FINAL DRAFT
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# The GHG Protocol for the U.S. Public Sector:

## *Interpreting the Corporate Standard for U.S. Public Sector Organizations*

A joint publication by World Resources Institute &
Logistics Management Institute

This is a final draft of the *GHG Protocol for the U.S. Public Sector: Interpreting the Corporate Standard for U.S. Public Sector Organizations.* It is referred to throughout the document as the *U.S. Public Sector Protocol.*

This protocol represents the culmination of a 6-month stakeholder review process incorporating feedback from over 60 U.S. federal, state and local government leaders. This final draft also incorporates the feedback from an internal review at World Resources Institute (WRI).

A final published version of the *U.S. Public Sector Protocol* will be available on the Greenhouse Gas Protocol Initiative website in June, pending final approval at WRI. A notification email will be sent out to stakeholders and any email addresses registered with the project website once the final version is available both online and in printed copies. Please visit the project webpage http://www.ghgprotocol.org/psp for updates.

**GHG Protocol Team Authors**

Stephen Russell
Mary Sotos

**Logistics Management Institute Team**

Virginia Bostock
Michael Canes
Emil Dzuray
Robert Hardison
Rachael Jonassen
Julia Kalloz
Snapper Poche

**Core Advisors**

Peggy Foran, The Climate Registry
Jill Gravender, The Climate Registry
Matthew Gray, US Department of Energy
Verena Radulovic, US EPA Climate Leaders
John Sottong, US EPA Climate Leaders
Bella Tonkonogy, US EPA Climate Leaders

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# Introduction

## THE GREENHOUSE GAS PROTOCOL INITIATIVE

The Greenhouse Gas Protocol Initiative was launched in 1998 with the mission of developing internationally accepted greenhouse gas (GHG) accounting and reporting standards and to promote their broad adoption. Designed as a multi-stakeholder partnership of businesses, non-governmental organizations (NGOs), and governments, it was convened by the World Resources Institute (WRI), a U.S.-based environmental NGO, and the World Business Council for Sustainable Development (WBCSD), a Geneva-based coalition of international companies.

## THE GHG PROTOCOL CORPORATE STANDARD

The cornerstone document of the GHG Protocol Initiative is the revised edition *GHG Protocol Corporate Accounting and Reporting Standard (GHG Protocol Corporate Standard)*, which provides a step-by-step guide for quantifying and reporting GHG emissions.

Published first in 2001 and revised in 2004 by World Resources Institute and World Business Council for Sustainable Development, the *GHG Protocol Corporate Standard*, has been widely accepted and adopted around the globe by businesses, NGOs, and governments (see Box 1 and Appendix A). Widespread adoption of the *GHG Protocol Corporate Standard* is attributable to the inclusion of many stakeholders in its development and to the fact that it is robust, practical, and builds on the experience and expertise of numerous experts and practitioners. The *GHG Protocol Corporate Standard* was designed to be program or policy neutral, allowing users the flexibility to adapt the core methodology and concepts to their specific accounting and reporting needs. To provide guidance on how to build GHG policies, reporting programs[1] and tools based on the concepts of the *GHG Protocol Corporate Standard*, the GHG Protocol Initiative developed two accompanying documents:

- *Measuring to Manage: A Guide to Designing GHG Accounting and Reporting Programs* (2007), and
- *Designing a Customized Greenhouse Gas Calculation Tool* (2007).

| BOX 1. Programs based on the *GHG Protocol Corporate Standard* |
| --- |

[1] GHG program is a generic term used to refer to any voluntary or mandatory international, national, sub-national government or non-governmental authority that registers, certifies, or regulates GHG emission or removals.

- Voluntary GHG reporting programs
    - U.S. EPA Climate Leaders
    - The Climate Registry
    - The World Wildlife Fund Climate Savers
    - ICLEI (Local Governments for Sustainability)
    - Carbon Disclosure Project
    - Brazil GHG Protocol Program
    - China Energy and Carbon Registry
    - Mexico GHG Program
    - Philippine GHG Accounting & Reporting Program
    - India GHG Inventory Program
    - South Korea Greenhouse Gas Emission Information System (GEI).
- GHG trading programs
    - Chicago Climate Exchange
    - European Union Greenhouse Gas Emissions Allowance Trading Scheme.
- Sector-specific protocols developed by industry associations
    - The International Aluminum Institute
    - International Council of Forest and Paper Associations
    - International Iron and Steel Institute
    - World Business Council on Sustainable Development Cement Sustainability Initiative
    - International Petroleum Industry Environmental Conservation Association.
- ISO 14064
- Global Reporting Initiative

# WHY A GHG PROTOCOL FOR THE U.S. PUBLIC SECTOR?

Government organizations worldwide have identified the need to start tracking and managing their greenhouse gas emissions, both to demonstrate environmental leadership and to prepare for future policies and regulations. While the *GHG Protocol Corporate Standard* provides the basic means by which any type of organization can create a GHG inventory, many public organizations have sought tailored guidance to interpret the *GHG Protocol Corporate Standard* specifically for the public sector context, especially when coordinating GHG reporting requirements across multiple government organizations. All stakeholders benefit from accounting and reporting GHG emissions in a way that makes it easier to calculate, track and compare progress over time. In the United States, public sector activities often involve shared resources between multiple organizations, and leasing arrangements for buildings, vehicles and land that can pose challenges attributing ownership/control of GHG emissions. Public organizations have asked for case studies reflecting the experiences and challenges of public sector GHG accounting and reporting, acknowledging the ways decision-making approaches and priorities differ in the public sector versus private sector (e.g., greater public accountability and freedom of information requirements), and providing examples of best practices. For governments that already monitor and report energy use and other environmental metrics, GHG emissions reporting represents a new and integrative performance indicator.

As reflected in the title, this *The GHG Protocol for the U.S. Public Sector: Interpreting the Corporate Standard for U.S. Public Sector Organizations* does not include substantively new or different accounting or reporting requirements from the *GHG Protocol Corporate Standard*, and does not constitute a separate or different "standard." Instead, it interprets the content and structure of the *GHG Protocol Corporate Standard* for the context of the public sector. It is referred to interchangeably in this guidance document as the *U.S. Public Sector Protocol.*

## Focus on the United States

The structure and responsibilities of the public sector vary widely across countries, and the time and resources available for the development of this protocol did not permit a comprehensive engagement with public organizations and other stakeholders worldwide. The recent emergence of GHG reporting programs and policies for government organizations in the United States further elevated the priority of this region. Therefore, this *U.S. Public Sector Protocol* was developed primarily for U.S. government organizations. However, since it is based on the widely accepted *GHG Protocol Corporate Standard*, it should have applicability to governments worldwide.

## Objectives of the *U.S. Public Sector Protocol*

This *U.S. Public Sector Protocol* was designed with the following objectives in mind:

- To help public organizations prepare a GHG inventory that represents a true and fair account of their emissions, through the use of standardized approaches
- To simplify the process and reduce the costs of compiling a GHG inventory
- To provide public sector organizations with information for use in building an effective strategy to manage and reduce GHG emissions
- To support voluntary and mandatory GHG reporting
- To increase consistency and transparency in GHG accounting and reporting among public sector organizations and GHG programs.

# How This Protocol was developed

To engage the public sector and provide a robust interpretation of the *Corporation Standard* principles, in 2008 WRI partnered with the Logistics Management Institute (LMI). LMI is a not-for-profit consulting company that primarily serves U.S. government organizations. Throughout this process, LMI worked with the Department of Energy Federal Energy Management Program and EPA Climate Leaders to ensure that this protocol could function as the background for U.S. Federal government GHG reporting requirements related to Executive Order 13514 (see Chapter 2 for a description of this policy).

Like the *GHG Protocol Corporate Standard,* this protocol was developed through a multi-stakeholder process. The *U.S. Public Sector Protocol* involved the input of over 60 experienced public sector managers, technical experts, and consultants across a range of organizations (see the Contributor's section). Several government organizations also "road tested" the protocol, including many U.S. federal agencies whose participation was coordinated by LMI and the Department of Energy.

Much of the text in the *U.S. Public Sector Protocol* is taken from the *GHG Protocol Corporate Standard*, but most chapters and diagrams include modifications in wording, examples, or structure in order to improve clarity and applicability to the public sector.

# Who Should Use This Protocol?

The "public sector" is a broad term that includes any organization owned, controlled or operated by the government, including government agencies, school systems, quasi-governmental organizations and utilities, as well as public-private partnerships. For the purposes of this document, the terms "entity," "agency" and "organization" are used interchangeably, though they may represent specific organizational types and relationships within a given jurisdictional context. This protocol is applicable to all levels of government in the United States, including federal, state, regional, and municipal/city government. The protocol will help managers of organizations at all government levels design and develop a GHG inventory. Policymakers developing new regulations and organization-level GHG management strategies can also look to the case studies highlighting successes in implementing and administering GHG management programs.

For organizations that have already created GHG inventories through voluntary or mandatory programs that are based on the *GHG Protocol Corporate Standard* (see Appendix A for a list of existing programs), this protocol can provide useful background information and clarify the rationale behind key accounting issues.

# Relationship to GHG Programs

*The U.S. Public Sector Protocol's* consistency with the *GHG Protocol Corporate Standard* ensures that it maintains compatibility with most reporting programs and registries. The *GHG Protocol Corporate Standard* is designed to provide a common, flexible framework defining the key concepts and processes: they do not specify technical details such as calculation methods, emission factors, reporting formats or verification requirements. Many voluntary reporting programs and registries have adapted and customized the *GHG Protocol Corporate Standard* to serve as the basis for their reporting protocols and procedures, usually pairing them with specific calculation tools and reporting templates to ensure that members' reports are accurate and consistent.

Mandatory reporting requirements for government organizations will likely specify details that are left open in this protocol, such as which specific scope 3 emission categories, if any, should be included; fiscal year versus calendar year reporting; centralized vs. decentralized data calculation; and GHG targets. The *GHG Protocol Corporate Standard* and *U.S. Public Sector Protocol* are considered "program and policy-neutral" in that they allow these technical policy decisions to be made by GHG programs.

### *Local Government Operations (LGO) Protocol*

The Local Government Operations (LGO) Protocol provides a flexible framework focused on serving the needs of local government organizations. The LGO Protocol was drafted jointly by The Climate Registry, ICLEI (Local Governments for Sustainability), California Climate Action Registry, and the California Air Resources Board, and reflects the compiled best practices and insights of a broad stakeholder process. These partner programs have based their individual reporting protocols and the LGO Protocol on the *GHG Protocol Corporate Standard*, and each has directed its local government members to report based on the LGO Protocol. The LGO Protocol includes calculation procedures and appendices detailing how each partner's reporting requirements differ (emission factors, verification requirements, etc.). Because of its compatibility with both the *GHG Protocol Corporate Standard* and this *U.S. Public Sector Protocol*, local government bodies should consult the LGO Protocol for accounting guidance that is tailored to cities, counties, and municipalities.

# What this protocol includes

This is a stand-alone protocol that provides standards and guidance for U.S. public organizations. It contains all the same accounting standards as the *GHG Protocol Corporate Standard,* but features updates in wording and format, consolidation of key points for the public sector, and additional case studies, graphs, and tables. It covers the accounting and reporting of the six GHGs regulated by the Kyoto Protocol— carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride ($SF_6$).

Although this protocol is designed to develop a verifiable inventory, it does not provide a standard for conducting verification. This protocol should not be used to quantify the reductions associated with GHG mitigation projects—the *GHG Protocol for Project Accounting* provides guidance for this purpose (see "What This Protocol Does Not Include" below).

### *Format: Standards and Guidance*

Most chapters are divided into "standards" and "guidance" sections, with the "standard" sections conveying the required elements for each inventory component, and the "guidance" sections elaborating on how the public sector context influences the types of choices that organizations might face when implementing this component.

Some chapters only feature a "guidance" section, with no "standard" section: these chapters address aspects of inventory development for which this protocol does not specify required elements, but offers recommended approaches.

"Guidance" chapters address how to define the goals for inventory design (Chapter 2), how to identify and calculate emissions (Chapter 6), how to establish an inventory quality management system (Chapter 7), how to prepare for and structure inventory verification (Chapter 9), and how to set a GHG target (Chapter 10).

### *Terminology: Shall, should and may*

The term "*shall*" is used in this protocol to indicate what is required in order for a GHG inventory to be in conformance with *The GHG Protocol for the U.S. Public Sector;* it *does not* convey a statutory requirement. The term "*should*" is used to indicate a recommendation, but not a requirement. The term "*may*" is used to indicate an option that is permissible or allowable.

## WHAT THIS PROTOCOL DOES NOT INCLUDE

There are other types of GHG accounting and/or reporting beyond the "organizational" or "entity-wide" inventories outlined in this protocol and the *GHG Protocol Corporate Standard*, including project-level accounting, community-level inventories and national inventories.  This protocol does not provide guidance on these methodologies.

### *Project-Level Accounting:*

The GHG Protocol Initiative developed *The GHG Protocol for Project Accounting (Project Protocol)* in 2005, to serve as a guide for quantifying the reductions and avoided emissions from GHG mitigation projects such as renewable energy generation projects, landfill methane gas capture, land-use, land-use change and forestry, etc. Two supplements to the *Project Protocol* provide methodologies for specific types of projects:

- *The Land Use, Land-Use Change, and Forestry Guidance* (2006)
- *Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects* (2007)

### *Community-level Inventories*

Community-level inventories focus on emissions from all sectors within a geographically-defined community, including electricity generation, transportation, land use change, etc. Many public sector leaders are being called upon to create these geographically-defined inventories for their region in order to identify larger sectoral emissions trends and guide reduction priorities and policies. This type of inventory is based upon boundaries, assumptions and methodologies which are significantly different from those referenced and utilized in the *U.S. Public Sector Protocol* and the *GHG Protocol Corporate Standard,* which only track emission sources that a given entity owns or controls. For example, a county government organization may prepare a GHG inventory of its own operations, and also conduct an inventory reflecting the county's residential power use, energy generation, transportation, etc. Guidelines for community-wide inventories are available through programs such as ICLEI (Local Governments for Sustainability).[2]

### *National Inventories*

National-level (country) GHG inventories represent emissions from all sectors within a country, including electricity generation, transportation, land use change, etc. These inventories are usually compiled via a top-down exercise using national economic data for the purposes of the United Nations Framework Convention on Climate Change process. See IPCC, 2006 for best practices on national inventories.

## REPORTING IN ACCORDANCE WITH *THE GHG PROTOCOL FOR THE U.S. PUBLIC SECTOR*

This protocol focuses on designing and developing a GHG inventory, including the accounting and reporting of emissions: it does not require emissions information to be reported to LMI, WRI, WBCSD, or any other organization. When regulatory requirements are not consistent with *The GHG Protocol for the U.S. Public Sector*, the organization's report must describe the variances and the reasons for them.

[2] See ch. 3.2.2 on community-level GHG inventories in *International Local Government GHG Emissions Analysis Protocol (IEAP) v. 1.0,* ICLEI (Local Governments for Sustainability), 2009.

# GHG Calculation Tools

For many public organizations, the calculation methods and tools utilized to complete a GHG inventory may be selected at a technical management level and/or integrated into existing environmental reporting mechanisms. This *U.S. Public Sector Protocol* does not require the use of any particular calculation tool, but does require that all methods, procedures and tools utilized in completing a GHG report are transparently detailed. Additionally, when a comprehensive tool does not exist, estimates and thorough documentation of the assumptions and shortcomings of those estimates are required.

To complement its published standards, WRI offers a number of calculation tools for free on the GHG Protocol Initiative website (www.ghgprotocol.org). These provide step-by-step guidance and electronic worksheets to help users calculate GHG emissions from specific sources or sectors. The cross-sector tools calculate emissions from sources common to many sectors and operations, including transportation, electricity consumption, stationary combustion, and refrigerant use. (Most public sector emissions fall within these cross-sector sources). The sector-specific tools calculate emissions from specialized industrial processes such as aluminum, cement or paper and pulp production. All of these tools are consistent with those proposed by the Intergovernmental Panel on Climate Change (IPCC) for compilation of emissions at the national level (IPCC, 2006). They are designed to be user-friendly for non-technical staff and to increase the accuracy of emissions data at an organization level.

# Frequently Asked Questions

Below is a list of frequently asked questions, with directions to the relevant chapters:

What are the principles that underpin a GHG inventory? Chapter 1

What goals should I consider when setting out to account for and report emissions? Chapter 2

How do I set an organizational boundary that determines which operations or facilities are included in the inventory? Chapter 3

How do I deal with complex organizational structures and shared GHG emissions ownership? Chapter 3

What is the difference between direct and indirect emissions and why does it matter? Chapter 4

Which indirect emissions should I report? Chapter 4

How do I account for leased buildings and vehicles? Chapter 4

How do I account for contracted or outsourced operations? Chapter 4

What is a base year and why do I need one? Chapter 5

My emissions change with alterations to the organization's structure. How do I account for these changes? Chapter 5

How do I identify and calculate my organization's emission sources? Chapter 6

What kinds of tools are there to help me calculate emissions? Chapter 6

What data collection activities and data management issues do my facilities have to deal with? Chapter 6

What determines the quality and credibility of my emissions information? Chapter 7

What information should be included in a GHG public emissions report? Chapter 8

What data must be available to obtain external verification of the inventory data? Chapter 9

What is involved in setting an emissions target and how do I report performance in relation to my target? Chapter 10

# Chapter 1
# GHG Accounting and Reporting Principles

## *WHAT ARE THE PRINCIPLES THAT UNDERPIN A GHG INVENTORY?*

## STANDARD

As with financial accounting and reporting, generally accepted greenhouse gas (GHG) accounting principles are intended to underpin and guide GHG accounting and reporting to ensure that the information represents a faithful, true, and fair account of an organization's GHG emissions. These principles also permit data to be accurately compared from year to year, and across multiple entities—which is particularly critical for departments or sub-organizations rolling up or aggregating their inventories to higher organizational units (division, bureau. etc.)

GHG accounting and reporting practices are evolving and are new to many organizations; however, the following principles established by the *GHG Protocol Corporate Standard* and applicable to this *U.S. Public Sector Protocol* are derived in part from generally accepted financial accounting and reporting principles. They reflect the outcome of a collaborative process involving stakeholders from a wide range of technical, environmental, and accounting disciplines. These are not legal definitions, but are the principles on which specific reporting policies or choices should be based.

GHG accounting and reporting shall be based on the following principles:

Relevance: Ensure the GHG inventory appropriately reflects the GHG emissions of the organization and serves the decision-making needs of users—both internal and external to the organization.

Completeness: Account for and report on all GHG emission sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusions.

Consistency: Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.

Transparency: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.

Accuracy: Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

# GUIDANCE

The application of these principles will ensure that the GHG inventory constitutes a faithful, true and fair representation of an organization's GHG emissions. Their primary function is to guide the implementation of the *U.S. Public Sector Protocol*, particularly when the application of the standards to specific issues or situations is ambiguous.

There may be situations in which certain principles such as accuracy and completeness are in tension with each other: for example, when a lack of accurate data impedes the creation of a complete inventory. In these situations, the other principles such as relevance and transparency provide the context in which those choices can be made: i.e., how relevant is the lack of specific data in relation to the entire inventory? Documenting all information with transparency also ensures that the decisions an organization makes are clear to managers, verifiers and other stakeholders.

These principles have been repeated in most voluntary GHG reporting program protocols, including those for The Climate Registry, ICLEI (Local Governments for Sustainability), and the Global Reporting Initiative. These programs may add other specific requirements to these principles and terms.

## Relevance

For a public organization's GHG report to be relevant means that it contains the information that users—both internal and external to the organization—need for their decision making. An important aspect of relevance is the selection of an appropriate inventory boundary, or the selection of which activities should be accounted for and reported in an organization's GHG inventory. This selection should reflect the substance and nature of the organization's responsibilities and sphere of control, not merely its legal form. Relevance may also be dictated by regulatory requirements that stipulate the information to be included or the reporting frequency. The choice of the inventory boundary is dependent on the characteristics of the organization, the intended purpose of information, and the needs of the users. When choosing the inventory boundary, a number of factors should be considered:

Organizational structures: Determining which activities an organization owns, controls or operates

Operational boundaries: Identifying on-site and off-site activities, shared facilities, processes, and services

Operational context: Understanding the nature of activities, geographic locations, sector(s), purposes of information, and users of information.

More information on defining an appropriate inventory boundary is provided in Chapters 2 (Inventory Goals), 3 (Organizational Boundaries), and 4 (Operational Boundaries).

## Completeness

All relevant emissions sources within the chosen inventory boundary need to be accounted for so that a comprehensive and meaningful inventory is compiled. In practice, a lack of data or the cost of gathering it may be a limiting factor. Sometimes it is tempting to define a minimum emissions accounting threshold (often referred to as a *de minimis* threshold), specifying that a small source or group of sources not exceeding a certain size can be omitted from the inventory. Technically, such a threshold simply means that the total emissions listed in the final inventory represent a predefined underestimate. Although it appears useful in theory, and multiple established GHG programs allow for *de minimis* thresholds, the practical implementation of such a threshold is not compatible with the completeness principle. In order to utilize a *de minimis* threshold, the emissions from a particular source or activity would have to be quantified to ensure they were under the threshold. But once emissions are quantified, most of the benefit of having a threshold is lost.

However, many GHG reporting programs such as The Climate Registry have modified the *de minimis* concept so that rather than omitting certain sources from an inventory that fall beneath a defined threshold, reporting organizations may apply a "simplified estimation methodology" or "alternate methodology" to calculate the emissions from these sources. This type of approach can reduce the reporting burden for sources for which data are difficult to locate or use, while still achieving the requirement of a complete inventory.

In the context of verification, a "materiality threshold" is often used to determine whether an error or omission is a material discrepancy or not—that is, whether it significantly impacts the final emissions reported in the inventory. This is not the same as a *de minimis* threshold for defining a complete inventory. For cases where certain emissions have been excluded, or estimated imprecisely (e.g., due to insufficient data), it is important that this is transparently documented and justified. Verifiers can determine the potential impact and relevance of the exclusion, or imprecision, on the overall inventory report.

More information on completeness is provided in Chapters 7 (Managing Inventory Quality) and 10 (Verification of GHG Emissions).

## Consistency

Users of GHG information will want to track and compare GHG emissions information over time in order to identify trends and to assess progress towards stated targets and objectives. The consistent application of accounting approaches, inventory boundary, and calculation methodologies is essential to producing GHG emissions data that can be compared internally over time as well as externally with inventories from other reporting organizations. If there are changes in the inventory boundary, methods, data, or any other factors affecting emission estimates, they need to be transparently justified, documented, and disclosed.

More information on consistency is provided in Chapters 5 (Tracking Emissions Over Time) and 8 (Reporting Emissions).

## Transparency

Transparency relates to the degree to which information on the processes, procedures, assumptions, and limitations of the GHG inventory are disclosed in a clear, factual, neutral, and understandable manner based on clear documentation and archived data (i.e., an audit trail). Information needs to be recorded, compiled, and analyzed in a way that enables internal reviewers and external verifiers to confirm its credibility. Specific exclusions or inclusions need to be clearly identified and justified, assumptions disclosed, and appropriate references provided for the methodologies applied and the data sources used. The information should be sufficient to enable a third party to derive the same results if provided with the same source data. A transparent report will provide a clear understanding of the issues in the context of the reporting organization and a meaningful assessment of performance. An independent external verification is a good way of ensuring transparency and determining that an appropriate audit trail has been established and documentation provided.

More information on transparency is provided in Chapters 8 (Reporting Emissions) and 9 (Verification of GHG Emissions).

## Accuracy

Data should be sufficiently accurate to enable intended users to make decisions with reasonable assurance that the reported information is credible. GHG measurements, estimates, or calculations should be systematically neither over nor under the actual emissions value, as far as can be judged, and uncertainties should be reduced as far as practicable. Reporting on measures taken to ensure accuracy in the accounting of emissions can help promote credibility while enhancing transparency.

More information on accuracy is provided in Chapter 7 (Managing Inventory Quality).

# Chapter 2
# Public Sector Goals and Inventory Design

### *WHAT GOALS SHOULD I CONSIDER WHEN SETTING OUT TO ACCOUNT FOR AND REPORT GHG EMISSIONS?*

## GUIDANCE

Public organizations at the local/city, state or federal level generally want their GHG inventory to be capable of serving multiple goals. Identifying the inventory goals from the outset will ensure that the inventory provides information for both current and future purposes. It will also assist in determining at what organizational level to conduct an inventory—i.e., at a division, bureau, agency or multi-agency level.

The *U.S. Public Sector Protocol* has been designed as a comprehensive GHG accounting and reporting framework to provide the information building blocks capable of serving most organizational goals (see Box 2). The inventory data collected according to the *U.S. Public Sector Protocol* can be aggregated and disaggregated for various organizational and operational boundaries and for different geographic scales (country, state, facility, bureau, field office, etc.).

Public sector managers should be aware that certain facilities and sub-units within their organizations may already be collecting, managing, and reporting energy data and other information that is essential for GHG accounting. For example, U.S. federal agencies track and report energy and fuel use through Environmental Management Systems (EMS), or comprehensive planning mechanisms that facilitate data gathering, quality checking and reporting. It is important that such existing efforts be leveraged to maximize efficient reporting and to avoid duplication of effort, overlaps, gaps, or conflicts in reporting requirements. The guidance sections of Chapters 3 and 4 provide additional information on how to design an inventory for different goals and uses.

| BOX 2. Organizational Goals Served by GHG Inventories |
| --- |
| Demonstrating leadership<br>• Voluntary public reporting of GHG emissions and setting GHG reduction targets<br>• Participation in voluntary GHG reporting programs (e.g., The Climate Registry)<br>• Green procurement policies (e.g., EPA's Environmentally Preferable Purchasing program)<br>Managing GHG risks and identifying reduction opportunities |

- Managing risks associated with GHG constraints in the future
- Identifying cost effective GHG and energy reduction opportunities
- Setting GHG targets, measuring and reporting progress

Complying with mandatory reporting requirements

- Meeting local, regional or national mandatory reporting requirements for facility or entity-wide reporting (e.g., Executive Orders)
- Preparing for upcoming regulation

Gaining relevant GHG inventory experience to inform public policy design

- Building experience that allows informed participation in policy-making and standards development
- Developing in-house technical expertise to assist other organizations
- Acting as a demonstration laboratory for citizens and other organizations

## Demonstrating Leadership

As concerns over climate change grow, stakeholders such as citizens and civic organizations are increasingly calling for greater disclosure of GHG information by both private companies and government operations. In response, a growing number of public sector organizations are demonstrating leadership and "walking the talk" by tracking and reporting their performance across a wide range of environmental issues, including GHG emissions (see Virginia Municipal League box).

Voluntary reporting programs are often the means by which government organizations commit to reporting and reducing their GHG emissions. Such programs can ensure accountability, provide a platform for public reporting, and usually offer technical assistance in developing the inventory and setting voluntary targets. Most voluntary programs require the reporting of direct emissions from operations (including all six Kyoto GHGs), as well as indirect emissions from purchased electricity. A GHG inventory prepared in accordance with the *U.S. Public Sector Protocol* will usually be compatible with most requirements, particularly for programs that are based upon the *GHG Protocol Corporate Standard*. However, since the accounting guidelines for many voluntary programs are periodically updated, organizations planning to participate are advised to contact the program administrator to check the current requirements. Appendix A provides an overview of GHG programs—many of which are based on the *GHG Protocol Corporate Standard* and therefore consistent with the *U.S. Public Sector Protocol*.

In addition, organizations may demonstrate leadership through committing to environmentally preferable procurement policies impacting GHG emissions along the supply chain. US programs such as the EPA Environmentally Preferable Purchasing program or ENERGY STAR can leverage the purchasing power of government organizations to drive GHG reductions in their supply chains and support the development of new markets for zero or low GHG-intensive goods and services.

**Virginia Municipal League: The Green Government Challenge**

The Virginia Municipal League (VML) is a statewide, nonprofit, nonpartisan association of city, town and county governments established in 1905 to improve and assist local governments through legislative advocacy, research, education and other services. The Green Government Challenge, the cornerstone of the VML's Go Green Initiative (www.gogreenva.org), inspired 41 local governments in 2008 to implement specific environmental policies and practical actions that reduce GHG emissions. Current registration for the 2009 program includes 65 local governments. One of the 30 action items city governments can take is to conduct a GHG inventory of government operations. For each action item points are awarded with a total possible score of 200. Members achieve *VML-Certified Green Government* status by accumulating a minimum of 100 points. Such regional initiatives can strengthen the impact of individual governments' demonstration of leadership.

## Managing GHG Risks and Identifying Reduction Opportunities

What gets measured gets managed. Compiling a GHG inventory improves a public sector organization's understanding of its emissions profile and the opportunities to reduce emissions and save money. It also provides an indication of potential liability or "exposure," An organization's GHG exposure is increasingly becoming a management issue in light of heightened scrutiny by the public, and the emergence of environmental regulations designed to reduce GHG emissions. Such policies may apply directly to an organization's operations, but can also have impacts throughout the organization's supply chain (i.e., its purchased goods and services). A limited focus on an organization's direct emissions may miss GHG risks and opportunities, while leading to a misinterpretation of the organization's actual GHG exposure. Indeed, an organization's indirect emissions can be numerically the most significant within their inventory (see Chapter 4 for an explanation of indirect emissions in scope 2 and scope 3).

Accounting for emissions can help identify the most effective reduction opportunities that drive increased materials and energy efficiency, as well as identify zero or low emission products and services. This in turn can reduce operating costs, enable more effective use of limited organizational budgets, and help distinguish the organization as a leader in an increasingly environmentally conscious society.

## Complying with Mandatory Reporting Requirements

Some government organizations have had experience with mandatory GHG emissions reporting for specific facilities (e.g., for energy generators above a certain threshold size). But increasingly, government authorities at various levels have set policies that require GHG reporting for government activities. These policies may take the form of Executive Orders (EOs), which are policy directives issued by executive bodies usually intended to manage operations within the government. For example, EO 13514 sets energy and water use reduction goals for federal operations (see Executive Order case study), EO S-20-04 sets energy efficiency goals for California state buildings and EO 07-126 obligates Florida's state government to reduce GHG emissions.[3]

As mandatory GHG programs continue to develop at regional, state and national levels, organizations may need to coordinate and leverage their reporting practices to achieve consistency. Preparing a credible and comprehensive inventory early on can initiate the data collection mechanisms and practices necessary for almost all reporting purposes. It can also serve to document an organization's early emission reductions, which some programs may take into consideration for the application of future reporting requirements. For instance, the state of California has stated that it will use its best efforts to ensure that organizations that registered certified emission reports with the California Climate Action Registry will receive appropriate consideration under any future California regulatory program relating to GHG emissions.

**Executive Order 13514: Federal Leadership in Environmental Performance**

On October 5, 2009, President Obama signed an executive order requiring federal agencies to conduct annual GHG inventories of their operations and set reduction goals, in addition to tracking and reducing water, energy and petroleum use. The GHG inventory reporting requirements were designed according to the framework in this *U.S. Public Sector Protocol.* According to the EO, each federal agency has to set their own reduction targets , expressed as a reduction in absolute emissions by 2020 compared to the agency's estimated emissions from 2008. The agencies have created separate targets for each scope. The aggregate of 35 agencies' goals for scope 1 and scope 2 collectively represent a 28% reduction, with scope 3 reduction targets to be announced at a later date.

See Executive Order No. 13514, 74 Fed. Reg. 52117 (Oct. 9, 2009), available at *http://www.whitehouse.gov/assets/documents/2009fedleader_eo_rel.pdf*

[3] See California Executive Order No. S-20-04 (July 27, 2004) and Florida Executive Order 07-126 (July 13, 2007)

## Gaining Relevant GHG Experience to Inform Public Policy Design

Organizations that have taken the initiative to develop a GHG inventory often have the opportunity to have a "seat at the table" during critical policy-making or standards development. Sharing GHG inventory experience with relevant policy makers can ensure that emerging GHG policies and regulations reflect practical insights and maximize synergies between multiple mandatory or voluntary reporting programs (see North Carolina example). Some government organizations with policy-making authority may find themselves in the position of actually crafting GHG policies and regulations; an in-house experience with GHG inventories may help in creating constructive and effective rules. Private firms as well as individual citizens may also find it unfair for a public organization to impose regulations for GHG reporting if the public sector is not participating.

Furthermore, by creating a GHG inventory or participating in a voluntary GHG reporting regime, the public sector can also act as a demonstration laboratory for developing new data collection methods and efficient reporting procedures that later may be adopted by other organizations. Public organizations often have the latitude to share their experiences and GHG inventory resources widely.

**North Carolina Department of Natural Resources: Building Support and Capacity**

With a mission to manage the state's natural resources and regulate its air/water quality, the North Carolina Department of Environment and Natural Resources (DENR) represents environmental leadership in the state. In 2006, the DENR participated in a state-wide climate action initiative to examine the state's GHG emissions and reduction options. This process brought together stakeholders from different sectors (called the Climate Action Plan Advisory Group) to assess the state's opportunities for reducing its GHG emissions. One-cross cutting measure the group identified was for the DENR to inventory its GHG emissions and report them as a member of The Climate Registry. With emissions occurring in multiple divisions across the state, the DENR needed to coordinate its data collection systems, and state-wide accounting with other agencies such as the Department of Administration and the Department of Transportation. Building this internal capacity was aided by the momentum of a large, internal stakeholder process, management support from the department's secretary and division directors, and streamlining the GHG inventory process with existing legislative mandates to reduce energy and petroleum consumption in state government buildings and fleets.

# Chapter 3
# Setting Organizational Boundaries

### *HOW DO I SET AN ORGANIZATIONAL BOUNDARY THAT DETERMINES WHICH OPERATIONS OR FACILITIES ARE INCLUDED IN THE INVENTORY?*

### *HOW DO I DEAL WITH COMPLEX ORGANIZATIONAL STRUCTURES AND SHARED GHG EMISSIONS OWNERSHIP?*

## STANDARD

Public sector operations vary in their legal and organizational structures; they include those fully owned and operated by the government, those owned by the government but operated by a contractor or private entity, and those owned and operated by multiple government organizations. Tables 3-1 and 3-2 detail several structures and relationships common to government organizations, though some government operations may be permutations of one of the categories. The complexity of these arrangements means that particular care must be taken when setting organizational boundaries, and thorough documentation is required to ensure transparency.

