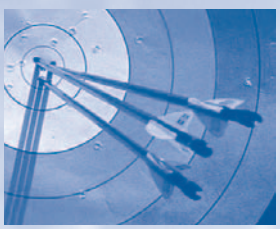
CLIMATE LEADERS GREENHOUSE GAS INVENTORY PROTOCOL

Design Principles



CLIMATE LEADERS
U.S. Environmental Protection Agency

May 2005

The Climate Leaders Greenhouse Gas Inventory Protocol is based on the Greenhouse Gas Protocol (GHG Protocol) developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The GHG Protocol consists of a corporate accounting and reporting standard and separate calculation tools. The Climate Leaders Greenhouse Gas Inventory Protocol is an effort by EPA to enhance the GHG Protocol to fit more precisely what is needed for Climate Leaders. The Climate Leaders Greenhouse Gas Protocol consists of the following components:

- Design Principles
- Core Modules
- Optional Modules

All changes and additions to the GHG Protocol made by Climate Leaders are summarized in the Climate Leaders Greenhouse Gas Inventory Protocol Design Principles.

For more information regarding the Climate Leaders Program, visit us on the web at www.epa.gov/climateleaders

Appendices

Glossary of Terms 81

Tables

Figures

Abbreviations and Acronyms

AC	Air Conditioning
BLS	Bureau of Labor Statistics
CDM	Clean Development Mechanism
CEMS	Continuous Emission Monitoring System
CH_4	Methane
CER	Certified Emission Reduction
CCAR	California Climate Action Registry
CCX	Chicago Climate Exchange
CO_2	Carbon Dioxide
CO_2-eq	Carbon Dioxide Equivalent
EF	Emission Factor
EHS	Environmental Health and Safety
EPA	U.S. Environmental Protection Agency
EPER	European Pollutant Emission Register
EU ETS	European Union Emissions Allowance Trading Scheme
GHG	Greenhouse Gas
GAAP	Generally Accepted Accounting Principles
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
IMP	Inventory Management Plan
IPCC	Intergovernmental Panel on Climate Change
IPIECA	International Petroleum Industry Environmental Conservation Association
IPM	Integrated Planning Model
ISO	International Standards Organization
JI	Joint Implementation
KPI	Key Performance Indicator
MWh	Megawatt-hour
N_2O	Nitrous Oxide
NEMS	National Energy Modeling System
NGO	Non-Governmental Organization
NO_x	Nitrous Oxides
PFCs	Perfluorocarbons
QA/QC	Quality Assurance/Quality Control
SF_6	Sulfur Hexafluoride
T&D	Transmission and Distribution
UKETS	United Kingdom Emission Trading Scheme
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

Introduction

Overview and Goals of the Climate Leaders Program

Climate Leaders is an EPA industry-government partnership that works with companies to develop long-term comprehensive climate change strategies. Partners set a corporate-wide greenhouse gas (GHG) reduction goal and inventory their emissions to measure progress. By reporting inventory data to EPA, Partners create a lasting record of their accomplishments. Partners also identify themselves as corporate environmental leaders and strategically position themselves as climate change policy continues to unfold.

Climate Leaders Partners commit to:

- Develop a corporate-wide GHG inventory of all sources of the six major gases (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) using the Climate Leaders GHG Inventory Protocol.
- Set an aggressive corporate-wide GHG emissions reduction goal to be achieved over the next 5 to 10 years.
- Develop a corporate GHG inventory management plan.
- Annually report inventory data and document progress towards their reduction goal.
- Publicize their participation, reduction pledge, and accomplishments achieved through the program.

In return, EPA provides:

Recognition

- Press events
- Articles and public service announcements in business and trade publications
- Speaking engagements at industry conferences
- Case studies highlighting Partner achievements

Technical Assistance

- Assistance developing a GHG inventory
- Review of Partner's inventory management plan
- Assistance setting a GHG reduction goal
- Peer exchange through Climate Leaders Partner meetings

Credibility

- A credible, transparent GHG reporting mechanism that will develop with the science
- Assurance that Partners have created a high-quality GHG management process

Overview of Climate Leaders Greenhouse Gas Inventory Protocol

The Climate Leaders GHG Inventory Protocol defines how Partners inventory and report their GHG emissions. The Protocol consists of three major parts:

1. Climate Leaders Design Principles (this document)

   The Design Principles of the Protocol include overall guidance on issues such as defining inventory boundaries, identifying GHG emission sources, defining and adjusting a base year, reporting requirements, and goal-setting guidance. The Design Principles also define the minimum level of data Partners must report under Climate Leaders and various optional emission and reduction sources that a Partner may elect to report.

2. Core Modules (separate guidance documents)

   The Core Modules have specific guidance pertaining to the calculation and accounting of GHG emissions from core emissions. Core emissions include "direct" emission sources (sources that a Partner owns or controls) and "indirect" emissions associated with electricity purchased. All Partners are required, as a minimum, to report all core emissions.

3. Optional Modules (separate guidance documents)

   The Optional Modules provide GHG accounting guidance pertaining to other emissions sources that the Partner has some influence over but are beyond the Partner's core emissions. These sources may include activities such as employee commuting programs, off-site waste disposal, or carbon offsets investments.

Relationship to the WRI/WBCSD GHG Protocol

The Climate Leaders GHG Inventory Protocol is based on an existing corporate GHG inventory protocol developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Through a collaborative process involving representatives from industry, government, and non-governmental organizations (NGOs), WRI and WBCSD developed generally accepted accounting practices for measuring and reporting corporate greenhouse gas emissions. The WRI/WBCSD GHG Protocol Corporate Standard (GHG Protocol) consists of a corporate accounting and reporting standard and separate calculation tools. The Design Principles are based on the GHG Protocol corporate accounting and reporting standard. They provide detailed guidance, enhanced clarity, and a streamlined document to fit more precisely the needs of the Climate Leaders program. These Design Principles also include specific reporting requirements, and goal-setting guidance specific to Climate Leaders Partners.

All changes and additions to the GHG Protocol made by EPA are identified using italics beginning in Chapter 1 of this document. These changes and additions are summarized below:

Changes

- Merged standards and guidance sections to eliminate redundancy, streamline, and focus information.
- References to other reporting or trading programs are removed.
- GHG Accounting and Reporting Principles chapter:
  - Defines goals as achieving GHG reduction goal
  - Notes that the scope should be, at a minimum, all U.S. operations
- Setting Organizational Boundaries chapter:
  - Now includes section on leases
- Setting Operational Boundaries chapter:
  - Introduces Climate Leaders core direct, core indirect, and optional emissions
  - Section on leases moved to Setting Organizational Boundaries chapter
- Tracking Emissions Over Time chapter:
  - Defines the base year as the most current year that a Climate Leaders Partner has data available
  - Adds Table 5-1 to clarify rules for adjusting base year emissions.
- Identifying and Calculating GHG Emissions chapter:
  - Emphasizes Climate Leaders core and optional module guidance instead of GHG Protocol calculation tools
  - Section on rolling up data moved to Reporting chapter
  - Table 6-1, Example Data Collection Roadmap added
  - Reference information on CO_2-equivalent and Global Warming Potential added
- Managing Inventory Quality chapter:
  - Adds references for uncertainty analysis
  - Adds Table 7-1 to efficiently present information originally presented as text in GHG Protocol
  - Reorganizes chapter to streamline material
- Tracking Progress Towards the GHG Reduction Goal chapter:
  - Was previously titled Accounting for GHG Reductions
  - Expands the GHG Protocol section to address achieving the reduction goal and relevant accounting
  - Adds a section on accounting for project-based offsets
  - Enhances offsets and credits for meaningfulness and clarity
  - Graphics added

- Reporting GHG Emissions chapter:
  - Clarifies Climate Leaders requirements
  - Now includes roll-up of data to corporate level
- Guidance on Setting a GHG Reduction Goal chapter:
  - Provides guidance specific to the Climate Leaders program on the target type, target base year, target time period, use of project offsets or credits, target level, and progress against the target
  - Figure 11-1 added to illustrate methods for achieving the goal
- Appendix 1:
  - Reflects the Climate Leaders Core and Optional Modules

Additions

- New graphics to enhance clarity, meaningfulness, and usability
- A section on Climate Leaders Reporting requirements
- Appendix 2: provides useful information on unit conversion and fuel properties
- Appendix 3: Climate Leaders Inventory Management Plan checklist
- Appendix 4: Climate Leaders Annual Reporting Form

The Climate Leaders Core and Optional Modules are based on the WRI/WBCSD calculation tools. The differences between the modules and the tools are summarized below:

- All Climate Leaders Core Modules recommend U.S. specific emission factors for U.S. facilities, as opposed to the International Panel on Climate Change (IPCC) factors given by WRI/WBCSD.
- The Climate Leaders Modules provide, in some instances, guidance on the preferred choice of methods and activity data for reporting under Climate Leaders.

GHG Accounting and Reporting Principles

As with financial reporting, generally accepted GHG accounting and reporting principles are intended to underpin and guide GHG accounting and reporting to ensure that the reported information represents a faithful, true, and fair account of an organization's GHG emissions.

GHG accounting and reporting practices are evolving and are new to many businesses; however the principles are derived in part from generally accepted financial accounting and reporting principles. The principles, listed below and described in more detail in this chapter, reflect the outcome of a collaborative process involving stakeholders from a wide range of technical, environmental, and accounting disciplines.

- **Relevance.** Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users—both internal and external to the company.
- **Completeness.** Account for and report all GHG emissions sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusions.
- **Consistency.** Use consistent methodologies to allow meaningful comparison 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 true 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.

Relevance

For an organization's GHG report to be relevant means that it contains the information that users—both internal and external to the company—need for their decision making. An important aspect of relevance is the selection of an appropriate inventory boundary that reflects the substance and economic reality of the company's business relationships, not merely its legal form. The choice of the inventory boundary is dependent on the characteristics of the company, the intended purpose of the information, and the needs of the users. When choosing the inventory boundary, a number of factors should be considered, such as:

- Organizational structures: control (operational and financial), ownership, legal agreements, joint ventures, etc. *Climate*

Leaders Partners inventory GHG emissions from all U.S. operations, and have the option of including international operations as well.

- Operational boundaries: onsite and offsite activities, processes, services, and impacts. *The Core and Optional Modules of the Climate Leaders program provide guidance on the types of operations that should be included in your inventory.*

- Business context: *Partners are creating corporate inventories to design and achieve entity-wide GHG emissions reduction goals. Partners may find that the consistency of the Climate Leaders program with other GHG management or tracking programs facilitates use of the inventory for other purposes as well.*

More information on setting appropriate boundaries is provided in:

- Chapter 3: Setting Organizational Boundaries
- Chapter 4: Setting Operational Boundaries

Completeness

All relevant emissions sources within the chosen inventory boundary need to be included so that a comprehensive and meaningful inventory is compiled. In practice, a lack of data or the cost of gathering data may be a limiting factor. *An essential component of a complete inventory is a description of which greenhouse gases are included. Partners include CO_2, CH_4, N_2O, SF_6, PFCs, and HFCs to the extent that these gases exist in their operations.*

Sometimes it is tempting to define a minimum emissions accounting threshold (often referred to as a materiality threshold) stating that a source not exceeding a certain size can be omitted from the inventory. Technically, such a threshold is simply a predefined and accepted negative bias in estimates (i.e., an underestimate). Although it appears useful in theory, the practical implementation of such a threshold is not compatible with the completeness principle of *Climate Leaders.* To utilize a materiality specification, the emissions from a particular source or activity would have to be quantified to ensure that they were under the threshold. However, once emissions are quantified, most of the benefit of having a threshold is lost.

A threshold is often used to determine whether an error or omission is a material discrepancy. This is not the same as a de minimus for defining a complete inventory. Instead, *Partners* need to make a good faith effort to provide a complete, accurate, and consistent accounting of their GHG emissions. For cases where emissions cannot be estimated, or are estimated at an insufficient level of quality, it is important that this is transparently documented and justified. *Under the Climate Leaders Program, this doesn't necessarily require a rigorous quantification of all sources, but, at a minimum, an estimate based on available data should be developed for all sources.* Verifiers can determine the potential impact and relevance of the exclusion, or lack of quality, on the overall inventory report. *It is important to include as much information as possible so that the process of gathering quality data can be refined in later years. To facilitate completeness, consistency, and transparency in the data gathering process, part of the Climate Leaders program includes the development an Inventory Management Plan. Development of this plan facilitates better monitoring and data gathering of GHG emissions*

sources. More information on completeness is provided in:

- Chapter 6: Identifying and Calculating GHG Emissions
- Chapter 7: Managing Inventory Quality
- Chapter 10: Verification of GHG emissions

Consistency

Users of GHG information will want to track and compare GHG emissions over time to identify trends and assess the performance of the reporting company. The consistent application of accounting approaches, inventory boundary, and calculation methodologies is essential to producing comparable GHG emissions data over time. The GHG information for all operations within an organization's inventory boundary needs to be compiled in a manner that ensures that the aggregate information is internally consistent and comparable over time. If there are changes in the inventory boundary, methods, data or any other factors affecting emission estimates, they need to be transparently documented and justified. *A specific format for reporting the corporate emissions summary is required for Climate Leaders' Partners so that data reporting consistency can be maintained. Partners who choose to voluntarily report their facility level data to the Climate Leaders program may do so using any format they choose.*

More information on this is provided in:

- Chapter 5: Tracking Emissions Over Time
- Chapter 9: Reporting GHG 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 archives (i.e., an audit trail). Information needs to be recorded, compiled, and analyzed in a way that would enable internal reviewers and external verifiers to attest to 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 company 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. *The Climate Leaders program provides an Inventory Management Plan checklist to guide Partners towards construction of a Inventory Management Plan, which in turn, provides for a transparent, verifiable inventory.*

More information on this is provided in:

- Chapter 9: Reporting GHG Emissions
- Chapter 10: Verification of GHG Emissions

Accuracy

Data should be sufficiently precise 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 that uncertainties are reduced as far as practicable. The quantification process should be conducted in a manner that minimizes uncertainty. *Use of the calculation guidance provided in the Climate Leaders Core Modules, coupled with development of the Climate Leaders Inventory Management Plan, can significantly enhance data accuracy and transparency as well as promote credibility.*

More information on how to increase your inventory's accuracy and on how to minimize data uncertainties is provided in:

- Chapter 7: Managing Inventory Quality

Business Goals and Inventory Design

Improving your understanding of your company's GHG emissions by compiling a GHG inventory makes good business sense. Companies frequently cite the following five business goals as reasons for compiling a GHG inventory:

- Management of GHG risks and identifying reduction opportunities
- Public reporting and participation in GHG programs
- Participation in mandatory reporting programs
- Participation in GHG markets
- Recognition for early voluntary action

Compiling a comprehensive GHG inventory improves a company's understanding of its emissions profile and any potential GHG liability or "exposure." A company's GHG exposure is increasingly becoming a management issue in light of heightened scrutiny by the insurance industry, shareholders, and the emergence of environmental policies designed to reduce GHG emissions. In this context, significant GHG emissions in a company's value chain may result in increased costs (upstream) or reduced sales (downstream). Thus, investors may view significant indirect emissions upstream or downstream of a company's operations as potential liabilities that need to be managed and reduced. A limited focus on direct emissions from a company's own operations may miss major GHG risks and opportunities, while leading to a misinterpretation of the company's actual GHG exposure.

In general, what gets measured gets managed. Accounting for emissions can help identify the most effective reduction opportunities. This accounting can drive increased materials and energy efficiencies as well as the development of new products and services that reduce the GHG impacts of customers or suppliers. This can, in turn, reduce production costs and help differentiate the company in an increasingly environmentally conscious marketplace. Conducting a rigorous GHG inventory is also a prerequisite for setting an internal or public GHG reduction target and for subsequently measuring and reporting progress.

Setting Organizational Boundaries

Business operations vary in their legal and organizational structures; they include wholly owned operations, incorporated and non-incorporated joint ventures, subsidiaries, and others. For the purposes of financial accounting, they are treated according to established rules that depend on the structure of the organization and the relationships among the parties involved. In setting organizational boundaries, a company selects an approach for consolidating GHG emissions and then consistently applies the selected approach to define those businesses and operations that constitute the company for the purpose of accounting and reporting GHG emissions.

For corporate reporting, two distinct approaches can be used to consolidate GHG emissions: the equity share and the control approaches. Partners shall account for and report their consolidated GHG data according to either approach as presented below. *Under the Climate Leaders program, companies may additionally choose to report using both approaches, and additionally may include facilities that are neither owned nor controlled.*

If the reporting company wholly owns all its operations, its organizational boundary will be the same regardless of approach used. For companies with joint operations, the organizational boundary and the resulting emissions may differ depending on the approach used. However, in both wholly owned and joint operations, the choice of approach may change how emissions are categorized when operational boundaries are set (Chapter 4).

Equity Share Approach

Under the equity share approach, a *Partner* accounts for GHG emissions from operations according to its share of equity in the operation. The equity share reflects economic interest, which is the extent of rights a company 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 company'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 company has with the operation will always override the legal ownership form to ensure that equity share reflects the percentage of economic interest. The principle of economic substance taking precedent over legal form is consistent with international financial reporting standards. The staff preparing the inventory may therefore need to consult with the *Partner's* accounting or legal staff to ensure that the appropriate equity share percentage is applied for each joint operation (refer to Table 3-1 for definitions of financial accounting categories).

Table 3-1: Financial Accounting Categories

		Accounting for GHG Emissions		
			Control Approach	
Accounting Category	**Definition***	**Equity Share Approach**	**Financial Control**	***Operational Control***
Group Companies/ Subsidiaries	The parent company has the ability to direct the financial and operating policies of the company with a view of gaining economic benefits from its activities. One hundred percent of the subsidiary's income and expenses, and assets and liabilities are taken into the parent company's profit and loss account and balance sheet, respectively. *Typically, a subsidiary is a company whose voting stock is more than 50 percent owned by another company (the parent company).*	Equity share of GHG emissions	100 percent of GHG emissions	*100 percent of GHG emissions (if operational control)* *0 percent of GHG emissions (if no operational control)*
Associated/ Affiliated Companies	*Typically, the parent company owns less than 50 percent of the affiliated company's stock (or otherwise does not have financial control), but still has influence over its operations and financial policies.* This includes incorporated and non-incorporated joint ventures and partnerships over which the parent company has significant influence, but not financial control.	Equity share of GHG emissions	0 percent of GHG emissions	*100 percent of GHG emissions (if operational control)* *0 percent of GHG emissions (if no operational control)*
Proportionally Consolidated Joint Ventures (where partners have joint financial control)	A joint venture, partnership, or operation where each partner accounts for their proportion of the joint venture's income, expenses, assets, and liabilities. *Each partner has an equal financial share of the operation.*	Equity share of GHG emissions	Equity share of GHG emissions *(e.g., 50% if two partners, 33.33% if three partners, etc.)*	*100 percent of GHG emissions (if operational control)* *0 percent of GHG emissions (if no operational control)*
Fixed Asset Investments	The parent company has neither significant influence nor financial control. Typically financial accounting applies the cost/dividend method to these types of investments. This implies that only dividends received are recognized as income and the investment is carried at cost.	0 percent of GHG emissions	0 percent of GHG emissions	0 percent of GHG emissions
Franchises	A franchise is a separate legal entity, *usually not under the financial or operational control of its franchiser, which gives rights to sell a product or service.* Should the terms of a franchise grant financial or operational control to the franchiser, then emissions accounting should be consistent with the rules provided above.	Equity share of GHG emissions *(if the franchiser has equity rights)*	100 percent of GHG emissions *(if the franchiser has financial control)* *0 percent of GHG emissions (if the franchiser does not have financial control)*	*100 percent of GHG emissions (if operational control)* *0 percent of GHG emissions (if no operational control)*

**http://www.ventureline.com/glossary.asp and the GHG Protocol*

Control Approach

Under the control approach, a *Partner* accounts for 100 percent of the GHG emissions from operations over which it has control. It does not account for GHG emissions from operations in which it owns an interest but has no control. Control can be defined in either financial or operational terms. When using the control approach to consolidate GHG emissions, companies shall choose between either the operational or financial control criteria.

In most cases, whether an operation is controlled by the company or not does not vary based on whether the financial control or operational control criterion is used. A notable exception is the oil and gas industry, which often has complex ownership/operatorship structures.

Financial Control

A *Partner* has financial control over the operation if the former has the ability to direct the financial and operating policies of the latter with a view to gaining economic benefits from its activities. For example, financial control usually exists if the company has the right to the majority of benefits of the operation, without regard to the manner by which these rights are conveyed. Similarly, a company 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 company and the operation takes precedence over the legal ownership status, so that the company may have financial control over the 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 company and those held by other parties, is also taken into account. This criterion is consistent with international financial accounting standards; therefore, a company has financial control over an operation for GHG accounting purposes if the operation is considered as a group company for the purpose of financial consolidation, i.e., if the operation is fully consolidated in financial accounts. If this criterion is chosen to determine control, emissions from joint ventures where partners have joint financial control are accounted for based on the equity share approach (refer to Table 3-1 for definitions of financial accounting categories).

Operational Control

A *Partner* has operational control over an operation if the former or one of its subsidiaries (refer to Table 3-1 for definitions of financial accounting categories) has the full authority to introduce and implement its operating policies at the operation.

This criterion is consistent with the current accounting and reporting practice of many companies that report on emissions from facilities, which they operate (i.e., for which they hold the operating license). It is expected that, except in very rare circumstances, if the company or one of its subsidiaries is the operator of a facility, it will have the full authority to introduce and implement its operating policies and thus has operational control. Under the operational control approach, a company accounts for 100 percent of emissions from operations over which it or one of its subsidiaries has operational control.

It should be emphasized that having operational control does not mean that a company necessarily has authority to make all decisions concerning an operation. For example, big capital investments will likely require the approval of all the partners that have joint financial control. Operational control does mean that a company has the authority to introduce and implement its operating policies.

Sometimes a company can have joint financial control over an operation, but not operational control. In such cases, the company would need to look at the contractual arrangements to determine whether any one of the partners has the authority to introduce and implement its operating policies at the operation and thus has the responsibility to report emissions under operational control. If the operation itself will introduce and implement its own operating policies, the partners with joint financial control over the operation will not report any emissions under operational control.

