

3. Reducing Emissions from Energy End Use

Introduction

Greenhouse gas emissions from energy end use include emissions from both stationary and mobile sources.¹⁵ In 2004, the industrial, commercial, and residential sectors combined to emit 3,966 million MTCO₂, or 67 percent of total U.S. carbon dioxide emissions—nearly all from stationary sources (Figure 8). Emissions from stationary sources are produced both directly by the combustion of fossil fuels (e.g., natural gas consumption for home heating) and indirectly from the consumption of electricity (e.g., for commercial lighting). In 2004, the transportation sector accounted for 1,934 million MTCO₂, nearly all from mobile sources, and represented approximately 32 percent of U.S. carbon dioxide emissions.

Reducing Emissions from Stationary Sources

Emissions from stationary sources in 2004 included 2,320 million MTCO₂ from the generation of electricity that was ultimately consumed in the industrial, commercial, and residential sectors. Industry was responsible for the largest share of total stationary-source emissions (43 percent), followed by the residential sector (31 percent) and the commercial sector (26 percent).

Between 1990 and 2004, carbon dioxide emissions associated with industrial, commercial, and residential energy use increased by 16.3 percent. Of stationary sources, the commercial sector had the fastest-growing emissions, registering a 32.1-percent increase in emissions between 1990 and 2004. Emissions from the residential sector increased by 27.9 percent over the same period, and industrial sector emissions increased by 2.5 percent.¹⁶

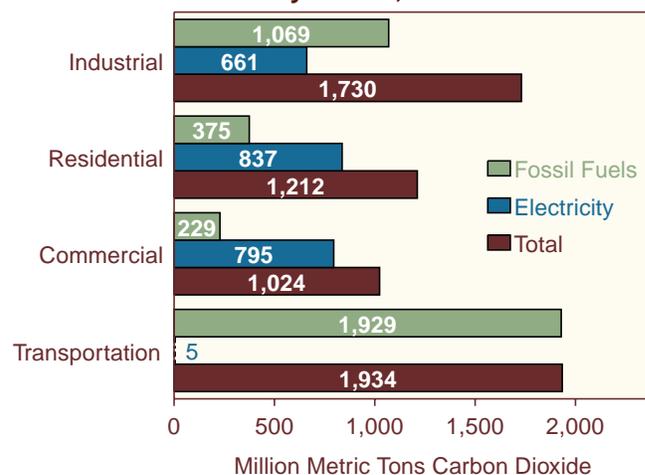
Projects Reported

Reported emission reduction projects affecting stationary sources include fuel switching (e.g., from fuel oil to natural gas); light bulb replacement (e.g., substituting compact fluorescent bulbs for incandescents); heating,

ventilation, and air conditioning (HVAC) system upgrades (e.g., maintenance or replacement with more efficient units); appliance replacement (e.g., retiring old appliances for ENERGY STAR¹⁷ products); motor and motor drive upgrades; and industrial power system improvements. For 2004, 64 entities reported 345 energy end-use projects on Form EIA-1605 (Table 10). These 345 projects accounted for 18 percent of all the projects reported on the long form.

For the 2004 reporting year, the number of entities reporting energy end-use projects, the number of energy end-use projects reported, and the total reported direct emission reductions resulting from energy end-use projects all were lower than for the 2003 reporting year (Table 10). The general decline was the result of a slight decrease in overall reporter participation this year. While reported direct reductions decreased from 25.3 million MTCO₂e for 2003 to 22.3 million MTCO₂e for 2004, reported indirect reductions increased from 10.0 million MTCO₂e to 13.8 million MTCO₂e. The increase

Figure 8. Sources of U.S. Carbon Dioxide Emissions by Sector, 2004



Note: The industrial sector includes agriculture; the residential and commercial sectors exclude transportation.

Source: Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2004*, DOE/EIA-0573(2004) (Washington, DC, December 2005).

¹⁵Stationary sources include emission sources at fixed locations, such as power plants, factories, refineries, mines, and heating plants or waste conversion facilities, among others. Mobile sources include transportation sector emissions from non-fixed locations, such as motor vehicles, aircraft, trains, and ships, among others.

¹⁶Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2004*, DOE/EIA-0573(2004) (Washington, DC, December 2005), web site www.eia.doe.gov/oiaf/1605/ggrpt.

¹⁷ENERGY STAR is a joint program of the U.S. Department of Energy and the U.S. Environmental Protection Agency helping businesses and individuals protect the environment through increased energy efficiency. See web site www.energystar.gov.

in reported indirect reductions resulted from revisions to previous data years and an influx of new projects reporting indirect reductions (71 percent of new reported projects for 2004). Overall, the reported total of indirect and direct reductions from energy end-use projects has increased significantly since 1994—indirect reductions by 947 percent and direct reductions by 145 percent—although the number of energy end-use reporters has increased by only 13 entities.

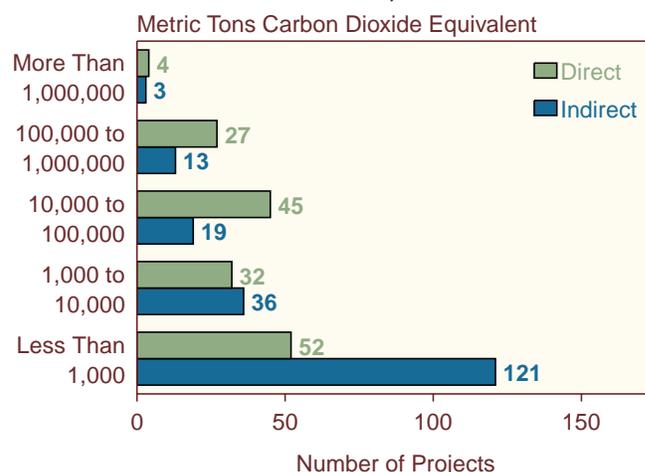
Among the 64 entities that reported energy end-use projects for 2004 on Form EIA-1605, 45 (70 percent) were electric power producers. Companies in the industrial sector included 6 automobile and transportation equipment manufacturers, 4 pharmaceutical and health care product companies, 3 cement companies, 2 electronic companies, and 1 oil company.

