# User's Guide

## Local Greenhouse Gas Inventory Tool: Community 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 |
| GPC | Global Protocol for Community-Scale GHG Emissions |
| 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: Community Module. The tool was developed to support communities across the United States to evaluate the greenhouse gas emissions. Understanding these emission levels provides a base year for tracking emission trends, developing mitigation strategies and policies, and assessing progress towards meeting goals.

The tool helps users to develop a base year community greenhouse gas inventory, following the Global Protocol for Community-Scale GHG Emissions (GPC). This is a companion tool to the Local Government Operations Module, and any totals estimated in the Local Government Operations Module should be included in the Industrial/Commercial sector in the Community GHG Inventory tool.

# 2. Getting Started

The Community Module 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.

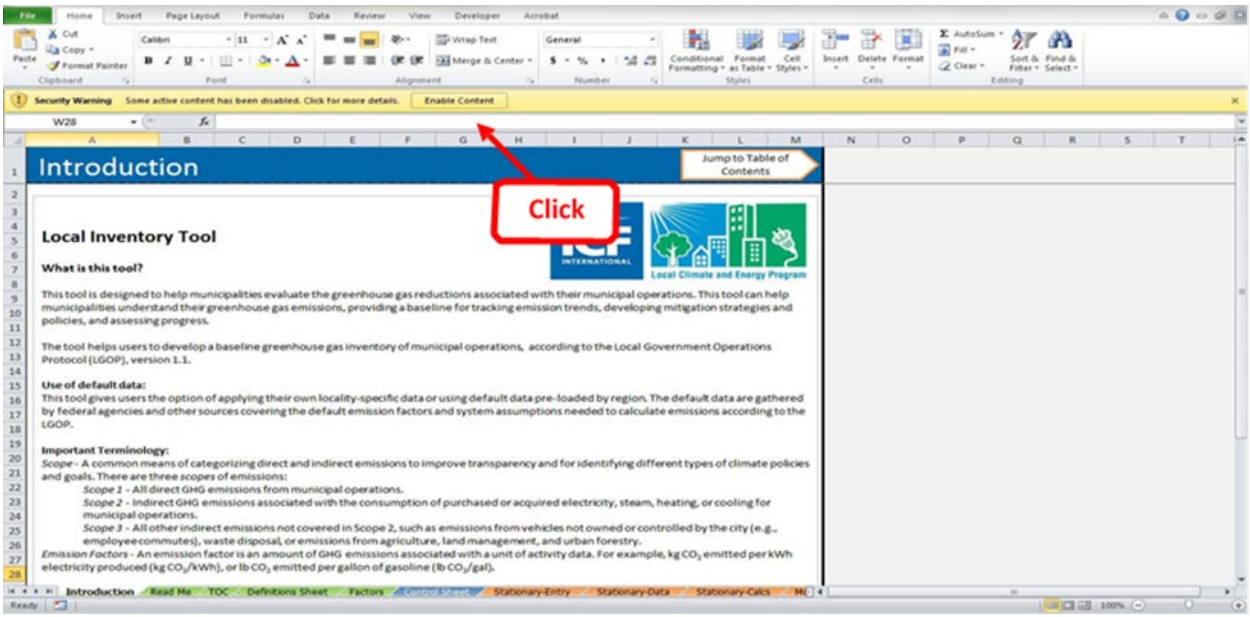
## Microsoft Excel Settings

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.

## Microsoft Excel Security

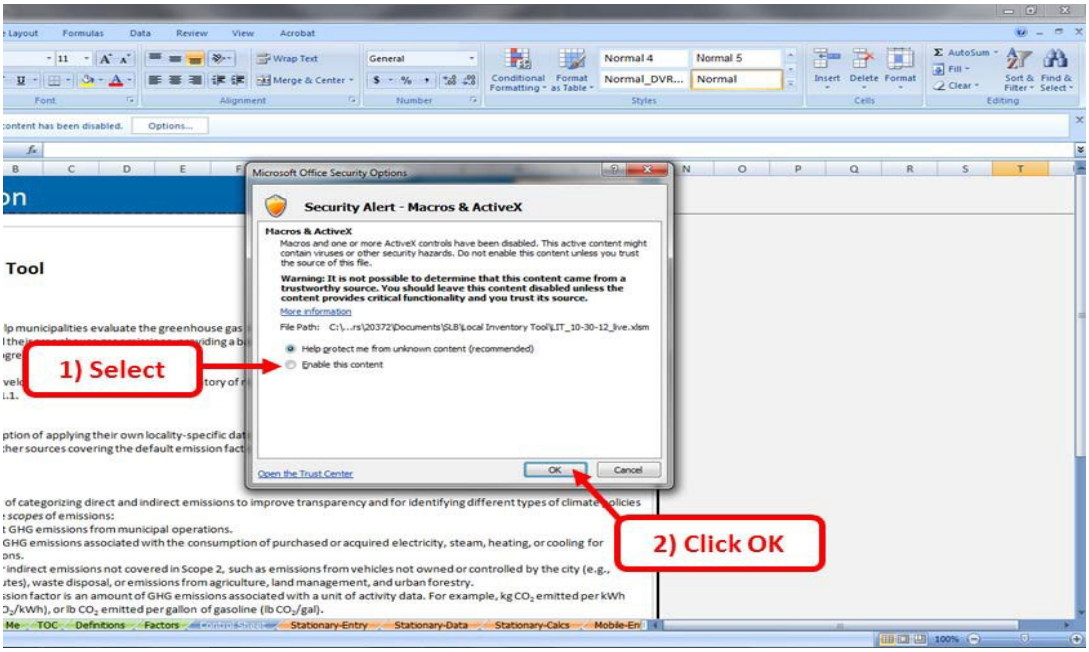
If Excel's security settings are set at the default level, a Security Warning appears above the formula box in Excel when the file is initially opened (Figure 1).

**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. Since the Community 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 temporarily in Excel but does not change the macro security settings.

**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 Community 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 Community 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.

