

3. Reducing Emissions from Energy End Use

Introduction

Greenhouse gas emissions from energy end use include emissions from the industrial, commercial, residential, and transportation sectors. Transportation accounts for 1,876 million metric tons carbon dioxide, nearly all from mobile sources, and represents approximately 32 percent of U.S. carbon dioxide emissions. The industrial, commercial, and residential sectors combined generate the balance of U.S. carbon dioxide emissions, accounting for 3,839 million metric tons carbon dioxide, 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).

Reducing Emissions from Stationary Sources

Energy use at stationary sources in the industrial, commercial, and residential sectors accounted for emissions of 3,839 million metric tons carbon dioxide in 2001—two-thirds of total U.S. carbon dioxide emissions. Emissions from stationary sources included 2,243 million metric tons carbon dioxide from the generation of electricity that was ultimately consumed in these three sectors. Industry was responsible for the largest share of stationary-source emissions (29 percent), followed by the residential sector (20 percent) and the commercial sector (18 percent).

Between 1990 and 2001, carbon dioxide emissions associated with industrial, residential, and commercial energy use increased by 12.8 percent. The commercial sector is the fastest-growing emissions source, registering a 31.5-percent increase in emissions between 1990 and 2001. Emissions from the residential sector increased by 22.3 percent over the same period, while industrial sector emissions declined by 1.2 percent.¹¹

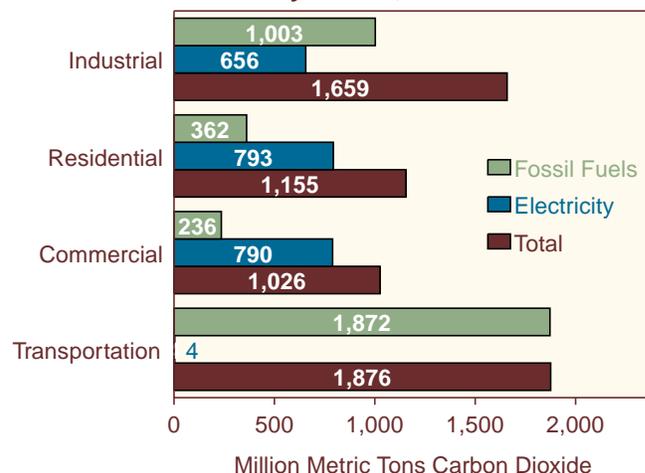
Projects Reported

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); and appliance replacement (e.g., retiring old appliances for Energy Star products). For 2001, 66 entities reported 329 energy end-use projects on Form EIA-1605 (Table 10). These 329 projects accounted for 22 percent of all the projects reported on the long form, ranking third behind electricity supply (26 percent) and sequestration (25 percent). An additional 31 projects reported for 2001 involved coal ash reuse (see box on page 32).

Among the 66 entities that reported energy end-use projects for 2001 on Form EIA-1605, 74 percent were electric utilities, of which 21 were publicly owned and 28 were privately owned. Cement companies and manufacturers of automobiles and other transportation equipment were represented by 5 reporters (8 percent) each. Two pharmaceutical and health care product companies reported energy end-use projects for 2001 (3 percent). The remaining 8 percent of reporters was made up of 1 electronic and other electrical equipment company, 1 food and kindred products company, 1 holding and other investment offices, 1 primary metal manufacturer, and 1 private household.

Figure 8. Sources of U.S. Carbon Dioxide Emissions by Sector, 2001



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 2001*, DOE/EIA-0573(2001) (Washington, DC, December 2002).

¹¹Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2001*, DOE/EIA-0573(2001) (Washington, DC, December 2002), p. 21, web site www.eia.doe.gov/oiaf/1605/1605a.html.

Both the number of entities reporting and the number of energy end-use projects reported for 2001 were lower than those for 2000, as were the total reported direct and indirect emission reductions resulting from energy end-use projects (Table 10). Changes in funding sources for efficiency programs and the transition toward competition in the electricity supply industry may have contributed to the decline in the numbers of entities and projects reported for 2001. For example, EIA reports that some States are now funding demand-side management (DSM) activities through State agencies, such as the California Board for Energy Efficiency, the New York Energy Research and Development Authority, and Efficiency Vermont.¹²

Emission reductions reported for individual energy end-use projects ranged from less than 1 metric ton carbon dioxide equivalent to almost 4.5 million metric tons,

primarily because of the flexibility allowed in defining the scope of a project. Some reporters include information on each individual end-use initiative separately, whereas others aggregate information on a range of activities in a single project. For example, an electric utility may report on a DSM project that achieves direct emission reductions through multiple supplemental approaches, such as encouraging their residential, commercial, and industrial customers to change light bulbs, temporally shift electric loads, implement urban forestry projects, and upgrade appliances, building shells, and HVAC systems.

