

Module 2: Quick Start Tutorial on the Solid Waste Emissions Estimation Tool



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About Module 2

This module introduces users to the [Global Methane Initiative's](#) (GMI) Solid Waste Emissions Estimation Tool (SWEET), model assumptions and limitations, and how to get started.



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Module Overview



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What is the Solid Waste Emissions Estimation Tool (SWEET)?

How can I get started with SWEET?

What are the assumptions of SWEET?

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What is the Solid Waste Emissions Estimation Tool (SWEET)?

SWEET is an Excel-based tool for **quantifying greenhouse gases** and other pollutants from sources **across the waste sector** at the project and municipal level.

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About SWEET



Select a topic to learn more about SWEET. Select “Next” to continue

Why was SWEET developed?

What is SWEET used for?

How does SWEET compare to other emissions estimation tools?

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Why was SWEET Developed?

Need for a simplified and user-friendly emissions estimation tool

Need for a tool to evaluate methane mitigation options in the waste sector

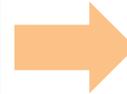


Select a topic to learn more or select "Next" to continue.

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Why was SWEET Developed?

Need for a simplified and user-friendly emissions estimation tool



Need for a tool to evaluate methane mitigation options in the waste sector

? Challenge: Estimating greenhouse gas (GHG) and short-lived climate (SLCPs) pollutants from the waste sector is **complex**.

✓ Solution: SWEET is a globally accessible tool designed for estimating emissions.

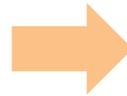
- 1. Provides flexible data input system:** SWEET allows users to input local data where available or rely on default values based on international guidelines (e.g., IPCC) when data is missing.
- 2. Models methane generation over time:** SWEET incorporates a first-order decay model, which accounts for the gradual decomposition of waste in landfills, improving accuracy compared to simpler methods. The tool **accounts for landfill site conditions and waste composition** and allows users to evaluate waste material flows to diversion or disposal facilities for up to **160 years**.
- 3. Covers multiple emissions types and waste management methods:** SWEET produces annual emissions estimates of methane, carbon dioxide, black carbon, particulate matter, and nitrous oxide from solid waste collection, transportation, burning, and disposal.

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Why was SWEET Developed?

Need for a simplified and user-friendly emissions estimation tool

Need for a tool to evaluate methane mitigation options in the waste sector



? Challenge: Evaluating methane emissions from waste management and identifying the most effective mitigation strategy can be complex because there are a variety of waste management options.

✓ Solution: SWEET allows users to analyze up to four alternative scenarios and compare these options with baseline emissions to support decision-making.

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What is SWEET used for?

SWEET can be used to estimate the following pollutants from the solid waste sector:

1. Carbon dioxide equivalent
2. Black carbon
3. Methane
4. Sulfur oxides
5. Particulate matter
6. Nitrogen oxides

SWEET can be used to inform policy decisions and regulatory frameworks to reduce methane from waste management. Users can use SWEET to estimate baseline emissions, as well as emissions from up to four alternative policy scenarios.

SWEET can be used to track changes in emissions over time to help measure the effectiveness of mitigations strategies. Users can get emissions estimates dating back to 1960, with projections to 2050.

 Read **SWEET case studies**

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Examples of Tools for Estimating Emissions from the Waste Sector

- **[GMI Solid Waste Emissions Estimation Tool \(SWEET\)](#)**: This Excel tool calculates the impacts of *methane, carbon dioxide equivalent, nitrogen oxides, sulfur oxides, black carbon, and particulate matter (PM_{2.5} and PM₁₀)* from different solid waste management interventions, including composting, anaerobic digestion, landfill gas capture, recycling, collection and transportation, and more. It allows users to enter up to four alternative scenarios in future years. Available outputs are emissions of GHGs and air pollutants, in metric tons in carbon dioxide equivalent (CO₂e).
- **[GIZ SWM GHG Calculator – Lifecycle Approach](#)**: This Excel tool from the German Society for International Cooperation (GIZ) calculates lifecycle *methane, carbon dioxide, and nitrous oxide* impacts of different waste processing and treatment interventions, including composting, anaerobic digestion, recycling, and waste-to-energy. Unlike SWEET, it does not calculate emissions from open burning, collection and transportation or waste handling equipment. Furthermore, outputs are in metric tons of CO₂e and *not broken down into metric tons of different pollutants*.
- **[U.S. EPA Waste Reduction Model \(WARM\)](#)**: This Excel tool estimates lifecycle *methane and carbon dioxide* from alternative materials management practices, including source reduction, recycling, composting, anaerobic digestion, combustion, and landfilling. This is a U.S.-specific tool with built-in U.S. data and does not allow users to import country-specific data. WARM presents outputs in *metric tons of CO₂e*.

