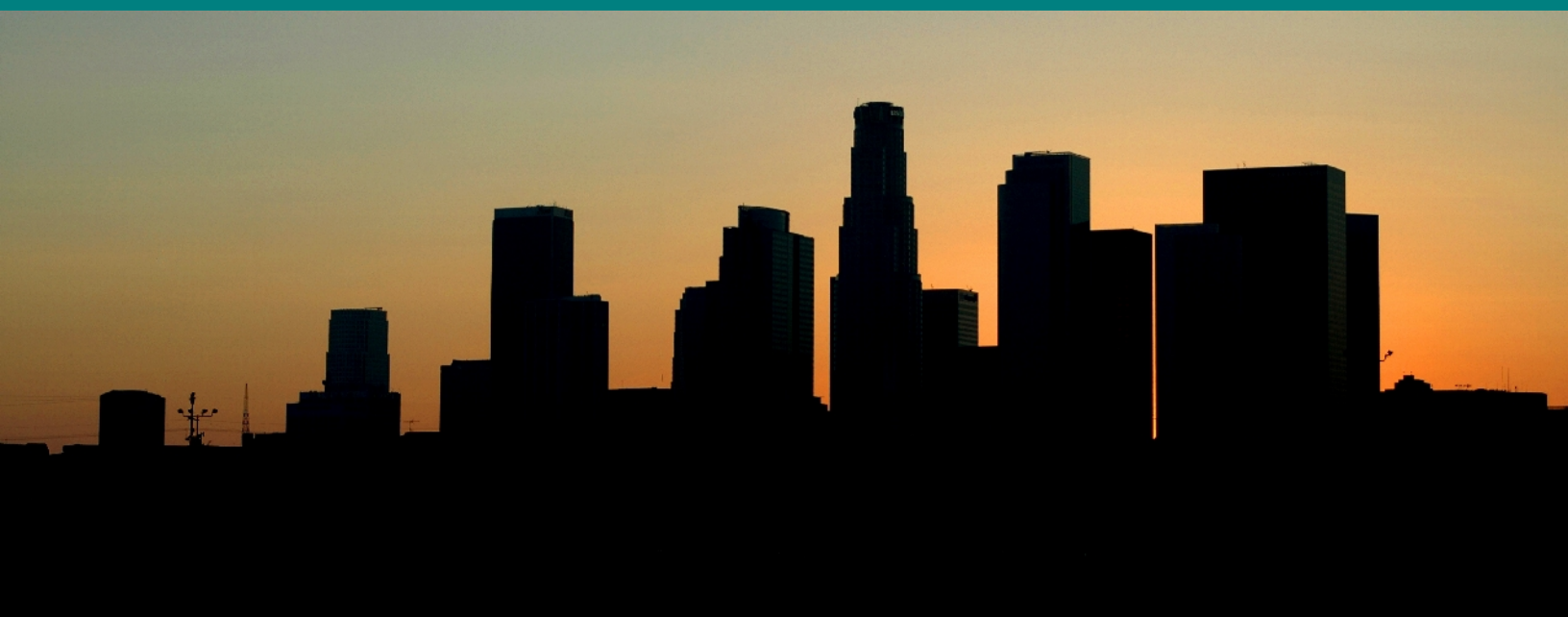


Community Greenhouse Gas Emissions Inventory Instructions



Part 1: Data Gathering
March 2011

Statewide Energy Efficiency Collaborative

AN ALLIANCE TO SUPPORT LOCAL GOVERNMENT

This Community Inventory Instructions document is a product of the **Statewide Energy Efficiency Collaborative (SEEC)**. SEEC is a new alliance to help cities and counties reduce greenhouse gas emissions and save energy. SEEC is a collaboration between three statewide non-profit organizations and California's four Investor Owned Utilities.

SEEC members are:

- ICLEI – Local Governments for Sustainability USA
- Institute for Local Government
- Local Government Commission
- Pacific Gas and Electric Company
- San Diego Gas and Electric Company
- Southern California Edison Company
- Southern California Gas Company

SEEC provides education and tools for climate action planning, venues for peer-to-peer networking, technical assistance and recognition for local agencies that reduce greenhouse gas emissions and energy use.

The collaborative effort is designed to build upon the unique resources, expertise and local agency relationships of each non-profit organization, as well as those of the four investor owned utilities.



The program is funded by California utility ratepayers and administered by Pacific Gas and Electric Company, San Diego Gas and Electric Company, Southern California Edison, and Southern California Gas Company under the auspices of the California Public Utilities Commission.

Table of Contents

Table of Contents.....	iii
List of Tables.....	v
List of Figures	v
Introduction.....	5
Residential, Commercial and Industrial Sources	11
1.1 Introduction.....	11
1.2 General Instructions.....	12
1.3 Using the Master Data Workbook	14
Transportation.....	17
2.2 General Instructions.....	19
2.3 What Data Need to be Collected?.....	20
2.4 Using the Master Data Workbook	24
Community Generated Waste	27
3.1 Introduction.....	27
3.2 General Instructions.....	27
3.3 What Data Need to be Collected?.....	28
3.4 Using the Master Data Workbook.....	29
Wastewater Treatment Facilities.....	30
4.1 Introduction.....	30
4.2 Does Your Local Government Need to Inventory Emissions from Wastewater?.....	30
4.3 Inventorying Emissions from Wastewater Treatment	32
4.4 What Data Need to be Collected?	33
4.5 Using the Master Data Workbook	35
Solid Waste Landfills.....	39
5.1 Introduction.....	39
5.2 Inventorying Emissions from Landfills.....	40
5.3 Landfill Inventory Process.....	41
5.4 What Data Need to be Collected?.....	42
5.5 Using the Master Data Workbook.....	43
Power Generation Facilities.....	44
6.1 Introduction.....	44
6.2 Inventorying Emissions from Power Generation Facilities.....	44
6.3 What Data Need to be Collected?.....	46
6.4 Using the Master Data Workbook.....	47
Information Items.....	52
7.1 Introduction.....	52

7.2 What Data Need to Be Collected?.....	53
7.3 Using the Master Data Workbook.....	53
Other Sources.....	55
8.1 Introduction.....	55
8.2 Inventorying Emissions from Other Sources.....	55
8.3 What Data Need to be Collected?.....	57
8.4 Using the Master Data Workbook.....	57

List of Tables

#	Table Name	Page
2.1	Data needed for inventory of CO ₂ emissions from vehicles and mobile equipment	17
2.2	Data needed for inventory of biofuel CO ₂ emissions from vehicles and mobile equipment	19
2.3	Data needed for inventory of CH ₄ and N ₂ O emissions from vehicles	19
2.4	Data needed for inventory of emissions from electric vehicles	20
3.1	Data needed for waste generation	25
4.1	Wastewater emission sources	29
4.2	Septic system data needs	30
4.3	Centralized water treatment data needs	30
4.4	Wastewater power generation data needs	31
5.1	Data needs for landfills with comprehensive LFG collection system	38
5.2	Data needs for landfills with no LFG collection system	39

List of Figures

#	Figure Name	Page
4.1	Wastewater treatment decision tree	27

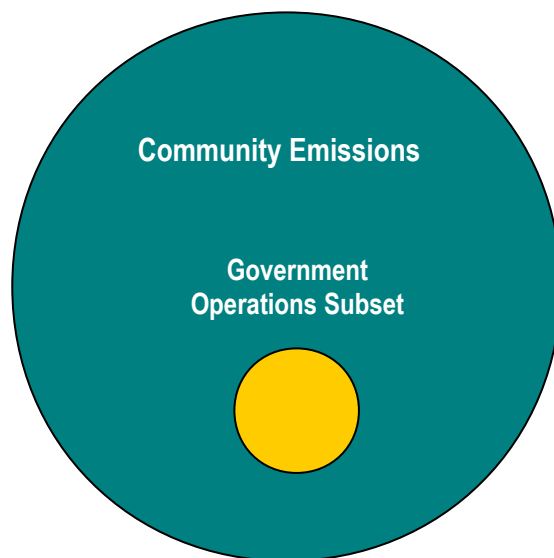
Introduction

Local governments play a fundamental role in addressing the causes and effects of human-caused climate change through their actions at both the community and government operations levels. While local governments cannot solve the problems of climate change by themselves, their policies can dramatically reduce greenhouse gas emissions from a range of sources and can prepare their communities for the potential impacts of climate change.

Within the context of community activities, local governments have direct control over their emissions-generating activities and influence over numerous actions taken by residents, businesses and industries. They can reduce energy consumption in buildings and facilities, promote programs to reduce the number of vehicles on the road, inform residents about energy saving programs, work with utilities to provide clean energy options, improve programs that divert recyclables and compostables from the waste stream, and much more. By quantifying the emissions coming from the community, your jurisdiction will be empowered to choose the most effective approach to reducing its contribution to climate change. The process of conducting such a quantitative analysis is called a community inventory.

Government Operations and Community Inventory Boundaries

It is important to note that the community-scale inventory is designed to represent the total quantity of greenhouse gas emissions produced by your community as defined by its geographic borders during a chosen year. Emissions from your local government operations are already embedded in the community inventory. For example, aggregate data for commercial energy use by the community includes energy used for municipal buildings and facilities; community vehicle miles traveled estimates include miles driven by municipal fleet vehicles; and total tons of solid waste landfilled by the community includes municipal waste. Although government operations inventories on occasion include Scope 3 activities that occur outside the geographic community boundary, the government operations inventory can be considered a subset of the community-scale inventory.



The objective of the community inventory is to identify the sources and quantities of greenhouse gas emissions resulting from activities within your jurisdiction in a chosen base year (see below for more on base year). The inventory is a necessary first step in addressing greenhouse gas emissions, serving two primary purposes:

- To create an emissions baseline against which your jurisdiction can set emissions reduction targets and measure future progress.
- To provide insight into the scale of emissions from the various sources within the community, underpinning informed and strategic emissions reductions, commonly called “climate action planning.”

Conducting a community inventory is the first step to an emissions reduction strategy. Community emission inventories are important for a variety of reasons including:

- Your local government has direct control over a significant portion of the emissions that emanate from the community at large.
- Local governments can implement programs to engage the community in numerous ways including education, energy efficiency, waste diversion programs, etc.
- State legislation may soon require community inventories.
- Energy efficiency measures can save your entire community money.

Sectors

The purpose of this instruction document is to help you understand the sectors that are included in a community inventory, the data that need to be collected, and the data collection process using your community *Master Data Workbook*. This document will help you collect data for the following sectors of your inventory:

- Residential, Commercial and Industrial
- Transportation
- Community-generated Waste
- Wastewater Treatment
- Solid Waste Landfills
- Power Generation Facilities
- Information Items
- Other

Master Data Workbook

As a corner-stone of ICLEI’s greenhouse gas emissions inventory tool set, the *Master Data Workbook*, will be the axis of all data collection and report preparation entailed in your emissions inventory. The *Master Data Workbook* is your central resource for identifying the energy and activity data that need to be gathered, recording and

organizing your data, and keeping notes on your progress. To get oriented, the *Master Data Workbook* has a few introductory tabs that are worth exploring:

- *Workbook Intro*: Table of contents for the workbook with descriptions and links to each worksheet (worksheets are sometimes referred to here as “tabs”)
- *Inventory Data Checklist*: Lists the major sources for which you will have to gather data and serves as a place to store notes, contact information, and progress reports on data collection from each source
- *Tables and Figure Legend*: Lists the tables and figures that are in the *Tables and Figures* tab as well as in the Narrative Report Template
- *Tables and Figures*: Displays template charts and tables for emissions outputs for use in your final report document
- *Inventory Log*: A place to record conversations and notes as data collection progresses. Record any assumptions that may be used in particular sectors. This is a journal documenting the evolution of your inventory
- *Demographics*: Contextual data for population trends used in creating a forecast
- *Emissions Outputs by Record and by Emissions Output by Source*: A place to store final emissions outputs

Emissions Calculator

ICLEI is currently developing an online community greenhouse gas emissions calculator that will be available to all California local governments. Users will be able to apply utility specific emissions factors and create multiple inventory years.

