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# Voluntary Reporting of Greenhouse Gases 1997

**May 1999**

**Energy Information Administration**
Office of Integrated Analysis and Forecasting
U.S. Department of Energy
Washington, DC 20585

This publication is on the WEB at:
www.eia.doe.gov/oiaf/1605/vr98rpt/front.html.

# For More Information

Individuals or members of organizations wishing to report reductions in emissions of greenhouse gases under the auspices of the Voluntary Reporting Program can contact the Energy Information Administration (EIA) at:


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The EIA has both a long form (EIA-1605) and a short form (EIA-1605EZ) available, as well as an electronic version of the form. They are available upon request or on EIA's web site at www.eia.doe.gov/oiaf/1605/frntend.html.

General or specific technical information concerning the contents of this report may also be obtained by contacting the Voluntary Reporting Program.

# Preface

Title XVI, Section 1605(b) of the Energy Policy Act of 1992 (EPACT) directed the Energy Information Administration (EIA) to establish a mechanism for "the voluntary collection and reporting of information on . . . annual reductions of greenhouse gas emissions and carbon fixation achieved through any measures, including fuel switching, forest management practices, tree planting, use of renewable energy, manufacture or use of vehicles with reduced greenhouse gas emissions, appliance efficiency, methane recovery, cogeneration, chlorofluorocarbon capture and replacement, and power plant heat rate improvement . . . ."

The legislation further instructed EIA to create forms for the reporting of greenhouse gas emissions and reductions, and to establish a database of the information voluntarily reported under this subsection of EPACT. The reporting Forms EIA-1605 and EIA-1605EZ, "Voluntary Reporting of Greenhouse Gases," were first made available to the public in July 1995, providing a vehicle for voluntary reporting on activities that occurred before and during 1994. This publication summarizes data reported for 1997, the fourth year of data collection for the Voluntary Reporting of Greenhouse Gases Program.

The data reported to the program are available through several media. All nonconfidential reports received by the program are compiled into a public-access database, available either on CD-ROM or on a set of diskettes. The software is interactive and modular by design, allowing the user to select, view, and if desired print the reports filed by the voluntary reporters, for each year of their participation. Structured queries allow the user to access and print a variety of summary reports. The user can also connect to and query the database with Microsoft Access 2.0 or other software that supports 16-bit open database connectivity (ODBC).

The Public Use Database and the current reporting software are also available at the program's FTP (File Transfer Protocol) site on the World Wide Web at *ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom*. Interested parties are encouraged to visit the program's home page at *http://www.eia.doe.gov/oiaf/1605/frntvrgg.html* for more information and background on the program. Software, additional copies of this report, paper reporting forms, and technical support information can be obtained from the Voluntary Reporting of Greenhouse Gases Communications Center by e-mail at *infoghg@eia.doe.gov*, toll-free at 1-800-803-5182, or locally at 202-586-0688.

This report was prepared under the guidance of Mary J. Hutzler, Director of EIA's Office of Integrated Analysis and Forecasting. People who have made significant contributions to the program, the current software, and the preparation of this report include Stephen Calopedis, Margaret Carey, Laura Gehlin, William LaPerch, Chris Minnucci, Michael Mondshine, Richard Richards, and Arthur Rypinski.

Arthur T. Andersen, Director of EIA's International, Macroeconomic, and Greenhouse Gases Division, retired in March 1999 after more than three decades of Federal service. Among his numerous accomplishments, Dr. Andersen led the development of EIA's Voluntary Reporting Program from its inception in 1993. The authors would like to dedicate this publication, which would have doubtless been much improved by his editorial ministrations, to Arthur Andersen, with affection and gratitude.

EIA would also like to express special thanks to the voluntary reporters, without whom this program would be impossible.

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# Executive Summary

The Voluntary Reporting of Greenhouse Gases Program, required by Section 1605(b) of the Energy Policy Act of 1992, records the results of voluntary measures to reduce, avoid, or sequester greenhouse gas emissions. In 1998, 156 U.S. companies and other organizations reported to the Energy Information Administration that, during 1997, they had achieved greenhouse gas emission reductions and carbon sequestration equivalent to 166 million tons of carbon dioxide, or about 2.5 percent of total U.S. emissions for the year. For the 1,229 emission reduction projects reported, reductions usually were measured by comparing an estimate of actual emissions with an estimate of what emissions would have been had the project not been implemented.

Both the number of projects and the quantity of emission reductions reported have roughly doubled since 1994, and the number of organizations participating in the Voluntary Reporting Program has increased by 44 percent (Table ES1). Fifty-six of the organizations reporting in 1998 provided estimates of emissions and/or emission reductions for the entire organization. Sixty-five reporters recorded commitments to take action to reduce emissions in future years, mostly by the year 2000.

For the 56 organizations that estimated their total 1997 emissions, the combined total was 1.5 billion metric tons carbon dioxide equivalent, equal to about 23 percent of all U.S. emissions. Forty-nine of the 56 companies also estimated corporate-wide emission reductions in addition to (or instead of) the reductions reported for individual projects. The combined total reduction for the 49 companies was 128 million metric tons carbon dioxide equivalent.

The Voluntary Reporting of Greenhouse Gases Program is used as a registry by several U.S. Government-sponsored voluntary programs to limit greenhouse gas emissions, notably the Climate Challenge program for electric utilities and the Climate Wise program for manufacturers. Most (71 percent) of the reporters to the Voluntary Reporting Program were electric utilities, usually participants in the Climate Challenge program. Nonutility participants included manufacturers such as General Motors, IBM, Dow, Johnson & Johnson; facilities such as Alcan's Sebree aluminum plant and Motorola's Austin, Texas, integrated circuit fabrication plant; a coal company (Peabody Holdings); several operators and developers of landfill methane recovery projects; a trade association (the Integrated Waste Services Association); and private voluntary organizations, such as American Forests.

Some 360 of the projects reported in 1998 were related to the generation, transmission, or distribution of electricity. Another 273 were related to energy end use, 20 were cogeneration projects, and 62 were transportation projects. The energy-related projects accounted for about 79 percent of the total 166 million metric tons of emission reductions reported. The largest reductions were reported for projects that improved the performance of nuclear power plants.

Public interest in the Voluntary Reporting Program increased in 1998, in part because of growing awareness of climate change issues inspired by the signing of Kyoto Protocol and in part because of public interest in the concept of credit for early reductions. In October 1997, the White House announced that it favored offering "credit for early reductions" as a means to limit future U.S. greenhouse gas emissions. Generally, an early credit program would offer regulatory credit—in the form of "carbon allowances" against a future cap on greenhouse gas emissions—for organizations that take steps to reduce their emissions now. Neither "credits" nor "reductions" were defined, however, and the exact nature of such a program is a subject of ongoing debate

**Table ES1. Reporting Indicators for the Voluntary Reporting of Greenhouse Gases Program, Data Years 1994-1997**

| Indicator | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|
| Number of Entities Reporting | 108 | 142 | 149 | 156 |
| Number of Projects Reported | 645 | 967 | 1,038 | 1,229 |
| Number of Entity-Level (Organization-Wide) Reports Received | 40 | 51 | 57 | 56 |
| Project-Level Reductions Reported (Million Tons Carbon Equivalent) | 73.5 | 146.1 | 154.4 | 165.6 |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

among policymakers, interest groups, and private organizations.

In March 1999, Senators Chafee, Lieberman, Mack, and seven other Senators introduced S. 547, the "Credit for Voluntary Reductions Act," which among its other provisions would make it possible, subject to several conditions, for participants to receive "credit" for reductions reported to the Voluntary Reporting Program. In April, Senators Murkowski, Hagel, Byrd, and seven other senators introduced S. 882, which among its other provisions would modify Section 1605(b) of the Energy Policy Act to enhance recognition for reporters and to provide for revising the program's guidelines to improve the accuracy and reliability of reporting. Congressional consideration of these bills (and perhaps other approaches not yet introduced) may generate further interest in the experience of the Voluntary Reporting Program.

# 1. Voluntary Reporting of Emission Reduction Actions: An Overview

## Introduction

The Energy Policy Act of 1992 (EPACT) directed the Energy Information Administration (EIA) to develop a program to document voluntary actions that reduce emissions of greenhouse gases or remove them from the atmosphere (see box on page 2).[1] The Voluntary Reporting of Greenhouse Gases Program was developed in cooperation with the Office of Policy, U.S. Department of Energy (DOE), and with the U.S. Environmental Protection Agency (EPA). Voluntary reporting of emission mitigation initiatives can help identify innovative actions that can spur imitation and widespread replication.

To date, U.S. policy initiatives to promote progress toward the goal of stabilizing U.S. greenhouse gas emissions have emphasized voluntary approaches. President Clinton's Climate Change Action Plan sought to energize cooperative approaches to identify and implement actions that could reduce emissions of greenhouse gases.[2] In that spirit, an array of government/industry partnerships were formed to search for and pursue opportunities to mitigate greenhouse gas emissions. Most of the reporters to the Voluntary Reporting Program are affiliated with one or more government-sponsored voluntary programs.

This report presents information on the fourth reporting cycle of the Voluntary Reporting Program. The reports received in 1998 included information on emissions, emission reductions, and carbon sequestration activities through 1997. Reports were received from 156 volunteers describing 1,229 projects that either reduce greenhouse gas emissions or sequester carbon. The projects relate to emissions of carbon dioxide from energy production and use; methane and nitrous oxide emissions from energy use, waste management, and agricultural processes; emissions of a variety of halocarbons; and actions that increase carbon sequestration. Current reporters represent 18 different industries, as defined by the two-digit Standard Industrial Classification (SIC) code. Although most are electric utilities, representation from other sectors is significant and increasing, including large enterprises in the automotive, metals, mining, chemicals, petroleum, and computer industries.

This report is divided into seven chapters. This chapter provides an overview of participation in the Voluntary Reporting Program, a perspective on the composition of activities reported, and a review of some key issues in interpreting and evaluating achievements associated with reported emission mitigation initiatives. Chapters 2 through 6 provide a more detailed review of the variety of project-level emission reduction initiatives reported to the program. Chapter 2 examines projects in the electricity sector involving energy efficiency improvements in power production and distribution and reductions in the use of higher emitting carbon-based fuels. Chapter 3 considers improvements in end-use efficiency and fuel switching in the residential, commercial, industrial, and transportation sectors. Activities to improve or expand carbon sinks, notably through reforestation and afforestation, are the subject of Chapter 4. Emission reduction initiatives associated with methane and halogenated substances are examined in Chapters 5 and 6, respectively. Chapter 7 reviews emissions reports from participants who provided data on aggregate entity emissions. A total of 56 reporters, including most of the largest electric utilities in the United States, provided information on aggregate emissions or aggregate reductions. Appendixes provide information on the development and structure of the data collection instrument, a discussion of issues in the interpretation of the data, and summary lists of reporters and projects.

The reports submitted to EIA have been compiled into a database that can be obtained on CD-ROM by contacting the Voluntary Reporting of Greenhouse Gases Program Communications Center at 1-800-803-5182 or can be downloaded from EIA's World Wide Web site at *http://www.eia.doe.gov/oiaf/1605/ftphlp.html*.

[1]Title XVI of the Energy Policy Act, Public Law 102-486 (October 24, 1992), in Section 1605(a) called for an annual report on national aggregate emissions of greenhouse gases. EIA has issued the report—*Emissions of Greenhouse Gases in the United States*—every year since 1993. Section 1605(b) called for the establishment of a database on annual reductions of emissions as reported on a voluntary basis.

[2]U.S. Department of State, *Climate Action Report*, Publication 10496 (Washington, DC, July 1997), http://www.state.gov/www/global/oes/97climate_report/index.html.

**The Energy Policy Act of 1992, Sections 1605(b) and (c)**

**(B) Voluntary Reporting.—**

(1) ISSUANCE OF GUIDELINES.—Not later than 18 months after the date of the enactment of this Act, the Secretary shall, after opportunity for public comment, issue guidelines for the voluntary collection and reporting of information on sources of greenhouse gases. Such guidelines shall establish procedures for the accurate voluntary reporting of information on—

(A) greenhouse gas emissions—

(i) for the baseline period of 1987 through 1990; and

(ii) for subsequent calendar years on an annual basis;

(B) annual reductions of greenhouse gas emissions and carbon fixation achieved through any measures, including fuel switching, forest management practices, tree planting, use of renewable energy, manufacture or use of vehicles with reduced greenhouse gas emissions, appliance efficiency, methane recovery, cogeneration, chlorofluorocarbon capture and replacement, and power plant heat rate improvement;

(C) reductions in greenhouse gas emissions achieved as a result of—

(i) voluntary reductions;

(ii) plant or facility closings; and

(iii) State or Federal requirements; and

(D) an aggregate calculation of greenhouse gas emissions by each reporting entity.

Such guidelines shall also establish procedures for taking into account the differential radiative activity and atmospheric lifetimes of each greenhouse gas.

(2) REPORTING PROCEDURES.—The Administrator of the Energy Information Administration shall develop forms for voluntary reporting under the guidelines established under paragraph (1), and shall make such forms available to entities wishing to report such information. Persons reporting under this subsection shall certify the accuracy of the information reported.

(3) CONFIDENTIALITY.—Trade secret and commercial or financial information that is privileged or confidential shall be protected as provided in section 552(b)(4) of title 5, United States Code.

(4) ESTABLISHMENT OF DATA BASE.—Not later than 18 months after the date of the enactment of this Act, the Secretary through the Administrator of the Energy Information Administration shall establish a data base comprised of information voluntarily reported under this subsection. Such information may be used by the reporting entity to demonstrate achieved reductions of greenhouse gases.

**(C) Consultation.—**

In carrying out this section, the Secretary shall consult, as appropriate, with the Administrator of the Environmental Protection Agency.

## Who Reported?

Reports for the 1997 data year were received from 156 participants in 18 different industries or services. In comparison, reports for the 1994 data year were received from 108 participants in 9 different industries or services (Table 1). Most reporters were utilities actively involved in the production and distribution of electricity. Electric utilities accounted for 111 of the entities reporting in each of the last two reporting cycles; however, their share of the total reports received fell slightly, from 74 percent for 1996 to 71 percent for 1997 (Figure 1). Although the number of reporters from other industries remained relatively small, in many cases reports were received from key companies in those industries: for example, General Motors in the automotive products industry, Noranda and an operating division of Alcan in the metals industry, Peabody in the coal mining industry, BP America in the petroleum industry, and IBM in the electronic equipment industry. A complete listing of all reporters is provided in Appendix C, Table C1.

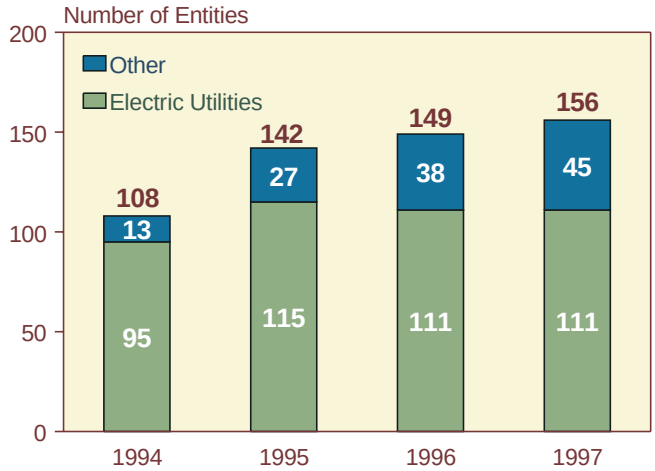
Most reporters indicated that their projects were affiliated with one or more government-sponsored voluntary programs. Of the 1,229 projects reported for 1997, 870 were affiliated with the Climate Challenge Program, 41 with the Climate Wise Recognition Program, 24 with EPA's Green Lights Program, 32 with the U.S. Initiative on Joint Implementation, 30 with the Landfill Methane Outreach Program, 18 with Energy Star Buildings, and 6 with the Natural Gas STAR Program. Other voluntary programs cited included Energy Star Computers,

**Table 1. Forms Filed by Standard Industrial Classification, Data Years 1994-1997**
(Number of Reports)

| SIC Code | Description | Data Year | | | |
|---|---|---|---|---|---|
| | | 1994 | 1995 | 1996 | 1997 |
| 08 | Forestry | 1 | 2 | 1 | 1 |
| 12 | Coal Mining | 1 | 2 | 2 | 1 |
| 27 | Printing and Publishing | 0 | 1 | 0 | 1 |
| 28 | Chemical and Allied Products | 1 | 3 | 2 | 2 |
| 29 | Petroleum Refining and Other Related Industries | 0 | 0 | 2 | 3 |
| 32 | Stone, Clay, Glass, and Concrete Products | 0 | 0 | 2 | 1 |
| 33 | Primary Metals | 2 | 2 | 4 | 4 |
| 34 | Fabricated Metal Products, Except Machinery and Transportation Equipment | 0 | 2 | 1 | 1 |
| 36 | Electronic Equipment | 1 | 1 | 2 | 4 |
| 37 | Transportation Equipment | 1 | 1 | 1 | 2 |
| 38 | Miscellaneous Manufacturing Industries | 0 | 1 | 1 | 0 |
| 49 | Electric, Gas, and Sanitary Services | 98 | 123 | 124 | 127 |
| 65 | Real Estate | 0 | 1 | 1 | 1 |
| 67 | Holding and Other Investment Offices | 0 | 0 | 1 | 1 |
| 82 | Educational Services | 1 | 2 | 2 | 2 |
| 86 | Membership Organizations | 0 | 0 | 0 | 1 |
| 87 | Engineering and Management Services | 0 | 0 | 2 | 2 |
| 88 | Private Households | 2 | 1 | 1 | 1 |
| 89 | Services Not Elsewhere Classified | 0 | 0 | 0 | 1 |
| **Total** | | **108** | **142** | **149** | **156** |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Figure 1. Electric Utilities and Other Entities Submitting Reports to the Voluntary Reporting of Greenhouse Gases Program, Data Years 1994-1997**




Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

Energy Star Transformers, the Voluntary Aluminum Industrial Partnership, Motor Challenge, WasteWi$e, the Coalbed Methane Outreach Program, and the Cool Communities Program. Not all participants in the various voluntary programs provided information to the Voluntary Reporting Program.

Twenty-seven entities that had filed reports in one or more of the previous reporting cycles did not report for 1997. Most of them had filed their reports on the short form (Form EIA-1605EZ), and they did not represent a significant proportion of the total emissions, emission reductions, or carbon sequestration reported.

## What Was Reported?

The data collection program for emission mitigation actions is highly flexible. At one extreme, participants can limit their reporting to a single project. At the other extreme, a report can include multiple projects placed in the context of the reporter's aggregate or "entity-level" emissions inventory.

Of the 156 reporters, 145 (93 percent) provided information on a total of 1,229 projects. A total of 56 reporters, including most of the largest electric utilities in the United States, submitted aggregate emissions or emission reduction data, and 11 reported only aggregate data, without providing specific information on mitigation actions (Table 2). The total number of projects reported increased by 191, or 18 percent, compared with the previous reporting cycle (Table 3). Most projects

**Table 2. Distribution of Projects by Reduction Objective and Project Type, Data Year 1997**

| Reduction Objective and Project Type | Number of Projects | Number of Reporters |
|---|---|---|
| **Reducing Carbon Dioxide Emissions** | **715** | **112** |
| Electricity Generation, Transmission, and Distribution | 360 | 90 |
| Cogeneration and Waste Heat Recovery | 20 | 14 |
| Energy End Use | 273 | 87 |
| Transportation and Offroad Vehicles | 62 | 37 |
| **Reducing Methane and Nitrous Oxide Emissions** | **100** | **44** |
| Waste Treatment and Disposal (Methane) | 79 | 30 |
| Agriculture (Methane and Nitrous Oxide) | 3 | 2 |
| Oil and Natural Gas Systems and Coal Mining (Methane) | 18 | 14 |
| **Carbon Sequestration** | **302** | **74** |
| **Halogenated Substances** | **30** | **21** |
| **Other Emission Reductions** | **82** | **53** |
| **Entity-Level Reporting (No Projects)** | **0** | **11** |
| **Total** | **1,229** | **156** |

Note: The total number of reporters is smaller than the sum of the numbers of reporters for each project type, because most reporters provided information on more than one project.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Table 3. Geographic Scope of Reports Received and Location of Emission Reductions Projects, Data Years 1994-1997**

| Geographic Scope | Reports Received | | | | Projects Reported | | | |
|---|---|---|---|---|---|---|---|---|
| | 1994 | 1995 | 1996 | 1997 | 1994 | 1995 | 1996 | 1997 |
| U.S. Only | 102 | 124 | 124 | 125 | 636 | 931 | 1,005 | 1,160 |
| Foreign Only | 2 | 2 | 1 | 1 | 9 | 36 | 33 | 69 |
| Both U.S. and Foreign | 4 | 16 | 24 | 30 | NA | NA | NA | NA |
| **Total** | **108** | **142** | **149** | **156** | **645** | **967** | **1,038** | **1,229** |

NA = not applicable.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

involve actions within the United States; however, some are foreign based, designed to test various concepts of joint implementation with other nations. Fifty-three of the 69 foreign projects represent shares in two forestry programs in Belize and Malaysia sponsored by the U.S. electric utility industry.

Most of the 1,038 projects reported for 1996 were also among the 1,229 projects reported for 1997, because they continued to yield emission reductions. Projects often yield emission reductions over an extended period of time; for example, an availability improvement project at a nuclear power plant typically involves the adoption of new maintenance and refueling programs that, once in place, are followed over a multi-year period. The project may even involve no new activity. The reforestation of an area in one year can result in the sequestration of carbon in many subsequent years, even if no additional trees are planted. Reporters continue to report the annual emission reductions and carbon sequestration achieved by such long-lived projects on a yearly basis.

About one-third of all the project activity relates to electricity generation, transmission, and distribution. About 250 projects improved power generation heat rates or reduced energy losses associated with transmission and distribution. Another 119 projects increased reliance on non-carbon or low-carbon fuels for generation. The largest reported emission reductions came from projects that improved the performance of nuclear power plants and thus reduced coal-fired generation. Other carbon-reducing projects used wind power or biomass for electricity generation.

Many projects (335) designed to reduce emissions from energy end use by both stationary and mobile sources were also reported, most of them by electric utilities. Projects affecting stationary sources include an array of demand-side management efforts to replace inefficient equipment and improve building shell integrity. Projects reported by industrial firms include motor drive replacement; integrated control of heating, cooling, and lighting systems; and cogeneration. Many utilities

reported multiple projects affecting both supply and consumption of energy.

Sixty-two projects affecting transportation fuel use were reported. Slightly more than half (53 percent) promoted substitution of alternative fuels for gasoline. Natural gas conversions were the most numerous. From an emission reduction perspective, the single largest project involved the replacement of conventional steel railroad cars used for transporting coal with lightweight cars made of aluminum, which reduced fuel consumption per ton of coal shipped. Also reported were projects that reduced the demand for transportation services, including a program at a printing concern which ensured that its delivery trucks were rerouted to pick up raw materials and supplies rather than returning empty; using videoconferencing to reduce travel between corporate facilities for meetings; and a variety of programs to reduce emissions associated with employee commuting, such as carpooling, vanpooling, and mass transit subsidies.

Among the remaining projects reported, those designed to improve carbon sinks were most numerous. A wide variety of forestry projects were identified. Of those undertaken in the United States, 20 percent involved urban tree planting, and 73 percent involved reforestation or afforestation. One or more such projects were undertaken in each of 44 States. Although utilities sponsored most of the projects, substantial activity was reported by a nonprofit organization. Sixty-one foreign forestry projects were also reported in nine different countries (Table 3).

A variety of efforts to reduce methane emissions and the emissions of other gases with high global warming potential were also reported. (For a discussion of global warming potential, see "What Are Greenhouse Gases?" on page 6.) One hundred projects to reduce methane emissions in 1997 were reported, with most (82 percent) capturing methane from waste in landfills, wastewater treatment, or animal husbandry. The recovered methane usually was burned to generate electricity. The largest methane reduction related to waste treatment was associated with a large waste diversion project reported by the Integrated Waste Services Association (IWSA) on behalf of 65 of the Nation's waste-to-energy facilities. IWSA estimated that, by burning rather than landfilling municipal solid waste, emissions of 145,000 metric tons of methane were avoided in 1997. Other projects reduced fugitive emissions from coal mining and natural gas production and delivery. The largest overall methane emission reduction was reported for a coal mine degasification project that eliminated 228,000 metric tons of emissions in 1997.

As shown in Table 4, projects having the principal objective of reducing carbon dioxide emissions accounted for most of the emission reductions (79 percent of the carbon dioxide equivalent) reported for 1997. Many achieved small reductions in emissions of other gases. For example, projects involving fuel switching to residual biomass fuels and those that involved recycling also reported reductions in methane that otherwise would have been emitted as a result of anaerobic decomposition of waste materials.

**Table 4. Summary of Project-Level Emission Reductions and Carbon Sequestration by Reduction Objective, Data Year 1997**
(Metric Tons Carbon Dioxide Equivalent)

| Gas | Reductions by Primary Project Objective | | | | Total Reductions |
|---|---|---|---|---|---|
| | Reduce Carbon Dioxide Emissions | Reduce Methane and Nitrous Oxide Emissions | Increase Carbon Sequestration | Reduce Emissions of High-GWP Gases | |
| Carbon Dioxide | 129,504,634 | 2,291,784 | 9,691,464 | 0 | **141,487,882** |
| Methane | 1,080,298 | 18,552,734 | 0 | 0 | **19,633,032** |
| Nitrous Oxide | 218,342 | 6,187 | 0 | 0 | **224,529** |
| PFCs | 3,910 | 0 | 0 | 3,669,730 | **3,673,641** |
| Other Gases | 0 | 0 | 0 | 556,345 | **556,345** |
| **Total** | **130,807,184** | **20,850,705** | **9,691,464** | **4,226,076** | **165,575,429** |
| CFCs, HCFCs | 0 | 0 | 0 | 80,864 | **80,864** |

Notes: Totals include all emission reductions reported. No attempt has been made to correct for double counting, where more than one entity has (or may have) reported on the same emission reduction project. "Other Gases" includes $SF_6$ and HFCs. CFCs and HCFCs are not included in the totals because of the uncertainty associated with estimates of their net global warming potential. Their direct warming effects (radiative forcing) are offset by indirect cooling effects (destruction of stratospheric ozone, another greenhouse gas). The values shown for CFCs and HCFCs reflect direct warming effects only.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## What Are Greenhouse Gases?

Many chemicals found in the Earth's atmosphere act as "greenhouse gases," which tend to be transparent to sunlight radiated largely in the visible and ultraviolet spectra but absorb infrared radiation (heat) that is radiated back into the atmosphere from the Earth's surface. This process traps the heat from sunlight at, or close to, the Earth's surface and significantly raises the average temperature of the planet. Many gases exhibit such "greenhouse" properties, including some that occur naturally in the atmosphere (water vapor, carbon dioxide, methane, and nitrous oxide) and an array of largely manufactured chemicals.

Other gases have so-called "indirect effects" on global warming, because they may contribute to the buildup or decomposition of other greenhouse gases in the atmosphere. For instance, some urban air pollutants (nitrogen oxides and nonmethane volatile organic compounds) react in the presence of sunlight to create ozone ($O_3$), which is also a greenhouse gas. Sulfur dioxide may have a net cooling effect by promoting cloud formation, while chlorofluorocarbons and hydrochlorofluorocarbons have a direct warming effect that is partially or fully offset by an indirect cooling effect caused by their propensity to destroy ozone in the stratosphere.

Atmospheric concentrations of several important greenhouse gases (carbon dioxide, methane, nitrous oxide, and most halogenated substances) have been increasing rapidly for many years. The growth in their concentrations is believed to be caused by human activities—particularly by the burning of fossil fuels and by deforestation. In recent years, some scientists and policymakers have become concerned that the atmospheric buildup of greenhouse gases may increase the share of the sun's heat retained in the atmosphere, which in turn may affect the Earth's climate in uncertain but potentially disruptive ways.

Some greenhouse gases are more effective in trapping reflected infrared radiation than others. Policymakers need to know on which gases their efforts should be concentrated, and scientists working with the Intergovernmental Panel on Climate Change (IPCC) have engaged in efforts to develop an index of the relative marginal heat-trapping capacities of various greenhouse gases. This index, called a "global warming potential" (GWP), is intended to measure the marginal direct radiative forcing potential of greenhouse gases. GWPs are calculated on the basis of the radiative forcing ability of a unit of carbon dioxide, which is set equal to 1, integrated over periods of 20, 100, and 500 years.

The IPCC periodically revises its GWP calculations. The table below shows the most recent (1995) 100-year GWPs for some of the most important greenhouse gases. The IPCC indicates that the typical uncertainty for these estimates is ±35 percent.

### Numerical Estimates of 100-Year Global Warming Potential Relative to Carbon Dioxide

(Carbon Dioxide = 1)

| Gas | 100-Year Global Warming Potential* |
|---|---|
| **Carbon Dioxide** | **1** |
| **Methane** | **21** |
| **Nitrous Oxide** | **310** |
| **Halogenated Substances** | |
| HFC-23 | 11,700 |
| HFC-32 | 650 |
| HFC-41 | 150 |
| HFC-43-10mee | 1,300 |
| HFC-125 | 2,800 |
| HFC-134 | 1,000 |
| HFC-134a | 1,300 |
| HFC-143 | 300 |
| HFC-143a | 3,800 |
| HFC-152a | 140 |
| HFC-227ea | 2,900 |
| HFC-236fa | 6,300 |
| HFC-245ca | 560 |
| Chloroform | 4 |
| Methylene Chloride | 9 |
| Perfluoromethane | 6,500 |
| Perfluoroethane | 9,200 |
| Perfluoropropane | 7,000 |
| Perfluorobutane | 7,000 |
| Perfluoropentane | 7,500 |
| Perfluorohexane | 7,400 |
| Perfluorocyclobutane | 8,700 |
| Trifluoroiodomethane | <1 |
| Sulfur Hexafluoride | 23,900 |

*The Kyoto Protocol to the Framework Convention on Climate Change adopted 100-year GWPs for the calculation of the carbon dioxide equivalence of greenhouse gases. The uncertainty of the GWP estimates is ±35 percent.

Source: Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996), p. 121.

Projects that capture and burn methane can also yield substantial carbon emission reductions. Such benefits accrue when captured methane displaces oil or coal as an energy source, or when reduced landfilling results in the release of less carbon dioxide from aerobic decomposition (in the presence of oxygen). Projects that reduced emissions of perfluorocarbons and sulfur hexafluoride also generated large reductions on a carbon dioxide equivalent basis. Overall, the 130 projects (11 percent) that focused on controlling emissions of gases other than carbon dioxide—excluding chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs)—were responsible for nearly 15 percent of the total carbon dioxide equivalent reductions reported. Despite the large reductions reported. No carbon dioxide equivalent reduction was calculated for CFCs and HCFCs because of the uncertainty associated with their net warming potential.[3] The carbon dioxide equivalent of the total emission reductions and carbon sequestration reported for all projects has more than doubled from 73.5 million metric tons in 1994 to 165.6 million metric tons in 1997 (Table 5).

## Voluntary Reporting and National Emissions Trends

Emission mitigation projects reported for 1997 indicate total reductions of 165.6 million metric tons carbon dioxide equivalent. An important question is whether the reported emission reductions can be reconciled with the total national emissions levels, which are rising at an annual rate of 50 to 100 million metric tons carbon dioxide equivalent.

In fact, the voluntary reporting database and the national emissions estimates reflect two different accounting frameworks. The national inventory calculates emissions based largely on energy consumption. Year-to-year comparisons thus reflect trends in energy production and consumption.

On the other hand, voluntary reporting data are not necessarily related to historical experience. Most reporters estimate emission reductions by comparison with a hypothetical baseline—what emissions would have been had the mitigation effort not been undertaken. Reporters can estimate reductions even for projects that involve new activities for which no historical records exist. Successful projects may only reduce the growth rate of emissions. Similarly, an entity whose customer base is growing may report reduction actions that only slow a rise in emissions. Thus, it is possible to observe both specific emission mitigation successes and rising levels of national emissions.

Several other factors complicate the interpretation of data on emission mitigation efforts. Many actions have both direct and indirect effects on emissions, and the scope of project accounting may ignore indirect increases associated with a project's implementation. Thus, the shutdown of a coal-fired power plant could save direct emissions for a reporter which, in some measure, might be offset if replacement power were supplied by a nonreporting emitter.

Even if a project is unambiguous in its effect, the responsibility for its implementation may not be. Is the entity capturing methane from a landfill the mitigating agent,

**Table 5. Summary of Project-Level Emission Reductions and Carbon Sequestration, Data Years 1994-1997**
(Metric Tons Carbon Dioxide Equivalent)

| Gas | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|
| Carbon Dioxide | 66,217,993 (R) | 118,634,468 (R) | 116,649,424 (R) | 141,487,882 |
| Methane | 3,197,079 (R) | 23,861,796 (R) | 34,015,736 (R) | 19,633,032 |
| Nitrous Oxide | 584,811 (R) | 200,752 (R) | 201,580 (R) | 224,529 |
| PFCs | 3,448,668 | 3,192,463 | 3,604,265 | 3,673,641 |
| Other Gases | 89,950 (R) | 208,850 (R) | -57,612 (R) | 556,345 |
| **Total** | **73,538,501 (R)** | **146,098,329 (R)** | **154,413,394 (R)** | **165,575,429** |
| CFCs, HCFCs, and Methyl Chloroform | 357,919 (R) | 20,467,843 (R) | 2,478,691 (R) | 80,864 |

(R) = revised.

Notes: Totals include all emission reductions reported. No attempt has been made to correct for double counting, where more than one entity has (or may have) reported on the same emission reduction project. "Other Gases" includes $SF_6$ and HFCs. CFCs and HCFCs are not included in the totals because of the uncertainty associated with estimates of their net global warming potential. Their direct warming effects (radiative forcing) are offset by indirect cooling effects (destruction of stratospheric ozone, another greenhouse gas). For the same reason, methyl chloroform has been excluded from the "Other Gases" category. The values shown for CFCs, HCFCs, and methyl chloroform reflect direct warming effects only. Totals may not equal sum of components due to independent rounding.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

[3]For a detailed discussion of the global warming potential of CFCs and HCFCs, see Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996).

or is it the utility that promises to purchase the methane as fuel (thereby justifying investment in recovery equipment)? Multiple sponsorship of individual projects can lead to double reporting of emission savings when *pro rata* contributions to project implementation cannot be readily identified and adjusted.

Still another consideration affecting interpretation of reduction reports relates to the selection bias inherent in voluntary reporting. Reporters participate in order to share data on successes. Many nonreporters may have successes to report as well. Even more important, however, is the fact that the nonreporters include organizations with no reductions or with increasing emissions of greenhouse gases.

How then does the voluntary reporting of emission mitigation efforts help to address the national problem of rising levels of greenhouse gas emissions? The establishment of an accounting framework for enterprises to assess emissions sources and options for reductions helps provide a new metric for decisionmakers reviewing the consequences of actions taken. Heightened awareness can set the stage for emission avoidance or mitigation. The program can help promote activism and innovation in the search for emission reduction strategies in at least three ways:

- *Replicating small projects on a large scale*. Many projects achieve modest emission reduction benefits individually, but are widely applicable. One major utility described how videoconferencing reduced employee travel between its various locations for meetings. Although the reduction in emissions resulting from the decrease in vehicle miles traveled was not extraordinary, if it were multiplied by even a fraction of the number of companies across the United States that are similarly geographically dispersed, a substantial aggregate benefit could be produced. By sharing information on such projects, voluntary reporting can promote replication of cost-effective emission mitigation measures.
- *Enhancing project scale through pooling of resources*. Organizational initiatives in which several participants pool resources can enhance the scale of the projects undertaken. For example, 40 different electric utilities are jointly sponsoring a forestry project in Belize that will enhance carbon sequestration through improved forest management techniques on 120,000 acres. Voluntary reporting promotes such collaborations by providing recognition to the participating companies.
- *Identifying reduction opportunities*. Through the accounting of emissions performance records necessary for voluntary reporting, reporters gain an understanding of the greenhouse gas emissions consequences of their activities, which enables them to identify the most cost-effective reduction opportunities. The realization that the global warming potential of sulfur hexafluoride is nearly 24,000 times that of carbon dioxide spurred at least one reporter to halve its emissions of this gas.

If the Voluntary Reporting of Greenhouse Gases Program assists in any of these dimensions, it will have made a useful contribution to national environmental objectives.

## Recent Policy Developments

The Kyoto Protocol to the Framework Convention on Climate Change, negotiated in December 1997, established binding national greenhouse gas emissions targets for 39 industrialized countries. (Although the United States has signed the Kyoto Protocol, it has not yet been submitted to the Senate for ratification, and the Protocol has not yet entered into force.) To meet the targets established under the Framework Convention on Climate Change, the Administration proposed to reward organizations taking early, voluntary action to reduce emissions.[4] Several groups have proposed alternative programs that would offer credits for early emission reductions.[5] In October 1998, the President's Council on Sustainable Development published a description of "principles" for a credit for early action bill.[6] In this year's State of the Union Address, President Clinton reaffirmed his support for rewarding companies that take early, voluntary action to reduce greenhouse gas emissions.[7]

The interest shown in the concept of credit for early action also stimulated increased interest in the Voluntary Reporting Program. During 1998, the U.S. General Accounting Office issued two reports based on the work of the Voluntary Reporting Program. The first was a

[4]Office of the Press Secretary, The White House, "Press Briefing by Chair of the National Economic Council Gene Sperling, Assistant to the President for International Economic Policy Dan Tarullo, Deputy National Security Advisor Jim Steinberg, Staff Secretary Todd Stern, Chair of Council on Environment Quality Katie McGinty, and Deputy Secretary of Treasury Larry Summers" (Washington, DC, October 22, 1997).

[5]Early reduction proposals issued by the Environmental Defense Fund, Coalition to Advance Sustainable Technology, Center for Clean Air Policy, Resources for the Future, and Niagara Mohawk Power Corporation were evaluated in Robert R. Nordhaus and Stephen C. Fotis, *Analysis of Early Action Crediting Proposals* (Washington, DC: Pew Center on Global Climate Change, October 1, 1998), http://www.pewclimate.org/report1.html.

[6]President's Council on Sustainable Development, Climate Task Force, *Principles for Early Action* (Washington, DC, October 1998).

[7]President William Jefferson Clinton, State of the Union Address, January 1, 1999 (White House Press Release).

summary presentation on the results of the program. The second was an analysis of some emissions accounting issues encountered by the Voluntary Reporting Program that may be relevant to the design of a credit for early reduction program.[8]

In October 1998, Senators Chafee (R-RI), Mack (R-FL), and Lieberman (D-CT) introduced a bill to authorize the President to enter into agreements to provide regulatory credit for voluntary early action to mitigate greenhouse gas emissions.[9] Senator Chafee reintroduced a modified version of the bill in early 1999 with several additional cosponsors.[10] The current bill proposes to provide credit, usable in a possible future domestic regulatory program that would limit greenhouse gas emissions, for voluntary actions taken before such a regulatory program comes into effect.

The proposed legislation provides that an "early action agreement" between the U.S. Government and an organization "may provide that a participant shall be entitled to receive" credits for reductions reported to the Voluntary Reporting Program for the period 1991-1998 if the report was received before January 1, 1999, and the reporter provided "information sufficient to verify, to the satisfaction of the President . . . that actions reported . . .

(A) have been accurately reported;

(B) are not double-counted; and

(C) represent actual reductions in greenhouse gases or actual increases in net carbon sequestration."[11]

On April 28, 1999, Senators Murkowski (R-AK), Hagel (R-ND), Byrd (D-WV), and seven other Senators introduced S. 882, the "Energy and Climate Policy Act of 1999." The bill contains several provisions. One section would amend Section 1605(b) of the Energy Policy Act to:

- Expand the list of statutory reportable actions under the program
- Enhance public recognition of reporters
- Direct the Department of Energy to conduct a review of the program's reporting guidelines with a view to improving the accuracy and reliability of reporting, and encouraging the participation of small businesses and farmers
- Require the Department of Energy to promulgate revised Voluntary Reporting guidelines within 18 months.

Consideration of these proposals by the 106th Congress may lead to other proposals or amendments.

[8]U.S. General Accounting Office, *Climate Change: Basic Issues in Considering a Credit for Early Action Program*, GAO/RCED-99-23 (Washington, DC, November 1998), http://www.gao.gov/AIndexFY99/abstracts/rc99023.htm.

[9]"Credit for Voluntary Early Reduction Act," S. 2617, 105th Congress (October 10, 1998), http://thomas.loc.gov.

[10]"Credit for Voluntary Reductions Act," S. 547, 106th Congress (March 4, 1999), http://thomas.loc.gov.

[11]"Credit for Voluntary Reductions Act," S. 547, 106th Congress (March 4, 1999), Section 5(d)(2), http://thomas.loc.gov.

# 2. Reducing Emissions from Electricity Supply

The electric utility sector produces more than 1.9 billion metric tons of carbon dioxide emissions per year—slightly more than one-third of all U.S. carbon dioxide emissions. Emissions result from the combustion of fossil fuels—coal, oil, and natural gas—during electricity generation. Coal, which accounts for 88 percent of utility emissions, is the primary energy source for U.S. electricity generation (about half the total) and has the highest emissions per unit of energy used. When it is burned, coal emits about 70 percent more carbon dioxide per unit of energy consumed than does natural gas.

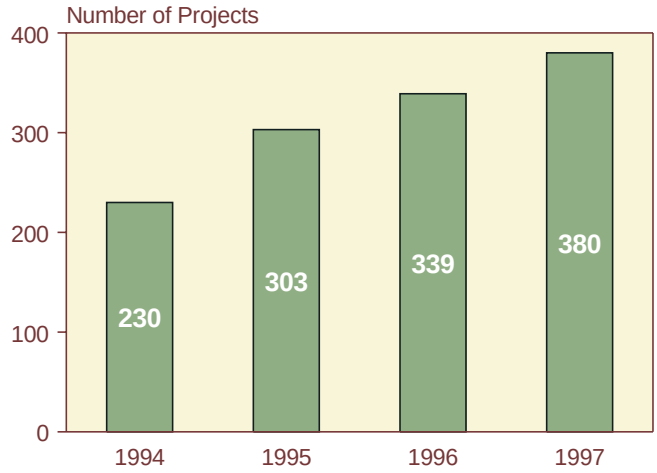
Between 1990 and 1997, carbon dioxide emissions from the utility sector[12] increased by 204 million metric tons or 11.6 percent—a trend that reflects U.S. economic growth and corresponding increases in energy consumption. Electric utility carbon dioxide emissions grew at a faster rate than total energy consumption, which increased by 9.9 percent between 1990 and 1997; however, both utility emissions and total energy consumption grew more slowly than the U.S. economy (18.5 percent).

## Overview of Projects Reported

Electricity supply projects are the most numerous reported to the Voluntary Reporting Program, accounting for 31 percent of all projects reported for 1997. Electricity supply projects include such actions as fuel switching, heat rate improvements, and reductions in the line losses associated with electricity transmission and distribution. A total of 380 electricity supply projects were reported by 104 different organizations, a 12-percent increase from the previous reporting year and a 65-percent increase from the first (1994) reporting cycle (Figure 2). Twenty-one new projects were reported as having been undertaken in 1997—a slight increase over 1996 (18 new projects reported) but a decline from previous years (49 new projects in 1994 and 44 in 1995).

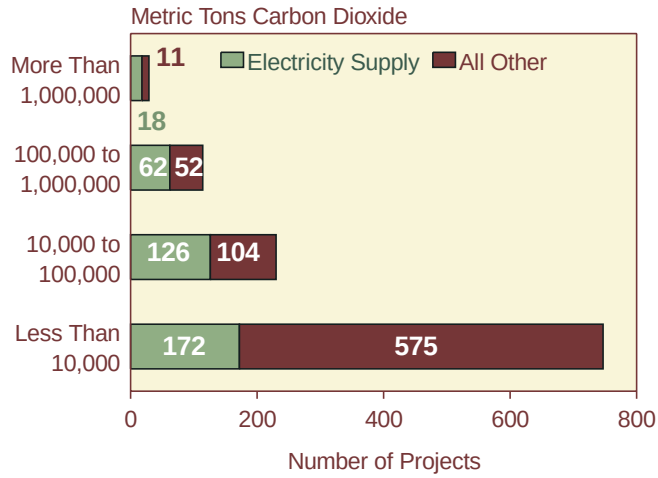
More than one-half of all electricity supply projects reported for 1997 achieved estimated carbon dioxide reductions in excess of 10,000 metric tons each. Of the 29 projects in the largest size category (more than 1 million metric tons of carbon dioxide reductions in 1997), 18 were electricity supply projects (Figure 3).

**Figure 2. Reported Electricity Supply Projects, Data Years 1994-1997**




Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Figure 3. Reported Electricity Supply Projects Compared to All Other Projects by Size of Reduction or Sequestration, Data Year 1997**




Note: The project sizes shown are only for reported carbon dioxide reductions. "All Other" includes only projects that reported carbon dioxide.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

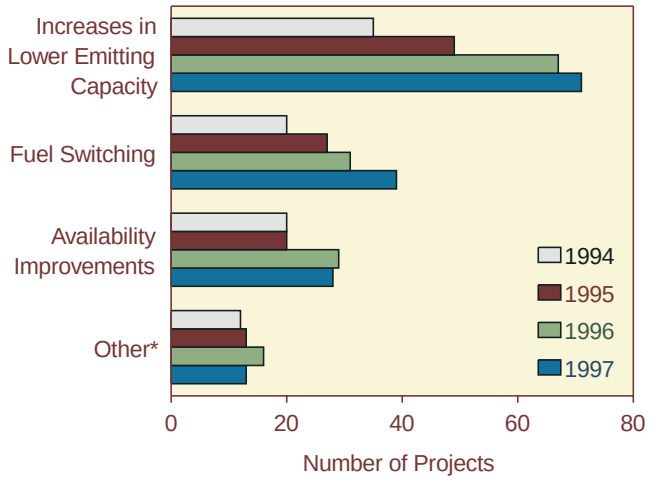
[12]Excluding independent power producers and cogeneration facilities.

Projects undertaken by the electric utility industry usually reduce emissions in one of two ways. They may displace higher emitting fossil fuels (e.g., coal) with lower emitting fuels (e.g., natural gas) or non-emitting energy sources (hydropower, geothermal, solar, wind, and nuclear). Or, by improving the efficiency of electricity generation, transmission, and distribution, they may reduce the quantity of fossil fuel used by power plants. The following sections consider these two groups of projects separately.

## Reducing the Carbon Content of Energy Sources

Fuel-switching projects, power plant availability improvements, and increases in low- or zero-emitting capacity typically reduce the amount of carbon consumed to generate a unit of electricity. A total of 151 such projects were reported for 1997 (Figure 4), including some of the largest projects reported to the Voluntary Reporting Program. It should be noted that some carbon content reduction projects are in fact "hybrids," combining efficiency improvements with measures such as availability improvements or increases in low-emitting capacity (see box on page 13 for definitions).

**Figure 4. Reported Carbon Content Reduction Projects by Type, Data Years 1994-1997**




*Other = decrease in high-emitting capacity and dispatching changes.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

### *Availability Improvements*

By increasing generation from lower emitting power plants, availability improvement projects provide a commensurate reduction in the amount of generation supplied by higher emitting plants. The number of availability improvement projects reported for 1997 was 28, one less than the 29 reported for 1996 (Figure 4). As has been the case in previous reporting years, availability improvement projects were once again among the most effective in terms of the magnitude of impact on carbon dioxide emissions. On average, availability improvements reduced carbon dioxide equivalent emissions by approximately 1.3 million metric tons per project in 1997.[13]

Availability improvement projects primarily reflect developments within the nuclear power industry. Of the 28 availability improvement projects reported, 17 involved nuclear power plants. Mainly through significant advances in operating, maintenance, and refueling procedures, capacity factors at nuclear plants were increased, displacing fossil-based power generation. Because nuclear power plants are invariably large baseload facilities, even a fairly small improvement in plant availability can lead to a sizable reduction in fossil fuel consumption.

Examples of specific actions taken to improve nuclear plant capacity factors include:

- Efforts by American Electric Power, Inc., to increase the availability of its nuclear units through an intensive program to reduce forced outage rates and shorten the downtime associated with the refueling cycle
- Efforts by Illinois Power Company to improve the availability of its Clinton Power Station by reducing forced outages and shortening the length of refueling outages.

### *Fuel Switching*

Thirty-nine fuel-switching projects were reported,[14] up from 31 in the previous reporting year and 27 in 1995. Twenty of the projects involved switching from coal to other fuel types. Fuels used in place of (or co-fired with) coal included natural gas, waste oil from transformers, wood waste, and fuel derived from discarded tires. Because coal is the highest emitting fossil fuel, switching from coal to other fuels lowers carbon dioxide emissions. For example, switching from bituminous coal to natural gas will reduce carbon dioxide emissions per unit of energy consumed by approximately 43 percent. Although other reported actions, such as switching from oil to gas, may not lead to reductions of the same magnitude, they too will reduce emissions. Average carbon

[13]Estimates of average reductions across reporters should be viewed with caution. Reporters may not calculate reductions in the same way, and multiple reporters may report on some of the same activities (if, for example, a project is undertaken jointly by two or more reporters). Averages are presented only to provide a rough indication of the relative sizes of different types of projects.

[14]Some of these projects were "hybrids," combining fuel switching with other project types.

dioxide emission equivalent reductions on the order of 87,000 metric tons per year were achieved as a result of the fuel-switching projects reported for 1997.[15]

The 39 reported fuel switching projects included a few new projects initiated in 1997. Illinois Power Company conducted a demonstration of the use of a new fuel, orimulsion, at its Hennepin power plant. Orimulsion is an emulsion consisting of 70 percent bitumen and 30 percent water, with fluid properties similar to those of residual fuel[16] and a carbon content of approximately 45 pounds per million Btu. The demonstration was conducted between September and November 1997. Although the project was undertaken primarily to control emissions of nitrogen oxide, the orimulsion displaced coal that would otherwise have been burned, and hence carbon dioxide emissions were also reduced by approximately 1,100 metric tons. The demonstration project has been completed, and Illinois Power is currently analyzing its technical and economic results.[17] The use of orimulsion may be resumed in the future as part of a nitrogen oxide emissions compliance strategy.

NIPSCO Industries also conducted a fuel-switching test at its generating station in Michigan City, Indiana. For the test, coal was co-fired with biomass (specifically, wood waste). Because biomass is a renewable fuel, the carbon it contains is considered part of the natural carbon cycle, and carbon dioxide released during its combustion does not add to atmospheric concentrations of carbon dioxide. NIPSCO conducted nine biomass co-firing tests over a 4-day period in September 1997. The resulting decrease in coal consumption reduced carbon dioxide emissions by approximately 1,300 metric tons. Although the initial tests were completed in 1997, NIPSCO subsequently began a long-term testing program involving three 30-day tests and, potentially, a 6-month test.[18]

Finally, Northern States Power Company converted two of the six combustion turbines at its Wheaton power plant in Wisconsin from oil to natural gas. Per British thermal unit (Btu) of energy produced, oil emits 27 to 33 percent more carbon dioxide than natural gas. The conversions at the Wheaton plant in the summer of 1997 resulted in a carbon dioxide emission reduction of approximately 1,100 metric tons. In addition, Northern States Power estimates that the project reduced nitrous oxide emissions by approximately 0.05 metric tons. Methane emissions increased slightly (0.2 metric tons) as a result of the project.

### Electricity Supply Carbon Reduction Projects: Definitions and Terminology

The combustion of fossil fuels to produce heat for electricity generation causes greenhouse gas emissions. In addition to substantial releases of carbon dioxide, fossil fuel combustion also emits small quantities of methane and nitrous oxide. Carbon content reduction projects typically reduce greenhouse gas emissions by replacing higher emitting fuels (such as coal) with cleaner burning fuels (such as natural gas) or non-emitting energy sources (such as nuclear power or renewables). Projects that reduce the carbon content of electricity supply include the following.

**Availability Improvements.** By reducing the frequency and length of planned and unplanned power plant outages, availability improvement projects can result in increased use of the affected plant. This is particularly true if the plant is a *baseload* plant (i.e., a plant that is generally used on an around-the-clock basis except during plant outages), but it may hold true for other types of plants as well. If the resulting increase in generation from the affected plant displaces generation that otherwise would have been produced by a higher emitting plant, emission reductions will result. Power plant utilization is measured by the plant's *capacity factor*, defined as the ratio of the average load on the plant over a given period to its total capacity. For example, if a 100-megawatt plant operates (on average) at 75 percent of capacity (i.e., at a load of 75 megawatts) over a period of a year, the plant's capacity factor is 75 percent.

**Fuel Switching.** The amount of carbon contained in fossil fuels and released in the form of carbon dioxide during combustion varies, depending on the type of fuel. Thus, carbon dioxide emissions from a power plant can be reduced by switching from a higher emitting fuel (such as coal) to a lower emitting fuel (such as natural gas).

**Increases in Lower Emitting Capacity.** By increasing the capacity of an existing lower emitting or non-emitting plant (e.g., a hydroelectric plant), or by constructing new generating capacity (e.g., wind turbines), a utility can reduce or avoid reliance on higher emitting plants. The result will be a reduction in greenhouse gas emissions from the displaced plants.

[15]This average excludes the effects of one fuel-switching project reported by Integrated Waste Services Association, a trade association which reported on the emissions impacts of U.S. waste-to-energy facilities on behalf of its members. Because this project covers numerous facilities and affects landfill methane emissions as well as power plant emissions, its associated emission reductions differ greatly from those of the other fuel-switching projects reported; therefore it was excluded from the average as being unrepresentative.

[16]Personal Communication with Jim Smithson of Illinois Power, March 17, 1999.

[17]Personal Communication with Jim Smithson of Illinois Power, March 17, 1999.

[18]Personal Communication with Patty Hus of NIPSCO, March 18, 1999.

### *Increases in Lower Emitting Capacity*

Projects involving the construction of new, lower emitting power plants or increases in the capacity of existing lower emitting plants were among the most numerous electricity supply projects reported. A total of 71 such projects were reported for 1997,[19] up from 67 reported for 1996 and 35 for 1994. Most involved the installation of new nuclear, renewable, and hydropower capacity, with essentially no greenhouse gas emissions; 7 projects involved additional natural-gas-fired capacity.

