.07%
2030	1,407	1,485	2,892	0.06%

Cumulative CO2 reduction, 1996-2030 = 93 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	966	0	966	0.01%
2000	2,108	0	2,108	0.02%
2005	3,338	0	3,338	0.04%
2010	3,992	0	3,992	0.05%
2015	3,380	0	3,380	0.04%
2020	2,565	0	2,565	0.04%
2025	1,752	0	1,752	0.03%
2030	1,406	0	1,406	0.03%

Cumulative SO2 reduction, 1996-2030 = 91,860 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	607	263	869	0.01%
2000	1,569	630	2,199	0.03%
2005	2,686	1,208	3,893	0.06%
2010	3,469	1,628	5,097	0.07%
2015	3,134	1,838	4,971	0.07%
2020	2,565	1,733	4,298	0.06%
2025	1,919	1,628	3,547	0.06%
2030	1,728	1,418	3,146	0.05%

Cumulative NOx reduction, 1996-2030 = 130,408 tons

Table 39
Reduction of Pollutants for Ovens - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	430	385	815	0.04%
2000	1,174	935	2,109	0.08%
2005	2,281	1,705	3,986	0.14%
2010	3,230	2,365	5,595	0.17%
2015	3,470	2,585	6,055	0.17%
2020	3,457	2,475	5,932	0.15%
2025	3,339	2,365	5,704	0.13%
2030	3,394	2,200	5,594	0.12%

Cumulative CO2 reduction, 1996-2030 = 165 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	2,416	0	2,416	0.02%
2000	4,215	0	4,215	0.05%
2005	6,933	0	6,933	0.08%
2010	8,428	0	8,428	0.10%
2015	7,293	0	7,293	0.10%
2020	5,843	0	5,843	0.09%
2025	4,379	0	4,379	0.08%
2030	3,391	0	3,391	0.07%

Cumulative SO2 reduction, 1996-2030 = 201,949 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	1,517	368	1,884	0.02%
2000	3,138	893	4,031	0.06%
2005	5,578	1,628	7,205	0.10%
2010	7,324	2,258	9,582	0.13%
2015	6,762	2,468	9,229	0.13%
2020	5,843	2,363	8,206	0.12%
2025	4,798	2,258	7,056	0.11%
2030	4,168	2,100	6,268	0.11%

Cumulative NOx reduction, 1996-2030 = 249,364 tons

Table 40
Reduction of Pollutants for Ovens - Level Four

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	516	440	956	0.04%
2000	1,425	990	2,415	0.10%
2005	2,704	1,815	4,519	0.16%
2010	3,825	2,475	6,300	0.20%
2015	4,147	2,750	6,897	0.19%
2020	4,048	2,640	6,688	0.17%
2025	4,007	2,530	6,537	0.15%
2030	4,057	2,365	6,422	0.13%

Cumulative CO2 reduction, 1996-2030 = 187 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	2,899	0	2,899	0.02%
2000	5,119	0	5,119	0.06%
2005	8,216	0	8,216	0.09%
2010	9,980	0	9,980	0.12%
2015	8,716	0	8,716	0.11%
2020	6,841	0	6,841	0.10%
2025	5,255	0	5,255	0.09%
2030	4,053	0	4,053	0.08%

Cumulative SO2 reduction, 1996-2030 = 238,528 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	1,820	420	2,240	0.03%
2000	3,811	945	4,756	0.07%
2005	6,611	1,733	8,343	0.12%
2010	8,673	2,363	11,036	0.15%
2015	8,081	2,625	10,706	0.15%
2020	6,841	2,520	9,361	0.14%
2025	5,758	2,415	8,173	0.13%
2030	4,982	2,258	7,239	0.12%

Cumulative NOx reduction, 1996-2030 = 287,223 tons

Table 41
Reduction of Pollutants for Ovens - Level Five

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	947	495	1,442	0.06%
2000	2,432	1,210	3,642	0.15%
2005	4,478	2,090	6,568	0.23%
2010	6,375	2,915	9,290	0.29%
2015	6,939	3,190	10,129	0.28%
2020	6,999	3,135	10,134	0.26%
2025	6,928	3,025	9,953	0.23%
2030	7,037	2,860	9,897	0.21%