Among projects for which direct emission reductions were reported for 2001, 86 percent had reductions of less than 100,000 metric tons carbon dioxide equivalent (Figure 9). Similarly, among projects for which indirect emission reductions were reported, 94 percent had

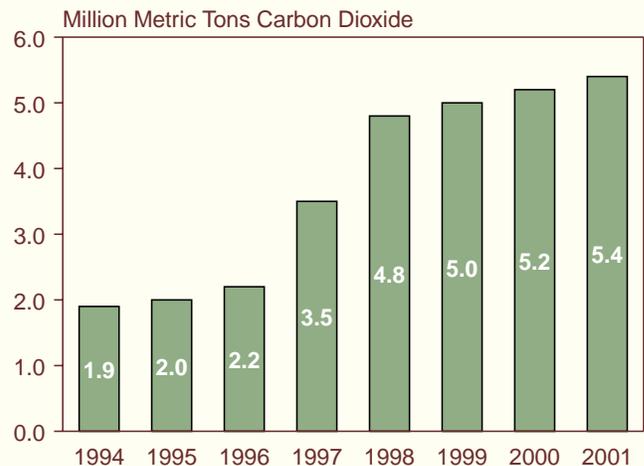
Coal Ash Reuse Projects

Coal ash, a byproduct of coal combustion, is a marketable commodity for the electric power sector, which accounts for 91 percent of coal use in the United States.^a The most common use of coal ash is as a replacement for Portland cement in the manufacture of concrete, and reductions in carbon dioxide emissions are achieved by reducing emissions from the calcination process. Electric utilities sell coal ash produced at their facilities to avoid landfill disposal costs and to meet increasing demand for the commodity.

In 2001, the total number of entities reporting coal ash reuse projects (28) decreased slightly from the 34 entities reporting such projects in 2000. There was a corresponding decrease in the total number of projects reported for 2001 (31), down from 38 reported for 2000. The total carbon dioxide emission reductions reported increased by almost 3 percent, however, to 5.4 million metric tons (see figure). The combined indirect emission reductions reported for coal ash reuse projects in 2001 accounted for 7.6 percent of the indirect carbon dioxide emission reductions reported for all projects. Just over 7 million metric tons of coal ash was reported to have been reused in 2001, primarily as a substitute for Portland cement in concrete. A small assortment of reporters indicated that fly ash was reused in materials including road base, anti-skid material, or structural fill; however, emission reductions from these applications were not quantified. The largest quantities of coal ash reused were reported by TXU (917,264 metric tons), by American Electric Power (672,974 metric tons), and by Alliant Energy (567,907 metric tons).

Reporters used different emission coefficients to estimate their carbon dioxide reductions for cement substitution, ranging from 0.8 to 1.0 metric ton per ton of coal ash reused. The emissions avoided by using coal ash in concrete vary, depending on the fuels used to produce the thermal and electrical energy needed for manufacturing the displaced cement and the proportion of coal ash in the concrete. The largest individual carbon dioxide reductions from coal ash reuse were reported by the same three reporters: TXU (733,811 metric tons), Alliant Energy (567,907 metric tons), and American Electric Power (532,771 metric tons).

Indirect Emission Reductions from Coal Ash Reuse Projects Reported on Form EIA-1605, Data Years 1994-2001



Source: Energy Information Administration, Form EIA-1605.

¹²Energy Information Administration, "Electric Utility Demand-Side Management 2000" (January 2002), web site www.eia.doe.gov/cneaf/electricity/dsm00/dsm_sum.html.

Table 10. Number of Energy End-Use Reporters, Projects, and Emission Reductions Reported on Form EIA-1605, Data Years 1994-2001

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	66	329	19,439,140	7,600,756

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.