In general, most of the projects reported were either small additions to existing power plants or the opening of new plants, primarily small renewable plants. The emission reductions achieved therefore tended to be small in comparison with those for availability improvement projects. Two major exceptions involve the Browns Ferry and Watts Bar nuclear plants owned by the Tennessee Valley Authority (TVA). Browns Ferry Units 2 and 3, which had been shut down in 1985, were reopened in 1991 (Unit 2) and 1995 (Unit 3). The emission reductions resulting from their reopening increased steadily from about 3.5 million metric tons in 1991 to 9.3 million metric tons in 1995. In 1996, the first full year of operation for Unit 3, estimated emission reductions jumped to 15.8 million metric tons for the two units.

TVA's Watts Bar Nuclear Plant Unit 1, a new unit, began commercial service in March 1996. By displacing fossil-fired generation, Watts Bar reduced carbon dioxide emissions by 5.5 million metric tons in 1996 and 7.1 million metric tons in 1997. Although in 1996 TVA had projected total emission reductions from the Browns Ferry and Watts Bar projects at more than 16 million metric tons per year, actual reductions in 1997 were estimated at 22.9 million metric tons—equal to 1.2 percent of all carbon dioxide emissions from the U.S. electricity sector in 1997.

### *Other Carbon Reduction Projects*

Thirteen other carbon reduction projects were reported (down from 16 for 1996), including 9 projects involving decreases in higher emitting capacity and 4 involving changes in the dispatching of power plants. The demand for electricity is not constant but fluctuates according to such factors as time of day and season. Individual power plants are brought on line or taken off as demand fluctuates. The order in which power plants are used or dispatched is generally determined by economics; i.e., the plants that can be operated at the lowest cost are dispatched first, and the highest cost plants are last in the dispatch order. Changes in the dispatch order can reduce carbon dioxide emissions when lower emitting plants are moved up in the order and used more frequently.

As an example, Southern California Edison (SCE) reported three projects involving their purchase of electricity from independent power producers (IPPs). Because the IPPs generated the power using new (post-1990) renewables facilities (specifically, biomass, geothermal, and wind facilities), the power purchases effectively represented a change in SCE's dispatch order. Specifically, the renewable energy displaced SCE's marginal natural-gas-fired generating stations. It should be noted that the IPPs that generated the power were classified as "qualifying facilities" under the Public Utility Regulatory Policies Act of 1978 (PURPA). Under PURPA, electric utilities are required to purchase power from such qualifying facilities. SCE estimated that, in 1997, carbon dioxide emissions were reduced by about 500,000 metric tons as a result of the three dispatching projects.

The 1997 report from General Public Utilities Corporation (GPU) provides examples of projects involving decreases in higher emitting capacity. GPU reported the retirement of generating units at the oil/gas-fired Gilbert, oil/gas-fired Sayreville, coal-fired Front Street, oil-fired Werner, and coal-fired Williamsburg power plants as five separate projects. Total emission reductions for the five projects were estimated at 368,000 metric tons of carbon dioxide in 1997.

## Increasing Efficiency in Electricity Production and Distribution

Reported projects that improved the efficiency of electricity generation, transmission, and distribution were both more numerous and smaller than the other electricity supply projects reported. Efficiency improvement tends to be an ongoing effort by electric utilities, yielding a continuous stream of small, incremental improvements rather than one-time dramatic increases in efficiency. For example, heat rate improvement projects often are undertaken in response to normal plant deterioration. As power plants age, efficiency tends to erode gradually. Utilities seek to maintain heat rates by replacing old, worn-out equipment. Similarly, new energy-efficient transformers are often installed gradually over a period of years, as old transformers fail.

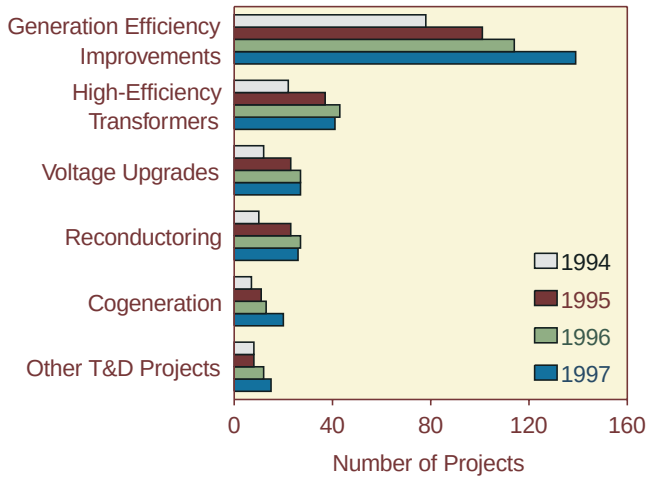
Although the impact of any one efficiency project on carbon dioxide emissions may be relatively small, their combined potential is significant. Consider, for example, electricity transmission and distribution. Among U.S. utilities, energy losses from transmission and distribution typically are in the range of 5 to 10 percent and average about 7 percent. The carbon dioxide emissions associated with the lost energy total about 127 million metric tons per year (based on the average fuel mix for the United States). Hence, a reduction of one percentage

[19]Some of these projects were "hybrids," combining capacity additions with other project types.

point in transmission losses for the United States as a whole would yield an annual reduction in emissions of 18 million metric tons. This is a sizable quantity, representing 0.9 percent of the total carbon dioxide emissions of U.S. electric utilities in 1997 and approximately two-thirds of the projected annual growth in utility emissions.[20]

A total of 272 efficiency improvement projects were reported for 1997, including some "hybrid" projects that combined efficiency improvements with measures such as availability improvements. Efficiency improvement projects fall into two main categories: (1) generation, involving efficiency improvements in the conversion of fossil fuels and other energy sources into electricity; and (2) transmission and distribution, involving improvements in the delivery of electricity from the power plant to the end user (see box on page 16 for definitions). For 1997, 159 generation projects and 113 transmission and distribution projects were reported (Figure 5).

**Figure 5. Reported Efficiency Improvement Projects by Type, Data Years 1994-1997**




Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

### *Generation Projects*

**Efficiency Improvements.** Improvements in generating efficiency are the most numerous type of efficiency project reported (Figure 5). A total of 139 such projects were undertaken in 1997,[21] up 22 percent from the number reported for 1996 and 78 percent from the number reported in the first (1994) reporting cycle. Heat rate improvements at coal-fired power plants are a particularly popular means of increasing efficiency and reducing emissions. The average carbon dioxide equivalent emission reduction per project was roughly 70,000 metric tons per year, making these projects somewhat larger than transmission and distribution projects but significantly smaller than the fuel switching, availability improvement, and other electricity supply carbon reduction projects discussed in the preceding section.[22] There are numerous opportunities for improving efficiency at existing power plants, but the efficiency gains—and hence reductions in fuel consumption and emissions—are limited by technology and tend to be small. Even in the context of long-established technologies (e.g., coal-fired steam plants) efficiency gains were reported for a wide range of projects. Reported heat rate improvements typically were between 0.5 and 2.5 percent.

New projects undertaken in 1997 provide some examples of the types of improvements made and the magnitude of the resulting efficiency gains:

- Western Resources, Inc., upgraded the boiler controls for Unit 3 at its Jeffrey Energy Center. The new control system is digital. Western Resources estimates that the new system improved the unit's heat rate by 0.5 percent and reduced its carbon dioxide emissions by nearly 8,000 metric tons.
- Entergy Services, Inc., replaced the high-pressure feedwater heater for Unit 1 at its White Bluff power plant, resulting in a 2-percent heat rate improvement and a carbon dioxide emission reduction of approximately 67,000 metric tons.

**Cogeneration.** A total of 20 cogeneration projects were reported this year—nearly three times the 7 reported in the first reporting cycle. The average carbon dioxide equivalent emission reduction resulting from cogeneration projects was about 170,000 metric tons in 1997, making cogeneration projects the largest of the various efficiency improvement projects but smaller than the electricity supply carbon reduction projects described in the preceding section.[23] Some of the industrial partners in the cogeneration projects include a grain processor, a greenhouse, a chemical plant, a food processing plant, and a steel mill. Eleven of the projects used

[20]Based on the reference case projection of carbon dioxide emissions in 2020 from EIA's *Annual Energy Outlook 1999*, DOE/EIA-0383(99) (Washington, DC, December 1998), Table A19, p. 136, http://www.eia.doe.gov/oiaf/aeo99/homepage.html. This projection assumes that carbon dioxide emissions remain unregulated.

[21]Some of these projects were "hybrids," combining efficiency improvements with other project types.

[22]Estimates of average reductions across reporters should be viewed with caution. Reporters may not calculate reductions in the same way, and multiple reporters may report on some of the same activities (see Appendix B). Averages are presented only to provide a rough indication of the relative sizes of different types of projects.

[23]Estimates of average reductions across reporters should be viewed with caution. Reporters may not calculate reductions in the same way, and multiple reporters may report on some of the same activities. Averages are presented only to provide a rough indication of the relative sizes of different types of projects.

## Efficiency Projects: Definitions and Terminology

### Generation Projects

It is neither theoretically nor practically possible to convert all the thermal or other energy produced by a power plant into electrical energy. In fact, much of the energy is lost rather than converted. Typically, U.S. steam-electric generating plants operate at efficiencies of about 33 percent, meaning that two-thirds of the thermal energy produced is lost. Some more advanced power plants have higher efficiencies, but even new combined-cycle plants (in which the waste heat from a gas turbine is recovered to produce steam to drive a turbine) typically have efficiencies of only 50 to 60 percent. Generation projects seek to improve power plant efficiencies either by reducing the amount of energy lost during the conversion process or by recovering the lost energy for subsequent application.

**Efficiency Improvements.** By increasing the efficiency of the generation process, efficiency improvement projects at fossil-fuel-fired power plants reduce the plants' *heat rate*, defined as the amount of fossil energy (measured in Btu) needed to produce each kilowatthour of electricity. The result is a reduction in the amount of fuel that must be burned to meet generation requirements, and hence a reduction in carbon dioxide (and other greenhouse gas) emissions. Efficiency improvements at nonfossil (e.g., hydroelectric) power plants can also reduce greenhouse gas emissions. Emission reductions occur if the efficiency improvement leads to an increase in the amount of electricity generated by the affected plant, with a consequent reduction in the amount of electricity that must be generated by other (fossil fuel) plants to meet demand.

**Cogeneration.** Only a portion of the heat generated during the combustion of fossil fuels can be converted into electrical energy; the remainder is generally lost. Cogeneration involves the recovery of thermal energy for use in subsequent applications. Cogeneration facilities typically employ either topping or bottoming cycles. In a *topping cycle*, thermal energy is first used to produce electricity and then recovered for subsequent applications. Topping cycles are widely used in industry as well as utility power plants that sell electricity and steam to customers. In a *bottoming cycle*, the thermal energy is first used to provide process heat, from which waste heat is subsequently recovered to generate electricity. Bottoming cycle applications are less common, usually associated with high-temperature industrial processes. Because cogeneration involves the recovery and use of thermal energy that would otherwise be wasted, it reduces the amount of fossil fuel that must be burned to meet electrical and thermal energy requirements, hence reducing greenhouse gas emissions.

### Transmission and Distribution Projects

The purpose of the electricity transmission and distribution system is to deliver electrical energy from the power plant to the end user. Resistance to the flow of electrical current in cables, transformers, and other components of the transmission and distribution system causes a portion of the energy (typically about 7 percent) to be lost in the form of heat. Improving the efficiency of the various system components can decrease such "line losses," reducing the amount of generation required to meet end-use demand and, thus, power plant fossil fuel consumption and greenhouse gas emissions.

**High-Efficiency Transformers.** Transformers, used to change the voltage between different segments of the transmission and distribution system, are a major source of system losses. Transformer losses occur as a result of impedance to the flow of current in the transformer windings and because of hysteresis and eddy currents in the steel core of the transformer. When existing transformers are replaced with high-efficiency transformers (including improved silicon steel transformers and amorphous core transformers), losses are reduced.

**Reconductoring.** Like transformers, conductors (including feeders and transmission lines) are a major source of transmission and distribution system losses. In general, the smaller the diameter of the conductor, the greater its resistance to the flow of electric current and the greater the consequent line losses. Reconductoring involves the replacement of existing conductors with larger diameter conductors.

**Distribution Voltage Upgrades.** Line losses are dependent, in part, on the voltage at which the various segments of the transmission and distribution system operate. Upgrading the voltage of any segment can reduce line losses.

natural-gas-fired cogeneration systems, one used coal, and the remainder used various other fuel types (such as blast furnace gas). Reported end uses of the thermal energy included electricity generation, process heat applications, and space heating/cooling.

Two new cogeneration projects were reported in 1997. One was reported by NIPSCO Industries, an investor-owned utility serving the northern Indiana region. NIPSCO's service territory includes the heavily industrialized vicinity of Gary, Indiana, long a steel-producing center. With National Steel as its partner, NIPSCO installed a steam turbine/generator, a heat recovery steam generator, two auxiliary boilers, and a water treatment system at its Portside Energy facility. The new gas-fired cogeneration system produces approximately 55 megawatts of electricity, displacing power that would otherwise have been produced by NIPSCO's coal-fired power plants. In addition, the project provides steam and hot water to National Steel, thus replacing the gas-fired boilers that were previously used for this purpose. Although the cogeneration system did not begin operating until September 1997, it nonetheless yielded an estimated emission reduction in excess of 50,000 metric tons of carbon dioxide.

Although begun in 1996, another cogeneration project was reported for the first time for 1997. The project, undertaken at the Bynov district heating plant in the Czech Republic, was actually reported by three different U.S. utilities—NIPSCO, UNICOM, and Wisconsin Electric Power Company—each of which provided an interest-free loan to finance the project in exchange for one-third of the project's emission reduction credits. The credits are to be awarded under the U.S. Initiative on Joint Implementation (USIJI), following annual certification of the emission reductions by the Czech Ministry of Environment. The project consists of a fuel switch from coal to gas at an existing cogeneration facility. Specifically, the lignite-fired boilers at the Bynov plant were replaced with highly-efficient natural gas engines. In addition, heat exchange equipment and an insulated heat distribution network were installed. The Bynov plant generates electricity as well as steam used for district heating in the city of Decin. In addition to the impact of the fuel switch, the project will reduce emissions by improving plant efficiency; it is expected that energy consumption will be cut by 30 percent as a result of efficiency gains. In 1997, each of the three U.S. partners in the project reported 2,654 metric tons as its share of the project's carbon dioxide emission reduction; hence, the total project reduction was equal to nearly 8,000 metric tons.

### *Transmission and Distribution Projects*

Transmission and distribution projects, although not as frequently reported as generation projects, were nonetheless reported in significant numbers. Reported transmission and distribution projects remained at 109 in 1997, a 20-percent increase from 1995 and a 100-percent increase from 1994 (Figure 5). Only one new transmission and distribution project was initiated in 1997. Unlike generation projects, which typically have discrete start and completion dates, efforts such as upgrading conductors and replacing transformers are ongoing activities by electric utilities. Consequently, most of the transmission and distribution efficiency improvements made in 1997 were reported as continuations of long-standing projects rather than as new projects.

In terms of average emission reductions, transmission and distribution projects typically are somewhat smaller than generation projects. There are numerous opportunities for improving efficiencies in the delivery of electricity, but the magnitude of the efficiency gains that can be realized is limited.

The three most frequently reported types of transmission and distribution projects were (1) high-efficiency transformers (including improved silicon steel and amorphous core transformers), (2) reconductoring (replacing existing conductors with large-diameter conductors to reduce line losses), and (3) distribution voltage upgrades (increasing the voltage at which the various segments of the system operate, to reduce line losses). Figure 5 shows the number of reported projects of each type. Installation of high-efficiency transformers was the most frequently reported. A total of 41 such projects were reported for 1997, down slightly from the 43 reported for 1996. Many of these projects were "hybrids," combining high-efficiency transformer installation with one or more other activities (e.g., reconductoring).

Twenty-six projects involving reconductoring and 27 projects involving distribution voltage upgrades (again often in combination with other activities) were reported. Fifteen projects were classified as "general" or "other" transmission and distribution by the reporters, up from 12 in 1996.

The sole new project undertaken in 1997, reported by Northern States Power Company, involved an upgrade at the company's Kohlman Lake Substation. Three 345-kilovolt breakers were installed at the substation, along with associated buswork and protective equipment. The project yielded an estimated reduction of about 10,000 metric tons of carbon dioxide in 1997.

### Reported Coal Ash Reuse Projects

Coal ash, a byproduct of coal combustion, continues to be a usable commodity for the electric utility industry. In 1997, 17.5 million metric tons, or 32 percent of total coal ash produced, were used in a wide range of applications.[a] The most conventional use of coal ash is as a replacement for portland cement in the manufacture of concrete. Concrete manufacturing is the largest industrial process source of carbon dioxide emissions, and using coal ash as a substitute material has become an environmentally and economically sound method of reducing carbon dioxide emissions. Half of the carbon dioxide reductions are the result of avoided liberation of carbon dioxide during the calcination of limestone; the other half are the result of avoided emissions from the combustion of kiln fuel. Electric utilities sell coal ash produced at their facilities to avoid landfill disposal costs and to meet increasing demand.

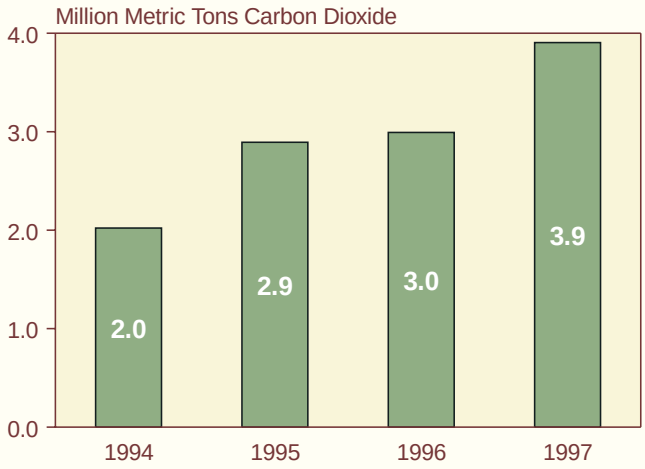
A total of 40 electric utilities reported 43 coal ash reuse projects in the 1997 data year, a 29-percent increase in the number of reporters and a 34-percent increase in the number of reported projects over the 1996 data year. The projects resulted in nearly 4 million metric tons of carbon dioxide reductions, a 30-percent increase over reductions reported for 1996, and contributed 3 percent of the total reported carbon dioxide emission reductions for the 1997 data year. More than 5 million metric tons of coal ash were reported to have been reused, equal to nearly 30 percent of the total coal ash reused nationwide in 1997.

Overall, reductions of carbon dioxide from coal ash reuse projects continued to increase (see figure). The largest reductions from coal ash reuse projects were reported by American Electric Power, Inc. (over 400,000 metric tons) and by Central and Southwest Corporation (over 300,000 metric tons). All the reported projects focused on the sale of coal ash as a substitute for portland cement in concrete manufacturing. Baltimore Gas and Electric Company and New England Electric System Company also suggested that reduced emissions could result from secondary effects, such as a reduced need to transport raw materials, although neither entity calculated the reductions from secondary effects.

Reporters used different emissions coefficients to estimate their carbon dioxide reductions, ranging from 0.8 to 1.0 ton of carbon dioxide released per ton of coal ash reused. The coefficients varied depending on the fuel used to fire the kilns, the proportion of coal ash used in cement, and the electricity used to grind raw materials. Other coefficients were derived using the ratio of the molecular weights of carbon dioxide and calcium oxide (the chemical compounds involved in the calcination of limestone) and the ratio of the specific gravities of coal ash and cement.

[a]Derived from American Coal Ash Association, *1997 Coal Combustion Product Production and Use*, http://www.acaa-usa.org.

### Reported Reductions from Coal Ash Reuse Projects, Data Years 1994-1997




Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## Federal Voluntary Programs for the Electric Utility Industry

Most of the electricity supply projects reported by the utility industry were undertaken at least in part to fulfill commitments made under various federally sponsored voluntary emission reduction programs. Many of the programs have their roots in the President's Climate Change Action Plan (CCAP), which identified nine specific action items aimed at reducing supply-side greenhouse gas emissions from the electric utility sector. The action items are designed to increase the use of natural gas, enhance the commercialization of renewable technologies, improve the performance of hydroelectric generating stations, and improve the efficiency of electricity transmission and distribution systems.[24]

As part of the last goal, the U.S. Environmental Protection Agency (EPA) has launched the Energy Star

[24]President William J. Clinton, *The Climate Change Action Plan* (Washington, DC, October 1993), Summary Table of Actions, Actions 23-31, http://www.gcrio.org/USCCAP/toc.html

Transformers program. Under this voluntary program, electric utilities enter into agreements with the EPA to purchase high-efficiency distribution transformers, and manufacturers commit to produce and market Energy Star distribution transformers. Six of the electricity supply projects reported to the Voluntary Reporting Program were Energy Star Transformer projects. In the area of renewables, the Renewable Energy Commercialization program of the U.S. Department of Energy (DOE) sponsors cost-shared pilot and demonstration projects with utility and industry partners. Renewable technologies covered by the program include geothermal, photovoltaics, wind, and biomass.

The cornerstone of the CCAP for electric utilities is the Climate Challenge program. Administered by DOE, Climate Challenge is a voluntary program in which electric utilities enter into formal agreements that spell out their commitments to reduce greenhouse gas emissions or sequester carbon. The contents of the formal accords vary from utility to utility. They may, for example, include commitments to stabilize overall greenhouse gas emissions at or below 1990 levels or commitments to undertake specific greenhouse gas reduction projects. In addition to the individual utility-DOE accords, the Climate Challenge program has spawned nine separate utility industry initiatives for collective action. Examples include the Earth Comfort Program, which has the goal of increasing annual sales of energy-efficient geothermal heat pumps; the Utility Forest Carbon Management Program and its affiliated nonprofit UtiliTree Carbon Company, which funds four domestic and international forestry projects; and the International Utility Efficiency Partnership. The other Climate Challenge collective initiatives include the Envirotech charter, the Combined Purchasing Initiative, EV America (electric vehicles), the Electric End Use Efficiency Technology Initiative, Tree Power, and the International Donated Equipment Initiative.

Climate Challenge participants are encouraged to report their emission reduction activities to the Energy Information Administration (EIA). The Climate Challenge program is designed to give individual utilities flexibility in identifying and pursuing the most cost-effective approaches to greenhouse gas reductions.[25] There are currently 124 participants in the Climate Challenge program, representing more than 71 percent of total U.S. electric generating capacity (excluding nonutility generators) and 71 percent of 1990 electric utility carbon dioxide emissions.[26] Most of the electricity supply projects reported to the EIA (89 percent of the total) were included in the reporters' Climate Challenge commitments.

[25]President William J. Clinton, *The Climate Change Action Plan* (Washington, DC, October 1993), Foundation Actions, Launch the Climate Challenge, http://www.gcrio.org/USCCAP/toc.html.

[26]Personal Communication with Larry Mansueti, Office of Utility Technologies, U.S. Department of Energy, March 1999.

# 3. Reducing Carbon Dioxide Emissions from Energy End Use

## Reducing Energy Demand at Stationary Sources

Energy use in the residential, commercial, and industrial sectors accounted for 3.7 billion metric tons of carbon dioxide emissions in 1997—about two-thirds of U.S. carbon dioxide emissions. Emissions from energy use included nearly 2 billion metric tons of carbon dioxide from the generation of electricity consumed by each of the three sectors. Industry was the largest of the three sectors in terms of emissions, accounting for nearly half the total; the residential sector accounted for about 28 percent of the total energy-related emissions from stationary sources, and the commercial sector contributed an additional 24 percent.[27]

Between 1990 and 1997, carbon dioxide emissions associated with industrial, residential, and commercial energy use increased by 10.1 percent. More than half the growth occurred in 1996 and 1997. The commercial sector is the fastest-growing emissions source, having registered a 14.7-percent increase in emissions between 1990 and 1997. Emissions from the residential sector increased by 13.2 percent over the same period, and industrial sector emissions rose by 6.3 percent. The upward trend in emissions for all three sectors reflects U.S. economic growth and corresponding increases in energy consumption, although end-use energy emissions grew at a slower rate than the U.S. economy.[28]

### Projects Reported

Energy end-use projects accounted for 22 percent of all projects reported to the Voluntary Reporting of Greenhouse Gases Program for 1997, third behind electricity supply and carbon sequestration in the number of projects reported. Eighty-seven entities reported energy end-use projects. Most (76) of them were utilities. Most of the other reporters were industrial companies including, for example, a printing company (Quad/Graphics, Inc.), a pharmaceutical company (Johnson & Johnson), an automobile manufacturer (General Motors), and an oil company (BP America).

Only 9 new energy end-use projects were reported as having begun in 1997, as compared with 9 in 1996, and 26 in 1994. The downward trend in new projects reflects the fact that most of the reported end-use projects are demand-side management (DSM) programs sponsored by electric utilities, usually introduced in the late 1980s and early 1990s. Most DSM projects reported in 1997 were established, ongoing programs. The decline in the total number of energy end-use projects reported for 1997 may indicate the beginning of a decline in utility-sponsored DSM activity (see box on page 23).

Carbon dioxide emission reductions reported for individual energy end-use projects ranged from less than 1 metric ton to more than 1 million metric tons, primarily because of the flexibility allowed in defining the scope of a project. Projects could range from the installation of a compact fluorescent light bulb reported by a household to a system-wide DSM program reported by a large utility. Nonetheless, like other project types, most energy end-use projects (86 percent) fell in the emission reduction range of less than 100,000 metric tons carbon dioxide equivalent (Figure 6). Thirty-one large projects yielded emission reductions between 0.1 and 1 million metric tons, and seven very large projects yielded reductions in excess of 1 million metric tons.

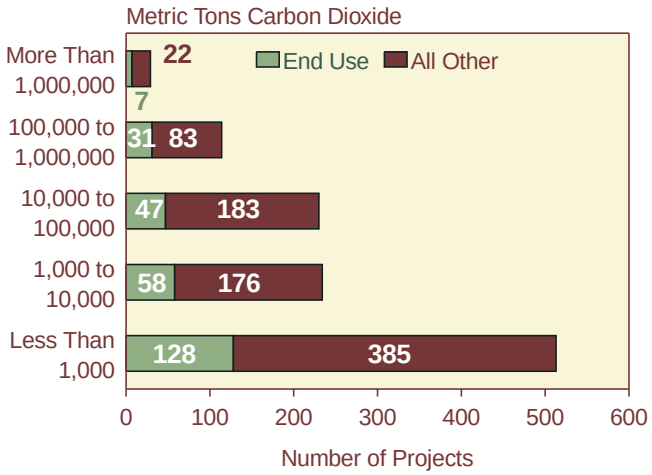
### Project Types

Most of the reported projects are "hybrids" that target multiple end uses, particularly, the DSM programs reported by electric utilities. Overall, the most frequent targets of end-use projects were lighting and lighting controls, equipment and appliances, and heating, ventilation, and air conditioning (HVAC) (Figure 7). Their prevalence reflects the importance of those three energy end uses in the United States. HVAC is the primary

[27]In terms of their contribution to overall energy-related carbon dioxide emissions in 1997, the industrial sector led with a 33-percent share of the total, followed by the residential sector (19 percent) and the commercial sector (16 percent). Transportation, which is considered in the next section of this chapter, accounted for the remaining 32 percent.

[28]Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998), pp. 15-21, http://www.eia.doe.gov/oiaf/1605/1605a.html.

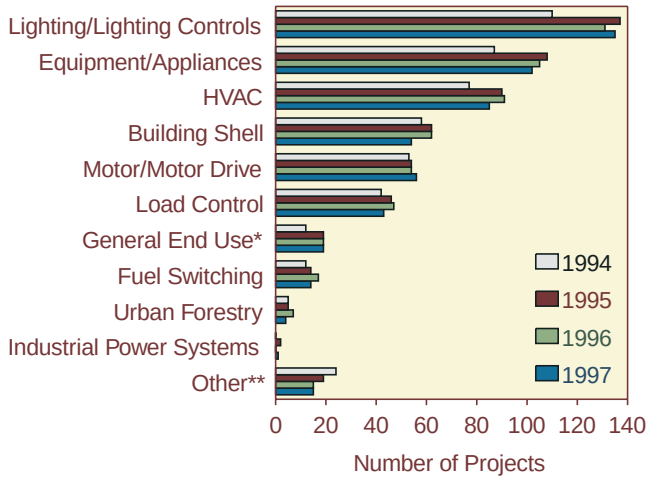
**Figure 6. Reported Energy End-Use Projects Compared to All Other Projects by Size of Carbon Dioxide Reduction or Sequestration, Data Year 1997**




Note: The project sizes shown are only for reported carbon dioxide reductions. "All Other" includes only projects that reported carbon dioxide.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Figure 7. Reported Energy End-use Projects by Project Type, Data Years 1994-1997**




*Includes projects reported on Form EIA-1605EZ that encompass more than one project type category. Since Form EIA-1605 requires reporters to identify each project type category encompassed by a project, the General End Use category is specific to Form EIA-1605EZ reporting.

**Includes all projects that cannot meaningfully be included in any of the standard project type categories.

Note: Some projects may be counted in more than one category.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

energy end use in the residential sector (where it accounts for about 58 percent of total energy use),[29] and in the commercial sector it accounts for 33 percent of total energy consumption.[30] Furthermore, the potential for reducing the amount of energy consumed by HVAC equipment is considerable. Consider, for example, that new homes (constructed between 1988 and 1993) use only 79 percent of the electricity consumed by old (pre-1988) homes for space heating and only 88 percent of the electricity used by old homes for air conditioning—in part because they are more likely to use high-efficiency HVAC equipment, such as heat pumps.[31]

Energy use for equipment and appliances accounts for 39 percent of the U.S. total in the residential sector and about one-fourth of the total in the commercial sector. Lighting is a less significant energy end use in the residential sector (about 3 percent of the total), but it is important in the commercial sector, where it accounts for 34 percent of total energy consumed.[32]

End-use projects in the residential and commercial sectors in 1997 outnumbered those in the industrial sector, which, in turn, greatly outnumbered agricultural projects (Figure 8). Fewer projects were reported for the residential and industrial sectors than in the previous reporting cycle, two more were reported for the commercial sector, and the number of agricultural projects reported was unchanged at 30. It should be noted that many projects—particularly, utility DSM programs—cover more than one end-use sector and are counted in each applicable sector.

Individual projects in the industrial sector yielded slightly larger carbon dioxide emission reductions than those in the commercial and residential sectors. Industrial sector energy consumption is used mainly for direct process applications, which account for more than half the energy used by the U.S. manufacturing sector.

[29]Estimated from data contained in Energy Information Administration, *Household Energy Consumption and Expenditures 1993*, DOE/EIA-0321(93) (Washington, DC, October 1995), http://www.eia.doe.gov/emeu/consumption/.

[30]Estimated from data contained in Energy Information Administration, *A Look at Commercial Buildings in 1995: Characteristics, Energy Consumption, and Energy Expenditures*, DOE/EIA-0625(95) (Washington, DC, October 1998), pp. 18-19, http://www.eia.doe.gov/emeu/consumption/.

[31]Energy Information Administration, *Household Energy Consumption and Expenditures 1993*, DOE/EIA-0321(93) (Washington, DC, October 1995), p. 15, http://www.eia.doe.gov/emeu/consumption/.

[32]Estimated from data contained in Energy Information Administration, *Household Energy Consumption and Expenditures 1993*, DOE/EIA-0321(93) (Washington, DC, October 1995), and *A Look at Commercial Buildings in 1995: Characteristics, Energy Consumption, and Energy Expenditures*, DOE/EIA-0625(95) (Washington, DC, October 1998), http://www.eia.doe.gov/emeu/consumption/.

### Utility Deregulation and Demand-Side Management Programs

Reporting of energy end-use projects has leveled off in the past 2 years. The number of end-use projects reported for 1997 increased only slightly (2 percent) and remained 1 percent below the 1995 high of 276 projects. Only 9 new end-use projects were reported as having begun in 1997 and 9 in 1996, down from 20 in 1995 and 26 in 1994. In contrast, reporting of other project types has doubled since 1994. The onset of deregulation of the electric utility industry may contribute to the slow growth in number of end-use projects reported.

Most of the energy end-use projects reported on Form EIA-1605 are demand-side management (DSM) programs sponsored by electric utilities. In the past, DSM programs have been supported by State public utility commissions as an alternative to the installation of new generating capacity. With deregulation of the electricity generation industry beginning in many States, however, utilities may be freed from their regulatory obligations to continue their DSM programs. Without regulatory impetus, utilities may lack an incentive to pursue the programs, inasmuch as DSM reduces demand for the utilities' product. Recent EIA data indicate that, although energy savings from DSM programs continue to grow, the rate of growth is on the decline. Between 1992 and 1993, total DSM energy savings achieved by U.S. utilities with annual sales of more than 120,000 megawatthours increased by 27 percent. In contrast, between 1995 and 1996 (the most recent year for which data are available), total DSM savings rose by only 8 percent. On the basis of projections reported to EIA by utilities, DSM energy savings are expected to grow by only 4 percent per year between 1997 and 2001.[a]

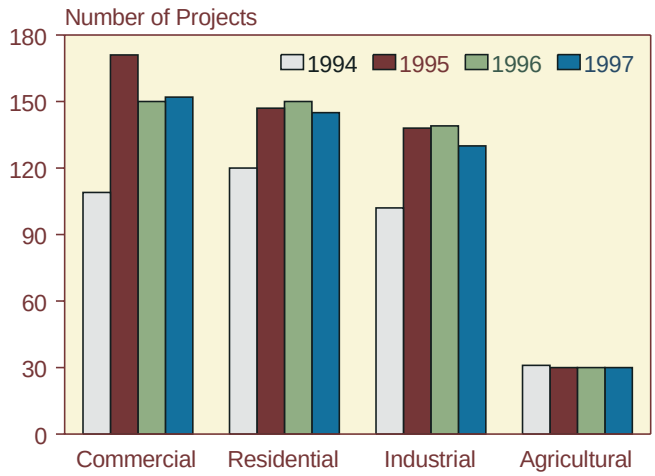
On the other hand, deregulation may lead to the development of competitive markets for DSM services. In a competitive electricity market, customers may be willing to pay for DSM programs designed to adjust energy usage in response to fluctuating electricity prices. Such programs might be offered by utilities as part of a package of services including electricity generation, as a means of retaining and expanding market share. Alternatively, energy service companies (ESCOs) might seek to fill the void left by cutbacks in utility-sponsored DSM services.

Some States are also using Public Benefit Funds to support DSM (along with renewable technologies and low-income support programs), financed through small surcharges collected from customers for each kilowatthour of electricity used.[b] Thus, while DSM energy savings are likely to grow at a slower rate in the future, they may continue to play a role in reducing energy consumption and greenhouse gas emissions.

[a]Energy Information Administration, *U.S. Electric Utility Demand-Side Management 1996*, DOE/EIA-0589(96) (Washington, DC, December 1997), p. 8, http://www.eia.doe.gov/cneaf/electricity/dsm/dsm_1996.html.

[b]Energy Information Administration, *Annual Energy Outlook 1999*, DOE/EIA-0383(99) (Washington, DC, December 1998), p. 15, http://www.eia.doe.gov/oiaf/aeo99/homepage.html.

**Figure 8. Reported Energy End-use Projects by Sector, Data Years 1994-1997**




Notes: Excludes energy end-use projects reported on Form EIA-1605EZ. Some projects may be counted in more than one category.

Source: Energy Information Administration, Form EIA-1605.

Process heating is the primary direct process application, accounting for more than one-third of the manufacturing energy use. Motors and motor drives are also an important industrial end use, however, with about a 13-percent share of total consumption.[33] Fifty-six projects involving motor and motor drive efficiency improvements were reported for 1997.

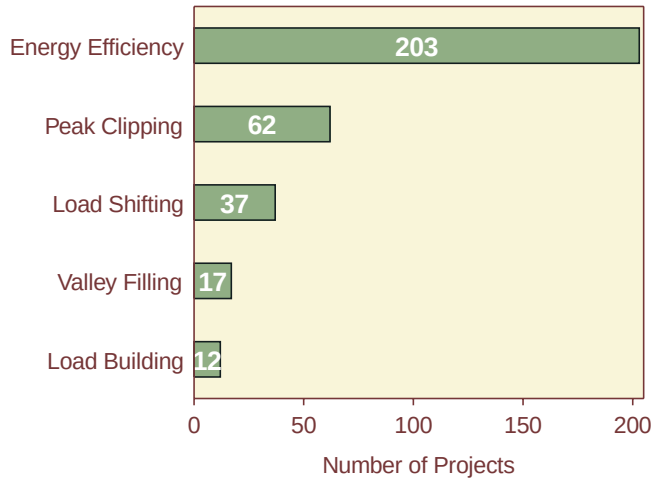
Many of the utility DSM programs reported on Form EIA-1605 have multiple load shape objectives (see box on page 24); however, simply improving energy efficiency is at least one of the objectives for a majority of the reported DSM programs (Figure 9). Peak clipping was the second most frequently reported load shape objective, and load shifting was the third.

## New Projects and New Reporters

Although relatively few in number, some new energy end-use projects were reported as having begun in 1997. Two reporters accounted for seven of the nine new

[33]Energy Information Administration, *Manufacturing Consumption of Energy 1991*, DOE/EIA-0512(91) (Washington, DC, December 1994), pp. 18-19, http://www.eia.doe.gov/emeu/consumption/.

**Figure 9. Reported Energy End-use Projects by Load Shape Objective, Data Year 1997**




Notes: Excludes energy end-use projects reported on Form EIA-1605EZ. Some projects may be counted in more than one category.

Source: Energy Information Administration, Form EIA-1605.

projects reported in 1997. Rochester Institute of Technology led the reporting with four new projects:

- A lighting project to replace magnetic ballasts and T-12 gold lamps with electronic ballasts and T-8 gold lamps in three buildings on the campus
- A project to replace 433 motors, used mostly for fan drives, with premium efficiency TECO motors
- An HVAC project to replace 26 constant air volume boxes with variable air volume (VAV) boxes
- A project to install variable-speed drives in campus buildings.

The Rochester Institute of Technology estimates the total carbon dioxide emission reductions resulting from its four projects at slightly over 900 metric tons in 1997.

The other primary reporter of new projects was CLE Resources, a subsidiary of Central Louisiana Electric that invests in energy demand reduction technologies. CLE Resources reported three projects undertaken in 1997:

- Investment in Active Power, a company that has developed a flywheel energy storage system. The system is designed to replace lead-acid batteries at commercial and industrial facilities with uninterruptible power supply systems. Active Power's flywheel storage system is rated at 100 kilovolt-amperes or higher. The system reduces greenhouse gas emissions by eliminating the need for electricity to cool lead-acid battery storage areas.
- Investment in OK Industries, a developer of industrial application technologies that improve process efficiencies and lower energy use, including fume extraction equipment, precision dispensing systems, and electronic lighting that increases the energy efficiency of solder/desolder equipment. In addition, OK Industries has developed electronic ballasts for use with fluorescent lighting systems and Metcal griddles that reduce energy consumption by 30 percent.
- Investment in Industrial Devices Corporation (IDC), a developer of motors, motor drives, and electromechanical motion control systems. IDC's products control the speed, force, position, and timing of a machine's movement and combine the mechanical, electronic, and software components into a single package.

CLE Resources estimates the total carbon dioxide emission reductions resulting from its three projects at 390 metric tons in 1997.

### Load Shape Objectives of Utility Demand-Side Management Projects

Utility DSM programs may have a number of different objectives beyond simply improving energy efficiency. Some DSM programs have the objective of altering load shapes. For example, programs aimed at peak clipping seek to reduce energy consumption at certain critical times, typically, when demand on the utility system is at its peak. Load shifting programs typically have the objective of shifting energy consumption from peak to off-peak periods. Overall energy consumption is not necessarily reduced by load shifting, but emission reductions may nonetheless occur, depending on the types of fuel used during peak and off-peak periods. For example, load shifting will reduce emissions if hydropower is used to meet baseload demand and natural-gas-fired generators are used as peaking units. Similarly, load building programs, which seek to increase electricity consumption (e.g., through the promotion of industrial electrotechnologies) may reduce emissions if the increased electricity use displaces higher emitting energy sources. Valley filling, which is aimed at increasing off-peak electricity consumption, may also reduce emissions, depending on the energy sources displaced.

## Federal Voluntary Programs To Increase End-Use Energy Efficiency

Most of the reported end-use projects were undertaken in conjunction with various Federal voluntary emission reduction programs. The President's Climate Change Action Plan (CCAP) includes 18 different action items aimed at reducing energy demand through efficiency

improvements and conservation. In the industrial sector, 7 action items seek to accelerate efficiency improvements in motors, compressors, pumps, fans, and process technologies, to promote source reduction and recycling (see box below), and to reduce the amount of energy used in the manufacture of fertilizers (by reducing fertilizer usage). In the commercial sector, CCAP includes 5 action items aimed at improving energy efficiency in commercial buildings, demonstrating emerging energy efficiency and renewable technologies, and providing the building industry with information and training on renewable and energy efficiency options. In the residential sector, 6 action items are designed to improve the efficiency of houses and home appliances.[34]

The Federal Government sponsors many programs aimed at reducing greenhouse gas emissions by lowering energy consumption. Some were created under the Climate Change Action Plan; others predate CCAP. Energy Star programs administered by the U.S. Environmental Protection Agency (EPA) seek to improve the efficiency of buildings and appliances through such

## The Role of Recycling in Reducing Greenhouse Gases

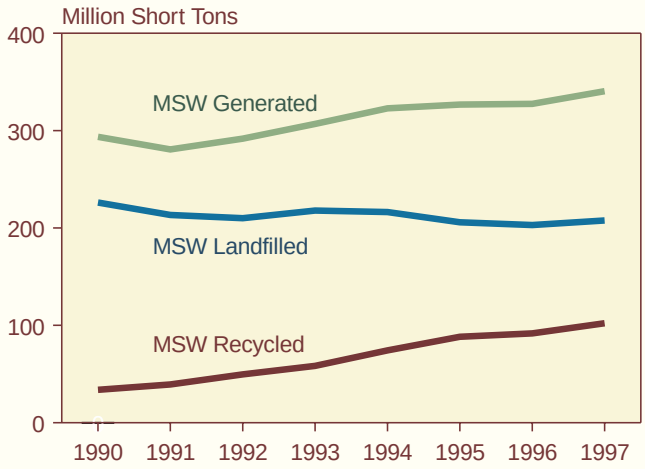
In the United States, recycling is second only to landfilling as a waste management technique. Since 1990, the amount of municipal solid waste (MSW) generated has grown by 16 percent. Meanwhile, the amount of recycled MSW tripled from 34 million short tons in 1990 to 102 million short tons in 1997 (see figure). In 1997, 30 percent of the total amount of MSW generated was recycled, compared with 11.5 percent in 1990. The percentage of MSW landfilled decreased from 77 percent in 1990 to 61 percent in 1997, while the percentage of incinerated MSW remained steady at around 10 percent. The growth of recycling has contributed to a 7-percent decrease in U.S. methane emissions from landfills since 1990. In addition, recycling can reduce emissions of other greenhouse gases by affecting energy consumption, carbon sequestration, and non-energy-related emissions from manufacturing processes.

Recycling projects reported to the Voluntary Reporting Program for 1997 were estimated to have resulted in the recycling of a total 162,770 metric tons of waste (less than 0.5 percent of the national total of MSW recycled). In terms of global warming potential, the reported recycling projects reduced about 364,000 metric tons carbon dioxide equivalent. Of the 19 entities that reported, only one—Quad/Graphics, a printing and publishing company—was not an electric utility. The gases reduced from reported recycling projects included carbon dioxide, methane, and perfluorocarbons (PFCs). Reported reductions of carbon dioxide from recycling projects totaled more than 306,000 metric tons. Reported PFC and methane reductions were nearly 4,000 and 49,000 metric tons carbon dioxide equivalent, respectively.

The greatest single emission reduction resulted from the waste paper reduction program reported by Quad/Graphics, which reduced the company's emissions by more than 102,000 metric tons carbon dioxide equivalent. Niagara Mohawk reported a 92-percent increase in emission reductions over the previous reporting year from its investment recovery project. GPU's recycling project was the most comprehensive, involving the recycling of a wide variety of materials, including asphalt, cement, treated wood, motor oil, and batteries in addition to paper and scrap metal. Most of the reported recycling projects involved paper recycling. Other waste diversion projects are described in Chapter 4 of this report.

In 1998, EIA and the U.S. Environmental Protection Agency's Office of Solid Waste introduced a worksheet and lookup tables for estimating greenhouse gas reductions from source reduction or recycling of selected materials. The worksheet was cited in the Estimation Methods section for 11 reported projects.

### U.S. Municipal Solid Waste Generated, Landfilled, and Recycled, 1990-1997




Source: "Biocycle Nationwide Survey: The State of Garbage," *Biocycle* (April 1998), Table 2, p. 36.

[34]President William J. Clinton, *The Climate Change Action Plan* (Washington, DC, October 1993), "Summary Table of Actions," http://www.gcrio.org/USCCAP/toc.html.

means as certifying equipment that meets EPA specifications with the Energy Star label. The Energy Star programs include Energy Star Buildings, Energy Star Homes, Energy Star Exit Signs, Energy Star Office Equipment, and Energy Star Residential Heating and Cooling. Eighteen Energy Star Building projects and one Energy Star Computer project were reported to the Voluntary Reporting Program for 1997.

The analog of the Climate Challenge program within the industrial sector is the Climate Wise Recognition Program, jointly supported by the U.S. Department of Energy (DOE) and EPA. Participating companies enter into agreements to reduce greenhouse gas emissions. Specifics of the agreements vary for each participant, but they may, for example, include commitments to undertake specific emission reduction projects, or to reduce overall company emissions to 1990 levels. Current participants include DuPont, General Motors, Johnson & Johnson, and Quad/Graphics, among others. Climate Wise companies are encouraged to report on Form EIA-1605. Twenty-six of the energy end-use (i.e., residential, commercial, and industrial) projects reported for 1997 were Climate Wise projects, and 191 (70 percent of the total) were Climate Challenge projects. The dominance of Climate Challenge projects reflects the fact that the majority of energy end-use projects were reported by electric utilities.

Other voluntary programs include:

- DOE's Building America program, which is aimed at researching and testing systems engineering approaches to improving the energy efficiency of residential buildings (project funding is 50 percent cost-shared with industry participants)
- DOE's Cool Communities program, which encourages the use of lighter wall and roof colors and the planting of shade trees around buildings, through technical assistance and education
- DOE's Rebuild America program, under which participating communities agree to develop and implement action plans for energy-efficient retrofits of existing buildings
- DOE's Energy Efficiency and Renewable Energy Information and Training programs, which are aimed at the building industry
- DOE's Energy Fitness program, which seeks to identify and remove barriers (e.g., information barriers) to increasing the delivery of energy-efficient technologies to energy service companies
- EPA's Green Lights program, under which participants commit to surveying their facilities and upgrading their lighting where profitable within 5 years (24 Green Lights projects were reported to the Voluntary Reporting Program for 1997)
- DOE's Energy Analysis and Diagnostic Centers
- DOE's Motor Challenge program, under which industrial participants showcase energy-efficient motor systems installed with technical assistance from DOE and EPA (10 projects reported)
- The NICE$^3$ Industrial Pollution Prevention Grants program (jointly sponsored by DOE, EPA, and the Department of Agriculture), which provides grants to prevent pollution and improve energy efficiency
- EPA's Waste Wi$e program, which encourages businesses and State, local, and tribal governments to reduce waste through waste prevention, collection of recyclables, and the purchase of recycled products.

# Reducing Transportation Fuel Use

## Overview

A total of 62 transportation projects were reported for 1997 by 37 entities, all but three of which were electric utilities or, in the case of CLE Resources, a subsidiary of an electric utility. The three others were an automobile manufacturer (Volvo Cars of North America, Inc.), a printing company (Quad/Graphics, Inc.), and a household. Detailed information was provided for 53 (85 percent) of the projects on the long form (Form EIA-1605). Summary information for the remaining 9 projects was reported on the short form (Form EIA-1605EZ). Forty-seven (76 percent) of the projects reported for 1997 were affiliated with either the Climate Challenge or Climate Wise program.

Table 6 shows the trends in the number of projects and emission reductions reported for transportation projects in the first four reporting cycles of the Voluntary Reporting Program. As in previous reporting cycles, the projects reported for 1997 fell into three broad categories:

- Alternative fuel use (33 projects or 53 percent)
- Travel reduction (22 projects or 35 percent)
- Vehicle efficiency improvements (8 projects or 13 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 4 projects. For 7 of the 62 projects reported, either reductions did not occur in 1997 or they were not estimated. The total carbon dioxide

**Table 6. Number of Projects and Emission Reductions Reported for Transportation Projects by Project Type, Data Years 1994-1997**

| Project Type | Number of Projects | | | | Emission Reductions (Metric Tons Carbon Dioxide Equivalent) | | | |
|---|---|---|---|---|---|---|---|---|
| | 1994 | 1995 | 1996 | 1997 | 1994 | 1995 | 1996 | 1997 |
| Vehicle Efficiency | 2 | 6 | 7 | 8 | 6,729 | 54,285 | 57,250 | 68,272 |
| Travel Reduction | 9 | 19 | 18 | 22 | 594 | 20,248 | 20,531 | 54,202 |
| Alternative Fuels | 22 | 25 | 33 | 33 | 13,047 | 12,396 | 17,255 | 18,660 |
| **Total** | **33** | **50** | **57** | **62** | **21,280** | **86,930** | **95,036** | **141,134** |

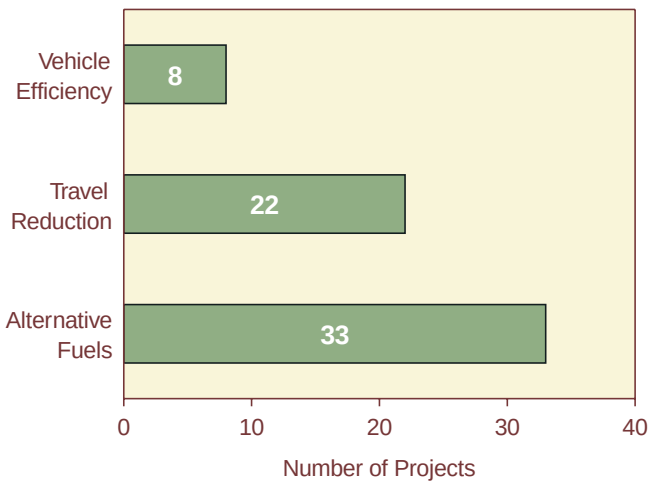
Note: Project totals may not equal sum of components because projects may be counted in more than one category. Emission reductions totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

equivalent emission reductions in 1997 reported for the remaining 55 transportation projects was 141,134 metric tons, an increase of 49 percent over the total reported for 1996 and more than six times the 21,280 metric tons reported in the first (1994) reporting cycle. Leaving aside 3 projects that were reported in 1995 but not again until 1997, reported reductions increased by about 16,891 metric tons (18 percent) between 1996 and 1997.[35] Large increases in emission reductions were also reported for 4 efficient vehicle projects involving aluminum coal cars and for a vehicle use reduction project conducted by Texas Utilities, with a combined increase of 10,486 metric tons of emission reductions in 1997 over those reported for 1996.

Slightly more than half (53 percent) of the projects reported for 1997 involved alternative fuel vehicles. Although reductions achieved by individual projects were small, these initiatives in total accounted for about 13 percent of the reported transportation in 1997 (Table 6). Vehicle efficiency projects tend to have larger effects individually. The eight projects reported in this category accounted for nearly half (49 percent) of the estimated 1997 emission reductions for transportation. Six projects involving freight transportation accounted for 62 percent of the carbon dioxide emission reductions reported for 1997. On average, freight transportation projects reduced emissions by about 14,660 metric tons, nearly 14 times the average reduction achieved for measures involving passenger travel. The number and mean size of transportation projects reported for 1997 are summarized in Figure 10 and Figure 11, respectively.

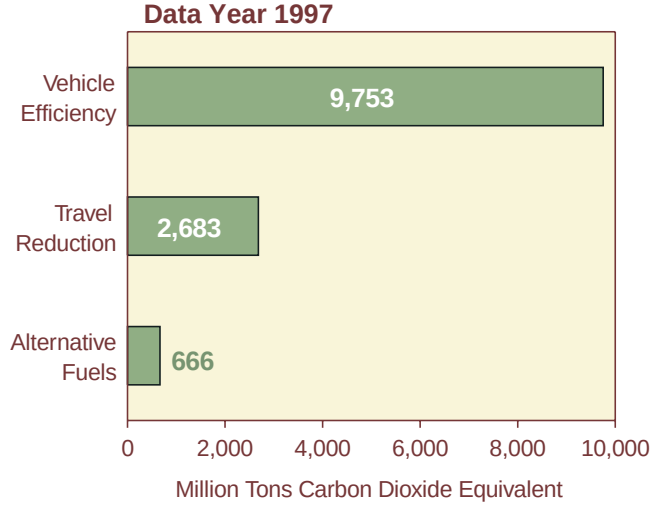
The level of activity necessary for passenger travel projects to reduce emissions by more than 100 metric tons of carbon dioxide is substantial. For example, to achieve a reduction in carbon dioxide emissions of 147 metric tons

**Figure 10. Number of Transportation Projects by Type, Data Year 1997**




Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Figure 11. Mean Emission Reductions for Transportation Projects by Type, Data Year 1997**




Note: Mean emission reductions reflect only those projects for which estimates were reported.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

[35]Quad / Graphics, Inc., a printing company that first reported for 1995, reported again for 1997, providing data for both 1996 and 1997. Emission reductions resulting from the reported travel reduction efforts were the largest reported for this type of project.

in 1997, Baltimore Gas & Electric Co. (BG&E) undertook large-scale fuel switching, converting a fleet of 188 vehicles to compressed natural gas instead of gasoline. Although individual transportation initiatives may produce only modest emission reductions, many of the projects reported to the program have wide applicability and could significantly reduce national carbon dioxide emissions if they were duplicated by other companies.

