Business Roundtable

RESOLVE To Improve Energy Efficiency in Office Buildings

Business Roundtable's Guide to Everyday Actions that Address Climate Change

CLIMATE RESOLVE

Responsible Environmental Steps
Opportunities to Lead by Voluntary Efforts

Business Roundtable

Business Roundtable (www.businessroundtable.org) is an association of chief executive officers of leading corporations with a combined workforce of more than 10 million employees in the United States and $4 trillion in annual revenues. The chief executives are committed to advocating public policies that foster vigorous economic growth and a dynamic global economy.

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September 2004

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Foreword

Business Roundtable developed this guide as part of its Climate RESOLVE (**R**esponsible **E**nvironmental **S**teps, **O**pportunities to **L**ead by **V**oluntary **E**fforts) initiative to help companies in the service sectors of the economy devise strategies and specific actions for addressing greenhouse gas (GHG) emissions and the risk of climate change.

Climate RESOLVE, which was launched in early 2003, is a unique multisector CEO-led initiative to promote enhanced voluntary action to manage GHG emissions. It is helping to meet the challenge of climate change by mobilizing the resources and expertise of Business Roundtable's diverse membership, which represents $4 trillion in annual revenues and more than 10 million U.S. employees. Climate RESOLVE is the vehicle through which Business Roundtable participates in the federal government's voluntary public-private partnership to reduce GHG emissions from economic sectors, known as Climate VISION (**V**oluntary **I**nnovative **S**ector **I**nitiatives: **O**pportunities **N**ow).

Because an individual company's GHG emissions represent only a small fraction of emissions worldwide, meaningful progress will require the collective actions of every company and every industry segment. This guide is targeted at one particular sector — the large number of service providers that conduct their business in commercial buildings, such as offices, stores, hotels or data-processing centers. These companies include banks, investment managers, insurers, advertising agencies, publishing houses, software developers, telecommunication service providers, retailers and real estate management companies.

Many service providers may believe that they do not contribute to GHG emissions because they do not produce manufactured items, raw materials or power. But companies do not need to have a smokestack to have an impact on GHG emissions. For example, service businesses are important consumers of electricity, natural gas, oil and other forms of energy, the production and use of which are one of the largest sources of GHG emissions.

In the new business environment, companies increasingly are sensitive to the importance of energy efficiency and are taking practical steps to reduce energy consumption in offices and other commercial buildings. While these steps may seem small in themselves, they can add up to millions of tons in GHG reductions if implemented by businesses across the economy. As numerous leading companies have discovered, energy-efficiency measures also make good business sense because reducing energy costs and improving productivity can contribute substantially to a company's bottom line.

This guide:

- Introduces service companies to basic scientific facts about climate change.
- Explains the role of energy use in commercial buildings in driving demand for electricity and other forms of power that produce GHG emissions.
- Outlines the business case for reducing GHG emissions by making energy-efficiency investments.
- Describes the elements of successful energy management programs for commercial buildings and provides examples of actions being taken by leading companies.
- Identifies practical, cost-effective options that successful companies are using to improve energy efficiency.
- Highlights other GHG management strategies that service companies can adopt, including publicizing and reporting successful efforts to improve their GHG footprints.

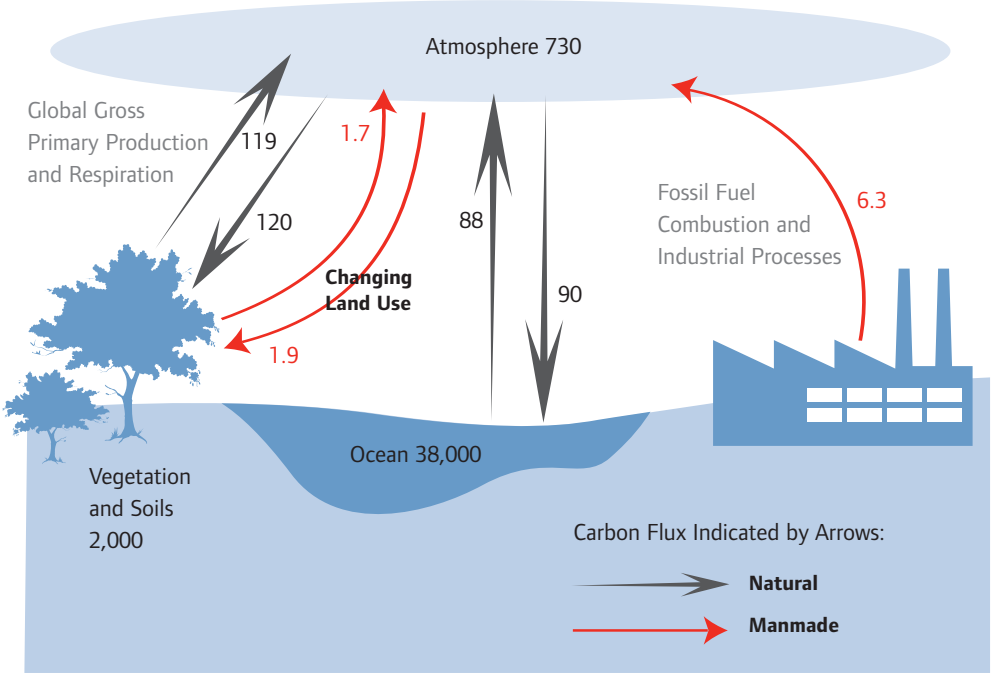
Business Roundtable, with the assistance of the Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE), created a Web-based tool to further assist businesses in improving energy efficiency. The tool provides a step-by-step approach to building an energy-efficiency program using the framework and resources developed by the EPA and DOE for their successful and widely praised ENERGY STAR initiative. It offers strategic support for companies just getting started as well as those seeking to obtain larger energy savings from existing programs.

In developing this guide and tool, Business Roundtable has drawn liberally on the many excellent resources that have been developed on climate change and commercial buildings by government agencies, such as EPA and DOE, and nonprofit organizations, such as the World Resources Institute. Numerous studies and brochures have been issued by these and other organizations that are useful in designing and constructing successful GHG management programs. Throughout the guide, additional resources are cited for further information.

What Is Climate Change?

Climate change is an issue of growing importance to government officials, scientists and the public. The Earth's temperature averages a livable 57°F because of the "greenhouse effect" created by certain gases, known as "greenhouse gases" (GHGs). GHGs absorb infrared radiation leaving the surface of the Earth and trap this radiation in the atmosphere, where it is reflected back to the Earth's surface. Without the presence of these naturally occurring GHGs, which include water vapor, carbon dioxide and methane, the average Earth temperature would be a frigid -2°F.

Emissions of Natural and Manmade Carbon Contribute to the Greenhouse Effect
(Billion Metric Tons of Carbon)



Source: Intergovernmental Panel on Climate Change. *Climate Change 2001: The Scientific Basis* (U.K., 2001).

Since the dawn of the industrial age, human activities have resulted in the formation of certain GHGs in the atmosphere, increasing their concentrations above naturally occurring levels. As GHGs accumulate in the atmosphere, the amount of infrared radiation that is trapped increases as well. This additional greenhouse effect can increase the net absorption of energy by the Earth, creating the potential for temperatures to rise.