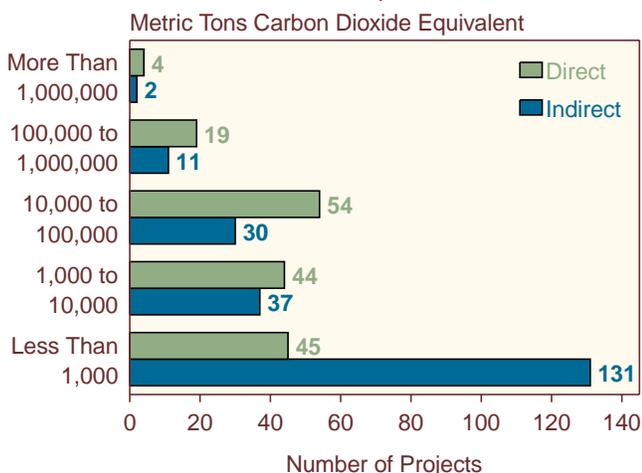
Source: Energy Information Administration, Form EIA-1605.

reductions of less than 100,000 metric tons carbon dioxide equivalent. Only six energy end-use projects reported emission reductions greater than 1 million metric tons each for 2001 (one fewer than for 2000).

The 10 largest projects reported in terms of emission reductions achieved in 2001 were aggregated electric utility DSM programs. DSM projects may focus on one or more load shape objectives (see box on page 34). Although the most common load shape objective of reported DSM projects was increased energy efficiency (310 projects), electric utilities also attempted to balance their load profiles with various other load shape objectives including peak clipping (62 projects), load shifting (33 projects), valley filling (17 projects), and load building (10 projects) (Figure 10).

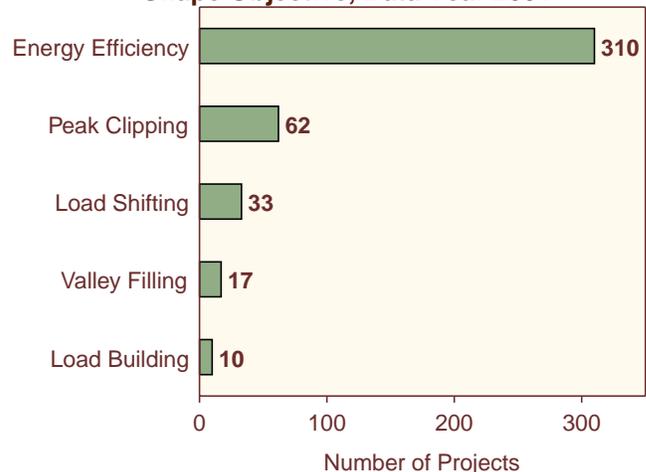
Energy end-use projects can be carried out anywhere energy is consumed. Reporters indicate whether their energy end-use projects affect emissions in the industrial, commercial, residential, or agricultural sector. For 2001, 193 projects were reported to have reduced emissions in the industrial sector, 128 in the residential sector, 112 in the commercial sector, and 19 in the agricultural sector. Fewer end-use projects were reported for each sector for 2001 than were reported for 2000, and the total number of end-use projects reported was 14 percent below the total for 2000 (Figure 11). It should be noted that many projects—particularly utility 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.

Figure 9. Energy End-Use Projects Reported on Form EIA-1605 by Size and Type of Emission Reduction, Data Year 2001



Source: Energy Information Administration, Form EIA-1605.

Figure 10. Demand-Side Management Projects Reported on Form EIA-1605 by Load Shape Objective, Data Year 2001



Notes: Some projects may be counted in more than one category. Figure excludes data from confidential reports.