Cumulative CO2 reduction, 1996-2030 = 280 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	5,316	0	5,316	0.04%
2000	8,732	0	8,732	0.10%
2005	13,609	0	13,609	0.16%
2010	16,633	0	16,633	0.20%
2015	14,586	0	14,586	0.19%
2020	11,829	0	11,829	0.18%
2025	9,087	0	9,087	0.16%
2030	7,031	0	7,031	0.15%

Cumulative SO2 reduction, 1996-2030 = 404,878 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	3,337	473	3,809	0.05%
2000	6,500	1,155	7,655	0.11%
2005	10,949	1,995	12,944	0.18%
2010	14,455	2,783	17,238	0.24%
2015	13,524	3,045	16,569	0.24%
2020	11,829	2,993	14,822	0.22%
2025	9,956	2,888	12,843	0.20%
2030	8,642	2,730	11,372	0.19%

Cumulative NOx reduction, 1996-2030 = 451,360 tons

Table 42
Reduction of Pollutants for Microwave Ovens - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	723	0	723	0.03%
2000	1,643	0	1,643	0.07%
2005	2,492	0	2,492	0.09%
2010	2,380	0	2,380	0.07%
2015	982	0	982	0.03%
2020	17	0	17	0.00%
2025	-8	0	-8	0.00%
2030	-8	0	-8	0.00%

Cumulative CO2 reduction, 1996-2030 = 39 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	4,059	0	4,059	0.03%
2000	5,901	0	5,901	0.07%
2005	7,575	0	7,575	0.09%
2010	6,210	0	6,210	0.07%
2015	2,063	0	2,063	0.03%
2020	29	0	29	0.00%
2025	-11	0	-11	0.00%
2030	-8	0	-8	0.00%

Cumulative SO2 reduction, 1996-2030 = 118,044 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	2,548	0	2,548	0.03%
2000	4,393	0	4,393	0.07%
2005	6,094	0	6,094	0.09%
2010	5,397	0	5,397	0.07%
2015	1,913	0	1,913	0.03%
2020	29	0	29	0.00%
2025	-12	0	-12	0.00%
2030	-10	0	-10	0.00%

Cumulative NOx reduction, 1996-2030 = 94,479 tons

Table 43
Reduction of Pollutants for Microwave Ovens - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	844	0	844	0.04%
2000	1,845	0	1,845	0.07%
2005	2,737	0	2,737	0.10%
2010	2,643	0	2,643	0.08%
2015	1,252	0	1,252	0.03%
2020	295	0	295	0.01%
2025	284	0	284	0.01%
2030	290	0	290	0.01%

Cumulative CO2 reduction, 1996-2030 = 48 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	4,736	0	4,736	0.04%
2000	6,624	0	6,624	0.07%
2005	8,319	0	8,319	0.10%
2010	6,897	0	6,897	0.08%
2015	2,633	0	2,633	0.03%
2020	499	0	499	0.01%
2025	372	0	372	0.01%
2030	289	0	289	0.01%

Cumulative SO2 reduction, 1996-2030 = 138,308 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	2,973	0	2,973	0.04%
2000	4,931	0	4,931	0.07%
2005	6,694	0	6,694	0.10%
2010	5,994	0	5,994	0.08%
2015	2,441	0	2,441	0.03%
2020	499	0	499	0.01%
2025	408	0	408	0.01%
2030	356	0	356	0.01%

Cumulative NOx reduction, 996-2030 = 112,216 tons

Table 44
Reduction of Pollutants for Microwave Ovens - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	938	0	938	0.04%
2000	2,012	0	2,012	0.08%
2005	2,957	0	2,957	0.10%
2010	2,873	0	2,873	0.09%
2015	1,498	0	1,498	0.04%
2020	548	0	548	0.01%
2025	543	0	543	0.01%
2030	563	0	563	0.01%

Cumulative CO2 reduction, 1996-2030 = 56 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	5,267	0	5,267	0.04%
2000	7,226	0	7,226	0.08%
2005	8,987	0	8,987	0.10%
2010	7,496	0	7,496	0.09%
2015	3,149	0	3,149	0.04%
2020	926	0	926	0.01%
2025	712	0	712	0.01%
2030	562	0	562	0.01%

Cumulative SO2 reduction, 1996-2030 = 156,181 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	3,306	0	3,306	0.04%
2000	5,380	0	5,380	0.08%
2005	7,231	0	7,231	0.10%
2010	6,515	0	6,515	0.09%
2015	2,919	0	2,919	0.04%
2020	926	0	926	0.01%
2025	780	0	780	0.01%
2030	691	0	691	0.01%