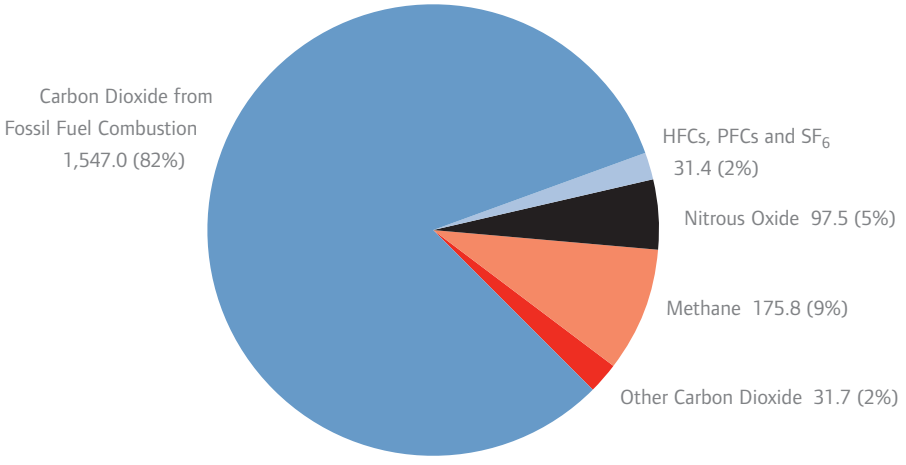
SIX MANMADE GREENHOUSE GASES

Carbon Dioxide	CO_2
Methane	CH_4
Nitrous Oxide	N_2O
Hydrofluorocarbons	HFCs
Perfluorocarbons	PFCs
Sulphur Hexafluoride	SF_6

Although the greenhouse effect is well understood by scientists, there are still major gaps in our ability to assess how GHG buildup in the atmosphere affects the magnitude, timing and regional distribution of climate change. Consequently, it is not possible to predict future climate change accurately. Nor is it possible to predict accurately the impact of changes in the Earth's climate on our economy and society. Similarly, the Earth's climate varies as a result of natural forces, and there is much to be learned about the causes and extent of this variability and how it interacts with climate change stemming from human activities.

A range of human activities result in GHG emissions. A major source of manmade emissions is combustion of fossil fuels, which causes CO_2 to be released into the atmosphere from power plants, vehicle tailpipes and various manufacturing operations.

Carbon Dioxide Is the Largest Source of Greenhouse Gas Emissions
(Million Metric Tons of Carbon Equivalent)



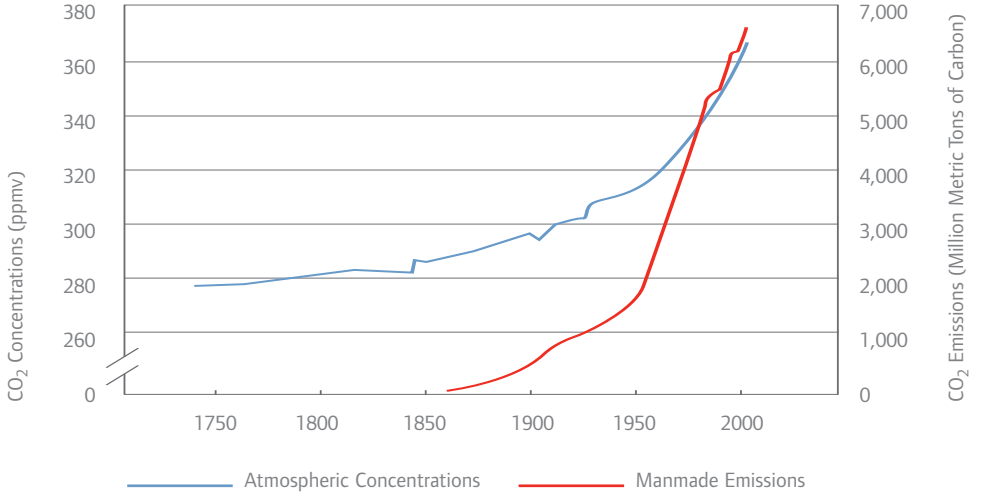
Source: Energy Information Administration. *Emissions of Greenhouse Gases in the United States 2001* (Washington, DC, 2002).

Despite great improvements in energy efficiency as technology has advanced, combustion of fossil fuels has increased steadily over the last century due to growing industrialization, increased demand for power and greater dependence on vehicles for transportation. As a result, manmade GHG emissions have grown substantially, reaching a net 6.1 billion metric tons a year of CO_2 (measured in carbon equivalent tons). While natural processes remove some of these GHGs from the atmosphere, the Energy Information Administration has projected that an estimated 3.2 billion metric tons of carbon are added annually.[1]

[1] *Greenhouse Gases, Climate Change, and Energy.* Energy Information Administration, www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html.

CO_2 accounts for approximately 85 percent of U.S. GHG emissions. As emissions of CO_2 have grown, its concentrations in the atmosphere have risen by 32 percent over preindustrial levels. Yet, even if emissions decline, CO_2 concentrations will continue to rise because the amount of GHGs emitted will exceed the amount removed from the atmosphere and because CO_2 and other GHGs persist in the atmosphere for a long time.

Concentrations of Carbon Dioxide in the Atmosphere Are Rising as Emissions Increase



Source: Oak Ridge National Laboratory. Carbon Dioxide Information Analysis Center, cdiac.esd.ornl.gov.

Despite this buildup, it remains uncertain whether observed changes in the Earth's climate are the result of natural climate variability or the greenhouse effect associated with man-made emissions.

Why Should Service-Sector Companies Be Concerned about Greenhouse Gas Emissions?

Some corporate managers may believe that only factories, automobiles or power plants emit GHGs. However, businesses engaged in industries such as financial services, retailing or communications also have responsibility for reducing emissions.

While the industrial sector *is* the largest source of GHG emissions in the United States, commercial buildings are substantial consumers of energy. Most of this energy is produced by burning fossil fuels, such as coal, natural gas or petroleum, which release CO_2. Consequently, while some commercial buildings may not emit GHGs directly, they contribute to GHG emissions by consuming energy. Indeed, energy use in all buildings, including electricity, accounts for about 40 percent of GHG emissions. If businesses use energy more efficiently to light, heat or air condition office buildings and operate office equipment, power plants will produce less electricity, and less CO_2 will be emitted for each unit of goods or services created.

Improving the energy productivity of commercial buildings can make a big difference in reducing or avoiding GHG emissions. Consider the following:

- There are 4.6 million commercial buildings in the United States.
- Office buildings account for 19 percent of all commercial energy consumption.[1]
- Energy use is the single largest component of a commercial property's operating expenses, accounting for nearly 30 percent of operating budgets.[2]
- The commercial end-use sector (which includes office buildings, stores and other commercial buildings) was responsible for 18 percent of the CO_2 emissions from fossil fuel consumption in 2002.[3]
- 70 percent of the energy consumption in the commercial end-use sector is attributable to the use of electricity for lighting, heating, cooling and operating office equipment. The remainder is due to consumption of natural gas and petroleum for heating, hot water and cooking.[4]