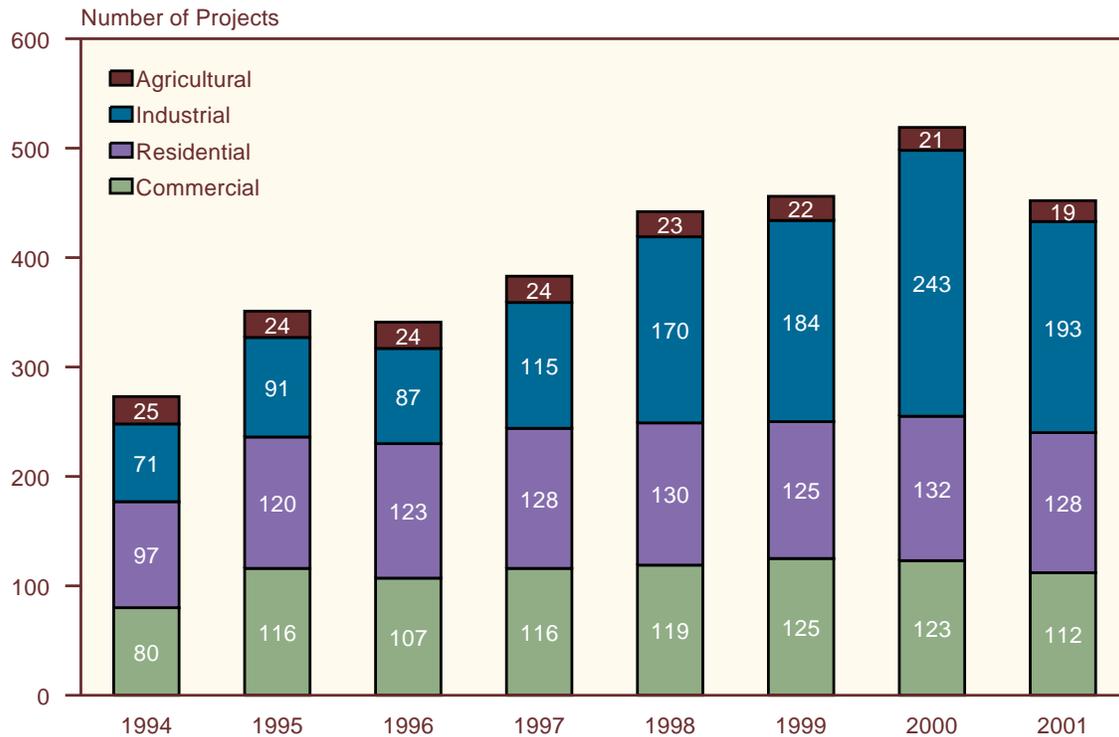
Source: Energy Information Administration, Form EIA-1605.

Project Types

Of the 329 energy end-use projects reported, 33 percent involved two or more project types. The most frequently reported type of energy end-use project for 2001 was equipment and appliances, with 150 projects, followed by lighting and lighting controls (134 projects) and

HVAC (106 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 1994-2001



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.

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 utility experiences peak demands) and allow the units to operate at night (during the utility's off-peak period).

Peak Clipping. Projects that reduce energy demand at certain critical times, typically when the utility experiences system 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.

Equipment and Appliances

Equipment and appliance replacements with more energy efficient units (e.g., Energy Star products) are frequently reported energy end-use projects to reduce greenhouse gas emissions. For 2001, two new reporters to the Voluntary Reporting of Greenhouse Gas Emissions Program submitted reports on equipment and appliance projects. City Public Service reported two new projects that reduced direct emissions. The Wash Right Rebate program, operational since 1998, is a residential washing machine rebate program. The Mow Down Smog program, which also became operational in 1998, offers incentives for City Public Service customers to trade in gasoline-powered lawn mowers for electric. Ford Motor Company, the other new reporter, continued process upgrades and energy efficiency programs that produced emission reductions during 2001. In one project, the company upgraded 17 recuperative thermal oxidizers or replaced them with catalytic units, saving both natural gas and electricity consumption at plants throughout the United States. In 1996, the company made more than 200 equipment and appliance upgrades, producing recurring savings of electricity and natural gas and their associated greenhouse gas emissions.

In addition to the new reporters' projects, two other new equipment and appliance projects were reported for 2001. Lucent Technologies, Inc., reported a newly operational project in addition to other ongoing projects reported in previous years. The Lucent Technologies

project eliminated a 15-horsepower fan in an industrial plant. Seattle City Light reported on its Neighborhood Power Weatherization/Warm Home Program for the first time for 2001. The Warm Home Program, which became operational in 1994, provides incentives for energy-conserving equipment and appliance upgrades to reduce hot water heater system usage, such as efficient-flow showerheads, kitchen and bath faucet aerators, and water heater thermostat setbacks. The program also includes building shell and lighting project activities.