## Defining the Organization

Government operations are often structured in hierarchies with individual organizations exercising different levels of autonomy. The appropriate organizational level for the conducting a GHG inventory—i.e., a division, agency, or multiple agencies—must first be defined. Some factors to consider in making this designation might include the levels specified by previous reporting requirements; the levels or units where meaningful operational policy decisions can be implemented; and at what level the data can be most conveniently collected. Once determined, the management of the headquarters organization or overarching governing body has to decide on a consolidation approach (i.e., the financial or operational control, or the equity share approach). Once an organization-wide consolidation policy has been selected, it shall be applied consistently to all levels of the organization to avoid double counting or omitting emissions.

## Selecting a consolidation approach

For the purpose of accounting and reporting GHG emissions, organizations must select an approach for consolidating or "grouping" together the activities or GHG-emitting sources that fall under the organization's responsibility. This grouping is known as the organizational boundary.

The *GHG Protocol Corporate Standard* describes two distinct approaches that can be used to consolidate GHG emissions for organizational reporting: control and equity share. The control approach can be further subdivided into financial control and operational control. Public sector activities usually do not involve buying or trading of equity, and individual organizations do not usually directly own or generate value from assets such as real estate. Therefore, the equity share approach is less applicable, and is discussed separately in Appendix B for those organizations for which an equity share inventory may produce a more meaningful reflection of their GHG emissions than the control approach. This *U.S. Public Sector Protocol* recommends the operational control approach as the most appropriate boundary for government organizations, as their primary activities most often consist of providing public services through specific operations. Most government organizations' operations are not structured to gain economic benefit from managing financial assets. However, there may be organizations whose core activities include financially controlling and managing assets like real estate, vehicle fleets and land, and for whom the financial control approach may be relevant..

Organizations shall account for and report their consolidated GHG data according to either one of the control approaches as presented below, or if appropriate, the equity share approach. Only one approach can be used to prepare a given inventory, and that approach must be applied consistently across all of an organization's operations. To reflect the range of these activities, organizations may choose to develop multiple separate inventories using different consolidation approaches. If the reporting organization wholly owns and operates all of its activities, its organizational boundary will be the same no matter which approach is used.[4] For organizations with joint or shared operations, or who manage leased assets as a lessee or lessor, the resulting emissions profile will differ depending on which approach is used. The choice of approach will also affect whether emissions from these operations or assets are categorized as direct or indirect (see Chapter 4).

## Control Approach

Control can be defined in either financial or operational terms. Under the control approach, an organization accounts for 100 percent of the GHG emissions from operations over which it exercises control. It does not account for GHG emissions from operations in which it owns an interest but has no control. When using the control approach to consolidate GHG emissions, organizations shall choose between either operational control or financial control criteria (see Box 3 for the definitions of operational and financial control).

In many cases, organizations exercise both forms of control in a given operation or activity. In making the choice between the two control approaches, organizations should select the criterion that best reflects the

[4] The term "operations" is used here as a generic term to denote any kind of organizational activity, irrespective of its organizational, governance, or legal structures.

organization's actual ability to control emissions, as well as how GHG reporting can be aligned with financial and environmental reporting and any other emissions reporting requirements.

### OPERATIONAL CONTROL

An organization has operational control over an operation if it or one of its sub-organizations (see Table 3-1 for organizational types and relationships) has the authority to introduce and implement operating policies. This criterion is consistent with the current practice of many organizations who report on emissions from facilities they operate (i.e., for which they hold the operating license), and is also the approach recommended by the LGO Protocol. In most cases, the operational control approach will most accurately represent the emissions associated with the activities of public sector organizations, as:

- These activities are usually centered on an operational mandate to provide a public service
- Many individual US government organizations do not own GHG-emitting sources such as vehicle fleets and buildings, but would instead lease, operate and exercise control over these sources. These sources are often a necessary part of how an organization fulfils its mission or provides a public service.

It is expected that except in very rare circumstances, if the organization or one of its sub-organizations is the operator of a facility, it will have the full authority to introduce and implement operating policies and thus will have operational control.

Under the operational control approach, an organization shall account for 100 percent of emissions from operations over which it or one of its sub-organizations has operational control. It should be emphasized that having operational control does not mean that an organization necessarily has authority to make all decisions concerning an operation. For example, substantial capital investments will likely require the approval of organizations within the hierarchical structure who have joint financial or budgetary control.

| BOX 3. Defining operational and financial control. |
|---|
| ***Operational Control**: the authority to introduce and implement operating policies. Operational control generally demonstrated if organization holds an operating license for the facility.*<br><br>***Financial Control:** the authority to direct the financial and operating policies of the operation with a view to gaining economic or other benefits from its activities. This includes a right to the majority of risks and rewards of ownership of the operation's assets. Financial control demonstrated if the operation is fully consolidated in the organization's financial accounts.* |

### FINANCIAL CONTROL

The organization has financial control over an operation if it has the authority to direct the financial and operating policies of the latter with a view to gaining economic or other benefits from its activities.[5] For example, financial control usually exists if the organization has the right to the majority of benefits of the operation, however these rights are conveyed. Similarly, an organization is considered to financially control an operation if it retains the majority risks and rewards of ownership of the operation's assets.

Under this criterion, the economic substance of the relationship between the organization and the operation takes precedence over the legal ownership status, so that the organization may have financial control over an operation even if it has less than a 50 percent interest in that operation. In assessing the economic substance of the relationship, the impact of potential voting rights, including both those held by the organization and those held by other parties, is also taken into account. This criterion is consistent with international financial accounting standards; therefore, an organization has financial control over an operation for GHG accounting purposes if the operation is fully consolidated in the organization's financial accounts. If this criterion is chosen to determine control, emissions from partnerships where partners have joint financial control and joint reporting requirements are accounted for based on percentage of financial ownership (see Table 3-1).

Importantly, having financial control does not necessarily mean that a public sector organization also exerts operational control. There may be situations where an organization has financial control of an asset (e.g. a public transit fleet), but does not maintain operational control of that asset (i.e., its operation has been contracted out).

### Joint Control

Multiple organizations can have joint financial control over an operation, but joint operational control for the purposes of GHG accounting is more difficult to delineate. Many criteria can be used to define operational control over an operation, facility, building, vehicle fleet, or source. Multiple organizations may each have control over certain aspects of an operation, such as in leased spaces. For instance, a tenant organization may have the ability to implement policies that influence the use of heating and cooling equipment, while the owner of the building may be responsible for purchasing and maintaining such equipment. When applying the operational control approach, organizations shall clearly define how control is determined so that overall program goals are met, and the GHG accounting and reporting principles of consistency and transparency are followed. See the section below and Chapter 4 for more information on leases.

[5] Financial accounting standards use the generic term "control" for what is denoted as "financial control" in this chapter.

## Applications of the Control Approaches

Government activities span a substantial range of structures and control arrangements, and Table 3-1 shows how several common types of public sector organizations should account for GHG emissions depending on which control approach is chosen. In addition, Table 3-2 details how to account for emissions related to leased or permitted land. The percentages reflected here indicate whether the emissions from those activities must be included in the inventory. However, even if an activity's emissions do not fall under an organization's control according to the selected boundary approach, they may still be reported optionally in scope 3. See Chapter 4 for how to categorize direct and indirect sources into scopes.

Public sector organizations frequently operate their own equipment, such as remedial systems or emergency equipment, on or in privately-owned facilities. In these cases, the associated GHG emissions would be considered direct emissions regardless of the consolidation approach adopted, since the organization has both financial and operational control of the equipment .

Table 3-1. Organization Types and Consolidation Approaches from the Government Organization's Perspective[a]

| Type of organization | Definition | Accounting for GHG emissions[b] | |
|---|---|---|---|
| | | Based on operational control (percent) | Based on financial control (percent) |
| GOGO | Government-owned/government operated facility | 100 | 100 |
| GOCO | Government-owned/contractor-operated facility (in whole or part) | 0 | 100 |
| GOPO | Government-owned/privately-operated facility where the government has leased all or part of its facility to a private operator for its operation and profit | 0 | 100 |
| POGO | Privately-owned/government-operated facility where the government uses leased buildings or space for its operations | 100 | 0 |
| COCO | Contractor owned/contractor operated facility that provides goods and/or services to a government organization under contract | 0 | 0 |
| COCO(E) | Same as COCO. However, the contractor may be furnished government equipment to manufacture a product or provide a service | 0 | 100 percent of emissions from owned equipment |

| Type of organization | Definition | Accounting for GHG emissions[b] | |
|---|---|---|---|
| | | Based on operational control (percent) | Based on financial control (percent) |
| Jointly operated government operations | Government facilities owned and operated by multiple government organizations | Track the activities the organization operates [c] | Track the activities the organization financially controls |
| Public-Private Partnership | Partnerships in which a government organization and private entity contribute various amounts of real property, financial capital, and borrowing ability for the purpose of establishing operating capacity | Varies depending on which activities the organization operates [c] | Track the activities the organization financially controls |
| Public sector organizations may be responsible for the environmental remediation of private sites, particularly if the site owner cannot be identified or compelled to undertake the remediation. GHG emissions from fuel, electricity and biogenic fugitive emissions at these sites may be substantial. | | 100 percent of emissions from operated equipment | 100 percent of emissions from financially-controlled equipment |

Source: Adapted from "The Yellow Book: Guide to Environmental Enforcement and Compliance at Federal Facilities," EPA 315-B-98-001, February 1999.

[a] Here, "government" means the distinct organization within a governmental structure conducting a GHG inventory.

[b] "Emissions reported" means those required under scopes 1 and 2 as opposed to optional scope 3 emissions. Further detail on scopes is provided in Chapter 4.

[c] The percentage would depend on contractual or operational arrangements between the partners, or on legislative directives.

[d] In the quasi-governmental designation, the Congressional Research Service (CRS) includes: Quasi Official Agencies, Government Sponsored Entities, Federally Funded Research and Development Centers, Agency-Related Nonprofit Organizations, Venture Capital Funds, and Congressionally Chartered Nonprofit Organizations among others. See "The Quasi Government: Hybrid Organizations with Both Government and Private Sector Legal Characteristics," CRS, February 2007.

Table 3-2. Accounting for the Transfer of Land Use Rights.

| Type of arrangement | Definition | How the GHG emissions from the land concerned are accounted for by the reporting organization | |
|---|---|---|---|
| | | Based on operational control (percent) | Based on financial control (percent) |
| Permit | The reporting organization awards a permit to a private party for the use of government owned land | 0 | 100 |
| Withdrawal from Public Use | The reporting organization receives a permit to use land owned by another government organization for up to 20 years administratively, as long as the intended use does not involve destruction of the land (e.g., military uses, dams) | 100 | 0 |

| Type of arrangement | Definition | How the GHG emissions from the land concerned are accounted for by the reporting organization | |
|---|---|---|---|
| | | Based on operational control (percent) | Based on financial control (percent) |
| Grant | The reporting organization bestows a grant permanently authorizing the use of a given right-of-way. Grants usually involve a single payment for the land or transfer of land use rights. | 0 | 0 |
| Easement | The reporting organization has rights to use the real property of another entity for a specified purpose. | 100 | 0 |

# GUIDANCE

When planning the consolidation of GHG data, it is important to distinguish between GHG accounting and GHG reporting. GHG accounting concerns the development of GHG inventories – that is, the consolidation of GHG emissions from operations for which an organization has control, and attributing these to specific operations, sites, geographic locations, processes, and owners. GHG reporting, on the other hand, concerns the presentation of GHG data in formats tailored to the needs of various reporting uses and users.

An organization must consider its reporting objectives carefully before designing its GHG accounting and reporting systems. For instance, achieving emissions reductions frequently depends on an understanding of GHG emissions at a finely disaggregated level, so GHG reports would need to be sufficiently detailed to allow the identification of emission reduction opportunities. In addition, public organizations may have several goals for GHG reporting, e.g., regulation-based reporting requirements, demonstrating leadership, or responsibility for the public interest (see Chapter 2). Therefore, it is important to ensure that GHG accounting systems are capable of meeting a range of reporting requirements. Ensuring that data are collected and recorded at a sufficiently disaggregated level will provide organizations with flexibility to meet a range of reporting requirements.

## Reporting Goals and Level of Consolidation

Reporting requirements for GHG data may exist at various levels, from a specific local facility level to an aggregated organization-wide level. Examples of drivers for various levels of reporting include:

*Mandatory reporting*: Official government reporting programs or regulations may require GHG data to be reported at a facility level, particularly for power plants or industrial processes. In these cases, consolidation of organizational GHG data is not relevant. However, organizations may also be required to conduct a more comprehensive

GHG inventory that goes beyond facility-level reporting, in which case an appropriate consolidation method must be determined.

*Geographic reporting:* Government reporting which require that data be consolidated within certain geographic and operational boundaries (e.g., the National Parks Service conducts inventories for all activities within park boundaries). This can become tedious when organizations are required to report to multiple entities (e.g., emissions data from one site may need to feed into accounts for state, national, or organization-level reports).

*Voluntary initiatives:* The organization's willingness to publicly account for its emissions to a wide array of stakeholders through voluntary public reporting. This may involve consolidating organization-wide GHG data to show the emissions of its entire scope of activities, or consolidating function-specific emissions such as those related to transportation. It may also involve consolidating emissions from facilities falling within a site specific boundary or "fence line".

Developing inventories and managing data to facilitate consolidation at these various levels may be particularly important for entities from different parent organizations that share facilities and for organizations that are geographically dispersed. For example, military installations such as an Air Force base may host activities from multiple departments or services, such as the Army. Under operational control in such situations, the Army and Air Force would need to agree on which organization controlled which emissions sources and electricity uses on the base, and they would then need to roll up emissions to their respective headquarters so as to avoid double counting and/or gaps.

## Leasing Arrangements

Leased assets introduce complexities when determining organizational boundaries. How GHG emissions associated with leased assets are accounted for depends on which consolidation approach is utilized and the lease type. Chapter 4 discusses how the particular combination of consolidation approach and lease type determines whether the lessor or lessee has financial or operational control. This in turn impacts whether emissions are considered to be direct or indirect, and therefore either required or optional for reporting purposes.

## Contracts That Cover GHG Emissions

To clarify ownership (rights) and responsibility (obligations) issues, organizations involved in joint operations may draw up contracts that specify how the ownership of emissions or the responsibility for managing emissions and associated risk is distributed between the parties. Where such arrangements exist, organizations may opt to describe the contractual arrangement and include information on allocation of related risks and obligations in their GHG reports (see Chapter 8). In some situations, public sector organizations may choose to include language that clarifies ownership and responsibilities regarding GHG emissions and accounting in the contracts they develop with private businesses.

## Double Counting

When two or more organizations hold interests in the same operation and use different consolidation approaches (e.g., in a public-private partnership where Government Agency A follows the operational control approach while Company B uses the equity approach), emissions from that joint operation could be double counted or not counted at all. This may not matter for voluntary reporting as long as there is adequate disclosure from the company on its consolidation approach. However, double counting or omitting emissions needs to be avoided in mandatory government reporting programs, or programs across a single government level (i.e., all state or federal government organizations). Such policies and programs should ensure that the organizational boundaries of the reporting entities are transparently and consistently established

## Treatment of Exceptional, Multi-Organization Activities

Multi-organization responses to emergencies (e.g., fires and other natural disasters) may pose complications for drawing organizational boundaries and responsibility. Organizations may maintain informal cost-sharing arrangements for fuel/vehicle use, with the understanding that the responsibility for emissions reporting will be evenly shared or distributed through time. In other situations, financial responsibility for these resources may be articulated in legal agreements which can be modified to also include responsibility for the associated GHG emissions. In all cases, parties should strive to avoid double counting or omitting any emissions.

# Chapter 4
# Setting Operational Boundaries

### *WHAT IS THE DIFFERENCE BETWEEN DIRECT AND INDIRECT EMISSIONS, AND WHY DOES IT MATTER?*

### *WHICH INDIRECT EMISSIONS SHOULD I REPORT?*

### *HOW DO I ACCOUNT FOR LEASED BUILDINGS AND VEHICLES?*

### *HOW DO I ACCOUNT FOR CONTRACTED OR OUTSOURCED OPERATIONS?*

## STANDARD

Once an organization has established its organizational boundaries through applying a consolidation approach (see Chapter 3), it then sets its operational boundaries. The established organizational and operational boundaries together constitute an organization's inventory boundary.

Setting operational boundaries involves identifying emission sources and then categorizing these sources in two steps:

1. Categorization as either direct or indirect. Direct GHG emissions come from sources that are controlled by the reporting organization. Indirect GHG emissions are those that are a consequence of the activities of the organization, but that occur at sources owned or controlled by another organization or company.[6] What is classified as direct or indirect depends on the consolidation approach selected for setting the organizational boundary (see Chapter 3). Figure 4-1 shows the relationship between the organizational and operational boundaries of an organization.

2. Categorization by scope. All direct emission sources are classified as scope 1, but indirect emission sources are classified as either scope 2 or scope 3.

   Public sector organizations shall separately account for and report on all scope 1 and 2 emissions at a minimum.

[6] The terms "direct" and "indirect" as used in this document should not be confused with their use in national GHG inventories where "direct" refers to the six Kyoto gases and "indirect" refers to the precursors nitrogen oxide ($NO_x$), non-methane volatile organic compounds, and carbon monoxide.

Such categorization improves transparency, eliminates the risk of double counting and facilitates more effective management of GHG risks and opportunities along an organization's "value chain," encompassing all of its upstream and downstream activities. Even without any policy drivers, accounting for GHG emissions along the value chain may reveal potential for greater efficiency and lower costs. Making indirect emissions reductions, such as electricity efficiency improvements, may be a more cost-effective measure than reducing scope 1 emissions, so accounting for indirect emissions can help identify where to allocate limited resources in a way that maximizes GHG reductions and reduces operational costs. Finally, emission reductions along the value chain support public sector organizations' efforts to further the public good by reducing overall GHG emissions.

Figure 4-2 provides an overview of the relationship between the scopes and activities that generate direct and indirect emissions.

*Figure 4-1. Organizational and Operational Boundaries of an Organization*

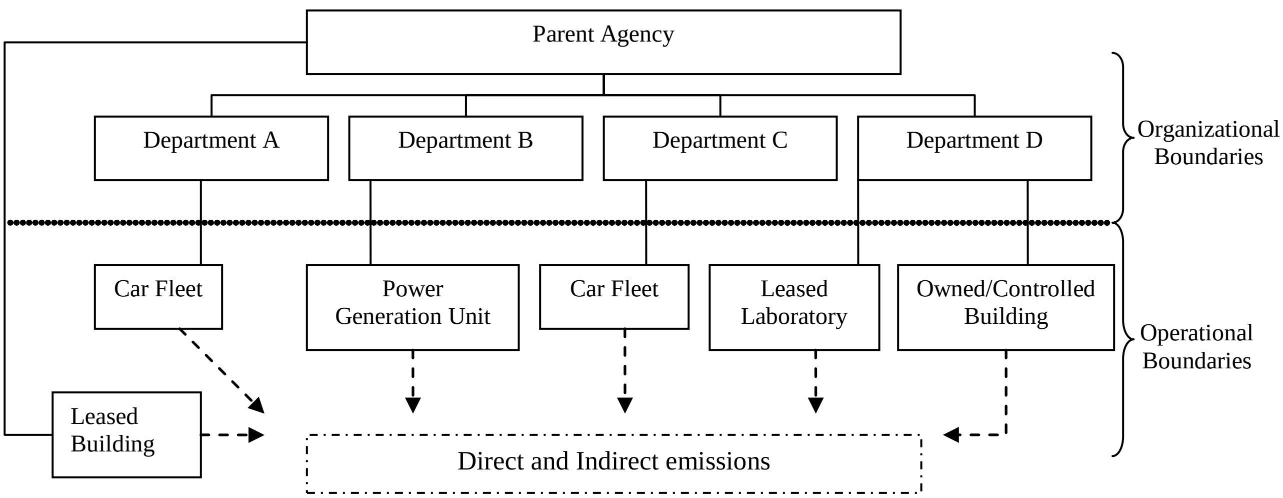
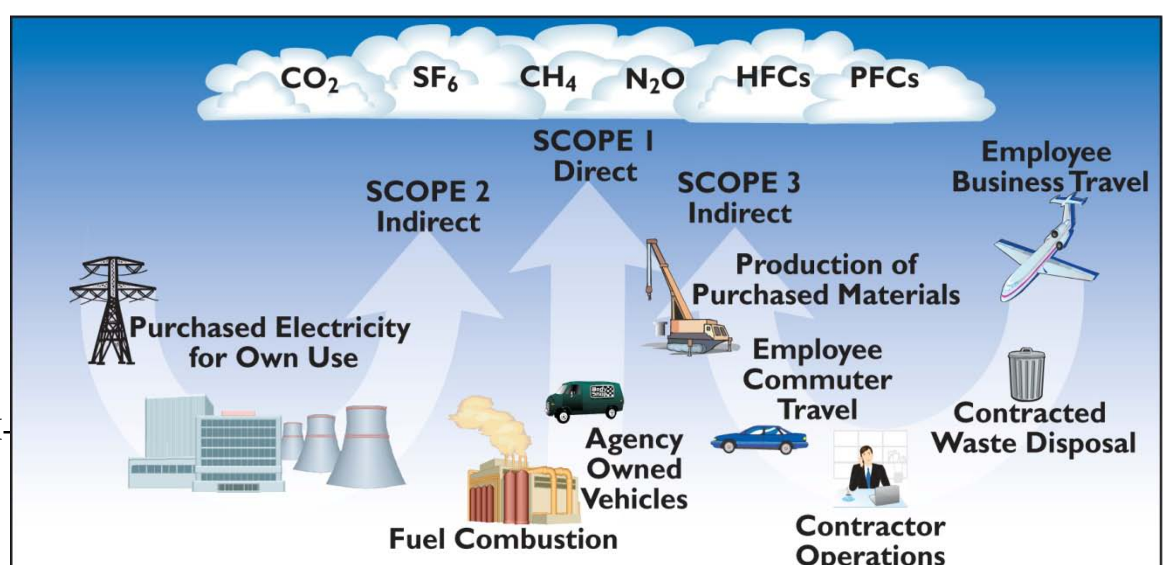



*Figure 4-2. Overview of Scopes and Emissions across Activities*



Adopted from NZBCSD, 2002.

## Scope 1: Direct GHG Emissions

Direct GHG emissions come from sources owned or controlled by the organization. These scope 1 emissions come from:

- Stationary combustion, including boilers, furnaces, emergency generators, etc.
- Mobile combustion from transportation vehicles
- Chemical production from owned or controlled process equipment
- Fugitive emissions, including leaks or unintended releases.

Direct $CO_2$ emissions from the combustion of biomass or biofuels shall not be included in scope 1 but shall be reported separately (see Box 4). However, the $CH_4$ and $N_2O$ emitted from combustion of these materials will be reported as scope 1. For fuels which contain a blend of biofuel and fossil fuel (for example, ethanol products like E85), all GHG emissions from the fossil fuel portion must be calculated and reported as scope 1 direct emissions. The emissions from the biofuel portion must be calculated separately, with $CH_4$ and $N_2O$ emissions reported as scope 1, and $CO_2$ emissions reported separately from the scopes (see Chapter 6 for a table explaining these calculations).

| BOX 4. Why Biogenic $CO_2$ emissions are reported separately from the scopes |
|---|
| Biogenic emissions are those that result from the combustion of materials that naturally sequester $CO_2$ - biomass - including those materials used to make biofuels (e.g., crops, vegetable oils or animal fats). For the purposes of national-level GHG inventories such as those outlined by IPCC, land-use activities (e.g., forest felling) are recorded as sources of $CO_2$ emissions. Reporting the emissions from combusting these fuels would result in double counting on a national level. This double counting issue does not typically affect the GHG inventories of government organizations or private corporations, as the biofuels would not likely arise from land-use changes falling within the organization's boundaries. However, to maintain consistency with this national-level accounting convention, biogenic $CO_2$ emissions are reported separately from the scopes.<br><br>A life cycle analysis of a given biofuel would include an assessment of the GHG impact of the land-use changes associated with the generation of the biofuel. But calculating the indirect GHG emissions from these land-use changes and attributing them to specific fuels still presents significant methodological challenges. See Appendix C for more information on calculating sequestered atmospheric carbon. |

GHG emissions not covered by the Kyoto Protocol, e.g., chlorofluorocarbons (CFCs) and $NO_x$, shall not be included in scope 1 but may be reported separately (see Chapter 8).

## Scope 2: Electricity Indirect GHG Emissions

Scope 2 accounts for GHG emissions from the generation of purchased electricity, steam and district heating/cooling consumed by the organization. [7] Purchased electricity is electricity purchased or otherwise brought into the organizational boundary of the organization. Scope 2 emissions physically occur at the facility where electricity is generated, and would be considered a direct scope 1 emission by that facility. (Note: this is not considered "double counting" within an organizations inventory, as scopes 2 and 3 are by definition indirect emissions, constituting another organization's direct scope 1).

## Scope 3: Other Indirect GHG Emissions

Scope 3 is an optional reporting category for this *U.S. Public Sector Protocol* that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the organization, but come from sources not owned or controlled by the organization. Some examples of scope 3 activities prominent in government activities include emissions from employee commuting, business travel, and outsourced contractor activities. The forthcoming *GHG Protocol Scope 3 Standard* specifies procedures for comprehensively accounting and reporting scope 3 emissions, and organizations who wish to conduct an inventory in conformance with this standard can do so separately.

# GUIDANCE

After applying a consolidation approach, emissions from within the organizational boundary are then categorized as direct or indirect. Organizations may further subdivide emissions data within scopes where this aids transparency or facilitates comparability over time. For example, they may subdivide data by facility, region, routine versus non-routine operations, source type (stationary combustion, process, fugitive, etc.), and activity type (production of electricity, consumption of electricity, generated or purchased electricity that is sold to end users, etc.).

In addition to the six Kyoto gases, organizations may also provide emissions data for other GHGs (e.g., Montreal Protocol gases) to give context to changes in emission levels of Kyoto Protocol gases. Switching from a CFC to HFC, for example, will increase emissions of Kyoto Protocol gases. Information on emissions of GHGs other than the six Kyoto gases may be reported separately from the three scopes in a GHG public report.

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[7] The term "electricity" is used in this chapter as shorthand for electricity, steam, and district heating/cooling.

## Scope 1: Direct GHG Emissions

Organizations report GHG emissions from sources they control as scope 1. Direct GHG emissions are principally the result of the following types of activities undertaken by the organization:

Generation of electricity, heat, or steam. These emissions result from combustion of fuels in stationary sources, e.g., boilers, furnaces, turbines, and emergency generators.

Physical or chemical processing.[8] Most of these emissions result from the manufacture or processing of chemicals and materials, e.g., cement, aluminum, adipic acid, ammonia manufacture, and waste processing, and are not typical of most public sector organizations.

Transportation of materials, products, waste, and employees. These emissions result from the combustion of fuels in organization-owned/controlled mobile combustion sources (e.g., trucks, trains, ships, airplanes, buses, and cars). The $CO_2$ from biofuel combustion is tracked separately from the scopes; see Chapter 8.

Fugitive emissions. These emissions result from intentional or unintentional releases, e.g., equipment leaks from joints, seals, packing, and gaskets; methane emissions from coal mines and venting[9]; HFC emissions from the use of refrigeration and air conditioning equipment; methane from solid waste and wastewater treatment facilities; methane leakages from gas transport; and $SF_6$ emissions from owned electricity transformers and from leaking electrical equipment.

Less common but still significant, direct emissions may include those from on-site landfills, composting, wastewater treatment plants and incinerators, laboratory activities, munitions firing, and organization-specific activities (such as space shuttle launches).

### Sale of Own-Generated Electricity

Emissions associated with the sale of generated electricity to another organization are not deducted or “netted” from scope 1. This treatment of sold electricity is consistent with how other sold GHG intensive products are accounted for, e.g., emissions from the production of sold clinker by a cement company or the production of sold scrap steel by an iron and steel company are not subtracted from their scope 1 emissions. Emissions associated with the sale or transfer of generated electricity may additionally be reported in optional information (see Chapter 8).

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[8] For some integrated manufacturing processes, such as ammonia manufacture, it may not be possible to distinguish between GHG emissions from the process and those from the production of electricity, heat, or steam.

[9] The categorization of venting as a fugitive emission is consistent with IPCC 2006 Guidelines for National Greenhouse Gas Inventories.

## Scope 2: Electricity Indirect GHG Emissions

Organizations report the emissions from the generation of purchased electricity, steam, or district heating/ cooling that is consumed in their owned or controlled equipment or operations as scope 2. For many organizations, purchased electricity represents one of the largest sources of GHG emissions and the most significant opportunity to reduce these emissions. Accounting for scope 2 emissions allows organizations to assess the risks and opportunities associated with changing electricity and GHG emissions costs, in addition to providing information necessary for some GHG reporting programs.

Organizations can reduce their use of electricity by investing in energy efficient technologies and energy conservation. Additionally, emerging green power markets provide opportunities for some organizations to switch to less GHG-intensive sources of electricity.[10,11] Organizations can also install an efficient on-site co-generation plant, particularly if it replaces the purchase of more GHG-intensive electricity from the grid or electricity supplier. Reporting of scope 2 emissions allows transparent accounting of GHG emissions and assists in identifying reduction opportunities associated with such emissions.

### Indirect Emissions Associated with Transmission and Distribution

Electric utility companies often purchase electricity from independent power generators or the grid and resell it to end-consumers through a transmission and distribution (T&D) system.[12] A portion of the electricity purchased by a utility company is lost or "consumed" during its transmission and distribution to end-consumers (see Table 4-1); this is usually referred to as T&D loss.

| BOX 5. Electricity Balance | | |
|---|---|---|
| GENERATED ELECTRICITY | = | Purchased electricity consumed by the utility company during T&D<br>+<br>Purchased electricity consumed by end-consumers |

Adopted from the *GHG Protocol Corporate Standard, 2004*

Consistent with the scope 2 definition, emissions from the generation of purchased electricity consumed during T&D are reported in scope 2 by the organization that owns or controls the T&D operation. End consumers of the purchased electricity do not report indirect emissions associated with T&D

[10] Green power includes renewable energy sources and specific clean energy technologies that reduce GHG emissions relative to other sources of energy that supply the electric grid, e.g., solar photovoltaic panels, geothermal energy, landfill gas, hydropower and wind turbines.

[11] This Public Sector Standard recognizes the potential role green power markets can play in GHG reduction programs, but does not provide guidance on how such considerations should be incorporated at this time.

[12] A T&D system includes T&D lines and other T&D equipment (e.g., transformers).

losses in scope 2 because they do not own or control the T&D operation where the electricity is consumed.

This approach ensures that there is no double counting within scope 2 since only the T&D utility company accounts for indirect emissions associated with T&D losses in scope 2. Another advantage is that it adds simplicity to the reporting of scope 2 emissions by allowing the use of commonly available emission factors that in most cases do not include T&D losses. End consumers may, however, report their indirect emissions associated with T&D losses in scope 3 under the category "generation of electricity consumed in a T&D system." Appendix D provides more guidance on accounting for emissions associated with T&D losses.

### Other Electricity-Related Indirect Emissions

Indirect emissions from activities upstream of an organization's electricity provider (e.g., exploration, drilling, flaring, and transportation) are reported under scope 3. Emissions from the generation of electricity that has been purchased for resale to end-users are reported in scope 3. Emissions from the generation of purchased electricity for resale to non-end users (e.g., electricity traders) may be reported separately in "optional information."

The following two examples illustrate how GHG emissions from the generation, sale, and purchase of electricity are accounted for.

Example one (Figure 4-3): Company A is an independent power generator that owns a power generation plant. The power plant produces 100 megawatt hours (MWh) of electricity and releases 20 tonnes of emissions per year. Company B is an electricity trader and has a supply contract with company A to purchase all its electricity. Company B resells the purchased electricity (100 MWh) to organization C, a public utility that owns or controls the T&D system. Organization C consumes 5 MWh of electricity in its T&D system and sells the remaining 95 MWh to organization D. Public sector organization D is an end user who consumes the purchased electricity (95 MWh) in its own operations.

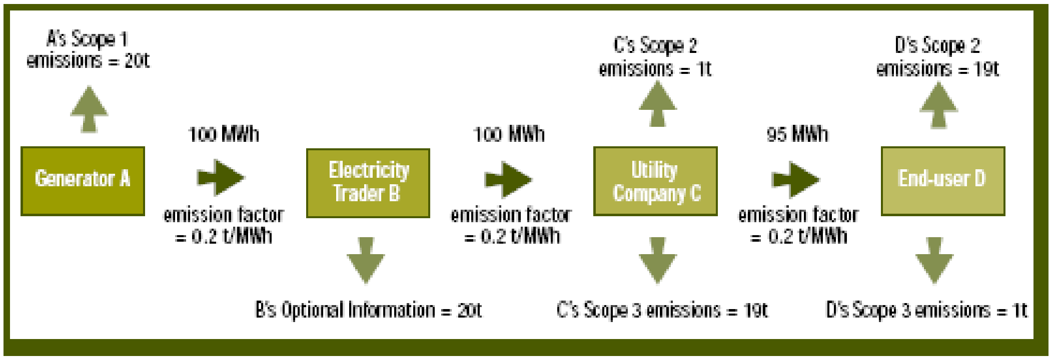
- Company A reports its direct emissions from power generation under scope 1.

- Company B reports emissions from the purchased electricity sold to a non-end user as optional information separately from the scopes.

- Organization C reports the indirect emissions from the generation of the part of the purchased electricity that is sold to the end user under scope 3 and the part of the purchased electricity that it consumes in its T&D system under scope 2.

- End user D reports the indirect emissions associated with its own consumption of purchased electricity under scope 2 and can optionally report emissions associated with upstream T&D losses in scope 3. Figure 4-3 shows the accounting of emissions associated with these transactions.

