

Preface

Title XVI, Section 1605(a) of the Energy Policy Act of 1992 (enacted October 24, 1992) provides:

Not later than one year after the date of the enactment of this Act, the Secretary, through the Energy Information Administration, shall develop, based on data available to, and obtained by, the Energy Information Administration, an inventory of the national aggregate emissions of each greenhouse gas for each calendar year of the baseline period of 1987 through 1990. The Administrator of the Energy Information Administration shall annually update and analyze such inventory using

available data. This subsection does not provide any new data collection authority.

The first report in this series, *Emissions of Greenhouse Gases 1985-1990*, was published in September 1993. This report—the twelfth annual report, as required by law—presents the Energy Information Administration's latest estimates of emissions for carbon dioxide, methane, nitrous oxide, and other greenhouse gases. These estimates are based on activity data and applied emissions factors and not on measured or metered emissions monitoring.

For this report, data on coal and natural gas consumption and electricity sales and losses by sector were obtained from the Energy Information Administration's (EIA's) November 2004 *Monthly Energy Review*. Additional detailed information on petroleum consumption was obtained from unpublished material in support of EIA's *Annual Energy Review 2003*. Data on electric power sector emissions were obtained from EIA's *Electric Power Annual*. In keeping with current international practice, this report presents data on greenhouse gas emissions in million metric tons carbon dioxide equivalent. The data can be converted to carbon equivalent units by multiplying times 12/44.

Contents

Executive Summary	ix
1. U.S. Emissions of Greenhouse Gases: Background and Context	1
About This Report	1
What's New	1
U.S. Emissions in a Global Perspective	2
The Greenhouse Effect and Global Climate Change	4
Current U.S. Climate Change Initiatives	14
International Developments in Global Climate Change	16
2. Carbon Dioxide Emissions	19
Overview	19
Energy Consumption	20
Adjustments to Energy Consumption	26
Other Carbon Dioxide Emissions	26
3. Methane Emissions	33
Overview	33
Energy Sources	34
Waste Management	37
Agricultural Sources	39
Industrial Sources	40
4. Nitrous Oxide Emissions	51
Overview	51
Energy Use	52
Agriculture	53
Waste Management	54
Industrial Sources	55
5. Other Gases: Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride	63
Overview	63
Hydrofluorocarbons (HFCs)	64
Perfluorocarbons (PFCs)	68
Sulfur Hexafluoride (SF_6)	69
6. Land Use Issues	71
Overview	71
Land Use Change and Forestry Carbon Sequestration	72
Changes in Forest Carbon Stocks	74
Changes in Urban Tree Carbon Stocks	76
Changes in Agricultural Soil Carbon Stocks	78
Changes in Landfilled Yard Trimming and Food Scrap Carbon Stocks	78
Land Use and International Climate Change Negotiations	79
Land Use Data Issues	79
References	85
Related Links	97
Glossary	99
Appendices	
A. Common Conversion Factors	
B. Emissions of Energy-Related Carbon Dioxide in the United States, 1949-2003	
C. Energy-Related Carbon Dioxide Emissions by State	

Special Topics

Units for Measuring Greenhouse Gases	xi
Yearly Changes in Atmospheric Carbon Dioxide Concentrations: The Mauna Loa Anomaly	8
Comparison of Global Warming Potentials from the IPCC's Second and Third Assessment Reports	12
The Methane to Markets Partnership	14
Trends in U.S. Carbon Intensity and Total Greenhouse Gas Intensity	15
Energy-Related Carbon Dioxide Emissions in Manufacturing	23
Methane Emissions from Abandoned Coal Mines	36
Methane Emissions from Industrial Wastewater Treatment	39
EPA Revises Emissions Estimation Methodology	65
The EPA Vintaging Model: Estimation Methods and Uncertainty	66
IPCC Good Practice Guidance for Land Use, Land Use Change, and Forestry (LULUCF)	72
Inventory of Woody Residuals in the United States	73
USDA Agriculture and Forestry Greenhouse Gas Inventory	74
Accounting for Harvested Wood Products in Future Greenhouse Gas Inventories	77
Global Forest Resources Assessment 2000	80
Carbon Dioxide Capture and Geologic Storage	82