Cumulative NOx reduction, 1996-2030 = 127,936 tons

Table 45
Reduction of Pollutants for Microwave Ovens - Level Four

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,024	0	1,024	0.04%
2000	2,205	0	2,205	0.09%
2005	3,236	0	3,236	0.11%
2010	3,170	0	3,170	0.10%
2015	1,803	0	1,803	0.05%
2020	869	0	869	0.02%
2025	868	0	868	0.02%
2030	894	0	894	0.02%

Cumulative CO2 reduction, 1996-2030 = 65 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	5,751	0	5,751	0.04%
2000	7,919	0	7,919	0.09%
2005	9,834	0	9,834	0.11%
2010	8,272	0	8,272	0.10%
2015	3,789	0	3,789	0.05%
2020	1,468	0	1,468	0.02%
2025	1,139	0	1,139	0.02%
2030	893	0	893	0.02%

Cumulative SO2 reduction, 1996-2030 = 177,609 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	3,610	0	3,610	0.04%
2000	5,895	0	5,895	0.09%
2005	7,912	0	7,912	0.11%
2010	7,189	0	7,189	0.10%
2015	3,513	0	3,513	0.05%
2020	1,468	0	1,468	0.02%
2025	1,247	0	1,247	0.02%
2030	1,098	0	1,098	0.02%

Cumulative NOx reduction, 1996-2030 = 146,928 tons

Table 46
Reduction of Pollutants for Microwave Ovens - Level Five

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,085	0	1,085	0.05%
2000	2,323	0	2,323	0.09%
2005	3,388	0	3,388	0.12%
2010	3,332	0	3,332	0.10%
2015	1,972	0	1,972	0.05%
2020	1,046	0	1,046	0.03%
2025	1,052	0	1,052	0.02%
2030	1,076	0	1,076	0.02%

Cumulative CO2 reduction, 1996-2030 = 71 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	6,089	0	6,089	0.05%
2000	8,340	0	8,340	0.09%
2005	10,296	0	10,296	0.12%
2010	8,694	0	8,694	0.10%
2015	4,145	0	4,145	0.05%
2020	1,767	0	1,767	0.03%
2025	1,379	0	1,379	0.02%
2030	1,075	0	1,075	0.02%

Cumulative SO2 reduction, 1996-2030 = 189,945 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	3,822	0	3,822	0.05%
2000	6,209	0	6,209	0.09%
2005	8,284	0	8,284	0.12%
2010	7,555	0	7,555	0.10%
2015	3,843	0	3,843	0.05%
2020	1,767	0	1,767	0.03%
2025	1,511	0	1,511	0.02%
2030	1,322	0	1,322	0.02%

Cumulative NOx reduction, 1996-2030 = 157,793 tons

3.6 POOL HEATERS

Decreases in the amounts of CO_2, SO_2, and NO_x emitted at trial standards levels 1 through 4 for gas pool heaters are summarized in Tables 47 through 50.

3.6.1 Sulfur and Nitrogen Oxide Emissions

Sulfur dioxide emissions would be decreased by a cumulative total of 0.00 million tons between 1996 and 2030 in the level 4 scenario. In the year 1996, decreases in sulfur dioxide will represent about 0.00% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, decreases in SO_2 emissions will represent about 0.00% of the SO_2 emissions estimated to come from power plants in that year.

Level 4 design changes to pool heaters would result in an estimated decrease in NO_x emissions of 0.04 million tons between 1996 and 2030. NO_x decreases would represent 0.003% and 0.03% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

3.6.2 Carbon Dioxide Emissions

The cumulative reduction in CO_2 emissions from level 4 design changes is 43 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 270 thousand tons of CO_2 or about 0.01% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 reduction is 1744 thousand tons of CO_2 or about 0.04% of estimated U.S. power plant CO_2 emissions in 2030.

