User's Guide

Local Greenhouse Gas Inventory Tool: Government Operations Module

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Acronyms and Abbreviations

%	percent
BAU	business-as-usual
BOD_5	Biological Oxygen Demand (the amount of oxygen consumed in five days by decomposing waste, used to measure the amount of waste input or output into a system)
CH_4	Methane
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent emissions
days/yr	days per year
eGRID	Emissions & Generation Resource Integrated Database
EPA	U.S. Environmental Protection Agency
ft^3	cubic feet
ft^3/yr	cubic feet per year
G.G.E.	gasoline gallon equivalent
IPCC	Intergovernmental Panel on Climate Change
kg	kilograms
kWh	kilowatt-hours
kg N/day	kilograms of Nitrogen per day
LFG	Landfill gas
LGOP	Local Government Operations Protocol
LGGIT	Local Greenhouse Gas Inventory Tool: Government Operations Module
mcf	thousand standard cubic feet
MMSCF	million standard cubic feet
MMSCF/yr	million standard cubic feet per year
MT	metric Tons
N_2O	Nitrous oxide
WARM	EPA's WAste Reduction Model

1. Tool Overview

This User's Guide accompanies and explains the Local Greenhouse Gas Inventory Tool: Government Operations Module. The module was developed to support municipal governments across the United States to evaluate the greenhouse gas emissions associated with their municipal operations. Understanding these emission levels provides a base year for tracking emission trends against, developing mitigation strategies and policies, and assessing progress towards meeting goals.

The tool helps users to develop a municipal greenhouse gas inventory of city operations for a base year, following the Local Government Operations Protocol (LGOP), version 1.1. A companion tool for estimating greenhouse gas emissions at the community level is also available. While the Government Operations Module estimates emissions at the local government level, the separate Community Module estimates emissions for the community as a whole and follows the Global Protocol for Community-Scale GHG Emissions. Any emissions estimated in the Government Operations Module can be included in the Industrial/Commercial sector in the Community Module.

2. Getting Started

The Local Greenhouse Gas Inventory Tool: Government Operations Module (LGGIT) was developed using Microsoft® Excel 2007 and 2010. The tool will only operate properly using Excel 2007 or later. Before using the tool, ensure your computer meets the system requirements. In order to install and run the tool, you must have:

- IBM-PC compatible computer with the Windows XP operating system or later;
- Microsoft® Excel 2007 or later, with calculation set to automatic and macros enabled;
- Hard drive with at least 20MB free; and
- Monitor display setting of 800 x 600 or greater.

Microsoft Excel Settings

For the tool to function properly, Excel must be set to automatic calculation. Go to the Formulas ribbon and select "Calculation Options." Make sure that the box next to the "Automatic" option is checked.

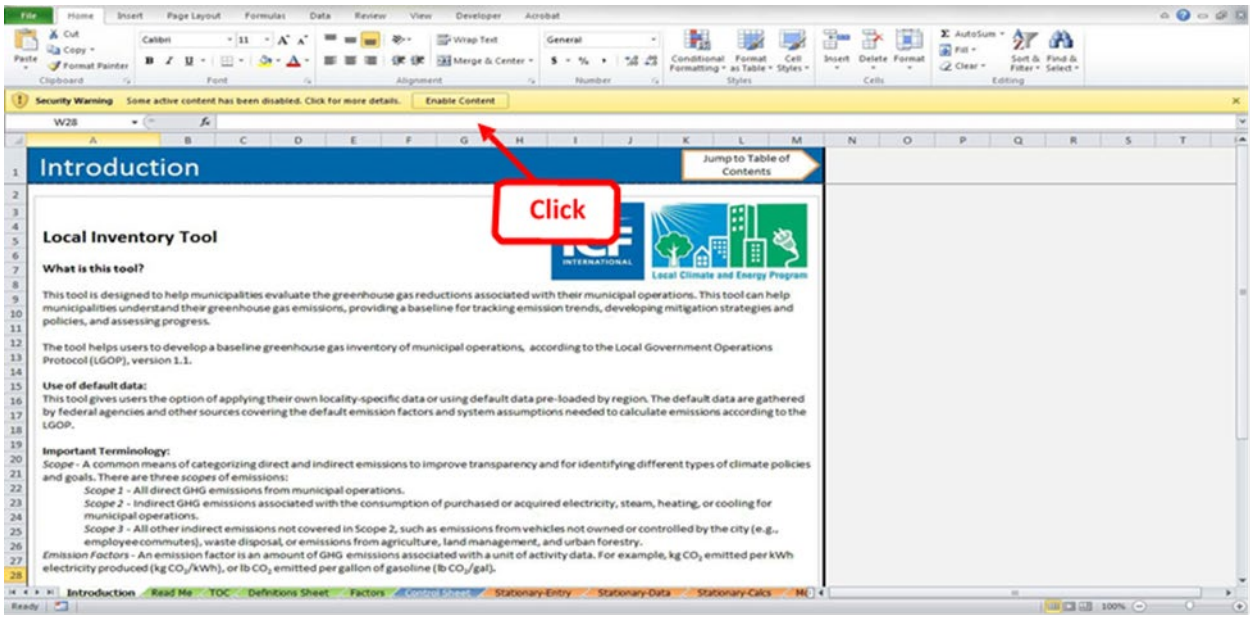
The tool will not function properly if opened in Protected View in Excel. In order to turn off Protected View, click File, Options, Trust Center, Trust Center Setting, and then Protected View. Uncheck "Enable Protected View for files originating from the internet." The user should restore default and/or desired security settings after closing the tool.

Running Macros in Microsoft Excel

To make the user's experience as smooth as possible, the LGGIT uses macros. Macros are series of commands and functions that are stored in Excel that run automatically to perform tasks, which allow the tool to carry out tasks in an automated way. Because macros are such a powerful tool, Excel checks with the user for approval before allowing them to run.

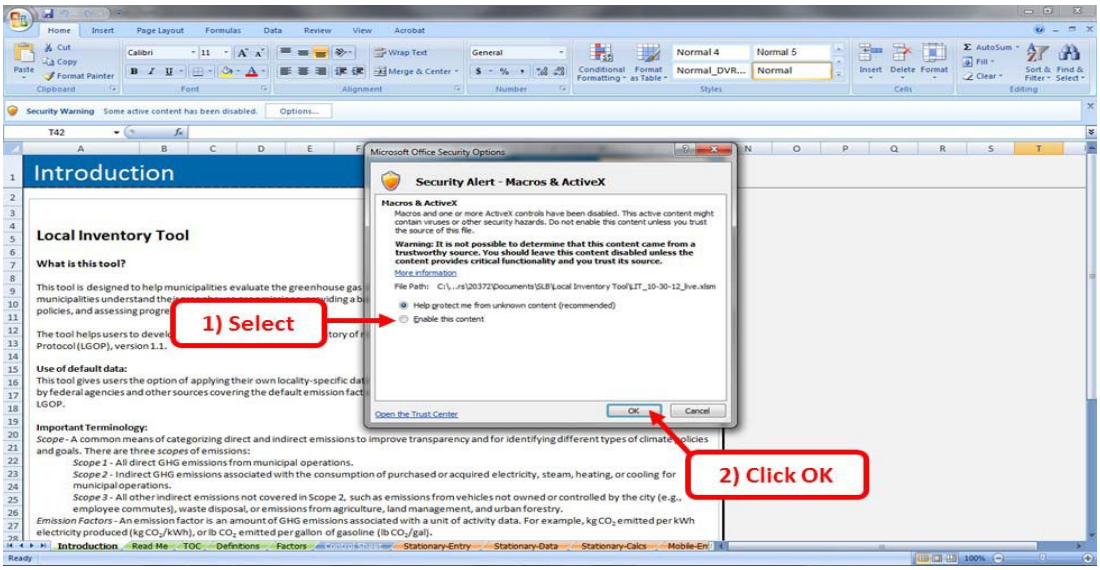
If Excel's security settings are set at the default level, a Security Warning appears above the formula box in Excel when the file is initially opened (Figure 1).