Emission reductions reported for individual energy end-use projects ranged from less than 1 MTCO₂e to almost 4.8 million MTCO₂e, in part because some reporters included information on each individual end-use initiative separately, whereas others aggregated information on a range of activities into a single project. For example, an electric power distributor may report on a demand-side management (DSM) project that achieves direct emission reductions through multiple supplemental approaches, such as encouraging residential, commercial, and industrial customers to change light bulbs, temporally shift electric loads, implement urban forestry projects, and upgrade appliances, building shells, and heating, ventilation and air-conditioning (HVAC) systems.

Among projects for which direct emission reductions were reported for 2004, 81 percent had reductions of less than 100,000 MTCO₂e (Figure 9). Similarly, among projects reporting indirect reductions, 92 percent had reductions of less than 100,000 MTCO₂e. Only eight of the energy end-use projects reported for 2004 had emission reductions greater than 1.0 million MTCO₂e each.

In terms of emission reductions achieved in 2004, 5 of the 7 largest projects reported were aggregated electric company DSM programs. DSM projects may focus on one or more load shape objectives (see box on page 28).

Figure 9. Energy End-Use Projects Reported on Form EIA-1605 by Size and Type of Emission Reduction, Data Year 2004



Source: Energy Information Administration, Form EIA-1605.

Table 10. Number of Energy End-Use Reporters, Projects, and Emission Reductions Reported on Form EIA-1605, Data Years 1994-2004

Data Year	Number of Reporters	Number of Projects Reported	Emission Reductions Reported (Metric Tons Carbon Dioxide Equivalent)	
			Direct	Indirect
1994	51	160	9,103,753	1,318,092
1995	63	221	12,450,879	1,591,590
1996	62	214	15,288,497	1,538,196
1997	67	249	16,685,010	3,798,030
1998	79	308	18,282,751	5,026,424
1999	80	330	16,047,912	6,786,832
2000	77	382	19,663,333	8,155,193
2001	68	338	19,550,862	7,668,988
2002	65	339	24,707,214	9,061,773
2003 ^(R)	68	390	25,291,434	9,955,603
2004	64	345	22,295,753	13,806,106

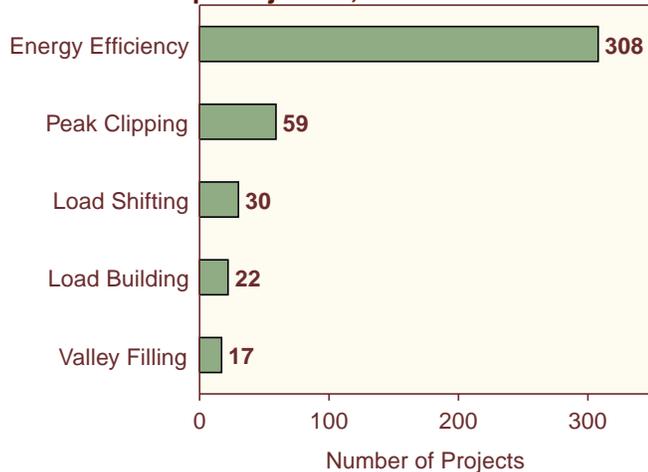
^(R) Revised data.

Notes: More than one project type may be assigned to a single project; therefore, the sums of the projects and reductions in each project type category may exceed the total numbers of projects and reductions in the totals and subtotals. Table excludes data from confidential reports.

Source: Energy Information Administration, Form EIA-1605.

Although the most common load shape objective of reported DSM projects for 2004 was increased energy efficiency (308 projects), electric utilities also attempted to balance their load profiles with various other load shape objectives, including peak clipping, load shifting, valley filling, and load building (Figure 10).

Figure 10. Demand-Side Management Projects Reported on Form EIA-1605 by Load Shape Objective, Data Year 2004



