Carbon Accounting
Corporate Accounting and Reporting Standards

Dr. Richard Venditti

Forest Biomaterials

North Carolina State University

Two major standard methods:

- International Organization for Standardization (ISO) ISO 14064
- World Resources Institute and World Business Council for Sustainable Development, Greenhouse Gas Protocol (more robust)

- If one standard is met, the other is also likely to be met

- *Life Cycle Assessment, Principles Practice and Prospects, Horne, Grant, Verghese, CSIRO Publishing 2009.*

Common elements to the two standards:

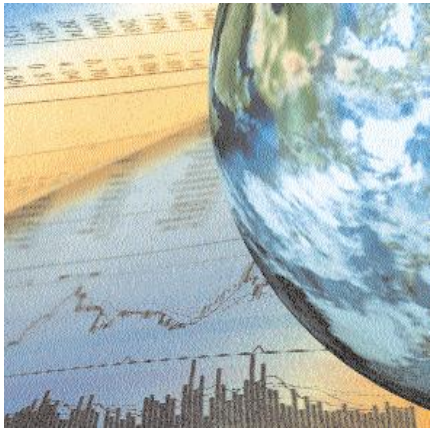
- Determining boundaries for GHG accounting
- Classifying emissions
- Identifying and calculating GHG emissions
- Providing rules for changing base year inventories
- Providing rules for tracking emissions over time
- Providing rules for assessing uncertainty
- Providing rules for reporting

- *Life Cycle Assessment, Principles Practice and Prospects, Horne, Grant, Verghese, CSIRO Publishing 2009.*

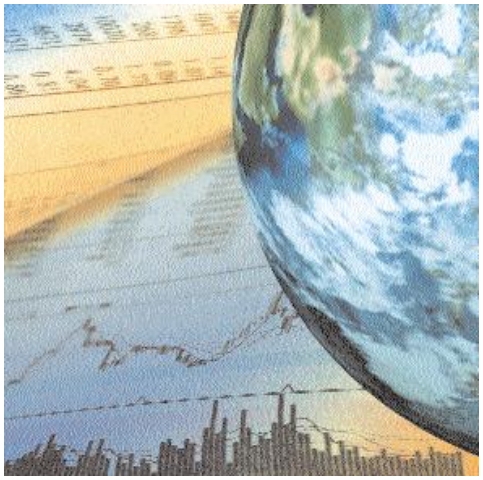
Greenhouse Gas Protocol Initiative

- A multi-stakeholder partnership of businesses, nongovernmental organisations (NGOs), governments, academics, and others, convened by:
- World Resources Institute
- World Business Council for Sustainable Development
- Two linked documents:
  - *GHG Protocol Corporate Accounting and Reporting Standard: evaluation of an organization*
  - *GHG Protocol Project Quantification Standard: evaluation of a project*

- *WWW.ghgprotocol.org*



GHG Protocol Corporate Accounting and Reporting Standard



- *WWW.ghgprotocol.org*

Global trends point to having a GHG inventory

- Global warming and climate change coming to fore as sustainability issues
- Governments are making national policies including: emissions trading programs, voluntary programs, carbon or energy taxes, regulations, standards on energy eefficiency and emissions'
- Companies must understand their position in GHG's to ensure long term success

Business goals served by a GHG inventory :

- Managing GHG risks and identifying reduction opportunities
- Public reporting and participation in voluntary GHG programs
- Participating in mandatory reporting programs
  - Facilities in Europe under the Integrated Pollution Prevention and Control (IPPC) Directive must report emissions
- Participating in GHG markets
  - The Chicago Climate Exchange, CCX, is a voluntary reduction marketplace consisting of corporations, state and local governments and various institutions.
- Recognition for early voluntary action.