International Emissions Analysis Protocol

The International Emissions Analysis Protocol (IEAP) is an international standard for community and government operations inventories. It provides a general framework for inventories around the world and draws on existing best practices from the Intergovernmental Panel on Climate Change (IPCC) and The World Resources Institute (WRI). The IEAP outlines community boundary issues, relevant sources, data collection requirements and basic calculation equations. ICLEI supplements this basic framework with U.S. specific emission coefficients and years of experience working with communities on their GHG inventories. The IEAP, along with ICLEI’s years of experience, provide the foundation for data requirements and calculation methods described in this instruction document.

Along with IEAP's general framework, ICLEI has developed a U.S. specific protocol for local government operations inventories (the Local Government Operations Protocol) and is in the process of developing a protocol for community-scale greenhouse gas emissions.

National Standard for Community Emissions Accounting and Reporting

This protocol is expected to be complete in August 2011 and will be a companion document to the Local Government Operations Protocol (LGO Protocol), and a national supplement to the IEAP. The community protocol will share many of the same emission coefficients and calculation methods (where applicable) with the LGO Protocol. Many of the calculation methods and data requirements outlined here and in the *Master Data Workbook* stem from methods published in the LGO Protocol. ICLEI has utilized the best nationally recognized calculation methods for the emissions activities contained here but recognizes that some communities may wish to increase the scope of their inventory and include additional trans-boundary and lifecycle emissions. The community protocol currently in development will address trans-boundary and lifecycle emissions. Discussions regarding trans-boundary and lifecycle emissions are limited to a few methods contained primarily in the Solid Waste sector. Trans-boundary and lifecycle emission quantification methods are applicable to numerous sectors but since these methods are not nationally standardized, they have largely been omitted here. ICLEI encourages local governments to report on trans-boundary and lifecycle emissions where they are relevant to your community. Please stay tuned for community protocol related announcements at: <http://www.icleiusa.org/programs/climate/ghg-protocol/community-greenhouse-gas-emissions-inventory-protocol>.

The Scopes Framework

For community inventories, the IEAP categorizes emissions according to the degree of control community members and organizations have over the emissions sources. These categorizations (developed by the World Resources Institute and the World Business Council for Sustainable Development) are called *emissions scopes*. The scopes framework helps communities to:

- Determine which emissions should be inventoried.
- Organize emissions by degree of control and therefore the potential for reduction.
- Avoid “double counting” of emissions, i.e., summing up of different emissions sources that may result in reporting these emissions twice.

The emissions scopes are defined as follows:

Scope 1: All direct emissions sources located within the geopolitical boundary of the local government. This includes stationary combustion to produce electricity, steam, heat, and power equipment; mobile combustion of

fuels; process emissions from physical or chemical processing; fugitive emissions that result from production, processing, transmission, storage and use of fuels; leaked refrigerants; and other sources.

Scope 2: Indirect emissions that result as a consequence of activity within the local government's geopolitical boundary limited to electricity, district heating, steam and cooling. Electricity purchased from a utility that lies inside or outside the geopolitical boundary is considered Scope 2.

Scope 3: All other indirect and embodied emissions that occur as a result of activity within the geopolitical boundary. Scope 3 emission sources include (but are not limited to) emissions resulting from the decomposition of community-generated solid waste, materials flows and other lifecycle analyses.

Baseline Year

Part of the local government operations emissions inventory process requires selecting a base year for the focus of your analysis. This year will provide a “performance datum” against which you will be able to compare current and future emissions, tracking your progress. Local governments should examine the range of data they have over time and select a year that has the most accurate and complete data for all key emission sources. It is also preferable to establish a base year several years in the past to be able to account for the emissions benefits of recent actions. A community inventory should comprise all greenhouse gas emissions occurring during a selected *calendar* year.

Many California local governments have chosen to use 2005 as a baseline year – this is increasingly becoming the standard for inventories in the state. Due to a lack of available data, a 1990 baseline year is usually difficult for most local governments to complete and would not produce an accurate inventory.

Types of Emissions

As described in LGO Protocol, emissions from each of the greenhouse gases can come in a number of forms:

Stationary or mobile combustion: These are emissions resulting from on-site combustion of fuels (natural gas, diesel, gasoline, etc.) to generate heat, electricity, or to power vehicles, mobile equipment, appliances, and so forth.

Purchased electricity: These are emissions produced by the generation of power from utilities outside of the jurisdiction.

Fugitive emissions: Emissions that result from the unintentional release of greenhouse gases into the atmosphere (e.g., leaked refrigerants, methane from waste decomposition, etc.).

Process emissions: Emissions from physical or chemical processing of a material (e.g., wastewater treatment).

Note: In community inventories, data on leaked refrigerants in the form of hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are typically not gathered because of a lack of data availability even though these are considered Scope 1 emissions at the local government operations level. In the case of power generation facilities or other buildings where you have already gathered information on refrigerant and fire-suppressant data, feel free to include these in your inventory as Information Items. ICLEI does not recommend including refrigerant and fire-suppressant data as a Scope 1 emission in your community inventory unless information on these sources has been gathered at a community level.

Reporting the Community Inventory

Although the ICLEI Reporting Standard for Local Government Operations has been completed, there is no current standard for reporting a community inventory. Through ICLEI's extensive experience working with local governments, we have developed guidance on how to report your community emissions inventory in a separate document. Please see the Reporting Instructions section¹ for more information on how to report your emissions.

The new community protocol scheduled for release in August 2011 will contain standardized reporting guidance.

In general, ICLEI recommends reporting all Scope 1 and Scope 2 emissions along with reporting a few key Scope 3 sources like waste generation. Maintaining this minimum baseline will help local governments ensure that they are including core emission sources, can set targets for emission reductions and have comparable inventories for benchmarking emission goals.

As with the LGO Protocol Standard Report, all community emissions should be reported by sector. Additional reporting by scope and source is also recommended for improved detail and clarity.

¹ This Reporting Document is expected to be complete in February 2011. It will include information on how to utilize emission calculation information from an online tool currently being developed by ICLEI and set for release in February 2011.

Residential, Commercial and Industrial Sources

1.1 Introduction

What are residential, commercial and industrial sources of greenhouse gas emissions? These stationary sources include any residential, commercial or industrial facility, operation, or activity that produces emissions in a fixed location. Emissions from residential, commercial and industrial sources typically fall into one of three categories: stationary combustion, fugitive emissions, or process emissions. The most common types of residential, commercial and industrial source emissions



include electricity and natural gas supplied by your local utility, but may also include other fuel sources, such as diesel, heating oil, propane or gasoline for generators or furnaces. Fuel used for cars, trucks, and mobile equipment will be addressed in the Transportation chapter.

These instructions will enable you to collect information on residential, commercial and industrial emissions sources and enter it into one central location, the *Master Data Workbook*. From here you will be able to easily use any greenhouse gas emission quantification software including the soon-to-be-released online community inventory tool being developed by ICLEI.



The data needed to fill out the *Master Data Workbook* will be obtained from a variety of city/county departments as well as from metropolitan planning organizations, electric utilities, water utilities, local air districts, landfill operators and other regional bodies who oversee emissions from the commercial, industrial and transportation sectors. ***It is therefore of the utmost importance that detailed notes are kept on where, and from whom, different pieces of data are gathered.*** This will be important when you wish to perform a new inventory to monitor changes in community emissions. There is a tab in the *Master Data Workbook* called the ***Inventory Log*** that was created to facilitate this process and you should also find a space to enter data source information next to each data entry record.

Potential Stationary Emissions Sources

Residential, commercial and industrial sources emissions sources include *any* building and facility or fixed equipment that uses energy. Common community stationary sources include:

- Government owned and operated buildings
- Residential houses
- Commercial buildings
- Power generation facilities
- Industrial facilities
- Wastewater treatment facilities
- Landfill operation facilities
- Public lighting (streetlights, traffic signals, park lighting etc)
- Ports, marinas and airports

Forms of Residential, Commercial and Industrial Emissions

Emissions from community residential, commercial and industrial sources take the following forms:

- Scope 1 CO₂, CH₄ and N₂O emissions from the combustion of fossil fuels, such as gasoline, diesel, natural gas, fuel oil and propane to power buildings and facilities (including back-up generators)
- Scope 1 Methane (CH₄) and Nitrous Oxide (N₂O) emissions from the combustion of biofuels (typically biodiesel) in back up generators or other stationary combustion sites
- Scope 2 CO₂, CH₄ and N₂O emissions from purchased electricity used to power buildings and facilities

Note that Scope 1 Hydrofluorocarbon (HFC) Perfluorocarbon (PFC) and other fugitive emissions from the leaking of refrigerants used for air conditioning (HVAC) or refrigeration (refrigerators) are not typically included in community inventories.

1.2 General Instructions

For most communities, your local utility will supply the bulk of electricity and natural gas consumption. To complete the residential, commercial and industrial sources portion of the inventory, it is recommended that your community also gather the following data and enter it into the *Master Data Workbook*:

- Annual amount and type of energy used by any facilities/stationary equipment supplied by non-utility sources (e.g., fuel oil, propane, steam heat)

- Number of residential households (optional)
- Number of commercial businesses, number of commercial employees, total floor area of commercial businesses (optional)
- Number of industrial facilities, number of industrial employees, total floor area of industrial buildings (optional)
- Gallons of wastewater treated, delivered, and people served (optional)
- Tons of waste accepted at solid waste facilities (optional)
- Gallons of drinking water treated, delivered, and people served (optional)

Note that some facility types have their own tabs in the *Master Data Workbook* and in this instructions document. These facility types include wastewater facilities, solid waste landfills and power generation facilities. The type of energy used to operate these facilities is the same as the power used to operate other buildings and will likely be aggregated by your local utility when they report the residential, commercial and industrial usage numbers. ICLEI recommends that you keep all the data on power used to operate wastewater, solid waste and power generation facilities in the *Industrial Final Data* tab of your Master Data Workbook. Data on process and fugitive emissions from wastewater treatment, landfills and power generation will be kept in their respective tabs elsewhere.

Once you obtain residential, commercial and industrial data from your power utility, copy and paste this data into the *Utility Raw Data* tab and then separate out the consumption that goes into the residential, commercial and industrial sectors in the *Master Data Workbook*. Fuels burned on site in generators, or power obtained from a source other than a power utility will go in the *Non-Utility Raw Data* tab.

Step 1: Identify Key Staff Contacts

Identify contacts at your power utility and City staff with knowledge of community buildings and facilities, who may have access to data on other fuels used for power; record this information in the *Inventory Data Checklist*.

Step 2: Identify Available Data

What data your jurisdiction is able to gather will determine whether you can use direct measurements or must calculate emissions estimates from your community's residential, commercial and industrial facilities. Once you have determined what data is available and where there may be gaps in the data, consult Section 1.3 on how to enter the data in the *Master Data Workbook*.

Step 3: Gather Data

Work with the contacts you have identified and any other necessary staff to gather all required data. Whenever possible, save a copy of the data you gathered *in its original form*. This data will be saved in the *Utility Raw Data* or the *Non-Utility Raw Data* sections of the *Master Data Workbook*.

Again, it is vital to take detailed notes of the data gathering process, including data sources, any problems with the data, and estimates made. As you gather data, use the Inventory Log tab as well as the spaces within each final data entry tab as places for these notes and sources.

Step 4: Enter Data into the Master Data Workbook

As you gather the necessary raw data, you should save it in your *Master Data Workbook* in the residential, commercial and industrial tabs provided. From your raw data, you will complete the working and final tabs. Please see Section 1.3 below for more information on working with the *Master Data Workbook*.

Step 5: Perform Quality Control Check (QC) on Master Data Workbook

Once you have completed the working and final tabs in the *Master Data Workbook* and the residential, commercial and industrial sources emissions section is complete, you should perform a final review of all data to ensure accuracy. At ICLEI we have set up a “buddy system” where staff QC each others’ work – setting up a similar system would be worthwhile.