How is SWEET different from other emissions estimation tools?

| Tool Methods | SWEET | GIZ SWM GHG Calculator | EPA WARM |
|--|-------|------------------------|----------|
| Waste decay method | ✓ | | |
| Lifecycle assessment method | | ✓ | ✓ |
| Default values available | ✓ | ✓ | |
| IPCC equations basis | ✓ | | |
| Global/ international scope | ✓ | ✓ | |
| Waste Interventions Addressed | SWEET | GIZ SWM GHG Calculator | EPA WARM |
| Waste reduction | ✓ | | ✓ |
| Collection expansion | ✓ | | |
| Replacing inefficient equipment/ vehicles | ✓ | | |
| Reduction in open burning | ✓ | ✓ | |
| Dumpsite remediation | ✓ | ✓ | |
| Composting, anaerobic digestion, incineration, & recycling | ✓ | ✓ | ✓ |

The table on this slide presents a high-level comparison of several publicly available solid waste sector emissions calculation tools.

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SWEET vs. Lifecycle Models

- The WARM and the SWM Calculator use **lifecycle models** for their calculations. Lifecycle models often provide long-term aggregate results but can be limited in their ability to reflect a site-specific calendar year emissions and may not be able to monitor annual emissions reductions progress.
- SWEET was designed to provide **an alternative to lifecycle modeling** for the waste sector. By using site-level, calendar year data to calculate landfill methane emissions, SWEET presents both annual emissions estimates as well as site-specific material flows and diversion to alternative waste management scenarios.
- SWEET was also designed to be comprehensive and customizable by incorporating four organic waste category values and five global precipitation categories to refine results. SWEET also estimates black carbon emissions from waste burning, as well as emissions reductions from ending burning or closing dumpsites.

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Additional Information about SWEET

■ Peer review

- **SWEET underwent a formal technical peer review managed by EPA in 2021.** Peer review is intended to identify any technical problems or unresolved issues in a work product using independent experts.

■ Versions

- SWEET has been continuously enhanced through user feedback and the integration of updated default values based on the latest data in solid waste management.
- Translated into four languages: Spanish, French, Brazilian Portuguese, and Serbian

■ Usage

- SWEET is downloaded approximately **900 times per year**.
- **Many countries and cities have used SWEET** for assessing waste sector emissions.
- **16+ organizations referenced** SWEET in publications.

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What are the Model Assumptions in SWEET?



Select a topic to learn more about each assumption

Methane Correction Factor (MCF)
Assumption

Gas Collection Efficiency
Assumption

Gas Flaring Assumption

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Assumption: Methane Correction Factor (MCF)

Different waste disposal methods manage waste and site conditions in different ways. The Methane Correction Factor (MCF) adjusts for this by recognizing that unmanaged waste sites have partially aerobic conditions, and therefore produce less methane than well-managed, oxygen-free (anaerobic) sites. SWEET uses the MCF to lower the estimated methane emissions based on the type of waste site selected in the tool.

Each type of solid waste disposal site is assigned a specific MCF, as defined by the Intergovernmental Panel on Climate Change (IPCC).

| Type of Solid Waste Disposal Site | MCF default value | Methane Reduction |
|--|-------------------|-------------------|
| Landfills: managed anaerobic | 1.0 | None |
| Dumpsite – deep (waste depth greater than 5 m) | 0.8 | 20 % |
| Dumpsite – shallow (waste depth equal to or less than 5 m) | 0.6 | 40 % |

Insight

Anaerobic conditions (i.e., without oxygen) in a disposal site develop as the site's volume increases. Shallow disposal sites experience greater air intrusion, while deeper sites have less air intrusion, leading to anaerobic conditions.