*Figure 4-2. GHG Accounting from the Sale and Purchase of Electricity*




Adopted from the *GHG Protocol Corporate Standard, 2004*

Example two: Public sector organization D installs a co-generation unit and sells surplus electricity to a neighboring Organization E for its consumption. Organization D reports all direct emissions from the co-generation unit under scope 1. Under optional information, Organization D may also identify and report the amount of emissions from the co-generation unit that were associated with the electricity sold to Organization E. In turn, Organization E reports the emissions from the electricity it purchased from Organization D as under scope 2. For more guidance, see Appendix D on accounting for indirect emissions from purchased electricity.

## Scope 3: Other Indirect GHG Emissions

Scope 3 is considered optional for reporting in conformance with this *U.S. Public Sector Protocol*, but certain voluntary or regulatory programs may require the reporting of specific scope 3 categories. Scope 3 provides an opportunity to be innovative in GHG management. Organizations may want to initially focus on accounting for and reporting activities that are relevant to their organizational mission and goals, and for which they have reliable information. Further, organizations should consider their ability to influence scope 3 reductions and the costs associated with such efforts. Given the substantial impact public sector organizations can have on indirect GHG emissions through the use of contractors, scope 3 emissions for the public sector may be quite significant. Accounting for scope 3 emissions highlights opportunities to reduce overall GHG emissions through procurement and leasing contracts, policies and practices.

The forthcoming GHG Protocol *Scope 3 Standard* will offer detailed guidance on comprehensively identifying scope 3 sources, determining which sources are relevant, and specify accounting, calculation and reporting requirements. However, the *GHG Protocol Corporate Standard* and this *U.S. Public Sector Protocol* state that scope 3 emissions may be reported optionally, and suggest that it is usually valuable to focus on major scope 3 GHG-generating activities. In addition, the forthcoming *GHG Protocol Product Standard* will provide guidelines for conducting comprehensive life-cycle assessments of specific products.

Since organizations have discretion over which categories they choose to report, scope 3 may not be comparable across organizations. This section provides a list of scope 3 categories common to government activities and includes case studies on some of the categories. However, this does not constitute a complete list of potential scope 3 sources. Some of these activities are included under scope 1 if the pertinent emission sources are owned or controlled by the organization (e.g., if employee transportation is done in vehicles owned or controlled by the organization). To determine whether an activity falls within scope 1 or scope 3, the organization should refer to the selected control approach used in setting its organizational boundaries.

Transport-related activities (in vehicles not owned or controlled by the reporting organization)

- Employee business travel
- Employee commuting to and from work
- Transportation of purchased materials or goods
- Upstream transportation of purchased fuels
- Transportation of waste (by a contracted service).

Leased assets and outsourced activities. (Note: emissions from such contractual arrangements are only classified as scope 3 if the selected consolidation approach (operational or financial control) does not require their reporting. See the subsection on leases below).

Waste treatment and disposal at sites owned or controlled by third parties

- Wastewater treatment
- Disposal of waste generated in operations
- Disposal of waste generated in the production of purchased materials and fuels
- Disposal of purchased or sold products at the end of their life.

Electricity-related activities not included in scope 2 (see Appendix D)

- Extraction, production, and transportation of fuels consumed in the generation of electricity (either purchased or own-generated by the reporting company)

- Purchase of electricity that is sold to an end user (reported by a utility)

- Generation of electricity that is consumed in a T&D system (reported by end user).

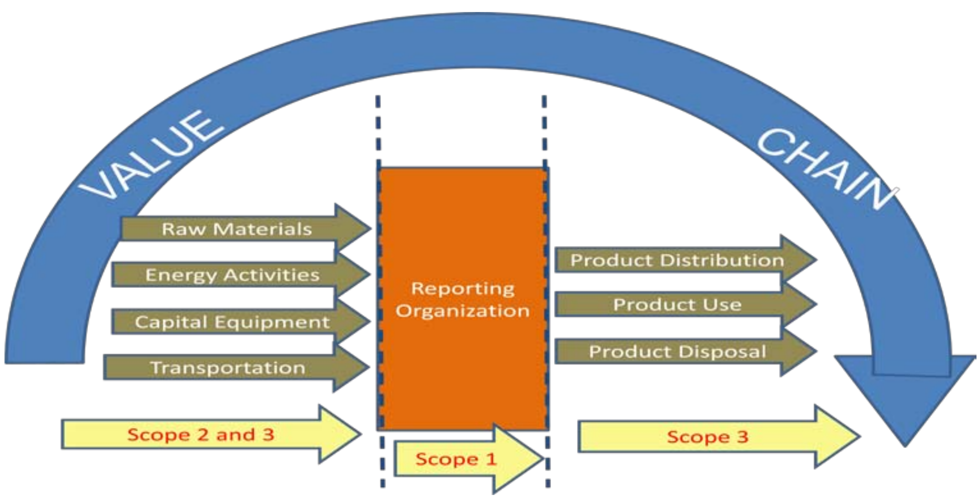
Extraction and production associated with purchased materials and fuels.[13]

## ACCOUNTING FOR SCOPE 3 EMISSIONS

Five general steps can be articulated in accounting for scope 3 emissions:

1. *Describe/Map the value chain.* The purpose of mapping the value chain is to identify the full range of possible scope 3 categories before an organization determines which are most relevant and should be included in the scope 3 inventory. This value chain represents all the activities upstream and downstream of the organization that contribute to, or are a consequence of, its operations (see Figure 4-4 below). Describing the value chain might include listing all the suppliers, inputs and outputs related to the organization, also encompassing the activities already tracked in scope 1 and scope 2. For this step, the list of scope 3 categories given earlier can be used as a checklist.

*Figure 4-4. Illustration of value chain mapping.*




Adapted from *Scope 3 Accounting and Reporting Standard* – Draft for Road Testing, January 2010

2. *Determine which scope 3 categories are relevant*. Only some types of upstream or downstream emissions categories might be relevant to the organization. They may be relevant for several reasons:

[13] "Purchased materials and fuels" are those purchased or otherwise brought into the organizational boundary.

They are large (or believed to be large) relative to the organization's scope 1 and scope 2 emissions

Potential emissions reductions in these categories could be undertaken or influenced by the organization.

They contribute to the organization's GHG risk exposure (e.g., climate change related risks such as financial, regulatory, supply chain, product and technology, compliance/litigation, reputational and physical risks)

They are deemed critical by key stakeholders (e.g., feedback from constituents, suppliers, citizens, or legislators)

They are an outsourced activity that previously contributed significantly to an organization's scope 1 or scope 2 emissions, or represent an activity that comparable government organizations typically perform "internally" with own staff and facilities

The following are examples of scope 3 activities that may be relevant to organizations:

- Organizations whose work involves a significant amount of employee business travel may want to report on related emissions.

- If fossil fuel or electricity is required to use any products produced by the organization, the resulting emissions may be a relevant category to report. This would be especially important if the organization can influence product design attributes (e.g., energy efficiency) or users' behavior in ways that reduce GHG emissions during the use of the products.

- If GHG-intensive materials (such as cement or steel) are involved in the production of a significant amount of the supplies and materials used for an organization's activities, the organization may want to examine whether there are opportunities to reduce consumption of the product or to substitute with less GHG-intensive materials.

3. *Identify and engage partners along the value chain*. Identify any partners that contribute potentially significant amounts of GHGs along the value chain (e.g., constituents, suppliers and manufacturers, energy providers, etc.). This is important when trying to identify sources, obtain relevant data, and calculate emissions.

4. *Quantify scope 3 emissions*. While the availability and reliability of data, calculation tools, and commonly accepted methodologies may influence which scope 3 activities are included in the inventory, it is accepted that data accuracy may be lower. It may be more important to

understand the relative magnitude of and possible changes to scope 3 activities. Emission estimates are acceptable as long as there is transparency with regard to the estimation approach, and the data used for the analysis are adequate to support the objectives of the inventory. Verification of scope 3 emissions is often difficult and may only be meaningful if data are of reliable quality.

**Scope 3 Emissions at National Parks**

National Park authorities have the ability to affect direct emissions from their own facilities and equipment, as well as the ability to affect emissions from their visitors, concessions, etc., both within park boundaries and beyond. Parks that participate in the Climate Friendly Parks (CFP) Program—a joint program between EPA and the National Park Service—account not only for their own scope 1 and scope 2 sources, but also for many scope 3 category sources, such as visitor vehicle travel, off-site landfilled solid waste and wastewater treatment, commercial aircraft, cruise ships and concession operations, among others.

Visitor vehicle emissions within the park are a particularly important source, as the National Parks collectively receive over 250 million visitors each year. In most cases, these visitors travel within the park in their own vehicles. For parks participating in the CFP Program, this means that a significant amount (often greater than 90 percent) of the GHG emissions that occur within park boundaries result from visitor vehicle travel. These scope 3 sources are a consequence of the operation of the park, but are not from sources it owns or controls.

CFP parks work with their surrounding communities, concessions, visitors and contractors to plan ways to reduce emissions, set emission reduction targets, and implement mitigation actions. Through these efforts, CFP parks have found that accounting for, and seeking to reduce, scope 3 emissions provides opportunities for resource sharing, knowledge sharing, and community action.

**Emissions Accounting from Employee Business Travel**

When calculating the emissions of an organization, it can be easy to overlook the day-to-day activities of office workers as a significant contribution to the total GHG inventory. However, many of those workers are not just sitting behind a desk; they are traveling across town for a meeting, around the country on an investigation, or maybe even around the world on business. Employee business travel can be a significant source of an organization's GHG emissions.

As an example, one section in a federal agency has about 600 employees who take around 3,000 trips per year. If each trip is estimated to involve about 2,000 miles of air travel, this section's annual GHG contribution from air business travel alone is over 1,000 metric tons of $CO_2$.

The transportation sector accounted for 29 percent of the total US energy consumption in 2007, with air travel responsible for over 3 percent of the total. The U.S. Government, projected to spend nearly $15 billion on travel and transport of persons in 2008, has significant purchasing power in this sector. Reporting emissions related to the government employees' travel could provide important data and impetus to modify activities in an effort to reduce overall emissions.

From: EPA (2009), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007,"* U.S. Environmental Protection Agency

Lewis, H. (2008), *Green Meetings, Conferences, and Events: A Federal Procurement Strategy*, EPA presentation at the Federal Environmental Symposium.

## Leased Assets

Most public organizations encounter leasing situations as either a lessee or lessor of building space, vehicles, or equipment, and must decide how to account for and report the GHG emissions associated with these assets. A common leasing arrangement is for a single public organization to lease and manage assets for multiple other government organizations. The General Services Administration (GSA) fulfills this role at the federal level, for example.

These leasing arrangements can be complex, and both lessees and lessors contribute to the total emissions that are incurred from the leased asset (see Box 6).

| BOX 6. Principal-Agent Problems in Leased Spaces |
| --- |
| Attributing responsibility for GHG emissions from leased assets (and in particular, buildings) presents numerous challenges. It is unavoidable that the "operation" and resulting GHG emissions of a building is shaped by both its infrastructure and equipment (the purview of the landlord) and its use (the activities and consumption |

choices of the tenants). The responsibility for reducing emissions may not always align with the party that has the incentive – financial or otherwise—to reduce emissions. The disconnections between users ("operators") and owners are known as "principal-agent problems" or "split incentives," and are acknowledged as one of the barriers preventing greater uptake of energy efficiency improvements in building infrastructure and product design.

While principal-agent problems may be impossible to avoid entirely, they can be reduced by aligning the incentives as much as possible for both parties to make reductions. For example, sub-metering and other mechanisms that isolate individual tenant's energy consumption can incentivize tenant responsibility and help landlords identify priority areas for structural upgrades. More fundamentally, ensuring that both landlords and tenants report emissions (in different scopes depending on the lease type and consolidation approach chosen) can provide the means to track the impact of efficiency and behavioral changes over time.

For both the lessee or the lessor to account for emissions from leased assets, the clearest approach is to first identify the types of leases maintained by the organization (elaborated below), and then apply the selected consolidation approaches (operational or financial control) mentioned in Chapter 3. Leases generally fall into one of two categories established by financial accounting: capital leases and operating leases.

*Capital lease*. This type of lease, often referred to as a finance lease in the private sector, 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 lease are considered wholly owned assets in financial accounting and are recorded as such on the balance sheet.

Under a capital lease, the tenant/lessee is considered to have ownership and both financial and operational control of the leased asset. Therefore, emissions associated with fuel combustion[14] 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 4-1).

The landlord/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.

*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

[14] For this discussion, we assume that most emissions that could be categorized as direct emissions are associated with fuel combustion. However, organizations may also have other sources of emissions, such as emissions from industrial processes or HFC emissions from refrigeration and air conditioning, which 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 in this appendix for simplicity.

or rewards of owning the asset. Any lease that is not a capital lease is an operating lease.[15] Government organizations working through a central provider (like GSA) will most often maintain some type of operating lease.

Under an operating lease, the tenant/lessee does not have ownership or financial control but has operational control of the leased asset. 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). But if the lessee uses the financial control or equity approach, the emissions associated with fuel combustion and electricity use are categorized as scope 3.

Likewise, the landlord/lessor has ownership and financial control of these assets but not operational control. Therefore, if the operational control approach is used, emissions from the tenant/lessee's fuel combustion and the use of purchased electricity will always be scope 3 (indirect) for the lessor. But 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).

*Table 4-1. Emissions from Leased Assets: Leasing Agreements and Boundaries for Lessees and Lessors*

<table>
<tr><th rowspan="2">Boundary Approach</th><th colspan="2">Type of leasing arrangement</th></tr>
<tr><th>Capital lease</th><th>Operating lease</th></tr>
<tr><td>Operational Control</td><td colspan="2">Tenant/Lessee has operational control.<br><br>**TENANT/LESSEE**: Emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2.[a]<br><br>**LANDLORD/LESSOR**: Emissions associated with tenant's fuel combustion and purchased electricity are scope 3.</td></tr>
<tr><td>Financial Control or Equity Share</td><td>Tenant/Lessee has financial control or ownership.<br><br>**TENANT/LESSEE**: Emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2.<br><br>**LANDLORD/LESSOR**: Emissions associated with tenant's fuel combustion and purchased electricity are scope 3.</td><td>Landlord/lessor has financial control or ownership.<br><br>**TENANT/LESSEE**: Emissions associated with fuel combustion and with use of purchased electricity are scope 3.<br><br>**LANDLORD/LESSOR**: Emissions associated with tenant's fuel combustion are scope 1 and with use of purchased electricity are scope 2.</td></tr>
</table>

[15] Financial Accounting Standards Board, Statement of Financial Accounting Standards, no. 13, "Accounting for Leases" (1976).

*Table 4-1. Emissions from Leased Assets: Leasing Agreements and Boundaries for Lessees and Lessors*

| Boundary | Type of leasing arrangement |
| --- | --- |

[a] Some organizations may be able to demonstrate that they do not have operational control over a leased asset held under an operating lease. In these cases, the organization may report emissions from the leased asset as scope 3, but must state clearly in its GHG inventory report the reason(s) why they do not have operational control. See section below on determining control in centralized heat/cooling systems.

### Multi-Tenant Buildings

For multi-tenant buildings, tenants are generally only required to account for emissions from their portion of the leased building. Where energy use is tracked on an individual basis (i.e., through sub-meters), emissions from energy use in common spaces such as a lobby, elevators, shared conference spaces, etc. should be divided up proportionally among the tenants based on occupancy and floor space, and reported optionally under scope 3. Where energy use is only tracked on a building-wide level, the general procedures for estimating the organization's relative share of overall energy use recommend taking occupancy into account, so these common space emissions will already be incorporated, unless responsibility for common space emissions is otherwise accounted for. See Chapter 6 for further information on performing these calculations.

## Boundary setting with Centralized Heating/Cooling Systems in Leased Buildings

As shown in Table 4-1, emissions from combustion (for example, natural gas burned in a boiler for building heat) or fugitive emissions from an air-conditioning unit would be considered the tenant's direct scope 1 emissions under the recommended operational control approach, regardless of lease type.

However, some organizations have interpreted their control of a leased space to be limited to the contractual square footage denoted in their lease agreement. In the case of centralized heating or cooling systems, the lessee may feel that the operational control they exert is limited as the landlord may maintain and operate equipment serving a multi-tenant building, or set a building-wide thermostat. As a result, the tenant/lessee may wish to categorize the emissions from these centralized heating/cooling emissions as indirect (scope 3) rather than direct.

This *U.S. Public Sector Protocol* recommends that emissions from centralized heating/cooling systems be classified as scope 1 under the operational control approach, consistent with current best practices. However, if the tenant/lessee can demonstrate that they do not have operational control in these situations, the inventory report should explain the reasons and record the emissions as scope 3.

## Scopes and Double Counting

Concern is often expressed that accounting for indirect emissions will lead to double counting when two different organizations include the same emissions in their respective inventories. By definition, scope 2 emissions are "indirect" and reflect the electricity generator's scope 1 emissions. Scope 3 captures all emissions associated with upstream/downstream operations and therefore will always be reflected as another entity's Scope 1 or 2. The *U.S. Public Sector Protocol* is designed to prevent double counting of emissions between different organizations *within* scope 1 and 2. For example, the scope 1 emissions of Organization A (generator of electricity) can be counted as the scope 2 emissions of Organization B (end user of electricity), but organization A's scope 1 emissions cannot be counted as scope 1 by any other organization's using the same consolidation approach as A. Similarly, the electricity consumed by Organization B (end user) can only be categorized as scope 2 by B.

Organizations do, however, need to ensure that emissions are not double counted when emissions from multiple entities are consolidated within a single GHG inventory. In general, the consistent application of either the control or equity share approach for defining organizational boundaries allows only one organization to exercise ownership of scope 1 or scope 2 emissions.

Double counting also needs to be avoided when compiling national (country) inventories under the Kyoto Protocol, but these are usually compiled via a top-down exercise using national economic data, rather than aggregation of bottom-up organizational data from entity-wide inventories described in this *U.S. Public Sector Protocol*. Compliance regimes are more likely to focus on the "point of release" of emissions (i.e., direct or scope 1 emissions) and/or indirect emissions from use of electricity. For GHG risk management and voluntary reporting, double counting is less important.

# Chapter 5
# Tracking Emissions Over Time

### *WHAT IS A BASE YEAR AND WHY DO I NEED ONE?*

### *MY EMISSIONS CHANGE WITH ALTERATIONS TO THE ORGANIZATION'S STRUCTURE. HOW DO I ACCOUNT FOR THESE?*

## STANDARD

Public sector organizations often undergo significant reorganizations, including the acquisition, elimination, reassignment, and merging of existing programs or subordinate organizations. These changes can alter an organization's fundamental structure, making meaningful comparisons of emissions over time difficult. To maintain consistency over time—in other words, to keep comparing "like with like"—historic emission data may have to be adjusted or recalculated.

A meaningful and consistent comparison of emissions over time requires that public organizations set a performance datum with which to compare current emissions. This performance datum is referred to as the base year emissions.[16] For consistent tracking of emissions over time, the base year emissions may need to be recalculated if a public organization undergoes significant structural change such as reorganization, merger, division, or consolidation where operations are reassigned from one reporting organization to another. The base year may also need to be adjusted if significant calculation or methodological improvements materialize. The first step in tracking emissions, however, is the selection of a base year.

### Choosing a Base Year

Public organizations shall choose and report a base year for which verifiable emissions data are available and specify their reasons for choosing that particular year as the base year. In many voluntary reporting programs, the base year is the first year that a member submits a report. Most public organizations select a single year as their base year. However, it is also

[16] "Base year" differs from "baseline," which is mostly used in the context of project-based accounting. Base year emissions refer to actual emissions in a year identified as a reference year to which subsequent annual emissions will be compared. A baseline is a hypothetical scenario for what GHG emissions would have been in the absence of a GHG reduction project or activity. However, many reporting programs use these terms interchangeably, and reporting organizations should be clear on which definition is being referenced.

possible to choose an average of annual emissions over several consecutive years. For example, the Chicago Climate Exchange members who joined during the first period the program (Phase I) use average emissions from 1998–2001 as the base year reference for tracking reductions. A multiyear average may help smooth out unusual fluctuations in GHG emissions that would make a single year's data unrepresentative of the organization's typical emissions profile.

The base year can also be used as a basis for setting and tracking progress towards a GHG target, in which case it is referred to as a target base year (see Chapter 10).

## Recalculating Base Year Emissions

Public organizations shall develop a base year emission recalculation policy, and clearly articulate the basis and context for any such recalculation. If applicable, the policy shall state a "significance threshold" to apply when deciding if the base year emissions should be recalculated. "Significance threshold" is a qualitative or quantitative criterion used to define any significant change to the data, inventory boundary, methods, or any other relevant factors relative to the base year. The organization or overriding reporting program is responsible for determining and disclosing the "significance threshold" that triggers base year emissions recalculation. The verifier is responsible for confirming the organization's adherence to the threshold policy. The following cases shall trigger recalculation of base year emissions, if the stated significance threshold is met:

- Structural changes in the reporting organization that significantly impact its base year emissions. A structural change involves the transfer of control of emissions-generating activities or operations from one organization to another. While a single structural change might not significantly impact the base year emissions, the cumulative effect of a number of minor structural changes can. Structural changes include the following:
  - Reorganization, division, or consolidation of organizational activities
  - Outsourcing or insourcing of activities.
- Changes in calculation methodology or improvements in the accuracy of emission factors or activity data that significantly impact the base year emissions estimate.
- Discovery of significant errors, or a number of cumulative errors that are collectively significant.

In summary, base year emissions shall be retroactively recalculated to reflect changes in the organization that would otherwise compromise the consistency and relevance of the reported GHG emissions information. Once an organization has determined its policy on how it will recalculate base year emissions, it shall apply this policy in a consistent manner. For example, it shall recalculate for both GHG emissions increases and decreases.

## GUIDANCE

Selection and recalculation of a base year should relate to the organizational goals and the particular context of the organization:

A public organization subject to a mandatory GHG reporting program may face external rules governing the choice and recalculation of base year emissions.

For voluntary public reporting or internal management goals, the organization may follow the standard and guidelines recommended in this protocol, or it may develop its own approach, which should be followed consistently.

### Choosing a Base Year

Public organizations should choose as a base year the earliest relevant point in time for which they have reliable data. National inventories prepared in accordance with the Kyoto Protocol set 1990 as a base year, but obtaining reliable and verifiable data for an historical base year this far in the past can be very challenging. Other organizations will have to use a base year prescribed through legislation, regulation, or executive order. For example, EO 13514 specifies Fiscal Year 2008 as the base year for federal GHG reduction goals.

Some public organizations may require multiple base years due to the cyclical nature of their operations. A government census bureau, for instance, may utilize vehicle fleets and offices to undertake a periodic census, but then relinquish these resources following the completion of the census. This bureau may therefore need two base years -- one with and one without the census activities. Other organizations with noncyclical, but highly variable emissions may require the use of an average of emissions over multiple but consecutive years. For example, an emergency response organization may want to create a base year using an average emissions rate across multiple consecutive years to account for unusually large and non-routine activities in any given year. Performance ratios can also serve to normalize emissions by set metrics (for example, emissions per emergency response incident), to provide context to measuring these non-routine activities. However, most emissions trading and registry programs require a fixed base year policy.

In choosing a base year and, more generally, in designing a GHG accounting system, public organizations should choose between fiscal year or calendar year as the basis for reporting. Calendar year reporting is consistent with most voluntary GHG reporting programs and UNFCCC reporting standards. While using the same reporting period for both financial and GHG emissions accounting will reduce data collection and reporting burdens, doing so may not always be possible. For instance, public sector organizations may have to report their GHG emissions to voluntary or mandatory reporting programs on a calendar year basis, and their utility or energy data on a fiscal year basis. Such issues should be addressed early on in the design of a GHG inventory.

## Significance Thresholds for Recalculations

Whether base year emissions are recalculated depends on the significance of the changes. The determination of a significant change may require considering the cumulative effect on base year emissions of a number of small consolidations or divisions. The *U.S. Public Sector Protocol* makes no specific recommendations as to what constitutes "significant." However, some GHG reporting programs do specify numerical significance thresholds. For example, The Climate Registry establishes a cumulative change of five percent or larger in an entity's total base year emission as the trigger for recalculation of base year emissions. If the cumulative change in base year emissions due to any of the earlier discussed factors is more than the significance threshold, the base year emissions should be recalculated.

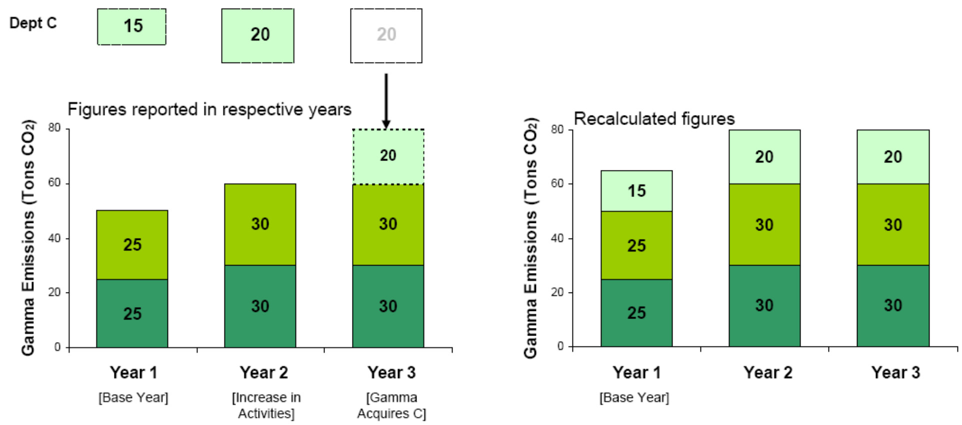
## Base Year Emissions Recalculation for Structural Changes

Structural changes trigger recalculation because they merely transfer emissions from one organization to another without any change in emissions released to the atmosphere. For instance, a consolidation or division of subordinate organizations only transfers existing GHG emissions from one organization's inventory to another. Examples of structural changes that would require the recalculation of base year emissions include:

- The consolidation of school districts
- Significant reorganization of departments or creation of new organizations or commissions.

Figures 5-1 and 5-2 illustrate the effect of structural changes and the application of this standard on recalculation of base year emissions.

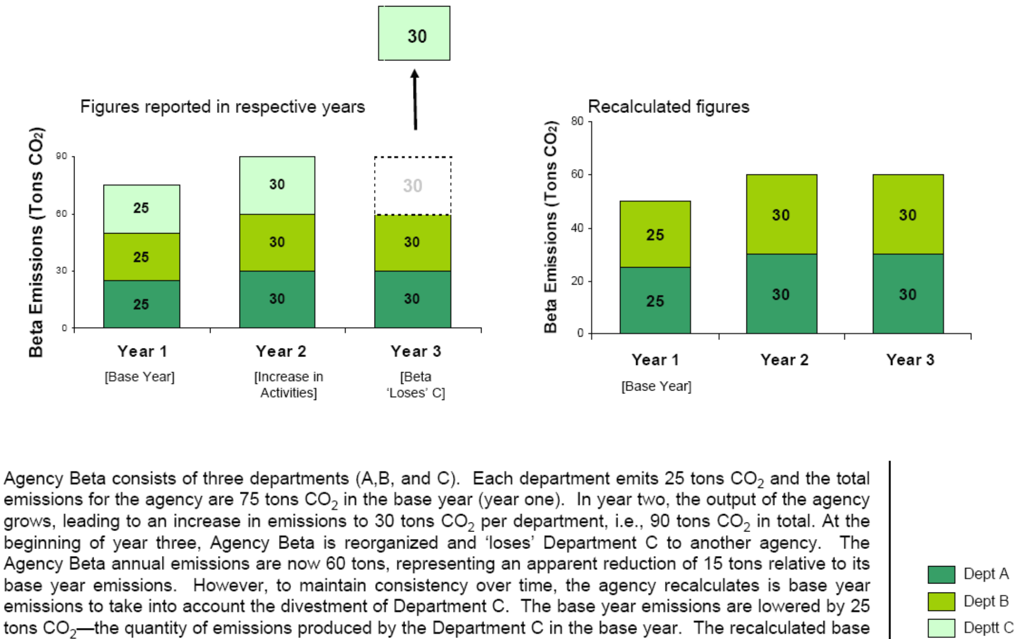
*Figure 5-1. Base Year Emissions Recalculation for Consolidation*




Agency Gamma consists of two departments (A and B). In its base year (year one), each department emits 25 tons $CO_2$. In year two, the agency undergoes "organic growth," leading to an increase in emissions to 30 tons $CO_2$ per department, i.e., 60 tons $CO_2$ in total. The base year emissions are not recalculated in this case. At the beginning of year three, the agency is reorganized and acquires Department C from another agency. The annual emissions of Department C in year one were 15 tons $CO_2$, and 20 tons $CO_2$ in years two and three. The total emissions of Agency Gamma in year three, including Department C, are therefore 80 tons $CO_2$. To maintain consistency over time, the agency recalculates its base year emissions to take into account the addition of Department C. The base year emissions increase by 15 tons $CO_2$—the quantity of emissions produced by Department C in Gamma's base year. The recalculated base year emissions are 65 tons $CO_2$. Gamma also (optionally) reports 80 tons $CO_2$ as the recalculated emissions for year two.

Adopted from the *GHG Protocol Corporate Standard,* 2004.

*Figure 5-2. Base Year Emissions Recalculation for Realignment of Operations*




Agency Beta consists of three departments (A,B, and C). Each department emits 25 tons $CO_2$ and the total emissions for the agency are 75 tons $CO_2$ in the base year (year one). In year two, the output of the agency grows, leading to an increase in emissions to 30 tons $CO_2$ per department, i.e., 90 tons $CO_2$ in total. At the beginning of year three, Agency Beta is reorganized and 'loses' Department C to another agency. The Agency Beta annual emissions are now 60 tons, representing an apparent reduction of 15 tons relative to its base year emissions. However, to maintain consistency over time, the agency recalculates is base year emissions to take into account the divestment of Department C. The base year emissions are lowered by 25 tons $CO_2$—the quantity of emissions produced by the Department C in the base year. The recalculated base year emissions are 50 tons $CO_2$, and the emissions of Agency Beta are seen to have risen by 10 tons $CO_2$ over the three years. Beta (optionally) reports 60 tons $CO_2$ as the recalculated emissions for year two.

Adopted from the *GHG Protocol Corporate Standard,* 2004.

## Timing of Recalculations for Structural Changes

When significant structural changes occur during the middle of the reporting year, the base year emissions should be recalculated for the entire year, rather than only for the remainder of the reporting period after the structural change occurred. This avoids having to recalculate base year emissions again in the succeeding year. Similarly, current year emissions should be recalculated for the entire year to maintain consistency with the base year recalculation. If it is not possible to recalculate in the year of the structural change (e.g., due to lack of data for an acquired organization), it may be done the following year.[17]

## Recalculations for Changes in Calculation Method or Improvements in Data Accuracy

A public organization might report the same sources of GHG emissions as in previous years, but measure or calculate emissions differently. For example, an organization might have used a national electric power generation emissions factor to estimate scope 2 emissions in year one of reporting. In

[17] For more information on the timing of base year emissions recalculations, see the guidance document "Base year recalculation methodologies for structural changes" on the GHG Protocol website (http://www.ghgprotocol.org/calculation-tools/all-tools).

later years, it may obtain more accurate region-specific emission factors (for the current as well as past years) that better reflect the GHG emissions associated with the electricity it has purchased. If the differences in emissions resulting from such a change exceed the defined significance threshold, historic data are recalculated applying the new data or method.

Sometimes the more accurate data points may not be available for all past years. The organization may then have to backcast these data points, or the change in data source may be acknowledged without recalculation. This acknowledgment should be made in the report each year to enhance transparency; otherwise, new users of the report in years after the change may make incorrect assumptions about the performance of the organization.

Any changes in emission factor or activity data that reflect real changes in emissions (i.e., changes in fuel type or technology) do not trigger a recalculation.

**New York City: Recalculation of base year emissions because of methodological improvements**

After producing an initial baseline, New York City has now categorized its emissions into scopes based on the *GHG Protocol Corporate Standard*, and has revised its methodology for calculating emissions from solid waste. Due to improvements in available data, the City has also updated its emissions coefficients for electricity and steam and its base year for on-road transportation emissions. These changes have been applied to the City government base year GHG inventory, resulting in adjusted base year figures for the fiscal year 2006 City government analysis. As a result of the adjustments, the City government fiscal year 2006 GHG base year inventory increased 5.9 percent from 3.8 million metric tons (MMT) $CO_2$-e to 4.1 MMT$CO_2$-e, an increase of 0.23 MMT.

Source: Inventory of New York City Greenhouse Gas Emissions, September 17, 2008.

## Optional Reporting for Recalculations

Optional information that public organizations may report on recalculations includes the following:

The recalculated GHG emissions data for all years between the base year and the reporting year if new data or methodologies make this possible.

All actual emissions as reported in respective years in the past, i.e., the figures that have not been recalculated. Reporting the original figures in addition to the recalculated figures contributes to transparency because it illustrates the evolution of the organization’s structure over time.

## No recalculation for Base Year Anomalies

As an organization tracks its GHG emissions over time, it may experience anomalous situations that temporarily cause its emissions to increase or decrease. Table 5-1 provides three examples of such anomalies, which will be familiar to public sector managers. While such anomalies should not lead to the recalculation of base year emissions, they do have important implications for the type of base year an organization should select. For instance, the periodic changes in emissions associated with cyclical census activities may require the use of multiple base years (see Table 5-1). Also, instead of adopting individual base years, organizations may use a base period, which represents the average of emissions over a continuous multi-year period.

Regardless of the solution chosen, organizations must provide a justification for making this choice and a description of the anomalies in their GHG emissions reports.