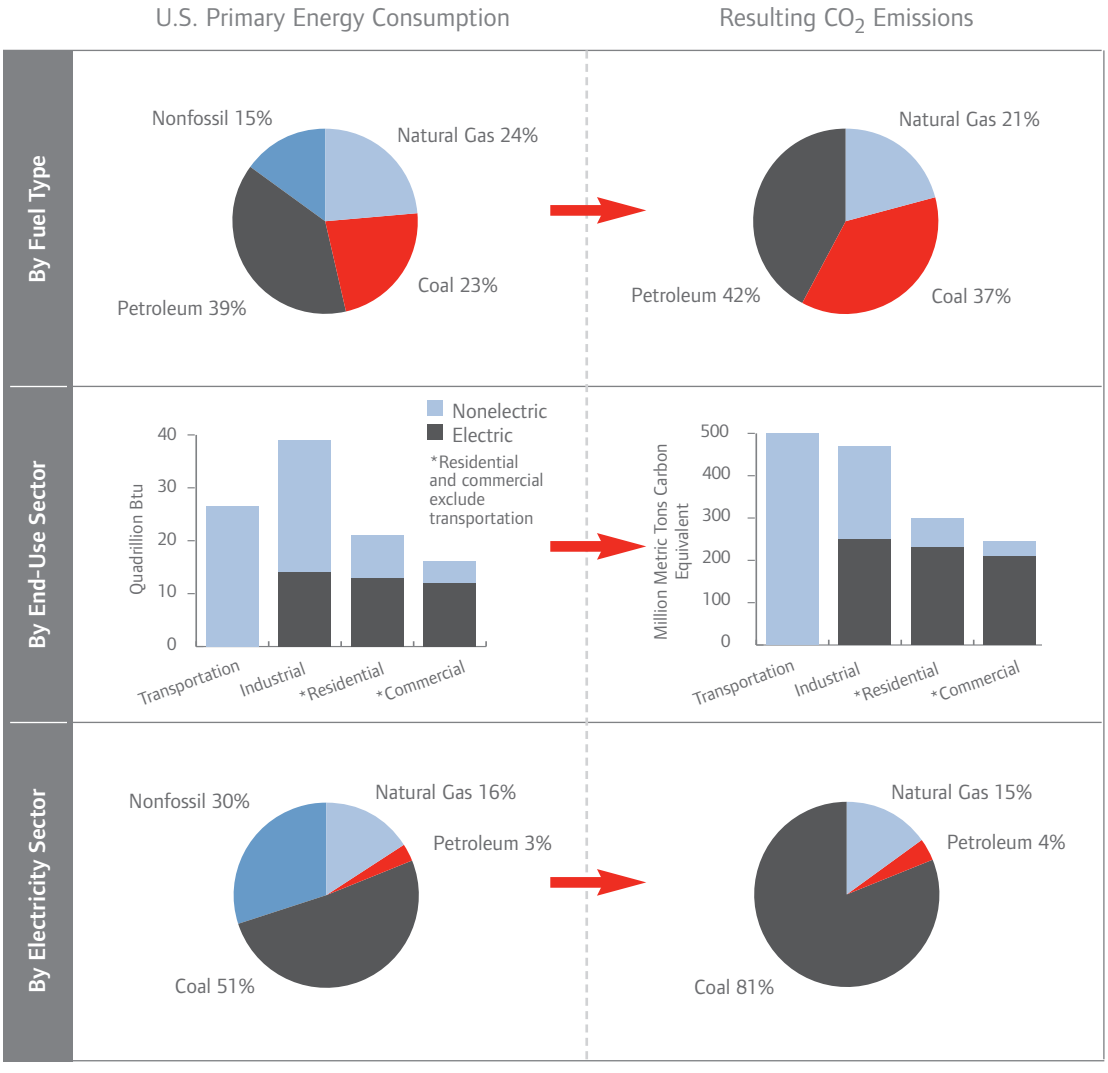
[1] 1999 Commercial Buildings Energy Consumption Survey (CBECS). Detailed Tables, EIA, www.eia.doe.gov/emeu/cbecs.

[2] Presentation by Cushman and Wakefield at Business Roundtable Learning Session on May 13, 2004, www.businessroundtable.org/climateresolve.

[3] EPA.

[4] 1999 Commercial Buildings Energy Consumption Survey (CBECS). Detailed Tables, EIA, www.eia.doe.gov/emeu/cbecs.

U.S. Primary Energy Consumption and Carbon Dioxide Emissions, 2001



Source: Energy Information Administration. *Greenhouse Gases, Climate Change, and Energy,* www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html.

Reducing energy waste in a single office building by turning off computers or installing energy-efficient lighting may seem like a small step. However, given the huge amount of electricity used in commercial office buildings, these small energy-saving measures can add up to a big reduction in fossil fuel consumption — and millions of tons of CO_2 avoided or reduced — if implemented in offices across the United States. Companies that step forward and lead by example can motivate action by many of their peers — and these collective efforts can translate into real economywide reductions in GHG emissions.

Using Energy More Productively Pays Off for Companies

Investing in energy efficiency can contribute significantly to a company's bottom line. According to the ENERGY STAR program, energy costs for a typical office building in the United States are $1.50 per square foot, and using energy-efficient office equipment can reduce these costs by 30 percent.

Eastman Kodak Company, a leader in the creation and use of images in the photography, health and commercial markets, announced in 1998 a five-year goal of reducing energy use (indexed to production) by 15 percent. By 2003, Kodak had exceeded this target, cutting energy consumption by 19 percent. The Kodak energy team, working together with the basic manufacturing operations, implemented a strategic energy management plan that emphasized motor upgrades; pump upgrades; water recycling; heating, ventilation and air conditioning (HVAC) and lighting optimization; and process dryer optimization. The plan has saved the company more than $8.5 million in operating costs and enough energy to operate all of Kodak's plants worldwide for a full month. Reductions in CO_2 emissions from the energy productivity gains were equivalent to planting more than 216,000 acres of trees.

AT&T, a leading telecommunications company, developed a national energy program that calls for the assurance of energy reliability, supply- and demand-side management, and energy and environmental awareness for the purpose of promoting wise energy use and environmental stewardship. Programs implemented to date as part of this program include an aggressive demand-side management strategy, centralization of the bill payment process, implementation of the "You've Got the Power" energy awareness and efficiency program in the network facilities, and comprehensive energy audits of network and administrative buildings. Other energy savings programs include recycling and telework — more than 60 percent of AT&T managers telework; 22 percent have virtual offices that eliminate their commutes. Not only has this program saved the company money, but the environmental savings from energy management programs alone also were substantial in 2002 — the company saved an equivalent of 40,400 tons of CO_2 emissions. That same year, the corporate telework program averted 70,000 tons of CO_2 emissions.

General Motors, the world's largest vehicle manufacturer, developed lighting efficiency plans for several of its facilities. These plans involve replacing T12 fluorescent fixtures with T8 fixtures, which consume substantially less electricity. In addition, unnecessary lights will

be removed or relocated, and motion sensors will be installed to regulate lighting use. By the end of 2004, these plans will be implemented at 73 facilities, with estimated energy cost savings of more than $16 million and avoidance of 261,200 tons of CO_2 emissions.

Sprint, a major provider of telecommunications services, established a One Sprint Energy Team in 1997 to integrate energy conservation programs for the company's different business units. The team concluded that Sprint uses the majority of its avoidable energy for lighting and HVAC equipment at its office and equipment operation facilities. In response, the team took several measures, including retrofitting efficient T8 fluorescent lamps and electronic ballasts, implementing design standards to match facility energy requirements with equipment capacity, avoiding oversizing of equipment, adopting temperature and control standards to avoid overcooling, purchasing high-efficiency air conditioning units, and installing automated systems to monitor temperatures and equipment performance 24 hours a day. These actions reduced utility bills by nearly $20 million and saved more than 300 million kWhs of electricity annually.

TIAA-CREF, a leading financial services provider, manages a real estate investment portfolio valued at $5.7 billion. TIAA-CREF asset managers instruct property managers to track their energy performance using the ENERGY STAR benchmarking tool and report energy performance. TIAA-CREF evaluates the performance of property managers by reviewing average scores across their managed properties. It has estimated that its best performing buildings saved $5.8 million in energy costs and avoided 97 million pounds of CO_2 emissions, equivalent to removing 9,000 cars from U.S. roads.

Johnson Controls, Inc., through a partnership with the Denver Federal Center, is reducing energy and operating costs by more than $450,000 per year. The project includes traditional building improvements as well as the installation of new, high-efficiency chillers and pumps. Johnson Controls decommissioned an existing solar domestic hot water heating system and improved an irrigation control system. The water savings for the project will total nearly 11 million gallons per year, and the Denver Federal Center is expected to reduce $C0_2$ emissions by more than 8,000 tons.

As these examples illustrate, leading companies have discovered that energy productivity programs do more than just contribute to reducing or avoiding CO_2 emissions — they reduce energy costs and have real economic value as well.

