



Module 5 – Undertaking and Interpreting Greenhouse Gas Inventories

1 Expected outcomes of this module

The expected outcomes of this module are that the Steering Committee will:

- Understand the principles of setting greenhouse gas reporting boundaries
- Research and collect the relevant data and emissions factors
- Develop a basic greenhouse gas inventory
- Identify Council's major emission sources

2 Resources required for module delivery

Delivery schedule	The outputs from this module should feed into the Council's climate change action plan developed through module 7 " <i>Preparing an Action Plan</i> "
Time	Varied depending on data collection
Participants	The Steering Committee
Materials	<ul style="list-style-type: none"> • A computer (ideally with internet access) • Microsoft Excel • Meeting Agenda template
Assistance	The assistance of data custodians is required

3 How to complete the module

The following tasks should ensure that the expected outcomes of the module are achieved:

- Define the boundary for Council's greenhouse gas inventory
- Develop a data collection template and collect emissions data
- Develop and populate a greenhouse gas inventory for Council
- Identify the major sources of emissions in the greenhouse gas inventory

The objective of this module is to develop a basic greenhouse gas inventory to identify Council's main emissions sources. This module does not provide information for life cycle analysis, carbon management strategy development or advanced greenhouse gas inventory development for regulatory compliance.

3.1 Module preparation

3.1.1 Arranging a meeting of the Steering Committee

A meeting of the Steering Committee should be arranged so that the Committee can make the relevant decisions to instigate a greenhouse gas inventory being undertaken.

The facilitator should:

- Read the information in this module and the useful references (listed on page 8) and brief the Steering Committee on this information
- Prepare a meeting agenda (a meeting agenda template is available)

3.1.2 Defining the boundary for Council's greenhouse gas inventory

The purpose of this task is to decide which emissions will be included within the greenhouse gas (GHG) inventory. This can be done at the meeting of the Steering Committee with advice from the facilitator.

Council should decide on an emissions boundary that is realistic for management and will be credible when presented to stakeholders. The scoping processes used within this module are derived from the "The Greenhouse Gas Protocol" (WBCSD/WRI). Under this protocol, the Council emission sources can be delineated into three "scopes" (Scope 1, Scope 2 and Scope 3) for greenhouse gas accounting and reporting purposes.

The GHG protocol definitions for each scope are presented in Figure 1 and described in further detail.

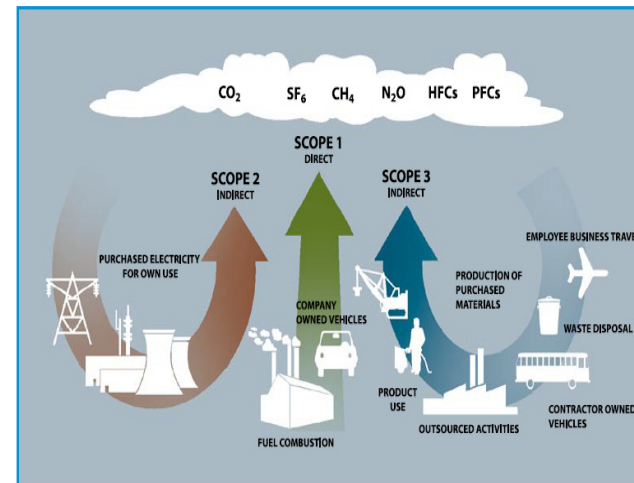


Figure 1: Overview of scopes and emission sources (Source: World Business Council for Sustainable Development)

- **Scope 1 – Direct GHG emissions:** Scope 1 emissions are direct emissions that occur from sources that are owned or controlled by Council. This would include emissions arising from landfills and the combustion of fuels in on-site equipment, buildings and/or vehicles.
- **Scope 2 – Electricity indirect GHG emissions:** Scope 2 emissions account for GHG emissions arising from the generation of purchased electricity consumed by Council. Scope 2 emissions are considered indirect as they occur at the facility where electricity is generated.
- **Scope 3 – Other indirect GHG emissions:** Scope 3 emissions are a consequence of the activities of Council, but occur from sources not owned or controlled by Council. Examples of Scope 3 emissions include:
 - Extraction and production of purchased materials
 - Business travel, employee commuting, transport of purchased materials
 - Leased assets, franchised and outsourced activities
 - Waste disposal

It is standard practice to include all Scope 1 and 2 sources of emissions (e.g. fleet fuel, natural gas, landfill emissions, electricity) in a greenhouse gas inventory. Setting boundaries for greenhouse gas inventories essentially only involves deciding which additional Scope 3 emissions to include in the inventory. Common Scope 3 emissions for councils include:

- Outsourced waste disposal (i.e. employing waste contractors/ delivering waste to non-Council waste management facilities)
- Outsourced services to manage parks and gardens (lawn mowing contractors)
- Business travel (flights, taxis, car hire)
- Employee commuting

Prior to the meeting the facilitator should:

- Investigate the feasibility of collecting data for each emissions source

At the meeting the Steering Committee should:

- Agree on the emissions sources which are appropriate for inclusion in the inventory

3.1.3 Developing a data collection template and collecting emissions data

Knowledge of Council data management systems and discussion with the appropriate staff is important in efficient and successful data collection. Some recommendations for data collection include:

- Decide on an appropriate reporting year to collect data
- Provide data custodians with a background as to why the data is being collected
- Provide a template that specifies the data required and the preferred reporting units
- Negotiate a timeline for data delivery with data custodians
- Ensure that data is collected over the same time period (financial/ calendar year)

Some councils may wish to record data on a monthly or quarterly basis to identify seasonal variations in energy use. Understanding seasonal variation may assist in developing energy saving measures.

Table 1 outlines the main emissions sources for Council as a business. It also illustrates the data required for collection and potential data custodians.

Table 1: Example of emissions sources for local Council (Adapted from ICLEI, 2009)

Emissions source	Recommended data for collection	Potential data source / custodian
Buildings (Scope 1 & 2)	<ul style="list-style-type: none"> Electricity use (kWh) Natural gas use (MJ) Other on-site fuel use and type Indicator inputs: operating hours, occupants, floor area 	<ul style="list-style-type: none"> Accounts department Assets manager Property manager Building manager Electricity/ gas bills Utility providers Energy tracking and subscription service providers
Vehicle fleet (Scope 1)	<ul style="list-style-type: none"> Fuel use (L) Fuel type Vehicle type Indicator inputs: Vehicle kilometres travelled, number of vehicles 	<ul style="list-style-type: none"> Finance department Fleet manager Fuel invoices/ fleet cards
Council owned Landfill (Scope 1)	<ul style="list-style-type: none"> Methane emissions Electricity use (kWh) Natural gas use (MJ) Other on-site fuel use and type Electricity generated (KWh) 	<ul style="list-style-type: none"> Landfill manager Accounts department First order decay modelling Electricity/ gas bills Fuel invoices

Council owned waste water treatment (Scope 1)	<ul style="list-style-type: none"> Methane emissions Electricity use (kWh) Natural gas use (MJ) Other on-site fuel use and type 	<ul style="list-style-type: none"> Treatment plant manager Accounts department Emissions generation models Electricity/ gas bills Fuel invoices
Employee commuting (Scope 3)	<ul style="list-style-type: none"> Mode of transport (other than in Council owned fleet vehicles) Distance travelled 	<ul style="list-style-type: none"> Staff travel survey
Street lighting (Scope 2)	<ul style="list-style-type: none"> Electricity use (kWh) for street lights, traffic signals, parks, public lighting, etc. Indicator inputs: types, power, hours of operation and numbers of street lights 	<ul style="list-style-type: none"> Energy retailer Traffic and roads operational groups Finance department Electricity bills Assets manager
Outsourced waste management (Scope 3)	<ul style="list-style-type: none"> Total waste generated (by stream) Fate of waste (by stream) Indicator input: number of employees 	<ul style="list-style-type: none"> Waste audits – by weight and composition Waste management invoices Industry benchmarks
Business travel (Scope 3)	<ul style="list-style-type: none"> Details of business trip (origin and final destination) 	<ul style="list-style-type: none"> Accounts department Travel agent(s)

- Km travelled
- Mode of transport (flight, taxi, hire car)

For larger councils with a high number of facilities (e.g. over 150) it may not be appropriate to collect detailed data about each facility.

At the meeting the Steering Committee should:

- Identify data custodians
- Nominate someone to develop a template for collecting data from data custodians (section 3.1.3). An electronic Excel template is recommended (Box 1)
- Delegate the task of collecting all required data from relevant custodians

After the meeting the Steering Committee should:

- Assist to engage data custodians about the project requirements

Box 1 – Developing a data collection template

When developing a data collection template, it is important to keep it simple. It is also important to design the template so that data can easily be transferred to the final greenhouse gas inventory. The template should include general information, emissions source data in specific units, indicator data (if applicable) and a comments section. An example for building energy use is shown.