Figure 1. Enabling Macros, Excel 2010



The Security Warning lets the user know that some active content from the spreadsheet has been disabled, meaning that Excel has prevented the macros in the spreadsheet from functioning. Because the Government Module needs macros in order to function properly, the user must enable macros. To do so in Excel 2010, simply click the "Enable Content" button in the security message (Figure 1). To do so in Excel 2007, click the "Options" button in the security message and then select, "Enable this content" in the pop-up box (Figure 2). Enabling the macro content for the tool in these ways only enables macros while you are using this spreadsheet. The security settings will return to your default when you close the spreadsheet.

Figure 2. Enabling Macros, Excel 2007



If the Security Warning does not appear when the tool is first opened, it may be necessary to change the security settings for macros.

To change the settings in Excel 2010, follow the steps below:

1. Exit out of the tool and re-launch Microsoft Excel without opening the Government Module.
2. On the "File" tab, select Options from the bottom of the left-hand menu.
3. In the Excel Options pop-up box, click on "Trust Center" at the bottom of the left-hand menu.
4. Click on the gray "Trust Center Settings" button.
5. When the Trust Center options box appears, click "Macro Settings" in the left-hand menu.
6. Select "Disable all macros with notification."
7. Click "OK" to exit out of all pop-up boxes.
8. Once the security level has been adjusted, open the tool and enable macros in the manner described in Figure 1 above.

To change the settings in Excel 2007, follow the steps below:

1. Exit out of the tool and re-launch Microsoft Excel without opening the Government Module.
2. Click on the Microsoft Excel icon in the top left of the screen.
3. Scroll to the bottom of the menu and select the "Excel Options" button to the right of the main menu.
4. When the Excel Options box appears, select "Trust Center" in the left-hand menu of the box.
5. Click the gray "Trust Center Settings" button.
6. When the Trust Center options box appears, click "Macro Settings" in the left-hand menu.

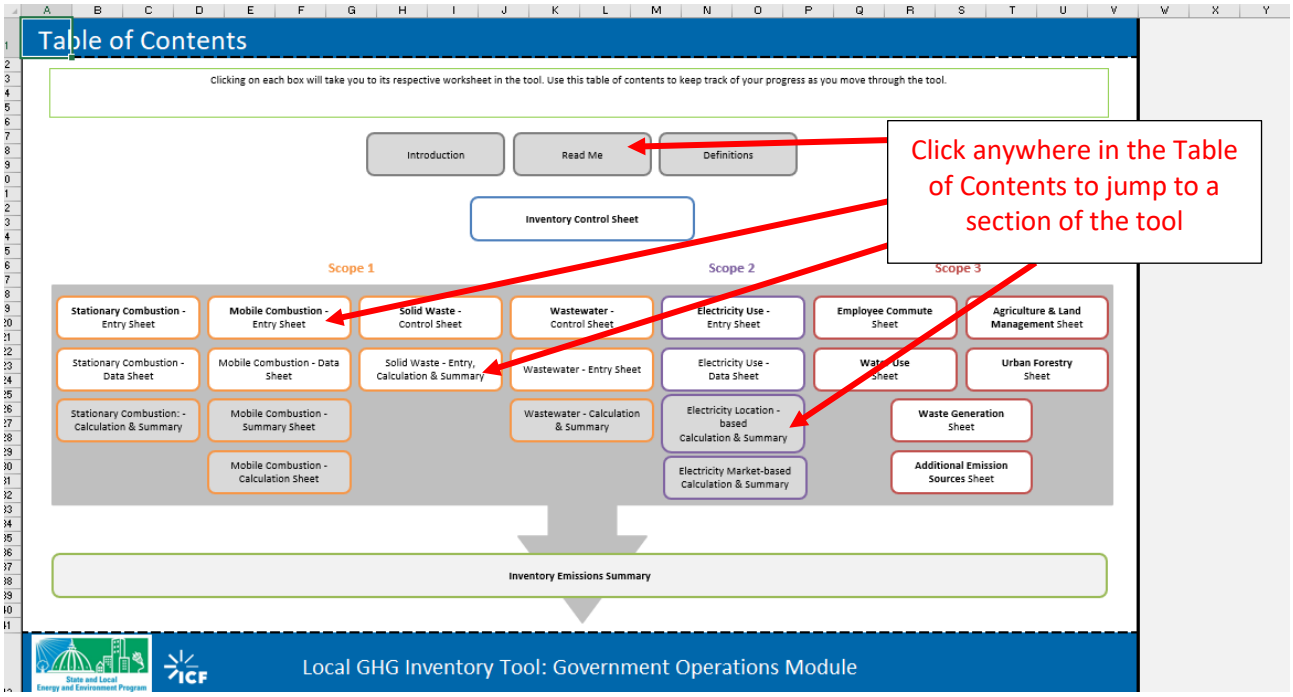
7. Select “Disable all macros with notification.”
8. Click “OK” to exit out of all pop-up boxes.
9. Once the security level has been adjusted, open the tool and enable macros in the manner described in Figure 2 above.

Navigating the Tool

The Government Module’s Table of Contents is its main navigational portal. The Table of Contents is also used to track your progress throughout the tool. You may click on the name of any part of the tool within the Table of Contents to be taken to that sheet (Figure 3). Every sheet also features an arrow-shaped navigation button on the upper right-hand corner that returns the user to the Table of Contents.

There are two main sections of this tool: Background Data Collection and Emissions Calculations. In each, the user will enter data to configure the tool to their specific municipality and receive customized results.

Figure 3. Table of Contents



The Table of Contents is also used to track your progress as you complete the tool. On every sheet that requires user action, you will see a check box in the upper right-hand corner of the tool that reads “Check if you have completed this sheet” (Figure 4). Check this box as you complete each sheet. Doing so will change the color of that sheet’s icon in the Table of Contents. For example, Figure 5 shows the Table of Contents after the “Mobile Combustion - Entry” sheet has been completed. The “Mobile Combustion – Entry Sheet” box has changed and is now filled in with color.