Tables

ES1. Summary of Estimated U.S. Emissions of Greenhouse Gases, 1990 and 1995-2003	ix
ES2. U.S. Emissions of Greenhouse Gases, Based on Global Warming Potential, 1990 and 1995-2003	x
1. World Carbon Dioxide Emissions by Region, 1990-2025	3
2. Global Atmospheric Concentrations of Selected Greenhouse Gases	5
3. Global Natural and Anthropogenic Sources and Absorption of Greenhouse Gases in the 1990s	6
4. Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide	13
5. U.S. Carbon Dioxide Emissions from Energy and Industry, 1990 and 1995-2003	28
6. U.S. Carbon Dioxide Emissions from Energy Consumption by End-Use Sector, 1990 and 1995-2003	28
7. U.S. Carbon Dioxide Emissions from Residential Sector Energy Consumption, 1990 and 1995-2003	29
8. U.S. Carbon Dioxide Emissions from Commercial Sector Energy Consumption, 1990 and 1995-2003	29
9. U.S. Carbon Dioxide Emissions from Industrial Sector Energy Consumption, 1990 and 1995-2003	30
10. U.S. Carbon Dioxide Emissions from Transportation Sector Energy Consumption, 1990 and 1995-2003	30
11. U.S. Carbon Dioxide Emissions from Electric Power Sector Energy Consumption, 1990 and 1995-2003	31
12. U.S. Carbon Sequestered by Nonfuel Use of Energy Fuels, 1990 and 1995-2003	31
13. U.S. Carbon Dioxide Emissions from Industrial Processes, 1990 and 1995-2003	32
14. U.S. Methane Emissions from Anthropogenic Sources, 1990 and 1995-2003	42
15. U.S. Methane Emissions from Coal Mining and Post-Mining Activities, 1990 and 1995-2003	43
16. U.S. Methane Emissions from Natural Gas Systems, 1990 and 1995-2003	44
17. U.S. Methane Emissions from Petroleum Systems, 1990 and 1995-2003	44
18. U.S. Methane Emissions from Stationary Combustion Sources, 1990 and 1995-2003	45
19. U.S. Methane Emissions from Mobile Sources, 1990 and 1995-2003	47
20. U.S. Methane Emissions from Landfills, 1990 and 1995-2003	48
21. U.S. Methane Emissions from Enteric Fermentation in Domesticated Animals, 1990 and 1995-2003	48
22. U.S. Methane Emissions from the Solid Waste of Domesticated Animals, 1990 and 1995-2003	49
23. U.S. Methane Emissions from Industrial Processes, 1990 and 1995-2003	50
24. Estimated U.S. Emissions of Nitrous Oxide, 1990 and 1995-2003	57
25. U.S. Nitrous Oxide Emissions from Mobile Combustion, 1990 and 1995-2003	58
26. U.S. Nitrous Oxide Emissions from Stationary Combustion, 1990 and 1995-2003	59
27. U.S. Nitrous Oxide Emissions from Nitrogen Fertilization of Agricultural Soils, 1990 and 1995-2003	61
28. U.S. Nitrous Oxide Emissions from Solid Waste of Domesticated Animals, 1990 and 1995-2003	62
29. U.S. Nitrous Oxide Emissions from Industrial Sources, 1990 and 1995-2003	62
30. U.S. Emissions of Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride, 1990 and 1995-2003	70
31. U.S. Emissions of Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride, 1990 and 1995-2003	70
32. Net Carbon Dioxide Sequestration from U.S. Land Use Change and Forestry, 1990 and 1996-2002	71
33. Net Carbon Dioxide Sequestration in U.S. Forests, 1990 and 1996-2002	75
34. Net Carbon Dioxide Sequestration in U.S. Agricultural Soils, 1990 and 1996-2002	78
35. Net Carbon Dioxide Sequestration from Landfilled Yard Trimmings and Food Scraps, 1990 and 1996-2002	79

Figures

ES1. U.S. Greenhouse Gas Emissions by Gas, 2003	x
ES2. Carbon Dioxide Emissions Intensity of U.S. Gross Domestic Product, Population, and Electricity Production, 1990-2003.....	xi
ES3. U.S. Carbon Dioxide Emissions by Sector, 1990-2003.....	xii
ES4. U.S. Emissions of Methane by Source, 1990-2003	xiii
ES5. U.S. Emissions of Nitrous Oxide by Source, 1990-2003	xiv
1. Annual Change in U.S. Carbon Dioxide Emissions, 1990-2003	19
2. U.S. Emissions of Methane by Source, 1990-2003	34
3. U.S. Emissions of Nitrous Oxide by Source, 1990-2003	51
4. U.S. Emissions of Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride, 1990-2003.....	63