Table 3-2 on page 14 illustrates the selection of a consolidation approach at the corporate level and the identification of those joint operations that should be in the organizational boundary depending on the choice of the consolidation approach.

Leased Assets, Outsourcing, and Franchises

The selected consolidation approach (equity share or one of the control approaches) is also applied to account for and characterize direct and indirect GHG emissions from contractual arrangements such as leased assets, outsourcing, and franchises. Specific guidance on leased assets is provided below:

Using Equity Approach or Financial Control

A lessee only accounts for emissions from leased assets that are treated as wholly owned assets in financial accounting and are recorded as such on the balance sheet (i.e., finance or capital leases). *A finance/capital lease is one that transfers substantially all the risks and rewards of ownership to the lessee. All leased assets that do not meet the criteria for finance/capital leases are considered operating leases.*

Guidance on which leased assets are considered operating leases and which are considered finance/capital leases should be obtained from the company accountant.

Using Operational Control

A lessee only accounts for emissions from leased assets that it operates (i.e., if the operational control criterion applies). *This applies to both finance/capital leases and operating leases.*

Climate Leaders assumes operational control of a lease applies if the lessee has the ability to track energy use and/or emissions from the lease.

The ability of a Partner to track energy use and/or emissions from its leases includes the following methods:

- *The Partner pays the utility bill for leased space or the fuel bill for leased vehicles and has data on the actual amount of fuel and electricity used by the lease.*
- *The Partner leases part of a larger building and does not pay its own utility bill. However, it can get the fuel and electricity use for the entire building from the landlord, and there is an accurate method to allocate total energy use/emissions to the Partner's leased space (e.g., separate electricity meter for the Partner's space).*

- *The Partner leases many homogeneous sites (e.g., commercial and retail space) that represent a significant portion of their inventory and for which the individual sites have data on the amount of fuel and electricity used. However, it would be difficult to get the data from all the decentralized leased sites. In this case, the Partner could do a statistical sampling of sites to get emissions and extrapolate those results to the remainder of its leased sites.*

For the last two methods, the Partner should be careful when tracking changes in emissions for these leases over time. In the case of allocating energy use from the entire building, the allocation method should allow for tracking changes made to the Partners leased space only (e.g., not just allocating based on a percentage of total building floor space). In the case of like sites, the Partner should ensure that emissions reductions or increases are actually happening in all sites and not just the ones measured for the statistical sample, or that the statistical sample and analysis is accurate enough to account for differences at different leased sites.

A *Partner* can also choose to include emissions from leases that fall outside of its organizational boundaries. These emissions would be reported under the *optional emissions source category* on the *Climate Leaders Annual GHG Inventory Summary and Goal Tracking Form.*

Consolidation at Multiple Levels

The consolidation of GHG emissions data will only result in consistent data if all levels of the organization follow the same consolidation policy. In the first step, the management of the parent company has to decide on a consolidation approach (i.e., either the equity share or the financial or operational control approach). Once a corporate consolidation policy has been selected, it is applied to all levels of the organization.

State-Ownership

The rules provided in this chapter can also be applied to account for GHG emissions from industry joint operations that involve state ownership or a mix of private/state ownership.

Double Counting

When two or more companies hold interests in the same joint operation and use different consolidation approaches (e.g., Company A follows the equity share approach while Company B uses the financial control approach), emissions from that joint operation could be double counted. This may not matter for voluntary corporate public reporting, including the *Climate Leaders program,* as long as there is adequate disclosure from the company on its consolidation approach *(via the Inventory Management Plan).*

Contracts That Cover GHG Emissions

To clarify ownership (rights) and responsibility (obligations) issues, companies 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, companies may optionally provide a description of the contractual arrangement and include information on allocation of CO_2 related risks and obligations (see Chapter 9).

Using the Equity Share or Control Approach

Climate Leaders makes no recommendation as to whether reporting should be based on the equity share or control approach, however whichever method is selected, it should be applied consistently throughout the inventory. The reporting method a Partner chooses should be clearly stated in the company's Inventory Management Plan.

Companies should decide on the approach best suited to their business activities and GHG accounting and reporting requirements. Examples of how these may drive the choice of approach include the following:

- **Reflection of commercial reality.** It can be argued that a company that derives an economic profit from a certain activity should take ownership for any GHG emissions generated by the activity. This is achieved by using the equity share approach, because this approach assigns ownership for GHG emissions on the basis of economic interest in a business activity. The control approaches do not always reflect the full GHG emissions portfolio of a company's business activities, but have the advantage that a company takes full ownership of all GHG emissions that it can directly influence and reduce.
- **Liability and risk management.** While reporting and compliance with regulations should most likely continue to be based directly on operational control, the ultimate financial liability will often rest with the group company that holds an equity share in the operation or has financial control over it. Hence, for assessing risk, GHG reporting on the basis of equity share and financial control approaches provides a more complete picture. The equity share approach is likely to result in the most comprehensive coverage of liability and risks. In the future, *Partners* might incur liabilities for GHG emissions produced by joint operations in which they have an interest, but over which they do not have financial control. For example, a company that is an equity shareholder in an operation but has no financial control over it might face demands by the companies with a controlling share to cover its requisite share of GHG compliance costs.
- **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 a company creates by its joint operations, the same consolidation rules that are 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 seem to be 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, since it can be difficult and time consuming to collect GHG emissions data

from joint operations not under the control of the reporting company. *Partners* 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.** Companies 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 that are included in the organizational boundary.

The following example, illustrated in Figure 3-1 and Table 3-2, illustrates how to account for GHG emissions from the various wholly owned and joint operations under both the equity share and control approaches.

Example

Holland Industries is a chemicals group comprising a number of companies/joint ventures active in the production and marketing of chemicals.

In setting its organizational boundary, Holland Industries first decides whether to use the equity or control approach for consolidating GHG data at the corporate level. It then determines which operations at the corporate level meet its selected consolidation approach. Based on the selected consolidation approach, the consolidation process is repeated for each lower operational level. In this process, GHG emissions are first apportioned at the lower operational level (subsidiaries, associate, joint ventures, etc.) before they are consolidated at the corporate level. Figure 3-1 presents the organizational boundary of Holland Industries based on the equity share and control approaches.

Note that in this example, Holland America (not Holland Industries) holds a 50 percent interest in BGB and a 75 percent interest in IRW. If the activities of Holland Industries itself produce GHG emissions (e.g., emissions associated with electricity use at the head office), then these emissions should also be included in the consolidation at 100 percent.

Figure 3-1: Defining the Organizational Boundary of Holland Industries

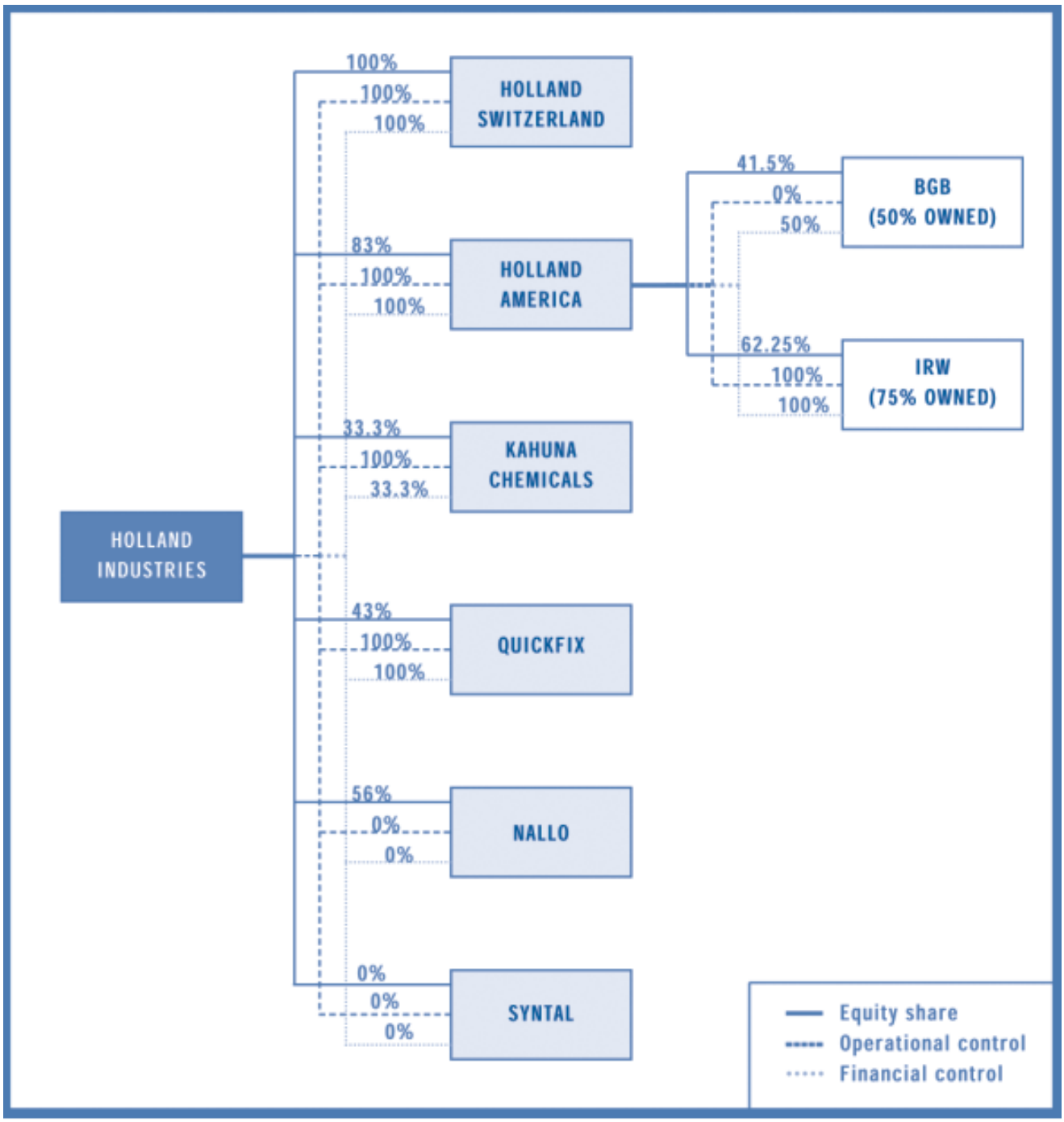


Table 3-2: Holland Industries Organizational Structure and GHG Emissions Accounting

					Emissions Accounted for by Holland Industries	
Wholly Owned and Joint Operations of Holland	**Legal Structure and Partners**	**Economic Interest Held by Holland Industries**	**Control of Operating Policies**	**Treatment in Holland Industries' Financial Accounts**	**Equity Share Approach**	**Control Approach**
Holland Switzerland	Incorporated company	100%	Holland Industries	Wholly owned subsidiary	100%	100% for operational control 100% for financial control
Holland America	Incorporated company	83%	Holland Industries	Subsidiary	83%	100% for operational control 100% for financial control
BGB	Joint venture, partners have joint financial control; the other partner is Rearden	50% owned by Holland America	Rearden	Via Holland America	41.5% (83% x 50%)	0% for operational control 50% for financial control (50% x 100%)
IRW	Subsidiary of Holland Industries	75% owned by Holland America	Holland America (subsidiary of Holland Industries)	Via Holland America	62.25% (83% x 75%)	100% for operational control 100% for financial control
Kahuna Chemicals	Non-incorporated joint venture; partners have joint financial control; two other partners: ICT and BCSF	33.3%	Holland Industries	Proportionally consolidated joint venture	33.3%	100% for operational control 33% for financial control
QuickFix	Incorporated joint venture; the other partner is Majox	43%	Holland Industries	Subsidiary (Holland Industries has financial control because it treats QuickFix as a subsidiary in its financial accounts)	43%	100% for operational control 100% for financial control
Nallo	Incorporated joint venture; the other partner is Nagua Co.	56%	Nallo	Associated company (Holland Industries does not have financial control because it treats Nallo as an associated company in its financial accounts)	56%	0% for operational control 0% for financial control
Syntal	Incorporated company, subsidiary of Erewhon Co.	1%	Erewhon Co.	Fixed asset investment	0%	0% for operational control 0% for financial control

Setting Operational Boundaries

After a company has determined its organizational boundaries in terms of the operations that it owns or controls, it then sets its operational boundaries. This involves identifying the emissions associated with its operations and categorizing them as *core direct, core indirect, and optional emissions. The Climate Leaders program requires Partners to report, at a minimum, all core direct and indirect emissions. Partners have the option of including other emissions sources from upstream and downstream activities (optional emissions), if a credible emissions accounting methodology exists.*

The selected operational boundary is then uniformly applied to identify and categorize direct and indirect emissions at each operational level. The established organizational and operational boundaries together constitute a *Partner's* inventory boundary.

Emissions Categorization

Emissions may be either directly or indirectly derived from *Partner* activities. Classifying emissions as either direct or indirect is dependent on the consolidation approach (equity share or control) selected for setting the organizational boundary (Chapter 3). Direct emissions versus indirect emissions are defined as follows:

- **Direct** emissions are from sources that are owned or controlled by the company, e.g., emissions from combustion in owned or controlled boilers, furnaces, vehicles; emissions from chemical production in owned or controlled process equipment.

  Direct CO_2 emissions from the combustion of biomass *or of GHG emissions not covered by this protocol (e.g., chlorofluorocarbons (CFCs), nitrous oxide (NO_x), etc.)* shall not be included as part of *core direct* emissions, but may be reported separately.

- **Indirect** emissions are a consequence of the activities of the company, but occur at sources owned or controlled by another company. Indirect emissions for the purchaser are characterized as direct emissions for the facility where the emissions are generated. An example of indirect emissions is the emissions from the generation of purchased electricity consumed by a company.

Reporting for the Climate Leaders Program is delineated by core and optional emissions as described below. These categories are designed to provide a uniform basis to allow companies to compare their own performance over time, and to enhance transparency. Core emissions include those emissions included under Scope 1 and 2 of the WRI/WBCSD GHG Protocol. Optional emissions include those emissions included under Scope 3 as well as under "optional" information in the WRI/WBCSD GHG Protocol. Table 4-1 depicts this relationship. Partners shall separately account for and report core direct and indirect emissions at a minimum.

Table 4-1: Relationship of Climate Leaders to GHG Protocol Reporting Scope Terminology

Climate Leaders	WRI/WBCSD GHG Protocol
Core Emissions (Direct and Indirect)	Scopes 1 and 2
Optional Emissions	Scope 3 and optional information

Core direct and indirect emissions are carefully defined to ensure that two or more companies do not account for the same emissions in the same scope, as defined in the GHG protocol.

Core Emissions Reporting

Core emissions reporting includes both direct and indirect emissions. Core direct emissions result from stationary, mobile, and process-related sources at a facility. Core indirect emissions are emitted as a consequence of the import of electricity, heating/cooling, or steam. Partners should account for and report GHG information separately for each emissions category. To facilitate comparability over time or to aid transparency, Partners are encouraged to further subdivide emissions data, e.g., by business units/facilities, country, source types (production of electricity or steam, transportation, processes, etc.), and activity type (production of electricity, consumption of electricity, generation of purchased electricity that is sold to end users, etc.).

The components of core direct and indirect emissions are described in more detail below:

Core Emissions Reporting – Direct Emissions

Core direct emissions are GHG emissions from sources that are owned or controlled by the reporting company. All Partner companies must report core direct emissions according to their chosen organizational boundary approach. Core direct emissions are principally the result of the following activities undertaken by the company:

- **Generation of electricity, heat, or steam.** For example, fossil fuel combustion in stationary sources such as boilers, furnaces, turbines, or generators. *These emissions are reported without netting sale of own-generated electricity to another reporting company.* These emissions do not include emissions from the combustion of biomass, those should be reported separately.
- **Physical or chemical processing.** Most of these emissions result from manufacture or processing of chemicals and other materials, e.g., cement, aluminum, adipic acid, waste processing, and ammonia manufacture.
- **Transportation of materials, products, waste, and employees.** These emissions result from the combustion of fuels in company-owned/controlled mobile combustion sources, such as trucks, trains, ships, airplanes, buses, and cars (leased mobile sources need to be evaluated as described in Chapter 3).
- **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; HFC emissions from refrigeration and air conditioning equipment; and CH_4 leakages from gas transport.

Exported carbon content sequestered in products should not be reported as core direct emissions.

Core Emissions Reporting – Indirect Emissions

Core indirect emissions are associated with the generation of GHG emissions from sources not owned or controlled by the reporting company and are specifically the result of the following activities:

- **Imported/purchased electricity, heating/cooling, or steam** that a company purchases or otherwise brings into the organizational boundaries of the reporting company (i.e., not self-generated) for its own use.

  For many companies, purchased electricity represents one of the largest sources of GHG emissions and the most significant opportunities to reduce these emissions. Companies can reduce their use of electricity by investing in energy efficient technologies and energy conservation. Additionally, emerging green power markets (i.e., renewable energy sources such as solar photovoltaic panels, geothermal energy, landfill gas, and wind turbines) provide opportunities for some companies to switch to less GHG intensive sources of electricity. Companies can also install an efficient onsite co-generation plant if it replaces the purchase of more GHG intensive electricity from the grid or electricity supplier. *Core indirect* reporting facilitates the transparent accounting of the GHG emissions and benefits associated with such opportunities.

- **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. A portion of the electricity purchased by a utility company is consumed (T&D loss) during its transmission and distribution to end-consumers.

  The reporting company that owns the T&D lines should report the emissions associated with the purchased electricity that is consumed during T&D as core indirect emissions (i.e., not reported by the end users, as they do not own or control the T&D operation where the electricity is consumed, or, therefore, the T&D loss). This approach ensures that there is no double counting because only the T&D utility company will account for indirect emissions associated with T&D losses.

  End consumers may, however, report their indirect emissions associated with T&D losses in optional emissions as "generation of electricity consumed in a T&D system."

- **GHG emissions from activities upstream of the electricity provider** (e.g., exploration, drilling, flaring, transportation, and refining) shall not be included with the *core indirect emissions* reporting but may be reported as optional emissions.

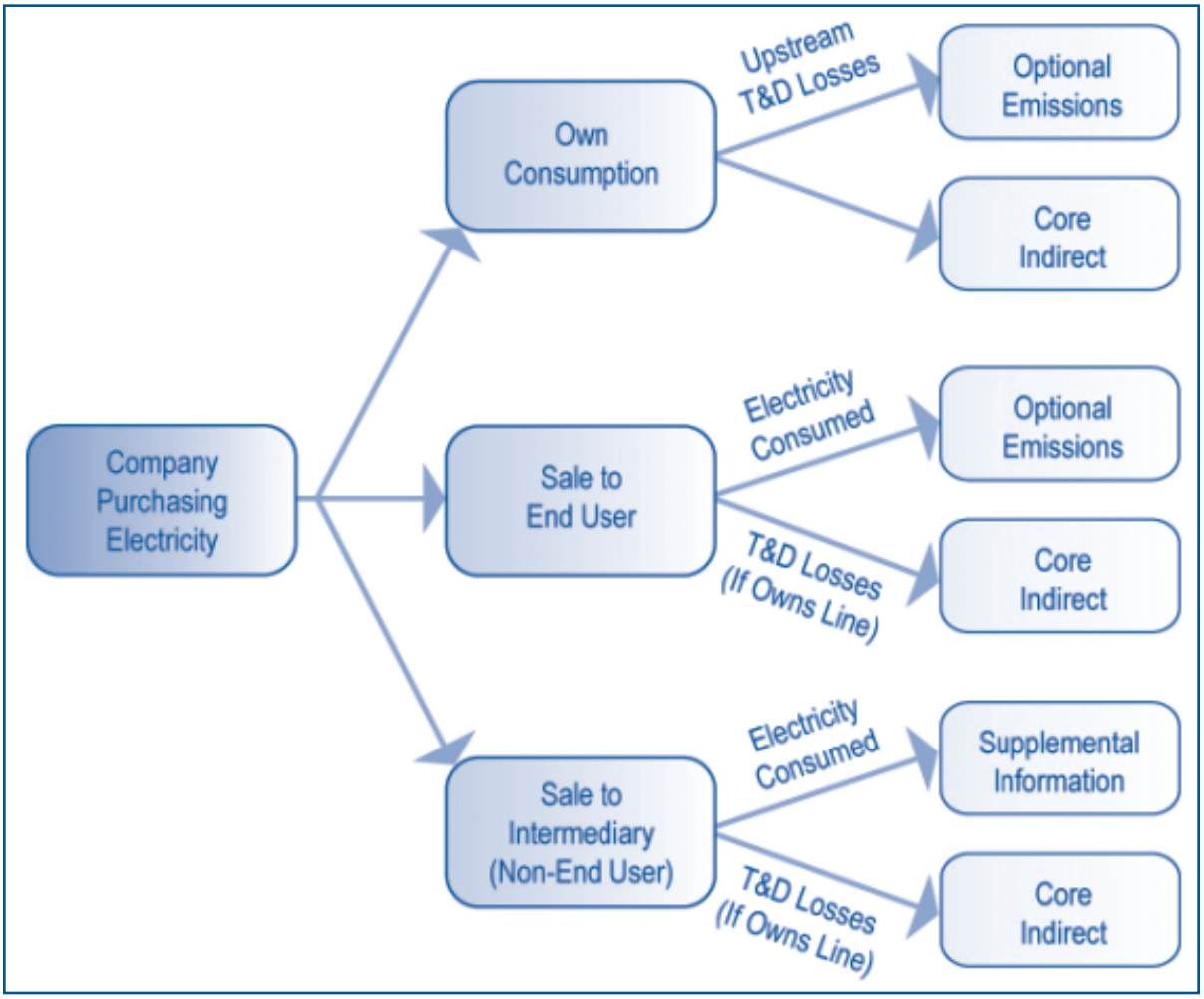
- **Purchase of electricity for sale to end-users.** Should not be reported under *core indirect emissions,* but may be reported in optional emissions.

- **Purchase of electricity for resale.** Also referred to as trading transactions of electricity should not be reported under *core indirect emissions or optional emissions,* but may be reported under supplemental information.

Figure 4-1 summarizes emissions reporting from the sale and purchase of electricity.