## Using Alternative Fuels

Alternative fuel vehicle projects involved a variety of fuels, including natural gas, electricity, propane, and M-85 (a blend of 85 percent methanol and 15 percent gasoline). More than 95 percent of the reductions associated with alternative fuels were attributed to vehicles using natural gas. Fifteen projects included the operation of electric vehicles. Thirteen were exclusively electric vehicle projects. The emission reductions reported for electric vehicle projects in 1997 were relatively small (about 2 percent of the total for alternative fuel vehicles), because all but one were research or pilot programs involving one or two vehicles. The exception was Los Angeles Department of Water and Power (LADWP), which operated 36 electric vehicles in 1997. LADWP estimated that use of the vehicles reduced carbon dioxide emissions by a net 6.1 metric tons, which reflects a fuel-cycle analysis that considered the increased emissions associated with the generation of electricity used by the electric vehicles as well as the reduced emissions associated with avoided gasoline consumption. At least three alternative fuel vehicle projects also included infrastructure improvements, such as the deployment of refueling stations for natural gas vehicles.

Three projects were oriented toward research, development, and demonstration. The Southern Company conducted or sponsored a range of research, development, and demonstration activities, including participation in the United States Advanced Battery Consortium, the Electric Power Research Institute's Electric Transportation Business Unit, and the Electric Vehicle Research Network. Southern Company reported that activities involving the demonstration of electric vehicle technology reduced carbon dioxide emissions by 186 metric tons in 1997. Public Utility District No. 1 of Snohomish County reported its sponsorship of an annual battery- and solar-powered boat race and an electric car race; however, it did not report emission reductions for those activities.

## Reducing Vehicle Travel

Travel reduction accounted for 38 percent of the total reduction in carbon dioxide emissions reported for transportation projects for 1997, up from 3 percent for the first year of reporting (1994). Of the 22 travel reduction projects reported, 15 involved employee commute reduction programs, including carpooling, vanpooling, increased use of mass transit, compressed work weeks, and subscription bus service. Six of the seven remaining projects focused on reducing employee travel on company business. The largest of these projects was Texas Utilities Electric Company's efforts to reduce its use of fleet vehicles, which resulted in a reported reduction of 10,255 metric tons of carbon dioxide emissions in 1997.

Two utilities reported on videoconferencing projects that have reduced corporate travel. GPU, Inc., implemented a videoconferencing system in 1991 that reduced employee travel by nearly 2 million miles between 1991 and 1997. Cooperative Power Association used videoconferencing to eliminate employee airline travel, reducing carbon dioxide emissions by an estimated 42 metric tons in 1997.

The largest travel reduction project, reported by Quad/Graphics, involved ensuring that delivery vehicles were diverted to pick up raw materials and supplies on return trips from delivering printed materials to customers. Quad/Graphics estimates that the project reduced carbon dioxide emissions by nearly 20,000 metric tons in 1997, representing 36 percent of the total for all the travel reduction projects reported.

## Improving Vehicle Efficiency

Eight projects involving vehicle efficiency improvements were reported, five of which claimed relatively large carbon dioxide emission reductions (more than 5,000 metric tons) in 1997. Four Midwestern utilities reported the use of aluminum railroad cars to transport coal to their plants. UNICOM reduced 1997 carbon dioxide emissions by more than 20,000 metric tons. Substantial reductions were achieved by three other utilities using aluminum coal cars: Kansas City Power & Light (14,880 metric tons), Western Resources, Inc. (13,898 metric tons), and Union Electric Company (14,052 metric tons). CLE Resources, a subsidiary of Central Louisiana Electric Company, reported its investment in a company that developed and commercialized a device for monitoring and adjusting tire pressure on trucks to achieve

### Legislative Initiatives May Increase Future Consumption of Alternative Transportation Fuels

The U.S. transportation sector emitted 1.7 billion metric tons of carbon dioxide in 1997, about 32 percent of total emissions from energy consumption.[a] Reductions in vehicle carbon dioxide emissions can be achieved by using alternative fuels, such as natural gas, liquefied petroleum gas, ethanol, methanol, and electricity, that are less carbon intensive than petroleum-based transportation fuels. Alternative vehicle fuels accounted for an estimated 2.7 percent of the vehicle fuels consumed in 1997.[b] The percentage may climb in the future, however, as legislative initiatives designed primarily to improve air quality begin to take effect.

The Clean Air Act Amendments of 1990 (CAAA90) established the Low Emission Vehicle Program (LEVP) as a pilot program in California, setting sales mandates for three categories of vehicles based on their relative emissions of air pollutants: low emission vehicles (LEVs), ultra-low emission vehicles (ULEVs), and zero emission vehicles (ZEVs). Although the legislation does not dictate that alternative fuels be used, in practice the most cost-effective approach to meeting the ULEV and ZEV standards will involve alternative fuel vehicles.

The LEVP is a voluntary, opt-in program that allows other States to set sales mandates for vehicles meeting the California standards. To date, New York and Massachusetts have opted into the LEVP and have adopted the same mandate as California, which requires that 10 percent of auto company sales must be ZEVs beginning with the 2003 model year.

The Alternative Motor Fuels Act of 1988 required the Federal Government to acquire the maximum practical number of alternative fuel light-duty vehicles for its fleet. It also provides credits toward corporate average fuel economy (CAFE) standards to automobile manufacturers producing alternative fuel vehicles. The Energy Policy Act of 1992 (EPACT) accelerated the Alternative Motor Fuels Act requirements for purchasing alternative fuel vehicles for the Federal fleet. EPACT also expanded mandated purchases of alternative fuel vehicles to non-Federal fleets by requiring minimum purchases for centrally fueled automobile fleets operated by State and local governments and by fuel providers, such as electric and gas utilities.

The Energy Information Administration projects that, with no further legislative or regulatory intervention, alternative fuel vehicle sales will exceed 1.2 million annually by 2020, representing 8 percent of total vehicle sales. By that time, the use of alternative fuel vehicles is expected to reduce carbon dioxide emissions by 3.7 million metric tons annually.[c]

[a]Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998), p. 21, http://www.eia.doe.gov/oiaf/1605/1605a.html.

[b]Energy Information Administration, *Alternatives to Traditional Transportation Fuels 1996*, DOE/EIA-0585(96) (Washington, DC, December 1997), p. 20. Alternative transportation fuels accounted for 0.2 percent of vehicle fuels consumed when oxygenates, such as MTBE and the ethanol in gasohol, are excluded.

[c]Energy Information Administration, *Annual Energy Outlook 1999*, DOE/EIA-0383(99) (Washington, DC, December 1998), p. 56, http://www.eia.doe.gov/oiaf/aeo99/homepage.html.

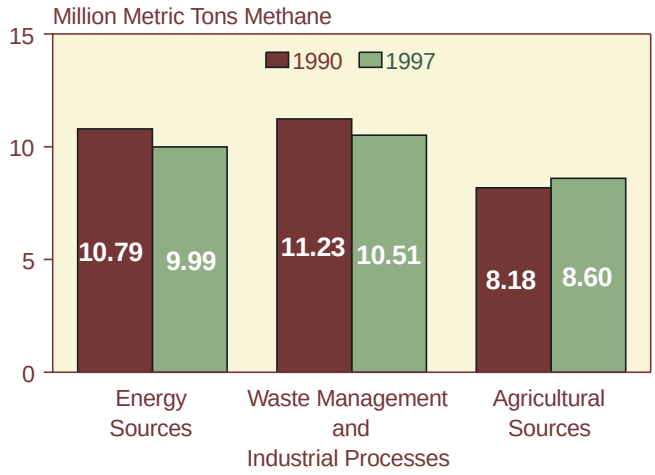
optimal fuel efficiency, reducing fuel consumption by about 2.5 percent. CLE Resources reported carbon dioxide emission reductions of 5,383 metric tons of carbon dioxide for its 5-percent share of the project. With truck travel accounting for emissions of about 250 million metric tons of carbon dioxide in the United States, universal use of the tire pressure device could reduce national emissions by more than 6 million metric tons annually.[36]

[36]U.S. Department of Transportation, U.S. Bureau of Transportation Statistics, *National Transportation Statistics 1997*, DOT/VNTSC-BTS-96-4 (Washington, DC, December 1996), Table 4-8, p. 168, http://www.bts.gov/btsprod/nts/. Single-unit (2-axle, 6-tire or more) and combination trucks consumed 28,440 gallons of fuel per vehicle in 1995. Assuming an emissions factor of 19 pounds of carbon dioxide per gallon, 249 metric tons of carbon dioxide were emitted.

# 4. Reducing Methane Emissions

U.S. anthropogenic (human-caused) methane emissions total more than 29 million metric tons annually. Because the heat trapping capacity of methane is 21 times that of carbon dioxide integrated over a 100-year horizon, U.S. methane emissions are equivalent to more than 600 million metric tons of carbon dioxide per year. Thus, methane represents just under 10 percent of all U.S. greenhouse gas emissions. There are three major sources of U.S. methane emissions: waste management, agriculture, and energy production and consumption. Methane emissions typically are either accidental or the byproduct of biological processes. Thirty-six percent of the U.S. total can be attributed to the anaerobic decomposition of waste, 33 percent to fugitive emissions from coal mines or oil and gas systems, and 30 percent to agricultural activities (primarily, the management of domesticated livestock) (Figure 12).

**Figure 12. U.S. Methane Emissions by Source, 1990 and 1997**




Source: Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998), p. 28.

Between 1990 and 1997, U.S. methane emissions declined by about 1 million metric tons or 3.6 percent. The drop can be attributed to a 1.1 million metric ton decrease in emissions from coal mining and a 0.7 million metric ton decrease in emissions from landfills.[37] The declines occurred despite increases in activity data for both the coal mining and waste management sectors. In 1997, U.S. coal production reached a record level of nearly 1.1 billion metric tons, but industry consolidation moved production away from the Nation's gassiest mines. At the same time, a record level of waste generation was offset by increased recycling and waste combustion, reducing the volume of waste susceptible to decomposition in landfills.

Beyond source reduction, U.S. emissions were further reduced by methane capture. At landfills, wells are drilled into the waste and a vacuum pulls out landfill gas, including methane, before it can migrate out of the landfill. At coal mines, wells may be drilled to degasify a coal seam before mining or down through the gob (collapsed portion of a coal seam) to capture gas during mining operations. Between 1990 and 1997, the level of methane recovery for energy from coal mines rose by 0.7 million metric tons. During the same period, methane recovery for energy from landfills also grew from 0.9 to 1.7 million metric tons.

## Overview of Projects Reported

Forty-four organizations, including 13 gas resource developers and 26 utilities, reported a total of 100 projects to reduce methane emissions, an 11-percent increase from the previous reporting year and a 133-percent increase from the first (1994) reporting cycle (Table 7). Twenty-five projects were submitted for the first time in the 1997 reporting cycle, as compared with 35 projects reported for the first time in 1996. A number of projects reported in 1996 were not reported in the 1997 reporting cycle. Because the Voluntary Reporting Program schedule was accelerated to compile reduction data in the year subsequent to its occurrence, some respondents chose to wait for the 1998 reporting cycle.

The average methane emission reduction project achieved a reduction of 8,835 metric tons of methane—or 185,530 metric tons carbon dioxide equivalent—in 1997. Three large projects significantly raised the overall average for all reported projects. First, MCNIC Oil and Gas Company recovered methane from coal mines, lowering emissions by 228,000 metric tons. Second, the 65 waste-to-energy plants operated by members of the Integrated Waste Services Association (IWSA) burned municipal solid waste (MSW) rather

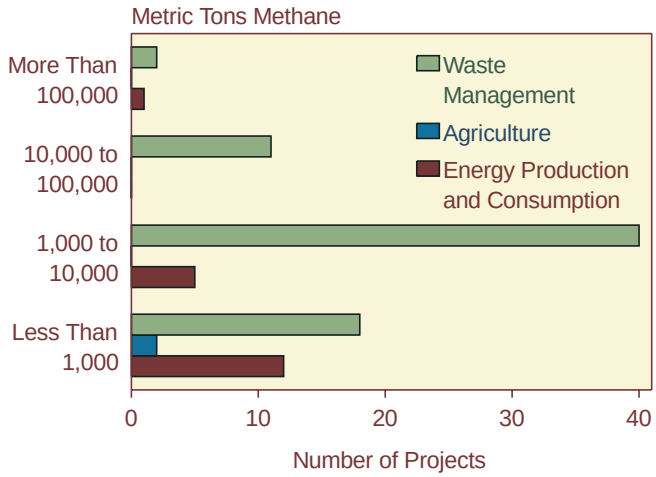
[37] Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998), p. 36, http://www.eia.doe.gov/oiaf/1605/1605a.html.

**Table 7. Methane Reduction Projects Reported by Project Type, Data Years 1994-1997**
(Million Metric Tons)

| Project Type | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|
| Waste Management and Disposal | 27 | 39 | 65 | 79 |
| Agriculture | 3 | 3 | 3 | 3 |
| Energy Production and Consumption | | | | |
| Coal Mining | 2 | 2 | 4 | 5 |
| Natural Gas Production, Transmission, and Distribution | 11 | 14 | 18 | 13 |
| **Total** | **43** | **58** | **90** | **100** |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Figure 13. Methane Projects Reported, by Size of Methane Emission Reduction, Data Year 1997**




Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

than sending it to landfills, achieving 145,000 metric tons of methane emission reductions. Finally, UNICOM reported gas recovery activities at 13 landfills that reduced methane emissions by 104,000 metric tons. Excluding those three very large projects, the average methane reduction equaled 4,190 metric tons or 88,000 metric tons carbon dioxide equivalent (Figure 13).

Reducing emissions from waste treatment and disposal sites was by far the most frequently reported method for lowering methane emissions. The number of such projects reported grew by 22 percent from the previous reporting year and nearly tripled from 27 in the first (1994) reporting year to 79 in 1997. The principal reported method for reducing methane emissions from waste management and disposal is the capture of methane generated during the anaerobic decomposition of wastes in a landfill. The methane may be flared, used as a boiler fuel, or used to generate electricity, thus offsetting other, perhaps more carbon-intensive fuels. Other methods of lowering emissions from waste treatment and disposal include reducing the volume of waste reaching landfills through combustion or recycling, and capturing methane generated during anaerobic decomposition of organic material in wastewater. In addition to those projects that lowered emissions from waste treatment and disposal, 5 projects reduced fugitive methane emissions from coal mining, and 13 projects reduced methane emissions from leakage in the oil and gas system.

## Reducing Methane Emissions from Waste Treatment and Disposal

The 79 reported waste treatment and disposal projects accounted for 637,000 metric tons of methane emission reductions in 1997, about 68 percent of all the methane reductions reported (Tables 8 and 9). Two-thirds of the reductions from waste treatment and disposal projects were reported as indirect (i.e., occurring at facilities not owned by the reporter). Seventy-four of the 79 projects reduced methane emissions from landfills, including 6 that lowered emissions through diversion of wastes that would have emitted methane during decomposition and 68 that captured methane from landfill gas generated at the waste disposal site (see box on page 33).

Despite the growth in the number of waste treatment and disposal projects, reported reductions appear to have declined (Table 9). The apparent decline does not represent an actual diminution in reduction activities. The decline is associated with a refinement of the emissions estimation methods for one large project. For previous data years, IWSA reported the annual reduction benefits associated with a stream of waste diversion activities going back to 1987, because emission reductions from such activities continue for many years. Together, the stream of waste diversion activities resulted in estimated emission reductions of 750,000 metric tons of methane annually. For 1997, IWSA chose to report only the reductions associated with the current year's waste diversion activities. Thus, the apparent decline in methane emission reductions reported by IWSA is the result of the exclusion of the effects from activities carried out in previous years. In both cases the

**Table 8. Total Reported Methane Emission Reductions, Data Years 1994-1997**
(Metric Tons)

| Reporting Form | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|
| EIA-1605 | | | | |
| Direct Reductions | 25,079 | 8,450 | 409,182 | 378,500 |
| Indirect Reductions | 102,642 | 1,077,289 | 1,157,068 | 477,055 |
| EIA-1605EZ | 24,523 | 50,555 | 53,739 | 79,365 |
| **Total** | **152,244** | **1,136,294** | **1,619,989** | **934,920** |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Table 9. Reported Methane Emission Reductions for Waste Treatment and Disposal Projects, Data Years 1994-1997**
(Metric Tons)

| Reporting Form | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|
| EIA-1605 | | | | |
| Direct Reductions | * | 619 | 128,451 | 135,640 |
| Indirect Reductions | 99,433 | 1,061,709 | 1,142,896 | 422,773 |
| EIA-1605EZ | 24,388 | 50,325 | 53,007 | 78,625 |
| **Total** | **123,821** | **1,112,653** | **1,324,354** | **637,038** |

*Less than 0.5 metric ton.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

### Landfill Gas Recovery Reduces Greenhouse Gas Emissions

Between 1990 and 1997, the volume of methane in landfill gas captured in the United States doubled, from 1.2 million metric tons to 2.4 million metric tons. In 1990, about 0.9 million metric tons of methane were captured and used as an energy resource. The remainder was collected and flared. In 1997, 1.7 million metric tons were captured for energy and 0.7 million metric tons were flared. In 1997 an estimated 150 landfills were converting methane from landfill gas into usable energy, compared with just over 100 in 1990. This trend is expected to continue in response to EPA regulations. The New Source Performance Standards and Emission Guidelines require the collection and combustion of gas from all landfills with more than 2.5 million metric tons of waste in place and annual emissions of non-methane volatile organic compounds exceeding 50 metric tons.

Landfill gas-to-energy project reporting to the Voluntary Reporting Program has grown with national recovery trends. The 1997 reporting cycle included 68 separate projects that captured landfill gas from 80 different landfills. Eleven of the projects flared the recovered gas. Fifty-seven used the recovered gas as an energy resource, including 44 that burned the gas to generate electricity and 13 that injected the gas into pipelines for delivery to industrial boilers or the gas transmission system. Reported landfill gas-to-electricity projects lowered methane emissions by more than 320,000 metric tons. Reported landfill gas-to-pipeline projects reduced methane emissions by more than 110,000 metric tons. Altogether, reported reductions from landfill gas capture equaled 465,000 metric tons of methane. With 150 landfills known to have landfill gas-to-energy projects in place and 57 reporting to this program, more than one-third are represented in the data totals; however, only about one-quarter of the emissions savings from landfill gas-to-energy operations are reported, suggesting that some very large landfill gas-to-energy projects have not been reported.

Flaring methane after capture can also have significant emissions benefits. During combustion methane is converted to carbon dioxide. Methane has 21 times the warming impact of carbon dioxide per ton emitted. Thus, flaring methane and converting it to carbon dioxide can reduce its warming effect substantially. Reported reductions in this category for 1997 were just over 30,000 metric tons of methane, or one-twentieth of the estimated national total.

data reported were accurate, but the reductions reported reflect the estimation method chosen.

## Recovery of Landfill Gas

As waste decomposes in a landfill it produces a biogas that is approximately 50 percent carbon dioxide and 50 percent methane. Because of the presence of methane, landfill gas has a heat content of about 500 British thermal units (Btu) per cubic foot, or about half that of commercially marketed natural gas. Thus, landfill gas is a potentially valuable source of energy. Because of its relatively low Btu content and the presence of several impurities, the typical method for using landfill gas has been to burn it for electricity generation rather than upgrading it for sale to a pipeline. The electricity generated is then sold to the grid. The process lowers methane emissions and reduces consumption of other fuels for electricity generation. When the electricity generated displaces oil- or coal-fired generation, carbon dioxide emissions are reduced.

In the first years of the Voluntary Reporting Program, landfill gas recovery projects were reported by electric utilities that purchased electricity generated at landfills. As landfill gas developers (those generating and selling electricity to the utilities) learned more about the Voluntary Reporting Program, however, they began to participate in larger numbers. In addition to emission reductions associated with energy sales, many reported reductions associated with the capture and flaring of gas without collateral energy sales. Naturally, the program participation of both electric utilities and landfill gas developers raises concerns about the potential for double counting. Where double reporting does occur, double counting is avoided because utilities report reductions as indirect unless they have an ownership stake in the landfill or its gas resource, while landfill gas developers report reductions as direct. Further, an analysis of the data has shown only three instances in which methane reductions at the same landfill were reported as direct and indirect reductions (Table 10). More recently, as electricity generated from landfill gas has grown less competitive with other fuel sources, there has been an increase in projects that pipe landfill gas directly to industrial boilers for use as a medium-Btu fuel.

## Waste Diversion

When waste is diverted from a landfill through recycling, source reduction, or waste combustion, methane emissions that would have resulted when the waste decomposed at a landfill are avoided. Fourteen such projects that reported methane emission reductions were submitted to the Voluntary Reporting Program for 1997, including eight that were reported as recycling projects (see box in Chapter 3, page 25) rather than methane reduction projects. Together, those eight projects reduced methane emissions by a total of 2,300 metric tons. The six other waste diversion projects reported showed more substantial reductions. The Minnesota Resource Recovery Association (MRRA) reported four projects, including an MSW combustion project that reduced methane emissions by 20,190 metric tons. United Power Association reported a project to burn refuse-derived fuel, and IWSA reported reductions associated with the combustion of waste at facilities owned by its members across the United States. Because the IWSA project covered 65 waste-to-energy facilities, it reported a very large reduction of nearly 145,000 metric tons of methane in 1997.

## Reducing Methane Emissions from Wastewater Treatment Plants

When wastewater is treated under anaerobic conditions, the decomposition of its organic portion yields methane. Like methane generated from waste at landfills, the methane generated from wastewater treatment may be captured and either flared or used as an energy resource. Because captured methane has value as an energy resource, operators may use an anaerobic digester to treat the wastewater and maximize methane generation. Five projects to capture methane generated from wastewater treatment were reported for 1997. The Platte River Power Authority and its four owner cities produce energy from methane collected at the City of Loveland wastewater treatment facility, reducing methane emissions by nearly 72 metric tons in 1997. Platte River also reported a second project that flared gas collected from the Longmont wastewater treatment plant. The gas was not used as a fuel because of its high sulfide content; however, the flaring lowered methane emissions by 226 metric tons. The City of Fairfield, Debourgh Manufacturing, and General Public Utilities also reported wastewater management projects.

**Table 10. Landfills with Multiple Entities Reporting Reductions**

| Landfill Reported | First Reporter | Second Reporter |
|---|---|---|
| Martone Sanitary Landfill. . . . . | Zahren Alternative Power | New England Power |
| Hamm's Landfill . . . . . | Zahren Alternative Power | General Public Utilities |
| Mallard Ridge . . . . . | Wisconsin Electric | Wisconsin Power and Light |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

# Reducing Emissions from Energy Production and Consumption

## Reducing Emissions from Coal Mines

As coal is formed from organic material by natural chemical and physical processes, methane is also produced. The methane is stored in the pores (open spaces) of the coal itself and in cracks and fractures in the coalbed. As coal is mined, the pressure surrounding the stored methane decreases, allowing much of it to be released into the operating coal mine. Because methane in concentrations of 5 to 15 percent is explosive, mine operators use large fans to provide a steady airflow across the mine face and ventilate the mine shaft. Because the methane is valuable as an energy resource, mine operators may also employ degasification wells to capture methane and either inject it into gas pipelines or use it to generate electricity.

When a mine is closed it may continue to have significant although slowly declining emissions over many years. Northwest Fuel Development reported methane emission reductions of 236 metric tons in 1997 from a project to use methane recovered from abandoned coal mines to generate electricity. As the purchaser of electricity from the project, Pacificorp also reported associated indirect reductions.

The largest methane reduction project was reported by MCNIC Oil and Gas. MCNIC owns the gas rights for several very gassy mines operated by CONSOL in Buchanan County, Virginia. Total methane recovery from the mines equaled more than 228,000 metric tons in 1997, representing 93 percent of all reported methane reductions from energy production and consumption (Table 11). During previous reporting cycles, CONSOL has reported entity-wide reductions of methane emissions. In 1996, CONSOL reported direct reductions of 626,000 metric tons. Thus, the MCNIC project represents more than a third of all reductions achieved at CONSOL coal mines.

## Reducing Emissions from Natural Gas Production, Transmission, and Distribution

Methane is the principal constituent of natural gas (about 95 percent of the mixture). Natural gas is released at several stages of gas production, from the transmission and distribution system through leakage, during normal maintenance, and, rarely, as a result of accidents. Thus, methane emissions can be reduced by replacing leaky system components, improving operations and maintenance, and limiting routine venting procedures. Thirteen such projects were reported for 1997, with an average reduction of 1,047 metric tons of methane per project. The largest projects were reported by three entities. NIPSCO industries lowered emissions by 2,600 metric tons; Western Resources reported two projects, one with reductions in excess of 6,000 metric tons; and Public Service Company of New Mexico reported a project that decreased emissions by 2,900 metric tons.

# Reducing Emissions from Agriculture

Only three projects reported reductions in methane emissions from agricultural activities. In two cases, methane was recovered from the decomposition of animal waste in an anaerobic digester and used to generate electricity. As the purchaser of the electricity, General Public Utilities reported the projects. Methane was captured from dairy cow waste in the first project and from swine waste in the second project, with combined methane emission reductions of 1.4 metric tons in 1997. The third project was a study on reducing emissions from rice cultivation, financed by Houston Lighting and Power Company.

# Federal Programs To Reduce Methane Emissions

The U.S. Government sponsors several voluntary programs targeted specifically toward lowering methane emissions. The programs, initiated under the Climate

**Table 11. Reported Methane Emission Reductions from Energy Production and Consumption, Data Years 1994-1997**
(Metric Tons)

| Reporting Form | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|
| EIA-1605 | | | | |
| Direct Reductions | 19,687 | 7,174 | 279,770 | 242,044 |
| Indirect Reductions | 0 | 3,543 | 4,039 | 3,653 |
| EIA-1605EZ | 135 | 230 | 732 | 741 |
| **Total** | **19,822** | **10,947** | **284,541** | **246,438** |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

Change Action Plan in October 1993, are largely administered by EPA's Office of Air and Radiation. The most prominent are the Landfill Methane Outreach Program (LMOP), which works to promote the use of landfill gas to generate electricity or as a medium-Btu boiler fuel;[38] the Coalbed Methane Outreach Program (CMOP), which encourages the recovery and use of methane that otherwise would be emitted during mining operations;[39] and Natural Gas STAR, a program to promote cost-effective technologies and practices for emissions control in the natural gas industry.[40] Of the 100 projects to reduce methane emissions reported to the Voluntary Reporting Program for 1997, 30 were associated with the LMOP program, 2 with the CMOP program, and 6 with the Natural Gas STAR program.

The EPA and U.S. Department of Agriculture (USDA) jointly administer the AgSTAR program,[41] which aims to reduce methane emissions from animal waste. The USDA also sponsors the Ruminant Livestock Methane Program,[42] which seeks to lower emissions from enteric fermentation in domesticated livestock through improved feed and animal management. No projects associated with AgStar or the Ruminant program were reported.

There are also a number of regulatory and tax subsidy programs that are not specifically targeted at emission reductions but tend to have the ancillary consequence of lowering methane emissions. The New Source Performance Standards and Emissions Guidelines administered by the EPA require all landfills with more than 2.5 million metric tons of waste in place and annual emissions of nonmethane volatile organic compounds exceeding 50 metric tons to collect and burn their landfill gas either through flaring or as an energy resource. In addition to the estimated 600 landfills that currently flare gas, this regulation could affect as many as 500 additional landfills.

The Section 29 tax credit for alternative fuels has also affected methane emissions, prompting a large expansion in the use of both coalbed methane and landfill methane as a fuel source. The tax credit expired for coalbed methane on January 1, 1993, and for landfill methane in 1998. Legislative discussions currently underway could establish an alternative tax credit for landfill gas-to-energy projects.

[38] More information on this program can be found at http://yosemite.epa.gov/methane/home.nsf/pages/lmop.
[39] More information on this program can be found at http://yosemite.epa.gov/methane/home.nsf/pages/cmop.
[40] More information on this program can be found at http://www.epa.gov/gastar.
[41] More information on this program can be found at http://yosemite.epa.gov/methane/home.nsf/pages/agstar.
[42] More information on this program can be found at http://www.epa.gov/rlep/.

# 5. Carbon Sequestration

## Background

Carbon sequestration plays an important role in the global carbon cycle. Green plants remove (sequester) carbon from the atmosphere through photosynthesis, extracting carbon dioxide from the air, separating the carbon atom from the oxygen atoms, returning oxygen to the atmosphere, and using the carbon to make biomass in the form of roots, stems, and foliage.

Every year in the United States and throughout the world a very large amount of carbon dioxide—on the order of 100 billion metric tons—is sequestered in biomass.[43] At the same time, carbon is released to the atmosphere from vegetative respiration, combustion of wood as fuel, degradation of manufactured wood products, consumption of biomass for food by animals, and the natural decay of expired vegetation. The net numerical difference, or flux, between carbon sequestration and release can be viewed as a measure of the relative contribution of biomass to the carbon cycle. World flux associated with Earth's living matter is difficult to measure, but biomass is thought to provide a net "sink" equivalent to about 5 billion metric tons of carbon dioxide per year.[44]

Forests can play an important role in offsetting human-produced carbon emissions. On average, trees are approximately 25 percent carbon by weight (live trees are approximately 50 percent water by weight, and oven-dried wood is approximately 50 percent carbon by weight).[45] The amount of carbon a plant can sequester depends on a number of variables, including species and age, but can be quite large. For example, one large sugar maple tree is capable of removing more than 450 pounds of carbon dioxide from the atmosphere in a year. At that rate, preserving 29 trees per operating automobile in the United States would offset all U.S. automobile-related carbon dioxide emissions.[46]

Carbon sequestration on a national scale is substantial; the U.S. Department of Agriculture (USDA) Forest Service estimates that all the forests in the United States combined sequestered a net of approximately 281 million metric tons of carbon per year from 1952 to 1992, offsetting approximately 25 percent of U.S. anthropogenic emissions of carbon during that period.[47]

## Projects Reported

Seventy-four entities reported projects involving forestry or natural resources that sequestered carbon or reduced emissions in 1997 (Table 12). The reporters included 65 electric utilities, 3 operating subsidiaries of an independent power producer, a major petroleum company, a real estate company, a nonprofit forestry organization, a university, a fabricated metals product manufacturer, and an agricultural services company. A total of 302 carbon sequestration projects were reported, an increase of 53 percent over the previous reporting cycle. Forestry projects were the second most commonly reported project type after electricity supply (380), accounting for 25 percent of all the projects reported for 1997 (see Table 2 in Chapter 1). The reported forestry projects were dispersed over a wide geographic area, including 44 States and 8 foreign countries. A total of 241 domestic and 61 international forestry projects were reported.

The total sequestration and reduction in emissions reported for 1997 increased by 11 percent from the previous year, to 9.7 million metric tons of carbon dioxide (Table 12). Carbon sequestration projects typically are considerably smaller than projects that reduce emissions of carbon dioxide (such as electricity supply and energy end use). Seventy-five percent of the forestry projects reported for 1997 sequestered between 10 and 10,000 metric tons of carbon dioxide (Figure 14), with the median being less than 200 metric tons. A significant

[43]Intergovernmental Panel on Climate Change, *Greenhouse Gas Inventory Reference Manual*, IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 3 (Paris, France, 1995), p. 5.2, http://www.iea.org/ipcc.htm.

[44]Intergovernmental Panel on Climate Change, Climate Change 1995: The Science of Climate Change (Cambridge, UK: Cambridge University Press, 1996), p. 77.

[45]R.A. Birdsey, *Carbon Storage and Accumulation in United States Forest Ecosystems* (Washington, DC: USDA Forest Service, 1992), p. 12.

[46]Average mileage and fuel consumption for passenger cars from Energy Information Administration, *Annual Energy Review 1997*, DOE/EIA-0384(97) (Washington, DC, July 1998), p. 53. Carbon dioxide emissions per mile driven and gallon of motor fuel from U.S. Department of Energy, *Sector-Specific Issues and Reporting Methodologies Supporting the General Guidelines for the Voluntary Reporting of Greenhouse Gases Under Section 1605(b) of the Energy Policy Act of 1992*, DOE/PO-0028 (Washington, DC, October 1994), Vol. 2, p. 4.19.

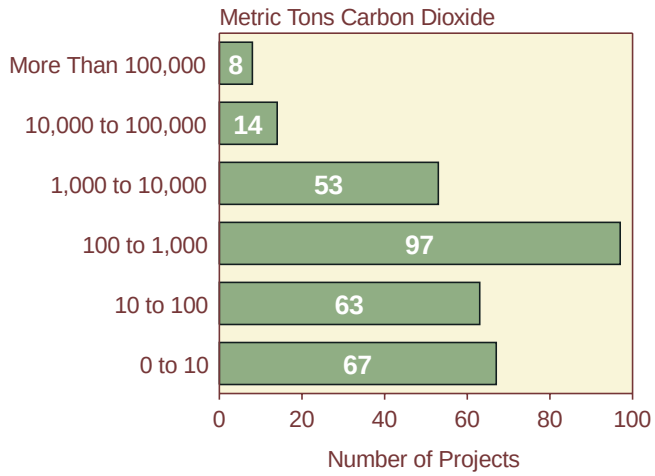
[47]R.A. Birdsey and L.S. Heath, "Carbon Changes in U.S. Forests," in L.A. Joyce (ed.), *Productivity of America's Forests and Climate Change*, General Technical Report RM-GTR-271 (Fort Collins, CO: USDA Forest Service, 1995).

**Table 12. Number of Projects and Sequestration and Net Reductions Reported for Sequestration Projects, Data Years 1994-1997**

| Project Type | Data Year | | | |
|---|---|---|---|---|
| | 1994 | 1995 | 1996 | 1997 |
| Number of Reporters | 40 | 62 | 67 | 74 |
| Number of Projects | 78 | 199 | 198 | 302 |
| Sequestration and Net Reductions (Metric Tons Carbon Dioxide) | 772,330 | 1,247,430 (R) | 8,713,126 | 9,691,464 |

(R) = revised.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Figure 14. Carbon Sequestration Projects by Amount of Carbon Sequestered, Data Year 1997**




Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

number (16 percent) of the reported projects were urban forestry projects, involving the planting of trees in urban and suburban areas.[48] Urban forestry projects are typically much smaller than forestry projects undertaken in rural or wilderness areas. The average carbon dioxide sequestration reported for 1997 for urban forestry projects was just 92 metric tons. Projects in rural or wilderness areas are sometimes large: eight such projects sequestered more than 100,000 metric tons of carbon dioxide each in 1997. On average, sequestration projects sequestered 32,852 metric tons of carbon dioxide equivalent.

Of the projects reporting carbon sequestration for 1997, most (224 or 76 percent) involved tree planting, including afforestation, reforestation, urban forestry, and woody biomass production or agroforestry (Table 13).[49] These projects accounted for 23 percent of the sequestration (and related emission reductions) reported for 1997. Although only 38 forest preservation projects were reported, they accounted for 76 percent of the sequestration reported for 1997. Ninety-six percent of the total sequestration for 1997 was reported on behalf of foreign projects, which include some very large forest preservation and agroforestry initiatives.

More than half (62 percent) of the reported forestry projects were undertaken in part to fulfill commitments made under the Climate Challenge program. In addition, 29 (10 percent) were undertaken as part of the U.S. Initiative on Joint Implementation (USIJI). Established under the Climate Change Action Plan (CCAP),[50] the USIJI is a pilot program that seeks to encourage foreign-based emission reduction and carbon sequestration projects conducted by U.S. and non-U.S. partners. Partners must submit a proposal to USIJI to receive approval of proposed projects. Thus far, 36 projects have been approved,[51] encompassing a wide variety of measures, including energy conservation in district heating systems, conversion of biomass waste to energy, wind power, and forestry projects. The following USIJI-approved forestry projects were reported to the Voluntary Reporting Program: the Rio Bravo Carbon Sequestration Pilot Project (in Belize); Oregon State University's RUSAFOR-SAP project (Russia); New England Electric System Companies' Reduced Impact Logging Project (Malaysia); and the Noel Kempf Mercado Climate Change Action Project (Bolivia).

In addition to the USIJI projects, one urban forestry project was reported as part of the Cool Communities program sponsored by the U.S. Department of Energy (DOE), which seeks to reduce energy consumption associated with air conditioning through the use of lighter

[48] Urban forestry projects include projects reported as general tree planting projects on Form EIA-1605EZ.

[49] Afforestation is the planting trees in unforested areas. Reforestation is the planting of trees in forest areas that have recently been harvested. Urban forestry is the planting of trees individually or in small groups in urban or suburban settings. Agroforestry is the cultivation of trees in plantations for fuel or fiber.

[50] President William J. Clinton, *The Climate Change Action Plan* (Washington, DC, October 1993), Appendix II, http://www.gcrio.org/USCCAP/toc.html.

[51] U.S. Department of Energy, "Four Central and South American Projects to Reduce Over 100 Million Tons of Greenhouse Gases," Press Release (Washington, DC, March 17, 1999).

**Table 13. Number of Sequestration Projects Reported by Project Type, Data Years 1994-1997**

| Project Type | Number of Projects Reported | | | |
|---|---|---|---|---|
| | 1994 | 1995 | 1996 | 1997 |
| Afforestation | 26 (R) | 38 | 38 | 87 |
| Reforestation | 15 | 82 | 80 | 92 |
| Urban Forestry | 27 (R) | 40 | 41 | 47 |
| Modified Forest Management | 12 | 20 | 10 | 33 |
| Woody Biomass Production and Other Agroforestry | 8 (R) | 14 | 2 | 3 |
| Forest Preservation | 2 (R) | 24 | 29 | 38 |
| Conservation Tillage | 1 | 1 | 1 | 2 |
| Other Projects | 3 (R) | 4 | 6 | 11 |

(R) = revised.

Notes: Urban forestry includes general tree planting projects reported on Form EIA-1605EZ. Some projects are counted in more than one category.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

wall and roof colors and the planting of shade trees around buildings. The program provides technical assistance and education to its participants.

## Afforestation and Reforestation

More than half (57 percent) of the sequestration projects reported for 1997 involved either afforestation or reforestation. All but one of the 172 afforestation and reforestation projects are domestic. The exception is Oregon State University's RUSAFOR-SAP project in Russia, which includes reforestation of a 50-hectare site that suffered a forest fire and afforestation of two sites totaling 450 hectares.

Two years ago, American Forests, a nonprofit conservation organization, and American Electric Power, Inc. (AEP), a large investor-owned utility, accounted for nearly 73 percent of the 114 domestic afforestation and reforestation projects reported for 1995. For the 1997 reporting cycle, American Forests and AEP increased the number of afforestation and reforestation projects they reported by 24 percent; however, their combined share of the total number of projects in the two categories fell to 60 percent, because the total number of reports on afforestation and reforestation projects increased by 50 percent.

A large part of the increase in the number of domestic afforestation and reforestation projects can be attributed to two domestic programs initiated in 1997 by the UtiliTree Carbon Company.[52] Shares in the new UtiliTree projects were reported by 21 of the participating utilities, resulting in 41 project reports for carbon dioxide sequestered in 1997.[53] The Western Oregon Carbon Sequestration Project is an afforestation project on nonindustrial timberland in Oregon, where native species, such as Douglas fir, western red cedar, and ponderosa pine, were planted in 1997 on privately owned sites totaling 79 acres. A long-term forest management plan has been developed for each site and incorporated into a contract with the landowner. The contracts obligate the landowners to keep the sites forested for a minimum of 65 years. In the Mississippi Valley Bottomland Hardwood Restoration Project, UtiliTree is investigating the feasibility of sequestering carbon by restoring bottomland hardwood forest on marginal farmland located in Catahoula Parish, Louisiana. This pilot study is evaluating restoration techniques on an 80-acre tract. An additional 70,000-acre tract is available for large-scale afforestation efforts should the pilot phase prove successful.

American Forests reported a total of 85 projects under its Global ReLeaf Forests program, 24 of which were initiated after 1995. Global ReLeaf supports the restoration of U.S. forest ecosystems that have been damaged by natural events or human actions. American Forests plans to plant 20 million trees through Global ReLeaf by the year 2000. Through the end of 1997, nearly 6 million trees had been planted, sequestering 38,627 metric tons of carbon dioxide in 1997—enough to offset carbon dioxide emissions from about 6,500 automobiles.[54] All but five of the Global ReLeaf projects involved reforestation.

AEP reported 15 projects involving afforestation on land owned by its operating companies, which sequestered a reported 22,901 metric tons of carbon dioxide in 1997.

[52]The UtiliTree Carbon Company, managed by the Edison Electric Institute, is a partnership of 40 investor-owned electric utilities.

[53]One utility reported its share in only one of the two projects.

[54]Average mileage and fuel consumption for passenger cars from Energy Information Administration, *Annual Energy Review 1997*, DOE/EIA-0384(97) (Washington, DC, July 1998), p. 53. Carbon dioxide emissions per mile driven and gallon of motor fuel from U.S. Department of Energy, *Sector-Specific Issues and Reporting Methodologies Supporting the General Guidelines for the Voluntary Reporting of Greenhouse Gases Under Section 1605(b) of the Energy Policy Act of 1992*, DOE/PO-0028 (Washington, DC, October 1994), Vol. 2, p. 4.19.

Six of the projects were initiated in 1996 or 1997. AEP also reported 11 afforestation projects on its own land initiated in 1995 and earlier, fewer than the 21 projects reported for 1995. It appears, however, that AEP has consolidated and renamed its afforestation projects to simplify reporting: the number of acres involved in its projects increased from 2,041 in 1995 to 9,792 in 1997.

DTE Energy / Detroit Edison reported on two afforestation efforts, including an existing effort with new activity in 1996 and 1997 and a new effort initiated in 1996.[55] The existing effort involved plantings on various vacant plots owned by Detroit Edison or its customers. In 1996 and 1997, 813,610 trees were planted on 1,134 acres. In addition, in a cooperative venture with the Michigan Department of Natural Resources, DTE / Detroit Edison was responsible for the planting of about 6 million tree seedlings on State Forest land in 1996 and 1997. Most of the trees planted were jack pine intended to provide habitat for the endangered Kirtland warbler. Together, the afforestation efforts conducted by DTE / Detroit Edison within its service territory sequestered a reported 29,148 metric tons of carbon dioxide in 1997.

Another new domestic tree planting effort was reported for 1997 by South Carolina Electric and Gas Company (SCE&G). SCE&G's Forest Management Plan has involved the planting of a minimum of 100,000 tree seedlings annually since 1993. SCE&G also continues to manage the 6 million seedlings already planted on company lands.

## Urban Forestry

Urban forestry projects are unique, in that under some circumstances they can reduce energy consumption as well as sequester carbon. Shade trees planted near buildings reduce summer air conditioning requirements; in addition, trees can also act as windbreaks, reducing heating needs in the winter. A total of 47 urban forestry projects were reported for 1997. For the 42 urban forestry projects for which estimates were developed, a total of 4,320 metric tons of carbon dioxide was sequestered in 1997—an amount that would offset less than 0.1 percent of the emissions from a 1,000-megawatt coal-fired power plant.[56]

The emission reductions associated with energy savings were provided for only four urban forestry projects.[57] There are probably two main reasons why the effects of urban forestry on energy consumption are reported so infrequently. First, not all such projects involve the planting of shade trees near buildings. Urban forestry encompasses tree planting in all urban and suburban settings, including parks, utility rights of way, and city streets, as well as around buildings. Second, it is often difficult to estimate the energy savings resulting from urban forestry projects. Models have been developed for this purpose, but they are complex and not widely used. Typically, the emission reductions resulting from energy saved by urban tree planting projects are several times greater than the carbon sequestration achieved by the trees themselves. For example, PacifiCorp reported that the trees planted in its urban forestry program in Salt Lake City, Utah, sequestered 3.8 metric tons of carbon dioxide equivalent in 1997, whereas the carbon dioxide emission reductions associated with the energy saved by the trees was estimated at 156.7 metric tons.

Urban forestry projects were reported by 36 reporters, all but one of which were electric utilities. The exception was DeBourgh Manufacturing Company, a fabricated metal products manufacturer, which reported planting 50 trees in a landscaping project.

## Forest Preservation

A total of 38 forest preservation projects were reported for 1997, all but three of which were foreign. The two largest forest preservation projects were reported by AES Hawaii and AES Shady Point, subsidiaries of the AES Corporation (see box on page 41). Together, the two AES projects sequestered a reported 5.68 million tons of carbon dioxide in 1997, which represents 77 percent of the sequestration reported for forest preservation projects.

Two utilities (AEP and PacifiCorp) and a petroleum company (BP America) reported on the Noel Kempf Mercado Climate Action Project in Bolivia. This project was accepted by the USIJI in November 1996. It involves the preservation of 634,286 hectares of land on the southern and western boundary of the Noel Kempf Mercado National Park by incorporating it into the park. The project includes the following components: (1) carbon dioxide emission reductions through the cessation of logging activities and the protection of forest land from conversion to agricultural use; (2) protection, regeneration, and preservation; and (3) leakage prevention.[58] The project increased sequestration or reduced emissions by a reported 1 million metric tons of carbon dioxide in 1997.

[55]For both efforts, DTE Energy / Detroit Edison reported each year's planting activity separately, resulting in a total of five project reports.

[56]Assuming a power plant with a heat rate of 12,000 Btu per kilowatthour, operating at 85 percent availability, using subbituminous coal that emits 227.4 pounds of carbon dioxide per million Btu.

[57]Including one project for which sequestration effects were not reported.

[58]Leakage refers to the migration of logging and land-clearing activities that would have occurred in the preserve to areas outside the preserve, which would offset the sequestration achievements of the project.

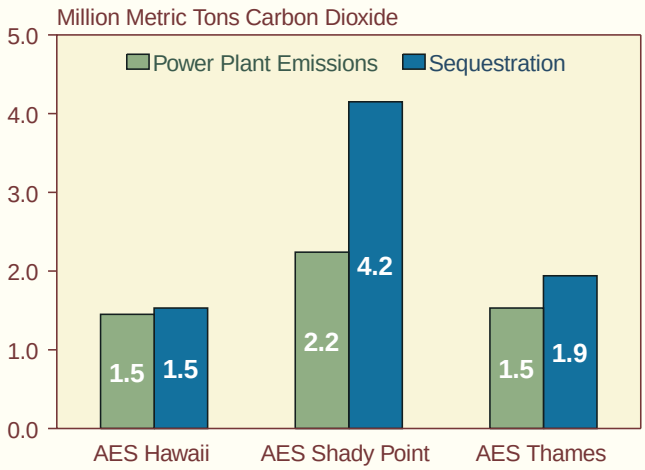
### AES Corporation Forestry Projects Offset Power Plant Emissions

The AES Corporation, an independent power producer based in Virginia, has developed forestry projects intended to offset the emissions from three of its power plants. Two of the projects involve forest preservation and the third is an agroforestry initiative that will include tree planting. Each project was reported by the responsible AES operating subsidiary, and each subsidiary reported both the total emissions from its power plant and the annual sequestration for the forestry project it sponsored. Each of the three AES subsidiaries reported its actions both as projects and as entity-wide emissions and offsets. In 1997, reported carbon dioxide emissions for the three AES plants totaled 5.2 million metric tons, and sequestration from the three forestry projects totaled 7.62 million metric tons, more than offsetting the power plant emissions for that year (see figure).

AES Hawaii is funding a forest preservation project in Paraguay with the Nature Conservancy and the Moises Bertoni foundation to offset the emissions of a 180-megawatt circulating fluidized-bed coal-fired cogeneration plant on the island of Oahu, Hawaii. The project will protect the 143,000-acre Mbaracayu Nature Reserve, one of South America's last remaining major tracts of undisturbed dense tropical forest. Establishment of the preserve prevented the sale of the Mbaracayu to a local timber products company. AES Hawaii's report indicates that the project will preserve 14.6 million metric tons of carbon sequestration over 35 years, equivalent to an average of 1.53 million metric tons of carbon dioxide per year, which is more than the 1.43 million metric tons of carbon dioxide emitted annually by the power plant.

AES Shady Point is supporting a program coordinated by OXFAM America to protect tropical forests in the Amazon regions of Peru, Ecuador, and Bolivia. The project will offset emissions from AES Shady Point's coal-fired plant in Oklahoma. OXFAM America is working with indigenous groups to gain control of the tropical forests and develop sustainable resource extraction plans, which are expected to protect 1.2 million acres of pristine rain forest. AES suggests that, without the project, 15 percent of the protected forest would have been cleared over the next 15 years, increasing average net annual emissions by 4.15 million metric tons of carbon dioxide—nearly twice the 2.24 million metric tons of carbon dioxide emitted by the AES Shady Point generating plant in 1997.

#### AES Reported Emissions and Sequestration, Data Year 1997




Source: Energy Information Administration, Form EIA-1605.

AES Thames is sponsoring the CARE Guatemala agroforestry project, which includes the planting of between 40 and 50 million fruit, lumber, and fuelwood trees on forest plantations over a 10-year period. Sustainable use of the plantations is intended to eliminate the need to clear threatened existing forests. Between 1990 and 1997, trees were planted on 127,650 acres. AES reports that the project sequestered 1.94 million metric tons of carbon dioxide in 1997, which exceeded the 1.45 million tons emitted by the AES Thames fluidized-bed coal plant.

The Rio Bravo Carbon Sequestration Pilot Project, a forest preservation project in Belize, was included in the reports submitted by 29 utilities, each of which reported its prorated share of the total sequestration for the project. Begun in 1995, the project is being undertaken through a partnership between Cinergy Corporation, DTE/Detroit Edison, PacifiCorp, Wisconsin Electric Power Co., the UtiliTree Carbon Company, the Nature Conservancy, and a Belizean nongovernmental organization (Programme for Belize). The project includes the purchase of a 14,400-acre parcel of endangered forest threatened with conversion to agriculture. The entire project sequestered an estimated 807,330 metric tons of carbon dioxide in 1997, of which 625,125 metric tons (77 percent) was reported to the Voluntary Reporting of Greenhouse Gases Program.[59]

[59]Several UtiliTree participants and one of the utility partners did not submit reports to the Voluntary Reporting Program for data year 1997.

Domestic forest preservation projects were reported by Wisconsin Power & Light, Tacoma Public Utilities, and Wisconsin Public Service Corporation. Wisconsin Power & Light reported sequestering 1,597 metric tons of carbon dioxide in 1997 by maintaining forested buffer lands around its power plants. Tacoma Public Utilities reported preserving nearly 11,000 acres of forest but did not estimate the sequestration achieved. Wisconsin Public Service Corporation reported forest preservation as a component of its afforestation and reforestation efforts.

## Modified Forest Management

Of the 33 modified forest management projects covering sequestration of carbon in 1997, 25 reports were associated with two related reduced-impact logging initiatives in Malaysia. The first initiative was a pilot project sponsored by New England Power Company and reported by its parent company, New England Electric System (NEES) Company.[60] Started in 1992, this project implemented new logging techniques with the goal of reducing logging damage by 50 percent. The new techniques include pre-cutting of vines, directional felling, and planned extraction of timber on properly constructed and used skid trails. Twenty-four utilities reported their shares in the second initiative—a full-scale project sponsored by UtiliTree that introduced reduced-impact logging practices to 2,500 acres of forest beginning in 1997. Together, these two initiatives increased sequestration by a reported 53,300 metric tons carbon dioxide equivalent in 1997.

Between 1991 and 1997, AEP selectively harvested more than 2,500 acres of upland central hardwood and bottomland hardwood stands to improve growing space relationships and maximize growth rates. The efforts increased sequestration on the affected tracts by a reported 3,778 metric tons of carbon dioxide in 1997. DTE Energy / Detroit Edison conducted similar thinning operations in previously unmanaged wood lots and reported increasing sequestration by nearly 800 metric tons in 1997. Enhanced forest management activities were also reported by Wisconsin Power & Light and Wisconsin Public Service Corporation as components of their afforestation or reforestation activities.

## Forest Plantations

Forest plantations include woody biomass production and agroforestry. Woody biomass production is the cultivation of trees in intensively-managed plantations for the purpose of producing fuel or fiber. Agroforestry involves mixing trees with annual crops to provide wind shelter, stabilize soil, and produce fuelwood and fruit crops.

Woody biomass production projects were reported by Minnesota Power and J.M. Gilmer and Company. Minnesota Power has negotiated contracts with land owners for the planting of hybrid poplars. Since 1994, trees have been planted on 2,682 acres of cleared land, resulting in the sequestration of more than 22,000 metric tons of carbon dioxide in 1997. The trees will be harvested after 12 years for use by the forest products industry or as biomass for energy production. J.M. Gilmer and Company established a short-rotation cottonwood plantation on a river bottom site in Alabama. The cottonwoods will also be harvested on a 12-year rotation and used as biofuel (displacing fossil fuel) or for pulpwood.

AES Thames reported an agroforestry project in Guatemala that involves establishing a plantation of fruit, pulp, and fuel wood trees (see box on page 41). AES Thames reported that its project sequestered nearly 2 million metric tons of carbon dioxide in 1997.

## Other Sequestration Projects

Not all carbon sequestration projects involved forestry. New projects reported for 1997 by Environmentally Correct Concepts, Inc. (ECC), Entergy Services, Inc., and UNICOM (formerly Commonwealth Edison Company) used other approaches to increase carbon sequestration. ECC established permanent pastures on three tracts, comprising 33 acres on a farm in Illinois used primarily for cattle grazing and hay production. ECC reports that 55 percent of the carbon fixed by grassy and herbaceous plants is stored below ground in roots, corms, tubers, etc., and that the accumulated carbon is either retained in the plant structures themselves or released into the soil as the plants decay. The remainder of the fixed carbon is stored above ground in structures such as leaves, stems, and seeds. ECC has implemented enhanced management techniques to increase the accumulation of carbon below ground. ECC estimated the average sequestration for 1997 for these tracts at 8.8 metric tons of carbon dioxide per acre (5.7 below ground and 3.1 above ground).

Entergy Services, Inc., initiated a project in 1996 to enhance 4,000 acres of degraded wetland by modifying the existing hydrologic regime and planting wetland grasses. The project sequestered a reported 39,844 metric tons of carbon dioxide in 1997.

[60] In August 1998, USGen New England, Inc. (USGenNE) completed the acquisition of New England Electric System (NEES) Company's hydroelectric and fossil power generation business previously operated by New England Power. As part of the acquisition, USGenNE acquired the rights to the emission reductions and carbon sequestration achieved by this and other projects.