Figure 4. Sheet Navigation and Tracking Tools

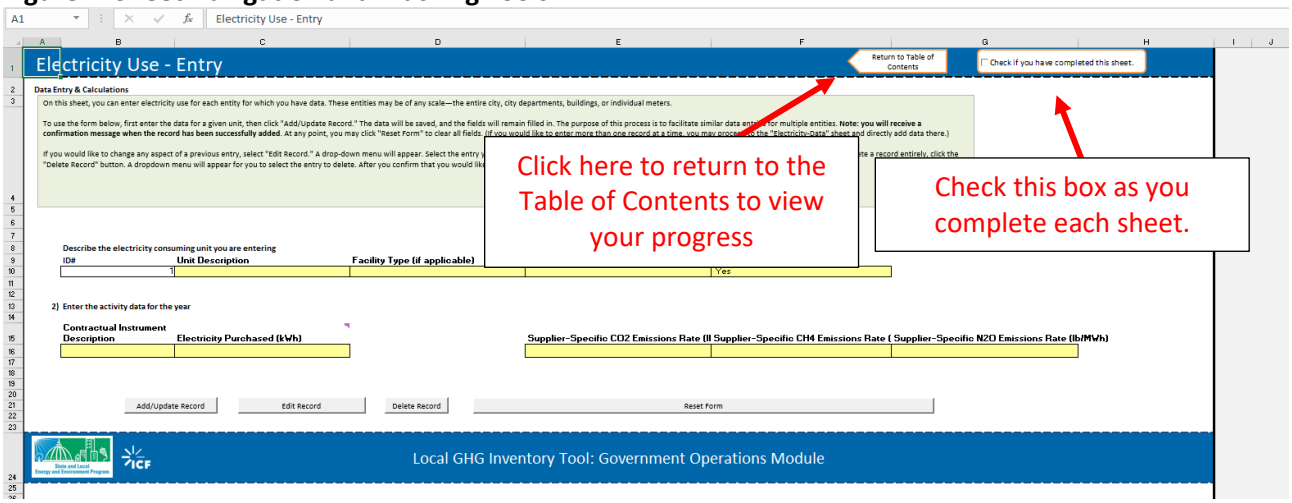
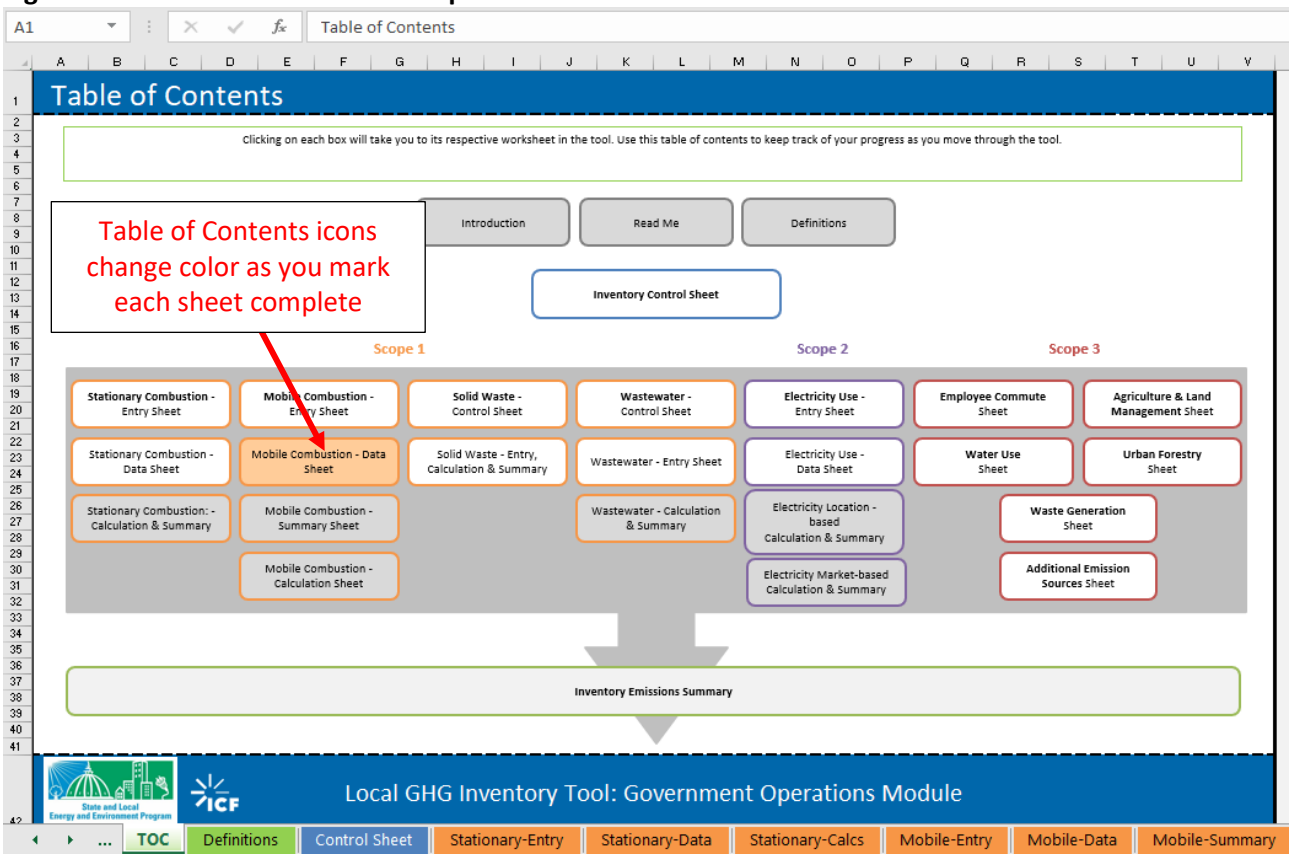


Figure 5. Table of Contents with Completed Sheet



Data Requirements

The Government Module is designed to accept any level of data granularity in order to be flexible to the needs and constraints of different municipalities. Data can be entered at any scale, ranging from city-wide activity data to data by facility or meter. The more specific the data provided by the user, however, the more accurate and useful the tool will be. See Box 1 for details.

The GHG inventory segment of the tool proceeds through ten main sectors of municipal government emissions. These sectors and the type of data the user needs to provide are show in Table 1. Gray cells indicate if a default value is available for that input or if the input is optional.

In general, this tool is pre-programmed with default emission factors and system assumptions needed to calculate emissions from the LGOP. Default emission factors are generally provided from national or state publications and provide a relatively accurate estimate of emissions. If local, or site-specific factors are available for your locality, those should be used to overwrite the default factors. Wherever possible in the inventory process, default values from the LGOP are used. The tool provides users the option to use default data or to override default values if they have city-specific information.

Throughout the tool, cells are shaded yellow where the user is required to enter data.

Box 1. GHG Inventory Data Input Options

Option A: "Quick" Inventory

- Enter municipality-wide fuel, electricity, and water consumption data.
- This method takes less time but does not allow the tool to as effectively calculate emission levels.

Option B: Thorough Inventory

- Enter fuel, electricity, water consumption by facility or meter.
- This method requires more time and data availability from the user but provides the most detailed GHG inventory.

Table 1. Required Data Inputs for the Local Greenhouse Gas Inventory Tool: Government Operations Module —Inventory Calculations

GHG Sectors	Input Data
Stationary Combustion of Fossil Fuels (e.g. fuel use at city facilities)	Stationary fuel use (by fuel type, by department)
Electricity Consumption and Purchases	Electricity consumed or purchased (kWh) Electric utility Utility-Specific Emissions Rate (lb/MWh)*
Mobile Combustion of Fossil Fuels (i.e., fuel use by city fleet)	Fuel consumed (by fuel type) (gallons or G.G.E.) Vehicle Miles Traveled (miles) Vehicle Model Year Vehicle Type
Solid Waste Management	City Landfills (number) Landfill Gas Collected (MMSCF/yr) Fraction of CH_4 in landfill gas Landfill Gas Collection Area (fraction)
Wastewater Treatment	Wastewater treatment process details (aerobic, anaerobic, nitrification, denitrification) Population served by wastewater treatment system(s) (people) Population served by septic systems (people) Digester gas produced daily (ft^3/day) Fraction of CH_4 in biogas System BOD_5 load/influent (kg BOD_5/day) Fraction BOD_5 removed in primary treatment Industrial Nitrogen load (kg N/day) Average total Nitrogen discharged (kg N/day)
Employee Commute	Number of employees (people) Employees who use each mode of transit (%) Average one-way commute length (miles) Work days per year (days/yr)
Agriculture & Land Management	Synthetic fertilizer use (short tons N) Organic fertilizer use (short tons) Manure fertilizer use (short tons)
Urban Forestry	Total urban area (km^2) Urban area with tree cover (%)
Waste Generation	Waste emissions ($MTCO_2e$ from EPA's Waste Reduction Model) Department contribution to total waste (%)
Water Use	Percentage of imported water (%) Water use (gallons)
Additional Emission Sources	GHG emissions from each additional source, by gas (MT CO_2e)

*Required for Scope 2: Market-Based approach only.

Tool Layout

There are two main sections of this tool: *Background Data Collection*, and *Emissions Calculations*. In each, the user will enter data to configure the tool to their specific municipality and receive customized results.

Background Controls

On the Inventory Control Sheet, identify the municipality, the inventory year for the inventory, and set up and define city departments. Depending on what data are available and at what scale, the user can determine how to configure the tool. The departments input into the tool do not need to correspond to every department within the municipality but set up to reflect organizational units for which the most comprehensive data are available. For example, if the user has City-wide data, they may set up only one department, "City." Alternatively, if the user has data broken down by billing units which are different from city departments, they may name the "Departments" after those units. You must enter a minimum of 1 department in this step.

The user will also set up information about their electricity providers. Users can select which eGRID sub-region serves the area view the default emission factors and can enter up to five utilities with utility-specific emission factors (if available).

GHG Emission Scopes

To account for direct and indirect emissions, and to provide transparency and a guiding framework for the inventory tool, GHG estimates are categorized according to 3 scopes. The following scopes are defined by the Local Government Operations Protocol and are used throughout the tool:

Scope 1: All direct GHG emissions (with the exception of direct CO_2 emissions from biogenic sources).

Scope 2: Indirect GHG emission associated with the use of purchased or acquired electricity, steam, heating, or cooling.

- **Location-based method** reflects grid-average emission factors. Municipalities must report Scope 2 emissions using the location-based method.
- **Market-based method** reflects emissions from electricity that municipalities have purposefully chosen and derives emission factors from contractual instruments, such as renewable energy credits (RECs). Municipalities have the option to report Scope 2 emissions using the market-based method, in addition to the location-based method, to account for avoided emissions from renewable energy sources.