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Assumption: Gas Collection Efficiency

Methane generated in a landfill or dumpsite is either collected and combusted, oxidized, or emitted. The percentage collected by a gas collection system, known as “collection efficiency,” is assigned a default value based on the disposal site type:

- 60% for landfills
- 50% for remediated controlled dump sites
- 45% for controlled dump sites
- 30% for remediated dump sites
- 0% for unmanaged dumpsites.

These values, estimated by landfill gas modeling experts, are conservative and introduce uncertainty since methane generation is modeled rather than measured.

Landfills with high-Btu methane utilization projects have their default collection efficiency reduced by 20% due to stringent gas quality requirements. Default values can only be overridden for landfills if actual methane recovery flow rates (m^3/hour) are provided, allowing for site-specific collection efficiencies up to 85% (70% for high-Btu projects).



Assumption: Gas Flaring

If collected, landfill gas will in most cases be combusted in an on-site landfill gas flare, which can achieve a methane destruction efficiency of 98%, according to the World Bank. Methane destruction efficiencies can be somewhat lower if collected methane is combusted in a facility that uses the gas as an energy source. A **methane destruction efficiency of 98% is assumed in SWEET** based on the average of values for various combustion devices.

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What are the Potential Limitations of SWEET?



Select a topic to learn more about each limitation

Data Quality and Accuracy Issues

Uncertainty in Emission Factors
and Decay Rates

Model Simplification Issues

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Potential Limitation: Data Quality and Accuracy

Common sources of uncertainty:

- Estimates are derived from user input data, so low quality or inaccurate inputs have a large effect on accuracy of outputs. For example, available waste composition data may not be representative of actual waste disposed at the site.
- Actual current and future MSW collection rates could vary significantly over time and may not be well-represented by estimated annual waste collection and growth rates.
- Estimates of waste burning rates are highly uncertain, yet they largely determine the range of possible black carbon emissions.
- Waste handling equipment emissions are significant, but lack of data is common.
- Forecasting unknown future conditions and scenario implementation dates introduces uncertainty.

Tips

The U.S. EPA on behalf of the Global Methane Initiative developed the Waste Characterization Handbook and accompanying Excel tool to help decision-makers and solid waste professionals to understand the composition of waste streams.

[Access the Handbook](#)

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Potential Limitation: Uncertainty in Emission Factors and Decay Rates

SWEET relies on emission factors and decay rates to estimate methane emissions, but due to the complex and variable nature of solid waste disposal sites, **these factors are inherently uncertain**. For example:

- The rate at which organic waste in landfills decays is variable. The decay process, which produces methane as organic matter breaks down anaerobically, is influenced by factors such as moisture, temperature, waste composition, and the age of the landfill.
- The emission factor for methane generation from landfills can vary depending on multiple factors including the type of waste, climate, moisture, and the management practices at the site. SWEET accounts for some of these variables, but it is not designed to incorporate all site-specific conditions.
- The emission factor for black carbon can be highly uncertain because it depends on burning conditions, which are often poorly documented or estimated.

Potential Limitation: Model Simplification Issues

- **Ease of Use vs. Detailed Data.** One of the main goals of SWEET is to be user-friendly, allowing users to estimate emissions without needing highly specialized knowledge. To achieve this, the tool simplifies the input requirements, relying on generalized parameters and broad assumptions. However, this approach means that the model cannot fully capture the complexities of specific sites, such as unique waste compositions, site management practices, or local environmental conditions.
- **Limited Input Flexibility.** While this simplification makes the tool accessible to a wide range of users, it limits the level of detail available for input. For example, a user might have to input a generalized waste composition for their site, rather than the specific types and quantities of waste being disposed of. Similarly, the model requires simplified assumptions about future waste collection rates, rather than detailed projections based on specific local plans or trends.

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Get Started with SWEET

Download the tool

www.globalmethane.org/SWEET or select the button below.

Select the version of SWEET you'd like to download. As of 2025, SWEET is available in English, Brazilian Portuguese, French, Serbian, and Spanish.

Microsoft Excel must be installed to proceed.