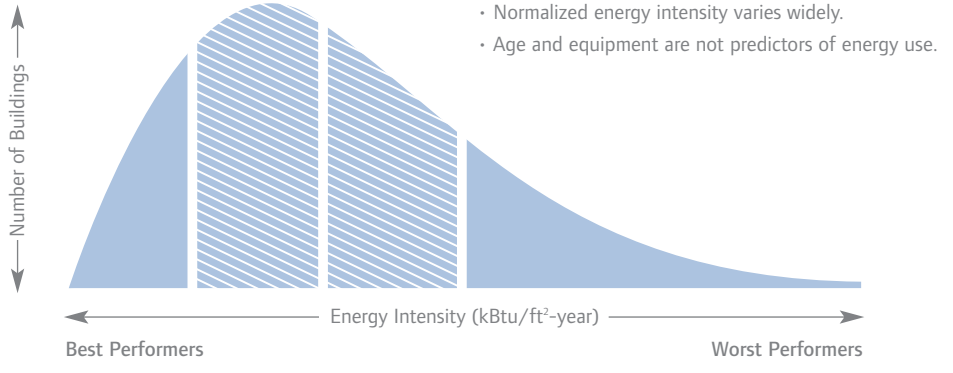
What Can You Do?

Establish Effective Energy Management Programs for Your Office Building

U.S. businesses are changing how they think about energy efficiency. Historically, corporate energy management was decentralized and often focused on the reliability — not the cost-effectiveness — of energy systems. Some managers had little incentive to improve efficiency because they lacked good information on energy use in different parts of their organizations and about the most promising opportunities for productivity gains. Additionally, many commercial building owners made no effort to reduce energy costs because tenants failed to use their bargaining power to insist on lower electricity bills.

As a consequence, the intensity of energy use varied tremendously among buildings — by as much as 400 percent according to EPA — without relation to such obvious factors as building age, size or climate conditions. These variations often were the result of poor energy design. For example, many building systems (such as fans or chillers) have been oversized in relation to demand and therefore consume extra energy to meet occupant needs.

Energy Intensity Varies Widely among Office Buildings



Source: ENERGY STAR Program.

Leading companies have taken aggressive action to overcome these problems by developing strong and effective energy management systems. The experience of these companies has shown that dramatic improvements in energy efficiency can be achieved by adopting a system with the following elements:

- Top-down commitment to higher energy productivity.
- Use of a management systems approach.
- Recognition of energy management as a top business priority.
- A focus on continuous improvement in energy efficiency.

- Systems for regularly assessing and tracking energy performance.
- Clear goals for reducing energy use and costs.
- Metrics for determining the bottom-line financial benefits of energy savings.
- A dedicated, team-oriented approach to energy management.

FIND OUT MORE

For more information and details about ENERGY STAR guidelines for establishing an energy-efficiency program, visit Business Roundtable's Web site at www.businessroundtable.org/climateresolve.

The ENERGY STAR program has developed guidelines for energy management that recommend these steps for establishing programs:

Source: ENERGY STAR Program.

For each of these critical steps, the ENERGY STAR guidelines offer suggestions on how to organize company programs and optimize their effectiveness. Business Roundtable has established a link to the ENERGY STAR guidelines to help companies put enhanced energy management programs in place. ENERGY STAR also offers companies valuable partnership opportunities, access to information about best practices and methodologies, and recognition for outstanding performance.

In addition, DOE's Rebuild America program provides a variety of resources to help companies implement energy performance-enhancing measures in their buildings. Rebuild America's network of professionals offers technical assistance in engineering, architecture, finance and planning and helps managers make decisions about heating, cooling, lighting, insulation, and the associated financing and environmental issues. Rebuild America partners have access to technical assistance, expertise, and products and services in critical areas of facilities management, such as energy audits for buildings, energy project design, construction management, metering and monitoring, and more.

FIND OUT MORE

For more information about Rebuild America programs and downloadable guides on low-cost efficiency measures, retrofits, major renovations, new construction and energy-efficiency practices, visit Rebuild America's Web site at www.rebuildamerica.gov.

Take Specific Actions To Improve Energy Efficiency in Your Office Building

Once companies put energy management systems in place, the next step is to identify specific actions that will reduce energy consumption. Given the great variety of building types and uses, there is no universal list of cost-effective energy-efficiency measures.

Companies committed to improving their energy efficiency should assess the buildings they own or occupy to develop energy performance goals and action steps. This assessment begins with collecting data about building characteristics and uses such as total square footage; hours of occupancy; energy system operation and maintenance; heating and cooling fuels used; type of lighting, heating and cooling systems; and extent of computer use. The next step is to collect data on energy use — including monthly electricity consumption and cost, peak electricity demand, and natural gas consumption.

With this information, companies then can conduct energy audits of specific buildings to identify inefficiencies in energy performance. For example, audits may find leaks in windows or roofs, excessive consumption of hot water, poor maintenance practices, or inefficient use of cooling or heating systems. A review of utility bills can help pinpoint excessive costs. Automated systems can be installed to monitor temperatures or equipment performance.

Once inefficiencies have been identified, companies can develop options for reducing energy consumption and analyze the net savings in energy costs that can be achieved. These options then will need to be prioritized based on cost-effectiveness, ease of implementation, timing of previously planned maintenance or equipment upgrade operations, and other factors.

One of the best times to incorporate energy-efficiency measures is during new construction and building rehabilitation because the costs are lower than they would be during later retrofits. These lower costs could mean that improvements that may not be possible or cost-effective in a retrofit situation, such as adding insulation to a wall of an occupied building, may become viable during construction or rehabilitation, when such measures can be easier to perform.

Although the optimum energy-efficiency strategy will be tailored to the results of a targeted analysis of a specific building, certain energy-efficiency measures tend to be implemented more frequently than others because they often offer substantial energy savings, rapid paybacks, low costs and ease of implementation. Following are some examples of proven and cost-effective approaches that are available in the office environment.

Operate office equipment efficiently. Companies can take a number of steps to use energy-efficient modes on equipment. These steps include activating energy-efficient or power management modes on equipment, purchasing timers for photocopiers or printers so they switch off automatically during nonworking hours, and encouraging employees to turn off their computers when they leave the office. EPA estimates that if power management features were used on all computers in the country, the resulting CO_2 reductions would be equivalent to removing 1.5 million cars from the road.

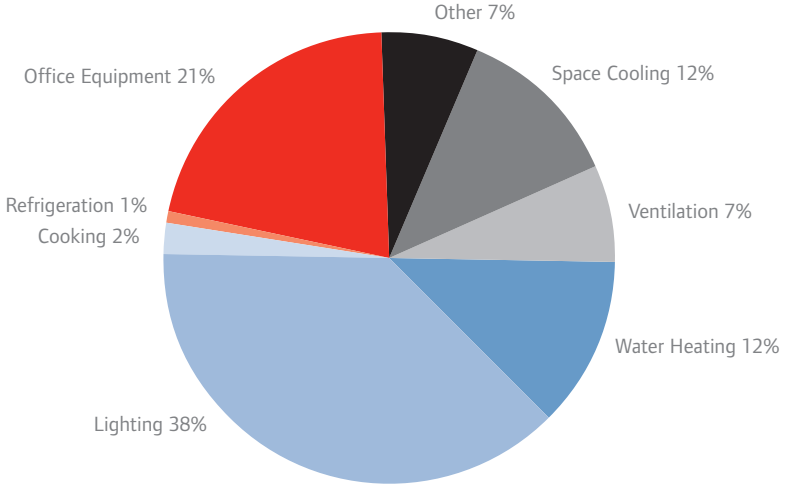
Install energy-efficient office equipment. When companies first occupy an office or upgrade equipment, purchase of energy-efficient products with the ENERGY STAR label can save money and reduce emissions cost-effectively. EPA and DOE work closely with more than 1,000 manufacturers to determine the energy performance levels that must be met for a product to earn the ENERGY STAR rating. The label is awarded only to energy-efficient products that offer the features and performance consumers desire and that provide a reasonable payback if the purchase price is higher than nonqualifying products.