1.3 Using the Master Data Workbook

The section of the Master Data Workbook that is set up for recording stationary sources data includes the following tabs: Industrial Final Data, Industrial Working Data, Commercial Final Data, Commercial Working Data, Residential Final Data, Residential Working Data, Direct Access Calculator, Utility Raw Data and Non-Utility Raw Data.

Industrial Final Data

This tab is a location for you to record your industrial electricity, natural gas and other fuel consumption that has been fully organized in the *Industrial Working Data* tab. It is up to you how you want to group this data. In most cases, you will have one row for each type of industrial fuel. However, if you would like a higher degree of resolution, you can break out consumption as you see fit. The *Industrial Final Data* tab includes fields for useful indicator data like industrial floor area, employees and the number of industrial establishments. Since you will be recording electricity and other power consumption to operate wastewater, water delivery and solid waste facilities in the Industrial tabs of the *Master Data Workbook*, there are also indicator tabs for the number of people served by

the facility, gallons of waste water/drinking water treated, gallons of waste water/drinking water delivered and tons of waste accepted at solid waste facility..

Industrial Working Data

This sheet is a place to organize industrial utility data as well as non-utility data that has been collected in the *Utility Raw Data* and *Non-Utility Raw Data* tabs. Copy and paste relevant data from your *Raw Data* tabs here and organize it into any relevant subcategories. ICLEI has provided a very basic layout for this tab but feel free to alter it and include more data that you think is pertinent.

Commercial Final Data

This tab is a location for you to record data for your commercial electricity, natural gas and other fuel consumption that has been organized in your *Commercial Working Data* tab. This Final Data tab includes fields for useful indicators like commercial floor area, employees and the number of commercial establishments. It is up to you if you want to group this data. In most cases, you will have one row for each type of commercial fuel. However, if you would like a higher degree of resolution, you can break out consumption as you see fit.

Commercial Working Data

This sheet is a place to organize commercial utility data, and non-utility data that has been collected in the *Utility Raw Data* and *Non-Utility Raw Data* tabs. Copy and paste relevant data from your *Raw Data* tabs here and organize it into relevant subcategories. ICLEI has provided a very basic layout for this tab but feel free to alter it and include more data that you think is pertinent.

Residential Final Data

This tab is a location for you to record data for your residential electricity, natural gas and other fuel consumption that has been grouped in the *Residential Working Data* tab. This tab includes fields for useful indicator data like residential households. It is up to you how you want to group this data. In most cases, you will have one row for each type of residential fuel. However, if you would like a higher degree of resolution, you can break out consumption as you see fit.

Residential Working Data

This sheet is a place to organize residential utility data and non-utility data that has been collected in the *Utility Raw Data* and *Non-Utility Raw Data* tabs. Copy and paste relevant data from your *Raw Data* tabs here and organize it into any relevant subcategories. ICLEI has provided a very basic layout for this tab but feel free to alter it and include more data that you think is pertinent.

Direct Access Calculator

Many communities in California consume some direct access power – electricity generated from outside the community from a location other than their local power utility. This power is distributed through utility power lines and is recorded by power utilities. Unlike utility-generated power, the component fuels used to generate direct access power are not typically known, and most direct access power tends to be from “dirtier” sources than utility power. This tab will help you estimate the amount of direct access power consumed by your utility if you are not able to get this data directly from your utility. Follow the instructions contained within the worksheet.

Utility Raw Data

You will obtain the majority of your residential, commercial and industrial data from your local utility, which will address most electricity and natural gas usage. You will need to transfer this data from the *Utility Raw Data* tab to the *Residential, Commercial and Industrial Working Data* tabs. This entails using the identifier fields provided by the utility to categorize the data into the different categories of stationary sources: residential, commercial and industrial. The purpose of the *Utility Raw Data* tab is to keep an unaltered record of your utility data. Do not reorganize, color code or edit this *Utility Raw Data* tab – organizing will be done on the *Working Data* tabs.

Non-Utility Raw Data

Your community may also use diesel generators, steam heat, or other fuels to power its facilities, streetlights, businesses, water delivery pumps, etc. Please be sure to gather data on every non-utility stationary power source that helps power your residential, commercial and industrial sources and input the data into the *Non-Utility Raw Data* tab. In most cases, this will likely be estimates of propane or fuel oil consumption within the community using data from the Energy Information Administration. If you want to attach the raw data files directly to this tab do the following:

Go to:

Insert > Object

Create from File > Browse > Insert

Before hitting OK, be sure to click "Display as icon" otherwise the document will open up in the Excel tab.

Transportation

2.1 Introduction

Transportation emissions emanate from vehicles driving on your local roads and highways, as well as some off road equipment at construction sites and other locations within your community boundary. These mobile source emissions generally make up 50 percent or more of community emissions in California and are therefore vital for policy consideration.

Potential Transportation Emissions Sources

Transportation emissions sources are primarily diesel and gasoline vehicles that travel on highways, ramps, and local and arterial roads plus fuel consumption from other off-road sources like grounds keeping equipment, construction equipment, etc. The most common data sources for on-road transportation data will come from your local Metropolitan Planning Organization (MPO) who has likely studied the volume and behavior of vehicles on the road through Caltrans' Highway Performance Monitoring System². Note that unlike government operations inventories, we do not directly measure fuel consumption at the community level but rather infer fuel consumption based on measured VMT and known fuel efficiency.



Note: Fuel consumption records from community fueling stations are not a good source of data for the community inventory. It is not known from fuel sales how much of that fuel was burned within the community or on what roadway. The inventory methodology described here will focus on using estimates of VMT for common fuels like gasoline and diesel, ethanol, biodiesel and CNG used on roadways. It is important to know that VMT estimates are estimates, not precise measures of exactly how many miles were travelled within your community. Consult your local MPO for the exact method used to estimate VMT.

If possible, obtain data from your MPO that lists VMT information by fuel type *and* vehicle type. Common fuel types for the community inventory include:

- Diesel
- Gasoline
- Biodiesel

² <http://www.dot.ca.gov/hq/tsip/hpms/index.php>

- Ethanol

Common vehicle types include:

- Heavy Trucks
- Light Trucks
- Passenger Vehicles
- Transit Buses
- Motorcycles

Common off-road vehicle types include:

- Agricultural Equipment
- Construction Equipment
- Utility Vehicles
- Locomotives
- Ships and Boats

Use the list above to identify what vehicles and equipment were used in your inventory year and work with your MPO to identify every vehicle and equipment type for which you can obtain data. Unlike government operation inventories, model year data is not typically available for community inventories, and is therefore not gathered.

Note: Emissions from electric vehicles will be considered Scope 2 emissions. Electric vehicles run on batteries charged by electricity consumed at a building or stationary source. This power is typically bundled into the residential, commercial and industrial power provided by the utility. Be careful not to double count the power used to recharge your electric vehicles in both your transportation and residential, commercial and industrial sectors. The best way to ensure that you are not double counting is to subtract the power consumed by your electric vehicles from the appropriate residential, commercial and industrial sector and count it in the transportation sector. In most cases, this level of detail will not be provided by your utility.

Forms of Transportation Emissions

Emissions from transportation sources take the following forms:

- Scope 1 CO₂ emissions from the combustion of fossil fuels (gasoline, diesel, natural gas, propane) to power vehicles and equipment
- Scope 1 Methane (CH₄) and Nitrous Oxide (N₂O) emissions from the combustion of fossil and biofuels (gasoline, diesel, natural gas, propane, ethanol and biodiesel) to power vehicles

- Information Item CO₂ from biofuels. The distinction of emissions from biomass fuel and fossil fuel combustion applies only to CO₂³ and not to CH₄ and N₂O, which are also emitted from biomass combustion. This is because no CH₄ or N₂O would have been produced had the biomass naturally decomposed. Therefore, CH₄ and N₂O emissions from biomass combustion should be reported as part of your Scope 1 emissions while biomass CO₂ is an Information Item.
- Scope 2 CO₂, CH₄ and N₂O emissions from purchased electricity used to power electric vehicles

Note: Jurisdictions are not responsible for accounting for emissions that result from life cycle impacts of biofuels (i.e., growing of crops or producing the biofuels).

Note: Communities typically are not able to estimate fugitive emissions from refrigerants. If your community has access to this data, ICLEI encourages you to inventory these emissions. Due to the complexity of this sort of estimation, ICLEI recommends that communities do not spend large amounts of time trying to gather refrigerant data from the community.

Data on Scope 1 Hydrofluorocarbon (HFC) and other fugitive emissions from the leaking of refrigerants used for air conditioning of vehicles or refrigerated transportation⁴ are not gathered for the community inventory because this data is not widely available.

2.2 General Instructions

Data quality for your transportation emissions will vary by the data availability of your MPO.

Step 1: Identify Key Staff Contacts

Using the *Inventory Data Checklist* located in your *Master Data Workbook*, identify MPO and local government staff with knowledge of community VMT. If your jurisdiction employs a fleet manager, this will be a good contact.

Step 2: Identify Available Data

What data your MPO is able to provide will determine the level of detail your transportation inventory will have. Using the list below in Section 2.3, work with your fleet manager or local government staff to determine what data you have available in your inventory year.

³ The biogenic portion of CO₂ emissions are not directly included in the inventory but are recorded as an information item. See Section 6 for more information.

⁴ Leaked refrigerants from mobile sources are not covered in this document since most communities will not be able to gather this data.

Step 3: Gather Data

Please work with the fleet manager or local government staff to gather all necessary data. Whenever possible, save a copy of the data you gathered **in its original form** in the *VMT-Raw Data* tab or the *Off-Road Fuel Raw Data* tab in the *Master Data Workbook*.

Again, it is vital to take detailed notes of the data gathering process, including data sources, any problems with the data, and estimates made. As you gather data, use the *Inventory Log* tab as well as the spaces within each final data entry tab as places for these notes and sources.

Step 4: Enter Data into the Master Data Workbook

As you gather the necessary raw data, you should save it in your *Master Data Workbook* in the *VMT-Raw Data* for on-road highway local road VMT estimates. Use the *Off-Road Fuel Raw Data* tab for any estimates of fuel used in agricultural equipment, agricultural equipment, etc. Please see Section 2.4 for more information on working with the *Master Data Workbook*.

Step 5: Perform Quality Control Check (QC) on Master Data Workbook

Once you have completed all of the transportation tabs in the *Master Data Workbook* and your transportation section is complete, you must perform a final review of all data to ensure accuracy. At ICLEI we have set up a “buddy system” where staff QC each others’ work – setting up a similar system would be worthwhile.

2.3 What Data Need to be Collected?

At the most basic level, data on vehicle miles travelled by fuel type and vehicle type need to be collected. The level of detail that you can obtain will depend on the studies conducted by your local MPO. Where possible, gather data from gasoline and diesel burning vehicles on your highways and local roads since these will make up the bulk of your emissions.

In some cases, communities have been able to work with their MPOs to develop regionally specific fuel efficiencies which can help improve the accuracy of your transportation inventory. Emissions calculators that use the methods outlined in the Local Government Operations Protocol will need a fuel efficiency to convert VMT to an amount of fuel consumption in order to calculate CO₂ emissions – the largest contributor in your transportation inventory. Therefore, having local fuel efficiency figures can be useful. ICLEI’s calculation tools employ national average fuel efficiencies if you cannot obtain a local one. Unlike the government operations inventory, you will need only one data point for highway and local roads: VMT.

Scope 1 CO₂, CH₄ and N₂O emissions from the combustion of fossil fuels (gasoline, diesel) to power vehicles

Introduction

Carbon Dioxide (CO₂), Methane (CH₄) and Nitrous Oxide (N₂O) are potent greenhouse gases that are emitted from the combustion of fuels to run vehicles. In order to accurately report emissions, you will need to gather data related to the number of miles traveled by various vehicle types on roadways within the jurisdiction boundary. Unlike other sectors, these emissions calculations will not strictly follow recommended methods outlined in the LGO Protocol since we do not have direct measurements of fuel consumption, only estimates of VMT based on MPO studies or other models. Once we have obtained VMT estimates, we will utilize LGO Protocol factors and alternate methods where applicable.