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 of Greenhouse Gases Program. Six new lighting projects were reported for 2001, five by repeat reporters. A new reporter for 2001, City Public Service, submitted a residential lighting and lighting controls project that became operational in 2000. In this project, City Public Service initiated a program to replace mercury vapor streetlights with energy-efficient metal halide lights. For 2000 and 2001, the lighting project reported 39 and 1,453 metric tons of direct carbon dioxide emission reductions. Moorhead Public Service, a previous reporter but a first-time reporter on the long form in 2001, included a new project called Custom Rebate for Concordia College. The effort entailed retrofitting a bathroom in one dormitory building with occupancy sensors, which achieved a reported reduction of

Table 11. Number of Projects and Emission Reductions Reported on Form EIA-1605 for Energy End-Use Projects by Project Type, Data Year 2001

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	150	79	90	19	14.9	6.4
Lighting/Lighting Controls	134	73	70	9	16.6	6.1
HVAC	106	61	56	11	16.3	5.1
Building Shell	60	39	28	7	15.4	4.6
Load Control	57	38	29	10	13.4	3.0
Motor/Motor Drive	54	35	28	9	13.9	4.3
Fuel Switching	17	12	10	5	5.5	0.9
Energy Effects of Urban Forestry . .	9	8	3	2	4.0	*
Industrial Power Systems	5	1	4	0	*	0.2
Other ^a	25	15	15	5	1.4	0.2
Total	329	166	201	38	19.4	7.6

^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.

12 metric tons of direct carbon dioxide emissions. Lucent Technologies reported two new small projects, in which a light switch was installed in a data closet and a timer was installed on outdoor lights, for total reductions of 7 metric tons carbon dioxide equivalent in indirect emissions. Allergan, Inc., reported a lighting upgrade project at its plant in Irvine, California, with reductions of 66 metric tons carbon dioxide equivalent in indirect emissions. PacifiCorp reported a project in which it began mailing about 602,000 forms for free compact fluorescent bulbs to its customers in January 2001, estimating a reduction of 62,647 metric tons of direct carbon dioxide emissions in 2001.

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, three new projects were reported for 2001. Lucent Technologies reported a newly operational project in addition to other ongoing HVAC projects that it has reported in past years. Using an energy conservation approach, Pratt & Whitney, Middletown, reduced the operation of the exhaust and supply air handling units in an industrial building from 24 hours a day year-round to an operation that cycles the units on and off. Pratt & Whitney reported no changes in the temperature of the building and detected no ventilation problems after implementation of the project, which reduced greenhouse gas emissions by a reported 374 metric tons carbon dioxide equivalent in 2001. Allergan, Inc., reported a project in which a variable frequency drive was added to an existing 380-ton chiller in October 2001, achieving a reported carbon dioxide emission reductions of 26 metric tons by the end of the year.

Building Shell

Building shell projects improve the energy efficiency of buildings through upgrades to ceilings, walls, floors, windows, or doors (e.g., insulation, air sealing, or efficient materials). A large share of the projects reported in the building shell category involved DSM programs by electric power providers. There were three new building shell projects reported for 2001. The Los Angeles Department of Water and Power reported that its Reflective Window Film Rebate Program avoided 56 metric tons of direct carbon dioxide emissions. In addition, Pratt & Whitney, Middletown, conducted a roof replacement and installed high-speed doors, for a combined emission reduction of 312 metric tons carbon dioxide.

Load Controls

Load controls are energy management techniques for minimizing—either overall or at specific times of the day—the load demands on the electric power provider. Power companies themselves can use load management options and also, 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 times, reduce their consumption during peak times, and save energy costs. Load control options include energy efficiency projects, load building, load shifting, peak clipping, and valley filling (see box on page 34).

For 2001, Los Angeles Department of Water and Power reported on a newly operational Reflective Window Film Rebate Program that reduced emissions through peak clipping. In addition, FirstEnergy Corporation, which in 2001 completed a merger with GPU, Inc., reported a new Thermal Energy Storage project that reduced carbon dioxide emissions by 3,772 metric tons in 2001. This project, which became operational in 1993, reduced summer weekday peak electric loads for space and process cooling applications by shifting those loads to off-peak periods.

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 electrical consumption by adjusting motor speeds or turning off motors when appropriate. Motor and motor drive projects are generally reported in the commercial and industrial categories, and often they are a component of DSM programs.

All 54 motor and motor drive projects reported for 2001 are projects that were initiated in previous years and are either ongoing or completed but continue to provide recurring emission reductions. For example, FirstEnergy Corporation reported on an existing motor/motor drive project that became operational in 1991. The FirstEnergy project involved efficiency and electrotechnology as a component of a DSM program. Moorhead Public Service submitted an ongoing project that offered a customer rebate to a manufacturing company for two motor and adjustable-speed drive upgrades in 1996 and an additional unit replacement in 1998.