BOX 2. Difference between Location-Based and Market-Based Approaches for Scope 2 Emissions

Local governments and communities have a growing interest in accounting for green power or renewable energy credits (RECs) in their municipal government inventories. According to section 6.2.4 of the LGOP, a local government or community "may not deduct these purchases from your Scope 2 emissions because doing so would constitute double counting. This is because the renewable energy portion of a utility's power supply is already accounted for in the region's eGRID factor." The LGOP encourages local governments and communities to disclose information about these activities in their inventory report, but not to include them in the calculations, as this would lead to double counting. The LGOP guidance is specific to the location-based accounting method. However, updated guidance from WRI (2014, 2015) offers an alternative method, called the market-based method, which considers local governments' or communities' green electricity choices.

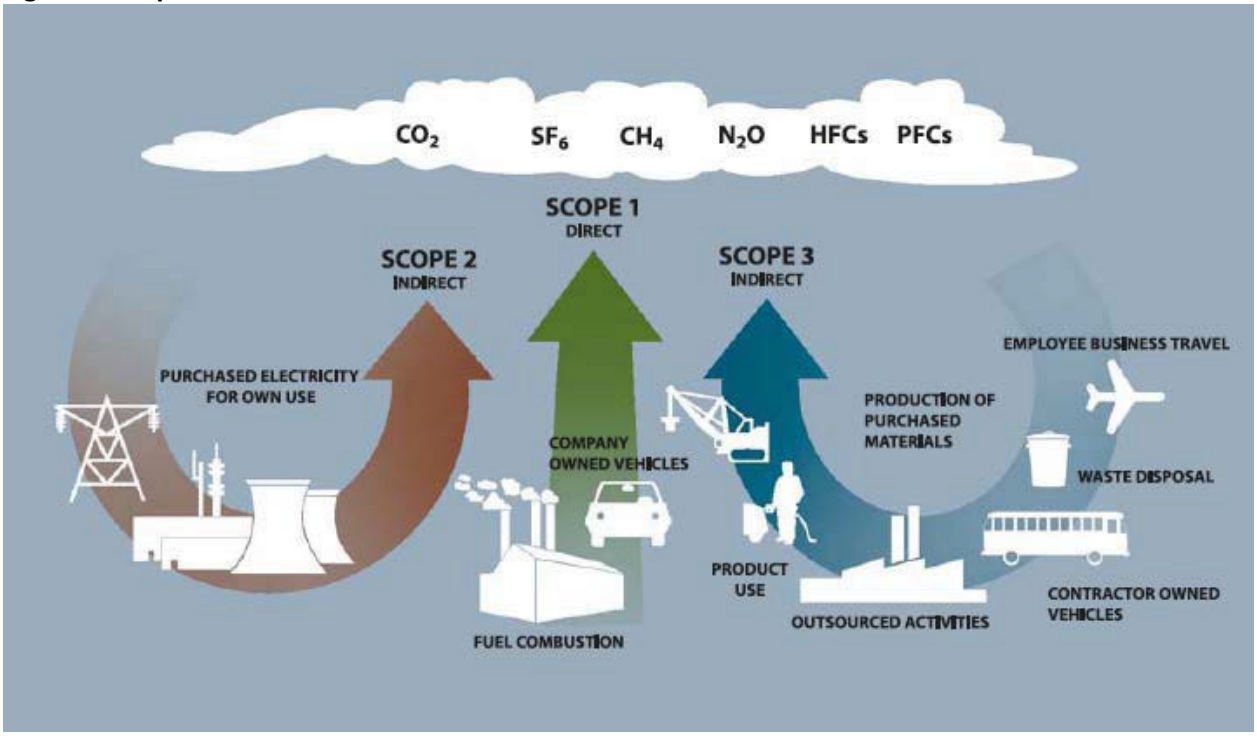
WRI's *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories* (2014) and WRI's *GHG Protocol Scope 2 Guidance* (2014) details the difference between location-based and market-based scope 2 emissions. A **location-based method** reflects grid-average emission factors (i.e., eGRID factors), while a **market-based method** reflects emissions from electricity that cities or communities have purposefully chosen and derives emission factors from utilities and/or contractual instruments, such as RECs.

The GHG Protocol states that cities or communities shall use the location-based method (using the region's eGRID factor) for scope 2 calculations and may separately document emissions from the market-based method (using a utility or contract-specific emission factor), where relevant. For transparency, local governments and communities must always report Scope 2 emissions using the location-based method. If local governments purchase electricity through contractual instruments, they have the option to report Scope 2 emissions using the market-based method, which accounts for electricity purchases including renewables. Governments and communities may use the market-based method even if they purchase less than 100% of electricity usage through contractual instruments.

Scope 3: All other indirect emissions not covered in Scope 2, such as emissions resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel), outsourced activities, waste disposal, etc.

In addition to accounting for emissions according to these 3 scopes, the LGOP provides guidance on imports and exports by a local government, and how emissions for these should be taken into account. As an example, waste imported into the city, and treated at a government run facility is reported as Scope 1 emission estimates. Waste generated by the local government and exported and treated outside of the local government's boundaries is included in Scope 3 estimates. The LGGIT accounts for in-boundary consumption and resulting emissions and excludes any emissions released from products consumed or services exported from the locality.

Figure 6. Scope of Greenhouse Gas Emissions



Source: *WRI/WBCSD GHG protocol Corporate Standard, Chapter 4 (2004).*

Because Scope 3 emissions vary in complexity and in the activities they represent, it is recommended that users calculate emission estimates for additional sources outside the tool and enter the estimates in the Additional Emission Sources worksheet. An example of Scope 3 calculations from one local government is included in the box below.

BOX 3. City of Eugene 2000 and 2005 GHG Inventory Report Scope 3 Emissions

The City of Eugene included Scope 3 emissions from vehicle fuels used by City employees commuting to work, disposal of the City's solid waste from internal operations, and the embodied energy in goods and services purchased by the City.

- For embodied energy in goods and services purchased by the City, the City of Eugene provided an estimate that was derived from a national model (developed by Carnegie Mellon University) of the GHG emissions embodied in different types of purchases. The City estimated that approximately 18,120 metric tonnes of GHG emissions was attributable to $40 million in purchases of local goods and services.

Inventory Calculations

After the user has configured the tool on the Control Sheet, the tool will calculate the municipal emissions, or the base year greenhouse gas inventory for the city's municipal operations. The inventory is separated into the 10 main emission sources below, from the Local Government Operations Protocol (LGOP), and these sources are further organized by scope. Users can also enter emissions for any additional sources they would like to calculate outside of the tool and enter the estimates in the Additional Emission Sources worksheet.

1. Stationary Combustion of Fossil Fuels (Scope 1)
2. Building/Facility Electricity Consumption (Scope 2)
3. Mobile Combustion of Fossil Fuels (Fleet) (Scope 1)
4. Solid Waste Disposal (Scope 1)
5. Wastewater Treatment (Scope 1)
6. Employee Commutes (Scope 3)
7. Water Consumption in City Facilities (Scope 3)
8. Agriculture & Land Management (Scope 3)
9. Urban Forestry (Scope 3)
10. Waste Generation (Scope 3)
11. Additional Emission Sources (optional) (Scope 1, 2, or 3)

For each source, the user will be asked to enter data about relevant city activities (e.g. electricity consumed, fuel used) during the inventory base year. The tool can be used to develop emissions estimates for a base year, as well as used to track emissions over time if different versions of the Excel file are saved. Default emission factors for each activity are provided, and the user is given the option to override these factors, if necessary. Default global warming potentials (GWPs) from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report are also used to calculate emissions estimates and can be overridden by the user; they are editable on the 'Factors' tab. There are multiple sheets for some emission sources, but not for all sources. Each emissions source follows a distinct process the user will follow to determine the emissions, as explained below:

Stationary Combustion, Electricity Use, and Mobile Combustion

1. Users enter activity/fuel use data on Entry Sheet OR
2. Users can batch import data on Data Sheet.
3. Emissions are calculated and summarized on the Calculation Sheet.