Climate Leaders strongly encourages electric utility Partners to include the emissions of electricity purchased for sale to end users in their GHG inventory and goal. This is especially true for utilities that purchase power for a significant portion of their end user demand.

Figure 4-1: Emissions Reporting From the Purchase and Subsequent Use or Sale of Electricity



Example: Reporting GHGs from Generation, Purchase, and Sale of Electricity

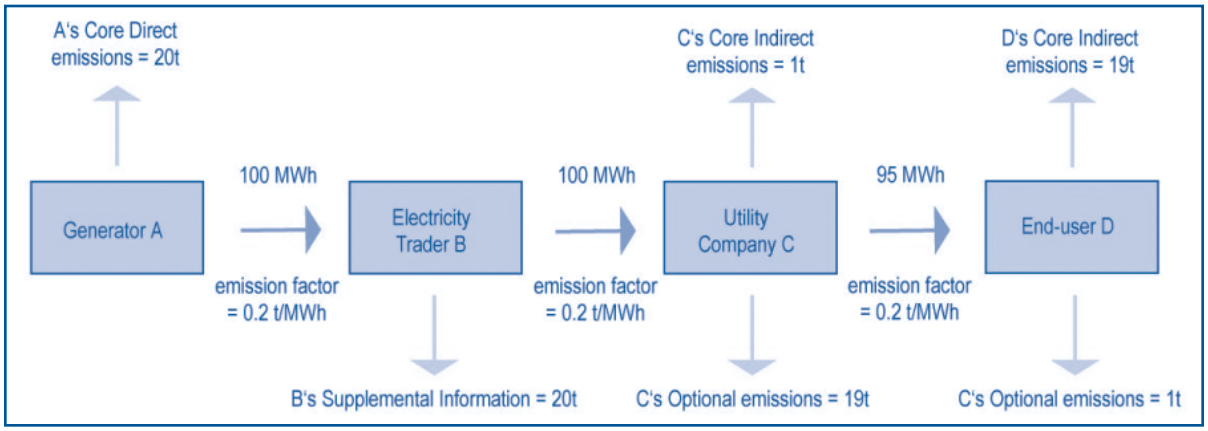
Example one: Company A is an independent power generator that owns a power generation plant. The power plant produces 100 MWh of electricity and releases 20 tons of emissions per year. Company B is an electricity trader and has a supply contract with Company A to purchase all of its electricity. Company B re-sells the purchased electricity (100 MWh) to Company C, a utility company that owns/controls the T&D system. Company C consumes 5 MWh of electricity in its T&D system and sells the remaining 95 MWh to Company D. Company 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 as *core direct* emissions. Company B *may optionally* report emissions from the purchased electricity sold to a non-end-user as *supplemental* information separately from *optional* emissions. Company C *may* report the indirect emissions from the generation of the part of the electricity that is sold to the end-user as *optional* emissions. *However, Company C shall report* the part of the purchased electricity that it consumes in its T&D system as *core indirect* emissions. Company D (end-user) reports the indirect emissions associated with its own consumption of purchased electricity under *core indirect* emissions and can optionally report emissions associated with upstream T&D losses as *optional* emissions.

Figure 4-2 shows the accounting of emissions associated with these transactions.

Example two: Company D installs a co-generation unit and sells surplus electricity to neighboring Company E for its consumption. Company D reports all direct emissions from the co-generation unit as *core direct* emissions. Company D *optionally* reports indirect emissions from the generation of electricity for export to Company E under supplemental information separate from *optional* emissions *(see Chapter 8 on accounting for this in Climate Leaders goal tracking).* Company E reports indirect emissions associated with the consumption of electricity purchased from the Company D's co-generation unit under *core indirect* emissions.

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



Optional Emissions Reporting

Optional emissions reporting allows for the inclusion of emissions that are a consequence of the activities of the reporting company, but occur from sources not owned or controlled by the reporting company, and are not part of the reporting company's *core* emissions. *Partners* may choose to report optional emissions to take a leading role in achieving comprehensive GHG reductions and environmental stewardship.

Emissions reported under these *optional* emissions sources should be adequately explained and supported by data and evidence. It will not be relevant or appropriate for companies to report on all of the activities listed below. Companies should report those activities that are relevant to their business and goals, and for which they have reliable information.

Such *optional* emission sources might include:

- Extraction and production of purchased materials and fuels
- Transport-related activities:
  - Transportation of purchased materials or goods
  - Transportation of purchased fuels
  - Employee business travel
  - Employees commuting to and from work
  - Transportation of sold products
  - Transportation of waste
- Electricity-related activities not included as part of core indirect emissions:
  - Extraction, production, and transportation of fuels consumed in the generation of electricity (either purchased or self-generated by the reporting company).
  - Purchase of electricity that is sold to an end-user (reported by the utility company).
  - Generation of electricity that is consumed in a T&D system (reported by the end-user).
- Leased assets, outsourced activities, and franchises: Emissions from such contractual arrangements are only classified as optional emissions if the selected consolidation approach (equity or control) does not apply to them. Clarification on the classification of leased assets should be obtained from the company accountant (see guidance on leased assets, outsourced activities, and franchises in Chapter 3).
- Waste disposal
  - Disposal of waste generated in operations
  - Disposal of waste generated in the production of purchased materials and fuels
  - Disposal of sold products at the end of their life

Some activities mentioned above may be included under *core direct* emissions if the pertinent emission sources are included in the organizational boundaries of the reporting company (e.g., if the transportation of products is done in vehicles owned or controlled by the company). To determine if an activity falls within *core direct or indirect* emissions, *Partners*

should refer to the selected consolidation approach (equity or control) used in setting its organizational boundaries (Chapter 3).

Accounting for *optional* emissions need not involve a full-blown GHG life cycle analysis of all products and operations. Usually it is valuable to focus on one or two major GHG-generating activities. Although it is difficult to provide generic guidance on *optional* emissions to include in an inventory, some general steps include the following:

1. **Describe the value chain.** It is important, for the sake of transparency, to provide a general description of the value chain and the associated GHG sources. Consideration of the company's inventory or business goals and relevance of the various *optional* categories will guide the choice as to how many levels upstream and downstream to include in this category.

2. **Consider the relevance of the various optional emission categories.** Only some types of upstream or downstream emissions categories might be relevant to the company. They may be relevant for several reasons: 1) they are or are believed to be of significant magnitude relative to *core* emissions, 2) they contribute to the GHG risk exposure, 3) they are deemed critical by stakeholders (e.g., feedback from customers, suppliers, investors, or civil society) or 4) there are potential emission reductions that could be undertaken or influenced by the company.

   Examples include large manufacturing companies that have significant freight transport-related emissions or outsourced activities (especially if the activity previously contributed to *core* emissions). Commodity and consumer product companies may want to account for GHGs from transporting raw materials, products, and waste.

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

4. **Quantify optional emissions.** *EPA encourages Partners to report emissions from optional sources to maximize opportunities to meet a GHG reduction target. In some cases, optional sources may be a significant piece of a Partner's total climate footprint, so including optional sources could greatly increase the credibility of a company's inventory. However, there are many sources of optional emissions that are difficult to calculate due to challenges in collecting data and lack of standardized calculation methodologies. To maintain the accuracy and credibility of Climate Leaders Partners' inventories, EPA only allows Partners to report optional emissions from sources for which a standardized calculation methodology exists.*

Double Counting

Core direct and core indirect emissions have been carefully defined to ensure that two different reporting companies will not account for emissions in the same category, to avoid double counting. Nonetheless, concern is often expressed that accounting for indirect emissions will lead to double counting when two different companies include the same emissions in their respective inventories. This depends on how consistently companies with shared ownership choose the same approach (equity or control) to set the organizational boundaries. However, for GHG risk management and voluntary reporting, double counting is less important. *The inventories created for the Climate Leaders program are designed to reflect as accurately and transparently as possible the emissions over which Partner companies have control and can proactively implement reductions.*

Appendix 1 lists common GHG emissions sources and activities by emission category and industrial sector.

Tracking Emissions Over Time

The *Climate Leaders program requires participants to establish a historic performance datum for comparing emissions over time. This performance datum is referred to as "base year emissions."* Companies often undergo significant structural changes such as acquisitions, divestments, and mergers. These changes will alter a company's historical emission profile, making meaningful comparisons over time difficult. To maintain consistency over time, or in other words, to keep comparing "like with like," historic emission data will have to be recalculated. This chapter describes the process for choosing and adjusting the base year.

Choosing a Base Year

A Climate Leaders Partner's base year is the most recent year for which data is available when the Partner joins the program. Data for years as far back as 1990 may be reported to Climate Leaders; however base year data is used for purposes of assessing a company's progress towards its emission reduction goal.

Recalculating Base Year Emissions

Partners shall develop a base year emissions recalculation policy *(as documented in the Inventory Management Plan),* and clearly articulate the basis and context for any recalculations. The policy shall state any "significance threshold" applied for deciding on historic emissions recalculation. "Significance threshold" is a qualitative and/or quantitative criterion used to define any significant change to the data, inventory boundary, methods, or any other relevant factors. It is the responsibility of the company to determine the "significance threshold" that triggers base year emissions recalculation and to disclose it. It is the responsibility of the verifier to confirm the company's adherence to its threshold policy. The following cases shall trigger recalculation of base year emissions:

- Structural changes in the reporting organization that have a significant impact on the company's base year emissions. A structural change involves the transfer of ownership or control of emissions-generating activities or operations from one company to another. While a single structural change might not have a significant impact on the base year emissions, the cumulative effect of a number of minor structural changes can result in a significant impact. Structural changes include:
  - Mergers, acquisitions, and divestments
  - Outsourcing and insourcing of emitting activities
- *Changes in status of leased assets (ending leases or obtaining new leases)*
- Changes in calculation methodology or improvements in the accuracy of emission factors or activity data that result in a significant impact on the base year emissions data

- Discovery of significant errors, or a number of cumulative errors, that are collectively significant

Not all structural changes may turn out to be significant. The concept of significance should be used to judge whether a base year recalculation is needed due to a structural change. It is the responsibility of the Partner to use its best judgement to define significance for considering base year emissions adjustments. In most cases, determining an adjustment of the base year depends on the intended use of the information, the characteristics of the company, and the cumulative effect of numerous structural changes.

In summary, base year emissions shall be retroactively recalculated to reflect changes in the company that would otherwise compromise the consistency and relevance of the reported GHG emissions information. Once a *Partner* 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.

Timing of Recalculations for Structural Changes

When significant structural changes occur during the middle of a 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. Recalculating the base year emissions 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 make a recalculation in the year of the structural change (e.g., due to lack of data for an acquired company), the base year recalculation may be carried out in the following year.

Recalculations for Changes in Calculation Methodology or Improvements in Data Accuracy

A *Partner* might report the same sources of GHG emissions as in previous years, but measure or calculate them differently. For example, a *Partner* might have used a national electric power generation emissions factor to estimate *core indirect* emissions in the first year of reporting. In later years, the *Partner* may obtain more accurate utility-specific emission factors (for the current year as well as past years) that better reflect the GHG emissions associated with the electricity that it has purchased. If the differences in emissions resulting from such a change are significant, historic data is recalculated applying the new data and/or methodology.

Sometimes the more accurate data input may not be reasonably applied to all past years or new data points may not be available for past years. The *Partner* may then have to backcast these data points, or the change in data source may simply be acknowledged (i.e., via the *Inventory Management Plan*) without recalculation. This acknowledgement should be made each year to enhance transparency; otherwise, new users of the report in the two or three

years after the change may make incorrect assumptions about the performance of the company.

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.

No Base Year Emissions Recalculations for Facilities that Did Not Exist in the Base Year

Base year emissions are not recalculated if the company makes an acquisition of (or insources) operations that did not exist in its base year. There *should* be a recalculation of historic data back to the year in which the acquired company came into existence. The same applies to cases where the company makes a divestment of (or outsources) operations that did not exist in the base year.

No Recalculation for "Outsourcing/ Insourcing" if Reported Under Core Indirect and/or Optional Emissions

Structural changes due to "outsourcing" or "insourcing" do not trigger base year emissions recalculation if the company is reporting its indirect emissions from relevant outsourced or insourced activities. For example, outsourcing production of electricity, heat, or steam does not trigger base year emissions recalculation, because the *Climate Leaders Design Principles* requires *core indirect* reporting. However, outsourcing/insourcing that shifts significant emissions between *core direct* and *optional* emissions reporting when *optional* emissions are not reported does trigger base year emissions recalculation (e.g., when a company outsources the transportation of products).

No Recalculation for Organic Growth or Decline

Base year emissions and any historic data are not recalculated for organic growth or decline. Organic growth/decline refers to increase/decrease in production output, changes in product mix, and closures and openings of operating units that are owned or controlled by the company. The rationale for this is that organic growth or decline results in a change of emissions to the atmosphere and, therefore, needs to be counted as an increase or decrease in the company's emissions profile over time. *Change in lease status is not considered organic growth or decline, even if the vacated lease goes unrented.*

Climate Leaders tracks the originally established base year emissions as well as subsequent recalculated base year emissions to ensure transparency. In addition, the Inventory Management Plan documents the base year adjustment policy developed by the Partner, the implementation of which will be reviewed during the onsite IMP review at the selected facility.

Table 5-1 presents basic rules that shall be observed for base year emissions recalculations.

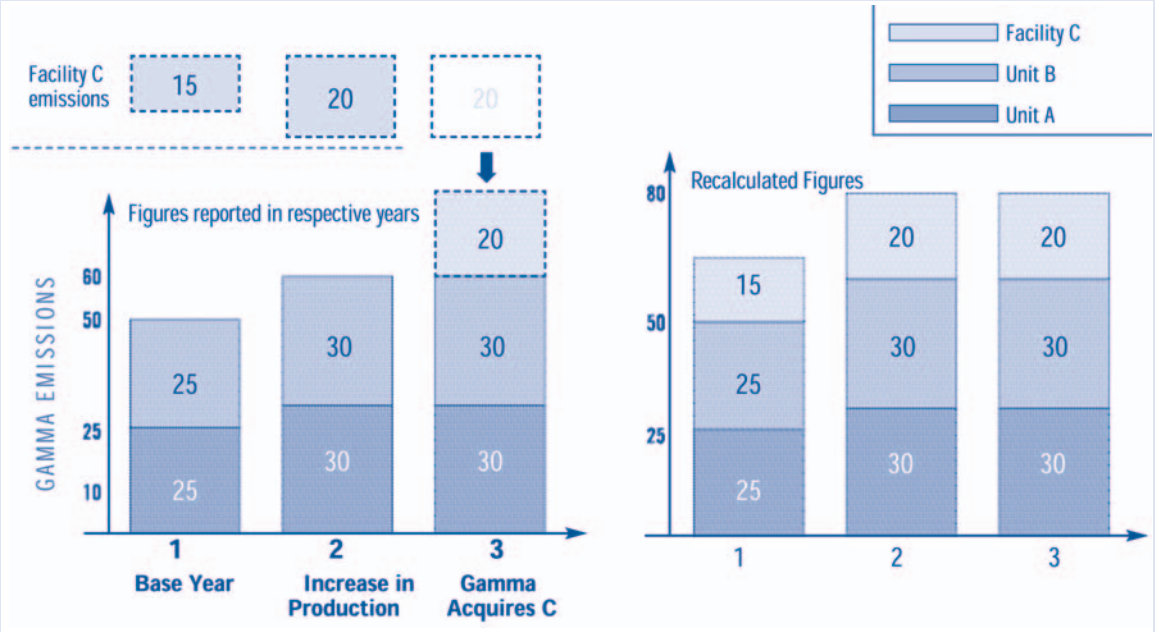
Table 5-1: Basic Rules for Base Year Emissions Recalculations

Condition	Base Year Recalculation Action
Mergers, Acquisitions, Divestitures	
1. Acquisition of (or insourcing) a facility that existed during the base year	Add the new facility's emissions generated during the base year to overall entity base year emissions, unless the now insourced operation was already included in the inventory as an *optional emission.*
2. Acquisition of (or insourcing) a facility that did not exist during the base year	No base year recalculation is needed.
3. Divestiture of (or outsourcing) a facility that existed during the base year	Subtract the divested facility's emissions generated during the base year from overall entity base year emissions, unless the now outsourced operation is still included in the inventory as an *optional emission.*
4. Divestiture of (or outsourcing) a facility that did not exist during the base year	No base year recalculation is needed.
5. Transfer of ownership/control of emissions sources. This includes changes in lease status.	Increased ownership shall be treated the same as a new acquisition; decreased ownership shall be treated the same as a divestiture. See 1-4 above.
Organic Growth and Decline	
6. Organic growth: ■ Increase in production output ■ Changes in product mix resulting in increased emissions ■ Opening of new plants or operating units	No base year recalculation is needed.
7. Organic decline: ■ Decrease in production output ■ Changes in product mix resulting in decreased emissions ■ Closing of plants or operating units	No base year recalculation is needed.
Changes in Quantification Methodologies/Errors	
8. Changes in emission factors or methodologies that reflect real changes in emissions (i.e., changes in fuel type or technology)	No base year recalculation is needed.
9. Changes in measurement or quantification methodologies, improvements in the accuracy of emission factors/activity data, or discovery of previous errors/number of cumulative errors	Recalculate base year emissions to be consistent with new approach or to correct errors.

Example One:
Base Year Emissions Recalculation for an Acquisition

Company Gamma consists of two business units (A and B), as shown below in Figure 5-1. In its base year (year one) each business unit emits 25 tons CO_2. In year two, the company undergoes "organic growth," leading to an increase in emissions to 30 tons CO_2 per business unit, i.e., 60 tons in total. The base year emissions are not recalculated in this case. At the beginning of year three, the company acquires a production facility C from another company. The annual emissions of facility C in year one were 15 tons CO_2, and 20 tons CO_2 in years two and three.

Figure 5-1: Base Year Emissions Recalculation for an Acquisition

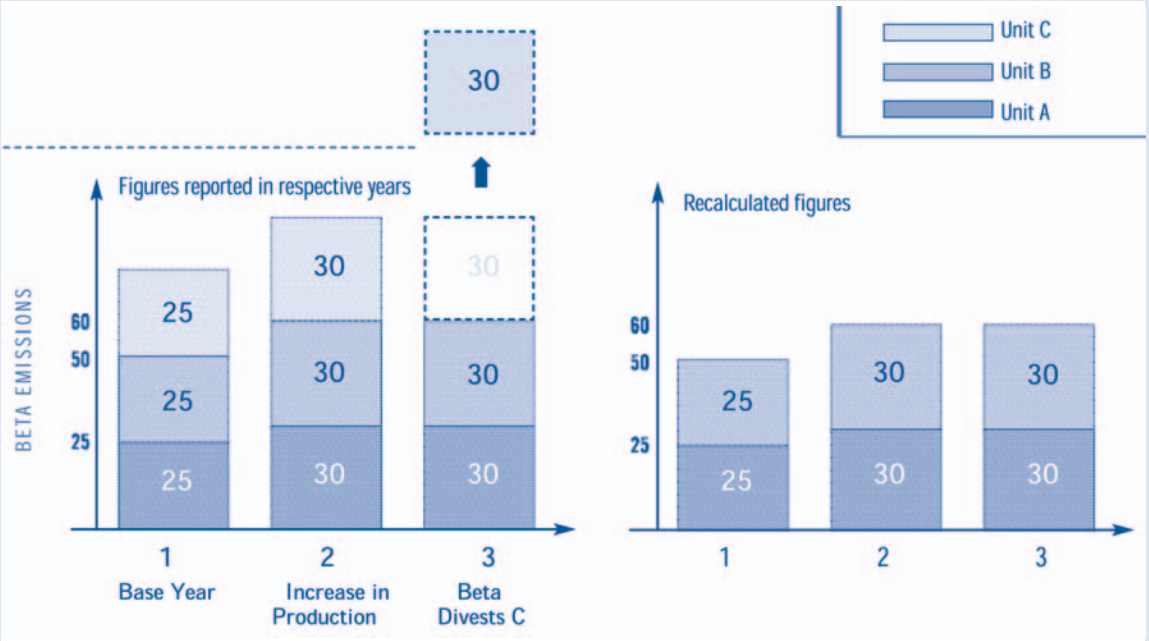


The total emission of company Gamma in year three, including facility C, are therefore 80 tons CO_2. To maintain consistency over time, the company recalculates its base year emissions to take into account the acquisition of facility C. The base year emissions increase by 15 tons CO_2—the quantity of emissions produced by facility C during its base year. The adjusted base year emissions are 65 tons CO_2. Gamma also reports 80 tons CO_2 as the recalculated emissions for year two.

Example Two:
Base Year Emissions Recalculation for a Divestment

Company Beta consists of three business units (A, B, and C), as shown in Figure 5-2. Each business unit emits 25 tons CO_2 and the total emissions for the company are 75 tons CO_2 in the base year (year one). In year two, the output of the company grows, leading to an increase in emissions to 30 tons CO_2 per business unit, i.e., 90 tons CO_2 in total. At the beginning of year three, Beta divests business unit C and its annual emissions are now 60 tons, representing an apparent reduction of 15 tons relative to the base year emissions. However, to maintain consistency over time, the company recalibrates its base year emissions to take into account the divestment of business unit C. The base year emissions are lowered by 25 tons CO_2—the quantity of emissions produced by the business unit C in the base year. The recalculated base year emissions are 50 tons CO_2, and the emissions of company Beta are seen to have risen by 10 tons CO_2 over the three years. Beta also reports 60 tons CO_2 as the recalculated emissions for year two.