Beginning in 1996, UNICOM began reusing wood utility poles by applying a "pole bandage" impregnated with sodium fluoride at the ground line to reinforce the wood preservative. The same technique can also extend the life of poles set in concrete. UNICOM estimates that about 3 percent of the 20,000 poles it replaces each year could be reused in this way. UNICOM reported reusing 870 poles in 1997, and it contends that its action avoided the harvest of the same number of southern longleaf pines, each of which sequesters an estimated 238 pounds of carbon dioxide a year.

Other carbon sequestration projects reported for 1997 and previous years include the following: conservation tillage projects reported by PP&L Resources, Inc., and Wisconsin Power & Light; UNICOM's planting of Illinois prairie grasses on company properties; Wisconsin Power & Light's restoration of 700 acres of abandoned old field to prairie/savanna habitat; and Salt River Project's halophyte farming.

# 6. Halogenated Substances

## U.S. Emissions of Halogenated Substances

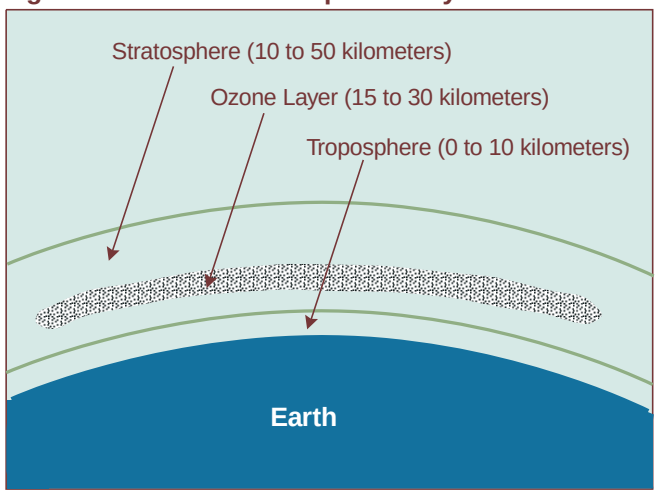
Halogenated substances are chemicals that have been engineered for a variety of industrial uses. Some are potent greenhouse gases and, therefore, may have an effect on global climate. Emissions of halogenated substances can be classified into two groups according to the accuracy with which their global warming potential (GWP) can be determined (for a discussion of GWPs, see Chapter 1).

The first group consists of chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and other chlorine-containing gases. These compounds absorb infrared radiation at wavelengths that would not otherwise be absorbed, making them potent greenhouse gases with direct radiative forcing effects hundreds or thousands of times greater than that of carbon dioxide. Because they contain chlorine, however, these substances also tend to destroy the ozone layer, located in the middle to upper stratosphere (Figure 15), which absorbs damaging ultraviolet radiation from the sun. Because ozone is a greenhouse gas, its destruction tends to offset the net warming effects of the chlorine-containing halogens to varying degrees. As a result, their effective GWPs are difficult to determine.

CFC production ceased in January 1996 in accordance with the Copenhagen Amendments to the Montreal Protocol (except for production of CFCs used in metered dose inhalers for asthma patients). In addition, all HCFC production is required to be phased out by 2030. The United Nations Framework Convention on Climate Change (UNFCCC) excludes from its provisions gases covered by the Montreal Protocol and, therefore, does not address CFCs and HCFCs.

The second group of halogenated substances includes hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride ($SF_6$). These compounds also absorb infrared radiation that would not otherwise be absorbed in the troposphere, and they have relatively high radiative forcing impacts. In contrast to the chlorine-containing halogenated substances, these compounds do not destroy ozone. Thus, their estimated GWPs, expressed in carbon dioxide equivalent, can be more accurately evaluated. The Kyoto Protocol to the UNFCCC explicitly lists HFCs, PFCs, and sulfur hexafluoride as greenhouse gases affected by its provisions.

**Figure 15. Earth's Atmospheric Layers**

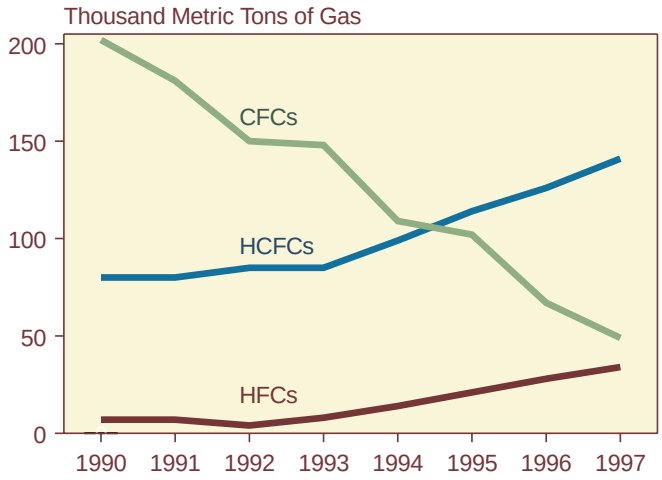



Source: U.S. Environmental Protection Agency, Stratospheric Protection Division, http://www.epa.gov/spdpublc/index.html.

In 1997, U.S. emissions of HFCs, PFCs, and sulfur hexafluoride were estimated to be 137.5 million metric tons carbon dioxide equivalent, a 68-percent increase over 1990 levels, primarily due to increases in HFC emissions.[61] Emissions of HCFCs and HFCs, which are used as replacements for CFCs as blowing agents, refrigerants, solvents, and in automobile air conditioners, are growing (Figure 16). In turn, emissions of CFCs are decreasing. Estimated PFC emissions as a byproduct of aluminum smelting rose in 1997 along with aluminum production. PFC use in semiconductor manufacturing as etchants and cleaning agents has also been growing. In contrast, emissions of sulfur hexafluoride have remained relatively unchanged.

[61] Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998), http://www.eia.doe.gov/oiaf/1605/1605a.html.

**Figure 16. Estimated U.S. Emissions of CFCs, HCFCs, and HFCs, 1990-1997**




Source: Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998).

## Projects Reported

For the 1997 data year, 21 entities reported on 30 projects that reduced emissions of halogenated substances—a 30-percent increase from 1996 in the number of projects reported and a 17-percent increase in the number of entities reporting. Seventeen of the reporting entities were electric utilities; two were aluminum smelters; and two were from the chemical and allied products industry and the electronics and other electrical equipment industry. Most (76 percent) of the entities participated in the Climate Challenge Program sponsored by the U.S. Department of Energy (DOE). Other voluntary programs in which the entities participated included the Climate Wise Recognition Program and the Voluntary Aluminum Industrial Partnership. All but one of the entities used the long form to report their activities to the Voluntary Reporting Program. Recycling and emissions avoidance were the two most frequently reported project types (14 each), followed by substitution of other chemicals (7 projects reported). Other reported projects included the destruction of halogenated substances, the use of improved appliances, and general reduction activities (Table 14).

Thirteen projects reported reductions of HFCs, PFCs, and sulfur hexafluoride. In terms of GWP, the reported reductions are significant, totaling more than 4 million metric tons carbon dioxide equivalent in 1997 (Table 15).[62] GWPs were not calculated for CFCs and HCFCs.

## Emission Reductions by Gas

In terms of metric tons (non-GWP-weighted), overall reported reductions of halogenated substances in 1997 were lower than those reported for 1996 (Table 16), primarily because of the increased use of HCFCs and HFCs as replacements for CFCs. The largest reductions in metric tons of gas and in metric tons carbon dioxide equivalent were reported for PFCs. Reductions were reported for three CFCs, the greatest of which were for CFC-12, followed by CFC-11 and CFC-113. Reported reductions of sulfur hexafluoride have nearly tripled since 1995, and the number of reported projects has nearly doubled (see box on page 48). For 1997, net increases in emissions of HCFC-22, HCFC-123, HCFC-124, and HCFC-142b were reported, suggesting that the use of HCFCs is increasing as the use of CFCs declines.

### Perfluorocarbons

PFCs are emitted primarily during the aluminum smelting process when the amount of alumina in solution drops below the level necessary to drive the desired chemical reactions. In 1997, efforts by VANALCO, Inc., and Noranda Aluminum, Inc., to reduce PFC emissions were focused on controlling the amount of alumina in solution to avoid emissions by monitoring the process

**Table 14. Number of Projects Reported for Halogenated Substances, Data Years 1994-1997**

| Project Type | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|
| General | 1 | 1 | 0 | 1 |
| Reclamation: Recycling | 7 | 10 | 10 | 14 |
| Reclamation: Destruction | 0 | 0 | 1 | 1 |
| Substitution | 2 | 6 | 8 | 7 |
| Emissions Avoidance | 3 | 6 | 8 | 14 |
| Use of Improved Appliances | 0 | 1 | 1 | 1 |
| Other Projects/Activities | 1 | 1 | 0 | 0 |
| **Total Number of Projects** | **15** | **22** | **23** | **30** |

Note: Total number of projects may not equal the sum of project types as some projects are categorized as more than one project type.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ

[62] Global warming potentials from Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996), p. 121. A table of GWP values is included in Chapter 1 of this report.

**Table 15. Reported Reductions of Hydrofluorocarbon, Perfluorocarbon, and Sulfur Hexafluoride Emissions, Data Year 1997**

| Gas | Emission Reductions Reported | |
|---|---|---|
| | Metric Tons of Gas | Metric Tons Carbon Dioxide Equivalent |
| HFC-134a | -0.03 | -42 |
| Perfluoromethane | 482.00 | 3,133,000 |
| Perfluoroethane | 58.34 | 536,730 |
| Sulfur Hexafluoride | 23.28 | 553,387 |
| **Reported Total** | **NA** | **4,222,830** |

NA = not applicable.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Table 16. Reported Reductions in Emissions of Halogenated Substances, Data Years 1994-1997**
(Metric Tons of Gas)

| Gas | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|
| CFC-11 | 3.74 | 4.10 | 7.00 | 6.72 |
| CFC-12 | 40.08 | 3,256.90 | 85.89 | 58.26 |
| CFC-113 | 0.03 | 0.33 | 0.03 | 0.03 |
| HCFC-22 | 1.00 | 0.26 | 2.69 | -82.12 |
| HCFC-123 | 0.61 | -0.09 | -0.16 | -0.19 |
| HCFC-124 | NR | NR | NR | -0.91 |
| HCFC-142b | NR | -3,295.21 | 973.02 | -162.81 |
| Perfluoromethane | 465.77 | 437.00 | 486.12 | 482.00 |
| Perfluoroethane | 45.78 | 42.50 | 48.34 | 58.34 |
| HFC-134a | -0.02 | -0.03 | -0.03 | -0.03 |
| HFC-152a | NR | NR | 126.96 | 0.00 |
| Sulfur Hexafluoride | 3.76 | 8.74 | -3.15 | 23.28 |

NR = not reported.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

more closely. Noranda reported the greatest individual reductions among projects in this category: 473 metric tons of perfluoromethane and 47 metric tons of perfluoroethane emissions were avoided in 1997. VANALCO contributed 10 metric tons of PFC reductions via reductions in anode effects. Advanced Micro Devices, Inc., reduced PFC emissions by 10 metric tons by substituting octofluoropropane (perfluoropropane), which has a lower GWP than perfluoroethane and is needed in lesser quantities, for perfluoroethane. In total, PFC reductions reported for 1997 amounted to nearly 3.7 million metric tons carbon dioxide equivalent. EPA sponsors the Voluntary Aluminum Industrial Partnership, which seeks to reduce emissions of PFCs, carbon tetrachloride, and sulfur hexafluoride during primary aluminum processing. In 1997, VANALCO and Noranda reported participation in the program.

## Hydrofluorocarbons

HFCs are used as replacements for ozone-depleting substances such as CFCs. U.S. emissions of HFCs were estimated at 76.3 million metric tons carbon dioxide equivalent in 1997, a 112-percent increase over 1990 levels.[63] HFCs replace CFCs as blowing agents, in automobile air conditioners and refrigerators, and in other manufacturing applications, where emissions result from system leaks. In the semiconductor industry, HFCs are used in plasma etching and chemical vapor deposition processes. HFC-23 is a byproduct of HCFC-22 manufacturing.

Two HFC projects reported to the Voluntary Reporting Program resulted in a net increase in emissions of 126 metric tons, equivalent to more than 17,700 metric tons of carbon dioxide. EPA works with the semiconductor industry to reduce HFC emissions.

[63]Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998), p. 54, http://www.eia.doe.gov/oiaf/1605/1605a.html.

## Greenhouse Gas Profile: Sulfur Hexafluoride Emission Reduction Projects

Electric utilities use sulfur hexafluoride as an insulator for circuit breakers, switch gear, and other electrical equipment. Sulfur hexafluoride is also used in magnesium manufacturing as a cover gas and in certain semiconductor production processes. Emissions from these uses result from leaky breakers and other transforming equipment (in the case of electrical equipment) and from certain semiconductor production processes. Overall, U.S. sulfur hexafluoride emissions have remained relatively unchanged since 1990. Although national emissions of sulfur hexafluoride are relatively low, its high GWP (23,900) makes it a potent greenhouse gas. Therefore, even small reductions are significant.

For the 1997 data year, eight electric utilities reported a total of 23 metric tons of sulfur hexafluoride reductions, equivalent to more than 556,000 metric tons of carbon dioxide. The increase in reported reductions resulted mainly from projects reported by Texas Utilities Electric Company, Duquesne Light Company, Tucson Electric Power Company, and GPU, Inc.:

- Texas Utilities reported a program in 1997 to identify and repair leaking circuit breakers. The program reduced sulfur hexafluoride emissions by 9 metric tons, or slightly more than 200,000 metric tons carbon dioxide equivalent.

- Duquesne Light Company reported sulfur hexafluoride reductions of nearly 6 metric tons, the equivalent of 143,000 metric tons of carbon dioxide, through its replacement of gaskets to reseal leaky breaker and bus joints.

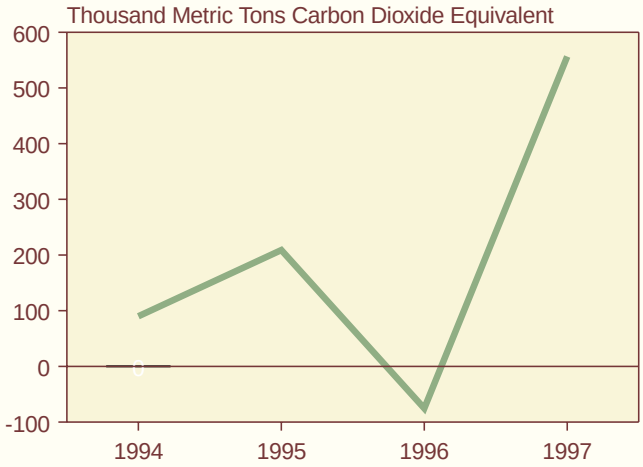
- Tucson Electric reported a sulfur hexafluoride recycling project that reduced emissions by nearly 3.5 metric tons of sulfur hexafluoride, the equivalent of nearly 82,000 metric tons of carbon dioxide. In addition to repairing or replacing leaky equipment, Tucson Electric recovered sulfur hexafluoride during maintenance and implemented strict work practices to avoid emissions.

- GPU reported reductions of nearly 2 metric tons of sulfur hexafluoride emissions, equivalent to more than 40,000 metric tons of carbon dioxide, from maintenance and replacement of sulfur hexafluoride charged breakers.

A net increase in sulfur hexafluoride emissions of just over 3 metric tons, equivalent to 75,000 metric tons of carbon dioxide, was reported in 1996 (see figure), due in part to an increase in emissions from a reported transmission and distribution facility maintenance program.

In early 1999, the U.S. Environmental Protection Agency (EPA) launched the Sulfur Hexafluoride Partnership for Electric Power Systems, a voluntary partnership with the electric power industry to pursue technically and economically feasible activities to reduce sulfur hexafluoride emissions. EPA's main role is as a clearinghouse for technical information on successful reduction methods and a repository for data on sulfur hexafluoride emission reductions. Participants in the program receive recognition for their achievements. There were 50 charter members.

### Reported Reductions in Sulfur Hexafluoride Emissions, Data Years 1994-1997




Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## Chlorofluorocarbons

U.S. emissions of CFCs have decreased from 202,000 metric tons in 1990 to 49,000 metric tons in 1997,[64] as U.S. production ceased in compliance with the Copenhagen Amendments to the Montreal Protocol and usage declined. A reflection of this decline can be seen in decreased sizes reported for projects that reduced CFCs. The Dow Chemical Company, for example, reported reductions of nearly 550 metric tons of CFCs from a refrigeration systems conversion project in 1996. By the end of that year, Dow had phased out its use of CFCs as blowing agents to manufacture foams; therefore, no reductions were reported from this project for 1997. Similarly, several refrigerator recycling and replacement programs operating in previous years have been discontinued, resulting in fewer reported CFC-12 reductions. Overall reported CFC reductions were down by 30 percent from 1996 levels in 1997.

Reported projects that reduced CFC emissions included recycling CFCs from refrigerators, chillers, coolers, and air conditioners and/or replacing CFCs with other, non-ozone-depleting substances. Dow reported reducing CFC emissions by 54 metric tons by converting existing CFC refrigerant systems to non-CFC refrigerant systems, achieving the largest reductions of CFCs among 1997 reporters. Tucson Electric Power Company installed a variety of systems to reduce or avoid emissions of CFCs from its chillers, including a refrigeration recovery system that prevents CFC emissions during repairs.

## Hydrochlorofluorocarbons

National emissions of HCFCs increased by 12 percent in 1997, as they were used increasingly to replace CFCs as solvents, as blowing agents for foams, and in refrigerator applications. According to EPA estimates, the use and emissions of HCFCs in these applications are expected to increase over the next several years before production of all HCFCs is phased out by 2030.[65]

In 1997, four projects reduced HCFC-22 emissions by 0.35 metric tons. HCFC-22 was the only member of the HCFC group of gases for which reported projects achieved reductions in 1997. Baltimore Gas and Electric Company and New England Electric System Company reported reductions of HCFC-22 from refrigerator recycling projects. Tennessee Valley Authority and Tucson Electric Power Company reported reductions of HCFC-22 from replacing and recycling air conditioners. The emission reductions reported for these four projects were offset, however, by projects reported by several other entities that involved net increases in HCFC emissions. The effect of all projects reported for 1997 on HCFC emissions was a net increase of 246 metric tons (Table 16).

[64]Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998), p. 61, http://www.eia.doe.gov/oiaf/1605/1605a.html.

[65]U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-1996*, EPA 236-R-98-006 (Washington, DC, March 1998), Annex K, http://www.epa.gov/globalwarming/inventory/1998-inv.html.

# 7. Entity-Level Reporting and Future Commitments

## Overview

The Voluntary Reporting Program permits three distinct types of emissions reporting:

- Entity-level emissions and reductions, defined as the emissions and reductions of an entire organization, usually defined as a corporation
- Project-level emissions and reductions, defined as the emission reductions consequences of a particular action
- Commitments to take action to reduce emissions in the future.

Chapters 2 through 6 of this report are concerned with project-level emissions. This chapter is concerned with entity-level emissions and commitments to reduce emissions in the future. Entity reporting and project reporting are not mutually exclusive. They correspond to different views of the appropriate answer to the question, "What is a reduction?" Most reporters (145) reported project-level reductions, and 56 reported entity-level emissions and reductions. As these numbers imply, most (43) of the firms that reported entity-level emissions also reported project-level emissions. Only 13 firms reported entity-level emissions only, whereas 100 firms submitted only project-level reports. Thus, among entity-level reporters, the norm was to report both kinds of reductions. In some cases, the reduction in emissions reported at the entity level equaled the sum of reductions reported at the project level; however, there were many instances in which the two estimates of reductions differed.

Entity-level emission reductions show outcomes, including the emissions consequences of weather, growing sales of the entity's products, and other external factors: project-level emission reductions generally indicate the emissions consequences of a particular set of actions. Thus, entity- and project-level reporting are alternative accounting frameworks for measuring emissions and reductions, which will produce identical estimates of emission reductions only if the reporter specifically defines entity-level reductions as the sum of project-level reductions.

Total 1997 greenhouse gas emissions reported to the program at the entity level were about 1.4 billion metric tons carbon dioxide equivalent, or about 23 percent of total U.S. emissions of greenhouse gases. About 98 percent of reported emissions—weighted by global warming potential (GWP)—were carbon dioxide. Aggregate reported emissions among entity-level participants in the program have risen by about 15 percent since 1990, in part as a result of increases in emissions by individual reporters but also in part because of increasing participation in the program.

The single largest category of reported emissions was 918 million metric tons of carbon dioxide emitted (directly) by stationary combustion sources, mostly electric utilities. The second largest category was the report by General Motors (GM) of 359 million metric tons of indirect carbon dioxide emissions on behalf of the entire U.S. fleet of GM-built vehicles, which accounted for about 24 percent of the emissions reported for 1997.

Reported reductions were, in general, much smaller than reported emissions. Reported entity-level reductions totaled 121 million metric tons of carbon dioxide in 1997, or about 8 percent of reported emissions.

## Entity-Level Reporting

### Who Reported

Electric utilities accounted for 40 of the 56 entity-level reporters. They included Southern Company, the Tennessee Valley Authority (TVA), and most of the other largest electric utilities in the United States. Three subsidiaries of the AES Corporation (an independent power producer) reported on domestic power plants with emissions offset by international forestry projects. The 13 other entity reporters included aluminum smelters (Alcan and VANALCO), a chemical company (Dow), two semiconductor manufacturers (Lucent and Motorola Austin), several large manufacturers (GM, IBM, Johnson & Johnson), a coal producer (Peabody Holdings), an oil company (BP America), a trade association (the Integrated Waste Services Association), and one household.

Most of the entity-level reporters were participants in U.S. Government-sponsored voluntary programs. All the utilities were participants in Climate Challenge, the manufacturers were participants in Climate Wise, the smelters in the Voluntary Aluminum Industrial Program, and the coal company in the Coalbed Methane Outreach Program.

Seven companies (five utilities and two aluminum smelters) reported emissions but not reductions at the entity level. Six of them reported reductions at the project level. A single company (AmerenCIPS, formerly Central Illinois Public Service) reported only emissions. In its report, AmerenCIPS indicated that it plans to report on emission reduction projects in the future.

## Reported Emissions

The 56 entity-level reporters claimed some 921 million metric tons of direct carbon dioxide emissions and 500 million tons of indirect carbon dioxide emissions in 1997 (Table 17). Total reported emissions in both categories have been rising since 1990.

The distinction between "direct" and "indirect" emissions corresponds to differing definitions of "ownership" of emissions. A "direct" emission is defined in the Voluntary Reporting Program as an emission from a stack or exhaust pipe owned by the reporter, arising from the combustion of fuel owned by the reporter. An "indirect" emission is an emission from a stack not owned by the reporter, but which has been caused by the reporter. Among entity-wide reporters, the most important examples of indirect emissions were emissions from motor vehicles built by GM and emissions arising from the purchase or sale of electric power.

Reported direct emissions were moderately concentrated. The largest direct emissions reported were from the Southern Company, with emissions of about 100 million metric tons of carbon dioxide. The second largest emitter was TVA, with emissions of about 80 million metric tons of carbon dioxide, followed by PacifiCorp, with emissions of 54 million metric tons of carbon dioxide in 1997.

As noted above, GM claimed indirect emissions of 359 million metric tons of carbon dioxide from the operation of GM-built vehicles in the United States during 1997. Emissions from GM-built vehicles declined during the 1990s, due to both the rising fuel efficiency of the GM-built vehicle fleet and the shrinking size of the fleet. Although emissions did decline over time, GM elected not to claim a corporate reduction in indirect emissions under the Voluntary Reporting Program.

Another form of indirect emissions in the Voluntary Reporting Program is the emissions arising from the purchase or sale of electricity. Manufacturers that purchase electricity usually view themselves as responsible for the electricity they consume and, consequently, for any reductions in the quantity of electricity consumed. Utilities, however, have adopted more diverse views.

Most electric utilities view themselves as responsible only for the direct emissions from their stacks. This view is unambiguous, relatively easy to verify, and prevents the same emission from being reported by more than one utility; however, accounting for reductions in emissions caused by substitutions of purchased power for company-generated power adds complexity to the picture.

Some utilities (for example, Niagara Mohawk, Northeast Utilities, and Long Island Lighting Company) view themselves as responsible for their direct emissions plus the indirect emissions from electricity purchases necessary to support their customer base. This approach accounts for the possibility that a decline in generation may be associated with an increase in power purchases, but it may create the appearance of an increase in emissions when a firm is both buying and selling (i.e., trading) increasing volumes of wholesale electricity. Also,

**Table 17. Total Reported Entity-Level Carbon Dioxide Emissions by Type of Activity, Data Years 1990-1997**
(Million Metric Tons Carbon Dioxide)

| Type of Reduction | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|---|
| **Direct Emissions** | | | | | | | | |
| Stationary Combustion | 795.2 | 648.6 | 741.7 | 778.8 | 810.8 | 859.0 | 876.9 | 918.5 |
| Transportation | 2.5 | 0.1 | 0.1 | 0.1 | 0.6 | 1.8 | 1.8 | 2.0 |
| Other Direct Sources | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.6 |
| **Total Direct** | **797.9** | **648.9** | **742.0** | **779.1** | **811.6** | **861** | **878.9** | **921.1** |
| **Indirect Emissions** | | | | | | | | |
| Purchased Power | 72.6 | 65.8 | 64.4 | 71.2 | 71.8 | 75.5 | 83.3 | 141.9 |
| Other Indirect Emissions | 380.2 | 371.2 | 375.3 | 376.5 | 378.0 | 372.5 | 365.8 | 358.7 |
| **Total Indirect** | **452.8** | **437.0** | **439.7** | **447.7** | **449.8** | **448.0** | **449.1** | **500.6** |
| **Total Reported** | **1,250.7** | **1,085.9** | **1,181.7** | **1,226.8** | **1,261.4** | **1,309.0** | **1,328.0** | **1,421.7** |
| (Memo) Electricity Wholesaling | 35.0 | 31.4 | 31.8 | 33.1 | 32.1 | 34.1 | 35.9 | 63.7 |

Source: Energy Information Administration, Form EIA-1605.

double reporting is possible, because both the buyer and seller of the electricity may claim ownership.

A few utilities (for example, Central Hudson and DTE Energy) have taken a "net" view, in which they see themselves as being responsible for direct generation emissions plus indirect electricity purchase emissions, minus emissions from "wholesale" electricity sales to other utilities. This approach captures net emissions to supply an end-use customer base, but there is greater potential for double counting, because double reporting is possible for both buying and selling. Further, "generation only" electricity producers, such as independent power producers or generation and transmission cooperatives, would be in the position of defining essentially all their direct emissions as belonging to their customers.

Any organization that reports indirect emissions and reductions is presented with a methodological problem: because the reporter does not control the source of emissions, the reporter may not have sufficient information to estimate emissions accurately. Most reporters, however, reported only direct emissions. For those who reported indirect emissions, with a few exceptions, the impact of indirect emissions was generally small in comparison with the magnitude of direct emissions.

Emissions of other greenhouse gases reported at the entity level were much smaller than the reported emissions of carbon dioxide and represented proportionately smaller shares of U.S. emissions (Table 18). Emissions of other gases tended to be concentrated, with only a few companies reporting emissions.

Only five companies reported entity-level methane emissions, and only three reported nitrous oxide emissions. Almost all the reported emissions of both gases were attributable to GM's reported indirect emissions from GM-built vehicles. The rapid rise in reported hydrofluorocarbon emissions also resulted from GM's increasing use of HFC-134a as a replacement air conditioning refrigerant in automotive air conditioners. Only one company (Alcan Ingot) reported PFC emissions at the entity level. Two companies (NIPSCO and Dow) reported sulfur hexafluoride emissions.[66]

## Reported Reductions

The 49 companies that reported entity-level emission reductions in the 1997 reporting cycle reported reductions totaling 127 million tons carbon dioxide equivalent (Table 19), equal to about 2 percent of total U.S. greenhouse gas emissions. The largest single reported 1997 reduction was that of TVA, at 24 million metric tons carbon dioxide equivalent, followed by the Integrated Waste Services Association, reporting on behalf of the entire "waste-to-energy" industry at 21 million tons, and Florida Power & Light at 20 million tons. The next largest reporter, Entergy Services, reported reductions of 5.5 million tons carbon dioxide equivalent. Thus, three reporters accounted for slightly more than half the reductions claimed for 1997.

Most of the emission reductions reported were attributable to energy-related carbon dioxide, although the Integrated Waste Services Association reported that its combustion of municipal solid waste reduced emissions of methane by 3 million metric tons carbon dioxide equivalent, and the New England Electric System reported methane emission reductions, mostly from landfill gas capture operations, of 0.8 million metric tons carbon dioxide equivalent.

The largest reported reductions were computed on the basis of "modified" reference cases—i.e., the reporter indicated that emissions were lower than they would have been without the actions taken by the reporter. TVA, for example, used a generation planning model to calculate what its emissions during the 1990s would have been if they had used the set of generating units

**Table 18. Total Reported Entity-Level Emissions of Other Greenhouse Gases by Type of Gas, Data Years 1990-1997**
(Million Metric Tons Carbon Dioxide Equivalent)

| Gas | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|---|
| Methane | 1.5 | 1.5 | 1.6 | 1.5 | 1.6 | 1.5 | 1.5 | 1.4 |
| Nitrous Oxide | 15.9 | 16.6 | 17.4 | 18.0 | 18.8 | 18.5 | 17.8 | 17.0 |
| Hydrofluorocarbons | * | * | * | 0.2 | 0.8 | 1.3 | 1.8 | 2.3 |
| Perfluorocarbons | 1.7 | 1.5 | 1.4 | 1.4 | 1.0 | 0.8 | 0.7 | 0.7 |
| Sulfur Hexafluoride | NR | 0.1 | 0.1 | 0.1 | 1.1 | 1.4 | 1.4 | 1.0 |
| **Total Emissions** | **19.1** | **19.6** | **20.4** | **21.1** | **22.2** | **22.1** | **21.8** | **21.4** |

*Less than 0.05 million metric tons.
NR = no emissions reported.
Source: Energy Information Administration, Form EIA-1605.

[66]Several other companies reported sulfur hexafluoride emissions at the project level.

operational in 1990 at their 1990 capacity factors and heat rates. Since 1990, TVA has greatly expanded nuclear generation. Browns Ferry Unit 2 was returned to service in 1991, Browns Ferry Unit 3 returned to service in 1995, and Watts Bar Unit 1 started commercial operation in 1996. TVA's 1997 carbon dioxide emissions were several million metric tons below 1990 levels and 24 million metric tons below what they would have been if TVA's 1990 generation mix and heat rates had been used.

Florida Power & Light also calculated its reductions on the basis of a modified reference case. The company, which did not report on a project basis, indicated that its reductions were based on nuclear availability improvements, fuel switching to natural gas, heat rate improvements at existing plants, demand-side management programs, and carbon sequestration.

The Integrated Waste Services Association claimed two sources for its reductions: (1) by burning municipal solid waste to generate electricity, its members made it possible for other utilities to burn less coal; and (2) if the municipal solid waste had not been burned, it could reasonably have been expected to be landfilled, and some portion of the landfilled waste would have decomposed anaerobically, producing methane emissions. Thus, the Association reported that burning the waste reduced fossil fuel burning and methane emissions on the part of others.

Eleven companies (ten electric utilities and the Peabody Holding Company) reported emission reductions at the entity level using a "basic reference case." A basic reference case is defined as total emissions in some baseline year—usually, but not always, 1990. Nine firms used 1990 as a baseline year; two firms (Northeast Utilities and Long Island Lighting Company) used their average 1987-1990 emissions as a baseline. In these cases, reductions were calculated as the difference between actual emissions and emissions in the baseline year.

Six of the eight electric utilities reporting declining emissions between 1990 and 1997 separately reported rising sales to end users between 1990 and 1996 or 1997. In the two cases where sales did decline (Niagara Mohawk and Central Hudson), sales declined much more slowly than emissions.

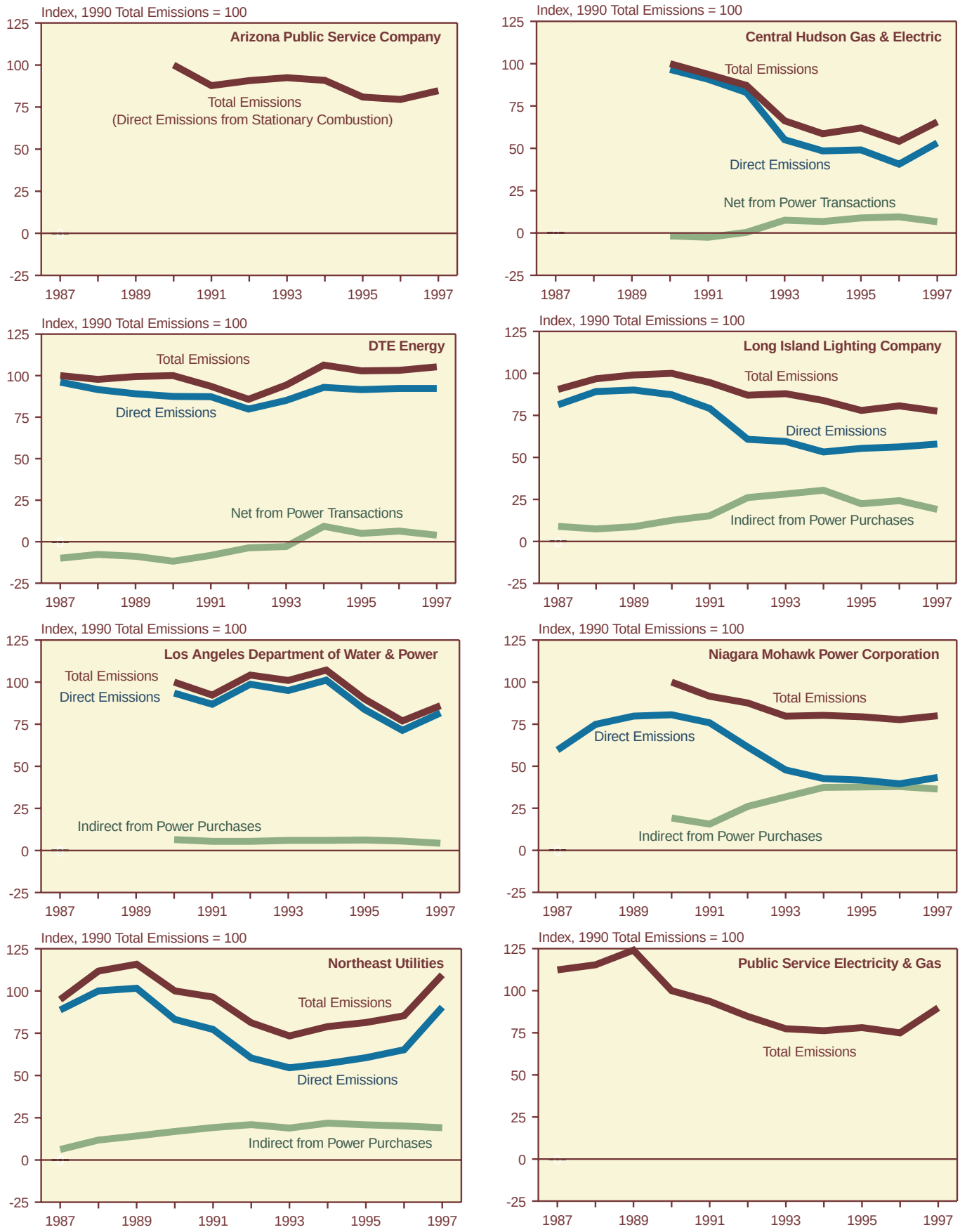
The results obtained by companies reporting basic reference cases may have been influenced by their treatment of indirect emissions from electric power purchases and sales (Figure 17). Three companies that did not report indirect emissions (Arizona Public Service Company, Potomac Electric Power Company, and Public Service Electric & Gas) had rising electricity sales to end users and declining emissions, suggesting that they may have been able to meet growing customer demand in part by purchasing, rather than generating, electricity.

**Table 19. Total Reported Entity-Level Carbon Dioxide Emission Reductions by Type of Activity, Data Years 1991-1997**
(Million Metric Tons Carbon Dioxide)

| Type of Reduction | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Direct Reductions** | | | | | | | |
| Stationary Combustion | 28.4 | 46.7 | 54.0 | 66.5 | 84.2 | 95.4 | 89.8 |
| Transportation | * | * | * | 0.1 | 0.1 | 0.1 | * |
| Other Direct Sources | NR | * | * | * | * | * | * |
| **Total Direct** | **28.4** | **46.7** | **54** | **66.6** | **84.3** | **95.5** | **89.8** |
| **Indirect Reductions** | | | | | | | |
| Purchased Power | 4.9 | 3.8 | 6.5 | 3.3 | 5.3 | 4.5 | 2.7 |
| Other Indirect Sources | | | | | | | |
| IWSA | NR | NR | NR | NR | 17.5 | 18.4 | 18.1 |
| All Other Reporters | 0.3 | 0.1 | -0.2 | 1.7 | 2.9 | 3.7 | 2.2 |
| **Total Indirect** | **5.2** | **3.9** | **6.3** | **5.0** | **25.7** | **26.6** | **23.0** |
| Carbon Sequestered | 2.0 | 3.5 | 7.7 | 7.7 | 8.0 | 8.2 | 6.9 |
| **Total Reported Reductions** | **34.9** | **54.0** | **68.1** | **77.0** | **118.0** | **130.3** | **121.1** |
| (Memo) Electricity Wholesaling | 5.5 | 7.2 | 6.7 | 8.1 | 6.4 | 6.6 | 5.6 |

* = less than 0.05 million metric tons of carbon dioxide.
NR = not reported.
Note: "Total Reported" does not add to the sum of reported components because some reporters did not disaggregate their emission reduction categories, and because of differences in the accounting treatment of purchased power by various reporters.
Source: Energy Information Administration, Form EIA-1605.

## Figure 17. Entity-Level Emissions of Selected Reporters Using a Basic Reference Case, 1987-1997




Source: Energy Information Administration, Form EIA-1605.

# Future Commitments To Reduce Emissions

The Voluntary Reporting Program also permits entities to report commitments to reduce emissions or to take action to reduce emissions in the future. In previous years, virtually all companies reporting future commitments were electric utility participants in the Climate Challenge voluntary program. However, 9 of the 65 future commitment reporters in 1997 were not utilities: Dow, BP America, Noranda, Alcan, Lucent, IBM, Motorola Austin, CLE Resources, and VANALCO. All nine were participants in other voluntary programs, such as Climate Wise for manufacturers and the Voluntary Aluminum Industrial Program.

There are three forms of future commitment in the Voluntary Reporting Program: entity commitments, financial commitments, and project commitments. Entity and project commitments roughly parallel the entity and project aspects of emissions reporting: an entity commitment is a commitment to reduce the emissions of an entire organization; a project commitment is a commitment to take a particular action that will have the effect of reducing the reporter's future emissions. A financial commitment has no emissions reporting counterpart: it is a commitment to spend a particular sum of money on emission reduction activities, without a specific promise on the emissions consequences of the expenditure. Most firms reported more than a single commitment, and many reported more than one type of commitment.

Entity commitments are usually to make emissions lower than some level in a target year. Project commitments are usually to reduce emissions by a particular amount over a period of years. Because project commitments can cover a range of years, they are sometimes difficult to compare directly with project-level data for a single year of "achieved reductions."

## Entity Commitments

Twenty-nine firms made entity commitments. They made 40 specific promises to reduce, avoid, or sequester future emissions at the corporate level. As in the case of entity reporting, some commitments were to reduce emissions below a specific baseline, others to limit the growth of emissions per unit of output, and others to limit emissions by a specific amount by comparison with a baseline emissions growth trend.

The entity future commitments often (but not always) mirror reported entity-level emission reductions. Niagara Mohawk, Public Service Electric & Gas, New England Electric System, Cedar Falls Utilities, and Waverley Light & Power committed to reduce emissions to or below baseline levels by 2000. The commitments made by Niagara Mohawk, Public Service Electric & Gas, and New England Electric System matched their reporting, but both Cedar Falls and Waverley have reported reductions to date using a modified reference case.

In their reports for 1997, companies committed to reducing emissions by 99.6 million metric tons of carbon dioxide. Most companies committed to making their reductions by the year 2000—92.3 million metric tons of reductions, with about two-thirds of that amount from the TVA (22.6 million metric tons), the Los Angeles Department of Water and Power (16 million metric tons), Niagara Mohawk Power (15 million metric tons), and Florida Power & Light (10 million metric tons). TVA and Florida Power & Light measured their commitments using modified reference cases. Niagara Mohawk and the Los Angeles Department of Water and Power used basic reference cases. A few companies specified time horizons other than 2000: Wisconsin Electric committed to reducing emissions by 5 million metric tons carbon dioxide equivalent by 1999, and Dow Chemical committed to reducing emissions of a range of gases by 0.9 million metric tons by 2005.

## Project Commitments

Forty-two companies reported on commitments to undertake some 265 individual emission reductions projects. Some of the commitments were linked to future results from projects already underway and forming part of the reporters' submissions. Others were for projects not yet begun.

Reporters indicated that the projects were expected to reduce future emissions by 92 million metric tons carbon dioxide equivalent, most of which (84 million metric tons) would be carbon dioxide emissions. The two largest individual project commitments (at 17 million metric tons of carbon dioxide each) were made by Texas Utilities and TVA. The TVA project was described as "an increase in low emitting capacity," almost certainly a result of TVA's nuclear program. The Texas Utilities commitment was described as "availability improvement" linked to the performance of its Comanche Peak nuclear plant.

## Financial Commitments

Thirty-one firms, all electric utilities, made financial commitments. The total amount of funds promised was $43 million, of which $13 million was reported actually to have been expended in 1997. The largest single financial commitment was made by South Carolina Electric & Gas, which committed to spend $12 million on a "carbon burnout plant" to make fly ash suitable for sale to cement companies. South Carolina Electricity & Gas reported that it actually spent $15 million in 1997, exceeding its commitment.

Appendix A

# The Voluntary Reporting Program: A Developmental Overview

## Appendix A

# The Voluntary Reporting Program: A Developmental Overview

## Introduction

Rising global atmospheric concentrations of carbon dioxide, methane, nitrous oxide, and other "greenhouse gases" have been a subject of increasing scientific and policy concern for the past decade. Many scientists and policymakers believe that increasing atmospheric concentrations of these gases (thought to be caused by human activities, particularly the combustion of fossil fuels) may cause significant long-term changes in global weather and climate by trapping more of the sun's heat in the atmosphere. The heat-trapping properties of greenhouse gases are discussed in the box in Chapter 1, page 6 of this report.

In 1992, President George Bush signed a multilateral treaty, the Framework Convention on Climate Change, which committed the United States to take steps, in conjunction with other signatory states, to ". . . achieve . . . stabilization of the greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[67]

As the Framework Convention was being negotiated, the Congress began to consider measures that would help the U.S. Government develop the national "commitment" required by the treaty. One such measure was Section 1605(b) of the Energy Policy Act of 1992, which requires the Energy Information Administration (EIA) to create reporting forms and a database for the voluntary reporting of emissions and reductions in emissions of greenhouse gases. The Voluntary Reporting Program was developed in a cooperative effort with potential reporters, the Department of Energy's Office of Policy, and the U.S. Environmental Protection Agency. The program permits individuals, corporations, and other organizations to report to the EIA on actions taken that have reduced emissions of greenhouse gases.

Reporters choose to undertake the effort of preparing their voluntary submissions for a variety of reasons, such as:

- To establish a public record of their contributions to achieving a national policy objective
- To provide the opportunity for others to benefit from their experience in reducing emissions
- To demonstrate their commitment to voluntary approaches to solving or ameliorating environmental conditions
- To record the activities undertaken pursuant to voluntary programs under the President's Climate Change Action Plan
- To establish a basis for requesting consideration of prior actions in a possible future "credit for early reductions" program or a possible future regulatory scheme to stabilize or reduce national emissions of greenhouse gases.

## Development of the Voluntary Reporting Program

About 3 years elapsed between the passage of Section 1605(b) of the Energy Policy Act of 1992 and the completion of the first reporting cycle of the Voluntary Reporting Program. The development of the Program consisted of three phases:

- Guidelines development (October 1992 to October 1994)
- Forms development (February 1994 to July 1995)
- First report processing (July 1995 to March 1996).

### Guidelines Development

The principal clauses of Section 1605(b) of the Energy Policy Act require the U.S. Department of Energy (DOE), in consultation with the U.S. Environmental Protection Agency (EPA), to issue guidelines for reporting emissions of greenhouse gases. The EIA was then required to develop a reporting framework consistent

[67] United Nations, "Report of the Intergovernmental Negotiating Committee for a Framework on Convention for Climate Change on the Work of the Second Part of its Fifth Session, Held at New York from 30 April to 9 May 1992," UN Document A/AC.237/18, Part II (May 15, 1992), http://www.unfcc.de.

with the guidelines. The information collected was to be accessible for public use.

The development of the guidelines was assigned to DOE's Office of Policy, which began a series of public workshops to gather information about public expectations of the program. The public workshops on the guidelines ran from September 1993 to March 1994 and were held in Washington, DC, Atlanta, GA, and Chicago, IL. The workshops spanned a range of issues related to the objectives of the Voluntary Reporting Program, the definition of a "credible" report, and methods of reporting.

Differing notions of the purpose of the Voluntary Reporting Program were expressed, as well as differing views about the nature and type of information to be collected. Many potential reporters tended to stress the notion that the reporting system should be "simple and flexible." They typically opposed suggestions to construct detailed "official" definitions of baselines, reporting entities, and coverage of reports. It was argued that such definitions were premature in an experimental program, would discourage companies from reporting, and would render the program relatively narrow.

Some commenters, who were not potential reporters, argued the reverse. They urged explicit and specific definitions of "who is responsible for an emission." The individuals and organizations holding these views hoped to elicit reports that revealed absolute and verifiable emission reductions.

Following the workshops, a public review draft of the guidelines was published in May 1994. After further public comment, final guidelines were published in October 1994.[68] The guidelines contain several broad themes that have shaped the program:

- The Department held that the primary objective of the program was "broad participation." Any U.S. "legal person" (i.e., individual, corporation, trade association, or private voluntary organization) may report.
- Within the confines of the statute, reporters were given nearly complete flexibility in crafting their reports. Reporters were free to define as they saw fit the nature of the reporting entity, the emissions and reductions to be reported, methods of calculating emissions and reductions, and the type of activity deemed to cause emission reductions.
- Reporters were to be permitted to report on activities both in the United States and abroad, so long as they distinguish between domestic and foreign activities.
- Reporters were to be encouraged to report both emissions and emission reductions as comprehensively as possible, accounting for both "direct" and "indirect" emissions, and also for "primary" and "secondary" effects. (These terms are defined in Appendix B.)
- Reporters were to be encouraged to report on emissions and emission reductions for a range of greenhouse gases.
- Reporters were to report "achieved reductions," defined as emission reductions achieved since 1990. Reductions occurring prior to 1990 or reductions expected to occur in the future are not permitted.

The guidelines did not define "property rights" in emissions. For example, the emissions from generating electricity could be the responsibility of an electric utility or the purchaser of the electricity. By accepting the validity of differing possible interpretations of who "owns" emissions, reporters were given considerable flexibility in reporting on their greenhouse gas emissions and emission reduction activities. The guidelines explicitly recognized the possibility that, in the absence of clear "property rights," two or more organizations might report on the same emission reduction activity, an eventuality called "double reporting." The flexibility of the guidelines has, of necessity, resulted in a relatively complex reporting form and database.

## Forms Development

The EIA developed, in parallel, reporting forms and a database consistent with the guidelines. In early November 1994, 2 weeks after the issuance of the final guidelines, the EIA issued draft forms for public review. The draft forms were pre-tested by several firms interested in reporting, including Niagara Mohawk Power, Houston Light & Power, and General Motors. Many useful comments were received, both from pre-testers and from the public review process.

Following the public review, the EIA sent the forms to the Office of Management and Budget (OMB) for formal clearance under the Paperwork Reduction Act, a legal requirement for any Federal data collection exercise. The OMB requested further public comment and, after reviewing the forms, cleared them for public use in May

[68] U.S. Department of Energy, *Voluntary Reporting of Greenhouse Gases Under Section 1605(b) of the Energy Policy Act of 1992: General Guidelines;* and *Sector-Specific Issues and Reporting Methodologies Supporting the General Guidelines for the Voluntary Reporting of Greenhouse Gases Under Section 1605(b) of the Energy Policy Act of 1992*, Volumes 1 and 2, DOE/PO-0028 (Washington, DC, October 1994), http://www.eia.doe.gov/oiaf/1605/guidelns.html.

1995. After final editing and layout revisions to enhance readability, the EIA released the forms to the public in July 1995.

### The Voluntary Reporting Program and the Climate Change Action Plan

On April 21, 1993 (Earth Day), President Clinton committed the United States to stabilizing its emissions of greenhouse gases at 1990 levels by the year 2000. The methods by which the Government proposed to achieve this objective were described in the President's *Climate Change Action Plan*, published in October 1993.[69] That document spelled out a range of largely voluntary programs intended to limit emissions of greenhouse gases. The *Climate Change Action Plan* is updated yearly through the preparation and submission of the United States' *Climate Action Report*, under the annual requirement to the United Framework Convention on Climate Change. The most recent report, *The 1997 Climate Action Report*, was released in July 1997.[70]

As the President's Climate Change Action Plan began to be implemented, managers of certain DOE- and EPA-sponsored voluntary emission reduction programs (as well as some participants) felt the need for a reporting system to record and describe the actions of participants in those programs. The 1605(b) Voluntary Reporting Program, already underway with an OMB-approved data collection instrument and a requirement to collect information about a broad range of emission reduction activities, was a useful vehicle for recording results of the voluntary reduction programs. Participants in the Climate Challenge program (for electric utilities) and the Climate Wise program (for manufacturing firms) were strongly encouraged to file reports with the Voluntary Reporting Program documenting their emission reduction efforts.[71]

## Forms Design

The data collection forms for the Voluntary Reporting Program, as developed, endeavored to cover the complexity in categories of emissions required by the guidelines. To this end, the structure of the voluntary reporting database needed to be expansible to cover many different contingencies, including the following:

- Reporters ranged from some of the largest industrial firms in the United States to individual households.
- Reporters could report on particular actions they had taken to reduce emissions or on the emissions (and reductions) of their entire organizations.
- The statute required, and reporters requested, the ability to report on many different classes of actions that have the effect of reducing greenhouse gas emissions, ranging from energy conservation to carbon sequestration.
- The reporting format sought to identify areas where multiple reporting of the same project actually occurred, and to make possible a general assessment of the reliability and possible ownership of the reports.
- The lack of generally accepted accounting principles for greenhouse gas emissions required a design that permitted a variety of reporting formats. This led to ambiguities that the forms design tried to clarify.
- The guidelines permitted the reporting of foreign emission reduction actions.
- The guidelines permitted reporting on reductions for a range of greenhouse gases.
- Managers of voluntary programs asked the EIA to develop a mechanism for collecting participants' commitments to reduce future emissions.

The EIA developed two alternative reporting instruments: the long form (Form EIA-1605), which comprises four schedules (described in the box on page 62), and the short form (Form EIA-1605EZ). The short form is intended to cover reporting solely on emission reduction projects and for a single year only.

The text box on page 62 outlines the basic structure of the long form. The form has four schedules. The first schedule asks for the name and address of the reporter, along with some particulars about the report. The most fundamental distinction is between "project reporting" in Schedule II and "entity reporting" in Schedule III. Project reporters are reporting on specific actions they have taken to reduce emissions. Entity reporters are reporting on emissions and emission reductions for an entire organization. For example, during the fourth reporting cycle of the Voluntary Reporting Program (1997 data year), 56 reporters provided entity-level reports, and 145 reporters provided project-level reports. Forty-five reporters filed both entity-level and project-level reports, while 11

[69] President William J. Clinton, *The Climate Change Action Plan* (Washington, DC, October 1993), p. i, http://www.gcrio.org/USCCAP/toc.html.

[70] U.S. Department of State, *The 1997 Climate Action Report*, DOS/10496 (Washington DC, July 1997), http://www.state.gov/www/global/oes/97climate_report/index.html.

[71] Not all participants in those programs have filed 1605(b) reports. Many participants have promised to take actions in the future, which will not be reportable until the actions have produced results. Section 1605(b) obliges the EIA to receive reports of "achieved reductions," meaning the results of actions already taken. Further, many participants joined the voluntary programs after the close of the first reporting cycle in 1995. Finally, some voluntary program participants may have experienced difficulty in gathering together the necessary information to file their reports.

reporters filed only entity-level reports. Within Schedule II, the report is further subdivided into ten sections, reflecting the diversity of anticipated reduction actions. Each section contains general questions that are applicable to all ten sections, as well as other questions specific to the particular type of project, to help reporters and the EIA understand and describe the project.

In order to clarify what reporters are claiming as "their" emissions, the Voluntary Reporting Program generally distinguishes between "direct" and "indirect" emissions. A direct emission is defined as an emission from a facility actually owned by a reporter. An indirect emission is defined as an emission from a facility owned by someone else, but for whose emissions the reporter claims be responsibility. Some reporters reported only direct emissions and some reported only indirect emissions, depending on the nature of the project and the reporter's view on the ownership of the emission.

Schedule IV was added to assist participants in DOE- and EPA-sponsored voluntary programs in recording their commitments to reduce future emissions. Sixty-five firms reported on Schedule IV during the 1997 data reporting cycle. Most Schedule IV reporters were electric utilities participating in DOE's Climate Challenge program.

### The Structure of Form EIA-1605

**Schedule I. General Information**

This schedule asks for the reporter's name, address, and type of entity, and whether the report contains confidential information.