Table 2.1: Data needed for inventory of community CO₂, CH₄ and N₂O emissions from vehicles

Required Data	Optional Data
Miles traveled by vehicle type, and fuel type	Number of vehicles of each type and model year by fuel type
Data Source contact information	Regional fuel efficiency for each type of fuel type and vehicle type

Carbon Dioxide Calculations

In the community inventory, we are not able to use the LGO Protocol recommended method of directly applying an emissions factor to an empirical amount of fuel consumed to calculate CO₂. Instead, we rely on vehicle miles travelled and a fuel efficiency factor to estimate fuel consumed. We then apply an emission factor for CO₂ output.

Since our emissions factors are in the units of kg CO₂ per gallon of fuel, we must convert the VMT figures we get from our local MPO into an amount of fuel. This is done by dividing VMT by ***fuel efficiency*** (miles driven in a vehicle per gallon of fuel). ICLEI's CACP 2009 software contains default national average fuel efficiencies by vehicle type. These fuel efficiencies are applied to an amount of VMT per fuel type, resulting in an amount of fuel which is then used to calculate CO₂.

The calculation is as follows:

Emissions from Vehicle Type A = $\text{VMT \{Vehicle Type A\}} \div \text{Fuel Efficiency \{Vehicle Type A\}} \times \text{CO}_2$
Emission Factor = CO_2 Emissions for Vehicle Type A

Nitrous Oxide and Methane Calculations

Nitrous oxide and methane emissions are calculated directly from VMT in terms of grams per mile. No conversions from VMT are necessary to calculate these gases and no regional fuel efficiencies are used.

Regional Fuel Efficiency

Since our emission calculations for CO_2 at the community level rely on a conversion from VMT to fuel consumption based on fuel efficiency, you have the option to using a region specific fuel efficiency to get a tailored picture of local CO_2 emissions. In some cases, MPOs have performed studies and have this kind of data. In California, the Air Resources Board's (ARB) Emissions FACtor (EMFAC) model⁵ may be able to provide you with regional fuel efficiencies. Note that ICLEI's CACP 2009 software contains national averages for fuel efficiency and that regional numbers are optional.

Information Item and Scope 1 CO_2 emissions from biofuel blends (e.g., blends of ethanol or biodiesels with fossil fuels such as E85, B20, etc.) to power vehicles and equipment

To calculate CO_2 emissions from community biofuel usage, it is necessary to gather data on VMT driven and biomass-based fuel in each blend. For example, if you are using B20 biodiesel, your consumption will be 20% biodiesel and 80% diesel fuel. In the *Master Data Workbook*, you will want to itemize amounts of VMT for the component parts of the biofuels. For example, 100 miles travelled of B20 by a light truck would be split as 20 miles travelled with B100 and 80 miles travelled with diesel fuel in a light truck⁶. You will then separately calculate and report your anthropogenic CO_2 (Scope 1) emissions from fossil fuels and biogenic CO_2 (Information Item)⁷ emissions.⁸

CO_2 from B100 and E100 is an Information Item. CO_2 from diesel and gasoline is a Scope 1 emission.

Other than this distinction, the data required to calculate CO_2 emissions from biofuels is the same as the data required for strictly fossil fuels – VMT data. Likewise, you may choose to use a regional fuel efficiency for each biofuel.

⁵ For more on ARB's Emission FACtor model, go to http://www.arb.ca.gov/msei/onroad/latest_version.htm

⁶ Note that this is a rough estimation. Fuel efficiencies for biofuels vary from diesel or gasoline and so a 20% biodiesel blend may not equate to 20% of the miles driven. To get a more accurate amount of vehicle miles travelled for each fuel, you can apply a weighted average with the percent blend and the fuel efficiency of each fuel.

⁷ The biogenic portion of CO_2 emissions are not directly included in the inventory but are recorded as an information item. See Section 6 for more information.

⁸ In CACP 2009 v3.0, CO_2 emissions from biogenic fuels are automatically classified as Information Items. Previous versions of CACP 2009 require additional steps to make this distinction.

Note that fuel efficiencies for biofuels are different than fossil fuels and so breaking out the VMT by percent of the fuel blend is only a rough estimate. For more accurate results, use a weighted average.

Table 2.2: Data needed for inventory of biofuel CO₂ emissions from vehicles and mobile equipment

Required Data	Optional Data
VMT for each type of biofuel blend by vehicle type	Number of vehicles and equipment by type
Blend type – Percent fossil and percent biogenic	Regional fuel efficiency for each type of fuel type and vehicle type
Data source contact information	

Scope 1 CH₄ and N₂O emissions from the combustion of biofuels (ethanol and biodiesel) to power vehicles

Nitrous oxide and methane emissions are calculated directly from VMT in terms of grams per mile. No conversions from VMT are necessary to calculate these gases and no regional fuel efficiencies are used.

The data gathering requirements for calculating N₂O and CH₄ from biofuels are exactly the same as the data requirements for fossil fuels. Once you have obtained VMT data for your biofuels, you will then need to break this out into its fossil and biogenic components. For example, if you are using B20 biodiesel, your consumption will be 20% biodiesel and 80% diesel fuel. Make sure that you have separated the fossil and biogenic portions of each fuel before entering a total amount of 100% ethanol (E100) or 100% biodiesel (B100) in the *VMT-Final Data* tab. Record the fossil portion of the fuel as well.

Table 2.3: Data needed for inventory of CH₄ and N₂O emissions from vehicles

Required Data	Optional Data
VMT for each type of biofuel blend by vehicle type	Number of vehicles and equipment by type
Blend type – Percent fossil and percent biogenic	Regional fuel efficiency for each type of fuel type and vehicle type
Data source contact information	

Scope 2 CO₂, CH₄ and N₂O emissions from electric vehicles and equipment

Carbon dioxide CO₂, methane (CH₄) and nitrous oxide (N₂O) are potent greenhouse gases that are emitted from electricity producers which in turn power electric vehicles. In order to use the recommended methods from the LGO Protocol, you will need to gather data on the amount of power consumed by the recharging of your electric

vehicles. Like other transportation emission types, this will depend on the availability of electric vehicle information from your MPO or other relevant organization. Make sure to use the grid average electricity coefficients from your local utility.

If you or your MPO has data on the amount of VMT travelled by electric vehicles, be sure to convert this VMT into an amount of electricity consumption using a fuel efficiency factor. Once you have the total amount of electricity consumed, make sure to record this consumption as a Scope 2 source in your transportation sector. Doing so in both residential and transportation will double count these emissions. Note that when your utility provides you with electricity consumption data, the electricity consumed by electric vehicles will likely be bundled in with other consumption.

Note that most communities will not have data on electric vehicles.

Table 2.4: Data needed for inventory of emissions from electric vehicles

Required Data	Optional Data (For Greater Accuracy)
Amount of power consumed	Number of vehicles and vehicle type
Data Source contact information	Amount of power used by vehicle type

2.4 Using the Master Data Workbook

There are seven transportation emissions tabs in the *Master Data Workbook*:

VMT- Final Data

This tab is for recording all final VMT from any on-road vehicles that will be included in your community inventory. The data inputs are located under the “Required Inputs” columns, as are the data source fields where you can record data sources. Under “Indicator Inputs (Recommended)”, there is a column for the number of vehicles on the road. Feel free to add other indicators that you feel might be useful when you are reporting your emissions. If the number of rows is not adequate, feel free to insert rows into the tab so you can add records. This tab is also used to input data on biofuel consumption in the community.

VMT-Final Data Transport %

This tab is a place to help you break out your VMT data if it has been given to you in one lump sum for all vehicle types and fuel types. Use this tab to help track the fuel type and vehicle types that make up an aggregate amount of VMT. This tab will not be needed if your MPO can give you VMT figures by fuel type and vehicle type. Once you

have entered the total Amount VMT, and the Percentage of Total VMT, use these two numbers to determine the Calculated VMT based on %. If you are using CACP 2009, the software will automatically calculate VMT based on the Total VMT and the percentages you assign to each vehicle and fuel type in the Transport Assistant.

VMT-Working Data

This tab is a place for you to group, color code, and sort any raw data that that you have entered in the *VMT-Raw Data* tab. Since local governments will obtain data on their transportation VMT in a variety of ways, there is no set format for this tab. Note that the goal is to obtain VMT information for each vehicle type that falls under each fuel type, for example, total VMT for diesel-burning light trucks or total VMT for gasoline-burning passenger vehicles.

VMT-Raw Data

This tab has been created for you to paste all electronic raw data. It is important to include all raw data so it can be clearly demonstrated how data inputted into the final forms were generated. It is important to keep data entered in the *VMT-Raw Data* tab in an undisturbed format devoid of extraneous user groupings, edits or manipulations. You can use the *VMT-Working Data* tab for data organization. If you want to attach the raw data files directly to this tab, do the following:

Go to:

Insert → Object

Create from File > Browse > Insert

Before hitting OK make sure to click “Display as icon” otherwise the document will open up in the Excel tab.

Off-Road Fuel Final Data

This tab is used to house final data on construction and mining equipment, and lawn and garden equipment that burn common transportation fuels like gasoline and diesel, but don’t travel on the roadways and other kinds of off road equipment. Unlike other tabs that record fuel consumption or VMT, this tab houses total amounts of CO₂, N₂O and CH₄ obtained directly from outside studies, or calculated in the *Off-Road Fuel Working Data* tab.

Off-Road Fuel Working Data

This tab is a place for you to group, color code, and sort any raw data that that you have entered in the *Off-Road Fuel Raw Data* tab. ICLEI has organized this tab to include fields for final CO₂, N₂O and CH₄ emissions from light commercial equipment, construction and mining equipment, lawn and garden equipment, and industrial equipment.

These are examples and not a complete list. Feel free to use this *Working Data* tab for any required calculations when gathering your off-road data.

Off-Road Fuel Raw Data

This tab has been created for you to paste all electronic raw data. It is important to include all raw data so it can be clearly demonstrated how data inputted into the final forms were generated. It is important to keep data entered in the *Off-Road Fuel Raw Data* tab in an undisturbed format devoid of extraneous user groupings, edits or manipulation. You can use the *Off-Road Fuel Working Data* tab for data organization. If you want to attach the raw data files directly to this tab do the following:

Go to:

Insert → Object

Create from File > Browse > Insert

Before hitting OK make sure to click “Display as icon” otherwise the document will open up in the Excel tab.

Community Generated Waste

3.1 Introduction

Many communities generate solid waste, much of which is eventually sent to a landfill. Typical sources of waste in a community include paper and food waste from offices and facilities, construction waste, and plant debris, residential food waste, etc. Organic materials in government-generated solid waste generate methane (a greenhouse gas which is twenty-one times more powerful than carbon dioxide) as they decay in the anaerobic environment of a landfill. These emissions are not generated in the same year that the waste is disposed, but over a lengthy decomposition period. An estimated 75 percent of this methane is routinely captured via landfill gas collection systems (where collection systems exist); however, a portion escapes into the atmosphere, contributing to the greenhouse effect.

While waste generation is considered a Scope 3 emissions source, ICLEI stresses that waste generation is an important part of any community inventory and recommends that it be included in your inventory.

Forms of Waste Generation Emissions

Emissions from waste generation take the form of Scope 3 CH₄ fugitive emission from the decomposition of organic material that is collected via the community solid waste stream. These emissions do not have to be measured at a particular landfill, but are rather estimated based on decay rates applied to the amount of waste collected in the baseline year.



3.2 General Instructions

To gather community waste generation data, you may have to contact the waste hauler operating in your community. In most cases, you will obtain an amount of waste in short tons. Be sure to ask about the make-up of that waste – how much of it is made up of paper products, food waste, plant debris, wood or textiles and all other (non organic) waste.