Figure 5-2: Base Year Emissions Recalculation for a Divestment

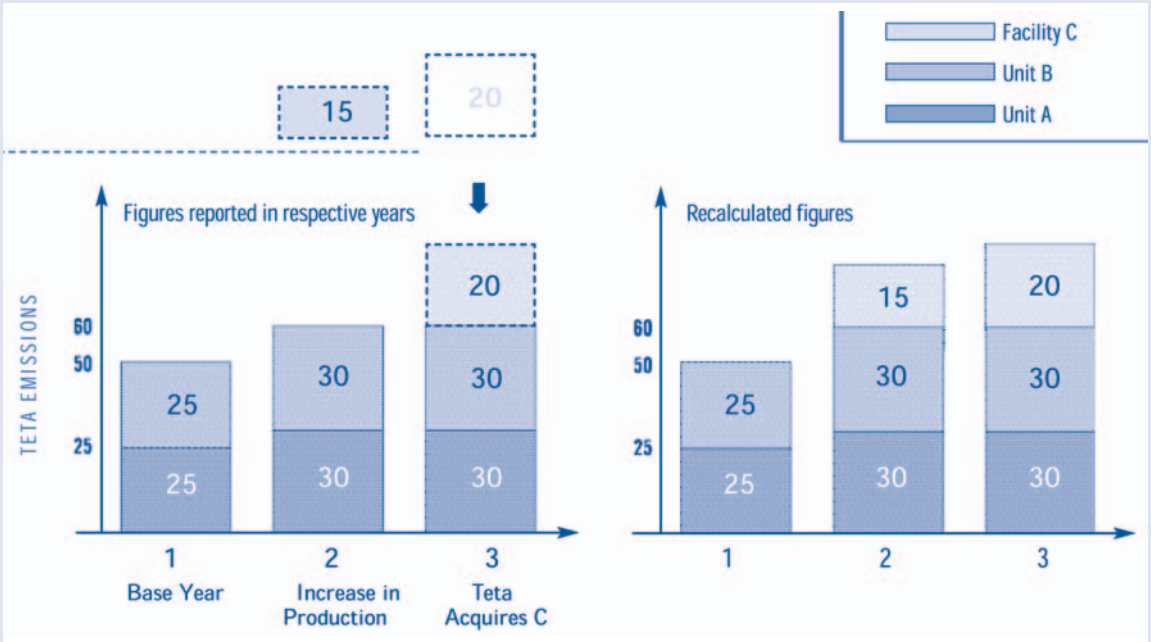


Example Three:
Acquisition of a Facility That Came Into Existence After the Base Year was Set

Company Teta consists of two business units (A and B). In its base year (year one), the company emit 50 tons CO_2. In year two, the company undergoes organic growth, leading to an increase in emissions to 30 tons CO_2 per business unit, i.e., 60 tons CO_2 in total. The base year emissions are not recalculated in this case.

At the beginning of year three, Teta acquires a production facility C from another company. 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 company Teta in year three, including facility C, are therefore 80 tons CO_2. In this acquisition case, the base year emissions of company Teta do not change because the acquired facility C did not exist in year one when the base year of Teta was set. The base year emissions of Teta therefore remains at 50 tons CO_2. Teta also reports 75 tons as the recalculated figure for year two emissions.

Figure 5-3: Acquisition of a Facility That Came Into Existence After the Base Year was Set



Identifying and Calculating GHG Emissions

Once the inventory boundary has been established, companies generally calculate GHG emissions via the following steps:

1. Identify GHG emissions sources
2. Select an emissions calculation approach
3. Collect activity data and choose emissions factors
4. Apply quantification methodology to estimate GHG emissions
5. Roll-up emissions data to the corporate level (covered in Chapter 9)

These steps are described in the following sections. *A short description of the Core Module guidance developed by and available from the Climate Leaders program is also provided. Core Modules are available on the Climate Leaders website at http://www.epa.gov/climateleaders.*

Identify GHG Emissions Sources

The process of identifying emissions sources is typically completed with the following three steps:

1. Identify *core direct* emissions sources
2. Identify *core indirect* emissions sources
3. Identify *optional* emissions sources to the extent desired

Refer to Chapter 4 for a refresher on common sources of emissions and how they should be categorized (direct or indirect core emissions, or as optional emissions). Every business has some processes, products, or services that generate direct and/or indirect emissions from one or more broad source categories. Almost all businesses generate indirect emissions due to the purchase of electricity for use in their processes or services. Appendix 1 provides an overview of GHG emissions sources organized by emission category and industry sector. The appendix may be used as an initial guide to identify your major GHG sources.

The emissions identification step should look for emissions sources that result from both routine and non-routine operations. Non-routine operations might include maintenance activities (including turnarounds) and upset conditions. In some cases, non-routine operations may be a significant source of emissions.

Select an Emissions Calculation Approach

Direct measurement of GHG emissions by monitoring concentration and flow rate is not common. More often, emissions are calculated based on a mass balance or stoichiometric basis specific to a facility or process. 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 proxy measure of activity at an emissions source. The

revised IPCC Guidelines for National GHG Inventories refer to a hierarchy of calculation approaches and techniques ranging from the application of generic emission factors to direct monitoring.

In many cases, particularly when direct monitoring is either unavailable or prohibitively expensive, accurate emission data can be calculated from fuel use data. Even small users usually know both 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. Companies should use the most accurate calculation approach that is available to them and that is appropriate for their reporting context.

Collect Activity Data and Choose Emissions Factors

The third step in identifying and calculating emissions is to collect the data necessary to complete the quantification method selected in the previous step. To facilitate completion of this step, the reporting entity should list the quantification method and relevant data required to quantify each emission source. Table 6-1 presents an example. *Documentation of these data elements is part of the Inventory*

Table 6-1: Example Data Collection Roadmap

Emission Source	*Quantification Method*	*Data Required*	*Data Sources**
Onsite stationary combustion sources	*Insert selected method here, e.g., fuel use times fuel – specific emission factor (EF)*	*Fuel use measured in mass, volume, or energy units* *Fuel-specific emission factor.*	*Insert specific data source here*
Imported electricity use	*Electricity use times source specific EF*	*Electricity use* *Source-specific (or regional grid) emission factor*	*Insert specific data source here*
Process specific: Ex. Production of adipic acid	*Calculate N_2O emissions by multiplying the amount of adipic acid produced by the N_2O emissions factor; deduct fraction abated*	*Adipic acid production (tonnes)* *Emission factor (tonnes of N_2O/tonnes of adipic acid produced)* *Fraction abated (%) – percent of emissions abated by reduction technologies and practices* *Utilization factor (%) – percent of time abatement technology was in use*	*Insert specific data source here*
Continue list of reporter-specific emission sources or groups of emission sources	*Continue list of relevant quantification methodology*	*Continue list of data needs unique to the selected quantification methodology*	*Continue list of data needs unique to the selected quantification methodology*

**For ease of data collection and to facilitate the verification exercise, the data sources should include specification of where the required data can be derived, e.g., AP 42 emission factor, fuel use data from plant site-specific data collection system, etc.*

Management Plan submittal required under the Climate Leaders program. Documentation of these data elements helps to facilitate the data collection activity, enhance data verifiability, and identify opportunities for further improvement in inventory accuracy and efficiency.

For most small- to medium-sized companies and for many larger companies, *core direct* emissions should be calculated based on the purchased quantities of commercial fuels (such as natural gas and heating oil) multiplied by relevant published emissions factors. *Core indirect* emissions should typically be calculated from metered electricity consumption and supplier-specific, local grid, or other published emission factors. *Optional* emissions should be calculated from activity factors such as passenger miles and published or third-party emissions factors. In all of these cases, if source/facility-specific emissions factors are available, it is preferable that they be used. *Climate Leaders provides source-specific guidelines to help facilitate the emissions estimation approach.*

Industrial companies, such as those involved in fuels extraction and processing, chemicals, minerals, pulp and paper, waste management, and primary metals, will be faced with a wider range of alternative approaches/methodologies. *These companies should seek guidance from the Climate Leaders sector-specific guidelines* (where available) or from their industry associations, e.g., International Aluminum Institute, American Petroleum Institute, WBCSD project: Toward a Sustainable Cement Industry, etc.

In some cases, unit conversions will be required to adjust activity data to the same units used in emission factors. Selected unit conversions are presented in Appendix 2.

Apply Quantification Methodology to Estimate GHG Emissions

This section provides an overview of the *Climate Leaders GHG Inventory Protocol Core Module guidance documents.* Companies may use their own GHG calculation tools, provided they are consistent with the approaches described in the respective sector guidelines.

There are two main categories of guidance documents:

- **Cross-sector guidance** that can be applied to many different sectors: stationary combustion, indirect electricity, mobile combustion, and HFC use in refrigeration and air-conditioning
- **Sector-specific guidance,** e.g., aluminum, iron and steel, cement, etc.

Most companies will need to refer to more than one guidance document to cover all of their GHG sources. For example, to calculate GHG emissions from an aluminum smelter, the company would use the calculations for aluminum production, stationary combustion (for any generation of energy on-site), and mobile combustion (for owned transportation of materials and products, and vehicles employed on-site).

Structure of Guidance Documents

All cross-sector and sector-specific *core module* guidance documents are based on a similar structure and offer step-by-step guidance on measuring and calculating emissions data.

The general structure of the guidance section is as follows:

- **Overview:** provides a description of purpose and scope, the calculation method recommended, and a process description
- **Calculation methods:** describes different calculation methods depending on the availability of site-specific activity data and emissions factors
- **Choosing activity data and emissions factors:** provides good practice guidance and references for default emissions factors
- **Quality control:** provides good practice guidance
- **Internal reporting and documentation:** provides guidance on internal documentation to support emissions calculations

Default emissions factors are provided, but it is also possible to use customized emissions factors if more accurate emissions factors are available. The emissions of different GHGs are calculated separately and then converted to CO_2-equivalents on the basis of their global warming potential.

Some of the guidance takes a tiered approach, offering a choice between a simple and a more advanced calculation approach. The more advanced approach results in more accurate emissions data, but usually requires a higher level of data detail and a more thorough understanding of the technologies used in the business operations.

Table 6-2 provides an overview of the calculation guidance documents available from the *Climate Leaders program,* and their main features.

*Table 6-2: Overview of GHG Guidance Documents Currently Available Through Climate Leaders**

Guidance Documents	*Main Features*
Stationary Combustion	■ *Calculates direct GHG emissions from combustion of fuels in stationary equipment* ■ *Default emission factors provided for different fuels*
Indirect Electricity	■ *Calculates indirect GHG emissions from purchased electricity* ■ *Default emission factors provided for grid electricity* ■ *Provides guidance for allocating emissions from a cogeneration facility to the separate steam and electricity outputs*
Mobile Combustion	■ *Calculates direct GHG emissions from mobile sources, including road, air, water, and rail transport* ■ *Default emission factors provided*
Refrigeration and Air Conditioning (AC) Unit Use	■ *Calculates emissions resulting from leaks of HFCs and PFCs from refrigeration and AC units* ■ *Found in industrial and commercial facilities as well as mobile sources*
Municipal Solid Waste Landfilling	■ *Calculates direct GHG emissions from landfill gas emissions at owned/operated municipal solid waste landfill sites*
Iron and Steel (DRAFT)	■ *CO_2 and other GHG emissions (direct and indirect) associated with the manufacturing of iron and steel*
Cement Manufacturing (DRAFT)	■ *Process CO_2 and other GHG emissions associated with the manufacturing of cement*
Refrigeration and AC Unit Mfg. (DRAFT)	■ *Calculates emissions resulting from leaks of HFCs and PFCs from refrigeration and AC unit manufacturing*

**Additional calculation guidance modules are in development.*

CO_2-equivalent and Global Warming Potential

EPA has adopted the convention forwarded by the United Nations Framework Convention on Climate Change (UNFCCC) and the IPCC of comparing the radiative forcing ability of individual gases by using a relative measure for each GHG, termed its global warming potential (GWP). GWP is the ability of each greenhouse gas to trap heat in the atmosphere relative to carbon dioxide, which serves as the reference gas. Table 6-3 lists GWPs for the primary recognized GHGs.

Partners can report emissions of other GHGs (i.e., those listed in the IPCC Third Assessment Report) as optional emissions.

Table 6-3: Gas Atmospheric Lifetime GWP[a]

Greenhouse Gas	Formula	Atmospheric Lifetime (years)	Global Warming Potential
Carbon dioxide	CO_2	50 — 200	1
Methane[b]	CH_4	12 +/- 3	21
Nitrous oxide	N_2O	120	310
Sulfur hexafloride	SF_6	3,200	23,900
HFCs:			
HFC-23	CHF_3	264	11,700
HFC-32	CH_2F_2	5.6	650
HFC-41	CH_3F	3.7	150
HFC-125	C_2HF_5	32.6	2,800
HFC-134	$C_2H_2F_4$	10.6	1,000
HFC-134a	$C_2H_2F_4$	14.6	1,300
HFC-143	$C_2H_3F_3$	3.8	300
HFC-143a	$C_2H_3F_3$	48.3	3,800
HFC-152a	$C_2H_4F_2$	1.5	140
HFC-227ea	C_3HF_7	36.5	2,900
HFC-236fa	$C_3H_2F_6$	209	6,300
HFC-245ca	$C_3H_3F_5$	6.6	560
HFC-4310mee	$C_5H_2F_{10}$	17.1	1,300
PFCs:			
PFC-14	CF_4	50,000	6,500
PFC-116	C_2F_6	10,000	9,200
PFC-218	C_3F_8	2,600	7,000
PFC-3-1-10	C_4F_{10}	2,600	7,000
PFC-c318	$c\text{-}C_4F_8$	3,200	8,700
PFC-4-1-12	C_5F_{12}	4,100	7,500
PFC-5-1-14	C_6F_{14}	3,200	7,400

Source: IPCC Second Assessment Report (SAR)

a 100-year time horizon

b The methane GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapor. The indirect effect due to the production of CO_2 is not included

To provide consistency within the inventory, the Partner's GHG inventory should be based on metric tonnes of CO_2-equivalents (CO_2-eq). CO_2-equivalents are calculated by multiplying tonnes of any particular GHG times its relevant GWP. The following example illustrates this approach.

Example: Calculating CO_2-equivalents

A Partner's GHG inventory contains 7,000,000 tonnes/yr of CO_2 emissions, 400,000 tonnes/yr of CH_4 emissions, and 700 tonnes/yr of N_2O emissions.

Total CO_2-eq = tonnes CO_2(GWP[CO_2]) + tonnes CH_4(GWP[CH_4]) + tonnes N_2O(GWP[N_2O])=

7,000,000 (1) + 400,000 (21) + 700 (310) = 15,617,000 metric tonnes CO_2-eq

Other useful conversion factors for units of measure and fuel characteristics can be found in Appendix 2.

Managing Inventory Quality

For the purposes of reporting for the Climate Leaders program, it is sufficient to document inventory assumptions and to note major sources of uncertainty (i.e., as part of the Inventory Management Plan). An uncertainty analysis is not required.

A corporate GHG *inventory management plan (IMP)* includes all institutional, managerial, and technical arrangements made for the collection of data, preparation of the inventory, and implementation of steps to manage the quality of the inventory. *An IMP* provides a systematic process for preventing and correcting errors, and identifies areas where investments will likely lead to the greatest improvement in overall inventory quality. However, the primary objective of *an IMP* is ensuring the credibility of a company's GHG inventory information.

Chapter 1 outlines five accounting principles that set an implicit standard for the faithful representation of a company'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 *an IMP* is to ensure that these principles are put into practice.

This chapter addresses the implementation of an *IMP*, practical inventory quality measures for implementation, as well as inventory quality and inventory uncertainty (i.e., types and limitations of uncertainty estimates).

An Inventory Program Framework

A practical framework is needed to help companies conceptualize and design a quality management system and plan for future improvements. This framework focuses on the following institutional, managerial, and technical components of an inventory. *Climate Leaders calls this framework an Inventory Management Plan.* An effective and efficient *Inventory Management Plan* should address the following four fundamentals.

- Methods
- Data
- Inventory processes and systems
- Documentation

Table 7-1 summarizes the four fundamentals of inventory development. The exact inventory management plan components, the associated detail required, and issues to consider for each component are outlined in more detail in Chapter 9 and Appendix 3.

Table 7-1: Fundamentals of Inventory Development

Methods – the technical aspects of inventory preparation	■ *Define inventory boundaries, treatment of joint ventures, identify sources, etc. Chapters 3, 4, and 6 help with this.* ■ *Identify methodologies for estimating emissions (Climate Leaders provides many default methods and Protocols to help companies with this effort.)* ■ *Establish procedures for applying and updating inventory methodologies in response to new business activities, new technical information, or new reporting requirements.*
Data – the basic information on activity levels, emission factors, processes, and operations	■ *Develop approach, and assign roles and responsibilities to facilitate collection of high quality inventory data.* ■ *Create 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 Climate Leaders accounting and reporting standards.* ■ *Whenever reasonable, integrate these processes with other corporate processes.*
Documentation – the record of methods, data, processes, systems, assumptions, and estimates used to prepare an inventory	■ *Identify internal and external audiences and develop procedures to document information intended for their use.* ■ *Establish documentation sufficient for an inventory development team to accurately and efficiently continue preparing and improving all four fundamentals in the company's inventory.* ■ *Ensure that documentation provides sufficient transparency to facilitate potential internal or external verification.*

Implementing an Inventory Management *Plan*

An IMP for a company's program should address all four of the components described above. To implement the system, a company should take the following steps:

1. **Establish an inventory team.** This team should be responsible for implementing *the IMP,* and continually improving inventory quality, as well as coordinating activities between relevant business units and facilities.

2. **Develop *an IMP*** that describes the steps the company is taking in the implementation of *calculating an inventory.* The plan should include procedures for all organizational levels and inventory development processes (i.e., from initial data collection to final reporting of accounts). For efficiency and comprehensiveness, *Partners* are encouraged to consider the integration of their inventory management *plan* with their overall corporate and environmental information management systems, including any procedures in place as part of their International Standards Organization (ISO) 9000 (Quality Management) or ISO 14001 (Environmental Management) certifications.

3. **Perform generic quality checks.** Generic quality checking procedures applicable to

inventory data and processes at all levels (i.e., data handling, documentation, and emission calculation activities, as noted in further detail in Table 7-2).

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, and a qualitative description of the major causes of uncertainty in the data (see section on implementation below).
5. **Review final inventory estimates and reports,** including internal technical and managerial reviews and potential external verification.
6. **Institutionalize formal feedback loops** so that errors are corrected and improvements are made following quality checks, investigations, and reviews.
7. **Establish reporting, documentation, and archiving procedures,** including internal recordkeeping procedures, information for external stakeholders, etc. These procedures should also include formal feedback mechanisms.

Table 7-2: Generic Quality Management Measures

Data Gathering, Input, and Handling Activities	■ Check a sample of input data for transcription errors ■ Identify spreadsheet modifications that could provide additional controls or checks on quality ■ Ensure that adequate version control procedures for electronic files have been implemented ■ Others
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 methods, activity data, emission factors, and other parameters are documented ■ Check that changes in data or methodology are documented ■ Others
Calculating Emissions and Checking Calculations	■ Check whether emission units, parameters, and conversion factors are appropriately labeled ■ Check if units are properly labeled and correctly carried through from beginning to 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 checks) ■ Check the aggregation of data across source categories, business units, etc. ■ When methods or data have changed, check consistency of time series inputs and calculations ■ Others

As part of Climate Leaders, EPA assists Partners by providing technical assistance on completing their inventory and IMP. This includes desktop reviews that encompass some of the quality management checks listed in Table 7-2. For more details on technical assistance refer to Chapter 9.

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. A company should implement these measures at multiple levels within the company, from the point of primary data collection to the final corporate inventory approval process. It is important to implement 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. While corporate-level inventory quality may initially be emphasized, it is important to ensure quality measures are implemented at all levels of disaggregation (e.g., facility, process, geographical, according to a particular *category of emission*, etc.).

Companies also need to ensure the quality of their historical emission estimates and trend data. They can achieve this 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.

Step 3 in implementing *an IMP* is to perform generic quality checking measures, which apply to all source categories and all stages of inventory preparation. Table 7-2 provides a sample list of such measures.

Step 4 in implementing *an IMP* is source category-specific data quality investigations.[1] The following discussion addresses the types of source-specific quality measures that can be employed for emission factors, activity data, and emission estimates.

Emission Factors and Other Parameters

For a particular source category, emissions calculations will generally rely on emission factors and other parameters (e.g., utilization factors, oxidation rates, and methane conversion factors)[2]. These factors and parameters may be published or default factors, based on company-specific data, 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-based or volume-based factors have been measured at a company-specific or site-specific level. Quality investigations need to assess the representative data and applicability of emission factors and other parameters to the specific characteristics of a company. Differences between measured and default values need to be qualitatively explained and justified based upon the company's operational characteristics.

1 The information gathered from these investigations is to be used in the assessment of data uncertainty (see section on uncertainty in Chapter 7).

2 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, companies should also consider whether the internal assumptions (including assumed parameters in the model) are appropriate to the nature of the company's operations.

Activity Data

The collection of high quality activity data will often be the most significant limitation for corporate GHG inventories. Therefore, establishing robust data collection procedures needs to be a priority in the design of any company'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.
- Fuel consumption data should be converted to energy units before applying carbon content emission factors, which may be better correlated to a fuel's energy content than its mass. *The CO_2 emissions from burning a unit of a specific fuel will be more accurately determined if the amount of energy units burned is used to calculate emissions.*
- Current year data should be compared with previous year's data and historical trends. If data do not exhibit relatively consistent changes from year to year, but rather undergo sharp increases or decreases, then the causes for this pattern should be investigated (e.g., changes of over 10 percent from year to year may warrant further investigation).
- Activity data from multiple reference sources (e.g., government survey data or data compiled by trade associations) should be compared with corporate data when possible. Although all data may have the same origin, such checks can ensure that consistent data is being reported to all parties. Data can also be compared among facilities within a company.
- Investigate activity data that is generated for purposes other than preparing a GHG inventory. In doing so, companies will need to check the applicability of this 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) may have already been conducted during the data's original preparation. These measures can be integrated with the company's inventory quality management system.
- Check that base year recalculation procedures have been followed consistently and correctly.
- Check that operational and organizational boundary decisions have been applied correctly and consistently to the collection of activity data.
- *Partners* should investigate whether biases or other characteristics that could affect the data quality have already been previously identified (e.g., by communicating with experts at a particular facility or elsewhere). For example, a bias could be the unintentional exclusion of operations at smaller facilities or data that does not correspond exactly with the company's organizational boundaries.
- If *Partners* are using additional data to estimate emission intensities or other ratios (i.e., sales, production, etc.), quality management measures should also extend to these additional data.
- *If Partners are reporting data to the EPA for other reporting purposes, such as reporting under Title IV or Title V of the U.S. Clean Air*

Act, then the same data should form the basis for Climate Leaders reporting.