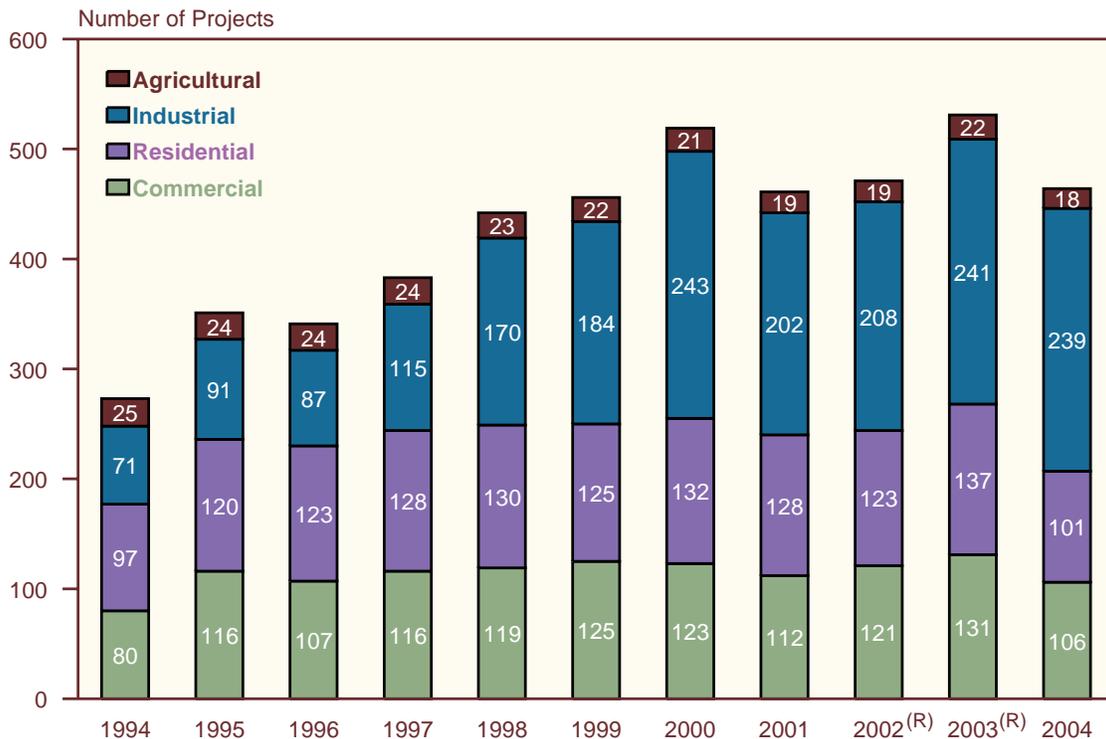
Notes: Some projects may be counted in more than one category. Figure excludes data from confidential reports.
Source: Energy Information Administration, Form EIA-1605.

Energy end-use projects can be carried out anywhere energy is consumed. Reporters indicate whether their energy end-use projects affect emissions in the industrial, commercial, residential, or agricultural sector. For 2004, 239 projects were reported to have reduced emissions in the industrial sector, 106 in the commercial sector, 101 in the residential sector, and 18 in the agricultural sector (Figure 11). Reporting of end-use projects in the industrial sector increased slightly but in every other sector decreased between 2003 and 2004. It should be noted that many projects—particularly, electric company DSM programs—affect more than one end-use sector and are included in each applicable sector for the purposes of counting types of projects reported.

Project Types

Of the 12 new reporters for 2004, 2 reported energy end-use projects. In addition, many repeat reporters included new energy end-use projects along with their ongoing projects. The most frequently reported type of energy end-use project for 2004 was equipment and appliance replacement/improvements (146 projects), followed by lighting and lighting controls (132 projects) and HVAC (108 projects) (Table 11). Because of the varied levels of data aggregation in reports by different entities, it is not possible to calculate average emission reductions by project type or to draw conclusions about the most effective energy end-use project types in terms of total emission reductions achieved.

Figure 11. Energy End-Use Projects Reported on Form EIA-1605 by Sector, Data Years 1994-2004



Notes: Some projects target more than one sector and may be counted in multiple categories. Figure excludes data from confidential reports.
Source: Energy Information Administration, Form EIA-1605.

Equipment and Appliances

Replacements of equipment and appliances with more energy-efficient units (e.g., ENERGY STAR products) to reduce greenhouse gas emissions are frequently reported energy end-use projects. For 2004, Michael Paul Taylor, a new household reporter, submitted reports for two new equipment and appliance projects. In his Personal Home Electricity Reduction Program,

Mr. Taylor used compact fluorescent light bulbs, reductions in phantom loads, and reductions in fuel consumption to reduce his overall electrical consumption from that of the previous owner. Mr. Taylor began the project in 2000 but reported it for the first time for 2004. Overall, the household measures he created resulted in energy savings of 2,455 kilowatthours in 2004, for a total emission reduction of 2.0 MTCO₂e. Mr. Taylor also

Table 11. Number of Projects and Emission Reductions Reported on Form EIA-1605 for Energy End-Use Projects by Project Type, Data Year 2004

Project Type	Number of Projects Reported	Number of Projects Reporting Emission Reductions			Emission Reductions Reported (Million Metric Tons Carbon Dioxide Equivalent)	
		Direct	Indirect	Both Direct and Indirect	Direct	Indirect
Equipment/Appliances	146	69	99	22	26.4	23.6
Lighting/Lighting Controls	132	63	80	11	33.9	23.0
HVAC	108	58	62	12	32.5	18.7
Load Control	57	33	34	10	22.2	13.3
Building Shell	49	30	36	17	23.9	19.0
Motor/Motor Drive	48	28	29	9	21.6	15.6
Fuel Switching	34	25	14	5	16.5	3.3
Other ^a	33	21	18	6	4.7	0.9
Energy Effects of Urban Forestry . .	7	7	1	1	11.1	*
Industrial Power Systems	4	3	1	0	1.2	*
Total	345	171	220	46	22.3	13.8

^aIncludes all projects that cannot meaningfully be included in any of the specific project type categories.

*Less than 0.05 million metric tons.

Note: Project totals and emission reductions do not equal sum of components, because some projects are counted in more than one category.

Source: Energy Information Administration, Form EIA-1605.

Load Shape Effects: Definitions and Terminology

Energy Efficiency. Projects that improve the energy efficiency of specific end-use devices and systems. Such projects usually reduce overall energy consumption, often without regard for the timing of project-induced savings. Generally, energy savings are achieved through the substitution of technically more efficient measures (i.e., equipment, systems, or operating procedures) to produce the same level of end-use service (e.g., lighting or warmth) with less energy use.