Table 47
Reduction of Pollutants for Pool Heaters - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	0	110	110	0.00%
2000	0	292	292	0.01%
2005	0	292	292	0.01%
2010	0	198	198	0.01%
2015	0	44	44	0.00%
2020	0	-11	-11	0.00%
2025	0	-11	-11	0.00%
2030	0	-17	-17	0.00%

Cumulative CO2 reduction, 1996-2030 = 4 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	0	0	0	0.00%
2000	0	0	0	0.00%
2005	0	0	0	0.00%
2010	0	0	0	0.00%
2015	0	0	0	0.00%
2020	0	0	0	0.00%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative SO2 reduction, 1996-2030 = 0 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	0	105	105	0.00%
2000	0	278	278	0.00%
2005	0	278	278	0.00%
2010	0	189	189	0.00%
2015	0	42	42	0.00%
2020	0	-10	-10	0.00%
2025	0	-11	-11	0.00%
2030	0	-16	-16	0.00%

Cumulative NOx reduction, 1996-2030 = 3,864 tons

Table 48
Reduction of Pollutants for Pool Heaters - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	0	149	149	0.01%
2000	0	396	396	0.02%
2005	0	479	479	0.02%
2010	0	440	440	0.01%
2015	0	319	319	0.01%
2020	0	292	292	0.01%
2025	0	319	319	0.01%
2030	0	347	347	0.01%

Cumulative CO2 reduction, 1996-2030 = 12 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	0	0	0	0.00%
2000	0	0	0	0.00%
2005	0	0	0	0.00%
2010	0	0	0	0.00%
2015	0	0	0	0.00%
2020	0	0	0	0.00%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative SO2 reduction, 1996-2030 = 0 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	0	142	142	0.00%
2000	0	378	378	0.01%
2005	0	457	457	0.01%
2010	0	420	420	0.01%
2015	0	305	305	0.00%
2020	0	278	278	0.00%
2025	0	305	305	0.00%
2030	0	331	331	0.01%

Cumulative NOx reduction, 1996-2030 = 11,870 tons

Table 49
Reduction of Pollutants for Pool Heaters - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	0	226	226	0.01%
2000	0	616	616	0.02%
2005	0	891	891	0.03%
2010	0	990	990	0.03%
2015	0	963	963	0.03%
2020	0	1,018	1,018	0.03%
2025	0	1,122	1,122	0.03%
2030	0	1,232	1,232	0.03%

Cumulative CO2 reduction, 1996-2030 = 32 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	0	0	0	0.00%
2000	0	0	0	0.00%
2005	0	0	0	0.00%
2010	0	0	0	0.00%
2015	0	0	0	0.00%
2020	0	0	0	0.00%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative SO2 reduction, 1996-2030 = 0 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	0	215	215	0.00%
2000	0	588	588	0.01%
2005	0	851	851	0.01%
2010	0	945	945	0.01%
2015	0	919	919	0.01%
2020	0	971	971	0.01%
2025	0	1,071	1,071	0.02%
2030	0	1,176	1,176	0.02%

Cumulative NOx reduction, 1996-2030 = 30,508 tons

Table 50
Reduction of Pollutants for Pool Heaters - Level Four

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	0	270	270	0.01%
2000	0	748	748	0.03%
2005	0	1,128	1,128	0.04%
2010	0	1,304	1,304	0.04%
2015	0	1,326	1,326	0.04%
2020	0	1,430	1,430	0.04%
2025	0	1,584	1,584	0.04%
2030	0	1,744	1,744	0.04%

Cumulative CO2 reduction, 1996-2030 = 43 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	0	0	0	0.00%
2000	0	0	0	0.00%
2005	0	0	0	0.00%
2010	0	0	0	0.00%
2015	0	0	0	0.00%
2020	0	0	0	0.00%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative SO2 reduction, 1996-2030 = 0 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	0	257	257	0.00%
2000	0	714	714	0.01%
2005	0	1,076	1,076	0.02%
2010	0	1,244	1,244	0.02%
2015	0	1,265	1,265	0.02%
2020	0	1,365	1,365	0.02%
2025	0	1,512	1,512	0.02%
2030	0	1,664	1,664	0.03%

Cumulative NOx reduction, 1996-2030 = 41,176 tons

3.7 FLUORESCENT BALLASTS

Decreases in the amounts of CO_2, SO_2, and NO_x are presented for two baseline cases: a low demand side management (DSM) case and a high DSM case. Demand side management programs are offered by utilities for the purpose of reducing end-use energy demand. Trial standards levels 1 through 3 for the low DSM case are summarized in Tables 51 through 53 while trial standards levels 1 through 3 for the high DSM case are summarized in Tables 54 through 56. For an explanation of the differences in the two cases, please refer to the appropriate sections and appendices in the Technical Support Document.