*Table 5-1. Anomalous Conditions and Base Year Decisions*

| Type of anomaly | Definition | Example | Potential solution and implication |
|---|---|---|---|
| Discontinuous | Significant and sudden change (either up or down) in GHG emissions due to a major change in the organization's mission. | NASA's transition from the "Space Shuttle Program" to the expanded operational scale and launch tempo of the "Constellation Program for Human Space Exploration. | Use original base year and recognize that the new mission has led to increased (or decreased) emissions. |
| Periodic | Temporary (repeating) increase in GHG emissions due to a foreseen activity change within an organizational mission. | U.S. Census Bureau's acquiring new temporary office space and vehicles to conduct the U.S. nation-wide census every 10 years. | Base year consists of two separate years, one with and one without census. Comparison to the appropriate base year shows real increases or decreases. |
| Episodic | Temporary increase in GHG emissions due to an unforeseen event outside the organization's control. | U.S. Federal Emergency Management Agency (FEMA) responding to an unusually high number of national emergencies in a particularly active season. | • Use original base year and recognize that the increase is real, even if temporary. However, if base year is an anomalously large disaster year, this produces apparent decreases that are misleading.<br>• Multi-year base periods may be particularly useful in averaging over the effects of such episodic anomalies. |

## No Base Year Emissions Recalculations for Operations That Did Not Exist in the Base Year

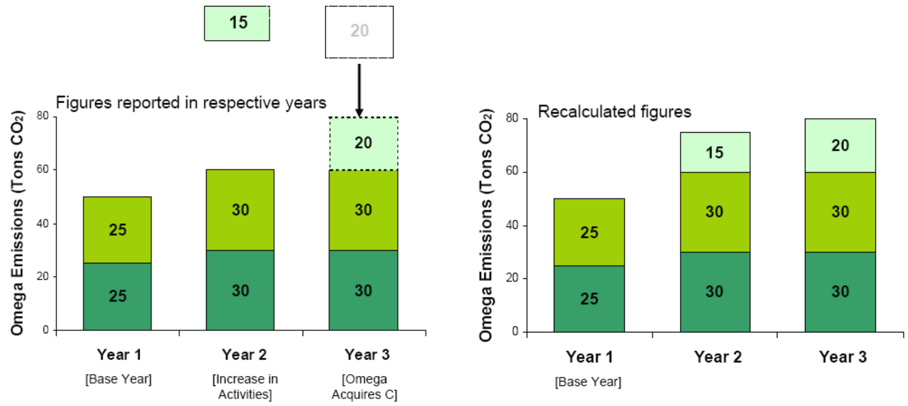
Base year emissions are not recalculated if the organization makes an acquisition of—or takes back (insources) previously outsourced—operations that did not exist in its base year (see Box 7 for definitions of insourcing/outsourcing).

| BOX 7. Definitions of insourcing and outsourcing for the purposes of GHG reporting |
|---|
| **<u>Outsourcing</u>:** Contracting out to other entities activities that were previously performed by the reporting organization.<br><br>**<u>Insourcing</u>:** The inverse of outsourcing; that is, the reporting organization performing activities previously contracted out to other entities. |

There may only be a recalculation of historic data back to the year in which the acquired operations came into existence. The same applies to cases where the organization loses ownership of (or outsources) operations that did not exist in the base year.

Figure 5-3 illustrates a situation where no recalculation of base year emissions is required because the acquired facility came into existence after the base year.

*Figure 5-3. Acquisition of Operations That Came Into Existence after Base Year*




Agency Omega consists of two departments (A and B). In its base year (year one), the organization emits 50 tons $CO_2$. In year two, the organization undergoes organic growth, leading to an increase in emissions to 30 tons $CO_2$ per department, i.e., 60 tons $CO_2$ in total. The base year emissions are not recalculated in this case. At the beginning of year three, Omega acquires a facility C from another agency. Facility C came into existence in year two, its emissions being 15 tons $CO_2$ in year two and 20 tons $CO_2$ in year three. The total emissions of agency Omega in year three, including facility C, are therefore 80 tons $CO_2$. In this acquisition case, the base year emissions of agency Omega do not change because the acquired facility C did not exist in year one when the base year of Omega was set. The base year emissions of Omega therefore remain at 50 tons $CO_2$. Omega (optionally) reports 75 tons as the recalculated figure for year two emissions.

Dept A
Dept B
Dept C

Adopted from the *GHG Protocol Corporate Standard,* 2004

## No Recalculation for Expansion, Contraction, or Closure

Base year emissions and any historic data are not recalculated for expansion, contraction, or closure. Expansion includes new or increased emissions from new regulatory responsibilities or increased operations, often accompanied by an increase in organizational budget. Sudden expansions or contractions may appear as historical anomalies, but they represent a substantive change in operations that is more than a temporary shift, the base year emissions should not be recalculated. Expansion does not include subsuming another organization's existing emissions through reorganization. Closures should be considered as reductions in emissions against a base year, and so they do not trigger base year recalculations. The rationale for this is that expansion or contraction results in an actual change of emissions to the atmosphere and therefore needs to be counted as an increase or decrease in the organization's emissions profile over time.

## When to Recalculate for "Outsourcing or Insourcing"

Structural changes due to "outsourcing" or "insourcing" do not trigger base year emissions recalculation if the emissions are still reflected in the inventory under a different scope (see Table 5-2). For example, an organization may have previously purchased electricity from the grid and recorded the emissions in the required scope 2 category; but "insourcing" that service and producing electricity onsite from burning fuel such as natural gas, for example, incurs scope 1 emissions. This does not trigger base year emissions recalculation, since the emissions associated with the organization's power needs are still reflected in the inventory, but simply in different scopes. These changes should be documented in the overall report to ensure transparency.

However, because activities falling within the scope 3 categories are optional to report, there may be insourced operations that were not previously reported, or outsourced operations that the organization chooses not to track in scope 3 in its current inventory. Here, outsourcing or insourcing can trigger a base year emissions recalculation, as those activities may not be recorded in either the base year inventory or the current reporting year inventory. For example, an organization that previously carried out transportation for its products would have incurred scope 1 emissions from vehicle fuel combustion. It may decide to outsource that activity to a logistics firm, but choose not to track those emissions under the scope 3 category. A recalculation of base year is appropriate here, as the outsourced activity is not captured anywhere in the current year's inventory, making the current year's emissions appear disproportionately low.

For reporting or compliance purposes, an organization might decide to track emissions over time separately for different scopes. In such cases, separate base years could be established for each scope, and the base year emissions would be recalculated for any outsourcing or insourcing of activities.

*Table 5-2. When to Recalculate the Base Year Emissions Due to Outsourcing or Insourcing*

<table>
<tr><td>Action</td><td>How recorded in current inventory, after the outsourcing/insourcing?</td><td>How recorded in the base year inventory?</td><td>Recalculation of base year emissions?</td></tr>
<tr><td rowspan="4">OUTSOURCED<br>Example: Transportation of goods and services previously carried out in organization-owned vehicles now contracted out to private company</td><td rowspan="2">Scope 3</td><td>Scope 1 and 2</td><td rowspan="2">No</td></tr>
<tr><td>Activity did not exist in base year</td></tr>
<tr><td rowspan="2">Not tracked in scope 3</td><td>Scope 1 and 2</td><td>Yes, if passes significance threshold. Considered a “structural change”</td></tr>
<tr><td>Activity did not exist in base year</td><td>No</td></tr>
<tr><td>INSOURCED<br>Example:</td><td></td><td>Scope 3</td><td>No</td></tr>
</table>

| | | | |
|---|---|---|---|
| Administrative office services previously contracted out to private management company now carried out by government organization. (Emissions included building energy and heat) | Scope 1 and scope 2 | Not tracked in scope 3 | Yes if passes significance threshold. Considered a “structural change” |
| | | Activity did not exist in the base year | No |

# Chapter 6
# Identifying and Calculating GHG Emissions

### *HOW DO I IDENTIFY AND CALCULATE MY ORGANIZATION'S EMISSION SOURCES?*

### *WHAT KINDS OF TOOLS ARE THERE TO HELP ME CALCULATE EMISSIONS?*

### *WHAT DATA COLLECTION ACTIVITIES AND DATA MANAGEMENT ISSUES DO MY FACILITIES HAVE TO DEAL WITH?*

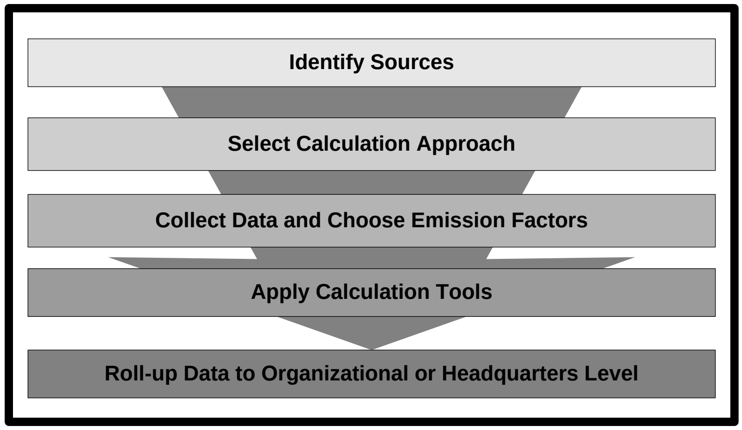
## GUIDANCE

Once the inventory boundary has been established, public organizations generally calculate GHG emissions using the following five steps:

1. Identify GHG emissions sources.
2. Select a GHG emissions calculation approach.
3. Collect activity data and choose emission factors.
4. Apply calculation tools.
5. Roll up GHG emissions data to the relevant organizational or headquarters level.

This chapter does not identify specific methodologies or equations by which emissions must be calculated, but only describes the steps necessary in the process. Appendix A offers a list of GHG reporting programs, most of which have accompanying methodologies and calculation/reporting tools. This is not a comprehensive list, and government organizations may be directed to use specific calculation or reporting tools. The GHG Protocol Initiative also maintains a set of calculation tools available on the GHG Protocol Initiative website at www.ghgprotocol.org.

*Figure 6-1. Steps in Identifying and Calculating GHG Emissions*




Adopted from *GHG Protocol Corporate Standard,* 2004

## Identify GHG Emissions Sources from Government Operations

The first of the five steps in calculating an organization's emissions as outlined in Figure 6-1 is to identify GHG sources within the organization's boundaries. Direct (Scope 1) GHG emissions from government operations typically occur from the following source categories:

*Stationary combustion*: combustion of fuels in stationary equipment such as boilers, furnaces, burners, turbines, heaters, incinerators, engines, and flares.

*Mobile combustion:* combustion of fuels in transportation devices such as automobiles, trucks, buses, trains, airplanes, boats, ships, barges, and vessels.

*Process emissions:* a range of emissions from physical or chemical processes such as laboratory activities and weapons production.

*Fugitive emissions:* intentional and unintentional releases, such as equipment leaks from joints, seals, packing, and gaskets; HFC or PFC emissions from the use of refrigeration and air conditioning equipment; methane emissions from coal mines and venting;[18] methane leakages from gas transport; $SF_6$ emissions from owned electricity transformers; as well as fugitive emissions from detonation and firing of munitions, rocket firing, coal piles, wastewater treatment, cooling towers, and gas processing facilities.

The GHG Protocol calculation tools are organized on the basis of these categories. Table 6-1 shows a sample of GHG emissions from typical public sector operations, though some government organizations will have industrial

[18] The categorization of venting as a fugitive emission is consistent with the IPCC 2006 Guidelines for National Greenhouse Gas Inventories.

operations not listed here. Appendix E provides an overview of direct and indirect GHG emission sources organized by activity and scopes that may be used as an initial guide to identify major GHG emission sources in public organizations.

*Table 6-1. Illustrative Emissions Sources Associated with Public Sector Operations*

| Emission source | Type | Possible data needs | Potential data source |
|---|---|---|---|
| Buildings<br>(Government-owned, operated or occupied facilities) | S, P, F | 1) For stationary combustion sources: amounts of natural gas and other fuels consumed ($CO_2$, $CH_4$, and $N_2O$).<br>2) For electricity consumption: amount of electricity purchased from the grid ($CO_2$, $CH_4$, and $N_2O$).<br>3) Amount of imported steam or district heating or cooling ($CO_2$, $CH_4$, and $N_2O$).<br>4) For refrigeration and heating, ventilation, and air conditioning (HVAC) systems: type of refrigerants, type and quantities of air conditioning (A/C) equipment, total refrigerant charge, and annual leak rates (HFCs and PFCs). | Utility provider that transmits the power (e.g., investor-owned utility, municipal utility)<br>Accounts payable<br>Property management<br>HVAC maintenance contract manager |
| Road and marine vehicle and aircraft fleets<br>(Vehicles in organization-managed fleet) | M, F | 1) Fuel consumption or mileage data by vehicle, vehicle type, and vehicle year ($CO_2$, $CH_4$, and $N_2O$).<br>2) For vehicle A/C systems: type of refrigerants, number and type of vehicles in fleet, total refrigerant charge, and annual leak rates (HFCs). | Fleet management<br>Accounts payable |
| Water and Sewage<br>Treatment and pumping (at treatment facility) | S,P, F | 1) See buildings.<br>2) Information on the volume and composition of water/sewage treated at water/sewage treatment plants and type of treatment technologies ($CH_4$ and $N_2O$). | Utility provider that transmits the power (e.g., investor-owned utility, municipal utility)<br>Accounts Payable<br>Public Works Dept<br>Municipal Utility District (Water District) |
| Solid Waste Facilities (Landfill) | F | 1) See fleets (waste hauling)<br>2) Information on the total amount of waste deposited annually, amount of $CH_4$ flared or used for energy, and amount of $CH_4$ oxidized in landfills<br>3) Information about the landfill operation | Utility provider that transmits the power (e.g., investor-owned utility, municipal utility)<br>Public Works Dept |
| Stationary combustion equipment (including power plants and generators) | S | 1) Amount of fuel consumed ($CO_2$, $CH_4$, and $N_2O$). | Bulk Fuel Purchases<br>Maintenance/testing records |
| Fire Protection<br>(Vehicles, fire suppression systems) | S, M, F | 1) See buildings.<br>2) See fleets.<br>3) For fire suppression systems: type of suppressants, number and type of vehicles in fleet, total charge, and annual leak rates (HFCs). | Maintenance records<br>Coolant purchase records |

*Table 6-1. Illustrative Emissions Sources Associated with Public Sector Operations*

| Emission source | Type | Possible data needs | Potential data source |
|---|---|---|---|
| Road Construction (Vehicles, cement, and asphalt use) | S, M, P | 1) See buildings.<br>2) See fleets.<br>3) Data on cement production.<br>4) See parks and lands (soils and forests)<br>5) Traffic lights and other signal/lighting equipment. | Materials purchase records |
| Laboratories | S, F | 1) See buildings.<br>2) Gases for testing: $N_2O$, HFCs, PFCs. | Bulk Fuel Records |
| Parks and lands | S, F | 1) See buildings.<br>2) See fleets.<br>3) Fish hatcheries: potential $N_2O$ and potential $CH_4$ from fish food.<br>4) Soils: $CO_2$ emissions (and removals) and $N_2O$ emissions.<br>5) Forests: $CO_2$ emissions and removals associated with changes in above-ground forest stocks<br>6) Off-road mobile sources (snowmobiles, lawnmowers, ATVs) | Fleet management<br>Fish stock and food purchase records<br>Land management records or surveys |
| Other (Emissions that may not be captured in above categories) | S, M, F | Examples include portable equipment, lawnmowers, weed-whackers, leaf-blowers, and scissor lifts, forklifts): fuel consumption, hours of use, and, for fire suppression systems, data necessary to calculate emissions of PFCs. | Dependent on emissions source<br>Maintenance records<br>Air permits |

Source: Adapted from http://www.theclimateregistry.org/downloads/State_Government_GHG_Sources.pdf.
Note: S = stationary emissions; M = mobile emissions; P = process emissions; F = fugitive emissions.

## Identify Scope 1 Emissions

As a first step, a public organization should undertake an exercise to identify its direct (scope 1) emission sources in each of the four source categories listed above. Process emissions are usually only relevant to certain industry sectors like oil and gas, aluminum, and cement. Public organizations that generate process emissions or that own or control a power production facility, such as defense facilities, will likely have direct emissions from all the main source categories. Office-based public organizations may not have any direct GHG emissions except in cases where they own or operate a vehicle, combustion device, or refrigeration and air-conditioning equipment.

## Identify Scope 2 Emissions

The next step is to identify indirect emission sources from the consumption of purchased electricity, heat, or steam. Almost all public organizations generate indirect emissions due to the purchase of electricity for use in their processes or services.

### Identify Scope 3 Emissions

This optional step involves identification of other indirect emissions from an organization's upstream and downstream activities; for government organizations, these can include emissions from outsourced or contracted services that were not included in scope 1 or scope 2.

The inclusion of scope 3 emissions allows public organizations to expand their inventory boundary along their value chain, providing a broad overview of linkages (such as inter-organization management of shared resources) which offer opportunities for significant GHG emission reductions. See Chapter 4 for an overview of activities that can generate GHG emissions along an organization's value chain.

**NASA: Leveraging EMS and Collecting Scope 3 Data**

Like many federal agencies, NASA's Goddard Space Flight Center's (GSFC) utilizes an Environmental Management System (EMS) to both collect information and communicate it to key decision makers. Through implementing an EMS, GSFC's has also defined roles, responsibilities, and lines of communication within the organization, ensuring that GSFC's management will be a part of the GHG inventory process. The importance of internal communication became clear as the GSFC began collecting information for its scope 3 sources. Here, interviews with the Logistics Division revealed an additional database system which tracked fuel usage for both government and contractor mobile sources. Integrating this source allowed for contractor vehicle use to be accounted for in scope 3 (contractor vehicles).

## Select a Calculation Approach

The IPCC guidelines (IPCC, 2006) refer to a hierarchy of calculation approaches and techniques, ranging from direct monitoring to the application of generic emission factors. The most accurate GHG emission data can be obtained through direct measurement by monitoring concentration and flow rate (with technology commonly known as continuous emissions monitoring, or CEMs), but this approach is not commonly available or practical for all organizations. Emissions can also be calculated on a mass balance or stoichiometric basis specific to a facility or process, based on the quantities of chemical inputs and outputs. However, the most common approach for calculating GHG emissions is through the application of documented emission factors. These factors are calculated ratios relating GHG emissions to a measure of activity; for example, electricity emission factors are expressed in tons of CO2 equivalent per kilowatt-hour. These emission factors are then applied to the appropriate activity data (such as kilowatt-hours of electricity) in order to calculate the emissions resulting from the activity (See Box 8).

BOX 8. Example Application of Emission Factors

| | | |
|---|---|---|
| **Emissions** (tons of $CO_2e$) | = | **Emission factor** (tons of $CO_2e$/kWh) x **Activity data** (kWh) |

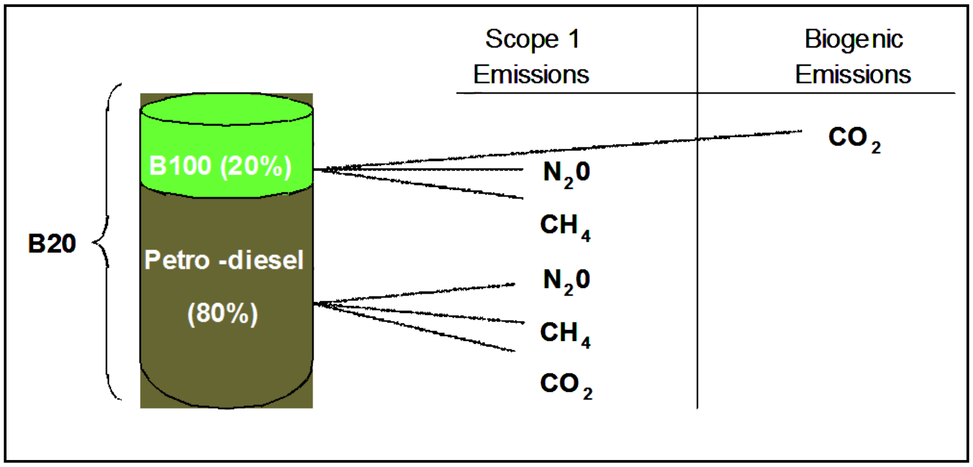
In many cases, accurate emissions can be calculated from fuel use data. Even small users usually know the amount of fuel consumed and have access to data on the carbon content of the fuel through default carbon content coefficients or through more accurate periodic fuel sampling. Public organizations should use the most accurate calculation approach available to them and appropriate for their reporting context.

## Collect Activity Data and Choose Emission Factors

For most organizations, scope 1 GHG emissions are calculated on the basis of the purchased (or consumed) quantities of commercial fuels (such as natural gas, vehicle fuels, and heating oil) using published emission factors. Special attention is needed when calculating and categorizing the emissions from biofuels, particularly blended fuels (see Box 9). Much of the information required to complete the inventory may already be available in other data bases maintained by the organization. For example, U.S. federal agencies are required to measure and report annually their facility and vehicle fleet energy use to the Federal Energy Management Program to satisfy Energy Policy Act 2005 and EO 13423 requirements. Coordinating with the parties responsible for such data may simplify reporting and avoid unnecessary duplication of effort. However, some organizations may have difficulty gathering sufficiently disaggregated data to allow for inventory calculations at the appropriate level; in these cases, organizations must clearly identify limitations on data in the inventory report.

BOX 9. Calculating Emissions from Biofuels

Biofuels are alternative, non-petroleum fuels made from renewable biological material. One common biofuel is biodiesel, crafted from vegetable oil and animal fats. Pure biodiesel, also known as B100, is often combined with various amounts of petro-diesel to create a blended product. A common blend, B20, consists of 20 percent biodiesel and 80 percent petro-diesel. Such intermingling of fuels complicates the accounting of GHG emissions. In order to calculate B20's combustion emissions, a percentage breakdown into its fuel constituents (i.e., Petro-diesel & pure biodiesel) is required. The $N_20$, $CH_4$, and $CO_2$ emissions from the 80% petro-diesel portion should all be reported under scope 1 within the appropriate organizational boundaries. However, combustion of the 20% biodiesel is accounted for in two places: the $CH_4$ and $N_2O$ are reported in scope 1, and the $CO_2$ is separately reported "biogenic" emissions category. See Chapter 4 for more information.




Some public organizations (e.g., DoD and NASA) have industrial operations and operate their own power generation facilities. Organizations should seek guidance from sector-specific guidelines, protocols and studies to ensure that they use or develop appropriate emissions factors for these unique emission sources.

Scope 2 GHG emissions are primarily calculated from metered electricity consumption and supplier-specific, local grid, or other published emission factors. Scope 3 GHG emissions are primarily calculated from activity data such as fuel use or passenger miles and published or third-party emission factors. In most cases, if source- or facility-specific emission factors are available, they are preferable to more generic or general emission factors. The forthcoming *GHG Protocol Scope 3 Standard* provides further guidance on identifying and calculating these emissions.

The *U.S. Public Sector Protocol* recognizes that numerous sources of emissions factors for a wide range of emissions sources exist, and some are better developed and more widely recognized than others. Most often, this is due to the fact that the science behind the factors is evolving at different rates in different sectors: for example, emissions factors for power production are generally well-established, while those for $CH_4$ released from composting are less so. Even some emission factors for the same sector include different pieces of information (e.g., factors related to power production include transmission and distribution (T&D) losses while others do not), so they must be applied appropriately to avoid double counting. For these reasons, the *U.S. Public Sector Protocol* does not specify the use of particular emission factors, but encourages inventorying organizations to carefully select those that will best represent a given situation. The GHG Protocol Initiative maintains a suite of calculation tools based on widely-accepted emission factors, which can offer organizations a place to start. Regulatory or voluntary programs will usually specify which emission factors their reporting members should use.

### Activity Data for Leased Spaces

Energy bill/meter records that track the consumption of electricity and/or heat by individual users will provide the most specific activity data for GHG emissions calculations. However, collecting energy use data this level is not always possible, particularly in multi-tenant leased facilities that do not have sub-meters to track individual tenant energy use. If total building energy use is known, then approximate activity data for electricity use may be employed, including:

- Building-specific estimation, where the building's total energy use is divided by the portion of the total building area the organization occupies. For buildings with less than 100% occupancy, the total building energy use is divided by the occupancy rate to more accurately capture the tenant's total portion of emissions.

- Similar building/facility estimation, where data is extrapolated from other similar buildings/facilities owned by the reporting organization. This method should only be used if the reporting organization has multiple buildings/facilities of a similar type, with similar energy use patterns, and is able to obtain accurate, reliable energy use data for some of them using actual energy/fuel use records.

- Generic building space data method, using default data from a published source on energy use per area of generic building space in a particular country. This method is only recommended as a last-resort method that serves as a very rough estimate that may be significantly inaccurate.

For multi-tenant buildings, tenants are only required to account for emissions from their leased space, as determined by building area and occupancy. Tenants in a multi-tenant building whose energy use is sub-metered may optionally account for their portion of emissions from common spaces such as a lobby or shared conference space, etc, under scope 3.

**NREL: Calculating emissions in leased spaces**

The National Renewable Energy Laboratory (NREL) has been reporting its GHG emissions since 2003 as a partner in the EPA Climate Leaders program. NREL's inventory is composed of several sites in Colorado. The main site on South Table Mountain (STM) is composed of buildings owned, built and controlled by NREL. Each building has data acquisition systems so utility data can be tracked at the building level and reported in NREL's scope 1 and scope 2 emissions. This is also the case with the National Wind Technology Center, which is located about 30 minutes North of the STM site.

The laboratory does lease space for some of its administrative and non-research offices, and emissions from natural gas and electricity use in these leased facilities are calculated based on the percentage of the building area occupied by NREL. Emissions from natural gas and electricity are reported in NREL's scope 1 emissions and scope 2 emissions, respectively. To account for the energy usage and the requisite GHG emissions in the leased space, NREL uses the following formula:

NREL electric = (NREL leased office space area/Total Building area) x (1/occupancy rate) x Electric bill for building

Then: NREL GHGs = NREL Electric x eGrid factors for the appropriate region

NREL is currently constructing new office buildings on the STM site, mitigating its need for leased office space and providing opportunities to implement energy-efficient design features. In order to help manage traffic on the STM site, and cut down on its commuter emissions, the laboratory is piloting a telecommuting plan for administrative staff.

## Apply Calculation Tools

This *U.S. Public Sector Protocol* does not require specific calculation tools to be utilized to create an inventory, but recommends the use of tools that have been peer reviewed by experts and industry leaders, are regularly updated, and are believed to be the best available. There are two main categories of calculation tools, reflected in the GHG Protocol calculation toolset:

- Cross-sector tools that can be applied to different sectors. These include stationary combustion, mobile combustion, HFC and PFC use in refrigeration and air conditioning, and measurement and estimation uncertainty.

- Sector-specific tools that are designed to calculate emissions in specific sectors such as aluminum, iron and steel, cement, oil and gas, pulp and paper, and office-based organizations.

Many public organizations may need to use more than one calculation tool to cover all of their GHG emission sources. Mandatory or voluntary program reporting may also specify tools and practices to be used for whole inventories or particular sources. Utilizing tools established by voluntary GHG reporting programs may also offer the advantage of access to technical assistance. In addition, some government organizations have developed GHG inventory calculation tools specific to their organization's activities. Such individualized tools have the advantage of increasing the efficiency of inventory development by streamlining data gathering, calculation and reporting functions (see Box: Climate Leadership in Parks (CLIP): Greenhouse Gas Emissions Inventory Tool). In developing or using such integrated tools, sufficient access to raw data and calculation formulas should be ensured for cross-checking and verification purposes.

**Climate Leadership In Parks (CLIP): Greenhouse Gas Emissions Inventory Tool**

The Climate Friendly Parks (CFP) program stems from a partnership between the U.S. EPA and National Park Service (NPS) and works to educate, communicate, and mitigate climate change by:

- Educating every park employee about climate change and what role each can take in addressing the problem.
- Identifying a strategy for each CFP to reduce their GHG emissions in order to help mitigate the effects of climate change.
- Empowering every park employee to communicate to the public how climate change is affecting their park's natural resources, how the park is dealing with these effects, and the difference each person can make in being stewards of our climate and other natural resources.

The CFP program created the CLIP Tool in order to help National Parks conduct emission inventories, develop action plans, and communicate about climate change. The emissions inventory tool has been designed to assist park employees to approximate emissions that occur within park boundaries. It also pinpoints how employees, concessionaires, and visitors each impact climate change. The tool looks at both GHGs and criteria air pollutants (CAPs).

The emissions inventory module estimates emissions of GHGs and CAPs. While both types of emissions often result from similar activities, there are some differences in how these emissions are estimated.

The Emissions Inventory Tool is broken into four key sections: control, background, GHG sources, and CAP sources. The control section is the main interface of the inventory tool, where users insert all key information about a park. The background component provides users with directions and assistance on how to make use of the tool. It specifically focuses on what data needs to be collected and how to go about obtaining that information. The next two sections focus on calculations. They are broken into GHG calculations and CAP calculations. Both calculators are separated into the individual emission sources that are relevant to each park. At the end the user is presented with a summary sheet.

Source: http://www.nps.gov/climatefriendlyparks/CLIPtool/emissioninventory.htm.

## Roll Up GHG Emissions Data to Organizational or Headquarters Level

To report an organization's total GHG emissions, public organizations will usually need to gather and summarize data from multiple facilities, potentially across different subordinate sub-organizations or divisions and even in different countries. Carefully planning this process minimizes the reporting burden, reduces the risk of errors that might occur while compiling data, and ensures that all facilities are collecting information on an approved, consistent basis.

Ideally, organizations integrate GHG reporting with their existing reporting tools and processes, and take advantage of any relevant data already collected and reported by facilities. Depending upon the amount of detail headquarters wishes to be reported from facilities, data collection and management tools could include the following:

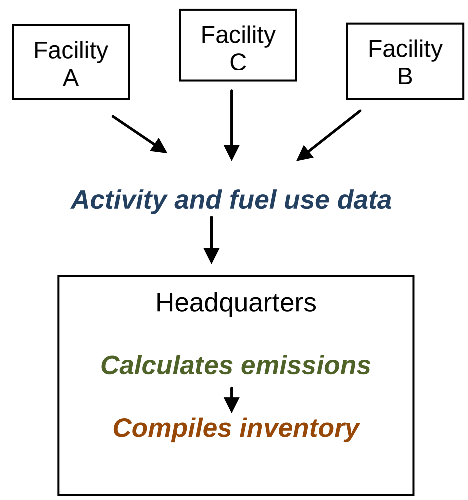
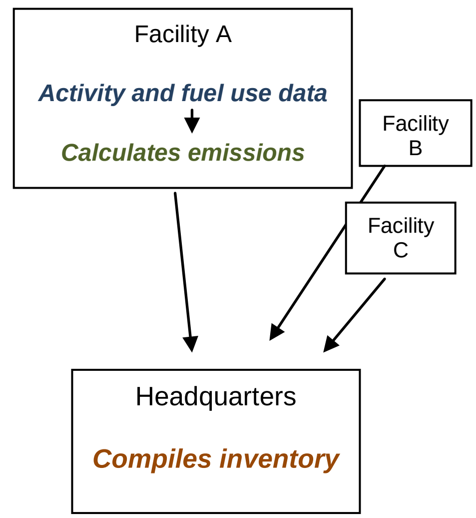
- Secure databases available over the organizations' intranet or internet, for direct data entry by facilities
- Spreadsheet templates filled out and sent to a headquarters or division office, where data are processed further

For internal reporting up to the headquarters level, the use of standardized reporting formats is recommended to ensure that data received from different facilities are comparable and that internal reporting rules are observed. Standardized formats can significantly reduce the risk of errors.

## Approaches for rolling up GHG emissions data to headquarters level

There are two basic approaches for gathering data on GHG emissions from a public organization's subordinate facilities: the centralized approach, where the emissions are calculated at headquarters level, or the decentralized approach, where emissions are calculated by individual facilities. These approaches may be used individually or in combination for certain groups of facilities. The two approaches are not mutually exclusive and should produce the same result. Asking facilities to calculate GHG emissions themselves helps to increase their awareness and understanding. However, it may also lead to resistance, increased training needs, an increase in calculation errors, and a greater need for auditing of calculations. See Table 6-2 below detailing these approaches.

*Table 6-2: Centralized and Decentralized data collection and calculation approaches*

| | ***Centralized*** | ***Decentralized*** |
|---|---|---|
| |  |  |
| *Definition* | Individual facilities report activity and fuel use data (such as quantity of fuel used) to the headquarters level, where GHG emissions are calculated. | Individual facilities collect activity and fuel use data, directly calculate their GHG emissions using approved methods, and report this data to the headquarters level |
| *When preferred option?* | The staff at the headquarters or division level can calculate emissions data in a straightforward manner on the basis of activity or fuel use data<br><br>Emissions calculations are standard across a number of facilities. | Mitigation decisions (such as funding allocation) requires knowledge of emissions at the level of individual equipment<br><br>Local regulations require reporting of GHG emissions at a facility level<br><br>Calculations require detailed knowledge of the kind of equipment being used at facilities<br><br>Calculation methods vary across a number of facilities<br><br>Process emissions (in contrast to emissions from burning fossil fuels) make up an important share of total GHG emissions<br><br>Resources are available to train the facility staff to conduct these calculations and to audit them<br><br>A user-friendly tool is available to simplify the calculation and reporting task for the |

| | | |
|---|---|---|
| | | facility-level staff |

The difference between these two approaches lies in where the emissions calculations occur (i.e., where activity data are multiplied by the appropriate emission factors) and in what type of quality management procedures must be put in place at each level of the organization. Facility-level staff members are generally responsible for initial data collection under both approaches. The choice of collection approach depends on the needs and characteristics of the reporting organization.

Although the two approaches should produce the same result, often information may be initially available at the headquarters level that is not readily available at the facility level, and vice versa. Individual facility managers may identify sources of emissions that headquarters may not monitor. To maximize accuracy and minimize reporting burdens, some public organizations use a combination of the two approaches. Complex facilities with process emissions may calculate their emissions at the facility level, while facilities with uniform emissions from standard sources only report fuel use, electricity consumption, and travel activity. The headquarters database or reporting tool then calculates total GHG emissions for each of these standard activities. Public organizations desiring a consistency check on facility-level calculations can follow both approaches and compare the results. Even when facilities calculate their own GHG emissions, the headquarters staff may still wish to gather activity and fuel use data to double-check calculations and explore opportunities for emissions reductions. These data should be available and transparent to staff at the headquarters level. The headquarters staff should also verify that facility-reported data are based on well defined, consistent, and approved inventory boundaries, reporting periods, calculation methodologies, etc.

## Common Guidance on Reporting to Headquarters Level

Reports from facility level to headquarters or division offices should include all relevant information as specified in Chapter 8. Some reporting categories are common to both the centralized and decentralized approaches and should be reported by facilities to their headquarters offices, including the following:

A brief description of the emission sources

A list and justification of specific exclusion or inclusion of sources

Comparative information from previous years

The reporting period covered

Any trends evident in the data

Progress toward any organizational targets

A discussion of uncertainties in activity/fuel use or emissions data reported, their likely cause, and recommendations for how data can be improved

A description of events and changes that have had an impact on reported data (acquisitions, restructuring, closures, technology upgrades, changes of reporting boundaries or calculation methods applied, etc.).