Load Building. Projects that increase energy consumption, generally without regard to the timing of the increase. Promotion of residential electric space heating systems and promotion of new industrial electrotechnologies are examples of electricity load-building projects.

Load Shifting. Projects that move energy consumption from one time to another (usually during a single day). For example, water-heater timers typically turn off the

units during the daytime (when an electric company experiences peak demands) and allow the units to operate at night (during the company's off-peak period).

Peak Clipping. Projects that reduce energy demand at certain critical times, typically when the electric system experiences peaks. These projects generally have only small effects on overall energy use but focus sharply on reducing energy use at critical times. Load-shifting and peak-clipping differ because the former shifts much of the energy use from one time to another, whereas the latter eliminates a load without shifting it to another time period.

Valley Filling. Projects that increase off-peak energy consumption (without necessarily reducing on-peak demands). Replacement of an oil-fired furnace with an electric heat pump is an example of valley filling. Such projects can aim to fill daily or seasonal valleys.

developed a Personal Home Natural Gas Use Reduction Program, using a programmable thermostat, plastic window cling, and weatherization techniques, that resulted in energy savings of 25.9 million Btu of natural gas, for a total emission reduction of 1.4 MTCO₂e.

The Los Angeles Department of Water and Power (LADWP) added a new equipment and appliance program in 2004, called “Refrigerator Turn-In and Recycle” (RETIRE). RETIRE provides incentives of up to \$192 per year to LADWP customers to turn in older spare refrigerators or freezers. There is no cost to the customer for pickup or recycling of the spare units, and LADWP provides an additional incentive of a free 6-pack of 23-watt compact fluorescent bulbs. For 2004, LADWP reported that the program effectively removed 2,288 refrigerators for recycling, resulting in overall energy savings of 4,118 megawatthours and total emission reductions of 3,079 MTCO₂e.

Lighting and Lighting Controls

Lighting and lighting control projects, such as installing compact fluorescent bulbs and occupancy sensor lighting controls, have consistently been popular projects in the Voluntary Reporting Program. The Estee Lauder Companies reported two new lighting projects for 2004. In a lighting upgrade project, Estee Lauder replaced 445 existing metal halide lights with more energy-efficient T5/HO industrial hi-bay lights. This project allowed the Estee Lauder Companies to save 228,500 kilowatthours of electricity in 2004 and to reduce indirect emissions by 121 MTCO₂e. Estee Lauder anticipates future energy savings of 914,000 kilowatthours over the life of the project. In a second new project, the Estee Lauder Companies added occupancy sensors to T8 Octron fluorescent lights already in place. Despite the relatively small size of this project, Estee Lauder was able to save an additional 750 kilowatthours and to reduce indirect emissions by 0.2 MTCO₂e.

Heating, Ventilation, and Air Conditioning (HVAC)

HVAC projects involve the reduced use or upgrade of HVAC systems in homes, businesses, offices, or industrial plants. Although there were no new reporters in the HVAC category, a number of new projects were reported for 2004. The majority of the new projects were not limited to HVAC activities but had HVAC components included in larger DSM efforts.

Sikorsky Aircraft Corporation reported a chiller replacement project, started in September 2004, as both an equipment and appliance improvement and HVAC project. The project replaced two chillers that the company had built and installed in 1983 with more energy-efficient chillers. The older chillers had a power requirement of 0.8 kilowatt per ton; the newer models have a power requirement of 0.5742 kilowatt per ton. As a result, Sikorsky saved 92,200 kilowatthours of electricity

and reduced its emissions by 39.4 MTCO₂e over 4 months in 2004. In a similar project, Allergan, Inc. installed a more energy-efficient chiller to upgrade its Botox Core Three unit, resulting in energy savings of 86,574 kilowatthours and a reported emission reduction of 66.7 MTCO₂e in 2004.

Building Shell

Building shell projects improve the energy efficiency of buildings through improved insulation and the prevention of air leaks in ceilings, walls, floors, windows, or doors. A large share of the projects reported in the building shell category for 2004 involved DSM programs implemented by electric power providers. The projects reported in the building shell category tend to be components of larger end-use projects. Despite the lack of new building shell projects in 2004, ongoing projects continued to report reduced energy consumption and emissions in 2004.

The Energy Smart Services project of Seattle City Light, operational since October 2001, continues to promote energy savings and greenhouse gas reductions. Between 2003 and 2004, the initiative nearly doubled Seattle City’s energy savings and its emission reductions. Energy savings for the project as a whole increased by 88 percent, from 41,792 megawatthours in 2003 to 78,546 megawatthours in 2004. Emission reductions also increased by 88 percent, from 16,393 MTCO₂e in 2003 to 30,810 MTCO₂e in 2004. The project, which replaced the Energy Savings Plan and Energy Smart Design programs, contains several different components offering commercial and industrial customers incentives and services to reduce the use of electricity, water, and other resources. Several options of the overall plan contain building shell components, including the Energy Analysis Assistance option, which provides customers with an in-depth consultant analysis of proposed electrical efficiency measures for new and remodeled commercial buildings. Seattle City Light pays 100 percent of the cost for new construction applications. The Building Commissioning option of the project funds commissioning plans for newly constructed buildings.

