

Enterprise Climate Change **Solutions** Awareness:

Introduction to
GHG Inventorying

May 2012

**Part 1 –
GHG Inventorying – Carbon ERP**

Part 1 – GHG Inventorying - GHGs -

Greenhouse Gases

GHG	Chemical formula	Global Warming Potential (100 yr)
Carbon dioxide	CO ₂	1
Methane	CH ₄	21
Nitrous Oxide	N ₂ O	310
Perfluorocarbons	CF ₄	5700
Perfluorocarbons	C ₂ F ₆	11900
HFC-152a	CH ₃ CHF ₂	120
HFC-134a	CH ₂ FCF ₃	1300
HFC-227ea	CF ₃ CHFCF ₃	3500
HFC-23	CHF ₃	12000
Sulfur hexafluoride	SF ₆	22200



Part 1 – GHG Inventorying

- Emissions Estimation (*Definitions*)-

Emission categories

Emission estimates are presented in accordance with the categories of the Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories (1996).

Sectors and Categories

Greenhouse gas emission and removal estimates are divided into main sectors, which are groupings of related processes, sources and sinks:

- Energy
- Industrial Processes and Product Use (IPPU)
- Agriculture, Forestry and Other Land Use (AFOLU)
- Waste
- Other (e.g., indirect emissions from nitrogen deposition from non-agriculture sources⁵)

Each sector comprises individual categories (e.g., transport) and sub-categories (e.g., cars). Ultimately, countries will construct an inventory from the sub-category level because this is how IPCC methodologies are set out, and total emissions calculated by summation. A national total is calculated by summing up emissions and removals

Part 1 – GHG Inventorizing

- Emissions Estimation (*Definitions*)-

Activity data

Activity data, according to the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, are defined as data on the magnitude of human activity resulting in emissions or removals taking place during a given period of time.

Emission factors

An emission factor is defined as the average emission rate of a given GHG for a given source, relative to units of activity.

Global Warming Potentials

The Global Warming Potentials ([GWP](#)) used for presentation of CH₄ and N₂O in terms of CO₂ equivalent are 21 and 310, respectively.

Implied emission factor

An implied emission factor is defined as emissions divided by the relevant measure of activity:

IEF = Emissions / Activity data

Part 1 – GHG Inventorying

- Emissions Estimation Methodology & Definitions-

Tiers: A *tier* represents a level of methodological complexity. Usually three tiers are provided. Tier 1 is the basic method, Tier 2 intermediate and Tier 3 most demanding in terms of complexity and data requirements. Tiers 2 and 3 are sometimes referred to as *higher tier* methods and are generally considered to be more accurate.

Default data: Tier 1 methods for all categories are designed to use readily available national or international statistics in combination with the provided default emission factors and additional parameters that are provided, and therefore should be feasible for all countries.

Key Categories: The concept of *key category*⁸ is used to identify the categories that have a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level of emissions and removals, the trend in emissions and removals, or uncertainty in emissions and removals. *Key Categories* should be the priority for countries during inventory resource allocation for data collection, compilation, quality assurance/quality control and reporting.

In Approach 1, *key categories* are identified using a pre-determined cumulative emissions threshold. *Key categories* are those that, when summed together in descending order of magnitude, add up to 95 percent of the total level⁴. The method is described in more detail in Section 4.3.1, Approach 1 to identify key categories.

Part 1 – GHG Inventories - Emission Sources -

Emission Source Categories

GHG	Main Sources
CO ₂	Fossil fuel combustion, (coal, petroleum oil products and natural gas) cement manufacturing (clinker production), industrial processes
CH ₄	Rice cultivation, enteric fermentation and manure from livestock, landfills and underground sewerage (waste), coal mining, oil & gas exploration & transport
N ₂ O	Use of synthetic fertilizers, biomass consumption, soil and other agriculture emissions, nitric acid production.
PFC	Aluminum production and semiconductor manufacturing
HFC	Domestic and commercial refrigeration including automobiles
SF ₆	Specialized industrial applications such as in transformers and circuit breakers