### Reporting for the Centralized Approach

In addition to the aforementioned common categories of reporting data, facilities following the centralized approach by reporting activity/fuel use data to the headquarters level should also report the following:

Activity data for freight and passenger transport activities (e.g., freight transport in ton-miles)

Activity data for process emissions (e.g., tons of waste in landfills)

Clear records of any calculations undertaken to derive activity/fuel use data

Local emission factors necessary to translate fuel use and/or electricity consumption into $CO_2$e emissions.

### Reporting for the Decentralized Approach

In addition to the aforementioned common categories of reporting data, individual facilities following the decentralized approach by reporting calculated GHG emissions to the headquarters level should also report the following:

A description of GHG calculation methods and any changes made to those methods relative to previous reporting periods

Details on any data references used for the calculations, in particular information on emission factors used

Ratio indicators as defined by program policies (see Chapters 8 and 10)

Clear records of calculations undertaken to derive emissions data should be kept for any future internal or external verification.

# Chapter 7
# Managing Inventory Quality

## WHAT DETERMINES THE QUALITY AND CREDIBILITY OF MY EMISSIONS INFORMATION?

## GUIDANCE

An organization's GHG reporting objectives should guide the design of an inventory quality management system, as well as the treatment of uncertainty regarding inventory estimates. Given an uncertain future, high quality information will have greater value and more uses, while low quality information may have little or no value or use, and may even incur penalties. For example, an organization may currently be focusing on voluntary GHG reporting, but also want its inventory data to meet the anticipated requirements of future regulations. A quality management system will help ensure that an inventory meets the principles of the *U.S. Public Sector Protocol* and adequately prepares public organizations for requirements of potential future GHG emissions programs.

Even if an organization is not anticipating a future regulatory mechanism, internal and external stakeholders will demand high quality inventory information. Therefore, the implementation of some type of quality management system is important. However, the *U.S. Public Sector Protocol* recognizes that public organizations have limited resources and, unlike financial accounting, organizational GHG inventories involve a level of scientific and engineering complexity. Organizations should develop their inventory program and quality management system as a cumulative effort in keeping with their resources, the broader evolution of policy, and their own organizational mission.

A practical framework for the quality management of a GHG accounting system, such as the Inventory Management Plan (IMP) developed by the EPA Climate Leaders program, should describe the steps a public organization can take in developing a GHG inventory, including GHG accounting procedures, and data collection and reporting.[19] It should provide a process for preventing and correcting errors, and identifying areas where investments will likely lead to the greatest improvement in overall inventory quality. However, the primary objective of quality management is to ensure the credibility of an organization's GHG inventory information. The first step towards achieving this objective is defining inventory quality.

[19] See EPA, *Program Guide for Climate Leaders*, March 2007.

## Defining inventory quality

Chapter 1 outlines five accounting principles that set an implicit standard for the faithful representation of an organization's GHG emissions through its technical, accounting, and reporting efforts. Putting these principles into practice will result in a credible and unbiased treatment and presentation of issues and data. The goal of a quality management system is to ensure that these principles are put into practice.

This chapter outlines the steps a public organization can take to implement practical inventory quality assurance measures, and addresses the limitations of uncertainty estimates.

## An inventory program framework

A practical framework is needed to help public organizations conceptualize and design a quality management system and to help plan for future improvements. This framework focuses on the following institutional, managerial, and technical components of an inventory (see Table 7-1):

*Methods*. These are the technical aspects of inventory preparation. Public organizations should select or develop methods for estimating emissions that accurately represent the characteristics of their source categories. The GHG Protocol maintains a set of online calculation tools which contain default methods and emission factors to help with this effort. In addition, many voluntary and mandatory reporting programs specify calculation methodologies and procedures. The design of an inventory program and quality management system should provide for the selection, application, and updating of inventory methods as new research becomes available, changes are made to organizational operations, or the importance of inventory reporting is elevated.

*Data*. Data are the basic information on activity levels, emission factors, processes, and operations. Although methods need to be appropriately rigorous and detailed, data quality is as important. No method can compensate for poor quality input data. The design of an organization's inventory program should facilitate the collection of high-quality inventory data and the maintenance and improvement of collection procedures.

*Inventory processes and systems*. These are the institutional, managerial, and technical procedures for preparing GHG inventories. They include the team and processes charged with the goal of producing a high-quality inventory. To streamline GHG inventory quality management, these processes and systems should be integrated, where appropriate, with other organizational processes related to quality.

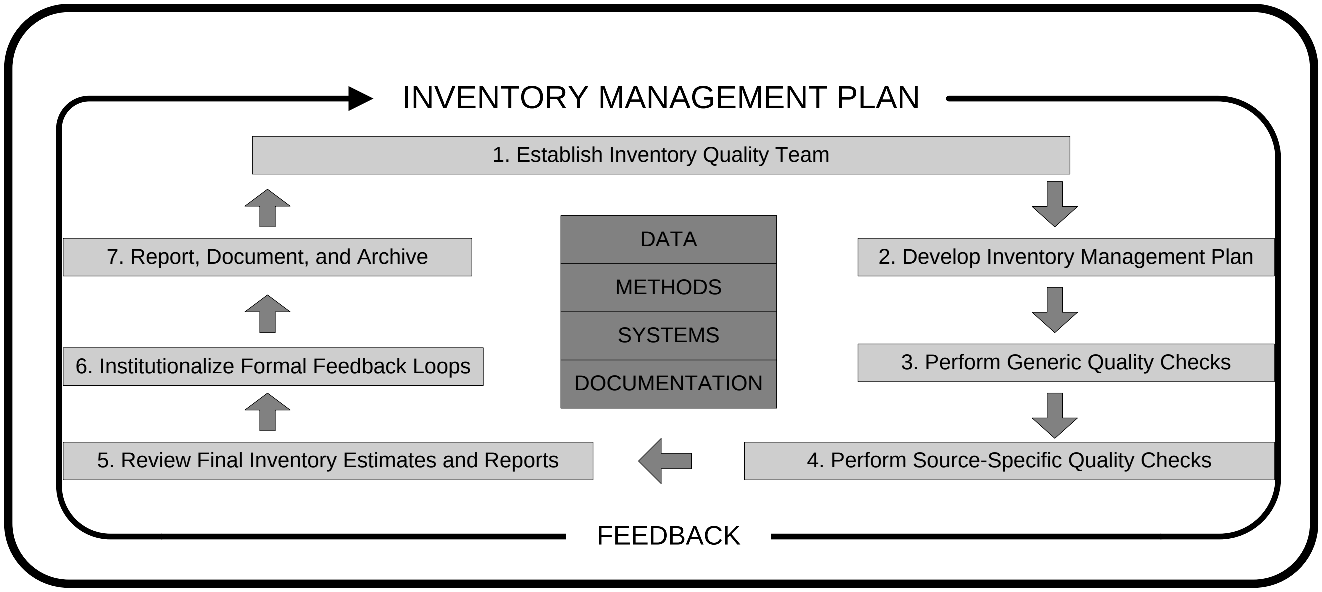
*Documentation*. This is the record of methods, data, processes, systems, assumptions, and estimates used to prepare an inventory. It includes everything employees need to prepare and improve an organization's inventory. Because estimating GHG emissions is inherently technical (involving engineering and science) and data intensive, high-quality, transparent documentation is particularly important for credibility. If information is not credible or fails to be effectively communicated to internal and external stakeholders, it will not have value.

*Table 7-1. Inventory Quality Management Fundamentals*

| Inventory component | Details |
|---|---|
| Methods—the technical aspects of inventory preparation | Define inventory boundaries and treatment of joint ventures and identify sources, etc. (see Chapters 3, 4, and 6).<br>Identify methods for estimating emissions; the GHG Protocol website (http://www.ghgprotocol.org/) provides many default methods and tools to help organizations with this effort.<br>Establish procedures for applying and updating inventory methods in response to new organization activities, new technical information, or new reporting requirements. |
| Data—the basic information on activity levels, emission factors, processes, and operations | Develop the approach and assign roles and responsibilities to facilitate collection of high-quality inventory data.<br>Create a process for the maintenance and improvement of data collection procedures. |
| Inventory processes and systems—the institutional, managerial, and technical procedures for preparing GHG inventories | Define all institutional, managerial, and formal procedural aspects required to develop and maintain a GHG inventory that meets the *U.S. Public Sector Protocol* accounting and reporting standard.<br>Whenever reasonable, integrate these processes with other organizational processes. |
| Documentation—the record of methods, data, processes, systems, assumptions, and estimates used to prepare an inventory | Identify data requirements and document procedures for obtaining the data, including data sources and contact information for key personnel.<br>Identify internal and external audiences and develop procedures to document information intended for their use.<br>Establish documentation sufficient for an inventory development team to accurately and efficiently continue preparing and improving all four fundamentals in the organization's inventory.<br>Ensure that documentation provides sufficient transparency to facilitate potential internal or external verification. |

Adopted from EPA, *Program Guide for Climate Leaders*, March 2007, http://epa.gov/climateleaders/

*Figure 7-1. Inventory Quality Management System*




Adopted from the *GHG Protocol Corporate Standard*, 2004

## Implementing an inventory quality management system

An organization's quality management system should address all four of the inventory components described above. To implement the system, an organization should take the following seven steps (see Figure 7-1):

1. *Establish an inventory quality team*. This team is responsible for implementing a quality management system and continually improving inventory quality. The team or manager should coordinate interactions between relevant operational units, facilities, and external entities such as government programs, research institutions, verifiers, or consulting firms.

2. *Develop an Inventory Quality Management Plan*. This plan describes the steps an organization is taking to develop a GHG inventory, which should be incorporated into the design of its inventory program from the beginning, although further rigor and coverage of certain procedures may be phased in over multiple years. The Quality Management Plan should include procedures for all organizational levels and inventory development processes—from initial data collection to final reporting of accounts. For efficiency and comprehensiveness, public organizations should integrate (and extend as appropriate) existing quality assurance systems to cover GHG management and reporting, such as any procedures in the ISO 9000 (Quality Management) and ISO 14001 (Environmental Management) family of standards. To ensure accuracy, the bulk of the plan should focus on practical measures for ensuring quality, as described in steps 3 and 4.

3. *Perform generic quality checks*. These checks are "generic" in that they apply to data and processes across the entire inventory, focusing on data handling, documentation, and emission calculation activities (e.g., ensuring that the correct unit conversions are used). Guidance on quality checking procedures is provided in the section on implementation below (see Table 7-2).

*Table 7-2. Generic Quality Management Measures*

| |
|---|
| **Data gathering, input, and handling activities** |
| Check a sample of input data for transcription errors. |
| Validate input data prior to calculating GHG emissions to check for outliers (e.g., impossibly high fuel economy rates for vehicles) |
| Identify spreadsheet modifications that could provide additional controls for data protection or checks on quality. |
| Ensure that adequate version control procedures for electronic files have been implemented. |
| **Data documentation** |
| Confirm that bibliographical data references are included in spreadsheets for all primary data. |
| Check that copies of cited references have been archived. |
| Check that assumptions and criteria for selection of boundaries, base year, methods, activity data, emission factors, and other parameters are documented. |
| Check that changes in data or methods are documented. |
| **Calculating emissions and checking calculations** |
| Check whether emission units, parameters, and conversion factors are appropriately labeled. |
| Check whether units are properly labeled and correctly carried through from the beginning to the end of calculations. |
| Check that conversion factors are correct. |
| Check the data processing steps (e.g., equations) in the spreadsheets. |
| Check that spreadsheet input data and calculated data are clearly differentiated. |
| Check a representative sample of calculations, by hand or electronically. |
| Check some calculations with abbreviated calculations (i.e., back-of-the-envelope calculations). |
| Check the aggregation of data across source categories, operational units, etc. |
| Check consistency of time series inputs and calculations. |
| Get staff not involved in inventory development to spot check data handling and calculations |

Adopted from the *GHG Protocol Corporate Standard,* 2004

4. *Perform source-category-specific quality checks*. This includes more rigorous investigations into the appropriate application of boundaries, recalculation procedures, and adherence to accounting and reporting principles for specific source categories, as well as the quality of the data input used (e.g., examining whether electricity bills or meter readings are the best source of consumption data) and a qualitative description of the major causes of uncertainty in the data. The information from these investigations can also be used to support a quantitative assessment of uncertainty. Guidance on these investigations is provided in the section below on implementation.

5. *Review final inventory estimates and reports*. After the inventory is completed, an internal technical review should focus on its engineering, scientific, and other technical aspects. Subsequently, an internal managerial review should focus on securing official organizational approval of and support for the inventory. Chapter 10 addresses a third type of review involving experts external to the organization's inventory program who can verify the inventory. Most voluntary or mandatory reporting programs will specify required or recommended verification procedures.

6. *Institutionalize formal feedback loops*. The results of the reviews in step 5, as well as the results of every other component of an organization's quality management system, should be formally fed back to the person or team identified in step 1. Errors should be corrected and improvements implemented based on this feedback.

7. *Establish reporting, documentation, and archiving procedures*. The system should contain record-keeping procedures that specify the information to be documented for internal purposes, how that information should be archived, and the information to be reported to external stakeholders. Like internal and external reviews, these record-keeping procedures should include formal feedback mechanisms.

An organization's quality management system and overall inventory program should be treated as evolving, in keeping with an organization's reasons for preparing an inventory. The plan should address the organization's strategy for a multiyear implementation (i.e., recognize that inventories are part of a long-term effort), including steps to ensure that all quality control findings from previous years are adequately addressed.

## Practical Measures for Implementation

Although principles and broad program design guidelines are important, any guidance on inventory management would be incomplete without a discussion of practical inventory management measures. An organization should implement these measures at multiple levels, from the point of primary data collection to the final headquarters inventory approval process. Implementing these measures at points in the inventory program where errors are most likely to occur—such as the initial data collection phase and during calculation and data aggregation—is important. Although headquarters-level inventory quality may initially be emphasized, ensuring quality measures are implemented at all levels of disaggregation (e.g., facility, process, geographical, according to a particular scope, etc.) better prepares the organization for GHG regulation in the future.

Public organizations also need to ensure the quality of their historical emission estimates and trend data. They can do so by employing inventory quality measures to minimize biases that can arise from changes in the characteristics of the data or methods used to calculate historical emission estimates and by following the standards and guidance in Chapter 5. Source-specific quality measures that can be employed for emission factors, activity data, and emission estimates are addressed below.

### EMISSION FACTORS AND OTHER PARAMETERS

For a particular source category, calculations generally rely on emission factors and other parameters (e.g., utilization factors, oxidation rates, and methane conversion factors).[20] These factors and parameters may be published default factors, or may be based on organization or site-specific data, or direct emission or other measurements. For fuel consumption, published emission factors based on fuel energy content are generally more accurate than those based on mass or volume, except when mass- or volume-based factors have been measured at the organization- or site-specific level. Quality investigations need to assess the representativeness and applicability of emission factors and other parameters to the specific characteristics of an organization. Differences between measured and default values need to be qualitatively explained and justified on the basis of the organization's operational characteristics.

### ACTIVITY DATA

The collection of high-quality activity data is often the most significant challenge in creating GHG inventories. Therefore, establishing robust data collection procedures takes priority in the design of any organization's inventory program. The following are useful measures for ensuring the quality of activity data:

Develop data collection procedures that allow the same data to be efficiently collected in future years.

When sufficient activity data are not available to allow for reliable calculations, ensure that this lack of information is transparently conveyed in the inventory report. Note the shortcomings and attempts to estimate the missing data, and work to implement corrective measures for subsequent inventories.

Convert fuel consumption data to energy units before applying carbon content emission factors, which may better correlate to a fuel's energy content than its mass. (See the GHG Protocol calculation tools for further information about this).

Compare current year data with historical trends. If data do not exhibit relatively consistent changes from year to year, the causes for these patterns should be investigated (e.g., changes of more than 10 percent from year to year may warrant further investigation).

[20] Some emission estimates may be derived using mass or energy balances, engineering calculations, or computer simulation models. In addition to investigating the input data to these models, organizations should consider whether the internal assumptions (including assumed parameters in the model) are appropriate to the nature of their operations.

Compare activity data from multiple reference sources (e.g., government survey data or data compiled by trade associations) with organization data when possible. Such checks can ensure that consistent data are being reported to all parties. Data should also be compared among facilities within an organization.

Investigate activity data that are generated for purposes other than preparing a GHG inventory. In doing so, public organizations need to check the applicability of these data to inventory purposes, including completeness, consistency with the source category definition, and consistency with the emission factors used. For example, data from different facilities may be examined for inconsistent measurement techniques, operating conditions, or technologies. Quality control measures (e.g., ISO 9000) may have already been conducted during the data's original preparation. These measures can be integrated with the organization's quality management system.

Check that base year recalculation procedures have been followed consistently and correctly (see Chapter 5).

Check that operational and organizational boundary decisions have been applied correctly and consistently to the collection of activity data (see Chapters 3 and 4).

Investigate whether biases or other characteristics that could affect data quality have been previously identified (e.g., by communicating with experts at a particular facility or elsewhere). For example, a bias could arise from the unintentional exclusion of operations at smaller facilities or data that do not correspond exactly with organizational boundaries.

Extend quality management measures to cover any additional data (sales, production, etc.) used to estimate emission intensities or other ratios.

Use and compare data compiled for other purposes, such as U.S. federal agency energy and fuel use data that is reported to DOE under the Energy Independence and Security Act. Title IV of the Clean Air Act requires owners or operators of regulated facilities to measure and report sulfur dioxide, $NO_x$, and $CO_2$ emissions under the EPA's Acid Rain Program, and reported data on $CO_2$ emissions can often be used directly in an organization's GHG inventory.

## Emission Estimates

Estimated emissions for a source category can be compared with historical data or other estimates to ensure they fall within a reasonable range. Potentially unreasonable estimates are cause for checking emission factors or activity data and determining whether changes in method, market forces, or other events are sufficient reasons for the difference. In situations where actual emission monitoring occurs (e.g., power plant $CO_2$ emissions), the data from monitors can be compared with calculated emissions using activity data and emission factors.

If any of the above emission factor, activity data, emission estimate, or other parameter checks indicate a problem, more detailed investigations into the accuracy of the data or appropriateness of the methods may be required. More detailed investigations can also be utilized to better assess the quality of data. One potential measure of data quality is a quantitative and qualitative assessment of their uncertainty.

**USDA Forest Service: Ensuring data quality**

Through the process of creating a GHG inventory for the 6 National Forests in the Greater Yellowstone Area, the USDA Forest Service identified several important procedures that helped ensure data quality and the accuracy of the GHG inventory. Given that organizations are often faced with inconsistent and incomplete data records, an important first step was to create user-friendly templates when requesting data from field offices or utility companies, with instructions as to whether the data should be gathered on a calendar or fiscal-year basis, and expressed in consistent units (BTUs, kWhs, etc.). The Forest Service also noted the importance of documenting all calculation assumptions and creating copies of the raw data, so that different individuals could each perform quality-control checks throughout the inventory process. These quality-control checks became critical when they sought to calculate the GHG emissions from its leased vehicles. The leasing agency provided data on fuel consumption and vehicle miles traveled; but when performing a quality control check, the Forest Service determined that the data implied impossibly high vehicle fuel economies. Had the Forest Service not performed these checks, it would have based its GHG mitigation strategies on incorrect data.

## Inventory Quality and Inventory Uncertainty

Preparing a GHG inventory is inherently both an accounting and a scientific exercise. Most applications for organization-level emissions and removal estimates require that these data be reported in a format similar to financial accounting data. In financial accounting, it is standard practice to report individual point estimates (i.e., single values rather than a range of possible values). In contrast, the standard practice for most scientific studies of GHG and other emissions is to report quantitative data with estimated error bounds (i.e., uncertainty). Just like financial figures in a profit/ loss statement or bank account statement, point estimates in an organization emission inventory have obvious uses. However, what value does a quantitative measure of uncertainty bring to an emission inventory?

In an ideal situation, in which an organization had perfect quantitative information on the uncertainty of its emission estimates at all levels, the primary use of this information would almost certainly be comparative. Such comparisons might be made across public organizations, operational units, or source categories or through time. In this situation, inventory estimates could even be rated or discounted on the basis of their quality before they were used, with uncertainty being the objective quantitative metric for quality. Unfortunately, such objective uncertainty estimates rarely exist.

## Types of Uncertainties

Uncertainties associated with GHG inventories can be broadly categorized into *scientific uncertainty* and *estimation uncertainty*. Scientific uncertainty arises when the science of the actual emission or removal process is not completely understood. For example, many direct and indirect factors associated with global warming potential (GWP) values that are used to combine emission estimates for various GHGs involve significant scientific uncertainty. Analyzing and quantifying such scientific uncertainty is extremely problematic and is likely to be beyond the capacity of most organization inventory programs.

Estimation uncertainty arises any time GHG emissions are quantified. Therefore, all emissions or removal estimates are associated with estimation uncertainty. Estimation uncertainty can be further classified into two types: model uncertainty and parameter uncertainty.[21]

**Model uncertainty** refers to the uncertainty associated with the mathematical equations (i.e., models) used to characterize the relationships between various parameters and emission processes. For example, model uncertainty may arise either due to the use of an incorrect mathematical model or inappropriate input into the model. As with scientific uncertainty, estimating model uncertainty is likely to be beyond most organization's inventory efforts.

**Parameter uncertainty** refers to the uncertainty associated with quantifying the parameters used as inputs (e.g., activity data and emission factors) into estimation models. Parameter uncertainties can be evaluated through statistical analysis, measurement equipment precision determinations, and expert judgment. Quantifying parameter uncertainties and then estimating source category uncertainties on the basis of these parameter uncertainties will be the primary focus of public organizations that choose to investigate the uncertainty in their emission inventories.

## Limitations of Uncertainty Estimates

Given that only parameter uncertainties are within the feasible scope of most public organizations, uncertainty estimates for organization GHG inventories are inherently imperfect. Complete and robust sample data are not always available to assess the statistical uncertainty in every parameter.[22] For most parameters (e.g., gallons of gasoline purchased or tons of limestone consumed), only a single data point may be available. In some cases, public organizations can utilize instrument precision or calibration information to inform their assessment of statistical uncertainty. However, to quantify some of the systematic uncertainties associated with parameters and to supplement

[21] Emissions estimated from direct emissions monitoring generally only involve parameter uncertainty (e.g., equipment measurement error).

[22] Statistical uncertainty results from natural variations (e.g., random human errors in the measurement process and fluctuations in measurement equipment). Statistical uncertainty can be detected through repeated experiments or sampling of data.

statistical uncertainty estimates,[23] public organizations usually have to rely on expert judgment.[24] The problem with expert judgment, though, is that it is difficult to obtain in a comparable (i.e., unbiased) and consistent manner across parameters, source categories, or different public organizations.

For these reasons, almost all comprehensive estimates of uncertainty for GHG inventories are not only imperfect but also have a subjective component and, despite the most thorough efforts, are themselves highly uncertain. In most cases, uncertainty estimates cannot be interpreted as an objective measure of quality, nor can they be used to compare the quality of emission estimates between source categories or public organizations.

The following cases—which assume that either statistical or instrument precision data are available to objectively estimate each parameter's statistical uncertainty (i.e., expert judgment is not needed)—are exceptions:

When two operationally similar facilities use identical emission estimation methods, the differences in scientific or model uncertainties can, for the most part, be ignored. Quantified estimates of statistical uncertainty can be treated as being comparable between facilities. Some trading programs that prescribe specific monitoring, estimation, and measurement requirements aim for this type of comparability. However, even in this situation, the degree of comparability depends on the flexibility that participants are given for estimating emissions, homogeneity across facilities, and level of enforcement and review of the methods used.

Similarly, when a single facility uses the same estimation method each year, the systematic parameter uncertainties—in addition to scientific and model uncertainties—in a source's emission estimates for 2 years are, for the most part, identical.[25] Because the systematic parameter uncertainties then cancel out, the uncertainty in an emission trend (e.g., the difference between the estimates for 2 years) is generally less than

[23] Systematic parameter uncertainty occurs if data are systematically biased. In other words, the average of the measured or estimated value is always less or greater than the true value. Biases arise, for example, because emission factors are constructed from non-representative samples, all relevant source activities or categories have not been identified, or incorrect or incomplete estimation methods or faulty measurement equipment have been used. Because the true value is unknown, such systematic biases cannot be detected through repeated experiments and, therefore, cannot be quantified through statistical analysis. However, identifying biases (and, sometimes, quantifying them) through data quality investigations and expert judgments is possible.

[24] The role of expert judgment can be twofold: first, it can provide the data necessary to estimate the parameter, and second, it can help (in combination with data quality investigations) identify, explain, and quantify both statistical and systematic uncertainties.

[25] Biases may not be constant from year to year, instead exhibiting a pattern over time (e.g., growing or falling). For example, an organization that continues to disinvest in collecting high-quality data may create a situation in which the biases in its data get worse each year. These types of data quality issues are extremely problematic because of the effect they can have on calculated emission trends. In such cases, systematic parameter uncertainties cannot be ignored.

the uncertainty in total emissions for a single year. In such a situation, quantified uncertainty estimates can be treated as being comparable over time and used to track relative changes in the quality of a facility's emission estimates for that source category. Such estimates of uncertainty in emission trends can also be used as a guide for setting a facility's emissions reduction target. Trend uncertainty estimates are likely to be less useful for setting broader (e.g., organization-wide) targets (see Chapter 10) because of the general problems with comparability between uncertainty estimates across gases, sources, and facilities.

Given these limitations, the role of qualitative and quantitative uncertainty assessments in developing GHG inventories includes the following:

Promoting a broader learning and quality feedback process.

Supporting efforts to qualitatively understand and document the causes of uncertainty and help identify ways of improving inventory quality. For example, collecting the information needed to determine the statistical properties of activity data and emission factors forces one to ask hard questions and to carefully and systematically investigate data quality.

Establishing lines of communication and feedback with data suppliers to identify specific opportunities to improve the quality of the data and methods used.

Providing valuable information to reviewers, verifiers, and managers for setting priorities for investments into improving data sources and methods.

The *U.S. Public Sector Protocol* has a supplementary guidance document on uncertainty assessments ("Guidance on uncertainty assessment in GHG inventories and calculating statistical parameter uncertainty") along with an uncertainty calculation tool, both of which are available on the GHG Protocol website. The guidance document describes how to use the calculation tool in aggregating uncertainties. It also discusses in more depth different types of uncertainties, the limitations of quantitative uncertainty assessment, and how uncertainty estimates should be properly interpreted.

Additional guidance and information on assessing uncertainty—including optional approaches to develop quantitative uncertainty estimates and elicit judgments from experts—can also be found in EPA's Emissions Inventory Improvement Program, Volume VI: Quality Assurance/Quality Control (1999) and in Chapter 6 of the IPCC's Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. (2000a).

# Chapter 8
# Reporting GHG Emissions

## *WHAT INFORMATION SHOULD BE INCLUDED IN A GHG EMISSIONS REPORT?*

## STANDARD

A credible GHG emissions report presents relevant information that is complete, consistent, relevant, accurate, and transparent. While it takes time to develop a rigorous and complete organizational inventory of GHG emissions, knowledge will improve with experience in calculating and reporting data. A public GHG report should:

Be based on the best data available at the time of publication, while being transparent about its limitations;

Communicate any material discrepancies identified in previous years; and

Include the organization's gross emissions for its chosen inventory boundary separate from and independent of any purchases or trades of external GHG reduction instruments such as offsets, credits, or allowances.

The standards and guidance here are designed to be an overview of essential components in a GHG report. However, many organizations will develop their GHG reports according to requirements specified in legislation or internal management systems. Appendix A summarizes the requirements of various GHG reporting programs. For those organizations that are currently developing reporting policies, the key components listed here can serve as a foundation for inventory information.

## Required Information

Reported information shall be in accordance with the principles highlighted in Chapter 1 of this *U.S. Public Sector Protocol*; namely, it will be "relevant, complete, consistent, transparent, and accurate." In addition, inventories shall include reporting of scope 1 and scope 2 emissions at a minimum. A public GHG emissions report that is in accordance with the *U.S. Public Sector Protocol* shall include the information in the following subsections.

### DESCRIPTION OF BOUNDARIES AND REPORTING PERIOD

This description shall include the following:

An outline of the organizational boundaries chosen, including the chosen consolidation approach

An outline of the operational boundaries chosen, and if scope 3 is included, a list specifying the types of activities covered

The reporting period covered

### Information on Emissions

This information shall include the following:

Emissions data for all six GHGs separately ($CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, and $SF_6$) in metric tons, and also in metric tons of carbon dioxide equivalent ($CO_2e$)

Emissions data separately for each scope (scope 1 and 2 required, scope 3 is optional)

Total scope 1 and 2 emissions, independent of any sales, purchases, transfers, or banking of GHG offsets/credits/allowances

Emissions data for direct $CO_2$ emissions from the combustion of biologically sequestered carbon (e.g., $CO_2$ from burning biomass or biofuels), reported separately from the scopes

Year chosen as base year (designated as calendar year or fiscal year), and an emissions profile over time that is consistent with and clarifies the chosen policy for making base year emission recalculations.

Appropriate context for any significant emission changes that trigger base-year emissions recalculation (subsuming or shedding resources and responsibilities, outsourcing or insourcing, changes in reporting boundaries or calculation methods, etc.)

Methods used to calculate or measure emissions, providing a reference or link to any calculation tools used

Any specific exclusion of sources, facilities, programs, or operations (for example, for exemptions required for security).

## Optional Information

A public GHG emissions report should include, when applicable, the following additional information.

### Information on Emissions and Performance

This information includes the following:

Emissions data from relevant scope 3 activities for which reliable data can be obtained

Emissions data further subdivided, where this aids transparency, by program, facilities, location, source types (stationary combustion, process, fugitive, etc.), and activity types (production of electricity, transportation, generation of purchased electricity that is sold to end users, etc.)

Emissions from on-site generation of electricity, heat, or steam that is sold or transferred to another organization (see Chapter 4)

Emissions from the generation of electricity, heat, or steam that is purchased for resale to non-end users (see Chapter 4)

A description of performance measured against internal and external benchmarks (see Chapter 10 for more on target setting)

Emissions from GHGs not covered by the Kyoto Protocol (e.g., CFCs, NOx), reported separately from scopes

Relevant ratio performance indicators (e.g., emissions per kilowatt-hour or emissions per unit of service provided) (see Chapter 10)

An outline of any GHG management or reduction programs or strategies

Information on any contractual provisions addressing GHG-related risks and obligations

An outline of any external assurance provided and a copy of any verification statement, if applicable, of the reported emissions data

Information on the causes of emission changes that did not trigger a base-year emissions recalculation (e.g., process changes, efficiency improvements, plant closures)

GHG emissions data for all years between the base year and the reporting year (including details of and reasons for recalculations, if appropriate)

Information on the quality of the inventory (e.g., information on the causes and magnitudes of uncertainties in emission estimates) and an outline of policies in place to improve inventory quality (see Chapter 7)

Information on any GHG sequestration

A list of facilities included in the inventory.

A contact person

### INFORMATION ON OFFSETS

This information should include the following:

Information on allowable offsets that have been purchased or developed outside the inventory boundary, subdivided by GHG storage or removals and emission reduction projects, including specification whether the offsets are verified or certified or approved by an external GHG program (e.g., the Clean Development Mechanism, Green-e, etc.)

Information on emission reductions at sources inside the inventory boundary that have been sold or transferred as offsets to a third party, when allowed, including specification whether the reduction has been verified or certified or approved by an external GHG program.

# GUIDANCE

By following the *U.S. Public Sector Protocol* reporting requirements, users adopt a comprehensive standard with the necessary detail and transparency for credible public reporting. The reporting of optional information can be determined by the objectives and intended audience for the report. An organization may wish to use parts of an inventory report as a policy planning tool, and others for compliance reporting.

Not every circulated report must contain all information as specified by this standard, but a link or reference should be made to a publicly available full report where all required information is available. For some organizations, providing emissions data for specific GHGs or facilities or programs, or reporting ratio indicators, may compromise confidentiality or security concerns. If this is the case, such data need not be publicly reported, but can be made available to those auditing the GHG emissions data, assuming confidentiality and security are assured. In contrast, other organizations have found that exposing their raw, disaggregated data as well as their final reports to multiple audiences can help provide critical fact cross-checking and feedback.

All organizations should strive to create a report that is as transparent, relevant, accurate, consistent, and as complete as possible. Structurally, this may be achieved by adopting the reporting categories of the standard (e.g., required description of the boundaries and reporting period, required information on organization emissions, optional information on emissions and performance, and optional information on offsets) as a basis of the report. Qualitatively, including a discussion of the reporting organization's strategy and goals for GHG accounting, any particular challenges or tradeoffs faced, the context of decisions on boundaries and other accounting parameters, and an analysis of emissions trends may help provide a complete picture of the organization's inventory efforts.

**Washington State Department of Transportation: an Inventory Report Identifying Significant Sources**

The Washington state Department of Transportation (DOT) conducted an inventory of its GHG emissions from 2007, and prepared an inventory report based on The Climate Registry's *General Reporting Protocol* in order to better understand its emissions. The report highlighted that 69 percent of its emissions came from operating the ferry fleet which provides access across Puget Sound, to British Columbia and to a number of other islands. Vehicle fleets constituted 14 percent of emissions, including DOT- owned passenger cars, as well as snowplows and other specialty equipment. Conducting a GHG inventory allowed the DOT to prioritize where it can reduce the most emissions and costs. In addition, having experience with a GHG inventory gave the agency an opportunity to participate in and prepare for state-level reporting requirements targeting vehicle fleets above a certain size threshold.

## Double Counting

Organizations should take care to identify and exclude from reporting any scope 2 or scope 3 emissions that are also reported as scope 1 emissions by other facilities, sub-units, or organizations included in the emissions inventory consolidation (see Chapters 4 and 6).