Load Controls

Load controls are energy management techniques for minimizing—either overall or at specific times of the day—end-use demand for electricity. Power companies themselves can use load management options and, through DSM programs, encourage their customers to apply load controls. Independently, power consumers can employ load controls to reduce their energy consumption, shift their demand to non-peak hours, reduce their consumption during peak hours, and reduce energy costs. Load control options include energy efficiency projects, load building, load shifting, peak clipping, and valley filling (see box on page 28).

Bristol-Myers Squibb Company reported on its Compressed Air System Renovation & Leak Survey/Repair program for the first time in 2004. The program, begun in June 1995, is designed to optimize the efficiency of the company's compressed air system. Compressed air is vital for plant operations to comply with stringent quality controls for the production of food and pharmaceutical goods. Before the project was undertaken, the plant's compressed air system consisted of three 300-horsepower lubricant-free rotary screw compressors that produced up to 3,000 standard cubic feet of compressed air per minute during periods of high demand, at discharge pressures between 95 and 105 pounds per square inch. As the plant's production evolved over time, the compressed air system was having difficulty meeting the minimum pressure requirements. Compressed air leaks were identified and repaired in 1994 and 1995, resulting in a more efficient system. The project has reportedly saved roughly 2,000 megawatthours of electricity in every year since it began, with reported emission reductions of 1,896 MTCO₂e in 2004.

Motor and Motor Drive

High- or ultra-high-efficiency motors and variable-speed or variable-frequency motor drives are more energy efficient than regular motors and motor drives. In addition, controls can be used to reduce electricity consumption by adjusting motor speeds or turning off motors when appropriate. Motor and motor drive projects generally are reported in the commercial and industrial categories, and often they are components of DSM programs. There were no new reporters or projects reported in the motor and motor drive category for 2004.

Fuel Switching

Switching from high-carbon to low-carbon fuels reduces carbon dioxide emissions generated during combustion. In January 2004, Lehigh Cement Company (formerly, Lehigh Portland Cement Company) began four new projects aimed at reducing emissions by using either high-carbon coal ash waste or obsolete crop seeds as a supplemental fuel in kilns at its plants in Leeds, Alabama; Mason City, Iowa; and Union Bridge, Maryland.¹⁸ Ordinarily, the kilns use natural gas, bituminous coal, or petroleum for fuel.

At Lehigh's Alabama plant, which typically consumes both natural gas and bituminous coal, consumption of ash waste increased to 74,799 million Btu in 2004, displacing other fossil fuels. In particular, its bituminous coal consumption was reduced by 452,152 million Btu.

¹⁸Emission reductions are based on the use of coal ash waste (186 pounds CO₂ per million Btu) to displace bituminous coal (205.3 pounds CO₂ per million Btu) and petroleum coke (225.13 pounds CO₂ per million Btu). The emission coefficient for coal ash waste is based on an Excel spreadsheet calculation tool, "CO₂ Emissions Inventory Protocol, Version 2.0," developed for the World Business Council for Sustainable Development, Cement Sustainability Initiative and available at web site www.wbcsdcement.org/pdf/tf1/co2_protocol.xls. Crop seeds, considered biogenic and with an emission factor of 0.0 pounds CO₂ per million Btu, are mostly obsolete corn seeds past their shelf life.

Overall, the project reduced CO₂ emissions by 36,037 metric tons in 2004. Lehigh also substituted ash waste and seeds for bituminous coal and petroleum coke. At the Iowa plant, bituminous coal consumption was reduced by 199,475 million Btu and petroleum coke consumption by 173,938 million Btu, resulting in direct emission reductions of 25,666 MTCO₂e for seed burning and 25,277 MTCO₂e for ash waste burning. The Maryland plant had by far the largest emission reduction reported for 2004, increasing ash waste consumption by 388,196 million Btu and distillate fuel consumption by 93,531 million Btu while reducing bituminous coal consumption by 2,793,583 million Btu. The result was reported as a direct emission reduction of 220,537 MTCO₂e.

Energy Effects of Urban Forestry

Urban forestry is the planting and maintenance of individual trees within a city or community. The energy effects of urban forestry projects include reductions in the space heating and/or cooling requirements of buildings as a result of planting trees to provide shade or windbreaks. In addition to reducing emissions by lowering fuel consumption, urban forestry projects can also sequester carbon, as discussed in Chapter 4.

There were no new urban forestry projects reported for 2004. LADWP continued to report an ongoing project, "Cool Schools Urban Forestry," to plant trees on campuses of the Los Angeles Unified School District throughout the city. The project serves several purposes in addition to reducing carbon dioxide emissions, including environmental and scientific instruction for the district's students. In the first 2 years of the program, 1998 and 1999, LADWP planted 3,278 trees at schools throughout the district and since then has planted 742 trees in 2000, 591 in 2001, 1,735 in 2002, 1,179 in 2003, and 123 in 2004. The trees generally are 2 years old and 10 feet tall when planted, and they are replaced immediately if they die. The goal of the program is to plant 8,000 trees at more than 80 schools. For 2004, the project was reported to have resulted in electricity savings of 619,488 kilowatthours (about 8 times the 75,978 kilowatthours savings reported for 1998, the first year of the program) and carbon dioxide emission reductions of 463 MTCO₂e.

Industrial Power Systems

Industrial power system projects are designed to reduce emissions from industrial power systems through efficiency improvements such as boiler system upgrades and replacements and turbine optimization. One new

industrial power system project was reported for 2004, the Estee Lauder Companies' Aveda cooling tower variable-speed drives project. Initiated in January 2004, the project was designed to ensure that cooling towers at the Aveda facility can run at optimum efficiency for the cooling load. Variable-speed drives were installed on the units, saving 394,333 kilowatthours of electricity in 2004, with reported indirect emission reductions of 272 MTCO₂e.