Solid Waste

1. Users answer questions about their city's solid waste disposal system on the Control Sheet.
2. Based on the answers to the questions, users will enter data about their solid waste system and view emissions summary on the Entry, Calculation & Summary Sheet.

Wastewater Treatment

1. Users answer questions about their city's wastewater treatment system(s) on the Control Sheet.
2. Based on the answers to the questions, users will enter data about their wastewater treatment systems on the Entry Sheet; and
3. Emissions will be calculated and summarized on the Calculation & Summary Sheet.

Employee Commutes, Water Consumption, Agriculture & Land Management, Urban Forestry, and Waste Generation

1. Users will enter necessary data, and view emissions on a single sheet.

Additional Emission Sources

1. Users can enter emissions from up to 10 additional sources on a single sheet.

All municipal emissions for the inventory year are summarized on the Emissions Summary sheet.

The tool estimates emissions for the 6 Kyoto Gases- CO_2, CH_4, N_2O, PFCs, HFCs, and SF_6. Gases included for each Scope are provided in the following table.

Table 2. Greenhouse Gases Included by Source and Scope

Local Government GHG Inventory Tool Worksheet	Gases Included
Scope 1	
Stationary Combustion	CO_2, CH_4, N_2O
Mobile Combustion	CO_2, CH_4, N_2O
Solid Waste	CH_4
Wastewater	CH_4, N_2O
Scope 2	
Electricity Use: Location-based (required)	CO_2, CH_4, N_2O
Electricity Use: Market-based (optional)	CO_2, CH_4, N_2O
Scope 3	
Employee Commute (Scope 3)	CO_2
Agriculture & Land Management (Scope 3)	N_2O
Urban Forestry (Scope 3)	CO_2 (sequestered)
Waste Generation (Scope 3)	CH_4
Water Use (Scope 3)	CO_2, CH_4, N_2O
Other (Scope 1, 2, or 3)	
Additional Emission Sources	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6

Biogenic emissions are not included in the module, and as a standard practice the CO_2 emissions occurring from biofuel combustion are not included in total inventory estimates. According to the U.S. Environmental Protection Agency, biogenic CO_2 emissions are defined as CO_2 emissions related to the natural carbon cycle, as well as those resulting from the combustion, harvest, combustion, digestion, fermentation, decomposition, or processing of biologically based materials. EPA provides examples of biogenic CO_2 emissions including:

- CO_2 from the combustion of biogas collected from biological decomposition of waste in landfills, wastewater treatment, or manure management processes
- CO_2 from combustion of the biological fraction of municipal solid waste or biosolids

- CO_2 derived from combustion of biological material, including forest-derived and agriculture-derived feedstocks.

According to the LGOP, because of the distinction between biogenic and anthropogenic emissions, local governments should track the biogenic CO_2 emissions from biomass combustion separately from Scope 1 direct emissions. In addition, the LGOP advises the following:

> "Biogenic emissions related to forestry and land management should not be quantified under this Protocol as the Protocol is designed to account primarily for the anthropogenic sources of GHG emissions and is not designed to assess the carbon stocks of government-owned lands (see Section 2.3 in the LGOP). Biogenic emissions also occur from sources other than combustion, such as the aerobic decomposition of organic matter. These non-combustion biogenic emissions should not be included in your GHG inventory."

Emission factors for each calculation are included in the "Factors" worksheet of the module, and specific sources for each of the emission factors are provided in the table below.

Table 3. Source of Emission Factors

Scope 1	**Emission Factor Source**
Stationary Combustion	U.S. EPA GHG Emission Factor Hub, National GHG Inventory, The Climate Registry
Mobile Combustion	U.S. EPA, National GHG Inventory
Solid Waste	U.S. EPA, National GHG Inventory
Wastewater	U.S. EPA, National GHG Inventory
Scope 2	
Electricity Use	U.S. EPA's eGRID
Scope 3	
Employee Commute	U.S. EPA, National GHG Inventory
Agriculture & Land Management	U.S. EPA, National GHG Inventory
Urban Forestry	U.S. EPA, State Inventory Tools
Waste Generation	U.S. EPA, National GHG Inventory
Water Use	California Energy Commission

3. Sheet Instructions and Methodology

This section provides a guide to using the Government Operations Module to estimate greenhouse gas emissions from municipal government operations. The methods and default values used for the inventory component of this tool are from the LGOP. Calculation sheets are provided so that methods and emission estimates are transparent in the tool. Instructions for completing each sheet of the tool are below.

Control Sheet

Use the Control Sheet to configure the tool to your local government. Enter up to 20 municipal departments, identify city electricity providers, and click the "Set Up" button (in Step 4 at the bottom of the Control Sheet) to get started.

The module can be used to inventory GHG emissions from 2000 through 2025. EPA decided not to include inventory years going back to 1990, as there is limited availability of emission factors dating back to 1990 and local governments will likely not have data going back to 1990. According to the LGOP, “It is good practice to compile an emissions inventory for the earliest year for which complete and accurate data can be gathered. The base year for the UNFCCC and subsequent Kyoto Protocol is calendar year 1990. However, required data from 1990 is often prohibitively difficult or impossible to collect. Given that the priority for a greenhouse gas management program should be on practical results, it is more important that the base year be documented with enough detail to provide a good basis for local action planning than it is that all local governments produce an inventory with the same, stipulated base year.”

NOTE: Once you click the “Set Up” button, you may not go back and change city departments you have already entered. You may add city departments, but be sure to click “Set Up” again.

Stationary Combustion and Electricity Consumption Inventory Sheets

Entry Sheets

Enter annual stationary fuel use and electricity consumption for each entity for which you have data in the yellow cells. These entities may be of any scale—the entire municipality, municipal departments, buildings, or individual equipment such as furnaces. To use the form, first enter the data for a given unit (Unit Description, Facility Type, Department, Fuel Type, and Fuel Consumption). For electricity consumption, enter if the electricity unit is a contractual instrument. In this module, contractual instruments can include energy attribute certificates (RECs, GOs, etc.), direct contracts (PPAs, etc.), and residual grid mix emission rates. If yes, enter the required data (contractual instrument description, supplier-specific emission rates). If you do not know the emissions rate for the contractual instrument, the emission rates will default to zero. If the electricity unit is not a contractual instrument, select your electricity utility from the drop-down menu labeled “Select Electric Utility…”. If you are unsure of the specific electric utility supplying the electricity unit, then select your eGRID subregion. Then click "Add/Update Record." The data will be saved in a data sheet, and the fields will remain with the current data entered. The purpose of this process is to facilitate similar data entries

for multiple entries. You will receive a confirmation message when the record has been successfully added. At any point, you may click “Reset Form” to clear all fields. If you would like to enter more than one record at a time, you may proceed to the "Stationary-Data" or “Electricity-Data” sheet and directly add data there.

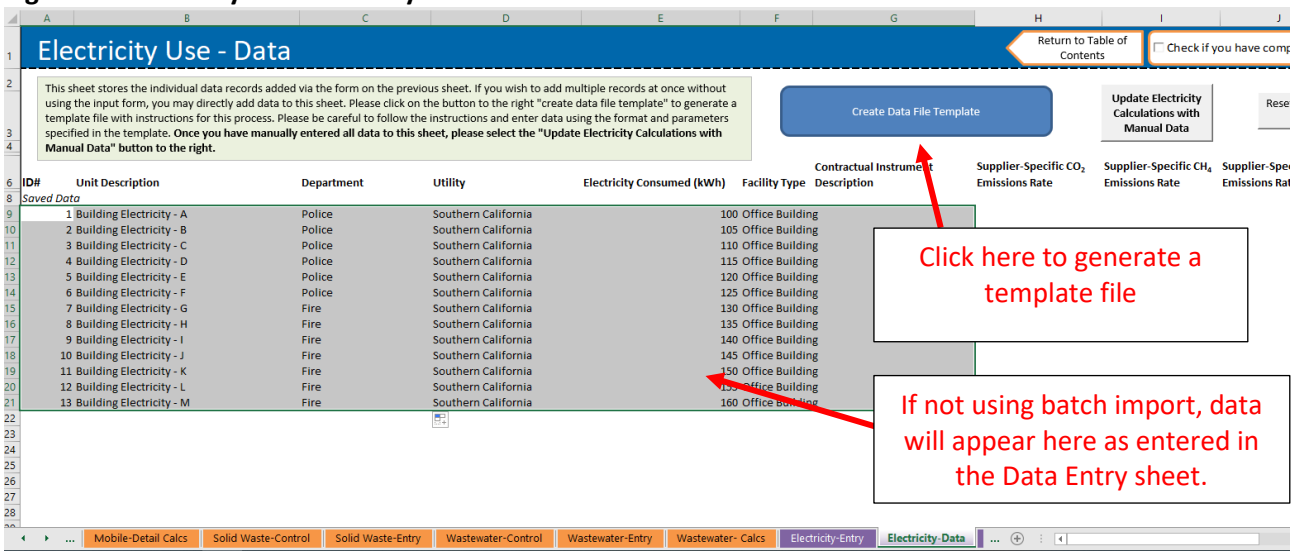
If you would like to change any aspect of a previous entry, select "Edit Record." A drop-down menu will appear. Select the entry you would like to change, make changes to the entry fields as needed, and then click "Add/Update Record." To delete a record entirely, click the "Delete Record" button. A dropdown menu will appear that contains the previously entered data. Select the entry to delete from the drop-down, and confirm that this entry should be deleted. After you confirm that you would like the entry deleted, the saved data will be erased.