**Schedule II. Project Level Emissions and Reductions**

This schedule covers reporting of specific actions that the reporter has taken that have reduced emissions. It is divided into ten parts, each covering a specific type of project. Each part requests general information about the location and nature of the project, emissions, emission reductions, and (if applicable) fuel or energy savings. Each part also asks a number of questions specific to the project type that will enhance the ability of data users to assess the emission reductions claimed.

| | |
|---|---|
| Section 1 | Electric Power Generation, Transmission, and Distribution |
| Section 2 | Cogeneration and Waste Heart Recovery |
| Section 3 | Energy End Use |
| Section 4 | Transportation and Off-Road Vehicles |
| Section 5 | Waste Treatment and Disposal—Methane |
| Section 6 | Agriculture—Methane and Nitrous Oxide |
| Section 7 | Oil and Natural Gas Systems and Coal Mining—Methane |
| Section 8 | Carbon Sequestration |
| Section 9 | Halogenated Substances |
| Section 10 | Other Emission Reduction Projects |

**Schedule III. Entity Level Emissions and Reductions**

This schedule covers reporting on the emissions of an entire entity. It requests direct emissions (Part Ia) and reductions in direct emissions (Part Ib) from sources such as stationary combustion, transportation, and other direct sources. Schedule III also requests indirect emissions (Part IIa) and reductions in indirect emissions (Part IIb) from sources such as power transactions, which include purchased power and electricity wholesaling, and other indirect sources. Carbon sequestered, total emissions, and total reductions in emissions (Parts III, IVa, and IVb, respectively) for the entire entity are also requested on Schedule III. It should also be noted that if reporting entities had both foreign and domestic emission reduction activities, they were requested to submit two separate copies of Schedule III, Parts I through III—one representative of their domestic emission reduction activities and the other representative of their foreign emission reduction activities.

**Schedule IV. Commitments to Emission Reduction or Sequestration Projects**

This schedule permits reporters to outline commitments to reduce emissions some time in the future, generally as part of a Government-sponsored voluntary program. Commitments can take several forms. The reporter can describe entity-level commitments to reduce greenhouse gas emissions (Section 1). Section 2 allows the reporter to report on commitments in terms of financial commitments or dollars pledged toward emission reduction or sequestration activities or research. Section 3 can be used to report on commitments to undertake specific actions or projects whose intended objective is to reduce greenhouse gas emissions.

Appendix B

# Emissions Accounting Issues

## Appendix B

# Emissions Accounting Issues

## Introduction

The Department of Energy's guidelines for the Voluntary Reporting Program took the view that reporters should themselves define the emissions and reductions for which they felt themselves responsible. The Energy Information Administration (EIA) attempted to develop a reporting system in which diverse definitions could be made clear to data users. In attempting to achieve this objective, the EIA has identified several emissions accounting issues that presented significant problems in understanding and interpreting the data.

These accounting issues are common to the design of many programs to limit the emissions of environmental residuals and, consequently, may be of interest beyond the Voluntary Reporting Program. The sulfur trading program under the Clean Air Act Amendments, Climate Change Action Plan voluntary programs, Joint Implementation, and the "Clean Development Mechanism" proposed under the Kyoto Protocol all must confront similar challenges, which can be summed up by four questions:

- Who participates?
- What is a reportable action?
- Who owns the emission or reduction?
- What is a reduction?

In addition to these central questions, the Department of Energy and EIA also confronted the following, more technical reporting issues:

- Fuel cycle costs
- Confidentiality of reporting
- Domestic vs. foreign reporting
- Mergers and acquisitions
- Emissions trading
- Data validation and accuracy.

This appendix describes the nature of the issues and the approaches adopted by the Department of Energy's Guidelines and the EIA.

## Who Participates: The Nature of the Entity

As noted in Chapter 7 of this report, there are different views about the nature of the entity, and reporters have adopted various conventions. In general, the most common definition of the entity is a corporation; however, reporters have made a number of modifications to this concept. For example, General Motors excluded its overseas operations from its definition of its corporate entity. Most electric utilities defined their entities as their regulated utility activities, excluding unrelated activities owned by their holding companies. Houston Light & Power excluded the activities of its parent company, Houston Industries, which include a cable TV operation.

Not all entities are corporations. Several reporters are facilities, notably, Alcan's Sebree Aluminum Plant, which reduced emissions of perfluorocarbons. Similarly, AES Corporation's subsidiaries, AES Hawaii and AES Shady Point, reported on forest preservation projects in the South American countries of Paraguay and Bolivia, respectively. AES Thames, another subsidiary of the AES Corporation, reported on its CARE Agroforestry project in Guatemala, which was designed to plant trees, to prevent or reduce the future loss of forest, and to control soil erosion through reforestation activities and soil conservation measures.

In addition, there were a number of instances of one organization reporting on behalf of another organization. A trade association, the Integrated Waste Services Association, reported on the aggregated emissions and reductions of its members. Several firms and nongovernmental organizations reported on projects, such as landfill methane recovery or forest planting or preservation, which they undertook on behalf of another organization. In these cases, the legal owner of the project, the emission, or the emission reduction was not necessarily the reporter.

## Reportable Actions: Types of Reports

The language of the statute calls for reporting of "annual reductions of greenhouse gas emissions . . . achieved

through any measures . . ." (1605(b)(1)(B)), and separately calls for "an aggregate calculation of greenhouse gas emissions by each reporting entity." As interpreted in the guidelines and in the forms, it establishes two categories for the reporting of emission reductions:

- An "entity-wide" report, where the emissions reported are the emissions of the entire entity (for example, the total emissions of a particular electric utility). The emissions of the entity can rise or fall. Some firms (6) did not report emission reductions for 1997 but simply reported emissions.
- A "project report," where the reporter indicates the results of certain specified actions taken (called "projects") that resulted in a reduction of emissions of greenhouse gases (or increased sequestration). Most firms that filed entity-wide reports also filed one or more reports on projects.

These two approaches to reporting encompass alternative approaches to accounting for emission reductions activities. An entity report reflects the view that the relevant unit for analysis is an institution, defined as a legal person or a facility. A project report, on the other hand, reflects the view that the relevant unit of analysis is the emission reduction action taken by the reporter.

## Ownership of Emissions and Reductions

An issue that emerged in the process of developing the guidelines was the question of defining exactly who is responsible for or "owns" particular emissions and reductions. The most intuitive definition is that ownership of the emission comes with ownership of the source of the emission: the smoke stack or the fuel. Emissions accounting based on source ownership is relatively easy to understand and measure and can in principle be objectively audited. Source ownership (usually based on facilities) has been adopted for most U.S. environmental regulation of point-source emissions.

The source ownership approach works best when all relevant sources participate. In a closed system, the emission reductions of one participant may be offset by the emissions growth of another participant, but both participants' emissions are reported. In an open system, where some emitters participate and others do not, any individual company can reduce its emissions by "outsourcing" (buying rather than making an emissions-intensive product, such as electricity), while companies with growing emissions may elect not to participate.

An alternative approach is to define responsibility on the basis of causation: an emission or reduction is the responsibility of the person whose action caused the emission or reduction to occur. A causation-based approach is, in principle, more comprehensive than a source ownership-based approach, permits the recognition of an enormous range of emissions-reducing actions, and accommodates fuel cycle costs. On the other hand, actions may have multiple causes, causation may be difficult to define, and causation-based ownership may overlap or be inconsistent with source-based ownership.

Suppose, for example, in response to an EPA initiative, that a refrigerator manufacturer designs and builds an energy-efficient refrigerator with performance that far exceeds that of other refrigerators on the market. An electric utility then offers rebates to customers if they purchase the energy-efficient refrigerator. Customers buy the refrigerator and accept the rebate. The customers purchase less electricity, and the electric utility generates less electricity from fossil fuels, thus reducing emissions. But who is "responsible" for the reduction, and on what grounds?

- The EPA (for sponsoring the initiative)?
- The refrigerator manufacturer (for building the refrigerator)?
- The refrigerator dealer (for choosing to buy and carry the efficient model in preference to some other model)?
- The electric utility (for offering the rebate)?
- The customer (for choosing to buy the refrigerator)?
- The customer (for purchasing less electricity)?
- The electric utility (for burning less fuel)?
- Some other electric utility (for burning less fuel, as a consequence of selling less electricity to the customer's utility)?

There is no perfect answer to this question. All the participants have some influence on the eventual outcome. Further, "responsibility" can have multiple meanings. Will a firm be made legally responsible for the emissions in some hypothesized future regulatory environment? Or, alternatively, who gets "recognition" for taking an action that reduces emissions?

In addition, different observers could choose a particular responsible party for different reasons, which means that they might agree on this example and disagree on some other example. Some might view the payment of the rebate as the "act" that makes the utility the "responsible" party. Others might view the utility as the responsible party because it was the utility whose emissions actually declined.

The guidelines, in accordance with legislative provisions and the objective of broad participation, do not assign the "right" to report emissions or reductions. Thus, in the Voluntary Reporting Program, all the participants in the hypothetical transaction described can justifiably report on their actions to reduce emissions, because ownership is not exclusive.

The Voluntary Reporting Program attempts to identify instances of multiple reporting and to clarify reporters' definitions of emissions. To clarify instances of multiple reporting, project-level reporters are asked whether other entities might be reporting on the same activity and, if so, who. Reporters are also asked about joint-venture partners (if any) for projects, which helps to identify a particular class of multiple reporting with precision.

In order to clarify the reporters' diverse definitions of "ownership" of emissions, the guidelines define (and the forms implement) the concept of "direct" and "indirect" emissions. "Direct" emissions are emissions from a source owned and controlled by the reporter. "Indirect" emissions are emissions that the reporter in some sense "caused" to occur, although the reporter did not own or control the facility producing the emission. The Voluntary Reporting Program requires reporters to specifically identify all reported emissions and reductions as either "direct" or "indirect." This distinction has proved useful in understanding reporters' definitions of "ownership."

In practice, with a few exceptions, reporters tended to have very straightforward and intuitive definitions of "their" emissions and "their" reductions; however, these straightforward and intuitive definitions were not always consistent across reporters. Nearly everyone tended to accept the notion that direct emissions and reductions belong to the owner of the source producing the emissions. Thus, if a reporter owns and operates a fossil fuel power plant, usually the reporter is viewed as being responsible for the emissions of the plant. In the case of a jointly owned plant, the reporting entity takes a prorated share of the "ownership" of the emissions.

In the case of sales of electricity, views were much more diverse. Electricity consumers, such as households and manufacturing firms, tended to view themselves as responsible for indirect emissions arising from their use of electricity. On the other hand, electric utilities also tended to view themselves as responsible for their customers' use of electricity.

Reporters accounted for wholesale electricity transactions in various ways:

- Distribution-only electric utilities tended to behave like end-use consumers and to view themselves as responsible for the electricity consumption of their customers and, hence, for the indirect emissions of their suppliers.
- Electric utilities that both bought and sold electricity had diverse views: some utilities assumed responsibility only for their direct emissions (i.e., sales to wholesale and retail customers) but took no responsibility for emissions associated with electricity purchases.
- Other utilities added direct emissions associated with their wholesale electricity purchases but did not deduct those associated with their wholesale electricity sales.
- Still others summed their wholesale purchases and sales of electricity to calculate "net" indirect emissions as an addition to direct emissions.

Each approach produces a different figure for the total emissions of the reporter, and there is no theoretical basis for defining one approach as "correct." Each approach has conceptual and practical merits and drawbacks, depending on the intended purpose of the calculation and the circumstances of the particular reporter.

In general, the treatment of wholesale power transactions is not always material to electric utility emissions estimates. In many cases, the volume of purchased power is small or stable over time. The importance of wholesale power transactions is likely to grow in the near future, however, if utility restructuring and changes in transmission access regulations greatly increase the amount of electric power traded among utilities in the United States. In the absence of a common definition of responsibility for wholesale transactions, it will be increasingly difficult to compare reports from different utilities without a careful study of the underlying assumptions.

## Defining Reductions: The Nature of the Reference Case

The emphasis of the Voluntary Reporting Program is on reporting reductions in emissions; however, the development of the guidelines raised the question: reductions compared to what? The guidelines developed the notion that a "reduction" in emissions is defined by comparison with an alternative situation, called a "reference case." The guidelines defined two ways in which a reference case could be defined: "basic" and "modified."

A basic reference case is the most straightforward. A basic reference case is the reporter's level of emissions at some period in the recent past—for example, in the year 1990. This definition is closest to the definitions implicit in the Framework Convention and those used in the

Clean Air Act emissions trading scheme. If the reporter's emissions today are less than they were in 1990, then the size of the reporter's reduction is equal to the difference between current emissions and 1990 emissions.

Basic reference cases are most meaningful in the context of entity-wide emissions. When applied to specific projects, however, a basic reference case can often become ambiguous or meaningless. For example, suppose an electric utility offers a program to induce homebuilders to add more energy-efficient appliances to newly constructed houses. The new appliances will consume less energy in the future than some alternative device, but there are no baseline historic emissions. Any new project that is not an exact, one-for-one replacement for an old project faces a similar problem. It is useful to recall that one of the purposes of the Voluntary Reporting Program is to recognize and encourage actions that reduce greenhouse gas emissions, whether they are new or existing sources.

In the Voluntary Reporting Program, therefore, a second method of calculating reductions is provided: the "modified reference case." A modified reference case is, in effect, a hypothetical case. The notion is that a reporter's emissions would have been higher had certain actions not been taken. In the case of the electric utility above, the modified reference case would be the putative emissions of the new houses with the appliances that homebuilders would have chosen without the intervention of the electric utility, and the reduction would be the difference between emissions with the energy-efficient appliances and emissions with "typical" appliances.

Modified reference cases always have a degree of uncertainty about them, because it is never possible to be certain about what would have happened in the absence of a particular action. By providing modified reference cases, the guidelines permitted the reporting of an extensive range of important and interesting projects. In practice, most project reports used various forms of a modified reference case. About two-thirds of entity-wide reporters also used a modified reference case, indicating that while emissions increased, they did not increase as much as they would have increased in the absence of actions by the reporter.

# Technical Reporting Issues

## Reporting Fuel Cycle Effects

The authors of the Department of Energy's guidelines designed a program in which a broad range of emission reduction activities could be reported. They recognized, however, that projects might have significant consequences distant from the direct effects of the project itself. The particular issue that concerned the designers of the program was the measurement of fuel cycle effects. In many cases, fuel cycle effects are minor; however, in several relevant instances (e.g., electric cars and other alternative fuel vehicles) it is impossible to know whether or not a particular project actually reduces greenhouse gas emissions without estimating fuel cycle effects. The solution adopted by the guidelines was to create the concept of "primary" and "secondary" effects.

As an example, a reporter claims to have reduced emissions by replacing his gasoline-powered automobile with an electric automobile. The primary effect is the direct reduction in emissions from the reduction in burning gasoline. Most reporters would also consider the increased electricity consumption for the electric automobile to be a primary effect, but the emissions associated with the generation of that electricity would generally be considered as indirect emissions—a secondary effect. Other secondary effects might also be considered. For example, mining additional coal or producing additional natural gas to fuel electricity generation causes additional emissions of methane, whereas reducing gasoline consumption also reduces emissions from oil refining and methane emissions from crude oil and gasoline transportation and storage.

Primary and secondary effects are loosely related to direct and indirect emissions. Direct emission reductions are generally the primary effect. Indirect emission reductions may be a primary or a secondary effect, but the secondary effects almost always cause indirect emissions.

In practice, reporters almost universally ignored secondary effects (whether positive or negative) in their reporting. When queried about this point, reporters tended to argue that they had no basis for estimating secondary effects, which would require "certifying the accuracy" of an estimate of emissions from other industries remote in space and time from the reporter's knowledge and concern.

## Mergers and Acquisitions

The definition of reference cases for measuring reductions presupposes that the definition of the entity itself remains stable over time. This is not always the case. Firms can merge, buy and sell assets, expand, shrink, or even go out of business altogether. In those instances, the basis for comparing past emissions with present emissions becomes more complex.

In general there are three approaches to an entity that is changing shape over time. One can either accept that a changing entity will produce changing emissions and report the results, or one can restate historical emissions "as if" the new entity had always existed. Finally, one

can restate current emissions "as if" the older form of the entity existed today.

The CONSOL Coal Group chose the second approach in its report for data year 1995. CONSOL reported emissions estimates for 1990, 1994, and 1995 based on recorded measurements where possible and best estimates if measurements were unavailable. In 1993, CONSOL acquired Island Creek Coal Company, whose mines are located in a very gassy coal seam in Buchanan County, Virginia. Parallel to the financial accounting of mergers, acquisitions, and divestment guided by standard accounting practices, CONSOL has "restated" 1990 emissions to include emissions from the subsequently acquired Island Creek mines.

Each of the three approaches above will have its merits in particular situations. In many cases, however, the problem can best be addressed by proper accounting of changes in indirect emissions. For example, if a utility signs a power purchase agreement with an independent power producer (IPP), in principle it is outsourcing its power generation, and a reduction in direct emissions (from the utility's own capacity) is offset by an increase in indirect emissions (from the IPP).

### Domestic and Foreign Actions

Reporters are permitted to file reports on actions both within the United States and abroad, but they are required to distinguish between domestic and foreign emissions and reductions and report them separately. The rationale for this distinction is that, on the one hand, the President's commitment under the Framework Convention is to reduce domestic emissions. Therefore, only domestic emissions "count" in achieving the President's commitment. On the other hand, it has long been an objective of U.S. climate change policy to promote "joint implementation," wherein one country participates in emission reduction projects in another country. Further, since greenhouse gas emissions have equal consequences no matter where the source of the emissions is located, foreign reductions are just as valuable as domestic reductions in ameliorating climate change. Therefore, both kinds of report are permitted, while the distinction between domestic and foreign reports is preserved. In practice, only a relatively small number of reports were received relating to projects or activities abroad, largely forestry projects.

### Confidentiality

Section 1605(b)(3) requires the Energy Information Administration to offer protection from publication and Freedom of Information Act requests to reporters who are submitting trade secret and commercial or financial information. In practice, for most firms wishing to participate in a public, voluntary program, one of whose benefits is public recognition of their actions, confidentiality is unnecessary. Firms worried about proprietary data can refrain from reporting or design their reporting definitions to protect proprietary data. During the 1997 reporting cycle, none of the reporting entities requested confidentiality.

### Emissions Trading

One of the most striking uses of a voluntary report occurred when Niagara Mohawk Power Corporation and the Arizona Public Service Company engineered the first-ever trade of carbon dioxide emission reductions. Arizona Public Service Company traded 20,000 sulfur dioxide allowances (obtained under the Clean Air Act Amendments) in exchange for rights to 2.27 million metric tons of carbon dioxide emission reductions achieved by Niagara Mohawk in the period 1991 through 1993. Niagara Mohawk donated the sulfur dioxide allowances to a nonprofit environmental organization, which subsequently retired the allowances, in effect reducing national sulfur dioxide emissions by 20,000 tons.

Both companies reported the transaction to the Voluntary Reporting Program: Nigara Mohawk incorporated the trade into its report, and Arizona Public Service indicated that it would use the tons acquired to reduce its 2000 emissins if necessary.

## Data Validation and Accuracy

Section 1605(b) of the Energy Policy Act requires the Secretary of Energy to issue guidelines that "establish procedures for the accurate voluntary reporting of greenhouse gases." During the development of the Voluntary Reporting Program, there was considerable discussion of the related topics of "data validation" and "data accuracy." Some observers, who were concerned about the accuracy of emissions reporting, recommended "third-party validation," meaning, in essence, reviews or audits of reporting by disinterested third parties. The law also states: "Persons reporting under this subsection shall certify the accuracy of the information reported." That sentence has been interpreted to mean that it is the reporter who is responsible for the accuracy and correctness of the emissions and reductions claimed in the Voluntary Reporting Program.

The EIA devotes considerable effort to the review of incoming reports. Each report is assigned to an EIA reviewer, who reviews the reported information for internal consistency, accuracy of calculation, and comparability with other sources of information. The reviewer then prepares a list of issues for discussion

with the reporter, who is asked about possible problem areas identified in the review. In many cases, reporters subsequently choose to revise their reports.

This work has given EIA useful insights into the potential and limitations of data validation and accuracy. Nothing in the review process has given credence to the idea that reporters have deliberately prepared and submitted inaccurate voluntary reports. Reporters have found the task of developing emissions and reductions estimates sufficiently daunting in itself. The notion of deliberately inaccurate reporting has tended to divert attention from the genuine problems faced by reporters in attempting to prepare accurate reports. Some of those problems included:

- Lack of generally accepted "accounting standards" for emissions. This left each reporter to make judgments about the limits of the reporting entity and the ownership of emissions. Most reports were clear about the judgments that had been made, but it still can be difficult to aggregate and compare reports.
- Imprecision in estimation methods. Emissions of greenhouse gases generally are estimated on the basis of operating data, particularly, consumption of fossil fuels. Estimates of direct emissions from the combustion of fossil fuels should be reasonably accurate; however, there are significant uncertainties inherent in the estimation of indirect emissions generally, as well as in the estimation of emissions (direct or indirect) of other gases (particularly, methane and nitrous oxide). Many reporters chose not to report indirect emissions or emissions of other gases because of those uncertainties.
- Limited expertise in emissions estimation. Organizations rarely collect information on greenhouse gas emissions, and they have no reason to develop corporate expertise in estimating emissions. Reporters must start from scratch in collecting underlying operating data and developing expertise in estimating emissions on the basis of operating data.
- Limited availability of data within the organization. A comprehensive emissions and reductions report might cover direct combustion of fossil fuels, electricity purchases, use of halogenated substances as refrigerants and solvents, consumption of transportation fuels (gasoline and diesel), and any process emissions peculiar to the reporter. Collecting such information within an organization can present significant challenges, particularly for manufacturing companies, where energy is a relatively small portion of total operating costs. Companies may not collect data on fuel, electricity, or refrigerant consumption at all, and many companies may record financial (but not quantitative) data in their accounting systems. Alternatively, the information may be collected only at the local (plant) level and never forwarded to corporate headquarters. In such cases, the person preparing the report must obtain information from a host of individual plant managers. Personnel in separately managed subsidiaries may be unable or unwilling to provide information. While current data may be available, historical data may be destroyed, archived, or otherwise practically unrecoverable.

These considerations have shaped the reports submitted to the Voluntary Reporting Program. Reporters have tended to calculate emissions where data are available, to make the calculations they can make, and to form reasonable judgments about what information they should meaningfully include.

Appendix C

# Summary of Reports Received

## Table C1. Reporting Entities, Data Year 1997

| Reporter Name | Type of Form | Number of Projects Reported (Schedule II) | Entity-Wide Report (Schedule III) | Commitments (Schedule IV) |
|---|---|---|---|---|
| A&N Electric Cooperative | 1605 | 2 | No | Yes |
| Advanced Micro Devices, Inc. | 1605EZ | 4 | No | No |
| AES Hawaii | 1605 | 1 | Yes | No |
| AES Shady Point | 1605 | 1 | Yes | No |
| AES Thames | 1605 | 1 | Yes | No |
| Alcan Ingot, Sebree Aluminum Plant | 1605 | 2 | Yes | Yes |
| Allegheny Power Service Corporation | 1605 | 33 | Yes | Yes |
| AmerenCIPs | 1605 | 0 | Yes | Yes |
| American Electric Power, Inc. | 1605 | 41 | No | No |
| American Forests | 1605 | 86 | No | No |
| American Municipal Power - Ohio | 1605 | 19 | No | Yes |
| Anoka Municipal Utility | 1605EZ | 4 | No | No |
| Arizona Electric Power Cooperative, Inc. | 1605EZ | 3 | No | No |
| Arizona Public Service Company | 1605 | 0 | Yes | Yes |
| Arthur Rypinski & Jacquelyn Porth | 1605 | 5 | Yes | No |
| Asheville Landfill Gas, LLC | 1605 | 1 | No | No |
| Atlantic Energy, Inc (AEI) | 1605 | 5 | No | Yes |
| Baltimore Gas & Electric Co. | 1605 | 18 | Yes | Yes |
| BARC Electric Cooperative | 1605 | 2 | No | No |
| Berkeley Electric Cooperative | 1605EZ | 3 | No | No |
| Bountiful City Light & Power | 1605 | 7 | Yes | Yes |
| BP America | 1605 | 7 | Yes | Yes |
| Buckeye Power Incorporated | 1605 | 3 | No | No |
| Burlington County Board of Chosen Freeholders | 1605EZ | 1 | No | No |
| Carolina Power & Light Company | 1605 | 1 | No | No |
| Cedar Falls Utilities | 1605 | 15 | Yes | Yes |
| Centerior Energy Corporation | 1605 | 5 | Yes | Yes |
| Central and South West Corporation | 1605 | 7 | Yes | Yes |
| Central Hudson Gas & Electric Corporation | 1605 | 8 | Yes | Yes |
| Central Illinois Light Company | 1605 | 7 | No | Yes |
| Choptank Electric Cooperative | 1605 | 1 | No | No |
| City of Austin Electric Utility | 1605EZ | 7 | No | No |
| City of Edmond, Oklahoma, Electric Department | 1605EZ | 3 | No | No |
| City of Fairfield Wastewater Division | 1605EZ | 8 | No | No |
| City of Palo Alto | 1605EZ | 9 | No | No |
| City of Sherrill Power & Light | 1605EZ | 1 | No | No |
| City Utilities of Springfield | 1605 | 5 | No | No |
| CLE Resources | 1605 | 5 | No | Yes |
| Cleco Corporation | 1605 | 4 | No | Yes |
| Columbia Falls Aluminum Company | 1605 | 0 | Yes | No |
| COM/Electric | 1605EZ | 7 | No | No |
| Community Electric Cooperative | 1605 | 1 | No | No |

## Table C1. Reporting Entities, Data Year 1997

| Reporter Name | Type of Form | Number of Projects Reported (Schedule II) | Entity-Wide Report (Schedule III) | Commitments (Schedule IV) |
|---|---|---|---|---|
| Cooperative Power Association | 1605 | 24 | No | Yes |
| DeBourgh Manufacturing Company | 1605EZ | 9 | No | No |
| Delaware Electric Cooperative | 1605 | 1 | No | Yes |
| Delmarva Power | 1605 | 13 | No | No |
| The Dow Chemical Company | 1605 | 4 | Yes | Yes |
| DTE Energy / Detroit Edison | 1605 | 24 | Yes | No |
| Duke Engineering and Services | 1605EZ | 1 | No | No |
| Duke Power Company | 1605 | 8 | Yes | Yes |
| Duquesne Light Company | 1605 | 13 | No | Yes |
| Entergy Services, Inc. | 1605 | 16 | Yes | No |
| Environmentally Correct Concepts, Inc. | 1605 | 3 | No | No |
| Fayetteville Gas Company, LLC | 1605 | 1 | No | No |
| Florida Power & Light Company | 1605 | 0 | Yes | Yes |
| Florida Power Corporation | 1605 | 0 | Yes | No |
| General Motors Corporation | 1605 | 2 | Yes | No |
| Golden Valley Electric Association, Inc. | 1605EZ | 4 | No | No |
| GPU, Inc. | 1605 | 40 | No | No |
| Granger Electric Company | 1605 | 6 | No | No |
| GSF Energy, LLC | 1605 | 8 | No | No |
| Hopkinsville Electric System | 1605EZ | 2 | No | No |
| Houston Lighting & Power Company | 1605 | 5 | Yes | Yes |
| IBM | 1605 | 0 | Yes | Yes |
| Illinois Power Company | 1605 | 25 | Yes | Yes |
| Integrated Waste Services Association | 1605 | 2 | Yes | No |
| Iredell Landfill Gas, LLC | 1605 | 1 | No | No |
| J.M. Gilmer and Company, Inc. | 1605 | 3 | No | No |
| Jacksonville Electric Authority | 1605EZ | 10 | No | No |
| Johnson & Johnson | 1605 | 9 | Yes | No |
| Kansas City Power & Light Company | 1605 | 13 | Yes | Yes |
| LAHD Energy, Inc. | 1605EZ | 1 | No | No |
| Long Island Lighting Company | 1605 | 0 | Yes | No |
| Los Angeles Department of Water and Power | 1605 | 4 | Yes | Yes |
| Lower Colorado River Authority | 1605 | 5 | Yes | Yes |
| Lucent Technologies | 1605 | 0 | Yes | Yes |
| MCNIC Oil & Gas Co. | 1605 | 1 | No | No |
| Mecklenberg Electric Cooperative | 1605 | 1 | No | No |
| Minnesota Power | 1605 | 8 | No | No |
| Minnesota Resource Recovery Association | 1605EZ | 6 | No | No |
| Missouri River Energy Services | 1605EZ | 1 | No | No |
| Montana Power Company | 1605 | 6 | No | Yes |
| Monteco Gas, LLC | 1605EZ | 2 | No | No |
| Moorhead Public Service | 1605EZ | 5 | No | No |

## Table C1. Reporting Entities, Data Year 1997

| Reporter Name | Type of Form | Number of Projects Reported (Schedule II) | Entity-Wide Report (Schedule III) | Commitments (Schedule IV) |
|---|---|---|---|---|
| Motorola Austin | 1605 | 0 | Yes | Yes |
| Municipal Electric Authority of Georgia | 1605 | 1 | Yes | Yes |
| Nashville Electric Service | 1605EZ | 5 | No | No |
| NC Muni Landfill Gas Partners, LP | 1605 | 1 | No | No |
| Nebraska Public Power District | 1605EZ | 4 | No | No |
| Nevada Power Company | 1605EZ | 6 | No | No |
| New England Electric System (NEES) Company | 1605 | 19 | Yes | Yes |
| New York Power Authority | 1605 | 0 | Yes | Yes |
| Newton Landfill Gas, LLC | 1605 | 1 | No | No |
| Nexstar Pharmaceuticals, Inc. | 1605EZ | 2 | No | No |
| Niagara Mohawk Power Corporation | 1605 | 14 | Yes | Yes |
| NIPSCO Industries | 1605 | 24 | Yes | Yes |
| Noranda Aluminum Inc. | 1605 | 1 | No | Yes |
| North American Carbon, Inc. | 1605 | 1 | No | Yes |
| North Carolina Electric Membership Corporation | 1605EZ | 1 | No | No |
| Northeast Utilities | 1605 | 0 | Yes | Yes |
| Northern Neck Electric Cooperative | 1605 | 2 | No | Yes |
| Northern States Power Company | 1605 | 17 | No | Yes |
| Northern Virginia Electric Cooperative | 1605 | 2 | No | No |
| Northwest Fuel Development, Inc. | 1605 | 1 | No | No |
| Ohio Edison Company | 1605 | 23 | Yes | Yes |
| Old Dominion Electric Cooperative | 1605 | 2 | No | No |
| Omaha Public Power Distric | 1605EZ | 9 | No | No |
| Oregon State University (State of Oregon) | 1605 | 1 | No | No |
| Pacific Gas and Electric Company | 1605EZ | 9 | No | No |
| PacifiCorp | 1605 | 35 | Yes | Yes |
| Peabody Holding Company, Inc. | 1605 | 1 | Yes | No |
| Platte River Power Authority & 4 owner cities | 1605 | 12 | No | No |
| Portland General Electric Co. | 1605 | 20 | Yes | No |
| Potomac Electric Power Company | 1605 | 4 | Yes | Yes |
| PP&L RESOURCES, INC | 1605 | 13 | Yes | Yes |
| Prince George Electric Cooperative | 1605 | 1 | No | Yes |
| Public Service Company of New Mexico | 1605 | 4 | No | Yes |
| Public Service Electric and Gas Company | 1605 | 4 | Yes | Yes |
| Public Utility District No. 1 of Snohomish County | 1605 | 9 | No | No |
| Quad/Graphics, Inc. | 1605 | 6 | No | No |
| Rappahannock Electric Cooperative | 1605 | 2 | No | No |
| Rochester Institute of Technology | 1605 | 9 | No | No |
| Sacramento Municipal Utility District | 1605 | 6 | Yes | No |
| Salt River Project | 1605EZ | 7 | No | No |
| Santee Cooper | 1605 | 6 | Yes | Yes |
| Seattle City Light | 1605 | 17 | No | No |