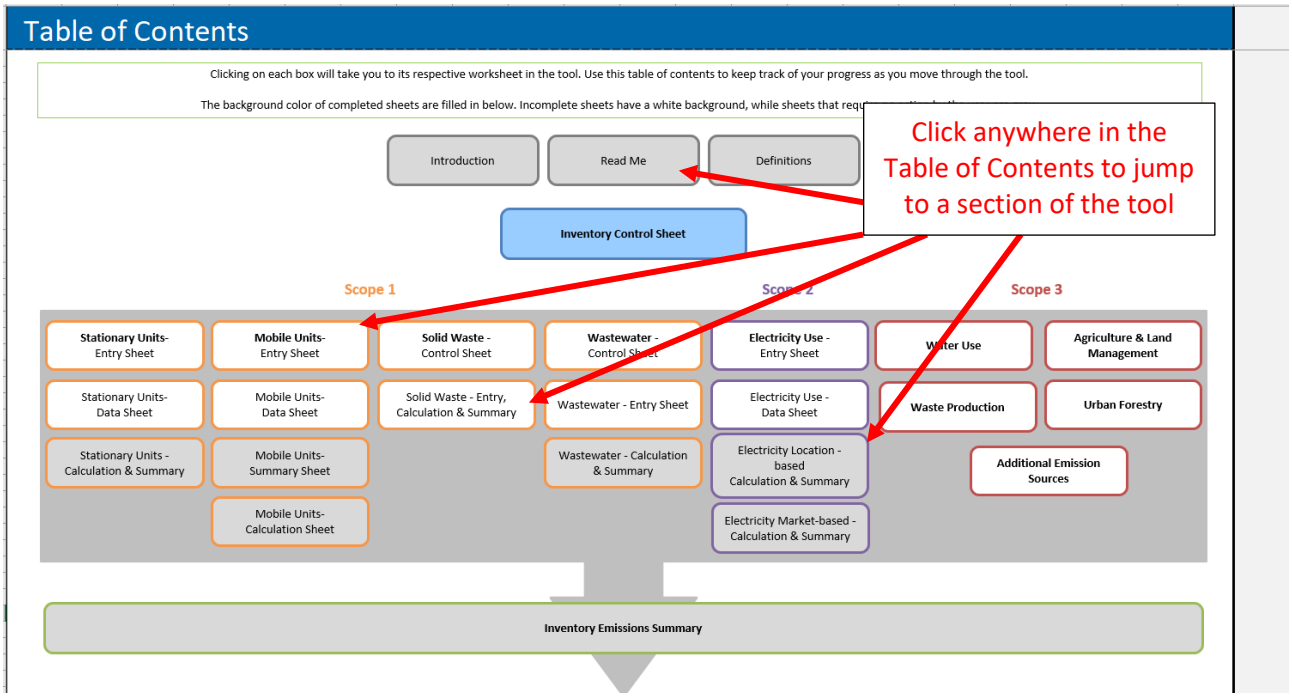
**Once the security level has been adjusted, open the tool and enable macros in the manner described above.**

# Navigating the Tool

The Community 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 community 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 “Stationary - Entry” sheet has been completed. The “Stationary Units – Entry Sheet” box has changed, and is now filled in with color.