3.7.1 Sulfur and Nitrogen Oxide Emissions

Low DSM Case

Sulfur dioxide emissions would be decreased by a cumulative total of 2.99 million tons between 1996 and 2030 in the level 3 scenario. In the year 1996, decreases in sulfur dioxide will represent about 0.06% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, decreases in SO_2 emissions will represent about 1.18% of the SO_2 emissions estimated to come from power plants in that year. As discussed earlier, the possible reductions of SO_2 emissions caused by standards can be earned as credits. To the extent credits are used for future emissions, the standards' net effect on those SO_2 emissions would be only a postponement.

Level 3 design changes to fluorescent ballasts would result in an estimated decrease in NO_x emissions of 2.74 million tons between 1996 and 2030. NO_x decreases would represent 0.06% and 1.18% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

High DSM Case

Sulfur dioxide emissions would be decreased by a cumulative total of 0.72 million tons between 1996 and 2030 in the level 3 scenario. In the year 1996, decreases in sulfur dioxide will represent about 0.06% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, decreases in SO_2 emissions will represent about 0.28% of the SO_2 emissions estimated to come from power plants in that year. As discussed above, the possible reductions of SO_2 emissions caused by standards can be earned as credits. To the extent credits are used for future emissions, the standards' net effect on those SO_2 emissions would be only a postponement.

Level 3 design changes to fluorescent ballasts would result in an estimated decrease in NO_x emissions of 0.65 million tons between 1996 and 2030. NO_x decreases would represent 0.06% and 0.27% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

3.7.2 Carbon Dioxide Emissions

Low DSM Case

The cumulative reduction in CO_2 emissions from level 3 design changes is 1450 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 1325 thousand tons of CO_2 or about 0.06% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 reduction is 56,050 thousand tons of CO_2 or about 1.17% of estimated U.S. power plant CO_2 emissions in 2030.

High DSM Case

The cumulative reduction in CO_2 emissions from level 3 design changes is 338 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 1419 thousand tons of CO_2 or about 0.06% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 reduction is 12,957 thousand tons of CO_2 or about 0.27% of estimated U.S.power plant CO_2 emissions in 2030.

Table 51
Reduction of Pollutants for Fluorescent Ballasts (Low DSM Case) - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	990	-41	949	0.04%
2000	11,763	-503	11,260	0.45%
2005	25,359	-1,014	24,345	0.85%
2010	38,414	-1,470	36,945	1.15%
2015	43,599	-1,583	42,016	1.17%
2020	46,741	-1,596	45,145	1.14%
2025	49,630	-1,629	48,001	1.09%
2030	45,414	-1,270	44,144	0.92%

Cumulative CO2 reduction, 1996-2030 = 1,174 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	5,557	-16	5,542	0.04%
2000	42,244	-219	42,025	0.47%
2005	77,068	-423	76,645	0.88%
2010	100,233	-595	99,639	1.19%
2015	91,646	-610	91,035	1.20%
2020	78,998	-595	78,403	1.17%
2025	65,090	-595	64,496	1.11%
2030	45,372	-673	44,699	0.93%

Cumulative SO2 reduction, 1996-2030 = 2,417,491 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	3,489	-38	3,451	0.04%
2000	31,448	-459	30,990	0.46%
2005	62,009	-926	61,082	0.87%
2010	87,107	-1,344	85,763	1.17%
2015	84,970	-1,451	83,519	1.19%
2020	78,998	-1,465	77,533	1.16%
2025	71,316	-1,497	69,820	1.11%
2030	55,770	-1,146	54,624	0.93%

Cumulative NOx reduction, 1996-2030 = 2,218,305 tons

Table 52
Reduction of Pollutants for Fluorescent Ballasts (Low DSM Case) - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,188	-61	1,127	0.05%
2000	13,595	-580	13,015	0.52%
2005	29,343	-1,174	28,169	0.98%
2010	44,377	-1,693	42,683	1.33%
2015	50,313	-1,826	48,488	1.35%
2020	53,917	-1,845	52,072	1.31%
2025	57,310	-1,875	55,435	1.26%
2030	53,506	-1,516	51,990	1.08%

Cumulative CO2 reduction, 1996-2030 = 1,358 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	6,669	-31	6,638	0.05%
2000	48,823	-250	48,572	0.54%
2005	89,174	-485	88,689	1.02%
2010	115,791	-673	115,118	1.37%
2015	105,761	-704	105,057	1.38%
2020	91,127	-689	90,438	1.35%
2025	75,162	-673	74,489	1.28%
2030	53,457	-751	52,706	1.10%