## Table C1. Reporting Entities, Data Year 1997

| Reporter Name | Type of Form | Number of Projects Reported (Schedule II) | Entity-Wide Report (Schedule III) | Commitments (Schedule IV) |
|---|---|---|---|---|
| Seminole Electric Cooperative, Inc. | 1605EZ | 4 | No | No |
| Separation Technologies, Inc. | 1605EZ | 3 | No | No |
| Shenandoah Valley Electric Cooperative | 1605 | 3 | No | Yes |
| Shrewsbury Electric Light Plant | 1605EZ | 2 | No | No |
| South Carolina Electric & Gas Company | 1605 | 7 | No | Yes |
| Southern California Edison Co. | 1605 | 9 | No | No |
| Southern Company | 1605 | 18 | Yes | No |
| Southside Electric Cooperative | 1605 | 1 | No | No |
| Steuben Rural Electric Co-op | 1605EZ | 3 | No | No |
| Tacoma Public Utilities | 1605EZ | 7 | No | No |
| Tampa Electric Company | 1605 | 4 | Yes | Yes |
| Taunton Municipal Lighting Plant | 1605EZ | 4 | No | No |
| Tennessee Valley Authority | 1605 | 18 | Yes | Yes |
| Texas Utilities Electric Company | 1605 | 18 | No | Yes |
| Tucson Electric Power Company | 1605 | 12 | No | Yes |
| UNICOM (Commonwealth Edison Company) | 1605 | 13 | No | Yes |
| Union Electric Company | 1605 | 18 | No | Yes |
| United Power Association | 1605 | 9 | No | Yes |
| Utah Municipal Power Agency | 1605EZ | 6 | No | No |
| VANALCO, INC. (Primary Aluminum Reduction Plant | 1605 | 1 | Yes | Yes |
| Vermont Public Power Supply Authority | 1605 | 12 | No | No |
| Volvo Cars of North America, Inc. | 1605EZ | 1 | No | No |
| Waverly Light & Power Company | 1605 | 10 | Yes | Yes |
| Western Resources, Inc. | 1605 | 45 | No | Yes |
| Wisconsin Electric Power Co. | 1605 | 14 | No | Yes |
| Wisconsin Power & Light | 1605 | 17 | Yes | Yes |
| Wisconsin Public Power, Inc. | 1605EZ | 13 | No | No |
| Wisconsin Public Service Corporation | 1605 | 3 | Yes | Yes |
| Zahren Alternative Power Corporation | 1605EZ | 19 | No | No |
| Zeeland Board of Public Works | 1605EZ | 3 | No | No |
| **Total Number of Projects Reported for 1997** | | **1,229** | | |
| **Total Number of Entities Reporting on Schedule III** | | | **56** | |
| **Total Number of Entities Reporting on Schedule IV** | | | | **65** |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **A&N Electric Cooperative** | | | | | | | |
| Indirect | — | 1 | 85 | 169 | 169 | 2,583 | 2,571 |
| Total Reductions | — | 1 | 85 | 169 | 169 | 2,583 | 2,571 |
| Total for Entity | — | 1 | 85 | 169 | 169 | 2,583 | 2,571 |
| **Advanced Micro Devices, Inc.** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 98,224 |
| **AES Hawaii** | | | | | | | |
| Sequestration | — | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 |
| Total for Entity | — | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 |
| **AES Shady Point** | | | | | | | |
| Sequestration | — | — | 4,150,000 | 4,150,000 | 4,150,000 | 4,150,000 | 4,150,000 |
| Total for Entity | — | — | 4,150,000 | 4,150,000 | 4,150,000 | 4,150,000 | 4,150,000 |
| **AES Thames** | | | | | | | |
| Sequestration | 1,880,000 | 1,880,000 | 1,880,000 | 1,880,000 | 1,880,000 | 1,940,000 | 1,940,000 |
| Total for Entity | 1,880,000 | 1,880,000 | 1,880,000 | 1,880,000 | 1,880,000 | 1,940,000 | 1,940,000 |
| **Allegheny Power Service Corporation** | | | | | | | |
| Direct Reductions | 158,688 | 240,497 | 330,730 | 526,288 | 812,086 | 963,417 | 906,110 |
| Indirect | 11,209 | 29,542 | 37,098 | 39,192 | 69,783 | 59,404 | 78,089 |
| Total Reductions | 169,898 | 270,039 | 367,828 | 565,480 | 881,870 | 1,022,821 | 984,198 |
| Sequestration | — | 66 | 66 | 66 | 4,357 | 4,276 | 5,099 |
| Total for Entity | 169,898 | 270,105 | 367,894 | 565,546 | 886,227 | 1,027,098 | 989,297 |
| **American Electric Power, Inc.** | | | | | | | |
| Direct | 4,158,476 | -3,225,069 | 5,590,423 | -260,298 | 4,422,315 | 6,922,732 | 1,922,751 |
| Indirect | 282,222 | 373,865 | 438,189 | 482,112 | 393,537 | 416,622 | 433,385 |
| Total Reductions | 4,440,698 | -2,851,203 | 6,028,612 | 221,815 | 4,815,852 | 7,339,354 | 2,356,136 |
| Sequestration | 1,199 | 1,775 | 2,826 | 4,552 | 18,339 | 28,741 | 730,231 |
| Total for Entity | 4,441,897 | -2,849,429 | 6,031,438 | 226,367 | 4,834,191 | 7,368,095 | 3,086,367 |
| **American Forests** | | | | | | | |
| Sequestration | 2,925 | 4,479 | 8,872 | 18,753 | 24,859 | 33,607 | 38,627 |
| Total for Entity | 2,925 | 4,479 | 8,872 | 18,753 | 24,859 | 33,607 | 38,627 |
| **American Municipal Power - Ohio** | | | | | | | |
| Direct | 3,292 | 38,736 | 111,418 | 149,870 | 132,818 | 152,020 | 172,621 |
| Indirect | 84,729 | 157,550 | 219,725 | 128,630 | 151,375 | 61,535 | 2,388 |
| Total Reductions | 88,021 | 196,286 | 331,143 | 278,500 | 284,193 | 213,554 | 175,009 |
| Sequestration | — | 4 | 4 | 4 | 37 | 46 | 28 |
| Total for Entity | 88,025 | 196,290 | 331,147 | 278,537 | 284,239 | 213,582 | 175,009 |
| **Anoka Municipal Utility** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 73 |
| **Arizona Electric Power Cooperative, Inc.** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 36,527 |
| **Arthur Rypinski & Jacquelyn Porth** | | | | | | | |
| Direct | 2 | 2 | 3 | 4 | 4 | 4 | 4 |
| Indirect | — | — | 0 | 1 | 1 | 1 | 1 |
| Total Reductions | 2 | 2 | 3 | 5 | 5 | 5 | 5 |
| Total for Entity | 2 | 2 | 3 | 5 | 5 | 5 | 5 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Asheville Landfill Gas, LLC** | | | | | | | |
| Direct | — | — | — | — | — | — | 30,481 |
| Total Reductions | — | — | — | — | — | — | 30,481 |
| Total for Entity | — | — | — | — | — | — | 30,481 |
| **Atlantic Energy, Inc. (AEI) (Preliminary)** | | | | | | | |
| Direct | — | -375,960 | -459,630 | -564,690 | -606,210 | -180,520 | -184,825 |
| Indirect | — | 557,210 | 708,390 | 830,440 | 873,320 | 293,950 | 299,555 |
| Total Reductions | — | 181,250 | 248,760 | 265,750 | 267,110 | 113,430 | 114,730 |
| Total for Entity | — | 181,250 | 248,760 | 265,750 | 267,110 | 113,430 | 114,730 |
| **Baltimore Gas & Electric Co.** | | | | | | | |
| Direct | 1,495 | 24,774 | 73,663 | 348,855 | 432,702 | 543,649 | 597,550 |
| Indirect | — | — | — | 1,705 | 15,301 | 20,503 | 29,900 |
| Total Reductions | 1,495 | 24,774 | 73,663 | 350,560 | 448,003 | 564,152 | 627,449 |
| Sequestration | — | — | — | — | 1,226 | 1,203 | 1,130 |
| Total for Entity | 1,495 | 24,774 | 73,663 | 350,560 | 449,229 | 565,356 | 628,579 |
| **BARC Electric Cooperative** | | | | | | | |
| Indirect | 393 | 670 | 1,539 | 900 | 1,395 | 1,180 | 2,435 |
| Total Reductions | 393 | 670 | 1,539 | 900 | 1,395 | 1,180 | 2,435 |
| Total for Entity | 393 | 670 | 1,539 | 900 | 1,395 | 1,180 | 2,435 |
| **Berkeley Electric Cooperative** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 297 |
| **Bountiful City Light & Power** | | | | | | | |
| Direct | 28 | 1,339 | 10,320 | 6,426 | 11,851 | 14,629 | 16,796 |
| Total Reductions | 28 | 1,339 | 10,320 | 6,426 | 11,851 | 14,629 | 16,796 |
| Sequestration | — | — | — | — | 0 | 0 | 1 |
| Total for Entity | 28 | 1,339 | 10,320 | 6,426 | 11,851 | 14,629 | 16,797 |
| **BP America** | | | | | | | |
| Direct | 1,357 | 12,081 | 23,488 | 199,655 | 382,263 | 632,104 | 989,062 |
| Total Reductions | 1,357 | 12,081 | 23,488 | 199,655 | 382,263 | 632,104 | 989,062 |
| Sequestration | — | — | — | — | — | — | 68,708 |
| Total for Entity | 1,357 | 12,081 | 23,488 | 199,655 | 382,263 | 632,104 | 1,057,770 |
| **Buckeye Power Incorporated** | | | | | | | |
| Direct | 12,901 | 19,565 | 26,421 | 33,200 | 58,203 | 95,218 | 134,328 |
| Total Reductions | 12,901 | 19,565 | 26,421 | 33,200 | 58,203 | 95,218 | 134,328 |
| Total for Entity | 12,901 | 19,565 | 26,421 | 33,200 | 58,203 | 95,218 | 134,328 |
| **Burlington County Board of Chosen Freeholder** | | | | | | | |
| Direct | — | — | — | — | — | 5,464 | 64,724 |
| Total Reductions | — | — | — | — | — | 5,464 | 64,724 |
| Total for Entity | — | — | — | — | — | 5,464 | 64,724 |
| **Carolina Power & Light Company** | | | | | | | |
| Direct | — | — | — | 3,493,951 | 4,906,992 | 5,182,056 | 5,595,117 |
| Total Reductions | — | — | — | 3,493,951 | 4,906,992 | 5,182,056 | 5,595,117 |
| Total for Entity | — | — | — | 3,493,951 | 4,906,992 | 5,182,056 | 5,595,117 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Cedar Falls Utilities (Preliminary)** | | | | | | | |
| Direct | 3,886 | 3,858 | 4,167 | 8,661 | 9,377 | 9,008 | 8,920 |
| Indirect | — | 673 | 1,071 | 1,368 | 1,770 | 1,139 | 1,303 |
| Total Reductions | 3,886 | 4,531 | 5,238 | 10,030 | 11,148 | 10,147 | 10,223 |
| Sequestration | — | — | — | 1 | 2 | 3 | 4 |
| Total for Entity | 3,886 | 4,532 | 5,240 | 10,032 | 11,152 | 10,147 | 10,223 |
| **Centerior Energy Corporation** | | | | | | | |
| Direct | 3,018,344 | 3,833,946 | 795,471 | 1,392,434 | 4,735,447 | 2,867,347 | 3,937,897 |
| Indirect | | 63,503 | 72,575 | 54,431 | 59,421 | 63,503 | 64,410 |
| Total Reductions | 3,072,775 | 3,897,449 | 868,046 | 1,446,865 | 4,794,867 | 2,930,850 | 4,002,307 |
| Total for Entity | 3,072,775 | 3,897,449 | 868,046 | 1,446,865 | 4,794,867 | 2,930,850 | 4,002,307 |
| **Central and South West Corporation** | | | | | | | |
| Direct | 240,051 | 202,944 | 128,670 | 320,104 | 339,667 | 382,811 | 234,873 |
| Indirect | | 278,370 | 239,228 | 230,826 | 274,635 | 228,815 | 321,146 |
| Total Reductions | 460,607 | 481,314 | 367,898 | 550,930 | 614,302 | 611,626 | 556,019 |
| Sequestration | 860 | 860 | 860 | 860 | 3,097 | 3,051 | 4,996 |
| Total for Entity | 461,466 | 482,174 | 368,757 | 551,789 | 617,399 | 614,677 | 561,015 |
| **Central Hudson Gas & Electric Corporation** | | | | | | | |
| Direct | — | 415,949 | 170,789 | 386,081 | 468,842 | 177,216 | 345,706 |
| Indirect | 718 | 775 | 4,743 | 13,039 | 27,019 | 14,967 | 29,458 |
| Total Reductions | 718 | 416,724 | 175,532 | 399,120 | 495,861 | 192,183 | 375,164 |
| Total for Entity | 718 | 416,724 | 175,532 | 399,120 | 495,861 | 192,183 | 375,164 |
| **Central Illinois Light Company** | | | | | | | |
| Direct | — | 1,238 | 1,856 | 20,989 | 58,492 | 51,834 | 141,884 |
| Indirect | — | — | — | 67,528 | 181,836 | 177,098 | 419,747 |
| Total Reductions | — | 1,238 | 1,856 | 88,517 | 240,328 | 228,932 | 561,631 |
| Sequestration | — | — | — | — | 1,226 | 1,204 | 931 |
| Total for Entity | — | 1,238 | 1,856 | 88,517 | 241,554 | 230,136 | 562,562 |
| **Choptank Electric Cooperative** | | | | | | | |
| Indirect | 9,771 | 14,850 | 2,238 | 29,120 | 25,471 | 17,382 | 21,107 |
| Total Reductions | 9,771 | 14,850 | 2,238 | 29,120 | 25,471 | 17,382 | 21,107 |
| Total for Entity | 9,771 | 14,850 | 2,238 | 29,120 | 25,471 | 17,382 | 21,107 |
| **City of Austin Electric Utility** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 19,979,453 |
| **City of Edmond, Oklahoma, Electric Department** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 1,444 |
| **City of Fairfield Wastewater Division** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 436 |
| **City of Palo Alto** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 2,141 |
| **City of Sherrill Power & Light** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 2 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **City Utilities of Springfield** | | | | | | | |
| Direct | 12,501 | 37,703 | 40,315 | 27,696 | -1,001 | -38,954 | 50,334 |
| Total Reductions | 12,501 | 37,703 | 40,315 | 27,696 | -1,001 | -38,954 | 50,334 |
| Sequestration | — | 15 | 24 | 48 | 57 | 66 | 75 |
| Total for Entity | 12,501 | 37,718 | 40,339 | 27,744 | -944 | -38,888 | 50,409 |
| **CLE Resources** | | | | | | | |
| Indirect | — | — | — | — | 303 | 635 | 6,186 |
| Total Reductions | — | — | — | — | 303 | 635 | 6,186 |
| Total for Entity | — | — | — | — | 303 | 635 | 6,186 |
| **Cleco Corporation** | | | | | | | |
| Sequestration | — | — | — | — | 1,839 | 1,805 | 2,217 |
| Total for Entity | — | — | — | — | 1,839 | 1,805 | 2,217 |
| **Columbia Falls Aluminum Company** | | | | | | | |
| Indirect | — | — | — | — | — | 81 | 81 |
| Total Reductions | — | — | — | — | — | 81 | 81 |
| Total for Entity | — | — | — | — | — | 81 | 81 |
| **COM/Electric** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 37,121 |
| **Community Electric Cooperative** | | | | | | | |
| Indirect | 332 | 731 | 1,294 | 1,453 | 2,501 | 2,984 | 2,654 |
| Total Reductions | 332 | 731 | 1,294 | 1,453 | 2,501 | 2,984 | 2,654 |
| Total for Entity | 332 | 731 | 1,294 | 1,453 | 2,501 | 2,984 | 2,654 |
| **Cooperative Power Association** | | | | | | | |
| Direct | — | — | 34,458 | 108,257 | 109,478 | 119,654 | 102,363 |
| Indirect | 19,282 | 30,810 | 33,488 | 41,472 | 40,470 | 49,381 | 53,602 |
| Total Reductions | 19,282 | 30,810 | 67,946 | 149,729 | 149,948 | 169,035 | 155,966 |
| Sequestration | — | 3 | 6 | 9 | 13 | 18 | 23 |
| Total for Entity | 19,282 | 30,813 | 67,952 | 149,738 | 149,961 | 169,053 | 155,988 |
| **DeBourgh Manufacturing Company** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 33 |
| **Delaware Electric Cooperative** | | | | | | | |
| Indirect | 7,366 | 9,470 | 12,891 | 16,048 | 2,280 | 25,525 | 18,201 |
| Total Reductions | 7,366 | 9,470 | 12,891 | 16,048 | 2,280 | 25,525 | 18,201 |
| Total for Entity | 7,366 | 9,470 | 12,891 | 16,048 | 2,280 | 25,525 | 18,201 |
| **Delmarva Power** | | | | | | | |
| Direct | 87,053 | 141,925 | 447,572 | 888,551 | 1,181,020 | 1,186,301 | 613,205 |
| Indirect | 1,068 | 16,832 | 3,901 | 6,504 | 0 | 0 | 0 |
| Total Reductions | 88,121 | 158,756 | 451,473 | 895,055 | 1,181,020 | 1,186,301 | 613,205 |
| Sequestration | 14 | 30 | 50 | 73 | 1,323 | 1,331 | 1,289 |
| Total for Entity | 88,135 | 158,786 | 451,523 | 895,128 | 1,182,343 | 1,187,632 | 614,494 |
| **The Dow Chemical Company** | | | | | | | |
| Direct | — | — | — | — | 8,795 | 17,775 | 0 |
| Total Reductions | — | — | — | — | 8,795 | 17,775 | 0 |
| Total for Entity | — | — | — | — | 8,795 | 17,775 | 0 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **DTE Energy/ Detroit Edison** | | | | | | | |
| Direct | -635,562 | 523,279 | 1,477,311 | -6,353,826 | -1,537,225 | -1,800,164 | -645,677 |
| Indirect | -25,394 | 37,715 | 1,183 | 55,463 | 263,720 | 347,530 | 397,927 |
| Total Reductions | -660,956 | 560,994 | 1,478,493 | -6,298,364 | -1,273,505 | -1,452,634 | -247,750 |
| Sequestration | — | — | — | — | 167,872 | 186,498 | 202,314 |
| Total for Entity | -660,956 | 560,994 | 1,478,493 | -6,298,364 | -1,105,634 | -1,266,136 | -45,436 |
| **Duke Engineering and Services** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 141,624 |
| **Duke Power Company** | | | | | | | |
| Direct | 5,395,464 | 3,751,314 | 6,858,749 | 9,963,832 | 12,640,570 | 5,524,723 | 3,976,186 |
| Indirect | — | — | 29,057 | 72,973 | 166,484 | 126,999 | 96,494 |
| Total Reductions | 5,395,464 | 3,751,314 | 6,887,806 | 10,036,805 | 12,807,054 | 5,651,722 | 4,072,680 |
| Sequestration | — | — | — | — | 1,226 | 1,203 | 2,175 |
| Total for Entity | 5,395,464 | 3,751,314 | 6,887,806 | 10,036,805 | 12,808,280 | 5,652,925 | 4,074,855 |
| **Duquesne Light Company** | | | | | | | |
| Direct | 1,242 | 2,484 | 85,969 | 123,491 | 142,300 | 104,745 | 152,931 |
| Indirect | 495 | 17,528 | 34,982 | 35,274 | 35,683 | 36,215 | 36,537 |
| Total Reductions | 1,737 | 20,012 | 120,951 | 158,765 | 177,983 | 140,960 | 189,468 |
| Sequestration | — | — | — | — | 1,226 | 1,203 | 1,652 |
| Total for Entity | 1,737 | 20,012 | 120,951 | 158,765 | 179,209 | 142,163 | 191,121 |
| **Entergy Services, Inc.** | | | | | | | |
| Direct | 447,549 | 427,454 | 805,532 | 745,899 | 2,581,469 | 3,210,180 | 5,459,874 |
| Indirect | — | — | — | — | 93,583 | 93,583 | 93,583 |
| Total Reductions | 447,549 | 427,454 | 805,532 | 745,899 | 2,675,052 | 3,303,763 | 5,553,457 |
| Sequestration | — | — | — | — | 2,452 | 22,328 | 46,305 |
| Total for Entity | 447,549 | 427,454 | 805,532 | 745,899 | 2,677,504 | 3,326,091 | 5,599,762 |
| **Environmentally Correct Concepts, Inc.** | | | | | | | |
| Direct | — | — | — | — | — | — | -1 |
| Total Reductions | — | — | — | — | — | — | -1 |
| Sequestration | — | — | — | — | — | — | 292 |
| Total for Entity | — | — | — | — | — | — | 291 |
| **Fayetteville Gas Company, LLC.** | | | | | | | |
| Direct | — | — | — | — | 0,249 | 31,167 | 25,966 |
| Total Reductions | — | — | — | — | 10,249 | 31,167 | 25,966 |
| Total for Entity | — | — | — | — | 10,249 | 31,167 | 25,966 |
| **General Motors Corporation** | | | | | | | |
| Direct | 43,000 | 116,000 | 62,000 | 80,000 | 32,582 | 330,057 | 348,706 |
| Indirect | 64,000 | 173,000 | 104,509 | 158,802 | 54,399 | 249,013 | 184,991 |
| Total Reductions | 107,000 | 289,000 | 166,509 | 238,802 | 86,981 | 579,070 | 533,697 |
| Total for Entity | 107,000 | 289,000 | 166,509 | 238,802 | 86,981 | 579,070 | 533,697 |
| **Golden Valley Electric Association, Inc** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 10,954 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **GPU, Inc.** | | | | | | | |
| Direct | 370,613 | 1,875,754 | 1,504,404 | 1,318,558 | 2,183,349 | 2,045,490 | 2,003,557 |
| Indirect | 639,039 | 200,441 | 183,415 | 192,546 | 157,260 | 160,465 | 422,794 |
| Total Reductions | 1,009,652 | 2,076,195 | 1,687,820 | 1,511,105 | 2,340,609 | 2,205,954 | 2,426,351 |
| Sequestration | — | 2 | 3 | 5 | 6,137 | 6,025 | 6,386 |
| Total for Entity | 1,009,652 | 2,076,197 | 1,687,823 | 1,511,110 | 2,346,746 | 2,211,979 | 2,432,737 |
| **Granger Electric Company** | | | | | | | |
| Direct | -6,623 | -8,051 | -14,880 | -35,941 | -50,901 | -60,821 | -60,435 |
| Indirect | 102,150 | 113,574 | 158,785 | 341,888 | 474,005 | 542,053 | 599,339 |
| Total Reductions | 95,527 | 105,523 | 143,905 | 305,947 | 423,104 | 481,232 | 538,904 |
| Total for Entity | 95,527 | 105,523 | 143,905 | 305,947 | 423,104 | 481,232 | 538,904 |
| **GSF Energy, LLC** | | | | | | | |
| Direct | 1,976,712 | 2,253,183 | 2,572,509 | 2,440,726 | 2,628,213 | 2,621,475 | 2,592,046 |
| Total Reductions | 1,976,712 | 2,253,183 | 2,572,509 | 2,440,726 | 2,628,213 | 2,621,475 | 2,592,046 |
| Total for Entity | 1,976,712 | 2,253,183 | 2,572,509 | 2,440,726 | 2,628,213 | 2,621,475 | 2,592,046 |
| **Hopkinsville Electric System** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 2 |
| **Houston Lighting & Power Company** | | | | | | | |
| Direct | 15,422 | 25,401 | 60,781 | 290,208 | 533,425 | 823,724 | 769,293 |
| Indirect | 139,706 | 160,572 | 194,138 | 225,889 | 563,362 | 663,152 | 641,380 |
| Total Reductions | 155,129 | 185,973 | 254,919 | 516,097 | 1,096,786 | 1,486,876 | 1,410,672 |
| Total for Entity | 155,129 | 185,973 | 254,919 | 516,097 | 1,096,786 | 1,486,876 | 1,410,672 |
| **Illinois Power Company** | | | | | | | |
| Direct | 1,934 | 510,100 | 1,315,341 | 2,685,575 | 1,712,666 | 945,989 | 278,514 |
| Indirect | — | 7,649 | 4,879 | 3,919 | 4,522 | 7,727 | -1,771,114 |
| Total Reductions | 1,934 | 517,749 | 1,320,220 | 2,689,495 | 1,717,189 | 953,716 | -1,492,600 |
| Sequestration | — | — | — | — | 4,904 | 11,079 | 23,175 |
| Total for Entity | 1,934 | 517,749 | 1,320,220 | 2,689,495 | 1,722,093 | 964,794 | -1,469,424 |
| **Integrated Waste Services Association** | | | | | | | |
| Direct | — | — | — | — | -23,591,186 | -23,954,267 | -23,591,250 |
| Indirect | — | — | — | — | 20,019,037 | 21,279,581 | 21,257,577 |
| Total Reductions | — | — | — | — | -3,572,149 | -2,674,686 | -2,333,673 |
| Total for Entity | — | — | — | — | -3,572,149 | -2,674,686 | -2,333,673 |
| **Iredell Landfill Gas, LLC** | | | | | | | |
| Direct | — | — | — | — | — | — | 26,195 |
| Total Reductions | — | — | — | — | — | — | 26,195 |
| Total for Entity | — | — | — | — | — | — | 26,195 |
| **J.M. Gilmer and Company, Inc.** | | | | | | | |
| Sequestration | — | — | — | — | 298 | 584 | 609 |
| Total for Entity | — | — | — | — | 298 | 584 | 609 |
| **Jacksonville Electric Authority** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 243,591 |
| **Johnson & Johnson** | | | | | | | |
| Direct | — | 3,690 | 12,296 | 1,179 | 5,035 | 1,785 | 8,254 |
| Indirect | 5,278 | 12,504 | 24,837 | 16,484 | 23,523 | 33,357 | 19,646 |
| Total Reductions | 5,278 | 16,195 | 37,134 | 17,663 | 28,558 | 35,142 | 27,900 |
| Total for Entity | 5,278 | 16,195 | 37,134 | 17,663 | 28,558 | 35,142 | 27,900 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Kansas City Power & Light Company** | | | | | | | |
| Direct | 306,499 | 163,897 | 220,095 | 487,720 | 452,250 | 462,395 | 561,187 |
| Indirect | 69,712 | 79,435 | 99,539 | 133,644 | 121,722 | 159,561 | 148,189 |
| Total Reductions | 376,210 | 243,332 | 319,634 | 621,364 | 573,971 | 621,956 | 709,376 |
| Sequestration | — | — | — | — | 2,452 | 2,406 | 3,305 |
| Total for Entity | 376,210 | 243,332 | 319,634 | 621,364 | 576,423 | 624,362 | 712,681 |
| **LAHD Energy, Inc.** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 3,939 |
| **Los Angeles Department of Water and Power** | | | | | | | |
| Direct | — | — | — | — | — | 1,122 | 1,126 |
| Indirect | 8,508 | 8,508 | 8,508 | 8,508 | 8,508 | 8,508 | 8,508 |
| Total Reductions | 8,508 | 8,508 | 8,508 | 8,508 | 8,508 | 9,630 | 9,633 |
| Sequestration | — | 1,681 | 1,998 | 1,998 | 1,998 | 1,998 | 1,998 |
| Total for Entity | 8,508 | 10,189 | 10,505 | 10,505 | 10,505 | 11,628 | 11,631 |
| **Lower Colorado River Authority** | | | | | | | |
| Direct | 14,152 | 23,678 | 35,199 | 48,262 | 89,721 | 226,343 | 266,259 |
| Indirect | — | 50,802 | 68,130 | 91,172 | 112,037 | 121,018 | 126,643 |
| Total Reductions | 14,152 | 74,480 | 103,328 | 139,434 | 201,758 | 347,361 | 392,902 |
| Total for Entity | 14,152 | 74,480 | 103,328 | 139,434 | 201,758 | 347,361 | 392,902 |
| **MCNIC Oil & Gas Co.** | | | | | | | |
| Direct | — | 652,683 | 2,741,403 | 4,242,784 | 4,770,950 | 5,367,567 | 4,792,611 |
| Total Reductions | — | 652,683 | 2,741,403 | 4,242,784 | 4,770,950 | 5,367,567 | 4,792,611 |
| Total for Entity | — | 652,683 | 2,741,403 | 4,242,784 | 4,770,950 | 5,367,567 | 4,792,611 |
| **Mecklenburg Electric Cooperative** | | | | | | | |
| Indirect | 1,758 | 3,065 | 5,916 | 2,639 | 11,685 | 11,420 | 10,045 |
| Total Reductions | 1,758 | 3,065 | 5,916 | 2,639 | 11,685 | 11,420 | 10,045 |
| Total for Entity | 1,758 | 3,065 | 5,916 | 2,639 | 11,685 | 11,420 | 10,045 |
| **Minnesota Power** | | | | | | | |
| Direct | 31,893 | 84,943 | 132,556 | 250,231 | 328,159 | 348,784 | 489,057 |
| Indirect | — | — | 7,852 | 51,788 | 76,561 | 76,561 | 76,561 |
| Total Reductions | 31,893 | 84,943 | 140,408 | 302,019 | 404,720 | 425,345 | 565,618 |
| Sequestration | — | — | — | — | 4,012 | 18,578 | 22,324 |
| Total for Entity | 31,893 | 84,943 | 140,408 | 302,019 | 408,731 | 443,924 | 587,942 |
| **Minnesota Resource Recovery Association** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 449,382 |
| **Missouri River Energy Services** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 146 |
| **Montana Power Company** | | | | | | | |
| Direct | -1,461,503 | -1,896,863 | 1,530,472 | -1,117,341 | 470,818 | 3,022,872 | 228,648 |
| Indirect | 141,116 | -332,320 | 208,286 | -187,519 | 166,621 | 581,118 | 621,323 |
| Total Reductions | -1,320,387 | -2,229,183 | 1,738,758 | -1,304,860 | 637,439 | 3,603,990 | 849,972 |
| Total for Entity | -1,320,387 | -2,229,183 | 1,738,758 | -1,304,860 | 637,439 | 3,603,990 | 849,972 |
| **Monteco Gas, LLC** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 383,113 |
| **Moorhead Public Service** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 4,773 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997
(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Municipal Electric Authority of Georgia** | | | | | | | |
| Direct | 863,000 | 1,144,000 | 1,353,000 | 1,590,000 | 2,234,000 | 2,125,000 | 2,415,000 |
| Total Reductions | 863,000 | 1,144,000 | 1,353,000 | 1,590,000 | 2,234,000 | 2,125,000 | 2,415,000 |
| Total for Entity | 863,000 | 1,144,000 | 1,353,000 | 1,590,000 | 2,234,000 | 2,125,000 | 2,415,000 |
| **Nashville Electric Service** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 2,006 |
| **NC Muni Landfill Gas Partners, LP** | | | | | | | |
| Direct | — | — | — | — | 19,184 | 30,043 | 57,629 |
| Total Reductions | — | — | — | — | 19,184 | 30,043 | 57,629 |
| Total for Entity | — | — | — | — | 19,184 | 30,043 | 57,629 |
| **Nebraska Public Power District** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 12,667 |
| **Nevada Power Company** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 55,898 |
| **New England Electric System (NEES) Company** | | | | | | | |
| Direct | 312,182 | 1,190,022 | 1,426,810 | 2,095,679 | 2,703,895 | 3,716,091 | 4,007,939 |
| Indirect | 162,517 | -160,378 | -39,633 | -237,860 | -331,464 | -108,194 | 103,796 |
| Total Reductions | 474,699 | 1,029,644 | 1,387,177 | 1,857,818 | 2,372,431 | 3,607,897 | 4,111,735 |
| Sequestration | — | — | — | 8,682 | 24,930 | 58,016 | 44,246 |
| Total for Entity | 474,699 | 1,029,644 | 1,395,859 | 1,882,749 | 2,430,447 | 3,652,143 | 4,154,045 |
| **Newton Landfill Gas, LLC** | | | | | | | |
| Direct | — | — | — | — | — | 14,707 | 35,301 |
| Total Reductions | — | — | — | — | — | 14,707 | 35,301 |
| Total for Entity | — | — | — | — | — | 14,707 | 35,301 |
| **Nexstar Pharmaceuticals, Inc.** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 111 |
| **Niagara Mohawk Power Corporation** | | | | | | | |
| Direct | 2,406,388 | 1,588,975 | 3,264,903 | 4,113,486 | 3,598,268 | 4,305,889 | 3,095,609 |
| Indirect | 5,835 | 7,368 | 12,922 | 15,123 | 57,247 | 45,674 | 78,004 |
| Total Reductions | 2,412,222 | 1,596,343 | 3,277,825 | 4,128,610 | 3,655,515 | 4,351,563 | 3,173,612 |
| Total for Entity | 2,412,222 | 1,596,343 | 3,277,825 | 4,128,610 | 3,655,515 | 4,351,563 | 3,173,612 |
| **NIPSCO Industries** | | | | | | | |
| Direct | 6,649 | 9,766 | 12,888 | 17,635 | 54,767 | 337,507 | 1,026,107 |
| Indirect | 19,414 | 0 | 20,953 | 26,268 | 95,752 | 112,282 | 109,217 |
| Total Reductions | 26,063 | 9,766 | 33,842 | 43,903 | 150,519 | 449,789 | 1,135,324 |
| Sequestration | | | 12 | 56 | 1,280 | 1,308 | 1,032 |
| Total for Entity | 26,063 | 9,766 | 33,853 | 43,958 | 151,799 | 451,097 | 1,136,355 |
| **Noranda Aluminum Inc.** | | | | | | | |
| Direct | 2,793,600 | 3,000,500 | 3,074,700 | 3,168,400 | 3,148,900 | 3,526,400 | 3,506,900 |
| Total Reductions | 2,793,600 | 3,000,500 | 3,074,700 | 3,168,400 | 3,148,900 | 3,526,400 | 3,506,900 |
| Total for Entity | 2,793,600 | 3,000,500 | 3,074,700 | 3,168,400 | 3,148,900 | 3,526,400 | 3,506,900 |
| **North American Carbon, Inc.** | | | | | | | |
| Indirect | — | — | — | — | 21,799 | 111,085 | 387,984 |
| Total Reductions | — | — | — | — | 21,799 | 111,085 | 387,984 |
| Total for Entity | — | — | — | — | 21,799 | 111,085 | 387,984 |
| **North Carolina Electric Membership Corporation** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 598,828 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Northern Neck Electric Cooperative** | | | | | | | |
| Indirect | 933 | 893 | 2,126 | 1,435 | 2,431 | 2,832 | 2,060 |
| Total Reductions | 933 | 893 | 2,126 | 1,435 | 2,431 | 2,832 | 2,060 |
| Total for Entity | 933 | 893 | 2,126 | 1,435 | 2,431 | 2,832 | 2,060 |
| **Northern States Power Company** | | | | | | | |
| Direct | 169,722 | 382,257 | 754,511 | 1,223,837 | 1,871,538 | 2,291,725 | 2,629,957 |
| Indirect | 60,268 | 71,936 | 119,221 | 170,269 | 207,200 | 218,945 | 429,250 |
| Total Reductions | 229,989 | 454,193 | 873,732 | 1,394,106 | 2,078,738 | 2,510,671 | 3,059,207 |
| Total for Entity | 229,989 | 454,193 | 873,732 | 1,394,106 | 2,078,738 | 2,510,671 | 3,059,207 |
| **Northern Virginia Electric Cooperative** | | | | | | | |
| Indirect | 37 | 15,309 | 28,042 | 9,980 | 32,355 | 32,509 | 30,961 |
| Total Reductions | 37 | 15,309 | 28,042 | 9,980 | 32,355 | 32,509 | 30,961 |
| Total for Entity | 37 | 15,309 | 28,042 | 9,980 | 32,355 | 32,509 | 30,961 |
| **Northwest Fuel Development, Inc.** | | | | | | | |
| Direct | — | 499 | 18,625 | 238,635 | 10,396 | 10,560 | 4,494 |
| Indirect | — | 45 | 281 | 1,270 | 1,579 | 1,606 | 452 |
| Total Reductions | — | 544 | 18,906 | 239,905 | 11,975 | 12,165 | 4,946 |
| Total for Entity | — | 544 | 18,906 | 239,905 | 11,975 | 12,165 | 4,946 |
| **Ohio Edison Company** | | | | | | | |
| Direct | 395,553 | 459,724 | 402,096 | 676,327 | 643,999 | 938,787 | 1,019,034 |
| Indirect | 13,574 | 10,199 | 8,116 | 10,629 | 1,522 | 10,270 | 14,104 |
| Total Reductions | 409,127 | 469,923 | 410,211 | 686,957 | 645,521 | 949,057 | 1,033,138 |
| Sequestration | — | 12 | 28 | 44 | 12,320 | 12,108 | 21,847 |
| Total for Entity | 409,127 | 469,935 | 410,239 | 687,001 | 657,841 | 961,165 | 1,054,985 |
| **Old Dominion Electric Cooperative** | | | | | | | |
| Indirect | — | — | — | — | 60 | 62 | 62 |
| Total Reductions | — | — | — | — | 60 | 62 | 62 |
| Sequestration | — | — | — | — | 0 | 1 | 1 |
| Total for Entity | — | — | — | — | 60 | 63 | 63 |
| **Omaha Public Power District** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 1,380,714 |
| **Oregon State University (State of Oregon)** | | | | | | | |
| Direct | — | — | — | 380 | 760 | 1,140 | 5,698 |
| Total Reductions | — | — | — | 380 | 760 | 1,140 | 5,698 |
| Sequestration | — | — | — | 636 | 636 | 1,909 | 4,825 |
| Total for Entity | — | — | — | 1,016 | 1,396 | 3,048 | 10,523 |
| **Pacific Gas and Electric Company** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 2,085,244 |
| **PacifiCorp** | | | | | | | |
| Direct | — | — | 136,429 | 272,592 | 531,575 | 738,495 | 871,518 |
| Indirect | 3,663 | 108,214 | 107,523 | 120,175 | 121,393 | 233,521 | 191,102 |
| Total Reductions | 3,663 | 108,214 | 243,952 | 392,767 | 652,968 | 972,016 | 1,062,620 |
| Sequestration | — | — | 361 | 2,116 | 169,553 | 169,443 | 409,638 |
| Total for Entity | 3,663 | 108,214 | 244,313 | 394,883 | 822,521 | 1,141,459 | 1,472,258 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997
(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Peabody Holding Company, Inc.** | | | | | | | |
| Direct | 14,079 | 33,472 | 55,476 | 49,056 | 76,013 | 99,122 | 77,194 |
| Total Reductions | 14,079 | 33,472 | 55,476 | 49,056 | 76,013 | 99,122 | 77,194 |
| Total for Entity | 14,079 | 33,472 | 55,476 | 49,056 | 76,013 | 99,122 | 77,194 |
| **Platte River Power Authority & 4 owner cities** | | | | | | | |
| Direct | -189 | -179 | 6,286 | 8,337 | 8,738 | 8,688 | 13,569 |
| Indirect | 20,314 | 21,488 | 28,247 | 25,913 | 20,905 | 31,682 | 45,079 |
| Total Reductions | 20,126 | 21,310 | 34,532 | 34,251 | 29,643 | 40,369 | 58,647 |
| Total for Entity | 20,126 | 21,310 | 34,532 | 34,251 | 29,643 | 40,369 | 58,647 |
| **Portland General Electric Co.** | | | | | | | |
| Direct | — | — | 3 | 8 | 8 | 12 | 23 |
| Indirect | 97,005 | 167,584 | 275,001 | 467,971 | 652,055 | 728,799 | 763,476 |
| Total Reductions | 97,005 | 167,584 | 275,004 | 467,980 | 652,064 | 728,811 | 763,499 |
| Sequestration | — | — | — | — | | 1 | 135 |
| Total for Entity | 97,005 | 167,584 | 275,004 | 467,980 | 652,064 | 728,811 | 763,634 |
| **Potomac Electric Power Company** | | | | | | | |
| Indirect | — | — | — | 93,157 | 118,236 | 137,556 | 133,009 |
| Total Reductions | — | — | — | 93,157 | 118,236 | 137,556 | 133,009 |
| Total for Entity | — | — | — | 93,157 | 118,236 | 137,556 | 133,009 |
| **PP&L RESOURCES, INC.** | | | | | | | |
| Direct | -14,275 | 74,605 | 123,150 | -409,943 | -336,898 | -194,133 | -124,045 |
| Indirect | 42,004 | 63,015 | 91,813 | 240,182 | 526,026 | 1,013,661 | 1,034,984 |
| Total Reductions | 27,728 | 137,620 | 214,964 | -169,761 | 189,127 | 819,528 | 910,940 |
| Sequestration | — | 323 | 523 | 546 | 2,379 | 2,011 | 6,891 |
| Total for Entity | 27,728 | 137,943 | 215,486 | -169,215 | 191,506 | 821,539 | 917,831 |
| **Prince George Electric Cooperative** | | | | | | | |
| Indirect | 15 | 30 | 45 | 60 | 60 | 1,386 | 2,264 |
| Total Reductions | 15 | 30 | 45 | 60 | 60 | 1,386 | 2,264 |
| Total for Entity | 15 | 30 | 45 | 60 | 60 | 1,386 | 2,264 |
| **Public Service Company of New Mexico** | | | | | | | |
| Direct | 501,446 | 567,896 | 181,988 | 318,976 | 758,940 | 1,328,879 | 1,541,554 |
| Total Reductions | 501,446 | 567,896 | 181,988 | 318,976 | 758,940 | 1,328,879 | 1,541,554 |
| Total for Entity | 501,446 | 567,896 | 181,988 | 318,976 | 758,940 | 1,328,879 | 1,541,554 |
| **Public Service Electric and Gas Company** | | | | | | | |
| Sequestration | — | — | — | — | 1,226 | 1,203 | 2,175 |
| Total for Entity | — | — | — | — | 1,226 | 1,203 | 2,175 |
| **Public Utility District No. 1 of Snohomish County** | | | | | | | |
| Direct | 27 | 44 | 60 | 75 | 110 | 151 | 153 |
| Indirect | 1,298 | 22,914 | 44,435 | 65,114 | 87,999 | 111,619 | 125,213 |
| Total Reductions | 1,325 | 22,958 | 44,494 | 65,189 | 88,109 | 111,769 | 125,366 |
| Total for Entity | 1,325 | 22,958 | 44,494 | 65,189 | 88,109 | 111,769 | 125,366 |
| **Quad/Graphics, Inc.** | | | | | | | |
| Direct | — | 12,080 | 12,080 | 12,080 | 12,080 | 14,345 | 19,714 |
| Indirect | 25,716 | 82,054 | 48,398 | 71,121 | 86,869 | 98,589 | 130,045 |
| Total Reductions | 25,716 | 94,134 | 60,478 | 83,201 | 98,949 | 112,935 | 149,759 |
| Total for Entity | 25,716 | 94,134 | 60,478 | 83,201 | 98,949 | 112,935 | 149,759 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Rappahannock Electric Cooperative** | | | | | | | |
| Indirect | 2,021 | 1,595 | 12,786 | 5,379 | -10,619 | 32,886 | 27,469 |
| Total Reductions | 2,021 | 1,595 | 12,786 | 5,379 | -10,619 | 32,886 | 27,469 |
| Sequestration | 0 | 0 | 1 | 1 | 1 | 2 | 3 |
| Total for Entity | 2,021 | 1,596 | 12,786 | 5,380 | -10,617 | 32,888 | 27,472 |
| **Rochester Institute of Technology** | | | | | | | |
| Indirect | — | — | 331 | 873 | 1,285 | 1,494 | 2,985 |
| Total Reductions | — | — | 331 | 873 | 1,285 | 1,494 | 2,985 |
| Total for Entity | — | — | 331 | 873 | 1,285 | 1,494 | 2,985 |
| **Sacramento Municipal Utility District** | | | | | | | |
| Direct | — | — | — | 529 | 947 | 1,515 | 2,228 |
| Indirect | — | — | — | — | — | 458,545 | 487,087 |
| Total Reductions | — | — | — | 529 | 947 | 460,060 | 489,315 |
| Sequestration | 66 | 115 | 183 | 251 | 271 | 269 | 281 |
| Total for Entity | 66 | 115 | 183 | 780 | 1,218 | 460,329 | 489,596 |
| **Salt River Project** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 200,033 |
| **Santee Cooper** | | | | | | | |
| Direct | 12,789 | 17,696 | 185,506 | 169,824 | 217,230 | 453,130 | 426,433 |
| Indirect | 12,591 | 17,110 | 13,935 | 10,437 | 48,795 | 66,278 | 92,697 |
| Total Reductions | 25,380 | 34,806 | 199,441 | 180,261 | 266,025 | 519,408 | 519,130 |
| Sequestration | 155 | 397 | 875 | 921 | 940 | 980 | 1,004 |
| Total for Entity | 25,535 | 35,203 | 200,316 | 181,183 | 266,965 | 520,387 | 520,134 |
| **Seattle City Light** | | | | | | | |
| Indirect | 7,519 | 33,983 | 57,004 | 84,921 | 125,919 | 171,983 | 188,547 |
| Total Reductions | 7,519 | 33,983 | 57,004 | 84,921 | 125,919 | 171,983 | 188,547 |
| Sequestration | — | — | — | — | 2 | 9 | 15 |
| Total for Entity | 7,519 | 33,983 | 57,004 | 84,921 | 125,921 | 171,992 | 188,562 |
| **Seminole Electric Cooperative, Inc.** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 445,456 |
| **Separation Technologies, Inc.** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 107,816 |
| **Shenandoah Valley Electric Cooperative** | | | | | | | |
| Indirect | — | 229 | 899 | 922 | 1,107 | 15,244 | 10,106 |
| Total Reductions | — | 229 | 899 | 922 | 1,107 | 15,244 | 10,106 |
| Sequestration | — | 0 | 0 | 0 | 0 | | 1 |
| Total for Entity | — | 229 | 899 | 922 | 1,107 | 15,244 | 10,107 |
| **Shrewsbury Electric Light Plant** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 2,250 |
| **South Carolina Electric & Gas Company** | | | | | | | |
| Direct | — | — | — | 84,727 | 323,775 | 316,517 | 315,938 |
| Indirect | — | — | — | — | — | — | 1,437,888 |
| Total Reductions | — | — | — | 84,727 | 323,775 | 316,517 | 1,753,826 |
| Sequestration | — | — | 627 | 1,146 | 3,590 | 4,152 | 4,433 |
| Total for Entity | — | — | 627 | 85,874 | 327,365 | 320,669 | 1,758,259 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997
(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Southern California Edison Co.** | | | | | | | |
| Direct | 461,757 | 1,091,343 | 1,784,433 | 2,392,609 | 2,586,656 | 2,907,237 | 3,243,224 |
| Indirect | 57,969 | 57,697 | 60,328 | 64,773 | 72,393 | 82,254 | 86,093 |
| Total Reductions | 519,726 | 1,149,040 | 1,844,760 | 2,457,382 | 2,659,049 | 2,989,491 | 3,329,317 |
| Total for Entity | 519,726 | 1,149,040 | 1,844,760 | 2,457,382 | 2,659,049 | 2,989,491 | 3,329,317 |
| **Southern Company** | | | | | | | |
| Direct | — | 2,251,943 | 2,433,505 | 2,871,528 | 3,382,473 | 4,035,962 | 4,914,192 |
| Indirect | — | 158,214 | 343,854 | 796,838 | 711,468 | 669,458 | 728,677 |
| Total Reductions | — | 2,410,157 | 2,777,359 | 3,668,366 | 4,093,941 | 4,705,420 | 5,642,869 |
| Sequestration | — | 3,397 | 1,080 | 1,154 | 15,389 | 56,052 | 84,815 |
| Total for Entity | — | 2,413,554 | 2,778,439 | 3,669,520 | 4,109,330 | 4,761,472 | 5,727,684 |
| **Southside Electric Cooperative** | | | | | | | |
| Indirect | -1,003 | 21,794 | 18,012 | 3,038 | 15,582 | 8,494 | 6,792 |
| Total Reductions | -1,003 | 21,794 | 18,012 | 3,038 | 15,582 | 8,494 | 6,792 |
| Total for Entity | -1,003 | 21,794 | 18,012 | 3,038 | 15,582 | 8,494 | 6,792 |
| **Steuben Rural Electric Co-op** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 682 |
| **Tacoma Public Utilities** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 196,845 |
| **Tampa Electric Company** | | | | | | | |
| Indirect | 240,404 | 237,682 | 234,054 | 240,585 | 265,406 | 267,583 | 266,857 |
| Total Reductions | 240,404 | 237,682 | 234,054 | 240,585 | 265,406 | 267,583 | 266,857 |
| Sequestration | — | — | — | — | 1,226 | 1,203 | 1,129 |
| Total for Entity | 240,404 | 237,682 | 234,054 | 240,585 | 266,632 | 268,786 | 267,986 |
| **Taunton Municipal Lighting Plant** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 12,393 |
| **Tennessee Valley Authority** | | | | | | | |
| Direct | 2,870,634 | 8,507,901 | 6,866,398 | 7,718,579 | 10,219,904 | 22,224,606 | 23,843,208 |
| Indirect | 1,091 | 70,105 | 72,873 | 85,050 | 118,987 | 196,899 | 271,577 |
| Total Reductions | 2,871,725 | 8,578,006 | 6,939,271 | 7,803,629 | 10,338,891 | 22,421,506 | 24,114,785 |
| Sequestration | 1,064 | 1,710 | 2,701 | 3,087 | 31,057 | 32,663 | 32,416 |
| Total for Entity | 2,872,790 | 8,579,716 | 6,941,972 | 7,806,716 | 10,369,948 | 22,454,169 | 24,147,201 |
| **Texas Utilities Electric Company** | | | | | | | |
| Direct | 6,498,346 | 8,103,570 | 11,718,761 | 15,542,156 | 17,822,717 | 15,936,756 | 18,461,933 |
| Indirect | 93,356 | 115,668 | 84,615 | 104,555 | 108,518 | 363,379 | 386,738 |
| Total Reductions | 6,591,703 | 8,219,237 | 11,803,376 | 15,646,710 | 17,931,235 | 16,300,135 | 18,848,671 |
| Sequestration | 543 | 1,087 | 1,630 | 2,174 | 5,655 | 7,572 | 13,107 |
| Total for Entity | 6,592,246 | 8,220,324 | 11,805,006 | 15,648,884 | 17,936,890 | 16,307,707 | 18,861,778 |
| **Tucson Electric Power Company** | | | | | | | |
| Direct | 37,066 | 32,295 | 51,484 | 37,781 | 38,627 | 41,565 | 82,544 |
| Indirect | — | 18,878 | 45,521 | 62,576 | 83,477 | 91,237 | 94,543 |
| Total Reductions | 37,066 | 51,173 | 97,005 | 100,357 | 122,103 | 132,802 | 177,087 |
| Sequestration | — | — | 4 | 5 | 1,230 | 1,209 | 1,134 |
| Total for Entity | 37,066 | 51,173 | 97,009 | 100,361 | 123,334 | 134,010 | 178,222 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **UNICOM (Commonwealth Edison Company)** | | | | | | | |
| Direct | 33,558 | 32,301 | 215,202 | 732,886 | 883,868 | 619,509 | 1,118,881 |
| Indirect | 907,231 | 867,322 | 1,229,587 | 1,455,313 | 1,564,450 | 2,307,576 | 2,161,872 |
| Total Reductions | 940,788 | 899,624 | 1,444,789 | 2,188,199 | 2,448,318 | 2,927,086 | 3,280,753 |
| Sequestration | — | — | — | — | 349 | 483 | 537 |
| Total for Entity | 940,788 | 899,624 | 1,444,789 | 2,188,199 | 2,448,667 | 2,927,569 | 3,281,290 |
| **Union Electric Company** | | | | | | | |
| Direct | 1,932,744 | 117,298 | 433,327 | 2,042,924 | 363,408 | 1,029,094 | 1,111,638 |
| Indirect | 921 | 1,166 | 2,643 | 5,651 | 15,949 | 34,833 | 67,604 |
| Total Reductions | 1,933,664 | 118,464 | 435,969 | 2,048,575 | 379,357 | 1,063,927 | 1,179,242 |
| Total for Entity | 1,933,664 | 118,464 | 435,969 | 2,048,575 | 379,357 | 1,063,927 | 1,179,242 |
| **United Power Association** | | | | | | | |
| Direct | 4,618 | 5,541 | 19,612 | 74,764 | 79,667 | 101,403 | 104,980 |
| Indirect | 12,212 | 48,243 | 95,888 | 134,672 | 157,724 | 184,986 | 175,737 |
| Total Reductions | 16,829 | 53,784 | 115,499 | 209,435 | 237,391 | 286,389 | 280,717 |
| Total for Entity | 16,829 | 53,784 | 115,499 | 209,435 | 237,391 | 286,389 | 280,717 |
| **Utah Municipal Power Agency** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 36,281 |
| **VANALCO, INC. - (Primary Aluminum Reduction)** | | | | | | | |
| Direct | — | 28,700 | 39,000 | 67,700 | 216,100 | 54,700 | 67,700 |
| Total Reductions | — | 28,700 | 39,000 | 67,700 | 216,100 | 54,700 | 67,700 |
| Total for Entity | — | 28,700 | 39,000 | 67,700 | 216,100 | 54,700 | 67,700 |
| **Vermont Public Power Supply Authority** | | | | | | | |
| Indirect | — | 29 | 62 | 851 | 1,280 | 1,899 | 2,051 |
| Total Reductions | — | 29 | 62 | 851 | 1,280 | 1,899 | 2,051 |
| Total for Entity | — | 29 | 62 | 851 | 1,280 | 1,899 | 2,051 |
| **Volvo Cars of North America, Inc.** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 10 |
| **Waverly Light & Power Company** | | | | | | | |
| Direct | — | 1 | 1 | 1 | 1 | 1 | 1 |
| Indirect | 4,135 | 9,014 | 13,215 | 18,162 | 18,222 | 18,578 | 18,809 |
| Total Reductions | 4,135 | 9,015 | 13,217 | 18,163 | 18,223 | 18,579 | 18,810 |
| Sequestration | 18 | 37 | 55 | 73 | 85 | 96 | 107 |
| Total for Entity | 4,153 | 9,052 | 13,272 | 18,236 | 18,308 | 18,675 | 18,917 |
| **Western Resources, Inc.** | | | | | | | |
| Direct | 57,595 | 61,981 | 96,338 | 269,478 | 357,207 | 534,869 | 714,578 |
| Indirect | 23,958 | 29,766 | 73,252 | 123,447 | 207,592 | 226,906 | 263,012 |
| Total Reductions | 81,553 | 91,747 | 169,590 | 392,925 | 564,798 | 761,774 | 977,590 |
| Sequestration | — | — | — | — | 6,130 | 8,422 | 6,513 |
| Total for Entity | 81,553 | 91,747 | 169,590 | 392,925 | 570,928 | 770,197 | 984,103 |
| **Wisconsin Electric Power Co.** | | | | | | | |
| Direct | 438,707 | 901,695 | 1,456,364 | 1,983,546 | 2,199,344 | 2,597,033 | 2,898,654 |
| Indirect | 657,770 | 753,250 | 797,222 | 857,230 | 902,364 | 918,897 | 959,949 |
| Total Reductions | 1,096,477 | 1,654,945 | 2,253,585 | 2,840,777 | 3,101,708 | 3,515,930 | 3,858,604 |
| Sequestration | — | — | — | — | 162,658 | 162,386 | 162,585 |
| Total for Entity | 1,096,477 | 1,654,945 | 2,253,585 | 2,840,777 | 3,264,366 | 3,678,316 | 4,021,189 |

## Table C2. Project-Level Emission Reductions and Sequestration Reported, Data Year 1997
(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Wisconsin Power & Light** | | | | | | | |
| Direct | 55,691 | 88,468 | 224,831 | 397,172 | 541,815 | 634,630 | 765,518 |
| Indirect | 17,732 | 27,809 | 41,061 | 59,023 | 72,622 | 85,510 | 102,343 |
| Total Reductions | 73,423 | 116,277 | 265,892 | 456,195 | 614,437 | 720,140 | 867,861 |
| Sequestration | — | 28,149 | 28,149 | 28,149 | 28,149 | 28,149 | 28,552 |
| Total for Entity | 73,423 | 144,426 | 294,041 | 484,344 | 642,586 | 748,289 | 896,413 |
| **Wisconsin Public Power Inc.** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 18,274 |
| **Wisconsin Public Service Corporation** | | | | | | | |
| Direct | 202,991 | 333,917 | 461,074 | 527,727 | 687,390 | 776,743 | 833,028 |
| Total Reductions | 202,991 | 333,917 | 461,074 | 527,727 | 687,390 | 776,743 | 833,028 |
| Sequestration | 67,612 | 67,612 | 67,612 | 67,612 | 68,560 | 69,518 | 70,492 |
| Total for Entity | 270,603 | 401,530 | 528,686 | 595,339 | 755,951 | 846,261 | 903,520 |
| **Zahren Alternative Power Corporation** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 698,291 |
| **Zeeland Board of Public Works** | | | | | | | |
| Total (EZ) | — | — | — | — | — | — | 395 |
| **Grand Totals** | **40,536,947** | **48,390,096** | **78,081,042** | **86,609,702** | **115,160,498** | **133,392,186** | **165,575,429** |

Notes: “Direct” refers to direct reductions. “Indirect” refers to indirect reductions. This table excludes those gases, such as CFCs and HCFCs, with ambiguous global warming potentials (GWPs), as determined by the Intergovernmental Panel on Climate Change. For further discussion of GWPs, see Chapter 1 of this report.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## Table C3. Entity-Level Total Reductions by Reporter, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **AES Hawaii** | | | | | | | |
| $CO_2$ | - | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 |
| Entity Total | - | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 | 1,530,000 |
| **AES Shady Point** | | | | | | | |
| $CO_2$ | - | - | 4,160,000 | 4,160,000 | 4,160,000 | 4,160,000 | 4,160,000 |
| Entity Total | - | - | 4,160,000 | 4,160,000 | 4,160,000 | 4,160,000 | 4,160,000 |
| **AES Thames** | | | | | | | |
| $CO_2$ | 1,880,000 | 1,880,000 | 1,880,000 | 1,880,000 | 1,880,000 | 1,940,000 | 1,940,000 |
| Entity Total | 1,880,000 | 1,880,000 | 1,880,000 | 1,880,000 | 1,880,000 | 1,940,000 | 1,940,000 |
| **Allegheny Power Service Corporation** | | | | | | | |
| $CO_2$ | 169,898 | 270,105 | 367,894 | 565,546 | 886,227 | 1,027,097 | 989,297 |
| Entity Total | 169,898 | 270,105 | 367,894 | 565,546 | 886,227 | 1,027,097 | 989,297 |
| **Arizona Public Service Company** | | | | | | | |
| $CO_2$ | 1,703,681 | 1,303,436 | 1,078,664 | 1,304,753 | 2,678,136 | 2,880,803 | 2,231,309 |
| Entity Total | 1,703,681 | 1,303,436 | 1,078,664 | 1,304,753 | 2,678,136 | 2,880,803 | 2,231,309 |
| **Arthur Rypinski and Jacquelyn Porth** | | | | | | | |
| $CO_2$ | 2 | 2 | 3 | 5 | 5 | 5 | 5 |
| Entity Total | 2 | 2 | 3 | 5 | 5 | 5 | 5 |
| **Bountiful City Light and Power** | | | | | | | |
| $CO_2$ | 28 | 1,339 | 10,320 | 6,426 | 11,851 | 14,629 | 16,797 |
| Entity Total | 28 | 1,339 | 10,320 | 6,426 | 11,851 | 14,629 | 16,797 |
| **BP America** | | | | | | | |
| $CO_2$ | 1,357 | 12,081 | 23,488 | 199,654 | 382,262 | 626,661 | 1,057,769 |
| Entity Total | 1,357 | 12,081 | 23,488 | 199,654 | 382,262 | 626,661 | 1,057,769 |
| **Cedar Falls Utilities (Preliminary)** | | | | | | | |
| $CO_2$ | - | 29,937 | 29,205 | 35,779 | 38,285 | 21,828 | 67,891 |
| Entity Total | - | 29,937 | 29,205 | 35,779 | 38,285 | 21,828 | 67,891 |
| **Central Hudson Gas and Electric Corporation** | | | | | | | |
| $CH_4$ | - | - | - | - | 5,258 | 9,068 | 13,393 |
| $CO_2$ | 480,347 | 972,919 | 2,568,732 | 3,155,543 | 2,909,522 | 3,495,725 | 2,640,386 |
| Entity Total | 480,347 | 972,919 | 2,568,732 | 3,155,543 | 2,914,780 | 3,504,793 | 2,653,779 |
| **The Dow Chemical Company** | | | | | | | |
| HFC-23 | - | - | - | - | - | - | -10,050 |
| HFC-134a | - | - | - | - | -8,743 | -6,745 | -17 |
| HFC-152a | - | - | - | - | 8,794 | 17,775 | -1 |
| $SF_6$ | - | - | - | - | -334,121 | 11,492 | 381,973 |
| $CH_4$ | - | - | - | - | 4,191 | 3,239 | 47,437 |
| $CO_2$ | - | - | - | - | 431,820 | -1,238,307 | 1,620,232 |
| $N_2O$ | - | - | - | - | -658,072 | -2,193,573 | 1,996,714 |
| Entity Total | - | - | - | - | -556,130 | -3,406,120 | 4,036,288 |
| **DTE Energy/Detroit Edison** | | | | | | | |
| $CO_2$ | 4,334,075 | 7,806,960 | 4,694,953 | -2,857,904 | -1,122,369 | -1,249,375 | -2,183,957 |
| Entity Total | 4,334,075 | 7,806,960 | 4,694,953 | -2,857,904 | -1,122,369 | -1,249,375 | -2,183,957 |
| **Duke Power Company** | | | | | | | |
| $CO_2$ | 7,865,486 | 4,969,328 | 6,887,806 | 10,036,865 | 12,807,054 | 5,651,722 | 4,072,680 |
| Entity Total | 7,865,486 | 4,969,328 | 6,887,806 | 10,036,865 | 12,807,054 | 5,651,722 | 4,072,680 |

## Table C3. Entity-Level Total Reductions by Reporter, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Entergy Services, Inc.** | | | | | | | |
| $CO_2$ | 1,282,893 | -116,610 | 1,975,614 | 40,356 | 2,583,921 | 3,232,508 | 5,506,179 |
| Entity Total | 1,282,893 | -116,610 | 1,975,614 | 40,356 | 2,583,921 | 3,232,508 | 5,506,179 |
| **Florida Power and Light Company** | | | | | | | |
| $SF_6$ | - | 121,275 | 121,275 | 121,275 | 2,024 | 18,701 | 0 |
| $CO_2$ | - | 6,080,651 | 13,476,339 | 18,116,526 | 22,175,107 | 22,526,487 | 19,620,502 |
| Entity Total | - | 6,201,926 | 13,597,614 | 18,237,801 | 22,177,131 | 22,545,188 | 19,620,502 |
| **Florida Power Corporation** | | | | | | | |
| $CO_2$ | - | - | - | 4,437,347 | 5,607,021 | 3,985,430 | 2,934,597 |
| Entity Total | - | - | - | 4,437,347 | 5,607,021 | 3,985,430 | 2,934,597 |
| **General Motors Corporation** | | | | | | | |
| $CO_2$ | 681 | 1,039 | 3,770 | 5,319 | 8,089 | 9,339 | 10,253 |
| Entity Total | 681 | 1,039 | 3,770 | 5,319 | 8,089 | 9,339 | 10,253 |
| **Houston Lighting and Power Company** | | | | | | | |
| $CO_2$ | 2,580,034 | 2,923,857 | 590,577 | 1,626,582 | 3,120,716 | 3,856,443 | 2,950,165 |
| Entity Total | 2,580,034 | 2,923,857 | 590,577 | 1,626,582 | 3,120,716 | 3,856,443 | 2,950,165 |
| **IBM** | | | | | | | |
| $CO_2$ | 125,192 | 120,202 | 114,124 | 100,607 | 102,693 | 57,606 | 80,921 |
| Entity Total | 125,192 | 120,202 | 114,124 | 100,607 | 102,693 | 57,606 | 80,921 |
| **Illinois Power Company** | | | | | | | |
| $CO_2$ | - | 517,749 | 1,320,215 | 2,689,508 | 1,722,093 | 964,795 | -1,491,129 |
| Entity Total | - | 517,749 | 1,320,215 | 2,689,508 | 1,722,093 | 964,795 | -1,491,129 |
| **Integrated Waste Services Association** | | | | | | | |
| $CH_4$ | - | - | - | - | 2,423,825 | 2,736,697 | 3,044,636 |
| $CO_2$ | - | - | - | - | 17,508,667 | 18,415,851 | 18,052,978 |
| $N_2O$ | - | - | - | - | 95,617 | 99,836 | 96,461 |
| Entity Total | - | - | - | - | 20,028,108 | 21,252,384 | 21,197,074 |
| **Johnson and Johnson** | | | | | | | |
| $CO_2$ | - | 16,194 | 37,133 | 17,663 | 27,304 | 33,186 | 27,900 |
| Entity Total | - | 16,194 | 37,133 | 17,663 | 27,304 | 33,186 | 27,900 |
| **Kansas City Power and Light Company** | | | | | | | |
| $CO_2$ | 376,210 | 243,332 | 319,634 | 621,364 | 576,423 | 624,362 | 712,681 |
| Entity Total | 376,210 | 243,332 | 319,634 | 621,364 | 576,423 | 624,362 | 712,681 |
| **Long Island Lighting Company** | | | | | | | |
| $SF_6$ | 0 | 0 | 0 | 0 | 0 | 2,168 | 3,252 |
| $CH_4$ | 33,089 | 30,773 | 29,866 | 27,500 | 21,131 | 15,989 | 16,348 |
| $CO_2$ | 599,740 | 1,549,744 | 1,582,584 | 2,137,327 | 2,859,719 | 2,588,561 | 2,848,016 |
| Entity Total | 632,829 | 1,580,517 | 1,612,450 | 2,164,827 | 2,880,850 | 2,606,719 | 2,867,616 |
| **Los Angeles Department of Water and Power** | | | | | | | |
| $CO_2$ | 1,261,529 | -684,980 | -160,248 | -1,172,088 | 1,638,223 | 3,787,463 | 2,299,843 |
| Entity Total | 1,261,529 | -684,980 | -160,248 | -1,172,088 | 1,638,223 | 3,787,463 | 2,299,843 |
| **Lower Colorado River Authority** | | | | | | | |
| $CO_2$ | 62,959 | 77,292 | 109,588 | 150,411 | 210,467 | 347,361 | 392,902 |
| Entity Total | 62,959 | 77,292 | 109,588 | 150,411 | 210,467 | 347,361 | 392,902 |
| **Lucent Technologies** | | | | | | | |
| $CO_2$ | 0 | 0 | 14,000 | 30,000 | 60,000 | 90,000 | 110,000 |
| Entity Total | 0 | 0 | 14,000 | 30,000 | 60,000 | 90,000 | 110,000 |

## Table C3. Entity-Level Total Reductions by Reporter, Data Year 1997

(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Motorola Austin** | | | | | | | |
| $CO_2$ | - | - | - | - | - | 56,065 | 34,366 |
| Entity Total | - | - | - | - | - | 56,065 | 34,366 |
| **Municipal Electric Authority of Georgia** | | | | | | | |
| $CO_2$ | 771,700 | 841,600 | 539,100 | 25,600 | 587,400 | 890,200 | 516,400 |
| Entity Total | 771,700 | 841,600 | 539,100 | 25,600 | 587,400 | 890,200 | 516,400 |
| **New England Electric System (NEES) Company** | | | | | | | |
| $CH_4$ | 310,015 | 393,782 | 526,471 | 534,072 | 509,020 | 664,095 | 838,010 |
| $CO_2$ | 164,684 | 635,862 | 869,388 | 1,348,676 | 1,921,426 | 2,988,048 | 3,316,035 |
| Entity Total | 474,699 | 1,029,644 | 1,395,859 | 1,882,749 | 2,430,447 | 3,652,143 | 4,154,045 |
| **New York Power Authority** | | | | | | | |
| $CO_2$ | 7,400 | 36,850 | 91,558 | 161,717 | 221,652 | 287,647 | 353,246 |
| Entity Total | 7,400 | 36,850 | 91,558 | 161,717 | 221,652 | 287,647 | 353,246 |
| **Niagara Mohawk Power Corporation** | | | | | | | |
| $CO_2$ | 1,577,231 | 1,637,831 | 2,445,044 | 3,708,934 | 3,863,246 | 4,191,194 | 3,754,203 |
| Entity Total | 1,577,231 | 1,637,831 | 2,445,044 | 3,708,934 | 3,863,246 | 4,191,194 | 3,754,203 |
| **NIPSCO Industries** | | | | | | | |
| $SF_6$ | - | - | 0 | 0 | 0 | 26,452 | 26,452 |
| $CH_4$ | 4,046 | 5,372 | 6,744 | 6,744 | 13,031 | 46,484 | 61,706 |
| $CO_2$ | 22,016 | 4,371 | 27,093 | 37,181 | 138,714 | 378,076 | 1,048,049 |
| Entity Total | 26,063 | 9,743 | 33,837 | 43,925 | 151,745 | 451,011 | 1,136,206 |
| **Northeast Utilities** | | | | | | | |
| $CO_2$ | 1,206,556 | 3,184,219 | 4,200,266 | 3,483,590 | 3,166,075 | 2,648,980 | -508,023 |
| Entity Total | 1,206,556 | 3,184,219 | 4,200,266 | 3,483,590 | 3,166,075 | 2,648,980 | -508,023 |
| **Ohio Edison Company** | | | | | | | |
| $CO_2$ | 409,127 | 469,934 | 410,240 | 687,001 | 657,841 | 961,164 | 1,054,985 |
| Entity Total | 409,127 | 469,934 | 410,240 | 687,001 | 657,841 | 961,164 | 1,054,985 |
| **Peabody Holding Company, Inc.** | | | | | | | |
| $CH_4$ | 14,079 | 33,472 | 55,476 | 49,037 | 76,013 | 99,122 | 77,194 |
| $CO_2$ | - | - | - | 293,638 | 355,299 | 398,732 | 327,865 |
| Entity Total | 14,079 | 33,472 | 55,476 | 342,675 | 431,312 | 497,854 | 405,059 |
| **Portland General Electric Co.** | | | | | | | |
| $CO_2$ | 97,069 | 167,829 | 275,060 | 468,022 | 652,090 | 728,750 | 764,079 |
| Entity Total | 97,069 | 167,829 | 275,060 | 468,022 | 652,090 | 728,750 | 764,079 |
| **Potomac Electric Power Company** | | | | | | | |
| $CO_2$ | 591,953 | 2,282,052 | 1,362,979 | 1,303,700 | 1,270,078 | 2,073,728 | 1,952,961 |
| Entity Total | 591,953 | 2,282,052 | 1,362,979 | 1,303,700 | 1,270,078 | 2,073,728 | 1,952,961 |
| **PP&L RESOURCES, INC.** | | | | | | | |
| $CO_2$ | 27,729 | 137,098 | 215,721 | -210,242 | 135,321 | 823,566 | 923,614 |
| Entity Total | 27,729 | 137,098 | 215,721 | -210,242 | 135,321 | 823,566 | 923,614 |
| **Public Service Electric and Gas Company** | | | | | | | |
| $CO_2$ | 2,412,095 | 3,530,258 | 4,448,033 | 4,588,152 | 4,361,005 | 4,747,345 | 2,895,457 |
| Entity Total | 2,412,095 | 3,530,258 | 4,448,033 | 4,588,152 | 4,361,005 | 4,747,345 | 2,895,457 |
| **Sacramento Municipal Utility District** | | | | | | | |
| $CO_2$ | - | - | - | - | - | 631,236 | 551,646 |
| Entity Total | - | - | - | - | - | 631,236 | 551,646 |

**Table C3. Entity-Level Total Reductions by Reporter, Data Year 1997**
(Metric Tons Carbon Dioxide Equivalent)

| Reporter | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|
| **Santee Cooper** | | | | | | | |
| $CO_2$ | 25,535 | 35,203 | 200,315 | 181,183 | 266,965 | 520,388 | 520,134 |
| Entity Total | 25,535 | 35,203 | 200,315 | 181,183 | 266,965 | 520,388 | 520,134 |
| **Southern Company** | | | | | | | |
| $CO_2$ | 1,410,831 | 2,255,340 | 2,434,585 | 3,012,052 | 3,617,132 | 4,311,274 | 5,225,951 |
| Entity Total | 1,410,831 | 2,255,340 | 2,434,585 | 3,012,052 | 3,617,132 | 4,311,274 | 5,225,951 |
| **Tampa Electric Company** | | | | | | | |
| $CO_2$ | 218,094 | 237,682 | 234,054 | 240,585 | 266,632 | 268,786 | 267,986 |
| Entity Total | 218,094 | 237,682 | 234,054 | 240,585 | 266,632 | 268,786 | 267,986 |
| **Tennessee Valley Authority** | | | | | | | |
| $CH_4$ | - | 78,032 | 78,337 | 87,177 | 118,135 | 137,890 | 139,167 |
| $CO_2$ | 2,872,386 | 8,501,690 | 6,863,627 | 7,719,552 | 10,251,855 | 22,316,796 | 24,008,117 |
| Entity Total | 2,872,386 | 8,579,722 | 6,941,964 | 7,806,729 | 10,369,990 | 22,454,686 | 24,147,284 |
| **VANALCO, INC. (Primary Aluminum Reduction Plant)** | | | | | | | |
| $CF_4$ | 227,500 | 19,500 | 39,000 | 58,500 | 188,500 | 45,500 | 58,500 |
| $C_2F_6$ | 27,600 | 9,200 | 0 | 9,200 | 27,600 | 9,200 | 9,200 |
| Entity Total | 255,100 | 28,700 | 39,000 | 67,700 | 216,100 | 54,700 | 67,700 |
| **Waverly Light and Power Company** | | | | | | | |
| $CO_2$ | 4,153 | 9,052 | 13,272 | 18,236 | 18,308 | 18,675 | 18,917 |
| Entity Total | 4,153 | 9,052 | 13,272 | 18,236 | 18,308 | 18,675 | 18,917 |
| **Wisconsin Power and Light** | | | | | | | |
| $CO_2$ | 73,423 | 144,422 | 294,041 | 484,344 | 642,586 | 748,289 | 896,413 |
| Entity Total | 73,423 | 144,422 | 294,041 | 484,344 | 642,586 | 748,289 | 896,413 |
| **Wisconsin Public Service Corporation** | | | | | | | |
| $CO_2$ | 288,878 | 420,165 | 546,207 | 629,615 | 791,987 | 878,113 | 956,366 |
| Entity Total | 288,878 | 420,165 | 546,207 | 629,615 | 791,987 | 878,113 | 956,366 |
| **Grand Total** | **35,521,301** | **54,727,443** | **68,942,149** | **77,892,630** | **120,471,051** | **131,990,621** | **127,877,357** |

- = Not reported.

Abbreviations: $CH_4$, methane; $CO_2$, carbon dioxide; $N_2O$, nitrous oxide; $CF_4$, perfluoromethane; $C_2F_6$, perfluoroethane; $SF_6$, sulfur hexafluoride.