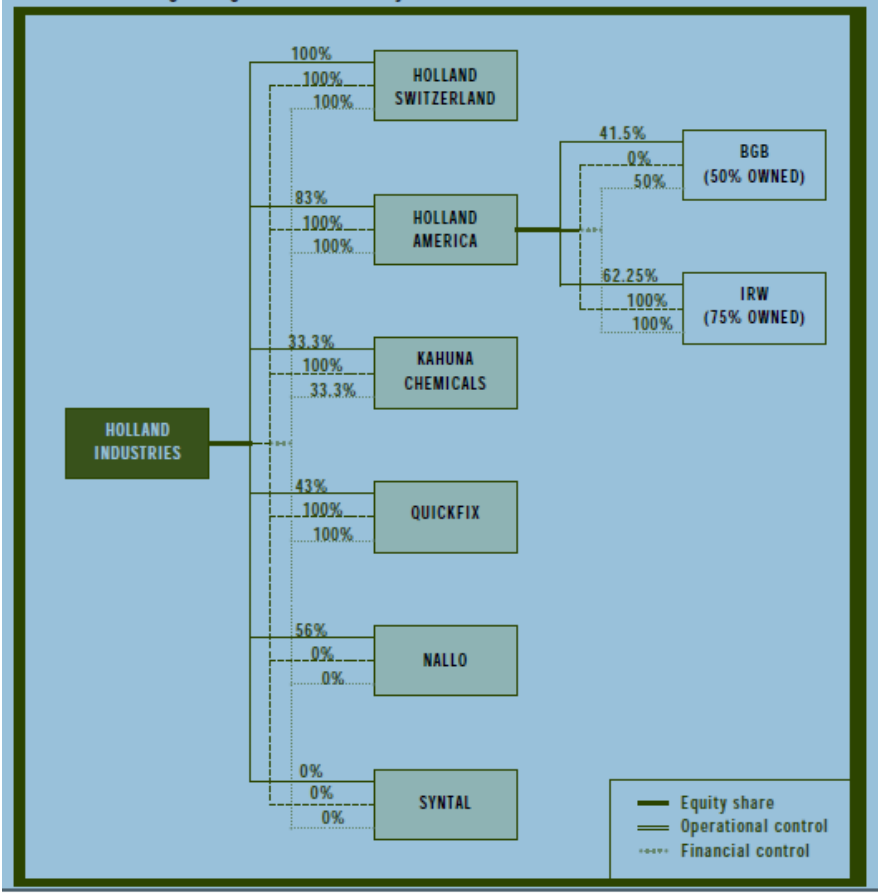
GHG accounting and reporting principles:

- Relevance
- Completeness
- Consistency
- Transparency
- Accuracy

Setting *Organizational* boundaries:

- **Equity share approach**
- Under the equity share approach, a company accounts for GHG emissions from operations according to its share of equity in the operation.
- **Control approach**
- Under the control approach, a company accounts for100 percent of the GHG emissions from operations overwhich it has control. It does not account for GHG emissionsfrom operations in which it owns an interest but has no control.
  - Can either be financial control or operational control
- Potential for double counting if 2+ companies hold mutual interests but use different approaches

FIGURE 1. Defining the organizational boundary of Holland Industries



AN ILLUSTRATION.

TABLE 2. Holland Industries - organizational structure and GHG emissions accounting

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 (SEE TABLE 1)	EMISSIONS ACCOUNTED FOR AND REPORTED BY HOLLAND INDUSTRIES	
					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 other partner Rearden	50% 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 America	75% by Holland America	Holland America	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 33.3% for financial control
QuickFix	Incorporated joint venture, other partner Majox	43%	Holland Industries	Subsidiary (Holland Industries has financial control since it treats Quick Fix as a subsidiary in its financial accounts)	43%	100% for operational control
Nallo	Incorporated joint venture, other partner Nagua Co.	56%	Nallo	Associated company (Holland Industries does not have financial control since 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

Business goals served by a GH...

Setting *Operational* boundaries:

- Direct GHG emissions are emissions from sources that are owned or controlled by the company.
- Indirect GHG emissions are emissions that are a consequence of the activities of the company but occur at sources owned or controlled by another company.

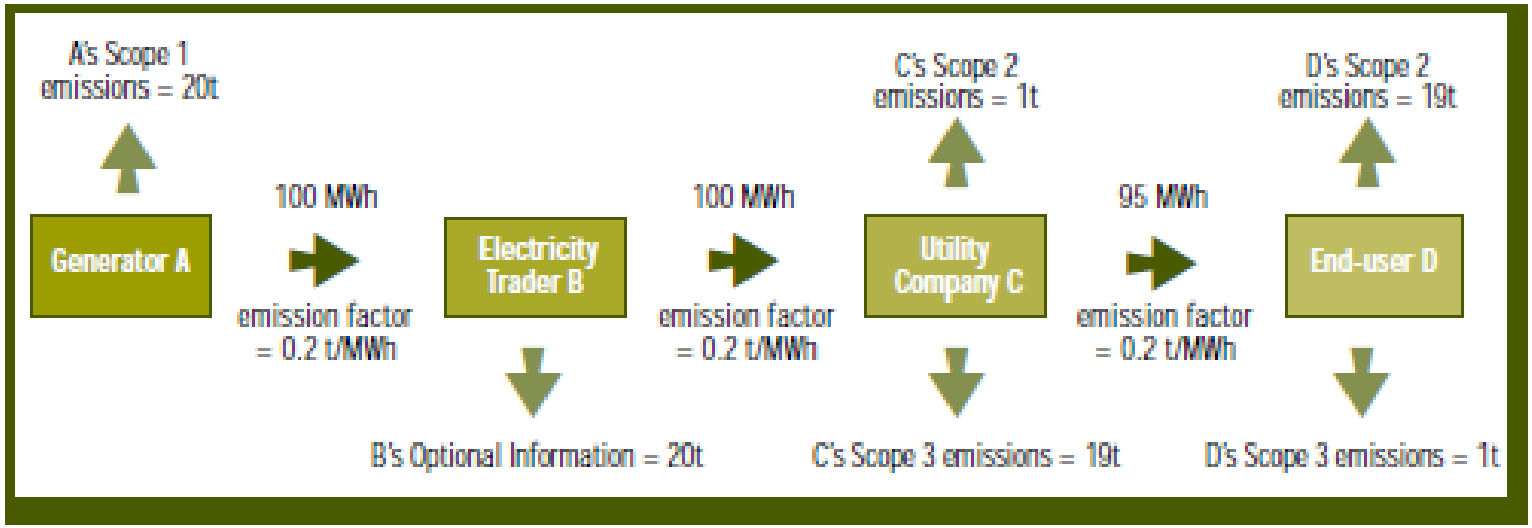
Scope 1: Direct GHG emissions:

- Occur from sources that are owned or controlled by the company, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment.
- Direct CO**2** emissions from the combustion of biomass shall not be included in scope 1 but reported separately (see chapter 9).
- GHG emissions not covered by the Kyoto Protocol, e.g.CFCs, NOx, etc. shall not be included in scope 1 but maybe reported separately (see chapter 9).

Scope 2: Electricity indirect emissions:

- GHG emissions from the generation of purchased electricity consumed in its owned or controlled equipment or operations by the company.
- Transmission and distribution losses are considered emissions of the company that controls the T&D operation.
- Structure to eliminate double counting in scopes 1 and 2

FIGURE 4. GHG accounting from the sale and purchase of electricity



Scope 3: Other indirect GHG emissions

- A consequence of the activities of the company, but occur from sources not owned or controlled by the company.
- Some examples of scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.
- Leased assets, outsourcing, franchises may be accounted in Scope 3
- Need not have an extensive GHG LCA of everything.
  - Describe the value chain
  - Define which scope 3 emissions are relevant: large, risk exposure, critical by stakeholders, potential reductions
- Example where critical: the company's product uses fossil fuel or electricity in use. The company can influence company design to reduce GHG emissions. (Levi's jeans)

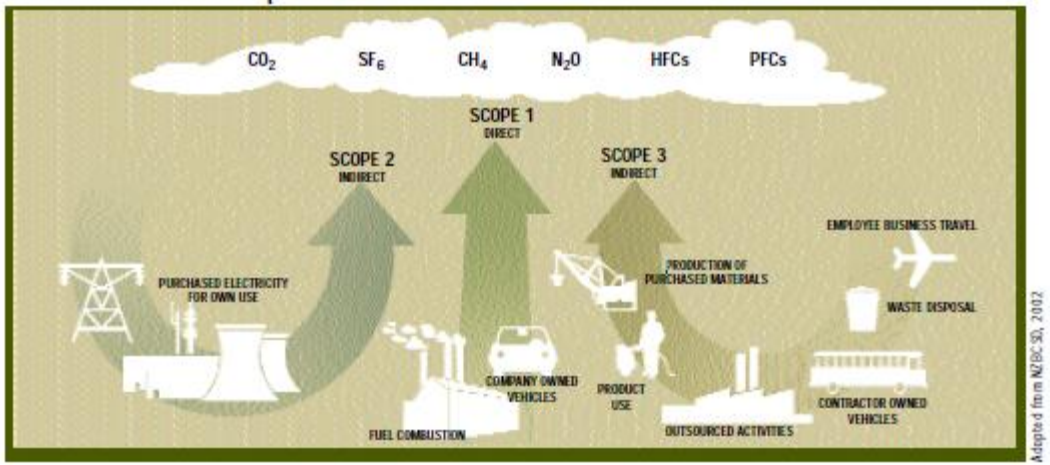
DHL Nordic Express: case for accounting for outsourced services (Scope 3)

- A major transportation and logistics company
- Large and special load transport, courier, express, specialty business services.
- 98% of emissions are form transport of goods by partner transportation firms.
- Scope 1: 7265 tCO2
- Scope 2: 52
- Scope 3: 327,634
- Total: 334,951

Setting Organizational and operational boundaries

- Organization X is a parent company that has full ownership and financial control of operations A and B, but only a 30% non operated interest and no financial control in operation C.
- Choose either equity share or financial control
  - Equity control: 100% of A and B, 30% of C
  - Financial control: 100% of A and B, 0% of C
- Decide whether to account for only scopes 1 and 2 or to include scope 3