Title V of the U.S. Clean Air Act requires an operating permit for each industrial facility that is a "major source" of air pollution. Under this operating permits program, a facility is considered a major source when it emits minimum levels of a specific air pollutant. This can be a little as 10 tons per year. Data collected under Title V that may be relevant to GHG reporting includes identification of sources of emissions at a facility and potentially data on energy flows.

Title IV of the U.S. Clean Air Act requires owners or operators of affected units to measure and report sulfur dioxide (SO_2), nitrogen oxide (NO_x), and CO_2 emissions under the U.S. EPA's Acid Rain Program. Data on CO_2 emissions reported under Title IV can be used directly in the Climate Leaders program.

Emission Estimates

Estimated emissions for a source category can be compared with historical data or other estimates to ensure that they fall within a reasonable range. Potentially unreasonable estimates provide cause for checking emission factors or activity data and determining whether changes in methodology, market forces, or other events are sufficient reasons for the change. In situations where actual emission monitoring occurs (e.g., power plant CO_2 emissions), the data from monitors can be compared with estimated 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, *Climate Leaders encourages Partners* to consider more detailed investigations into the accuracy of the data or appropriateness of the methods to reduce inventory error. These 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.

Inventory Quality and Inventory Uncertainty

Preparing a GHG inventory is inherently both an accounting and a scientific exercise. Most applications for company-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., a single value versus 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 and loss or bank account statement, point estimates in a corporate emission inventory have obvious uses. However, the addition of some quantitative measure of uncertainty to an emission inventory may also have some uses.

In an ideal situation, in which a company 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 companies, across business units, across source categories, or through time. In this situation, inventory estimates could be rated or discounted based on 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 and/or removal process is not completely understood. For example, many of the direct and indirect factors associated with 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 scope of most company inventory programs.

Estimation uncertainty arises any time GHG emissions are quantified. Therefore all emission or removal estimates are associated with estimation uncertainty. Estimation uncertainty can be further classified into two types: model uncertainty and parameter uncertainty[3].

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 also likely to be beyond most company's inventory efforts; however, some companies may wish to utilize their unique scientific and engineering expertise to evaluate the uncertainty in their emission estimation models.

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 based on these parameter uncertainties will be the primary focus of companies that choose to investigate uncertainty in their emission inventories.

Limitations of Uncertainty Estimates

Given that only parameter uncertainties are within the feasible scope of most companies, uncertainty estimates for corporate GHG inventories will, of necessity, be imperfect. Complete and robust sample data will not always be available to assess the statistical uncertainty in every parameter. For most parameters (e.g., liters of gasoline purchased or tons of limestone consumed), only a single data point may be available. In some cases, companies can utilize instrument precision or calibration information to inform their assessment of statistical uncertainty. However, to quantify some of the systematic uncertainties (defined below) associated with parameters and to supplement statistical uncertainty estimates, companies will usually have to rely on expert judgement[4]. The problem with expert judgement, though, is that it is difficult to obtain in a comparable (i.e., unbiased) and consistent manner across parameters, source categories, or companies.

3 Emissions estimated from direct emission monitoring will generally only involve parameter uncertainty (e.g., equipment measurement error).

4 The role of expert judgement in the assessment of the parameter can be twofold: Firstly, expert judgement can be the source of the data that are necessary to estimate the parameter. Secondly, expert judgement can help (in combination with data quality investigations) identify, explain, and quantify both statistical and systematic uncertainties (see following section).

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

An exception to this includes the following case in which it is assumed that either statistical or instrument precision data are available to objectively estimate each parameter's statistical uncertainty (i.e., expert judgement is not needed):

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

Given these limitations, the role of uncertainty assessments in developing GHG inventories includes:

- 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 investment priorities to improve data sources and methodologies.

The GHG Protocol has developed a supplementary guidance 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 the 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 developing quantitative uncertainty estimates and eliciting judgments from experts—can be found in Volume VI of EPA's Emissions Inventory Improvement Program documents on Quality Assurance/Quality Control and in chapter 6 of the IPCC's Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

Characterizing uncertainty is not required under Climate Leaders.

Tracking Progress Towards the GHG Reduction Goal

As described in Chapter 11, Climate Leaders Partners establish corporate-wide GHG reduction goals. Tracking progress towards that goal entails comparing current corporate-wide emissions to base year emissions. The final Climate Leaders goal evaluation is a comparison of corporate-wide GHG emissions in the goal year vs. the base year emissions. Climate Leaders goal accounting does not set requirements for interim years. While emissions increases may occur at individual sources, ideally a Partner's overall emissions profile should be reduced over time in a clearly verifiable progression toward the reduction goal. GHG reductions can be measured by comparing absolute changes in the company's overall GHG emissions over time, or by developing ratio indicators to track relative performance.

Overview

Focusing on the overall company GHG impact has the advantage of helping companies more effectively manage their aggregate GHG risks and opportunities. It also helps guide the transfer of resources to activities resulting in the most effective GHG emission savings.

This chapter provides guidance on tracking progress toward the reduction goal. *The Climate Leaders Partner's goal should be achieved by reducing overall corporate emissions or emissions rate; and may also include successful completion of emission reduction "offset" projects.*

Corporate-Wide GHG Emissions

Climate Leaders recommends calculating GHG emissions using a bottom-up approach. This involves calculating emissions at the level of an individual source and then rolling this up via facilities to the corporate level. This approach enables companies to scrutinize their GHG emissions information at different scales, thereby allowing enhanced understanding of their GHG emissions profile. This approach best allows companies to isolate, evaluate, and prioritize emission saving opportunities. *Progress towards a goal* can then be measured by comparing emissions over time on a facility-specific, nationwide or even global basis. *The Climate Leaders program requires comparison of summed corporate-wide emissions from all U.S. operations at a minimum.*

Offsets

In some cases, companies may find that they can obtain lower-cost emission reductions by investing in offset projects. Offsets are reductions of direct or indirect emissions that occur outside the boundaries of the reporting company and occur as a result of projects that either reduce GHG emissions or through activities that promote carbon sequestration. Some example offset projects might include:

Example 1: *Coal mine methane emission reductions: offset investment by a company other than the coal mine operator or owner.*

Example 2: *Replacing diesel fuel-fired generator with a photovoltaic system: offset investment by a company*

other than the solar system manufacturer or distributor, or the electricity generator or user.

Example 3: Replacement of old HVAC systems with more energy-efficient systems in schools: offset investment by an entity other than the school system

Offsets may be generated through a variety of activities such as energy efficiency, low carbon no carbon energy projects, process emission reductions, or carbon sequestration activities. Fundamentally, offsets are generated by investing in projects that result in verifiable emissions reductions or in removing GHGs from the atmosphere (e.g., enhancing carbon sinks).

Appropriate supporting information addressing the validity and credibility of purchased offsets must be included. Key elements in quantifying and reporting emissions from offset projects include:

- *Determining the project temporal, spatial, and operational boundaries.*
- *Establishing the baseline. The baseline emissions scenario provides a reference point for what emissions would have been without the project intervention.*
- *Confirming project environmental additionality and regulatory surplus: Offset activities must result in GHG reductions that are additional to any that would otherwise occur in the absence of the offset project activity. Activities must be surplus to those that are required by any type of regulation (GHG, criteria pollutants, or other).*
- *Examining project leakage. Leakage relates to increases or decreases of GHG emissions elsewhere as a result of a project.*
- *Permanence, saturation, and duration in carbon sequestration projects.*
- *Monitoring and verification guidelines.*

Climate Leaders allows Partners to invest in offset projects as a way to meet their GHG reduction goal. Of paramount importance is the delineation of offset project reductions with a robust, valid, and quantifiable accounting system that provides credible and verifiable data. The WRI and WBCSD are currently co-convening an effort to develop a guidance module for accounting for project-based emission reductions that is robust and consistent with the potential financial value and integrity of any commodity that may be attached to reductions. Climate Leaders will provide offset guidance consistent with that evolving standard to the extent practicable. Climate Leader offset guidance is currently under development.

Accounting for Emissions from Electricity/Steam Sales

Non-utility Partners may sell a portion of their own generated electricity and/or steam output to another company directly or to the grid. The emissions from these energy sales are not included when calculating a Partner's progress towards their Climate Leader's normalized GHG reduction goal. Partners first include the emissions associated with energy production as direct emissions in their inventory. They then calculate the emissions associated with only the sales of electricity and/or steam and report them separately as absolute emissions (as per the Climate Leaders guidance for Indirect Emissions from Purchases/Sales of Electricity and Steam). These emissions are normalized using the Partner's normalization factor and listed as an emission reduction. These emission reductions from sold electricity and/or steam are not netted with total direct emissions but are accounted for when evaluating a Partners progress towards meeting their reduction goal and can be use to meet a normalized reduction target.

Reporting GHG Emissions

The Climate Leaders GHG inventory reporting requirements are designed to provide credibility and promote continuous improvement in corporate emissions accounting procedures.

This chapter provides guidance to Partners, third-party verifiers, and other interested parties on the steps needed to fulfill the Climate Leaders reporting requirements. It is not intended to provide EPA guidance on GHG inventory verification. However, EPA allows Partners who wish to undertake a rigorous third-party verification of their GHG inventories to submit a verification report certifying that, at a minimum, the requirements of the Climate Leaders GHG inventory review have been met.

GHG Inventory Reporting Requirements Overview

All Climate Leaders Partners can receive free technical assistance from EPA's team of experts to complete the program's reporting requirements. The reporting requirements consist of three major components:

1. *Partners complete and maintain an Inventory Management Plan (IMP) — or a similar collection of Standard Operating Procedures — that describes the process for completing a high quality, corporate entity-wide inventory.*
2. *Partners complete and submit to EPA on a yearly basis the Annual GHG Inventory Summary and Goal Tracking Form that reports GHG emissions at a corporate level and details progress towards meeting their GHG reduction goal.*
3. *EPA conducts the following reviews:*

- *A desktop review of the Partner's GHG accounting methods and systems as detailed in their IMP.*
- *A desktop review of the Partner's corporate GHG inventory data as reported in their Annual GHG Inventory Summary and Goal Tracking Form.*
- *An optional desktop review of the Partner's facility-level GHG data.*
- *One on-site visit to review facility-level implementation of the IMP.*

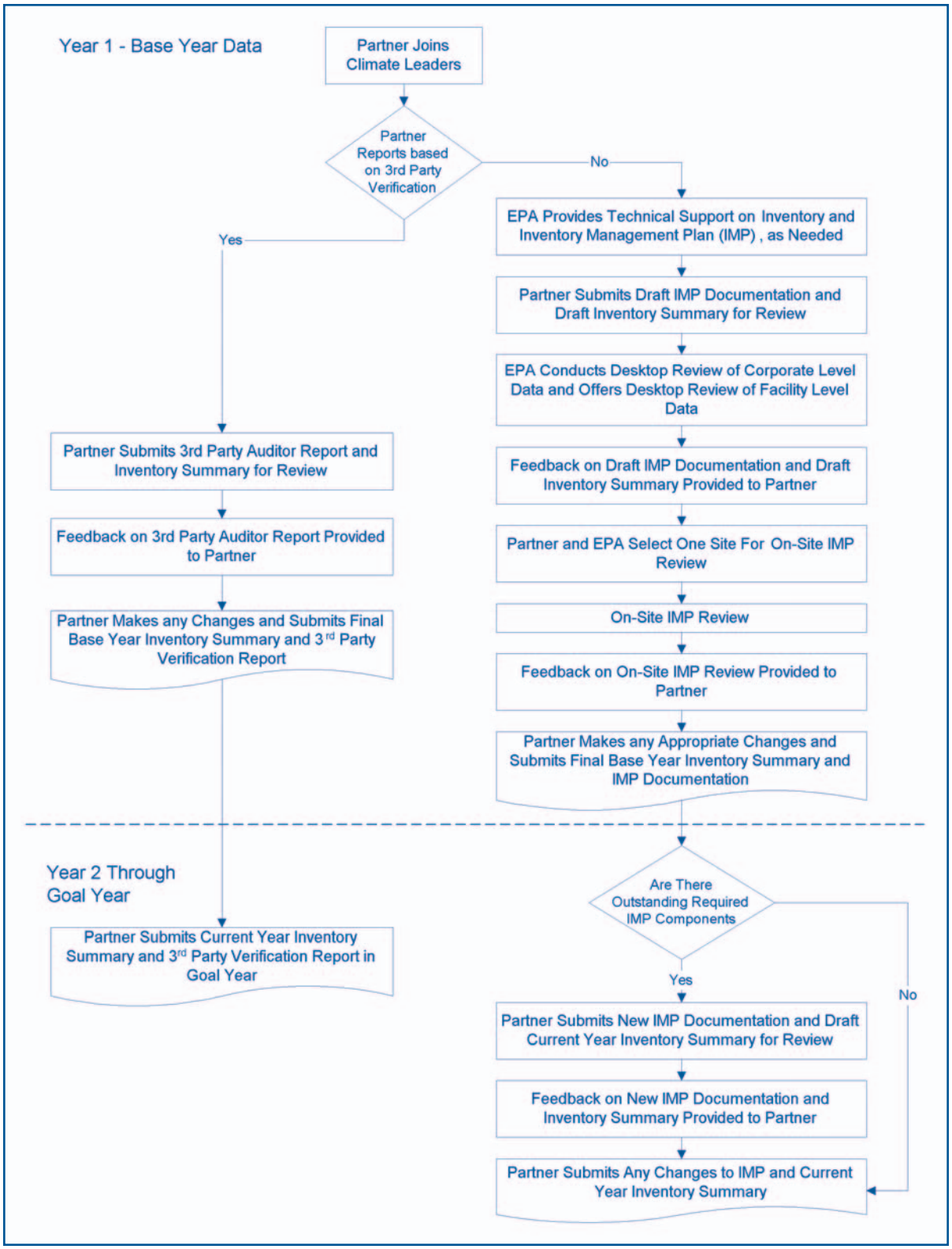
An initial review is conducted for the Partner's IMP and base year inventory. A follow-up is then conducted for the goal year inventory to provide assurance that the goal is met. Interim year inventories are reviewed; however, the IMP is reviewed only when there have been major revisions or updates.

A flow chart describing the reporting process is provided in Figure 9-1.

Reporting Requirements and Technical Assistance

The major components of the Climate Leaders reporting requirements consist of the IMP, the Annual GHG Inventory Summary and Goal Tracking Form, and the review process as described in further detail below. Technical assistance is available to Partners as they develop and document their IMP and complete their inventory, as well as during their EPA review process. Technical assistance is also described in further detail below.

Figure 9-1: Reporting Requirements Flow



GHG Accounting Methods and Systems – Inventory Management Plan

Partners complete and maintain an IMP that describes their process for completing a high-quality, corporate-wide inventory. Companies use an IMP to institutionalize a process for collecting, calculating, and maintaining GHG data. A detailed IMP checklist describing the individual components and level of detail necessary is attached as Appendix 3 (Columns 1 & 2). Partners may have a single IMP document that addresses all of the elements that go into developing their corporate inventory, or they might have an equivalent collection of procedures and other relevant information. EPA expects the critical elements of an IMP to be developed within one year of a Partner joining the program, while other elements can be phased in over time (as noted in Appendix 3). The seven major sections of the IMP are described below.

- ***Partner Information:*** *company name, address, and inventory contact information*
- ***Boundary Conditions:*** *organizational and operational boundary descriptions*
- ***Emissions Quantification:*** *quantification methodologies and emissions factors*
- ***Data Management:*** *data sources, collection process, and quality assurance*
- ***Base Year:*** *base year adjustments for structural and methodology changes*
- ***Management Tools:*** *roles and responsibilities, training, and file maintenance*
- ***Auditing & Verification:*** *auditing, management review, and corrective action*

The IMP is an internal process for the Partner to institutionalize the completion of a high quality inventory. The IMP should be designed with this in mind, not strictly as a reporting requirement to EPA. The checklist in Appendix 3 outlines what should be included in an IMP and can be used as a guide for creating an IMP or pulling together existing documents. The checklist does not represent, and should not be used as a substitute for an IMP

Annual GHG Inventory Summary and Goal Tracking Form

Partners complete and submit the Annual GHG Inventory Summary and Goal Tracking Form to EPA each year. This form describes emissions in terms of total CO_2-equivalent at a corporate level, broken out by emission source type — core direct (e.g., stationary, process, and mobile sources), core indirect (e.g., electricity or steam purchases), optional (e.g., offsite waste disposal, product transport), and offsets (e.g., sequestration, renewables) — for both domestic and international (if applicable) sources. The form also includes historical totals and a performance indicator (if applicable) that is used to track progress toward a reduction goal.

The Annual GHG Inventory Summary and Goal Tracking Form is attached as Appendix 4.

Review Process

EPA provides a desktop review of both the Partner's IMP and its corporate GHG inventory data. EPA also offers a desktop review of facility-level GHG data for interested Partners. Many Partners have found the facility-level data review to be helpful in improving the quality of their inventory. One site visit is also conducted to ensure accurate facility-level implementation of the Partner's IMP.

Desktop Review of the Inventory Management Plan

EPA conducts a desktop review of the Partner's GHG accounting methods and systems as detailed in the IMP Checklist.

A complete list of issues to consider for the desktop review is attached as Appendix 3 (Column 3). Once the desktop review of the IMP is completed, EPA informs the Partner whether their IMP meets or is below expectations for each item on the IMP Checklist. The desktop review also identifies required areas for improvement, optional areas for improvement, and best practices. For required areas for improvement, Partners submit a revised IMP to correct the deficiency. Optional areas for improvement are recommendations to the Partner that could help improve the accuracy, efficiency, or relevance of their inventories. Best practices are also noted and compiled into a database that will enable EPA to highlight and share innovative IMP practices with Partners in the future.

Desktop Review of Corporate GHG Inventory Data

The desktop review of the Partner's GHG inventory covers a review of corporate inventory data disaggregated to the categories broken out in the Annual GHG Inventory Summary and Goal Tracking Form. The desktop GHG inventory review of corporate data includes identifying issues such as:

- ***Boundary Conditions.*** *Are all emission source types within operational boundaries included as specified in IMP? Are all significant differences in the annual emissions profile explained?*
- ***Base Year.*** *If structural or methodology changes are reported: Do changes appear to be reflected in adjustments to base year emissions? Do changes appear to be consistent with changes in annual inventory from the previous year's inventory?*
- ***Data Management/Goals.*** *Does the inventory adequately provide data that allows the Partner to evaluate facility- and entity-wide progress against their Climate Leaders goal? Does the inventory appear to be on track for achieving reduction goal? What percentage of emissions and emissions reductions are occurring domestically vs. outside the U.S.? What percentage of reductions is occurring through offsets vs. emissions reductions?*

Based on the desktop review of corporate inventory data, EPA provides the Partner with findings and recommendations to improve the accuracy and relevance of their inventory.

Desktop Review of Facility-Level GHG Inventory Data

While not a requirement, EPA's preference is to see facility level data; however, EPA recognizes that some Partners have confidentiality concerns with reporting at this level of disaggregation. If confidentiality is a concern, EPA can review the data at the Partner site. Many Partners have found the facility-level data review to be helpful in improving the quality of their inventory.

The desktop GHG inventory review of facility data includes identifying issues such as:

- ***Boundary Conditions.*** *Are all facilities identified in the IMP included? Are emission source types at each facility consistent with the IMP? Do emission totals appear consistent between facilities based on magnitude and type of operations?*
- ***Data Management/Goals.*** *Are emissions of each GHG correctly converted to CO_2-equivalents? Are calculations outlined in the IMP correctly completed for each emission type at*

each facility? Does activity data used reflect that specified in the IMP? Do facility subtotals sum to the reported corporate totals?

Based on the desktop review of facility inventory data, EPA provides the Partner with findings and recommendations to improve the accuracy and relevance of their inventory.

On-Site Review of IMP Implementation

Once the desktop reviews have been completed, one on-site visit is conducted to review facility-level implementation of the IMP. This on-site review is designed to give confidence in the credibility of the data reported to EPA, as well as to foster continuous improvement in the emissions accounting and reporting procedures of Climate Leaders Partners. The goal of the review is to determine whether there are ways to improve the accuracy, efficiency, and relevance of the inventory created by the IMP. To accomplish this, the inventory performance at the site should be significant to the overall inventory and notably relevant to other facilities. EPA, in consultation with its Partners, determines the most appropriate site to visit based on the following factors:

- **Risk.** *EPA strives to review facilities with the greatest overall contribution to corporate emissions, or those with emissions profiles that are the most representative of corporate emissions*
- **Potential Benefit to Partners.** *EPA strives to review facilities that offer the best opportunity for technical assistance to benefit Partners' inventory efforts.*

Ideally, a site that is a large emitter, has many of the largest emission types, and represents the most common business activity, data management system, and environmental/quality management system is identified. Where process emissions are a large fraction of the total corporate inventory, preference is given to these sites, especially in cases where sector-specific guidance is not available from EPA.

Once a site is selected, EPA conducts a telephone conference with the Partner to identify the GHG emissions sources at the site, key personnel at the site, data sources to review, equipment/processes to be visited, safety/security issues, and other logistics. It is anticipated that most site visits will last one day, but more complicated facilities may require more time. An example of a typical schedule for an onsite visit is shown in Figure 9-2.

The site review includes sampling source data, tracing data through the entire data management chain, and checking calculations. A complete list of issues to consider for the on-site review is attached as Appendix 3 (Column 4). Once the site review is complete, EPA informs the Partner whether their IMP implementation at the site meets expectations or requires improvement for each item on the IMP Checklist. The site review also identifies optional areas for improvement, as well as best practices. For required areas for improvement, Partners submit additional documentation detailing the steps taken to address these issues. The optional areas for improvement are recommendations to the Partner that could help improve the accuracy, efficiency, or relevance of their inventory management systems. Best practices are also noted and compiled into a database that will enable EPA to highlight and share innovative IMP practices with Partners in the future.

Third-Party Verification

Many Climate Leaders Partners have completed or are considering third-party verification of their inventories. As an alternative to the primary reporting option, EPA allows Partners that undertake a rigorous third-party verification of their GHG inventories to submit a verification report

Figure 9-2: Sample Onsite IMP Review Schedule

Typical Schedule for Climate Leaders Onsite IMP Review

This schedule assumes that a facility of moderate complexity would be visited. Very complex facilities may require a longer agenda; very small or noncomplex facilities may require a shorter agenda.