**Figure 4. Sheet Navigation and Tracking Tools**

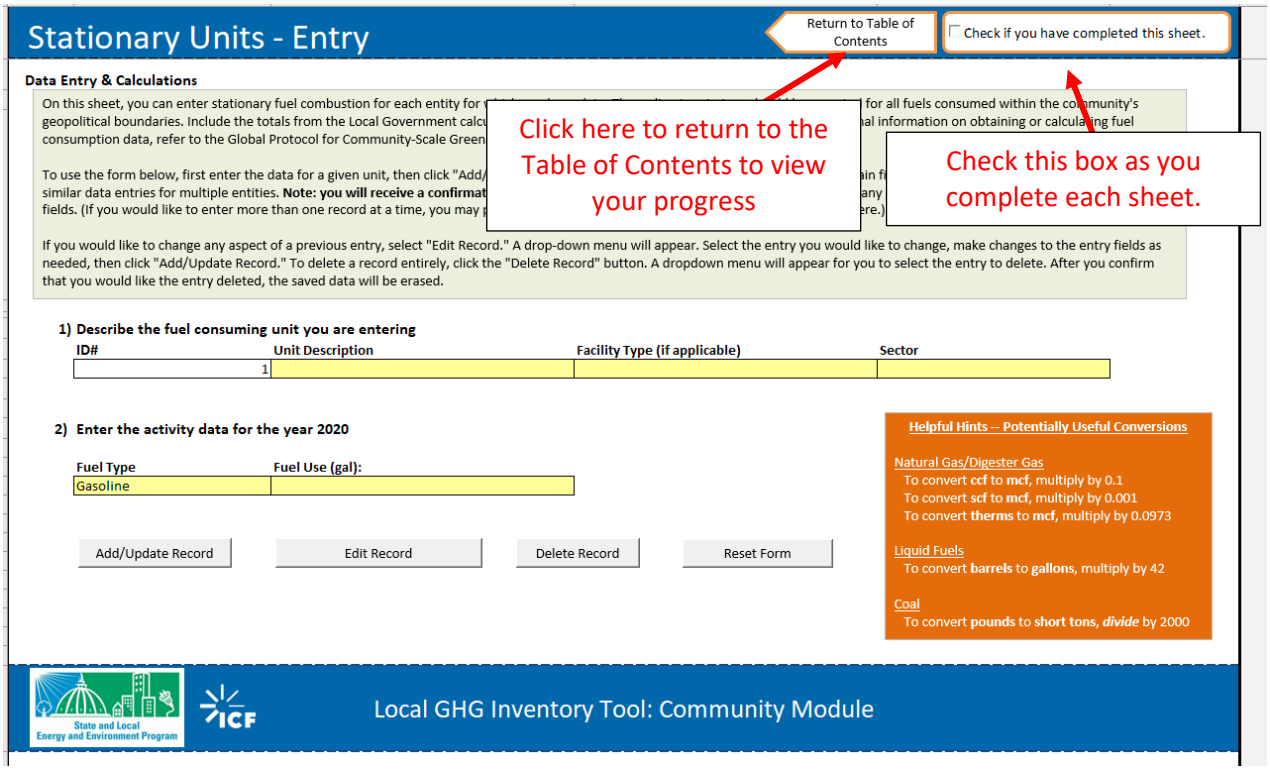
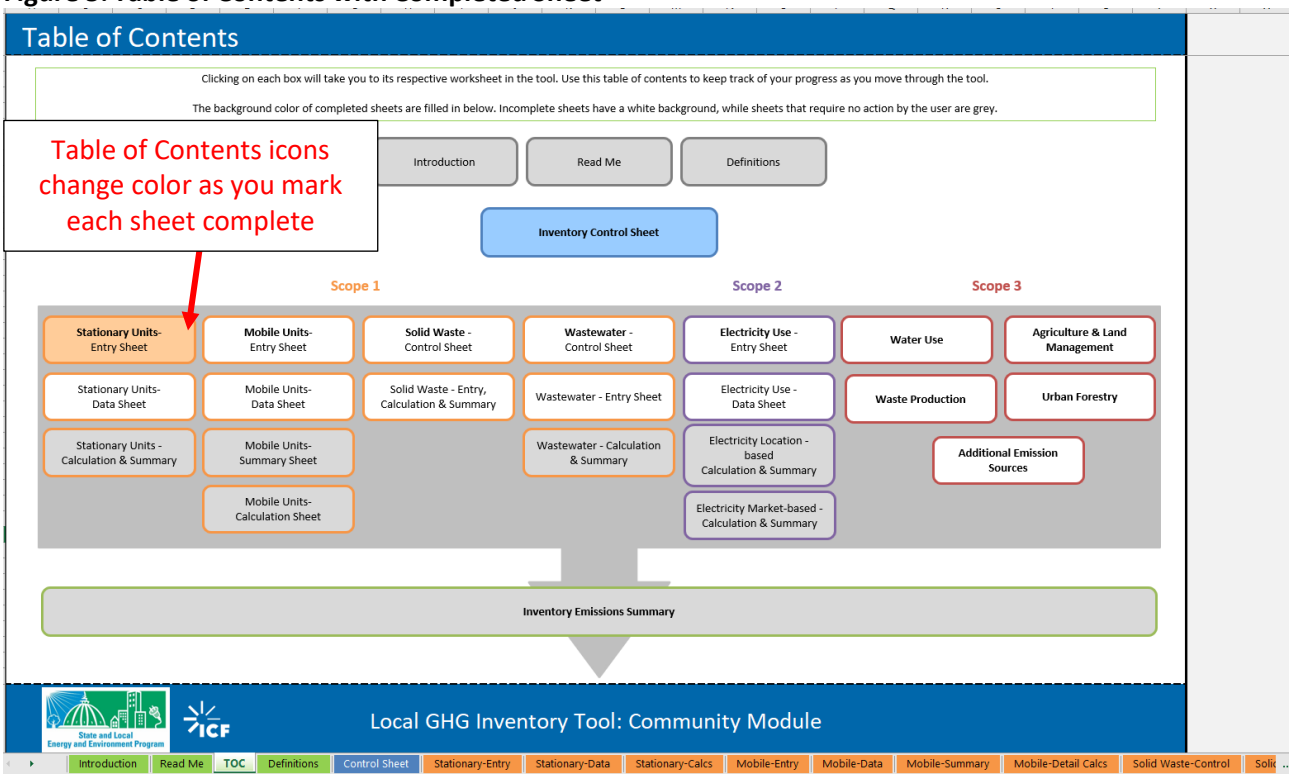



**Figure 5. Table of Contents with Completed Sheet**



# Data Requirements

The Community Module is designed to accept any level of data granularity in order to be flexible to the needs and constraints of different cities. 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 nine main sectors of community-scale 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 Global Protocol for Community-Scale GHG Emissions, and 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 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 city-wide fuel, electricity, and water consumption data by sector.
- This method takes less time, but does not allow the tool to as effectively calculate emission levels.

Option B: Comprehensive Inventory

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

**Table 1. Required Data Inputs for the Community Module—Inventory Calculations**

| GHG Sectors | Input Data |
|---|---|
| Stationary Combustion of Fossil Fuels (e.g. fuel use at residential, commercial, industrial, and electric generating facilities) | Stationary fuel use (by fuel type, by sector) |
| Electricity Consumption | Electricity consumed (kWh) |
| | Electric utility |
| | Utility-Specific Emissions Rate (lb/MWh)* |
| Mobile Combustion of Fossil Fuels (fuel use by vehicles) | 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) |
| 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) |
| | Sector 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.

### Box 2. Data Download Guidance

Users can consult the Appendix to Local Greenhouse Gas Inventory Tool: Community Module for more information about accessing community level energy data using the SLOPE Data Viewer and Scenario Planner.

Users can consult the Agriculture and Land Management Appendix to Local Greenhouse Gas Inventory Tool: Community Module for more information about accessing and downloading agricultural and land management data at the county level.

Users can consult the Incorporating National Emissions Inventory Data into the Local or Tribal GHG Inventory Tools guidance on how to use National Emissions Inventory transportation data at the county or tribal level.

# 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 community and receive customized results.

# Background Controls

On the Inventory Control Sheet, identify the city, and the inventory year for the inventory. The sectors in the Community Module have already been determined and follow in line with the sectors provided in the Global Protocol for Community-Scale GHG Emissions. The sectors used in the tool set up the tool to reflect organizational units for which the most common data are available at the community level.

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 Global Protocol for Community-Scale GHG Emissions and are used throughout the tool:

**Scope 1**: All direct GHG emission sources from activities taking place within the community's geopolitical boundary.

**Scope 2**: Energy-related indirect emissions that result as a consequence of consumption of grid-supplied electricity, heating and/or cooling, within the community's geopolitical boundary.

- **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 3. 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 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 contractual instruments, such as RECs.