Fuel Switching

Switching from high-carbon to low-carbon fuels reduces carbon dioxide emissions generated during combustion. There were no new reporters in the fuel switching energy end-use category for 2001, but one entity reported a new project. Portland General Electric Co. reported a fuel-switching project that offered rebates to customers to purchase electric lawnmowers and turn in gas-powered mowers. The project is applicable to both the fuel switching and the equipment and appliances project types.

Energy Effects of Urban Forestry

Urban forestry is the planting and maintenance of individual trees within a city or community. Urban forestry projects can reduce both carbon dioxide emissions and energy expenditures for urban heating and cooling. In terms of energy end use, urban forestry projects can increase the efficiency of building heating and cooling. Urban forestry projects can also sequester carbon, as discussed in Chapter 4.

For 2001, the Los Angeles Department of Water and Power reported on a newly operational project, called Trees for a Green LA, which capitalized on the energy effects of urban forestry. This project is an urban tree-planting program that provides energy efficiency and environmental benefits for customers. The purpose of the project is to increase energy efficiency in residential, commercial, and newly constructed buildings; to plant trees for public buildings and public spaces; and to replace trees under power lines. The goal is to plant 100,000 trees a year for two years under this pilot program, 95 percent of which are slated for residential areas. Recipients attend workshops to learn about proper placement, benefits, and care of trees and are given a comprehensive tree guide to take home. The Los Angeles Department of Water and Power attributed a reduction of 6 metric tons carbon dioxide to Trees for a Green LA in 2001.

Industrial Power Systems

Industrial power system projects include boiler system upgrades or replacements and turbine optimization. There were no new reporters or projects in the industrial power system category for 2001. Ongoing projects include the replacement of an existing centrifugal compressor with a more efficient three-stage centrifugal air compressor by Pratt & Whitney, Middletown. In addition, Alliant Energy reported continuing reductions in greenhouse gas emissions from industrial power system projects that were implemented to comply with energy efficiency legislation enacted in Iowa.

Other

There were four new projects in the other project type category for the 2001 reporting year, one of which was from a new reporter. The reporters of new projects include Allergan, Inc., Ford Motor Company, and

Pratt & Whitney, Middletown. The newly operational projects include an Allergan facility closure that reduced indirect emissions by 1,867 metric tons carbon dioxide equivalent and two Pratt & Whitney, Middletown, projects that repaired compressed air leaks in various facilities. The new reporter, Ford Motor Company, reported reducing direct carbon dioxide emissions by 61,930 metric tons and indirect emissions by 83,828 metric tons carbon dioxide equivalent in 2001 through performance contracts that Ford implemented with energy supply companies. The reported emission reductions were achieved through boiler conversions, lighting improvements, and other energy efficiency projects. Ford reported that energy savings and related cost savings are third-party verified as part of each contract.

Reducing Emissions from Transportation

The transportation sector is the largest contributing sector to the total U.S. emissions of carbon dioxide, accounting for 32 percent of emissions in 2001. These emissions result from the combustion of fossil fuels, and 98 percent result from the use of petroleum fuels. Emissions from the transportation sector increased by 19 percent between 1990 and 2001, from 1,582 million metric tons carbon dioxide to 1,876 million metric tons carbon dioxide.¹³ The increase was caused by increases in both the average number of miles driven per vehicle and the total number of vehicles on the road. The average number of miles driven by motor vehicles increased by 9.6 percent between 1990 and 2000,¹⁴ and the number of vehicles on the road increased by 14.2 percent between 1990 and 1999.¹⁵ Although emissions were extenuated somewhat by an increase in average U.S. vehicle fleet fuel efficiency from 16.4 miles per gallon to 16.9 miles per gallon between 1990 and 2000, the trend has been reversed since 1997 when fuel efficiency peaked at 17.0 miles per gallon.¹⁶

A total of 53 transportation projects were reported on Form EIA-1605 for 2001 by 31 entities, all but 3 of which were electric utilities. One of the nonutilities was CLE Resources, a subsidiary of an electric utility. The 2 others were a cement producer (Arizona Portland Cement Co.) and a household. All but 1 of the 53 transportation projects reported on Form EIA-1605 have been reported

¹³Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2001*, DOE/EIA-0573(2001) (Washington, DC, December 2002), Table 9, p. 34, web site www.eia.doe.gov/oiaf/1605/1605a.html.