If you enter data at the facility level, please specify the type of facility from the dropdown menu under “Facility Type (if applicable).” Types of facilities include office buildings, warehouses, outdoor lighting, wastewater infrastructure, health, school, and other.

Data Sheets

Data entered through the Entry Sheet forms appears here (Figure 7). If you would like to upload a large set of data without using the form, you may do so by clicking the blue “Create Data File Template” button. This will open up a new batch data template file, which has two tabs. The “Read Me” tab explains any restrictions (such as units) you need to know when preparing your data file. Complete the template data sheet with your data, then copy and paste it into the Data sheet below the “Saved Data” section, beginning in Row 9.

Figure 7. Stationary and Electricity Data Sheets



The process for completing the mobile combustion sector and electricity sector follows nearly the same format as the stationary sector. However, due to the complicated nature of mobile and electricity emissions calculations, one extra step is required. For mobile emissions, after all data has been entered, either through the Entry Sheet form or the batch data template file, you must click the “Update Calculations” near the bottom of the Mobile Entry sheet, as shown below in Figure 8. For electricity emissions, if data were manually entered using the batch data template, after all data has been entered, you must click the “Update Electricity Calculations with Manual Data” button near the top right of the Electricity Data tab, as shown in Figure 9.

Figure 8. Mobile Entry—Update Calculations

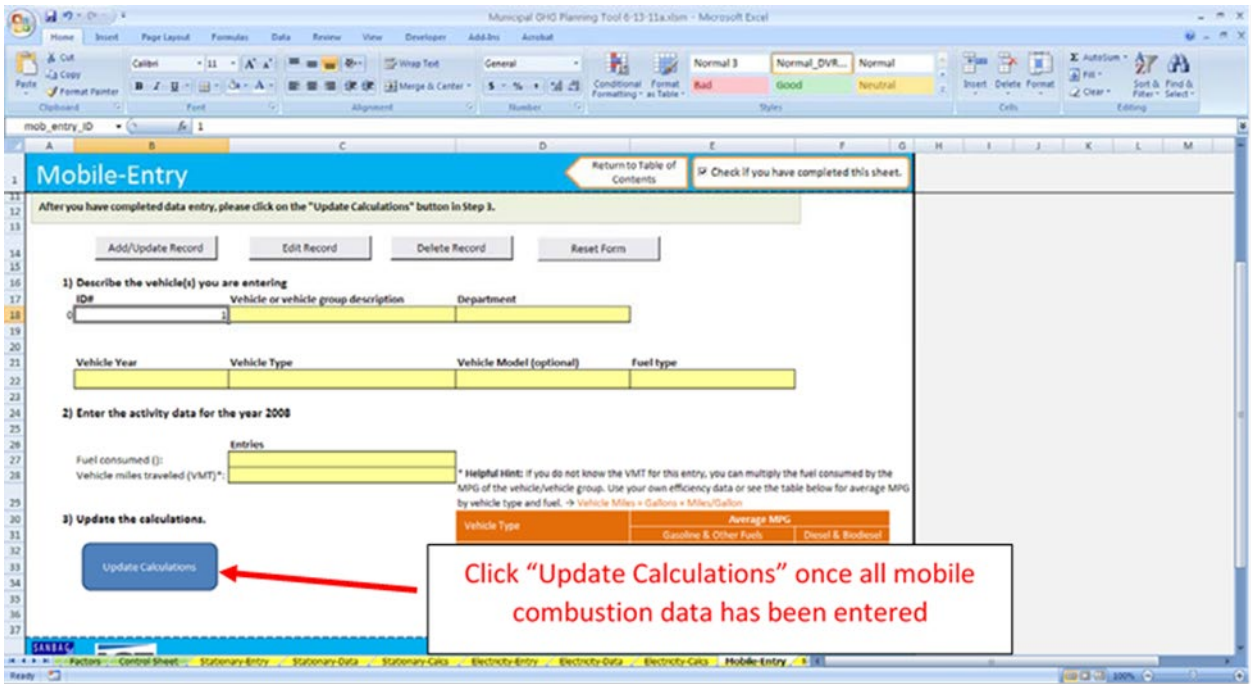
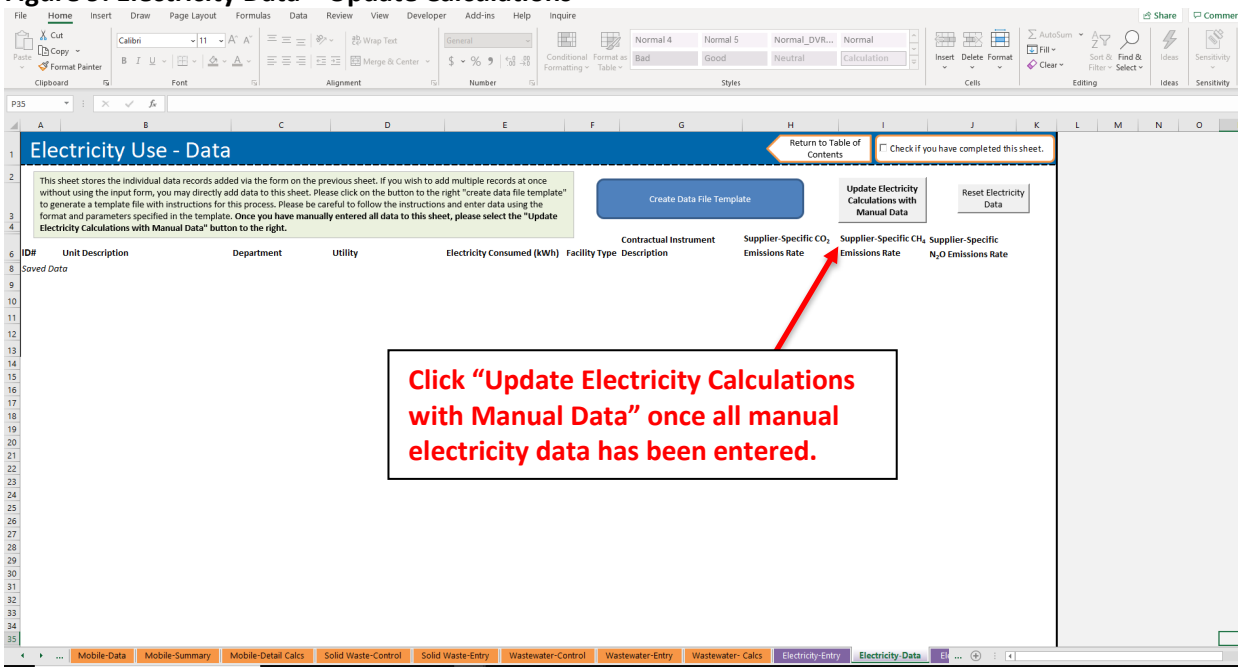


Figure 9. Electricity Data – Update Calculations



Electricity Calculations Sheet

Location-Based Calculations

This sheet is where Scope 2 emissions from electricity usage using the location-based method are calculated. Please note that the location-based emission calculations by department on this tab will only show the total amount of grid usage and will not include kWh purchased through contractual instruments (e.g., RECs, PPAs). Users should still enter all kWh purchased through contractual instruments in the Electricity-Entry tab or the Electricity-Data tab, but emissions from these purchases are only reflected in the Electricity MarketBased-Calcs tab. The Location-based methodology calculates emissions for each utility entered on the Electricity-Entry tab, by department, using exclusively the eGRID emissions rates.