Step 1: Identify Key Staff Contacts

Using the *Inventory Data Checklist*, located in your *Master Data Workbook*, identify staff with knowledge of community-generated solid waste. If local government staff are unable to provide you with waste generation data

for the inventory year, request the contact information of the waste hauler. In many cases waste hauling is contracted out by local governments.

Step 2: Identify Available Data

Identify what data is available and where there may be gaps in the data.

Step 3: Gather Data

Work with the waste hauler or department staff to gather all necessary data. Wherever possible, save a copy of the data you gathered in its original form. This data will be saved in the *WG-Solid Waste Raw Data* tab in the *Master Data Workbook*.

Again, it is vital to take detailed notes of the data gathering process, including data sources, any problems with the data, and estimates made. As you gather data, use the Inventory Log tab as well as the spaces within each final data entry tab as places for these notes and sources.

Step 4: Enter Data in the Master Data Workbook

As you gather the necessary raw data, you should save it in your *Master Data Workbook* in the *WG-Solid Waste Raw Data* tab in the *Master Data Workbook*. From your raw data, you will complete the *WG-Solid Waste Final Data* tab. Please see Section 3.4 below for more information on working with the *Master Data Workbook*.

Step 5: Perform Quality Control Check (QC) on Master Data Workbook

Once you have completed the working and final tabs in the *Master Data Workbook*, and your waste generation emissions section is complete, you should perform a final review of all data to ensure accuracy. At ICLEI we have set up a “buddy system” where staff QC each others’ work – setting up a similar system would be worthwhile.

3.3 What Data Need to be Collected?

The emissions from waste generation do not result at the point of waste generation (as with fuel combustion), but in a landfill which may be located outside of the local community’s jurisdictional boundaries. The emissions are not generated in the same year that the waste is disposed, but over a lengthy decomposition period. ICLEI utilizes LGO Protocol data collection and calculation methods based upon previous experience and national standard calculation methods like EPA’s Waste Reduction Model (WARM) model⁹.

Table 3.1 Data needed for waste generation

⁹ http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html

Required Data	Optional Data
Amount of waste sent to a landfill during the inventory year	Community population
Waste Characterization	
Data Source contact information	

Waste characterization – the percentage of waste that is paper, food, plant debris, wood/textile or ‘other’ - has been provided by ICLEI through a California Integrated Waste Management Board study. These default percentages can be found in the *WG-Solid Waste Final Data* tab of the *Master Data Workbook*.

3.4 Using the Master Data Workbook

In order to conduct an inventory of greenhouse gas emissions resulting from solid waste, one must determine the amount of waste that is sent to a landfill in the inventory year. The waste generation tabs provide tables for tracking annual waste production by weight (tonnage) per facility.

There are two waste generation tabs in the *Master Data Workbook*:

WG-Solid Waste Final Input Data

This tab is used to consolidate all data from the *WG-Solid Waste Raw Data* tab. This tab does not generate any new calculations; it simply represents data from the previous tabs in one central location.

WG-Solid Waste Raw Data

This tab is a bin for cataloguing any raw, unprocessed data. It is advisable that you use this tab for saving all of the files that you may receive in the process of gathering your waste disposal information and that you never manipulate the data in this tab so as to preserve accuracy.

Troubleshooting - Inserting & Deleting Rows: We encourage you to insert as many rows as are needed for a given facility or waste group. When inserting new rows it is best to do so at the middle of the set that you are working with – if you insert a new row at the very bottom of a sub table it may not be included in the subtotal calculation for that table.

Wastewater Treatment Facilities

4.1 Introduction

Wastewater treatment is a source of both methane (CH₄) and nitrous oxide (N₂O) emissions, created by septic systems and centralized wastewater treatment operations. The volume of these emissions may be far less than the carbon dioxide (CO₂) released in plant operations, but the gases themselves have a higher global warming potential. Methane is a greenhouse gas twenty-one times more powerful than CO₂, while nitrous oxide is 310 times more powerful than CO₂.

ICLEI has created wastewater emissions calculators in the *Master Data Workbook* to guide you through the complex process of determining which emissions apply to your local government's wastewater operations, and what data you need to collect to calculate emissions. These instructions describe the various types of emissions, the necessary data, and process that local governments will need to go through to complete the wastewater portion of their inventories.

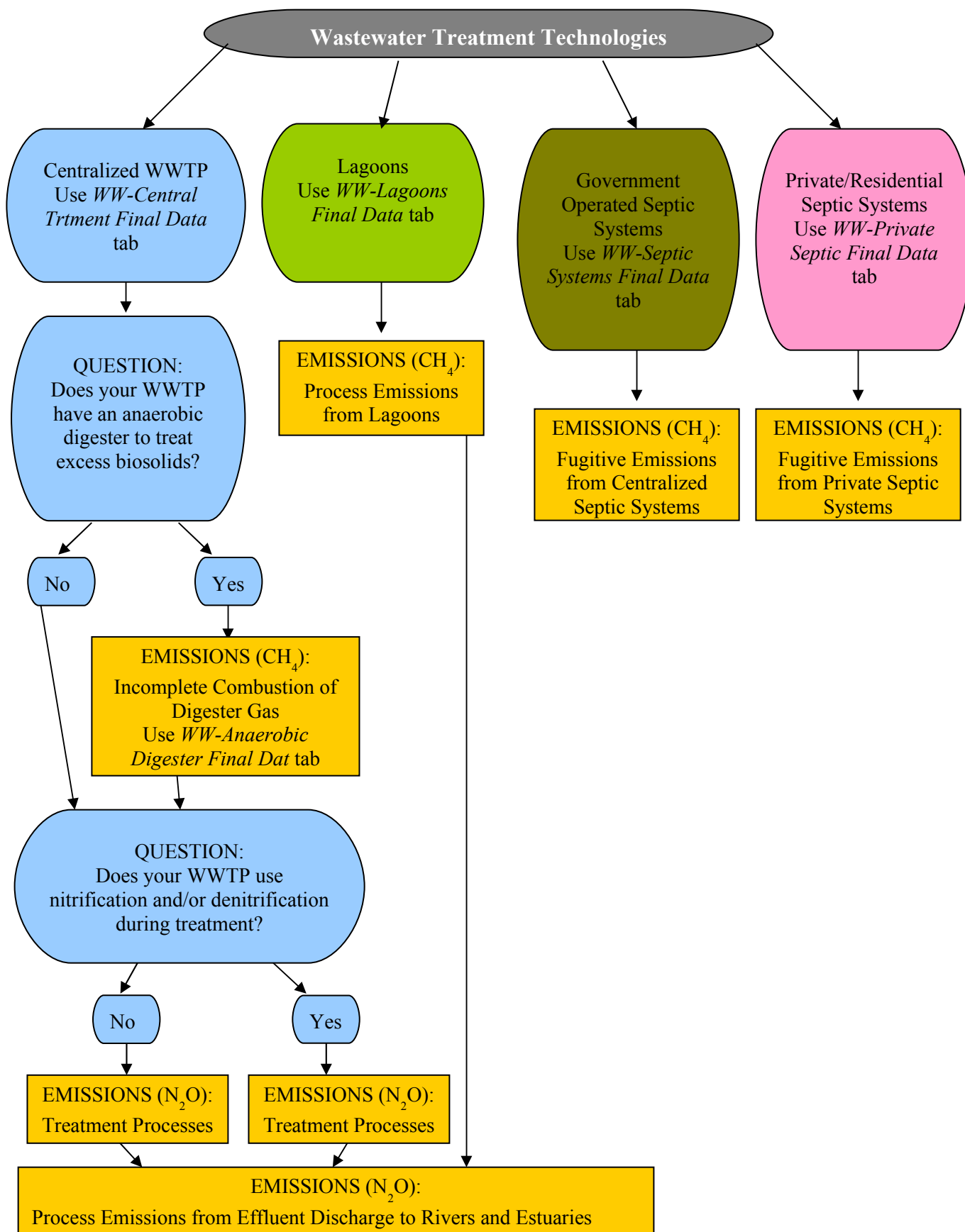
On the community level, power consumed to operate your wastewater facilities will be bundled with energy consumption from your residential, commercial and industrial sectors. Any electricity, natural gas or other fuel consumed to power your wastewater treatment facility should be included in the Industrial sector.

4.2 Does Your Local Government Need to Inventory Emissions from Wastewater?

The first step is determining whether or not emissions from wastewater treatment need to be inventoried in your community. You should include wastewater emissions if your community has a wastewater treatment facility located within your community boundary - regardless of who operates it or what communities it services.

See below for a decision tree illustrating what emissions you will need to inventory based on the types of wastewater treatment processes your wastewater treatment facility employs.

Figure 4.1 Wastewater treatment decision tree



4.3 Inventorying Emissions from Wastewater Treatment

Wastewater Treatment Plant Inventory Process

Step 1: Identify Community Wastewater Treatment Centers and Key Contacts

Determine if your community contains any wastewater treatment centers. Wastewater treatment centers that do not reside within your community boundary do not need to be counted in this inventory. Some communities have opted to include emissions from wastewater facilities which service their residents but which reside in other communities.

Step 2: Identify Available Data

Identify what data is available and where there may be gaps in the data.

Step 3: Collect Necessary Data

If you have determined that your jurisdiction needs to inventory emissions from wastewater treatment, there are certain steps to follow. Even though there are many types of emissions from wastewater treatment, there are relatively few data points needed to effectively calculate emissions. The wastewater emissions calculators contained in the *Master Data Workbook* are designed to walk you through the process of figuring out what data you need to collect with these instructions as a guide. Use the workbook tools to determine which types of emissions are necessary to inventory.

As you collect the necessary data, it is vital to record the data sources, contacts, and any assumptions or estimations you have made in collecting the data

Step 4: Enter Data in the Master Data Workbook

As you gather the necessary raw data, you should save it in the *WW-Raw Data* tab in the *Master Data Workbook*. From your raw data you will complete the *Final Data* tabs for each wastewater treatment process.

Step 5: Perform Quality Control Check (QC) on Master Data Workbook

Once you have completed the working and final tabs in the *Master Data Workbook*, and your wastewater emissions section is complete, you should perform a final review of all data to ensure accuracy. At ICLEI we have set up a “buddy system” where staff QC each others’ work – setting up a similar system would be worthwhile.

Forms of Wastewater Treatment Plant Emissions

Emissions from wastewater treatment plants take the following forms (all emissions except for electricity are Scope 1; electricity consumption is a Scope 2 emission):

Table 4.1 Wastewater emission sources

Wastewater Treatment Process Emissions Sources
Incomplete Combustion of Digester Gas
Anaerobic and Facultative Lagoons
Wastewater Treatment Process (Nitrification/Denitrification)
Effluent Discharged to Aquatic Environments
Fugitive Methane

4.4 What Data Need to be Collected?

The LGO Protocol provides methods for calculating emissions from centralized community wastewater treatment and from private septic systems. These methods depend upon the type of wastewater treatment used in the plant and whether site-specific data are available. If the site-specific data are not available, you can use the default/general method which makes estimates based on default values for the wastewater data and the population that the wastewater treatment plant serves. The wastewater calculators in the *Master Data Workbook* will guide you through choosing what emissions are required to inventory, which method you will be able to use, and which data are required for the appropriate method.

Note that the electricity, natural gas and other power used to run wastewater facilities should have been gathered in the Residential, Commercial and Industrial sections through contact with your power utility. In your community inventory, you will not be required to itemize the power used to run your wastewater treatment facilities. Likewise, methane that is gathered from wastewater treatment facilities and burned to generate power will be covered in the Power Generation section of this document. Emissions from power generation are typically either itemized in community inventory reports, or bundled into the Industrial sector.

Private/Residential and Government Operated Septic Systems

If you have a government owned or operated septic system network, you will need to inventory emissions from this system using site-specific data (see below). See the *Master Data Workbook* for more details on what data you need to collect to inventory these emissions). If your community residents use septic systems for their homes, and your

government owned septic system does not have site-specific data, you can estimate the emissions from these systems using the Default Method listed below – namely using the number of people served by the septic system as a data input to estimate the total amount of fugitive methane.