Other

The "other" project category captures the effects of energy-end use projects that cannot be meaningfully included in another category. Exelon Corporation began its Energy Delivery Internal Energy Efficiency Initiative in January 2003 but did not report it until the 2004 data year. In this project, the corporation charged the Exelon Environmental Strategy Energy Efficiency Team with the goal of improving the energy efficiency of Exelon Energy Delivery facilities by 3 percent per year for the 5-year period 2003-2007, relative to 2002. The team is also responsible for developing recommendations for expanding the project in other Exelon facilities.

During 2003 and 2004, the Exelon project focused on three core activities: developing a communication and education campaign to influence tenant behaviors, installing energy-efficient lighting retrofits at a few facilities, and reprogramming existing control systems to match heating and cooling to hours of occupancy. Through these efforts, the team developed measures within the communications strategy, including: publishing internal articles about the initiative, sending a brochure to employees through company mail, providing stickers to remind employees to turn off monitors and wall switches, displaying posters to remind employees and contractors about the initiative, working with the real estate and facilities departments to involve cleaning and security personnel, and sending internal e-mail reminders and "desk-drops" to remind employees about the initiative. Overall, the initiative helped to reduce electricity consumption by 2,289 megawatthours in 2003 and 6,948 megawatthours in 2004, resulting in emission reductions of 232 MTCO₂e in 2003 and 585 MTCO₂e in 2004. Exelon intends to initiate similar projects in other business units, such as Exelon Power and Exelon Nuclear, in the future.

Reducing Emissions from Transportation

The transportation sector is the largest contributing end-use sector to total U.S. energy-related carbon dioxide emissions, accounting for 32 percent of emissions in 2004. Direct use of petroleum fuels in mobile source applications accounts for 98 percent of transportation sector carbon dioxide emissions, and most of the remaining 2 percent results from the consumption of natural gas. Indirect emissions resulting from the use of purchased electricity account for about 0.3 percent of transportation sector emissions.

Carbon dioxide emissions from the transportation sector increased by 23 percent between 1990 and 2004, from 1,570 million metric tons to 1,934 million metric tons.¹⁹ The increase was caused by both rising average miles driven per vehicle and the number of vehicles on the road. The average number of miles driven per vehicle increased by 10 percent between 1990 and 2003,²⁰ and the number of vehicles on the road increased by 23 percent between 1990 and 2003.²¹ Emissions growth was moderated somewhat by an increase in average U.S. vehicle fleet fuel efficiency from 16.4 miles per gallon to 17.0 miles per gallon between 1990 and 2003.²²

For 2004, 34 entities reported 65 transportation projects on Form EIA-1605. All but 5 of the reporters were electric power sector companies. The other reporters were AT&T (telecommunications), BNSF Railway²³ (transportation), Blue Source, LLC (emissions offset brokerage), Arizona Portland Cement, and Michael Paul Taylor (private household). Of the 65 transportation projects reported on Form EIA-1605 for 2004, 60 have been reported in previous years. A new reporter, Pepco Holdings Inc., reported 5 projects for 2004 that had previously been included in separate reports submitted for 2003 by subsidiaries of Pepco Holdings Inc. (Conectiv Atlantic Generation and Conectiv Delmarva Generation). A total of 5 new projects were reported for 2004, including 3 that had been reported in a different form for 2003:

- Exelon Corporation submitted a consolidated project report on alternative-fuel vehicle activities for 2004 by two operating companies (Commonwealth Edison and PECO). Exelon's 2004 report also retained

¹⁹Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2004*, DOE/EIA-0573(2004) (Washington, DC, December 2005), web site www.eia.doe.gov/oiaf/1605/ggrpt.

²⁰Energy Information Administration, *Annual Energy Review 2004*, DOE/EIA-0384(2004) (Washington, DC, August 2005), p. 57, web site www.eia.doe.gov/aer.

²¹U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2005* (Washington, DC, June 2005), Table 1-11, web site www.bts.gov/publications/national_transportation_statistics/2005/html/table_01_11.html.

²²Energy Information Administration, *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004), p. 57, web site www.eia.doe.gov/aer.

²³BNSF Railway reported for 2003 as the Burlington Northern and Santa Fe Railway Co.

the separate project reports for alternative-fuel vehicle activities conducted by the two operating companies before 2004.

- Pepco Holdings Inc. included information on its pilot study of using gasoline-electric hybrid vehicles to replace its fleet vehicles.
- PG&E Corporation included two new project reports covering 2000 through 2004: compressed natural gas (CNG) vehicle usage by its own fleet and, separately, by its customers. Previously, PG&E had included all its CNG vehicle activities in a single project report. PG&E's 2004 report retained the project including both fleet and customer CNG activities but limited its coverage to the 1994-1999 period.
- Michael Paul Taylor, a new reporter, provided information on how he reduced his transportation-related emissions by increasing his reliance on busing, biking, walking, and carpooling to meet his transportation needs.

Of the 65 transportation projects reported for 2004, 37 were affiliated with DOE's Climate Challenge program. A single project indicated an affiliation with the Climate Wise program, which was originally a joint DOE/EPA program but has since been merged into EPA's ENERGY STAR program.