Market-Based Calculations

This sheet is where Scope 2 emissions from electricity usage using the market-based method are calculated. Electricity use by department shows the total amount of kWh grid usage and purchased contractual instruments that are associated with direct electricity use (e.g., RECs, PPAs). Emissions are calculated for each electricity unit entered on the Electricity-Entry tab, by department, using the supplier or utility-specific emissions rates, where applicable. Emissions from electricity purchased through contractual instruments are calculated based on the emission factors entered for each contractual instrument (generally emission factors for renewable energy contractual instruments are zero). If electricity is purchased from more than one utility, then the total kWh from contractual instruments is divided based on proportion of total electricity purchased and subtracted from the utilities. Finally, to calculate the total emissions by department, emissions from contractual instruments and emissions from other grid-supplied electricity are summed. An example of Location- and Market- based electricity purchases is shown below in Table 4, Figure 10, and Box 4.

Box 4. Electricity Data Entry Example

A county government employee wants to estimate location-based and market-based emissions for two departments and their respective offices. During the past year, department A consumed 1,000 kWh of grid electricity at Office A and purchased a 500kWh REC to offset a portion of their electricity emissions. Department B consumed 500 kWh of grid electricity at Office B and purchased 500 kWh through a Power Purchase Agreement (PPA). Both offices are in the same eGRID region but procure electricity from different utilities. The supplier-specific emissions rates for Office B are unknown, so the eGRID region is used in calculations.

On the Electricity-Entry tab, the employee enters a description “Office A Grid” and selects “No” from the Contractual Agreement dropdown list. The employee enters 1,000 kWh and selects the utility. Then, the employee repeats the process for Office B, entering “Office B Grid”, selecting “No” from the Contractual Agreement dropdown list, entering 500 kWh, and selecting the eGRID region as the utility.

After entering all grid electricity purchases, the employee creates a third electricity consuming unit on the Electricity-Entry tab to account for the Office A REC. The employee enters a unit description “REC-1” and selects “Yes” from the Contractual Agreement dropdown list. The employee enters a unique ID for the REC (Office A REC) and enters 500 kWh to represent the electricity purchased. Finally, the user enters zero for each of the supplier-specific emissions rates because the REC has zero emissions.

Then, the employee creates a final electricity consuming unit to account for the Office B PPA. The employee enters a unit description “PPA-1” and selects “Yes” from the Contractual Agreement dropdown list. The employee enters a unique ID for the PPA (Office B PPA) and enters 500 kWh to represent the electricity purchased. Finally, the user enters zero for each of the supplier-specific emissions rates because the PPA is 100% renewable. Emissions and electricity consumption totals for both methodologies are summarized across both departments in Figure 10 below and on the “Electricity LocationBased-Calcs” and “Electricity MarketBased-Calcs” tabs in the module.

Figure 10. Scope 2 Emissions Estimates using the Location- and Market- Based Methods

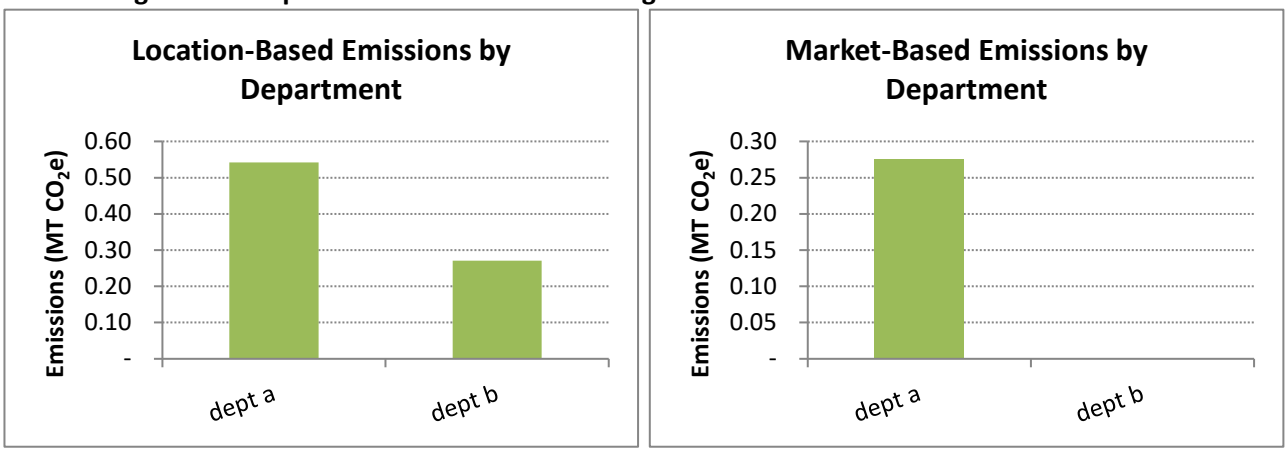


Figure 11. Electricity Data Sheet for Example Location- and Market- Based Calculation

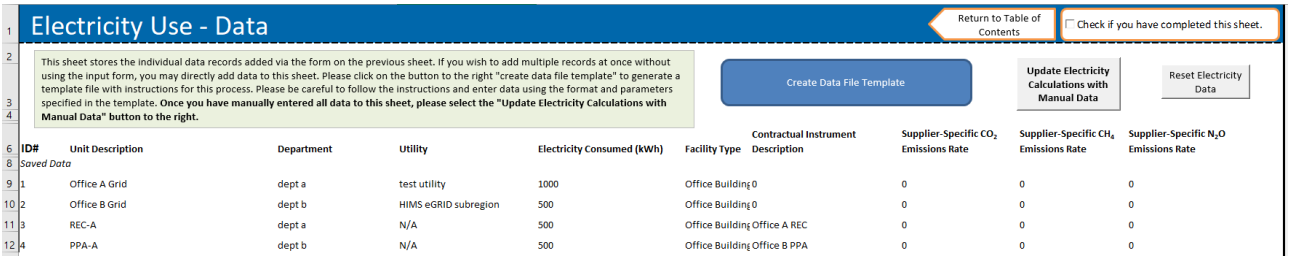


Table 4. Example Location- and Market- Based Calculation Methods[a]

Location-Based Method			
Entity	**Grid Electricity Consumed** (kWh)	**eGRID Emission Factor** (lb CO_2e/MWh)	**Emissions** (MT CO_2e)
Office A	1,000	1,196	0.54
Office B	500	1,196	0.27
Total	**1,500**	**1,196**	**0.81**

Market-Based Method						
Entity	**Grid-Supplied Consumption** (kWh)	**REC/PPA Purchases** (kWh)	**Market-Based Electricity** (kWh)	**Utility-Specific Emission Factor[b]** (lb CO_2e/MWh)	**Contractual Instrument (e.g., REC) Emission Factor** (lb CO_2/MWh)	**Emissions** (MT CO_2e)
Office A	1,000	500	500	1,200	0	0.27
Office B[c]	500	500	0	1,196	0	0
Total	**1,500**	**1,000**	**500**			**0.27**

[a] Adopted from WRI 2015.

[b] Utility-specific emission factors are considered contractual instruments under Scope 2 Guidance. However, to simplify data entry in the LGGIT module, utility-specific emission factors are accounted for separately on the Control Sheet and should not be listed as contractual instruments.

[c] The specific utility supplying electricity for Office B is unknown, so the eGRID Emission Factor is used.

Solid Waste Inventory Sheets

Control Sheet

On the control sheet, first select whether your municipality has operational control over any landfills. If not, you may opt to use the U.S. Environmental Protection Agency's (EPA) Waste Reduction Model (WARM) to calculate your Scope 3 emissions. This step is optional but can also be used to calculate waste emission reductions.