Part 1 – GHG Inventorizing - Emission Sources -

Emission Types from Some Activities

Type of firms/activities	Main emissions/ avoided emissions
Fossil based power generation, steel, cement, fertilizer Plants	CO ₂
Oil & Gas exploration	CO ₂ , CH ₄
Municipal solid waste	CH ₄
Paper manufacturing	CO ₂ , CH ₄
Energy efficiency improvement	CO ₂
Agribusiness - cattle feed digesters	CH ₄
Agribusiness - Nitrogen inhibitors	N ₂ O
Consulting/ financial institutions	CO ₂



Part 1 – GHG Inventorying

- Emission Sources -

Type of firms/activities	Main emissions / avoided emissions
Solar, wind, hydro, nuclear electricity	No direct emissions but CO ₂ avoided
Biogas	Carbon neutral, CH ₄ avoided
Biodiesel, ethanol	Carbon neutral, CO ₂ avoided
Biomass cogeneration	Carbon neutral, CO ₂ avoided
Coal bed methane as energy	CO ₂
Waste to energy	CO ₂ , CH ₄ avoided



Part 4 – GHG Inventoring - Principles -

Principles of GHG Accounting and Reporting

- Transparency: Factual & coherent documentation
- Accuracy: Neither under or over estimation
- Consistency: Across time series and operations
- Comparability: Across operations and outside enterprise boundaries
- Completeness: All emissions and removals accounted for