Tables 12 and 13 show historical trends in the reporting of transportation projects to the Voluntary Reporting Program. The large increase in direct emission reductions beginning in 2003 results from two vehicle efficiency projects reported for the first time last year by BNSF Railway, which reported improving locomotive efficiency, and Blue Source, LLC, which reported an intermodal transportation initiative involving integration of road and rail networks. The projects reported for 2004 fall into three broad categories:

- Alternative fuel use, 34 projects
- Travel reduction, 23 projects
- Vehicle efficiency improvements, 8 projects.

The primary effect of the transportation projects reported was to reduce emissions of carbon dioxide. Reductions in emissions of nitrous oxide or methane were also reported for 7 projects. For 14 of the 65 projects reported, either reductions did not occur in 2004 or they were not estimated.²⁴

Direct reductions totaling 2.7 million MTCO₂e were reported for 34 transportation projects in 2004 (Table 12), representing an 8.7-percent increase over the amount

reported for 2003. The two largest transportation projects accounted for nearly all of the increase in reported emission reductions. BNSF Railway reported a reduction of 1.1 million MTCO₂e for its locomotive efficiency initiative in 2004, an increase of 144,000 MTCO₂e from 2003. Blue Source, LLC reported a reduction of 1.4 million MTCO₂e for its intermodal transportation project in 2004, 99,000 MTCO₂e greater than the reduction reported for 2003.

Participants also reported indirect emission reductions in 2004 totaling 192,000 MTCO₂e for 24 transportation projects. The sources of the reduced emissions included "fuel cycle" emissions associated with production, refining, transportation, and distribution of fossil fuels; customer-owned conventional vehicles replaced by CNG vehicles refueled by natural gas distribution companies; employee vehicles affected by reporter-sponsored travel reduction programs, such as carpooling; and railroad-owned locomotives hauling coal in lightweight aluminum rail cars owned by electric utilities. The indirect reductions reported for 2004 were 42 percent greater than those reported for 2003.

Two projects reported by Ameren Corporation (formerly UE, CIPS, and CILCO) and PG&E Corporation were primarily responsible for the increase in indirect emission reductions. Ameren's use of lightweight, aluminum rail cars to ship subbituminous coal to its power plants resulted in a reported reduction of 47,000 MTCO₂e, an increase of 25,000 MTCO₂e over the reduction reported for 2003. PG&E included a new project in its submission involving the refueling of its customers' CNG vehicles, which reportedly reduced emissions by 31,000 MTCO₂e in 2004.

Using Alternative Fuels

Although 53 percent of the transportation projects reported for 2004 involved alternative-fuel vehicles, they accounted for less than 1 percent of the direct reductions but 17 percent of the indirect reductions reported for transportation projects. In general, the reported reductions for alternative-fuel vehicle projects were small, with reductions in excess of 1,000 MTCO₂e being reported for only 4 of the 34 projects.

Alternative-fuel vehicle projects reported to the Voluntary Reporting Program have involved a variety of fuels, including natural gas, electricity, propane, B20 (a blend of 20 percent biodiesel and 80 percent diesel), E85 (a blend of 85 percent ethanol and 15 percent gasoline), and M85 (a blend of 85 percent methanol and 15 percent gasoline). Electricity was the alternative fuel included in

²⁴In some cases, reductions for the project may have been reported for years before 2004. In other cases, the reductions were not estimated due to the lack of data or other difficulties in quantifying the effects of the project. Entities may elect to report projects without reporting reductions to make a public record of the fact that they have conducted an activity in fulfillment of a commitment made under a voluntary program such as Climate Challenge.

11 project reports; however, only 6 of them included reductions for 2004.

Direct emission reductions reported to have resulted from the use of electric vehicles totaled 772 MTCO_{2e} for 2004, down from the 1,081 MTCO_{2e} reported for 2003. Southern California Edison's electric vehicles reportedly logged 1.3 million miles in 2004, down from 1.8 million miles in 2003. LADWP reported operating 261 electric vehicles in 2004, up from 204 in 2001 and 18 in 1996. Southern Company reported operating a fleet of 63 electric vehicles in 2004, including cars, trucks,

neighborhood electric vehicles, and buses; however, the current size of Southern Company's electric fleet is less than one-quarter of the 484 vehicles it operated at its peak in 2000.

Information on the operation of natural-gas-fueled vehicles was included in reports on 17 projects, 9 of which were reportedly active in 2004. Two utilities reported operating fleets of more than 100 CNG or dual-fuel CNG-gasoline vehicles²⁵ in 2004: We Energies (328 vehicles) and NiSource (372 vehicles). We Energies reported a direct emission reduction of 310 MTCO_{2e} from its own

Table 12. Number of Projects and Emission Reductions Reported on Form EIA-1605 for Transportation Projects by Project and Reduction Type, Data Years 1994-2004

Year	Number of Projects				Emission Reductions (Metric Tons Carbon Dioxide Equivalent)	
	Vehicle Efficiency	Travel Reduction	Alternative Fuels	Total	Direct	Indirect
1994	3	6	18	26	4,203	6,346
1995	6	14	21	40	22,660	54,061
1996	7	15	26	47	28,813	54,043
1997	8	21	27	55	32,283	95,782
1998	9	23	28	58	25,085	89,174
1999	10	25	30	62	43,499	282,257
2000	9	25	32	64	22,611	134,519
2001	5	21	28	53	44,996	88,023
2002	5	26	30	60	41,916	161,156
2003	9	26	31	66	2,459,475	134,867
2004	8	23	34	65	2,673,820	191,681

Notes: Project totals do not equal sum of components, because some projects are counted in more than one category. Table excludes data from confidential reports.

