



WORLD
RESOURCES
INSTITUTE

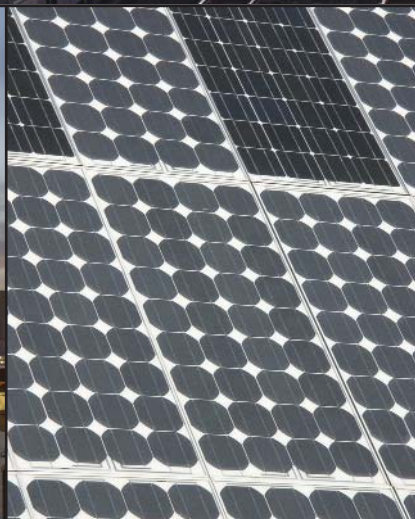
WRI REPORT



SAMANTHA PUTT DEL PINO

RYAN LEVINSON

JOHN LARSEN



HOT CLIMATE, COOL COMMERCE: A Service Sector Guide to Greenhouse Gas Management

HOT CLIMATE, COOL COMMERCE

A SERVICE SECTOR GUIDE TO GREENHOUSE GAS MANAGEMENT



SAMANTHA PUTT DEL PINO

RYAN LEVINSON

JOHN LARSEN

May 2006



WORLD
RESOURCES
INSTITUTE

WASHINGTON, DC

MARGARET B. YAMASHITA
EDITOR

HYACINTH BILLINGS
PUBLICATIONS DIRECTOR

MAGGIE POWELL
LAYOUT

Each World Resources Institute report represents a timely, scholarly treatment of a subject of public concern. WRI takes responsibility for choosing the study topics and guaranteeing its authors and researchers freedom of inquiry. It also solicits and

responds to the guidance of advisory panels and expert reviewers. Unless otherwise stated, however, all the interpretation and findings set forth in WRI publications are those of the authors.

Copyright © 2006 World Resources Institute. All rights reserved.

ISBN 1-56973-616-2

Library of Congress Control Number: 2006926292

Printed in the United States of America on chlorine-free paper with recycled content of 50%, 15% of which is post-consumer.

CONTENTS

Acknowledgments	iv
Executive Summary	1
Introduction	3
Getting Down to Business	10
Part 1: Plan Your Greenhouse Gas Inventory	16
<i>Step 1: Determining Resource Requirements</i>	17
<i>Step 2: Establishing Boundaries</i>	19
Part 2: Develop Your Greenhouse Gas Inventory	32
<i>Step 3: Gathering Data</i>	33
<i>Step 4: Calculating Emissions</i>	42
Part 3: Manage Your Greenhouse Gas Emissions	46
<i>Step 5: Establishing an Emission Reduction Target</i>	47
<i>Step 6: Reducing Emissions</i>	51
<i>Step 7: Reporting a Company's GHG Inventory</i>	59
Appendix 1: Unit Conversion Factors	62
Appendix 2: Sources for Emission Factors	63
Appendix 3: References and Resources	65
Appendix 4: Glossary of Terms	68

ACKNOWLEDGMENTS

This publication would not have been possible without valuable contributions of time and insight from a variety of people and organizations. We benefited enormously from their analyses and perspectives which we hope will help to educate and inform others on the role of the service sector in climate change solutions.

Technical Advisory Committee

Jay Wintergreen, First Environment, Inc.
Bhavna Prasad, JPMorgan Chase
Tommy Linstroth, Melaver, Inc.
Kelly Levin, NESCAUM
Vincent Camobreco, U.S. Environmental Protection Agency
Florence Daviet, World Resources Institute

Road-testers

Baker & McKenzie (Richard Saines)
Citizens Funds (David Loehwing)
Coastal Enterprises Inc. (Elizabeth Sheehan and Will H. Backman)
Cone Inc. (Mindy Gomes Casseres)
EcoProgresso (Catarina Furtado)
International Finance Corporation (Emma Wendt)
Staples (Jake Swenson)
United Nations Foundation (Hetal Mehta)

Reviewers

John Watson, Evergreen Consulting
Rowland Hill, Marks & Spencer
Anthony Pearce, Respect Europe
Vincent Camobreco, U.S. Environmental Protection Agency

Andrew Aulisi, World Resources Institute
Steven Barker, World Resources Institute
Pankaj Bhatia, World Resources Institute
Sarah Janicke, World Wildlife Fund

General Contributors

Business Leaders Initiative on Climate Change
Sam Hitz, California Climate Action Registry
Mike McCormick, California Climate Action Registry
Sophy Bristow, The Climate Group
Ryan Hobert, United Nations Foundation
Simon Schmitz, World Business Council for Sustainable Development
Kevin Baumert, World Resources Institute
Derik Broekhoff, World Resources Institute
Florence Daviet, World Resources Institute
Taryn Fransen, World Resources Institute
Timothy Herzog, World Resources Institute
Russell Meyer, World Resources Institute
Janet Ranganathan, World Resources Institute
Fred Wellington, World Resources Institute

Funders

WRI thanks the John Merck Fund and the Oak Foundation as well as Johnson & Johnson and the S.C. Johnson Fund, Inc. for their generous support of the Northeast Climate Leadership project which made this publication possible.

We also thank the individuals and organizations that fund the GHG Protocol Initiative upon which this guidance is based and other WRI funders that have supported our business and climate change work.

Special Thanks

We would like to express our appreciation to Pankaj Bhatia, Jennifer Layke and Jonathan Pershing for their expert guidance, Hyacinth Billings for production, Maggie Powell for design and layout, Emily Weninger for photo research, Margaret B. Yamashita for her skillful editing and Gayle Coolidge and David Jhirad for managing the review process.

We also thank the members of the Northeast Business Climate Collaborative for a very fruitful engagement in 2005:

Richard Saines, Baker & McKenzie
David Loehwing, Citizens Funds
Suresh Sethi, Citizens Funds
Elizabeth Sheehan, Coastal Enterprises, Inc.
Mindy Gomes Casseres, Cone Inc.
Ellen Castaldini, Connecticut Climate Coalition
Amy Davidsen, JPMorgan Chase
Bhavna Prasad, JPMorgan Chase
Sue Mills, OfficeMax
Michael Sadowski, PricewaterhouseCoopers
David Refkin, Time Inc.
Cathy Resler, Time Inc.
Romina Vinales, Vanasse Hangen & Brustlin



EXECUTIVE SUMMARY

Climate change is a global challenge with serious consequences for our social and economic infrastructure as well as the natural environment. The greenhouse gas (GHG) emissions that cause climate change are emitted mainly from burning fossil fuels such as coal, oil and natural gas. Because heavy industry is a leading source of GHG emissions, most of the business-focused programs responding to the problem emphasize participation by “emitters,” manufacturers and utilities. Action by industry alone, however, is not enough. Long-term solutions require emission reduction efforts by the entire economy, and this publication addresses service-sector companies such as banks, law firms, retailers, and real estate managers. Even though they are not considered large emitters, these companies do emit GHGs and can help mitigate climate change through changes in their energy use and the products and services they offer.

The most common greenhouse gas is carbon dioxide (CO₂) and two of the largest global sources are electricity and heat (32 percent) and transportation (17 percent).¹ Service-sector companies’ activities contribute to these sources through their electricity use, heating, cooling and travel. They may also contribute to other large global CO₂ emission sources such as land use change and forestry (24 percent) and manufacturing and construction (13 percent).² Service-sector companies have an opportunity to influence their operations, supply chains, customers, employees, and other stakeholders and to help change those behaviors necessary to curb the most dangerous effects of climate change.

To provide the context for service-sector companies’ action, this guide begins with:

- A brief overview of climate change science and expected impacts. This section describes climate change and why it is occurring, and summarizes some of the anticipated consequences, such as more intense weather events, water and food shortages, and possible changes in the geographic distribution of some infectious diseases.
- An outline of the connection between climate change and the service sector and the reasons that service-sector companies should take action. This section explains how service-sector companies contribute to global GHG emissions and the economic dangers of climate change that they face. Then we discuss the “business case” for service-sector companies to take action. At the outset, the business must develop a case for taking action and determine its goals for a program responding to climate change. Why should the company undertake this activity? What are the risks of undertaking or not undertaking it? What will the return on its investment be? What are the short- and long-term benefits for the company? How will its stakeholders react?

These sections are followed by a step-by-step manual for service-sector businesses ready to begin responding to climate change.

PLANNING YOUR GHG INVENTORY

In order to affect climate change, GHG emissions must be reduced, which service-sector companies can do by changing their energy use as well as the products and services they provide. In order for companies to track their performance and ensure that their actions do reduce their GHG emissions, they must measure them by developing a GHG inventory, a list of the sources of their GHG emissions and their quantities. This inventory is the foundation of an effective corporate climate change program. Measurement enables businesses to assess their risks and opportunities, follow their progress, and create a strategy to reduce emissions by measurable amounts.

To start, resources must be assigned, emission sources identified, and data gathered. Those staff charged with this task must be familiar with their company's organizational structure, for example, partnerships, joint ventures, or other organizational subunits of the parent company, so they can identify its emission-generating activities and associated sources of emissions. For example, will the company include emissions from transportation? Will this include all transportation, such as business trips to meetings and conferences, product distribution, and employees commuting to and from work, or just some of these? Will all the sources of energy that the business uses, such as electricity or other fuels for heating and cooling be included? Does the company lease assets such as buildings and vehicles that should be included in the inventory? The staff should use a framework based on the World Resources Institute/World Business Council for Sustainable Development's *GHG Protocol Corporate Accounting and Reporting Standard* (revised edition) (GHG Protocol) to make decisions that are comparable to those made by other businesses.

DEVELOPING YOUR GHG INVENTORY

Once your company has decided on a strategy for measuring emissions, it can begin developing its GHG inventory by collecting and managing data. First the company must decide for which year it is gathering information and then determine what information is needed for each emission source and where to find it. For example, is it best to start by gathering data for the current year, the previous year, or another year? How does the company measure electricity, and where can it find how much electricity each business unit uses? Are there circumstances under which this information may be estimated? Each emission source has a corresponding

emission factor, how are these factors applied and where are they found? Companies must devise a way to collect this information efficiently, as well as a system to store and manage it. How best can a data management system ensure the quality of the data?

Once information is gathered about each emission source, the company can begin calculating its emissions. Although this is relatively simple, the company must be careful not to make errors that can cause inaccuracies in the inventory, such as mistakes in data entry or basic math. How should the company make these calculations? Will it create its own tools or save time and resources by using established tools such as those provided by the GHG Protocol?

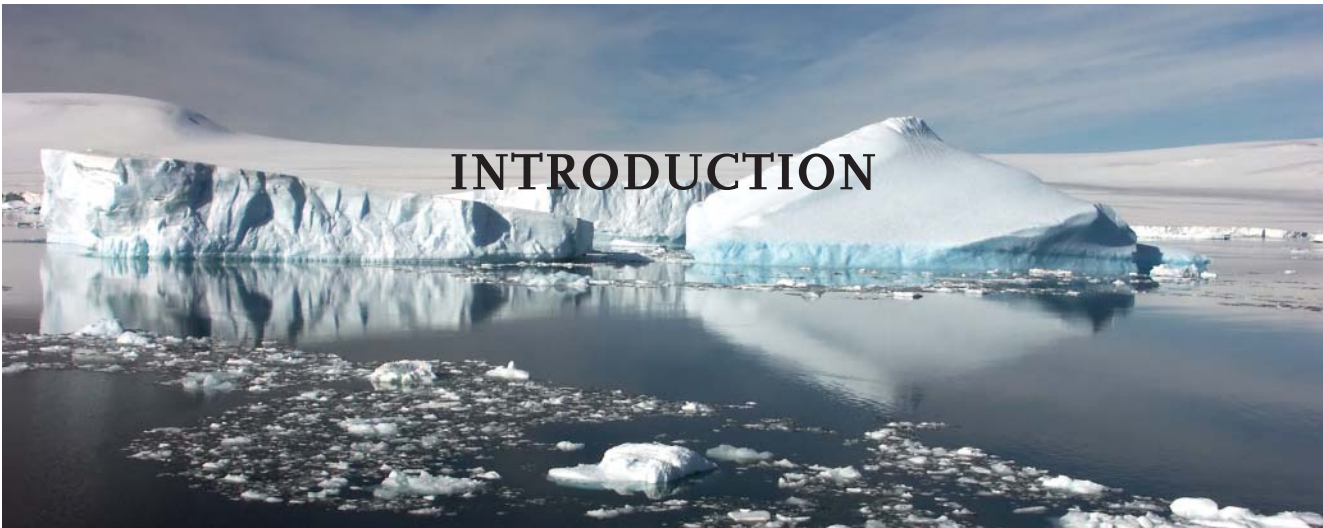
MANAGING YOUR GHG EMISSIONS

Once your company has measured its emissions, it can start to manage them. Its GHG inventory will help determine the best emission reduction opportunities. For example, is it better to reduce its own electricity use or to influence supply chain emissions? What other solutions might be feasible? What about obtaining energy from renewable sources, moving to green buildings, or improving vehicles' fuel efficiency? The company also should fix an emission reduction target to demonstrate to its stakeholders its commitment and intentions and to track its progress through public reporting. What are the reasons for establishing a target, and how does a company decide what type of target to set? What information should be included in a company's public GHG inventory report?

This guide answers all these questions according to the established framework of the GHG Protocol, to ensure that service-sector companies develop effective climate change response strategies that are compatible with both others in the business community and voluntary and mandatory climate change programs.

Notes

1. See World Resources Institute, Climate Analysis Indicators Tool (CAIT), version 3.0 (Washington, DC: World Resources Institute, 2006). Transportation emissions include international transport emissions, referred to as "international bunkers."
2. Ibid.



INTRODUCTION

WHAT DOES THE GUIDE PROVIDE?

Businesses of all types are discovering that climate change poses both challenges and opportunities. To understand what these may be for your company, you must first measure your company's greenhouse gas (GHG) emissions by developing a GHG "inventory," a list of the sources of your company's emissions and their quantities. This information will enable you to identify opportunities to reduce emissions and draw up a long-term plan to manage your company's impact on climate change. This guide is specifically for service-sector companies and provides:

- An introduction to climate change, its connection to service-sector companies, and the business case for taking action.
- Step-by-step guidance on assembling your company's GHG inventory and managing your company's emissions over time.
- Detailed information about GHG-accounting issues relevant to service-sector companies. Examples include accounting for the GHG emissions associated with leased assets such as buildings or vehicles, and guidance on deciding which emission-causing activities service-sector companies should measure.
- Case studies illustrating how service-sector companies are responding.

Note that technical terms and concepts that are part of the language of the GHG Protocol (see box 1) are explained and used in this guide. Uniform standards, including consistent methods and terminology, improve

the usefulness and credibility of inventory information. Appendix 4 is a glossary of the terms used in this guide.

BOX 1 | THE GHG PROTOCOL

The GHG Protocol is a multiple-stakeholder partnership of business, NGOs, and governments, led by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). It is the best source of information about corporate GHG accounting and reporting and draws on the expertise and contributions of individuals and organizations from around the world. The GHG Protocol's *Corporate Accounting and Reporting Standard* provides comprehensive guidance on accounting for and reporting corporate GHG emissions and is the most widely used standard for mandatory and voluntary GHG programs. Other international standards, such as the ISO 14064 standard, also are compatible with the GHG Protocol. The standards are analogous to the generally accepted financial accounting standards for companies' consistent accounting and reporting practices. The first edition was published in 2001, and the revised edition was released in 2004. For more information about the GHG Protocol or to download the standards and calculation tools, visit www.ghgprotocol.org.

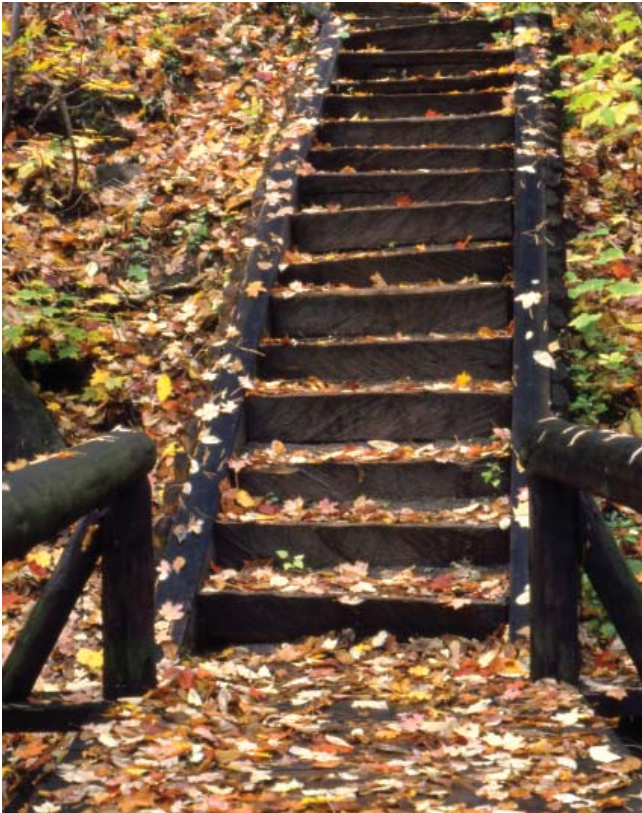


WHO CAN/SHOULD USE THIS GUIDE?

This guide is for companies in the service sector defined as those that do not undertake any manufacturing activities or use only contract manufacturers. Examples include banks, insurance, retail, law firms, real estate, publishing, shipping, marketing, and consulting companies. The methods of calculating emissions and strategies for reducing them apply to a variety of company sizes, types, and locations.

The management of emissions in service-sector companies often falls to nontechnical staff, for whom this guide has been written. Although you do not need to have a technical or engineering background to use this guide, you do need basic math skills and a solid understanding of your company's organizational structure.

This guide draws on and is consistent with the GHG Protocol, and it also builds on WRI's experiences managing its own impact on the climate (see box 2). Companies not covered by this guide, such as manufacturing companies, should refer directly to the GHG Protocol, which also provides more detailed information about many of the topics discussed in this guide.



BOX 2 | WALKING THE TALK AT WRI

WRI recognizes climate change as a critical threat to people's lives, the economy, and the environment. To minimize our own impact on the climate and to hold ourselves to the same standard that we expect from others, WRI is committed to reducing its CO₂ emissions to "net zero" each year and to publishing its "lessons learned." This project has given WRI firsthand experience and a better understanding of the climate policy issues facing businesses and also has informed our efforts to help service-sector companies reduce their greenhouse gas emissions.

WRI compiles a greenhouse gas inventory each year that follows the framework of the GHG Protocol's *Corporate Accounting and Reporting Standard* (revised edition) and publishes its inventory report on its Web site.

WRI has engaged in a number of activities to reduce its emissions. For example, it designed its leased Capitol Hill headquarters with energy conservation in mind. The building maximizes the use of natural daylight and uses energy-efficient compact fluorescent lamps (CFLs) throughout the space. Each office has motion sensors ensuring that lights are used only when the space is occupied. All our printers, fax machines, copiers, dishwashers and refrigerators are energy-efficient models. In addition, WRI collaborates with its landlord to make sure that the equivalent of 100 percent of its electricity comes from clean, renewable sources such as wind.

WRI's office helps staff minimize emissions from travel too. The office is located a few short blocks from the city's main mass transit hub, which connects travelers by rail to other East Coast cities and by subway to the local area. On-site shower facilities as well as a secured area for storing bicycles are important benefits for employees who prefer to commute by emissions-free means. In addition, WRI's video-conferencing equipment enables staff to connect with partners around the world without leaving the office.

In order for the organization to meet its goal each year, WRI uses a variety of mechanisms to offset any remaining emissions. More information about WRI's green office and its climate activities can be found on the WRI Web site, www.wri.org.

WHAT IS GLOBAL CLIMATE CHANGE?

Global climate change is one of the world's most serious and complex challenges. It is the destabilization of the earth's climate system caused by an increase in the concentration of greenhouse gases (GHGs) in the atmosphere (see box 3). These gases absorb infrared radiation as it is reflected from the earth's surface, acting like a blanket, trapping heat, and keeping the earth warm. The earth's atmosphere has always contained GHGs, which in fact keep our planet about 30° C (54° F) warmer than it would be otherwise. However, since the beginning of the Industrial Revolution, the levels of GHGs in the atmosphere have grown rapidly as a result of human activities, particularly the burning of fossil fuels like coal, oil, and natural gas as an energy source. The current concentrations of GHGs in the atmosphere are at levels unprecedented in at least the last 650,000 years¹ and as a result, the earth's climate is warming.

The most significant GHG is carbon dioxide (CO₂), which makes up approximately 77 percent of global GHG emissions (see figure 1). One-third of those emissions result from electricity generation and heat (see figure 2). Since the beginning of the Industrial Revolution, atmospheric concentrations of CO₂ emissions have

BOX 3 | GREENHOUSE GASES

The six main greenhouse gases are

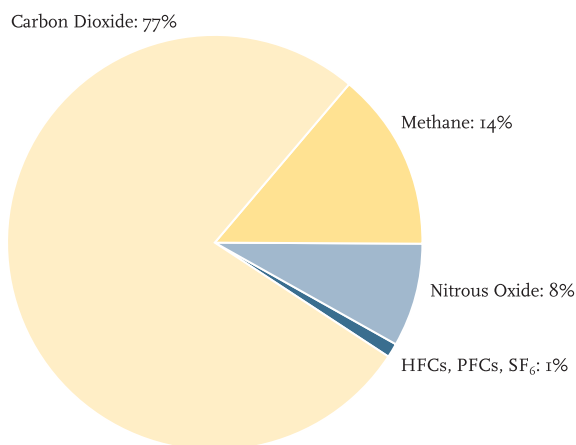
- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF₆)

Because GHGs vary in their ability to trap heat in the atmosphere, some are more harmful to the climate than others. Each GHG has a “global warming potential,” or “GWP,” which refers to its heat-trapping ability relative to that of carbon dioxide (CO₂). For example, CO₂ is the most prevalent GHG, but methane (CH₄) is 21 times more potent, thus the GWP of methane is 21.¹ GHGs are often reported as CO₂-equivalents (CO₂e).

Notes

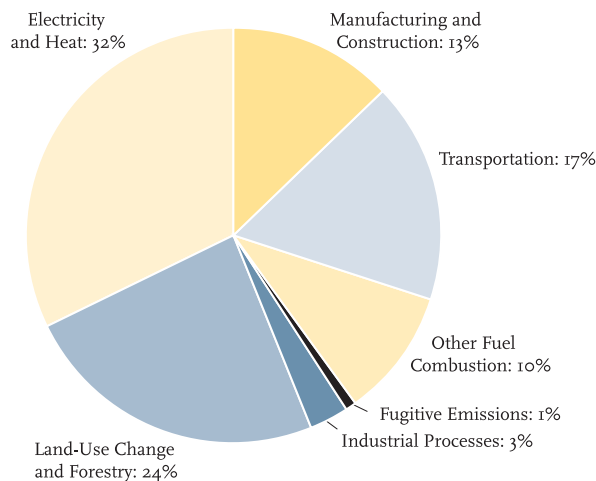
1. Intergovernmental Panel on Climate Change (IPCC), “Climate Change 1995: The Science of Climate Change.”

FIGURE 1 | GLOBAL GHG EMISSIONS BY GAS (2000)



Source: World Resources Institute, Climate Analysis Indicators Tool (CAIT), version 3.0 (Washington, DC: World Resources Institute, 2006).

FIGURE 2 | GLOBAL CO₂ EMISSIONS BY SECTOR (2000)



Source: World Resources Institute, Climate Analysis Indicators Tool (CAIT), version 3.0 (Washington, DC: World Resources Institute, 2006).

Note: Transportation emissions include international transport emissions, referred to as “international bunkers.”

increased by 35 percent,² primarily the result of the burning of fossil fuels and deforestation.

This increase in atmospheric CO₂ and other GHG concentrations is causing the temperature of the earth's surface and its lower atmosphere to warm at rates beyond natural variability. According to a 2001 report by the Intergovernmental Panel on Climate Change (IPCC),³ if the current emission trends continue, by 2100 the earth's global surface air temperatures are projected to warm by 1.4 to 5.8° C (2.5 to 10.4° F).⁴

While a global temperature rise of a few degrees may not seem serious at first, most scientists expect this increase to have a severe destabilizing effect on the earth's climate system, producing an array of negative social, economic, and health effects that would result from rising sea levels, intensified weather events, droughts, habitat destruction and other climate change impacts.