Download
SWEET



Read the
SWEET User Manual

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The screenshot shows the GMI website header with the logo and tagline "Leading methane action since 2004". A navigation bar includes links for "About GMI", "Sectors", "Partner Countries", "Project Network", "Technical Topics & Resources", and "Events and Communications". The main content area features a card for the "Solid Waste Emissions Estimation Tool (SWEET)" with a thumbnail image and a "List of Resources" link. Below the card, a table lists metadata: Sector (Biogas, Municipal Solid Waste), Year (2025), and Language (English, French, Spanish, Serbian). To the right, a "Downloads and Resources" section lists files for English, Brazilian Portuguese, French, Serbian, and Spanish, including SWEET v 5.0 (Excel), Data Collection Worksheets (PDF), and User Manuals (Doc).

| |
|--|
| Sector: Biogas, Municipal Solid Waste |
| Year: 2025 |
| Language: English, French, Spanish, Serbian |

Downloads and Resources

English

- SWEET v 5.0 (English, Excel)
- SWEET Data Collection Worksheet (PDF)
- SWEET User Manual (Doc)

Brazilian Portuguese

- Ferramenta para Estimativa de Emissões de Resíduos Sólidos (SWEET) v 5.0 (Brazilian Portuguese, Excel)

French

- l'Outil d'Estimation des Emissions de Déchets Solides (SWEET) v 5.0 (French, Excel)

Serbian

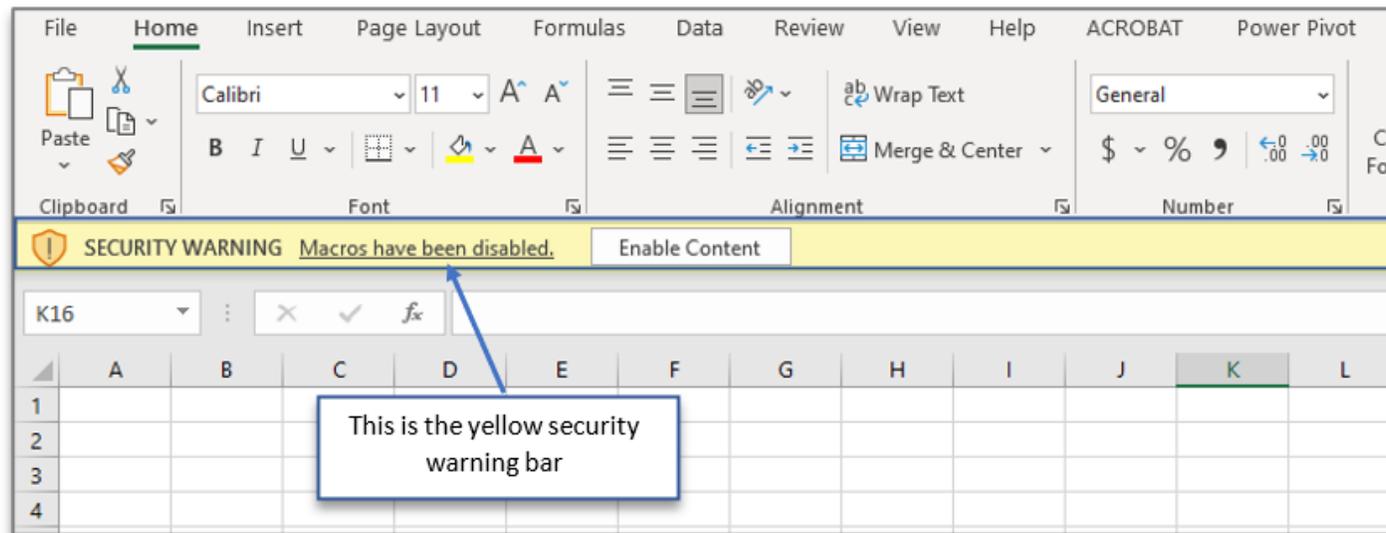
- Model za procenu emisija iz sektora upravljanja cvrstim otpadom (SWEET) v 5.0 (Serbian, Excel)
- SWEET Uputstvo za koriscenje (Serbian, PDF)

Spanish

- Herramienta de Estimación de Emisiones de Residuos Sólidos (SWEET) v 5.0 (Spanish, Excel)

Enable Macros

When you open the tool, you will be prompted by Excel to **enable the tool's macros**. You **must enable macros** for the tool to function correctly. You will either be prompted with a pop-up upon opening the tool, or a yellow warning bar will appear at the top of the program asking you to "Enable Content." If you did not choose to enable macros, close the tool and reopen it, and you will have the option again to enable macros.