FIND OUT MORE

For additional information about collecting building data and analyzing energy-efficiency measures, download these guides from Rebuild America's Web site:

- *How to Collect and Examine Your Building Data* (www.rebuild.org/attachments/SolutionCenter/RBA_how_to_collect_building_data.pdf).
- *Potential Energy-Efficiency Measures Overview* (www.rebuild.org/attachments/SolutionCenter/RBA_potential_energy_efficiency.pdf).
- *How to Finance Your Energy Program* (www.rebuild.org/attachments/SolutionCenter/RBA_how_to_finance_energy_program.pdf).

Lighting Largest Source of Energy Use in Office Buildings



Source: Presentation by The Watt Stopper at Business Roundtable Learning Session on energy-efficient lighting and system technologies on June 30, 2004, www.businessroundtable.org/climateresolve.

Operate energy-efficient lighting systems. Lighting accounts for approximately 38 percent of the electricity consumed in U.S. commercial buildings and represents approximately $22 billion in annual expenditures. An additional 10 percent of electricity consumed in buildings is for air conditioning to counter the heat generated by electric lights.

Energy costs for lighting can be cut substantially through a combination of good lighting practices and energy-efficient equipment. Even without lighting upgrades, offices can avoid energy waste by turning off lights when rooms are empty. Motion sensors can ensure that lights turn off when offices are unoccupied for more than a few minutes. Where natural light is available, lights should be turned off or dimmed during brighter parts of the day.

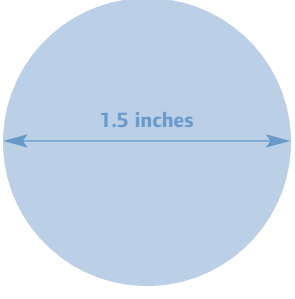
Upgrades to energy-efficient lighting can reduce energy costs by two-thirds compared to costs for standard incandescent lighting. Lighting upgrades also can improve employee performance by putting the right lights in the right place for employee comfort and productivity. Options include T8 lamps and electronic ballasts, compact fluorescent lamps, and high-intensity discharge lamps. These lamps typically save 50 percent to 80 percent of the energy costs associated with incandescent bulbs and last on average more than 10 times longer. According to DOE, the return on investment for lighting retrofits is typically more than 30 percent per year, with a simple payback within three years.

FIND OUT MORE

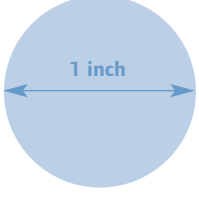
The telephone Learning Sessions sponsored by Business Roundtable to assist Climate RESOLVE participants include numerous presentations on different aspects of energy efficiency in commercial buildings. These presentations can be found at www.businessroundtable.org/climateresolve.

New Lighting Systems More Efficient

Old Technology: T12 Lamps

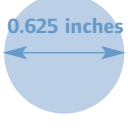


New Technology: T8 Lamps



- Direct replacement for T12
- Requires ballast change
- Up to 40 percent energy savings

Newest Technology: T5 Lamps



- Requires new fixtures
- Optimal for indirect lighting systems
- Provides fluorescent options for high ceilings

Source: Presentation by GE Lighting at Business Roundtable Learning Session on July 17, 2003, www.businessroundtable.org/climateresolve.

Install energy-efficient HVAC systems. HVAC systems also account for a major percentage of the energy used in commercial buildings. Advanced HVAC technology is more energy efficient than older equipment and has relatively short payback periods. For example, air conditioners represent about 12 percent of energy consumption in commercial buildings and are the largest contributor to peak electricity demand in hot weather. By replacing old air conditioning equipment with new energy-efficient models, office building owners can save up to 35 percent of electricity use. The payback period for new systems typically ranges from three to five years. Upgrading old furnaces and boilers with new energy-efficient models can likewise achieve large savings. Older systems have efficiencies of 56 percent to 70 percent, whereas modern heating systems can achieve efficiencies as high as 97 percent, converting nearly all fuel to useful heat. Conservation and installation of a new high-efficiency heating system often can cut fuel bills and GHG emissions in half cost-effectively. Another promising approach is to replace conventional water heaters with heat pump water heaters (HPWHs), which transport heat from a source such as outside air rather than producing it by combusting gas. While the installed costs are significantly higher, the lifecycle costs of HPWHs are significantly lower because of their greatly reduced operating costs.

Consider purchasing "green power." Many energy service providers are now offering to aggregate purchases of clean, renewable, "green" energy. These energy suppliers negotiate with wind, hydro, landfill gas, geothermal or solar energy producers to obtain nonfossil-burning electricity. More than 300 utilities already offer these services, and many large companies and governments are purchasing reliable green power.

FIND OUT MORE

For more information on green power:

- Visit the DOE Web site at www.eere.energy.gov/greenpower/.
- Download the WRI publication *Corporate Guide to Green Power,* available at www.wri.org.

Reduce Business-Related Energy Consumption outside the Office Building

Establishing effective energy management programs is a critical first step that all building owners or occupants can take to reduce or avoid GHG emissions. Once this foundation is in place and the company has decided on specific actions to reduce energy consumption in office buildings, responsible companies should consider further actions to help lower GHG emissions.

Reduce travel-related GHG emissions. Transportation is an important driver of energy consumption and GHG emissions for businesses in the service sector of the economy. Employees travel for business purposes in company-owned cars or trucks, rental cars, trains, buses, and planes. Most employees also commute to work in cars, often over long distances. Cumulatively, these activities are energy-intensive. More than one-fourth of U.S. GHG emissions result from fossil fuel consumption during transportation — a significant portion of which is business related.

Many simple strategies can reduce travel-related energy consumption and GHG emissions. For example, making some trips by train instead of plane can reduce emissions because air

travel is the most GHG-intensive form of transportation. Employee travel time also can be reduced through alternatives such as telephone, Web or video conferencing; consolidating trips; or reducing the number of employees who travel to meetings.

Teleworking is an increasingly popular alternative to commuting — it saves time, reduces stress and avoids fuel consumption from driving. In 2002, AT&T estimated that 22 percent of its managers had virtual offices, saving the company more than $180 million. The average commute avoided was 27 miles (one way), resulting in aggregate reductions for all AT&T employees of 155 million miles traveled, 7.4 million gallons of gasoline consumed and 70,000 tons of CO_2 emissions avoided. Additionally, 66 percent of AT&T managers said that having the telework option helped them retain and attract good employees.

Another strategy is to offer incentives for employees to carpool or use public transportation. For example, companies can arrange for employees to obtain discounts on mass transit or take advantage of government incentive programs offering tax benefits. EPA has established the Commuter Choice Leadership Program to assist employers in encouraging commuting alternatives through technical assistance, national recognition and other market-based tools.

Explore the availability of carbon offsets to augment the GHG reductions achieved through energy savings. Outside the commercial sector, many businesses and nonprofit organizations undertake projects that result in GHG emissions being reduced or avoided. To finance these projects, sponsors seek upfront funding from third-party investors or sell the resulting GHG benefits to investors after the fact. The tons of CO_2 reduced or avoided in these circumstances are called "offsets" and become the property of the investor. Companies seek to purchase offsets for many reasons. In some cases, the costs per ton to buy offsets are lower than the costs to reduce or avoid emissions within the company's own operations. Alternatively, companies may view offset projects as desirable environmentally and may support them to demonstrate climate stewardship or receive public recognition. The value of offsets depends on whether the tons of GHGs avoided or reduced are well documented and accurately quantified. It is therefore important to exercise due diligence before agreeing to purchase an offset.