Cumulative SO2 reduction, 1996-2030 = 2,797,165 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	4,186	-55	4,131	0.05%
2000	36,346	-529	35,816	0.53%
2005	71,749	-1,073	70,676	1.01%
2010	100,628	-1,550	99,078	1.36%
2015	98,056	-1,673	96,383	1.38%
2020	91,127	-1,693	89,434	1.33%
2025	82,352	-1,723	80,628	1.28%
2030	65,708	-1,373	64,335	1.09%

Cumulative NOx reduction, 1996-2030 = 2,566,401 tons

Table 53
Reduction of Pollutants for Fluorescent Ballasts (Low DSM Case) - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,386	-61	1,325	0.06%
2000	14,560	-622	13,938	0.56%
2005	31,286	-1,252	30,035	1.05%
2010	47,309	-1,807	45,503	1.41%
2015	53,622	-1,950	51,672	1.44%
2020	57,505	-1,975	55,530	1.40%
2025	61,054	-1,999	59,055	1.35%
2030	57,695	-1,645	56,050	1.17%

Cumulative CO2 reduction, 1996-2030 = 1,450 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	7,780	-31	7,749	0.06%
2000	52,285	-266	52,019	0.58%
2005	95,080	-516	94,563	1.09%
2010	123,442	-720	122,723	1.46%
2015	112,716	-751	111,965	1.47%
2020	97,191	-736	96,455	1.44%
2025	80,072	-720	79,352	1.37%
2030	57,642	-798	56,844	1.18%

Cumulative SO2 reduction, 1996-2030 = 2,985,814 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	%U.S. NOx Power Plant Emissions
1996	4,884	-55	4,829	0.06%
2000	38,923	-567	38,356	0.57%
2005	76,501	-1,144	75,357	1.08%
2010	107,277	-1,653	105,624	1.45%
2015	104,505	-1,787	102,718	1.47%
2020	97,191	-1,812	95,378	1.42%
2025	87,731	-1,837	85,894	1.36%
2030	70,852	-1,492	69,360	1.18%

Cumulative NOx reduction, 1996-2030 = 2,739,383 tons

Table 54

Reduction of Pollutants for Fluorescent Ballasts (High DSM Case) - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,089	-47	1,042	0.05%
2000	3,182	-138	3,044	0.12%
2005	6,024	-232	5,792	0.20%
2010	8,406	-312	8,094	0.25%
2015	8,953	-315	8,638	0.24%
2020	9,309	-315	8,994	0.23%
2025	9,504	-296	9,208	0.21%
2030	9,901	-253	9,648	0.20%

Cumulative CO2 reduction, 1996-2030 = 250 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	6,113	-16	6,097	0.05%
2000	11,427	-63	11,364	0.13%
2005	18,307	-94	18,213	0.21%
2010	21,934	-141	21,793	0.26%
2015	18,820	-125	18,695	0.25%
2020	15,734	-125	15,609	0.23%
2025	12,464	-110	12,355	0.21%
2030	9,892	-31	9,861	0.21%

Cumulative SO2 reduction, 1996-2030 = 536,129 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change (tons)	%U.S. NOx Power Plant Emissions
1996	3,837	-43	3,794	0.05%
2000	8,506	-126	8,381	0.13%
2005	14,730	-212	14,518	0.21%
2010	19,062	-284	18,777	0.26%
2015	17,449	-288	17,161	0.25%
2020	15,734	-288	15,446	0.23%
2025	13,656	-271	13,385	0.21%
2030	12,159	-239	11,921	0.20%

Cumulative NOx reduction, 1996-2030 = 483,517 tons

Table 55
Reduction of Pollutants for Fluorescent Ballasts (High DSM Case) - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,287	-66	1,221	0.05%
2000	3,953	-169	3,785	0.15%
2005	7,384	-293	7,091	0.25%
2010	10,263	-390	9,874	0.31%
2015	10,997	-392	10,605	0.30%
2020	11,443	-378	11,064	0.28%
2025	11,712	-373	11,339	0.26%
2030	12,091	-331	11,761	0.24%

Cumulative CO2 reduction, 1996-2030 = 307 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	7,225	-31	7,193	0.06%
2000	14,197	-78	14,118	0.16%
2005	22,441	-125	22,316	0.26%
2010	26,780	-172	26,608	0.32%
2015	23,116	-157	22,960	0.30%
2020	19,340	-141	19,199	0.29%
2025	15,360	-141	15,219	0.26%
2030	12,080	-63	12,018	0.25%