FIGURE 3. Overview of scopes and emissions across a value chain



Adapted from NZBCSD, 2002

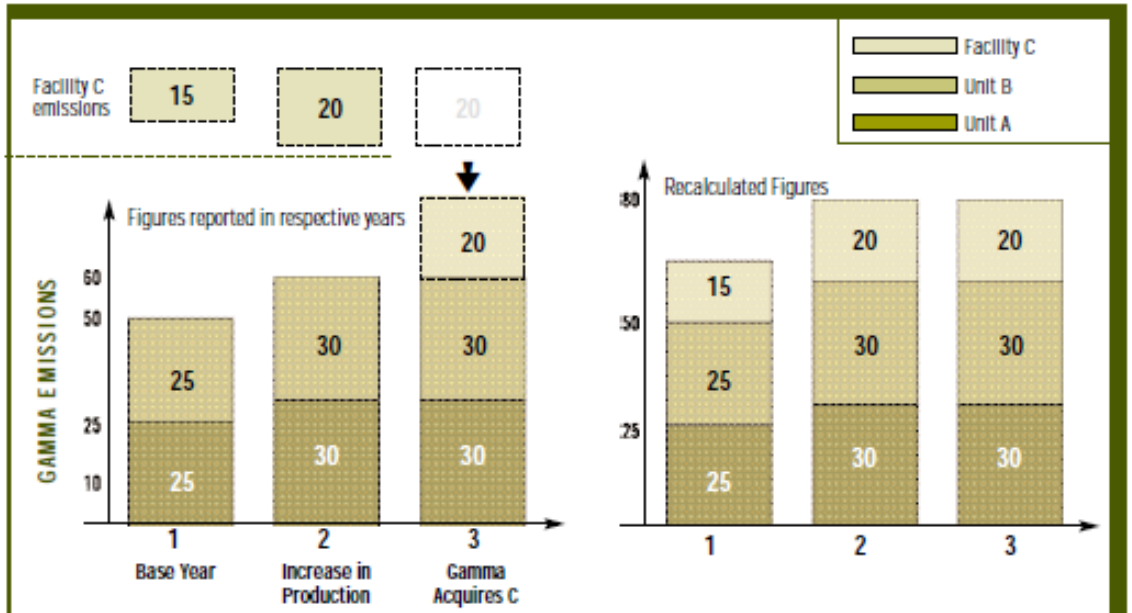
Example scopes for difft industries:

SECTOR	SCOPE 1 EMISSION SOURCES	SCOPE 2 EMISSION SOURCES	SCOPE 3 EMISSION SOURCES
MINERALS			
Cement and Lime[6]	• 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[7]			
Landfills, Waste combustion, Water services	• Stationary combustion (incinerators, boilers, flaring) • Process emissions (sewage treatment, nitrogen loading) • Fugitive emissions (CH_4 and CO_2 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 & PAPER			
Pulp and Paper[8]	• Stationary combustion (production of steam and electricity, fossil fuel-derived emissions from calcination of calcium carbonate in lime kilns, drying products with infrared driers 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)

Tracking Emissions Over Time

- Companies may be restructured over time
- Meaningful comparison over this time requires a recalculation of historic emission data
- Choose a base year emissions
- No recalculation for organic growth or decline. Organic growth is change in production output, product mix, closures/openings within the owned/controlled company.

FIGURE 6. Base year emissions recalculation for an acquisition

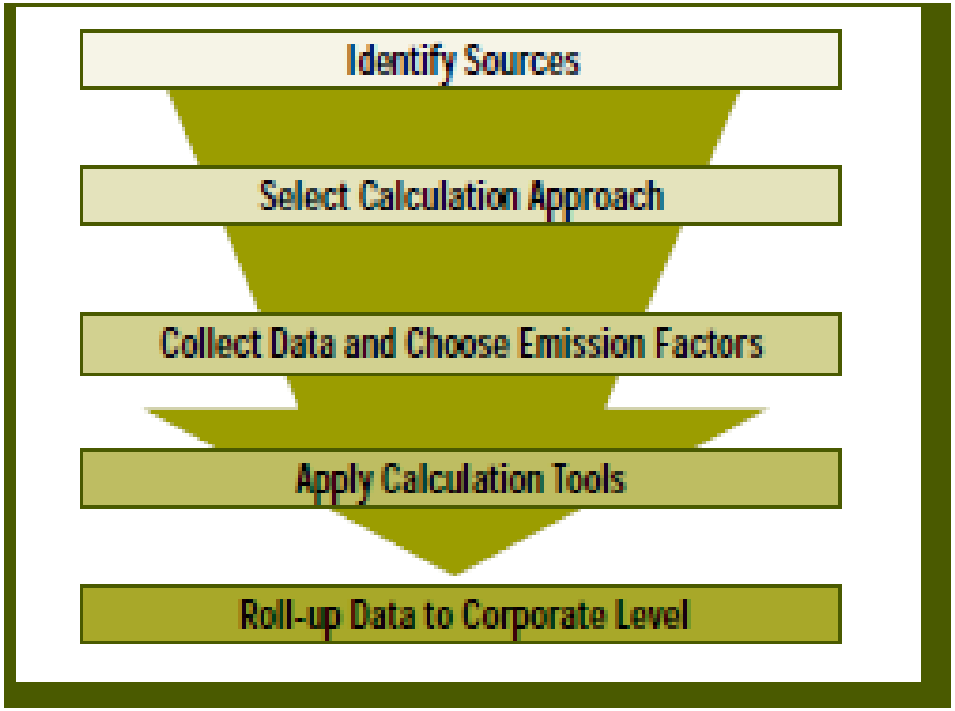


Company Gamma consists of two business units (A and B). In its base year (year one), each business unit emits 25 tonnes CO_2. In year two, the company undergoes "organic growth," leading to an increase in emissions to 30 tonnes CO_2 per business unit, i.e., 60 tonnes CO_2 in total. The base year emissions are not recalculated in this case. At the beginning of year three, the company acquires production facility C from another company. The annual emissions of facility C in year one were 15 tonnes CO_2, and 20 tonnes CO_2 in years two and three. The total emission of company Gamma in year three, including facility C, are therefore 80 tonnes 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 tonnes CO_2—the quantity of emissions produced by facility C in Gamma's base year. The recalculated base year emissions are 65 tonnes CO_2. Gamma also (optionally) reports 80 tonnes CO_2 as the recalculated emissions for year two.

Calculating GHG Emissions

FIGURE 9.

Steps in identifying and calculating GHG emissions



Identifying GHG Emissions

- Stationary combustion: combustion of fuels in boiler as an example
- Mobile combustion: fuels combusted in transportation devices
- Process emissions: emissions from physical or chemical processes, CO2 from calcining in cement mfg as an example
- Fugitive emissions: intentional and unintentionalreleases such as equipment leaks from joints, seals,packing, gaskets, as well as fugitive emissions fromcoal piles, wastewater treatment, pits, cooling towers,gas processing facilities, etc.

Identifying GHG Emissions

- Identify scope 1 emissions
- Identify scope 2 emissions
- Identify scope 3 emissions (optional): identify emissions from upstream and downstream and outsourced mfg, leases, franchises not in scopes 1 or 2

Calculating GHG Emissions

- Direct measurements unlikely
- More likely
  - Identify mass flows and stoichiometric relationships in processes
  - Use documented emissions factors to determine the emissions for a particular flow
  - Scope 1 based on flows of fuels purchased, and flows with known emissions due to stoichiometric considerations
  - Scope 2 based on meted electricity consumption and supplier specific emission factors
  - Scope 3 calculated from activity data such as fuel use or passenger miles or published third party emission factors
- Calculation tools available from ghgprotocol.com

Calculation tools from ghgprotocol.org

TABLE 3. **Overview of GHG calculation tools available on the GHG Protocol website**

	CALCULATION TOOLS	MAIN FEATURES
CROSS-SECTOR TOOLS	Stationary Combustion	• Calculates direct and indirect CO_2 emissions from fuel combustion in stationary equipment • Provides two options for allocating GHG emissions from a co-generation facility • Provides default fuel and national average electricity emission factors
	Mobile Combustion	• Calculates direct and indirect CO_2 emissions from fuel combustion in mobile sources • Provides calculations and emission factors for road, air, water, and rail transport
	HFC from Air Conditioning and Refrigeration Use	• Calculates direct HFC emissions during manufacture, use and disposal of refrigeration and air-conditioning equipment in commercial applications • Provides three calculation methodologies: a sales-based approach, a life cycle stage based approach, and an emission factor based approach
	Measurement and Estimation Uncertainty for GHG Emissions	• Introduces the fundamentals of uncertainty analysis and quantification • Calculates statistical parameter uncertainties due to random errors related to calculation of GHG emissions • Automates the aggregation steps involved in developing a basic uncertainty assessment for GHG inventory data
SECTOR-SPECIFIC TOOLS	Aluminum and other non-Ferrous Metals Production	• Calculates direct GHG emissions from aluminum production (CO_2 from anode oxidation, PFC emissions from the "anode effect," and SF_6 used in non-ferrous metals production as a cover gas)
	Iron and Steel	• Calculates direct GHG emissions (CO_2) from oxidation of the reducing agent, from the calcination of the flux used in steel production, and from the removal of carbon from the iron ore and scrap steel used
	Nitric Acid Manufacture	• Calculates direct GHG emissions (N_2O) from the production of nitric acid
	Ammonia Manufacture	• Calculates direct GHG emissions (CO_2) from ammonia production. This is for the removal of carbon from the feedstock stream only; combustion emissions are calculated with the stationary combustion module
	Adipic Acid Manufacture	• Calculates direct GHG emissions (N_2O) from adipic acid production
	Cement	• Calculates direct CO_2 emissions from the calcination process in cement manufacturing (WBCSD tool also calculates combustion emissions) • Provides two calculation methodologies: the cement-based approach and the clinker-based approach
	Lime	• Calculates direct GHG emissions from lime manufacturing (CO_2 from the calcination process)
	HFC-23 from HCFC-22 Production	• Calculates direct HFC-23 emissions from production of HCFC-22
	Pulp and Paper	• Calculates direct CO_2, CH_4, and N_2O emissions from production of pulp and paper. This includes calculation of direct and indirect CO_2 emissions from combustion of fossil fuels, bio fuels, and

Rolling up GHG emissions data to corporate level

- Centralized: individual facilitiies report activity/fuel use data to the corporate level where GHG emissions are calculated
  - Office based organizations where calculations are standard across a number of facilities
- Decentralized: individual facilities collect activity/fuel use data , directly calculate GHG emissions and report to the corporate level
  - If detailed process knowledge is required
  - GHG emissions calculation methods vary across facilities
  - Resources and tools are available at the facilities
  - Local regulations require this at the facilities

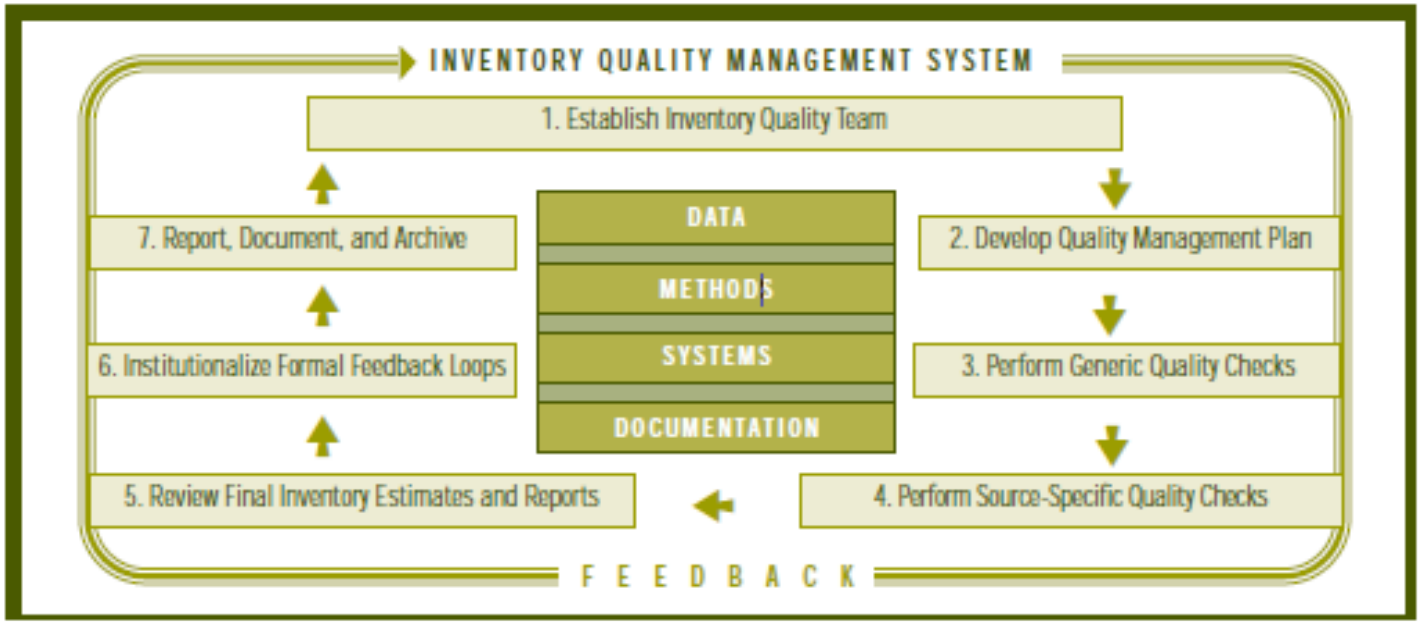
Reporting guidance for GHG emissions

- Description of emission sources
- List and justification of exclusions and inclusions
- Comparative info from previous years
- Reporting period covered
- Trends in the data
- Progress towards business targets
- Discussion of uncertainties
- Description of events that impact reported data (closures, calc methods, boundary changes)

Managing Inventory Quality

- Developing a credible and unbiased GHG emissions report requires some effort in managing quality
- Provides a system to prevent and correct errors

FIGURE 11: **Inventory quality management system**



Accounting for GHG Reductions

- *GHG Protocol Project Quantification Standard* focuses on the quantification of GHG reductions from GHG mitigation projects that will be used as offsets.
- *Offsets* are discrete GHG reductions used to compensate for (i.e.,offset) GHG emissions elsewhere, for example to meet a voluntary or mandatory GHG target or cap.
- Offsets are calculated relative to a baseline that represents a hypothetical scenario for what emissions would have been in the absence of the project.

Accounting for GHG Reductions

- Baseline selection, what would happen if the project did not occur
- Demonstration of additionality,
  - must demonstrate reductions AND
  - show that the project itself is not the baseline, that if the project went away their would be higher global emissions (ie., non-additional)
- ID and quantify relevant secondary (unintended effects) of project
- Consideration of reversibility, that reductions are temporary
- Avoidance of double counting, defining scope

Example: Accounting for GHG Reductions

- Alcoa (aluminum mfg) wants to implement strategies to lower its GHG emissions
- Purchases renewable energy certificates (RECs) which represent the enviromental benefits from electricity generated from renewable rather than fossil fuel sources
- In 2003 purchased RECs equivalent to 100% of electricity use in 4 corporate offices in TN, PA, NY
- Electricity from land fill gas avoiding 6.3 million kg of CO2 annually

Reporting GHG Emissions

- Reported information shall be “relevant, complete,consistent, transparent and accurate.” The following is required:
- Methods and boundaries
- The *GHG Protocol Corporate Standard* requires reporting a minimum of total scope 1 and scope 2 emissions, independent of GHG trades.
- Emissions data separately for each scope.
- Emissions data for all six GHGs separately (CO_2, CH_4,N_2O, HFCs, PFCs, SF_6) in metric tonnes and in tonnesof CO_2 equivalent.
- Base case year results and explanations of recalculations
- Emissions data for direct CO_2 emissions from biologicallysequestered carbon (e.g., CO_2 from burningbiomass/biofuels), reported separately from the scopes.
- Methods used for calculations including tools
- Specific exclusions of sources, facilities or operations

Reporting GHG Reductions

- Required Company and Inventory Boundary
  - Organizational boundary and consolidation approach
  - Outline of oprerational boundary and if Scope 3 is included with list of activiities covered
  - Reporting period
  - Total scope Baseline selection, what would happen if the project did not occur
- Required Info on Emissions
- Total scope 1 and 2 emissions independent of anyGHG trades such as sales, purchases, transfers, or
- banking of allowances.
- • Emissions data separately for each scope.
- • Emissions data for all six GHGs separately (CO**2**, CH**4**,
- N**2**O, HFCs, PFCs, SF**6**) in metric tonnes and in tonnes
- of CO**2** equivalent.
- • Year chosen as base year, and an emissions profile over
- time
- • Appropriate context for any significant emissions
- changes that trigger base year emissions recalculation
- • Emissions data for direct CO**2** emissions from biologically
- sequestered carbon (e.g., CO**2** from burning
- biomass/biofuels), reported separately from the scopes.
- • Methodologies used to calculate or measure emissions,
- providing a reference or link to any calculation tools used.
- • Any specific exclusions of sources, facilities,
- and / or operations.

Reporting GHG Emissions

- Optional items
  - Scope 3 emissions
  - Further divided data (eg. By facility)
  - Emissions from self generated electricity, heat or steam sold externally
  - Performance against benchmarks
  - Emissions from GHGs not covered by the KyotoProtocol (e.g., CFCs, NO**x**,), reported separately from scopes.
  - Others
  - Information on offsets that have been purchased ordeveloped outside the inventory boundary, and if certified
  - Information on reductions at sources inside the inventoryboundary that have been sold/transferred asoffsets to a third party and if certified
  - Reporting on ratio indicators

Verification of GHG Emissions

- Information is considered to be material if, by its inclusion or exclusion,it can be seen to influence any decisions or actions
- taken by users of it.
- A material discrepancy is an error(for example, from an oversight, omission or miscalculation)that results in a reported quantity or statementbeing significantly different to the true value or meaning.
- An error is considered materially misleading if tis value exceeds 5% of the total inventory for the part of the organization being verified.

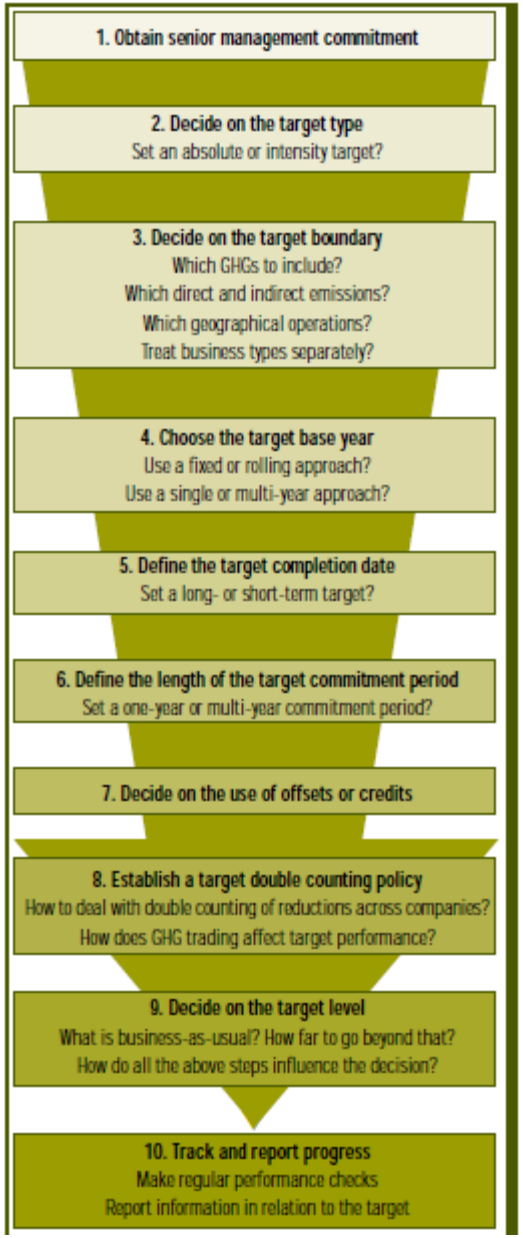
- Independent verifiers are useful (PricewaterhouseCoopers) evaluate both
  - Whether GHG accounting and reporting has been correctly implemented
  - Identification of any material discrepancies.

Setting a GHG Target

- Minimizing and managing GHG risks
- Achieving cost savings
- Stimulation innovation
- Preparing for future regulations
- Demonstrating leadership and corporate responsibility
- Participating in voluntary programs

Setting a GHG Target

FIGURE 12. Steps in setting a GHG target



BOX 5. Selected corporate GHG targets

ABSOLUTE TARGETS

- **ABB** Reduce GHGs by 1 percent each year from 1998 through 2005
- **Alcoa** Reduce GHGs by 25 percent from 1990 levels by 2010, and 50 percent from 1990 levels over same period, if inert anode technology succeeds
- **BP** Hold net GHGs stable at 1990 levels through 2012
- **Dupont** Reduce GHGs by 65 percent from 1990 levels by 2010
- **Entergy** Stabilize CO_2 from U.S. generating facilities at 2000 levels through 2005
- **Ford** Reduce CO_2 by 4 percent over 2003-2006 timeframe based upon average 1998-2001 baseline as part of Chicago Climate Exchange
- **Intel** Reduce PFCs by 10 percent from 1995 levels by 2010
- **Johnson & Johnson** Reduce GHGs by 7 percent from 1990 levels by 2010, with interim goal of 4 percent below 1990 levels by 2005
- **Polaroid** Reduce CO_2 emissions 20 percent below its 1994 emissions by year-end 2005; 25 percent by 2010
- **Royal Dutch/Shell** Manage GHG emissions so that they are still 5 percent or more below the 1990 baseline by 2010, even while growing the business
- **Transalta** Reduce GHGs to 1990 levels by 2000. Achieve zero net GHGs from Canadian operations by 2024

INTENSITY TARGETS

- **Holcim Ltd.** Reduce by the year 2010 the Group average specific[3] net CO_2 emissions by 20 percent from the reference year 1990
- **Kansai Electric Power Company** Reduce CO_2 emissions per kWh sold in fiscal 2010 to approx. 0.34 kg-CO_2/kWh
- **Miller Brewing Company** Reduce GHGs by 18 percent per barrel of production from 2001 to 2006
- **National Renewable Energy Laboratory** Reduce GHGs by 10 percent per square foot from 2000 to 2005

COMBINED ABSOLUTE & INTENSITY TARGETS

- **SC Johnson** GHG emissions intensity reduction of 23 percent by 2005, which represents an absolute or actual GHG reduction of 8 percent
- **Lafarge** Reduce absolute gross CO_2 emissions in Annex I countries 10 percent below 1990 levels by the year 2010. Reduce worldwide average specific net CO_2 emissions 20 percent below 1990 levels by the year 2010[3]

Questions?