Note: This table excludes those gases, such as CFCs and HCFCs, with ambiguous global warming potentials (GWPs), as determined by the Intergovernmental Panel on Climate Change. For further discussion of GWPs, see Chapter 1 of this report.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| A&N Electric Cooperative | EIA-1605 | Demand-side Management Load Control Program | U.S. | Energy End Use |
| | | Transmission and Distribution Efficiency Improvements | U.S. | Electric Power G & T |
| Advanced Micro Devices, Inc. | EIA-1605EZ | Chiller Load Optimization | U.S. | Energy End Use |
| | | Compressor Control Modification | U.S. | Energy End Use |
| | | Lighting Retrofits | U.S. | Energy End Use |
| | | PFC Reduction Project | U.S. | Halogenates |
| AES Hawaii | EIA-1605 | Mbaracayu Conservation | Foreign | Carbon Sequestration |
| AES Shady Point | EIA-1605 | OXFAM America Amazon | Foreign | Carbon Sequestration |
| AES Thames | EIA-1605 | CARE Agroforestry | Foreign | Carbon Sequestration |
| Allegheny Power Service Corporation | EIA-1605 | Adjustable Speed Drives for Plastic Injection Molding Machine | U.S. | Energy End Use |
| | | Application of Capacitors | U.S. | Electric Power G & T |
| | | Armstrong Boiler No. 1 Renovation Project | U.S. | Electric Power G & T |
| | | Armstrong Boiler No. 2 Renovation Project | U.S. | Electric Power G & T |
| | | Armstrong Unit 1 — Boiler Controls Replacement | U.S. | Electric Power G & T |
| | | Armstrong Unit 2 — Boiler Controls Replacement | U.S. | Electric Power G & T |
| | | Auxiliary Fuel Switching | U.S. | Electric Power G & T |
| | | Black Oak Property Tree Planting | U.S. | Carbon Sequestration |
| | | Carryall Vehicle Program | U.S. | Transportation |
| | | Conversion to Higher Voltage Distribution | U.S. | Electric Power G & T |
| | | Demand-Side Management Programs | U.S. | Energy End Use |
| | | Economic Conductor Selection | U.S. | Electric Power G & T |
| | | Efficient Distribution Transformers | U.S. | Electric Power G & T |
| | | Energy Star Transformer Program | U.S. | Electric Power G & T |
| | | Fly Ash use as replacement for cement | U.S. | Other |
| | | Green Lights Utility Ally Program | U.S. | Energy End Use |
| | | Hatfield Unit 1 — HP/IP Turbine Upgrade | U.S. | Electric Power G & T |
| | | Hatfield Unit 1 — LP Turbine Upgrade | U.S. | Electric Power G & T |
| | | Hatfield Unit 2 — HP/IP Turbine Upgrade | U.S. | Electric Power G & T |
| | | Hatfield Unit 3 — LP Turbine Upgrade | U.S. | Electric Power G & T |
| | | Lake Lynn Hydro Electric Station Relicensing | U.S. | Electric Power G & T |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Potomac Edison 138/500 kV System Split | U.S. | Electric Power G & T |
| | | R. P. Smith Unit 4 — Boiler Controls Replacement | U.S. | Electric Power G & T |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Replace Small Primary Conductors | U.S. | Electric Power G & T |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Rivesville Unit 6 — High Pressure Turbine Upgrade | U.S. | Electric Power G & T |
| | | Rivesville Unit No. 6 — Boiler Controls Replacement | U.S. | Electric Power G & T |
| | | Small Hydroelectric Station Relicensing | U.S. | Electric Power G & T |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| | | Willow Island — Low Pressure Turbine Upgrade | U.S. | Electric Power G & T |
| | | Wire Replacement on Transmission Lines | U.S. | Electric Power G & T |
| American Electric Power, Inc. | EIA-1605 | AEP Hydroelectric Facility Improvements | U.S. | Electric Power G & T |
| | | AEP-AGSPOIL-1992 | U.S. | Carbon Sequestration |
| | | AEP-AGSPOIL-1993 | U.S. | Carbon Sequestration |
| | | AEP-AGSPOIL-1994 | U.S. | Carbon Sequestration |
| | | AEP-AGSPOIL-1995 | U.S. | Carbon Sequestration |
| | | AEP-AGSPOIL-1996 | U.S. | Carbon Sequestration |
| | | AEP-AGSPOIL-1997 | U.S. | Carbon Sequestration |
| | | AEP-FM-1991 | U.S. | Carbon Sequestration |
| | | AEP-FM-1992 | U.S. | Carbon Sequestration |
| | | AEP-FM-1993 | U.S. | Carbon Sequestration |
| | | AEP-FM-1994 | U.S. | Carbon Sequestration |
| | | AEP-FM-1995 | U.S. | Carbon Sequestration |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | AEP-FM-1996 | U.S. | Carbon Sequestration |
| | | AEP-FM-1997 | U.S. | Carbon Sequestration |
| | | AEP-MARAG-1992 | U.S. | Carbon Sequestration |
| | | AEP-MARAG-1991 | U.S. | Carbon Sequestration |
| | | AEP-MARAG-1993 | U.S. | Carbon Sequestration |
| | | AEP-MARAG-1993-2 | U.S. | Carbon Sequestration |
| | | AEP-MARAG-1994 | U.S. | Carbon Sequestration |
| | | AEP-MARAG-1994-2 | U.S. | Carbon Sequestration |
| | | AEP-MARAG-1995 | U.S. | Carbon Sequestration |
| | | AEP-MARAG-1996 | U.S. | Carbon Sequestration |
| | | AEP-MARAG-1997 | U.S. | Carbon Sequestration |
| | | Commercial/Industrial Demand Side Management Programs | U.S. | Energy End Use |
| | | Distribution System Equipment Improvements | U.S. | Electric Power G & T |
| | | Enviro Tech Investment Fund I Limited Partnership — US | U.S. | Other |
| | | Enviro Tech Investment Funds — Foreign | Foreign | Other |
| | | Fly Ash Utilization Program (Cement Replacement) | U.S. | Other |
| | | Fuel Switch Coal to Natural Gas (Conesville Unit 1-3) | U.S. | Electric Power G & T |
| | | Green Lights | U.S. | Energy End Use |
| | | Heat Rate Improvement (Due to improved load optimization) | U.S. | Electric Power G & T |
| | | Heat Rate Improvement Projects (Oper. and Equip. Changes) | U.S. | Electric Power G & T |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Noel Kempff Mercado Climate Action Project | Foreign | Carbon Sequestration |
| | | Nuclear Plant Improved Utilization | U.S. | Electric Power G & T |
| | | Open-Loop Transmission Groundwire Resistive Loss Reduction | U.S. | Electric Power G & T |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Residential Demand Side Management Programs | U.S. | Energy End Use |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Transmission System Reinforcements | U.S. | Electric Power G & T |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| American Forests | EIA-1605 | Global ReLeaf Forests — Allegheny, Pennsylvania | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Apalacicola, Florida | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Applegate River, Oregon | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Appomattox, Virginia | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Aqua Fria, Arizona | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — ASCM Preserve, Maryland | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — AuSable, Michigan | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Bass River, New Jersey | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Beaver Creek, Ohio | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Bell Farm, Kentucky | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Belleplain, New Jersey | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Beltrami, Minnesota | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Betsie River, Michigan | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Big Woods, Minnesota | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Black Ridge, Colorado | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Black River, Wisconsin | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Blackfoot-Clearwater, Montana | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Blackwater, Florida | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Boise, Idaho | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Brokenback Diversity, Wyoming | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Cache River, Arkansas | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Caddo Parish, Louisiana | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Carson, New Mexico | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Casper, Wyoming | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Chittenden, Michigan | U.S. | Carbon Sequestration |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Global ReLeaf Forests — Choccolocco, Alabama | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Conecuh, Alabama | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Coshocton, Ohio | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Cossatot, Arkansas | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Croatan, North Carolina | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Cuba, New Mexico | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Darton College, Georgia | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — DeSoto, Mississippi | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Double Trouble, New Jersey | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Duck Creek, Ohio | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Econofina, Florida | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Ellis, Texas | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Fairfax, Virginia | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Farragut, Idaho | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Francis Marion, South Carolina | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Glades Preserve, Maryland | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Grailville, Ohio | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Great Plains RC & D, Oklahoma | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Greater Grand Forks, North Dakota | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Hakalau, Hawaii | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Harrison, Ohio | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Holly Springs, Mississippi | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Indian Creek, California | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Indian Lake, Ohio | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Indian Mounds, Texas | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Jordon River, Utah | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Kenosha Pass, Colorado | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Kettle Moraine, Wisconsin | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — King Range, California | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Kisatchie, Louisiana | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Lindsay, Oklahoma | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Little River, Arkansas | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Marys River, Nevada | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Mattole River, California | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Mescalero Apache, New Mexico | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Michaux, Pennsylvania | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Oklawaha, Florida | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Oneida County, New York | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Perry State Forest, Ohio | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Pike, Colorado | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Pillsbury, Minnesota | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Pine Barrens, New York | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Pine Creek, Idaho | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Rio Grande NWR, Texas | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Rio Salada, New Mexico | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Rockland Forest, Florida | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Sam Houston, Texas | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — San Pedro, Arizona | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Sanborn, South Dakota | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Spokane, Washington | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — St. Catherine, Mississippi | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Starr Hill, New York | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Stephens Forest, Iowa | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — SW OK Riparian Forest, Oklahoma | U.S. | Carbon Sequestration |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Global ReLeaf Forests — Tangipahoa, Louisiana | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Telfair, Georgia | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Temple, Michigan | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Three Mile Lake, Iowa | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Two Rocks, Pennsylvania | U.S. | Carbon Sequestration |
| | | Global ReLeaf Forests — Voyagers, Minnesota | U.S. | Carbon Sequestration |
| American Municipal Power - Ohio | EIA-1605 | AMP-OHIO: NYPA Hydro Purchases | U.S. | Electric Power G & T |
| | | City of Bowling Green Lighting Improvement | U.S. | Energy End Use |
| | | City of Columbus: O'Shaughnessy Hydro | U.S. | Electric Power G & T |
| | | City of Hamilton: Greenup Hydro | U.S. | Electric Power G & T |
| | | City of Niles: Lighting Improvement | U.S. | Energy End Use |
| | | City of Painesville: Heat Rate Improvement | U.S. | Electric Power G & T |
| | | City of Piqua: Plant Derating | U.S. | Electric Power G & T |
| | | City of Shelby: Lighting Improvement | U.S. | Energy End Use |
| | | City of Wadsworth: Lighting Improvement | U.S. | Energy End Use |
| | | Line Loss Reduction | U.S. | Electric Power G & T |
| | | Main Office Recycling Program | U.S. | Other |
| | | Ohio City: Lighting Improvement | U.S. | Energy End Use |
| | | Urban Forestry — Tree City USA | U.S. | Carbon Sequestration |
| | | Village of Arcadia Lighting Upgrade | U.S. | Energy End Use |
| | | Village of Custar: Lighting Improvement | U.S. | Energy End Use |
| | | Village of Eldorado: Lighting Improvement | U.S. | Energy End Use |
| | | Village of Lucas: Lighting Improvement | U.S. | Energy End Use |
| | | Village of New Knoxville: Lighting Improvement | U.S. | Energy End Use |
| | | Water Furnace | U.S. | Energy End Use |
| Anoka Municipal Utility | EIA-1605EZ | Central A/C Replacement | U.S. | Energy End Use |
| | | Demand Management Lighting Replacement | U.S. | Energy End Use |
| | | Urban Forestry | U.S. | Carbon Sequestration |
| | | Wind Generation | U.S. | Electric Power G & T |
| Arizona Electric Power Cooperative, Inc. | EIA-1605EZ | Flyash Sales | U.S. | Other |
| | | Lighting and Exit Sign Replacement | U.S. | Energy End Use |
| | | Utility Photovoltaic Group Membership Fees | U.S. | Other |
| Arthur Rypinski & Jacquelyn Porth | EIA-1605 | Compact Fluorescent Lightbulbs | U.S. | Energy End Use |
| | | High Efficiency Central Air Conditioning System | U.S. | Energy End Use |
| | | High Efficiency Water Heater | U.S. | Energy End Use |
| | | Mass Transit Commuting | U.S. | Transportation |
| | | Super Efficient Refrigerator | U.S. | Energy End Use |
| Asheville Landfill Gas, LLC | EIA-1605 | Buncombe County, NC Landfill | U.S. | Waste Methane |
| Atlantic Energy, Inc. (AEI) | EIA-1605 | AGI — Pedricktown Cogeneration Limited Partnership | U.S. | Cogeneration |
| | | AGI — Vineland Cogeneration Facility | U.S. | Cogeneration |
| | | Peach Bottom Nuclear Units #2 & 3 Uprate Program | U.S. | Electric Power G & T |
| Baltimore Gas & Electric Co. | EIA-1605 | Alternatively fueled vehicles — natural gas and 1 electric | U.S. | Transportation |
| | | Brandon Auxiliary Load Reductions | U.S. | Energy End Use |
| | | Brandon Shores Heat Rate Improvement | U.S. | Electric Power G & T |
| | | Coal Ash Substitution for Portland Cement | U.S. | Other |
| | | Crane Heat Rate Improvements | U.S. | Electric Power G & T |
| | | Demand Side Management Programs | U.S. | Energy End Use |
| | | ENERGY STAR @ CCNPP— Building/light/HVAC only | U.S. | Energy End Use |
| | | Energy Star @ GE Building | U.S. | Energy End Use |
| | | Gas Systems O & M | U.S. | Oil & Gas Methane |
| | | H.A. Wagner Heat Rate | U.S. | Electric Power G & T |
| | | Hydroelectric Generation Improvements | U.S. | Electric Power G & T |
| | | Miss. River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Refrigerant Recycling | U.S. | Halogenates |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Solid Waste Recycling | U.S. | Other |
| | | Transmission / Distribution Improvements | U.S. | Electric Power G & T |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| BARC Electric Cooperative | EIA-1605 | Demand-Side Management Load Control Programs | U.S. | Energy End Use |
| | | System Line Conversions and Reconductoring | U.S. | Electric Power G & T |
| Berkeley Electric Cooperative | EIA-1605EZ | DSM through Promoting Good Cents Energy | U.S. | Energy End Use |
| | | Earth Connect Geothermal Heat Pumps | U.S. | Energy End Use |
| | | Install Timers, Load Control Water Heaters (New & Replcmnts) | U.S. | Energy End Use |
| Bountiful City Light & Power | EIA-1605 | Air fuel ratio controller installed in dual fuel engine | U.S. | Electric Power G & T |
| | | Capacitor bank installation — increasing system efficiency | U.S. | Electric Power G & T |
| | | District heating | U.S. | Cogeneration |
| | | Hydroelectric plant operations | U.S. | Electric Power G & T |
| | | Residential compact fluorescent lighting program | U.S. | Energy End Use |
| | | Street lighting replacement | U.S. | Energy End Use |
| | | Tree planting | U.S. | Carbon Sequestration |
| BP America | EIA-1605 | Crude production and exploration process improvements | U.S. | Energy End Use |
| | | Crude Production Emission Reduction | U.S. | Other |
| | | Noel Kempff Mercado Climate Action Project | Foreign | Carbon Sequestration |
| | | Petroleum Refining and Chemicals process modifications | U.S. | Energy End Use |
| | | Petroleum refining emission control project | U.S. | Other |
| | | Petroleum refining VOC control projects | U.S. | Other |
| | | Thermal Process Efficiency Improvements | U.S. | Cogeneration |
| Buckeye Power Incorporated | EIA-1605 | Geothermal Heat Pump Project | U.S. | Energy End Use |
| | | Heat Rate Improvement Activities | U.S. | Electric Power G & T |
| | | Water Heater Replacement Program | U.S. | Energy End Use |
| Burlington County Board of Chosen Freeholders | EIA-1605 | Landfill Gas Flaring | U.S. | Waste Methane |
| Carolina Power & Light Company | EIA-1605 | Nuclear Capacity Improvement | U.S. | Electric Power G & T |
| Cedar Falls Utilities | EIA-1605 | Cedar Falls Trees (PROJECT 8.1) | U.S. | Carbon Sequestration |
| | | City Street Light Conversion (PROJECT 3.1) | U.S. | Energy End Use |
| | | Cooling Effect of Trees (Project 3.7) | U.S. | Energy End Use |
| | | Council Bluffs #3 ESP Hot-Side Conversion (PROJECT 1.5) | U.S. | Electric Power G & T |
| | | Good Cents Home Program (New Homes) (PROJECT 3.3) | U.S. | Energy End Use |
| | | Good Cents Improved Home (PROJECT 3.4) | U.S. | Energy End Use |
| | | High-Efficiency Transformers (PROJECT 1.2) | U.S. | Electric Power G & T |
| | | Home Energy Survey (PROJECT 3.2) | U.S. | Energy End Use |
| | | Neal #4 ESP Hot-Side Conversion (PROJECT 1.6) | U.S. | Electric Power G & T |
| | | Security Lighting Services (PROJECT 3.5) | U.S. | Energy End Use |
| | | Streeter ACC & VFD (PROJECT 1.7) | U.S. | Electric Power G & T |
| | | Streeter Unit 6 Controls Upgrade (PROJECT 1.1) | U.S. | Electric Power G & T |
| | | Water Heater Jacket Rebate (PROJECT 3.6) | U.S. | Energy End Use |
| Centerior Energy Corporation | EIA-1605 | Demand Side Management | U.S. | Energy End Use |
| | | Increased Generation at Davis-Besse Nuclear Power Station | U.S. | Electric Power G & T |
| | | Increased Generation at Perry Nuclear Power Plant | U.S. | Electric Power G & T |
| | | Use of Ash in Cement Production | U.S. | Other |
| | | Various CFC Replacements | U.S. | Halogenates |
| Central and South West Corporation | EIA-1605 | Coal Combustion By-product Use | U.S. | Other |
| | | CSW Land Management | U.S. | Carbon Sequestration |
| | | Demand Side Management (DSM) Activities | U.S. | Energy End Use |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Renewable Generation — Solar | U.S. | Electric Power G & T |
| | | Renewable Generation — Wind | U.S. | Electric Power G & T |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Rio Bravo Carbon Sequestration Project | Foreign | Carbon Sequestration |
| | | Transmission Efficiency Improvements | U.S. | Electric Power G & T |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Central Hudson Gas & Electric Corporation | EIA-1605 | Coal Ash Utilization | U.S. | Other |
| | | Danskammer Heat Pipe Air Heater | U.S. | Electric Power G & T |
| | | Danskammer Unit 4 Main Step-Up Transformer Replacement | U.S. | Electric Power G & T |
| | | Demand-Side Management | U.S. | Energy End Use |
| | | EPA Natural Gas Star Program | U.S. | Oil & Gas Methane |
| | | Natural Gas Vehicles | U.S. | Transportation |
| | | Roseton Gas Co-Firing | U.S. | Electric Power G & T |
| | | Roseton Unit 2 Main Step-Up Transformer Replacement | U.S. | Electric Power G & T |
| Central Illinois Light Company | EIA-1605 | In Concert With the Environment Education Program | U.S. | Other |
| | | CILCO Cogen One | U.S. | Cogeneration |
| | | E.D. Edwards Unit #3 Last Stage Bucket Heat Rate Improvement | U.S. | Electric Power G & T |
| | | Freon TF (CFC-113) Substitution | U.S. | Halogenates |
| | | Sangamon Valley Landfill Methane Outreach Program | U.S. | Waste Methane |
| | | Tazewell County Landfill Methane Outreach Program | U.S. | Waste Methane |
| | | TreeLine USA Program | U.S. | Carbon Sequestration |
| | | UtiliTree Carbon Company Forest Management | Foreign | Carbon Sequestration |
| Choptank Electric Cooperative | EIA-1605 | System Line Conversions and Reconductoring | U.S. | Electric Power G & T |
| City of Austin Electric Utility | EIA-1605EZ | Coal Combustion Byproduct Reutilization | U.S. | Other |
| | | Demand Side Management Programs | U.S. | Energy End Use |
| | | General Transmission/Distribution Efficiency Improvements | U.S. | Electric Power G & T |
| | | Landfill Gas Generation Power Purchase | U.S. | Electric Power G & T |
| | | Photovoltaic Generation | U.S. | Electric Power G & T |
| | | South Texas Project | U.S. | Electric Power G & T |
| | | West Texas Wind Turbine Power Purchase | U.S. | Electric Power G & T |
| City of Edmond, Oklahoma, Electric Department | EIA-1605EZ | High Efficiency Heat Pump Installation | U.S. | Energy End Use |
| | | High Efficiency Transformers | U.S. | Electric Power G & T |
| | | Tree/Shrub Planting | U.S. | Carbon Sequestration |
| City of Fairfield Wastewater Division | EIA-1605EZ | Motor Replacement Aeration Blower #1 | U.S. | Energy End Use |
| | | Motor Replacement Aeration Blower #2 | U.S. | Energy End Use |
| | | Motor Replacement Circulating Pump #3 | U.S. | Energy End Use |
| | | Motor Replacement Circulating Pump #4 | U.S. | Energy End Use |
| | | Pump & Motor Replacement Raw Sewage Pump #2 | U.S. | Energy End Use |
| | | Use of Methane from Anaerobic Digesters | U.S. | Waste Methane |
| City of Palo Alto | EIA-1605EZ | City employee carpooling | U.S. | Transportation |
| | | City employee mass transit | U.S. | Transportation |
| | | City fleet conversion to CNG | U.S. | Transportation |
| | | City fleet conversion to EV | U.S. | Transportation |
| | | DSM — Commercial Lighting | U.S. | Energy End Use |
| | | DSM — Refrigerator Replacement | U.S. | Energy End Use |
| | | DSM — Residential CFL | U.S. | Energy End Use |
| | | DSM — Commercial AC, motor | U.S. | Energy End Use |
| | | Utility Street Light conversion | U.S. | Energy End Use |
| City of Sherrill Power & Light | EIA-1605EZ | Tree Planting in Service Territory | U.S. | Carbon Sequestration |
| City Utilities of Springfield | EIA-1605 | HEAT RATE IMPROVEMENTS — SWPS | U.S. | Electric Power G & T |
| | | LOW SULFUR FUEL SWITCH — SWPS | U.S. | Electric Power G & T |
| | | Natural Gas Fleet | U.S. | Transportation |
| | | SF6 Recovery | U.S. | Halogenates |
| | | Urban Forestry | U.S. | Carbon Sequestration |
| CLE Resources | EIA-1605 | Active Power | U.S. | Energy End Use |
| | | Cycloid | U.S. | Transportation |
| | | Electronic Lighting (OK Industries) | U.S. | Energy End Use |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Industrial Devices Corporation (IDC) | U.S. | Energy End Use |
| | | Revolve Technologies — Dry Gas Seals | U.S. | Oil & Gas Methane |
| | | Revolve Technologies — Magnetic Bearings | U.S. | Energy End Use |
| Cleco Corporation | EIA-1605 | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Columbia Falls Aluminum Company | EIA-1605 | Lighting Replacement | U.S. | Energy End Use |
| COM/Electric | EIA-1605EZ | Canal Unit #2 Gas Conversion | U.S. | Electric Power G & T |
| | | Conservation Voltage Reduction | U.S. | Electric Power G & T |
| | | Energy Conservation Program (DSM) | U.S. | Energy End Use |
| | | Energy Star Transformer Program | U.S. | Electric Power G & T |
| | | Green Tree Spree (Tree Planting Incentive Program) | U.S. | Carbon Sequestration |
| | | Kendall Station Co generation | U.S. | Cogeneration |
| | | Transmission Line Upgrades | U.S. | Electric Power G & T |
| Community Electric Cooperative | EIA-1605 | System Line Conversion and Reconductoring | U.S. | Electric Power G & T |
| Cooperative Power Association | EIA-1605 | Capacitor Installation and Control | U.S. | Electric Power G & T |
| | | Coal Ash Programs | U.S. | Other |
| | | Coal Creek Station Vanpool | U.S. | Transportation |
| | | Continuous Blowdown | U.S. | Electric Power G & T |
| | | Cooling Tower Improvements | U.S. | Electric Power G & T |
| | | CP Carpool | U.S. | Transportation |
| | | Dakota Electric Tree planting programs | U.S. | Carbon Sequestration |
| | | Efficient Lighting | U.S. | Energy End Use |
| | | Energy Intelligent Business & Farm Grants | U.S. | Energy End Use |
| | | Excess Water Heating Setting Reductions | U.S. | Energy End Use |
| | | L-0 Buckets | U.S. | Electric Power G & T |
| | | Loss Reduction Measures | U.S. | Electric Power G & T |
| | | Low-Flow Showerheads | U.S. | Energy End Use |
| | | Other DSM | U.S. | Energy End Use |
| | | Recycling Projects & Activities | U.S. | Other |
| | | Residential and Commercial Audits | U.S. | Energy End Use |
| | | Retractable Packing HP-IP | U.S. | Electric Power G & T |
| | | Setback Thermostats | U.S. | Energy End Use |
| | | Transformer Sizing and Changeout | U.S. | Electric Power G & T |
| | | Tree-planting programs | U.S. | Carbon Sequestration |
| | | Ultrasonic & Helium Leak Detection Improvements | U.S. | Electric Power G & T |
| | | Videoconferencing | U.S. | Transportation |
| | | Water Heater Blankets | U.S. | Energy End Use |
| | | Water Pipe Insulation | U.S. | Energy End Use |
| DeBourgh Manufacturing Company | EIA-1605EZ | Compressed Air Dryer | U.S. | Energy End Use |
| | | Conversion from Liquid Paint to Powder Coating | U.S. | Other |
| | | Insulate Heat Generating Tanks | U.S. | Cogeneration |
| | | Landscaping | U.S. | Carbon Sequestration |
| | | Lighting Replacement | U.S. | Energy End Use |
| | | Monitoring Air Leaks from Compressor | U.S. | Energy End Use |
| | | On-site Wastewater Equalization | U.S. | Waste Methane |
| | | Radiant Heating | U.S. | Energy End Use |
| | | Ventilation Fan Installation | U.S. | Energy End Use |
| Delaware Electric Cooperative | EIA-1605 | System Line Conversions & Reconductoring | U.S. | Electric Power G & T |
| Delmarva Power | EIA-1605 | Ash Reuse | U.S. | Other |
| | | CNG Vehicles | U.S. | Transportation |
| | | Demand Side Management | U.S. | Energy End Use |
| | | DP&L Facility Energy Saving | U.S. | Energy End Use |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Edge Moor Landfill Gas Use | U.S. | Waste Methane |
| | | Edge Moor Natural Gas Use | U.S. | Electric Power G & T |
| | | Hay Road Combined Cycle | U.S. | Electric Power G & T |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Reduced Impact Logging of Nat. Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | T&D Loss Reduction | U.S. | Electric Power G & T |
| | | Urban Tree Planting | U.S. | Carbon Sequestration |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Dow Chemical Company | EIA-1605 | CFC Refrigeration Systems Conversion | U.S. | Halogenates |
| | | Replace CFC's as blowing agents to manufacture foams. | U.S. | Halogenates |
| | | Replacing HCFCs & HFCs as blowing agents — Foreign Operation | Foreign | Halogenates |
| | | Replacing HCFCs & HFCs as Blowing Agents — U.S. Operations | U.S. | Halogenates |
| DTE Energy/ Detroit Edison | EIA-1605 | Coal Ash Reuse — Canada | Foreign | Other |
| | | Coal Ash Reuse — U.S. | U.S. | Other |
| | | Distribution Improvements | U.S. | Electric Power G & T |
| | | Electric Vehicle Demonstration Project | U.S. | Transportation |
| | | Energy Partnerships | U.S. | Energy End Use |
| | | Forest Land Management | U.S. | Carbon Sequestration |
| | | Geothermal Projects | U.S. | Energy End Use |
| | | Greenwood Energy Center Fuel Switching | U.S. | Electric Power G & T |
| | | Increased Nuclear Utilization | U.S. | Electric Power G & T |
| | | Landfill Gas Recovery Projects and Energy Purchases | U.S. | Waste Methane |
| | | Miscellaneous Tree Plantings — 1995 | U.S. | Carbon Sequestration |
| | | Miscellaneous Tree Plantings — 1996 | U.S. | Carbon Sequestration |
| | | Miscellaneous Tree Plantings — 1997 | U.S. | Carbon Sequestration |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Plant Efficiency Improvements | U.S. | Electric Power G & T |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Program | Foreign | Carbon Sequestration |
| | | Solar Power | U.S. | Electric Power G & T |
| | | Southeast Michigan Afforestation — 1996 | U.S. | Carbon Sequestration |
| | | Southeast Michigan Afforestation — 1997 | U.S. | Carbon Sequestration |
| | | Southeastern Michigan Afforestation — 1995 | U.S. | Carbon Sequestration |
| | | State Forest Land Afforestation — 1996 | U.S. | Carbon Sequestration |
| | | State Forest Land Afforestation — 1997 | U.S. | Carbon Sequestration |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Duke Engineering and Services | EIA-1605EZ | White Street Landfill Gas Recovery Project, Greensboro | U.S. | Waste Methane |
| Duke Power Company | EIA-1605 | Increased Nuclear Generation at Catawba Nuclear Station | U.S. | Electric Power G & T |
| | | Increased Nuclear Generation at McGuire Nuclear Station | U.S. | Electric Power G & T |
| | | Increased Nuclear Generation at Oconee Nuclear Station | U.S. | Electric Power G & T |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Recycling Flyash | U.S. | Other |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Project | Foreign | Carbon Sequestration |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Duquesne Light Company | EIA-1605 | Air to air heat pumps | U.S. | Energy End Use |
| | | Allegheny Development Corporation Energy Facility | U.S. | Cogeneration |
| | | Fleet Vehicle Reduction Program | U.S. | Transportation |
| | | Fuel Cell — Pittsburgh International Airport | U.S. | Electric Power G & T |
| | | Hybrid Electric Bus | U.S. | Transportation |
| | | Low income weatherization | U.S. | Energy End Use |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Photovoltaics Research Project — Ambridge, PA | U.S. | Electric Power G & T |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | SF6 Reductions | U.S. | Halogenates |
| | | Thermal Storage | U.S. | Energy End Use |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Entergy Services, Inc. | EIA-1605 | Entergy Forestry Projects | U.S. | Carbon Sequestration |
| | | Entergy Integrated Solutions, Inc. (Entergy SASI Lighting) | U.S. | Energy End Use |
| | | Grand Gulf Nuclear Station Turbine Upgrade | U.S. | Electric Power G & T |
| | | Independence Unit 1 Feedwater Heater Replacement | U.S. | Electric Power G & T |
| | | Lewis Creek Combustion Control | U.S. | Electric Power G & T |
| | | Michoud Unit 3 Efficiency Improvement Project | U.S. | Electric Power G & T |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Nelson 4 Efficiency Improvement Project | U.S. | Electric Power G & T |
| | | Ninemile Turbine Retrofit | U.S. | Electric Power G & T |
| | | Raise Nuclear Unit Targets on Annual Capacity Factor | U.S. | Electric Power G & T |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Sabine Unit Feedwater Heater Replacement | U.S. | Electric Power G & T |
| | | Texas Eastern Gas Compressor Replacement | U.S. | Energy End Use |
| | | Transmission and Distribution Efficiency | U.S. | Electric Power G & T |
| | | Vidalia Hydroelectric Station | U.S. | Electric Power G & T |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| | | Wetlands and Carbon Sequestration — Southeast Louisiana | U.S. | Carbon Sequestration |
| | | White Bluff Unit 1 Feedwater Heater Replacement | U.S. | Electric Power G & T |
| | | White Bluff Unit 2 Feedwater Heaters Replacement | U.S. | Electric Power G & T |
| Environmentally Correct Concepts, Inc. | EIA-1605 | Caveny Farm Tract 1 | U.S. | Carbon Sequestration |
| | | Caveny Farm Tract 2 | U.S. | Carbon Sequestration |
| | | Caveny Farm Tract 3 | U.S. | Carbon Sequestration |
| Fayetteville Gas Company, LLC. | EIA-1605 | Cumberland City, Ann Street Landfill | U.S. | Waste Methane |
| General Motors Corporation | EIA-1605 | 1991-1997 GM Annual Energy Competition & Projects | U.S. | Energy End Use |
| | | 1993 — 1997 Mich. DSM and En. Partner Prog. and PwrHse Conv | U.S. | Energy End Use |
| Golden Valley Electric Association, Inc | EIA-1605EZ | Energy Sense DSM Program | U.S. | Energy End Use |
| | | Recycled coal ash | U.S. | Other |
| | | Tree give-away | U.S. | Carbon Sequestration |
| | | Use of Hydropower | U.S. | Electric Power G & T |
| GPU, Inc. | EIA-1605 | Biomass Co-firing R & D Program | U.S. | Electric Power G & T |
| | | Building Energy Consumption Reduction Program | U.S. | Energy End Use |
| | | Corry | U.S. | Waste Methane |
| | | Electric Vehicles and Employee Trip Reduction Program | U.S. | Transportation |
| | | FR & S Landfill NUG | U.S. | Waste Methane |
| | | Front Street Generating Station Retirement | U.S. | Electric Power G & T |
| | | Genco Lighting & Building Energy Consumption Reduction Progr | U.S. | Energy End Use |
| | | Gilbert #3 Retirement | U.S. | Electric Power G & T |
| | | GPU Service Lighting & Building Energy Efficiency Project | U.S. | Energy End Use |
| | | Hamm's Landfill NUG | U.S. | Waste Methane |
| | | Homer City Greenhouse Project | U.S. | Cogeneration |
| | | Information Services — Green Computers | U.S. | Energy End Use |
| | | JCP&L Green Lights Program | U.S. | Energy End Use |
| | | JCP&L Appliance Turn-In Service Program | U.S. | Halogenates |
| | | JCP&L DSM, Efficiency & Electrotechnology Program | U.S. | Energy End Use |
| | | JCP&L Fuel Cell-Crawford Hill | U.S. | Cogeneration |
| | | L & D Landfill NUG | U.S. | Waste Methane |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Lake View Landfill | U.S. | Waste Methane |
| | | Lebanon Methane NUG | U.S. | Waste Methane |
| | | Manchester Renewable | U.S. | Cogeneration |
| | | Mason Dixon Farms, Inc. | U.S. | Agriculture Methane |
| | | Met-Ed Lighting & Building Energy Consumption Reduction Prog | U.S. | Energy End Use |
| | | Met-Ed/Penelec DSM, Efficiency & Electrotechnology Program | U.S. | Energy End Use |
| | | Municipal Tree Replacement | U.S. | Carbon Sequestration |
| | | Oyster Creek Capacity/Availability Improvement Program | U.S. | Electric Power G & T |
| | | Photovoltaics Project-User Scale Applications-(USAPV) | U.S. | Electric Power G & T |
| | | Recycling Program | U.S. | Other |
| | | Sayreville Generating Station Retirements | U.S. | Electric Power G & T |
| | | Seneca Pumped Storage Upgrade | U.S. | Electric Power G & T |
| | | Shunt Capacitor Program | U.S. | Electric Power G & T |
| | | T & D System Improvements | U.S. | Electric Power G & T |
| | | TMI Capacity/Availability Improvement Program | U.S. | Electric Power G & T |
| | | Transformer Loss Evaluation Program | U.S. | Electric Power G & T |
| | | Transmission & Distribution Facility Maintenance — JCP&L | U.S. | Halogenates |
| | | UtiliTree Carbon Sequestration Project | Foreign | Carbon Sequestration |
| | | Valley Pork | U.S. | Agriculture Methane |
| | | Video — Conferencing | U.S. | Transportation |
| | | Werner #4 Retirement | U.S. | Electric Power G & T |
| | | Williamsburg Generating Station Retirement | U.S. | Electric Power G & T |
| | | Yards Creek Pumped Storage Upgrade | U.S. | Electric Power G & T |
| Granger Electric Company | EIA-1605 | Grand Blanc Landfill Generating Station | U.S. | Waste Methane |
| | | Granger #1 Generating Station — Wood Road Landfill | U.S. | Waste Methane |
| | | Granger #2 Generating Station — Grand River Avenue Landfill | U.S. | Waste Methane |
| | | Granger MotorWheel Facility | U.S. | Waste Methane |
| | | Ottawa County Farms Landfill Generating Station | U.S. | Waste Methane |
| | | Seymour Road Landfill Generating Station | U.S. | Waste Methane |
| GSF Energy, LLC | EIA-1605 | Acme Landfill Gas Recovery Plant | U.S. | Waste Methane |
| | | Davis Street Landfill Gas Recovery Plant | U.S. | Waste Methane |
| | | Fresh Kills Landfill Gas Recovery Plant | U.S. | Waste Methane |
| | | Kearny Landfill Gas Recovery Plant | U.S. | Waste Methane |
| | | McCarty Road Landfill Gas Recovery Plant | U.S. | Waste Methane |
| | | Mountaingate Landfill Gas Recovery Plant | U.S. | Waste Methane |
| | | Olinda Landfill Gas Recovery Plant | U.S. | Waste Methane |
| | | Rumpke Landfill Gas Recovery Plant | U.S. | Waste Methane |
| Hopkinsville Electric System | EIA-1605EZ | 1995 Tree Planting Program | U.S. | Carbon Sequestration |
| | | 1997 Tree Planting Program | U.S. | Carbon Sequestration |
| Houston Lighting & Power Company | EIA-1605 | Coal Fly Ash Sales | U.S. | Other |
| | | Demand Side Management | U.S. | Energy End Use |
| | | GT PRIME | U.S. | Electric Power G & T |
| | | Rice Field Methane Reduction Study | U.S. | Agriculture Methane |
| | | San Jacinto Steam Electric Generating Station | U.S. | Cogeneration |
| Illinois Power Company | EIA-1605 | Add Turbine Shell Heaters on Wood River 4 | U.S. | Electric Power G & T |
| | | Baldwin 2 Turbine H.E.L.P. Blades Installation | U.S. | Electric Power G & T |
| | | Baldwin 3 Flyash Sales | U.S. | Other |
| | | Baldwin 3 Heat Rate Improvement | U.S. | Electric Power G & T |
| | | Burn Waste Oil at Baldwin 3 | U.S. | Electric Power G & T |
| | | CNG Vehicle Conversions | U.S. | Transportation |
| | | Convert Vermilion Units 1 And 2 To Natural Gas | U.S. | Electric Power G & T |
| | | Fuel Switch To Natural Gas at Hennepin | U.S. | Electric Power G & T |
| | | Fuel Switch To Natural Gas at Wood River 4 | U.S. | Electric Power G & T |
| | | Havana 6 Cooling Tower Upgrade | U.S. | Electric Power G & T |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Hennepin Gas Reburn Project | U.S. | Electric Power G & T |
| | | Hennepin I Turbine Steam Path Upgrade | U.S. | Electric Power G & T |
| | | Hennepin Orimulsion Reburn | U.S. | Electric Power G & T |
| | | IDNR Tree Planting Partnership | U.S. | Carbon Sequestration |
| | | Improve Clinton Power Station Availability | U.S. | Electric Power G & T |
| | | Install Natural Gas Fired Aux. Boiler at Havana | U.S. | Electric Power G & T |
| | | MISSISSIPPI RIVER VALLEY BOTTOMLAND HARDWOOD RESTORATION | U.S. | Carbon Sequestration |
| | | New Boiler Controls at Hennepin | U.S. | Electric Power G & T |
| | | REDUCED IMPACT LOGGING OF NATURAL FOREST IN MALAYSIA | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Project — Component A | Foreign | Carbon Sequestration |
| | | Tire-Derived Fuel Cofiring at Baldwin | U.S. | Electric Power G & T |
| | | Vermilion 1 Heat Rate Improvements | U.S. | Electric Power G & T |
| | | Vermilion 2 Heat Rate Improvements | U.S. | Electric Power G & T |
| | | WESTERN OREGON CARBON SEQUESTRATION PROJECT | U.S. | Carbon Sequestration |
| | | Wood River 4 Turbine Rotor Replacement | U.S. | Electric Power G & T |
| Integrated Waste Services Association | EIA-1605 | Waste-to-Energy — Fuel Displacement | U.S. | Electric Power G & T |
| | | Waste-to-Energy — Waste Diversion | U.S. | Waste Methane |
| Iredell Landfill Gas, LLC | EIA-1605 | Iredell County Landfill, LLC | U.S. | Waste Methane |
| J.M. Gilmer and Company, Inc. | EIA-1605 | Flatwoods Tract Afforestation Project | U.S. | Carbon Sequestration |
| | | Smith Place Short Rotation Woody Crop Project | U.S. | Carbon Sequestration |
| | | Smith Place Tract Afforestation Project | U.S. | Carbon Sequestration |
| Jacksonville Electric Authority | EIA-1605EZ | Commercial Construction Workshops/Contractor Education | U.S. | Other |
| | | Fuel Switching | U.S. | Electric Power G & T |
| | | Fuel Switching Landfill Gas | U.S. | Electric Power G & T |
| | | Heat Rate Improvement | U.S. | Electric Power G & T |
| | | Low Income Residential Energy Audits | U.S. | Other |
| | | New Home Construction Workshops/Contractor Education | U.S. | Other |
| | | Non-residential energy audits | U.S. | Other |
| | | Power Factor Improvement | U.S. | Electric Power G & T |
| | | Residential Energy Audits | U.S. | Other |
| | | Urban Forestry | U.S. | Carbon Sequestration |
| Johnson & Johnson | EIA-1605 | Building Shell | U.S. | Energy End Use |
| | | Equipment & Appliances | U.S. | Energy End Use |
| | | Green Lights Upgrades | U.S. | Energy End Use |
| | | HVAC | U.S. | Energy End Use |
| | | Installation of Energy Efficient Systems | U.S. | Energy End Use |
| | | Installation of Timer Controls and Shutdowns | U.S. | Energy End Use |
| | | Load Control | U.S. | Energy End Use |
| | | Motor and Motor Drives | U.S. | Energy End Use |
| | | Process Improvements | U.S. | Energy End Use |
| Kansas City Power & Light Company | EIA-1605 | Aluminum Coal Cars | U.S. | Transportation |
| | | Coal Fly Ash Recycling | U.S. | Other |
| | | DSM — AC upgrade | U.S. | Energy End Use |
| | | ENVIROTECH Fund | U.S. | Other |
| | | EPA's Green Lights | U.S. | Energy End Use |
| | | Improve heat rate | U.S. | Electric Power G & T |
| | | Mississippi River Bottom Hardwood Restoration | U.S. | Carbon Sequestration |
| | | New Transmission Line & Reconductoring | U.S. | Electric Power G & T |
| | | Nuclear Unit Uprate | U.S. | Electric Power G & T |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Street Light Upgrade | U.S. | Energy End Use |
| | | Utilitree — Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| LAHD Energy, Inc. | EIA-1605EZ | Coal Mining: Other Methane Emissions Avoidance or Recovery | U.S. | Oil & Gas Methane |
| Los Angeles Department of Water and Power | EIA-1605 | Electric Vehicles | U.S. | Transportation |
| | | Energy Efficient Transformers | U.S. | Electric Power G & T |
| | | General Forestation and Tree Planting | U.S. | Carbon Sequestration |
| | | Rideshare Program | U.S. | Transportation |
| Lower Colorado River Authority | EIA-1605 | Coal Combustion By-Product Recycling | U.S. | Other |
| | | Hydroelectric Dam Modernization | U.S. | Electric Power G & T |
| | | Residential & Commercial DSM Program | U.S. | Energy End Use |
| | | Supply-Side Efficiency Improvements | U.S. | Electric Power G & T |
| | | Wind Power Project | U.S. | Electric Power G & T |
| MCNIC Oil & Gas Co. | EIA-1605 | Buchanan Production Company | U.S. | Oil & Gas Methane |
| Mecklenburg Electric Cooperative | EIA-1605 | System Line Conversion and Reconductoring | U.S. | Electric Power G & T |
| Minnesota Power | EIA-1605 | Demand Side Mgmt., Conservation and Efficiency Improvements | U.S. | Energy End Use |
| | | Electricity Substation, SF6 Breaker Replacement | U.S. | Halogenates |
| | | Expanded Generation from Existing Hydro Electric Resources | U.S. | Electric Power G & T |
| | | Expanded Use of Renewable Biomass (wood waste) | U.S. | Energy End Use |
| | | Heat Rate Improvements, Boswell Energy Center | U.S. | Electric Power G & T |
| | | Mud Lake Substation — Reduced Transmission Losses | U.S. | Electric Power G & T |
| | | Short Rotation Woody Crop Establishment | U.S. | Carbon Sequestration |
| | | Waste Paper Recycling Development | U.S. | Other |
| Minnesota Resource Recovery Association | EIA-1605EZ | Book ReUse Center Carbon Dioxide Reductions | U.S. | Waste Methane |
| | | Book ReUse Center Methane Reduction | U.S. | Waste Methane |
| | | MSW burning | U.S. | Waste Methane |
| | | Paper Recycling | U.S. | Other |
| | | Paper recycling | U.S. | Waste Methane |
| Missouri River Energy Services | EIA-1605EZ | Tree Planting | U.S. | Carbon Sequestration |
| Montana Power Company | EIA-1605 | Demand Side Management Programs | U.S. | Energy End Use |
| | | Gas Plant Catalytic Converters | U.S. | Oil & Gas Methane |
| | | Hydro-Electric Plant Upgrades | U.S. | Electric Power G & T |
| | | Natural Gas Vehicles — Fleet Conversion | U.S. | Transportation |
| | | Sale of Fly Ash | U.S. | Other |
| | | Upgrades to Colstrip Coal-Fired Units | U.S. | Electric Power G & T |
| Monteco Gas, LLC | EIA-1605EZ | Dallas Landfill Gas Recovery Plant — Flaring | U.S. | Waste Methane |
| | | Gas Flaring at City of Rosenberg Landfill, Rosenberg TX | U.S. | Waste Methane |
| Moorhead Public Service | EIA-1605EZ | Custom Rebate for Moorhead High School | U.S. | Energy End Use |
| | | Custom Rebate for Roffe Container | U.S. | Energy End Use |
| | | Insulation Improvement | U.S. | Energy End Use |
| | | Lighting Retrofit Program | U.S. | Energy End Use |
| | | Urban Forestry (sequestration only) | U.S. | Carbon Sequestration |
| Municipal Electric Authority of Georgia | EIA-1605 | Nuclear Generation Utilization | U.S. | Electric Power G & T |
| Nashville Electric Service | EIA-1605EZ | Distribution Voltage Upgrade | U.S. | Electric Power G & T |
| | | High-efficiency transformers | U.S. | Electric Power G & T |
| | | Urban Forestry/1995 Planting | U.S. | Carbon Sequestration |
| | | Urban Forestry/1996 Planting | U.S. | Carbon Sequestration |
| | | Urban Forestry/1997 Planting | U.S. | Carbon Sequestration |
| NC Muni Landfill Gas Partners, LP | EIA-1605 | Henderson County NC Landfill | U.S. | Waste Methane |
| Nebraska Public Power District | EIA-1605EZ | 1994-1996 Distribution Improvements | U.S. | Electric Power G & T |
| | | Plant Efficiency Improvements | U.S. | Electric Power G & T |
| | | Transformer Changeout | U.S. | Electric Power G & T |
| | | Tree Planting | U.S. | Carbon Sequestration |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| Nevada Power Company | EIA-1605EZ | Mohave Heat Rate Improvements | U.S. | Electric Power G & T |
| | | Office Lighting Replacement Dec. 1996 | U.S. | Energy End Use |
| | | Office Lighting Replacement Sep/Oct 1997 | U.S. | Energy End Use |
| | | Reduced Impact to Logging — Malaysia | Foreign | Carbon Sequestration |
| | | Rio Bravo Forest Preservation | Foreign | Carbon Sequestration |
| | | Solar Elec. Gen. | U.S. | Electric Power G & T |
| New England Electric System (NEES) Company | EIA-1605 | Appliance Removal Program | U.S. | Halogenates |
| | | Attleboro Landfill Gas to Electricity Project | U.S. | Waste Methane |
| | | Barre Landfill Gas to Electricity Project | U.S. | Waste Methane |
| | | Brayton Point Station Unit No. 4 Gas Conversion | U.S. | Electric Power G & T |
| | | Brayton Point Station Units No. 1, 2, 3 Natural Gas Usage | U.S. | Electric Power G & T |
| | | Coal Ash Recycling as Cement Replacement | U.S. | Other |
| | | Demand-Side Management Programs | U.S. | Energy End Use |
| | | Green Lights Program | U.S. | Energy End Use |
| | | Johnston Landfill Gas to Electricity Project | U.S. | Waste Methane |
| | | Lowell Landfill Gas to Electricity Project | U.S. | Waste Methane |
| | | Manchester Street Repowering | U.S. | Electric Power G & T |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Nashua Landfill Gas To Electricity Project | U.S. | Waste Methane |
| | | Power Purchases from Natural Gas Generation | U.S. | Electric Power G & T |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Reduced Impact Logging Project (NEP Pilot Project) | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Turnkey Landfill Gas to Electricity Project | U.S. | Waste Methane |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Newton Landfill Gas, LLC | EIA-1605 | Newton Landfill, Catawba County, NC | U.S. | Waste Methane |
| Nexstar Pharmaceuticals, Inc. | EIA-1605EZ | Heat Recovery Unit | U.S. | Energy End Use |
| | | Lighting Replacement | U.S. | Energy End Use |
| Niagara Mohawk Power Corporation | EIA-1605 | Alternative Fuel Vehicles | U.S. | Transportation |
| | | Amorphous Metal Core Transformers | U.S. | Electric Power G & T |
| | | Coal Ash Utilization | U.S. | Other |
| | | Cowley Ridge Windplant | Foreign | Electric Power G & T |
| | | Energy Efficiency and Conservation Programs (DSM) | U.S. | Energy End Use |
| | | Identify & Rehabilitate Leaky Gas Distribution Pipe | U.S. | Oil & Gas Methane |
| | | Installation and Operation of Photovoltaic Energy Systems | U.S. | Electric Power G & T |
| | | Installation and Operation of Wind Turbines | U.S. | Electric Power G & T |
| | | Investment Recovery Program (Recycling) | U.S. | Other |
| | | Nuclear Generation Capacity Improvements | U.S. | Electric Power G & T |
| | | Nuclear Generation Performance Improvements | U.S. | Electric Power G & T |
| | | Outdoor Lighting Lamp Conversion Program | U.S. | Energy End Use |
| | | Partial Conversion of Oil-Fired Plant to Natural Gas | U.S. | Electric Power G & T |
| | | Refrigerator Roundup | U.S. | Halogenates |
| NIPSCO Industries | EIA-1605 | Biomass Initiative | U.S. | Electric Power G & T |
| | | Capacitor Additions | U.S. | Electric Power G & T |
| | | Coal Combustion Byproduct Utilization | U.S. | Other |
| | | Electric Vehicles | U.S. | Transportation |
| | | Employee Commute Options | U.S. | Transportation |
| | | Employee Training | U.S. | Other |
| | | Fuel Switching at Bynov Plant in Decin, Czech Republic | Foreign | Cogeneration |
| | | Inland Steel -Northlake Energy | U.S. | Cogeneration |
| | | Landfill Methane Recovery — Deercroft | U.S. | Waste Methane |
| | | Landfill Methane Recovery — Wheeler | U.S. | Waste Methane |
| | | Landfill Methane Recovery — Prairie View | U.S. | Waste Methane |
| | | Low Loss Transformers | U.S. | Electric Power G & T |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | National Steel— Portside Energy | U.S. | Cogeneration |
| | | Natural Gas STAR | U.S. | Oil & Gas Methane |
| | | Natural Gas Vehicles | U.S. | Transportation |
| | | North Trenton Pipeline Replacement | U.S. | Oil & Gas Methane |
| | | Ozone Depleting Chemicals | U.S. | Halogenates |
| | | Recycling program | U.S. | Other |
| | | Rural Tree Planting | U.S. | Carbon Sequestration |
| | | SF6 Reductions | U.S. | Halogenates |
| | | Urban Tree Planting | U.S. | Carbon Sequestration |
| | | US Steel — Lakeside Energy | U.S. | Cogeneration |
| | | UtiliTree — Rio Bravo Pilot | Foreign | Carbon Sequestration |
| Noranda Aluminum Inc. | EIA-1605 | PFC Emission Reduction via Reductions in Anode Effects | U.S. | Halogenates |
| North American Carbon, Inc. | EIA-1605 | Glendale Hydroelectric Project | U.S. | Electric Power G & T |
| | | Lower Saranac Hydroelectric Project | U.S. | Electric Power G & T |
| | | Northland Iroquois 1 & 2 | Foreign | Cogeneration |
| North Carolina Electric Membership Corporation | EIA-1605EZ | Switch Away from Fossil Fuel Generated Power Purchases | U.S. | Electric Power G & T |
| Northern Neck Electric Cooperative | EIA-1605 | Demand-Side Management Programs | U.S. | Energy End Use |
| | | System Line Conversion and Reconductoring | U.S. | Electric Power G & T |
| Northern States Power Company | EIA-1605 | Appliance Recycling | U.S. | Halogenates |
| | | Chippewa Falls Hydro expansion | U.S. | Electric Power G & T |
| | | Coal ash utilization | U.S. | Other |
| | | Demand side management (electric) | U.S. | Energy End Use |
| | | Green Lights | U.S. | Energy End Use |
| | | Landfill gas purchase | U.S. | Waste Methane |
| | | Low Income Refrigerator Replacement | U.S. | Halogenates |
| | | Nuclear capacity increase | U.S. | Electric Power G & T |
| | | Nuclear capacity increase-2 | U.S. | Electric Power G & T |
| | | Nuclear capacity restoration | U.S. | Electric Power G & T |
| | | Recycling program | U.S. | Other |
| | | Refuse-derived fuel | U.S. | Electric Power G & T |
| | | Transmission upgrade | U.S. | Electric Power G & T |
| | | Transmission upgrade-2 | U.S. | Electric Power G & T |
| | | Upgrade for hydro capacity | U.S. | Electric Power G & T |
| | | Wheaton Plant conversion | U.S. | Electric Power G & T |
| | | Wind power | U.S. | Electric Power G & T |
| Northern Virginia Electric Cooperative | EIA-1605 | Demand-side Management Load Control Programs | U.S. | Energy End Use |
| | | System Line Conversions and Reconductoring | U.S. | Electric Power G & T |
| Northwest Fuel Development, Inc. | EIA-1605 | Utilization of Coal Mine Gas | U.S. | Oil & Gas Methane |
| Ohio Edison Company | EIA-1605 | Audit/Infiltration Single and Multi-Family | U.S. | Energy End Use |
| | | Efficient Lighting (Industrial and Commercial) | U.S. | Energy End Use |
| | | Efficient Lighting (Residential) | U.S. | Energy End Use |
| | | Efficient Motors | U.S. | Energy End Use |
| | | Energy Efficient Geothermal System | U.S. | Energy End Use |
| | | Food Service Conservation | U.S. | Energy End Use |
| | | Fuel Switching | U.S. | Electric Power G & T |
| | | Good Cents New Home Program | U.S. | Energy End Use |
| | | Heat Pump Maintenance Check | U.S. | Energy End Use |
| | | Heat Rate Improvement | U.S. | Electric Power G & T |
| | | High Efficiency Heat Pump Rebates | U.S. | Energy End Use |
| | | Hot Water Conservation | U.S. | Energy End Use |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Refrigerator Recycling | U.S. | Halogenates |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Refrigerator Recycling Program | U.S. | Energy End Use |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Substitution of Fly Ash for Portland Cement in Concrete | U.S. | Other |
| | | Thermal Energy Storage — Cooling | U.S. | Energy End Use |
| | | Tree Source | U.S. | Carbon Sequestration |
| | | Water Heater Efficiency Improvements | U.S. | Energy End Use |
| | | Water Heating — Conservation | U.S. | Energy End Use |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Old Dominion Electric Cooperative | EIA-1605 | Clover Power Station — Visual Screening | U.S. | Carbon Sequestration |
| | | Green Lights | U.S. | Energy End Use |
| Omaha Public Power District | EIA-1605EZ | Coal Heat Rate Improvement | U.S. | Electric Power G & T |
| | | Commercial & Industrial Audits | U.S. | Energy End Use |
| | | Heat Pump Program (RECP) | U.S. | Energy End Use |
| | | Nuclear Capacity Factor Improvement | U.S. | Electric Power G & T |
| | | Recycling Fly Ash | U.S. | Other |
| | | Right Lights | U.S. | Energy End Use |
| | | Street Lighting Replacement | U.S. | Energy End Use |
| | | T&D Capacitor Installations | U.S. | Electric Power G & T |
| | | Tree Planting | U.S. | Carbon Sequestration |
| Oregon State University (State of Oregon) | EIA-1605 | RUSAFOR-SAP | Foreign | Carbon Sequestration |
| Pacific Gas and Electric Company | EIA-1605EZ | 1996 high bleed device replacement | U.S. | Oil & Gas Methane |
| | | 1996 pipeline replacement | U.S. | Oil & Gas Methane |
| | | Continuing electric energy efficiency | U.S. | Energy End Use |
| | | Continuing nat gas use in vehicles | U.S. | Transportation |
| | | Continuing natural gas conservation | U.S. | Energy End Use |
| | | Expanded natural gas use in vehicles | U.S. | Transportation |
| | | New 97 pipeline replacement | U.S. | Oil & Gas Methane |
| | | New Electric Energy Efficiency | U.S. | Energy End Use |
| | | New natural gas energy efficiency | U.S. | Energy End Use |
| PacifiCorp | EIA-1605 | Coal Ash Recycling | U.S. | Other |
| | | Commercial Competitive Bid — EUA/Onsite | U.S. | Energy End Use |
| | | Competitive Bid — CES/Way | U.S. | Energy End Use |
| | | Energy FinAnswer | U.S. | Energy End Use |
| | | Energy FinAnswer Prescriptive | U.S. | Energy End Use |
| | | Energy FinAnswer Retrofit | U.S. | Energy End Use |
| | | Ethanol Production Carbon Offset Project | U.S. | Other |
| | | H_PRO: High Efficiency Heat Pumps | U.S. | Energy End Use |
| | | Hassle-Free Program | U.S. | Energy End Use |
| | | Home Comfort | U.S. | Energy End Use |
| | | Industrial Energy FinAnswer | U.S. | Energy End Use |
| | | Irrigation FinAnswer Program | U.S. | Energy End Use |
| | | Low Income Weatherization and Conservation Programs | U.S. | Energy End Use |
| | | Major Accounts Program | U.S. | Energy End Use |
| | | Manufactured Housing Acquisition Program (MAP) | U.S. | Energy End Use |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Noel Kempff Mercado Climate Action Project | Foreign | Carbon Sequestration |
| | | Northwest Fuels Methane Recovery From Coal Mines | U.S. | Oil & Gas Methane |
| | | PacifiCorp Facility DSM | U.S. | Energy End Use |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Reforestation in Eastern Washington | U.S. | Carbon Sequestration |
| | | Reforestation of Private Lands in Oregon — Site Class II | U.S. | Carbon Sequestration |
| | | Reforestation of Private Lands in Oregon — Site Class III | U.S. | Carbon Sequestration |
| | | Residential Competitive Bid — ECONS | U.S. | Energy End Use |
| | | Residential Weatherization Programs | U.S. | Energy End Use |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Salt Lake City Urban Forestry Project | U.S. | Carbon Sequestration |
| | | Salt Lake City Urban Forestry Project | U.S. | Energy End Use |
| | | Showerhead Program | U.S. | Energy End Use |
| | | Small Commercial Retrofit | U.S. | Energy End Use |
| | | Super Efficiency Refrigerator Program (SERP) | U.S. | Energy End Use |
| | | Super Good Cents | U.S. | Energy End Use |
| | | Utah Water Smart Kits (Schedule 5) | U.S. | Energy End Use |
| | | Water Heater / Solar | U.S. | Energy End Use |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Peabody Holding Company, Inc. | EIA-1605 | Coal Bed Methane Utilization | U.S. | Oil & Gas Methane |
| Platte River Power Authority & 4 owner cities | EIA-1605 | Fort Collins Distribution System Improvements | U.S. | Electric Power G & T |
| | | Longmont Distribution System Improvements | U.S. | Electric Power G & T |
| | | Longmont Efficient Lighting Projects | U.S. | Energy End Use |
| | | Longmont Hydro Project Upgrades | U.S. | Electric Power G & T |
| | | Longmont Wastewater Plant Waste Gas Flare | U.S. | Waste Methane |
| | | Loveland Digester Gas Production and Use | U.S. | Waste Methane |
| | | Loveland Hydroelectric Plant | U.S. | Electric Power G & T |
| | | Loveland Recycling Program | U.S. | Other |
| | | Loveland Thrifty Light Project | U.S. | Energy End Use |
| | | PRPA Heat Rate Improvements at Craig Powerplant | U.S. | Electric Power G & T |
| | | PRPA IRP Activities | U.S. | Energy End Use |
| Portland General Electric Co. | EIA-1605 | 1995 Colstrip Units 3&4 Ruggedizing | U.S. | Electric Power G & T |
| | | Beaver Efficiency Improvements | U.S. | Electric Power G & T |
| | | Boardman Efficiency Improvements | U.S. | Electric Power G & T |
| | | Building Rooftop Photovoltaic Systems | U.S. | Energy End Use |
| | | Bull Run Turbine Runner Replacements | U.S. | Electric Power G & T |
| | | Demand-Side Management Projects | U.S. | Energy End Use |
| | | Electric Fleet Vehicles | U.S. | Transportation |
| | | Energy Management Systems | U.S. | Energy End Use |
| | | Faraday Units 4&5 1994 | U.S. | Electric Power G & T |
| | | Friends of Trees | U.S. | Carbon Sequestration |
| | | Gas Lawnmower Turn In Rebate | U.S. | Energy End Use |
| | | Green Lights Programs | U.S. | Energy End Use |
| | | Heat Pump Rebate | U.S. | Energy End Use |
| | | Natural Gas Fleet Vehicles | U.S. | Transportation |
| | | Oak Grove Turbine Runner Replacements — 1991 — Units 1&2 | U.S. | Electric Power G & T |
| | | Photoelectric Streetlight Controls | U.S. | Energy End Use |
| | | River Mill Efficiency Improvements | U.S. | Electric Power G & T |
| | | Sullivan turbine rebuilds | U.S. | Electric Power G & T |
| | | T&D: Power Factor Correction Capacitors | U.S. | Electric Power G & T |
| | | Transformer Efficiency Improvements | U.S. | Electric Power G & T |
| Potomac Electric Power Company | EIA-1605 | Coal Combustion By-Product Utilization | U.S. | Other |
| | | Energy Mngt/Conservation Programs | U.S. | Energy End Use |
| | | GLP — Lighting Replacement | U.S. | Energy End Use |
| | | Investment Recovery | U.S. | Other |
| PP&L RESOURCES, INC. | EIA-1605 | Ash Use in Cement Making | U.S. | Other |
| | | Demand Side Management Project | U.S. | Energy End Use |
| | | Fossil Plant Efficiency | U.S. | Electric Power G & T |
| | | Martins Creek Gas | U.S. | Electric Power G & T |
| | | Pheasant Habitat Restoration Program (PHRP) | U.S. | Carbon Sequestration |
| | | Susquehanna SES Strategy 2000 | U.S. | Electric Power G & T |
| | | Susquehanna Steam Electric Station Re-Rate | U.S. | Electric Power G & T |
| | | Transformer Savings | U.S. | Electric Power G & T |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Trees for the Future | U.S. | Carbon Sequestration |
| | | Utilitree Co. — Malaysia Project | Foreign | Carbon Sequestration |
| | | Utilitree Co. — Mississippi R. V. Project | U.S. | Carbon Sequestration |
| | | Utilitree Co. — W. Oregon Project | U.S. | Carbon Sequestration |
| | | Utilitree Co. -Rio Bravo Project | Foreign | Carbon Sequestration |
| Prince George Electric Cooperative | EIA-1605 | Transmission and Dist. Efficiency Improvements | U.S. | Electric Power G & T |
| Public Service Company of New Mexico | EIA-1605 | CNG Vehicles | U.S. | Transportation |
| | | Heat Rate Improvements at San Juan Generating Station | U.S. | Electric Power G & T |
| | | Natural Gas Leak Surveying and Replacement | U.S. | Oil & Gas Methane |
| | | Palo Verde Generation Increase | U.S. | Electric Power G & T |
| Public Service Electric and Gas Company | EIA-1605 | UtiliTree — Miss R. Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | UtiliTree — Rio Bravo Carbon Seq. Pilot Project | Foreign | Carbon Sequestration |
| | | UtiliTree — Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| | | UtiliTree-Reduced Impact Logging of Nat'l Forest in Malaysia | Foreign | Carbon Sequestration |
| Public Utility District No. 1 of Snohomish County | EIA-1605 | Battery and Solar Powered Boat Races | U.S. | Transportation |
| | | Bicycles for Meter Readers | U.S. | Transportation |
| | | Commute Reduction Program | U.S. | Transportation |
| | | Conservation Voltage Reduction | U.S. | Electric Power G & T |
| | | Demand Side Management | U.S. | Energy End Use |
| | | Electric Car Race | U.S. | Transportation |
| | | Scrap Metals Recycling | U.S. | Other |
| | | Transmission Networking and Reconductoring | U.S. | Electric Power G & T |
| | | We-cycle Office Wastepaper (WOW) Program | U.S. | Other |
| Quad/Graphics, Inc. | EIA-1605 | 12 hour shift | U.S. | Transportation |
| | | Duplainville return load project | U.S. | Transportation |
| | | Energy Efficient Installations | U.S. | Energy End Use |
| | | New Mass Transit routes | U.S. | Transportation |
| | | Waste Paper Reduction Program | U.S. | Other |
| | | West Allis Plant Brownfield Site | U.S. | Other |
| Rappahannock Electric Cooperative | EIA-1605 | System Line Conversions and Reconductoring | U.S. | Electric Power G & T |
| | | Tree Planting | U.S. | Carbon Sequestration |
| Rochester Institute of Technology | EIA-1605 | Compact Fluorescent Lamps | U.S. | Energy End Use |
| | | Gold Lamp Replacement | U.S. | Energy End Use |
| | | HVAC CONVERSION TO VAV | U.S. | Energy End Use |
| | | LED Exit Signs | U.S. | Energy End Use |
| | | Motor Replacement | U.S. | Energy End Use |
| | | Occupancy Sensors | U.S. | Energy End Use |
| | | T-8 Lamp Conversion | U.S. | Energy End Use |
| | | VSD INSTALLATION | U.S. | Energy End Use |
| Sacramento Municipal Utility District | EIA-1605 | Employee Commute Program | U.S. | Transportation |
| | | Energy Efficiency Programs | U.S. | Energy End Use |
| | | Meter Reading — Bicycles | U.S. | Transportation |
| | | PV Pioneer | U.S. | Electric Power G & T |
| | | Ride Electric | U.S. | Transportation |
| | | Shade Tree Program | U.S. | Carbon Sequestration |
| Salt River Project | EIA-1605EZ | Cooperative Photovoltaic and Fuel Cell | U.S. | Other |
| | | Electric Vehicles Demonstration and Business Use | U.S. | Transportation |
| | | Fly Ash Sales | U.S. | Other |
| | | Halophyte Farming | U.S. | Carbon Sequestration |
| | | Heat Rate Improvement at Coronado Generating Station | U.S. | Electric Power G & T |
| | | Home Equipped with PV System for Demonstration | U.S. | Energy End Use |
| | | Replace Gasoline Lawnmowers with Electric Lawnmowers | U.S. | Energy End Use |
| Santee Cooper | EIA-1605 | Cross Unit 2 Upgrade | U.S. | Electric Power G & T |
| | | Demand Side Management Programs | U.S. | Energy End Use |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Fly Ash Used in Cement Manufacture | U.S. | Other |
| | | Forestation/Reforestation | U.S. | Carbon Sequestration |
| | | Summer Nuclear Upgrade | U.S. | Electric Power G & T |
| | | Winyah Unit 1 Turbine Upgrade | U.S. | Electric Power G & T |
| Seattle City Light | EIA-1605 | 4kV to 26kV Distribution System Conversion | U.S. | Electric Power G & T |
| | | Cedar Falls turbine runner replacement | U.S. | Electric Power G & T |
| | | Diablo Dam turbine runner replacement | U.S. | Electric Power G & T |
| | | Energy $avings Plan (E$P) | U.S. | Energy End Use |
| | | Energy Efficient Water Heater Rebate Program (EEWHRP) | U.S. | Energy End Use |
| | | Energy Smart Design | U.S. | Energy End Use |
| | | Gorge Dam turbine runner replacement | U.S. | Electric Power G & T |
| | | Home Water Savers Program | U.S. | Energy End Use |
| | | Long-Term Super Good Cents Program (LTSGC) | U.S. | Energy End Use |
| | | Low-Income Electric Program | U.S. | Energy End Use |
| | | Multifamily Common Area Lighting Program (MF-CAL) | U.S. | Energy End Use |
| | | Multifamily Conservation Program: Low-Income | U.S. | Energy End Use |
| | | Multifamily Conservation Program: Standard-Income | U.S. | Energy End Use |
| | | Ross Dam turbine runner replacement | U.S. | Electric Power G & T |
| | | South Fork Tolt River hydroelectric project | U.S. | Electric Power G & T |
| | | Urban Tree Replacement Program | U.S. | Carbon Sequestration |
| | | Warm Home Program (WMHM) | U.S. | Energy End Use |
| Seminole Electric Cooperative, Inc. | EIA-1605EZ | Fly Ash and Bottom Ash Reuse | U.S. | Other |
| | | Heat Rate Improvement | U.S. | Electric Power G & T |
| | | Lighting Replacement | U.S. | Energy End Use |
| | | Transmission Conductor Optimization | U.S. | Electric Power G & T |
| Separation Technologies, Inc. | EIA-1605EZ | STI Fly ash process at Carolina Power and Light Roxboro Sta. | U.S. | Other |
| | | STI Fly ash process at NEP Salem Harbor | U.S. | Other |
| | | STI Fly ash process at NEP Brayton Point | U.S. | Other |
| Shenandoah Valley Electric Cooperative | EIA-1605 | Demand-Side Management Load Control Programs | U.S. | Energy End Use |
| | | System Line Conversions and Reconductoring | U.S. | Electric Power G & T |
| | | Visual Screening-Tree Planting | U.S. | Carbon Sequestration |
| Shrewsbury Electric Light Plant | EIA-1605EZ | High Efficiency Transformer | U.S. | Electric Power G & T |
| | | Lighting Replacement | U.S. | Energy End Use |
| South Carolina Electric & Gas Company | EIA-1605 | Demand Side Management Technologies | U.S. | Energy End Use |
| | | Forest Management Plan | U.S. | Carbon Sequestration |
| | | Misc. Plant efficiency improvements | U.S. | Electric Power G & T |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Summer Nuclear Upgrade | U.S. | Electric Power G & T |
| | | Wateree Station heat rate improvement | U.S. | Electric Power G & T |
| | | Williams Station improvements | U.S. | Electric Power G & T |
| Southern California Edison Co. | EIA-1605 | Demand Side Management | U.S. | Energy End Use |
| | | Electric Vehicle Program | U.S. | Transportation |
| | | ENVEST SCE | U.S. | Energy End Use |
| | | Fly Ash Sales for Concrete Production | U.S. | Other |
| | | Internal Combustion Engine Replacement Program | U.S. | Energy End Use |
| | | Mohave Power Project Heat Rate Improvement Program | U.S. | Electric Power G & T |
| | | Renewable Energy Purchases — Biomass | U.S. | Electric Power G & T |
| | | Renewable Energy Purchases — Geothermal | U.S. | Electric Power G & T |
| | | Renewable Energy Purchases — Wind | U.S. | Electric Power G & T |
| Southern Company | EIA-1605 | Biomass | U.S. | Electric Power G & T |
| | | Bulk Power Transmission Improvements | U.S. | Electric Power G & T |
| | | Carbon Sequestration on Company Lands | U.S. | Carbon Sequestration |
| | | Carbon Sequestration on Noncompany Lands | U.S. | Carbon Sequestration |
| | | Chevron Cogenerating Plant — Unit 5 | U.S. | Cogeneration |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Demand-Side Management | U.S. | Energy End Use |
| | | Farley Nuclear Plant Availability Improvements | U.S. | Electric Power G & T |
| | | Hatch Nuclear Plant Availability Improvements | U.S. | Electric Power G & T |
| | | Hatch Nuclear Plant Capacity Uprate | U.S. | Electric Power G & T |
| | | Heat Rate Improvement on Coal-Fired Capacity | U.S. | Electric Power G & T |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | New Combustion Turbines | U.S. | Electric Power G & T |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Transportation Research | U.S. | Transportation |
| | | Vogtle Electric Generating Plant (Nuclear) Capacity Uprate | U.S. | Electric Power G & T |
| | | Vogtle Electric Generating Plant Availability Improvements | U.S. | Electric Power G & T |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Southside Electric Cooperative | EIA-1605 | System Line Conversion and Reconductoring | U.S. | Electric Power G & T |
| Steuben Rural Electric Co-op | EIA-1605EZ | Conductor Replacement | U.S. | Electric Power G & T |
| | | Farm Energy Efficiency | U.S. | Energy End Use |
| | | Water Heater Control Program | U.S. | Energy End Use |
| Tacoma Public Utilities | EIA-1605EZ | Forest Preservation | U.S. | Carbon Sequestration |
| | | Fuel Switching | U.S. | Electric Power G & T |
| | | General Energy Use | U.S. | Energy End Use |
| | | Generator Improvement (Cushman/Nisqually) | U.S. | Electric Power G & T |
| | | Generator Improvement (Wynochee) | U.S. | Electric Power G & T |
| | | Material Recycled | U.S. | Other |
| | | Reforestation (Cowlitz) | U.S. | Carbon Sequestration |
| Tampa Electric Company | EIA-1605 | Fly Ash Reuse | U.S. | Other |
| | | Malaysia Carbon Sequestration Project | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Taunton Municipal Lighting Plant | EIA-1605EZ | Electric Vehicle | U.S. | Transportation |
| | | Home Energy Audit | U.S. | Energy End Use |
| | | Lightwaves and Smartlights | U.S. | Energy End Use |
| | | T&D Reconductoring | U.S. | Electric Power G & T |
| Tennessee Valley Authority | EIA-1605 | Afforestation On TVA Lands | U.S. | Carbon Sequestration |
| | | Alternate Fuel Vehicles | U.S. | Transportation |
| | | CFC Management | U.S. | Halogenates |
| | | Comfort Plus Homes | U.S. | Energy End Use |
| | | Flyash Sales To Concrete Industry | U.S. | Other |
| | | Heat Rate Improvements At TVA Coal Fired Generating Units | U.S. | Electric Power G & T |
| | | Hydro Unit Modernization | U.S. | Electric Power G & T |
| | | Landfill Methane Recovery and Power Generation | U.S. | Waste Methane |
| | | Outdoor Lighting Replacements By Memphis Light, Gas And Water | U.S. | Energy End Use |
| | | Paper Recycling | U.S. | Other |
| | | Reduced Impact Logging Of Natural Forest In Malaysia | Foreign | Carbon Sequestration |
| | | Residential Marketing Program | U.S. | Energy End Use |
| | | Return Browns Ferry Nuclear Units 2 and 3 to Service | U.S. | Electric Power G & T |
| | | Rio Bravo Carbon Sequestration Project | Foreign | Carbon Sequestration |
| | | Start Watts Bar Nuclear Unit 1 | U.S. | Electric Power G & T |
| | | Transmission System Efficiency Improvements | U.S. | Electric Power G & T |
| | | Transportation Fleet Fuel Efficiency Improvement | U.S. | Transportation |
| | | Wood Waste Cofiring At Coal Fired Generating Plants | U.S. | Electric Power G & T |
| Texas Utilities Electric Company | EIA-1605 | Alternative Fuel Vehicle Program | U.S. | Transportation |
| | | Coal Ash Byproduct Use | U.S. | Other |
| | | Demand-Side Management Program | U.S. | Energy End Use |
| | | Employee Bus Pass Program | U.S. | Transportation |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Employee Carpool Program | U.S. | Transportation |
| | | Increased Reforestation in Land Reclamation Program | U.S. | Carbon Sequestration |
| | | Landfill Methane | U.S. | Waste Methane |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Operation of Nuclear Generation Units | U.S. | Electric Power G & T |
| | | Paper and Aluminum Recycling | U.S. | Other |
| | | Power Plant Heat Rate Improvement Projects | U.S. | Electric Power G & T |
| | | Ranger Exhaust Gas Project | U.S. | Other |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Renewable Energy Development Projects | U.S. | Electric Power G & T |
| | | SF6 Reductions | U.S. | Halogenates |
| | | Texas Reforestation Foundation | U.S. | Carbon Sequestration |
| | | UtiliTree Carbon Company Rio Bravo Pilot Project | Foreign | Carbon Sequestration |
| | | Vehicle Use Reductions | U.S. | Transportation |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Tucson Electric Power Company | EIA-1605 | Commercial DSM Programs | U.S. | Energy End Use |
| | | R-11 Recycling | U.S. | Halogenates |
| | | R-12 Emission Avoidance | U.S. | Halogenates |
| | | R-22 Recycling | U.S. | Halogenates |
| | | Residential DSM Programs | U.S. | Energy End Use |
| | | SF6 Recycling | U.S. | Halogenates |
| | | Travel Reduction Program | U.S. | Transportation |
| | | Trees for Tucson | U.S. | Carbon Sequestration |
| | | UtiliTree Carbon Company — Mississippi RVB Project | U.S. | Carbon Sequestration |
| | | UtiliTree Program — Malaysia | Foreign | Carbon Sequestration |
| | | UtiliTree Program — Rio Bravo Project | Foreign | Carbon Sequestration |
| | | UtiliTree Program — Western Oregon Project | U.S. | Carbon Sequestration |
| UNICOM (Commonwealth Edison Company) | EIA-1605 | Aluminum Railroad Cars | U.S. | Transportation |
| | | Coal Combustion By-product utilization | U.S. | Other |
| | | Collins Station 12345-Fuel Switch | U.S. | Electric Power G & T |
| | | Energy Cooperative & Demand Side Management Activities | U.S. | Energy End Use |
| | | Fuel Switching at Bynov Plant in Decin, Czech Republic | Foreign | Cogeneration |
| | | High Efficiency Transformers | U.S. | Electric Power G & T |
| | | Illinois Prairie Grass Plantings | U.S. | Carbon Sequestration |
| | | Investment Recovery/Life Cycle Management/Recycling | U.S. | Other |
| | | Methane Gas Landfill Recovery | U.S. | Waste Methane |
| | | Unicom Thermal Cooling Plant | U.S. | Halogenates |
| | | UNICOM Thermal Cooling Plant | U.S. | Energy End Use |
| | | Utility Pole Reuse | U.S. | Carbon Sequestration |
| | | Windmill | U.S. | Electric Power G & T |
| Union Electric Company | EIA-1605 | Conversion to a dry flyash handling system. | U.S. | Electric Power G & T |
| | | Demand Side Management Projects | U.S. | Energy End Use |
| | | EnviroTech Fund | U.S. | Energy End Use |
| | | Flyash substitution for cement. | U.S. | Other |
| | | Green Leaf Project | U.S. | Carbon Sequestration |
| | | Increased Nuclear generation | U.S. | Electric Power G & T |
| | | Install adjustable speed fan drives replacing fixed speed | U.S. | Electric Power G & T |
| | | Meramec Power Plant Control Upgrade | U.S. | Electric Power G & T |
| | | Meramec Power Plant Lighting Upgrade | U.S. | Energy End Use |
| | | Milam Landfill Methane Recovery | U.S. | Waste Methane |
| | | Purchase of Light Weight Rail Cars | U.S. | Transportation |
| | | Replaced motor-generator exciters with static exciter system | U.S. | Electric Power G & T |
| | | Sioux Plant Control Upgrade | U.S. | Electric Power G & T |
| | | Street Light Conversion | U.S. | Energy End Use |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Subtransmission Reconductoring | U.S. | Electric Power G & T |
| | | Transformer Replacement | U.S. | Electric Power G & T |
| | | Union Electric Car Pool | U.S. | Transportation |
| | | Waste Oil Heat Recovery | U.S. | Electric Power G & T |
| United Power Association | EIA-1605 | Coal Ash Programs | U.S. | Other |
| | | Conservation. | U.S. | Energy End Use |
| | | Cooling Tower Improvements | U.S. | Electric Power G & T |
| | | Ground-Source Heat Pumps | U.S. | Energy End Use |
| | | L-0 Bucket Improvements | U.S. | Electric Power G & T |
| | | Load Management | U.S. | Energy End Use |
| | | Refuse Derived Fuel (RDF) Project | U.S. | Waste Methane |
| | | Retractable Packing HP-IP | U.S. | Electric Power G & T |
| | | Ultra-sonic and Helium Leak Detection Improvements | U.S. | Electric Power G & T |
| Utah Municipal Power Agency | EIA-1605EZ | Geothermal Power | U.S. | Electric Power G & T |
| | | In-House Conservation | U.S. | Energy End Use |
| | | Light Replacement | U.S. | Energy End Use |
| | | Low Loss Transformers | U.S. | Electric Power G & T |
| | | Residential Audits | U.S. | Energy End Use |
| | | Tree Planting Program | U.S. | Carbon Sequestration |
| VANALCO, INC. — (Primary Aluminum Reduction Plant) | EIA-1605 | PFC Emission Reductions via Reductions in Anode Effects | U.S. | Halogenates |
| Vermont Public Power Supply Authority | EIA-1605 | Act 250 New Construction Program | U.S. | Energy End Use |
| | | Equipment Replacement and Remodeling Program | U.S. | Energy End Use |
| | | Farm Efficiency Program | U.S. | Energy End Use |
| | | Large Commercial and Industrial Audit Program | U.S. | Energy End Use |
| | | Residential Appliance Disposal Program | U.S. | Energy End Use |
| | | Residential Low Income Weatherization Piggyback Program | U.S. | Energy End Use |
| | | Residential Mail Order Lighting Program | U.S. | Energy End Use |
| | | Residential Water Heating and Lighting Efficiency Program | U.S. | Energy End Use |
| | | Small Commercial Retrofit Program | U.S. | Energy End Use |
| | | Street and Area Lighting Efficiency Program | U.S. | Energy End Use |
| | | Swanton Village Hydro Expansion | U.S. | Electric Power G & T |
| | | Transmission and Distribution System Efficiency Improvements | U.S. | Electric Power G & T |
| Volvo Cars of North America, Inc. | EIA-1605EZ | CNG Bi-fuel Test Fleet | U.S. | Transportation |
| Waverly Light & Power Company | EIA-1605 | Distribution System Upgrade (Project 3) | U.S. | Electric Power G & T |
| | | Electric Vehicle (Project 4.1) | U.S. | Transportation |
| | | Energy End-Use Programs (Project 3.1) | U.S. | Energy End Use |
| | | Energy Savings Due to Trees Forever (Project 3.3) | U.S. | Energy End Use |
| | | High-Pressure Sodium Lights (Project 3.2) | U.S. | Energy End Use |
| | | Hydro (Project 2) | U.S. | Electric Power G & T |
| | | Low-Loss Transformers (Project 4) | U.S. | Electric Power G & T |
| | | Trees Forever (Project 8.1) | U.S. | Carbon Sequestration |
| | | Wind Turbine (Project 1) | U.S. | Electric Power G & T |
| Western Resources, Inc. | EIA-1605 | Coal Fly Ash Recycling | U.S. | Other |
| | | Conversion of Company Fleet Vehicles to Alternative Fuels | U.S. | Transportation |
| | | Distribution Capacitor Additions | U.S. | Electric Power G & T |
| | | Electrotechnologies Marketing | U.S. | Energy End Use |
| | | GEV1 Feedwater Heater Upgrade | U.S. | Electric Power G & T |
| | | GEV2 Feedwater Controls Upgrade | U.S. | Electric Power G & T |
| | | GEV2 Feedwater Heater Upgrade | U.S. | Electric Power G & T |
| | | HEC4 Cooling Tower Upgrade | U.S. | Electric Power G & T |
| | | JEC1 Boiler Controls Upgrade | U.S. | Electric Power G & T |
| | | JEC1 On-Line Performance Monitoring | U.S. | Electric Power G & T |
| | | JEC1 Precipitator Intermittent Energization | U.S. | Electric Power G & T |
| | | JEC1 Seal Steam Recovery | U.S. | Electric Power G & T |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | JEC1 Superheater Replacement | U.S. | Electric Power G & T |
| | | JEC1 Turbine Upgrade | U.S. | Electric Power G & T |
| | | JEC2 Boiler Controls Upgrade | U.S. | Electric Power G & T |
| | | JEC2 On-Line Performance Monitoring | U.S. | Electric Power G & T |
| | | JEC2 Precipitator Intermittent Energization | U.S. | Electric Power G & T |
| | | JEC2 Seal Steam Recovery | U.S. | Electric Power G & T |
| | | JEC2 Superheater Replacement | U.S. | Electric Power G & T |
| | | JEC2 Turbine Upgrade | U.S. | Electric Power G & T |
| | | JEC3 Boiler Controls Upgrade | U.S. | Electric Power G & T |
| | | JEC3 On-Line Performance Monitoring | U.S. | Electric Power G & T |
| | | JEC3 Precipitator Intermittent Energization | U.S. | Electric Power G & T |
| | | JEC3 Seal Steam Recovery | U.S. | Electric Power G & T |
| | | JEC3 Superheater Replacement | U.S. | Electric Power G & T |
| | | JEC3 Turbine Upgrade | U.S. | Electric Power G & T |
| | | LAC2 Turbine Upgrade | U.S. | Electric Power G & T |
| | | LEC4 Controls Upgrade | U.S. | Electric Power G & T |
| | | LEC5 Circ Water Crosstie | U.S. | Electric Power G & T |
| | | LEC5 Controls Upgrade | U.S. | Electric Power G & T |
| | | LEC5 Replace Flyash Evaporator | U.S. | Electric Power G & T |
| | | LEC5 Upgrades | U.S. | Electric Power G & T |
| | | Natural Gas Distribution System Replacement Program | U.S. | Oil & Gas Methane |
| | | Natural Gas Transmission System Blowdown Reductions | U.S. | Oil & Gas Methane |
| | | Photovoltaic Installations | U.S. | Electric Power G & T |
| | | Purchase of Aluminum Rail Cars | U.S. | Transportation |
| | | Residential Conservation Use Rate DSM Program | U.S. | Energy End Use |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | TEC7 On-Line Performance Monitoring | U.S. | Electric Power G & T |
| | | TEC7 Precipitator Intermittent Energization | U.S. | Electric Power G & T |
| | | TEC8 Condenser Upgrade | U.S. | Electric Power G & T |
| | | TEC8 Precipitator Intermittent Energization | U.S. | Electric Power G & T |
| | | Transformer Replacements | U.S. | Electric Power G & T |
| | | Wolf Creek Increased Capacity Rating | U.S. | Electric Power G & T |
| | | Wolf Creek Turbine Modifications | U.S. | Electric Power G & T |
| Wisconsin Electric Power Co. | EIA-1605 | CFC-12 Recovery from Appliance Turn-In Program | U.S. | Halogenates |
| | | Beneficial use of landfill methane | U.S. | Waste Methane |
| | | Demand-side management energy efficiency programs | U.S. | Energy End Use |
| | | Energy for Tomorrow(TM) Renewable Energy Program | U.S. | Electric Power G & T |
| | | Fly ash substitution program | U.S. | Other |
| | | Fossil plant heat rate improvements | U.S. | Electric Power G & T |
| | | Fuel switching at Bynov Plant in Decin, Czech Republic | Foreign | Cogeneration |
| | | Hydro plant improvements and additions | U.S. | Electric Power G & T |
| | | Mississippi River Valley Bottomland Hardwood Restoration | U.S. | Carbon Sequestration |
| | | Reduced Impact Logging of Natural Forest in Malaysia | Foreign | Carbon Sequestration |
| | | Rio Bravo Carbon Sequestration Pilot Project | Foreign | Carbon Sequestration |
| | | Transmission & distribution system loss reductions | U.S. | Electric Power G & T |
| | | Vehicle conversion to dual fuel capability | U.S. | Transportation |
| | | Western Oregon Carbon Sequestration Project | U.S. | Carbon Sequestration |
| Wisconsin Power & Light | EIA-1605 | Afforestation | U.S. | Carbon Sequestration |
| | | Columbia 1 turbine blade Efficiency improvements | U.S. | Electric Power G & T |
| | | Columbia 1&2 Excess Air Efficiency improvements | U.S. | Electric Power G & T |
| | | Columbia 2 economizer Efficiency improvements | U.S. | Electric Power G & T |
| | | Columbia 2 turbine blade Heat rate improvement | U.S. | Electric Power G & T |
| | | Conservation tillage | U.S. | Carbon Sequestration |
| | | Edge 5 Excess Air Efficiency improvements | U.S. | Electric Power G & T |