One common type of offset project involves removing, or sequestering, atmospheric CO_2 by protecting threatened forests, planting trees on deforested land, improving forest management or changing agricultural practices. Sequestering atmospheric CO_2 in this way can help offset CO_2 emissions from energy use because trees and other vegetation are an important "sink" for CO_2. Increasing the density and size of forests can sequester millions of tons of CO_2. Forestry strategies for offsetting emissions are often very cost-effective, costing only a few dollars per ton of emissions offset. They also have positive secondary environmental and social benefits, such as restoration of degraded lands and protection of biodiversity.

FIND OUT MORE

To learn more about teleworking:

- Visit the AT&T Web site at www.att.com/telework.
- Download the WRI publication *Gaining the Air Quality and Climate Benefit for Telework,* available at www.wri.org.

To learn more about incentives for commuting alternatives, visit the EPA's Commuter Choice Leadership Program Web site at www.commuterchoice.gov.

Numerous organizations have well-established carbon sequestration programs supported by many corporate investors. The project portfolios they manage include both U.S. and international forestry initiatives. Companies should contact these organizations to obtain more information about forest carbon management opportunities.

FIND OUT MORE

To learn more about carbon offset programs, visit the following Web sites:

- The Nature Conservancy (http://nature.org).
- Environmental Protection Agency (www.epa.gov).

Another common type of offset project involves methane recovery. Methane from landfills, coalmines, oil and gas operations, and agriculture accounts for 10 percent of annual GHG emissions on a carbon equivalent basis. EPA has several programs to encourage capture and beneficial use of methane emissions:

- AgStar promotes methane recovery operations at animal feeding operations;
- the Coalbed Methane Outreach Program identifies and implements methods to recover and use coalmine methane productively;
- the Landfill Methane Outreach Program facilitates and encourages sound landfill gas projects; and
- Natural Gas STAR, a partnership with the oil and gas industry, promotes methane recovery during production, refining, transmission and distribution activities.

The growing number of methane recovery projects launched through these programs is increasing the availability of offsets to third-party investors.

Each individual company should consider whether these and other types of offset projects can play a role in its GHG management strategy along with energy-efficiency programs implemented by the organization.

Communicate Your Company's Progress

Once a company has taken action to reduce its GHG footprint, why not let key stakeholders know about these efforts? Public reporting is important so that company actions to address climate change are understood and recognized by employees, shareholders, communities and the general public. Successful company programs are also powerful motivating tools for other companies that are just beginning to address climate change. Moreover, the government can track overall progress and make informed decisions about future policy only if it has accurate information about the efforts of individual companies.

Estimate the CO_2 emissions associated with the consumption of energy in buildings and the amount of CO_2 reduced or avoided as a result of improvements in energy efficiency. An essential step in meaningful public reporting is translating reductions in energy consumption into CO_2 emissions reduced or avoided. This enables companies to

measure their contribution to effective GHG management and thereby inform external stakeholders about the climate-related impact of their improvements in energy efficiency.

To convert energy savings into CO_2 emissions reduced or avoided, companies first need to select a "baseline" year (or years) before energy-efficiency improvements were made and then identify a "follow-up year" during which these improvements were in effect. The comparison between energy use and related CO_2 emissions for these two years will provide the measure of the energy savings and CO_2 benefits achieved. In some cases, this comparison may need to be adjusted to account for changes in weather — and, hence, energy demand — from year to year.

To determine an office's electricity use, a company must know the kilowatt hours (kWhs) for which the organization was responsible. If companies own and occupy the entire building or if utilities are metered separately for leased space, this information can be obtained readily from monthly electric bills. If the organization occupies only part of the building and its electricity use is not metered separately, the assistance of the landlord or building manager will be needed to determine total building energy use in kWhs. It is then possible to estimate the company's share of these kWhs by calculating the area it occupies as a percentage of total building area.

To convert the organization's energy consumption into CO_2 emissions, a company needs to apply "emissions factors" to total kWhs used. Emissions factors for electricity vary based on the fuel burned by the power plant (coal, natural gas, oil, nuclear or renewables) and the technologies used to produce power. The most reliable source of emissions factors is the electric company from which the facility receives power. Alternatively, companies can access EPA's E-GRID emissions database for powerplants around the country. A simpler approach is to obtain a published emissions factor for a state or region from DOE. A similar calculation can be made for other types of energy consumed by organizations. For example, if a building uses natural gas for heating, companies first need to estimate the therms of natural gas consumed for the baseline and follow-up years. This number must be converted to terajoules since the emission factor for natural gas is expressed in tons of CO_2 per terajoule (tCO_2/TJ).

Following is a sample calculation for converting energy consumption into CO_2 emissions in commercial buildings, derived from the WRI publication *Working 9 to 5 on Climate Change*. Blank forms for doing your own calculations are available in the appendix. Or visit Business Roundtable's Web site (www.businessroundtable.org) for forms to automatically calculate your emissions reductions.

FIND OUT MORE

To obtain your emissions factor for calculating energy consumption, contact:

- The utility that provides your building's power.
- EPA's E-GRID database at www.epa.gov/airmarkets/egrid/.
- DOE at www.eia.doe.gov/oiaf/1605/ee-factors.html.

Example: **CALCULATING EMISSIONS FROM PURCHASED ELECTRICITY**

kWh of electricity x emissions factor = CO_2 emissions

S&P Enterprise's two locations are in New York City and Portland, OR. It uses a total of 1,845,586 kWh per year but makes the emissions calculations separately for each location because power is supplied by two different providers and therefore requires two different emissions factors. First, the emissions calculation is performed, and then the result is converted to metric tons.

**This emissions factor is from the EPA's E-GRID database (www.epa.gov/airmarkets/egrid/). The emissions in this database are expressed in lbs of CO_2/megawatt hour (MWh). The activity data are in kWh, so the emissions factor is first converted into CO_2/kWh by dividing by 1,000.*

**S&P Enterprises could not find an emissions factor from its local power plant or on E-GRID for this location so it used the average electricity emissions factor for the state of Oregon as provided by the DOE.*

New York City	
Calculate emissions:	980,326 ~~kWh~~ x 0.193* lbs of CO_2/~~kWh~~ = 189,202.9 lbs of CO_2
Convert to metric tons:	189,202.9 ~~lbs of CO_2~~ ÷ 2,205 ~~lbs~~/metric ton = 85.80 metric tons of CO_2
Portland, OR	
Calculate emissions:	865,260 ~~kWh~~ x 0.28* lbs of CO_2/~~kWh~~ = 242,272.8 lbs of CO_2
Convert to metric tons:	242,272.8 ~~lbs of CO_2~~ ÷ 2,205 ~~lbs~~/metric ton = 109.87 metric tons of CO_2

Total CO_2 emissions from purchased electricity:

85.80 metric tons of CO_2 in New York City	+	109.87 metric tons of CO_2 in Portland	=	195.67 metric tons of CO_2

S&P Enterprises' total CO_2 emissions from purchased electricity for this year are 195.67 metric tons of CO_2.

Source: World Resources Institute. *Working 9 to 5 on Climate Change* (2002).

Example: **CALCULATING EMISSIONS FROM NATURAL GAS**

units of natural gas used by your organization x emissions factor = CO_2 emissions

S&P Enterprises used 4,139.59 therms of natural gas this year. The emissions factor is expressed in metric tons of CO_2 per terajoule. Therefore, the activity data must first be converted from therms to terajoules.