1-2 Weeks in Advance
EPA and Partner discuss source types included at the facility, business/product divisions within the facility, partner personnel required during the visit, safety procedures, and logistics. The partner representative ensures that required personnel will be available.

Day of the Onsite Review
8:00-8:30 am
The reviewer arrives onsite, clears security, attends required safety briefing (if any). Data confidentiality is discussed. (Note: reviewers are not allowed to sign non-disclosure agreements).

8:30 -9:00 am
The reviewer meets with the Climate Leaders representative, local (define) EHS representative, and facility management (as appropriate) to discuss objectives for site visit, to review major operations and processes used at the facility, and to identify specific areas of interest for the onsite review.

9:00 - 11:00 am
Tour of facility. The reviewer will be attempting to understand chemical/manufacturing/generating processes used at the plant in order to review the completeness of the emission source list and to understand the specific mode of operation for these sources. Discussions occur with facility operators during the tour.

11:00 am - 12:00 pm
The reviewer and EHS representative meet with facility staff responsible for tracking electrical, steam, and fuel purchases (non-utilities) or for quality assurance/quality control (QA/QC) of Continuous Emissions Monitoring System (CEMS) data and Title IV reporting (utilities). Review of activity data used for this estimate and discussion of any unit conversions/calculations/QC of data performed by the Environmental Health and Safety (EHS) representative. Use of any data management tools and data review by other personnel are also discussed.

12:00 - 1:00 pm
Working lunch, onsite or offsite. As necessary, the reviewer and the Partner further discuss types of emission sources, business divisions, and key performance indicator (KPI) tracking.

1:00 - 3:00
The reviewer and the EHS representative meet with personnel responsible for tracking of activity data from other processes or emission sources, tracking of KPI (if performed at facility level), and for management and QA/QC of data.

3:00 - 4:00
The reviewer and the Partner's representative discuss preliminary findings and any areas of concern.

Approximately 1 Week After Visit
Formal report provided by EPA to the Partner.

certifying that, at a minimum, the requirements of the Climate Leaders GHG inventory review have been met. Partners choosing to submit to EPA a third-party verification report are not required to submit an IMP to EPA, nor are the IMP desktop review and on-site review by EPA required. However, Partners are still required to submit the Annual GHG Inventory Summary and Goal Tracking Form to EPA each year.

The third-party verification report must certify that the requirements of the Climate Leaders GHG inventory review process have been met. This includes a minimum of one on-site visit, although more may be appropriate. The third-party verification report must address all of the required IMP checklist components, both in a desktop review and during the site visit(s). EPA is available via telephone conference to answer Partner's or third-party verifier's questions on these requirements. When Partners choose to use third-party verification in lieu of submitting an IMP, then third-party verification is required for the Partner's base year inventory and for its goal year inventory.

Partners interested in third-party verification are encouraged to discuss this with EPA to better understand verification options and other considerations.

Technical Assistance to Complete Base Year Reporting

EPA provides up to 80 hours of technical assistance to each Partner as they develop and document their IMP and complete their base-year inventory. Technical assistance encompasses all aspects of creating a credible GHG inventory, including creating and implementing GHG accounting methods, and measuring, tracking, and reporting GHG emissions. EPA also provides an inventory review process to offer constructive feedback on improving the accuracy, efficiency, and relevance of Partners' GHG inventory data and management systems. The level of assistance involved will vary by the needs of the Partner.

Ongoing Technical Assistance

After the completion of a Partner's base year inventory, EPA experts continue to provide up to 10 hours annually of technical assistance in subsequent years to help Partners update their IMP, adjust their base year inventory for significant changes, and calculate new emission sources.

Types of technical assistance available include:

- *Assistance in understanding the Climate Leaders GHG Inventory Protocol, which includes the Design Principles, cross-sector modules, and sector-specific modules.*
- *Guidance on selecting organizational and operational boundaries.*
- *Assistance identifying sector-specific emissions sources.*
- *Assistance identifying methods, types of data needed, and emission factors used to calculate emissions.*
- *Help defining estimation methods for small sources of emissions to minimize unnecessary data collection.*
- *Support in creating a GHG management system or IMP based on best practices.*
- *One onsite visit to review implementation of the IMP.*
- *On-call support for technical queries.*

Corporate Data Management Approaches

The following describes various corporate GHG data management approaches.

Roll-Up GHG Emissions Data to Corporate Level

To report a corporation's total GHG emissions, companies usually need to gather and summarize data from multiple facilities, possibly in different countries and business divisions. It is important to plan this process carefully to minimize the reporting burden, reduce the risk of errors that might occur while compiling data, and ensure that all facilities are collecting information on an approved, consistent basis. Ideally, corporations will integrate GHG reporting with their existing reporting tools and processes, and take advantage of any relevant data already collected and reported by facilities to division or corporate offices, regulators, or other stakeholders.

For internal reporting up to the corporate level, it is recommended that standardized reporting formats be used to ensure that data received from different business units and facilities is comparable, and that internal reporting rules are observed. Standardized formats can significantly reduce the risk of errors. *Common differences between sites that can result in errors in the corporate inventory include:*

- *Different emission factors and quantification methodologies used by each site*
- *Sites reporting data in different units of measure that then go uncorrected*
- *Different interpretation of what constitutes* de minimus
- *Unclear roles and responsibilities resulting in incomplete data sets sent to corporate*
- *Different interpretation of how to establish organizational and operational boundaries*
- *Availability of activity or other measured data necessary to do emissions calculations*
- *Differences in reporting periods*

The reporting under the Climate Leaders program will help to ensure that there is a process in place for meeting GHG data standards. It will also provide suggestions for ongoing improvements and efficiencies in GHG inventory development through the corporate-wide IMP submittal and desktop review, as well as through the onsite IMP review, as documented above.

Centralized Approach: Individual Facilities Report Activity/Fuel Use Data

This approach may be particularly suitable for office-based organizations. Requesting that facilities report their activity/fuel use data may be the preferred option if:

- The staff at the corporate or division level can calculate emissions data in a straightforward manner on the basis of activity/fuel-use data; and
- Emissions calculations are standard across a number of facilities.

Decentralized Approach: Individual Facilities Calculate GHG Emissions Data

Asking facilities to calculate GHG emissions themselves will help to increase their awareness and understanding of the issue. However, it may also lead to resistance, increased training needs, an increase in calculation errors, and a greater need for auditing of calculations. Requesting

that facilities calculate GHG emissions themselves may be the preferred option if:

- GHG emission calculations require detailed knowledge of the kind of equipment being used at facilities.
- GHG emission calculations methods vary across a number of facilities.
- Process emissions (in contrast to emissions from burning fossil fuels) make up an important share of total GHG emissions.
- Resources are available to train facility staff to conduct these calculations and to audit them, or a user-friendly tool is available to simplify the calculation and reporting task for facility-level staff.
- Local regulations require reporting of GHG emissions at a facility level.

The choice of collection approach depends on the needs and characteristics of the reporting company. To maximize accuracy and minimize reporting burdens, some companies use a combination of two approaches. Complex facilities with process emissions 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 corporate database or reporting tool then calculates total GHG emissions for each of these standard activities.

The two approaches are not mutually exclusive and should produce the same result. Thus companies desiring a consistency check on facility-level calculations can follow both approaches and compare the results. Even when facilities calculate their own GHG emissions, corporate staff may still wish to gather activity/fuel use data to double-check calculations and explore opportunities for emissions reductions. These data should be available and transparent to staff at all corporate levels. Corporate staff should also verify that facility-reported data are based on well-defined, consistent, and approved inventory boundaries, reporting periods, calculation methodologies, etc.

Whether final GHG emissions figures are derived at the facility or corporate level, the data specified at the beginning of this chapter must be collected and supplied for the final report. *The Climate Leaders program requires that Partners report corporate-level emissions data and prefers that Partners provide supporting information for each facility, as detailed above.*

Verification of GHG Emissions

Climate Leaders Partners may choose to pursue third-party verification. However, Partners are still required to submit the Annual GHG Inventory Summary and Goal Tracking Form to EPA each year (as described in Chapter 9).

Verification is an objective assessment of the accuracy and completeness of reported GHG information to pre-established GHG accounting and reporting principles. Although the practice of verifying corporate GHG inventories is still evolving, the emergence of widely accepted standards, such as the GHG Protocol Corporate Standard and the forthcoming GHG Protocol Project Quantification Standard, should help GHG verification become more uniform, credible, and widely accepted.

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 methodologies. In practice, verification involves the prioritization of effort by the verifier toward the data and associated systems that have the greatest impact on overall data quality.

This section provides guidance on conducting an independent verification of a GHG inventory. It is highly recommended that a company develops its inventory in such a way that verification can be easily conducted. *The Climate Leaders program provides an IMP checklist (IMP elements, as discussed in Chapter 9) that delineates the components that must be included when Partners opt for third-party verification (Appendix 3).*

Internal Assurance

While verification is often undertaken by an independent, external third party, this may not always be the case. Many companies interested in improving their GHG inventories may subject their information to internal verification by personnel who are independent of the GHG accounting and reporting process. Both internal and external verification should follow similar procedures and processes. Independent internal verifications can provide valuable assurance over the reliability of information.

Internal verification can be a worthwhile learning experience for a company prior to commissioning an external verification by a third party. It can also provide external verifiers with useful information to begin their work.

The 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 the users of it. A material discrepancy is an error

(e.g., from an oversight, omission, or miscalculation) that results in a reported quantity or statement being significantly different from the true value or meaning. 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 judgement, the point at which a discrepancy becomes material (materiality threshold) is often pre-defined. As a rule of thumb, an error is considered to be materially misleading if the value exceeds 5 percent of the total inventory for the part of the organization being verified.

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

A specific materiality threshold will not be defined under the Climate Leaders program; it is left up to the discretion of the Partner and/or verifier. Partners need to at least make an estimate for all sources, facilities, and operations and include the estimates in the inventory. The estimates can be approximate, and Partners can work with EPA to determine the potential impact on the inventory. Sources can be excluded from the inventory only if it is justified that they represent an insignificant amount of a Partner's total emissions AND either: 1) there is insufficient scientific understanding to develop a reliable method for estimating emissions, or 2) an estimation method exists but data are not available (or would require excessive cost to the Partner to acquire) to estimate emissions.

Selecting a Verifier

When Partners choose to use external verification to meet EPA's reporting requirements, the verifier should be an independent, third-party verifier.

Some factors to consider when selecting a verifier include their:

- Previous experience and competence in undertaking GHG verifications
- Understanding of GHG issues, including calculation methodologies
- Understanding of the company's operations and industry
- Objectivity, credibility, and independence

It is important to recognize that the knowledge and qualifications of the individual(s) conducting the verification can be more important than those of the organization(s) they come from. Companies should select organizations based on the knowledge and qualifications of their actual verifiers and ensure that the lead verifier assigned to them is appropriately experienced. Effective verification of GHG inventories often requires a mix of specialized skills, not only at the technical level (e.g., engineering experience or an industry specialist) but also at a business level (e.g., verification and industry specialization).

Preparing for GHG Verification

Preparation of the IMP (as described in Chapter 9) allows Partners to prepare for the verification. The third-party verification report must certify that the requirements of the Climate Leaders GHG inventory review process have been met.

Appropriate documentation needs to be available to support the GHG inventory being subjected to external verification. Statements made by management for which there is no available supporting documentation cannot be verified. Where a *Partner* has not yet implemented systems for routinely accounting and recording GHG emissions data, an external verification will be 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.

Partners are responsible for ensuring the existence, quality, and retention of documentation so as to create an audit trail of how the inventory was compiled. If a *Partner* 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 borne in mind when designing and implementing GHG data processes and procedures.

IMP Checklist

When verification is undertaken to meet Climate Leaders reporting requirements, then the verification should address each of the elements of the IMP, which is located in Appendix 3.

Guidance on Setting a GHG Reduction Goal

EPA offers flexibility in goal setting because every company has a unique set of GHG emissions sources and reduction opportunities. Once Partners have completed their base year GHG inventory, EPA works closely with Partners to set an individualized GHG reduction goal. This goal must be:

- *Corporate-wide (including at least all U.S. operations)*
- *Based on the most recent base year for which data are available*
- *Achieved over 5 to 10 years*
- *Expressed as an absolute GHG reduction or as a decrease in GHG intensity*
- *Aggressive compared to the projected GHG performance for the Partner's sector*

Goal Evaluation Considerations

Partners represent a diverse group of companies, including energy producers, manufacturers, and service-oriented businesses. What EPA considers an aggressive goal may vary for different sectors and for different companies depending on a variety of factors:

- ***Sector Issues.*** *Historically, GHG intensity tends to decrease over time in most sectors as equipment is replaced with newer, more efficient technology. This trend can be rapid in sectors where capital stock turns over quickly, and much slower in traditional manufacturing sectors. The rate of intensity improvement can also be affected by the growth rate of the sector.*
- ***Company Issues.*** *Partners within the same sector can have different GHG emissions sources and a wide range of reduction opportunities. In addition, some Partners have undertaken GHG reduction activities prior to joining Climate Leaders. These actions are taken into consideration when evaluating a Partner's proposed goal.*

Goal Evaluation Methodology

EPA individually evaluates each proposed GHG reduction goal through the following process:

- *The goal is evaluated against a projected benchmark GHG emissions improvement rate for each Partner's sector. In cases where a Partner operates in multiple sectors, a weighted average is used. The benchmark is a combination of projected average energy intensity improvement and any projected process-related emissions intensity changes. EPA expects every goal to be markedly better than the projected benchmark performance for the Partner's sector.*
- *EPA also considers a Partner's current emissions intensity when evaluating its GHG reduction goal. By comparing the Partner's current performance to its sector, EPA recognizes that many companies have already made significant reductions in their GHG*

emissions or GHG intensity. Companies that are currently very efficient for their sector will not be expected to commit to a reduction goal that is as aggressive as companies that are less efficient than their sector average.

Defining Projected Sector Benchmarks for GHG Emissions Performance

The first step in evaluating a Partner's goal is to create a benchmark for comparison. EPA currently uses the following models to help develop an appropriate benchmark:

- *For commercial and industrial companies, EPA uses both the U.S. Department of Energy's National Energy Modeling System (NEMS) and the Bureau of Labor Statistics' (BLS) forecast input/output tables for the U.S. economy to project benchmark energy intensity improvement by sector.*
- *To project GHG emissions from electric generators, EPA uses the Integrated Planning Model (IPM) developed by ICF Resources Inc.*

In cases where emissions from industrial processes are a significant source of a Partner's inventory (such as cement or semiconductor manufacturing), EPA performs additional analysis based on sector-specific sources of process-related emissions data and projections. These data are then combined with the projected energy intensity improvement to develop a benchmark GHG emissions improvement rate for the Partner's sector.

Choosing a Key Performance Indicator for Normalized Goals

EPA allows goals to be expressed as an absolute GHG emissions reduction or as a decrease in GHG intensity. Absolute GHG reduction goals compare total GHG emissions in the goal year to those in a base year. GHG intensity goals allow a company to account for increases or decreases in production over time. The ratio of GHG emissions over an appropriate normalizing factor becomes the Partner's key performance indicator to measure GHG intensity. Normalizing factors are typically measured in physical units (e.g., tons of steel) or economic units (e.g., value of shipments). Due to the large variability in economic metrics, Climate Leaders generally prefers metrics based on physical values, which track year-to-year changes in emissions intensity more accurately. However, for companies that produce a wide diversity of products, using an economic metric might be more appropriate. EPA offers technical assistance to help Partners choose a suitable key performance indicator.

Reporting and Goal Tracking

Climate Leaders Partners report annual GHG inventory data to EPA to document progress towards their reduction goal. Partners with a worldwide goal report domestic and international emissions separately as well as reporting a worldwide total. This system allows EPA to ensure that Partners are demonstrating leadership through achieving a portion of their GHG reductions in the United States. Once Partners meet their initial Climate Leaders goal, EPA will work with them to set a new reduction goal.

Absolute and Intensity Targets

Partners may select either an absolute emissions target or an intensity target. Absolute targets track reductions in the total emissions of an organization. Intensity targets track reductions per unit of output of the organization, and may be applicable where growth of the organization may offset efficiency improvements or other reductions. Table 11-1 compares the two types of targets.

Table 11-1: Comparison of Absolute and Intensity Targets

Parameter	Absolute Target	Intensity Target
Reduction Type	Specified quantity of reductions to the atmosphere.	Reductions per a business metric. No guarantee that there will be less GHG emissions to the atmosphere – absolute emissions may rise even if intensity goes down (and output increases).
Metric Definition	Not applicable	May be difficult to define a single common business metric for companies with diverse operations. If a monetary variable is used for the business metric (i.e., dollar of revenue or sales), it *should* be adjusted for changes in product prices, product mix, and inflation – adds complexity to the tracking process.
Confidentiality	Not applicable—no business metric assigned to target	May be an issue—data on the business metric needs to be reported
Effects from Base Year Recalculations	Significant structural changes add complexity to tracking progress over time	GHG changes due to production fluctuations are usually not required
Relation to Organic Growth or Decline	Recognizes a company for reducing GHGs by decreasing production or output	Unrelated
Comparisons of GHG Intensity/ Efficiency	Does not allow for comparison of GHG performance between companies, if they choose to do so	Comparability of GHG performance between companies may be increased

Identifying GHG Reduction Opportunities

Partners may find it easiest to begin the process of meeting a goal by examining their Climate Leaders GHG inventory and developing a list of emission reduction activities. Figure 11-1 illustrates the broad palette of emission reduction choices individual companies and facilities might consider. Once the Partner has assembled an array of emission reduction opportunities, the firm should consider establishing evaluation criteria to prioritize the reduction activities. Such evaluation criteria might include:

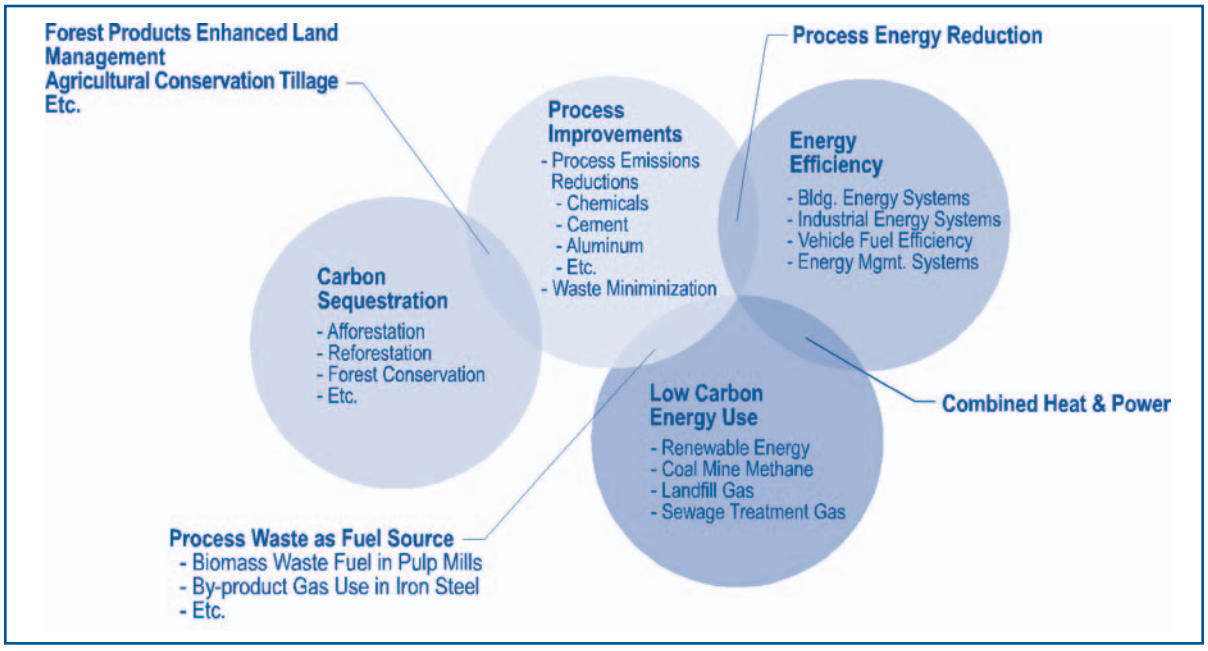
- *Cost to implement*
- *Collateral benefits to the firm, the environment, and the community*
- *Net Return on Investment*
- *Time to implement*
- *Contribution to core business*
- *Contribution to brand image*
- *Obstacles to implementation*

With an evaluation protocol in place, the company can then best evaluate top preferences for emission reduction activities over the 5 to 10 year time horizon and construct a defensible, credible, achievable GHG reduction goal.

In addition to considering emission reduction opportunities within a company's direct and indirect core emissions inventory and upstream/downstream optional emissions inventory, companies may also use emission offset projects towards completion of their GHG reduction goal.

As depicted in Figure 11-1, emission reduction (or sequestration) opportunities generally fall into four main categories:

Figure 11-1: Opportunities for GHG Reduction



- *Energy Efficiency*
- *Low Carbon or No Carbon Energy Use*
- *Process Optimization*
- *Carbon Sequestration*

The emissions associated with the generation of imported electricity, heat, or steam are a special case of indirect emissions. For many companies, electricity usage represents one of the most significant opportunities to reduce GHG emissions. Companies can reduce their use of electricity and/or use it more efficiently by investing in energy efficient technologies. Additionally, emerging green power markets enable some companies to switch to less GHG-intensive electricity suppliers. Companies can also install an efficient co-generation plant onsite to replace the import of more GHG-intensive electricity from the grid. Incorporating indirect emissions from electricity, heat, and steam usage into the core emissions reporting facilitates the transparent accounting of such choices.

Process optimization can result in directly reduced GHG and conventional pollutant emissions. In addition to these direct emission reductions, indirect emission reductions may occur from improvements in energy efficiency, resource efficiency, waste minimization, and emissions reductions.

Carbon can be sequestered in sinks including soil, woody debris, living plants, and even wood products. Challenges inherent in inventorying sequestered carbon include scientific uncertainty in measurement accuracy and precision, and questions about permanence, duration, and leakage.

No specific process for constructing a reduction goal is required by the Climate Leaders program. However, Table 11-2 lays out a recommended strategy and describes the typical steps to efficiently create a credible, achievable goal.