## Use of Ratio Indicators

Two principal aspects of GHG performance are of interest to management and stakeholders. One concerns the overall GHG impact of an organization—that is, the absolute quantity of GHG emissions released to the atmosphere. The other concerns the organization's GHG emissions normalized by some operational metric that results in a "ratio indicator." The *U.S. Public Sector Protocol* requires reporting of absolute emissions; reporting of ratio indicators is optional. Ratio indicators provide information on performance relative to operational activities, and can facilitate comparisons between similar organizations and processes over time. Organizations may choose to report GHG ratio indicators in order to:

- Evaluate performance over time, e.g., relate figures from different years, identify trends in the data, and show performance in relation to targets and base year (see Chapter 10)

- Establish a relationship between data from different categories, for example, an organization may want to establish a relationship between its organizational goals (e.g., tons of mail delivered) and its impact on society or on the environment (e.g., emissions from mail distribution)

- Improve comparability between different sizes of operations by normalizing figures (e.g., by assessing the impact of different sized organizations on the same scale).

The public sector is inherently diverse, and the circumstances of individual organizations can result in misleading indicators. Organizations should develop ratios that make sense for their activities, are relevant to their decision-making needs, and that best capture the benefits and impacts of their work, i.e., its operations, services, and effects on the marketplace and on the entire economy. Sub-units within an organization should coordinate the reporting of ratio indicators to ensure the indicators' relevance and consistency where possible.

Some examples of different ratio indicators are provided here and in Chapter 10.

### PRODUCTIVITY OR EFFICIENCY RATIOS

Productivity or efficiency ratios express the value or achievement of an organization divided by its GHG impact. Increasing efficiency ratios reflect a positive performance improvement. Examples of productivity ratios include resource productivity (e.g., units of service, such as number of public transportation passengers serviced per ton of $CO_2$e emitted) and process eco-efficiency (e.g., production volume per ton amount of $CO_2$e emitted).

### INTENSITY RATIOS

Intensity ratios express GHG impact per unit of physical activity or unit of productivity, reflecting the inverse of a productivity ratio. A physical intensity ratio is suitable when aggregating or comparing across organizations that have similar outputs or missions. An economic intensity ratio is suitable when aggregating or comparing across organizations that have differing operations. A declining intensity ratio reflects a positive performance improvement. Many organizations track environmental performance with intensity ratios, often called "normalized" environmental impact data. Examples of intensity ratios include product emission intensity (e.g., tons of $CO_2$e emissions per unit of electricity generated) and service intensity (e.g., tons of $CO_2$e emissions per function or per service).

### PERCENTAGES

A percentage indicator is a ratio between two similar values (with the same physical unit in the numerator and the denominator). Examples of percentages that can be meaningful in performance reports include current GHG emissions expressed as a percentage of base year GHG emissions.

For further guidance on ratio indicators, refer to GRI, 2002; and Verfaillie and Bidwell, 2000.

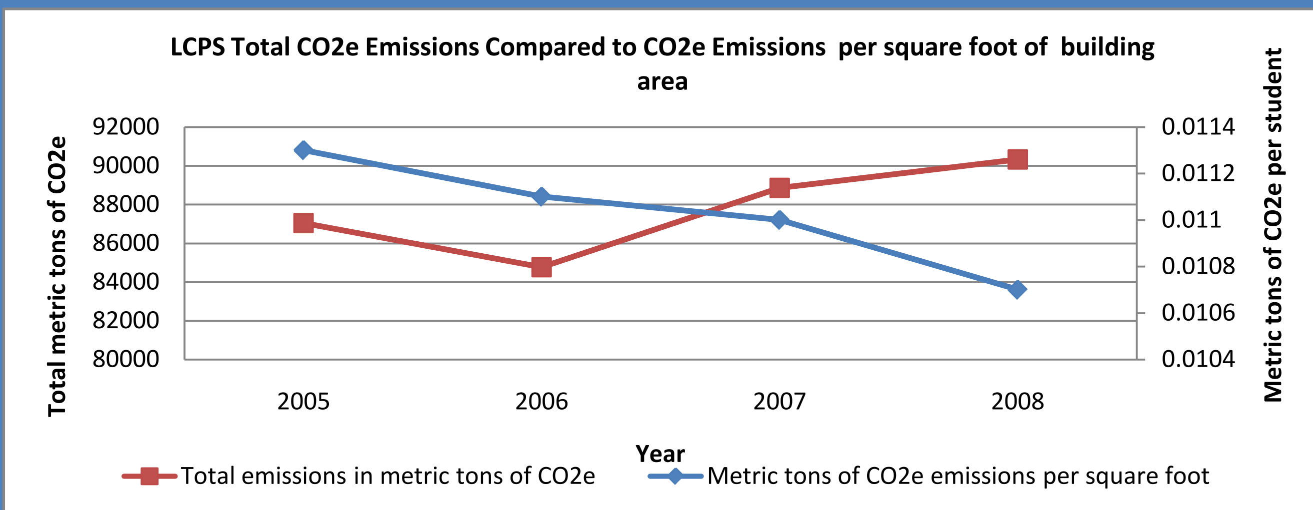
## Ratio Indicators for Loudoun County Public Schools GHG Inventory

The Energy Education Team at Loudoun County Public Schools (LCPS) in Virginia conducted its first GHG inventory based on the draft *U.S. Public Sector Protocol* in the fall of 2009. This inventory included Scope 1 and 2 emissions for each year during the period of 2005 - 2008. Previously, the team had coordinated energy conservation and efficiency improvement throughout all of the district's schools, instituted behavioral change initiatives and certified 25 buildings in the US EPA's ENERGY STAR buildings program. In recognition of the efforts made by the district, the EPA named LCPS a 2010 ENERGY STAR Partner of the Year.

Although absolute emissions for the district have increased, reductions in GHG intensity have occurred, as evidenced by the following ratios:

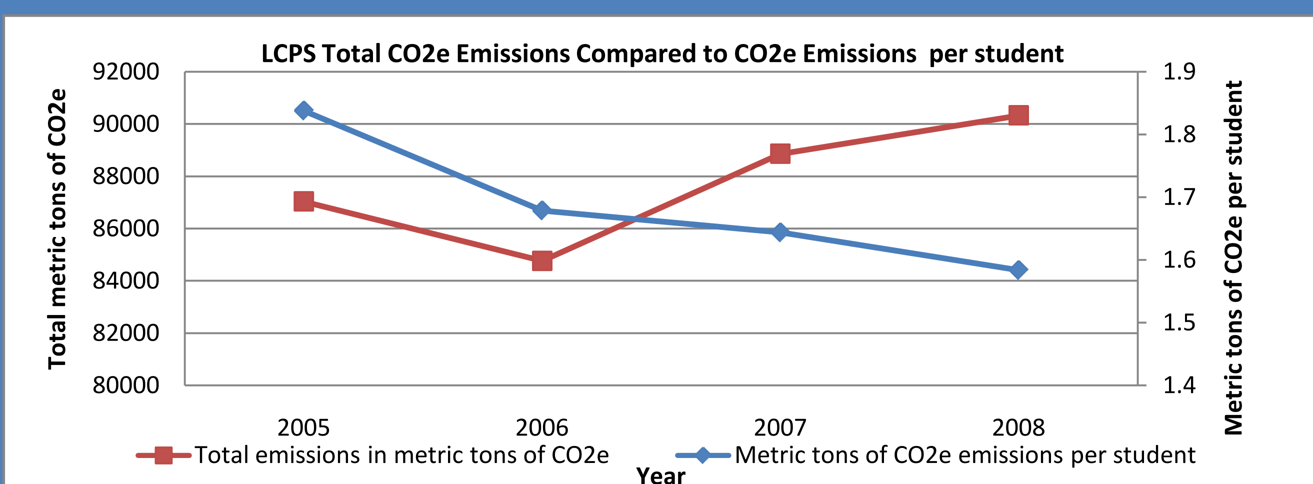
**Emissions Per Building Area**

As one of the fastest growing school districts in the nation, LCPS has increased its building area by nine percent, or over 711,183 square feet, from 2005-2008. During this same timeframe, emissions per square foot have gone down by .0006 metric tons/square foot, or 5% below 2005 levels. See the chart below.




**Emissions Per Student**

LCPS, like many public organizations, is unable to directly control the population growth trends within its boundaries. Over the four year period reflected in the GHG inventory, student enrollment grew by 9,648. This represents a 20% increase over the 2005 student enrollment level. During this same time period, emissions per student have declined by 0.254 metric tons / student, or 14% below 2005 levels. See the chart below.




The LCPS Planning & Legislative Services division projects that from 2010-2015, the district's student enrollment will expand by another 16,200 students. This will represent an increase of over 50% above the 2005 student level. Because of this rapid growth, there will likely be an increase in absolute emissions. However, considering the context of efforts made by a public body, and expressing emissions in terms of relevant ratio indicators can provide a critical performance benchmark by which the LCPS's energy management efforts can be meaningfully compared over time and to other similar organizations.

# Chapter 9
# Verification of GHG Emissions

### *WHAT DATA MUST BE AVAILABLE TO OBTAIN EXTERNAL VERIFICATION OF THE INVENTORY DATA?*

## GUIDANCE

Verification[26] is an objective independent assessment of the accuracy and completeness of reported GHG information and its conformance to pre-established GHG accounting and reporting principles. Although the practice of verifying public sector inventories is still evolving, verification methodologies have become well-established. This chapter provides an overview of the key elements of a GHG verification process. It is relevant to organizations that are developing GHG inventories and have planned for, or are considering, obtaining an independent verification of their results and systems. It is critical for public sector organizations who face potential conflict of interest issues when selecting external parties to provide inventory and verification services. This chapter is also important for government organizations that may be charged with verification, auditing, or compliance enforcement duties. Furthermore, as the process of developing a verifiable inventory is largely the same as that for obtaining reliable and defensible data, this chapter is also relevant to all organizations regardless of any intention to commission a GHG inventory verification.

Verification involves an assessment of the risks of material discrepancies in reported data. Discrepancies relate to differences between reported data and data generated from the proper application of the relevant standards and methods.

## Relevance of GHG Principles

The primary aim of verification is to provide confidence to users that the reported information and associated statements represent a faithful, true, and fair account of an organization's GHG emissions. Ensuring transparency of the inventory data is crucial for verification. The more transparent, well controlled, and well-documented an organization's emissions data and systems are, the easier it will be to verify. As outlined in Chapter 1, a number of GHG accounting and reporting principles need to be followed when compiling a GHG inventory. Adherence to these principles, along with a transparent, well-documented system (sometimes referred to as an audit trail)

[26] Verification is also known as "assurance"

will facilitate a successful verification. While transparency is essential, certain organizations may need to restrict the release of some information due to security concerns with its release.

## Goals

Before commissioning an independent verification, an organization should clearly define its goals and decide whether they are best met by an external verification process. Common reasons for undertaking verification include the following:

- Increased credibility of publicly reported emissions information and progress toward GHG targets, leading to enhanced stakeholder trust
- Increased senior management confidence in reported information on which to base investment and target-setting decisions
- Improvement of internal accounting and reporting practices (e.g., calculation, recording, and internal reporting systems, and the application of GHG accounting and reporting principles) and facilitation of learning and knowledge transfer within the organization
- Mandatory verification requirements of GHG programs
- Response to reporting requests or mandates from other sectors (e.g., states reporting to the federal government).

## Internal Assurance

As noted in Chapter 7, a quality GHG inventory requires a thorough "first party" review of data and procedures as a basic level of verification. Verification is often, but not always, also undertaken by an independent, external "third party" verifier. For stakeholders, external third-party verification is likely to significantly increase the credibility of the GHG inventory. Third-party reviews bring unbiased expert analysis to bear, providing a level of confidence to stakeholders that formal procedures and reliable data have been utilized and reported.

Many organizations interested in improving their GHG inventories may also subject their information to internal verification by personnel independent of the GHG accounting and reporting process through a "second party" verification process. Independent internal verifications can provide valuable assurance over the reliability of information. Internal verification can be a worthwhile learning experience for an organization prior to commissioning an external verification by a third party. It can also provide external verifiers with useful information to begin their work. Both internal and external verification should follow similar procedures and processes.

## Concept of Materiality

The concept of "materiality" is essential to understanding the process of verification. Chapter 1 provides a useful interpretation of the relationship between the principle of completeness and the concept of materiality. Information is considered to be material if, by its inclusion or exclusion, it can be seen to influence any decisions or actions taken by users of it. A material discrepancy is an error (for example, from an oversight, omission, or miscalculation) or combination of errors that results in a reported quantity or statement significantly differing from the true value or meaning[27]. To express an opinion on data or information, a verifier would need to form a view on the materiality of all identified errors or uncertainties.

While the concept of materiality involves a value judgment, the point at which a discrepancy becomes material (materiality threshold) is usually predefined. As a rule of thumb, an error is considered to be materially misleading if its value exceeds 5 percent of the total inventory for the part of the organization being verified.

However, the verifier needs to assess an error or omission in the full context in which information is presented. For example, if a 2 percent error prevents an organization from achieving its organizational target, this would most likely be considered material. Understanding how verifiers apply a materiality threshold enables companies to more readily establish whether the omission of an individual source or activity from their inventory is likely to raise questions of materiality.

Materiality thresholds may also be outlined in the requirements of a specific GHG program or determined by a national verification standard, depending on the entity requiring the verification and the reasons. A materiality threshold provides guidance to verifiers on what may be an immaterial discrepancy so that they can concentrate their work on areas that are more likely to lead to materially misleading errors.

## Assessing Risk of Material Discrepancy

Verifiers need to assess the risk of material discrepancy of each component of the GHG information collection and reporting process. This assessment is used to plan and direct the verification process. In assessing this risk, they consider a number of factors, including the following:

The structure of the organization and the approach used to assign responsibility for monitoring and reporting GHG emissions

The approach and commitment of management to GHG monitoring and reporting

[27] This is not the same as a *de minimis* threshold. A *de minimis* threshold establishes an emissions source or group of sources to either exclude from the inventory or apply an alternative estimation method. See discussion on completeness in Chapter 1.

Development and implementation of policies and processes for monitoring and reporting (including documented methods explaining how data are generated and evaluated)

Processes used to check and review calculation methods

The complexity and nature of operations

The complexity of the computer information system used to process the information

The type, state of calibration, and maintenance of equipment used

The reliability and availability of input data

Assumptions and estimations applied

Aggregation of data from different sources

Other assurance processes to which the systems and data are subjected (e.g., internal audit and external reviews and certifications).

## Establishing Verification Parameters

The scope of an independent verification and the level of assurance it provides are influenced by the organization's goals or any specific jurisdictional requirements. This scope may be predefined by legislation or guidance for public organizations. The verification provider may also be determined by law or regulation.

Verifying the entire GHG inventory or specific parts is possible. Discrete parts may be specified in terms of geographic location, operating units, facilities, and type of emissions. The verification process may also examine more general managerial issues, such as quality management procedures, managerial awareness, availability of resources, clearly defined responsibilities, segregation of duties, and internal review procedures.

The organization and verifier should reach an agreement upfront on the scope, level, and objective of the verification. This agreement (often referred to as the scope of work) will address issues such as the information to be included in the verification (e.g., head office consolidation only or information from all sites), the level of scrutiny to which selected data will be subjected (e.g., desk top review or on-site review), and the intended use of the results of the verification. The materiality threshold is another item to be considered in the scope of work. It is a key consideration for both the verifier and the organization and is linked to the objectives of the verification.

The scope of work is influenced by what the verifier actually finds once the verification commences and, as a result, the scope of work must remain sufficiently flexible to enable the verifier to adequately complete the verification.

A clearly defined scope of work is not only important to the organization and verifier, but also for external stakeholders to be able to make informed and appropriate decisions. Verifiers ensure that specific exclusions have not been made solely to improve the organization's performance. To enhance transparency and credibility, organizations should make the scope of work publicly available.

## Site Visits

Depending on the level of assurance required from verification, verifiers may need to visit a number of sites to enable them to obtain sufficient and appropriate evidence over the completeness, accuracy, and reliability of reported information. The sites visited should be representative of the organization as a whole. The selection of sites to be visited is based on a number of factors, including the following:

Nature of the operations and GHG sources at each site

Complexity of the emissions data collection and calculation process

Percentage contribution to total GHG emissions from each site

The risk that the data from sites are materially misstated

Security requirements of sites (e.g., restrictions)

Competencies and training of key personnel

Results of previous reviews, verifications, and uncertainty analyses.

## Timing of the Verification

A verifier can be engaged at various points during the GHG preparation and reporting process. Some organizations may establish a semi-permanent internal verification team to ensure that GHG data standards are continuously met and improved. Verification during a reporting period allows for any reporting deficiencies or data issues to be addressed before the final report is prepared. This may be particularly useful for organizations preparing high-profile public reports. However, some GHG programs may require, often on a random selection basis, an independent verification of the GHG inventory following the submission of a report. Verification timing may also be established by government regulation, law, or EO. In all cases, the verification cannot be closed out until the final data for the period has been submitted.

## Selecting a Verifier

Factors to consider when selecting a verifier include their

- Accreditation by relevant GHG programs

- Previous experience and competence in undertaking GHG verifications;

- Understanding of GHG issues, including calculation methods;

- Understanding of the organization’s operations and industry

- Objectivity, credibility, and independence.

The knowledge and qualifications of the individuals conducting the verification can be more important than those of the organizations from which they come. Large organizations may actually have a predefined internal verifier established by a regulation, law, or EO. In cases where the verifier is not pre-defined, organizations should select groups on the basis of their knowledge and qualifications and ensure that the lead verifier assigned is appropriately experienced. Effective verification of GHG inventories often requires a mix of specialized skills, not only at a technical level (e.g., engineering experience, industry specialists), but also at an operational level (e.g., verification and industry specialists).

## Preparing for GHG Verification

The internal processes described in Chapter 7 are likely to be similar to those followed by an independent verifier. Therefore, materials that the verifiers need are similar. Information required by an external verifier is likely to include the following:

Information about the organization (list of sub-organizations and their geographic location, ownership structure, financial entities within the organization)

Selected consolidation approach as defined in Chapter 3

Information about the organization’s main activities and GHG emissions (types of GHG produced, description of activity that causes GHG emissions)

Details of any changes to organizational boundaries or processes during the period, including the effects of these changes on emissions data

Details of inter-organization and other partnering agreements, outsourcing and contractor agreements, production sharing agreements, emissions rights and other legal or contractual documents that determine the organizational and operational boundaries

Documented procedures for identifying sources of emissions within the organizational and operational boundaries

Information on other assurance processes to which the systems and data are subjected (e.g., internal audit, external reviews and certifications)

- Data used for calculating GHG emissions. This might, for example, include the following:
  - Energy consumption data (invoices, delivery notes, weigh-bridge tickets, meter readings: electricity, as pipes, steam, and hot water, etc.)
  - Production data (tons of material produced, kWh of electricity produced, etc.)
  - Raw material consumption data for mass balance calculations (invoices, delivery notes, weigh-bridge tickets, etc.)
  - Emission factors (laboratory analysis, etc.)
- Description of how GHG emissions data have been calculated:
  - Emission factors and other parameters used and their justification
  - Assumptions on which estimations are based
  - Information on the measurement accuracy of meters and weigh-bridges (e.g., calibration records) and other measurement techniques
  - Documentation of any GHG sources or activities excluded due to, for example, technical or cost reasons
- Information gathering process:
  - Description of the procedures and systems used to collect, document, and process GHG emissions data at the facility and organization level
  - A roadmap documenting files (including filenames) containing the raw activity data, intermediate processed data and final calculations
  - Description of quality control procedures applied (internal audits, comparison with last year's data, recalculation by second person, etc.)
- Other information:
  - List of (and access to) persons responsible for collecting GHG emissions data at each site and at the organizational level (name, title, e-mail, and telephone numbers)
  - Information on uncertainties, qualitative and, if available, quantitative.

Appropriate documentation needs to be available to support the GHG inventory being subjected to external verification. Statements made by management for which no supporting documentation is available cannot be verified. When a reporting organization has not yet implemented systems for routinely accounting and recording GHG emissions data, an external verification is difficult and may result in the verifier being unable to issue an opinion. Under these circumstances, the verifiers may make recommendations on how current data collection and collation process should be improved so that an opinion can be obtained in future years.

Organizations are responsible for ensuring the existence, quality, and retention of documentation to create an audit trail of how the inventory was compiled. If an organization issues a specific base year against which it assesses its GHG performance, it should retain all relevant historical records to support the base-year data. These issues should be kept in mind when designing and implementing GHG data processes and procedures.

## Using the Verification Findings

Before the verifiers verify that an inventory has met the relevant quality standard, they may require the organization to adjust any material errors identified during the course of the verification. If the verifiers and the organization cannot agree on the adjustments, the verifier may not be able to provide the organization with an unqualified opinion. All material errors (individually or in aggregate) need to be amended prior to the final verification sign off.

As well as issuing an opinion on whether the reported information is free from material discrepancy, the verifiers may, depending on the agreed upon scope of work, also issue a verification report containing a number of recommendations for future improvements. The process of verification should be viewed as a valuable input to the process of continual improvement. Other entities outside of the organization may have responsibilities for improving the recording and reporting process as well. Whether verification is undertaken for the purposes of internal review, public reporting, or certifying compliance with a particular GHG program, it is likely to contain useful information and guidance on how to improve and enhance an organization's GHG accounting and reporting system.

Similar to the selected verifiers, those selected to assess and implement responses to the verification findings should also have the appropriate skills and understanding of GHG accounting and reporting issues.

# Chapter 10
# Setting a GHG Target

## *WHAT IS INVOLVED IN SETTING AN EMISSIONS TARGET AND HOW DO I REPORT PERFORMANCE IN RELATION TO MY TARGET?*

## GUIDANCE

Setting targets is a routine practice that helps ensure that an issue has senior management's attention and is factored into relevant decisions about the services provided, and the materials and technologies used. Often, an organizational GHG emission reduction target is the logical follow-up to developing a GHG inventory. Some government organizations may also be required to meet mandatory reduction targets, in which case these guidelines can serve to inform those policies.

Within an organization's target, there may be operating unit goals such as reducing $CO_2$ from a specific source, department or division. Further, within an operating unit, goals can be set for specific operations or locations. While setting targets may be within the authority of many organizations, the targets may also be imposed on an organization from within the hierarchical structure.

This chapter provides guidance on the process of setting and reporting on an organizational GHG target. Although the chapter focuses on emissions, many of the considerations equally apply to GHG sequestration (see Appendix C). This chapter does not prescribe an organization's target, but focuses on the steps involved, choices to be made, and implications of those choices.

### Why Set a GHG Target?

Any robust public sector performance strategy requires setting targets for productivity, mission accomplishment, and other core indicators, as well as tracking performance against those targets. Likewise, effective GHG management involves setting a GHG target. As organizations develop strategies to reduce the GHG emissions of their products and operations, organization-wide GHG targets are often key elements of these efforts, even if only some parts of the organization are or will be subject to mandatory GHG limits. Common drivers for setting a GHG target include the following:

*Demonstrating leadership and organizational responsibility*. With the emergence of GHG regulations in many parts of the world, as well as growing concern about the effects of climate change, establishing and publicizing a GHG target demonstrates leadership and organizational responsibility. This can improve an organization's standing and enhance reputation with taxpayers, employees, stakeholders, partners, and the general public.

*Minimizing and managing GHG risks*. While developing a GHG inventory is an important step toward identifying GHG risks and opportunities, a GHG target is a planning tool that can drive GHG reductions. A GHG target helps raise internal awareness about the risks and opportunities presented by climate change, and ensures the issue is on the operational agenda. This can serve to minimize and more effectively manage the risks associated with climate change.

*Saving costs and stimulating innovation*. Implementing a GHG target can result in cost savings by driving improvements in process innovation and resource efficiency. Targets that apply to products can drive research and development, which in turn creates products and services that can improve efficiencies and reduce emissions associated with the use of facilities.

*Preparing for future regulations*. Internal accountability and incentive mechanisms established to support a target's implementation can also equip organizations to respond more effectively to future GHG regulations. In addition, organizations which have set and worked towards reduction targets are better positioned to contribute practical insight to shape future policy requirements.

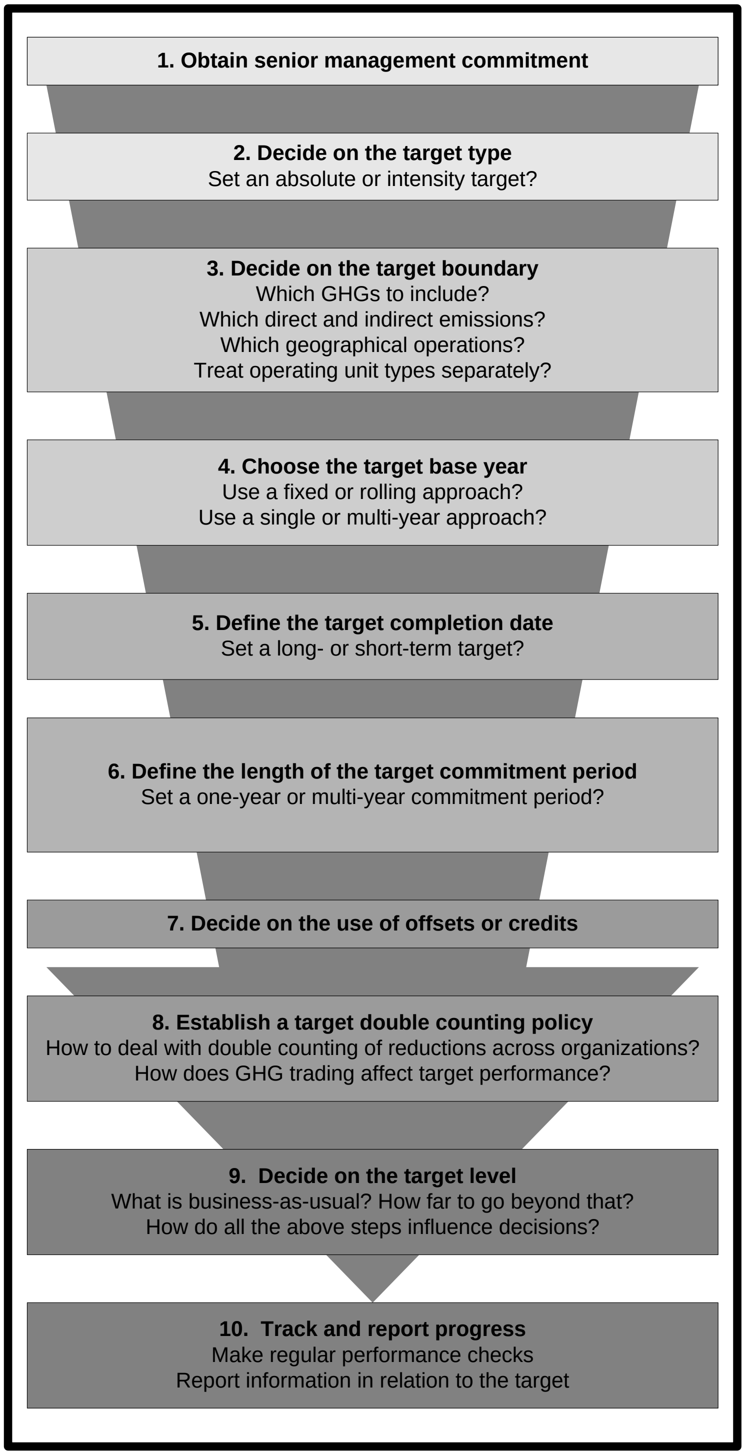
*Participating in voluntary programs*. A growing number of voluntary GHG programs are emerging to encourage and assist organizations in setting, implementing, and tracking progress toward GHG targets. Participation in voluntary programs can result in public recognition, prepare organizations for future regulations, and enhance an organization's GHG accounting and reporting capacity and understanding.

## Steps in Setting a Target

Setting a GHG target involves making choices among various strategies for defining and achieving a GHG reduction. The organizational goals, policy context, existing planning mechanisms such as Environmental Management Systems (EMS), costs of making reductions, and stakeholder discussions should inform these choices.

The following sections outline the 10 steps involved in target setting. Although presented sequentially, in practice target setting involves cycling back and forth between the steps. The organization is assumed to have developed a GHG inventory before implementing these steps. However, due to the nature of public-sector management, an EO or legislation could impose both simultaneously. Figure 10-1 summarizes the steps.

*Figure 10-1. Steps in Setting a GHG Target*




Adopted from the *GHG Protocol Corporate Standard,* 2004

## 1. OBTAIN SENIOR MANAGEMENT COMMITMENT

As with any organization-wide target, senior management buy-in and commitment, particularly at the highest level, are prerequisites for a successful GHG reduction program. Implementing a reduction target is likely to necessitate changes in behavior and decision making throughout the organization, as well as with landlords, tenants, and suppliers. It also requires establishing an internal accountability and incentive system and providing adequate resources to achieve the target. This will be difficult, if not impossible, without senior management commitment.

If a target is imposed, it may be necessary for a senior manager to understand the intricacies of an organization's GHG management plan. For example, the boundaries set (see Chapters 3 and 4) may carry legal implications in terms of which assets must be managed towards GHG emissions reductions under a mandatory program. Some elements of the program may be prescribed by regulations so adherence to these regulations will be part of official responsibilities. Delegation of responsibilities and accountability must be agreed at the senior management level.

Finally, while commitment from senior management is crucial, the setting and successful attainment of emission reduction goals requires commitment at all levels of an organization, as well as behavioral changes on the ground. Successful GHG mitigation strategies are embedded within the fabric of an organization's day-to-day operations.

## 2. Decide on the Target Type

There are two broad types of GHG targets: absolute and intensity-based. Targets can be imposed by external regulation or determined internally by an organization. An absolute target is usually expressed in terms of a specified reduction over time in the quantity of GHG emissions to the atmosphere, the unit typically being ton of $CO_2e$ (such as reducing $CO_2e$ by 20 percent below 2000 levels by 2010). An intensity target is usually expressed as a reduction in the ratio of GHG emissions relative to another operational metric over time (such as reducing $CO_2$ by 12 percent per hospital bed provided between 2000 and 2008).[28]

The comparative metric should be carefully selected. The Government Accounting Standards Board offers important guidance on the selection of measures of productivity, effectiveness, quality, and timeliness that may provide a useful starting point for organizations as they develop metrics.[29] The metric chosen can be the output of the organization (e.g., ton $CO_2e$ per blighted home restored, per student educated, or per mile of road paved) or some other metric such as office space. To facilitate transparency, organizations using an intensity target shall also report the absolute emissions from sources covered by the target. Table 10-1 summarizes the advantages and disadvantages of each type of target, and provides examples. Some organizations have both an absolute and an intensity target.

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[28] Some organizations set GHG targets by formulating this ratio the other way around.

[29] See "What is performance measurement?" *About Performance Reporting for Government*, available at: http://seagov.org/aboutpmg/performance_measurement.shtml. Accessed 3/15/2010.

*Table 10-1. Comparing Absolute and Intensity Targets*

| Advantages | Disadvantages | Examples |
|---|---|---|
| Absolute targets | | |
| Designed to achieve a reduction in a specified quantity of GHGs emitted to the atmosphere<br><br>Environmentally robust, entailing a commitment to reduce GHGs by a specified amount<br><br>Transparently address potential stakeholder concerns about the need to manage absolute emissions<br><br>Avoids complexity that may be involved with selecting intensity metrics that can apply across multiple, divers organizations | May be difficult to achieve if the organization grows unexpectedly and growth is linked to GHG emissions<br><br>Target base year recalculations for significant structural changes to the organization add complexity to tracking progress over time<br><br>Do not allow comparisons of GHG intensity or efficiency<br><br>Rewards absolute GHG reductions that may be achieved by decreasing production or services offered (contraction, see Chapter 5) | Tons $CO_2$<br><br>Tons $CH_4$<br><br>Tons $CO_2$e |
| Intensity targets | | |
| Reflect GHG performance improvements independent of expansion or contraction<br><br>Target base year recalculations for structural changes are usually not required (see step 4)<br><br>May increase the comparability of GHG performance among organizations | No guarantee that GHG emissions to the atmosphere will be reduced—absolute emissions may rise even if intensity goes down while output increases<br><br>Organizations with diverse operations may find it difficult to define a single common metric<br><br>If a monetary variable is used for the metric, it must be recalculated for changes in inflation, adding complexity to the tracking process<br><br>Especially sensitive to inaccuracies in the underlying data. Public organizations should take particular care to ensure that these data are reliable, complete and accurate.<br><br>If organization changes mission, chosen denominator in the metric may no longer be relevant. | Tons $CO_2$e/square foot of warehouse space<br><br>Tons $CO_2$e/tons of mail delivered<br><br>Tons $CO_2$e/number of employees<br><br>Tons $CO_2$e/square foot/person<br><br>Tons $CO_2$e/$ appropriated<br><br>Tons $CO_2$e/megawatt hour of electricity produced<br><br>$CO_2$e/British thermal unit<br><br>Tons $CO_2$e/park visitor<br><br>Tons $CO_2$e/mile of highway constructed |

Adopted from the *GHG Protocol Corporate Standard,* 2004

### *Indirect Emissions*

When considering whether to include indirect emissions in either absolute or intensity-based targets, it should be noted that changes in scope 2 or 3 emissions over time may not always accurately capture the actual reduction in the release of emissions to the atmosphere. This is because the activity of the reporting organization does not always have a direct cause-effect relationship with the resulting GHG emissions. For example, a reduction in air travel would reduce an organization's scope 3 emissions. This reduction is usually quantified on the basis of an average emission factor of fuel use per passenger. However, how this reduction actually translates into a change in GHG emissions to the atmosphere depends on a number of factors, including whether another person takes the "empty seat" or whether this unused seat contributes to reduced air traffic over the longer term. Similarly, reductions in scope 2 emissions calculated with an average grid emission factor may overestimate or underestimate the actual reduction, depending on the nature of the grid.

Generally, so long as the accounting of indirect emissions over time recognizes activities that in aggregate change global emissions, any such concerns over accuracy should not inhibit organizations from reporting their indirect emissions reductions. In cases where accuracy is more important, undertaking a more detailed assessment of the actual reduction using a project quantification method may be appropriate. See Appendix F for more examples of reductions in indirect emissions.