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Alternative Scenarios

In addition to assessing emissions from your current waste management scenario, SWEET allows you to explore alternative scenarios and their impacts on emissions. It is best to **have these alternative scenarios defined before beginning to use the tool.**

Alternative scenarios are plans that your city could pursue for municipal solid waste management that differ from what is currently planned. Defining a scenario means knowing the year the plan would be implemented and what sizes/types of equipment and facilities it would use.

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Organization of SWEET

SWEET is organized by tabs located at the bottom of the workbook, grouped by color as follows:

- Several **BROWN** tabs provide instructions, notes, assumptions, default values references, and additional information.
- Users are required to enter data in all five **BLUE** tabs 
- The three **BLACK** tabs provide several tables and charts that summarize the tool's outputs.
- The **GRAY** tabs provide more detailed emissions results from the baseline and alternative scenarios.

| |
|-----------------------------|
| General Information |
| Collection - Transportation |
| Waste Burning |
| Landfills and Dumpsites |
| Waste Handling Equipment |

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Entering Data

- Enter data for your city's current waste management situation and alternative scenarios into all **blue** (■) cells.
- You can also enter data in **green** (■) cells, which are not required but appear as options when you enter certain information into blue cells on the Landfills and Dumpsites tabs.
- **Yellow** (■) cells are default values that are automatically provided. You can change these values if you have local data available.
- The light **grey** (■) cells, except for those in columns labeled "source" or "notes," contain calculated values that cannot be edited.

Tips

Many of the **blue** and **green** cells contain helpful hints and definitions that will appear when you click on them.

You can reset any user-entered data to original default values by clicking on the "**Reset Default Values**" buttons provided on each data input page.

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Viewing Results

Once all the data has been entered, the results will be displayed across various tabs in the workbook. Below is a description of each group of tabs.

- The three **BLACK** tabs contain various tables and charts that summarize the outputs.
- The six **GRAY** tabs provide more detailed emissions results from the baseline, alternative scenarios and the waste burning emissions.



| |
|--|
| Emissions Summary Tables |
| Emissions Changes Versus Business-as-Usual |
| Emissions Graphics |



| |
|--|
| Business-as-Usual Detailed Emissions Summary |
| Alternative Scenario 1 Emissions Summary |
| Alternative Scenario 2 Emissions Summary |
| Alternative Scenario 3 Emissions Summary |
| Alternative Scenario 4 Emissions Summary |
| Waste Burning Emissions |

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For more information about SWEET, check out these resources



Select a box to learn more about each resource

Case Studies

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Case Studies

The Global Methane Initiative has published several case studies on real-world uses of SWEET.



Examining health and climate impacts of solid waste management in Accra, Ghana

[Read the case study](#)



Estimating short-lived climate pollutants from municipal solid waste in Tyre Caza, Lebanon

[Read the case study](#)



Scaling up organic waste management in Serbia's South Backa Waste Management Region

[Read the case study](#)