Table 4.2 Septic system data needs

Emissions Source	Site-specific Data Needed	Default Method Data Needed
Fugitive Methane Emissions	BOD ₅ load	Daily population served by the septic system network

Centralized Water Treatment Plants

You may need to inventory emissions from these sources if your local government operates a centralized wastewater facility. Use the *Master Data Workbook* to help determine if you need to inventory these emissions.

Table 4.3 Centralized water treatment plant data needs

Emissions Source	Site-specific Data Needed	Default Method Data Needed
Anaerobic Digestion of Biosolids	Average daily digester gas collected Percent of Methane (CH ₄) in biogas	Population served by the anaerobic digester
Anaerobic and Facultative Treatment Lagoons	BOD ₅ load Percent of overall BOD ₅ removed during primary treatment (if applicable)	Population served by the lagoon
Wastewater Treatment Process Emissions (Denitrification/Nitrification)	None	Domestic population served by the plant Nitrogen released in wastewater by industrial activities
Effluent Discharged to Aquatic Environments	Average daily nitrogen load discharged in effluent	Domestic population served by the plant Nitrogen released in wastewater by industrial activities

Power Generation/Consumption in Wastewater Facilities

The use of biogas to produce power should be included with other power generation information. Emissions from methane flaring (but not used to generate power) should be included with the other wastewater emissions described above.

Table 4.4 Wastewater power generation data needs

<i>Emissions Source</i>	<i>Data Needed</i>	<i>Do you Need to Collect in the Wastewater Sector?</i>	<i>Notes</i>
<i>Energy Used to Power Wastewater Facility</i>	Electricity Consumption	No	Gathered from electric utility in the <i>Industrial</i> sector of inventory
	Natural Gas Consumption		
	Diesel/Other Fuel Consumption	No	Most likely diesel used in backup generators and gathered in RCI sectors
<i>Emitted Methane Flared To Generate Power</i>	Amount of methane flared	Yes	Report in PG-Energy Use Final Data tab in <i>Master Data Workbook</i>
<i>Leaked Refrigerants from HVAC System/Fire Suppressants Used</i>	None	No	Refrigerants are gathered for government operations inventories – but are not typically gathered for community inventories. If you have refrigerant data, add this as a total amount of additional CO ₂ e along with the energy used to power wastewater facilities. There are no tabs in the <i>Community Inventory Master Data Workbook</i> for refrigerants and refrigerant data is not universally gathered in other sections.

4.5 Using the Master Data Workbook

Instead of simply being a data collection form, the wastewater calculators in the *Master Data Workbook* guide you through the process of collecting data and calculating emissions.

Using the Tool

In most wastewater worksheets, the *Master Data Workbook* will ask you for the relevant information needed to determine what data you need to gather. Once you have answered the questions and gathered the information, it will calculate emissions for those sources of greenhouse gases. Simply follow the instructions in each worksheet, answering the questions where indicated, and entering the appropriate data once you have it.

It is essential to record any relevant notes -- please use space provided!

WW-Central Trtment Final Data

This worksheet will guide you through the process of determining what data you need to collect to calculate N₂O emissions from the wastewater treatment facility.

To successfully use the sheet, you will need to know:

- Population served by the wastewater treatment plant
- If you choose **not** to use the default factor for industrial contributions to municipal systems, find information on BOD₅ discharged by industry to the municipal treatment system. ICLEI recommends using the default factor in the calculator.
- Whether the facility uses nitrification/denitrification during the treatment process
- Whether the facility uses aerobic or anaerobic processes during the treatment process
- Whether the facility has site-specific measurements for the daily nitrogen load in effluent discharged to aquatic environments and what the volume and nitrogen concentrations in the discharges are

Follow the instructions and answer the questions as appropriate-your answers will bring up a new instruction in the next box.

Note that this wastewater calculator will ask you to account for industrial discharges into municipal wastewater treatment facilities. ICLEI recommends that you use the default values for adjusting your co-industrial discharge into wastewater treatment facilities if necessary.

WW-Anaerobic Digester Final Data

This worksheet will guide you through the process of determining what data you need to collect to calculate CH₄ emissions from the anaerobic digesters.

To successfully use the sheet, you will need to know:

- Whether your community contains an anaerobic digester to treat excess biosolids
- Whether your wastewater facility tracks biogas data related to the anaerobic digestion process

If site specific data is available, gather:

- Measured standard cubic feet off digester gas produced per day
- Fraction of CH₄ in digester gas

If site specific data is not available, gather:

- Population served by anaerobic digesters

Follow the instructions and answer the questions as appropriate - your answers will bring up a new instruction in the next box.

WW-Lagoons Final Data

This worksheet will guide you through the process of determining what data you need to collect to calculate CH₄ emissions from anaerobic and facultative lagoons.

To successfully use the sheet, you will need to know:

- Whether your community contains an anaerobic or facultative lagoon to treat wastewater
- Whether your wastewater facility tracks BOD₅ load data related to the lagoons

If site specific data is available, gather:

- Influent into wastewater treatment process as an amount of BOD₅ produced per day
- Fraction of BOD₅ removed in primary treatment

If site specific data is not available, gather:

- Population served by wastewater treatment lagoons
- If you choose **not** to use the default factor for industrial contributions to municipal systems, find information on BOD₅ discharged by industry to the municipal treatment system. ICLEI recommends using the default factor in the calculator.

Follow the instructions in column A and answer the questions in green boxes as appropriate-your answers will bring up a new instruction in the next box.

Note that this wastewater calculator will ask you to account for industrial discharges into municipal wastewater treatment facilities. ICLEI recommends that you use the default values for adjusting your co-industrial discharge into wastewater treatment facilities if necessary.

WW-Septic Systems Final Data

This worksheet will guide you through the process of determining what data you need to collect to calculate fugitive CH₄ emissions from government operated septic systems.

To successfully use the sheet, you will need to know:

- Whether your jurisdiction operates a network of septic systems

If you have site specific data, gather:

- Amount of BOD₅ produced per day

If you do not have site specific data, gather:

- Population served by septic systems

Follow the instructions and answer the questions as appropriate-your answers will bring up a new instruction in the next box.

WW-Private Septic Final Data

This worksheet will guide you through the process of determining what data you need to collect to calculate fugitive CH₄ emissions from private residential operated septic systems.

To successfully use the sheet, you will need to know:

- Population served by septic systems

Follow the instructions and answer the questions as appropriate-your answers will bring up a new instruction in the next box.

WW-Raw Data

This tab has been created for you to paste all electronic raw data. It is important to include all raw data so it can be clearly demonstrated how data inputted into the final forms were generated. If you want to attach the raw data files directly to this tab do the following:

Go to:

Insert → Object

Create from File > Browse > Insert

Before hitting OK make sure to click “Display as icon” otherwise the document will open up in the Excel tab.

Solid Waste Landfills

5.1 Introduction

Along with emissions from fuels combusted and power consumed at the site of the landfill, decomposing organic solid waste in the landfill is a source of methane (CH₄), which is a greenhouse gas twenty-one times more powerful than carbon dioxide (CO₂). While the waste generation methods described in Chapter 3 of this document apply to all communities, the methods described below are only for those communities that have a landfill located within their community border. Communities have the opportunity to reduce the greenhouse gas emissions resulting from solid waste in two ways:

- Increase the methane capture rate of the landfill, and
- Reduce the amount of solid waste that is sent to landfills through reducing the generation of waste, recycling, and composting.

There are two tools that can assist local governments in assessing their emissions related to solid waste depending on their circumstances.

- 1) A landfill emissions calculator for landfills without methane capture (created by the California Air Resources Board, available at <http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm>)
- 2) A tool for landfills with partial or comprehensive landfill capture systems (created by ICLEI)

These instructions describe the various types of emissions, the necessary data, and process that communities will need to go through to complete the solid waste portion of their inventories.

Note that solid waste landfill facilities consume electricity, natural gas and other power to operate and that this energy consumption data gathering is covered in Chapter 1 of this document. Be sure not to double count the power used to run your landfills with data that might be embedded in your Residential, Commercial or Industrial sectors.

How to Determine if Your Community Will Need to Inventory Emissions from Landfills

The first step is determining whether or not emissions from landfills need to be inventoried in your local government. To do this, we must determine if there is a landfill that resides within your community border. If so, this landfill should be included as a Scope 1 source in your inventory regardless of who operates it or what other communities it serves.

If your community **does not** have a landfill within its border, you will **not** need to inventory emissions from landfills.

5.2 Inventorying Emissions from Landfills

Forms of Landfill Emissions

Emissions from landfills take the following forms:

- **Scope 1 CH₄, fugitive emissions from the decomposition of organic solid waste in community landfills**
- **Scope 1 CO₂, CH₄, and N₂O emissions from the combustion of fuels (diesel, natural gas, etc.) to operate landfills**
 - Natural gas consumption in landfills should be included in utility data in order to complete the Residential, Commercial and Industrial portions of the inventory. This source of emissions also includes any diesel generators used to operate landfills. N₂O and CH₄ emissions from biofuels are included here. Note that CO₂ from biofuels – including flared biogas – is an Information Item and should not be included as a Scope 1 source. These emissions should remain with the Residential, Commercial and Industrial sectors.
- **Scope 2 CO₂, CH₄, and N₂O emissions from electricity consumption used to power landfills**
 - Electricity consumption in landfills should be included in utility data in order to complete the Residential, Commercial and Industrial portions of the inventory. These emissions should remain with the Residential, Commercial and Industrial sectors.
- **Information Items from CO₂ produced from combusting captured methane (optional)**
 - Fugitive methane from a landfill is a Scope 1 emission but the CO₂ created from the combustion of this methane (biogas or landfill gas) is an Information Item under the assumption that if the organic matter that originally produced methane had decomposed aerobically, it would naturally have created CO₂.

Note that if your landfills employ equipment like bulldozers, the fuel used by these machines will be classified under Transportation as off-road equipment.

5.3 Landfill Inventory Process

Step 1: Identify Community Landfills and Key Contacts

Determine if your community contains any landfills. Landfills that do not reside within your community boundary do not need to be counted in this inventory. Some communities have opted to include emissions from landfills which service their residents but which reside in other communities.

Step 2: Gather data

Gather data indicated below to calculate Scope 1 fugitive emissions from the landfill. ICLEI has created a Scope 1 fugitive emissions calculator for this purpose.

Step 3: Enter Data Into the Master Data Workbook

As you gather the necessary raw data, you should save it in your *Master Data Workbook* in the landfill tabs provided. From your raw data you will complete the working and final tabs. Please see the Section 1.3 for more information on working with the *Master Data Workbook*.

Again, it is vital to take detailed notes of the data gathering process including data sources, any problems with the data, and estimates made. As you gather data, use the *Inventory Log* tab as well as the spaces within each final data entry tab as places for these notes and sources.

Step 4: Utilize Landfill Emissions Calculators

The inventory coordinator should be prepared to contact landfill operators or other staff for clarification as necessary. The *Master Data Workbook* contains calculators for landfills with partial and comprehensive LFG collection. Go to ARB's website for a copy of their FOD calculator for landfills with no landfill gas collection.
<http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm>

Step 5: Approve Completed Forms

Please make sure all relevant fields are filled out, including the names and titles of data sources, as well as any notes and assumptions that are not already included in the template.

Step 6: Perform a Quality Control Check (QC) on Master Data Workbook

Once you have completed the working and final tabs in the *Master Data Workbook*, and your landfill emissions section is complete, you should perform a final review of all data to ensure accuracy. At ICLEI we have set up a "buddy system" where staff QC each others' work – setting up a similar system would be worthwhile.

5.4 What Data Need to be Collected?

The Local Government Operations Protocol provides methods for calculating Scope 1 and 2 emissions from landfills. These methods depend upon the presence and type of landfill gas (LFG) collection system located in the landfill.