## 3. Decide on the Target Boundary

The target boundary defines which GHGs, geographic operations, sources, and activities are covered by the target. The target and inventory boundary can be identical, or the target may address a specified subset of the sources included in the organization inventory. The quality of the GHG inventory should be a key factor informing this choice. The questions to be addressed in this step include the following:

*Which GHGs*? Targets usually include one or more of the six major GHGs covered by the Kyoto Protocol. For organizations with significant non-$CO_2$ GHG sources, it usually makes sense to include these to increase the range of reduction opportunities. However, practical monitoring limitations may apply to smaller sources.

*Which direct and indirect emission sources*? Including indirect GHG emissions in a target will facilitate more cost-effective reductions by increasing the reduction opportunities available. Though indirect emissions are generally harder to measure accurately and verify than direct emissions, some categories such as scope 2 emissions from purchased electricity may be amenable to accurate measurement and verification. Including indirect emissions can raise issues with regard to ownership and double counting of reductions, as indirect emissions are by definition someone else's direct emissions (see step 8).

However, inclusion of both direct and indirect emissions in targets can help to prevent "leakage" of emissions that may occur when organizational activities shift between scopes. For example, organizations with only a scope 1 or 2 target may be incentivized to outsource certain activities such as printing, whereby scope 2 emissions from electricity used to power the internal printing machinery become scope 3, and may not be reported at all. Carefully selecting targets can ensure that the organization's total impact is tracked and managed.

*Which geographical operations*? Only country or regional operations with reliable GHG inventory data should be included in the target. For organizations with global operations, it makes sense to limit the target's geographical scope until a robust and reliable inventory has been developed for all operations. Organizations with facilities that are subject to GHG regulations or reporting programs need to decide whether or not to include the covered emission sources in their organizational target.[30]

*Separate targets for different types of operations*? For organizations with diverse operations, it may make more sense to define separate GHG targets for different core activities, especially when using an intensity target, where the most meaningful metric for defining the target varies across operating units.

## 4. Choose the Target Base Year

For a target to be credible, how target emissions are defined in relation to past emissions has to be transparent. Two general approaches are available: a fixed target base year or a rolling target base year.

*Using a fixed target base year*. Most GHG targets are defined as a percentage reduction in emissions below a fixed target base year (e.g., reduce $CO_2$ emissions 25 percent below 2008 levels by 2020). Chapter 5 describes how organizations should track emissions in their inventory over time in reference to a fixed base year. Although using different years for the inventory base year and the target base year is possible, to streamline the inventory and target reporting process, it usually makes sense to use the same year for both. As with the inventory base year, ensuring the emissions data for the target base year are reliable and verifiable is important. Using a multiyear average target base year is also possible, and the same considerations as described for multi-year average base years in Chapter 5 apply.

*Using a rolling target base year*. Organizations may consider using a rolling target base year if obtaining and maintaining reliable and verifiable data for a fixed target base year is likely to be challenging (for example, due to frequent acquisitions). With a rolling target base year, the base year rolls forward at regular intervals, usually one year, so that emissions are always compared with the previous year.[31]

[30] Examples include the UK ETS, the CCX, and the EU ETS.

[31] Using an interval other than 1 year is possible, but the longer the interval at which the base year rolls forward, the more this approach becomes like a fixed target base year. This discussion is based on a rolling target base year that moves forward at annual intervals.

However, emission reductions can still be collectively stated over several years. An example would be "from 2001 through 2012, emissions will be reduced by 1 percent every year, compared to the previous year." When the organization structure or calculation methodologies changes, recalculations only need to be made to the previous year, which is the target base year.[32] As a result, the emission inventories in the "target starting year" (2001 in the example) are not comparable with those of the "target completion year" (2012 in the example), because the former have not been corrected for structural or methodological changes, whereas the latter have been. In contrast, the current inventory is always comparable with the inventory for the preceding inventory period (the base year).

Chapter 5 provides standards on when and how to recalculate base year emissions to ensure like-with-like comparisons over time when structural changes (e.g., consolidations or realignments) or changes in measurement and calculation methods alter the emissions profile over time. The definition of what triggers a base-year emissions recalculation is the same under both the fixed base year and rolling base year approach. The difference lies in how far back emissions are recalculated. Table 10-2 compares targets using the rolling and fixed base year approaches, and Figure 10-2 illustrates one of the key differences

*Table 10-2. Comparing Targets with Rolling and Fixed Base Years*

| Question | Fixed target base year | Rolling target base year |
|---|---|---|
| How might the target be stated? | A target might take the form "we will emit X percent less in year B than in year A" | A target might take the form of "over the next X years we will reduce emissions every year by Y percent compared to the previous year"[a] |
| What is the target base year? | A fixed reference year in the past | The previous year |
| How far back is like-with-like comparison possible? | The time series of absolute emissions will compare like with like for all years if the emissions for intervening years are also recalculated in the event of base year recalculations | If there have been significant structural changes, the time series of absolute emissions will not compare like with like over more than two years at a time |
| What is the basis for comparing emissions between the target base year and completion year? (See Figure 10-2) | The comparison over time is based on what is owned/controlled by the organization in the target completion year | The comparison over time is based on what was owned/controlled by the organization in the years the information was reported[b] |

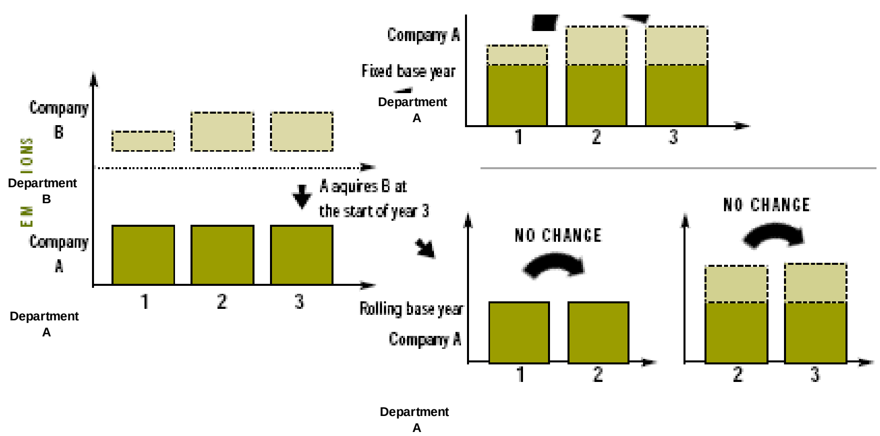
*Table 10-2. Comparing Targets with Rolling and Fixed Base Years*

| Question | Fixed target base year | Rolling target base year |
|---|---|---|
| How far back are recalculations made? | Emissions are recalculated for the fixed target base year | Emissions are recalculated only for the year prior to the structural change, or ex-post for the year of the structural change which then becomes the base year |
| How reliable are the target base year emissions? | If an organization with a target acquires an organization that did not have reliable GHG data in the target base year, then backcasting of emissions becomes necessary, reducing the reliability of the base year | Data from an acquired organization's GHG emissions are only necessary for the year before the acquisition (or even only from the acquisition onwards), reducing or eliminating the need for back-casting |
| When are recalculations made? | The circumstances which trigger recalculations for structural changes, etc., (see Chapter 5) are the same under both approaches | |

[a] Simply adding the yearly emissions changes under the rolling base year yields a different result from the comparison over time made with a fixed base year, even without structural changes. In absolute terms, an X percent reduction every year over five years (compared with the previous year) is not the same as an (X times 5) reduction in year 5 compared to year 1.

Adopted from the *GHG Protocol Corporate Standard*, 2004

*Figure 10-2. Comparing Stabilization Target under Fixed and Rolling Target Base Year Approach*




A stabilization target is one that aims to keep emissions constant over time. In this example, department A merges with and subsumes department B, which has experienced organic GHG growth since the target base year (or 'starting' year). Under the rolling approach, emissions growth in the subsumed department (B) from year 1 to year 2 does not appear as an emissions increase in relation to the target of the acquiring department (A). Thus department A would meet its stabilization target when using the rolling approach but not when using the fixed approach. In parallel to the example in chapter 5, past GHG growth or decline in divided organizations (GHG changes before the division) would affect the target performance under the rolling approach, while it would not be counted under the fixed approach.

Adopted from the *GHG Protocol Corporate Standard*, 2004

- ♦ *Recalculations under intensity targets*. While the standard in Chapter 5 applies to absolute inventory emissions of organizations using intensity targets, recalculations for structural changes for the purposes of the target are not usually needed unless the structural change results in a significant change in the GHG intensity. However, if recalculations for structural change are made for the purposes of the target, they should be made for both the absolute emissions and the operational metric. If the target operational metric becomes irrelevant through a structural change, a reformulation of the target might be needed.

## 5. Define the Target Completion Date

The target completion date determines whether the target is relatively short or long-term. Long-term targets (e.g., with a completion year 10 years from the time the target is set) facilitate long-term planning for large capital investments with GHG benefits. However, they might also encourage later phase-outs of less efficient equipment. Generally, long-term targets depend on uncertain future developments, which can have opportunities as well as risks. A 5-year target period may be more practical for organizations with shorter planning cycles. It is also possible that a target date will be imposed by legislation. Some organizations may face an imposed date or series of dates, with tiered targets.

## 6. Define the Length of the Commitment Period

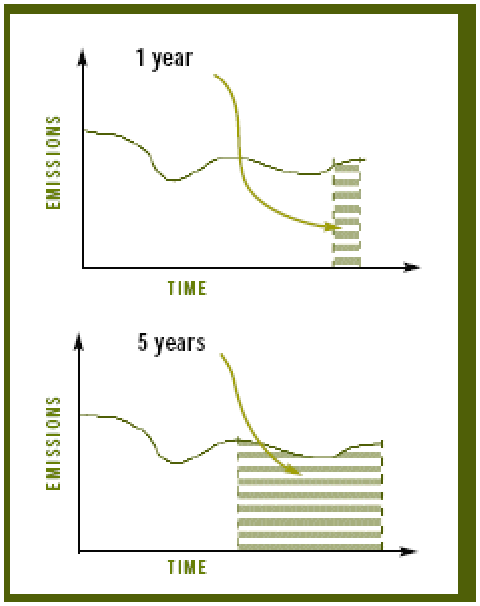
The target commitment period is the time during which emissions performance is actually measured against the target. It ends with the target completion date. Many organizations use single-year commitment periods, whereas the Kyoto Protocol, for example, specifies a multiyear “first commitment period” of 5 years (2008–12). The length of the target commitment period is an important factor in determining an organization’s level of commitment. In the public sector, legislation or higher authority can impose target commitment periods. Generally, the longer the target commitment period is, the longer the period during which emissions performance counts towards the target.

*Example of a single-year commitment period*. Organization Beta has a target of reducing emissions by 10 percent compared with its target base year 2000, by the commitment year 2010. For Beta to meet its target, it is sufficient for its emissions to be, in the year 2010, no more than 90 percent of year 2000 emissions.

*Example of a multiyear commitment period*. Organization Gamma has a target of reducing emissions by 10 percent, compared with its target base year 2000, by the commitment period 2008–12. For Gamma to meet its target, its sum total emissions from 2008–12 must not exceed 90 percent of year 2000 emissions times five (number of years in the commitment period). In other words, its average annual emissions over those 5 years must not exceed 90 percent of year 2000 emissions.

Target commitment periods longer than 1 year can be used to mitigate the risk of unpredictable events in one particular year influencing performance against the target. Figure 10-4 shows that the length of the target commitment period determines how many emissions are actually relevant for target performance.

*Figure 10-3. Short and Long Commitment Periods*




Adopted from the *GHG Protocol Corporate Standard*, 2004

For a target using a rolling base year, the commitment period applies throughout: emission performance is continuously being measured against the target every year from when the target is set until the target completion date.

**Setting a Target for Portland and Multnomah County government operations**

The City of Portland and Multnomah County have been conducting GHG inventories for several years. The 2009 effort included both an inventory of the government operations of the city and county, as well as an assessment of the whole county's emissions (i.e., a community-level inventory). Although the city and county government operations accounted for only one percent of the total county's emissions, the governments chose to lead by example and set GHG reduction targets for their activities. They pledged to reduce carbon dioxide emissions from City and County operations 50 percent below 1990 levels by 2050, and identified specific actions to be completed before 2012. Some of these actions include: installing more efficient technologies for street lighting, water pumps and water treatment; requiring all new City and County buildings to achieve energy efficiency performance targets; generating 15 percent electricity from on-site or district renewable energy sources; and recovering 75 percent of all waste generated in City and County operations. The City and County also emphasized the GHG impact of their supply chain.

See City of Portland and Multnomah County (2009) *City of Portland and Multnomah County Climate Action Plan*, City of Portland Bureau of Planning and Sustainability, and Multnomah County Sustainability Program

## 7. Decide on the Use of GHG Offsets or Credits[33]

A GHG target can be met entirely from internal reductions at sources included in the target boundary or through using offsets generated from GHG reduction projects that reduce emissions at sources (or enhance sinks) external to the target boundary.[34] Offsets are discrete GHG reductions used to compensate for (i.e., offset) GHG emissions elsewhere and are generally calculated relative to a baseline that represents a hypothetical scenario for what emissions would have been in the absence of the project. However, it is important to note that offsets are a policy issue and that a variety of standards and methods have been defined for different voluntary or mandatory programs. The use of offsets may be appropriate when the cost of internal reductions is high, opportunities for reductions are limited, or the organization is unable to meet its target because of unexpected circumstances.

Reporting on the target should specify whether offsets are used and how much of the target reduction was achieved using them.

### Credibility of Offsets and Transparency

Offsets/credits reflect activities that occur outside of the organizational and operational boundaries of entity-level inventories, and the methodology by which these reductions are quantified is beyond the scope of this *U.S. Public Sector Protocol.* The *Project Protocol* and its accompanying supplements on *Land-Use, Land-Use Change and Forestry* and *Grid-Connected Electricity Projects* detail basic methodology for these types of external reduction projects.

Still, the uncertainties that surround GHG project accounting make it difficult to establish that an offset is equivalent in magnitude to the internal emissions it is offsetting. This is why organizations should always report their own internal emissions in separate accounts from offsets used to meet the target, rather than providing a net figure (see step 10). It is also important to carefully assess the credibility of offsets used to meet a target and to specify the origin and nature of the offsets when reporting. Information needed includes

The type of project,

Geographic and organizational origin,

[33] This chapter uses the term offsets as a generic term, but offsets can be converted to credits or allowances in a cap and trade regulatory program.

[34] For the purposes of this chapter, the terms “internal” and “external” refer to whether the reductions occur at sources inside (internal) or outside (external) the target boundary.

- How offsets have been quantified, and
- Whether they have been recognized by external programs (Clean Development Mechanism (CDM), Joint Implementation (JI), etc.).

One important way to ensure the credibility of offsets is to demonstrate that the quantification method adequately addresses these key project accounting challenges.

Additionally, it is important to check that purchased offsets have not also been counted toward another organization's GHG target. This might involve a contract between the buyer and seller that transfers ownership of the offset. Step 8 provides more information on accounting for GHG trades in relation to an organizational target, including establishing a policy on double counting.

### Offsets and Intensity Targets

When using offsets under intensity targets, all the above considerations apply. To determine compliance with the target, the offsets can be subtracted from the absolute emissions value (the numerator); the resulting difference is then divided by the corresponding metric. Absolute emissions are still reported separately both from offsets and the operational metric (see step 9 below).

## 8. Establish a Target Double-Counting Policy

This step addresses double counting of GHG reductions and offsets, as well as allowances issued by external trading programs. It applies only to organizations that engage in trading (sale or purchase) of GHG offsets or whose organizational target boundaries interface with other organizations' targets or external programs.

Given that there is currently no consensus on how such double-counting issues should be addressed, organizations should develop their own "target double-counting policy." This should specify how reductions and trades related to other targets and programs are reconciled with their organization target and, accordingly, which types of double-counting situations are regarded as relevant. The following are some examples of double counting that might need to be addressed in the policy:

- *Double counting of offsets*. This can occur when a GHG offset is counted toward the target by both the selling and purchasing organizations. For example, organization A undertakes an internal reduction project that reduces GHGs at sources included in its own target. Organization A then sells this project reduction to organization B to use as an offset toward its target, while still counting the reduction toward its own target. In this case, reductions are counted by two different organizations against targets that cover different emissions sources. Trading programs address this by using registries that allocate a serial number to all traded offsets or credits and ensuring the serial numbers are retired once they are used. In the absence of registries, this could be addressed by a contract between seller and buyer, so that the emissions reductions are only reflected in one inventory.

*Double counting due to target overlap.*[35] This can occur when sources included under an organization's target are also subject to limits by an external program or another organization's target. Two examples follow:

Organization A has a target that includes GHG sources that are also regulated under a trading program. In this case, reductions at these common GHG sources are used by organization A to meet both its organizational target and the trading program target.

Organization B has a target to reduce its direct emissions from the generation of electricity. Organization C purchases electricity directly from organization B and also has a target that includes reducing its indirect emissions from purchased electricity (scope 2). Organization C undertakes energy efficiency measures to reduce its consumption of electricity. These may show up as reductions in both organizations' emissions (and contribute towards each organization's target) if a decrease in electricity consumption by organization C also leads to a decrease in electricity generation by organization B.[36]

These two examples illustrate that double counting is inherent when the GHG sources where the reductions occur are included as part of fulfilling more than one target of the same or different organizations. Ideally, an organization should try to avoid double counting in its organizational target if this undermines the environmental integrity of the target. Also, any prevented double counting between two organizations provides an additional incentive for one of these organizations to further reduce emissions. However, in practice, the avoidance of double counting can be quite challenging, particularly for organizations subject to multiple external programs and when indirect GHG emissions are included in the target. Organizations should therefore be transparent about their double-counting policy and state any reasons for choosing not to address some double-counting situations.

## 9. Decide on the Target Level

The decision on setting the target level should be informed by all the previous steps. Other considerations to take into account include the following:

Understanding the key drivers affecting GHG emissions by examining the relationship between GHG emissions and other operational metrics such as productivity, square footage of warehouse space, number of employees, unit of service provided, and costs of making reductions.

[35] Overlap here refers to a situation when two or more targets include the same sources in their target boundaries.

[36] The energy efficiency measures implemented by organization C may not always result in an actual reduction of organization B's emissions.

Considering whether there are any environmental or energy plans, capital investments, product or service changes, or targets that will affect GHG emissions. Are there plans already in place for fuel switching, on-site power generation, or renewable energy investments that affect the future GHG trajectory?

Developing different reduction strategies on the basis of the major reduction opportunities available and examining their effects on total GHG emissions. Investigate how emission projections change with different mitigation strategies.

Looking at the future of the organization as it relates to GHG emissions.

Benchmarking GHG emissions with similar organizations. Generally, organizations that have not previously invested in energy and other GHG reductions should be capable of meeting more aggressive reduction levels because they would have more cost-effective reduction opportunities available.

## 10. Track and Report Progress

Once the target has been set, it is necessary to track performance against it to check compliance and—to maintain credibility—to report emissions and any external reductions in a consistent, complete, and transparent manner:

- *Carry out regular performance checks*. To track performance against a target, it is important to link the target to the annual GHG inventory process and make regular checks of emissions in relation to the target. Some organizations use interim targets for this purpose (a target using a rolling target base year automatically includes interim targets every year).

- *Report information in relation to the target*. Organizations should include the following information when setting and reporting progress in relation to a target:

  1. Description of the target

     - Provide an outline of the target boundaries chosen.

     - Specify target type, target base year, target completion date, and length of commitment period.

     - Specify whether offsets can be used to meet the target; if yes, specify the type and amount.

     - Describe the target double-counting policy.

     - Specify the target level.

2. Information on emissions and performance in relation to the target

- Report emissions from sources inside the target boundary separately from any GHG trades.
- If using an intensity target, report absolute emissions from within the target boundary separately, both from any GHG trades and the operational metric.
- Report GHG trades relevant to compliance with the target (including how many offsets were used to meet the target).
- Report any internal project reductions sold or transferred to another organization for use as an offset.
- Report overall performance in relation to the target.

# APPENDIX B
# Equity Share Consolidation Approach

The *U.S. Public Sector Protocol* recommends the control approach as the most appropriate consolidation for public sector activities, and specifically recommends the use of operational control as discussed in Chapter 3. Nonetheless, the equity share approach may be applicable to certain public sector organizations where ownership boundaries can be clearly delineated, and where ownership of assets represents a significant aspect of the organization's mission. Some examples here might include a treasury department that owns stock or assets pursuant to policy directives, or a public organization that owns major assets such as real estate or land. In such circumstances, inventory reporting goals may require different data sets, and the reporting organization may need to account for its GHG emissions in two separate inventories, one using the equity share and one using the control approach.

## Equity Share Approach

Under the equity share approach, an organization accounts for GHG emissions from operations according to its share of equity or ownership in the operation. The equity share reflects economic interest, which is the extent of rights an organization has to the risks and rewards flowing from an operation. Typically, the share of economic risks and rewards in an operation is aligned with the organization's percentage ownership of that operation, and equity share will normally be the same as the ownership percentage. Where this is not the case, the economic substance of the relationship the organization has with the operation always overrides the legal ownership form to ensure that equity share reflects the percentage of economic interest. This principle is consistent with international financial reporting standards.

In the private sector, equity can include ownership of common stock or preferred stock, or any other assets. While government organizations might maintain major assets such as buildings or real estate, they generally do not buy stock in private companies. Certain financial public organizations such as a treasury department may purchase stock in private companies pursuant to specific policy directives. In this case, a GHG inventory prepared according to the equity share approach could reveal the GHG profiles and risks associated with those companies, and provide a more comprehensive picture of the organization's total GHG impact.

The staff preparing the inventory may therefore need to consult with the organization's accounting or legal staff to ensure that the appropriate equity share percentage is applied for each joint operation. For assets which are leased to other entities, the emissions would be treated the same as the financial control approach, as both approaches reflect financial ownership or control rather than operation of the asset. Tables 4-2 and 4-3 in Chapter 4 detail this accounting.

## Which approach is most suitable?

In general, organizations should choose a consolidation approach that is best suited to their organizational goals and mission, activities, and GHG accounting and reporting requirements. Examples of how such considerations may drive the selection of an approach include the following:

*Government reporting programs*. Government regulatory programs need to monitor and enforce compliance. Since compliance responsibility generally falls to the operator (not equity holders or the organization that has financial control), governments usually require reporting on the basis of operational control, either through a facility-level-based system or involving the consolidation of data within certain geographical boundaries (e.g., RGGI allocates emission permits to the operators of certain installations).

*Alignment with financial accounting*. Future financial accounting standards may treat GHG emissions as liabilities and emissions allowances/credits as assets. To assess the assets and liabilities an organization creates through joint operations, the same consolidation rules used in financial accounting should be applied in GHG accounting. The equity share and financial control approaches result in closer alignment between GHG accounting and financial accounting.

*Management information and performance tracking*. For the purpose of performance tracking, the control approaches are more appropriate because managers can only be held accountable for activities under their control.

*Cost of administration and data access*. The equity share approach can result in higher administrative costs than the control approach because it can be difficult and time consuming to collect GHG emissions data from joint operations not under the control of the reporting organization. Organizations are likely to have better access to operational data and therefore greater ability to ensure that it meets minimum quality standards when reporting on the basis of control.

*Completeness of reporting*. Organizations might find it difficult to demonstrate completeness of reporting when the operational control criterion is adopted because there are unlikely to be any matching records or lists of financial assets to verify the operations.

Appendix C
# Accounting for Sequestered Atmospheric Carbon

A key purpose of the *U.S. Public Sector Protocol* is to provide organizations with guidance on how to develop inventories that provide an accurate and complete picture of their GHG emissions both for their direct operations as well as those along the value chain. For some types of organizations, this is not possible without addressing the organization's impact on sequestered atmospheric carbon.[37]

## Sequestered Atmospheric Carbon

During photosynthesis, plants remove carbon (as $CO_2$) from the atmosphere and store it in plant tissue. Until this carbon is cycled back into the atmosphere, it resides in one of a number of "carbon pools." These pools include (a) above ground biomass (e.g., vegetation) in forests, farmland, and other terrestrial environments, (b) below ground biomass (e.g., roots), and (c) biomass-based products (e.g., wood products) both while in use and when stored in a landfill.

Carbon can remain in some of these pools for long periods of time, sometimes for centuries. An increase in the stock of sequestered carbon stored in these pools represents a net removal of carbon from the atmosphere; a decrease in the stock represents a net addition of carbon to the atmosphere. In general, carbon sequestration in plants is recognized as an opportunity for organizations to offset GHG emissions, but it should be noted that intact plants may also represent a liability in that certain unplanned events such as fires and diseases can unexpectedly release stored carbon back into the atmosphere.

## Why Include Impacts on Sequestered Carbon in Organizational GHG Inventories?

Changes in stocks of sequestered carbon and the associated exchanges of carbon with the atmosphere are important to national- level GHG emissions inventories, and consequently, these impacts on sequestered carbon are commonly addressed in national inventories (UNFCCC, 2000). Similarly, for organizations managing large stocks of biomass such as public lands and

[37]In this appendix, the term "sequestered atmospheric carbon" refers exclusively to sequestration by biological sinks, such as harvested wood products, above ground and below ground biomass, and dead organic matter.

forests, some of the most significant aspects of an organization's overall impact on atmospheric $CO_2$ levels will occur as a result of impacts on sequestered carbon through their direct operations as well as along their value chain.

Information on an organization's impacts on sequestered atmospheric carbon can be used for strategic planning, for educating stakeholders, and for identifying opportunities for improving the organization's GHG profile. Opportunities may also exist to create value from reductions along the value chain by organizations acting alone or in partnership with private companies, constituents, or the public.

# Accounting For Sequestered Carbon in the Context of *The GHG Protocol for the U.S. Public Sector*

Consensus methods have yet to be developed under the *GHG Protocol Corporate Standard* or this *U.S. Public Sector Protocol* regarding the accounting of sequestered atmospheric carbon. Nonetheless, some issues that would need to be addressed when addressing impacts on sequestered carbon in organizations' inventories can be examined in the context of existing guidance as highlighted below.

## Setting Organizational Boundaries

This protocol recommends the control approach for consolidating GHG data. In some cases, it may be possible to apply this approach directly to emissions/removals associated with sequestered atmospheric carbon. Among the issues that may need to be examined is the ownership of sequestered carbon under the different types of contractual arrangements involving land and wood ownership, harvesting rights, and control of land management and harvesting decisions. This is particularly important when logging rights for timber on publically owned lands are involved. Where disparate accounting practices are used by the parties involved, explicit contractual agreements may be required to clarify the transfer of ownership as carbon moves through the value chain.

## Setting Operational Boundaries

As with GHG emissions accounting, setting operational boundaries for sequestered carbon inventories would help organizations transparently report their impacts along their value chain. At this time, the three scopes have not been defined to capture information about sequestered atmospheric changes and an organization's impacts on it; the scopes primarily reflect emissions from combustion and other known processes. Until consensus methods are developed for characterizing impacts on sequestered atmospheric carbon along the value chain, this information can be included in the "optional information" section of a GHG inventory compiled using the *U.S. Public*

*Sector Protocol.* Organizations should indicate which pools are included in the analysis, which are not, and the rationale for the selections.

## Tracking Removals Over Time

As is sometimes the case with accounting for GHG emissions, base year data for impacts on sequestered carbon may need to be averaged over multiple years to accommodate the year-to-year variability expected of these systems. The temporal scale used in sequestered carbon accounting will often be closely tied to the spatial scale over which the accounting is done. The question of how to recalculate base year to account for land acquisition and divestment, land use changes, and other activities also needs to be addressed.

## Identifying and Calculating GHG Removals

The *U.S. Public Sector Protocol* does not include consensus methods for sequestered carbon quantification. Organizations should, therefore, explain the methods used. In some instances, quantification methods used in national inventories can be adapted for organization-level quantification of sequestered carbon. IPCC (1997; 2000b) provides useful information on how to do this. IPCC has issued *Good Practice Guidance for Land Use, Land Use Change and Forestry*, with information on methods for quantification of sequestered carbon in forests and forest products.

In addition, although organizational inventory accounting differs from project-based accounting (as discussed below), it may be possible to use some of the calculation and monitoring methods derived from project level accounting of sequestration projects.

## Accounting for Carbon Removal Enhancements

An organizational inventory can be used to account for yearly removals within the organizational boundary. In contrast, the *GHG Protocol for Project Accounting* is designed to calculate project reductions that will be used as offsets, relative to a hypothetical baseline scenario for what would have happened without the project. In the forestry sector, projects take the form of carbon removal enhancements. The GHG Protocol has developed *The Land Use, Land-Use Change, and Forestry Guidance for GHG Project Accounting* to supplement the *Project Protocol*, specifying carbon measurement, accounting, reporting, and ownership issues associated with sequestration projects.

## Reporting GHG Removals

Until consensus methods are developed for characterizing impacts on sequestered atmospheric carbon along the value chain, this information can be included in the "optional information" section of the inventory (see chapter 8). Information on sequestered carbon in the organization's inventory boundary should be kept separate from project-based reductions at sources that are not in the inventory boundary. However, they should also be identified separately to ensure that they are not double counted. This is especially important when they are sold as offsets or credits to a third party.

As organizations develop experience using various methods for characterizing impacts on sequestered carbon, more information will become available on the level of accuracy to be expected from these methods. In the early stages of developing this experience, however, organizations may find it difficult to assess the uncertainty associated with the estimates and therefore may need to give special care to how the estimates are represented to stakeholders.

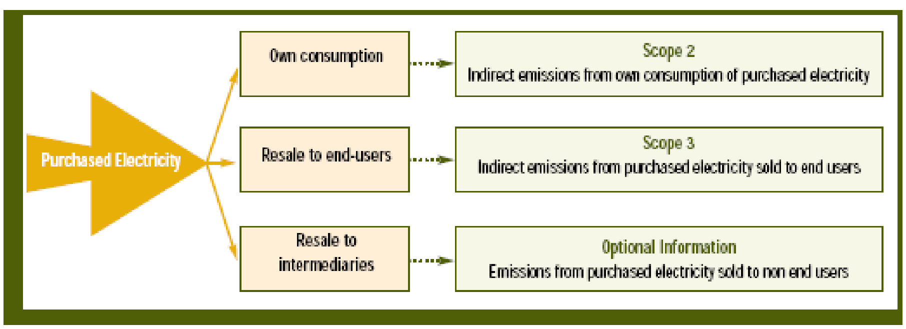
# Appendix D
# Accounting for Indirect Emissions from Purchased Electricity

This appendix provides guidance on how to account for and report indirect emissions associated with the purchase of electricity. Figure D-1 provides an overview of the transactions associated with purchased electricity and the corresponding emissions.

## Purchased Electricity for Own Consumption

*Emissions associated with the purchased electricity that is consumed by the reporting organization are reported in scope 2. Scope 2 only accounts for the portion of the direct emissions from generating electricity that is actually consumed by the organization. An organization that purchases electricity and transports it in a T&D system that it owns or controls reports the emissions associated with T&D losses under scope 2. However, if the reporting organization owns or controls the T&D system but generates (rather than purchases) the electricity transmitted through its wires, the emissions associated with T&D losses are not reported under scope 2, as they would already be accounted for under scope 1. This is the case when generation, transmission, and distribution systems are vertically integrated and owned or controlled by the same organization.*

*Figure D-1. Accounting for the Indirect GHG Emissions Associated with Purchased Electricity*




Adopted from the *GHG Protocol Corporate Standard*, 2004

## Purchased Electricity for Resale to End Users

Emissions from the generation of purchased electricity for resale to end users, for example purchases by a public utility, may be reported under scope 3 in the category "generation of purchased electricity that is sold to end users." This reporting category is particularly relevant for utilities that purchase wholesale electricity supplied by independent power producers for resale to their customers. Since utilities and electricity suppliers often exercise choice over where they purchase electricity, this provides them with an important GHG reduction opportunity. Since scope 3 is optional, organizations that are unable to track their electricity sales in terms of end users and non-end users can choose not to report these emissions in scope 3. Instead, they can report the total emissions associated with purchased electricity that is sold to both end users and non-end users under optional information in the category "generation of purchased electricity, heat, or steam for re-sale to non-end users."

## Purchased Electricity for Resale to Intermediaries

Emissions associated with the generation of purchased electricity that is resold to an intermediary (e.g., trading transactions) may be reported under optional information under the category "Generation of purchased electricity, heat, or steam for re-sale to non-end users." Examples of trading transactions include brokerage/

trading room transactions involving purchased electricity or any other transaction in which electricity is purchased directly from one source or the spot market and then resold to an intermediary (e.g., a non-end user). These emissions are reported under optional information separately from scope 3 because there could be a number of trading transactions before the electricity finally reaches the end user. This may cause duplicative reporting of indirect emissions from a series of trading transactions for the same electricity.

## GHG Emissions Upstream of the Generation of Electricity

Emissions associated with the extraction and production of fuels consumed in the generation of purchased electricity may be reported in scope 3 under the category "extraction, production, and transportation of fuels consumed in the generation of electricity." These emissions occur upstream of the generation of electricity. Examples include emissions from mining of coal, refining of gasoline, extraction of natural gas, and production of hydrogen (if used as a fuel).

## Choosing Electricity Emission Factors

The choice of emission factors depends on whether an organization obtains its purchased electricity directly from a known "off-grid" electric generation source or from the electric grid. In the former case, the *U.S. Public Sector Protocol* recommends that organizations obtain and use source/supplier specific emission factors for the electricity purchased. In the latter case, regional- or grid-specific emission factors should be used. For more information on choosing emission factors, see the relevant GHG Protocol calculation tools available on the GHG Protocol website (www.ghgprotocol.org).

## Emissions Associated with the Consumption of Electricity in T&D

Emissions from the generation of electricity that is consumed in a T&D system may be reported in scope 3 under the category "generation of electricity that is consumed in a T&D system" by end users. Published electricity grid emission factors do not usually include T&D losses. To calculate these emissions, it may be necessary to apply supplier or location specific T&D loss factors.

Organizations that purchase electricity and transport it in their own T&D systems would report the portion of electricity consumed in T&D under scope 2. However, if the reporting organization owns or controls the T&D system but generates (rather than purchases) the electricity transmitted through its wires, the emissions associated with T&D losses are not reported under scope 2, as they would already be accounted for under scope 1. This is the case when generation, transmission, and distribution systems are vertically integrated and owned or controlled by the same organization.