## Table C4. Emission Reduction Projects Reported, Data Year 1997

| Reporter | Form Type | Project | Location | Project Type |
|---|---|---|---|---|
| | | Energy end use projects-Electric | U.S. | Energy End Use |
| | | Energy end use-Gas | U.S. | Energy End Use |
| | | Forest preservation | U.S. | Carbon Sequestration |
| | | Fuel Switching | U.S. | Electric Power G & T |
| | | Habitat Restoration | U.S. | Carbon Sequestration |
| | | Mallard Ridge Landfill Methane | U.S. | Waste Methane |
| | | Tire Derived Fuel Generation | U.S. | Electric Power G & T |
| | | Transmission line improvements | U.S. | Electric Power G & T |
| | | Verona Landfill Methane | U.S. | Waste Methane |
| | | WP&L Green Lights Projects | U.S. | Energy End Use |
| Wisconsin Public Power Inc. | EIA-1605EZ | Boswell Heat Rate Reduction | U.S. | Electric Power G & T |
| | | Commercial Industrial Farm Program | U.S. | Other |
| | | Dispatch Change | U.S. | Electric Power G & T |
| | | Energy Education | U.S. | Other |
| | | Kaukauna CT I&C Upgrade | U.S. | Electric Power G & T |
| | | Residential Appliances | U.S. | Energy End Use |
| | | Street Lighting | U.S. | Energy End Use |
| Wisconsin Public Power Inc. | EIA-1605EZ | Tree Power 1991 Plantings (7 Year Olds) | U.S. | Carbon Sequestration |
| | | Tree Power 1992 Planting (6 Year olds) | U.S. | Carbon Sequestration |
| | | Tree Power 1993 Planting (5 Year Olds) | U.S. | Carbon Sequestration |
| | | Tree Power 1994 Planting (4 Year olds) | U.S. | Carbon Sequestration |
| | | Tree Power 1995 Planting (3 Year Olds) | U.S. | Carbon Sequestration |
| | | Tree Power 1996 Planting (2 Year olds) | U.S. | Carbon Sequestration |
| | | Tree Power 1997 Planting (1 Year olds) | U.S. | Carbon Sequestration |
| Wisconsin Public Service Corporation | EIA-1605 | Afforestation and Reforestation Efforts | U.S. | Carbon Sequestration |
| | | Demand Side Management Programs | U.S. | Energy End Use |
| | | Transmission Line Construction | U.S. | Electric Power G & T |
| Zahren Alternative Power Corporation | EIA-1605EZ | Landfill Gas Recovery for Energy — Flaring SPSA | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy — Flaring, Barre, MA | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy — Flaring, Dolton, IL | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy — Flaring, Willow Ranch, IL | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy Smithtown | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Amity Facility | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Barre, MA | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Bondi's Springfield | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Cape May | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Dunbarton — Manchester | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Hamm's | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Intervale — Burlington | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Oceanside | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Onondaga | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, Oyster Bay | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy, SPSA, VA | U.S. | Waste Methane |
| | | Landfill Gas Recovery for Energy — Flaring, Smithtown, NY | U.S. | Waste Methane |
| | | LFG Recovery for Energy — Flaring, 122nd, Chicago, IL | U.S. | Waste Methane |
| | | LFG Recovery for Energy — Flaring, Intervale — Burlington, VT | U.S. | Waste Methane |
| Zeeland Board of Public Works | EIA-1605EZ | Distribution Line Improvements | U.S. | Electric Power G & T |
| | | General Carbon Sequestration | U.S. | Carbon Sequestration |
| | | General Transmission & Distribution | U.S. | Electric Power G & T |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## Table C5. Reporting Entities by Type of Form and Organization, Data Years 1994-1997

(Number of Forms Received)

| Type of Reporting Entity | Reports Received | | | | Percent of Total | | | |
|---|---|---|---|---|---|---|---|---|
| | 1994 | 1995 | 1996 | 1997 | 1994 | 1995 | 1996 | 1997 |
| **Form EIA-1605** | | | | | | | | |
| Individual or Family | 1 | 1 | 1 | 1 | 1.4 | 1.0 | 0.9 | 0.9 |
| Partnership | 0 | 1 | 1 | 2 | 0.0 | 1.0 | 0.9 | 1.1 |
| Corporation | 56 | 67 | 74 | 78 | 76.7 | 66.3 | 67.9 | 66.7 |
| Publicly Held | 41 | 48 | 44 | 47 | 56.2 | 47.5 | 40.4 | 40.2 |
| Privately Held | 4 | 9 | 11 | 11 | 5.5 | 8.9 | 10.1 | 9.4 |
| Nonprofit | 5 | 4 | 5 | 6 | 6.8 | 4.0 | 4.6 | 5.1 |
| Subsidiary | 6 | 6 | 14 | 14 | 8.2 | 5.9 | 12.8 | 12.0 |
| Government | 12 | 13 | 11 | 12 | 16.4 | 12.9 | 10.1 | 10.3 |
| Federal | 1 | 1 | 1 | 1 | 1.4 | 1.0 | 0.9 | 0.9 |
| State | 3 | 3 | 2 | 3 | 4.1 | 3.0 | 1.8 | 2.6 |
| Regional | 1 | 1 | 0 | 1 | 1.4 | 1.0 | 0.0 | 0.9 |
| Local | 7 | 8 | 8 | 7 | 9.6 | 7.9 | 7.3 | 6.0 |
| Joint Venture | — | — | — | 1 | — | — | — | 0.9 |
| Trade Association | 0 | 1 | 1 | 1 | 0.0 | 1.0 | 0.9 | 0.9 |
| Other | 4 | 18 | 21 | 22 | 5.5 | 17.8 | 19.3 | 18.8 |
| **Total** | **73** | **101** | **109** | **117** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Form EIA-1605EZ** | | | | | | | | |
| Individual or Family | 1 | 0 | 0 | 0 | 2.9 | 0.0 | 0.0 | 0.0 |
| Company | 7 | 14 | 17 | 14 | 20.0 | 34.1 | 42.5 | 35.9 |
| Government | 20 | 18 | 16 | 19 | 57.1 | 43.9 | 40.0 | 48.7 |
| Nonprofit Organization | 4 | 6 | 5 | 4 | 11.4 | 14.6 | 12.5 | 10.3 |
| Other | 3 | 3 | 2 | 2 | 8.6 | 7.3 | 5.0 | 5.1 |
| **Total** | **35** | **41** | **40** | **39** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## Table C6. Summary of Reports Received by Schedule, Data Years 1994-1997

| Type of Information | Form EIA-1605 | | | | Form EIA-1605EZ | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1994 | 1995 | 1996 | 1997 | 1994 | 1995 | 1996 | 1997 | 1994 | 1995 | 1996 | 1997 |
| Emission Reduction Projects (Schedule II) | 64 | 88 | 99 | 106 | 35 | 41 | 40 | 39 | 99 | 129 | 139 | 145 |
| Entity-Wide Emissions or Reductions (Schedule III) | 40 | 51 | 57 | 56 | — | — | — | — | 40 | 51 | 57 | 56 |
| Commitments to Reduce Future Emissions (Schedule IV) | 42 | 59 | 60 | 65 | — | — | — | — | 42 | 59 | 68 | 65 |
| **Total Reports Received** | **73** | **101** | **109** | **117** | **35** | **41** | **40** | **39** | **108** | **142** | **149** | **156** |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## Table C7. Distribution of Projects Reported by Project Type Category, Data Years 1994-1997

| Project Type | Number of Reporters | | | | Number of Projects | | | |
|---|---|---|---|---|---|---|---|---|
| | 1994 | 1995 | 1996 | 1997 | 1994 | 1995 | 1996 | 1997 |
| Electricity Generation, Transmission, and Distribution | 71 | 86 | 87 | 90 | 223 | 292 | 326 | 360 |
| Cogeneration | 5 | 8 | 10 | 14 | 7 | 11 | 13 | 20 |
| Energy End Use | 77 | 91 | 84 | 87 | 208 | 276 | 265 | 273 |
| Transportation | 26 | 34 | 36 | 37 | 33 | 50 | 57 | 62 |
| Waste Treatment and Disposal (Methane) | 12 | 20 | 29 | 30 | 27 | 39 | 65 | 79 |
| Agriculture (Methane and Nitrous Oxide) | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| Oil and Natural Gas Systems and Coal Mining (Methane) | 8 | 10 | 14 | 14 | 13 | 16 | 22 | 18 |
| Carbon Sequestration | 40 | 62 | 67 | 74 | 78 | 199 | 198 | 302 |
| Halogenated Substances | 13 | 18 | 18 | 21 | 15 | 22 | 23 | 30 |
| Other Emission Reductions | 33 | 45 | 47 | 53 | 38 | 59 | 66 | 82 |
| All Categories | 99 | 129 | 139 | 145 | 645 | 967 | 1,038 | 1,229 |
| Did Not Report Projects | 9 | 13 | 10 | 11 | — | — | — | — |
| **Total, All Reporters** | **108** | **142** | **149** | **156** | **645** | **967** | **1,038** | **1,229** |

Note: The total numbers of reporters are smaller than the sums of the numbers of reporters for each project type, because most reporters provided information on more than one project.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

## Table C8. Distribution of Projects Reported by Project Type Category and Reporting Form, Data Year 1997

| Project Type | Form EIA-1605 | | Form EIA-1605EZ | | Total | |
|---|---|---|---|---|---|---|
| | Number of Reporters | Number of Projects | Number of Reporters | Number of Projects | Number of Reporters | Number of Projects |
| Electricity Generation, Transmission, and Distribution | 70 | 317 | 20 | 43 | 90 | 360 |
| Cogeneration | 12 | 18 | 2 | 2 | 14 | 20 |
| Energy End Use | 63 | 215 | 24 | 58 | 87 | 273 |
| Transportation | 32 | 53 | 5 | 9 | 37 | 62 |
| Waste Treatment and Disposal (Methane) | 24 | 51 | 6 | 28 | 30 | 79 |
| Agriculture (Methane and Nitrous Oxide) | 2 | 3 | 0 | 0 | 2 | 3 |
| Oil and Natural Gas Systems and Coal Mining (Methane) | 12 | 14 | 2 | 4 | 14 | 18 |
| Carbon Sequestration | 55 | 272 | 19 | 30 | 74 | 302 |
| Halogenated Substances | 20 | 29 | 1 | 1 | 21 | 30 |
| Other Emission Reductions | 41 | 61 | 12 | 21 | 53 | 82 |
| **Total (All Project Types)** | **106** | **1,033** | **39** | **196** | **145** | **1,229** |

Note: The total numbers of reporters is smaller than the sums of the numbers of reporters for each project type, because most reporters provided information on more than one project.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

**Table C9. Affiliation of Reported Reduction and Carbon Sequestration Projects with Voluntary Programs by Project Type Category, Data Year 1997**

| Voluntary Program | Number of Reporters | Project Type | | | | | Total Number of Projects |
|---|---|---|---|---|---|---|---|
| | | Electricity | End Use | Carbon Seques-tration | Methane | Halogens and Other Project Types | |
| Climate Challenge | 100 | 337 | 235 | 187 | 33 | 78 | **870** |
| Climate Wise Recognition | 8 | 2 | 29 | 1 | 1 | 8 | **41** |
| Coalbed Methane Outreach | 2 | — | — | — | 2 | — | **2** |
| Cool Communities | 1 | — | — | — | — | — | **1** |
| Energy Star Building | 3 | — | 18 | — | — | — | **18** |
| Energy Star Computers | 1 | — | 1 | — | — | — | **1** |
| Energy Star Transformers | 6 | 6 | — | — | — | — | **6** |
| Green Lights | 18 | — | 24 | — | — | — | **24** |
| Landfill Methane Outreach | 12 | — | — | — | 30 | — | **30** |
| Motor Challenge | 4 | — | 10 | — | — | — | **10** |
| Natural Gas STAR | 4 | — | — | — | 6 | — | **6** |
| Other Energy Star Programs | 2 | 1 | — | — | 1 | — | **2** |
| United States Initiative on Joint Implementation | 28 | 3 | — | 29 | — | — | **32** |
| Voluntary Aluminum Industrial Partnership | 2 | — | — | — | — | 2 | **2** |
| Waste Wi$e | 2 | — | — | — | — | 2 | **2** |
| Other or Not Applicable | 5 | 3 | 4 | 3 | 2 | 2 | **14** |

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

# Glossary

**Afforestation:** Planting of new forests on lands that have not been recently forested.

**Anaerobic lagoon:** A liquid-based manure management system, characterized by waste residing in water to a depth of at least 6 feet for a period ranging between 30 and 200 days.

**Associated gas:** Natural gas found mixed with crude oil in underground reservoirs, released as a byproduct of oil production.

**Baseline period:** The years 1987 through 1990 for which entity-level emissions may be reported.

**Biofuels:** Organic materials, such as wood, waste, and alcohol, burned to produce energy.

**Biogas:** A mixture of carbon dioxide and methane produced through bacterial action.

**Biomass:** Materials that are biological in origin, including organic material (both living and dead) from above and below ground, e.g., trees, crops, grasses, tree litter, roots, and animals and animal waste.

**British thermal unit (Btu):** A common unit used in measuring energy, equal to the amount of heat needed to raise the temperature of 1 pound of water by 1°F.

**Carbon sink:** A reservoir that absorbs or takes up released carbon. Vegetation and soils are common carbon sinks.

**Chlorofluorocarbons (CFCs):** A family of inert, nontoxic, and easily liquefied chemicals used in refrigeration, air conditioning, packaging, and insulation, or as solvents or aerosol propellants. Because they are nonreactive, they drift into the upper atmosphere, where they are disassociated by solar radiation and where their components destroy ozone.

**Cogeneration:** The sequential use of energy to generate electricity and another form of useful thermal energy, such as heat or steam.

**Commercial scale:** Application of a demonstrated technology at a cost-effective scale.

**Commitment:** An expressed intention to undertake an action or actions that will reduce greenhouse gas emissions, increase carbon sequestration, or achieve a stated emissions goal.

**Conversion factor:** A unique value used to convert one unit (e.g., acres) to another appropriate unit (e.g., hectares).

**Deforestation:** The removal of forest stands.

**Emission coefficient/factor:** A unique value for scaling emissions to activity data in terms of a standard rate of emissions per unit of activity (e.g., pounds of carbon dioxide emissions per unit of fossil fuel consumed).

**Emissions:** Anthropogenic (human-caused) releases of greenhouse gases to the atmosphere (e.g., the release of carbon dioxide during fuel combustion).

**Emissions, direct:** Emissions from sources owned (wholly or in part) or leased by an entity.

**Emissions, fugitive:** Emissions that are released inadvertently or accidentally from a controlled or closed system, such as natural gas pipelines.

**Emissions, indirect:** Emissions from sources not owned or leased by an entity that occur, wholly or in part, as a result of its activities.

**Emission reduction:** A decrease in annual greenhouse gas emissions.

**Energy conservation:** Activities that reduce end-use demand for energy by reducing the service demanded.

**Entity:** For the purposes of the Voluntary Reporting Program, an individual or organization that is a legal U.S. person (e.g., a U.S. citizen, resident alien, company, organization, or group incorporated under or recognized by U.S. law; or a Federal, State, or local government agency).

**Entity boundary:** Conceptually, a line drawn to encompass the emissions sources and sinks to be evaluated in an entity-level report. An entity boundary should include all the emissions sources and sinks owned (wholly or in part) or leased by the entity and, to the extent possible, other emissions sources and sinks affected by the entity's activities.

**Entity-level reporting:** The reporting of greenhouse gas emissions, emission reductions, and carbon sequestration for an entire entity.

**Estimation method:** The techniques, including key assumptions and data sources, used by the reporter to derive the reported emissions, emission reductions, or sequestration.

**Foreign activities:** All actions outside the United States, its territories, and trusts.

**Fossil fuel:** A hydrocarbon fuel, such as petroleum, derived from living matter of a previous geologic time.

**Fuel cycle:** The entire set of sequential processes or stages involved in the use of fuel, including extraction, transformation, transportation, and combustion. Emissions generally occur at each stage of the fuel cycle.

**Fuel switching:** The substitution of one type of fuel for another. The fuel substitution may be either temporary (as in the case of a power plant that temporarily switches from coal to natural gas) or permanent (as in the case of a fleet operator who replaces gasoline-powered automobiles with electric cars).

**Fugitive emissions:** See Emissions, fugitive.

**Global warming potential (GWP):** A term that describes the concept of determining the impacts of various gases on global warming compared to that of carbon dioxide. For example, methane has a GWP 21 times that of the equivalent amount of carbon dioxide over a 100-year period.

**Gob:** A zone of rubble created when the roof of a coal mine collapses behind the mining operations.

**Greenhouse effect:** A term used to describe the roles of water vapor, carbon dioxide, and other trace gases in keeping the Earth's surface warmer than it would otherwise be. These radiatively active gases are relatively transparent to incoming shortwave radiation but are relatively opaque to outgoing long-wave radiation. The latter radiation, which would otherwise escape to space, is trapped by the gases within the lower levels of the atmosphere. The subsequent reradiation of some of the energy back to the Earth maintains surface temperatures higher than they would be if the gases were absent. There is concern that increasing concentrations of greenhouse gases, including carbon dioxide, methane, and certain man-made gases, may enhance the greenhouse effect and cause global climate change.

**Greenhouse gases:** Those gases, such as water vapor, carbon dioxide, tropospheric ozone, nitrous oxide, and methane, that are transparent to solar radiation but opaque to long-wave radiation, thus preventing long-wave radiation energy from leaving the atmosphere. The greenhouse gases covered by the Voluntary Reporting Program are (1) carbon dioxide ($CO_2$), (2) methane ($CH_4$), (3) nitrous oxide ($N_2O$), and (4) halogenated substances. Increasing levels of greenhouse gases in the atmosphere may contribute to an increase in average global temperatures, resulting in adverse climate changes.

**Halogenated substance:** A volatile compound containing halogens, such as chlorine, fluorine, or bromine.

**Horizon year:** The year in which a commitment to reduce greenhouse gas emissions or increase sequestration (reported on Schedule IV) is expected to be met.

**Intergovernmental Panel on Climate Change (IPCC):** A panel established jointly in 1988 by the World Meteorological Organization and the United Nations Environment Program to assess scientific information related to climate change and to formulate realistic response strategies.

**Life cycle:** The progression of a product through its service life. For most products, emissions and energy-consuming characteristics will be altered as they age.

**Longwall mining:** A technique of underground mining in which a cutting machine is pulled back and forth along a panel of coal 300 to 1,000 feet wide and as much as 2 miles long. As the panel is cut, the broken coal is removed by a conveyor, and movable roof supports advance, allowing the roof in mined-out areas to collapse.

**Manure management:** The method used to dispose of the solid waste produced by livestock and poultry.

**Municipal solid waste:** Residential solid waste and some nonhazardous commercial, institutional, and industrial wastes.

**Ozone:** A molecule made up of three atoms of oxygen. In the stratosphere, ozone occurs naturally and provides a protective layer shielding the Earth from harmful ultraviolet radiation. In the troposphere, it is a chemical oxidant and major component of photochemical smog.

**Photosynthesis:** The manufacture of carbohydrates by plants from carbon dioxide and water in the presence of chlorophyll, with sunlight as the energy source. In this process, carbon is sequestered and oxygen is released.

**Pilot project:** A small-scale trial designed to test or demonstrate the efficiency or efficacy of a project.

**Project:** An action undertaken to reduce greenhouse gas emissions or sequester carbon.

**Project boundary:** Conceptually, a line drawn to encompass the emissions sources and sinks affected by a project. A project boundary should include all the significant and quantifiable effects of the project.

**Project ID code:** A unique code assigned by the Energy Information Administration to a reported project for tracking purposes.

**Project-level reporting:** Reporting on emission reductions or carbon sequestration achieved as a result of a specific action or group of actions.

**Reconductoring:** Replacement of existing conductors with large-diameter conductors to reduce line losses. Conductors (including feeders and transmission lines) are a major source of transmission and distribution system losses. In general, the smaller the diameter of the conductor, the greater its resistance to the flow of electric current, and the greater the consequent line losses.

**Reference case:** The emissions level to which current actual emissions levels are compared when emission reductions are calculated.

**Reference case, basic:** A reference case using actual historical emissions or sequestration values.

**Reference case, modified:** A reference case using projected emissions or sequestration values, representing the emissions level that would have occurred in the absence of reduction or sequestration efforts.

**Reforestation:** Replanting of forests on lands that have recently been harvested.

**Reporter:** An entity (see definition above) completing either Form EIA-1605 or Form EIA-1605EZ and submitting it to the Energy Information Administration.

**Room and pillar mining:** The most common method of underground coal mining, in which the mine roof is supported by coal pillars left at regular intervals.

**Sequestered carbon:** Carbon that is removed from the atmosphere and retained in a carbon sink (such as a growing tree) or in soil.

**Sequestration:** The fixation of atmospheric carbon dioxide in a carbon sink through biological or physical processes, such as photosynthesis.

**Sink:** See carbon sink.

**Third-party reporter:** An authorized party that submits a report on behalf of two or more entities which have engaged in emissions-reducing or sequestration-increasing activities. Possible third-party reporters include trade associations reporting on behalf of members that have undertaken reduction projects.

**Vhar metering:** Phase shifters on watthour meters that measure reactive volt ampere hours or varhours.

**Watt (W):** A common metric unit used in measuring power (the rate at which work is done), defined as 1 Joule per second and equivalent to 3.412 Btu per hour.