¹⁴Energy Information Administration, *Annual Energy Review 2001*, DOE/EIA-0384(2001) (Washington, DC, November 2001), p. 61, web site www.eia.doe.gov/emeu/aer/.

¹⁵U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001*, BTS02-06 (Washington, DC, July 2002), Table 1-9, web site www.bts.gov/publications/nts/html/table_01_09.html.

¹⁶Energy Information Administration, *Annual Energy Review 2001*, DOE/EIA-0384(2001) (Washington, DC, November 2002), p. 62, web site www.eia.doe.gov/emeu/aer/.

in previous years.¹⁷ The new project was a travel reduction initiative reported by Southern Company describing how two of its subsidiaries, Georgia Power and Alabama Power, encourage employees to carpool, vanpool, telecommute, and use mass transit. Thirty-six (68 percent) of the projects reported for 2001 were affiliated with the Climate Challenge program. Affiliation with the U.S. Environmental Protection Agency's ClimateWise Program, which has been absorbed into the Energy Star Program, was reported for one project.

Tables 12 and 13 show transportation project trends in the first eight reporting cycles of the Voluntary Reporting Program. The projects reported for 2001 fall into three broad categories:¹⁸

- Alternative fuel use (28 projects or 53 percent)
- Travel reduction (21 projects or 40 percent)
- Vehicle efficiency improvements (5 projects or 9 percent).

The primary effect of the transportation projects reported was to reduce emissions of carbon dioxide, although reductions in emissions of nitrous oxide or methane were also reported for 6 projects. For 9 of the 53 projects reported, either reductions did not occur in 2001 or they were not estimated.¹⁹

Direct reductions totaling 44,996 metric tons carbon dioxide equivalent were reported for 35 projects in 2001

(Table 12). This represents a significant increase from the 22,611 metric tons carbon dioxide equivalent in direct reductions reported for 2000, primarily as a result of increased activity in PG&E Corporation's natural gas vehicle project. PG&E reported reductions in direct emissions of carbon dioxide totaling 27,194 metric tons in 2001, up from 5,091 metric tons in 2000.

Indirect emission reductions in 2001 totaling 88,023 metric tons carbon dioxide equivalent were also reported for 22 projects. The sources of the reductions included "fuel cycle" emissions associated with production, refining, transportation, and distribution of fossil fuels; customer-owned natural gas 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. Indirect reductions from transportation projects reported for 2001 declined significantly from those reported for 2000, primarily due to the absence of 2001 reports from 5 reporters who reported 7 projects for 2000, with combined reductions of 58,017 metric tons carbon dioxide equivalent.

Using Alternative Fuels

More than one-half (53 percent) of the transportation projects reported for 2001 involved alternative-fuel vehicles (AFVs). These projects accounted for 73 percent

Table 12. Number of Projects and Emission Reductions Reported on Form EIA-1605 for Transportation Projects by Project and Reduction Type, Data Years 1994-2001

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	9	20	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

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.

¹⁷In some cases, projects reported last year (data through 2000) have been included in the reports submitted this year (data through 2001) by companies that have resulted from mergers of the companies that reported last year. Projects reported separately by ComEd and PECO for 2000 were reported by Exelon Corporation for 2001. Projects reported by GPU for 2000 were reported by FirstEnergy for 2001.

¹⁸The sum of projects in each category exceeds the total number of projects because some projects are counted in more than one category.

¹⁹In some cases, reductions for the project may have been reported for years before 2001. 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.

of reported direct reductions but only 2 percent of reported indirect reductions. In general, the reported reductions for AFV projects were small, with reductions in excess of 1,000 metric tons carbon dioxide equivalent being reported for only four projects. All the AFV projects reported for 2001 were reported in previous years.

AFV projects involved a variety of fuels, including natural gas, electricity, propane, and E-85 (a blend of 85 percent ethanol and 15 percent gasoline). Electricity was included in 13 project reports. Southern California Edison's electric vehicles reportedly logged over 1.9 million miles in 2001, more than 10 times the 174,000 miles reported in 1996. The Los Angeles Department of Water and Power (LADWP) reported operating 204 electric vehicles in 2001, up from 117 in 2000 and 18 in 1996. Southern Company reported operating an electric vehicle fleet of 416 vehicles in 2001, including cars, trucks, neighborhood electric vehicles, and buses.