Cumulative SO2 reduction, 1996-2030 = 657,463 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change (tons)	%U.S. NOx Power Plant Emissions
1996	4,535	-60	4,475	0.06%
2000	10,569	-153	10,415	0.16%
2005	18,056	-267	17,789	0.25%
2010	23,273	-355	22,918	0.31%
2015	21,432	-359	21,073	0.30%
2020	19,340	-347	18,993	0.28%
2025	16,829	-342	16,487	0.26%
2030	14,849	-309	14,539	0.25%

Cumulative NOx reduction, 1996-2030 = 593,047 tons

Table 56
Reduction of Pollutants for Fluorescent Ballasts (High DSM Case) - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,485	-66	1,419	0.06%
2000	4,339	-185	4,154	0.17%
2005	8,162	-323	7,838	0.27%
2010	11,241	-426	10,815	0.34%
2015	12,067	-434	11,634	0.32%
2020	12,606	-420	12,187	0.31%
2025	12,960	-414	12,545	0.29%
2030	13,329	-372	12,957	0.27%

Cumulative CO2 reduction, 1996-2030 = 338 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	8,336	-31	8,305	0.06%
2000	15,582	-78	15,503	0.17%
2005	24,803	-141	24,663	0.28%
2010	29,330	-188	29,143	0.35%
2015	25,366	-172	25,194	0.33%
2020	21,307	-157	21,150	0.32%
2025	16,996	-157	16,840	0.29%
2030	13,317	-78	13,238	0.28%

Cumulative SO2 reduction, 1996-2030 = 723,969 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change (tons)	%U.S. NOx Power Plant Emissions
1996	5,233	-60	5,173	0.06%
2000	11,600	-169	11,431	0.17%
2005	19,957	-295	19,662	0.28%
2010	25,489	-388	25,102	0.34%
2015	23,518	-397	23,121	0.33%
2020	21,307	-385	20,921	0.31%
2025	18,622	-380	18,242	0.29%
2030	16,368	-347	16,021	0.27%

Cumulative NOx reduction, 1996-2030 = 652,995 tons

3.8 TELEVISIONS

Decreases in the amounts of CO_2, SO_2, and NO_x emitted at trial standards levels 1 through 3 are summarized in Tables 57 through 59.

3.8.1 Sulfur and Nitrogen Oxide Emissions

Sulfur dioxide emissions would be decreased by a cumulative total of 0.60 million tons between 1996 and 2030 in the level 3 scenario. In the year 1996, decreases in sulfur dioxide will represent about 0.08% of the SO_2 emissions estimated to come from power plants in that year. In the year 2030, decreases in SO_2 emissions will represent about 0.16% of the SO_2 emissions estimated to come from power plants in that year. As discussed earlier, the possible reductions of SO_2 emissions caused by standards can be earned as credits. To the extent credits are used for future emissions, the standards' net effect on those SO_2 emissions would be only a postponement.

Level 3 design changes to televisions would result in an estimated decrease in NO_x emissions of 0.53 million tons between 1996 and 2030. NO_x decreases would represent 0.08% and 0.16% of the NO_x emissions estimated to come from power plants in the years 1996 and 2030, respectively.

3.8.2 Carbon Dioxide Emissions

The cumulative reduction in CO_2 emissions from level 3 design changes is 263 million tons of CO_2. For the year 1996, the estimated CO_2 reduction is 1902 thousand tons of CO_2 or about 0.08% of estimated U.S. power plant CO_2 emissions in 1996. For the year 2030, the estimated CO_2 reduction is 7774 thousand tons of CO_2 or about 0.16% of estimated U.S. power plant CO_2 emissions in 2030.