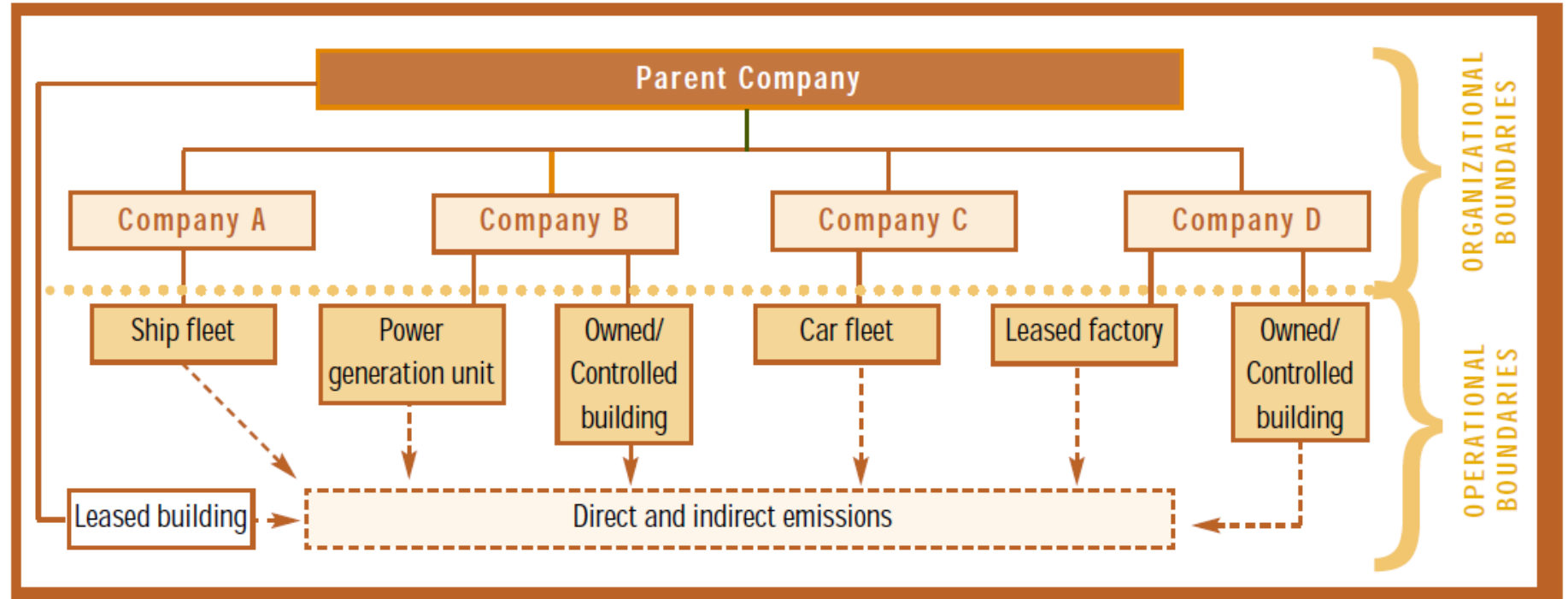


Corporate Reporting: Setting Boundaries

- **Organizational boundaries** specify which parts of an organization's emissions are included
- **Operational boundaries** characterize all the GHG emissions into direct and indirect emissions

Part 4 – GHG Inventories - Framework (Boundaries) -

FIGURE 2. Organizational and operational boundaries of a company



Setting Organizational Boundaries

- **Control:** The ability of a company to direct the policies of another operation.
 - Operational control
 - Financial control
- **Accounting approaches**
 - Equity share approach
 - Control approach (financial, operational)
- **Double counting**
 - Two or more reporting companies take ownership of the same emissions or reductions, e.g. joint ventures, sale of CER, EUA
 - Could apply to both direct and indirect emissions
- **Emissions on “as is where is basis”**

Part 4 – GHG Inventorizing - Operational Boundaries -

Direct & Indirect Emissions

- *Direct GHG emissions*: Physical emissions from sources that are owned or controlled by the company, e.g. from cars owned by IIMA.
- *Indirect GHG emissions*: Emissions that are a consequence of the activities of the company but occur at sources owned or controlled by another company, e.g. electricity used by IIMA.
- All emissions are reported as Direct emissions at national level. Normally sectoral reporting.



Operational Boundaries: Accounting Scopes

- **Scope 1**
 - Reporting organization's direct GHG emissions
 - Includes fossil fuel combustion, company owned vehicles
 - Biomass based emissions are not included, just reported separately as Memo items
- **Scope 2**
 - Indirect emissions from electricity/ heat/ steam used for own consumption
- **Scope 3**
 - Optional reporting category. Includes all other indirect emissions not covered under Scope 2
 - Emissions are consequent to organization's activities but occur from sources not controlled or owned by it.
 - Life cycle analysis of all products and services used by the organization may be included

Part 4 – GHG Inventorizing - Operational Boundaries -

Summary of the main types of emissions to be reported under each scope

Scope 1: Direct

Fuels Combustion
(e.g. boilers, furnaces or turbines)

Owned Transport
(e.g. trucks, trains, ships, airplanes, cars)

Process Emissions
(e.g. cement, aluminium, waste processing)

Fugitive Emissions
(e.g. air conditioning and refrigeration leaks, methane leaks from pipelines)

Scope 2: Energy Indirect

Consumption of purchased electricity, heat, steam and cooling

Scope 3: Other Indirect

Purchased materials and fuels
(e.g. extraction, processing and production)

Transport-related activities*
(e.g. commuting, business travel, distribution)

Waste disposal
(e.g. waste, recycling)

Leased assets, franchising and outsourcing

Sold Goods and Services (e.g. Use of goods and services)