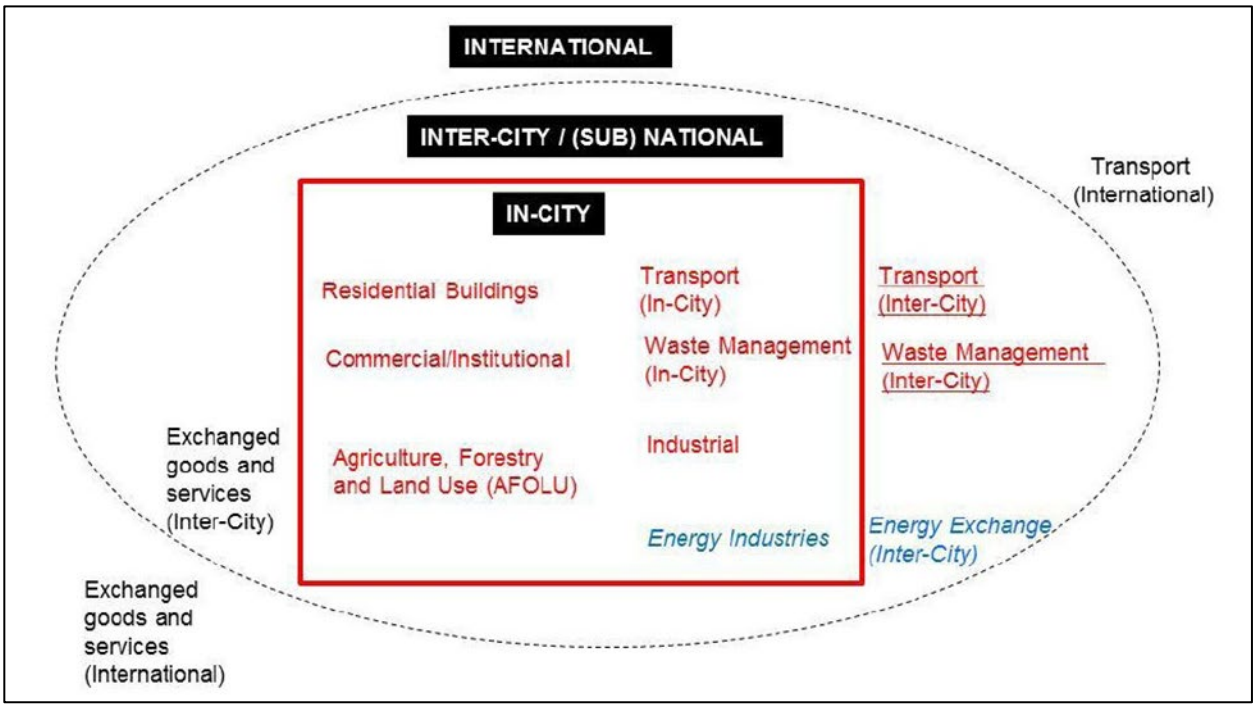
The GHG Protocol states that cities or communities shall use the location-based method (using the region's eGRID factor) for scope 2 calculations and may separately document emissions from the market-based method (using a utility or contract-specific emission factor), where relevant. For transparency, local governments and communities must always report Scope 2 emissions using the location-based method. If local governments or communities 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 and offsets. It is not required to purchase 100% of electricity usage through contractual instruments to use the market-based method.

**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, outsourced activities, waste disposal, etc.

In addition to accounting for emissions according to these 3 scopes, the GPC provides guidance on imports and exports by a community, and how emissions for these should be taken into account. As an example in the GPC (on pg. 86), waste imported into the city is reported as Scope 1 emission estimates. Waste generated by the city and exported and treated outside of the city's boundaries is included in Scope 3 estimates. The Community GHG Inventory Tool accounts for in-boundary consumption and resulting emissions and excludes any emissions released from products consumed or services exported from the locality.

The following graphic highlights sources of emissions that might be applicable to your community.

**Figure 6. Sources of Emissions**




Source: *Global Protocol for Community-Scale GHG Emissions (GPC)*

Since 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.

### Lakewood Colorado 2007 GHG Inventory Report Scope 3 Emissions

Lakewood included Scope 3 emissions in the Materials and Waste Sector for cement use (per capita), water and wastewater fugitive emissions, fuel production, food production, and municipal solid waste (MSW). Examples for cement use and food production are included below.

- For cement use, Lakewood established total cement use for the state from a Colorado Economic report. The city then determined per capita cement use by using the total expenditure of cement products in Colorado by the cost of cement per kilogram. The kilograms of cement attributed to the Lakewood population were calculated by taking the proportion of Lakewood population to the total Colorado population. The cement emission factor was taken from the National Renewable Energy Laboratory's (NREL) Life Cycle Inventory Database.
- Lakewood calculated the embodied energy from food and food packaging by first collecting information on food expenditures on a per-household basis from the Consumer Expenditure Survey. The city then estimated emissions by applying an emission factor (kg $CO_2e$/$ food consumed) from a Carnegie Mellon University Green Design Institute report.

# Inventory Calculations

After the user has configured the tool on the Control Sheet, the tool will calculate the community emissions, or the base year greenhouse gas inventory for the community. The inventory is separated

into the 9 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. Water Consumption (Scope 3)
7. Agriculture & Land Management (Scope 3)
8. Urban Forestry (Scope 3)
9. Waste Generation (Scope 3)
10. Additional Emission Sources (optional) (Scope1, 2, or 3)

For each source, the user will be asked to enter data about relevant community 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.

***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 community 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**

| Community 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** | |
| 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 tool, 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, if you choose to quantify biogenic emissions, they should be tracked 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 tool, 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 | EPA's eGRID |
| **Scope 3** | |
| 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 |

Recent discussion surrounding community-wide inventories has focused on the distinction between activities and sources. Unlike the sources and scopes discussed above, activities are defined as the use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions either directly or indirectly (ICLEI 2013). Sources are defined as any physical process *inside* the jurisdictional boundary that releases GHG emissions into the atmosphere. According to ICLEI's U.S. Community Protocol, "drawing a distinction between the two can help local governments to conceptualize, organize, and report on emissions associated with their communities." In addition, ICLEI's Protocol states that distinguishing between sources and activities "can help local governments decide how to group the emissions numbers they might gather for the purpose of reporting. For example, a purely source-based emissions inventory could be summed to estimate total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary." While some communities have calculated emissions for both, for simplicity, the Community GHG Inventory Tool accounts for sources of GHG emissions. Additional information on activities and scopes can be found in ICLEI's protocol, section 1.3. The table below provides details on how some of the activities prevalent in many communities relate to sectors and scopes.