Convert therms to gigajoules (GJ):	4,139.59 ~~therms~~ x 0.1055 GJ/~~therms~~ = 436.73 GJ
Convert GJ to terajoules (TJ):	436.73 ~~GJ~~ ÷ 1,000 ~~GJ~~/TJ = 0.437 TJ
Calculate emissions:	0.437 ~~TJ~~ x 56.0 metric tons of CO_2/~~TJ~~ = 24.47 metric tons of CO_2

S&P Enterprises' total CO_2 emissions from natural gas this year are 24.47 metric tons of CO_2.

Source: World Resources Institute. *Working 9 to 5 on Climate Change* (2002).

For companies that implement programs to reduce fuel consumption for travel-related activities, the WRI publication *Working 9 to 5 on Climate Change: An Office Guide* also provides methodologies to track fuel consumption during employee business travel and commuting; quantify the fuel savings from teleworking, travel reductions or public transit use; and convert these savings into CO_2 emissions reduced or avoided. Blank forms for calculating the CO_2 emissions associated with different types of transportation are included in the appendix or on Business Roundtable's Web site (www.businessroundtable.org).

Publicize and report the CO_2 reduced or avoided as a result of energy management efforts. Many federal and state programs publicly recognize companies that demonstrate leadership in energy efficiency and GHG mitigation. The DOE and EPA offer partnership opportunities to commercial building owners and occupants.

Another option is to report emissions reductions to DOE under §1605(b) of the 1992 Energy Policy Act. This program establishes a central database (known as the Registry) for tracking GHG emissions levels and voluntary measures to reduce or avoid these emissions. The DOE Registry enables companies to receive public recognition for their contribution to national emissions intensity goals. DOE is in the process of updating the §1605(b) program to improve its accuracy, reliability and verifiability, and new policies and technical guidelines governing the program are being developed.

Business Roundtable encourages all companies participating in Climate RESOLVE to report their actions under §1605(b). Many companies are now reporting the GHG emissions reductions achieved through energy-efficiency projects at manufacturing sites or commercial buildings to the DOE GHG Registry. Similar state-level reports can be submitted to voluntary GHG emissions registries in California, New Jersey, Wisconsin and other states.

Other excellent vehicles for communicating the results of successful energy-efficiency and GHG mitigation programs include employee newsletters; company Web sites; annual environment, health and safety reports; and reports to shareholders. Business Roundtable's experience has been that "celebrating success" is a powerful motivator and morale booster for the employees whose commitment and hard work are essential for sustained progress in reducing energy consumption and GHG emissions.

To further help companies get the word out about their participation in Climate RESOLVE and their actions to reduce GHG emissions, Business Roundtable has developed a set of materials that companies can customize with their own information. The materials include PowerPoint presentations with speakers' notes, a template press release, key talking points on Climate RESOLVE, sample questions frequently asked by the media and suggested answers, a draft memo to employees, and a suggested Web site statement. The Roundtable also has developed a poster regarding climate change that companies can customize with their logos. These materials are available for participating companies on Business Roundtable's Web site in a password-protected section. Please contact the Roundtable at 202-872-1260 for copies of these documents or for the password used by participating companies.

FIND OUT MORE

To publicize and report your emissions reductions, contact:

- Business Roundtable at www.businessroundtable.org/climateresolve.
- EPA's ENERGY STAR, Climate Leaders or Green Power Partnership programs at www.epa.gov.
- The DOE GHG registry at www.eia.doe.gov/oiaf/1605/1605b.html.
- State GHG registries.

Conclusion

Business Roundtable hopes this guide — together with a new Web-based tool kit in the Climate RESOLVE section of www.businessroundtable.org — will help companies recognize the many opportunities to strengthen the bottom line and contribute to effective management of GHG emissions by improving energy efficiency in commercial buildings. We look forward to working with our partners in the public and private sector to develop strategies and concrete actions that will enable the U.S. economy to reap the tremendous economic and environmental benefits of energy efficiency.

FIND OUT MORE

Business Roundtable's Web site (www.businessroundtable.org) includes worksheets companies can use to calculate their energy consumption and CO_2 emissions. It also contains materials companies can use to publicize their participation in Climate RESOLVE and their success in reducing emissions. Call 202-872-1260 for a password to access the materials on Business Roundtable's Web site.

Appendix
Calculate Emissions for Your Organization

Use the following worksheets, which are derived from the World Resources Institute (WRI) publication *Working 9 to 5 on Climate Change: An Office Guide,* to calculate emissions for your organization. Conversion factors vary substantially. See DOE's Web site (www.eia.doe.gov/oiaf/1605/ee-factors.html) and WRI's Web site (www.wri.org) for an extensive list of conversion factors. You also may visit Business Roundtable's Web site (www.businessroundtable.org/climateresolve) for online versions of these worksheets, which will calculate results automatically.

CALCULATING EMISSIONS FROM PURCHASED ELECTRICITY

Use your organization's data in the equation below to calculate your emissions from purchased electricity.

kWh of electricity used by your organization each year x emissions factor = CO_2 emissions

Part 1. Calculate Approximate kWh Used by Your Organization

To calculate the CO_2 emissions generated by your office's electricity use you need to know how many kilowatt hours (kWh) you use each month. If your organization owns and occupies the entire building, or if your utilities are separately metered, all the information you need can be obtained from your monthly electric bill, and you can skip to part 2. If your organization does not occupy the whole building or if it occupies leased office space, you will need to estimate your electricity use based on information from your property manager:

* total area of the building
* total area occupied by your organization
* total building energy use in kWh

Step A: Calculate the Proportion of Your Building Occupied by Your Organization

_____ square feet occupied by organization ÷ _____ square feet in total building = _____

Step B: Calculate Approximate kWh Used by Your Organization

_____ answer from Step A, above x _____ kWh used by total building = _____ kWh used by organization

(continued on next page)

Part 2. Calculate Emissions

Now that you have determined how many kWh are used by your organization, fill in the following equation to determine emissions from purchased electricity. You can obtain your emissions factor from your building's utility company, EPA's E-GRID database or DOE. Each place your organization is located may have a different emissions factor, so you will need to do a separate calculation for each location. If your emissions factor is expressed in megawatt hours (MWh), divide by 1,000 to obtain kWh.

Location 1

1. Calculate emissions:	_____ kwH x _____ lbs of CO_2/kWh = _____ lbs of CO_2
2. Convert to metric tons (2,205 lbs = 1 metric ton):	_____ lbs of CO_2 ÷ 2,205 lbs/metric ton = _____ metric tons of CO_2

Location 2

1. Calculate emissions:	_____ kwH x _____ lbs of CO_2/kWh = _____ lbs of CO_2
2. Convert to metric tons (2,205 lbs = 1 metric ton):	_____ lbs of CO_2 ÷ 2,205 lbs/metric ton = _____ metric tons of CO_2

Location 3

1. Calculate emissions:	_____ kwH x _____ lbs of CO_2/kWh = _____ lbs of CO_2
2. Convert to metric tons (2,205 lbs = 1 metric ton):	_____ lbs of CO_2 ÷ 2,205 lbs/metric ton = _____ metric tons of CO_2

Location 4

1. Calculate emissions:	_____ kwH x _____ lbs of CO_2/kWh = _____ lbs of CO_2
2. Convert to metric tons (2,205 lbs = 1 metric ton):	_____ lbs of CO_2 ÷ 2,205 lbs/metric ton = _____ metric tons of CO_2

Total Emissions from Purchased Electricity

Add the totals from each location to determine total emissions from purchased electricity for your organization.