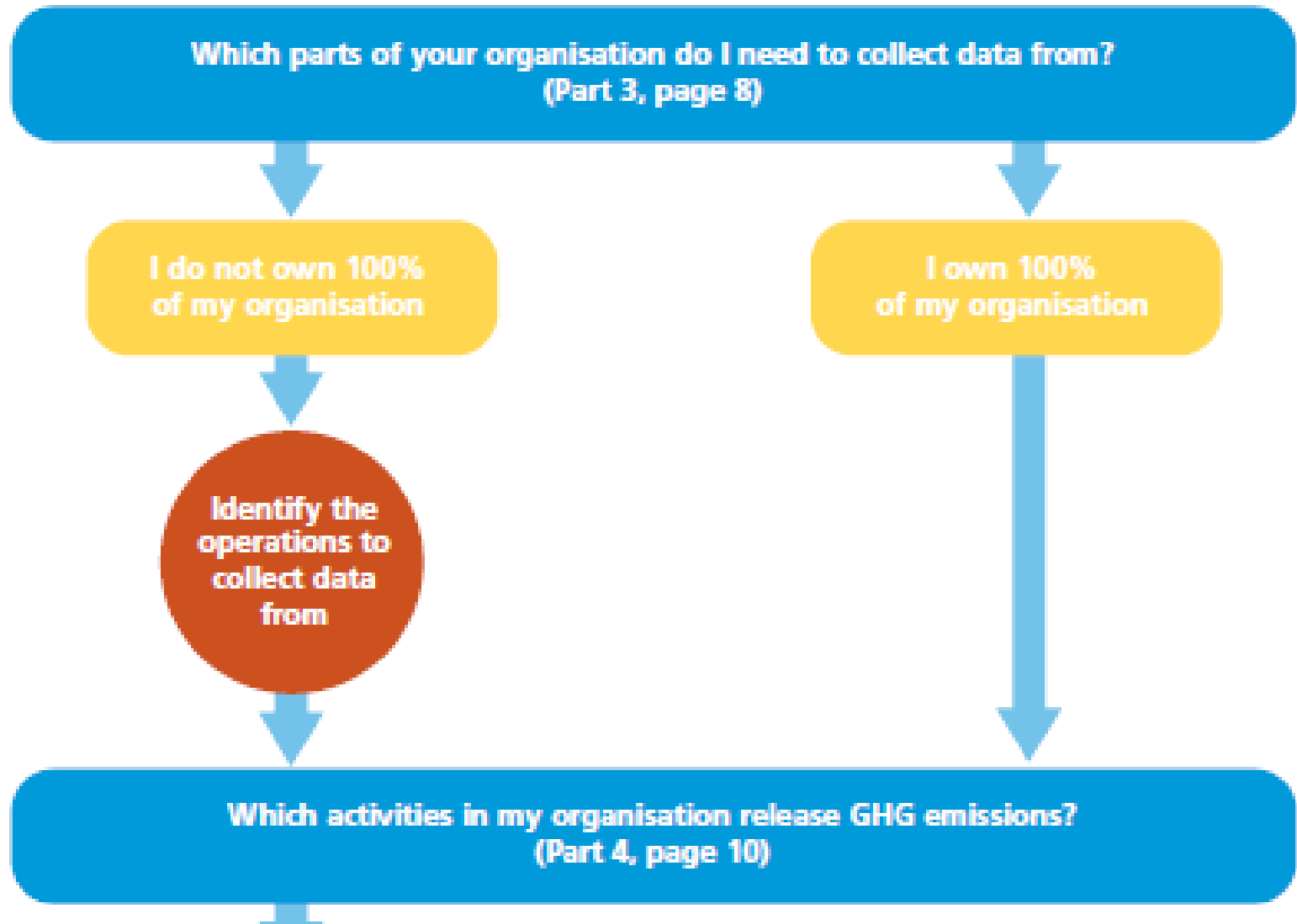
Accounting Scope 3 Emissions

Scope 3 emissions become relevant when;

- Relatively large w.r.t. company's scope 1 & 2 emissions (e.g. architects, courier companies)
- Contribute to company's GHG risk exposure (e.g. carbon intensive raw material)
- Deemed critical by stakeholders (e.g. location of IKEA stores)
- Potential mitigation possibilities exist (e.g. A.C. energy labeling)