**Table 4. Use-Activities and Associated Sources by Sector and Scope**

| **Communitywide Use-Activities by Sector** | **Associated Sources of GHG Emissions by Sector & Scope*** (*Ensure Scope 3 items are not already-counted in Scope 1) |
|---|---|
| **SECTOR 1: ENERGY SERVICE TO COMMUNITY BUILDINGS & FACILITIES** | |
| **1a. Activity: Use of Electricity:**<br><br>Residential kWh =<br><br>Commercial kWh =<br><br>Industrial kWh = | **1a. Associated SOURCES of GHG**<br><br>Scope 1: Direct GHG emission from producing electricity (Stationary Combustion) in power plants within the Community Boundary (even if in excess of local use)<br><br>Scope 2: Indirect GHGs from producing Electricity used by community that imported from outside, if any<br><br>Scope 3: Other transboundary/life cycle GHG emission associated with producing electricity used in community – e.g., coal mining, natural gas extraction occurring outside inventory boundary |
| **1b. Activity: Use of Other Energy Carriers/Fuels (Natural gas, Kerosene, Diesel, etc) in Community Buildings & Facilities**<br><br>Residential Natural Gas =<br><br>Commercial natural Gas =<br><br>Industrial Natural gas = | **1b. Associated Sources of GHGs**<br><br>Scope 1: Direct GHG emissions from combustion of fuels in the buildings and facilities of the community (stationary combustion)<br><br>Scope 2: none<br><br>Scope 3: Other transboundary/life cycle GHG emission associated with producing fuels used in community – e.g., oil refining. |
| **SECTOR 2: TRANSPORTATION SECTOR (Road, Rail, Air, Boat/Ship)** | |
| **2. Activity: VMT & Use of Road Transport Fuels**<br>Aggregated Community Wide VMT, with gasoline, diesel use estimates. Otherwise separate detail by sector as below (residential provided as an example)<br>- Residential Detail<br>VMT =<br>Gasoline & Diesel Use= | **2. Associated Sources of GHGs**<br><br>Scope 1: Direct GHG emissions from combustion of fuels in vehicles (mobile combustion)<br>Can be estimated by VMT driven only within boundary<br>Or by origin-destination allocation for VMT activities by trip.<br>Scope 2: none<br>Scope 3: Other transboundary/life cycle GHG emission associated with producing fuels used in community – e.g., oil refining. |
| **SECTOR 3: WASTEWATER TREATMENT/SERVICE SECTOR** | |
| **3. Activity: Generating wastewater that requires treatment/service**<br><br>Aggregated Community wastewater produced that requires treatment. Separate detail as below (only if possible)<br><br>- Residential Million Gallon WWT<br>- Commercial Million gallons WWT<br>- Industrial WWT | **3. Associated Non-energy Sources of GHGs**<br><br>Scope 1: Direct non-energy (process) GHG emissions from wastewater treatment if located within the community, even if the services are offered to others outside the community boundary<br><br>Can be allocated to the WWTP usage by the community being considered<br><br>Note electricity and energy use in WWT Facilities reported in Activity 1 & 2, can be allocated here to show results by sector.<br><br>Scope 2: None, see note above |

| | |
|---|---|
| | Scope 3: Other transboundary/life cycle GHG emission associated with producing WWT services, such as producing the chemicals and other materials used in the WWTP |
| **SECTOR 4: SOLID WASTE MANAGEMENT** | |
| **4. Activity: Use of MSW Management services by Community**<br>Separate by residential, commercial, and industrial (if possible) | **4. Associated Non-Energy Sources of GHGs**<br>Scope 1: Direct non-energy (process) GHG emissions from landfills if located in the community<br>Can be allocated to the WWT P usage of the community being considered<br>Note electricity and energy use in WWT Facilities reported in Sectors 1 and 2 can be separated out and shown here to show by sector.<br>Scope 2: none<br>Scope 3: Other transboundary/life cycle GHG emission associated with waste management, including the recycling computed by WARM. |
| **SECTOR 5: WATER SUPPLY & TREATMENT** | |
| **5. Activity: Treating and supplying water**<br><br>Aggregated Community water supplied.<br>Separate by residential, commercial, and industrial (if possible) | **5. Associated Sources of GHGs**<br>Scope 1: Direct non-energy (process) GHG emissions from water treatment if located in the community<br>Note electricity and energy use in water supply reported in Activity 1 & 2, can be allocated here to show results by sector.<br>Scope 2: none<br>Scope 3: Other transboundary/life cycle GHG emission associated with water treatment and water supply. |
| **SECTOR 6: PUBLIC/GREEN SPACES & URBAN AGRICULTURE IN COMMUNITY** | |
| **Activity: Use/provision of green spaces in the community** | **Associated GHG Emissions:**<br>- Scope 1: Direct non-energy agriculture or land use GHG emissions<br>- Scope 2: None (all electricity is accounted in Sector 1)<br>- Scope 3: Other transboundary and life cycle GHG, e.g., from producing fertilizer used in the community, or applying fertilizer to agricultural land |

# 3. Sheet Instructions and Methodology

This section provides a guide to using the Community Module to estimate greenhouse gas emissions from the community. The methods and default values used for the inventory component of this tool are from the Global Protocol for Community-Scale GHG Emissions and 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 community. The sectors for your community are already established as residential, commercial/institutional, industrial, and energy generation. Next identify city electricity providers, and click the "Set Up" button (in Step 4 at the bottom of the Control Sheet) to get started.

The tool 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 communities 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.”

# Stationary Combustion and Electricity Consumption Inventory Sheets

## Entry Sheets

Enter 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 community, by sector, buildings, or individual equipment such as furnaces. To use the form, first enter the data for a given unit (Unit Description, Facility Type, Sector, 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 vary by sector and include those listed in the table below.