- **Scope 1 CH₄, fugitive emissions from the decomposition of organic solid waste in community landfills**

Landfills with partial or comprehensive LFG collection systems:

If your local community contains a landfill that has a partial or comprehensive LFG collection system, you can calculate emissions based upon the amount of landfill gas collected. A comprehensive LFG system covers the entire area of the landfill, while a partial system covers a portion of the landfill area.

Table 5.1 Data needs for landfills with comprehensive LFG collection system

<i>Required Data</i>	<i>Notes</i>
Landfill gas collected (million standard cubic feet)	
Percent of methane in collected landfill gas	National default available (.5)
Methane destruction efficiency of LFG collection system	National default available (.99)
Methane soil oxidation factor	National default available (.10)
Area of landfill covered by LFG collection system	<i>For partial systems only</i> , measure in same units as area not covered by LFG system
Area of landfill <u>not</u> covered by LFG collection system	<i>For partial systems only</i> , measure in same units as area covered by LFG system

Landfills with no LFG collection systems:

For older, smaller landfills with no landfill gas collection systems, methane emissions will be estimated using the First Order Decay (FOD) model created by the California Air Resources Board. This calculator is available on the CARB website at: <http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm>

Unlike emissions from fuel combustion which are traced only as far back as the point at which they were burned, methane from landfills is emitted from waste deposited decades before. The FOD model for landfills with no LFG collection systems requires data inputs of historical solid waste deposition data over the life of the landfill, along with waste characterization information (what types of waste were deposited). Emissions factors and decay rates are applied to each type of waste in order to estimate the methane contribution on the inventory year from each year's waste deposition.

The ARB calculator is a stand-alone Excel document. Use it to calculate and store your emissions estimates from landfills with no landfill gas collection.

Table 5.2 Data needs for landfills with no LFG collection system

<i>Required Data</i>	<i>Notes</i>
Wet mass and characterization of solid waste deposited into landfill for <i>each year</i> from the opening of the landfill to the inventory year	Mass can be estimated based upon incomplete deposition data and historical population figures for the solid waste shed. Characterization can be estimated using defaults.
Wet mass and characterization of alternative daily cover deposited into landfill for <i>each year</i> from the opening of the landfill to the inventory year	Mass can be estimated based upon incomplete deposition data and historical population figures for the solid waste shed. Characterization can be estimated using defaults.
Average annual rainfall for <i>each year</i> from the opening of the landfill to the inventory year	Regional data available through NOAA from 1895 to 2008
Percent of methane in collected landfill gas	National default available (.5)

5.5 Using the Master Data Workbook

This section is provided to assist you in completing the data forms in the *Master Data Workbook* on Solid Waste.

SWL-Landfill Final Data

This tab is a calculator that will estimate your landfill emissions if your community contains a landfill with a partial or comprehensive landfill gas collection system. Even if you use all the default values given to you in the calculator, be sure to fill out the surface area covered (or not) by a landfill gas collection system at this particular landfill. If you have more than one landfill, copy the *SWL-Landfill Final Data* worksheet and add the relevant information for this additional landfill. Each landfill will need to have its emissions calculated and stored in a different worksheet. Be sure to take detailed notes and add these notes in the fields provided.

SWL-Landfill Raw Data

This tab is a place to store all the original data you receive regarding solid waste landfills. Information added here should not be altered from its original state. This will serve as a record and a key element in the QC process of your inventory. Once data is entered here, it can be copied and pasted into the *SWL-Landfill Final Data* tab.

Power Generation Facilities

6.1 Introduction

Communities that contain large combustion facilities may burn a number of fuels to produce electricity and/or heat and steam: coal, oil, natural gas, biomass, municipal solid waste, etc. Combustion of these fuels for energy emits the following greenhouse gases: CH₄, N₂O, and CO₂.

ICLEI has created a data collection form to assist local governments in assessing their emissions related to power generation. These instructions describe the various types of emissions, data needs, and the process that communities will need to go through to complete the power generation facilities portion of their inventories.

Power generation facilities are a “Facility” and instructions on gathering data for the power used to run the facility are covered in Chapter 1 of this document. Data for the energy consumed to operate your power generation facility may come from the local power utility. If this is the case, be sure not to double count this consumption since it will likely be bundled into your Residential, Commercial and Industrial sector data. Energy used to operate the power generation facility should not be included with emissions from fuels combusted to generate power that is sold or distributed by the power generation facility.

Determining if you need to inventory emission from power generation facilities

If a power generation facility is located within your community boundary, these emissions should be included in your community inventory.

6.2 Inventorying Emissions from Power Generation Facilities

Forms of Power Generation Emissions

Emissions from power generation facilities take the following forms:

- **Scope 1 CO₂, CH₄, and N₂O emissions from the combustion of fuels (coal, oil, natural gas, biomass (N₂O and CH₄ only), etc)**
- **Scope 1 fugitive emissions: SF₆ from electricity transmission and distribution systems; CH₄ from fuel handling, storage, and transmission distribution**
- **Scope 2 CO₂, CH₄, and N₂O emissions from transmission and distribution losses**
- **Information Item CO₂ emissions from biomass and municipal solid waste combustion**

Power Generation Facilities' Inventory Process

Step 1: Identify Key Staff Contacts

Using the *Inventory Data Checklist*, located in your *Master Data Workbook*, identify staff with knowledge and access to data on all fuels used for power generation. Record this information in the *Inventory Data Checklist*.

Step 2: Identify Available Data

What data your power generation facility is able to provide will determine which LGO Protocol recommended method you will use to determine the emissions from your community's power generation. Once you have determined what data is available and where there may be gaps in the data, consult Section 1.3 on how to enter the data in the *Master Data Workbook*.

Step 3: Gather Data

Based upon the method you select, please work with the power generation facilities manager or relevant local government department staff to gather all necessary data. Wherever possible, please save a copy of the data you gathered in its original form. This data will be saved in the *PG-Raw Data* section of the *Master Data Workbook*.

Again, it is vital to take detailed notes of the data gathering process including data sources, any problems with the data, and estimates made. As you gather data, use the *Inventory Log* tab as well as the spaces within each final data entry tab as places for these notes and sources.

Step 4: Enter Data into the Master Data Workbook

As you gather the necessary raw data, you should save it in your *Master Data Workbook* in the power generation facilities tabs provided. The tabs include: *PG-Energy Use Final Data*, *PG-CEMS Final Data*, *PG-Waste Fuels Final Data*, *PG-SF₆ Final Data*, *PG-T&D Loss Final Data*, *MPG-Fugitive CH₄-N₂O Data*, *PG-Raw Data*. From your raw data entered in *PG-Raw Data*, you will complete the Final Data tabs. Please see Section 1.3 for more information on working with the *Master Data Workbook*.

Step 5: Perform Quality Control Check (QC) on Master Data Workbook

Once the data collection section is complete, you should perform a final review of all data to ensure accuracy. At ICLEI we have set up a "buddy system" where staff QC each others' work – setting up a similar system would be worthwhile.

6.3 What Data Need to be Collected?

- **Scope 1 CO₂, CH₄, and N₂O emissions from the combustion of fuels**

To quantify Scope 1 stationary fuel combustion in power generation facilities, local governments should use one of the following two methods:

1) **Measurement-based methodology:**

Power generation facilities that report CO₂ emissions to the U.S. EPA and other agencies will have a continuous emissions monitoring system (CEMS) that track CO₂ emissions. It is recommended that CEMS data be used when available.

2) **Fuel use calculation-based methodology:**

In the absence of a CEMS for CO₂, and for calculating CH₄ and N₂O, a community should calculate emissions by following a six step process:

- Determine annual consumption of each fuel combusted at your power generation facility
- Determine the appropriate CO₂ emission factors for each fuel
- Determine the appropriate CH₄ and N₂O factors for each fuel
- Calculate each fuel's CO₂ emissions
- Calculate each fuel's CH₄ and N₂O emissions
- Convert CH₄ and N₂O emission to CO₂ equivalent and determine total emissions.

Specific data requirements for each step are detailed below in the sections relating to tabs in the *Master Data Workbook*.

- **Scope 1 fugitive emissions: SF₆ from electricity transmission and distribution systems; CH₄ from fuel handling, storage, and transmission distribution**

Fugitive emissions are those not physically controlled, but result from intentional or unintentional release of greenhouse gases. In regards to power generation and distribution, fugitive emissions commonly arise from joints, seals and gaskets, and during the handling and storage of fuels.

Fugitive SF₆ emissions from electricity transmission and distribution systems can be the result of routine operations and maintenance, the use of older equipment, or can escape when equipment is disposed of or stored. Fugitive SF₆ emissions can be calculated using the mass balance method as outlined in the worksheet instructions below.

Fugitive CH₄ emissions are generated from the release of methane from coal as it is processed (mined, transported, and stored) into fuel, from the transmission and storage of natural gas, and from the storage of biofuels. While there are currently no standardized methodologies for calculating these emissions sources, the LGO Protocol encourages local governments to use best practices to estimate emissions from these sources.

- **Scope 2 CO₂, CH₄, and N₂O emissions from transmission and distribution losses**

If communities purchase (rather than generate) electricity and transport it through a transmission and distribution system that is located within their community boundary, these emissions should be reported under Scope 2 and recorded as electricity consumed.

- **Biogenic emissions from biomass and municipal solid waste combustion**

Biofuels such as landfill gas, biosolids, wood, and wood waste may be combusted in addition to fossil fuels. CO₂ emissions from biomass combustion are reported separately from the scopes as Information Items. However, CH₄ and N₂O emissions from biomass are included in Scope 1 emissions. Similarly, for those utilities that combust municipal solid waste, CO₂ emissions resulting from the incineration of waste of fossil fuel origin (plastics, rubber, etc) are included in Scope 1 emissions, whereas CO₂ emissions resulting from the incineration of waste of biomass origin should be reported separately as biogenic Information Item emissions (this can be calculated from local waste characterization or other methodologies).

6.4 Using the Master Data Workbook

Many of the cells in the power generation *Master Data Workbook* sheets are protected. If you need to access certain cells that are protected please contact ICLEI for assistance. One function that is not limited is the insertion and deletion of most rows. We encourage you to insert as many rows as are needed to capture all of the power generation facilities within the jurisdiction boundary. When inserting new rows, it is best to do so at the middle of the set that you are working with – if you insert a new row at the very bottom of a sub table it may not be included in the subtotal calculation for that table.

PG-Energy Use Final Data

This worksheet allows the user to enter Scope 1 fuel use by fuel type and power generation facility. If you do not have a continuous emissions monitoring system (CEMS), this is the primary sheet that you will be working with. This is also the sheet that you will use to calculate CH₄ and N₂O; even for facilities that track CO₂ with a CEMS (most CEMSs do not track CH₄ or N₂O.)

This tab requests the following information:

- Name and contact information of the person completing the form
- Name and contact information of any individuals involved in gathering various data points
- Fuel purchases / acquisitions per facility and fuel type
- Fuel sales / distributions per facility and fuel type
- Fuel stock at beginning of inventory year per facility and fuel type
- Fuel stock at end of inventory year per facility and fuel type
- A check box identifying whether or not a given fuel is a biofuel or not (biofuel consumption should be included in this worksheet)
- Annual fuel costs
- Indicator inputs (optional)

This worksheet calculates fuel consumption based upon the difference of fuel acquisitions and fuel distributions, as well as the difference between fuel stocks at beginning and end of the inventory year. If you use the fields for “Fuels Consumed During Operations” be sure not to double count data if it is included in your utility data for the Residential, Commercial and Industrial sectors.

Please note that it is essential to record any relevant notes -- please use space provided!

PG-CEMS Final Data

This worksheet applies only to Scope 1 measurement-based stationary combustion, or for those communities that use a continuous emissions monitoring system (CEMS) which is used to report CO₂ emissions directly to the U.S. EPA and other agencies.