Fourteen projects involved the operation of compressed natural gas (CNG) or liquefied natural gas (LNG) vehicles. Three utilities reported operating fleets of CNG, LNG, or dual-fuel CNG/gasoline vehicles of more than 100 vehicles in 2001: We Energies (676 vehicles), PG&E Corporation (648 vehicles), and NiSource (982 vehicles).

Two AFV projects reported for 2001 involved fuels other than natural gas and electricity.²⁰ Exelon Corporation reported using E-85 in 241 vehicles and propane in another 110 vehicles. Cinergy Corp. also reported the use of AFVs fueled by propane.

Reducing Vehicle Travel

Travel reduction, which includes such activities as carpooling and vanpooling, mass transit, telecommuting, and service efficiency improvements, was reported

for 21 projects for 2001—accounting for 29 percent of the direct reductions and 39 percent of the indirect reductions reported for transportation projects in 2001. One project was newly reported by Southern Company, which has developed programs to encourage carpooling, vanpooling, mass transit use, and telecommuting. In the Atlanta area, employees of Southern Company and its subsidiary, Georgia Power, can receive free monthly passes to ride the area mass transit system (MARTA), and carpoolers can receive free downtown parking. In Birmingham and Mobile, employees are encouraged to carpool or telecommute, especially on ozone alert days in the summer. These programs resulted in reported emission reductions of 6,040 metric tons carbon dioxide in 2001.

Of the 21 projects reported in the travel reduction category, 12 involved carpooling or vanpooling, 9 increased mass transit ridership, 3 reduced employee vehicle use through telecommuting, 2 increased service efficiency for freight or service vehicles, and 8 involved other actions, such as work week compression, videoconferencing, and use of bicycles for commuting and utility meter reading.²¹

The largest travel reduction project was reported by Public Service Enterprise Group for its employee carpooling, vanpooling, and mass transit programs, which reduced indirect emissions by a reported 8,048 metric tons carbon dioxide equivalent. Reductions of more than 5,000 metric tons carbon dioxide equivalent were also reported for the following travel reduction projects:

- LADWP reported on its employee carpooling and vanpooling program (7,086 metric tons of indirect reductions of carbon dioxide emissions).

Table 13. Emission Reductions Reported on Form EIA-1605 for Transportation Projects by Project and Reduction Type, Data Years 1994-2001
(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	20,989	48,213	8,753	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	13,059	34,052	33,053	2,068

Notes: Table excludes data from confidential reports.
Source: Energy Information Administration, Form EIA-1605.

²⁰Two other reporters resubmitted information on projects that involved consumption of propane and M-85 in previous years; however, the projects were inactive in 2001.

²¹The 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.

- TXU reported efforts to reduce fleet vehicle use (7,358 metric tons carbon dioxide equivalent of direct emission reductions and 1,871 metric tons carbon dioxide equivalent of indirect reductions).
- CLE Resources reported its investment, through the Edison Electric Institute's EnviroTech investment fund, in McHugh Software, a company that developed software to improve routing for service vehicles (6,163 metric tons of indirect carbon dioxide emission reductions).

Improving Vehicle Efficiency

Emission reductions were reported for only two of the five vehicle efficiency projects reported for 2001. The two projects, both of which involved the use of light-weight aluminum railroad cars to transport coal, were among the three largest reductions reported for transportation projects in 2001. Both projects resulted in indirect emission reductions, in that the locomotives using less fuel were owned by the railroads. Ameren Corporation reported reducing emissions by 29,630

metric tons carbon dioxide and Kansas City Power & Light Company reported reducing emissions by 22,275 metric tons carbon dioxide.

For another project—Arizona Portland Cement Company's use of more efficient haul trucks—a direct emission increase of 1,109 metric tons carbon dioxide was reported for 2001. Because of scheduling and mechanical difficulties, Arizona Portland Cement Company increased the use of its older, less efficient 85-ton capacity trucks in place of its newer, more efficient 100-ton trucks to haul quarried limestone.

CLE Resources, a subsidiary of Cleco Corporation, continued to report its investment (through the EnviroTech fund established by the Edison Electric Institute) in a company that developed and commercialized a device for monitoring and adjusting tire pressure on trucks to achieve optimal fuel efficiency. CLE Resources did not report emission reductions for this project, due to the unavailability of reliable data on the number of devices sold.