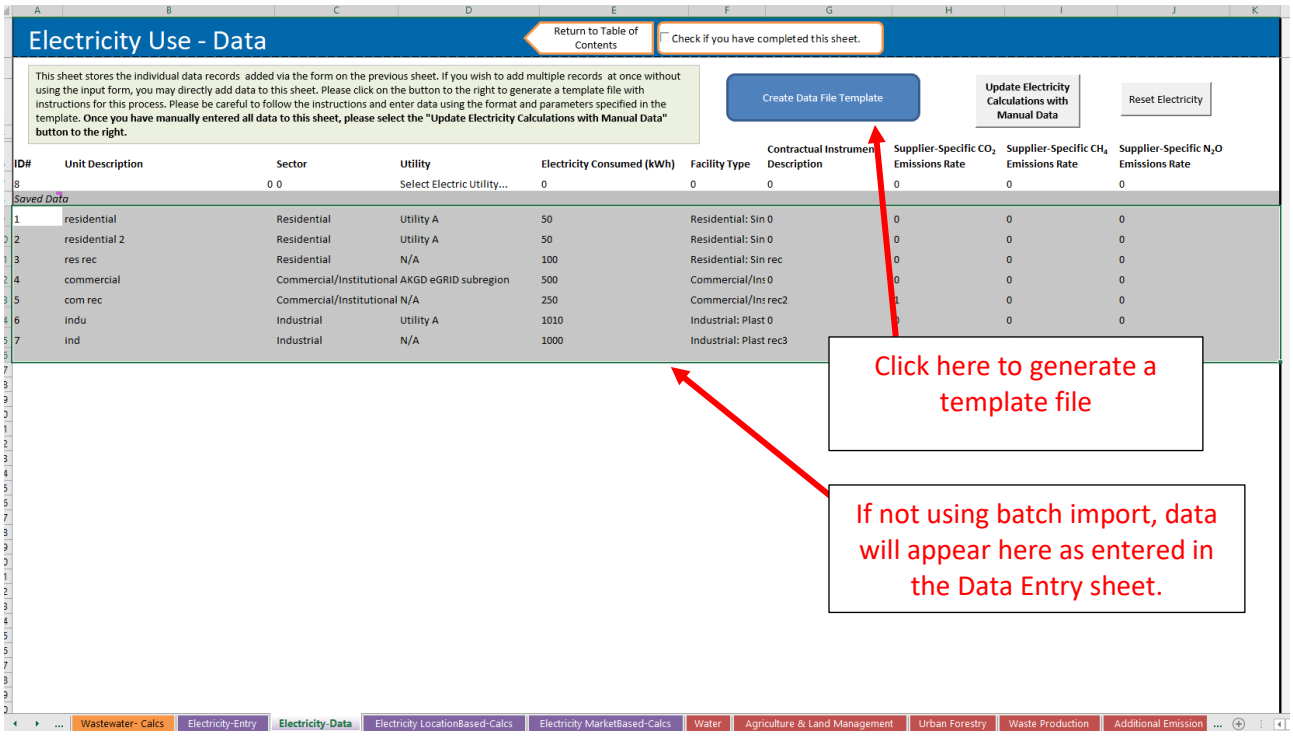
**Table 5. Facility Types by Sector**

| Sector | Facility Types |
|---|---|
| Residential | Single Family Units<br>Apartment Buildings<br>Mobile Homes |
| Commercial/Institutional | Education<br>Food Sales<br>Food Service<br>Health Care<br>Lodging<br>Mercantile<br>Office<br>Public Assembly<br>Public Order and Safety<br>Religious Worship<br>Service<br>Warehouse and Storage<br>Other<br>Vacant |
| Industrial | Food<br>Beverage and Tobacco Products<br>Textile Mills<br>Textile Product Mills<br>Apparel<br>Leather and Allied Products<br>Wood Products<br>Paper<br>Printing and Related Support<br>Petroleum and Coal Products<br>Chemicals<br>Plastics and Rubber Products<br>Nonmetallic Mineral Products<br>Primary Metals<br>Fabricated Metal Products<br>Machinery<br>Computer and Electronic Products<br>Electrical Equip., Appliances, and Components<br>Transportation Equipment<br>Furniture and Related Products<br>Miscellaneous |
| Energy Generation | Electricity Generators |

# 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 follows nearly the same format as the stationary and electricity sectors. However, due to the complicated nature of mobile and electricity emissions calculations, one extra step is required. 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**

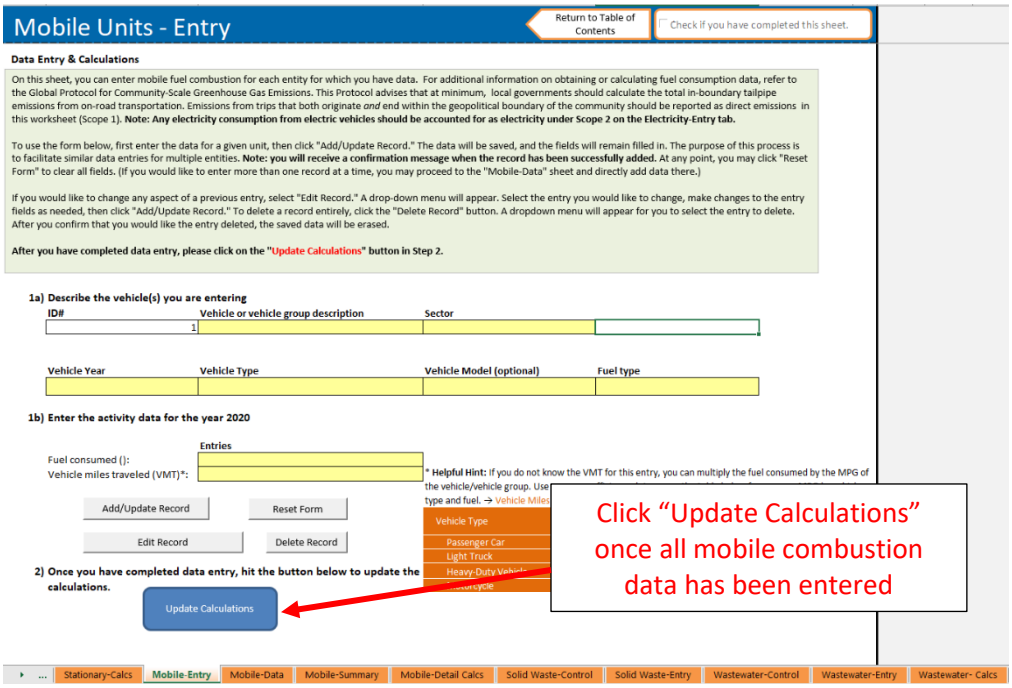
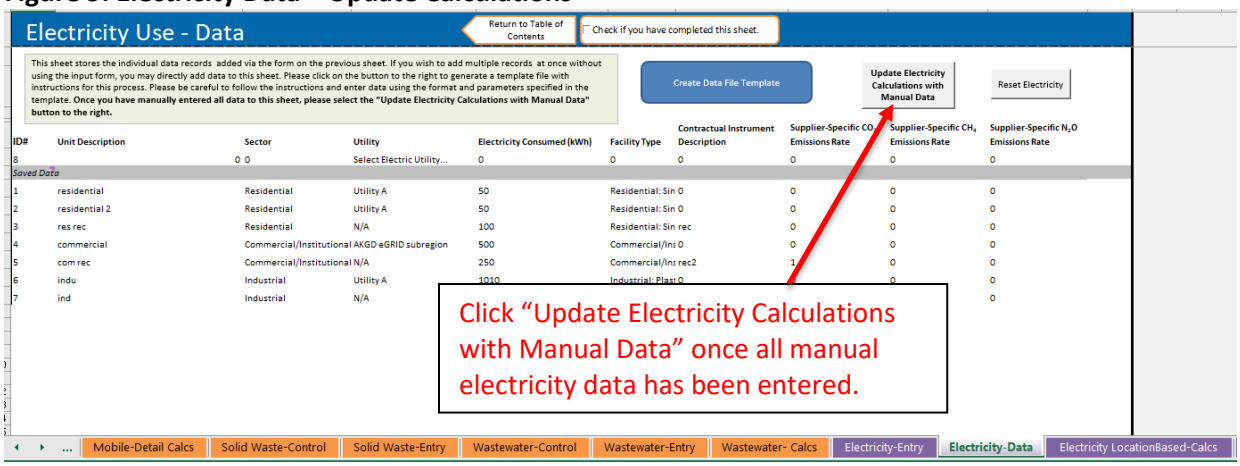