Greenhouse gas emissions inventory - Data template										
General information										
4	Data collection period	<input type="text"/>								
5	Data custodian name	<input type="text"/>								
6	Data custodian contact	<input type="text"/>								
7	Building name	<input type="text"/>								
Energy data										
10	Electricity	<input type="text"/>							kWh	
11	Electricity consumption	<input type="text"/>								
12	On-site fuel use	<input type="text"/>								
13	Fuel type 1	<input type="text"/>							litres/m3/MJ	delete as necessary
14	Fuel quantity 1	<input type="text"/>								
15	Fuel type 2	<input type="text"/>							litres/m3/MJ	delete as necessary
16	Fuel quantity 2	<input type="text"/>								
17	Fuel type 3	<input type="text"/>							litres/m3/MJ	delete as necessary
18	Fuel quantity 3	<input type="text"/>								
19	Fuel type 4	<input type="text"/>							litres/m3/MJ	delete as necessary
20	Fuel quantity 4	<input type="text"/>								
Indicator data										
23	Operating hours	<input type="text"/>								
24	Occupants	<input type="text"/>								
25	Floor Area	<input type="text"/>								
Comments/Assumptions										
<input type="text"/>										

Data templates can be developed in collaboration with data custodians to make sure that the layout and units are appropriate for accurate input of data. It is also important to clearly outline the data collection period to all data custodians. The comments section should include the assumptions made about estimating missing data. This information is important in reviewing and improving measurement in future inventories.

3.2 Finalising module outputs

3.2.1 Developing and populating a greenhouse gas inventory

There are a number of calculators, tools and manuals available to assist in the development of a greenhouse gas inventory. Beware of on-line calculators – many have been found to be inaccurate.

The Australian Government has developed the National Greenhouse and Energy Reporting System (NGERS) on-line calculator to assist corporations to self assess whether or not their corporate group or any of their facilities meet reporting thresholds under the *National Greenhouse and Energy Reporting (NGER) Act 2007*. The Australian Government has also developed a solid waste calculator for operators of solid waste (landfill) facilities and a waste water calculator for reporting under the NGER Act. Links can be found on the LGSA website (www.lgsa.org.au).

A basic inventory is relatively easy to develop. The most challenging part is to choose appropriate emissions factors. Emissions factors should be selected from the following two sources:

- *The National Greenhouse Accounts (NGA) Factors (DCC 2009)*
- *The Greenhouse Gas Protocol Calculation Tools (requires registration)*

It is recommended that the latest versions are used when developing greenhouse gas inventories, as these documents are regularly updated. The emissions factors provided in these documents may require some basic mathematical alteration to ensure that they are in appropriate units for Council data (See Box 2). A basic inventory can be developed using Excel or similar spreadsheet software (see the illustrated example in Box 2). A greenhouse gas calculator is not provided with the Workshop Package as it would quickly become inaccurate as emissions factors change.

The Steering Committee, facilitator or person nominated to undertake the greenhouse gas inventory should:

- Research relevant emissions factors
- Convert emissions factors so that they are based on the same units as the data collected by Council
- Develop Council's greenhouse gas inventory by applying relevant emissions factors to the data collected by Council

Box 2 – Developing a basic greenhouse gas inventory

A basic inventory requires emissions factors and Council data from emissions sources. An inventory does not need to be complex or technical and should be relatively easy to develop as an Excel spreadsheet (see example below). The inventory should be set out in a way which allows for easy interpretation. The example groups emissions according to scope. The inventory should include a cell for entering data (**A**), a cell for the emissions factor (**C**) and a cell for emissions (expressed in T/ CO₂-e) (**D**). The example included in the inventory below is based on a Council using 50,000 litres of diesel in fleet equipment. 50,000 L is entered into cell (**A**) and the emissions factor for diesel is entered into cell (**C**). The quantity of CO₂-e can be calculated by multiplying (**A**) by (**C**) = (**D**). In this case, the emissions factor (0.00268 T/CO₂-e/L) was derived from the NGA factors workbook (DCC 2009). In the NGA factors workbook, the emissions factor for diesel is expressed as 69.5 kg/CO₂-e/GJ. To calculate an emissions factor for diesel measured in litres (unlikely that council will measure diesel use in GJ), the following conversion must be made:

- Diesel contains 0.0386 GJ per litre (in the NGA workbook)
- Diesel emits 69.5 kg/CO₂-e per GJ (in the NGA workbook)

Greenhouse gas emissions inventory - Inventory template					
Inventory period					
Scope 1 emissions					
Council data	units	Emissions coefficient	units	Emissions quantity	
On-site fuel use (diesel)	50000 L	X	0.00268 tCO ₂ -e/L	=	0.134 tCO ₂ -e
On-site fuel use 2		X		=	tCO ₂ -e
Transport fuel use 1		X		=	tCO ₂ -e
Transport fuel use 2		X		=	tCO ₂ -e
Natural gas use		X		=	tCO ₂ -e
Scope 2 emissions					
Council data	units	Emissions coefficient	units	Emissions quantity	
Electricity consumption		X		=	tCO ₂ -e
Scope 3 emissions					
Council data	units	Emissions coefficient	units	Emissions quantity	
Waste stream 1		X		=	tCO ₂ -e
Waste stream 2		X		=	tCO ₂ -e
Business travel (flights)		X		=	tCO ₂ -e
Employee commuting		X		=	tCO ₂ -e
Car		X		=	tCO ₂ -e
Bus		X		=	tCO ₂ -e
Train		X		=	tCO ₂ -e
Comments/Assumptions					