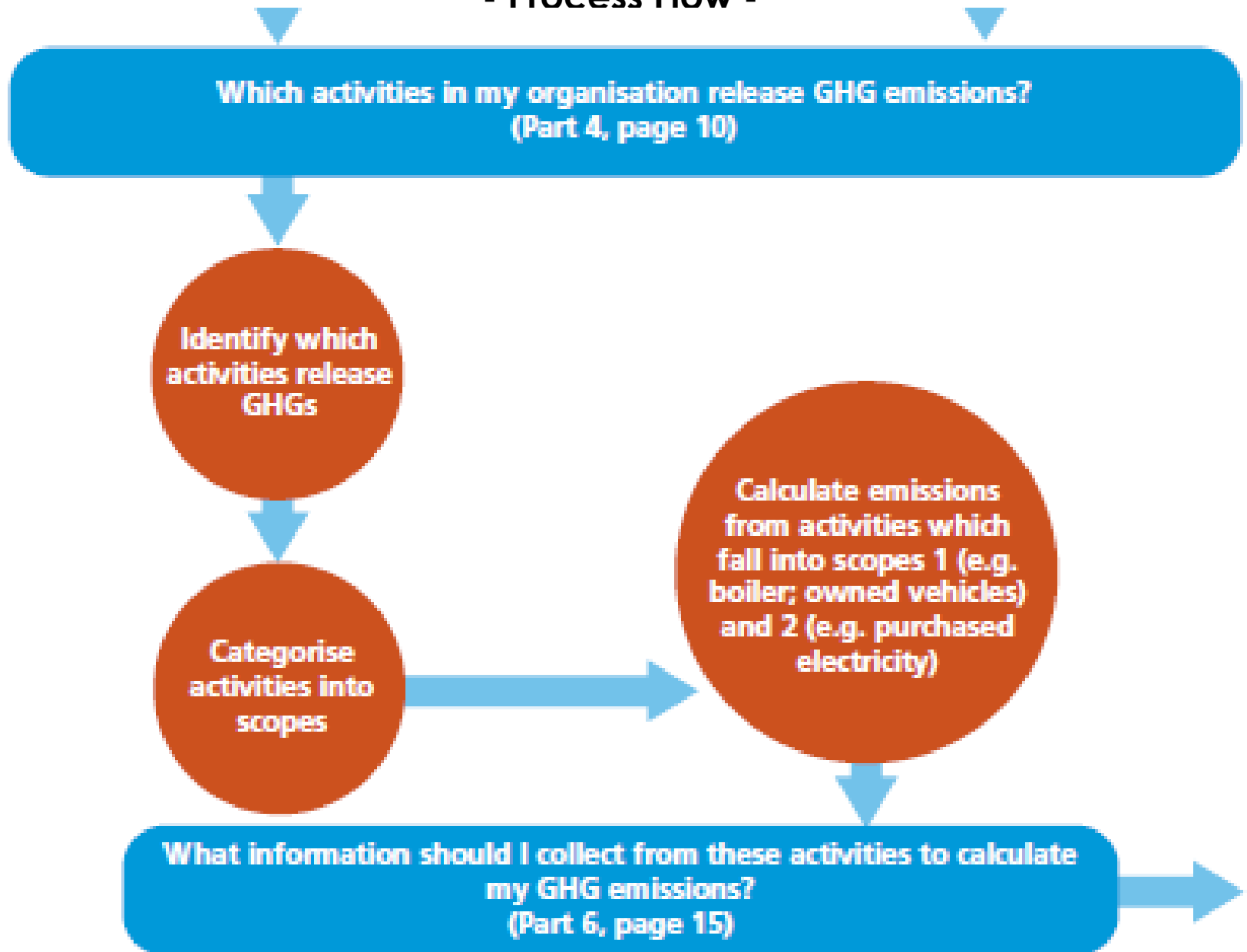


Part 4 – GHG Inventorizing - Process Flow -

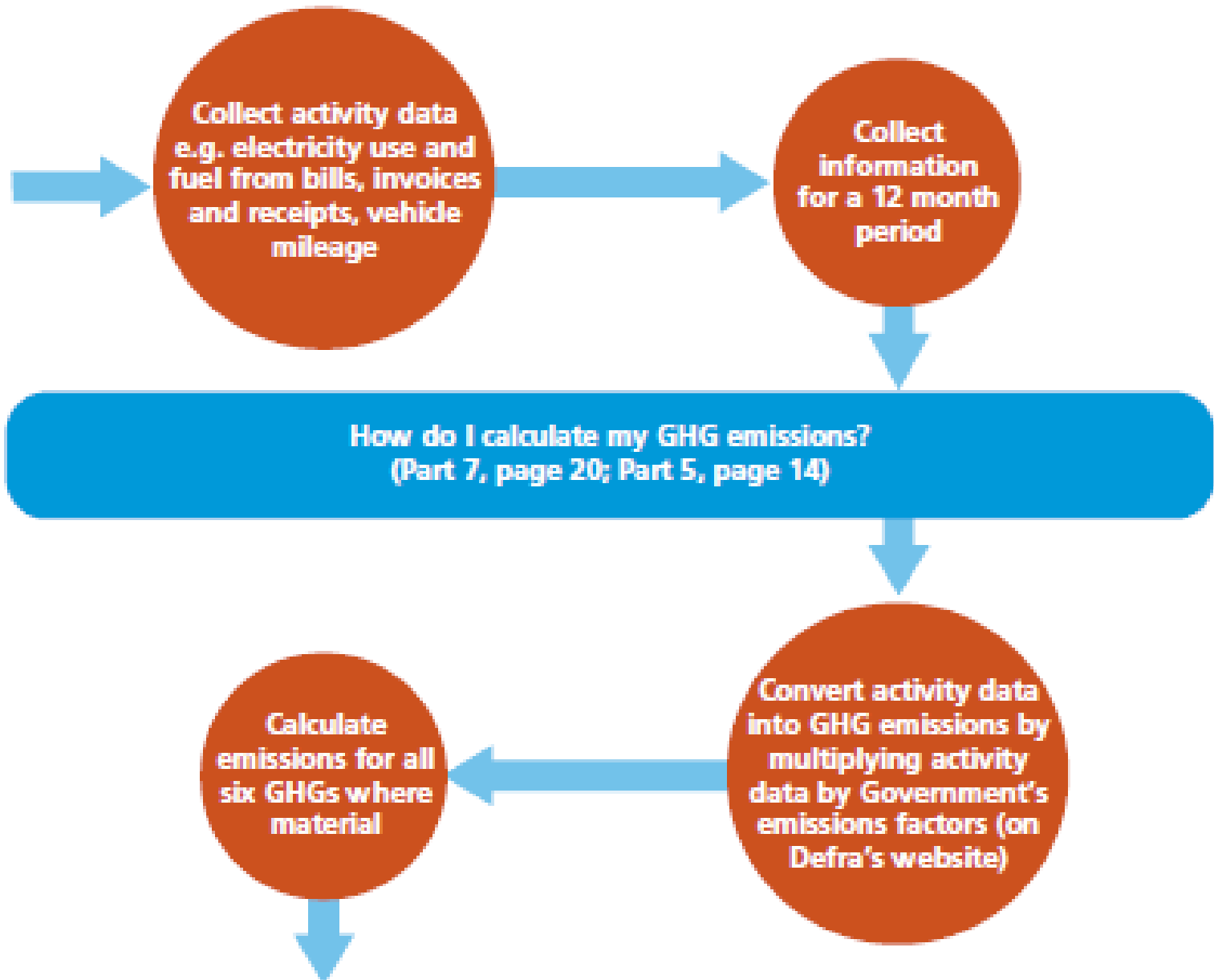


Part 4 – GHG Inventorizing

- Process Flow -



Part 4 – GHG Inventorizing - Process Flow -



Part 5 – GHG Inventorying

- Emissions Estimation (*Methodology*) –

As with the *1996 Guidelines* and *IPCC Good Practice Guidance* the most common simple methodological approach is to combine information on the extent to which a human activity takes place (called *activity data* or *AD*) with coefficients which quantify the emissions or removals per unit activity. These are called *emission factors (EF)*. The basic equation is therefore:

$$\text{Emissions} = AD \bullet EF$$

$$\text{Total emissions} = \sum_{\text{Company Source}} \sum_{\text{Sectors}} [\text{activity level} \times \text{emission coefficient}]$$