**Figure 9. Electricity Data – Update Calculations**




# 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 sector 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 sector, 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 sector 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 sector, 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 sector, 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 6, Figure 9, Figure 10, and Box 4.

## BOX 4. Electricity Data Entry Example

A community member wants to estimate location-based and market-based emissions for two sectors and their respective buildings. During the past year, the residential sector consumed 1,000 kWh of grid electricity at apartment complex A and purchased a 500kWh REC to offset a portion of their electricity emissions. The commercial sector consumed 500 kWh of grid electricity at Education centers and purchased 500 kWh through a Power Purchase Agreement (PPA). Both buildings are in the same eGRID region but procure electricity from different utilities. The supplier-specific emissions rates for the Education Center are unknown, so the eGRID region is used in calculations.

On the Electricity-Entry tab, the community member enters a description “Apartment Complex A Grid” and selects “No” from the Contractual Agreement dropdown list. The user enters 1,000 kWh and selects the utility. Then, the user repeats the process for the Education Center, entering “Education Center Grid”, selecting “No” from the Contractual Agreement dropdown list, entering 500 kWh, and selecting the eGRID region.

After entering all grid electricity purchases, the user creates a third electricity consuming unit on the Electricity-Entry tab to account for the apartment complex’s REC. The user enters a unit description “REC-A” and selects “Yes” from the Contractual Agreement dropdown list. The employee enters a unique ID for the REC (Apartment Complex 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 user creates a final electricity consuming unit to account for the Education Center PPA. The user enters a unit description “PPA-A” and selects “Yes” from the Contractual Agreement dropdown list. The user enters a unique ID for the PPA (Education Center 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 for both methodologies are summarized across both sectors in the two figures 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**

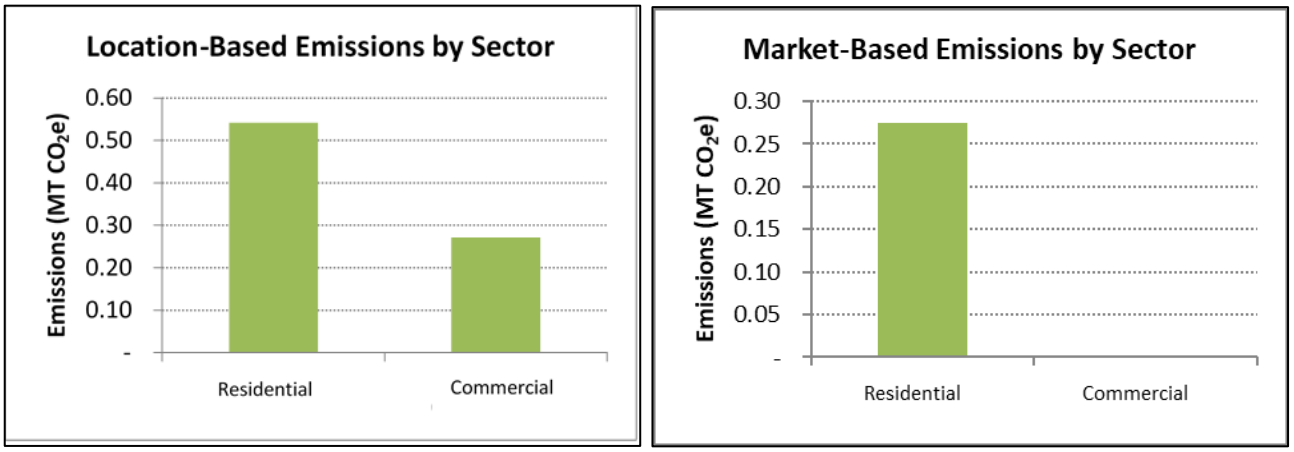
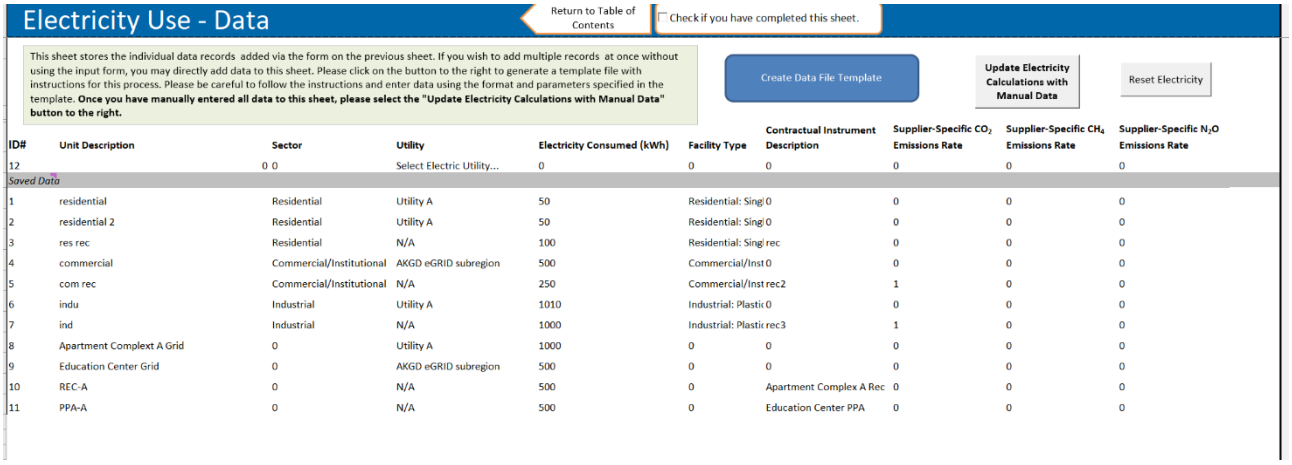