Location 1: _____ metric tons of CO_2

Location 2: _____ metric tons of CO_2

Location 3: _____ metric tons of CO_2

+ Location 4: _____ metric tons of CO_2

Total: _____ metric tons of CO_2

CALCULATING EMISSIONS FROM NATURAL GAS

Use your organization's data in the equation below to calculate your emissions from natural gas. You can obtain your emissions factor from your building's utility company or from the WRI, EPA or DOE databases.

units of natural gas used by your organization each year x emissions factor = CO_2 emissions

Location 1

1. Convert therms to terajoules (TJ):	(_____ therms x 0.1055 GJ/therm) ÷ 1,000 GJ/TJ = _____ TJ
2. Calculate emissions:	_____ TJ x _____ metric tons of CO_2/TJ = _____ metric tons of CO_2

Location 2

1. Convert therms to terajoules (TJ):	(_____ therms x 0.1055 GJ/therm) ÷ 1,000 GJ/TJ = _____ TJ
2. Calculate emissions:	_____ TJ x _____ metric tons of CO_2/TJ = _____ metric tons of CO_2

Location 3

1. Convert therms to terajoules (TJ):	(_____ therms x 0.1055 GJ/therm) ÷ 1,000 GJ/TJ = _____ TJ
2. Calculate emissions:	_____ TJ x _____ metric tons of CO_2/TJ = _____ metric tons of CO_2

Location 4

1. Convert therms to terajoules (TJ):	(_____ therms x 0.1055 GJ/therm) ÷ 1,000 GJ/TJ = _____ TJ
2. Calculate emissions:	_____ TJ x _____ metric tons of CO_2/TJ = _____ metric tons of CO_2

Total Emissions from Natural Gas

Add the totals from each location to determine total emissions from natural gas for your organization.

Location 1: _____ metric tons of CO_2

Location 2: _____ metric tons of CO_2

Location 3: _____ metric tons of CO_2

+ Location 4: _____ metric tons of CO_2

Total: _____ metric tons of CO_2

CALCULATING EMISSIONS FROM BUSINESS-RELATED CAR TRAVEL

Use your organization's data in either of the equations below to calculate your emissions from business-related car travel. You can obtain your emissions factor from the WRI, EPA or DOE databases.

Note: This does not include car travel for commuting to and from work.

1. **quantity of fuel x emissions factor = CO_2 emissions (preferred method)**

— OR —

2. **annual distance traveled x emissions factor incorporating default fuel efficiency value (if miles per gallon for car unknown) = CO_2 emissions**

Equation 1

Note: If employees travel together in a car, you will need to total the average gallons of fuel per employee per trip to determine the total quantity of fuel used for the year. For more information, see the WRI publication *Working 9 to 5 on Climate Change: An Office Guide*.

1. Calculate emissions:	_____ gallons x _____ kgs of CO_2/gallon = _____ kgs of CO_2
2. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

Equation 2

1. Calculate emissions, using emissions factor that incorporates default fuel efficiency:	_____ miles x _____ kgs of CO_2/mile = _____ kgs of CO_2
2. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

Travel in Commercial Planes

Use your organization's data in the equations below to calculate your emissions from air travel. You can obtain your emissions factor from the WRI, EPA or DOE databases.

Note: The following calculations are based on land kilometers and miles, not nautical kilometers and miles.

annual distance traveled x emissions factor = CO_2 emissions

Short Flights in Commercial Planes *(Flights of less than 453 km or 282 miles)*

1. Convert miles to kilometers:	_____ miles x 1.609 km/mile = _____ km
2. Calculate emissions:	_____ km x _____ kg of CO_2/km = _____ kg of CO_2
3. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

Medium Flights in Commercial Planes *(Flights of 453–1,600 km or 282–995 miles)*

1. Convert miles to kilometers:	_____ miles x 1.609 km/mile = _____ km
2. Calculate emissions:	_____ km x _____ kg of CO_2/km = _____ kg of CO_2
3. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

Long Flights in Commercial Planes *(Flights of more than 1,600 km or 995 miles)*

1. Convert miles to kilometers:	_____ miles x 1.609 km/mile = _____ km
2. Calculate emissions:	_____ km x _____ kg of CO_2/km = _____ kg of CO_2
3. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

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Travel in Company-Owned Planes

Use the following equation to calculate emissions from travel on company-owned planes.

annual gallons of fuel used x emissions factor = CO_2 emissions

Flights in Company-Owned Planes

1. Calculate emissions:	_____ gallons x _____ kg of CO_2/gallon = _____ kg of CO_2
2. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

Total Emissions from Air Travel

Add the totals from each type of air travel to determine total emissions from air travel for your organization.

Short Flights: _____ metric tons of CO_2

Medium Flights: _____ metric tons of CO_2

Long Flights: _____ metric tons of CO_2

+ Flights in Company-Owned Planes: _____ metric tons of CO_2

Total: _____ metric tons of CO_2

CALCULATING EMISSIONS FROM TRAIN TRAVEL

Use your organization's data in the equations below to calculate your emissions from train travel. You can obtain your emissions factor from the WRI, EPA or DOE databases.

annual distance traveled x emissions factor = CO_2 emissions

1. Calculate emissions:	_____ miles x _____ kg of CO_2/mile = _____ kg of CO_2
2. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

Commuting by Light Rail, Train or Bus

Use the following equation to calculate emissions from employee commuting by light rail, train or bus. You can obtain your emissions factor from the WRI, EPA or DOE databases.

annual distance traveled x emissions factor for each mode of transport = CO_2 emissions

Light Rail

1. Calculate emissions:	_____ miles x _____ kg of CO_2/mile = _____ kg of CO_2
2. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

Train

1. Calculate emissions:	_____ miles x _____ kg of CO_2/mile = _____ kg of CO_2
2. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

Bus

1. Calculate emissions:	_____ miles x _____ kg of CO_2/mile = _____ kg of CO_2
2. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

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Commuting by Car

Use the following equation to calculate emissions from employee commuting by car. You can obtain your emissions factor from the WRI, EPA or DOE databases.

quantity of fuel used x emissions factor = CO_2 emissions

Part 1. Calculate Quantity of Fuel Used Per Employee in Commuting by Car

1. Calculate total annual distance traveled by employee:	_____ days car used per week x _____ miles traveled round trip x _____ number of weeks worked per year = _____ miles traveled per year
2. Calculate fuel used:	_____ miles traveled per year x _____ miles per gallon for car = _____ approximate gallons used
3. Calculate fuel use per employee:	_____ approximate gallons used x _____ number of people in car = _____ approximate fuel use per employee

Part 2. Calculate Emissions from Commuting by Car

1. Calculate emissions:	_____ gallons x _____ kg of CO_2/gallon = _____ kg of CO_2
2. Convert to metric tons (1,000 kg = 1 metric ton):	_____ kgs of CO_2 ÷ 1,000 kg/metric ton = _____ metric tons of CO_2

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Total Emissions from Employee Commuting

Add the totals from each mode of transportation to determine total emissions from employee commuting for your organization.

Light Rail: _____ metric tons of CO_2

Train: _____ metric tons of CO_2

Bus: _____ metric tons of CO_2

+ Car: _____ metric tons of CO_2

Total: _____ metric tons of CO_2

If you were not able to have every employee respond to the survey, use the following calculation to estimate total emissions for all employees.

total emissions from survey group	**x**	**(number of employees in organization ÷ number of employees in survey)**	**=**	**organization's total estimated emissions**

1. Calculate emissions:	_____ metric tons of CO_2 x (_____ total employees/ _____ employees who completed the survey) = _____ metric tons of CO_2

CALCULATING TOTAL EMISSIONS FROM YOUR ORGANIZATION

Use your organization's data in the equation below to calculate total emissions from your organization.

Purchased Electricity:	_____ metric tons of CO_2
Natural Gas:	_____ metric tons of CO_2
Business-Related Car Travel:	_____ metric tons of CO_2
Air Travel:	_____ metric tons of CO_2
Train Travel:	_____ metric tons of CO_2
+ Employee Commuting:	_____ metric tons of CO_2
Total:	_____ metric tons of CO_2

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