The emissions factor (in T/ CO₂-e) for diesel is therefore (69.5/1000) multiplied by 0.0386 = 0.00268

When developing the inventory, Council should include all assumptions and references for emissions factors to maintain transparency.

Once the inventory has been developed and populated, it recommended that it be reviewed and verified by a third party for accuracy and credibility.

3.2.2 Identifying the major sources of emissions

Developing the inventory in Excel provides flexibility to produce visual representations such as bar graphs and pie charts which can be used in presentations to executive staff in Council. Examples are shown in Figure 2.

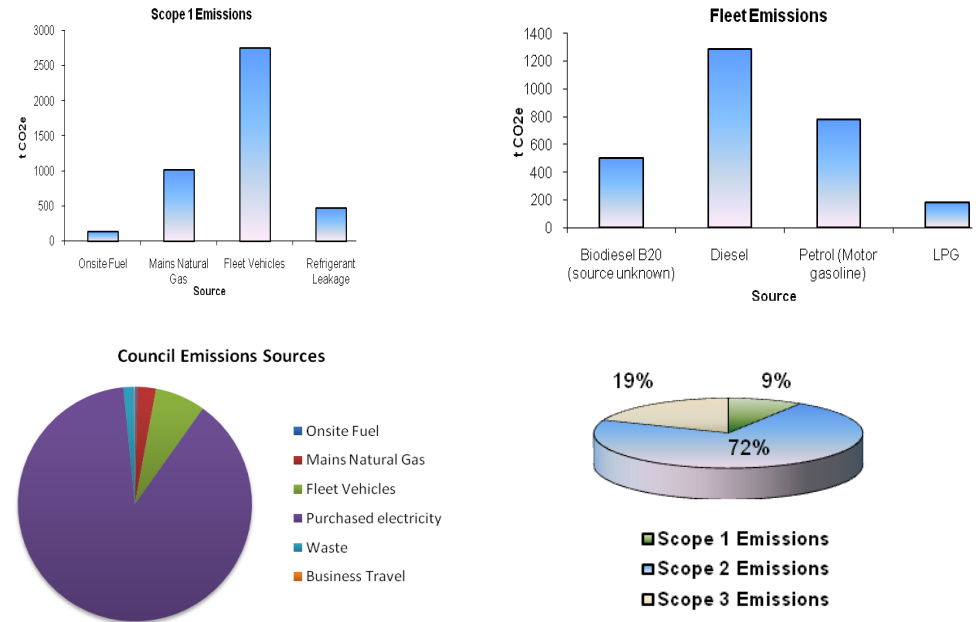


Figure 2: Example visual representations of Council emissions to assist in interpretation

Interpreting the greenhouse gas inventory in this way can assist Council to identify its priority emission sources. Councils may also wish to analyse energy use data on a monthly or quarterly basis to highlight seasonal variations in energy use. Understanding seasonal variation may assist in developing energy saving measures.

The Steering Committee, facilitator or person nominated to undertake the greenhouse gas inventory should:

- Analyse the greenhouse gas inventory using visual representations

4 The delivery checklist

After completion of this module Council should have achieved the following:

Module deliverables	Complete
Set an appropriate reporting boundary for the greenhouse gas inventory	Yes / No
Developed a greenhouse gas inventory for Council activities	Yes / No
Identified the priority sources of emissions	Yes / No

5 Useful references

City of Sydney, 2008, *Carbon Neutral Strategy*.

Department of Climate Change, 2009, *The National Greenhouse Accounts (NGA) Factors*.

Department of Climate Change and Energy Efficiency, 2010, *National Greenhouse and Energy Reporting System Calculator*.

Department of Climate Change and Energy Efficiency, 2010, *National Greenhouse and Energy Reporting Solid Waste Calculator*.

Department of Climate Change and Energy Efficiency, 2010, *National Greenhouse and Energy Reporting Waste Water Calculator*.

ICLEI, 2009, <http://www.iclei.org/index.php?id=iclei-home>

World Business Council for Sustainable Development and the World Resources Institute, 2009, *The greenhouse gas protocol*.

Links to useful resources are provided on the LGSA website (www.lgsa.org.au)