**Figure 11. Electricity Data Sheet for Example Location- and Market- Based Calculation**



Electricity Use - Data

Return to Table of Contents | Check if you have completed this sheet.

This sheet stores the individual data records added via the form on the previous sheet. If you wish to add multiple records at once without using the input form, you may directly add data to this sheet. Please click on the button to the right to generate a template file with instructions for this process. Please be careful to follow the instructions and enter data using the format and parameters specified in the template. **Once you have manually entered all data to this sheet, please select the "Update Electricity Calculations with Manual Data" button to the right.**

Create Data File Template | Update Electricity Calculations with Manual Data | Reset Electricity

| ID# | Unit Description | Sector | Utility | Electricity Consumed (kWh) | Facility Type | Contractual Instrument Description | Supplier-Specific $CO_2$ Emissions Rate | Supplier-Specific $CH_4$ Emissions Rate | Supplier-Specific $N_2O$ Emissions Rate |
|---|---|---|---|---|---|---|---|---|---|
| 12 | 0 0 | | Select Electric Utility... | 0 | 0 | 0 | 0 | 0 | 0 |
| *Saved Data* | | | | | | | | | |
| 1 | residential | Residential | Utility A | 50 | Residential: Sing | 0 | 0 | 0 | 0 |
| 2 | residential 2 | Residential | Utility A | 50 | Residential: Sing | 0 | 0 | 0 | 0 |
| 3 | res rec | Residential | N/A | 100 | Residential: Sing | rec | 0 | 0 | 0 |
| 4 | commercial | Commercial/Institutional | AKGD eGRID subregion | 500 | Commercial/Inst | 0 | 0 | 0 | 0 |
| 5 | com rec | Commercial/Institutional | N/A | 250 | Commercial/Inst | rec2 | 1 | 0 | 0 |
| 6 | indu | Industrial | Utility A | 1010 | Industrial: Plastic | 0 | 0 | 0 | 0 |
| 7 | ind | Industrial | N/A | 1000 | Industrial: Plastic | rec3 | 1 | 0 | 0 |
| 8 | Apartment Complext A Grid | 0 | Utility A | 1000 | 0 | 0 | 0 | 0 | 0 |
| 9 | Education Center Grid | 0 | AKGD eGRID subregion | 500 | 0 | 0 | 0 | 0 | 0 |
| 10 | REC-A | 0 | N/A | 500 | 0 | Apartment Complex A Rec | 0 | 0 | 0 |
| 11 | PPA-A | 0 | N/A | 500 | 0 | Education Center PPA | 0 | 0 | 0 |

**Table 6. 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 $CO_2e$) |
|---|---|---|---|
| Apartment Complex A | 1,000 | 1,196 | 0.54 |
| Education Center | 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 $CO_2e$) |
|---|---|---|---|---|---|---|
| Apartment Complex A | 1,000 | 500 | 500 | 1,200 | 0 | 0.27 |
| Education Center[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 the Education Center is unknown, so the eGRID Emission Factor is used.

# Solid Waste Inventory Sheets

## Control Sheet

On the control sheet, first select whether your community 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 that you have operational control over, 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 a 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 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, if applicable. 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 community. 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. 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 the methodology from the Local Government Operations Protocol. 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.

# Imported Water Inventory Sheet

The water sheet is where you will calculate the Scope 3 emissions associated with imported water consumption by your community. 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 included in the Electricity tab.

If your city imports water, enter the amount of water consumed by sector 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 the different sectors in your community. 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 sector 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 managed by your community. 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 GPC states that biogenic forestry emissions can be reported separately from totals (see pg. 39 in the GPC). EPA decided to include these estimates in the tool so that communities could optionally estimate carbon stocks if this was applicable.

Once you enter the information on the urban tree coverage for each sector, 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 the community, but landfilled elsewhere. This sheet applies to waste produced directly or indirectly by community activities and disposed of in a solid waste facility not operated by the community. 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 community, 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 sector 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 sector, note what scope the emissions fall under, and enter any greenhouse gas emissions in metric tons of carbon dioxide equivalent ($MTCO_2e$). The GPC provides a list of additional sources in Table 4.3 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 GPC. Users should refer to the GPC for a discussion of the uncertainty associated with default assumptions.

# 5. Tool References

These references refer to resources cited in the Community Module as well as in the User's Guide.

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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 community 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 |
| Global Protocol for Community-Scale GHG Emissions Inventories | http://www.ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities |
| 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 |
| SLOPE State and Local Planning For Energy | https://maps.nrel.gov/slope/ |
| USDA Fertilizer Use and Price | https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx |