

Climate Change

Activities in the **United States**

2004 UPDATE



This report summarizes climate change efforts in the United States, including activity:

- in **Congress**, where in October 2003, the U.S. Senate for the first time voted on legislation that would cap U.S. greenhouse gas (GHG) emissions and establish a national GHG trading system;
- at the **state** level, where governments are enacting mandatory carbon controls and other programs to reduce emissions; and
- in the **business** community, where a growing number of corporations are setting greenhouse gas targets and achieving significant emission reductions.

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I. Overview

Action by the United States—the world’s largest economy and largest emitter of greenhouse gases—is critical to the success of any long-term strategy to address global climate change. This publication provides an overview of climate-related efforts in the United States, including activity:

- In Congress, where in October 2003, the U.S. Senate for the first time voted on legislation that would cap U.S. greenhouse gas (GHG) emissions and establish a national GHG trading system;
- At the state level, where governments are enacting mandatory carbon controls and other programs that reduce GHG emissions;
- In the business community, where a growing number of corporations are setting GHG reduction targets and achieving significant emission reductions.

Several lessons emerge from this overview that are relevant to the development of comprehensive U.S. policy to address climate change:

- **Numerous opportunities exist to reduce GHG emissions cost-effectively while achieving multiple benefits.** Companies are finding that they can improve efficiency, save energy costs, and improve their competitiveness through new, climate-friendly products and processes. States are finding that they can simultaneously promote economic development, energy security, and environmental protection.
- **There is no single solution to climate change.** GHG emissions come from thousands of activities; they can be reduced through thousands of approaches.
- **To take advantage of these opportunities and to achieve the right mix of solutions, federal policies are needed with certain ends and flexible means.** U.S. policy must harness market forces to spur innovation and to motivate companies and jurisdictions to identify and implement solutions that can be tailored to specific circumstances.

While encouraging, the activities described in this publication represent only a start toward the sustained, comprehensive effort needed to significantly reduce U.S. GHG emissions. Overviews of the kinds of measures that could help launch such an effort are provided in other Pew Center publications, *The U.S. Domestic Response to Climate Change: Key Elements of a Prospective Program* (available at www.pewclimate.org/policy/index_dom.cfm) and *Designing a Mandatory Greenhouse Gas Reduction Program for the U.S.* (available at www.pewclimate.org/global-warming-in-depth/all_reports/mandatory_ghg_reduction_prgm/index.cfm).

The current U.S. Administration is supportive of research and development of new climate-friendly technologies, which is one important component of the needed domestic response. For example, through the FutureGen project, the U.S. Department of Energy (DOE) plans to work together with private companies to develop a full-scale commercial demonstration of an integrated coal gasification combined cycle power plant with carbon capture and geological sequestration. However, the Administration has proposed no policies that would create a market for such technologies. Examples of such policies include targeted tax incentives for purchasing low-emitting technologies, and a GHG “cap-and-trade” program that would establish an overall constraint on GHG emissions and allow companies to trade emissions credits to meet that constraint at the lowest possible cost. Instead, the Administration has rejected the Kyoto Protocol without proposing an alternative international framework, set a voluntary domestic GHG intensity target that would allow U.S. emissions to actually increase by 12 percent by 2012, and established no mechanism for ensuring that even that target will be met.

Other developments in Congress, at the state level, and in the business community suggest growing support for stronger efforts to reduce U.S. emissions. This report focuses on these other developments. New steps are being taken, and a genuine debate over U.S. climate policy has begun.

II. Congressional Activity in 2003

The U.S. Congress plays a key role in determining how the United States responds to the challenge of global climate change. Legislation enacted by Congress will be necessary to reduce U.S. GHG emissions substantially. Any international climate change treaty must be ratified by the U.S. Senate for the United States to be a party to it. The budgets of all federal agencies, which may include funding for programs to curb U.S. emissions, are established in the agencies' annual spending (or "appropriations") bills, enacted by Congress. Congress conducts hearings that focus attention on global climate change and shape the national debate over how best to address it. With climate change, as with other issues, congressional action can differ significantly from that proffered by the U.S. President. Once a law is enacted, the President is bound to implement and enforce it.

As the scientific evidence of climate change has mounted, so has congressional activity. The number of climate change-related legislative proposals introduced increased from seven in the 105th Congress (1997-1998) to 25 in the 106th Congress (1999-2000) and to over 80 in the 107th Congress (2001-2002). Nearly 70 such legislative proposals were introduced in 2003, the first year of the 108th Congress (2003-2004).¹

Climate change measures are increasingly being offered by members of both the Democratic and Republican parties. Bipartisan support is building for certain legislative proposals, including measures to require the reporting and disclosure of GHG emissions, to protect companies reducing GHG emissions from being penalized under a future GHG reduction program, and to promote carbon sequestration. Addressing the challenge of climate change will ultimately require a more comprehensive set of approaches, however, possibly including a mandatory program to reduce GHG emissions and to allow the trading of GHG emissions credits, and efficiency standards to promote the use of efficient products and technologies.² Enactment of such policies will likely be a longer-term proposition.

Energy Policy Act

During action on the Energy Policy Act of 2003, the 108th Congress voted on but did not enact legislation that would cap U.S. GHG emissions, require establishment of a U.S. climate change strategy, lead to reporting and disclosure of GHG emissions, promote renewable energy sources and energy efficiency, promote carbon sequestration, promote "clean coal" power plants, promote automotive fuel efficiency, and support U.S. participation in international climate change negotiations.

The House of Representatives and the Senate passed competing versions of an Energy Policy

Act during the 107th Congress (2001-2002). The Senate version included several significant climate change provisions (mentioned below), while the House version did not. The Senate bill was also generally more climate-friendly than the House bill; for example, it provided more support for renewable energy and energy efficiency.³ Efforts to reconcile the two lengthy bills failed, partly because of differences over the climate change provisions, and the Energy Policy Act was not signed into law during the 107th Congress.

The House started the process again in the 108th Congress, passing in April 2003 an Energy Policy Act of 2003 (H.R.6 E.H.) that was substantively similar to the 2002 House bill. The Senate Energy Committee produced its version of the bill later that month, but was unable to gain enough support to pass the bill out of the full Senate. After a two-month stalemate, the Senate instead passed by a vote of 84 to 14 a version of the bill identical to the Energy Policy Act of 2002 (designating the new bill H.R.6 E.A.S.). In November 2003, a Senate-House conference committee passed a “conference report” on the bill—a reconciliation of the House and Senate bills—that was more similar to the House bill than to the Senate bill. The conference report passed the House by a vote of 246 to 180 but failed to win a sufficient number of votes in the Senate to stop a filibuster of the bill (58 to 40). Consequently, the bill was not sent to the President to be signed into law.

Greenhouse Gas Cap-and-Trade

In October 2003, the first congressional vote on a measure to limit U.S. economy-wide GHG emissions was held in the Senate. The Climate Stewardship Act of 2003 (S.139) was introduced in January 2003 by Senators Joseph I. Lieberman (D-Connecticut) and John McCain (R-Arizona). It went through modifications and was voted on by the full Senate in October. The version of the bill brought to a vote in October by Senators Lieberman and McCain (S.Amdt.2028) would cap U.S. GHG emissions after 2010 at the level emitted in 2000. The bill would cap emissions of six major greenhouse gases from the electricity generation, transportation, industrial, and commercial sectors, which account for approximately 85 percent of U.S. emissions. Entities subject to the cap would be required to hold emission allowances equal to their actual emissions. The measure would allow unlimited trading of emission allowances among entities subject to the cap, and any entity would be allowed to satisfy up to 15 percent of its total allowance requirements by submitting (a) tradeable allowances from another nation’s GHG market; (b) a well-documented net increase in carbon sequestration; (c) a well-documented GHG emission reduction by a non-covered entity; and (d) allowances “borrowed” from future years. The measure did not pass (43 to 55), but the sponsors have stated their intention to bring it to a vote again.

United States Climate Change Strategy; Disclosure of Greenhouse Gas Emissions

The version of the Energy Policy Act of 2003 passed by the Senate included two significant measures addressing climate change—measures inherited from the Senate’s Energy Policy Act of 2002.

The first measure, written by Senators Robert C. Byrd (D-West Virginia) and Ted Stevens (R-Alaska), would require development of a U.S. National Climate Change Strategy with the goal of stabilizing GHG concentrations in the atmosphere and would establish an Office of National Climate Change Policy within the Executive Office of the President. The second measure, written by Senators Sam Brownback (R-Kansas) and Jon S. Corzine (D-New Jersey), would provide initially for voluntary disclosure of GHG emissions, leading to mandatory disclosure by the largest emitters if fewer than 60 percent of U.S. GHG emissions were reported voluntarily.

Both measures were attached by voice vote to the Energy Policy Act of 2002. During renewed action on the Energy Policy Act in 2003, Senator Bingaman prepared an amendment incorporating both measures. Before he could offer the amendment, however, the Senate passed its bill, which was identical to the Energy Policy Act of 2002. Neither measure was then included in the House-Senate conference report version of the Energy Policy Act of 2003.

Renewable Energy and Energy Efficiency

A “renewable fuels standard” that would double the amount of ethanol blended with gasoline in U.S. markets by 2012 and create incentives for the use of cellulosic ethanol was a major provision of the Energy Policy Act of 2003 and was included in the House-Senate conference report. The conference report also included provisions extending production tax credits for wind, solar, and geothermal power and creating tax incentives for energy-efficient equipment. A “renewable portfolio standard” requiring that electric utilities generate at least 10 percent of their electricity by 2020 from renewable sources was included in the Senate version of the Energy Policy Act, but not in the House-Senate conference report.

Power Plant Emissions; Carbon Sequestration

The House-Senate conference report on the Energy Policy Act of 2003 contained a provision that would establish a “clean coal technology tax credit” that would be available for coal-burning units meeting a specified limit on the amount of carbon emitted per kilowatt-hour (kWh) of electricity generated. This provision was derived from a bill originally written by Senator Byrd. The

ENACTING LAW IN THE UNITED STATES

In order to become law, a bill must be agreed to by both the House of Representatives and the Senate and be signed by the President. If the President vetoes a law, it may still be passed with a two-thirds majority in both the House and the Senate. The Supreme Court has the power to overturn a law it rules to be unconstitutional.

There are two major political parties in the United States, the Democratic and Republican parties, to which all but two members of Congress belong. The majority political party in each house of Congress holds a great deal of power. Though currently the President and the majorities of both the House and Senate are Republican, it is often the case that one or both houses of Congress are controlled by a party different from that of the President.

Members of the majority party in either house chair the house's committees, make up the majority of each committee's members, and are allowed to hire more committee staff than the minority party. Committee chairmen decide which of the bills referred to their committees are acted upon. The leader of the majority party in the House, the Speaker of the House, usually decides what bills are brought to a vote by the House and what amendments may be offered. The Senate Majority Leader has somewhat less power than his House counterpart, and seeks the unanimous consent of all Senators in order to take up any legislation. If even one Senator disagrees with the process propounded by the Majority Leader and threatens to

filibuster (i.e., to monopolize the Senate floor with a very long speech), the Majority Leader must be supported by sixty Senators to stop the filibuster. Thus, though a simple majority is all that is theoretically necessary to pass legislation in the Senate, controversial legislation typically requires sixty votes.

Any member of the House or Senate can introduce legislation, and most legislation is initiated by members of Congress. Some bills are introduced at the request of the President. The vast majority of introduced bills are never acted upon. In both houses, once a bill is introduced it is referred to a committee or committees, where, if the committee chairman chooses, it may be the subject of hearings, negotiations, amendments, and votes. Once a bill is reported favorably by the committee or committees of jurisdiction, the leader of the house's majority party (the Speaker of the House or the Senate Majority Leader) may bring it to a vote by that house. Both houses must agree on a bill before it can be sent to the President and signed into law. Because of this, when a bill passed by the Senate is different from its House counterpart, the bills must be reconciled, typically by a House-Senate conference committee. Because the President may choose to veto a bill, the Administration is typically involved in House-Senate conference negotiations over major legislation.

conference report would also authorize research into carbon capture and sequestration from coal-burning power plants.

“Multi-pollutant” legislation, addressing the sulfur dioxide (SO₂), nitrogen oxides (NO_x), mercury, and possibly carbon dioxide (CO₂) emissions of power plants, was the subject of several legislative hearings in 2003 but was not brought to a vote, partly due to disagreements over the handling of CO₂ emissions. Multi-pollutant bills have been introduced in both houses. A bill that would reduce power plant CO₂ emissions to 1990 levels by 2009 was introduced in the House by Rep. Henry A. Waxman (D-California) and in the Senate by Sen. James M. Jeffords (I-Vermont). A bill that would reduce the emissions to 2001 levels by 2013 was introduced in the Senate by Sen. Thomas R. Carper (D-Delaware) and in the House by Rep. Charles Bass (R-New Hampshire), and finally a bill that would limit emissions of the first three pollutants, but not CO₂, was introduced in the House at the request of the President by Rep. W.J. Tauzin (R-Louisiana) and Sen. James M. Inhofe (R-Oklahoma).

Automotive Fuel Efficiency

The House defeated (162 to 268) an amendment to the Energy Policy Act written by Rep. Sherwood L. Boehlert (R-New York) requiring total oil consumption for cars and light trucks in 2010 to be at least 5 percent less than what would have been consumed if the average fuel economy standards were to remain at 2004 levels. Similarly, the Senate defeated (32 to 65) an amendment by Sen. Richard J. Durbin (D-Illinois) establishing model-year 2015 average fuel economy standards of 40 miles per gallon for cars, SUVs, and minivans, and 27.5 miles per gallon for pickup trucks and heavy-duty vans.

Participation in Climate Change Negotiations

Both the Senate Foreign Relations Committee and the House International Relations Committee passed resolutions urging the United States to participate in international negotiations with the objective of securing U.S. participation in a future binding climate change treaty. The House Energy and Commerce Committee, however, voted against the resolution. The resolution was included in the Senate-passed Energy Policy Act of 2003, but not in the subsequent House-Senate conference report on the Energy Policy Act.

III. State Activity

In the absence of comprehensive federal policy, states are leading the way in addressing climate change. Through their authority over areas affecting the environment, such as land use, transportation, utilities, and taxation, states are creating their own programs and policies that lessen their contribution to climate change. Many states are adopting policies that successfully reduce GHG emissions without threatening their economies and that provide solutions to climate change while offering a wide array of other benefits. Measures that have proven controversial at the federal level, such as renewable portfolio standards and mandatory GHG reporting, have often been implemented with little dissent in the states.

States are taking a range of approaches, from comprehensive, cross-cutting programs to those more narrowly focused on issues such as energy, air pollution, agriculture, transportation, natural resources, and education. While some state programs are expressly designed to confront the challenge of global warming, others are designed to achieve different policy goals but have the additional effect of reducing GHG emissions. In some cases, states enact new state laws and rules, while in others they utilize existing legal authorities and programs. Some states tackle climate change through their environmental agencies; others work through alternate agencies, such as agriculture and energy. This section provides some examples of state innovations.

Plans, Targets, and Standards

Twenty-eight states and Puerto Rico have developed or are developing strategies or action plans to reduce net GHG emissions. Several states have set numeric goals for reducing emissions to mitigate climate change. **New Jersey** has committed to reduce GHG emissions to 3.5 percent below 1990 levels by 2005. The state's 1990 GHG emissions were 136 million tons, and business-as-usual would have led to an estimated 151 million tons in 2005. The new plan will result in 131 million tons emitted in 2005. New Jersey's comprehensive approach to achieving its GHG target includes covenants with companies and organizations, a renewable portfolio standard, sector-specific goals, and mandatory GHG reporting. In May 2001, **Massachusetts** capped CO₂ emissions along with SO₂ and NO_x from its six highest-emitting power plants, with a goal of reducing CO₂ emissions from those plants by 10 percent over the next several years. Current emissions from the plants, which provide 40 percent of the state's electricity, average just over 2000 lbs CO₂/megawatt-hour (MWh). The new standard requires a reduction to an average of 1800 lbs CO₂/MWh by 2006 or 2008, depending on whether plants install control equipment or switch to

OREGON Power Plant CO₂ Offset Program

Oregon enacted landmark legislation in 1997 requiring new power plants to counter their global warming impact by offsetting approximately 17 percent of their CO₂ emissions. Electric utilities can meet the standard by paying a fee to the nonprofit Climate Trust, which invests the funds in projects that reduce or sequester CO₂ emissions. The Climate Trust was created when the legislation was enacted.

Projects selected for the Trust's current portfolio include distributed generation, traffic signal timing, building energy efficiency, riparian reforestation, and combined heat and power. The eleven projects currently financed through the Climate Trust will reduce CO₂ at an average of about \$2.00 per metric ton. These projects will offset about 2.5 million metric tons of CO₂ over their lifetimes of 10 to 100 years. They will also reduce traffic congestion, assist in developing renewable electricity resources, and preserve forestland.

by the non-profit Climate Trust (see box). The state of **Washington** is in the process of adopting rules similar to Oregon's.

NEW ENGLAND STATES and EASTERN CANADIAN PROVINCES

Regional Climate Change Action Plan

At their annual conference in August 2001, the New England Governors and Eastern Canadian Premiers (NEG/ECP) approved a comprehensive Climate Change Action Plan to jointly reduce regional GHG emissions.

The Plan aims to reduce regional GHG emissions to 1990 levels by 2010, reduce emissions by 10 percent below 1990 levels by 2020, and eventually reduce emissions sufficiently to eliminate any dangerous threat to the climate.

In addition, the plan calls for a regional standardized GHG emissions inventory and registry, and potentially a trading mechanism to achieve cost-effective emissions reductions. It also includes measures to adapt regional economies and infrastructure to the negative impacts likely to result from climate change. Programs to achieve the common GHG emissions reduction goal will be carried out by individual jurisdictions. In June 2003, Maine passed legislation requiring the state to adopt a plan to reduce emissions by the amount agreed upon by the NEG/ECP.

The regional leaders are motivated to work together by a shared energy system and transportation network, subject to the same market forces regarding energy and fuel diversity. Another motivator is shared regional air space, where pollutants and their environmental impacts are easily transported across borders. The Climate Plan builds on successful regional efforts to identify and reduce emissions that contribute to acid deposition and mercury pollution.

natural gas to meet the standard. Plants that fail to make adequate on-site reductions can still meet the standard by purchasing emissions credits. Similarly, in May 2002 **New Hampshire** passed a law to reduce power plant emissions of CO₂, SO₂, NO_x, and mercury. The program requires a reduction of CO₂ emissions to 1990 levels by 2006. **Oregon** enacted a law in 1997 establishing CO₂ standards for new power plants; the required reduction of 17 percent can be achieved through offset projects coordinated

At a regional level, the **New England** governors signed an agreement in August 2001 with the Eastern Canadian Premiers for a comprehensive regional Climate Change Action Plan, including regional emissions reduction targets (see box). In June 2003, **Maine** became the first state to codify this agreement in state law. In April 2003, **New York's** Governor Pataki sent out letters to the governors of ten other **Northeast states** inviting them to participate in the development of a regional CO₂ cap-and-trade program for power plants. The governors from **Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, Delaware, and New Jersey** responded with interest in working with **New York, Maryland and Pennsylvania** are participating under an "observer" status. The group, called the Regional Greenhouse Gas

Initiative (RGGI), has begun to work on the program design, which it aims to complete by April 2005. In September 2003, the governors of **Oregon**, **California**, and **Washington** directed their staffs to cooperate during the next year to arrive at policy recommendations for reducing GHG emissions. The recommendations will address ways that the three states can work together to obtain fuel-efficient vehicles; reduce emissions from diesel fuel; encourage renewable energy production; implement uniform efficiency standards; and develop coordinated GHG emission inventories, reporting protocols, and accounting methods.

Inventories and Reporting

Thirty-nine states and Puerto Rico have completed GHG inventories of their total GHG emissions, and one more state has an inventory in progress. **Wisconsin** requires large emitters to report their CO₂ emissions, and many smaller emitters have chosen to voluntarily report their emissions to the state. **New Jersey** requires that facilities that must report any other air emissions must also report CO₂ and methane (CH₄) emissions. **Maine**, in accordance with its new Climate Action Plan, is preparing to require reporting of GHG emissions. **New Hampshire**, **Wisconsin**, and **California** have established voluntary GHG reduction registries, in which entities may establish emission baselines and register GHG reductions. In addition, ten **Northeast states** are working together with the Northeast States for Coordinated Air Use Management (NESCAUM) to develop a regional registry. The registry, which will be based online, may serve as the emissions tracking system for whatever Northeast power sector carbon cap is adopted. Other potential functions include providing baseline protection against future state regulations, supporting mandatory GHG reporting in states where it may be required, and improving states' understanding of their GHG inventories. The Northeast registry will be designed to be as compatible as possible with existing registries, such as the California Climate Action Registry.

Carbon Sequestration

States are not only looking at ways to reduce their GHG emissions; they have also found various ways to increase the amount of CO₂ sequestered within their borders. **Idaho's** National Engineering and Environmental Laboratory is researching methods of extracting CO₂ from gaseous streams, such as smokestack exhaust or natural gas production lines, before the CO₂ can mix with the air. **Georgia's** No-Tillage Assistance Program leases "no-till" equipment to farmers, allowing them to increase the amount of carbon sequestered in their soils. It also provides them with the quickest and most cost-effective method of replanting, and forgoing tilling reduces thousands of gallons of fuel use (see box). In 2000, **Nebraska** formed an advisory committee to investigate the

GEORGIA No-Tillage Assistance Program

The Georgia No-Tillage Assistance Program leases “no-till” equipment to farmers. No-till farming involves sowing a crop without prior cultivation and with very little soil disturbance at seeding, thereby increasing the amount of CO₂ sequestered in the soil, as well as reducing fuel use, time, and cost of farmland preparation compared to conventional tilling techniques.

Although the technologies and farming methods used in the no-till process have been available for approximately 16 years, there have been only limited opportunities for most farmers to become acquainted with this method. The Georgia Environmental Facilities Authority solves this problem by leasing no-till equipment to many of Georgia’s 66,000 farmers. The program has grown from the state’s original purchase of five equipment units to more than 75 units in operation today, and many farmers have purchased their own no-till equipment after seeing the benefits of applying no-till to their fields.

Since 1987, the program has served more than 625,000 acres and saved 2.7 million gallons of fuel to avoid an estimated 25,000 tons of CO₂. In addition, the program has saved more than 2.1 million tons of soil. No-till agriculture, in conjunction with reduced fallow and increased retention of residues, also delivers the benefits of reduced soil erosion, improved soil quality, and reduced pollution of streams. Total funding since 1987 has been over \$3 million.

potential to sequester carbon in state soils, and **Wyoming, North Dakota, Oklahoma,** and **Illinois** followed by establishing similar committees, some of which investigated other potential forms of sequestration. **West Virginia** and **Ohio** are supporting a pilot project to sequester carbon in a deep underground rock formation near American Electric Power’s Mountaineer plant on the Ohio-West Virginia border.

Forestry programs in several states are also helping to sequester CO₂. The **Oregon** Forest Resource Trust provides up to 100 percent of reforestation costs to help landowners establish and maintain healthy forests on under-producing forest lands. The landowner accepts responsibility for manag-

ing the reforestation project based on an agreed-upon project plan. Landowners forego ownership of any carbon offset credits to the Trust, but share net revenues from any profitable timber harvest. Net emissions reductions of 1.16 million metric tons of CO₂ are estimated over the life of the forests established through the program. **Minnesota’s** Releaf Program, created by the state legislature in 1991, promotes and funds the planting, maintenance, and improvement of trees in the state to reduce CO₂ levels in the atmosphere and conserve energy. Between 1991 and 2001, Releaf supported 361 tree planting, forest health maintenance, and tree inventory projects involving nearly 200 communities and counties across Minnesota. The **New Mexico** Forest Re-Leaf Program, an environmental education and tree planting grant program, provides grants to municipalities, schools, and organizations for tree planting projects. Since the program was implemented in 1990, over 17,000 trees have been planted in more than 60 communities throughout the state.

Energy Efficiency

Because most U.S. energy is derived from GHG-emitting fossil fuels, measures that increase energy efficiency can reduce GHG emissions. **California’s** 2001 energy conservation package illustrates the array of energy and climate solutions available to states. The legislation dedicated \$850 million to conservation initiatives and incentives, designed to save over 2000 megawatts (MW)

during peak summer demand. The comprehensive package allocates money for various objectives, including agricultural energy efficiency and load reduction, high-efficiency lighting in commercial buildings, low-interest loans for energy efficiency projects in schools and local jurisdictions, innovative peak load reduction, energy-efficient household appliances, and energy efficiency in state buildings.

Maryland provides tax incentives to residents and businesses for purchases of and investments in energy-efficient products. For example, residents and businesses can avoid Maryland's 5 percent sales tax when buying new clothes washers, refrigerators, and room air conditioners that meet certain energy-efficiency standards. In addition, the state awards tax credits to commercial developers that construct or retrofit commercial buildings to make them resource and energy efficient. In **Oregon**, energy-efficient appliances that meet certain standards qualify for a state tax credit; certain efficient heating and cooling equipment also qualifies for the credit. The **New York** Keep Cool program provides bounty payments to consumers upon the return of older, working room air conditioners when they purchase new ENERGY STAR® room air conditioners. 154,000 air conditioners were replaced through the program in 2002 alone, shaving an estimated 56 MW off summer peak electricity demand.

Indiana's Public Facility Energy Efficiency Program provides loans from the Indiana Efficiency Loan Fund to help schools, political subdivisions, and public libraries identify and implement energy projects. Zero-interest loans are available for up to \$100,000 and do not require matching funds. The **Missouri** Department of Natural Resources has a revolving loan fund that provides schools and local governments with technological and financial assistance to implement energy-efficient upgrades. Since the program began in 1989, more than \$52 million has been loaned to schools and local governments, saving more than \$8.7 million each year in energy costs. In 2000, the program reduced CO₂ emissions by about 10,000 tons. The fund helped to finance over \$16 million in facility upgrades in 2003. **Louisiana** is constructing three new state buildings with energy efficiency in mind. The energy use of the buildings is expected to be approximately 40 percent less than in buildings that merely comply with efficiency standards. The projected energy savings over the next

IOWA Building Energy Management Program

Iowa's Building Energy Management program enables Iowa schools, local governments, private colleges, hospitals, and state agencies to identify and implement cost-effective energy management improvements without incurring any up-front costs.

Each client receives an analysis of its facilities by a professional auditor, engineer, or architect. This analysis identifies opportunities for cost-effective energy management improvements. Financial consultants help determine whether it is best to access in-house capital to fund the improvements or to use pre-arranged financing through a regional investment bank. The cost of the improvements is paid by energy savings resulting from program implementation, making the program budget-neutral for the client.

Approximately \$200 million has been invested in energy management improvements since the program began in 1989, which has resulted in \$230 million in savings for Iowa's taxpayers.

25 years completely cover the cost of the additional efficiency measures. **Iowa's** Building Energy Management Program helps schools, local governments, private colleges, and hospitals to identify, implement, and finance cost-effective energy management improvements (see box). In **New Hampshire's** Building Energy Conservation Initiative, a state agency contracts with a private energy services company (ESCO) to improve energy efficiency in state-owned buildings through retrofits and upgrades. The ESCO guarantees that the savings from energy improvements will pay for the project cost, eliminating risk on the part of the agency. The program will save an estimated 3,239,000 kWh of electricity and 2730 tons of CO₂ annually. The **Texas** Loan Star Program, administered by the Texas Energy Conservation Office, provides energy efficiency project financing for state agencies, institutions of higher education, school districts, and local governments. Through November 2003, the program has saved participants \$137 million and reduced emissions of CO₂ by 1.5 million tons.

Hawaii's Energy Performance Contracting Program is designed for both public and private buildings and organizations. An ESCO designs, purchases, installs, and maintains energy-saving equipment. The ESCO then guarantees to the building owner that the energy savings achieved will pay for all project costs. Examples of projects include replacing lighting equipment, modifying or replacing boilers and chillers, installing modern energy management control systems, and replacing motors. **New York's** statewide Green Building Tax Credit provides \$25 million in credits from 2000 to 2004 to encourage owners and tenants of commercial and residential buildings to incorporate environmentally beneficial features into buildings. The **Wisconsin** ENERGY STAR® Homes program provides assistance and incentives to those wishing to build an energy-efficient home or to modify an existing home. ENERGY STAR® homes are 25 percent more efficient on average than homes built according to Wisconsin's building codes.

A number of states have achieved significant reductions in electricity use through “demand side management”—requiring electric utilities to work with their customers to control electricity demand. **Twenty-three states** have authorized “public benefits funds” or similar mechanisms to collect revenue from electric utility customers to fund energy efficiency, research and development, renewable energy, low-income rate assistance, and weatherization. **Montana** recently extended its Universal Systems Benefit Program to operate through 2005. All electric and natural gas utilities within the state are required to collect funds from their customers, which are then distributed to individuals, organizations, and businesses for energy efficiency improvements and relief from high utility bills. The program resulted in 4,500 tons of CO₂-equivalent (CO₂e)⁴ reductions from 1999 to 2000. **Colorado's** Energy Saving Partner program provides cost-effective energy conservation services to low-income households for free. These improvements, which include comprehensive

insulation, safety inspections, and efficiency surveys, have significantly lowered energy demand and utility bills, resulting in emissions reductions of approximately 3,850 metric tons of CO₂e per year. **Indiana** supports industrial energy efficiency through several initiatives, including a loan program for efficiency improvements in existing industrial processes; another program, designed to attract high technology manufacturing facilities, provides grants to facilities that are highly energy efficient or that manufacture advanced energy-efficient products.

Renewable Energy

Energy generated from renewable sources can reduce demand for energy generated from fossil fuels and thereby reduce CO₂ emissions from fossil fuel combustion. **Thirteen states** have established renewable energy mandates, requiring that utilities generate a share of their electricity from renewable sources. Many of these programs set a standard for renewable energy as a proportion of the resource mix of electricity provided. **Texas** (see box) requires that a specific amount of new generating capacity, rather than a percentage of the total portfolio, be based on renewable energy. **Pennsylvania**, during electric restructuring agreements, arrived at different requirements for each utility. **Nevada** and **Arizona** require that a percent of the renewable energy be generated through solar technologies. Other states, such as **Illinois** and **Hawaii**, have stopped short of requiring more renewable energy but have adopted targets or goals to increase the production of renewables. **Iowa**, having reached its renewable generation mandate of 105 MW, has an additional goal of reaching 1000 MW by 2010. Iowa recently developed two major wind farms, which together produce enough electricity to power more than 70,000 homes, avoiding more than 700,000 tons of CO₂ emissions annually.

Several states have programs in place to encourage the development of renewable energy. **California** requires its major utilities to collect a total of \$135 million annually for deposit in the Renewable Resource Trust Fund, which offers funding to sustain and develop the renewable energy market in California. The Fund will also be used to pay for the administration of the RPS program, when it becomes operational. Through June 2003, the Fund had helped 4400 MW of renewable capacity to remain competitive or to return to service, and when all projects are completed, over 1200 MW of new renewable capacity will be added to the state. The Fund also supports efforts to educate consumers about renewable energy. **Illinois'** Clean Energy Community Trust, created in a settlement with one of the state's utilities, provides grants, loans, and other financial incentives to develop, improve, and implement energy efficiency and renewable energy projects and programs. **Indiana** provides grants of up to \$30,000 to businesses, non-profits, and local governments to cover the incremental cost of renewable energy projects.

States are using innovative methods to produce and use renewable energy. **Iowa's** Department of Natural Resources provides support, funding, and information to promote switchgrass as a biomass energy crop with the potential for large-scale production across Iowa. In the Chariton Valley Biomass Project, 200,000 tons per year of switchgrass are being co-fired with coal at the Ottumwa Generating Station. The switchgrass will provide approximately 6.2 percent of the heat input into the boiler, generating up to 35 MW of electricity. It has been estimated that this project will displace 284,600 tons of CO₂ generated from coal, or about 1 ton of CO₂ per MWh of power generated from switchgrass. The University of Iowa is also engaged in a co-firing demonstration using oat hulls, which are a waste product of one of the state's cereal production facilities. The **Missouri** Department of Natural Resources Energy Loan Program provides financing for the Pattonville High School Landfill Gas recovery project. This project captures methane from a neighboring landfill and

TEXAS Renewable Portfolio Standard

In the summer of 1999, Texas passed legislation that restructured the Texas electricity industry. A key part of this legislation is the Texas Renewable Portfolio Standard, which requires all electricity providers to obtain renewable energy capacity, finance construction of renewable energy facilities, and develop new renewable energy resources. The standard targets an additional 2,000 MW of renewable capacity by 2009.

Energy providers can meet the standard by developing renewable energy capacity or by purchasing Renewable Energy Credits, which are awarded to producers of energy from solar, wind, hydro, wave, tidal, biomass, and landfill gas projects within Texas. Also eligible for tradable credits are renewable energy sources on the customer side of the meter that offset electricity demand (e.g., photovoltaics and solar water heating).

The development of new renewable energy is well ahead of the law's targets. Since the enactment of the RPS, 1213 MW of new wind energy and landfill gas capacity has been developed in Texas, in addition to some hydropower development. Displacing 2,000 MW of fossil fuel generation reduces annual CO₂ emissions by approximately 3.3 million tons, SO₂ emissions by 18,000 tons, and NO_x emissions by 12,000 tons.

burns it to fuel the school's boilers, significantly reducing methane emissions to the atmosphere, eliminating the need to burn natural gas, and avoiding over 2,000 tons of CO₂ annually. Using landfill gas also saves the school at least \$40,000 per year. **Utah** has financed and installed solar energy and energy efficient technologies in many of its national parks and monuments, an effort that will reduce pollution in some of the state's most pristine areas and educate visitors about clean energy opportunities.

At least **23 states** require that customers be informed about the sources of energy used to generate the electricity that they purchase. Almost **40 states** now allow

some customers with their own electric generating systems (such as rooftop solar photovoltaic panels) to sell unused electricity back to their local electric utility. To accomplish this, these states have established "net metering" to measure electricity going out as well as coming in. Utilities in **35 states** offer customers the option of "green pricing," in which customers pay a premium on their electric bills to have a portion or all of their energy provided from renewable sources. While the electricity generated by renewable sources is not delivered directly to the customers who pay for it, the utility certifies that renewable energy has been generated in an amount equal to the

customer's purchase. In **Minnesota**, an applicant requesting permission to construct a nonrenewable generating facility must demonstrate that the nonrenewable source selected is less expensive (including environmental costs) than power generated by a renewable energy source.

Many states have tried to set up an economic environment friendly to the development of renewable energy. **Maryland** provides income tax credits for the production and sale of electric power from biomass combustion, including energy crops and poultry litter. **Oregon's** Office of Energy manages two programs that provide assistance to new green power projects. One is the Business Energy Tax Credit Program, which provides a 35 percent tax credit for eligible project costs, usually phased in over five years. The other is Oregon's Small-Scale Energy Loan Program, which offers low-interest loans for projects that save energy, produce energy from renewable resources, use recycled materials, or use alternative fuel. In **Washington**, wind, solar, and landfill-gas electric generating facilities are eligible for exemption from state sales and use taxes. **West Virginia** changed its tax code to remove barriers to wind power development and, subject to the renewal of the federal tax production credit for wind, a planned 315 MW of wind power will be operating in the state by the end of 2004.

Agriculture

In addition to the opportunities to address climate change through agriculture with carbon sequestration and renewable energy production, several states have found that improving livestock waste management can produce clean energy, as well as deliver other benefits, such as improving water quality and reducing odor. The **Vermont** Methane Pilot Project promotes the use of methane recovery technology on dairy farms. This method of dealing with livestock waste reduces emissions of a potent GHG to the atmosphere and displaces fossil fuel energy. In addition, through Vermont's net metering law, farmers that produce up to 125 kilowatt (kW) can sell their excess energy to the grid, providing supplementary income. Methane recovery from dairy manure alone could provide Vermont with 28,000 kW of renewable energy. **Wisconsin** assists one of its largest dairy farms with manure-to-energy technology that generates 750 kW of electricity, eliminating 26,250 tons of CO₂-equivalent emissions through methane capture and displacement of coal-fired electric generation. In **North Carolina**, the North Carolina State University Animal and Poultry Waste Management Center is evaluating several hog waste management technologies for implementation on private-sector hog farms throughout the state. These technologies would reduce methane emissions by using waste methane to generate energy, instead of releasing it into the atmosphere. (For more information on opportunities to address climate change through agriculture, see the sections on sequestration, renewable energy, and transportation.)

Transportation

Transportation accounts for about one-third of U.S. CO₂ emissions, and thus state transportation policies provide another opportunity to mitigate climate change. In July 2002, **California** (see box) enacted legislation requiring the California Air Resources Board to adopt GHG emission standards for passenger cars and light-duty trucks, to be applied to model years 2009 and later. **Minnesota** requires that all gasoline sold in the state contain 10 percent ethanol by volume. Replacing this quantity of gasoline with ethanol results in the reduction of an estimated 480,000 tons of CO₂ annually. Producing and using ethanol provides revenue for state farmers and also helps the state meet its clean air requirements.

Minnesota and **Washington** promote the purchase of “high mile per gallon” vehicles for their state fleets. **Maine** has a highway fuel economy standard for new state-owned cars of 30 miles per gallon. **Missouri** requires that vehicles purchased by state agencies meet or exceed the federal cor-

porate average fuel efficiency (CAFE) standards. Some states, such as **New York** and **Texas**, purchase higher percentages of alternative fuel vehicles for their state fleets than required by federal law. **Iowa** has a state fleet of flexible fuel vehicles, which are capable of running on an 85 percent ethanol blend (E85) or on gasoline. Each vehicle is equipped with a map of filling stations that sell E85, and the Department of Natural Resources is working on getting exit signs posted on highways that indicate the

CALIFORNIA Greenhouse Gas Standard for Vehicles

California is in the process of establishing the nation's first GHG emission standards for light-duty vehicles. Under legislation enacted in July 2003, the California Air Resources Board (ARB) is adopting standards that will achieve “the maximum feasible and cost-effective reduction of greenhouse gas emissions from motor vehicles,” taking into account environmental, social, technological, and economic factors. Standards will be adopted by 2005 to apply to model years 2009 and later, unless they fail to overcome expected legal challenges.

In setting the emission standards, the ARB may not impose mandatory trip reduction measures or land-use restrictions. It may not undertake the following measures in setting the standards: (1) imposing additional fees or taxes on vehicles, motor fuel, or travel, (2) banning the sale of any vehicle category, (3) requiring a reduction in vehicle weight, (4) limiting the speed limit, or (5) limiting vehicle miles traveled. The ARB is required to adopt regulations by January 1, 2005, and the regulations will apply to model years 2009 and after.

Californians drove 730 million miles per day in light-duty vehicles in 2000, emitting more than 350,000 tons per day of greenhouse gases. Thus, a standard affecting GHG emissions from new light-duty vehicles has the potential to achieve significant emission reductions. In addition, California's GHG standard for automobiles may eventually extend beyond its own borders. Because of a provision of the U.S. Clean Air Act, California is the only state with the authority to pass stronger air pollution standards than those set by the federal government. The U.S. Clean Air Act also allows other states to elect to adopt California's standards, opening the possibility for more states to adopt a GHG emissions standard for light-duty vehicles.

presence of an E85 vendor. **New York's** Clean Fuel Bus Program has provided \$30 million to purchase 528 clean-fuel buses since its inception in 1996. Each year, the buses eliminate nearly 4 million gallons of diesel fuel use and over 19,000 tons of CO₂ (see box).

Maryland grants an excise tax exemption of up to \$2000 for the purchase of new electric vehicles and up to \$1500 for the purchase of new hybrid-electric vehicles.

Kansas provides income tax credits equal to 50 percent of the incremental or conversion cost of an alternative-fuel vehicle. **Indiana**

encourages businesses and institutions to acquire alternative fuel vehicles and to make use of alternative transportation fuels. The program provides grants of up to \$30,000 to assist with the purchase of an alternative fuel vehicle, the conversion of a vehicle to run on alternative fuel, the purchase or installation of alternative refueling facilities, and the purchase of E85 or biodiesel blends. **California's** Zero Emission Vehicle Incentive Program provides grants of up to \$5,000 per vehicle toward the purchase or lease of new zero-emission vehicles (ZEVs).⁵ Up to \$11,000 is available for eligible fleets in areas of California with the worst air quality. A previous version of the program offered grants of up to \$9,000; both versions of the program together with the fleet incentive have placed approximately 1200 vehicles in service since October 2001.

Washington's Commute Trip Reduction law requires employers to participate in a program to change commuters' travel choices and reduce single-occupant vehicle use (see box). **Georgia's** Clean Air Campaign is a non-profit organization that works with state agencies to reduce traffic congestion and improve air quality. Through carpool programs, employer commuting programs, and public education, the Campaign aims for its projects to reduce automobile travel by 4.5 million light duty vehicle miles per day by the end of 2004, avoiding approximately 740,000 tons of CO₂ emissions per year. Several states, including **New York, Arkansas, Tennessee, Texas, Georgia,** and

NEW YORK Clean-Fueled Bus Program

New York State's Clean-Fueled Bus Program provides funding to transit authorities, state agencies, universities, municipalities, and schools to cover the incremental cost of a clean-fueled bus over a diesel bus.

Since its inception in 1996, the program, administered by the New York State Energy Research and Development Authority, has awarded \$30 million and leveraged more than \$120 million to place 528 clean-fueled buses on streets throughout the state. Transit agencies in and around New York City will operate 103 hybrid-electric buses and 406 compressed natural gas buses. Each year, these vehicles eliminate the need for nearly 5 million gallons of diesel fuel combustion and over 19,000 tons of CO₂ emissions.

The program has also spent \$5 million to fund Round I of the Clean Air School Bus Program. Under this program, 2,200 diesel school buses across New York State will be retrofitted with diesel oxidation catalysts and diesel particulate filters. Approximately 10 percent of these buses will operate in New York City.

California, have installed truck stop electrification (TSE) equipment. TSE equipment allows long-haul trucks to plug into a power source at truck stops, allowing truck drivers to use amenities within the cab without running their diesel engines for long periods. Since each hour of idling uses one gallon of fuel, the technology has the potential to significantly reduce associated emissions. **Maryland's** package of Smart Growth initiatives may reduce vehicle miles traveled through its strategies to limit the expansion of urban sprawl, preserve natural resources, and support existing communities by targeting state resources to those areas already developed or thoroughly planned.

WASHINGTON Commute Trip Reduction

The Commute Trip Reduction program, established by the Washington State Legislature in 1991, aims to reduce traffic congestion, air pollution, and fuel consumption by persuading people to change the way they commute to work. The law requires businesses with worksites employing more than 100 people in nine Washington counties to develop programs to encourage their workers to commute by mass transit, carpooling, vanpooling, telecommuting, walking, or biking.

The state supports the program with direct and indirect assistance to employers. As of September 2003, 1,090 worksites were implementing a commute program. For sites that have been in the program since 1993, employee use of mass transit increased by 29 percent, carpooling by 7 percent, vanpooling by 99 percent, telecommuting by 731 percent, walking by 6 percent, biking by 17 percent, and use of compressed work weeks by 46 percent. Direct emissions reductions resulting from these changes exceed

50,000 tons of CO₂ and 4,800 tons of NO_x and volatile organic compounds per year. Changes in employee commute choices at these sites have removed nearly 19,000 vehicles from the road statewide every weekday morning.

The \$4.9 million per year of state and local incentives for this program have triggered an additional \$37 million in program investment per year by employers. Many employers support the program because of the ancillary benefits they derive from reduced employee commuting, such as reduced need for parking spaces, and reduced need for office space due to teleworking. Changing employee commute choices is making significant improvements to the transportation system, reducing traffic delay in the Puget Sound region by 6.3 percent. Washington and Oregon were the only states where the percentage of people driving alone to work decreased between 1990 and 2000.

IV. Business Activity

A growing number of major companies are undertaking significant efforts to address climate change. These efforts include setting GHG reduction targets, improving energy efficiency, investing in the development of clean and renewable energy technologies, increasing the use and production of renewable energy, improving waste management, investing in carbon sequestration, participating in emissions trading, and developing energy-saving products. Some companies also are speaking out about climate change and encouraging stronger government efforts to reduce emissions throughout the economy.

Companies are acting in the absence of mandatory requirements for a number of reasons. The Pew Center's 2001 report, *Corporate Greenhouse Gas Reduction Targets*, cited several motivations for adopting a voluntary target. Companies believe that over the long term, the world will have to deal with climate change, and so their climate-friendly investments will pay off. They believe that by taking the initiative, they can help government craft climate change policies that work well for business. They also believe that emissions reduction efforts can drive innovation and improve their bottom line.

Through their efforts, these companies are demonstrating that GHG emissions can be reduced significantly and cost-effectively—with substantial ancillary benefits, including improved competitive positioning. Despite the cost-effective nature of many voluntary GHG emissions reductions, companies need clear policy signals in order to make informed investment decisions about additional GHG reductions. The diversity of approaches that companies are currently pursuing underscores the need for any future mandatory climate policy to include flexible mechanisms that allow companies to find the most cost-effective path to emissions reductions.

This section offers a sampling of corporate climate change efforts drawn from the efforts of the 38 companies that are members of the Pew Center's Business Environmental Leadership Council.

Greenhouse Gas Reduction Targets

Companies have adopted several kinds of targets leading to GHG emissions reductions. Some targets focus directly on greenhouse gases, while others focus on energy use, purchases, or products. Some serve as absolute limits, while others are pegged to indicators such as production levels or revenues. The type of target a company chooses depends on its products and production methods, policy environment, and business models. Four general considerations influence a company's choice of target type: the target's effect on emissions reductions, the existence of uncontrollable factors relating to emissions or energy use, the opportunity for cost-effective emissions or energy reductions, and the potential impact on company growth.

Corporate GHG Targets

(CHECK MARKS DESIGNATE TARGETS ALREADY ACHIEVED)

Company	Target(s)
ABB	<input type="checkbox"/> Reduce GHG emissions by 1 percent each year from 1998 through 2005. <input type="checkbox"/> Develop Environmental Product Declarations for every product produced.
American Electric Power (AEP)	<input type="checkbox"/> Reduce CO ₂ emissions by 1 percent in 2003, 2 percent in 2004, 3 percent in 2005, and 4 percent in 2006 below the average of 1998 to 2001 levels, using in-system reductions or carbon-equivalent offsets.
Alcoa	<input type="checkbox"/> Reduce GHG emissions by 25 percent from 1990 levels by 2010, and by 50 percent from 1990 levels once its inert anode technology is fully commercialized.
Baxter International	<input type="checkbox"/> Reduce energy use and associated GHG emissions by 30 percent per unit of product value from 1996 levels by 2005.
BP	<input checked="" type="checkbox"/> Reduce GHG emissions by 10 percent from 1990 levels by 2010. <input type="checkbox"/> Maintain net emissions at or below 2001 levels over the next decade.
Cinergy	<input type="checkbox"/> Reduce GHG emissions to an average of five percent below their 2000 level during the period 2010 through 2012.
Deutsche Telekom	<input checked="" type="checkbox"/> Reduce energy use by 15 percent from 1995 levels by 2000. <input type="checkbox"/> Reduce energy use by 3 percent from 2001 levels by 2004.
DTE Energy	<input type="checkbox"/> Reduce GHG emissions by 5 percent from 1999 levels by 2005.
DuPont	<input checked="" type="checkbox"/> Reduce GHG emissions by 65 percent from 1990 levels by 2010. ¹ <input type="checkbox"/> Hold total energy use flat at 1990 levels through 2010. ² <input type="checkbox"/> Source 10 percent of global energy use from renewable resources by 2010.
Entergy	<input type="checkbox"/> Stabilize CO ₂ emissions from U.S. generating facilities at 2000 levels through 2005.
Hewlett-Packard	<input type="checkbox"/> Reduce perfluorocarbon (PFC) ³ emissions by 10 percent from 1990 levels by 2005.
Holcim	<input type="checkbox"/> Reduce CO ₂ emissions by 12 percent per ton of product manufactured from 2000 by 2008.
IBM	<input type="checkbox"/> Conserve annually 4 percent of the energy that would otherwise have been consumed. <input type="checkbox"/> Reduce CO ₂ emissions associated with IBM's fuel use and electricity consumption by an average annual 4 percent of what would otherwise have been emitted, over the period 1998 to 2004. <input type="checkbox"/> Have 90 to 100 percent of the new product models introduced during each year meet ENERGY STAR [®] criteria. <input checked="" type="checkbox"/> Reduce PFC emissions from semiconductor manufacturing worldwide by 40 percent from 1995 levels by 2002 (indexed to production). <input type="checkbox"/> Achieve an absolute 10 percent reduction in PFC emissions from IBM's semiconductor manufacturing processes by 2005, using 2000 as the base year.
Intel	<input type="checkbox"/> Achieve an absolute 10 percent reduction in PFC emissions from 1995 levels by 2010. <input type="checkbox"/> Reduce normalized energy consumption by 4 percent per year from 2002 to 2010, for a cumulative reduction of 28 percent by 2010 as compared to 2002.
Interface Inc.	<input type="checkbox"/> Reduce non-renewable energy use per unit of production by 15 percent from 1996 levels by 2005. <input type="checkbox"/> Increase renewable energy use to 10 percent of total energy use by 2005.
Novartis	<input checked="" type="checkbox"/> Reduced CO ₂ emissions by 3 percent absolute (based on 2000, i.e. 1 percent/year). ⁴ <input type="checkbox"/> 2 percent average energy efficiency improvement per year (using most suitable denominator for activity of business unit). <input type="checkbox"/> Implement reduction projects representing 1 percent of past year's energy use and CO ₂ emissions (each year between 2004 and 2006).

Ontario Power Generation	<input type="checkbox"/> Stabilize net CO ₂ emissions at 1990 levels through 2000 and beyond.
PG&E Corporation	<input checked="" type="checkbox"/> Reduce annual sulfur hexafluoride (SF ₆) ⁵ emissions by 50 percent, compared with the 1998 baseline. <input type="checkbox"/> Reduce SF ₆ emissions by 60 percent by year-end 2007, compared with the 1998 baseline. <input checked="" type="checkbox"/> Reduced overall energy use at 88 facilities by 24 percent compared with the 1998 baseline.
Rio Tinto	<input checked="" type="checkbox"/> Reduced on-site GHG emissions per unit of production by 4.8 percent from 1998 levels by 2001. <input type="checkbox"/> Reduce on-site GHG emissions per unit of production by 4 percent from 2003 levels by 2008. <input type="checkbox"/> Group-wide energy efficiency target that seeks to reduce energy use per ton of product by 5 percent by 2008 from a 2003 base.
Rohm and Haas	<input checked="" type="checkbox"/> Reduce energy consumption by 5 percent per pound of product from mid-1999 levels by year-end 2001. <input checked="" type="checkbox"/> Implemented a corporate wide energy metrics program in 2001 and achieved targeted year on year energy utilization reductions in 2002 and 2003. <input type="checkbox"/> Reduce energy consumption by at least 1 percent per pound of product each year as compared to the year before. <input type="checkbox"/> Establishing business-level energy management programs with individual targets.
Royal Dutch/Shell	<input checked="" type="checkbox"/> Reduce GHG emissions by 10 percent from 1990 levels by 2002. <input type="checkbox"/> Meet 5-year (2002-2007) energy efficiency targets for global oil products and chemicals business units. For refining, this target is to improve its Refining Energy Index (REI) from 135 in 2002 to 128 by 2007 (or a 5 percent improvement in its REI). For chemicals, the target is to improve its Chemical Energy Index (CEI) from 100 in 2002 to 92 in 2007 (or an 8 percent improvement in its CEI). <input type="checkbox"/> Actively manage GHG emissions such that by 2010 emissions are still 5 percent or more below 1990 levels, even while the business grows.
SC Johnson	<input type="checkbox"/> Achieve an absolute GHG reduction of 8 percent for all U.S. operations from 2000 levels by 2005. <input type="checkbox"/> For all U.S. operations, reduce GHG emissions intensity by 23 percent (per kilograms of product manufactured) from 2000-2005.
Toyota	<input type="checkbox"/> Reduce CO ₂ emissions by 5 percent from 1990 levels by 2005, and by 10 percent from 1990 levels by 2010. ⁶ <input type="checkbox"/> Reduce energy consumption per unit of production by 15 percent from 2000 levels by 2005. ⁷
TransAlta	<input checked="" type="checkbox"/> Return GHG emissions to 1990 levels by 2000. <input type="checkbox"/> Achieve zero net GHG emissions from Canadian operations by 2024.
United Technologies	<input checked="" type="checkbox"/> Reduce energy consumption as a percentage of sales by 27 percent from 1997 levels by 2007 (target reached in 2003 resulting in a 15 percent reduction in absolute GHG emissions since 1997). <input type="checkbox"/> Achieve 40 percent reduction of energy and water use as a percentage of sales from 1997 levels by 2007.
Whirlpool	<input type="checkbox"/> Decrease absolute total GHG emissions from global manufacturing, product use, and end-of-life by 3 percent by 2008, based on a 1998 baseline.
Wisconsin Energy Corporation	<input type="checkbox"/> Fuel 5 percent of energy mix from renewable resources by 2011.

¹ Actual reduction by 2002 is 67 percent.

² Actual use in 2002 was 9 percent below 1990 levels while production has increased by almost 30 percent.

³ Perfluorocarbon is a greenhouse gas

⁴ Achieved 2.8 percent in spite of production increase of 4.8 percent.

⁵ Sulfur hexafluoride is a greenhouse gas.

⁶ Toyota Motor Corporation

⁷ Toyota Motor Manufacturing North America

Promoting Clean Energy

Burning fossil fuels to provide energy contributes significantly to total GHG emissions. Companies are reducing emissions in fuel production and electricity generation, developing technology and renewable energy sources, and purchasing renewable energy.

Renewable Energy and Clean Power

American Electric Power's second major wind farm, the 160 MW Desert Sky project, was dedicated in May 2002. This project brings the company's total wind generation to over 300 MW, making it one of the largest wind generators in the United States. Almost 125 schools participate in AEP's Learning From Light and Watts on Schools programs, in which AEP partners with learning institutions to install solar photovoltaic systems and uses these systems to track energy use. Similarly, AEP's Learning From Wind! program provides education on wind power and is used for renewable energy research. Online data from five 10 kW wind turbines allows consumers to monitor real time and historical data on both the local wind conditions and the operation of the turbines, to evaluate whether a small wind turbine might be able to meet their energy needs.

Baxter switched from using fuel oil to using wood to generate steam in one of its largest manufacturing facilities. The renewable wood fuel is comprised principally of scrap wood from local furniture and lumber operations. Baxter installed a solar photovoltaic system at its Marsa, Malta manufacturing plant

DTE Energy is partnering with the U.S. DOE, the State of Michigan, and the City of Southfield to develop, build, and operate a pilot project that will create hydrogen gas from tap water and use that gas in stationary fuel cell generators and to refuel fuel cell vehicles. DTE Energy's Hydrogen Technology Park, a \$3 million, five-year pilot project, will be capable of delivering about 100,000 kilowatt-hours of electricity per year. In 1996, Detroit Edison introduced the SolarCurrents® program and became the first utility in the nation to provide customers with solar power through the grid from a central facility. DTE Energy's Detroit Edison has promoted geothermal technology in its service area, where nearly 4,000 residential units and two dozen commercial businesses have geothermal systems.

Interface facilities use on-site power generation from photovoltaic arrays.

PG&E Corporation's utility in California delivered approximately 7.5 million MWh (10.6 percent of retail electricity sales) from renewable resources in 2002.

Royal Dutch/Shell Group's Shell Renewables was established to pursue commercial opportunities in solar, wind, and other renewable energy technologies. Over the period 2002 to 2007 the Group expects to invest between \$0.5 billion and \$1 billion, subject to economic review, in continuing to develop these business areas. The key objective for the solar business is to grow in line with the market, which is currently growing at around 25 percent a year. In the wind business, Shell is focusing on developing and operating wind farms, and selling "green" electricity.

Wisconsin Energy Corporation has adopted a target of supplying 5 percent of its energy mix with renewable resources by 2011, significantly exceeding Wisconsin's legal requirement. Wisconsin Energy produces or purchases more than 140 MW of renewable energy capacity from sources inside and outside Wisconsin for its Energy for Tomorrow™ program and to meet its requirements under the state of Wisconsin's RPS. In 2003, Wisconsin Energy Corporation signed 20-year power purchase agreements with two developers for the entire electricity output of three wind farms planned to be built in Wisconsin over the next two years. These agreements will increase the total amount of wind power generated in the state of Wisconsin from 53 MW today to 267 MW.

Green Power Programs

Cinergy Corp.'s Cinergy/PSI customers in the state of Indiana have the opportunity to contribute to the Green Power Fund. The fund collects money to be spent on purchasing or developing "green" power from sources such as "low-head"⁶ hydroelectric, wind, and solar photovoltaics. Cinergy/PSI works with the Citizens Action Coalition of Indiana to decide what types of investments the fund will make.

Wisconsin Energy gives consumers the choice of purchasing energy generated from renewable sources through its Energy for Tomorrow™ program. The energy mix for the program includes 17 percent wind, 75 percent landfill gas, and 8 percent low-impact hydro. Consumers can choose to participate in the program by selecting one of three premium payment levels on their monthly electric bills corresponding to 25 percent, 50 percent, or 100 percent of their electricity being generated by renewable resources. Between 1999 and 2002, an average of 10,586 residential and commercial customers enrolled in the program, purchasing 33,595 MWh of electricity annually.

Technological Developments for Cleaner Energy

ABB manufactures alternative energy and small-scale distributed power generation components and systems that complement existing power markets, including wind farms, fuel cells, and combined heat and power plants using miniature gas turbines. ABB is also developing a number of technologies for energy efficiency and clean energy, including a joint venture with **DuPont** to develop fuel cell systems.

Air Products and Chemicals is working with the DOE's Vision 21 Program and other business partners on the development of Ion Transport Membrane Oxygen technology. Many emerging energy-production technologies, environmental cleanup technologies, and industrial processes would be made more efficient by using oxygen in place of air.

Rio Tinto's energy product group invests in a number of commercial enterprises and collaborative programs to develop and commercialize new technologies aimed at improving the environmental performance of coal. This includes Pegasus Technologies, a company that uses neural networks to optimize the operation of coal-fired electricity generators, minimizing their fuel requirements and reducing the emission of major pollutants.

United Technologies' UTC Fuel Cells (UTCFC) subsidiary produces the world's only commercial fuel cell power plant. More than 255 of these 200 kW units have been sold to customers in 19 countries on five continents. Each unit can avoid up to 1,100 tons of CO₂ emissions annually. UTCFC is also developing fuel cells for commercial and transportation applications.

Cogeneration

AEP has constructed a 900 MW state-of-the-art natural gas cogeneration facility for Dow Chemical Company to provide energy and steam to its Plaquemine, LA site.

Air Products and Chemicals' larger hydrogen plants function as cogeneration facilities. Steam and power are often produced in addition to hydrogen and exported to a nearby user. The energy efficiency of these hydrogen plants is over 85 percent of what is theoretically achievable. A cogeneration unit was also installed to provide electricity, heating, and cooling at the Air Products Hershaw UK European headquarters, which reduced CO₂ emissions by 2,700 metric tons per year. Two Air Products European operations have contracted to purchase electric power from cogeneration units operated by customers, resulting in lower GHG emissions than would buying power off the public utility grid.

ABB has built approximately 1,500 small combined heat and power plants in Europe, reducing GHG emissions by 60 percent compared to coal-fired power plants and by about 30 percent compared to natural gas-fired plants.

Georgia-Pacific and **Weyerhaeuser** employ cogeneration in their integrated pulp and paper mills.

SC Johnson broke ground for its Landfill Gas Green Energies initiative in April 2003, installing a turbine that produces electricity and steam through cogeneration for its largest manufacturing plant, Waxdale, in southeastern Wisconsin.

Biomass Energy

AEP has been co-firing biomass at 4,000 MW of coal-based power generation in the United Kingdom (Fiddler's Ferry and Ferry Bridge) since 2002. AEP has begun testing of biomass co-firing at some smaller power plants in its U.S. service territory to evaluate potential reductions in CO₂ and GHG emission levels.

DuPont leads the Integrated Corn-Based Bioproducts Refinery (ICBR) project. As part of the ICBR, DuPont, the National Renewable Energy Laboratory, and other companies will develop the world's first integrated pilot-scale "biorefinery" that will make use of the entire corn plant—including the stalks, husks, and leaves—to make electricity, fuel-grade ethanol, and chemicals.

Georgia-Pacific self-generated 172,258 billion British thermal units (Btu) worth of energy at its manufacturing facilities in 2002 using on-site generated or purchased biomass fuels, providing for over 52 percent of the company's energy needs. In cooperation with the U.S. Environmental Protection Agency (EPA) and the U.S. DOE, Georgia-Pacific is applying gasifier technology to a full-scale commercial plant in Big Island, VA.

Interface Fabrics Group uses biomass from waste wood chips to supply over 40 percent of its non-electrical power needs.

Royal Dutch/Shell purchased an equity stake in Iogen Energy Corporation in 2002, a world-leading bioethanol technology company. The investment will enable the Canadian-based company to develop more rapidly the world's first commercial-scale biomass to ethanol plant. Iogen utilizes existing agricultural residues such as wheat, oat, and barley straw in its bioethanol process.

Weyerhaeuser pulp and paper mills supply more than two-thirds of their own energy needs through biomass fuels. Weyerhaeuser is also involved in the commercialization of gasification technology that significantly increases the amount of heat and electrical energy obtainable from biomass.

Wisconsin Energy Corporation purchases electrical capacity from three landfill gas⁷ facilities and two agricultural waste bio-gas digester facilities. In August 2003, Wisconsin Energy issued a request for proposals for up to 25 MW of electricity from biomass technologies such as agricultural manure, food processing waste, bio-waste, brewery residues, organic sludge, and crops grown specifically for energy production purposes. The intent is to encourage developers, farm operators, and other businesses to propose projects that could result in a contract to sell electricity to WEC beginning as early as 2004.

Renewable Energy Purchasing

Alcoa, DuPont, IBM, Interface Inc., and several other companies are partnering with World Resources Institute (WRI) to build markets for renewable energy. Convened in 2000, WRI's Green Power Market Development Group seeks to develop corporate markets for 1,000 MW of new, cost-competitive green power by 2010.

CH2M HILL purchases green tags from the Bonneville Environment Fund for its Portland, Oregon and Seattle offices. In addition, CH2M HILL's corporate headquarters campus in Denver is purchasing 100 blocks (each representing 100 kWh of electricity) of wind power per month from Excel Energy's Windsource program for a period of three years.

IBM met approximately 1.3 percent of its energy consumption needs with renewable energy sources including wind, solar photovoltaics, and biomass in 2002.

Intel buys about 14 million kWh of PGE Clean Wind power annually, enough to meet the needs of almost 1,300 average homes in the utility's service territory. Intel Corporation is Oregon's largest retail renewable power user and one of the largest in the West.

Interface, through its membership in the Green Power Market Development Group, recently purchased 4,614 MWh of green tags from wind and biomass resources for Interface Flooring Systems, Bentley Prince Street, and Interface Fabrics Group. Interface Flooring Systems is a charter partner in the U.S. EPA's Green Power Partnership, a voluntary program aimed at boosting the market for power alternatives that reduce the environmental and health risks of conventional electricity generation. Interface Fabric Group committed in March 2003 to purchase an additional 10 percent of renewable electricity beyond the percentage of renewable electricity it used in 2001.

Rio Tinto's Luzenac America subsidiary purchased green tags from the Bonneville Environmental Foundation to offset 100 percent of the GHG emissions associated with energy used at its Yellowstone Talc mine near Cameron, Montana.

Promoting Energy Efficiency

Companies are reducing energy use and GHG emissions by implementing energy conservation and efficiency measures and by providing energy-saving products.

Energy Conservation and Energy Efficiency

AEP is implementing energy efficiency plans to offset 10 percent of the annual energy demand growth in its Texas service territory. In 2003 alone, AEP invested over \$8 million to reduce more than 47 million kWh by installing energy efficiency measures in customers' homes and businesses. AEP plans to increase its level of investment in energy efficiency over the next three years. Total investment over that time period will exceed \$43 million, achieving over 247 million kWh of energy efficiency gains.

Air Products and Chemicals' efficiency engineers constantly monitor the performance of their major energy-intensive operations. In 2002, those engineers completed numerous global energy efficiency projects resulting in an estimated 26 MW of power savings; this is equivalent to the power consumed by 18,500 average homes annually and equivalent to avoiding 174,000 tons of CO₂ emissions. Air Products works closely with its energy suppliers to make the most efficient use of their generation facilities, which helps them minimize their GHG emissions. Air Products matches its energy needs to that of the energy supplier by shutting down production at times of peak demand and increasing production at other times. Such efforts contribute to "demand loading," a practice in which energy suppliers try to optimize the generational efficiency of a power plant by ensuring that it runs as close as possible to the point of maximum efficiency.

Alcoa has reduced the electricity required to produce a ton of aluminum by 7.5 percent over the last 20 years.

Baxter's corporate energy management group performs energy reviews of the company's manufacturing facilities, maintains energy use standards, and researches and communicates best practices in energy conservation. In 2002 alone, these efforts resulted in approximately \$4.3 million in reduced energy costs, and Baxter estimates that energy-efficiency initiatives between 1996 and 2002 resulted in \$28 million in annual savings in 2002. In 2002, Baxter achieved a 3 percent reduction in energy consumption per unit of production value while its output increased 7 percent. Baxter holds a bi-annual energy conference for energy managers of its 65 worldwide facilities to share the latest energy conservation technologies, and to recognize individuals and plants for their leadership and accomplishments in saving energy.

CH2M HILL conducted an inventory of energy consumption by over 100 office spaces that the company occupies as a tenant in the United States and Canada. The findings will be used to set energy conservation goals in 2004. The company's Denver-area employees moved into a new corporate campus, which was designed using the LEED™ green building system guidelines to reduce energy consumption by 24 percent compared to conventional commercial office buildings.⁸

Cummins Inc. has implemented energy conservation efforts in several of its facilities. Corporate headquarters and other major facilities have agreed to cut electricity consumption by 6 MW on peak demand days. Other facilities have installed air compressor controls and high-efficiency lighting, and have begun using hot water from engine testing to melt snow, reducing the need for electric resistance wiring.

DTE Energy works with customers to find ways to use energy wisely. DTE Energy Partnership has a staff of more than 40 energy engineers that work with businesses to increase efficiency.

DuPont used 9 percent less total energy in 2002 than it did in 1990, despite an almost 30 percent increase in production. Compared to a linear increase in energy with production, this achievement has resulted in \$2 billion in cumulative energy savings.

Entergy, under its commitment to stabilize its power plant CO₂ emissions, has implemented 44 internal GHG reduction programs as of December 2003 that will achieve a projected 1.2 million tons of CO₂e reduction by 2005. Several of these projects focus on using less fuel to generate electricity at power plants: two projects allow generating units to operate on less power when in standby mode, while two other projects are installing advanced controls to regulate the combustion processes in selected plant boilers. These projects are dedicated to improving the efficiency and capacity factor of Entergy's cleanest and lowest emitting fossil, nuclear, and renewable electric generating units.

Georgia-Pacific reduced the total energy use in all of its operations by nearly 3 percent between 2001 and 2002, reducing energy consumption from 331,900 billion Btu in 2001 to 326,300 billion Btu in 2002.

IBM achieved a 6.1 percent reduction in total conventional energy use through energy efficiency and conservation measures and through the procurement of renewables. This corresponds to an approximate reduction of 173,500 tons of CO₂ at a cost savings of \$17.3 million. During 1990 to 2002, IBM's energy conservation measures resulted in a savings of 12.8 billion kWh of electricity—avoiding approximately 7.8 million tons of CO₂ and saving the company \$729 million dollars in reduced energy costs.

Intel, working closely with ENERGY STAR®, implemented power management on 65,000 laptop displays and 45,000 desktop monitors worldwide. This initiative will save about 9,650,000 kWh over the next year, or enough electricity to light 11,000 U.S. homes for one month. At \$0.05 per kWh, Intel will realize an annual savings of \$482,000.

Interface's improved efficiencies and conservation efforts have reduced the total energy required to manufacture carpet per unit of production by 30 percent since 1996, and total energy required to manufacture a linear yard of fabric is down 18 percent since 1996.

PG&E Corporation's utility, Pacific Gas and Electric Company, reduced overall energy use in 2002 at 88 of its California facilities by almost 24 percent compared with 1998 baseline energy usage levels through energy efficiency and conservation. This resulted in savings of almost 28 gigawatt-hours of electricity, and prevented approximately 7,000 tons of CO₂ from being emitted to the atmosphere. Since 1990, Pacific Gas and Electric Company's customer energy efficiency programs have cumulatively saved more than 138 million MWh of electricity (cumulative 36 million to 80 million tons of CO₂ emissions avoided, depending on whether a base or peak load emission factor is used). Customer energy savings realized in 2002 were approximately 4.9 million MWh of electricity and 160 million therms of natural gas—enough to power approximately 740,000 homes for a year. The emissions avoided from these actions alone totaled approximately 2.8 million tons of CO₂.

Rio Tinto and the Australian Government announced the formation in 2002 of the Rio Tinto Foundation for a Sustainable Minerals Industry, a research and technical development partnership to jointly fund sustainable minerals industry programs, including projects related to energy efficiency and greenhouse gas sequestration.

Rohm and Haas's largest facility, in Deer Park, Texas, has maintained an aggressive energy management effort and continuously reduced its energy consumption each year since 1997. Energy consumption per pound of product at the site was 26.6 percent lower in 2003 than 1996, eliminating 76,700 tons per year of CO₂ and 1,200 tons per year of NO_x emissions. In 1999, the company began engaging its other production facilities in a parallel effort. In 2001 a corporate-wide metrics system was installed to track energy usage on a monthly basis, and a formal goal of year on year reductions (1 percent per pound of product) was implemented. Various efforts at the company's other facilities have included energy assessments, best practice implementation, and process improvements.

Royal Dutch/Shell is utilizing an in-house developed energy-efficiency program to support its 5-year energy-efficiency targets. The program, operated through Shell Global Solutions and known as Energise, helps facilities identify, implement, and sustain energy efficiency projects.

SC Johnson reduced volume and temperatures of aerosol water baths, which helped to reduce water bath energy use by 50 percent with no decrease in production quality at its Waxdale aerosol production facility.

Sunoco's energy consumption at refineries in 2002 on a per-barrel basis was 25.3 percent lower than in 1990. At its chemical plants, energy usage was 11.7 percent lower in 2002 than in 1990.

Toyota's 624,000 square-foot headquarters expansion in Torrance, CA includes buildings that are expected to exceed state energy-efficiency standards by 20 percent. The facility will also include a 500 kW photovoltaic system, and contractors are recycling more than 90 percent of the waste generated by the project. Toyota is pursuing LEED™ certification for the building.

United Technologies' energy efficiency program, covering more than 200 facilities and more than 30 countries, includes energy-efficient lighting, motors, and filters; co-generation; reduced water consumption; and implementation of energy management systems. Between 1999 and 2002, UTC reduced energy consumption by 27 percent and reduced water consumption by 34 percent, enabling a 15 percent reduction of GHG emissions. UTC's Otis Elevator's Breclav plant in the Czech Republic heating and lighting equipment retrofit and compressed air system improvements save more than 1 million kWh of electricity and 560,000 cubic meters of natural gas annually. UTC's Pratt & Whitney division is saving 3.5 million kWh of electricity per year through projects at its Middletown, Conn. jet engine assembly and test facility. United Technologies' Carrier now has 47,000 ComfortChoiceSM units in operation throughout the U.S. in partnership with local utilities, allowing customers to setback the temperature in participating homes and measure the effect of the setback on electricity demand. United Technologies' Sikorsky unit reduced energy demand by 1 percent at its main manufacturing plant in Stratford, Conn, by eliminating energy-intensive equipment in its rotor-painting process.

Weyerhaeuser practices minimum impact manufacturing (MIM), which helps reduce the amount of energy it uses to make its products. The MIM concept involves recycling and reuse, and maximizing the use of raw materials.

Wisconsin Energy Corporation's support of demand-side management programs has resulted in reductions of nearly 15 million tons of CO₂e emissions since 1995. From 2001 to 2002, Wisconsin Energy Corporation's low-income weatherization program saved an estimated 1,013,689 therms of natural gas, and in 2002 the company spent over \$38 million dollars in surcharges and direct payments on its low-income weatherization program and on Focus on Energy™ Program—a public-private partnership focused on providing consumers and commercial customers with information and technical assistance regarding energy management. Wisconsin Energy Corporation also sponsors load management programs utilizing financial incentives for residential, commercial, and industrial customers.

Energy-Saving Products

ABB provides drives, motors, generators, and power electronics designed for the greatest possible efficiency and uses life-cycle assessment studies to determine product environmental impacts, including energy use and CO₂ emissions.

Air Products and Chemicals and its partners were selected by the DOE Industries of the Future (IOF) Best Practices Program to demonstrate the potential for using CO₂ to manufacture polyurethane. In addition to using less energy, the new process will be cleaner, significantly reduce the environmental impact of making the foam, and reduce the net release of CO₂.

Alcoa supplies lightweight, recyclable materials for motor vehicle assembly; each kilogram of aluminum that replaces higher-density materials provides the potential to save 20 kilograms of CO₂e emissions via better fuel economy and recyclability. Alcoa produces high-efficiency turbine blades for the industrial turbine market in the electric power generation industry.

IBM sets targets for product efficiency for a wide range of products. One-hundred percent of new IBM personal computers, monitors, and printer office models introduced from 2001 through 2003 met the ENERGY STAR® criteria. Continued focus on reducing non-productive standby power (“off” mode for those products having power management) has resulted in AC adaptors offered with IBM's ThinkPads since 2001 having less than 1 watt in standby, with the majority having less than 0.6 watts.

Intel provides enabling technology for electronics manufacturers to build products that meet or exceed the ENERGY STAR® standard. For example, Intel's Instantly Available PC allows PCs to go to under 5 watts “sleep mode” with wake up in under 5 seconds. From 2002 to 2010, these savings will prevent 159 metric tons of CO₂ emissions.

Maytag and **Whirlpool** manufacture clothes washers, refrigerators, and dishwashers that qualify for the ENERGY STAR® label. Some of these appliances exceed U.S. energy efficiency standards by 30 to 50 percent.

Rohm and Haas's energy-saving products include its DURAPLUS™ roofing system, made with Rhoplex® Emulsion Polymers for reflective roof coatings that can be applied to rubberized roofs to increase the roofing material's life span while lowering the solar radiation to the roof; and SEA-NINE® 211, a biodegradable antifouling agent that prevents biological build-up on large ocean-going vessels, thereby reducing the ship's drag and energy consumption.

United Technologies' Carrier brand Evergreen VSS water-cooled chiller is 48 percent more energy efficient than comparable chillers that meet the industry standard. UTC's Gen 2 elevator system uses a machine that is only one-quarter the size of traditional technologies, eliminating the need for a separate machine room while providing superior reliability, energy efficiency, and advanced ride quality.

Process Improvements

Air Products and Chemicals, working with semiconductor manufacturers, helped to optimize chamber-cleaning processes resulting in perfluorocarbon (PFC)⁹ emission reductions of as much as 85 percent. As the world's leading supplier of hydrogen, Air Products is providing hydrogen to petroleum refiners to help them meet government mandates worldwide for producing low-sulfur, cleaner burning gasoline and diesel fuel.

Alcoa's 26 aluminum smelters reduced PFC-generating "anode effects" by 75 percent between 1990 and 2002, resulting in an annual savings of 12 million metric tons of CO₂e.

American Electric Power, Cinergy Corp., PG & E, and Wisconsin Energy Corporation are charter members of the U.S. EPA's Sulfur Hexafluoride (SF₆)⁹ Emissions Reduction Partnership for Electric Power Systems. **Wisconsin Energy** has committed to reducing SF₆ emissions to less than five percent of its equipment's nameplate capacity. By the end of 2002, Wisconsin Energy reduced annual emissions of SF₆ by nearly 95 percent, or to 2.3 percent of total capacity.

Baxter reduced its process-related GHG emissions by 99 percent between 1996 and 2002 by phasing out the use of high-GWP¹⁰ solvents. These process changes resulted in reductions of over 3 million metric tons of CO₂e.

Entergy has replaced electrical equipment containing SF₆.

Intel has deployed energy conservation solutions across the company by retrofitting boilers with more efficient Autoflame™ control technology. At Intel's New Mexico site, five boilers were successfully retrofitted at a cost of about \$250K. The return on investment realized was \$170,000 per year in natural gas fuel costs, \$50,000 per year in electrical energy savings, and \$40,000 per year in boiler maintenance costs. Similarly, where the new technology has been installed, there has been an average reduction of nitrous oxide (N₂O) and carbon monoxide (CO) emissions from the boilers of 32 percent and 92 percent respectively.

PG&E Corporation's Pacific Gas and Electric Company (PG&E) became a charter member of the U.S. EPA's Natural Gas Star Partnership in 1994, and its former subsidiary, National Energy and Gas Transmission (NEGT), joined the program in 2000. Through the systematic replacement of equipment and older pipelines, the company has adopted cost-effective technologies and best management practices to reduce methane losses. Efforts in this area continue to include focused inspections and maintenance at compressor stations, modifying system operations to reduce venting, and reducing frequency of engine restarts with gas. In 2002, the PG&E and NEGT undertook numerous activities that resulted in over 185,000 tons of methane avoided. These 2002 emissions avoided equate to over 4.2 million tons of CO₂e.

Rio Tinto reduced annual GHG emissions by 1.74 million tons compared to business as usual through projects undertaken with the Australian Government's Greenhouse Challenge, a program that helps industry identify opportunities to mitigate emissions.

Royal Dutch/Shell has ended the practice of continuous venting of gas at oil production facilities and has a target to end continuous operational flaring at such facilities by 2008.

Toyota reduced the energy required to produce a vehicle manufactured in its North American facilities by 7 percent in fiscal year 2002 through process improvements, such as reducing compressed air usage by improving system operating control, and the development of waste heat recovery systems in painting shops.

Waste Management Practices

Many companies achieve significant GHG emissions reductions through improved waste management. Emissions reductions from waste reduction and recycling programs result from decreased landfill gas production and reduction of energy required to extract and process raw materials. In some cases, waste gases or other waste materials from landfills or industrial processes can be collected and used to generate new energy, thereby displacing more carbon-intensive energy production.

Waste Reduction and Recycling

AEP has promoted the use of Coal Combustion Products (fly ash, bottom ash, boiler slag, and flue-gas desulfurization scrubber materials) since the early 1950's. In 2002 alone, AEP sold over 1.3 million tons of CCPs, utilized over 1.1 million tons for internal projects, and donated another 161,000 tons. In all, over 32 percent of CCPs were utilized, avoiding the use of substantial amounts of landfill space.

Air Products and Chemicals' Hometown, Pennsylvania plant received the Governor's award for Environmental Excellence for the second time in three years for reducing raw material usage, energy usage, and waste generation. Among the achievements were a 1.43 million kWh reduction in electricity usage, and 200,000 miles per year reduction in transport miles associated with raw material deliveries and waste transportation. Overall, Air Products has successfully reduced the amount of hazardous waste generated per pound of product by more than 50 percent and has reduced air emissions by 60 percent from chemicals facilities that the company has acquired since 1997.

Alcoa encourages aluminum recycling by sponsoring recycling programs, operating the Alcoa Recycling Company, supporting research on recycling and alloy separation, and purchasing large amounts of scrap. Aluminum produced from recycled metal requires only 5 percent of the energy required to produce the metal from bauxite ore. Alcoa sponsors life-cycle analyses of a number of products, including automotive components, beverage cans, aluminum wheels, and building components, to determine where processes and product designs could be improved.

Baxter reduced its generation of non-hazardous waste by 14 percent per unit of production value between 1996 and 2002 and recycled 47.3 million kilograms of waste in 2002 alone. Baxter also reduced the amount of packaging used per unit of production by 15 percent between 1995 and 2002, with a 3.7 percent reduction in 2002 alone (as compared to a 1995 baseline), a reduction of 1.8 million kilograms. Baxter's 2002 reduction alone has saved the company \$2.9 million dollars.

CH2M HILL surveyed its 100-plus U.S. and Canadian offices about sustainable office management practices. The 2003 survey results showed that 95 percent of offices are recycling white paper, and more than 86 percent are recycling aluminum cans and toner cartridges.

Cinergy Corp. has implemented an extensive program for the reuse of fly ash, a by-product of coal combustion. This significantly reduces the volume of materials that require land-filling and provides a substitute for more energy-intensive materials. Cinergy has implemented recycling programs in its offices (for paper) and generating plants (for metals).

Cummins' Inc. ReCon program facilitates the reuse and recycling of Cummins diesel and gasoline engines and components. Through the program, Cummins remanufactured 25,000 engines and over 1,000,000 diesel components in the year 2000. Each year, ReCon plants also generate approximately 3,000 tons of scrap metal for recycling each year. Through a voluntary recycling program, employees at Cummins' San Luis Potosi facility were able to save the equivalent of over 9,000 seven-year-old trees and over 2 million kWh of electricity.

Dupont's Carpet Reclamation Program, in its 10 years of operation, has recycled 70 million pounds of carpet for re-use in manufacturing products such as flooring tiles and automobile parts.

Entergy recycles over 70 percent of its power plant waste ash. The majority of the ash is utilized in the production of concrete. This reduces the volume of material sent to landfills and reduces the energy requirements and CO₂ emissions associated with the processing of materials traditionally used to produce concrete.

Georgia-Pacific used 68 percent of waste it generated in 2002 for a beneficial purpose. Georgia Pacific's North American facilities' formal waste reduction programs have avoided more than 8 million tons of waste since the program began. In 2002, Georgia-Pacific used 3.2 million tons of recovered paper to make its products and produced 1.5 million tons of 100 percent recycled content fiber for packaging and tissue products. In 2002, 16 percent of the total wallboard produced was reclaimed from a variety of sources including waste wallboard from construction sites, off-spec wallboard from production processes and byproducts of other industrial processes. In 2002, 5.1 tons of wood waste per thousand cubic feet of product manufactured were reused by Georgia Pacific's building products manufacturing facilities (including plywood, oriented strand board, and industrial wood product panels and lumber). This number is up from 3.9 tons in 2001.

Holcim is working within existing material specification standards to replace cement clinker with mineral components such as fly ash, a waste material from coal burning, and slag, a by-product of steel manufacturing. Each ton of clinker eliminated avoids 1 ton of CO₂ emissions that would have resulted from its manufacture. The company has eliminated 400,000 tons of CO₂ as a result of clinker-factor reductions and is working with government agencies to modify construction material specifications to encourage further use of lower clinker-factor cements in concrete.

IBM reduced its amount of total nonhazardous waste generated in 2002 by 7.8 percent compared to 2001. Of the waste generated in 2002, 78 percent was recycled. Hazardous waste generation indexed to output decreased by 14.2 percent in 2002, with a total quantity reduction of 28.5 percent. Over the past 5 years, IBM's total hazardous waste has decreased by 75.7 percent, and has decreased by 94 percent since 1987. In addition, IBM recycled approximately 78 percent of its non-hazardous waste and 54 percent of its hazardous waste in 2002.

Intel recycled 59 percent of its hazardous waste generated worldwide and 73 percent of its solid waste generated worldwide in 2003. Additionally, paper with 30 percent recycled content was purchased for all its U.S. copiers and printers.

Interface has reduced its carpet and textile solid waste sent to landfills by over 66 percent since 1996 through waste reduction programs and expanded recycling and reuse programs. Interface also uses post-consumer materials otherwise destined for landfills to manufacture its products (such as using soda bottles to manufacture Terratex® fabric).

SC Johnson has achieved more than a 90 percent recycling rate across its global operations since 1990. In 2003, SC Johnson reduced combined air emissions, water effluents, and solid wastes per kilogram of product produced by over 15 percent compared to its year-2000 baseline.

Toyota has reduced the amount of hazardous waste going to landfills from its plants by 40 percent since 2000 and its non-hazardous waste by 11 percent. In 2003, Toyota implemented a nationwide, web-based waste tracking system to better collect and analyze waste-related data to enable further reductions throughout Toyota's North American manufacturing and distribution operations. Toyota is also increasing the use of reusable packaging in shipments to distributors.

United Technologies reduced its domestic hazardous waste production by 41 percent between 1999 and 2002. The company set a goal in 1998 to reduce recycled waste by 35 percent and non-recycled waste by 60 percent by 2007.

Weyerhaeuser recycled more than 6.3 million tons of paper in 2002, enough to fill 126,000 rail cars. Typical recyclables include old corrugated containers, office wastepaper, old newspapers, and printing papers. More than 4 million tons of the recycled material Weyerhaeuser collects is used in its mills to make new paper. The rest is sold to customers around the world. Recycled fiber comprises about 40 percent of the content of new Weyerhaeuser paper, as averaged across all grades of paper produced by the company.

Wisconsin Energy Corporation utilizes fly ash, municipal wastewater, and paper mill sludge to produce a patented construction product, replacing fossil fuel generation and reducing the amount of solids placed in landfills. In 2002, the company beneficially used 96 percent of these combustion products, compared to a national average of 31.5 percent in 2001.

Waste-to-Energy

Air Products and Chemicals entered into an agreement with a neighboring company to provide the waste stream from one of its dimethylformamide plants for use as a fuel source for that company. This arrangement reduces the neighboring facility's energy demand and lowers the amount of CO₂-forming volatile organic compounds flared by the Air Products facility. The company also has numerous operations that recover hydrogen molecules and other waste gases from the industrial processes of other companies. Hydrogen recovery reduces the amount of natural gas that would otherwise be needed to produce hydrogen. At Air Products' Stockton, California cogeneration facility, scrap tires and petroleum coke are substituted for a portion of the coal used in energy production. Air Products also uses landfill gas to fuel a boiler at one of its operations in Cincinnati, Ohio.

Cinergy Corp's subsidiary company, United States Energy Bio-gas, recovers landfill gas and generates more than 60 MW of electricity from approximately 40 landfill gas recovery projects. In addition, Cinergy Corp. purchases recovered landfill gas from a large landfill in the Cincinnati, Ohio, area and uses the methane to help meet the supply needs of its natural gas customers.

DTE Biomass Energy operates 29 landfill gas recovery projects at sites across the United States. Methane recovered from these projects is converted into electricity, steam, or pipeline-quality gas. DTE Biomass landfill projects have captured the equivalent of more than 25 million metric tons of CO₂.

Entergy has funded a project in the eastern United States that will collect coal mine methane vented from abandoned mines and convert it to pipeline-quality gas or use it as fuel to generate electricity. The project will reduce GHG emissions by 400,000 metric tons of CO₂e through 2005.

Interface Flooring Systems has contracted with the City of LaGrange, Georgia to use methane gas from the local landfill to replace up to 20 percent of its natural gas usage at the LaGrange, Georgia manufacturing facility.

SC Johnson has refined technology to enable cleaner mixtures of landfill gas and natural gas to fuel boilers. This provides over a third of its Waxdale plant's steam energy needs. The company has also installed a 3.2 MW turbine and generator to burn waste methane gas that would otherwise be flared into the atmosphere. SC Johnson burns the methane gas instead of fossil fuels, such as natural gas or coal, to generate electricity and steam for the site's operations, providing about 50 percent of the facility's electricity and 20 percent of its process steam. Through this system, the company expects to reduce Waxdale's emissions of CO₂ and other GHGs by 47 percent and cut fossil fuel energy use nearly in half by 2005.

United Technologies' subsidiary UTCFC has designed fuel cell power plants fueled by methane from landfills and anaerobic digester gases from wastewater treatment facilities. These systems eliminate methane emissions and avoid burning fossil fuels. UTCFC operates these facilities in California, New York, Massachusetts, and Oregon, as well as in Germany and Japan.

Transportation

GHG emissions from the transportation sector represent approximately one third of U.S. total GHG emissions. Businesses are reducing emissions from this sector by developing cleaner, more efficient vehicles, using clean energy vehicles in their fleets, and moving people and goods more efficiently, thereby reducing fuel consumption.

Clean Energy Vehicle and Fuel Development

Air Products and Chemicals, BP, Shell, Toyota and **UTC** are providing hydrogen production, distribution, and vehicle expertise to collaborations of public, private, and government institutions, and are participating in numerous demonstration projects in North America and Europe on the development of hydrogen fuels, fueling systems, and vehicles.

Cummins Inc. joined the U.S. government and other industry partners in the Twenty-First Century Truck Initiative, with the goal of developing commercially viable truck and propulsion system technologies that will dramatically cut fuel use and emissions from medium and heavy-duty trucks and buses. Cummins sold over 2,000 compressed natural gas engines to the Beijing Public Transportation Corporation for the city bus fleet. These engines perform better than Euro II emissions standards. Cummins has partnered with **Lockheed Martin** Control Systems and Orion Bus to produce the diesel engine and soot filter for Lockheed's hybrid electric drive system for 125 Orion VII hybrid buses, to be purchased by the New York City Metropolitan Transit Authority.

Toyota is developing and producing clean energy vehicles, including hybrid, electric, compressed natural gas, and fuel cell electric vehicles. The Toyota Prius, a gas-electric hybrid, became available in the United States in June 2000. Through 2003, Toyota sold more than 59,000 hybrid Priuses in the United States.

Clean Energy Vehicle Fleets

Baxter has partnered with the University of Puerto Rico in Mayaguez in a pilot biodiesel project. A Baxter vehicle uses biodiesel produced by a system developed at the University. Baxter plans to expand its fleet of biodiesel vehicles in Puerto Rico.

Cinergy Corp. operates passenger vehicles, light trucks, and heavy trucks that utilize compressed natural gas or propane as an alternative to gasoline or diesel fuels.

PG&E Corporation began its Clean Air Transportation program in 1988 and currently has more than 650 natural gas vehicles in its fleet.

Wisconsin Energy Corporation has 120 natural gas vehicles in its fleet, representing approximately 8 percent of the company's total fleet. In addition, Wisconsin Energy has worked with other businesses to place over 700 natural gas vehicles in service and has been instrumental in siting 14 public-access and six private compressed natural gas stations.

Hydrogen in Transportation

Air Products and Chemicals develops hydrogen infrastructure and fuel-handling technologies to enable the commercialization of hydrogen as an energy carrier and is working with the private and public sectors to develop a market for hydrogen fuel.

Boeing is involved in a demonstration project aimed at exploring the use of fuel cell technology for future aerospace applications. The project will evaluate the potential application of fuel cell technology to future commercial airplane products. As part of the evaluation, the project will develop and demonstrate the use of fuel cells in auxiliary power units.

BP, Air Products, Royal Dutch/Shell's Shell Hydrogen, Toyota, and United Technologies' UTCFC subsidiary are part of the California Fuel Cell Partnership, a unique collaboration of auto manufacturers, energy companies, fuel cell companies, and government agencies. The partnership's goal is to advance and evaluate new automobile technology that can move the world toward practical and affordable environmental solutions. The organization was formed in April 1999 and placed over 40 fuel cell vehicles—cars and buses—on the road between 2000 and 2003. In addition to

facilitating the placement of up to 300 vehicles in fleet demonstrations between 2004 and 2007, partnership members will build demonstration hydrogen fuel stations, act to facilitate a path towards commercialization of hydrogen, and enhance public awareness and support.

Rio Tinto subsidiary US Borax is participating with Millenium Cell in the further development and possible commercialization of a process that generates pure hydrogen or electricity from environmentally friendly raw materials such as borates. In the Hydrogen on Demand™ process, the energy potential of hydrogen is carried in the chemical bonds of sodium borohydride, which in the presence of a catalyst either releases hydrogen or produces electricity.

Royal Dutch/Shell's Shell Hydrogen was established in early 1999 to pursue and develop global business opportunities related to hydrogen and fuel cells. Shell Hydrogen is involved, through Icelandic New England Ltd, in a pioneering project that may bring about a complete transition to a hydrogen economy in the coming decades in Iceland.

United Technologies' UTCFC subsidiary is developing quiet, highly efficient PEM¹¹ fuel cells for automotive and fleet vehicle applications. UTCFC is currently working with major automobile manufacturers on development and demonstration programs for automobiles, and has participated in demonstrating fuel cell technology in buses and cars.

Transportation Efficiency

Air Products and Chemicals' distribution fleet is over 50 percent more fuel-efficient than it was three decades ago. Air Products uses sophisticated logistics scheduling software to maximize the amount of product hauled in each load and determine the optimal delivery routes to customers. Air Products fleet managers have recently set new internal miles per gallon targets to increase fleet efficiency using best practices for driving and maintaining vehicles.

Baxter encourages corporate facilities to establish and offer ride-sharing programs to conserve the amount of fuel employees use to travel to work. Baxter estimates and reports energy-related GHG emissions associated with employee commuting and employee use of commercial airlines.

Boeing will launch production of its new 7E7 aircraft in 2004. The 7E7 will be lighter due to the use of composite materials (instead of metals) and will use 20 percent less fuel than other models.

CH2M HILL supports local commuter trip reduction programs by partially subsidizing the cost of annual transit passes and enabling full-time teleworking for employees whose jobs permit. The Denver office initiated a web-based commuting tool to help employees avoid congestion resulting from a major transportation construction project, to connect people to carpools, and to provide local transit information and traffic updates. Some local offices include hybrid gas-electric vehicles in their fleets or subscribe to FlexCar programs.

Interface addresses transportation impacts by reducing packaging materials, manufacturing its products closer to the customer, and transporting information rather than matter using electronic and on-line communication. Interface is a charter partner in the EPA's SmartWay Transport voluntary partnership. SmartWay focuses on reducing pollution and GHG emissions from ground freight carriers. Interface has partnered with Business for Social Responsibility's Green Freight Group. Interface has launched its own Transportation Working Group composed of representatives from all of its business units. The company is working to determine and reduce its transportation footprint, including setting a baseline year, developing metrics to monitor future performance, and collecting and sharing best practices between business units.

SC Johnson offers a Van Pool program to employees who commute everyday from Milwaukee or Chicago to its global headquarters in Racine, Wisconsin.

Wisconsin Energy Corporation sponsors commuter choice programs, including car pool and bus pass reimbursement, for employees at its downtown Milwaukee headquarters. More than 300 of the 1,500 employees who work in the headquarters participate in these programs.

Carbon Sequestration

Carbon sequestration is the long-term storage of carbon in forests, soils, geological formations, and other carbon "sinks." Some businesses are working to enhance carbon sinks such as forests and soils to offset their GHG emissions. Others are developing technologies to capture CO₂ exhaust from industrial processes or to sequester carbon in the ocean or underground, in depleted oil and gas reservoirs, coal seams, and saline aquifers, rather than releasing it to the atmosphere.

Managing Forests and Agricultural Lands for Carbon Sequestration

ABB, Alcoa, American Electric Power, Baxter, BP, DTE Energy, Entergy, Interface Inc., and Wisconsin Energy Corporation are participating in forest conservation and reforestation projects. By replanting degraded areas, or by protecting land that would otherwise be logged, these companies are helping to sequester millions of tons of carbon.

AEP, under DOE's Climate Challenge Tree Planting Project, has planted 21,914 acres with nearly 19 million mixed hardwood and conifer trees at a cost of approximately \$5.7 million. Projected CO₂ sequestration is 4.7 million metric tons over the term of the project. In a separate initiative in Louisiana, AEP has planted 9,784 acres with nearly 3 million bottomland hardwood trees at a cost of \$6.25 million. Projected carbon sequestration is over 4.4 million metric tons.

AEP, Cinergy, DTE Energy and Entergy are founding members of PowerTree Carbon Company, LLC, a voluntary carbon sequestration initiative. PowerTree, which has 25 member companies, will invest \$3.4 million for reforestation of over 3,800 acres of bottomland hardwood projects in Arkansas, Mississippi, and Louisiana. The project will sequester over 2 million tons of CO₂ over the 100-year project term.

BP is contributing to the development of a Blue Chip Standard, as part of the Climate and Biodiversity Alliance, for demonstrating the contribution of forestry projects to the goal of atmospheric greenhouse gas stabilization. This standard will support the creation of carbon sequestration credits that are generally recognized and therefore tradable.

Cinergy Corp. has developed partnerships with various conservancy groups, such as the Nature Conservancy, Ducks Unlimited, and the National Wild Turkey Federation, to plant trees to restore lowland wetlands and riparian zones along rivers and streams, and to reforest marginal agricultural lands.

Entergy in partnership with Trust for Public Land and the U.S. Fish and Wildlife Service (USFWS), is acquiring 1,600 acres of land adjacent to the Tensas River Wildlife Refuge, restoring bottom land hardwood habitat on marginal croplands and donating the improved land to USFWS who will manage the property. This will sequester 640,000 tons of CO₂ over the next 70 years. Entergy in partnership with the Conservation Fund, USFWS and Friends of the Red River, dedicated the Red River Wildlife Refuge in Natchitoches, Louisiana, and established a 600 acre sequestration site that will create 225,000 tons of CO₂ offset credits over the next 70 years. Entergy has leased 30,000 tons of CO₂ offset credits from the Pacific Northwest Direct Seed Association (PNDSA). Credits are generated by growers who have agreed to use direct seed agriculture methods for at least 10 years. Direct seed cultivation avoids soil losses from oxidation associated with traditional farming techniques and also reduces the growers' fuel use and soil erosion. Entergy has funded Winrock International and the Central Arkansas Resource Conservation Council to acquire easements from eligible landowners in the Arkansas delta. The funding will be used to convert 500 acres of marginal cropland to bottomland hardwood forest over the next two years. Within 80 years, the planted trees are projected to sequester over 200,000 tons of CO₂.

Georgia-Pacific practices sustainable forest management that results in a large and stable pool of sequestered carbon.

John Hancock Financial Services, via its subsidiary Hancock Natural Resource Group, has established the New Forests Program to design and implement investment programs that will establish and manage forests for carbon sinks and other environmental benefits. At present the program manages approximately 207,000 acres on behalf of institutional clients.

SC Johnson, in partnership with the Nature Conservancy, has made a major commitment to help protect the Caatinga, an important bioregion in northeastern Brazil. The project allows for the protection of two sites totaling more than 18,000 acres in the state of Ceara and for the establishment of a local conservation organization to manage the reserves.

Weyerhaeuser manages 43 million acres of forests worldwide. The company uses intensive silvicultural practices on the highly productive forests it owns to achieve the natural biological potential. In other areas it uses less intensive practices to emulate natural forest structure. In both cases, these sustainably managed forests sequester large pools of carbon. Weyerhaeuser invests in afforestation ventures in South America to sustainably sequester additional tons of CO₂. The company uses recycled fibers in products to extend the time that the CO₂ removed from the atmosphere during the tree-growing stage is stored in products.

Wisconsin Energy Corporation, AEP, Cinergy, DTE, and Entergy, are participating members of the UtiliTree Carbon Company. UtiliTree is a consortium of 41 utilities organized by the Edison Electric Institute to invest in a portfolio of forestry projects that manage GHG emissions, particularly CO₂. A \$3.2 million investment in eight domestic and two international projects will capture over 3 million tons of CO₂ over the life of these projects.

Developing Technology for CO₂ Capture and Storage

ABB built the world's first commercial CO₂ capture facility at its Shady Point, Oklahoma coal-fired power plant. It captures 200 tons of CO₂ a day from the plant's flue gas, which is purified, liquefied, and sold to the food products industry. ABB, in conjunction with international partners, is also studying the possibility of storing CO₂ in the ocean floor.

ABB, BP, Royal Dutch/Shell, and Wisconsin Energy Corp. are also engaged in research and development activities in CO₂ capture technology and geological sequestration.

AEP and **BP** are working with the MIT Energy Laboratory as part of a consortium researching the environmental impacts, technological approaches, and economic issues associated with carbon

sequestration. The MIT research focuses on efforts to better understand and reduce the cost of carbon separation and sequestration.

AEP's Mountaineer Plant is the site for a \$4.2 million carbon sequestration research project funded by the U.S. DOE and a consortium of public and private sector participants. Scientists from Battelle Memorial Institute lead this climate change mitigation research project, which will also involve researchers from several other organizations and universities. This project is obtaining the data required to better understand the capability of deep saline aquifers for storage of carbon dioxide emissions from power plants.

AEP and Kennecott Energy Company (a **Rio Tinto** subsidiary) are members of a consortium that is proposing to enter into an agreement with the U.S. DOE on FutureGen. FutureGen is a \$1 billion project that may lead to the world's first nearly emission-free hydrogen and electricity production plant from coal, while capturing and disposing of CO₂ in geologic formations.

BP and **Royal Dutch/Shell** are members of the CO₂ Capture Research Project (CCP), an international effort by seven of the world's leading energy companies. BP is learning from its CO₂ geologic storage facility in Algeria, where it will be storing around one million tons of CO₂ a year beginning in 2004. In addition, **Air Products and Chemicals** is a technology developer and provider for the CO₂ Capture Project.

Entergy became the first U.S. utility to purchase carbon emissions credits from geological sequestration projects. These projects will capture CO₂ vent gases, place them into oil-bearing geologic formations, and result in enhanced domestic oil recovery. Entergy purchased 100,000 tons of CO₂ emission reduction credits in 2004.

Rio Tinto is participating in a study of carbon fixation in photosynthetic organisms. Enhanced bio-fixation of carbon dioxide is a promising potential route to developing new chemical and biological processes of carbon dioxide sequestration. In partnership with Maxygen, a leader in this field, Rio Tinto is accelerating its research program in this area. The results of the study may be applied to carbon capture technology.

Wisconsin Energy Corporation funds the Electric Power Research Institute to assess the potential of existing options for capturing and sequestering CO₂ emissions, evaluate methods for CO₂ capture and sequestration at the point of electricity generation, and investigate enhanced terrestrial or oceanic processes that remove and store atmospheric CO₂.

Emissions Trading and Offsets

A number of companies, anticipating the establishment of domestic and international GHG emissions trading systems, are investing in a variety of emissions trading activities. Although the United States has withdrawn from the Kyoto Protocol, U.S.-based companies whose overseas operations will be subject to emissions limits, or whose domestic operations will be subject to state or regional limits, are likely to participate in emissions trading.

Trading activities undertaken by companies include the transfer of verified emissions reductions to or from other companies, collaboration with developing country partners in projects that generate emissions credits, participation in the development of voluntary trading systems, and participation in state-level programs. In some cases, these activities were undertaken in part to explore or demonstrate the feasibility of Joint Implementation (JI) and the Clean Development Mechanism (CDM), two of the trading mechanisms established under the Kyoto Protocol.

Emissions Trading

AEP, **Baxter**, and **DuPont** are founding and active members of the Chicago Climate Exchange (CCX)SM. These companies made legally binding commitments to reduce their GHG emissions by four percent below the average of their 1998 to 2001 baseline by 2006.

BP operated an internal emissions trading system between 1999 and 2001 that helped reduce operational GHG emissions by 10 percent. BP's UK Upstream and Petrochemicals assets are now part of the UK Government's emissions trading scheme (ETS). BP carried out the first trades in the UK ETS and has also helped customers trade in the market. BP is currently applying the evolving CDM rules and procedures to a BP solar project in Brazil, with the intention of registering the project with the CDM Executive Board. BP is currently piloting CDM projects for a range of technologies.

Cinergy Corp., working through its subsidiary company United States Energy Bio-gas, has completed the trading of carbon-equivalent offsets with a Canadian company.

DuPont has been active in working with others to pilot emissions trading systems and has completed small trades in both Canada and the United Kingdom. In the winter of 2002, Dupont donated 120,000 tons of CO₂e emissions credits to the Salt Lake City Organizing Committee. This helped the Winter Olympics to offset its emissions and be declared "climate neutral."

Entergy and Elsam, the largest Danish electricity supplier, executed the first international trade in CO₂ allowances under the Danish climate change program. Under the transaction, Entergy

purchased 10,000 Danish allowances from Elsam and will remove the allowances from the market, eliminating 10,000 metric tons of CO₂ emissions.

Ontario Power Generation (OPG) and US Gen New England (US Gen) successfully completed a GHG emissions trade in April 2000. US Gen sold OPG 1 million metric tons of CO₂e reductions generated by capturing and destroying methane that would otherwise be emitted from the Johnston Landfill in Rhode Island from 1998 to 2000. OPG has committed to have all of its emissions reduction purchases verified by the Ontario, Canada Pilot Emissions Trading Project and report them to Canada's Climate Change Voluntary Challenge and Registry Inc., where they are transferred and retired.

Royal Dutch/Shell Group developed and used a pilot internal emissions trading system (STEPS) to gain experience and understanding in the use of and structure for emissions trading. The system, which ran from 2000 to 2002, allowed trading between a number of Group entities located in Annex 1 countries.¹² The system covered over 33 million metric tons of CO₂e from over 22 separate sites, accounting for almost two-thirds of Shell's developed country emissions or over one-third of its global emissions. Shell has shifted emphasis from internal mechanisms to real external instruments and has established an Environmental Products Trading Business (EPTB). The Shell Group has entered the UK Emissions Trading System, and as a result, key Shell UK upstream production facilities now have a GHG emissions cap. Shell Trading, with Nuon, executed the first trade in EU CO₂ allowances in February 2003. The EPTB is also actively developing a CDM business for the Group.

Offsets

ABB participates in an Activities Implemented Jointly (AIJ)¹³ reforestation and forest conservation project in Costa Rica that will sequester an estimated net 230,800 metric tons of carbon over its 25-year lifetime. ABB funds and manages the China Energy Technology Program, a two-year project evaluating the costs and environmental impacts of various technological options to provide sustainable electricity generation in the Shandong Province of China. ABB has built power plants in Costa Rica through a mutually beneficial climate improvement project as part of a Norwegian consortium. The project could avoid an estimated 4 million tons of CO₂ emissions over a 20-year period. These avoided emissions could potentially be used to comply with emissions constraints in other countries.

American Electric Power and **BP** are part of a collaborative GHG mitigation pilot project with the Government of Bolivia, the Nature Conservancy, and the Bolivian Friends of Nature Foundation.

The Noel Kempff Mercado Climate Action Project will protect nearly 4 million acres of threatened forest and offset 5 to 7 million tons of carbon over the next 30 years.

AEP is a partner in the Guaraqueçaba Climate Action Project, which seeks to restore and protect nearly 20,000 acres of partially degraded or deforested land in the tropical rainforest of Brazil. The project is expected to offset approximately 1 million metric tons of carbon over the next 40 years.

AEP and **Ontario Power Generation** are part of the e7, a consortium of nine of the world's leading electric companies from G7 countries. e7 promotes sustainable energy projects through a “learn by doing” approach on electricity-related issues in developing countries with host countries, UN agencies, NGOs, and local energy providers. e7 also works to develop human capacity building—an example being its Micro-Solar Distance Learning Program, which focuses on electrification for information and telecommunications needs using photovoltaics. **AEP** serves as the U.S. delegate to the e7 and has undertaken the project leadership for an e7 effort to install wind turbines on environmentally sensitive San Cristobal Island in the Galapagos. This project may be eligible for certification under the CDM.

AEP has led the creation of Global 3E, a charitable organization designed to attract \$60 million in private contributions from the philanthropic sector in two years. Global 3E will provide zero interest loans for electricity-related humanitarian projects in developing nations.

Cinergy Corp., **DTE Energy**, and **Wisconsin Energy Corporation** are partners in the Rio Bravo Carbon Sequestration Project to protect 65,000 acres of endangered rainforest in Belize. The project combines land acquisition and sustainable forestry and is expected to sequester approximately 2.4 million metric tons of carbon over 40 years. Cinergy, the Nature Conservancy, and the Belize Government entered into an agreement to transfer the carbon offsets from the project to Cinergy Corp. The agreement was reviewed and approved by the U.S. Initiative on Joint Implementation (USIJI).

Interface's Cool Carpet™ option allows customers to purchase products from Interface Flooring Systems and Bentley Prince Street with a net-zero climate impact. All of the GHG emissions associated with modular or broadloom carpet during its entire life cycle are offset through the acquisition of certified emission reductions. The credits carry the Climate Neutral Network's “Climate Cool” certification. Additionally, Interface has sponsored the planting of over 37,000 trees since 1997 to offset CO₂ emissions resulting from air travel by its associates through its Trees for Travel program. The Interface Cool Fuel™ program enables the company to use corporate gas purchase rebates to offset the CO₂ emissions from business-related auto travel in company vehicles.

John Hancock Financial Services, via its subsidiary Hancock Natural Resource Group, has worked with the California Climate Action Registry to determine how to account for forestry offsets.

Whirlpool, in cooperation with government agencies, utilities, NGOs, and manufacturers, has a program to encourage the early retirement of inefficient appliances in Brazil. This program can potentially avoid more than 3 million tons of CO₂ emissions each year.

Wisconsin Energy Corporation participates in a project that involves fuel-switching (coal to natural gas), cogeneration, and efficiency improvements to a power plant in the city of Decin, Czech Republic. This project has improved local air quality, reduced GHG and other emissions, and provided educational opportunities and experience for other communities interested in improving air quality.

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- ¹ See “Legislation in the 108th Congress Related to Global Climate Change,” at http://www.pewclimate.org/policy_center/congressional/.
- ² See *The U.S. Domestic Response to Climate Change: Key Elements of a Prospective Program*, In Brief Number 1, Pew Center on Global Climate Change, Arlington, VA.
- ³ See Smith, Douglas W., Robert R. Nordhaus, and Thomas C. Roberts. *Designing a Climate-Friendly Energy Policy: Options for the Near Term*, Pew Center on Global Climate Change, Arlington, VA, July 2002.
- ⁴ Carbon dioxide equivalents (CO₂e) is a measure of GHG emissions that is weighted by the global warming potential (GWP), the warming impact of a gas over a given period, as compared to the GWP of carbon dioxide.
- ⁵ These cars are zero-emission in terms of criteria air pollutants, but not necessarily in terms of greenhouse gases.
- ⁶ “Low-head” hydro refers to river areas that have little or no pooling.
- ⁷ Landfill gas is mostly methane, a greenhouse gas.
- ⁸ LEED™ (Leadership in Energy and Environmental Design) is a voluntary national standard for rating “green” buildings, sponsored by the U.S. Green Building Council.
- ⁹ Perfluorocarbons and Sulfur Hexafluoride are two of five non-CO₂ greenhouse gases that in total contribute an estimated 17 percent of total GHG emissions in the U.S. For more information, see Reilly, Jacoby and Prinn, *Multi-Gas Contributors to Global Climate Change: Climate Impacts and Mitigation Costs of Non-CO₂ Gases*, Pew Center on Global Climate Change, Arlington, VA. February 2003.
- ¹⁰ Global Warming Potential
- ¹¹ Proton Exchange Membrane
- ¹² 36 industrialized countries, including countries with economies “in transition,” listed in Annex 1 of the United Nations Framework Convention on Climate Change.
- ¹³ Activities under the UNFCCC whereby parties implement voluntary GHG-reducing or offsetting projects on a pilot basis. Parties do not receive credits for implementing these projects; rather the idea behind these projects is to facilitate learning.

Notes

Related Pew Materials:

- Greenhouse and Statehouse: The Emerging State Government Role in Climate Change (November 2002)
- Reducing Greenhouse Gas Emissions from U.S. Transportation (May 2003)
- The Emerging International Greenhouse Gas Market (March 2002)
- Corporate Greenhouse Gas Reduction Targets (November 2001)
- Designing a Mandatory Greenhouse Gas Reduction Program for the U.S. (May 2003)
- Pew Center Policy Brief: “The U.S. Domestic Response to Climate Change: Key Elements of a Prospective Program” (August 2001)
- What Congress Is Doing About Global Warming
(www.pewclimate.org/what_s_being_done/in_the_congress/index.cfm)
- What States Are Doing About Global Warming
(www.pewclimate.org/what_s_being_done/in_the_states/)
- What the Business Community Is Doing About Global Warming
(www.pewclimate.org/what_s_being_done/in_the_business_community)

Requests for materials should be directed to our website, www.pewclimate.org/orderreport.cfm.

The Pew Center on Global Climate Change is a non-profit, non-partisan, independent organization dedicated to providing credible information, straight answers, and innovative solutions in the effort to address global climate change.

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