Table 57
Reduction of Pollutants for Televisions - Level One

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	542	0	542	0.02%
2000	1,342	0	1,342	0.05%
2005	2,112	0	2,112	0.07%
2010	2,269	0	2,269	0.07%
2015	1,913	0	1,913	0.05%
2020	801	0	801	0.02%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative CO2 reduction, 1996-2030 = 43 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	3,044	0	3,044	0.02%
2000	4,818	0	4,818	0.05%
2005	6,419	0	6,419	0.07%
2010	5,922	0	5,922	0.07%
2015	4,020	0	4,020	0.05%
2020	1,354	0	1,354	0.02%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative SO2 reduction, 1996-2030 = 120,177 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change (tons)	%U.S. NOx Power Plant Emissions
1996	1,911	0	1,911	0.02%
2000	3,586	0	3,586	0.05%
2005	5,165	0	5,165	0.07%
2010	5,146	0	5,146	0.07%
2015	3,727	0	3,727	0.05%
2020	1,354	0	1,354	0.02%
2025	0	0	0	0.00%
2030	0	0	0	0.00%

Cumulative NOx reduction, 1996-2030 = 99,428 tons

Table 58
Reduction of Pollutants for Televisions - Level Two

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	981	0	981	0.04%
2000	2,482	0	2,482	0.10%
2005	3,937	0	3,937	0.14%
2010	4,241	0	4,241	0.13%
2015	3,977	0	3,977	0.11%
2020	2,943	0	2,943	0.07%
2025	2,195	0	2,195	0.05%
2030	2,268	0	2,268	0.05%

Cumulative CO2 reduction, 1996-2030 = 108 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	5,509	0	5,509	0.04%
2000	8,912	0	8,912	0.10%
2005	11,965	0	11,965	0.14%
2010	11,067	0	11,067	0.13%
2015	8,361	0	8,361	0.11%
2020	4,974	0	4,974	0.07%
2025	2,879	0	2,879	0.05%
2030	2,266	0	2,266	0.05%

Cumulative SO2 reduction, 1996-2030 = 261,149 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change (tons)	%U.S. NOx Power Plant Emissions
1996	3,458	0	3,458	0.04%
2000	6,635	0	6,635	0.10%
2005	9,627	0	9,627	0.14%
2010	9,618	0	9,618	0.13%
2015	7,751	0	7,751	0.11%
2020	4,974	0	4,974	0.07%
2025	3,155	0	3,155	0.05%
2030	2,786	0	2,786	0.05%

Cumulative NOx reduction, 1996-2030 = 225,217 tons

Table 59
Reduction of Pollutants for Televisions - Level Three

CO2 Reduction (in Thousand Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. CO2 Power Plant Emissions
1996	1,902	0	1,902	0.08%
2000	5,115	0	5,115	0.20%
2005	8,364	0	8,364	0.29%
2010	9,052	0	9,052	0.28%
2015	8,987	0	8,987	0.25%
2020	8,146	0	8,146	0.21%
2025	7,555	0	7,555	0.17%
2030	7,774	0	7,774	0.16%

Cumulative CO2 reduction, 1996-2030 = 263 million tons of CO2

SO2 Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change	% U.S. SO2 Power Plant Emissions
1996	10,680	0	10,680	0.08%
2000	18,367	0	18,367	0.20%
2005	25,420	0	25,420	0.29%
2010	23,620	0	23,620	0.28%
2015	18,891	0	18,891	0.25%
2020	13,767	0	13,767	0.21%
2025	9,908	0	9,908	0.17%
2030	7,767	0	7,767	0.16%

Cumulative SO2 reduction, 1996-2030 = 599,166 tons

NOx Reduction (in Tons)

Year	Abated from Power Plant Generation	Abated from In-Home Generation	Net Change (tons)	%U.S. NOx Power Plant Emissions
1996	6,704	0	6,704	0.08%
2000	13,673	0	13,673	0.20%
2005	20,453	0	20,453	0.29%
2010	20,526	0	20,526	0.28%
2015	17,515	0	17,515	0.25%
2020	13,767	0	13,767	0.21%
2025	10,855	0	10,855	0.17%
2030	9,547	0	9,547	0.16%

Cumulative NOx reduction, 1996-2030 = 527,742 tons

4 REFERENCES

o Upon phone conversations with David Streets at Argonne National Laboratory (February 1992), it was determined that the carbon emissions data provided in the report accompanying the 1991 NES were mistakenly reported as tons of carbon emitted. David Streets was one of the authors at Argonne who contributed to the 1991 NES report.

1. National Appliance Energy Conservation Act, (NAECA). 1987. Public Law 100-12.

2. 1991. *Improving Technology: Modeling Energy Futures for National Energy Strategy.* Service Report to the 1991 National Energy Strategy, SR/NES/90-01.

3. J. Koomey. 1990. *Comparative Analysis of Monetary Estimates of External Environmental Costs Associated with Combustion of Fossil Fuels.* Lawrence Berkeley Laboratory, Berkeley CA, LBL-28313, July, 1990.