Global climate change is also a long-term problem, as CO₂ and other GHG emissions can remain in the atmosphere for decades to centuries and even longer.⁵ Consequently, because the potential impacts of climate change are likely to escalate over time as gases continue to accumulate in the atmosphere, it is imperative that steps to reduce emissions begin immediately. To prevent global temperatures from rising more than 2° C (3.6° F) above preindustrial levels—a level that still may have dangerous implications—global emissions must be

reduced 40 to 45 percent below 1990 levels by 2050.⁶ To accomplish this, action must begin now, with the participation of all sectors of society.

WHAT ARE THE EFFECTS OF CLIMATE CHANGE?

The impacts of climate change are diverse and could be damaging to billions of people across the world, particularly those in developing countries who are the most vulnerable. Many of the effects of climate change will have negative economic consequences. The number of severe weather events, for example, is likely to increase and intensify as a result of climate change, which could result in billions of dollars in economic damage annually⁷ (see "Getting Down to Business," p. 10).

The following is an overview of the potential implications of climate change.

Intensified and More Frequent Weather Events

The number of extreme weather events, such as heat waves, precipitation, floods, droughts, hurricanes, avalanches, and windstorms is expected both to increase and intensify because of climate change.⁸

Recent events demonstrate the consequences of extreme weather. In 2003, an abnormal and extreme heat wave in Europe killed more than 35,000 people. In



2005, at least 1,300 people died as a result of Hurricane Katrina, which hit the U.S. Gulf Coast causing an estimated \$135 billion in economic damage.⁹ New evidence shows that the recent increase in hurricane intensity is due to climate change, and figure 3 depicts the rise in category 4 and 5 hurricanes around the world since 1975. A study published in 2005 in the journal *Nature* links hurricane intensity and duration to the recent ocean-warming trends associated with climate change. This study also found that over the past three decades, the destructive power of hurricanes in the Atlantic and Pacific has doubled.¹⁰

Although no one particular heat wave, hurricane, or other extreme weather event can be attributed directly to climate change, it will likely cause these extreme weather events to intensify and occur more frequently over time.

Rising Sea Levels

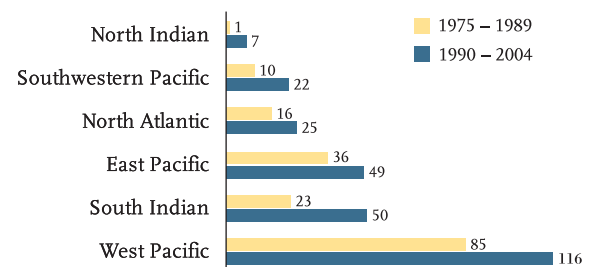
Sea levels around the world are rising faster because of the melting of land-based ice and the thermal expansion of oceans. According to the Arctic Climate Impact Assessment (ACIA, an intergovernmental forum composed of the eight arctic nations),¹¹ in the past two decades the global sea level has risen by an average of 8 centimeters (3 inches), and projections show an additional rise of 10 to 90 centimeters (4 inches to 3 feet) during the twenty-first century.¹² This rise in sea level, coupled with heavier than usual precipitation, may increase the risk of flooding for tens of millions of people in coastal areas across the world.¹³

Of particular concern is the Greenland Ice Sheet, which has been melting since 1979 more quickly than expected. Models indicate that over the longer term, climate change may eventually lead to its melting completely, which would raise the sea level by about 7 meters (23 feet).¹⁴

Water Shortages and Threats to Food Security

Water scarcity currently affects 1 billion to 2 billion people worldwide.¹⁵ Climate change may exacerbate this serious problem, as prolonged droughts and spreading desertification could stress already scarce water resources.¹⁶ Regions that rely on glacial melt water for their dry season water supply, such as the Himalaya-Hindu Kush region which includes China, India and other parts of Asia and is home to fifty to sixty percent of the world's population, may be impacted as glaciers recede and dry season water sources are not

FIGURE 3 CHANGE IN NUMBER OF CATEGORY 4 AND 5 HURRICANES BY OCEAN BASIN FOR THE 15-YEAR PERIODS 1975–1989 AND 1990–2004



Source: P. J. Webster et al., "Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment," *Science*, September 16, 2005.

replenished.¹⁷ In addition, climate change may threaten global food security, as agricultural productivity in the tropics and subtropics is projected to slow because of excessive heat and droughts.¹⁸

Disease and Other Health Effects

Climate change could expand the geographic distribution of and exposure to infectious diseases like malaria, dengue fever, cholera, and Lyme disease in parts of Africa, Asia, Latin America, and North America as warmer weather allows these and other diseases to thrive in locations previously too cold to support them.¹⁹

The World Health Organization estimates that climate change caused more than 150,000 fatalities in 2000, a figure projected to increase in the future.²⁰ Diseases linked to climate change that are attributed to fatalities and illnesses are cardiovascular mortality and respiratory illnesses due to heat waves, altered transmission of infectious diseases, and malnutrition from crop failures.²¹

Disruption of the Ecosystem

Climate change could magnify the cumulative impacts of other ecosystem stresses caused by human development, such as air and water pollution and habitat destruction. Natural systems, including glaciers, coral reefs, atolls, mangroves, boreal and tropical forests, polar and alpine ecosystems, prairie wetlands, and remnant native grasslands, are particularly vulnerable and may be

damaged irreversibly.²² Considerable harm has already been done. For instance, according to the Millennium Ecosystem Assessment, in the last several decades of the twentieth century, about 20 percent of the world's coral reefs were lost, and an additional 20 percent were degraded. This report also states that "by the end of the century, climate change and its impacts may be the dominant driver of biodiversity loss and changes in ecosystem services globally."²³ Changes in ocean water temperature and salinity as well as in CO₂ concentrations in ocean waters may compound other stresses placed on the world's fisheries, which would particularly hurt the poor. One billion people, mostly in developing countries, depend on fish for their primary source of protein.²⁴

Habitat Destruction and Species Extinction

Habitat loss and ecosystem changes are expected to bring about a decline in the local diversity of native species by 2050, and the rate of extinction for these species may be hastened by climate change.²⁵ In the Arctic, warmer temperatures and melting sea ice caused by climate change will be particularly harmful to native species like polar bears and ice-dependent seals. It is unlikely that these species will survive the century if climate change persists.²⁶

Notes

1. European Project for Ice Coring in Antarctica (EPICA), “Stable Carbon Cycle–Climate Relationship during the Late Pleistocene” and “Atmospheric Methane and Nitrous Oxide of the Late Pleistocene from Antarctic Ice Cores,” *Science*, November 25, 2005.
2. A. Neftel et al., “Historical CO₂ Record from the Siple Station Ice Core” (Bern: Physics Institute, University of Bern, 1994); C.D. Keeling and T.P. Whorf, “Atmospheric CO₂ Concentrations (ppmv) Derived from In Situ Air Samples Collected at Mauna Loa Observatory, Hawaii” (Scripps Institute of Oceanography, 2005).
3. The IPCC was established by the World Meteorological Organization (WMO) and the United Nations Environmental Program (UNEP). It consists of approximately 2,000 of the world’s leading scientists and economists who research and issue peer-reviewed reports on climate change.
4. Intergovernmental Panel on Climate Change (IPCC), “Climate Change 2001: Impacts, Adaptation, and Vulnerability (Summary for Policy Makers)” and “Climate Change 2001: The Scientific Basis.”
5. IPCC, “Climate Change 2001: The Scientific Basis (Summary for Policy Makers).”
6. Such an emissions reduction would achieve a 2°C target with a probability exceeding 85 percent. The reduction figure excludes emissions from changes in land use and forestry. Significant climate damages may still be associated with a 2° C increase in global temperatures. See M. G. den Elzen and M. Meinshausen, “Meeting the EU 2° C Climate Target: Global and Regional Emissions Implications” (Bilthoven: Netherlands Environmental Assessment Agency, 2005).
7. United Nations Environment Programme Finance Initiatives (UNEP FI), “Climate Change & The Financial Services Industry, Module 1—Threats and Opportunities,” report prepared for the UNEP FI Climate Change Working Group by Innovest Strategic Value Advisors, July 2002.
8. IPCC, “Climate Change 2001: Impacts, Adaptation, and Vulnerability (Summary for Policy Makers).”
9. Swiss Re, “Preliminary Swiss Re Sigma Estimates of Catastrophic Losses in 2005,” December 20, 2005.
10. K. Emanuel, “Increasing Destructiveness of Tropical Cyclones over the Past 30 Years,” *Nature* 436 (2005): 686–88.
11. The eight arctic nations are Canada, Denmark/Greenland/Faroe Islands, Finland, Iceland, Norway, Russia, Sweden, and the United States.
12. Arctic Climate Impact Assessment (ACIA), “Impacts of a Warming Arctic (Highlights)” (2004).
13. IPCC, “Climate Change 2001: Impacts, Adaptation, and Vulnerability (Summary for Policy Makers).”
14. ACIA, “Impacts of a Warming Arctic.”
15. Millennium Ecosystem Assessment, “Living beyond Our Means: Natural Assets and Human Well-Being,” Statement from the Board, March 2005.
16. IPCC, “Climate Change 2001: Impacts, Adaptation, and Vulnerability (Summary for Policy Makers).”
17. T.P. Barnett, J.C. Adam, D.P. Lettenmaier, 2005; “Potential Impacts of a Warming Climate on Water Availability in Snow-Dominated Regions,” *Nature*, November 2005, 438: 303–309.
18. Millennium Ecosystem Assessment, “Living beyond Our Means”; IPCC, “Climate Change 2001: Impacts, Adaptation, and Vulnerability (Summary for Policy Makers).”
19. IPCC, “Climate Change 2001: Impacts, Adaptation, and Vulnerability (Summary for Policy Makers).”
20. World Health Organization, A.J. McMichael, et al., “Climate and Human Health — Risks and Responses,” WHO, Geneva 2003.
21. J. A. Patz, D. Campbell-Lendrum, T. Holloway, and J. A. Foley, “Impact of Regional Climate Change on Human Health,” *Nature*, November 2005, 438: 310–17.
22. IPCC, “Climate Change 2001: Impacts, Adaptation, and Vulnerability (Summary for Policy Makers).”
23. Millennium Ecosystem Assessment, “Living beyond Our Means.”
24. World Resources Institute, “People and Ecosystems: The Fraying Web of Life” (Washington, DC: World Resources Institute, 2000/2001).
25. Millennium Ecosystem Assessment, “Living beyond Our Means.”
26. ACIA, “Impacts of a Warming Arctic.”



GETTING DOWN TO BUSINESS

This guide is designed to help service-sector companies take action on climate change. Although these companies are not generally viewed as polluters—they do not have smokestacks or manufacturing activities and are not likely to be the target of regulations aimed at reducing GHG emissions—they do contribute to climate change and thus should be part of the solution. This chapter explains why service-sector companies should take climate change seriously, with an overview of the connection between climate change and service-sector companies, including the economic impact that companies in this sector may face. We also discuss establishing the business case for your company to take action on climate change.

SERVICE-SECTOR COMPANIES AND CLIMATE CHANGE: UNDERSTANDING THE CONNECTION

Many of service-sector companies' daily activities consume energy, which is the leading contributor to global climate change. These energy-related activities are primarily electricity consumption for lighting, cooling, computers, building equipment, and appliances, as well as fuel use for transportation and heating.

Globally, the emissions from the production of electricity and heat together account for 25 percent of global GHG emissions and 32 percent of global CO₂ emissions.¹ Electricity generation alone accounts for 17 percent of the world's GHG emissions.² Service-sector companies contribute to these emissions from energy

use in offices, retail stores, distribution centers, and other company buildings.

Transportation, including road, air, marine, and rail, is another major contributor to global climate change, accounting for about 14 percent of global GHG emissions and 17 percent of global CO₂ emissions.³ Service-sector companies contribute to transportation emissions through the use of company vehicles, business travel to meetings and conferences, employee commuting, and the distribution of products and materials.

Activities that occur upstream and downstream from service-sector companies' main operations also generate GHG emissions. For example, the upstream manufacture and distribution of products result in GHG emissions and, downstream, emissions may come from the use or disposal of products and travel by customers or clients to and from companies' office or retail locations.

An Economic Threat to the Service Sector

Climate change may harm businesses' operations and profitability, including those of service-sector companies. For instance, businesses with operations or customers in areas like coastal regions may be at risk from physical damage to property caused by flooding and extreme weather events, the loss of revenue in the aftermath of a violent storm, and the ensuing higher insurance premiums in these regions. Damage to energy infrastructure resulting from extreme weather events may also raise energy prices which could also increase, in some situations, as a result of carbon regulations. While

not likely to be directly subject to these regulations, service-sector companies still could be impacted by changing energy prices.

In an increasingly interdependent global economy, companies' value chains may cover activities in different geographic locations. Such diversity can make almost any company vulnerable to the impact of climate change throughout the world, as any effect on an upstream supplier or a downstream consumer may significantly change a company's operations and profit margin. Some service-sector industries are at greater risk due to the nature of their business. Examples include:

- *Insurance and financial services.* The insurance industry—one of the world's largest industries with more than \$3 trillion in annual revenues—as well as financial services and asset management, is increasingly vulnerable to climate change.⁴ Insurance companies are already feeling the economic impact of the increase in extreme weather-related events across the globe. The overall costs of these extreme weather events reached record levels in both 2004 and 2005, a trend that is expected to continue,⁵ and may be compounded by increased development and rising property values in regions vulnerable to climate change impacts. For example, according to a report released by the United Nations Environment Programme Finance Initiative, worldwide economic losses resulting from natural disasters appear to be doubling every decade, and if current trends persist, annual economic losses will reach almost \$150 billion in the next decade.⁶ The report, which was produced in partnership with several major financial companies, states that the increasing frequency of severe climatic events, along with other social trends, “has the potential to stress insurers, reinsurers and banks to the point of impaired viability or even insolvency.”⁷
- *Tourism.* While climate change may benefit tourism in certain regions, in others it is likely to cause significant problems. In coastal regions, for example, tourism may suffer because of beach erosion, higher sea levels, damage to coral ecosystems, sea surges, and intensified storms. In areas dependent on winter activities, shorter winter seasons and less snowfall may dampen the demand for winter sports like skiing, snowboarding, and snowmobiling.⁸ According to the United Nations Environment Programme, low-altitude ski resorts are particularly at risk. For example, it estimates that changing snow levels in the next thirty

to fifty years could reduce Switzerland's number of “snow-reliable” resorts to 63 percent, down from 85 percent today. German and Austrian ski areas are similarly vulnerable, and as many as half of Italy's ski resorts are considered at risk. Fewer skiing days could cause significant economic damage to these regions.⁹

- *Real estate.* Real estate also could be affected by climate change. Physical damage to property could expose companies to financial risk. In addition, higher insurance premiums in these regions may hurt the real estate market. After all the hurricanes in Florida in 2004, seven private insurers stopped writing homeowners' policies in the state or withdrew from the market altogether, and at least one major insurance carrier announced that it would scale back homeowners' insurance policies in the U.S. Gulf states owing to “unacceptable” losses from Hurricane Katrina.¹⁰

MAKING THE BUSINESS CASE

Even if your company recognizes that service-sector companies contribute to climate change, it still must establish a business case to take action. Perhaps the best message to send to your company's decision makers is that GHG management—that is, measuring your company's GHG emissions, setting a reduction target, and implementing your reduction strategy—can build corporate value and earn benefits for your company. One example is improved brand management. A report by the Carbon Trust in 2005 states that climate change could become a mainstream consumer issue by the end of the decade.¹¹ The same report argues that many companies need time to change their operations or the products and services they provide, thus action is required now to ensure that they will be prepared for changing consumer perceptions.

Improved brand management is just one of several positive outcomes, or “value propositions,” that companies that take action on climate change can realize. Value propositions include both tangible returns, or measurable financial gains, and intangible benefits, which are difficult to measure but still build corporate value.¹² A successful climate change strategy for service-sector companies can bring tangible returns through cost savings from improved energy management and operational efficiencies, as well as greater market share and revenues from providing low-carbon products and services. Having a climate change strategy can help uncover money-saving activities or new products and



services that might not otherwise get attention or might not receive funding because of competition from other projects for capital. Intangible benefits could be competitive positioning, improved shareholder relations, and human resource management advantages such as better recruitment and retention of employees.

When considering all these possible returns and benefits, a strong case can be made that implementing a corporate climate change strategy is an excellent “win-win” opportunity that makes good business sense for the service sector.

Tangible Returns

- *Cost savings from improved energy management.* Reducing energy consumption by implementing energy efficiency and conservation measures is often a key component in a company’s strategy to reduce GHG emissions. From a financial perspective, this is simply good business, as better energy management can result in significant gains for many companies. This is particularly true when energy prices are high. Service-sector companies can save money by cutting fuel consumption in company vehicles and on-site building equipment such as boilers and furnaces, as well as by using less electricity in company facilities. Beginning in 2002, Staples, a U.S.-based office products supply company, used a range of energy efficiency measures in its stores and warehouses, which saved the company \$6.5 million.¹³
- *Cost savings from operational efficiencies.* One of the most important outcomes of measuring GHG emissions is finding ways of reducing them. In addition to energy-related savings, these opportunities for emission reductions can also stem from correcting operational inefficiencies. Such inefficiencies may be related to the distribution of products or the use of resources like paper. By focusing on them, companies can capitalize on opportunities to reduce emissions and costs. For example, UPS, the world’s largest package delivery company, uses “Package Flow Technology” to minimize the number of miles on its drivers’ routes. When the technology is fully deployed in 2007, the company expects to cut more than 100 million miles, saving the company almost 14 million gallons of fuel and reducing CO₂ emissions by 130,000 metric tons, while improving on the delivery time of shipments.¹⁴
- *Increased revenues and new markets from providing low-carbon products and services.* As climate change becomes more pressing, new markets for low-carbon products and services will continue to expand, providing business opportunities for service-sector companies to bring these products and services to market. For example,
 - Companies can sell energy-efficient products or offer services that promote sound energy management. For example, Fannie Mae offers a mortgage product—called an “energy-efficient mortgage”—which enables borrowers who buy a new energy-efficient home or make energy-efficient improvements to an existing home to qualify for a larger mortgage. These mortgages also can finance 100 percent of the energy improvements made to a home, up to 15 percent of an existing home’s value and up to 5 percent of a new home’s value.¹⁵
 - Insurance companies can offer preferential rates to drivers of highly fuel-efficient vehicles. For example, Sumpo Japan offers an “Eco-Car Discount” of 1.5 percent to drivers of hybrid or low-emission vehicles. In 2004, the discount was applied to drivers of approximately 3.25 million cars.¹⁶ Travelers, a U.S.-based insurance provider, has a similar service, called “Hybrid Travelers,” which offers an auto insurance discount of up to 10 percent to owners of hybrid cars.
 - Some of the most expansive greenhouse gas regulations treat carbon as a tradable commodity with a financial value. This represents a business opportunity for banks and investment companies entering these new markets. Companies also can invest in clean-energy technologies. These opportunities could each be nearly \$2 trillion-a-

year markets within 15 years.¹⁷ In addition, a better understanding of and more experience with climate change-related issues will help these companies advise clients on carbon-specific financial issues.

- Companies can brand products or services as “carbon neutral” by investing in GHG reduction projects—also known as GHG “offsets”—to counteract the GHGs generated from those products or services. For example, British Airways has a program that gives its customers an opportunity to offset their share of the CO₂ emissions created from the flights they take. Customers pay a small premium on their airfare, and in return British Airways invests in GHG reduction projects through a professional third-party offset provider. Companies can also offer low-carbon services and brand them as “climate friendly.” DHL Scandinavia offers a “Green

Tonnage” shipping product that allows customers to choose—for an extra fee—to have their shipments transported using low-carbon biofuels instead of conventional fuels such as diesel.

Intangible Benefits

- *Competitive positioning.* Enacting a strong corporate GHG management program can enhance your company’s image with customers and other stakeholders. Being the first company among your competitors to offer new low-carbon products or services can give your company a competitive advantage as the markets for these products and services expand and become more profitable.
- *Improved shareholder relations.* In recent years investors have become concerned with environmental performance and particularly the actions that companies are taking to address climate change. Investors increasingly view a successful corporate climate change strategy as an indication of superior business management. It even is possible that a corporate GHG management strategy that mitigates risks to the company or encourages profit opportunities or significant cost savings could result in a lower cost for capital or higher profit margins, which can in turn improve shareholder value.
- *Employee-related benefits.* Most companies strive to recruit and retain the best possible employees and to provide a productive work environment. Some aspects of a GHG program—such as incorporating green building design into new or existing space, offering employee incentive programs to promote emission-reducing activities, and discussing GHG management activities internally—may enhance employee recruitment and retention efforts and other human resource management advantages. For instance, research shows that high-performance green buildings can lead to increased productivity, more satisfying work environments, and improved occupant health and well-being.¹⁸



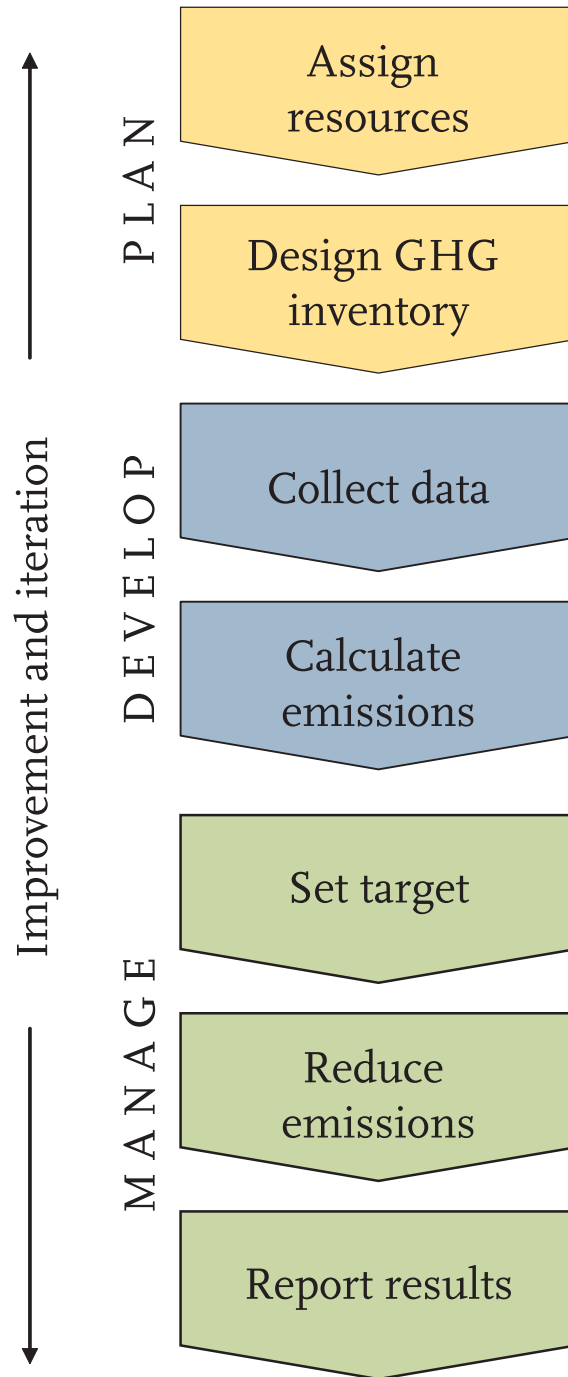
Notes

1. World Resources Institute, *Climate Analysis Indicators Tool (CAIT)*, version 3.0 (Washington, DC: World Resources Institute, 2006).
2. K. Baumert, T. Herzog, and J. Pershing, "Navigating the Numbers: Greenhouse Gas Data and International Climate Policy," World Resources Institute (WRI) report, December 2005.
3. *Climate Analysis Indicators Tool (CAIT)*, version 3.0. Transportation emissions include international transport emissions, which are referred to as "international bunkers."
4. Harvard Medical School, "Climate Change Futures: Health, Ecological and Economic Dimensions," a project of the Center for Health and the Global Environment, Harvard Medical School, sponsored by Swiss Re and the United Nations Development Programme, November 2005.
5. Harvard Medical School, "Climate Change Futures."
6. United Nations Environment Programme Finance Initiative (UNEP FI), "Climate Change and the Financial Services Industry: CEO Briefing," A document of the UNEP FI Climate Change Working Group, 2002.
7. UNEP FI, "Climate Change and the Financial Services Industry: CEO Briefing."
8. World Tourism Organization, "Climate Change and Tourism," Proceedings of the first International Conference on Climate Change and Tourism, Djerba, Tunisia, April 9–11, 2003; Intergovernmental Panel on Climate Change (IPCC), "Climate Change 2001: Impacts, Adaptation, and Vulnerability."
9. United Nations Environment Programme, "Climate Change and Winter Sports: Environmental and Economic Threats," report, December 2003.
10. E. Mills, R. J. Roth Jr. and E. Lecomte, "Availability and Affordability of Insurance under Climate Change: A Growing Challenge for the U.S." CERES, December 2005.
11. Carbon Trust, "Brand Value at Risk from Climate Change," report, February 2005.
12. See A. Aulisi, J. Layke, and S. Putt del Pino, "A Climate of Innovation: Northeast Business Action to Reduce Greenhouse Gases" (Washington, DC: World Resources Institute, 2004).
13. Green Power Market Development Group, "Parlaying Efficiency into Green Power: Staples' Experience with Optimizing GHG Performance," Corporate Case Study Series (Washington, DC: World Resources Institute).
14. 2004 UPS Corporate Sustainability Report, published 2005.
15. Fannie Mae Web site, "Mortgage Solutions, Energy Efficient Mortgage."
16. Sumpo Japan, Corporate Social Responsibility report, 2005.
17. UNEP FI, "Climate Change and the Financial Services Industry: CEO Briefing."
18. U.S. Green Building Council, "Building Momentum: National Trends and Prospects for High-Performance Green Buildings," report based on the April 2002 Green Building Roundtable and Prepared for the U.S. Senate Committee on Environment and Public Works, February 2003.

STEP-BY-STEP SUMMARY OF THIS GUIDE

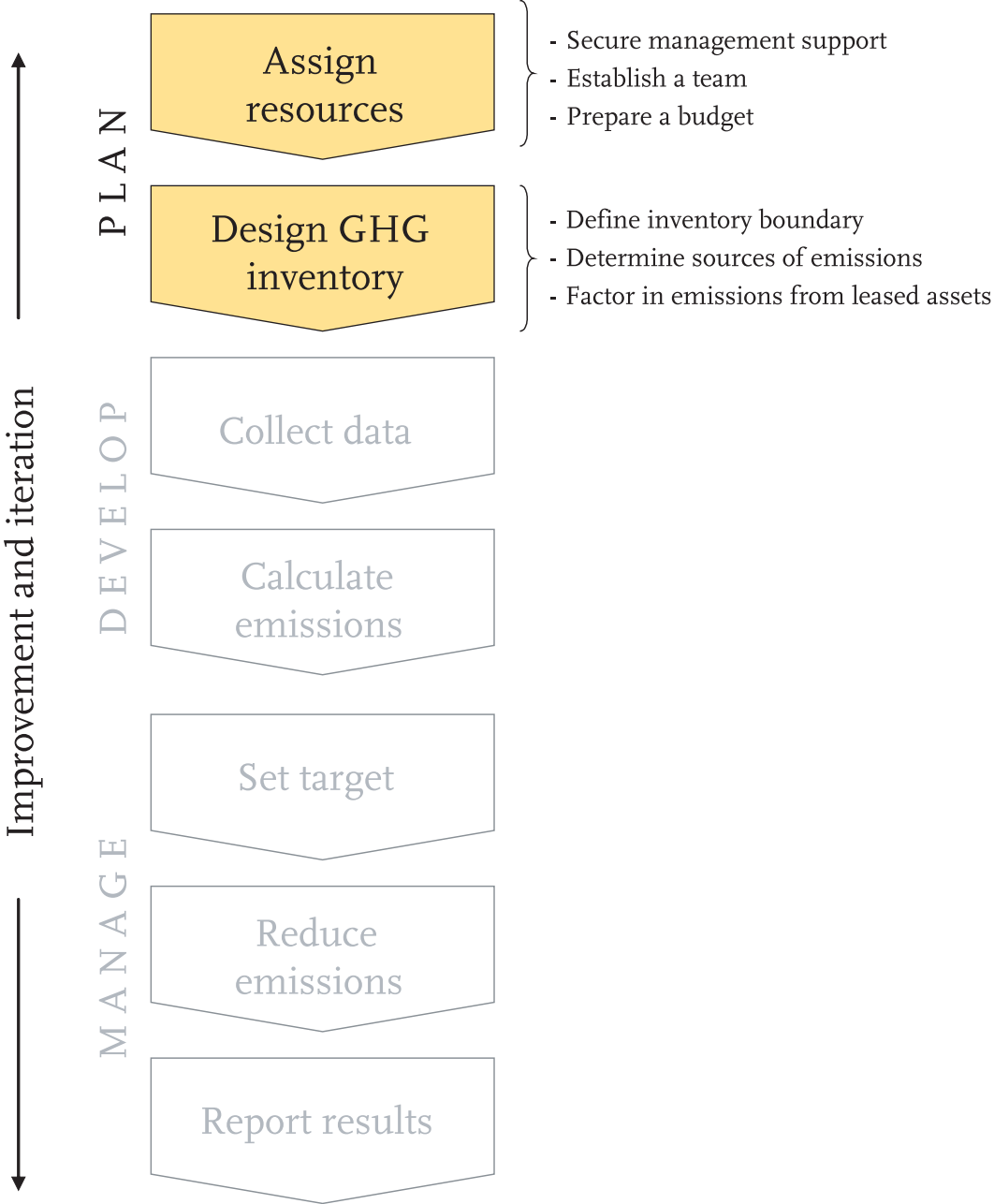
The following pages will help you plan, develop, and manage your company's commitment to reduce GHG emissions. The case studies cited

throughout the guide illustrate how other service-sector companies have tackled each stage. The following chart illustrates each step in the process.



Part 1

PLAN YOUR GREENHOUSE GAS (GHG) INVENTORY





STEP 1 DETERMINING RESOURCE REQUIREMENTS

No one person—facilities manager, concerned employee, or senior manager—can implement a climate change strategy alone. Rather, a successful reduction of GHG emissions requires (1) long-term planning, (2) changes in the company’s administrative and operational procedures, (3) a budget, (4) participation by as many people as possible (e.g., to track the use of energy or to promote energy conservation), and (5) regular and effective communication among staff and external stakeholders. For these reasons, securing senior management support will be critical to your success.

Developing and implementing a corporate climate change strategy is an iterative process, and you may not have all the information at the outset to understand your staffing and funding needs. This section is intended to help you think ahead about some of the resource issues you should consider in your planning.

CHOOSING A CLIMATE CHANGE TEAM

To manage your company’s commitment, you must choose a person or team of people to lead the effort, and you must incorporate the relevant activities in that person’s or team’s job description. The process of developing your inventory—particularly gathering the necessary data—can be time-consuming. Formalizing the responsibilities thus makes it more likely that they will be taken seriously and that the effort will be sustained. Since the staff on the inventory development team may change over time, it is important to ensure that your company’s annual inventory is institutionalized so that the lessons learned are applied each year to

improving the efficiency of your company’s inventory development.

What Staff Should Be on the Climate Change Team?

In smaller companies, enthusiasm is an important criterion for selecting the person who will lead the project, since generating interest is key to participation and successful implementation. You will need to find someone in your company who is familiar with the company’s organizational structure and so knows who the right person is to call to get the needed information. This person should also be comfortable communicating with all levels of staff, including senior management. While he or she does not have to be a math whiz, a solid understanding of the type of information required is necessary. For example, he or she should know that energy can be expressed in many different units, in order to obtain the necessary data and in the appropriate units, to spot common errors quickly, and to perform basic calculations. You also want to find someone who is both responsible and a skillful communicator (both orally and in writing), since he or she will need to work closely with staff and share findings and progress with the organization.

In large companies it may be more difficult to coordinate the information flow needed to create a GHG inventory. Data will likely come from different people within the organization, such as energy, facilities, and real estate managers and, in many cases, from several locations as well, so a team of people will be needed. It also is important to establish a well-structured and

efficient data management system (see step 3). The team should know what the company's business units are, for example, whether or not the company has joint ventures, subsidiaries, and/or partnerships. It is important to know this when designing your company's GHG inventory so that you can decide which business units to include in the inventory. (This is discussed in greater detail in the next step.) The team also should include a good communicator who can share findings and progress with the company as a whole as well as with external stakeholders. Either your corporate communications team or your environmental affairs staff can do this.



PREPARING A BUDGET

The cost of developing a GHG inventory varies significantly from company to company and may depend on such factors as the size of the company, the complexity of operations, and whether the company already has a data management system. For example, you may discover that your company already has a centralized record of much of the necessary information, which will speed up the development of your inventory. If not, you may need to spend time finding information and creating a record-keeping system. It also is likely to take more staff time to develop your inventory for the first year. Once the team has gained experience, the project is better established, and new or modified procedures are in place, less time will be needed. For any company, devising an efficient data-gathering process also will help save time, but a customized data management system comes with a cost. Keep in mind that if your company is large—for example, has several thousand people occupying several buildings—the responsibilities will be more time-consuming and may require more staff than will a small company housed in one or two offices.



STEP 2 ESTABLISHING BOUNDARIES

Once you've secured organizational support for your effort, your next task is to plan a GHG inventory for your company. A GHG inventory enables you to identify emission reduction opportunities, set a reduction target, and track your progress over time. For these reasons, your company's GHG inventory will provide the foundation for your company's climate change strategy (see case study A). While you are developing your company's inventory, refer to the GHG Protocol's guiding principles (see box 4).

Your company's GHG inventory is designed in two stages. The first is setting the "organizational boundary" for the inventory. Put simply, this means deciding which of your company's business units will be part of the inventory, such as:

- subsidiaries
- joint ventures
- partnerships
- franchises
- other business units

Second, consider all the activities of the operations within your organizational boundary that cause GHG emissions, for example,

- electricity use
- business travel
- product and material distribution
- heating and cooling of buildings
- employee commuting

These must then be categorized as either "direct" or "indirect" emissions so that you can track and try to reduce them. This step is called "setting the operational boundary for the inventory." A more complete list of emission-causing activities is provided in table 1 on page 24.

BOX 4 | GUIDING PRINCIPLES

As you develop your inventory, refer to the principles established by the GHG Protocol:

Relevance: Define boundaries that reflect the GHG emissions of your business and the decision-making needs of the inventory users.

Completeness: Account for all emissions sources and activities within your chosen organizational and operational boundaries. Justify specific exclusions.

Consistency: Allow a comparison of emissions performance over time. State any changes in the basis of reporting to make sure the comparison remains valid.

Transparency: Address all relevant issues, based on a clearly marked audit trail. Disclose any important assumptions, and cite the calculation methodologies used.

Accuracy: Ensure that your GHG calculations are accurate, and provide reasonable assurance of the GHG information's integrity.

CASE STUDY A

ECOMAGINATION EVOLUTION: HOW GE'S INVENTORY SUPPORTED THE FOUNDATION OF AN INNOVATIVE BUSINESS STRATEGY

General Electric (GE), a global, diversified corporation found that creating a GHG inventory enabled it to better identify its opportunities for emission reductions. This inventory also supported GE's "ecomagination" business strategy by generating the data needed to set a company-wide emission reduction target.

In 2001, GE had a shareholder resolution calling on the company to report the GHG emissions from its operations and products and to consider reducing them. While the resolution was defeated, GE was already considering conducting a GHG inventory and decided to proceed with this project. GE began creating its first GHG inventory in 2002 and gathered data through new tools that were included within its existing environmental compliance management systems. The company now reports its global corporate GHG emissions from sources such as energy use and makes the inventory available to the public in its annual citizenship report and on its website.

In 2005 GE's CEO, Jeffrey Immelt, introduced "ecomagination," which represents GE's commitment to develop products and services with lower environmental impacts, such as energy-efficient engines, appliances, locomotives, and wind turbines. Through "ecomagination," GE has committed to doubling its research and development investments in these technologies as well

as doubling its revenues from their sale, to \$20 billion by 2010. Convinced that "ecomagination" would be enhanced by GE's making its own GHG commitments, the company used its GHG inventory to assess its reduction opportunities and to help set a reduction target. Based on its GHG inventory, the company set an absolute corporate-wide target of 1 percent GHG reduction below 2004 levels by 2012, during which time the company expects significant business growth. (For information about absolute and intensity targets, see Step Five: Establishing an Emission Reduction Target).

GE has created a new position of Vice President for "ecomagination" who, along with GE's VP of Environmental Affairs, reports each quarter to the CEO on GE's progress toward all its GHG, research, and revenue goals. In addition, GE has asked its major GHG emitting business units to draw up plans for how they will meet the 1 percent goal, creating intra- and inter-business unit competition to achieve GE's goals. GE is now encouraging its employees to offer ideas for reducing emissions in addition to the comprehensive energy efficiency options it already has.

With ecomagination, GE is positioning itself as a global leader in a carbon-constrained world. Establishing a GHG inventory was crucial to supporting GE's innovative approach.

ORGANIZATIONAL BOUNDARIES

Before you start listing your company's emission-causing activities, you first must specify your inventory's organizational boundaries, that is, which of your company's business units will be included in your GHG inventory. The physical location of your company's business units—their geographic location and whether they are located in buildings that the company owns or space that it leases—is not relevant to establishing organizational boundaries. At this stage, consider only your company's organizational composition.

Your company's organizational boundary can be established using one of three approaches. If your company has full ownership of all its operations, your organizational boundary—that is, the business units

included in your inventory—will be the same, regardless of which approach you use. But if your company's organizational structure is more complex and includes, for example, joint operations and subsidiaries, your organizational boundary may vary depending on the approach you use. The three organizational boundary approaches are "equity share," and two control approaches, "financial control," and "operational control."

Equity Share Approach

If you use the equity share approach, the operations included in your company's organizational boundary and the percentage of emissions that you report will be equivalent to your company's equity share in the operation. For example, company A has a joint operation

with company B and a 40 percent equity share in the joint operation. When using the equity share approach, the joint operation is included in company A's organizational boundary, but only 40 percent of the resulting emissions are reported. A company's equity share in an operation usually is the same as its ownership percentage in that operation.

Control Approaches (Financial and Operational)

If you use one of the control approaches, those operations over which your company has "control" will be included in your inventory boundary, and your company will report 100 percent of the emissions from those operations. If your company has a share or interest in an operation but does not have "control," the operation will not be included in your organizational boundary, and your company will not report any of the operation's emissions.

Establishing "Control"

"Control" can be established using one of two criteria: "financial control" and "operational control."

- *Financial control.* Your company has financial control over an operation¹ if your company can direct its financial and operating policies to gain economic benefits from its activities. Note that the economic relationship between your company and the operation takes precedence over the operation's legal ownership. Therefore your company may have financial control over an operation even if it does not have majority ownership of it. Make sure if you select the financial control approach and your company has joint operations, that you use the equity share approach for the joint operations.
- *Operational control.* If your company, or any of its subsidiaries, has the ability to introduce and implement operating policies at an operation, then it has operational control. An example of operational control is the ability to implement policies to ensure that the operation follows your company's management practices.

Figure 4 illustrates how a company involved in several operations—all of which have different ownership and control structures—would account for and report all its emissions based on each organizational boundary approach.

The approach you use may determine how emissions are categorized as "direct" or "indirect" when you establish your company's operational boundaries. To understand these terms and their implications, be sure to read the section on p. 23 on operational boundaries. When you are deciding which approach is most suitable for your company, consider how your data may ultimately be used. The following section "Deciding Which Approach to Use" describes some of the advantages and disadvantages of each. Note that whichever approach you select, you should use it consistently across your company.

Deciding Which Approach to Use

A number of factors may influence your decision over which approach to use (see case study D on page 30). Some considerations relevant to service-sector companies include:

- *Completeness of inventory.* Many service-sector companies have assets such as leased office or retail space under operating leases. From the lessee's perspective, the operational control approach offers companies the most complete accounting and reporting of emissions from these sources. From the lessor's perspective, the equity share and financial control approaches offer the most complete accounting and reporting (for more details, see "Dealing with Leases," p. 26).
- *Management information and performance tracking.* To track performance, the control approaches generally are better, since managers can be held accountable for only those activities under their control.
- *Cost of administration and data access.* The equity share approach can lead to higher administrative costs than those of the control approaches, since collecting GHG emissions data from joint operations not under the control of the reporting company may be difficult and time-consuming. Companies are likely to have better access to operational data and therefore are better able to ensure that the information meets minimum quality standards when reporting on the basis of control.
- *Reflection of commercial reality.* A company that derives a profit from an activity should arguably take ownership of any GHG emissions resulting from the activity. To do so, select the equity share approach, because it assigns ownership for the GHG emissions

FIGURE 4 | ORGANIZATIONAL BOUNDARY APPROACHES

Company ALPHA Operations	Emissions Accounted For and Reported by Organizational Boundary Approach		
	Equity Share	Financial Control	Operational Control
Operation A: 500 tCO₂ Equity Share: 100% Operational control: yes Financial control: yes	500 tons	500 tons	500 tons
Operation B: 1,000 tCO₂ Equity Share: 51% Operational control: yes Financial control: yes	510 tons	1,000 tons	1,000 tons
Operation C: 1,000 tCO₂ Equity Share: 40% Operational control: yes Financial control: no	400 tons	0 tons	1,000 tons
Operation D: 2,000 tCO₂ Equity Share: 25% Operational control: no Financial control: no	500 tons	0 tons	0 tons
Company Alpha's Total Emissions	1,910 tons	1,500 tons	2,500 tons

on the basis of economic interest in a business activity. Although the control approaches do not always reflect a company's complete GHG emissions portfolio, they do have the advantage that a company takes full ownership of all the GHG emissions that it can directly influence and reduce.

- *Participation in a voluntary climate initiative.* Your company may wish to participate in a voluntary climate initiative (see table 5 on p. 60). If it does, check the program's guidelines, since they may specify which approach must be used with that program.

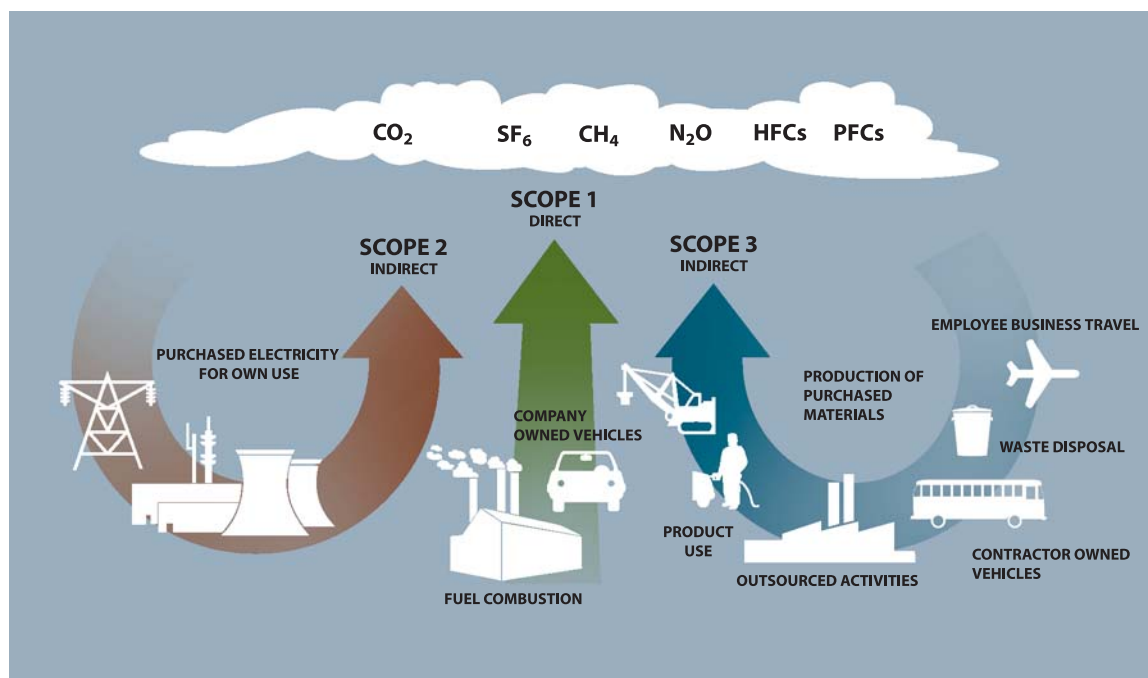
Other considerations that the GHG Protocol recommends are:

- *Liability and risk management.* The group company that holds an equity share in an operation or has financial control over it usually is financially liable for it as well.

Therefore, to assess risk, GHG reporting on the basis of the equity share and financial control approaches provides the most comprehensive coverage of liability and risks.

- *Alignment with financial accounting.* Future financial accounting standards pertaining to emissions-trading systems may treat GHG emissions as liabilities and emissions allowances and credits as assets on corporate balance sheets. The equity share and financial control approaches result in closer alignment between GHG accounting and standard financial accounting frameworks.
- *Government reporting and emissions-trading programs.* Government regulatory programs monitor and enforce compliance. Since the operator of a facility is generally responsible for compliance, governments usually require that the operational control approach

FIGURE 5 | OPERATIONAL BOUNDARIES



Source: New Zealand Business Council for Sustainable Development.

be used. Service-sector companies, however, are less likely to be subject to this type of government regulation.

One solution for companies, which the GHG Protocol encourages, is to use both the equity share and one of the control approaches for their inventory. The advantage is that your data will be versatile enough to apply to any program in which your company may participate and also meet the evolving goals of your company's GHG management program.

OPERATIONAL BOUNDARIES

Once you have set your organizational boundary, you will be ready to "define your operational boundary," that is, categorize your company's emission-causing activities in order to determine which to include in your inventory (see figure 5).

Emissions result from a variety of activities, like heating and cooling buildings, traveling to meetings, or shipping

products to consumers. You do not need to list all your company's emission-causing activities in your inventory, and the GHG Protocol's standards will help you decide which must be included and which may be left out. To start, you should understand the two categories of greenhouse gas emissions, "direct" emissions and "indirect" emissions, as well as the concept of "scope."

Direct Emissions

Direct emissions are emissions within your company's organizational boundary from sources that your company owns or controls, like business travel in a company car or the combustion of fuel in the company's boilers and furnaces. Table 1 lists other examples. The GHG Protocol requires that direct emissions be accounted for and reported. For reporting purposes, direct emissions are called "scope 1" emissions. Although not all service-sector companies have scope 1 emissions from power generated on-site, some do have company cars that should be accounted for in scope 1.

TABLE 1 EXAMPLES OF COMMON EMISSION-CAUSING ACTIVITIES	
Scope 1 Direct emissions from	<ul style="list-style-type: none"> • Combustion of fuel in boilers, furnaces, or generators that are owned or controlled by the reporting company. • Generation of electricity, steam, or heat in equipment that is owned or controlled by the reporting company. • Business travel in vehicles such as company cars or corporate jets that are owned or controlled by the reporting company. • Employee commuting in company-owned or -controlled vehicles such as company cars. • HFC emissions from company-owned or -controlled refrigeration or air-conditioning equipment.
Scope 2 Indirect emissions from	<ul style="list-style-type: none"> • Consumption of purchased electricity, steam, or heat.
Scope 3 Indirect emissions from	<ul style="list-style-type: none"> • Consumption of purchased electricity, steam, or heat (if consumption is in a leased operation not owned or controlled by your company. See “Dealing with Leases” on p. 26).
Scope 3 Indirect emissions from	<ul style="list-style-type: none"> • Business travel in non-company-owned or -controlled vehicles such as rental cars, employee cars, trains, and commercial planes. • Combustion of fuel in boilers or furnaces not owned or controlled by the reporting company. • Employee commuting in vehicles not owned or controlled by the reporting company, such as light rail, train, buses, and employees’ cars. • Third-party production or manufacture of materials and resources used by the reporting company, such as furniture, paper, and equipment (see box 5). • Outsourced activities such as shipping, courier services, and printing services. • End use of products sold by the reporting company.
<p>Key Blue = Mandatory reporting under the framework of the GHG Protocol and this guide. Grey = Mandatory reporting under the framework of this guide only. Yellow = Optional reporting under the framework of the GHG Protocol and this guide.</p>	

Indirect Emissions

Indirect emissions result from your company’s activities but from sources owned or controlled by another company. The most prominent example is electricity. Although all companies use electricity, the emissions occur at the point where the electricity is generated, usually at a power plant, so most companies’ emissions from electricity are indirect. Another example is emissions from travel: if your company’s employees fly to business meetings in a commercial aircraft, the emissions are indirect for your company, because the

emissions source—the plane—is not owned or controlled by your company. But if your company’s employees were to fly in your company’s corporate jet, the emissions would be direct, or scope 1, emissions (for other examples, see table 1).

For reporting purposes, indirect emissions are divided into the following two categories:

- “Scope 2” emissions refer to emissions from electricity² that is used by the reporting company but

is generated by another company. In GHG accounting terminology, this is called “purchased electricity.” The GHG Protocol requires that scope 2 emissions be accounted for and reported because they often make up a significant percentage of any company’s inventory, are relatively easy to quantify, and represent an important reduction opportunity. Note that in certain circumstances, such as when a building is leased, emissions related to the use of purchased electricity may be categorized as scope 3 emissions rather than scope 2. Be sure to read “Dealing with Leases,” on page 26, to find out when this might occur and how to properly account for these emissions.

- “Scope 3” emissions refer to all other indirect emissions. Some Scope 3 emissions can be difficult to account for, and the GHG Protocol does not require accounting for and reporting on them. But *relevant* scope 3 emissions should be accounted for, since for some companies they can represent a considerable source of emissions, as well as a significant opportunity to reduce them.

Why Is the Distinction between Direct and Indirect Emissions Important?

Government regulations of emissions by businesses generally apply to direct emissions. These regulations distinguish between direct and indirect emissions to make sure that different companies do not double-count the same emissions as direct emissions. For this reason, emissions are specifically defined and categorized to help clarify which are emitted from sources owned or controlled by the reporting company (direct) and which are not (indirect). The GHG Protocol developed the concept of “scope” to avoid double-counting the same emissions in scope 1 and scope 2. In other words, only one company may claim ownership of the same emissions within the same scope (1 and 2), providing that both companies with a potential claim use the same organizational boundary approach. Although scope 3 emissions may sometimes be double-counted, because these emissions are not likely to be included in a regulatory program, double-counting is not as important in this case. However, accounting for and reporting scope 3 emissions can help companies manage their GHG risks and opportunities. Scope 3 emissions are often included in voluntary GHG programs.

Deciding Which Scope 3 Indirect Emissions to Include in the Operational Boundary

Scope 3 is a very broad category of emission-causing activities that can cover just about every business or product to which your company is connected, however tangentially. It is not necessary to include all these activities in your company’s inventory, but you should consider those sources most relevant to your business (see case study B). Remember to follow the GHG Protocol’s guiding principles (see box 4) while you are deciding what to include. In general, the more inclusive your company’s operational boundary is, the more opportunities your company is likely to find to reduce emissions. You must be careful not simply to choose scope 3 indirect emissions sources only for convenience. Instead, consistent with the GHG Protocol’s guiding principles, establish a policy to decide which scope 3 sources your company will include in its inventory so that your decision-making process is clear. You might consider the following questions:

- Is the emission-causing activity large (or believed to be large) relative to your company’s scope 1 and scope 2 emissions?
- Is the emission-causing activity crucial to your company’s core business? Examples are a retail-sector company that uses a third party to ship its products to consumers and a magazine publisher that outsources its printing. Similarly, because paper is a core activity for many office-based companies, some may wish to include the emissions associated with the manufacture and disposal of paper in their inventory (see box 5 and case study C).
- Do your company’s stakeholders—for example, customers, suppliers, or investors—believe that it is important to account for particular emission-causing activities?
- Can your company reduce or mitigate some of these emissions?
- Do your company’s products require fossil fuels or electricity to use? If so, emissions from the use of your company’s products may be relevant, as your company may be able to change the product’s design or customer behavior to reduce these emissions.
- Does your company now outsource an activity that it previously categorized as scope 1? If so, it may be

CASE STUDY B

**INCLUDING EMISSIONS THAT MATTER:
IKEA AND DHL EXPRESS NORDIC COUNT THEIR CORE BUSINESS SCOPE 3 EMISSIONS**

Including relevant scope 3 emissions in a GHG inventory ensures that it is complete and may provide companies with innovative opportunities to reduce emissions. IKEA and DHL Express Nordic are good examples.¹

IKEA is a global home furnishings retailer with more than 160 stores in over 33 countries. When gathering data for its GHG inventory, IKEA included scope 3 emissions from its customers' trips to and from its stores because it perceived this activity as important to its business and expected these emissions to be large relative to its scope 1 and scope 2 emissions. IKEA's GHG inventory did confirm that this activity was a large source of emissions, accounting for 56 percent of its total emissions. IKEA's entire scope 3 emissions including customer travel accounted for 82 percent of its total emissions (see table). IKEA also found it could have significant influence over this source of scope 3 emissions when selecting sites for new stores. Consequently, IKEA set and has met its goal of making at least 75 percent of its stores accessible by public transit by locating them closer to cities and transit lines as well as funding transit projects near the stores. IKEA now informs its customers about their travel options by listing online customer ride-sharing, funding bicycle routes to its stores, and establishing park-and-ride bus services and in-store public transit information boards.

DHL Express Nordic, a division of Deutsche Post World Net, is a logistics and package delivery service operating in four Nordic countries. Although the company operates its own fleet of trains, trucks, ships, and planes, most of its deliveries are made by third-party contractors, and the

resulting emissions are scope 3 for the company. These services are essential to DHL Nordic's business and account for 94 percent of its total GHG emissions (see table). To reduce these emissions, DHL Express Nordic collects, through a mandatory survey, information about its contractors' environmental performance, including activity data such as fuel type, fuel usage, engine class, loading capacity and loading factors. Each contractor's performance receives a score, and since DHL Nordic Express works with only those contractors receiving scores above a certain number, they have an incentive to improve and maintain their environmental performance.

By including these scope 3 emission sources in their inventories, IKEA and DHL Express Nordic identified their largest sources of GHG emissions and thus were able to modify their operations and to encourage customers and suppliers to try to reduce these emissions.

Company	Scope 1	Scope 2	Scope 3	Total
IKEA	80,692 (3%)	421,142 (15%)	2,306,592 (82%)	2,808,424 (100%)
DHL Express Nordic	25,447 (5%)	4,969 (1%)	440,095 (94%)	470,511 (100%)

1. Business Leaders Initiative on Climate Change: Reports 1 – 4. 2002–2005. Amsterdam and London: Respect Europe.

relevant to report the outsourced activity as a scope 3 emission source.

- Are you able to find reliable data for the activity? The data for scope 3 emissions often are less accurate and reliable than those for scope 1 and scope 2 emissions. In fact, the data's availability and reliability may determine whether or not you decide to include some scope 3 emission sources in your inventory (for more information on the data collection requirements for different sources of emissions, see "Step 3: Gathering Data").

Dealing with Leases

Many companies lease some of their assets, such as space or vehicles, and must decide how to account for and report any resulting emissions. To do so, first you must know the type of your company's leased assets so that you can categorize the resulting emissions as direct or indirect. Whether the emissions are categorized as scope 1 (direct), scope 2 (indirect), or scope 3 (indirect) for your company depends on its organizational boundary approach and the type of lease. The following leasing guidance should be used to determine:

BOX 5 | ESTIMATING EMISSIONS FROM PAPER

Many service-sector companies, especially office-based ones, use a lot of paper. The greenhouse gases associated with paper are emitted during both its manufacture and its disposal, for example, in a landfill or by incineration or recycling. Deciding which emission factor to use in calculations can be difficult, as several variables and assumptions are involved. Environmental Defense's Paper Task Force researched these issues and created an easy-to-use Web-based calculator for paper, which can be accessed at www.papercalculator.org.

The calculation methodology for paper is difficult because of the many uncertainties involved. Nonetheless, it still may be worthwhile to include these emissions in your inventory, provided that you use the information appropriately. For example, although you should not report emission reductions from paper against a target, you still can measure and separately recognize reduction trends, provided that you use the same calculation method each year.

Another reason to include paper in your company's inventory is that it may be an effective method of building awareness in your company of your GHG reduction efforts. There are many ways to reduce the amount of paper that a business uses, and paper is a much more visible resource than electricity or fuel use (see case study C).

- Whether emissions that would normally be categorized as scope 1 (direct) in a nonleasing situation should be categorized as scope 1 (direct) or scope 3 (indirect)³ in a leasing situation.
- Whether emissions that would normally be categorized as scope 2 (indirect) in a nonleasing situation should be categorized as scope 2 (indirect) or scope 3 (indirect) in a leasing situation.

Emissions that are categorized as scope 3 (indirect) in nonleasing situations, such as upstream and downstream emissions, would also be categorized as scope 3 (indirect) emissions in leasing situations and so are not discussed further in this section.

CASE STUDY C
CONE INC.: USING PAPER USE REDUCTION TO COMMUNICATE ITS CLIMATE CHANGE COMMITMENT TO EMPLOYEES

Cone Inc., a strategic marketing and communications agency that helps its clients with corporate social responsibility (CSR) strategy and communications, decided to develop a GHG inventory to demonstrate to its stakeholders its environmental commitment. Cone specifically included paper in its inventory in order to make its employees aware of its climate strategy.

Most of Cone's 65 staff members were not aware of the company's new climate change initiative or of even the issue in general. They were, however, very aware of the large amount of paper consumed by the business, and several staff members believed that it was excessive. Cone's inventory planners thus decided to include paper not only to account for its effect on the climate but to also connect its employees' awareness of this effect with Cone's climate strategies. By measuring its scope 3 paper emissions and reducing its use of paper, Cone now is able to give its employees information about the company's effects and actions as well as tangible results. Whereas Cone's staff do not always see the benefits of other, less visible GHG reduction measures, the effect of reducing the use of paper is evident.

Differentiating Types of Leased Assets

The first step in determining how to categorize emissions from leased assets is to understand the two different types of leases: finance or capital leases and operating leases.

- *Finance or capital lease.* This type of lease enables the lessee to operate an asset and also gives the lessee all the risks and rewards of owning the asset. Assets leased under a capital or finance lease are considered wholly owned assets in financial accounting and are recorded as such on the balance sheet.
- *Operating lease.* This type of lease enables the lessee to operate an asset, like a building or vehicle, but does not give the lessee any of the risks or rewards of owning the asset. Any lease that is not a finance or capital lease is an operating lease.⁴

One way to determine whether an asset is leased under an operating or finance/capital lease is to check the company’s audited financial statements.

Categorizing Emissions from Leased Assets (Lessee’s Perspective)

Next you must determine whether the emissions associated with the leased assets should be categorized as direct (scope 1) emissions or indirect (scope 2 or 3) emissions in your company’s operational boundary.

- **Finance or capital lease.** Under a finance or capital lease, the lessee is considered to have ownership and both financial and operational control of the leased asset. Therefore, emissions associated with fuel combustion⁵ should be categorized as scope 1 (direct), and emissions associated with use of purchased electricity should be categorized as scope 2 (indirect), regardless of the organizational boundary approach selected (see table 2).
- **Operating lease.** Under an operating lease, the lessee is considered not to have ownership or financial control but to have operational control of the leased asset. Therefore, the categorization of emissions as direct or indirect depends on the organizational boundary approach selected. If the lessee uses the equity share or a financial control approach, the emissions associated with fuel combustion as well as with the use of purchased electricity should always be

categorized as scope 3 (indirect). But if the lessee uses the operational control approach, emissions associated with fuel combustion should be categorized as scope 1 (direct), and emissions associated with the use of purchased electricity should be categorized as scope 2 (indirect) (see table 2).

If these guidelines for categorizing emissions from leased assets have been correctly applied, indirect emissions from the use of purchased electricity may sometimes be categorized as scope 3 instead of scope 2. This is the case when a leased building is held under an operating lease and the organizational boundary approach used is either equity share or financial control. According to this guide’s framework, you must account for and report these scope 3 emissions. You must decide whether to report any other scope 3 indirect emissions in accordance with the scope 3 criteria you have established (see “Deciding Which Scope 3 Indirect Emissions to Include in the Operational Boundary,” p. 25).

Categorizing Emissions from Leased Assets (Lessor’s Perspective)

Some companies may lease assets to other companies, for example, real estate companies that lease office or retail space or vehicle companies that lease vehicle fleets. Whether emissions from these assets should be categorized by the lessor as direct (scope 1) or indirect (scope 2 or 3) depends on the organizational boundary approach and the type of leasing arrangement, because

TABLE 2 EMISSIONS FROM LEASED ASSETS: LEASING AGREEMENTS AND BOUNDARIES (LESSEE’S PERSPECTIVE)		
	Type of Leasing Arrangement	
	Finance/Capital Lease	Operating Lease
Equity Share or Financial Control Approach Used	Lessee <i>does</i> have ownership and financial control, therefore emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2.	Lessee <i>does not</i> have ownership or financial control, therefore emissions associated with fuel combustion are scope 3 and with use of purchased electricity are scope 3.
Operational Control Approach Used	Lessee <i>does</i> have operational control, therefore emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2.	Lessee <i>does</i> have operational control, therefore emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2. ^a
<i>Notes</i>		
a. Some companies may be able to demonstrate that they <i>do not</i> have operational control over a leased asset held under an operating lease. In this case, the company may report emissions from the leased asset as scope 3 but must state clearly in its GHG inventory report the reason(s) that operational control is not perceived.		

ownership and financial and operational control—in the case of finance or capital leases—and operational control—in the case of operating leases—is transferred to the lessee (see case study D).

- **Finance or capital lease.** The lessor does not have ownership or financial or operational control of these assets. Therefore, the associated emissions always are scope 3 (indirect) for the lessor, regardless of the type of organizational boundary approach used (see table 3).
- **Operating lease.** The lessor has ownership and financial control of these assets but not operational control. Therefore, if the equity share or a financial control approach is used, the emissions associated with fuel combustion should be categorized as scope 1 (direct), and the emissions associated with the use of purchased electricity should be categorized as scope 2 (indirect) for the lessor. However, if the operational control approach is used, emissions from fuel combustion and the use of purchased electricity will always be scope 3 (indirect) for the lessor, (see table 3).

Proper categorization of emissions from leased assets by lessors and lessees ensures that emissions in scopes 1 and 2 are not double-counted. For example, if a lessee categorizes emissions from the use of purchased electricity as scope 2, the lessor should categorize the same emissions as scope 3, and vice

versa. Whether emissions from the use of purchased electricity are categorized as scope 2 or 3, they always must be accounted for and reported under this guide's framework.

Why Does This Guide Require Reporting Indirect Scope 3 Emissions from the Use of Purchased Electricity?

The GHG Protocol provides only general guidance on dealing with leases. Consequently, many companies that occupy leased space mistakenly report emissions from the use of purchased electricity as scope 2, even when they do not own or control their leased space. This may lead to double-counting of emissions within scope 2. For example, if a company that leases building space records its emissions from purchased electricity as scope 2 and the company that owns the building does the same thing, the emissions will have been double-counted within that scope. When the GHG Protocol's organizational boundary guidance is correctly applied to leased assets, some companies find that their emissions from the use of electricity are scope 3 and not scope 2.

All companies use electricity, which is one of the largest sources of GHG emissions and also can usually be reduced. For these reasons, the GHG Protocol requires that all companies account for and report their emissions from the use of electricity. To do this, the concept of scope helps companies categorize their

TABLE 3 | EMISSIONS FROM LEASED ASSETS: LEASING AGREEMENTS AND BOUNDARIES (LESSOR'S PERSPECTIVE)

	Type of Leasing Arrangement	
	Finance/Capital Lease	Operating Lease
Equity Share or Financial Control Approach Used	Lessor <i>does not</i> have ownership or financial control, therefore emissions associated with fuel combustion are scope 3 and with use of purchased electricity are scope 3.	Lessor <i>does</i> have ownership and financial control, therefore emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2.
Operational Control Approach Used	Lessor <i>does not</i> have operational control, therefore emissions associated with fuel combustion are scope 3 and with use of purchased electricity are scope 3.	Lessor <i>does not</i> have operational control, therefore emissions associated with fuel combustion are scope 3 and with use of purchased electricity are scope 3. ^a

Note

- a. Some companies may be able to demonstrate that they *do* have operational control over an asset leased to another company under an operating lease, especially when operational control is not perceived by the lessee. In this case, the lessor may report emissions from fuel combustion as scope 1 and emissions from the use of purchased electricity as scope 2. The lessor must clearly state in the GHG inventory report the reason(s) that operational control is perceived.

CASE STUDY D

WHAT'S IN AND WHAT'S OUT: COASTAL ENTERPRISE INC.'S ORGANIZATIONAL BOUNDARY DECISION PROCESS

Coastal Enterprises Inc. (CEI) is a private, nonprofit Community Development Corporation (CDC) and Community Development Financial Institution (CDFI) founded in 1977 to develop job-creating natural resource industries and small business ventures. CEI serves all of Maine, its primary market, and areas of northern New England and upstate New York. CEI has participated in over \$1 billion in financing to 1,500 ventures. CEI consists of seven nonprofit and three for-profit subsidiaries, and it also manages several socially responsible venture capital funds. The corporation owns dozens of subsidized housing units that it leases out, manages one subsidized housing building owned by another company, leases office space, and owns and operates three other buildings. When determining its organizational boundary, CEI wanted to make sure that the emission sources it could directly affect through GHG management strategies could be categorized as scope 1 or 2 and that those GHG sources over which it had little control would be categorized as scope 3. To reach this goal, CEI found that the equity share approach was not adequate because it had several small-equity investments over which it had little control. Financial control was inadequate because it did not always include significant and manageable emissions sources in scope 1 and scope 2. Accordingly, CEI decided to use the operational control approach to set its organizational boundary.

But even after it had chosen the operational control method, CEI still had difficulty determining whether or not electricity use in some or all of its subsidized housing properties leased out to tenants would be included in scope 2 or scope 3. In order to decide in a transparent and consistent way how to categorize these emissions, CEI referred to legal language in its leasing agreements. The property that CEI manages but does not own is under a capital lease, meaning that CEI is responsible for all the risks and rewards of ownership, including operational control; thus indirect emissions from electricity are categorized as scope 2. Conversely, all emissions from the subsidized housing units owned by CEI but leased out to tenants are categorized as scope 3, because the operational control of these facilities belongs to the tenants who lease the properties under operational leases.

Using this approach, CEI is accounting for scope 1 and scope 2 emissions from the three buildings it owns and operates plus its leased office space and the one affordable-housing building that it manages on behalf of another company. CEI's inventory of GHG emissions from all these properties has enabled it to identify and pursue opportunities to reduce emissions in those buildings whose operations it controls. CEI will account for the remaining emissions from the other properties and activities over which it has no operational control as scope 3 if accurate activity data are available.

emissions into those that must be accounted for and reported (scopes 1 and 2) and those that are optional (scope 3). Given the purpose of the scopes—to ensure that both direct emissions and emissions from electricity use are accounted for and reported—WRI believes that companies should account for and report indirect emissions from the use of purchased electricity even when they are categorized as scope 3. Electricity used by leased assets can still represent a significant source of emissions, and although some companies may be less able to reduce these emissions, many will still have significant reduction opportunities.

Some service-sector companies may have other significant sources of scope 3 emissions, for example,

logistics companies that outsource transportation or publishing companies that outsource printing. Although these emissions do not have to be reported under the framework of the GHG Protocol or this guide, WRI encourages companies to thoughtfully follow the guiding principles of GHG accounting (see box 4) to ensure complete and relevant emissions reporting.

Emissions Threshold

Often when making a corporate-wide inventory, small emission-causing activities are discovered. The reporting company then must decide whether to include these *de minimus* emissions in its inventory. Neither the GHG Protocol nor this guide define a minimum threshold

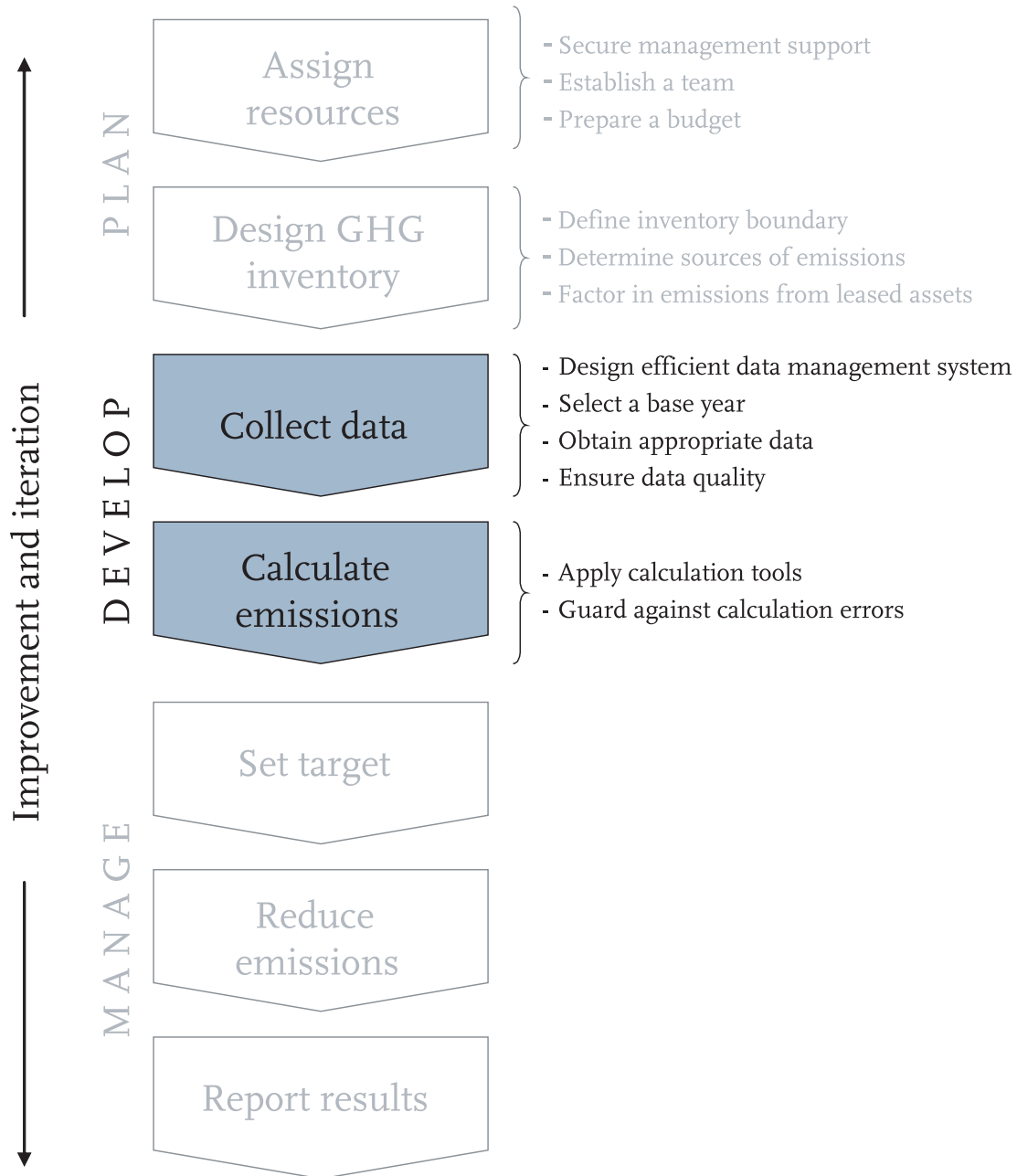
for reporting emissions; instead, refer to the guiding principles on page 19. Note that several small amounts of emissions may sometimes add up to a significant amount, but it may be difficult or too time-consuming to gather data on some of them. Some companies merely estimate these *de minimus* emissions, in which case your inventory report should document the basis for the estimation. In line with the guiding principle of “transparency,” you also should indicate in your inventory report if you have elected not to include what your company considers *de minimus* emissions.

Notes

1. For a definition of financial accounting categories, see the GHG Protocol’s *Corporate Standard*, rev. ed., table 1.
2. The term *electricity* is used in this chapter for electricity, steam, and heating/cooling.
3. Service-sector companies that have power-generating facilities and would normally categorize the facilities’ emissions as scope 1 (direct) in a nonleasing situation must determine whether these emissions would be scope 2 (indirect) or scope 3 (indirect) in a leasing situation. For more guidance, refer to the calculation tool on the GHG Protocol’s Web site (www.ghgprotocol.org) that deals with indirect emissions from electricity.
4. Financial Accounting Standards Board, Statement of Financial Accounting Standards, no. 13, “Accounting for Leases” (1976).
5. For this discussion, we assume that most emissions that could be categorized as direct emissions are associated with fuel combustion. However, companies may also have other sources of emissions, such as HFC emissions from refrigeration and air conditioning, that could also be categorized as direct emissions. For these other potential sources of direct emissions, companies should follow the leasing guidance described for fuel combustion. We have focused on fuel combustion for simplicity in explaining the leasing guidance.

Part 2

DEVELOP YOUR GREENHOUSE GAS (GHG) INVENTORY





Now that your company’s GHG inventory has been planned, you must decide exactly what information you will need to calculate your emissions and where you can find it. You must make sure too, that your company has an efficient data collection and management system. This step describes some of the questions to consider when you design your company’s system. Once you have collected the data you need, you will be ready to calculate your company’s emissions. Automated calculation tools are provided on the GHG Protocol’s Web site (www.ghgprotocol.org) for this purpose, and they are described further in step 4. First you must identify and collect the data and also select an appropriate “base year.”

SELECTING A BASE YEAR

The first time you develop your company’s GHG inventory, you will need to collect activity data for a “base year,” a reference year against which emissions performance is measured over time. For more information about selecting a base year and when it should be recalculated, see step 5.

IDENTIFYING DATA

You will need two general types of data to calculate your company’s GHG emissions. For each emission source identified in your company’s operational boundary, you should obtain the appropriate “activity data” and “emission factor” to apply to the following equation:

$$\text{activity data} \times \text{emission factor} = \text{GHG emissions}$$

Activity Data

Activity data quantify an activity, such as employee business trips, in units that will help you calculate the emissions generated. Each activity is presented in a specific unit, for example,

- cubic meters, cubic feet, or therms of natural gas
- gallons or liters of heating oil
- gallons or liters of jet fuel
- kilowatt hours (kWh) or megawatt hours (MWh) of electricity
- air miles or kilometers (km) traveled
- train miles or kilometers (km) traveled

Emission Factors

Emission factors convert activity data to emission values. Emission factors are published by various entities such as local, state, or national government agencies and intergovernmental agencies. Emission factors are presented in specific units, for example,

- kilograms of CO₂ per air kilometer traveled
- pounds of CO₂ per kilowatt hour of electricity
- kilograms of CO₂ per liter of petrol/gasoline

Note that GHGs are assigned a “global warming potential” (GWP) according to their impact on the climate (see box 3). GHGs often are reported as CO₂ equivalents (CO₂e). Emission factors for most sources of emissions can be found in units of CO₂ or CO₂e.

Appendix 2 lists emission factor sources, and a list of current emission factors can also be found in the GHG Protocol's calculation tools. Step 4 gives more information about the calculation tools.

Emission factors vary according to the type of GHG emission source. For example, the emission factors for electricity produced by coal are higher than those for electricity produced by natural gas, which is less carbon intensive. Similarly, emission factors for car travel vary according to the fuel type (e.g. gasoline; diesel). It is important to choose the emission factor most relevant to your activity data.

Emission factors are frequently updated to reflect new information or technologies, so you should use the most up-to-date emission factor available. We will discuss this later in this step.

COLLECTING ACTIVITY DATA

Collecting activity data for all your company's emission sources is often the most time-consuming and challenging part of developing a GHG inventory. Designing an effective data collection and management system is very important, so be sure to read the section "Designing a Data Collection and Management System," on page 39. Obtaining the most accurate and reliable data as possible is critical to ensuring the credibility of your company's inventory. This section describes how to find activity data for the sources most common to service-sector companies.

Direct Emissions

Direct emissions are generally the result of fuel combustion in company-owned or -controlled equipment,



such as boilers and furnaces, or in company-owned or -controlled vehicles. The preferred method of gathering activity data is from fuel purchase or fuel use records, since these are likely to be the most accurate. You can almost always use this method for direct emissions.

Indirect Emissions

Collecting data for indirect emission sources is more difficult because fuel use and fuel purchase records often are not available. You may need to look to a third party for your data or to estimate them. The following are some common examples of such data, along with some suggestions of how to find them.^a This section includes several formulas that can be used to estimate activity data and to help you understand the calculations. Most of the formulas, however, are included in the GHG Protocol's calculation tools for service-sector companies, which automatically complete the calculations for you. The tools can be downloaded from the GHG Protocol's Web site, www.ghgprotocol.org (also see step 4).

Finding Activity Data for Purchased Electricity

The activity data needed to calculate the GHG emissions generated by your company's electricity use are either kilowatt hours (kWh) or megawatt hours (MWh).¹ This information is usually obtained from the facility's monthly electric bill or from electricity meter readings. These are the preferred sources of activity data for this emissions category. Because the electricity costs for tenants of leased space are frequently included as part of their rental payments, the precise figures for their electricity use often are not known. In this instance, you may have to estimate your company's electricity use or use default data. But you should use estimated or default data only when you cannot obtain more accurate data, such as from an electricity bill or electricity meter. Note also that using estimated or default data makes it nearly impossible to track improvements in your company's energy efficiency or energy conservation measures. Always clearly document in your company's inventory report the method you used to obtain activity data. There are four methods for obtaining activity data for the use of purchased electricity.

a. Some of the activities described in this section, such as car travel, may be categorized as Scope 1 (direct emissions) if the company owns the vehicle. The data collection methods are the same regardless of how the emissions are categorized.

- **Method 1: Actual electricity use (preferred).** The facility's monthly electric bill or meter reading provides the activity data needed, usually in kWh.

If monthly electric bills or meter readings are not available, you will need to estimate your company's electricity use based on one of the following methods. Use these methods only if you cannot obtain more accurate data from an electric bill or meter:

- **Method 2: Building-specific data estimation.** Even though this method uses actual building-specific data for the entire building, the data are not specific to the space occupied by the reporting company. This method also assumes that all occupants of the building have similar patterns of electricity consumption. For these reasons, this method is less accurate than the preferred method. To use this method, find the following information from your property manager for each building:
 - total area of the building
 - total area occupied by your company
 - total building energy use in kWh or MWh

Using this information and the following formula, you can estimate the approximate kWh or MWh of electricity that can be attributed to your company:

$$\frac{\text{Area of company's space}}{\text{Total building area}} \times \text{Total building use of electricity} = \text{Approx. kWh or MWh used by your company}$$

Information about working with equations and using our automated spreadsheets can be found in step 4.

- **Method 3: Similar building/facility estimation.** If building-specific data are not available, you may be able to estimate electricity use based on actual electricity use data extrapolated from other similar buildings. Note that the electricity use for buildings varies greatly based on a number of factors such as the building's location, size, efficiency, use, and hours of operation. Therefore, this method should be used to estimate a building's electricity use only if it is based on the actual electricity use of a similar building with similar electricity use patterns.

- **Method 4: Generic building data.** If it is not possible to use one of the preceding methods, you may be able to find default data on kWh used per square foot or square meter of space from a published source such as from a government agency. Because this method offers only a very general estimate of building electricity use and may be very inaccurate, you should first try to use one of the other data collection methods described.

Finding Activity Data for Air Travel

The activity data for commercial air travel are the distance traveled by each passenger. The units are either passenger-miles or passenger-kilometers. Many companies log a large amount of air travel, and tracking these data can be difficult. Ideally, your company should have a system to track the miles or kilometers traveled on each flight leg. For example, a trip between Munich and Los Angeles may have multiple legs, such as Munich to London, London to New York, and then New York to Los Angeles. Because many of the greenhouse gases from air travel are emitted during takeoff and landing, the emissions per mile or kilometer traveled for short flights are higher than those for long flights. As a result, a different emission factor is used for "short," "medium," and "long" flights. The distance ranges for each of these flight categories are defined in the business travel tool available for download from the GHG Protocol's Web site. This calculation tool automatically categorizes activity data into the appropriate "short," "medium," or "long" category.

Some common ways of finding distance-traveled data for air travel are:

- **Travel agents.** Contact your company's in-house travel staff or travel agency. They may already be tracking miles traveled per flight. If not, ask whether they would be willing to establish such a system. If your company logs a lot of air travel, this may be your best option.
- **Flight itineraries.** Distance-traveled information is sometimes found on flight itineraries.
- **Online.** Distances between two points can be found using online tools (see appendix 3). Some resources provide only city-to-city information, but others provide information between airports and may be more accurate.

Caution! Air travel is measured in either land miles or kilometers or nautical miles or kilometers. A land mile is the distance between two points over land, and a nautical mile is the average distance on the earth's surface represented by one minute of latitude. Since the earth is not a perfect sphere, a nautical mile does not equal a land mile. Air travel emission factors are usually in CO₂ per passenger land mile or kilometer. If you have calculated distance traveled in nautical miles or kilometers, convert it to land miles or kilometers. Appendix 1 supplies conversion factors. Also, when estimating distance traveled, make sure your numbers are the total number of miles or kilometers for the round trip.

Finding Activity Data for Car Travel

The activity data required for calculating emissions from car travel are fuel use. You should know two things:

- total fuel use in gallons or liters
- type of fuel (e.g., gasoline or diesel)

There are two ways to obtain fuel use data. The more accurate and simpler method—and also the preferred method—is to look at fuel purchase receipts. If you do not have access to these receipts or if the car also is used for nonbusiness travel, estimate the fuel use using the following:

- total distance traveled
- car's average fuel efficiency

Make sure that the measures of distance traveled and the fuel efficiency are based on the same measurement units. For example, if you measure distance in miles, you also should measure fuel efficiency in miles (miles per gallon or liter).



The calculation to estimate fuel used is as follows:²

$$\frac{\text{Distance traveled}}{\text{Fuel efficiency}} = \text{Estimated fuel use}$$

If the car's fuel efficiency is not known, use a published source of vehicle fuel efficiency ratings. Note that fuel efficiencies for cars vary according to highway versus city travel. If the trip is a combination of both and you use a formula to estimate overall vehicle fuel efficiency, remember to state the formula you used when you report your emissions. If a published source of fuel efficiency ratings is not available in your country, then use only distance-traveled activity data plus an emission factor that incorporates default fuel efficiency values based on the size of the car (see appendix 2). Because this is a less accurate method, you should use it only if more detailed data are not available. Also, remember to record separately the fuel use for gasoline- and diesel-powered cars, because each has a different emission factor.

One method of determining activity data for car travel is to add a line to your company's reimbursement forms requiring employees to state their vehicle's average fuel efficiency and number of occupants, along with distance traveled. This will save your data collection team some accounting work and will help educate your employees about fuel efficiency.

Finding Activity Data for Employee Commuting

To calculate commuting emissions, you will need activity data on the distance that employees travel to and from work and the mode of transportation they use. If employees travel by car, you will need fuel use activity data too. To determine employee commuting activity data, you may need to survey your company's employees and estimate total activity data from the sample data. Note that the survey method cannot capture day-to-day variables and sometimes may be quite inaccurate. But using a survey will help you establish average commuting trends that you can track over time. To improve the accuracy of your data, try to achieve as high a participation rate in your survey as possible. A key to improving your response rate is to ensure that your survey is user friendly and does not take much time to complete (see case study E). The basic information that your survey will need is described next.

CASE STUDY E

WORLD RESOURCES INSTITUTE: INNOVATIONS IN ESTIMATING EMPLOYEE COMMUTING EMISSIONS

Collecting employee commuting activity data from WRI's 140 staff can be challenging. WRI surveys its employees once a year about their average commuting habits. In the first two years of the initiative, WRI used an Excel spreadsheet accessible to all employees on a shared internal network, but only 48 percent of them participated. Then in the third year, a simplified, web-based survey raised the employees' participation to 65 percent. Using feedback from the survey design, WRI further simplified and refined its survey questions, made the survey more user-friendly, and reduced the time needed to complete the survey to less than a minute. The employees' participation rate rose to 88 percent.

WRI created a tool to automate the calculation of emissions from its employees' commuting. Once the activity data have

been gathered through the online survey, the results are downloaded directly into the calculation tool which does the rest, streamlining a task that previously had been time-consuming. A brief overview of this tool is provided in Step Four: Calculating Emissions.

Designing an easily navigated survey with clearly worded questions significantly improved the completeness and accuracy of the employees' commuting-activity data. An added benefit was that the employees felt proud of having contributed to the inventory development process, and so this also was a positive internal communications opportunity.

WRI's commuting data can be found in its annual GHG inventory report, available online at www.wri.org.

Distance traveled is the principal piece of information for all modes of transportation, except cars, for which fuel use is the primary information. For each employee in your company or survey group, gather the following:

- Mode of transportation (e.g. bus, train).
- Average round trip distance traveled by the employee between work and home.
- Average number of days per week the employee commutes.
- For the employee who drives to work, the fuel efficiency of the employee's vehicle, fuel type, and the number of people who travel with the employee.
- Information about commuting combinations used. For example, an employee may drive to a central location such as a train station or a bus depot and then travel the rest of the way to work by train or bus.

Once you have collected this information, use the following method to estimate annual activity data for each mode of transport, except cars:

$$\begin{array}{l} \# \text{ of days} \\ \text{per week} \\ \text{vehicle is} \\ \text{used by each} \\ \text{employee} \end{array} \times \begin{array}{l} \text{distance} \\ \text{traveled} \end{array} \times \begin{array}{l} \text{number of} \\ \text{weeks worked} \\ \text{by the} \\ \text{organization} \\ \text{per year} \end{array} = \begin{array}{l} \text{total annual} \\ \text{distance} \\ \text{traveled by} \\ \text{survey group} \\ \text{for each mode} \\ \text{of transport} \end{array}$$

For car travel, obtaining fuel use activity data from fuel purchase receipts is usually not possible, since employees' vehicles are rarely used for commuting purposes only. Instead, use a three-step calculation to estimate fuel use for commuting. Fuel efficiency and fuel type differ for each car, so make separate calculations for each employee who drives to work:

1

$$\begin{array}{l} \# \text{ of days} \\ \text{per week} \\ \text{vehicle} \\ \text{is used} \end{array} \times \begin{array}{l} \text{distance} \\ \text{traveled} \end{array} \times \begin{array}{l} \text{number of} \\ \text{weeks worked} \\ \text{by the} \\ \text{organization} \\ \text{per year} \end{array} = \begin{array}{l} \text{total} \\ \text{annual} \\ \text{distance} \\ \text{traveled by} \\ \text{employee} \end{array}$$

2

$$\frac{\text{total annual distance} \\ \text{traveled by employee}}{\text{fuel economy of employee's car}} = \text{estimated fuel use}$$

3

$$\frac{\text{estimated fuel use}}{\text{number of people in car}} = \text{estimated fuel use} \\ \text{attributable to employee}$$

Sum the total quantity of fuel used by each employee who drives to work to obtain the total fuel use for all employees who drive to work.

For information about transportation devices not covered by this guide, such as ships, or if your company uses vehicles to transport products or raw materials, refer to the GHG Protocol calculation tools.

COLLECTING EMISSION FACTORS

Now that you have collected the activity data for each emission source, you must find the emission factors. Emission factors are published by various entities such as local, state, or national government entities and intergovernmental organizations such as the Intergovernmental Panel on Climate Change (IPCC). Emission factors are frequently updated, so it is important to use the most up-to-date and relevant emission factors available. Emission factors can be found in the calculation tools on the GHG Protocol's Web site (see step 4). Appendix 2 lists common emission factor sources for electricity and heating, as well as for car, air, rail, and bus travel.

Caution! Remember that emission factors must be expressed in the same measurement units as your activity data. If they are not, you must convert the activity data to the same measurement units as the emission factors. For example, to calculate the CO₂ emitted from flying a certain number of miles, the calculation is

$$\begin{array}{c} \text{miles} \\ \text{traveled} \end{array} \times \begin{array}{c} \text{emission} \\ \text{factor} \end{array} = \begin{array}{c} \text{quantity of} \\ \text{CO}_2 \text{ emissions} \end{array}$$

If the emission factor is for CO₂ per kilometer, you need to convert the activity data—miles traveled—to kilometers before completing the calculation. Appendix 1 supplies common unit conversion factors. Make sure that you use the same unit of measure that you use for reporting emissions. The standard unit is metric tons (tonnes). Be careful not to confuse this with “short tons” or “long tons”!³ If necessary, convert the result to metric tons (see the unit conversion table in appendix 1).

Electricity

Emission factors for electricity vary according to the fuel used to generate the electricity and the technologies employed by the electricity generator. The most accurate emission factor is site specific, but it is generally

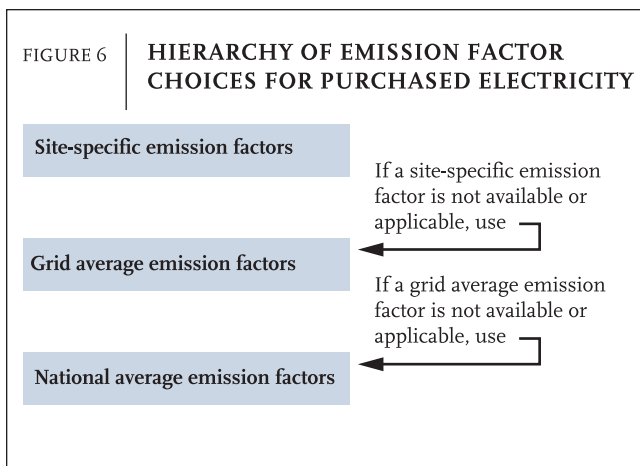


applicable only to large electricity customers that have a direct distribution line from the generating facility to the company site and so does not pertain to most service-sector companies. The best available factor for service-sector companies is more likely to be the grid average emission factor where company facilities are located. Grid average emission factors may be available from your national government agency in charge of energy. Remember that if your company has several facilities in multiple locations, you may need to select emission factors for each location. The least preferred (and least accurate) choice is to use a national average emission factor for your country, which can be obtained from the International Energy Agency (www.iea.org/). In some countries, this may be the only information available (see figure 6).

Car Travel

Car travel emission factors are based on fuel use, and the corresponding emission factors can be found in the GHG Protocol's calculation tools for service-sector companies. This is the preferred method.

If you are unable to determine fuel use and have only distance-traveled activity data, you must use an emission factor that incorporates default fuel efficiency values based on the size of the car. These emission factors may be expressed in *vehicle* miles or kilometers or *passenger* miles or kilometers. If there is only one occupant in the vehicle, an emission factor for vehicle miles or vehicle kilometers is used to calculate emissions. If there is more than one occupant in the vehicle (and therefore fewer per-person emissions), a passenger miles or passenger kilometers emission factor is used to calculate emissions. It also is acceptable to divide the distance traveled by the



number of occupants and then use a vehicle miles or kilometers emission factor to complete the calculation.

Train, Light Rail, and Bus Travel

Emissions from train, light rail, and bus travel are measured in CO₂ per passenger mile or kilometer. The emission factors assume an average level of occupancy on the train or bus and can be found in the GHG Protocol's calculation tools for service-sector companies.

Air Travel

Emission factors for air travel in commercial planes assume an average level of occupancy on the plane. The airplane type also affects the amount of emissions. The emission factors for "short" and "long" flights recommended in the GHG Protocol are from the U.K. Department of Environment, Food, and Rural Affairs (UK DEFRA). Another category of "medium" flights has been derived from these data and can be found in the GHG Protocol's calculation tools. These preferred emission factors do not consider airplane type, partly for simplicity and partly because comprehensive information is not yet available.

If your company owns a plane, the activity data will be fuel use. Note that jet fuel is used by jet engines only; aviation gasoline is used in piston-powered airplanes. Jet fuel is more common.

DESIGNING A DATA COLLECTION AND MANAGEMENT SYSTEM

Collecting data for your company's inventory can be laborious, especially for a large company. Your company's climate change team should design a system that will be both efficient and credible. Establishing a data collection and management system improves the efficiency of the data collection and thus can reduce costs over time. It also can help maintain the data's consistency over time in the event of staff turnover (see case study F). Some interrelated considerations are:

- *Which data need to be collected?* Once you have identified your company's emission sources, you must determine the relevant activity data and emission factors to be collected and the appropriate units of measure.
- *What is the source of the data?* Activity data may be collected from a variety of sources, such as fuel purchase records or utility bills. Your company may already have some of the data records, but others may need to be obtained from a third party. For example, if you are including an outsourced activity in your company's inventory, you will need to obtain data from the vendor or partner. In some cases—especially for scope 3 emission sources—it may be difficult to find accurate data, and so you will have to use estimates. In this situation, it is important to find the most accurate method for estimating data.
- *Who will collect the data?* A person or team should be assigned to collect data. In a small company, this may be one person, like an office manager, but in a large company this will be a task for several people. If your company has several facilities, data will likely be collected at the facility level and reported back to the headquarters. It thus may be a good idea to write this task into the job description of the staff involved. You also will need to decide at which point in the process you will calculate your emissions. For example, in the GHG Protocol's "centralized approach," facility-level staff report the activity data to the headquarters where emission factors are applied and calculations completed, and in the "decentralized approach," facility-level staff are responsible also for the calculation component. For more information about these approaches, see chapter 6 of the GHG Protocol's *Corporate Accounting and Reporting Standard* (revised edition). Your decision should be based on the most efficient and suitable method for your company.

CASE STUDY F

UNITED NATIONS FOUNDATION: DESIGNING AN EMISSIONS DATA COLLECTION AND MANAGEMENT SYSTEM IN A SMALL ORGANIZATION

An important part of a GHG management program is the design of an efficient data collection system to construct and consistently replicate inventories from year to year. Such a design is particularly important when considering staff changes that can make consistency difficult to achieve. In addition, small organizations often have only limited time and resources available to do this. The United Nations Foundation (UNF) overcame these obstacles by streamlining its data collection and management system to support its inventory development process. This new system allows the organization to complete its inventory in less time and with fewer resources while at the same time simplifying the process enough to allow any staff member to complete the task.

UNF is a public foundation that builds and implements public-private partnerships to address the world's most pressing problems. The organization's staff numbers nearly 100 and is located in two offices, the headquarters in Washington, D.C., and a smaller office in New York City. UNF did not have enough resources to implement an organization-wide electronic GHG data management system, so it instead created internal tracking methods that permit easy and streamlined data gathering.

An example of one of these methods is the tracking of staff air travel miles. UNF's original tracking method for business air travel required a staff member to review their credit card records and estimate the number of miles traveled, a tedious and time-consuming process. With the new system in place, UNF's travel agency provides electronic records of the total number of miles flown by UNF staff.

All of the UNF's methods are documented in a simple and concise manual that provides the necessary organization-specific instructions required to compile activity data and create a transparent and replicable GHG inventory. The manual codifies the UNF's data management system and lists the person to contact in order to gather the different types of data.

UNF's new data management system provides clear directions and will make it easier for staff to compile data for its inventory. The system ensures that even though different staff members may conduct the inventory each year, the results will be consistent and reliable, and will use minimal institutional resources.

Remember that completing calculations at the facility level usually means more staff training and a greater likelihood of errors.

- **Making sure that the staff is adequately trained.** Once a team to collect the data has been chosen, you should make sure that they understand what information needs to be collected, where to find it, the schedule for reporting the information back to you, and how it should be transmitted. You will need to ensure that your company's data are collected smoothly from year to year despite any changes in staff.
- **Maintaining data quality control.** Your company's inventory is only as good as the quality of data that it contains. In addition to regular staff training, you will need to incorporate internal controls into your company's data collection system to catch errors. Some common technical errors are incorrect units, incorrect emission factors used, and mistakes in data entry. For more information on managing inventory quality, see chapter 7 of the GHG Protocol's *Corporate Accounting and Reporting Standard* (revised edition).
- **Designing and implementing the data collection and management system.** An efficient data collection and management system is critical to managing your company's inventory. For companies with a single facility and few emissions sources, it is relatively easy to construct, but large companies with several facilities need a more sophisticated data management system. One solution may be to develop an online database via your company's Intranet that your data collection team can access. An alternative may be to hire a third party to manage your data (see case study G). Whatever type of system you design, you must make sure that your data collection team is adequately trained to use it.

CASE STUDY G

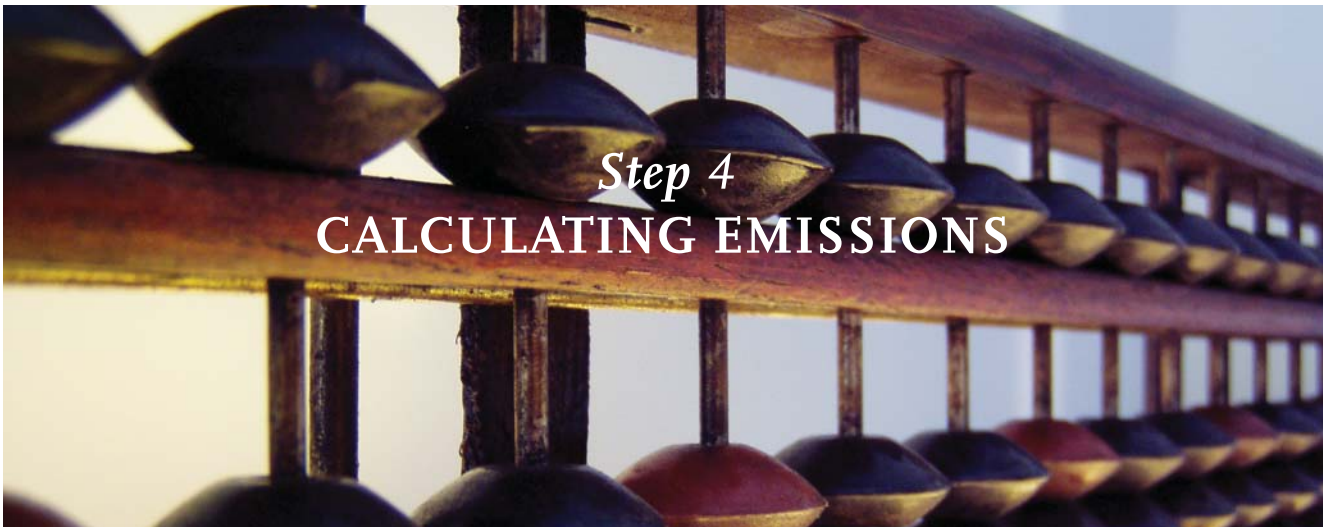
STAPLES' EXPERIENCE WITH THIRD-PARTY BILLING: AN ACTIVITY DATA MANAGEMENT SUCCESS

Staples, the office products company, uses its existing energy management system to gather activity data for its GHG inventory. The web-based energy system is provided through a contract with Avista Advantage and has been in operation since 2000. Before hiring Avista, Staples was having difficulty keeping track of its energy and water consumption, managing its utility bills, and ensuring prompt payment of bills. After the energy management system was in place, Staples could easily track energy and other utility usage and billing data and coordinate utility payments for the vast majority of the locations it leases or owns. The data are stored in an Internet-accessible database that enables Staples to generate various customized energy reports.

When Staples started constructing its GHG inventory, nearly all the data for its facilities' energy consumption were contained in its existing energy management system and were easily accessible with the click of a mouse. Data could be derived for several years and be made available for each individual facility or could be rolled up to the corporate level. Staples estimated the energy use of the remaining five percent or less of its facilities that were not in the system by using proxy data from similarly monitored facilities. Staples then applied regionally specific emission factors to construct accurate facility-level emissions data. The result was a robust inventory that tracks GHG emissions from more than 1,500 retail and non-retail facilities as of 2005, all assembled with minimal internal staff resources.

Notes

1. One thousand kilowatt hours (kWh) equals 1 megawatt hour (MWh).
2. Note that if any vehicle occupants are not company employees, you may factor this into your equation by dividing the fuel used by the number of occupants. This will enable you to determine the fuel use that can be attributed to your company's employees.
3. A metric ton equals 2,205 pounds; a short ton equals 2,000 pounds; and a long ton equals 2,240 pounds. Short tons are used in the United States, and long tons are used in the United Kingdom. Unit conversion factors are provided in Appendix 1.



Step 4 CALCULATING EMISSIONS

Now that you have all the activity data and emission factors that you need, you can calculate your company’s emissions. Although you will probably use an automated calculation tool, it is important first to understand the basic formula used and the errors most commonly made. This step explains how to perform emission calculations and the mistakes to avoid. WRI has developed some easy-to-use Excel-based calculation tools and supplemental guidance to make calculating emissions easy. We also present here an overview of these tools.

CALCULATING EMISSIONS

The calculations for your company’s emissions follow this basic formula:

$$\text{activity data} \times \text{emission factor} = \text{GHG emissions}$$

For example, if you want to calculate the emissions that result from traveling from New York to Paris on a commercial aircraft, a distance of approximately 3,620 miles one way, using the emission factor of 0.18 kg of CO₂ per passenger mile,¹ your calculation will be:

$$3,620 \text{ miles} \times 0.18 \text{ kg of CO}_2 \text{ per passenger mile} = 651.6 \text{ kg of CO}_2$$

Even though this calculation is straightforward, you should be careful to avoid some common errors:

- *The incorrect emission factor.* Make sure you use the emission factor that corresponds to your activity data. For example, if your activity data are units of natural gas, then your emission factor also must be for natural gas, *not* an emission factor for other forms of energy!
- *Unit conversion errors.* Your activity data and emission factor must be in the same units. You cannot, for example, multiply activity data expressed in kilometers by an emission factor expressed in miles. Instead, you must first convert your units so they are consistent (appendix 1 has a unit conversion table). To avoid errors if activity data and emission factor units are not consistent, use the “cancel out” method in your formula. For example, express the following calculation:

$$100 \text{ km} \times \frac{0.18 \text{ kg of CO}_2}{\text{per km}} = 18 \text{ kg of CO}_2$$

as:

$$100 \text{ km} \times \frac{0.18 \text{ kg of CO}_2}{\text{km}} = 18 \text{ kg of CO}_2$$

The common unit for reporting emissions is metric tons (tonnes), which often also requires a unit conversion,² for example, from kilograms of CO₂ to metric tons of CO₂.

To minimize inaccuracies in your inventory,

- Check regularly for technical errors. It's easy to make mistakes when converting measurement units, finding the right data, entering data, and using spreadsheets, calculation tools, and formulas.
- Ask someone at your company who is not directly involved in developing your inventory to double-check your calculations.
- Ask management to review your inventory to help find misreporting and inaccuracies and enhance the inventory's usefulness.

For more information on managing the quality of your inventory, refer to chapter 7 of the GHG Protocol's *Corporate Accounting and Reporting Standard* (revised edition).

USING CALCULATION TOOLS

Emission calculations are usually performed using an automated calculation tool. The GHG Protocol offers cross-sector and sector-specific tools. Each tool is based on Excel and contains a complete set of guidance instructions, emission factors, and emission factor sources. For each emission source, select the appropriate tool and enter the relevant activity data and emission factor; and the calculation tool will complete the process for you. All of WRI's GHG calculation tools are available for download free of charge from the GHG Protocol's Web site (www.ghgprotocol.org).

Sector-Specific Tools

Next we offer an overview of the GHG Protocol's sector-specific calculation tools developed for the service sector.

Calculation Tool for Emissions from Fuel Use in Facilities

This tool calculates emissions from fuel use in facilities, such as fuel use in boilers or furnaces used for space heating.

TABLE 4 | USING THE PURCHASED ELECTRICITY TOOL

Order of Preference	Method of Collecting Activity Data	Worksheet to Use
1	Actual electricity use method	Worksheet 1: Standard Method
2	Building-specific data estimation method	Worksheet 2: Building Estimation
3	Similar building/facility estimation method	Worksheet 1: Standard Method
4	Generic building data method	Worksheet 1: Standard Method

Calculation Tool for Emissions from Purchased Electricity

This tool contains activity data worksheets that can be used to enter activity data obtained from a utility bill or meter reading (actual electricity use method) or to estimate emissions based on the building-specific data estimation method, the similar building/facility estimation method, or the generic building data method (see step 3). The tool can be customized for use with multiple locations or multiple time periods. Table 4 describes which worksheet should be used for each activity data collection method.

Calculation Tool for Emissions from Business Travel

Activity data for business travel can be entered based on fuel use—the most accurate method for calculating emissions from car travel—or distance. The distance-traveled method can be used for travel by train, bus, car, and plane. As discussed in step 3, activity data for commercial air travel must be categorized as “short,” “medium,” or “long” flights in order for the appropriate emission factor to be applied. Although this can be time-consuming to complete manually, this tool automates the process: simply enter the miles traveled for each flight segment or “copy and paste” the information from another spreadsheet. The tool then converts miles to kilometers; automatically categorizes each flight as “short,” “medium,” or “long”; and multiplies by the corresponding emission factors.

Calculation Tool for Emissions from Employee Commuting

The employee commuting tool assumes that activity data are collected in a survey and then are exported into the tool. The tool is based on the survey that WRI uses to estimate annual commuting data for its employees. When the survey data have been downloaded into the tool, the emissions are automatically calculated for the various modes of transport used. Although you can customize the survey portion of the tool for your company, be careful, since this may necessitate changing the formulas used throughout the tool.

Cross-Sector Tools

The GHG Protocol's Web site offers a number of cross-sector tools, such as those for emissions from stationary and mobile combustion sources. The cross-sector tool most useful to service-sector companies deals with direct hydrofluorocarbon (HFC) emissions from air-conditioning and refrigeration units. HFC emissions result from the manufacturing process but also leak out during both the operational life of the equipment and its disposal. HFCs are 140 to 11,700 times more potent than CO₂ and thus can have a significant impact on the climate.

Calculation Tool for HFC Emissions from Refrigeration and Air-Conditioning Equipment

The two methods of calculating HFC emissions from refrigeration and air-conditioning equipment are the "sales-based method" for those companies that maintain their own equipment and the "lifecycle stage method" for those that use contractors to maintain their equipment. In the first method, activity data need to be obtained from purchase and service records. In the second, the contractor that maintains the equipment must supply the activity data. The tool also contains a method for companies to assess the significance of their HFC emissions compared with those of other sources of emissions.

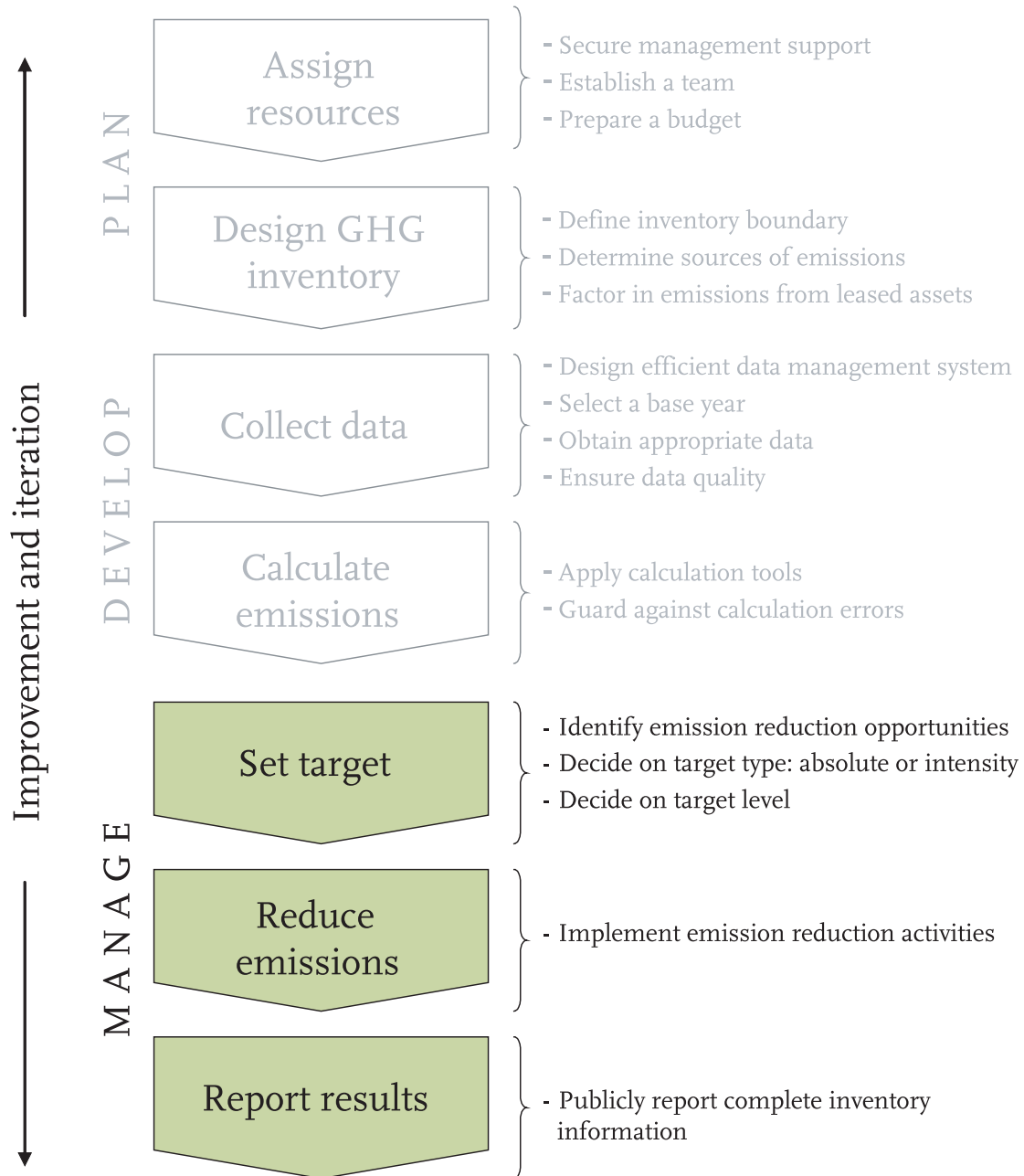


Notes

1. See the GHG Protocol calculation tools for emission factor sources.
2. A metric ton equals 2,205 pounds; a short ton equals 2,000 pounds; and a long ton equals 2,240 pounds. Unit conversion factors are provided in Appendix 1.

Part 3

MANAGE YOUR GREENHOUSE GAS (GHG) EMISSIONS





Now that you have developed an inventory, you should have a better understanding of the relative magnitude of each of your company's emission-causing activities and its emission reduction opportunities. This gives your company a base on which to establish an emission reduction target. This step presents an overview of some of the reasons to establish a target and describes the basic components of the process: selecting a base year, determining the target type, and deciding on an appropriate target level. The GHG Protocol's *Corporate Accounting and Reporting Standard* (revised edition, chapter 11) offers extensive guidance on this issue and should be consulted for more information.

REASONS TO ESTABLISH AN EMISSION REDUCTION TARGET

An emission reduction target is the amount of emissions your organization commits to reducing in a specified period of time. Examples of reasons to establish a target are:

- **Leadership.** Establishing a target and making it public communicates to your stakeholders—employees, shareholders, partners, and customers—your company's commitment to reducing global warming emissions.
- **Planning.** A target can be a useful tool to plan your company's emission reduction activities based on your performance, as well as a useful rallying point for both management and employees.
- **Participation in a program.** Some GHG programs require participating companies to set a target.

- **Performance tracking.** Once you have set a target, you will have a goal to strive for and a benchmark against which to assess your company's GHG performance each year.
- **Cost savings.** A target provides a focal point around which to plan and implement emission reduction activities. Implementing actions to achieve a GHG target can save money by using resources more efficiently.

Establishing a target is a key aspect of a company's GHG management strategy and may require an examination of several options and considerations to determine the most appropriate target for your company. You will need to involve several people in the process and importantly, you will need to secure the support of top management.

SELECTING A BASE YEAR

As mentioned in step 3, a base year is a reference year against which your company can track its performance over time. Tracking their performance enables companies to meet a variety of business goals, such as publicly reporting GHG reductions, managing risks and opportunities, and addressing the needs of investors and other stakeholders. It is important to select a base year for which accurate, reliable, and comprehensive data are available. If finding historical information is difficult, it should not be used to establish a base year. Some GHG programs have rules stating which year should be used as a base year. If your company plans to participate in one of these programs, check its guidelines to see whether it requires a particular base year.

When to Recalculate Base-Year Emissions

Since the purpose of a base year is to allow you to track your company's emission performance over time, it is important that you always compare "apples with apples." For these reasons, there are times when you should adjust the emissions calculated in your base year.

- *Structural changes.* When a company makes a structural change that may affect its base year emissions—such as through acquisitions, mergers, divestitures, and the outsourcing or insourcing of GHG-causing activities—the actual emissions into the atmosphere do not go up or down but merely move from one company to another. Accordingly, a company's base year should be recalculated to reflect structural changes. Note that recalculations are not necessary if the acquired or divested operation did not exist in the base year. Historic emissions need be recalculated back only to the year in which the company was acquired or divested.
- *Changes in calculation methodologies or emission factors.* A company may report the same emission sources each year, but over time it may improve its calculation methodologies or obtain more accurate emission factors. If this is the case, the historical emissions should be recalculated. For example, if a company is using a national average emission factor for calculating its emissions from the use of purchased electricity and then in subsequent years was able to obtain a grid average emission factor relevant to the previous years, it should recalculate its emissions. Note, however, that emission factors may change over time to reflect actual changes in emissions. For example, a power company may change its fuel source from coal to natural gas and thus update its emission factors. In this case, no recalculations of historical emissions are necessary.
- *Discovery of significant errors.* If significant errors—or a number of cumulative errors that collectively are significant—are found, the base-year emissions may have to be adjusted.

The base-year adjustments need not be made to reflect companies' organic growth or decline. For example, if a company's business increases and it opens new offices or stores or if business is slow and it closes some facilities, no recalculations are necessary.

In summary, base-year emissions should be adjusted to reflect changes in the company that would otherwise alter the consistency and relevance of its reported GHG emissions information. The GHG Protocol (chapter 5) offers several examples and should be consulted for more information.

DETERMINING THE TARGET TYPE

Once you have selected a base year, you can establish interim and long-term emission reduction targets, including a target completion date. In general, there are two kinds of reduction targets, "absolute" targets and "intensity" targets.

- *Absolute targets* are actual, concrete reduction goals that do not consider other factors, such as the company's growth. A 10 percent reduction in GHG emissions below 2000 levels by 2010 is an absolute target. In this case, 2000 is the base year and 2010 is the target completion date.
- *Intensity targets* are also known as "normalized" targets and are designed to reduce GHG emissions relative to some measure of business activity, such as the company's growth or a unit of production. "Emissions per unit of production" is a business activity against which performance may be tracked. The business activity used should be relevant to your company. For example, service-sector companies may want to express intensity targets as reducing emissions per employee or per square foot or square meter of office or retail space.

WRI considers absolute targets to be more useful because the problem of climate change is related to the actual concentrations of GHGs in the atmosphere. That is, the total amount of GHG emissions must be reduced to effect climate change, and absolute targets help achieve this. Even if they are reached, intensity targets do not necessarily reduce a company's overall emissions. For example, company A sets an intensity target of reducing emissions by 10 percent per employee between 2001 and 2005. In 2001 company A's emissions are 160 tons of CO₂ per employee. Its 5,000 employees emit 800,000 tons of CO₂. In 2005 company A reaches its goal of reducing emissions to 144 tons of CO₂ per employee. But in 2005 company A has 6,000 employees, so its total GHG emissions expressed in absolute terms are 864,000 tons of CO₂. Even though company A has reached its intensity target, its actual emissions of CO₂

BOX 6 | COMPARING ABSOLUTE AND INTENSITY TARGETS

Absolute targets

Reduce absolute emissions over time; for example, reduce GHGs by 25 percent below 2000 levels by 2010.

Advantages

- They are designed to reduce a specified quantity of GHGs emitted into the atmosphere and therefore are more environmentally robust.
- Since absolute targets are not measured relative to a specific business activity, it is not necessary to determine a common denominator against which to track performance.
- It is easy to communicate the amount of emissions the company intends to reduce and for a third party to evaluate the company's progress.

Disadvantages

- They do not allow comparisons of GHG intensity or efficiency unless more information is supplied.
- They may be difficult to achieve if the company grows unexpectedly and growth is linked to GHG emissions. However, revenue growth in service-sector companies is not necessarily tied to a growth in GHG emissions.
- A company may be rewarded for reducing GHGs that result from a decline in production or output.

Intensity targets

Reduce the ratio of emissions relative to a business activity over time; for example, reduce GHGs by 12 percent per dollar of revenue between 2004 and 2008.

Advantages

- They reflect GHG performance improvements independent of organic growth or decline.
- They may increase the comparability of GHG performance among companies within the same sector if the same unit of business activity measure is used.

Disadvantages

- They do not guarantee that GHG emissions into the atmosphere will be reduced; absolute emissions may rise even if intensity diminishes and output increases.
- Companies with diverse operations may find it difficult to define a single common business activity measure.
- If a monetary variable is used for the business activity measure, such as euros of revenue or sales, it must be recalculated for changes in product prices and product mix as well as inflation, making the tracking more difficult.
- They decrease the comparability of GHG performance among companies when different business activity measures are used.

into the atmosphere have increased. If intensity targets are used, WRI recommends that emissions also be clearly expressed in absolute terms.

Both types of targets have advantages and disadvantages, which are summarized in box 6.

DECIDING ON A TARGET LEVEL

Emission reduction targets vary widely in their scope (see box 7). Most companies that have not already invested in energy and other GHG emission reductions should be able to meet more aggressive reduction levels because more cost-effective reduction opportunities will be available to them. The target set for your company will depend on considerations specific to your company, such as:

- Understanding the key sources of emissions within your company.
- Examining different emission reduction strategies and determining their impact on total GHG emissions.
- Assessing your company's ability to influence emission reductions.
- Looking at the company's future and growth factors and how they might affect emissions.
- Considering whether environmental plans already in place could affect emissions, like a plan to incorporate energy efficiency upgrades into an office.

BOX 7 | EXAMPLES OF CORPORATE EMISSION REDUCTION TARGETS

Absolute Targets

BANK OF AMERICA: Reduce total U.S. GHG emissions by 9 percent from 2004 to 2009.

BRITISH TELECOM: Reduce total GHG emissions by 25 percent below 1996 levels by 2010.

DRESDNER BANK: Reduce total GHG emissions by 28 percent below 1990 levels by 2008.

FIRST ENVIRONMENT: Achieve net zero U.S. GHG emissions by 2008.

GOLDMAN SACHS: Reduce emissions by 7 percent below 2005 levels by 2012.

JP MORGAN CHASE: Reduce emissions by 5 to 7 percent below 2005 levels by 2012.

MELAVAR: Achieve net zero U.S. GHG emissions by 2006 and maintain that level through 2009.

NIKE: Reduce GHGs by 13 percent below 1998 levels by 2005.

NORM THOMPSON: Reduce GHGs by 90 percent below 2000 levels by 2005.

STAPLES: Reduce U.S. GHG emissions by 7 percent from 2001 to 2010.

SWISSCOM: Reduce CO₂ emissions by 17 percent below 2002 levels by 2012.

SWISS RE: Reduce GHGs by 15 percent below 2002 levels by 2013.

Intensity Targets

BRISTOL-MYERS SQUIBB: Reduce CO₂ emissions by 10 percent per dollar of sales between 2001 and 2010.

CANON: CO₂ emissions per unit of production by 25 percent between 1990 and 2010.

CATERPILLAR: Reduce CO₂ emissions per million dollars of revenue by 20 percent between 2002 and 2010.

GAP INC.: Reduce U.S. GHG emissions by 11 percent per square foot between 2003 and 2008.

HBOS: Reduce CO₂ emissions by 10 percent per full-time equivalent employee between 2001 and 2004 and set an additional 5 percent reduction target between 2005 and 2010.

INTERFACE: Reduce GHGs by 15 percent per unit of production between 2001 and 2010.

MARRIOTT INTERNATIONAL: Reduce U. S. GHG emissions by 6 percent per available room from 2004 to 2010.

Combined Target

GE: Reduce absolute emissions by 1 percent by 2012 and the intensity of GHG emissions by 30 percent by 2008 (both compared with 2004).

KIRIN BREWERY: Reduce absolute emissions and emissions per unit of production by 25 percent below 1990 levels by 2010.



Step 6 REDUCING EMISSIONS

Once you have calculated your company's GHG emissions, you can look for opportunities for emission reductions to achieve your company's target. As described in "Getting Down to Business," reducing your company's GHG emissions can result in many positive returns to and benefits for your business. For example, many companies are discovering that energy efficiency measures reduce their GHG emissions and can lower the cost of energy too.

For service-sector companies, many reduction opportunities are emission reductions from either facilities or transportation. Some companies may also find innovative ways to reduce emissions by engaging stakeholders across their supply chain, such as vendors (upstream) and customers (downstream). Many companies also buy offsets to reach their goal. This section provides a general introduction to common emission reduction activities in these categories. (A useful list of emission reduction resources can be found in appendix 3.)

EMISSION REDUCTIONS FROM BUILDINGS

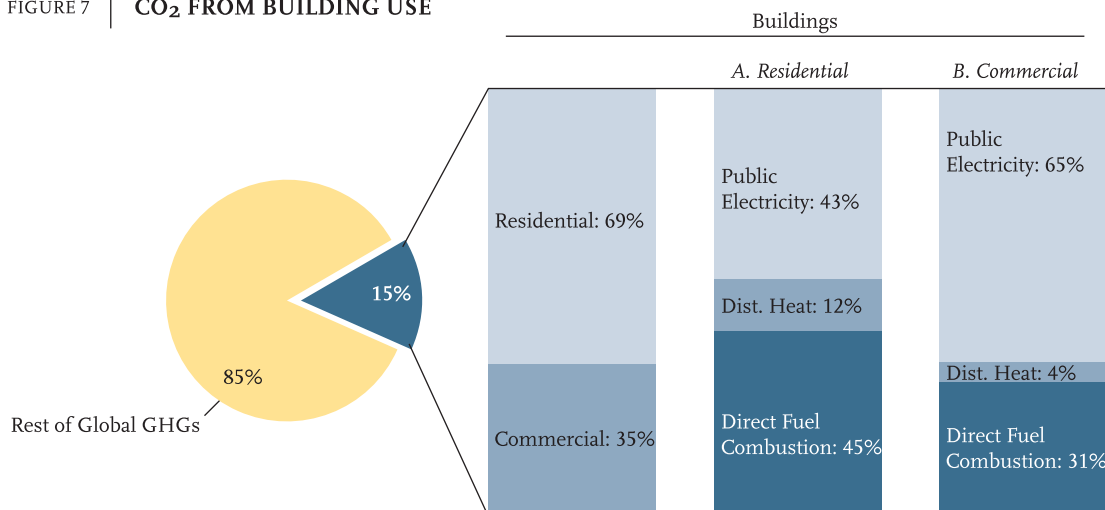
Globally, the buildings sector accounts for about 15 percent of the world's total GHG emissions (see figure 7), with commercial buildings emitting more than 2 billion tons of CO₂ annually.¹ These emissions stem primarily from energy use, particularly electricity consumption and fuel used for heating. These emissions can be reduced by conserving energy, using it more efficiently, or changing to cleaner, less carbon-intensive energy sources.

Reducing Electricity Use in Buildings

Some common strategies for reducing emissions from electricity use are:

- *Lighting.* Upgrading lighting is a simple way to reduce emissions. For example, compact fluorescent lightbulbs (CFLs) can use up to 66 percent less energy while lasting up to ten times longer than standard incandescent lightbulbs, leading to significant energy savings.² Other measures that reduce electricity used in lighting are replacing incandescent exit signs with light-emitting diode (LED) exit signs (LEDs are more efficient than incandescents and can last 40 times longer)³; installing motion sensors that automatically turn lights off when the space is unoccupied; turning lights off when offices and meeting rooms are empty; and maximizing the use of natural daylight, which can reduce the energy needed for lighting as well as heating and cooling.
- *Computers.* Most computers have power management features that enable the computer's monitor and/or hard drive to automatically power down after a specified period of inactivity. Since computers are commonly left on when not in use, power management can save 70 percent of the energy they use.⁴ In addition, some laptop computers are up to five times more energy efficient than desktop models.⁵ Replacing regular computer monitors with more energy-efficient flat-screen monitors can also reduce electricity use. Flat-screen monitors use approximately one-third less energy than a regular computer monitor does.⁶ (For more information on energy-efficient products and labeling systems, see appendix 3.)

FIGURE 7 | CO₂ FROM BUILDING USE



Source: Baumert, K., T. Herzog, and J. Pershing. 2005. "Navigating the Numbers: Greenhouse Gas Data and International Climate Policy", World Resources Institute (WRI) Report, December 2005.

- **Equipment.** When equipment like HVAC systems, boilers, and refrigeration units need to be upgraded, buying more energy-efficient models can save considerable energy. McDonald's Europe was able to reduce its emissions by as much as 32 percent by using natural refrigerants in its refrigeration appliances instead of the more common hydrofluorocarbons (HFCs) (see case study H).
- **Centralized energy management.** Service-sector companies with several facilities may be able to invest in an energy management system that centrally monitors, operates, and programs all their lighting, heating, and air-conditioning operations. These systems can greatly reduce electricity consumption and fuel use while also reducing operating costs (see case study I).

Reducing Fuel Use and Switching Fuels in Buildings

Some service-sector companies use fuel in buildings' boilers or furnaces for heating, which generate GHG emissions. Replacing old units with more energy-efficient units can reduce fuel use and GHG emissions. Another measure to reduce fuel use as well as electricity use is to install programmable thermostats, which automatically adjust a facility's temperature during

specified hours, such as at nighttime or weekends when the facility may be empty. Switching fuels may also reduce GHG emissions. For instance, old units can be replaced or upgraded to burn biofuels, such as biodiesel or ethanol, or a less carbon-intensive fuel, such as natural gas instead of fuel oil.

Green Power

An increasingly common way that service-sector companies are reducing emissions is by buying green power. Green power is defined as electricity or heat generated from renewable resources, including wind, solar, geothermal, biomass, landfill gas, and certified low-impact hydro. On-site renewables generate clean energy and reduce or eliminate your company's electricity consumption from the grid or fuel requirements for heating, as well as cutting your company's emissions.

On-site renewable energy options for service-sector companies include installing solar photovoltaic (PV) systems, solar thermal units, and small wind power systems. In addition to reducing GHGs, on-site renewable energy generation has other benefits too, including fewer operating losses during blackouts or grid failures and protection against volatile fossil fuel prices and high peak prices for grid-based power.⁷

CASE STUDY H

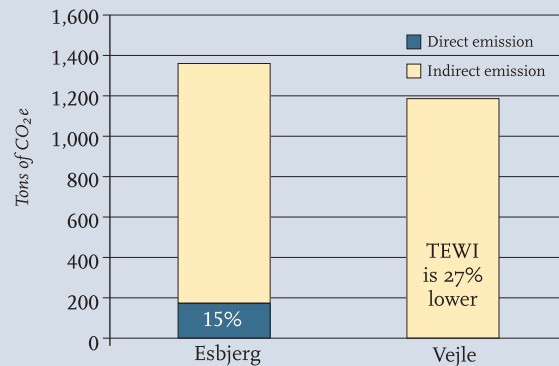
MCDONALD'S EUROPE: WORKING TOWARD AN HFC-FREE FUTURE

In 2003, McDonald's Europe opened a pilot restaurant in Vejle, Denmark, with equipment using natural refrigerants rather than the more common hydrofluorocarbons (HFCs).¹ The goal was to avoid emitting this potent greenhouse gas as well as to increase the energy efficiency of its refrigeration equipment.

After more than a year of systematically testing the equipment, the results were very encouraging. The tests—monitored by the Danish Technological Institute—showed that compared with a similar restaurant in Esbjerg, Denmark using conventional equipment, the HFC-free restaurant consumed approximately 12 percent less energy, and its CO₂ emissions were between 19 percent (summer) and 32 percent (winter) lower, averaging a 27 percent reduction in CO₂ emissions annually (see figure). Based on these promising results, McDonald's Europe has committed to an HFC-free future and plans to continue to optimize its appliance technologies and to introduce new HFC-free equipment to its restaurants as it becomes viable.

McDonald's Europe is focusing on the equipment with the highest environmental and energy-saving potential, such as HVAC systems, walk-in coolers and freezers, and shake and sundae machines, because out of the ten pieces of refrigeration equipment tested, these three accounted for 97 percent of the company's use of refrigeration electricity.

Total Equivalent-Warming Impact (TEWI) of an Average Restaurant (Esbjerg) and the HFC-Free Pilot Restaurant (Vejle)



1. Business Leaders Initiative on Climate Change: Report 4. 2005. Amsterdam and London: Respect Europe.

Green power products, such as renewable energy certificates (RECs), offer companies an efficient and cost-effective option to offset their indirect GHG emissions from electricity consumption (see box 8). (For more information about green power, visit WRI's Green Power Market Development Group's Web site at www.thegreenpowergroup.org, and for additional green power resources, see appendix 3.)

Green Building Design

Incorporating green building practices into new buildings or retrofits of existing buildings is becoming

an increasingly common and cost-effective way to reduce energy consumption and buildings' overall environmental impact. Green building designs have many features that reduce overall energy use, including retrocommissioning, energy-efficient windows, highly efficient insulation, reflective or vegetated "green" roofs, on-site renewable energy, and sites near public transportation. In addition to environmental benefits, high-performance green buildings offer a more pleasant work environment and human resource management advantages such as increased productivity and greater well-being for their occupants.⁸ (For a list of green building resources, see appendix 3.)

CASE STUDY I

THE BOTTOM LINE ON GHGS: HOW CITIGROUP SAVED MONEY WHILE REDUCING EMISSIONS

In 2002, Citigroup installed a new satellite-based energy management system to reduce its energy consumption and service calls at 241 retail branches in the northeastern United States. The new equipment can easily be added to or removed from each facility's existing system, thereby eliminating the need to extensively rewire the branches. As a result, the total installation time is minimal, and business operations are not interrupted. In addition, if a retail branch is closed or moved, this "clip on" system can be removed and reused at another location.

With Citigroup's new system, monitoring, maintenance, and help-desk activities for all branches are now centrally managed, and the lighting and heating, ventilating and air conditioning (HVAC) systems have specific hourly operation schedules for each branch. Although the cost of the retrofit project was \$2.5 million, Citigroup was able to apply for about \$500,000 in energy efficiency rebates through state and local energy programs, which offset part of the cost. Quantifying the expected financial payback of this type of GHG reduction project depends on several variables, including the timing of the installation, changes in energy rates, and changes in operating hours and weather. Taking these variables into account, Citigroup achieved payback in twelve months.

Since the program was started, thirteen branches using similar control systems were added to the portfolio. Based on a "pulse check" in 2005, Citigroup validated that the improved performance of its HVAC system alone has reduced its electrical consumption by 18 percent and natural gas use by 11 percent for 254 locations. Moreover, its central office managers' ability to remotely monitor and restart the HVAC systems has reduced the number of service calls by 30 percent. As a result, Citigroup has significantly cut its direct and indirect GHG emissions and has increased its operational and energy efficiency and thereby needs less energy and fewer service calls.

BOX 8

RENEWABLE ENERGY CERTIFICATES (RECS)

Some companies use renewable energy certificates (RECs) for their green power needs. One REC represents the environmental, social, and other positive attributes¹ associated with one thousand kilowatt hours (kWh)² of electricity generated by renewable resources. RECs can be sold separately from their associated physical electricity, thereby enabling customers to buy the positive attributes of renewable power generation independently of their retail power supply. Although purchasing RECs does not alter the physical electricity imported from the grid into a company's facility, they can help companies offset or "green up" their electricity consumption. (More information about offsets is provided in "Offsets," p. 57.)

Many leading companies buy RECs to "green up" their power supply. For example, in 2004 Staples purchased more than 48 million kWh, or 10 percent of its total U.S. electricity consumption, through RECs. The World Bank "greened up" 100 percent of its Washington, D.C., headquarters' electricity use with RECs equivalent to 85 million kWh. Whole Foods Market recently became the United States' leading corporate RECs user with its purchase of 458 million kWh of RECs sourced from wind farms, enough to completely offset the electricity used in all its U.S. stores, bakeries, distribution centers, regional offices, and headquarters. Generally accepted accounting and reporting methodologies for RECs purchases are still evolving.

Notes

1. U.S. Department of Energy, U.S. Environmental Protection Agency, World Resources Institute, Center for Resource Solutions. "Guide to Purchasing Green Power: Renewable Electricity, Renewable Energy Certificates and On-Site Renewable Generation," September 2004.
2. One thousand kilowatt hours (kWh) equals 1 megawatt hour (MWh)

EMISSION REDUCTIONS FROM TRANSPORTATION

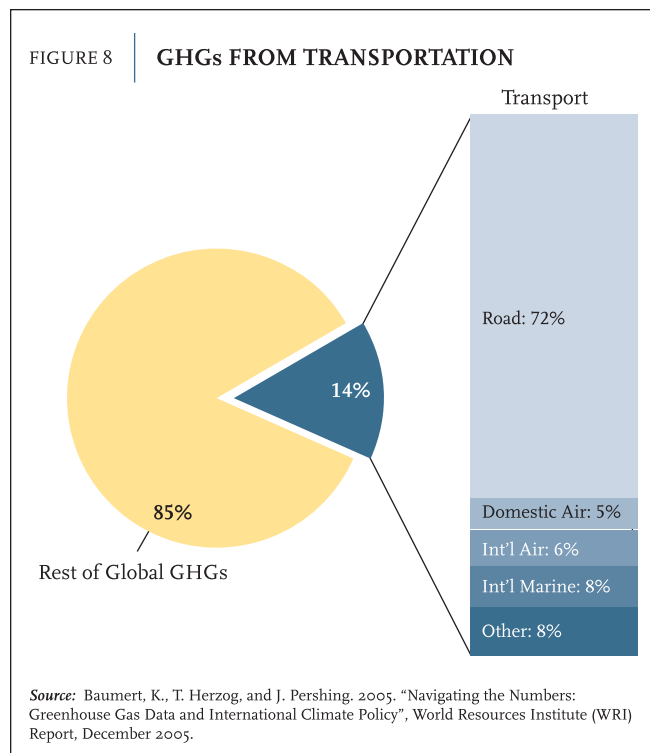
The transportation sector accounts for about 14 percent of global GHG emissions and 17 percent of global CO₂ emissions,⁹ with most of these emissions (72 percent) resulting from road transport, followed by aviation (about 12 percent), and marine (8 percent) transport¹⁰ (see figure 8). Service-sector companies can reduce GHG emissions from transportation by using less fuel or using alternative fuels like biodiesel in company vehicles, using alternatives to business air travel, and encouraging their employees to commute by greener means.

Reducing Fuel Use/Using Alternative Fuels in Vehicles

Emissions can be reduced by upgrading vehicle fleets to more fuel-efficient models, such as gas–electric hybrid vehicles, or to vehicles that can burn biofuels like biodiesel or ethanol. Similarly, switching to less carbon-intensive transportation methods, for instance, from air to rail or shipping, or consolidating trips can reduce emissions. In addition, companies can offer driver-training programs to teach driving styles that cut both fuel use and costs. Ensuring that vehicles used for product distribution are fully loaded and take the shortest route also cuts emissions and saves money (see case study K).

Reducing Business Travel Emissions

Emissions from business travel can be reduced by using alternatives to air travel, which is the most carbon-intensive travel method, for example, by taking the train when feasible instead of flying, consolidating business trips, organizing business trips so that they are multipurpose, and increasing the use of telephone-, video-, and Web-conferencing. Telia AB, a Swedish telecom company, replaced three of its four quarterly meetings of 60 to 70 managers with audio- and Web-conferencing, thereby saving the company approximately \$300,000 over two years in costs for travel, hotels, and lost working time. Following this lead, others in the company significantly increased their use of audio-conferencing, which helped the company cut air travel by 20 percent.¹¹



Reducing Employee Commuting Emissions

To decrease emissions from employee commuting, companies can offer incentives for employees to use public transportation, car pools, and other means of commuting, such as walking and cycling. Incentives may include discounts or tax incentives on mass transit, or even financial incentives for employees who buy fuel-efficient hybrid-electric vehicles (see case study J).

Teleworking, or using communications technology to work at a distance rather than commuting, is another alternative. In addition to reducing emissions, telework can offer companies financial advantages too. AT&T has an extensive telework program that it estimates saves the company \$25 million a year in real estate costs and \$100 million a year in greater employee productivity. AT&T also cites its telework program as a factor in its high employee retention rate.¹²

UPSTREAM AND DOWNSTREAM REDUCTION OPPORTUNITIES

When planning your company’s GHG reduction strategy, remember that it can reduce emissions not only in its operations but also upstream and downstream across its supply chain (see figure 9).

Working with suppliers to improve the efficiency and reduce the GHG intensity of their manufacturing operations or to build energy efficiency into their product design can cut emissions from upstream activities. Companies may also obtain upstream materials from

CASE STUDY J

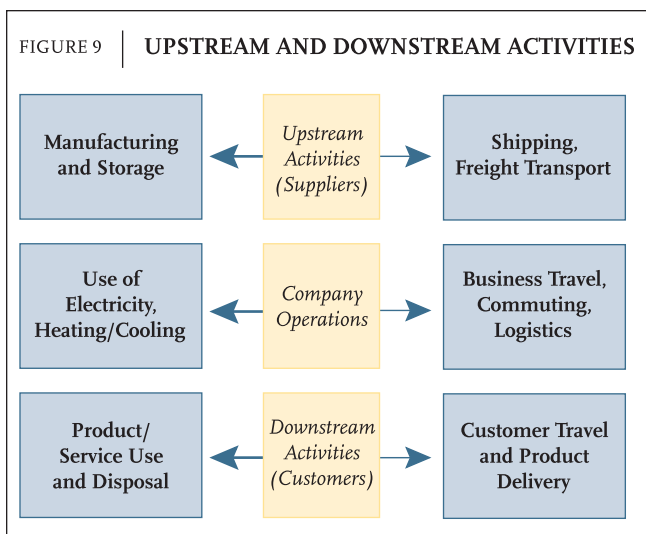
GOOGLE’S FUEL EFFICIENT VEHICLE INCENTIVE PROGRAM: A BENEFIT FOR EMPLOYEES AND THE ENVIRONMENT

To reduce the environmental impact of their employees’ commuting, Google, an Internet search engine company with nearly 5,000 employees worldwide, offered them an incentive to use fuel-efficient vehicles. The company’s innovative program gives all of Google’s full-time U.S. employees a taxable subsidy of \$5,000 toward the purchase, or \$2,500 toward the lease, of a car with an EPA highway rating of 45 miles per gallon or higher. In addition, the vehicle must also meet California’s partial low emissions vehicle (PLEV) standard. Currently, three hybrid vehicles qualify for the incentive: the Toyota Prius and the Honda Insight and Civic Hybrid. The company sees the program as a way to reduce its environmental impacts while providing an option within a benefits package that attracts and retains the best possible employees.

closer suppliers in order to reduce emissions from transportation or require supplies to be transported by less GHG-intensive modes such as rail and ships.

Reducing transport emissions generated by customers’ travel to the company offices or retail locations or reducing emissions from the use or disposal of a product sold by the company can cut emissions from downstream activities. Marks & Spencer, a United Kingdom–based retailer, has minimized the emissions from transporting products to its facilities and has reduced the energy required by customers to wash clothes purchased from its stores (see case study K).

Some companies may also be able to reduce emissions from their services. For example, loans and investments made by banks to activities or projects that generate high levels of GHG emissions may have a significant downstream impact on climate change. Banks may be able to mitigate the GHG risk exposure of their loan portfolios by evaluating the carbon risks of their lending practices and shifting their focus toward investment in low-carbon instead of high-carbon technologies. To help financial services companies assess the GHG risk of their investment portfolios, WRI is teaming up with



CASE STUDY K

MARKS & SPENCER: PURSUING INNOVATIVE EMISSION REDUCTIONS THROUGHOUT THE VALUE CHAIN

Marks & Spencer is a retailer based in the United Kingdom with 400 stores there and in the Republic of Ireland. Another 200 Marks & Spencer stores are operated by franchises in more than 30 other countries. In order to assess all the climate change impacts caused by activities along its value chain, the retailer constructed a greenhouse gas (GHG) inventory of its operations and then conducted life-cycle analyses of nearly 95 percent of its products. Through these assessments, Marks & Spencer found several opportunities to reduce emissions from upstream and downstream activities.

For example, a life-cycle analysis of a pair of trousers sold at Marks & Spencer's stores found that 76 percent of the energy consumed in connection with the trousers was from the customer's washing, drying, and ironing them. The same analysis discovered that a little more than 4 percent of Marks & Spencer's life-cycle energy was consumed during its distribution and retail operations. As a result, the company has worked with its suppliers to produce garments that require much lower wash temperatures, in order to reduce emissions from caring for the product.

Upstream, Marks & Spencer engages suppliers to reduce emissions from transporting products to its facilities, primarily through route optimization measures and less GHG-intensive transport options. For instance, the company imports most of its wine sold in the United Kingdom from France and other countries in continental Europe. Until recently, each supplier sent its goods via a separate freight ferry to the United Kingdom, regardless of how full each truck was. This transport method was inefficient and expensive and produced significant GHG emissions. The company worked with its suppliers to consolidate shipments from different suppliers in one mainland distribution center. From there, Marks & Spencer loads the products onto trains that travel via the English Channel Tunnel. Currently, Marks & Spencer sends two full trains a week across the channel, reducing freight costs, simplifying logistics, and greatly reducing upstream transport emissions.

representatives from the financial services sector to draw up guidelines for incorporating this type of GHG accounting and reporting into corporate GHG inventories. Visit www.ghgprotocol.org for more information.

OFFSETS

In addition to reducing emissions within their operations or from upstream and downstream activities, some companies also invest in offsets. An offset is an activity that reduces or sequesters GHG emissions and takes place outside the reporting company's GHG inventory boundary. These projects can be used to counteract the GHG emissions from the companies' operations. For example, Interface Inc. uses its innovative "Cool Fuel" program to offset the emissions from its sales fleet (see case study L). GHG offsets are sometimes used as well to meet emission reduction targets, especially when the cost of internal reductions is high, opportunities for reductions are limited, or the company cannot meet its target owing to unexpected circumstances. WRI recommends that emission reductions from sources within a company's boundaries be pursued

CASE STUDY L

COOL FUEL™: INTERFACE'S COST-NEUTRAL OFFSET PROGRAM

In 2002, Interface Inc., the world's largest manufacturer of modular carpet and a leading producer of commercial fabric, initiated its Cool Fuel program in the United States to reduce the impact of its employees' transportation on the climate. Interface's primary fuel supplier provides incentive rebates based on the volume of fuel purchased, and Interface Inc. invests the rebates in a portfolio of diverse carbon-offset projects. The offsets compensate for the carbon dioxide emissions from the vehicles driven by its U.S. sales representatives. Currently, the offset costs are no higher than the revenue recovered through the rebate program, so the program is not only "climate neutral" but cost neutral as well. Since August 2002, Interface's associates have bought more than 420,000 gallons of fuel with their Cool Fuel cards, enabling the company to buy more than 4,800 metric tons of carbon dioxide offsets.

BOX 9

WRI/WBCSD GHG PROTOCOL FOR PROJECT ACCOUNTING



The GHG Protocol for Project Accounting (Project Protocol), published in December 2005, describes methods of quantifying and reporting GHG reductions—that is, the decreases in GHG emissions or increases in removals and/or storage—from climate change mitigation projects (GHG Projects). The *Project Protocol* is the culmination of a four-year, multiple-stakeholder process, convened by WRI and WBCSD, with businesses, nongovernment organizations, governments, academics, and others from both developed and developing countries.

The *Project Protocol* combines the key concepts, principles, and methods to account for GHG emission reductions from any type of GHG project. Its objectives are to:

- Provide a credible and transparent approach to quantifying and reporting GHG reductions from GHG projects.
- Enhance the credibility of GHG project accounting by using common accounting concepts, procedures, and principles.
- Provide a platform for harmonizing different project-based GHG initiatives and programs.

first to ensure that its best opportunities for internal investments are fully leveraged. After that, offsets may be the most economically effective way of reducing emissions.

Note that the accounting and reporting process for GHG offsets is different from the accounting and reporting of emissions at the company or organization level, which is the focus of this guide. Reductions in corporate emissions are calculated by comparing changes in a company's actual emissions inventory over time with those of the base year. Conversely, offsets are calculated according to a "baseline" that represents a hypothetical scenario for what emissions would have been without the GHG reduction project. Companies that buy GHG offsets should make sure that their GHG reductions have been quantified using credible GHG project accounting

methodologies and procedures, such as those featured in the WRI/WBCSD *GHG Protocol for Project Accounting* (see box 9). Information about offset purchases should be included in your GHG inventory report (see step 7).

Notes

1. Data derived from K. Baumert, T. Herzog, and J. Pershing, "Navigating the Numbers: Greenhouse Gas Data and International Climate Policy," World Resources Institute (WRI) report, December 2005.
2. U.S. Department of Environmental Protection, U.S. Department of Energy, Energy Star Program.
3. Lighting Research Center, press release "LED Technology Saves Energy, Attracts Shoppers to Retail Windows", May 2005.
4. US EPA, US DOE, Energy Star Program.
5. Natural Resources Defense Council, "Laptop Computers: How Much Energy Do They Use, and How Much Can We Save?" (Natural Resources Defense Council, September 2003).
6. Tufts Climate Initiative.
7. C. Hanson, "Corporate Guide to Green Power Markets Installation 7: The Business Case for Using Renewable Energy," World Resources Institute report, December 2005.
8. U.S. Green Building Council, "Building Momentum."
9. World Resources Institute, Climate Analysis Indicators Tool (CAIT), version 3.0 (Washington, DC: World Resources Institute, 2006). Transportation emissions include international transport emissions, referred to as "international bunkers."
10. Baumert, Herzog, and Pershing, "Navigating the Numbers."
11. P. Arnfalk, "Can Virtual Meetings Replace Business Travel?" In *Sustainability at the Speed of Light: Opportunities and Challenges for Tomorrow's Society*, June 2002, WWF Sweden.
12. AT&T, "Telework: The AT&T Experience," Testimony before the U.S. House of Representatives Subcommittee on Technology and Procurement Policy of the Committee on Government Reform, March 22, 2001.