This worksheet requests the following information:

- Name and contact information of the person completing the form
- Name and contact information of any individuals involved in gathering various data points
- CO₂ emissions monitored and recorded
- CEMS system configuration
- Volumetric flow rate
- CO₂ concentration percent
- Annual unit operating time
- Type of fuel consumed
- If any biofuels are combusted (there is a separate sheet to input these data)
- Total annual cost
- Indicator inputs (optional)

Please note that it is essential to record any relevant notes -- please use spaces provided!

PG-Waste Fuels Final Data

This worksheet is arranged to organize data from facilities combusting municipal solid waste (MSW). As emissions from biomass and fossil-based waste fuels need to be calculated and reported separately, data pertaining to these fuels also needs to be recorded separately.

This worksheet requests the following information:

- Name and contact information of the person completing the form
- Name and contact information of any individuals involved in gathering various data points
- Waste characterization of fuel stock
- Annual waste fuel consumption
- Indicator inputs (optional)

Please note that it is essential to record any relevant notes -- please use spaces provided!

PG-SF₆ Final Data

This worksheet allows you to calculate the SF₆ fugitive emissions associated with electricity transmission and distribution systems using the mass balance method.

This worksheet requests the following information:

- Name and contact information of the person completing the form
- Name and contact information of any individuals involved in gathering various data points
- Type of transmission and distribution system
- Units of inventory
- Data to complete the mass balance method calculation (see below*)

Please note that it is essential to record any relevant notes -- please use space provided!

*Annual Fugitive SF₆ Emissions =

$$I_B - I_E + P - S - C$$

Where:

I_B = the quantity of SF₆ in inventory at the beginning of the year (in storage containers, not in equipment)

I_E = the quantity of SF₆ in inventory at the end of the year (in storage containers, not in equipment)

P = purchases/acquisitions of SF₆. This is the sum of all the SF₆ acquired from other entities during the year either in storage or in equipment, including SF₆ purchased from chemical producers or distributors in bulk, SF₆ purchased from equipment manufacturers or distributors with or inside of equipment, and SF₆ returned to site after off-site recycling.

S = sales/disbursements of SF₆. This is the sum of all the SF₆ sold or otherwise disbursed to other entities during the year either in storage containers or in equipment, including SF₆ returned to suppliers, SF₆ sent off-site for recycling, and SF₆ that is destroyed.

C = change in total nameplate capacity of equipment (Nameplate Capacity of New Equipment – Nameplate Capacity of Retiring Equipment). This is the net increase in the total volume of SF₆-using equipment during the year. Note that “total nameplate capacity” refers to the full and proper charge of the equipment rather than to the actual charge, which may reflect leakage. This term accounts for the fact that if new equipment is purchased, the SF₆ that is used to charge that new equipment should not be counted as an emission. On the other hand, it also accounts for the fact that if the amount of SF₆ recovered from retiring equipment is less than the nameplate capacity, then the difference between the nameplate capacity and the recovered amount has been emitted.

PG-T&D Power Loss Final Data

This worksheet assists in recording Scope 2 emissions associated with transmission and distribution losses from electricity purchased by the community, but not generated within the boundary.

This worksheet requests the following information:

- Name and contact information of the person completing the form
- Name and contact information of any individuals involved in gathering various data points
- Type of transmission and distribution system
- Electricity consumed – usage, units and cost

Please note that it is essential to record any relevant notes -- please use spaces provided!

PG-Fugitive CH₄-N₂O Data

This worksheet will allow you to record your estimations of CH₄ emissions associated with fuel handling and storage. Since there are no current standard methodologies for calculating these emissions sources, please use a best practices estimate and be sure to document your method.

This worksheet requests the following information:

- Name and contact information of the person completing the form
- Name and contact information of any individuals involved in gathering various data points

- Estimated CH₄ emissions
- Units of CH₄ emissions
- Methodology documentation
- Estimated N₂O emissions
- Units of N₂O emissions
- Methodology documentation

Please note that it is essential to record any relevant notes -- please use space provided!

PG-Raw Data

This tab is a place to store all the original data you receive regarding fuel consumption and energy consumption at the power generation facilities as well as other raw data relevant to fugitive emissions and the emissions factors that are used in the Master Data Workbook for these sources. Information added here should not be altered from its original state. This will serve as a record and a key element in the QC process of your inventory. Once data is entered here, it can be copied and pasted into the final data and working data tabs.

Information Items

7.1 Introduction

Information items are emissions sources that, for a variety of reasons, are not included as Scope 1, 2, or 3 emissions in a community inventory. Information Items are optional for reporting, however, in order to provide a more complete picture of emissions, ICLEI encourages communities to quantify and report Information Items.

Forms of Emissions

In this inventory, the following emissions may be included as Information Items:

- CO₂ emissions from combustion of biogenic fuels and the flaring or combusting of landfill gas or biogas
- Carbon offsets and Renewable Energy Certificates

Combustion of Biogenic Fuels/Gases

A common emission type that is categorized as an Information Item is CO₂ (carbon dioxide) caused by the combustion of biogenic fuels, or fuels that are derived from organic substances. These fuels include biodiesel or ethanol mixes, wood, organic solid waste, or other biomass. These fuels are often consumed in vehicles or during power generation and therefore these emissions are most likely to occur in the transportation and power generation sectors.

In addition to biofuels, methane contained in landfill gas or biogas from wastewater operations may be flared or combusted to generate power. The resulting CO₂ emissions are also considered biogenic and therefore are treated as Information Items.

Biogenic CO₂ emissions are Information Items because they are considered equivalent to what would happen in natural processes. Specifically, if the organic fuels were left to decompose in the natural environment, their decomposition would naturally release CO₂ into the atmosphere, where it would then enter back into the carbon cycle. Therefore, when wood or another biogenic fuel is combusted, the resulting CO₂ emissions are akin to natural emissions and should therefore not be considered as human activity-generated emissions.

Important Note: This applies only to CO₂ emissions. CH₄ and N₂O resulting from the combustion of biogenic fuels, would not have occurred naturally. Therefore these emissions are included as Scope 1 emissions in the emissions inventory.

Carbon Offsets/Renewable Energy Certificates

Many entities choose to purchase carbon offsets or Renewable Energy Certificates (RECs) to help offset their greenhouse gas emissions. These are financial mechanisms that commit money to the financing of renewable energy or other carbon-reducing technologies, and are often considered to be “credits” in the emissions inventory. There are currently no verifiable standards for the credibility of these transactions, however, they are a useful measure of how engaged in the credits market your community may be.

7.2 What Data Need to Be Collected?

Combustion of Biogenic Fuels/Gases

As with the combustion of fossil fuels, combustion of organic fuels is measured by applying an emissions factor to the amount of fuel combusted. Therefore, required data include the amount of biofuel or gas combusted. Specific emissions factors for these fuels are available in LGO Protocol.

For biofuel blends, such as B20 or E85, you must first separate the quantity of biofuel from the fossil fuel with which it blended. For example, B20, a common biodiesel blend, is composed of 20 percent biodiesel and 80 percent diesel fuel. Therefore, for every unit of B20 consumed, 80 percent of it should be reported as diesel consumption, and the resulting emissions from the diesel should be categorized as Scope 1. The other 20 percent should be reported as B100 consumption, with the resulting CO₂ emissions reported as Information Items, and the CH₄ and N₂O emissions reported as Scope 1.

Carbon Offsets/Renewable Energy Certificates

In order to estimate the emissions reduced via purchased carbon offsets or RECs, one need gather all information on offsets generated, sold and retired in the base year.

7.3 Using the Master Data Workbook

There is one *Information Items* emissions tab in the *Master Data Workbook*:

Information Items

This tab provides opportunities to report information items related to the combustion of biogenic fuels and the purchase, selling, or retiring of emissions offsets.

The biofuels portion of the *Information Items* tab includes fields for the quantity of fuel consumed, as well as the portion of the fuel that is biogenic (for biofuel blends). The resulting biofuel amount will be used to calculate the CO₂ emissions that will be the information items.

The Carbon Offsets/Renewable Energy Credits (RECs) portion of the *Information Item* tabs includes fields for the offsets generated, sold or retired. Carbon offsets are reported in metric tons of CO₂e, while RECs are generally reported in electricity units (such as kWh). RECs can be converted to emissions by using the appropriate emissions factor for your jurisdiction.

Other Sources

8.1 Introduction

Communities may have a variety of emissions sources that are uncommon, have no national standard calculation methodology, or are not covered by the IEAP or the LGO Protocol. Common other sources include Agriculture, Other Industrial, Rail and Air Travel. ICLEI has included blank worksheets in the *Master Data Workbook* in case your community chooses to quantify emission from these sectors but has not provided detailed guidance here on how to gather data as the methods vary. These sources should be considered optional.

8.2 Inventorying Emissions from Other Sources

Forms of Other Sources

GHG Sources from Agriculture can include, but are not limited to:

- Domesticated Animal Production
- Manure Decomposition and Treatment
- Cropping Practices
- Prescribed Fires
- Fertilizer Application
- Land Use/Land Change
- Forestry

For more information on how to inventory emissions from these sources, see the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry and Other Land Use <http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html>.

GHG Sources from Other Industrial Processes include, but are not limited to:

- Adipic Acid Production
- Aluminum Production
- Ammonia Production
- Cement Production
- HCFC-22 Production

- Iron and Steel Production
- Lime Production
- Nitric Acid Production
- Pulp and Paper Production
- Refrigeration and Air Condition Equipment Manufacturing
- Semiconductor Manufacturing

For links to resources that will help you inventory emissions from these sources, see Chapter 11 of the LGO Protocol <http://www.icleiusa.org/programs/climate/ghg-protocol/local-government-operations-protocol>

GHG Sources from Rail include:

- Electricity used to run locomotives on tracks within the community
- Diesel and other fuels used to run locomotive on tracks located within the community

GHG Sources from Air Travel include:

- Fuel used to power airplanes for trips emanating from an airport that is located within your community boundary
- A percentage of the fuel used to power airplanes from an airport outside of your community boundary based on the proportion of your community residents that use the airport to total airport users. This would be a Scope 3 source since it does not occur in your community boundary but can be a useful number to determine how much your community contributes to regional air travel hubs.

Other Sources Inventory Processes

Step 1: Identify Key Staff Contacts

Using the *Inventory Data Checklist*, located in your *Master Data Workbook*, identify staff with knowledge and access to data on all fuels used for power generation. Record this information in the *Inventory Data Checklist*.

Step 2: Identify Available Data

Once you have determined what data is available and where there may be gaps in the data, consult relevant calculation methodologies for data requirements.

Step 3: Gather Data

Based upon the method you select, work with relevant individuals or organizations to gather all necessary data. Whenever possible, please save a copy of the data you gathered *in its original form*. This data will be saved in the *Other-Agriculture*, *Other-Industrial*, *Other-Rail* and *Other-Air Travel* tabs of the *Master Data Workbook*.

Again, it is vital to take detailed notes of the data gathering process including data sources, any problems with the data, and estimates made. As you gather data, use the *Inventory Log* tab as well as the spaces within each final data entry tab as places for these notes and sources.

Step 4: Enter Data into the Master Data Workbook

As you gather the necessary raw data, you should save it in your *Master Data Workbook* in the “other” tabs provided. The tabs include: *Other-Agriculture*, *Other-Industrial*, *Other-Rail* and *Other-Air Travel*.

Step 5: Perform Quality Control Check (QC) on Master Data Workbook

Once the data collection section is complete, you should perform a final review of all data to ensure accuracy. At ICLEI we have set up a “buddy system” where staff QC each others’ work – setting up a similar system would be worthwhile.

8.3 What Data Need to be Collected?

Data requirements will vary for each source. Please consult the IPCC, LGO Protocol or other guidance documents for the data points that need to be collected. Be sure to take notes on where you obtained the method you have chosen to follow and reference this in your *Master Data Workbook* and any subsequent report.

8.4 Using the Master Data Workbook

Enter all your raw data along with any tables or calculations used to derive an amount of fuel consumption attributable to your community in the *Other-Agriculture*, *Other-Industrial*, *Other-Rail* and *Other-Air Travel*. Feel free to add tabs into the *Master Data Workbook* as needed.