For every landfill over which you have operational control, please select whether those landfills have landfill gas collection systems and whether those systems are comprehensive or partial. Under the LGOP, landfill gas (LFG) collection systems are considered "comprehensive" if the landfill is required to have an LFG collection system under EPA's New Source Performance Standards or a system more stringent as dictated by local regulations.

For these landfills that do not have LFG collection systems, you need to use the California Air Resources Board's (CARB) Landfill Emissions Tool, which is based on the IPCC First Order Decay (FOD) model. To use the model, you will need the annual waste deposited in each landfill as well as the opening and closing year of each landfill. Once you have run the model, please paste the final methane (CH_4) emissions output for each landfill in the yellow cells on in the tool.

Calculations Sheet

Depending on your entries on the Solid Waste control sheet, you will be presented with formulas to calculate your city's emissions from solid waste management. Enter values requested in the pale yellow cells. Click on the checkbox to use default values for the fraction of CH_4 in your city's landfill gas. Your solid waste emissions will be summarized at the bottom of the sheet.

Wastewater Treatment Inventory Sheets

Control Sheet

On the wastewater control sheet, answer the series of questions about the type(s) of wastewater treatment systems in your municipality. For every type of system (anaerobic or aerobic treatment with or without nitrification/denitrification), you will be asked to provide the population served by that system on the entry sheet. You will also answer questions about data availability for your wastewater treatment systems.

Entry Sheet

The wastewater entry sheet provides data input cells based on your answers to the questions on the wastewater control sheet. Enter data in the yellow cells in the specified units is requested.

Calculations Sheet

The calculation sheet shows the formulas used to determine your city's emissions from wastewater treatment, using methodology from the LGOP. The gray cells link to the values you entered on the Wastewater Entry Sheet.

Your total emissions are summarized in the table at the top of the sheet. You may scroll down to

view the detailed calculations, but no action is required on this sheet**.** If you would like to change any of the entered values, you may do so on the entry sheet.

Employee Commute Inventory Sheet

The employee commute sheet will calculate Scope 3 emissions from employee commutes to work. In the yellow cells, enter the number of employees per department, the proportion of those employees who take various modes of transportation to work, average commute distance, and the annual number of work days. Default data for every entry except number of employees has been provided, but you may change them if you have better data.

Once you enter this information, the total emissions from employee commutes will be calculated.

Imported Water Inventory Sheet

The water sheet is where you will calculate the Scope 3 emissions associated with imported water consumption by your municipal government. These emissions are indirectly associated with electricity use and other emissions required to provide water to your city. This does not include the electricity or energy use used directly at city water facilities. Any such electricity use associated with water within your city (such as city water pumps) should be entered under the Electricity tab.

If your city imports water, enter the amount of water consumed by department during the inventory year and where that water is imported from. Each import source is associated with different emission factors and will be used to calculate your city's indirect emissions from water consumption.

Agriculture & Land Management Inventory Sheet

The agriculture & land management sheet is where you will calculate the Scope 3 emissions associated with fertilizer application by your municipal government. These emissions are associated with the application of synthetic, organic, and manure fertilizers. A portion of applied fertilizers volatilize into the air in the form of N_2O.

Once you enter the information for each department on the amount of fertilizer applied by fertilizer type, the total emissions from this source will be calculated.

Urban Forestry Inventory Sheet

The urban forestry sheet is where you will calculate the Scope 3 emissions associated with urban trees (street trees, trees in parks, etc.) managed by your municipal government. Changes in carbon stocks in urban trees are calculated by estimating the total urban area, the percent of that urban area with tree cover, and applying a carbon storage factor to estimate carbon sequestration from urban trees. Note the LGOP states that biogenic forestry emissions are not quantified under the LGOP and can be reported optionally (see Section 2.3 in the LGOP). EPA decided to include these estimates in the tool so that local governments could optionally estimate carbon stocks of government-owned land if this was applicable.

Once you enter the information on the urban tree coverage for each department, the total carbon sequestration from this source will be calculated.

Waste Generation Inventory Sheet

The waste generation sheet is where you will calculate the Scope 3 emissions associated with the decomposition of waste generated within your borders by government operations but landfilled elsewhere. This sheet applies to waste produced directly or indirectly by government operations activities and disposed of in a solid waste facility not operated by the municipality. To calculate Scope 3 emissions from waste, utilize EPA's WAste Reduction Model (WARM) either as a web-based calculator or an Excel spreadsheet. If the waste is disposed of in a facility operated by the municipality, emissions should be calculated as Scope 1 emissions on the Solid Waste-Control and Solid Waste-Entry sheets.

Once you enter the information for each department on the waste generation, the total emissions from this source will be calculated.

Additional Sources Inventory Sheet

Use this sheet to enter emissions from any additional sources you would like to include in your inventory. Assign each source to a city department, note what scope the emissions fall under, and enter any greenhouse gas emissions in metric tons of carbon dioxide equivalent ($MTCO_2e$). In Chapter 11, the LGOP provides a list of other processes and fugitive emissions that could be estimated outside of the tool, and the results of the emissions calculations can be input on this sheet.

4. Uncertainty

The GHG inventory component of the tool follows the methodology of the LGOP. Users should refer to the LGOP for a discussion of the uncertainty associated with default assumptions.

5. Tool References

These references refer to resources cited in the Local Greenhouse Gas Inventory Tool: Government Operations Module as well as in the User's Guide.

LGOP (Local Government Operations Protocol). 2010. Local Government Operations Protocol, Version 1.1. California Air Resources Board, California Climate Action Registry, ICLEI – Local Governments for Sustainability, and The Climate Registry. Available at: http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm.

CEC (California Energy Commission). 2000-2010. Total Electricity System Power. California Energy Commission. Available at: http://energyalmanac.ca.gov/electricity/total_system_power.html.

CEC (California Energy Commission). 2006a. California Commercial End-Use Survey. California Energy Commission. Available at: http://www.energy.ca.gov/ceus/.

CEC (California Energy Commission). 2006b. Refining Estimates of Water-Related Energy Use in California. California Energy Commission. CEC-500-2006-118. Available at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF.

FHWA (Federal Highway Administration). 2010. Highway Statistics 2008. Federal Highway Administration, U.S. Department of Transportation. Available at:

http://www.fhwa.dot.gov/policyinformation/statistics/2008/.

The Climate Registry. 2023. Default Emission Factors. Available online at: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf.

U.S. Census Bureau. 2008. American Community Survey: Table S0801 – Commuting Characteristics. U.S. Census Bureau. Available at: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtm.

U.S. EPA. 2023a. Emissions Factors for Greenhouse Gas Inventories, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/system/files/documents/2023-03/ghg_emission_factors_hub.pdf.

U.S. EPA. 2023b. eGRID 2021 Version 1.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

U.S. EPA. 2023c. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. Office of Atmospheric Programs, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021.

U.S. EPA. 2022. eGRID 2020 Version 1.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

U.S. EPA. 2021. eGRID 2019 Version 1.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

U.S. EPA. 2020. eGRID 2018 Version 1.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

U.S. EPA. 2018. eGRID 2016 Version 1.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

U.S. EPA. 2017. eGRID 2014 Version 2.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

U.S. EPA. 2015. eGRID 2012 Version 1.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

U.S. EPA. 2012. eGRID 2010 Version 1.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

U.S. EPA. 2011. eGRID 2009 Version 1.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

U.S. EPA. 2010. eGRID 2007 Version 1.0. Office of Energy and the Environment, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

WRI. 2014. Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, An Accounting and Reporting Standard for Cities. Available at: https://ghgprotocol.org/sites/default/files/standards/GHGP_GPC_0.pdf

WRI. 2015. GHG Protocol Scope 2 Guidance. Available at: https://ghgprotocol.org/scope_2_guidance

6. Additional Resources

Below are additional resources that can help facilitate the development of your local government GHG inventory.

Resource Name	Link
ENERGY STAR Portfolio Manager	http://www.energystar.gov/buildings/about-us/how-can-we-help-you/benchmark-energy-use/use-energy-star-benchmarking-tools
Local Government Operations Protocol	http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm
Landfill Emissions Tool	https://www.arb.ca.gov/cc/landfills/landfills.htm
EPA MOVES on-road Emissions Model	https://www.epa.gov/moves
State and Local Energy Resources	https://www.epa.gov/statelocalenergy/state-and-local-energy-publications-0