Table 11-2: Steps in Setting and Tracking Performance Toward a GHG Target

Obtain senior management commitment.
Implementing a reduction target is likely to necessitate changes in behavior and decision-making throughout the organization, and requires establishing an internal accountability and incentive system, as well as adequate resources.
Decide on the target type (absolute vs. intensity).
An absolute target is expressed in terms of a reduction over time in a specified quantify of GHG emissions to the atmosphere (i.e., tons of CO_2-equivalents), whereas an intensity target is expressed as a reduction in the ratio of GHG emissions relative to another business metric (i.e., tons of CO_2-equivalents per ton of product, per kWh, ton-mileage, etc) or some other metric such as sales, revenues, or office space.
Decide on the target boundary.
Under the Climate Leaders program, targets must be for reduction of CO_2-equivalents on a absolute or intensity basis, for a minimum of core direct and indirect emissions from U.S. operations.
Choose the target base year.
Under the Climate Leaders program, for the purpose of assessing a company's performance against its emission reduction goal, the most current year that a Partner has data available should be its base year (fixed base year).
Define the target time period.
Under the Climate Leaders program, the goals should be based on prospective reductions beginning with the base year and looking 5-10 years into the future.
Decide on the use of project offsets or credits.
A GHG target can be met from internal reductions at sources included in the target boundary, or through additionally using offsets that are generated from GHG reduction projects that reduce emissions at sources outside the target boundary. It is important to ensure credibility of the offsets (see Chapter 8), specify the origin and nature of the offsets when reporting, as well as to check that the offsets have not also been counted toward another organization's target (i.e., via contract).
Establish a target double counting policy.
For example, the policy must ensure that a GHG offset is not counted toward the target by both the selling and purchasing organizations. For an internal reduction project, the missions need to be added back to the inventory if the reductions are subsequently "sold" as an offset to another company.
Decide on the target level.
In addition to the guidelines and requirements from Steps 1 through 7, considerations include understanding key drivers affecting GHG emissions, developing reductions strategies, looking at the future of the company, factoring relevant growth factors, evaluating existing environmental plans or energy plans that will affect GHG emissions, and benchmarking GHG emissions with similar organizations.
Track and report progress against the target.
EPA Annual GHG Inventory Summary and Goal Tracking Form tracks progress against the target.

GHG Emissions Sources by Sector

Appendix 1 indicates examples of GHG emissions by emission category and industry sectors. These examples are not exhaustive and the reporting company should refer to Chapter 4 and interpret the relevant emissions for its own situation.

Sector	*Core Direct Emission Sources*	*Core Indirect Emission Sources*	*Optional Emission Sources*
Energy			
Energy Generation	■ Stationary combustion (boilers and turbines used in the production of electricity, heat or steam, fuel pumps, fuel cells, flaring) ■ Mobile combustion (trucks, barges and trains for transportation of fuels) ■ Fugitive emissions (CH_4 leakage from transmission and storage facilities, HFC emissions from LPG storage facilities, SF_6 emissions from transmission and distribution)	■ Stationary combustion (consumption of purchased electricity, heat or steam)	■ Stationary combustion (mining and extraction of fuels, energy for refining or processing fuels) ■ Process emissions (production of fuels, SF_6 emissions) ■ Mobile combustion (transportation of fuels/ waste, employee business travel, employee commuting) ■ Fugitive emissions (CH_4 and CO_2 from waste landfills, pipelines, SF_6 emissions)
Oil and Gas Industry	■ Stationary combustion (process heaters, engines, turbines, flares, incinerators, oxidizers, production of electricity, heat and steam) ■ Process emissions (process vents, equipment vents, maintenance/ turnaround activities, non-routine activities) ■ Mobile combustion (transportation of raw materials/products/waste; company owned vehicles) ■ 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) ■ Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting, product use as fuel) ■ Process emissions (product use as feedstock or emissions from the production of purchased materials) ■ Fugitive emissions (CH_4 and CO_2 from waste landfills or from the production of purchased materials)

Sector	Core Direct Emission Sources	Core Indirect Emission Sources	Optional Emission Sources
Energy (continued)			
Coal Mining	■ Stationary combustion (methane flaring and use, use of explosives, mine fires) ■ Mobile combustion (mining equipment, transportation of coal) ■ 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) ■ Mobile combustion (transportation of coal/waste, employee business travel, employee commuting) ■ Process emissions (gasification)
Metals			
Aluminum	■ Stationary combustion (bauxite to aluminum processing, coke baking, lime, soda ash and fuel use, on-site CHP) ■ Process emissions (carbon anode oxidation, electrolysis, PFC) ■ Mobile combustion (pre- and post-smelting transportation, ore haulers) ■ Fugitive emissions (fuel line CH_4, HFC and PFC, SF_6 cover gas)	■ Stationary combustion (consumption of purchased electricity, heat or steam)	■ Stationary combustion (raw material processing and coke production by second party suppliers, manufacture of production line machinery) ■ Mobile combustion (transportation services, business travel, employee commuting) ■ Process emissions (during production of purchased materials) ■ Fugitive emissions (mining and landfill CH_4 and CO_2, outsourced process emissions)
Chemicals			
Nitric acid, Ammonia, Adipic acid, Urea, and Petro-chemicals	■ Stationary combustion (boilers, flaring, reductive furnaces, flame reactors, steam reformers) ■ Process emissions (oxidation/reduction of substrates, impurity removal, N_2O byproducts, catalytic cracking, myriad other emissions individual to each process) ■ Mobile combustion (transportation of raw materials/products/waste) ■ Fugitive emissions (HFC use, storage tank leakage)	■ Stationary combustion (consumption of purchased electricity heat or steam)	■ Stationary combustion (production of purchased materials, waste combustion) ■ Process emissions (production of purchased materials) ■ Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) ■ Fugitive emissions (CH_4 and CO_2 from waste landfills and pipelines)

Sector	*Core Direct Emission Sources*	*Core Indirect Emission Sources*	*Optional Emission Sources*
Minerals			
Cement and Lime	■ Process emissions (calcination of limestone) ■ Stationary combustion (clinker kiln, drying of raw materials, production of electricity) ■ Mobile combustion (quarry operations, on-site transportation)	■ Stationary combustion (consumption of purchased electricity, heat or steam)	■ Stationary combustion (production of purchased materials, waste combustion) ■ Process emissions (production of purchased clinker and lime) ■ Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) ■ Fugitive emissions (mining and landfill CH_4 and CO_2, outsourced process emissions)
Waste			
Landfills, Waste combustion, Water service	■ Stationary combustion (incinerators, boilers, flaring) ■ Process emissions (sewage treatment, nitrogen loading) ■ Fugitive emissions (CH_4 emissions from waste and animal product decomposition) ■ Mobile combustion (transportation of waste/products)	■ Stationary combustion (consumption of purchased electricity, heat or steam)	■ Stationary combustion (recycled waste used as a fuel) ■ Process emissions (recycled waste used as a feedstock) ■ Mobile combustion (transportation of waste/products, employee business travel, employee commuting)
Pulp and Paper			
Pulp and paper	■ Stationary combustion (production of steam and electricity, fossil fuel-derived emissions from calcination of calcium carbonate in lime kilns, drying products with infrared dryers fired with fossil fuels) ■ Mobile combustion (transportation of raw materials, products, and wastes, operation of harvesting equipment) ■ Fugitive emissions (CH_4 and CO_2 from waste)	■ Stationary combustion (consumption of purchased electricity, heat or steam)	■ Stationary combustion (production of purchased materials, waste combustion) ■ Process emissions (production of purchased materials) ■ Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) ■ Fugitive emissions (landfill CH_4 and CO_2 emissions)

Sector	Core Direct Emission Sources	Core Indirect Emission Sources	Optional Emission Sources
HFC, PFC, SF4, and HCFC 22 Production			
HCFC 22 production	■ Stationary combustion (production of electricity, heat or steam) ■ Process emissions (HFC venting) ■ Mobile combustion (transportation of raw materials/products/waste) ■ Fugitive emissions (HFC use)	■ Stationary combustion (consumption of purchased electricity, heat or steam)	■ Stationary combustion (production of purchased materials) ■ Process emissions (production of purchased materials) ■ Mobile combustion (transportation of raw materialsproducts/waste, employee business travel, employee commuting) ■ Fugitive emissions(fugitive leaks in product use, CH_4 and CO_2 from waste landfills)
Semiconductor Production			
Semi-conductor production	■ Process emissions (C_2F_6, CH_4, CHF_3, SF_6, NF_3, C_3F_8, C_4F_8, N_2O used in wafer fabrication, CF_4 created from C_2F_6 and C_3F_8 processing) ■ Stationary combustion (oxidation of volatile organic waste, production of electricity, heat or steam) ■ Fugitive emissions (process gas storage leaks, container remainders/heel leakage) ■ Mobile combustion (transportation of raw materials/products/waste)	■ Stationary combustion (consumption of purchased electricity, heat or steam)	■ Stationary combustion (production of imported materials, waste combustion, upstream T&D losses of purchased electricity) ■ Process emissions (production of purchased materials, outsourced disposal of returned process gases and container remainder/heel) ■ Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) ■ Fugitive emissions (landfill CH_4 and CO_2 emissions, downstream process gas container remainder/heel leakage)
Other Sectors*			
Service sector/Office-based organizations	■ Stationary combustion (production of electricity, heat or steam) ■ Mobile combustion (transportation of raw materials/waste) ■ 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) ■ Process emissions (production of purchased materials) ■ Mobile combustion (transportation of raw materials/ products/ waste, employee business travel, employee commuting)

* Businesses in "other sectors" can estimate GHG emissions using cross-sectoral estimation tools—stationary combustion, mobile (transportation) combustion, HFC use, measurement and estimation uncertainty, and waste.

Unit Conversions

This appendix provides useful information on conversion factors for basic units of measure and fundamental fuel characteristics. Unless otherwise referenced, material is drawn from the American Petroleum Institute Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry, February 2001.

Global warming potentials for various greenhouse gases are presented in Figure 6-3 of Chapter 6.

Table A2-1: Conversion Factors

Mass		
1 pound (lb)	= 453.6 grams (g)	= 0.4536 kilograms
1 kilogram	= 2.205 pounds (lb)	= 1000 grams (g)
1 short ton (ton)	= 2000 pounds (lb)	= 907.2 kilograms
1 metric tonne (tonne)	= 2205 pounds (lb) = 1.1025 tons	= 1000 kilograms
Volume		
1 cubic foot (ft^3)	= 7.4805 gallons	
1 cubic foot (ft^3)	= 28.32 liters (L)	= 0.02832 cubic meters (m^3)
1 gallon (gal)	= 3.785 liters (L)	
1 barrel (bbl)	= 42 gallons (gal)	= 158.99 liters (L)
Length		
1 inch (in)	= 2.540 centimeters	
1 foot (ft)	= 0.3048 meters (m)	
1 mile	= 1.609 kilometers	
Power		
1 horsepower (hp)	= 0.707 Btu/second	= 0.7457 kilowatts (10^3 W)
Energy		
1 horsepower-hour (hp-hr)	= 2545 Btu	= 0.7457 kilowatt-hour
1 kilowatt-hour	= 3412 Btu	= 3600 kilo-Joules (10^3 J)
1 megawatt (10^6 W)	= 1000 kilowatts (10^3 W)	
1 Btu	= 1055 Joules (J)	
1 million Btu (10^6 Btu)	= 293 kilowatt-hours	
Heating Value		
1 pound/million Btu ($lb/10^6$ Btu)	= 430 grams/giga-Joule ($g/10^9$ J)	
Pressure		
1 atmosphere (atm)	= 14.696 pounds per square inch (psia)	= 760 millimeters mercury (Hg)
1 atmosphere (atm)	= 101.325 kilo-Pascals (10^3 Pa)	
1 pound per square inch (psi)	= 51.71 millimeters mercury (Hg)	

Notes:

psig = Gauge pressure.

psia = Absolute pressure (note psia = psig + atmospheric pressure).

Table A2-2: Unit Prefixes

SI Units		US Designation	
Unit/Symbol	**Factor**	**Unit/Symbol**	**Factor**
peta (P)	10^{15}	quadrillion (Q)	10^{15}
tera (T)	10^{12}	trillion (T)	10^{12}
giga (G)	10^{9}	billion (B)	10^{9}
mega (M)	10^{6}	million (MM)	10^{6}
kilo (k)	10^{3}	thousand (k or M)	10^{3}
hecto (h)	10^{2}		
deka (da)	10^{1}		
deci (d)	10^{-1}		
centi (c)	10^{-2}		
milli (m)	10^{-3}		
micro (m)	10^{-6}		
nano (n)	10^{-9}		
pico (p)	10^{-12}		

Table A2-3: Power Output to Energy Input Conversions

Fuel/Service	Btu/hp-hr	Data Source
Large uncontrolled natural gas turbine	8,000	AP-42, Table 3.1-1
Large uncontrolled gas turbine firing fuel oil (distillate)		(10/96)
Natural gas prime mover: turbine	7,700	AP-42, Table 3.2-1
Natural gas prime mover: 2-cycle lean burn	7,800	(10/96)
Natural gas prime mover: 4-cycle lean burn	7,700	
Natural gas prime mover: 4-cycle rich burn	8,600	
Gasoline industrial engine	7,000	AP-42, Table 3.3-1
Diesel industrial engine		(10/96)
Large (>600 hp) Diesel Engine		
Dual (natural gas/diesel) engine		

Table A2-4: Conversion from Weight Percents to Mole Percents in Mixtures

$$\text{Mole\%}_i = \text{Wt\%}_i \times \frac{\text{MW}_{\text{Mixture}}}{\text{MW}_i}$$

$$\text{MW}_{\text{Mixture}} = \frac{1}{100} \times \sum_{i=1}^{\#\text{ compounds}} (\text{Mole\%}_i \times \text{MW}_i)$$

$$\text{MW}_{\text{Mixture}} = 100 \div \sum_{i=1}^{\#\text{ compounds}} \frac{\text{Wt\%}_i}{\text{MW}_i}$$

$\text{Mole\%}_i$ = individual weight percentage

$\text{MW}_{\text{Mixture}}$ = Molecular weight of the mixture

MW_i = individual molecular weights

IMP Checklist

The Inventory Management Plan (IMP) is an internal process for the Partner to institutionalize the completion of a high quality inventory. The IMP should be designed with this in mind, not strictly as a reporting requirement to EPA. The IMP checklist outlines what components should be included in an IMP and can be used as a guide for creating an IMP or pulling together existing documents. The checklist does not represent, and should not be used as a substitute for an IMP. Partners may either have a single formal IMP document that addresses all of these components, or Partners may have a collection of Standard Operating Procedures (SOPs) and other relevant information that address these components when taken in total.

For the most current version of the IMP checklist see the Climate Leaders website at: http://www.epa.gov/climateleaders.

	IMP Component	Corporate Level Detail Required	Corporate Desktop Review: Issues to Consider	On-site IMP Review Issues to Consider
Partner Information				
1.	Company Name	Legal name of entity		
2.	Corporate Address	Physical and mailing address		
3.	Inventory Contact	Contact name and title		
4.	Inventory Contact Information	Contact information (telephone/fax/ email)		
Boundary Conditions				
Organizational				
5.	Inclusion of Partially Owned or Controlled Assets	The basis for reporting emissions data from partially owned or controlled assets: – Equity Approach – Control Approach: – Financial control criterion – Operational control criterion	Is the approach consistent with the Climate Leaders Design Principles? If applicable, how is operational control defined? How is equity defined (e.g., based on financial ownership or value derived from company)? Are leases adequately addressed?	Identify all business units or major divisions at site. Confirm that all business units at the site are either included or specifically excluded. Consider shared, co-located, or outsourced operations. Is control demonstrated as documented?
6.	Facilities List	A list of all facilities with location, % ownership, or % control. Define if inventory is U.S. only or includes optional non-U.S. operations.	List should be complete and include all facilities (including leases if applicable). Fleet vehicles should also be included if not assigned to a facility. How does the list compare to other public sources listing company holdings? Has the Partner demonstrated due diligence on determining the accuracy of the list? What is the method for ongoing review of the list?	N/A

	IMP Component	Corporate Level Detail Required	Corporate Desktop Review: Issues to Consider	On-site IMP Review Issues to Consider
Boundary Conditions (continued)				
Operational				
7.	GHG List	A list of GHGs included in inventory.	If there are no releases of any of the six major GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) this should be documented to insure there is no oversight. Small sources of a GHG should not be excluded. How does this compare to the list of emission sources specified in #9 and #10?	Is the list of GHGs consistent with the IMP? Confirm all sources of GHGs are included in the inventory, as consistent with IMP.
8.	Emission Source Identification Procedure	A description of the procedure/method used to identify direct and indirect emission sources.	Is the procedure likely to identify all significant sources? Does the procedure capture all stationary, mobile, indirect, process, and fugitive sources? Including small sources (e.g., HFC emissions from refrigeration/AC equipment use, etc.)? Does the procedure include networking with all the appropriate people, whose roles and responsibilities are defined in #24?	Is it likely that all emission sources will be captured? Is there an existing inventorying process, permitting process (like Title V), or other mechanism to help most efficiently identify direct and indirect emission sources?
9.	Direct Sources	A list of groups of sources by emission category for each facility or reporting unit. (e.g., under stationary combustion: thermal oxidizers, engines, flares, etc.). It is not necessary to enumerate each piece of equipment.	Are all direct emission sources included (stationary, mobile, fugitive, and process)? How does this list compare with other company sources of emissions (e.g., Title V air permit)?	List all GHG emission source types identified. Confirm each source type included in the inventory, as consistent with IMP.
10.	Indirect Sources – Energy Import/Export	A list of energy imports or exports that are reflected in the inventory (e.g., steam, electricity, hot water, etc.).	Are all indirect emission sources included (purchased electricity, steam, and hot water)?	List all GHG emission source types identified. Confirm each source type included in the inventory, as consistent with IMP.
11.	Optional Sources	A list of other optional emission sources that are accounted for in the inventory (e.g., outsourced activities, upstream or downstream activities, etc.)	Are optional sources included accurately (i.e., entire emissions source accounted for and not just the reductions)? How does this list compare to company profile (e.g., company has a lot of 3rd party shipping but only employee commuting reported)?	If an optional source is included in the inventory, does the inventory capture the entire emission type? Is there evidence of similar optional sources which should also be included for consistency?

	IMP Component	Corporate Level Detail Required	Corporate Desktop Review: Issues to Consider	On-site IMP Review Issues to Consider
Emissions Quantification				
12.	Quantification Method	A description of the emission quantification methodologies and reference for each emission and offset category. Where multiple methods are used, specify which facility/source uses the respective method.	Are the correct quantification methodologies being used? Are the methods based on reliable accurate and current references? How do the methods compare to the Climate Leaders guidance documents?	Check a sample of each GHG related calculation that takes place at the site by confirming the algorithm and factors match those documented in the IMP, and recalculating no more than three of each computation type. Such calculations may include converting units, summing monthly totals to annual totals, computing emissions by source, converting to CO_2-eq, totaling facility CO_2-eq, or other computations. If GHG calculations are performed onsite, is there an existing process for communication of changes from the corporate level to this site? If past changes were made, were they indeed communicated?
13.	Emission Factors and Other Constants	A list of emission factors and other constants and reference for factors and constants (i.e., conversion factors) for each emission category. Descriptions of the process for how external references are kept current. Where multiple factors are used, specify which facility/source uses the respective factor.	Are the correct emission factors being used, based on reliable accurate and current references? Are factors updated annually? How do the factors compare to default values in the Climate Leaders guidance documents (e.g., do stationary combustion CO_2 factors account for carbon oxidation)? What do electricity production emission factors represent?	If facility-specific emission factors are used, does facility have documentation to support (e.g., carbon content of fuels, supplier-provided emission factors for electricity)? If default factors are used, does the facility have adequate information to develop specific emission factors to use instead? If activity data conversions are performed onsite, is there an existing process for communication of changes from the corporate level to this site? If past changes were made, were they indeed communicated?
Data Management				
14.	Activity Data	A description/name of the source of activity data documents or processes required to complete quantification methodology (e.g., monthly fuel purchase records, fuel meter, internal tracking and aggregation documents, etc.) for each item of activity data. Where multiple data sources are used, specify which facility/source uses the respective data source.	Is activity data based on appropriate sources? Is the right activity data being collected for the quantification method described in #12? Is activity data the most accurate available (e.g., fuel purchases adjusted for stock, fuel use based on physical units not $)?	Does the ultimate source and type of activity data collected for each emission type match that described in the IMP? Are any unit conversions, other than as described in the IMP, performed on the data before reporting? Is a better (more efficient, more accurate) source of activity data available? If the partner provided facility-level inventory data, does the reported facility total match that indicated by the activity data, conversion factors, and quantification method?