Step 7 REPORTING A COMPANY'S GHG INVENTORY

Once you have developed your company's inventory, set a credible emission reduction target, and formulated a strategy to reach your goal, it is important to share your company's progress with interested stakeholders. Your company's shareholders, employees, other businesses in your sector, the environmental community, and the general public all may want to learn about your company's commitment to protecting the climate. You may want to feature your company's achievements on your company's Web site, in its annual report, or in its sustainability report.

Following the guiding principles of GHG emissions accounting and reporting (see box 4), make sure your reporting is "relevant, complete, consistent, transparent and accurate." Your report should be based on the best data available at the time of publication.

REPORTING INFORMATION ABOUT EMISSIONS AND PERFORMANCE

The following information is required reporting under the framework of the GHG Protocol:

- Emissions in metric tons and in tons of CO₂e.
- Total scope 1 and scope 2 emissions.
- Separate emissions from each scope plus the total emissions from each scope, showing the sum of your company's emissions.
- The chosen base year and your company's emissions performance over time compared with that of your base year and reduction target.

- Methodologies used to calculate emissions, including emission factors and their sources, or a reference or link to the calculation tools used, with the same information.
- Appropriate context for any significant emission changes such as acquisitions or divestitures, outsourcing or insourcing, changes in reporting boundaries, and base-year recalculations.



TABLE 5 | GHG REPORTING PROGRAMS FOR SERVICE-SECTOR COMPANIES

Program	Geographic Region	Type of Program	Description	Website
Australia Greenhouse Challenge Plus	Australia	Voluntary registry and reduction program	This is a voluntary corporate–government partnership program with participants from every sector of the economy. Participants register emissions and agree on reduction targets.	www.greenhouse.gov.au/challenge/
California Climate Action Registry	California, USA	Voluntary registry	This registry facilitates the reporting of entity-wide GHG emissions throughout California and the United States to protect and encourage early action on climate change.	www.climateregistry.org/
Canadian GHG Challenge Registry	Canada	Voluntary registry and reduction program	The primary objective of this program is to challenge participants from all economic sectors to contribute to the reduction of Canada's GHG emissions.	www.ghgregistries.ca/challenge/index_e.cfm
Chicago Climate Exchange (CCX)	USA	Voluntary allowance-trading scheme	CCX is North America's first voluntary GHG reduction and trading system. Companies with few or no direct emissions may participate as associate members and commit to complying with CCX rules by offsetting the greenhouse gases associated with a selection of business-related activities.	www.chicagoclimatex.com/
Eastern Climate Registry	Northeast/ Mid-Atlantic, USA	Voluntary registry	The Eastern Climate Registry (formerly referred to as "RGGR") is a multi-state GHG Registry, whose goal is to provide a GHG emissions inventory to support state voluntary and mandatory GHG reporting programs and to provide the technical platform for state climate change initiatives, such as regional emissions trading.	www.easternclimateresistry.org
Mexico Greenhouse Gas Program	Mexico	Voluntary registry	This is the first voluntary registry in a developing country. GEI Mexico is a joint program of the Mexican Secretariat of Environment and Natural Resources (SEMARNAT), WRI and WBCSD.	www.geimexico.org
New Hampshire Greenhouse Gas Registry	New Hampshire, USA	Voluntary registry	This registry is intended to quantify and submit GHG emissions reduction actions to a state database for safekeeping against potential future state or federal requirements. Participants can report on entity, facility, or project levels.	www.des.state.nh.us/ard/ClimateChange/ghgr.htm

In addition, the following information is required reporting under the framework of this guide:

- Scope 3 emissions from the use of purchased electricity (see "Dealing with Leases," p. 26.)

The following information is optional reporting:

- All other scope 3 emissions.
- A description of any emission reduction activities.
- A description of offset projects invested in and information about the offsets' credibility, as well as how much of the reduction target was achieved using offsets.

- A description of inventory-related activities planned for the coming year.

You may also wish to have an external third party verify your emissions inventory. External verification lends credibility to your inventory and may be required if you intend to submit your inventory to a regulatory body, emissions registry, or voluntary GHG reporting program. For a summary of GHG registries and programs applicable to service-sector companies, see table 5. Note that if your company participates in a GHG program, it must follow that program's rules for reporting. For more information about GHG reporting, refer to chapter 9 of the GHG Protocol's *Corporate Accounting and Reporting Standard* (revised edition).

TABLE 5 | CONTINUED

Program	Geographic Region	Type of Program	Description	Website
UK Emissions Trading Scheme	United Kingdom	Voluntary allowance trading scheme	This is the world's first economy-wide emissions-trading scheme and is open to any of the 6,000 companies that have entered into climate change agreements with the U.K. government.	www.defra.gov.uk/environment/climatechange/trading/uk/index.htm
US Department of Energy 1605(b) program	USA	Voluntary registry	The 1605(b) program is the U.S. federal government's voluntary GHG registry. Started in 1992, more than 220 companies currently register their emissions and reductions through 1605(b). The program guidelines are currently being revised, with the final changes due by mid-2006.	www.eia.doe.gov/oiaf/1605/frntvrgg.html
US Environmental Protection Agency Climate Leaders Program	USA	Voluntary reduction program	Climate Leaders is a U.S. EPA industry-government partnership that works with companies to develop long-term comprehensive climate change strategies. Partners set a corporate-wide GHG reduction goal and inventory their emissions to measure progress.	www.epa.gov/climateleaders/
Wisconsin Voluntary Emission Reduction Registry ^a	Wisconsin, USA	Voluntary registry	This multipollutant registry allows reporting of GHGs as well as NO _x , SO ₂ , VOCs, and particulates.	www.dnr.state.wi.us/org/aw/air/registry/index.html
World Economic Forum: Greenhouse Gas Register	International	Voluntary registry	This program enables multinational corporations to report GHG emissions from different regions of the world. Reporting of voluntary reduction targets also is encouraged.	www.weforum.org/site/homepublic.nsf/Content/Global+Greenhouse+Gas+Register
WWF Climate Savers	International	Voluntary reduction program	The World Wildlife Fund administers this voluntary program. Participants agree to report emissions and meet reduction targets.	www.worldwildlife.org/climate/projects/climateSavers.cfm

Note

- a. Wisconsin is currently (2006) working with six other states in the Upper Midwest on plans for a possible midwestern registry. This planning effort is being coordinated by the Lake Michigan Air Directors Consortium. For further information, see www.ladco.org/regional_greenhouse.htm.

Appendix 1

UNIT CONVERSION FACTORS

APPENDIX 1 UNIT CONVERSION FACTORS				
Type	Unit	Equals	Equals	Equals
Mass	1 pound (lb) 1 kilogram (kg) 1 short ton (ton) 1 metric ton (tonne)	453.6 grams (g) 2.205 pounds (lb) 2,000 pounds (lb) 2,205 pounds (lb)	0.4536 kilograms (kg) 907.2 kilograms (kg) 1,000 kilograms (kg)	0.0004536 metric tons (tonnes) 1.102 short tons (tons)
Volume	1 cubic foot (ft ³) 1 cubic foot (ft ³) 1 gallon (gal) 1 barrel (bbl) 1 liter (l) 1 cubic meter (m ³)	7.4805 gallons (gal) 28.32 liters (l) 0.0238 barrel (bbl) 42 gallons (gal) 0.001 cubic meters (m ³) 6.2897 barrels (bbl)	0.1781 barrel (bbl) 0.02832 cubic meters (m ³) 3.785 liters (l) 158.99 liters (l) 0.2642 gallons (gal) 264.2 gallons (gal)	0.003785 cubic meters (m ³) 0.1589 cubic meters (m ³) 1,000 liters (l)
Energy	1 kilowatt hour (kWh) 1 megajoule (MJ) 1 gigajoule (GJ) 1 Btu (btu) 1 million Btu (million btu) 1 therm (therm) 1 hundred cubic feet of natural gas (CCF)	3,412 Btu (btu) 0.001 gigajoules (GJ) 0.9478 million Btu 1,055 joules (J) 1.055 gigajoules (GJ) 100,000 btu 1.03 therm (therm)	3,600 kilojoules (KJ) 277.8 kilowatt hours (kWh) 293 kilowatt hours (kWh) 0.1055 gigajoules (GJ)	29.3 kilowatt hours (kWh)
Other	Kilo Mega Giga Tera 1 land mile 1 nautical mile 1 metric ton carbon	1,000 1,000,000 1,000,000,000 1,000,000,000,000 1.609 land kilometers 1.15 land miles 3.664 metric tons CO ₂		

For additional unit conversion factors, visit www.onlineconversion.com.

Appendix 2

SOURCES FOR EMISSION FACTORS

Emission factors are published by various entities. It is important to select the most current and relevant emission factors available. A list of them can be found in the GHG Protocol's calculations tools developed for the service sector, at www.ghgprotocol.org. Always remember that the emission factors you use must be expressed in the same measurement unit as your activity data, which may require that you convert the units before completing your calculations (see appendix 1).

The following are common sources for emission factors for electricity, heating, and car, air, rail, and bus travel.

ELECTRICITY

- Country-level electricity emission factors are available from the International Energy Agency, www.iea.org, and the United National Environment Programme (UNEP), www.unep.org.
- Emission factors for U.S. electricity grid regions, states, generating companies, and power plants are available from the U.S. Environmental Protection Agency's (U.S. EPA) E-Grid database, www.epa.gov/cleanenergy/egrid/index.htm.

HEATING

Emission factors for fuels often used for heating are available from:

- Intergovernmental Panel on Climate Change (IPCC), *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1rb1.pdf.
- U.S. Department of Energy/Energy Information Administration (DOE/EIA), www.eia.doe.gov/oiaf/1605/factors.html.
- UK DEFRA, *Annexes to Guidelines for Company Reporting on Greenhouse Gas Emissions*, www.defra.gov.uk/Environment/business/envrp/gas/.

CAR TRAVEL

- Fuel efficiency ratings for cars are available in the United States from the *U.S. EPA Green Vehicle Guide*, www.epa.gov/autoemissions.
- Emission factors for motor fuels are available from the U.S. DOE/EIA, www.eia.doe.gov/oiaf/1605/factors.html.
- Emission factors for motor fuels and for cars that assume a default fuel efficiency value are available from UK DEFRA, *Annexes to Guidelines for Company Reporting on Greenhouse Gas Emissions*, www.defra.gov.uk/Environment/business/envrp/gas/.
- Emission factors for motor fuels are available from the IPCC, *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1rb1.pdf.



AIR TRAVEL

- Emission factors for aviation fuels as well as short and long flights in commercial planes are available from UK DEFRA, *Annexes to Guidelines for Company Reporting on Greenhouse Gas Emissions*, www.defra.gov.uk/Environment/business/envrp/gas/. The GHG Protocol's calculation tools use an additional emission factor for medium flights, which is derived from the UK DEFRA data, www.ghgprotocol.org.
- Emission factors for aviation fuels are available from the U.S. DOE/EIA, www.eia.doe.gov/oiaf/1605/factors.html.
- Emission factors for aviation fuels are available from the IPCC, *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1rb1.pdf.

RAIL TRAVEL

- Emission factors for U.K. rail are available from UK DEFRA, *Annexes to Guidelines for Company Reporting on Greenhouse Gas Emissions*, www.defra.gov.uk/Environment/business/envrp/gas/.
- Emission factors for U.S. diesel trains are available from the Bureau of Transportation Statistics, www.bts.gov.
- In the GHG Protocol's calculation tools, emission factors for U.S. electric trains, coal trains, and light rail are derived from U.S. diesel trains emission factors, www.ghgprotocol.org.

BUS TRAVEL

- Emission factors for bus travel are available from the U.S. Bureau of Transportation Statistics, www.bts.gov.
- Emission factors for motor fuels are available from the U.S. DOE/EIA, www.eia.doe.gov/oiaf/1605/factors.html.
- Emission factors for motor fuels and for cars that assume a default fuel efficiency value are available from UK DEFRA, *Annexes to Guidelines for Company Reporting on Greenhouse Gas Emissions*, www.defra.gov.uk/Environment/business/envrp/gas/.
- Emission factors for motor fuels are available from the IPCC, *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1rb1.pdf.

Appendix 3

REFERENCES AND RESOURCES

CLIMATE CHANGE AND ITS EFFECTS

More information about climate change can be found at the following Web sites:

- BBC Weather Center. A primer on the science, impacts, and policy dynamics of climate change; www.bbc.co.uk/climate/.
- Climate Analysis Indicators Tool (CAIT). WRI's Web database of climate change information for countries and U.S. states, including emissions and socioeconomic data as well as adaptation and vulnerability information; <http://cait.wri.org>.
- Intergovernmental Panel on Climate Change (IPCC). The most comprehensive and authoritative source for climate science research; www.ipcc.ch/.
- Pew Center on Global Climate Change. A nonpartisan NGO devoted to providing timely insight into climate change impacts, policies, and adaptation. Available in several languages; www.pewclimate.org/.
- Real Climate. Climate scientists' explanation of climate change in straightforward, nontechnical language; www.realclimate.org.

ACTIVITY DATA RESOURCES

Building Energy Use

- Commercial Buildings Energy Consumption Survey (CBECS). A service of the U.S. Department of Energy's Energy Information Administration. Provides regionally specific energy use data for different types of commercial buildings; www.eia.doe.gov/emeu/cbecs/

Air Travel

- Webflyer Milemarker. Airport-to-airport distance calculator; www.webflyer.com/travel/milemarker/.
- Indo Distance Calculator. Straight-line distance calculator; www.indo.com/cgi-bin/dist.

Car Travel

- U.S. Environmental Protection Agency. Fuel efficiency ratings for vehicles beginning with year 2000 models; www.epa.gov/autoemissions.

EMISSION REDUCTION RESOURCES

Energy Efficiency

Note that although some sites are country specific, the information they provide is relevant to individuals and businesses globally.

- Centre for Analysis and Dissemination of Demonstrated Energy Technologies (CADDET) Infostore. A searchable database of more than 1,500 renewable energy and energy efficiency projects and activities from all over the world. Several case studies highlight actions taken in the commercial sector that involve green buildings, cleaner transport fleets, and better lighting technologies. This service is maintained by the International Energy Agency; www.caddet.org/infostore/index.php.
- Collaborative Labeling and Appliance Standards Program (CLASP). A clearinghouse for global information on efficiency standards and product-

labeling programs. CLASP provides information on which countries have mandatory or voluntary energy efficiency standards and which products are covered, as well as labeling programs to help consumers obtain energy-efficient products;
www.clasponline.org/main.php.

- **Emprove.** A service of the New Zealand government, Emprove is an energy management and efficiency portal that provides information about the best energy management practices as well as incentives available to New Zealand businesses;
www.emprove.org.nz/index.aspx.
- **Energy Star Business Improvement.** A program jointly administered by the U.S. Environmental Protection Agency and the U.S. Department of Energy. The site provides a wealth of information about energy-efficient products and services as well as tools, calculators, and online training sessions that facilitate cost-effective energy use reduction strategies;
www.energystar.gov/.
- **European Commission Joint Research Center.** Information about energy efficiency, renewable energy, and green building programs throughout the EU; <http://energyefficiency.jrc.cec.eu.int/>.
- **Greentie.** An international searchable directory of suppliers whose products and services help reduce greenhouse gas emissions. The directory is maintained by the International Energy Agency and contains listings for countries in every region of the world; www.greentie.org/index.php.
- **U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Energy Information Portal.** Provides comprehensive information about various energy-efficient and renewable energy technologies as well as the best practices for implementing them; www.eere.energy.gov/.

Green Power

- **Centre for Analysis and Dissemination of Demonstrated Energy Technologies (CADDET) Infostore** (see entry in “Energy Efficiency”).
- **Database of State Incentives for Renewable Energy (DSIRE).** Web database of up-to-date information about renewable energy and energy efficiency incentives offered by the U.S. states and the federal government; www.dsireusa.org/.
- **Green-e certified renewable energy.** Certifies the environmental integrity of renewable energy certificates available in the United States. Also provides business information about green power; www.green-e.org/.
- **Green Power Market Development Group.** In the U.S., the Group is a collaboration of 12 leading corporations and WRI dedicated to building corporate markets for green power. In Europe, the Group is convened in partnership with The Climate Group. Business-centered publications on green power are available for download; www.thegreenpowergroup.org.
- **Green Power Partnership.** A voluntary program administered by the U.S. EPA to promote corporate renewable energy procurement; www.epa.gov/greenpower/.
- **Indian Renewable Energy Development Agency Limited (IREDA).** A public company that administers incentives like low-interest loans to companies that implement renewable energy installations and energy efficiency measures. It also has links to incentives provided by the Indian central government; www.iredaltd.com/default.asp.



Green Buildings

- GreenerBuildings.com. Guidelines and resources for reducing the environmental impacts of commercial buildings; www.greenerbuildings.com/.
- UNEP Division of Technology, Industry and Economics (DTIE): Sustainable Consumption product criteria database. Searchable database with links to ecolabeling and green procurement programs around the world at every level of government; www.uneptie.org/pc/sustain/design/green_find.asp.
- U.S. Department of Energy, Energy Efficiency and Renewable Energy, Building Technologies Program. Resources, tools, data, and case studies regarding green buildings. www.eere.energy.gov/buildings.
- U.S. Green Building Council. Dedicated to promoting environmentally responsible buildings; www.usgbc.org/.
- World Green Building Council. An umbrella group providing information about green building councils in Asia, Europe, and North and South America; www.worldgbc.org/.



Business Travel

- FedEx–Kinkos. Maintains more than 150 video-conferencing facilities throughout the United States; www.fedex.com/.
- Think of it: Web Conferencing Directory. Listing of free and fee-based U.S. and international voice and video-conferencing service and software providers; www.thinkofit.com/webconf/video.htm.
- WebEx. Provides the technology to hold real-time Internet-based, interactive meetings; www.webex.com/.

Telework

- AT&T's Telework Webguide. A telework primer for employees, managers, and companies; www.att.com/telework/.
- European Telework Directory. A listing of telework association Web sites located around the world; www.etw.org/2003/telework-associations.htm.

Appendix 4

GLOSSARY OF TERMS

Absolute target. A target defined by a reduction in absolute emissions over time, for example, reduce CO₂ emissions by 25 percent below 2000 levels by 2010.

Activity data. Data that quantify an emission-generating activity, such as the use of electricity, in units that allow for emissions to be calculated (e.g., kilowatt hours, kilometers traveled, gallons of heating oil).

Base year. A historic datum (a specific year or an average over multiple years) against which a company's emissions are tracked over time.

Base-year emissions. GHG emissions in the base year.

Base-year emissions recalculation. Recalculation of emissions in the base year to reflect a change in the company's structure or a change in the accounting methodology it used. This ensures data consistency over time, that is, comparisons of like with like over time.

Boundaries. GHG accounting and reporting boundaries, for example, organizational and operational boundaries. The inventory boundary determines which emissions are accounted for and reported by the company.

Capital lease. A lease transferring most of the risks and rewards of ownership to the lessee and accounted for as an asset on the lessee's balance sheet. Also known as a financial or finance lease. Leases other than capital/financial/finance leases are operating leases. Consult an accountant for further detail, as definitions of lease types differ among various accepted financial standards.

Carbon dioxide-equivalent (CO₂e). The universal unit of measurement to indicate the global warming potential (GWP) of greenhouse gases, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate releasing (or avoiding releasing) different greenhouse gases against a common basis.

Control. A company's ability to direct the policies of another operation. More specifically, it is defined as

either operational control (the organization or one of its subsidiaries has the full authority to introduce and implement its operating policies at the operation) or financial control (the organization has the ability to direct the financial and operating policies of the operation with a view to gaining economic benefits from its activities).

De minimus emissions. Emissions generated from small sources. Collectively, de minimus emissions may be large.

Direct emissions. GHG emissions from sources that are owned or controlled by the reporting company.

Emission allowance. A commodity giving its holder the right to emit a certain quantity of GHGs.

Emission factor. A factor that converts activity data to emission values.

Emissions. The release of GHGs into the atmosphere.

Equity share. A company's extent of rights to the risks and rewards flowing from an operation. Typically, the share of economic risks and rewards in an operation is aligned with the company's percentage ownership of that operation, and equity share normally is the same as the ownership percentage.

Finance or capital lease. See definition for "capital lease."

GHG credit. GHG offsets converted to GHG credits when used to meet an externally imposed target. A GHG credit is a convertible and transferable instrument usually offered by a GHG program.

GHG inventory. A list of greenhouse gas emission sources and their quantities.

GHG program. A generic term referring to any voluntary or mandatory international, national, sub-national, government, or non-governmental entity that registers, certifies, or regulates GHG emissions or removals outside the company.

GHG Protocol. A set of common standards and calculation tools for measuring and reporting corporate GHG emissions. Developed by a multiple-stakeholder group co-convened by the World Resources Institute and the World Business Council for Sustainable Development.

GHG registry. A public database of organizational GHG emissions and/or project reductions, for example, the California Climate Action Registry and the World Economic Forum's Global GHG Register. Each registry has its own rules regarding what and how information is reported.

GHG source. Any physical unit or process that releases GHG into the atmosphere.

Global warming potential. A factor describing the radiative forcing impact (degree of harm to the atmosphere) of one unit of a given GHG relative to one unit of CO₂.

Greenhouse gases (GHGs). Naturally occurring and man-made gases that trap infrared radiation as it is reflected from the earth's surface, trapping heat and keeping the earth warm.

Green power. A generic term for renewable energy sources and specific clean energy technologies that emit fewer GHG emissions compared with those of other sources of energy. Includes solar photovoltaic panels, solar thermal energy, geothermal energy, biomass, landfill gas, certified low-impact hydropower, and wind turbines.

Indirect emissions. GHG emissions that are a consequence of the reporting company's operations but occur at sources owned or controlled by another company.

Intensity target. A target defined by a reduction in emissions relative to a measurement of business activity, for example, reduce CO₂ per square foot of retail space by 12 percent between 2000 and 2008.

Life cycle analysis. Assessment of the sum of a product's effects (e.g., GHG emissions) at each step in its life cycle, including resource extraction, production, use, and waste disposal.

Offset. A specific activity or set of activities that reduce, remove, or sequester GHG emissions from the atmosphere.

Operating lease. A lease that does not transfer the risks and rewards of ownership to the lessee and is not

recorded as an asset in the lessee's balance sheet. Leases other than operating leases are capital/financial/finance leases. Consult an accountant for further detail, as definitions of lease types differ among various accepted financial standards.

Operational boundary. The boundaries that determine the direct and indirect emissions associated with operations owned or controlled by the reporting company. This assessment allows a company to establish which operations and sources cause direct and indirect emissions, and to decide which indirect emissions to include that are a consequence of its operations.

Organizational boundary. The boundaries that determine the operations owned or controlled by the reporting company, depending on the approach taken (equity share or control approach).

Purchased electricity. Electricity, heat or steam used by the reporting company but generated by another company.

Renewable energy. Energy taken from sources that are inexhaustible, for example, wind, water, solar, geothermal energy, and biomass.

Reporting. Presenting data to internal management and external users such as regulators, shareholders, the general public, and specific stakeholder groups.

Scope. Defines the operational boundaries in relation to direct and indirect GHG emissions.

Scope 1 emissions. The reporting company's direct emissions.

Scope 2 emissions. The reporting company's indirect emissions from purchased electricity, heat, and steam.

Scope 3 emissions. The reporting company's indirect emissions other than those covered in scope 2.

Target base year. The base year used for defining a GHG reduction target.

Target level. The level of emissions that a company intends to reduce by a specific date as part of its commitment.

ABOUT WRI

The World Resources Institute is an environmental think tank that goes beyond research to create practical ways to protect the Earth and improve people's lives. Our mission is to move human society to live in ways that protect Earth's environment for current and future generations.

Our program meets global challenges by using knowledge to catalyze public and private action:

- *To reverse damage to ecosystems.* We protect the capacity of ecosystems to sustain life and prosperity.
- *To expand participation in environmental decisions.* We collaborate with partners worldwide to increase people's access to information and influence over decisions about natural resources.
- *To avert dangerous climate change.* We promote public and private action to ensure a safe climate and sound world economy.
- *To increase prosperity while improving the environment.* We challenge the private sector to grow by improving environmental and community well-being.

In all of our policy research and work with institutions, WRI tries to build bridges between ideas and actions, meshing the insights of scientific research, economic and institutional analyses, and practical experience with the need for open and participatory decision-making.



WORLD
RESOURCES
INSTITUTE

10 G Street, N.E.
Washington, D.C. 20002, USA
www.wri.org/



WORLD
RESOURCES
INSTITUTE

10 G Street, NE
Suite 800
Washington, DC 20002
www.wri.org