Source: Energy Information Administration, Form EIA-1605.

Table 13. Emission Reductions Reported on Form EIA-1605 for Transportation Projects by Project and Reduction Type, Data Years 1994-2004
(Metric Tons Carbon Dioxide Equivalent)

Year	Vehicle Efficiency		Travel Reduction		Alternative Fuels	
	Direct	Indirect	Direct	Indirect	Direct	Indirect
1994	1,244	5,651	1,170	—	1,956	695
1995	18,148	36,137	2,179	16,461	2,463	1,495
1996	18,647	38,602	5,427	13,903	4,847	1,546
1997	20,979	48,213	8,762	45,227	2,582	2,352
1998	18,436	70,527	3,110	15,923	3,632	2,746
1999	14,671	174,553	6,077	106,841	22,866	2,148
2000	53	66,324	8,549	67,404	14,021	2,306
2001	-1,109	51,905	13,052	34,050	33,053	2,068
2002	15	48,160	10,920	108,912	31,030	4,085
2003	2,387,335	49,543	38,951	83,156	32,810	2,168
2004	2,629,658	75,339	36,354	83,384	7,808	32,958

Notes: Table excludes data from confidential reports.

Source: Energy Information Administration, Form EIA-1605.

fleet and an indirect reduction of 756 MTCO₂e from customer fleets using the 15 public refueling stations that We Energies operates. NiSource reported a direct emission reduction of 63 MTCO₂e for its natural-gas-fueled vehicle fleet, which includes forklifts and light-duty vehicles and trucks converted to CNG, as well as heavy-duty trucks using liquefied natural gas (LNG).

Projects involving fuels other than natural gas and electricity were included in 8 reports, 5 of which included activity in 2004.²⁶ All the active projects involved the use of biodiesel, usually as B20. Biodiesel use was reported by Cinergy Corp., Consolidated Edison Company of New York, Pepco Holdings Inc., Public Service Enterprise Group, and Exelon Corporation.

Reducing Vehicle Travel

Travel reduction, which includes such activities as carpooling and vanpooling, mass transit, telecommuting, and service efficiency improvements, was reported for 23 projects for 2004—accounting for 1 percent of the direct reductions and 44 percent of the indirect reductions reported for transportation projects in 2004. The 36,354 MTCO₂e of direct reductions and 83,384 MTCO₂e reported for 2004 were similar to the amounts reported for 2003 (38,951 and 83,156 MTCO₂e, respectively).

Of the 23 projects reported in the travel reduction category, 11 involved carpooling or vanpooling, 8 increased mass transit ridership, 3 reduced employee vehicle use through telecommuting, 2 increased service efficiency for freight or service vehicles, and 10 involved other actions, such as work week compression, videoconferencing, use of bicycles for electric or gas meter reading, promotion of employee commuting by bicycle or walking, and automation of electric or gas meter reading in areas of low population density.²⁷

AT&T reported the largest travel reduction project, a telecommuting program that reportedly reduced indirect emissions by 62,596 MTCO₂e in 2004. Reductions of more than 5,000 MTCO₂e in 2004 were also reported for the following travel reduction projects:

- The Blue Source, LLC, empty miles reduction program, which reduces the miles highway freight haulers travel without loads, reduced direct emissions by a reported 20,601 MTCO₂e.
- LADWP reported on its employee carpooling and vanpooling program (7,055 MTCO₂e indirect emission reductions).

- Southern Company reported on its carpooling and mass transit programs (6,060 MTCO₂e indirect emission reductions).
- TXU reported efforts to reduce fleet and employee vehicle use (7,170 MTCO₂e direct emission reductions and 4,119 MTCO₂e indirect emission reductions).
- AT&T reported on its fleet cost reduction program (8,231 MTCO₂e direct emission reductions).

Improving Vehicle Efficiency

Seven entities submitted reports on eight vehicle efficiency projects, six of which resulted in reported emission reductions for 2004. Four entities reported direct emission reductions for 2004 resulting from vehicle efficiency initiatives, including BNSF Railway's locomotive efficiency project and Blue Source, LLC's intermodal transportation project.

BNSF Railway reported a direct emission reduction of 1.1 million MTCO₂e for 2004, achieved by increasing locomotive efficiency through actions such as replacing older locomotives with more fuel-efficient units, using newer roller bearing technology on rail cars, positioning trailers on intermodal trains to reduce drag, adjusting train speeds to meet customer time frames while increasing fuel efficiency, adding idle control technology to switch locomotives, reducing terminal yard transit times, and using friction reducers on the wheel-to-rail interface. Blue Source reported reducing 2004 emissions by 1.4 million MTCO₂e through an intermodal transportation initiative, which integrates road and rail freight hauling networks to increase overall fuel efficiency. Blue Source also reported on an effort to reduce truck idle time, which reduced 2004 direct emissions by a reported 28,541 MTCO₂e.

Two electric utilities reported indirect emission reductions from projects involving the use of lightweight aluminum railroad cars to transport coal. These projects resulted in indirect emission reductions because the locomotives using less fuel were owned by the railroads. Ameren Corporation reported reducing emissions by 46,635 MTCO₂e for 2004, and Kansas City Power & Light Company reported reducing emissions by 28,704 MTCO₂e for 2004.

²⁶Three other reporters continued to submit information on projects that involved consumption of propane, E85, and M85 in previous years; however, these fuels were not used in 2004.

²⁷The total number of travel reduction projects is less than the sum of the projects in each subcategory, because some projects include activities in more than one subcategory.