## Accounting for Indirect Emissions Associated with T&D Losses

There are two types of electricity emission factors: emission factor at generation (EFG) and emission factor at consumption (EFC). EFG is calculated from $CO_2$ emissions from generation of electricity divided by amount of electricity generated. EFC is calculated from $CO_2$ emissions from generation divided by amount of electricity consumed.

$$\text{EFG} = \frac{\text{Total } CO_2 \text{ Emissions From Generation}}{\text{Electricity Generated}}$$

$$\text{EFC} = \frac{\text{Total } CO_2 \text{ Emissions From Generation}}{\text{Electricity Consumed}}$$

EFC and EFG are related as shown below.

$$\text{EFC} \times \text{Electricity Consumed} = \text{EFG} \times (\text{Electricity Consumed} + \text{T\&D Losses})$$

$$\text{EFC} = \text{EFG} \times \left(1 + \frac{\text{T\&D Losses}}{\text{Electricity Consumed}}\right)$$

As these equations indicate, EFC multiplied by the amount of consumed electricity yields the sum of emissions attributable to electricity consumed during end use and transmission and distribution. In contrast, EFG multiplied by the amount of consumed electricity yields emissions attributable to electricity consumed during end use only.

Consistent with the scope 2 definition (see Chapter 4), the *U.S. Public Sector Protocol* requires the use of EFG to calculate scope 2 emissions. The use of EFG ensures internal consistency in the treatment of electricity related upstream emissions categories and avoids double counting in scope 2. Additionally, there are several other advantages in using EFG:

It is simpler to calculate and widely available in published regional, national, and international sources.

It is based on a commonly used approach to calculate emissions intensity, i.e., emissions per unit of production output.

It ensures transparency in reporting of indirect emissions from T&D losses.

The formula to account for emissions associated with T&D losses is the following:

$$\text{EFG} \times \text{Electricity Consumed during T\&D} = \text{Indirect Emissions from Consumption of Electricity during T\&D}$$

In some countries such as Japan, local regulations may require utility organizations to provide both EFG and EFC to its consumers, and consumers may be required to use EFC to calculate indirect emissions from the consumption of purchased electricity. In this case, an organization still needs to use EFG to report its scope 2 emissions for a GHG report prepared in accordance with the *GHG Protocol Corporate Standard* and this *U.S. Public Sector Protocol*.

## Appendix E
# Public Operations and Scopes

| Sector | Scope 1 emission sources | Scope 2 emission sources | Scope 3 emission sources[a] |
|---|---|---|---|
| Office-Based Organizations | | | |
| Service Sector/ Office-based Organizations | ◆ Stationary combustion (production of electricity, heat or steam)<br>◆ Mobile combustion (transportation of raw materials/ waste)<br>◆ Fugitive emissions (mainly HFC emissions during use of refrigeration and air-conditioning equipment) | ◆ Stationary combustion (consumption of purchased electricity, heat or steam) | ◆ Stationary combustion (production of purchased materials)<br>◆ Process emissions (production of purchased materials)<br>◆ Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) |
| Waste | | | |
| Landfills, Waste Combustion, Water Services | ◆ Stationary combustion (incinerators, boilers, flaring)<br>◆ Process emissions (sewage treatment, nitrogen loading)<br>◆ Fugitive emissions ($CH_4$ emissions from waste and animal product decomposition. Biogenic $CO_2$ emissions should be reported separately from the scopes.)<br>◆ Mobile combustion (transportation of waste/ products) | ◆ Stationary combustion (consumption of purchased electricity, heat or steam) | ◆ Stationary combustion(recycled waste exported from the site to be used as a fuel elsewhere)<br>◆ Process emissions (recycled waste exported from the site to be used as a feedstock elsewhere)<br>◆ Mobile combustion (transportation of waste/products, employee business travel, employee commuting) |
| Energy | | | |
| Energy Generation | ◆ Stationary combustion (boilers and turbines used in the production of electricity, heat or steam, fuel pumps, fuel cells, flaring)<br>◆ Mobile combustion (trucks, barges and trains for transportation of fuels)<br>◆ Fugitive emissions ($CH_4$ leakage from transmission and storage facilities, HFC emissions from Liquid Propane Gas (LPG) storage facilities, $SF_6$ emissions from transmission and distribution equipment) | ◆ Stationary combustion (consumption of purchased electricity, heat or steam) | ◆ Stationary combustion (mining and extraction of fuels, energy for refining or processing fuels)<br>◆ Process emissions (production of fuels, $SF_6$ emissions)<br>◆ Mobile combustion (transportation of fuels/ waste, employee business travel, employee commuting)<br>◆ Fugitive emissions ($CH_4$ and $CO_2$ from waste landfills, pipelines, $SF_6$ emissions) |

| Sector | Scope 1 emission sources | Scope 2 emission sources | Scope 3 emission sources[a] |
|---|---|---|---|
| Oil and Gas[b] | ◆ Stationary combustion (process heaters, engines, turbines, flares, incinerators, oxidizers, production of electricity, heat and steam)<br>◆ Process emissions (process vents, equipment vents, maintenance/ turnaround activities, non-routine activities)<br>◆ Mobile combustion (transportation of raw materials/ products/waste; company owned vehicles)<br>◆ Fugitive emissions (leaks from pressurized equipment, wastewater treatment, surface impoundments) | ◆ Stationary combustion (consumption of purchased electricity, heat or steam) | ◆ Stationary combustion (product use as fuel or combustion for the production of purchased materials)<br>◆ Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting, product use as fuel)<br>◆ Process emissions (product use as feedstock or emissions from the production of purchased materials)<br>◆ Fugitive emissions ($CH_4$ and $CO_2$ from waste landfills or from the production of purchased materials) |
| Coal Mining | ◆ Stationary combustion (methane flaring and use, use of explosives, mine fires)<br>◆ Mobile combustion (mining equipment, transportation of coal)<br>◆ Fugitive emissions ($CH_4$ emissions from coal mines and coal piles) | ◆ Stationary combustion (consumption of purchased electricity, heat or steam) | ◆ Stationary combustion (product use as fuel)<br>◆ Mobile combustion (transportation of coal/waste, employee business travel, employee commuting)<br>◆ Process emissions (gasification) |

[a] This does not constitute a complete list of Scope 3 sources for each activity, but offers several common sources.

[b] The American Petroleum Institute's Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry (2009) provides guidelines and calculation methodology for calculating GHG emissions from the oil and gas sector.

# Appendix F
# Accounting for Indirect Emission Reductions

Some organizations can make changes to their own operations that result in GHG emissions changes not fully captured by comparing emissions changes over time, or at sources not included in their own inventory boundary. These reductions may be separately quantified, for example, using the processes described in the *Project Protocol*, and reported in an organization's public GHG report under optional information.

Some examples relating to indirect effects of emissions include:

- Substituting purchased grid electricity with an on-site power generation plant (e.g., a combined heat and power, or CHP, plant), where both the heat/steam and electricity outputs are used by the organization
    - This may increase an organization's direct GHG emissions while reducing the GHG emissions associated with purchased grid electricity. This reduction may be overestimated or underestimated when merely comparing scope 2 emissions over time, if the latter are quantified using an average grid emission factor. This is because an average grid emissions factor represents the total GHG emissions from electricity production on the grid divided by the total kWh produced, and most electricity generation systems dispatch different types of energy sources (with different GHG intensities) depending on the demand of the grid. Reducing grid electricity demand through an on-site CHP project might therefore prevent the dispatching of a specific type of fuel source to the grid and  a higher or lower reduction in emissions (depending on that dispatched source) than would be reflected in the average.
- Installing an on-site power generation plant (e.g., CHP), where surplus electricity is sold to other organizations
    - This may increase the on-site organization's direct GHG emissions while reducing the other organization's need to purchase grid electricity. Any resulting emissions reductions at the plants where this grid- electricity would have otherwise been produced will not be captured in the inventory of the on-site organization.
- Substituting purchased fossil fuel with the organization's own waste-derived fuel

- The organization’s waste might have otherwise been sent to a landfill or incinerated without energy recovery. Such substitution will decrease the organization’s scope 1 emissions (as $CO_2$ from biogenic combustion will be reported separately from the scopes), but also could result in emissions reductions elsewhere by another organization, e.g., through avoiding landfill gas and related fossil fuel use.

# Acronyms

| | |
|---|---|
| A/C | air conditioning |
| $CaCO_3$ | calcium carbonate |
| CAP | criteria air pollutant |
| CCAR | California Climate Action Registry |
| CCX | Chicago Climate Exchange |
| CDM | clean development mechanism |
| CEM | continuous emission monitoring |
| CFCs | chlorofluorocarbons |
| CFP | Climate Friendly Parks |
| $CH_4$ | Methane |
| CHP | combined heat and power |
| CLIP | Climate Leadership In Parks |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | carbon dioxide equivalent |
| COCO | contractor owned/contractor operated |
| CRS | Congressional Research Service |
| DoD | Department of Defense |
| DOE | Department of Energy |
| EFC | emission factor at consumption |
| EFG | emission factor at generation |
| eGRID | Emissions & Generation Resource Integrated Database |
| EMS | Environmental Management Systems |
| EO | executive order |
| EPA | Environmental Protection Agency |
| EU ETS | European Union Emissions Allowance Trading Scheme |
| GHG | greenhouse gas |
| GRI | Global Reporting Initiative |
| GWP | global warming potential |
| HCFC | hydrochlorofluorocarbons |
| HFCs | hydrofluorocarbons |
| HVAC | heating, ventilation, and air conditioning |
| IMP | inventory management plan |

| | |
|---|---|
| IPCC | Intergovernmental Panel on Climate Change |
| ISO | International Standards Organization |
| JI | joint implementation |
| kWh | kilowatt hour |
| LMI | Logistics Management Institute |
| MMT | million metric tons |
| MWh | megawatt hour |
| $N_2O$ | nitrous oxide |
| NASA | National Aeronautics and Space Administration |
| NASA-JSC | National Aeronautics and Space Administration – Johnson Space Center |
| NGO | non-governmental organization |
| $NO_x$ | nitrogen oxide |
| NPS | National Park Service |
| PFCs | perfluorocarbons |
| REC | renewable energy certificate |
| RGGI | Regional Greenhouse Gas Initiative |
| $SO_2$ | sulfur dioxide |
| $SF_6$ | sulfur hexafluoride |
| T&D | transmission and distribution |
| UK ETS | United Kingdom Emission Trading Scheme |
| UNFCC | United Nations Framework Convention on Climate Change |
| WBCSD | World Business Council for Sustainable Development |
| WRI | World Resources Institute |

# Glossary

*Absolute target*. A target defined by reduction in absolute emissions over time e.g., reduces $CO_2$ emissions by 25 percent below 1994 levels by 2010.

*Additionality*. A criterion for assessing whether a project has resulted in GHG emission reductions or removals in addition to what would have occurred in its absence. This is an important criterion when the goal of the project is to offset emissions elsewhere.

*Agency*. Term used interchangeably with "organization" in this *U.S. Public Sector Protocol* to denote a public sector entity.

*Allowance*. A commodity giving its holder the right to emit a certain quantity of GHGs.

*Audit trail*. Well-organized and transparent historical records documenting how an inventory was compiled.

*Baseline*. A hypothetical scenario for what GHG emissions, removals, or storage would have been in the absence of the GHG project or project activity.

*Base year*. A historic datum (a specific year or an average over multiple years) against which an organization'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 structure of the organization, or to reflect a change in the accounting methodology used. This ensures data consistency over time, i.e., comparisons of like with like over time.

*Biofuels*. Fuel made from plant material, e.g. wood, straw, and ethanol from plant matter.

*Biogenic emissions.* Emissions resulting from the combustion of materials that naturally sequester $CO_2$, such as biomass, or biofuels derived from vegetable oils or animal fats. These emissions are reported separately from the scopes.

*Biomass.* Organic, recently living non-fossil material, often used as the basis for creating biofuels.

*Boundaries*. The grouping of GHG activities following several dimensions, i.e. organizational, operational, geographic, business unit, and target boundaries. The inventory boundary determines which emissions are accounted and reported by the organization.

*Cap and trade system*. A system that sets an overall emissions limit, allocates emissions allowances to participants, and allows them to trade allowances and emission credits with each other.

*Capital lease*. A lease which transfers substantially all the risks and rewards of ownership to the lessee and is accounted for as an asset on the balance sheet of the lessee. 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 between various accepted financial standards.

*Carbon sequestration*. The uptake of $CO_2$ and storage of carbon in biological sinks.

*Clean development mechanism (CDM)*. A mechanism for project-based emission reduction activities in developing countries established by Article 12 of the Kyoto Protocol. The CDM is designed to meet two main objectives: to address the sustainability needs of the host country and to increase the opportunities available to Annex 1 Parties to meet their GHG reduction commitments. The CDM allows for the creation, acquisition, and transfer of CERs (certified emission reductions) from climate change mitigation projects undertaken in non-Annex 1 countries.

*Co-generation unit/combined heat and power*. A facility producing both electricity and steam/heat using a common fuel supply.

*Community-level inventories.* Inventories representing emissions from all sectors within a geographically-defined community, including electricity generation, transportation, land use change, etc. This type of inventory is based upon boundaries, assumptions and methodologies which are significantly different than those referenced and utilized in the *U.S. Public Sector Protocol* and the *GHG Protocol Corporate Standard,* which only track emissions that a given entity owns or controls.

*Consolidation*. The grouping together of GHG emissions data from separate operations according to a specific approach in order to create a consistent, complete inventory.

*Continuous Emissions Monitoring Systems (CEMS):* A technological means of monitoring the emissions from combustion facilities.

*Control*. The ability of an organization to direct the policies of an operation. It is defined as either operational control (the organization or one of its subsidiaries has the authority to introduce and implement 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).

*Corporate inventory program*. A program to produce annual corporate (or enterprise-wide) inventories that are in keeping with the principles, standards, and guidance of the *GHG Protocol Corporate Standard*. This includes all institutional, managerial and technical arrangements made for the collection of data, preparation of a GHG inventory, and implementation of the steps taken to manage the quality of their emission inventory.

*$CO_2$ equivalent*. The universal unit of measurement to indicate the global warming potential (GWP) of each of the six GHGs regulated by the Kyoto Protocol, expressed in terms of the GWP of one unit of $CO_2$. It is used to evaluate the impact of different GHG emissions against a common basis.

*Cross-sector calculation tool*. A GHG Protocol calculation tool that addresses GHG sources common to various sectors, e.g., emissions from stationary or mobile combustion. See also GHG Protocol calculation tools (www.ghgprotocol.org).

*De minimis.* A level of emissions from a single source or group of sources that is excluded from reporting because it is thought to be very small in the context of an organization's total emissions. However, such omission causes a predefined negative bias in estimates (i.e., an underestimate) and therefore is not compatible with the completeness principle of the *U.S. Public Sector Protocol*. Sometimes, *de minimis* is interpreted as a group of small or hard-to-measure sources to which a simplified estimation method is applied.

*Direct GHG emissions*. Emissions from sources that are owned or controlled by the reporting organization.

*Direct monitoring*. Direct monitoring of exhaust stream contents in the form of continuous emissions monitoring or periodic sampling.

*Double counting*. Two or more reporting organizations take ownership of the same emissions or reductions within the same scope. Indirect emissions (scopes 2 and 3) are inherently another entity's direct (scope 1) emissions but this is not considered double counting.

*eGRID.* A comprehensive inventory of environmental attributes of electric power systems, including various GHG emission factors for different electric grid regions in the United States.

*Emissions*. The release of GHGs into the atmosphere.

*Emission factor*. A factor expressing an amount of GHG emissions produced per a unit of activity data (e.g., tonnes of $CO_2$ per tonne of fuel consumed), which permits GHG emissions to be estimated for various activity types.

*Environmental Management Systems (EMS):* A set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency, as defined by the EPA.

*Equity share*. The equity share reflects economic interest, reflecting the rights an organization has to the risks and rewards flowing from an operation. Typically, the share of economic risks and rewards in an operation is aligned with the organization's percentage ownership of that operation, and equity share will normally be the same as the ownership percentage.

*Estimation uncertainty*. Uncertainty that arises whenever GHG emissions are quantified, due to uncertainty arising from incomplete or imprecise data and from imprecise calculation methodologies used to quantify GHG emissions.

*Executive Order*. A policy directive issued by an executive body usually intended to manage operations within the government.

*Finance lease*. A lease which transfers substantially all the risks and rewards of ownership to the lessee and is accounted for as an asset on the balance sheet of the lessee. Also known as a capital or financial lease. Leases other than capital/financial/finance leases are operating leases. Consult an accountant for further detail as definitions of lease types differ between various accepted accounting principles.

*Fugitive emissions*. Emissions that are not physically controlled but result from the intentional or unintentional releases of GHGs. They commonly arise from the production, processing, transmission, storage and use of fuels and other chemicals, often through joints, seals, packing, gaskets, etc.

*Green-e.*An independent certification and verification program for renewable energy and greenhouse gas emission reductions in the retail market.

*Green power*. A generic term for renewable energy sources and specific clean energy technologies that emit fewer GHG emissions relative to other sources of energy that supply the electric grid. Includes solar photovoltaic panels, solar thermal energy, geothermal energy, landfill gas, low-impact hydropower, and wind turbines.

*Greenhouse gases (GHGs)*. Gases that contribute to the greenhouse effect, trapping heat in the atmosphere. For the purposes of the *U.S. Public Sector Protocol*, GHGs are the six gases listed in the Kyoto Protocol: $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, and $SF_6$.

*GHG capture*. Collection of GHG emissions from a GHG-emitting source for storage in a sink.

*GHG credit*. GHG offset that can be used to meet an externally imposed target. A GHG credit is a convertible and transferable instrument usually bestowed by a GHG program.

*GHG offset*. Discrete GHG reductions used to compensate for (i.e., offset) GHG emissions elsewhere, for example to meet a voluntary or mandatory GHG target or cap. Offsets are calculated relative to a baseline that represents a hypothetical scenario for what emissions would have been in the absence of the mitigation project that generates the offsets. To avoid double counting, the reduction giving rise to the offset must occur at sources or sinks not included in the target or cap for which it is used.

*GHG program*. A generic term used to refer to any voluntary or mandatory international, national, sub-national, government or non-governmental authority that registers, certifies, or regulates GHG emissions or removals outside the company, e.g., CDM, EU ETS, CCX, and CCAR.

*GHG project*. Shorthand for a specific project or activity designed to achieve GHG emission reductions, storage of carbon, or enhancement of GHG removals from the atmosphere. GHG projects may be stand-alone projects, or specific activities or elements within a larger non-GHG related project.

*GHG Protocol calculation tools*. A number of cross-sector and sector-specific tools developed by the Greenhouse Gas Protocol Initiative at the World Resources Institute that calculate GHG emissions on the basis of activity data and emission factors (available at www.ghgprotocol.org).

*GHG Protocol Initiative*. A multi-stakeholder collaboration convened by World Resources Institute and the World Business Council for Sustainable Development (WBCSD) to design, develop, and promote the use of GHG accounting and reporting standards. Its two primary publications include the *GHG Protocol Corporate Standard* and the *GHG Protocol Project Protocol.* More information is available at http://www.ghgprotocol.org

*GHG Protocol for Project Accounting(Project Protocol)*. A module of the GHG Protocol Initiative addressing the quantification of GHG reduction projects. This includes projects that will be used to offset emissions elsewhere and/or generate credits.

*GHG public report*. A report that provides, among other details, the reporting organization's physical emissions for its chosen inventory boundary.

*GHG registry*. A public database of organization GHG emissions and/or project reductions. Examples include the DOE 1605b Voluntary GHG Reporting Program, CCAR and the World Economic Forum's Global GHG Registry. Each registry has its own rules regarding what and how information is reported.

*GHG removal*. Absorption or sequestration of GHGs from the atmosphere.

*GHG sink*. Any physical unit or process that stores GHGs, usually in reference to forests and underground/deep sea reservoirs of $CO_2$.

*GHG source*. Any physical unit or process which releases GHGs into the atmosphere.

*GHG trades*. All purchases or sales of GHG emission allowances, offsets, and credits.

*Global warming potential (GWP)*. 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 $CO_2$.

*Heating value*. The amount of energy released when a fuel is burned completely. Care must be taken not to confuse one measure of heating values, used in the United States and Canada (called higher heating values) with another that is used in all other countries (lower heating values). For further details refer to the calculation tool for stationary combustion available at www.ghgprotocol.org).

*Indirect GHG emissions*. Emissions that are a consequence of the operations of the reporting organization, but occur at sources owned or controlled by another organization.

*Insourcing*. The inverse of outsourcing; that is, the reporting organization performing work previously contracted out to other entities.

*Intensity ratios*. Ratios that express GHG impact per unit of physical activity or unit of economic value (e.g., tonnes of $CO_2$ emissions per unit of electricity generated). Intensity ratios are the inverse of productivity/efficiency ratios.

*Intensity target*. A reduction target defined by the ratio of emissions to a business metric over time e.g., reduce $CO_2$ per tonne of cement by 12 percent between 2000 and 2008.

*Intergovernmental Panel on Climate Change*. International body of climate change scientists. The role of the IPCC is to assess the scientific, technical and socio-economic information relevant to the understanding of the risk of human-induced climate change (www.ipcc.ch).

*Inventory*. A quantified compilation of an organization's GHG emissions and sources.

*Inventory boundary*. An imaginary line that encompasses the direct and indirect emissions that are included in the inventory. It results from the chosen organizational and operational boundaries.

*Inventory quality*. The extent to which an inventory provides a faithful, true, and fair account of an organization's GHG emissions.

*Joint Implementation*. A mechanism established in Article 6 of the Kyoto Protocol referring to climate change mitigation projects implemented between two Annex 1 countries. JI allows for the creation, acquisition, and transfer of "ERUs," or tradable commodities which can be used by Annex 1 countries to help meet their commitments under the Kyoto Protocol.

*Kyoto Protocol*. A protocol to the UNFCCC. It requires countries listed in its Annex B (developed nations) to meet reduction targets of GHG emissions relative to their 1990 levels averaged over the period 2008–12.

*Leakage (secondary effect)*. Leakage occurs when an activity designed to reduce GHGs in one location in fact increases GHG emissions elsewhere.

*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.

*Local Government Operations (LGO) Protocol.* A flexible framework serving the needs of local governmental organizations drafted jointly by The Climate Registry, ICLEI (Local Governments for Sustainability), the California Climate Action Registry, and the California Air Resources Board. Because of its compatibility with both the *GHG Protocol Corporate Standard* and the *U.S. Public Sector Protocol*, local government bodies should consult the LGO Protocol for accounting guidance that is tailored to cities, counties, and municipalities.

*Material discrepancy*. An error or combination of errors (for example from an oversight, omission, or miscalculation) that results in the reported quantity being significantly different from the true value to an extent that will influence performance or decisions. Also known as material misstatement.

*Materiality threshold*. A concept employed in the process of verification. It is often used to determine whether an error or omission is a material discrepancy or not. It should not be viewed as a *de minimus* threshold for defining a complete inventory.

*Mobile combustion*. Burning of fuels by transportation devices such as cars, trucks, trains, airplanes, ships, etc.

*Model uncertainty*. GHG quantification uncertainty associated with mathematical equations used to characterize the relationship between various parameters and emission processes.

*National-level inventories.* Inventories representing emissions from all sectors within a country, including electricity generation, transportation, land use change, etc. These inventories are usually compiled via a top-down exercise using national economic data for the purposes of the UNFCCC process.

*Non-Annex 1 countries*. Countries that have ratified or acceded to the UNFCC but are not listed under Annex 1 and are therefore not under any emission reduction obligation (see also Annex 1 countries).

*Operation*. A generic term used to denote any kind of business, irrespective of its organizational, governance, or legal structures. An operation can be a facility, subsidiary, affiliated company, or other form of joint venture.

*Operating lease*. A lease which 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. All leases other than capital/finance leases are operating leases (see above).

*Operational boundaries*. The boundaries that determine the direct and indirect emissions associated with operations owned or controlled by the reporting organization. This assessment allows an organization 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.

*Organic growth/decline*. Increases or decreases in GHG emissions as a result of changes in production output, product mix, plant closures, and the opening of new plants.

*Organizational boundaries*. The boundaries that determine the operations owned or controlled by the reporting organization, depending on the consolidation approach taken (equity or control approach).

*Outsourcing*. Contracting out work to outside entities previously performed internally by the reporting organization.

*Parameter uncertainty*. Uncertainty associated with quantifying the parameters used as inputs to GHG estimation models.

*Primary effects*. The specific GHG reducing elements or activities (reducing GHG emissions, carbon storage, or enhancing GHG removals) that a reduction project is intended to achieve.

*Process emissions*. Emissions generated from manufacturing processes, such as the $CO_2$ that arises from the breakdown of $CaCO_3$ during cement manufacture.

*Productivity/efficiency ratios*. Ratios that express the value or achievement of a business divided by its GHG impact. Increasing efficiency ratios reflect performance improvement, e.g., resource productivity (sales per tonne of GHG). Productivity/efficiency ratios are the inverse of intensity ratios.

*Public Sector Organization:* Any organization that is owned, controlled or operated by various levels of government. Such organizations usually provide basic public services such as law enforcement, public transport, environmental protection, etc.

*Ratio indicator*. Indicators providing information on relative performance such as intensity ratios or productivity/efficiency ratios.

*Renewable energy*. Energy taken from sources that are inexhaustible, e.g., wind, water, solar, geothermal energy, and biofuels.

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

*Reversibility of reductions*. This occurs when reductions are temporary, or where removed or stored carbon may be returned to the atmosphere at some point in the future.

*Rolling base year*. The process of shifting or rolling the base year forward by a certain number of years at regular intervals of time.

*Scientific uncertainty*. Uncertainty that arises when the science of the actual emission and/or removal process is not completely understood.

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

*Scope 1 inventory*. A reporting organization's direct GHG emissions.

*Scope 2 inventory*. A reporting organization's indirect emissions associated with the generation of electricity, heating/cooling, or steam purchased for own consumption.

*Scope 3 inventory*. A reporting organization's indirect emissions other than those covered in scope 2.

*Scope of works*. An up-front specification that indicates the type of verification to be undertaken and the level of assurance to be provided between the reporting organization and the verifier during the verification process.

*Secondary effects (leakage)*. GHG emissions changes resulting from the project not captured by the primary effect(s). These are typically the small, unintended GHG consequences of a project.

*Sequestered atmospheric carbon*. $CO_2$ removed from the atmosphere by biological sinks and stored in plant tissue. Sequestered atmospheric carbon does not include GHGs captured through carbon capture and storage.

*Significance threshold*. A qualitative or quantitative criterion used to define any significant change to the data, inventory boundary, methods, or any other relevant factors affecting a GHG inventory. The organization is responsible for determining the "significance threshold" that triggers base year emission recalculation and to disclose it.

*Stationary combustion*. Burning of fuels to generate electricity, steam, heat, or power in stationary equipment such as boilers, furnaces, etc.

*Structural change*. A change in the organizational or operational boundaries of an organization that result in the transfer of ownership or control of emissions from one organization to another. Structural changes usually result from a transfer of ownership of emissions, such as mergers, acquisitions, divestitures, but can also include outsourcing/insourcing.

*Target base year*. The base year used for defining a GHG target, e.g., to reduce $CO_2$ emissions 25 percent below 2000 levels (the base year) by the year 2010.

*Target boundary*. The boundary that defines which GHG's, geographic operations, sources, and activities are covered by the target.

*Target commitment period*. The period of time during which emissions performance is actually measured against the target. It ends with the target completion date.

*Target completion date*. The date that defines the end of the target commitment period.

*Target double counting policy*. A policy that determines how double counting of GHG reductions or other instruments, such as allowances issued by external trading programs, is dealt with under a GHG target. It applies only to organizations that engage in trading (sale or purchase) of offsets or whose target boundaries interface with other organizations' targets or external programs.

*Tonne.* One metric ton, with a mass equal to 1,000 kilograms, or 2,205 pounds.

*Transmission and distribution (T&D) system.* A network of cables and infrastructure that permits electrical energy to be sent from generators to substations to customers.

*Transmission and distribution (T&D) loss.* The amount or percentage of generated electricity that is lost during its transmission or distribution from the generator to either substations or customers. The extent of this loss is mostly determined by the age and quality of the T&D infrastructure.

*Uncertainty*.

1. Statistical definition: A parameter associated with the result of a measurement that characterizes the dispersion of the values that could be reasonably attributed to the measured quantity (e.g., the sample variance or coefficient of variation).

2. Inventory definition: A general and imprecise term which refers to the lack of certainty in emissions-related data resulting from any causal factor, such as the application of non-representative factors or methods, incomplete data on sources and sinks, lack of transparency, etc. Reported uncertainty information typically specifies a quantitative estimate of the likely or perceived difference between a reported value and a qualitative description of the likely causes of the difference.

*United Nations Framework Convention on Climate Change* (UNFCCC). Signed in 1992 at the Rio Earth Summit, the UNFCCC is a milestone Convention on Climate Change treaty that provides an overall framework for international efforts to mitigate climate change. The Kyoto Protocol is a protocol to the UNFCCC.

*Value chain emissions*. Emissions from the upstream and downstream activities associated with the operations of the reporting organization.

*Verification*. An independent assessment of the reliability (considering completeness and accuracy) of a GHG inventory. Also called assurance.

*World Business Council on Sustainable Development* (WBSCD): a Geneva-based association of over 200 companies. The WBSCD partners with World Resources Institute in the establishment of the GHG Protocol Initiative and the development of its GHG accounting standards.

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# Contributors

Kevin DeGroat, Antares Group, Inc.
Rachel Thompson, Austin Climate Protection Program
Sascha Petersen, Austin Climate Protection Program
David Edwards, California Air Resources Board
Alicia Ayars, Carbon Disclosure Project
Kyle Diesner, City of Portland
Rachael Tornek, Climate Action Reserve
Pete Brunelli, Connecticut Department of Environmental Protection
Christine Chulick, Defense Logistics Agency
Evan Fago, Eastern Research Group
David Wright, Eastern Research Group
Steve Sinclair, Fairfax County, VA
Michael Barancewicz, Loudoun County Public Schools, VA
Mary Jane Rutkowski, Maryland Department of the Environment
Molla Sarros, Maryland Department of the Environment
Rich Norling, Maryland Department of National Resources
Jeffrey King, Metropolitan Washington Council of Governments
Susan Heffron, Minnesota Pollution Control Agency
Jeremy Alcorn, National Aeronautics and Space Administration
Kathleen Moxley, National Aeronautics and Space Administration
Linda Wennerberg, National Aeronautics and Space Administration
Sam Higuch, National Aeronautics and Space Administration
Julie McNamee, National Park Service
Shawn Norton, National Park Service
Chris Steuer, National Park Service
Mark Lowery, New York State Department of Environmental Conservation
Sushma Masemore,
North Carolina Department of Environment and Natural Resources
Jason Hollett, Nova Scotia Environment
Dana Arnold, Office of the Federal Environmental Executive
Eva Musso, Ontario Ministry of Environment
Bill Drumheller, Oregon Department of Energy
Ed Pinero, Parsons Corporation
Matthew Dwyer, PricewaterhouseCoopers
Nick Shufro, PricewaterhouseCoopers
Tom Colbert, Prince William County Schools, Virginia
Cal Broomhead, San Francisco Department of Environment
Lisa Dickson, SEA Consultants
David Zimmerman, Tennessee Valley Authority
Dan Kowalczyk, US Air Force
Dave Sheets, U S Army Environmental Policy Institute
Peter Heinricher, U S Army Construction Engineering Research Laboratory
Denise Ingram, US Department of Agriculture/Forest Service

Craig Lasser, US Department of Agriculture/Forest Service
Julie Harllee Tucker, US Department of Agriculture/Forest Service
Paul McArdle, US Department of Energy
Chris Tremper, US Department of Energy
William Lintner, US Department of Energy/Federal Energy Management Program
Louis Martino, US Department of Energy/Argonne National Laboratory
John Nangle, US Department of Energy/National Renewable Energy Laboratory
Kathleen Judd, US Department of Energy/ Pacific Northwest Laboratory
Keith Rule, US Department of Energy/Princeton Plasma Physics Laboratory
David Asiello, US Department of Defense
Pete Aitcheson, US Department of Health and Human Services
Edward Rau, US Department of Health and Human Services/ National Institutes of Health
Lucas Hollenkamp, US Department of Health and Human Services/National Institutes of Health
Catherine Cesnik, US Department of the Interior
Robert Jolley, US Department of Interior/Bureau of Land Management
Susan Caplan, US Department of Interior/Bureau of Land Management
Angela Zahniser, US Department of Interior/Bureau of Land Management
Dawn Gunning, US Department of Justice
Renae Steichen, US Department of Justice
CJ Cordova, US Department of Veterans Affairs
Stephen Earsom, US Federal Highway Administration
Ann Kosmal, US General Services Administration
Kevin Kampschroer, US General Services Administration
Joseph Lerch, Virginia Municipal League
Karin Landsberg, Washington State Department of Transportation Air
Pankaj Bhatia, World Resources Institute
Jefferson Cox, World Resources Institute
Cynthia Cummis, World Resources Institute
Tom Demassa, World Resources Institute
Holly Lahd, World Resources Institute
Janet Ranganathan, World Resources Institute
Neelam Singh, World Resources Institute
Micah Ziegler, World Resources Institute
Carlos Calvo Ambel, zeroemissions

## About WRI

WRI is an independent environmental think tank that goes beyond research to find 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 and its capacity to provide for the needs and aspirations of current and future generations. We organize our work around four key programmatic goals: Climate Protection, Governance, Markets & Enterprise, and People& Ecosystems. A fifth goal—institutional excellence—supports and enhances WRI's ability to achieve results. The GHG Protocol Initiative is a joint partnership between WRI and the World Business Council on Sustainable Development.

## About LMI

LMI has a rich history of public service, bringing the best management and technical minds to address intricate issues across the Federal government. As administrations, priorities, and policies have changed over the last 50 years, LMI's mission—improving the management of government—has remained constant. Our employees come from diverse backgrounds: government and defense, business and industry, and academia and research. Their broad perspective and deep analytical skills, combined with LMI's public-service mission and not-for-profit status, allow us to offer practical—and often original and unconventional—solutions that enable Federal managers to attain their agency's objectives.