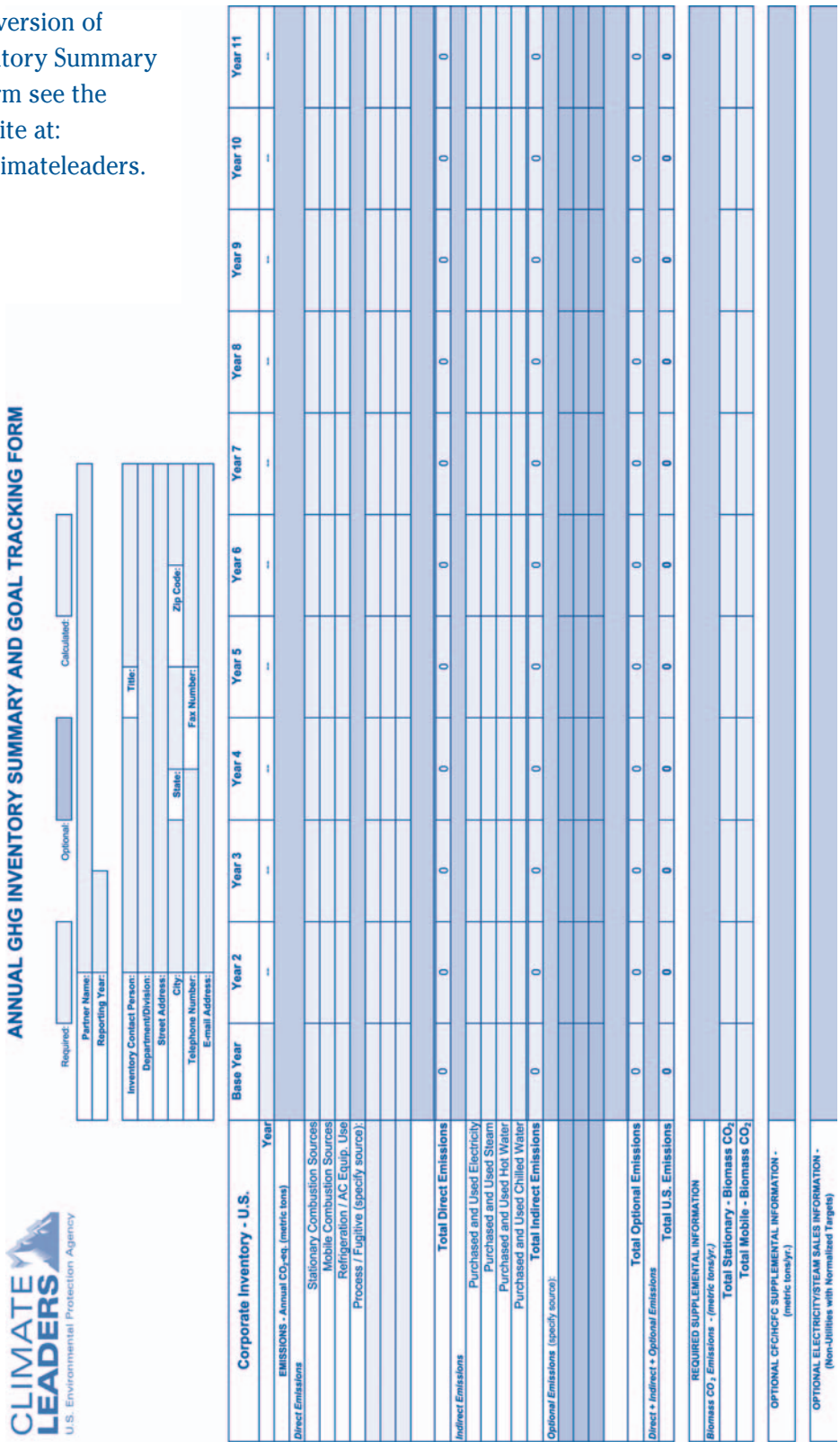
	IMP Component	Corporate Level Detail Required	Corporate Desktop Review: Issues to Consider	On-site IMP Review Issues to Consider
Data Management (continued)				
15.	Data Management **[Roles and responsibilities can be defined over time]**	A description of the process flow for collecting and processing activity or monitoring data from its original source to the final emission data entered into the inventory. Includes a description of roles and responsibilities.	Is the process likely to avoid data errors in computing final rolled up inventory totals? Are roles and responsibilities properly defined? Is the process adequately defined and institutionalized? Are the person/persons responsible for collecting data identified?	Does the process flow match that described in the IMP? Does each representative understand their role and responsibilities? More efficient method possible for data collection and processing? Where are likely areas for data corruption and how can error be minimized (from raw data to incorporation into the inventory)? Determine whether opportunities exist to integrate GHG data collection and management with other existing facility reporting tools. Trace approximately two (2) data points for each data type to confirm that raw data was correctly entered into data management system, calculation tool, or hand calculation.
16.	Normalization Factor(s) Selection **[Only necessary if Partner chooses to set goal based on an intensity target]**	A description of the normalization factor (units of product, $ revenue, etc.) used to calculate emissions intensity. Document how the normalization factor was selected.	Does the normalization factor and associated intensity value reasonably represent the emissions management performance?	Is the normalization factor and intensity value relevant for tracking performance at this facility? Is there a better normalization factor for this facility? Is the normalization factor and intensity value well communicated?
17.	Data Collection Process – Normalization Factor **[Only necessary if Partner chooses to set goal based on an intensity target]**	A description of the process flow for collecting and processing activity or monitoring data to obtain the final normalization factor data entered into the inventory.	Is the process likely to avoid data errors in computing final normalization factor and intensity value totals?	Is the process likely to avoid data errors in computing final normalization factor and intensity value totals?
18.	Data Collection Process – Quality Assurance	A description of the major sources of uncertainty and quality assurance measures for the data process flow. This includes information on how measurement system accuracy is assessed.	Is there a process for minimizing error? Are all likely error sources considered? How are uncertainties being addressed?	Are QC checks performed as described in the IMP? Are key staff aware of possible sources of error and means for minimizing that have not been considered in the IMP? Are reported uncertainty estimates for measurement devices realistic? Are measurement devices regularly calibrated?

	IMP Component	Corporate Level Detail Required	Corporate Desktop Review: Issues to Consider	On-site IMP Review Issues to Consider
Data Management (continued)				
19.	Data Collection System Security **[Can be defined over time]**	A description of how data collection system security is maintained.	How likely are errors to occur within the data collection and management system due to spreadsheets being damaged or otherwise transformed, unauthorized access to databases, and other information system problems?	Are safeguards implemented as described in the IMP? Are there opportunities for further improving data collection security?
20.	Integrated Tools **[OPTIONAL]**	A description of how GHG reporting and processing is integrated with other reporting tools.	Are tools integrated to enhance efficiency?	Are there opportunities for combining reporting systems to improve efficiency and consistency? Look for opportunities to leverage systems, schedules, data, etc.
21.	Frequency	The frequency for reporting facility data to the corporate level.	Is the reporting frequency sufficient to avoid significant errors in annual reporting (i.e., at least annual reporting)?	Is data reported at frequency described in the IMP? Would alternate frequencies improve site-level efficiency (for example matching GHG reporting timing to follow Title V reporting or GRI reporting.)
Base Year				
22.	Adjustment – Structural Changes	A description of the approach for adjusting base year emissions for mergers, acquisitions, divestitures, and outsourcing. This includes defining the process for determining when changes are necessary.	Is there an effective and accurate process for adjusting base year emissions for structural changes? What triggers changes? Are the changes implemented consistently (for emissions decreases as well as increases)? How is this linked to #5 (method) and #6 (list) of facilities?	Were structural changes incorporated in base year inventory, if appropriate based on IMP? Are organizational/operational boundary changes (if applicable) communicated to the site?
23.	Adjustment – Methodology Changes	A description of the approach for adjusting base year emissions for changes in calculation methodologies, emission factors, or error correction. This includes defining the process for determining when changes are necessary.	Is there an effective and accurate process for adjusting the base year emissions for methodology changes? What triggers changes? How is this linked to #12 (method) and #13 (factors) for calculating emissions?	Is there an effective and accurate process for adjusting the base year emissions for methodology changes? Are methodology changes (if applicable) communicated to the site?

	IMP Component	Corporate Level Detail Required	Corporate Desktop Review: Issues to Consider	On-site IMP Review Issues to Consider
Management Tools				
24.	Roles and Responsibilities **[Can be defined over time]**	A description of overall roles and responsibilities for corporate GHG inventory development and maintenance, include discussion of management role(s).	Are roles and responsibilities sufficiently spelled out to ensure that tasks are completed? Are roles and responsibilities adequately defined and institutionalized?	Do facility personnel feel that they adequately understand their responsibilities?
25.	Training **[Can be defined over time]**	A description of inventory development training received by inventory development team members.	Is sufficient training provided to ensure that tasks are completed accurately? Are new staff properly trained and aware of their roles and responsibilities?	Does training received match that described in the IMP? Based on discussions with facility personnel, is the training is appropriate, or can it be improved? Determine if roles are adequately institutionalized to ensure proper implementation.
26.	Document Retention and Control Policy **[Can be defined over time]**	A description of how version control is maintained for GHG inventory management guidelines. A description of the Partner's document retention policy.	Is there a reasonable process for ensuring that all participants are working to the same IMP guidelines? Does document retention policy insure data is maintained long enough to adjust base year emissions in goal year if needed?	Are document retention and control policies understood and implemented as described in IMP?
Auditing & Verification				
27.	Internal Auditing	A description of the internal audit process. Timing of the audit.	Is there an audit process that is likely to identify gaps and errors in inventory management? Are auditor roles and responsibilities properly defined in #24?	Have audits occurred as described in IMP? Have any corrective actions resulted?
28.	External Validation and/or Verification **[OPTIONAL]**	If applicable, a description of the process for external review. Timing of the audit.	What protocol was the external validation/verification performed to? What were the overall results of the validation/verification?	Have audits occurred as described in IMP? Have any corrective actions resulted?
29.	Management Review **[Can be defined over time]**	A description of the senior management review process.	Are senior managers involved in signing off on the inventory? Are manager roles and responsibilities properly defined in #24?	Are facility management reviewing inventory performance as (if) described in the IMP?
30.	Corrective Action **[Can be defined over time]**	A description of the process for implementing and documenting corrective actions for all internal and external reviews.	Is there a process for correcting errors or problems found? Is it clear who is responsible for correcting problem, when the problem should be solved, and how the correction process is tracked?	Is the process to ensure corrective actions are addressed appropriately (i.e., by the appropriate staff) and in a timely fashion occurring as described in the IMP? Can this process be improved based on findings onsite?

Annual GHG Inventory Summary and Goal Tracking Form

For the most current version of the Annual GHG Inventory Summary and Goal Tracking Form see the Climate Leaders website at: http://www.epa.gov/climateleaders.



CLIMATE LEADERS
U.S. Environmental Protection Agency

ANNUAL GHG INVENTORY SUMMARY AND GOAL TRACKING FORM

Required | Optional | Calculated

Partner Name:
Reporting Year:

Inventory Contact Person: | Title:
Department/Division:
Street Address:
City: | State: | Zip Code:
Telephone Number: | Fax Number:
E-mail Address:

Corporate Inventory - U.S.	Base Year	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Year	--	--	--	--	--	--	--	--	--	--	--
EMISSIONS - Annual CO_2-eq. (metric tons)											
Direct Emissions											
Stationary Combustion Sources											
Mobile Combustion Sources											
Refrigeration / AC Equip. Use											
Process / Fugitive (specify source):											
Total Direct Emissions	0	0	0	0	0	0	0	0	0	0	0
Indirect Emissions											
Purchased and Used Electricity											
Purchased and Used Steam											
Purchased and Used Hot Water											
Purchased and Used Chilled Water											
Total Indirect Emissions	0	0	0	0	0	0	0	0	0	0	0
Optional Emissions (specify source):											
Total Optional Emissions	0	0	0	0	0	0	0	0	0	0	0
Direct + Indirect + Optional Emissions											
Total U.S. Emissions	0	0	0	0	0	0	0	0	0	0	0

REQUIRED SUPPLEMENTAL INFORMATION											
Biomass CO_2 Emissions - (metric tons/yr.)											
Total Stationary - Biomass CO_2											
Total Mobile - Biomass CO_2											

OPTIONAL CFC/HCFC SUPPLEMENTAL INFORMATION - (metric tons/yr.)	
OPTIONAL ELECTRICITY/STEAM SALES INFORMATION - (Non-Utilities with Normalized Targets)	

CLIMATE LEADERS
U.S. Environmental Protection Agency

ANNUAL GHG INVENTORY SUMMARY AND GOAL TRACKING FORM

Required: Optional: Calculated:

Partner Name:
Reporting Year:

Corporate Inventory - Non-U.S. [OPTIONAL]	Base Year	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Year	--	--	--	--	--	--	--	--	--	--	--
EMISSIONS - Annual CO_2-eq. (metric tons)											
Direct Emissions											
Stationary Combustion Sources											
Mobile Combustion Sources											
Refrigeration / AC Equip. Use											
Process / Fugitive (specify source):											
Total Direct Emissions	0	0	0	0	0	0	0	0	0	0	0
Indirect Emissions											
Purchased and Used Electricity											
Purchased and Used Steam											
Purchased and Used Hot Water											
Purchased and Used Chilled Water											
Total Indirect Emissions	0	0	0	0	0	0	0	0	0	0	0
Optional Emissions (specify source):											
Total Optional Emissions	0	0	0	0	0	0	0	0	0	0	0
Direct + Indirect + Optional Emissions											
Total Non-U.S. Emissions	0	0	0	0	0	0	0	0	0	0	0

REQUIRED SUPPLEMENTAL INFORMATION											
Biomass CO_2 Emissions - (metric tons/yr.)											
Total Stationary - Biomass CO_2											
Total Mobile - Biomass CO_2											

OPTIONAL CFC/HCFC SUPPLEMENTAL INFORMATION - (metric tons/yr.)	

OPTIONAL ELECTRICITY/STEAM SALES INFORMATION (Non-Utilities with Normalized Targets)	

CLIMATE LEADERS
U.S. Environmental Protection Agency

ANNUAL GHG INVENTORY SUMMARY AND GOAL TRACKING FORM

Required: | Optional: | Calculated:

Partner Name:

Reporting Year:

Corporate Inventory - Total (U.S. + Non-U.S.)	Base Year	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Year	--	--	--	--	--	--	--	--	--	--	--
EMISSIONS - Annual CO_2-eq. (metric tons)											
Direct Emissions											
Stationary Combustion Sources	--	--	--	--	--	--	--	--	--	--	--
Mobile Combustion Sources	--	--	--	--	--	--	--	--	--	--	--
Refrigeration / AC Equip. Use	--	--	--	--	--	--	--	--	--	--	--
Process / Fugitive (specify source):											
	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--
Total Direct Emissions	0	0	0	0	0	0	0	0	0	0	0
Indirect Emissions											
Purchased and Used Electricity	--	--	--	--	--	--	--	--	--	--	--
Purchased and Used Steam	--	--	--	--	--	--	--	--	--	--	--
Purchased and Used Hot Water	--	--	--	--	--	--	--	--	--	--	--
Purchased and Used Chilled Water	--	--	--	--	--	--	--	--	--	--	--
Total Indirect Emissions	0	0	0	0	0	0	0	0	0	0	0
Optional Emissions (specify source):											
	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--
Total Optional Emissions	0	0	0	0	0	0	0	0	0	0	0
Direct + Indirect + Optional Emissions											
Total Emissions	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

REQUIRED SUPPLEMENTAL INFORMATION											
Biomass CO_2 Emissions - (metric tons/yr.)											
Total Stationary - Biomass CO_2	--	--	--	--	--	--	--	--	--	--	--
Total Mobile - Biomass CO_2	--	--	--	--	--	--	--	--	--	--	--

OPTIONAL CFC/HCFC SUPPLEMENTAL INFORMATION - (metric tons/yr.)	

OPTIONAL ELECTRICITY/STEAM SALES INFORMATION (Non-Utilities with Normalized Targets)	

CLIMATE LEADERS
U.S. Environmental Protection Agency

ANNUAL GHG INVENTORY SUMMARY AND GOAL TRACKING FORM

Required: | Optional: | Calculated:

Partner Name:
Reporting Year:

External Offset Projects	Base Year	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Year	--	--	--	--	--	--	--	--	--	--	--
REDUCTIONS FROM OFFSETS - Annual CO_2-eq. (metric tons)											

Partner Base Year:	--
Partner Goal Year:	
Goal Emissions Tracking "Absolute" or "Normalized":	
Goal Year Emissions Target: (expressed as a percent decrease from base year)	
Specify Normalization Factor (NF) Units: (only if tracking normalized emissions for goal)	

Corporate Goal Tracking	Base Year	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Year	--	--	--	--	--	--	--	--	--	--	--

Date Form Completed:	
Number of times base year has been adjusted since the first inventory submittal:	
Identify and describe changes made to the baseline data since the previous year's inventory (e.g. acquisitions, divestitures):	
Identify any changes in methodologies or sources that are different than the previous year's inventory:	
Describe any major differences from the previous year's inventory:	

Glossary of Terms

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.

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

Associated/affiliated company. The parent company has significant influence over the operating and financial policies of the associated/affiliated company, but not financial control.

Audit Trail. Well organized and transparent historical records documented how an inventory was completed.

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) against which a company's emissions are tracked over time.

Base year emissions. GHG emissions in the base year.

Base year emissions recalculation. Recalculation of emissions in the base year to reflect a change in the structure of the company, 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.

Boundaries. GHG accounting and reporting boundaries can have several dimensions, i.e., organizational, operational, geographic, business unit, and target boundaries. The inventory boundary determines which emissions are accounted and reported by the company.

Cap and trade system. A system that sets an overall emissions limit, allocates emissions allowances to participants, and allows them to trade emissions 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.

Co-generation unit/combined heat and power (CHP). A facility producing both electricity and steam/heat using the same fuel supply.

Consolidation. Combination of GHG emissions data from separate operations that form part of one company or group of companies.

Control. The ability of a company to direct the operating policies of another operation. More specifically, it is defined as either operational control (the organization or one of its subsidiaries has the full authority to introduce and implement its operating policies at the operation) or financial control (the organization has the ability to direct the financial and operating policies of the operation with a view to gaining economic benefits from its activities).

Corporate inventory program. A program to produce annual corporate inventories that are 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 (CO_2-eq). The universal unit of measurement to indicate the global warming potential (GWP) of each of the six greenhouse gases, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate releasing (or avoiding releasing) different greenhouse gases against a common basis.

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

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

Direct monitoring. Direct monitoring of exhaust stream contents in the form of continuous emissions monitoring (CEM) or periodic sampling.

Double counting Two or more reporting companies take ownership of the same emissions or reductions.

Emissions. The release of GHGs into the atmosphere.

Emission factor. A factor allowing GHG emissions to be estimated from a unit of available activity data (e.g., tons of fuel consumed, tons of product produced) and absolute GHG emissions.

Equity share. The equity share reflects economic interest, which is the extent of rights a company 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 company's percentage ownership of that operation, and equity share will normally be the same as the ownership percentage.

Emission Uncertainty. Uncertainty that arises whenever GHG emissions are quantified, due to uncertainty in data inputs and calculation methodologies used to quantify GHG emissions.

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.

Fixed asset investment. Equipment, land, stocks, property, incorporated and non-incorporated joint ventures, and partnerships over which the parent company has neither significant influence or control.

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 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). For the purposes of this standard, GHGs are the following six gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydroflurocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

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

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

GHG offset. Offsets are discrete GHG reductions used to compensate for (i.e., offset) GHG emissions elsewhere, for example to meet a voluntary 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, subnational, 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. 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 Initiative. A multi-stakeholder collaboration convened by the World Resources Institute and the World Business Council for Sustainable Development to design, develop, and promote the use of accounting and reporting standards for business. It comprises two separate but linked standards – the GHG Protocol Corporate Accounting and Reporting Standard and the GHG Protocol Project Quantification Standard.

GHG Protocol Project Quantification Standard. An additional 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 removal. Absorbtion or sequestration of GHGs from the atmosphere.

GHG sink. Any physical unit or process that stores GHGs; usually refers to forests and underground/deep sea reservoirs of CO_2.

GHG source. 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.

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.

Group company/subsidiary. The parent company has the ability to direct the financial and operating policies of the group company/subsidiary with a view to gaining economic benefits from its activities.

Heating value. The amount of energy released when a fuel is burned completely. Care must be taken not to confuse higher heating values (HHVs), used in the U.S. and Canada, and lower heating values, used in all other countries (for further details refer to the calculation tool for stationary combustion available at www.ghgprotocol.org).

Indirect emissions. Emissions that are a consequence of the operations of the reporting company, but occur from sources owned or controlled by another company, e.g., as a consequence of the import of electricity, heat, or steam.

Insourcing. The administration of ancillary business activities, formally performed outside of the company, using resources within a company.

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

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

Intergovernmental Panel on Climate Change (IPCC). 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 list of an organization's GHG emissions and sources.

Inventory boundary. An imaginary line that encompasses the direct and indirect emissions 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.

Leakage (Secondary effect). Leakage occurs when a project changes the availability or quantity of a product or service that results in changes in 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 phase and waste disposal.

Material discrepancy. An error (for example from an oversight, omission, or miscalculation) that results in the reported quantity being significantly different to 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 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.

Operation. A generic term used to denote any kind of business, irrespective or 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 balance sheet of the lessee. Leases other than Operating leases are Capital/Financial/Finance leases. Consult an accountant for further detail as definitions of lease types differ between various accepted financial standards.

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

Optional emissions. *Emissions that are a consequence of the activities of the reporting company, but are not part of the reporting companies core direct or indirect emissions as defined by Climate Leaders (e.g., employee commuting).*

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 company, depending on the consolidation approach taken (equity or control approach).

Outsourcing. The contracting out of activities to other businesses.

Parameter uncertainty. GHG quantification uncertainty associated with quantifying the parameters used as inputs to estimation models.

Primary effects. The specific GHG reducing elements or activities (reducing GHG emissions, carbon storage, or enhancing GHG removals) that the project is intended to achieve.

Process emissions. Emissions generated from manufacturing processes, such as cement or ammonia production.

Productivity/efficiency ratios. Ratios that express the value or achievement of a business divided by its GHG impact. Increasing efficiency ratios reflect a positive performance improvement, e.g., resource productivity (sales per ton of GHG).

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.

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 of work. An up-front specification that indicates the type of verification to be undertaken and the level of assurance to be provided between the reporting company 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. Carbon 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 criteria used to define a significance structural change. It is the responsibility of the company/verifier to determine the "significance threshold" for considering base year emissions recalculation. In most cases the "significance threshold" depends on the use of the information, the characteristics of the company, and the features of structural changes.

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 a company that result from a transfer of ownership or control of emissions from one company 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 the target base year levels specified by the target base year 2010.

Target boundary. The boundary that defines which GHGs, 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 and determines whether the target is relatively short- or long-term.

Target double counting policy. The 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 companies that engage in trading (sale or purchase) of offsets or whose corporate target boundaries interface with other companies' targets or external programs.

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 quality (e.g., the sample variance or coefficient of variation) (Chapter 9).
2. **Inventory Definition:** A general and imprecise term which refers to the lack of certainty in emissions-related data resulting from any casual 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 (UNFCCC) mitigate climate change.

Value chain emissions. Emissions from the upstream and downstream activities associated with the operations of a reporting company.

Verification. An independent assessment of the reliability (considering completeness and accuracy) of a GHG inventory.

Office of Air and Radiation (6202J)
EPA430-K-05-005
May 2005
www.epa.gov/climateleaders