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Videos



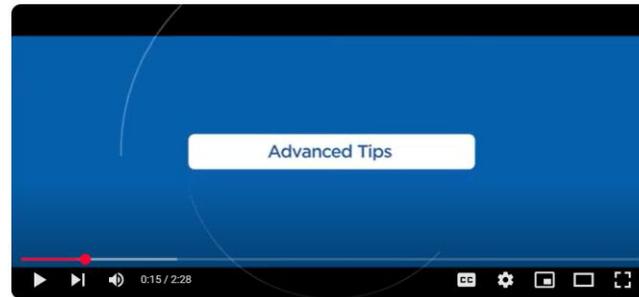
SWEET General Information

Watch the video



SWEET Landfills & Dumpsites

Watch the video



SWEET advanced tips

Watch the video

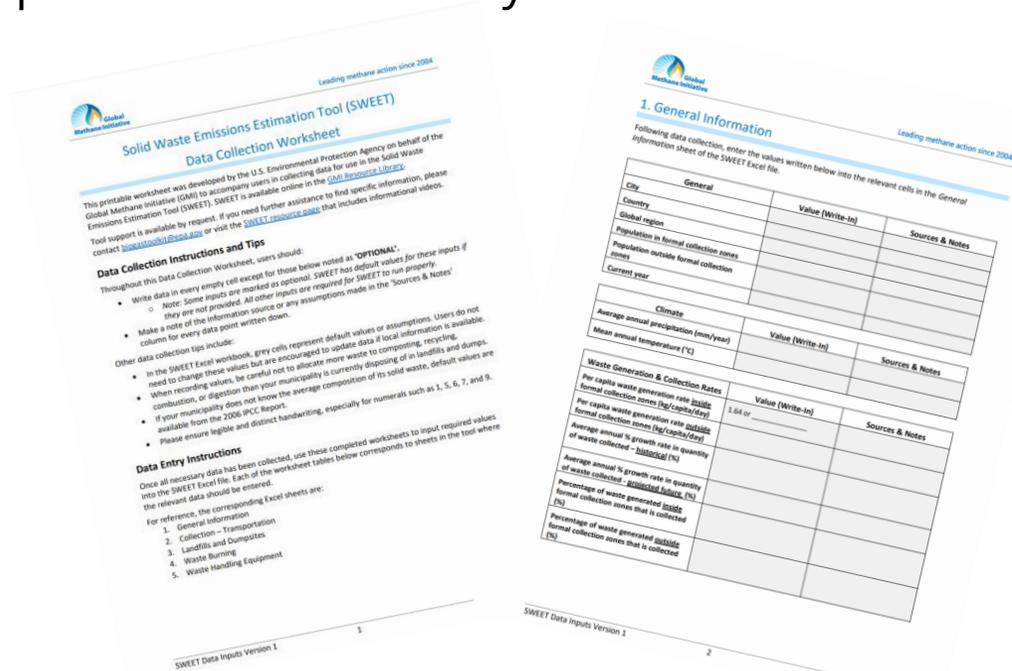
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SWEET Data Collection Worksheet

The tool requires data inputs for **all stages of waste management**, from collection to disposal and diversion. To streamline data entry into SWEET when a computer or tablet is not available, users are invited to use the SWEET data collection worksheet. This worksheet helps users organize data inputs on a printable form for easy transfer into SWEET.



Download the
SWEET Data Collection Sheet

This printable worksheet was developed by the U.S. Environmental Protection Agency on behalf of the GMI to accompany users in collecting data for use in SWEET.

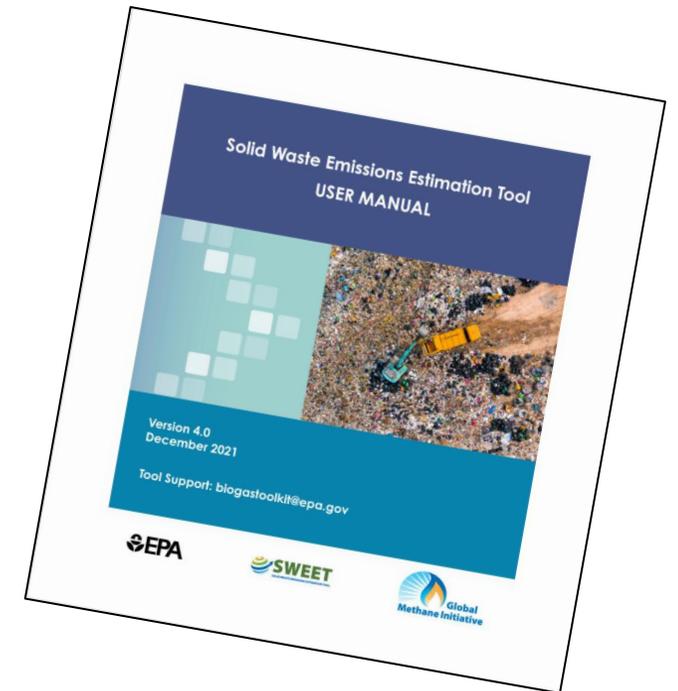
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SWEET User Manual

This User Manual accompanies the Solid Waste Emissions Estimation Tool (SWEET).

The manual contains:

- An overview of the tool and its design
- Detailed documentation on how to use the tool and interpret results
- Explanation of the tool's assumptions, methodology, and limitations
- Answers to frequently asked questions
- Links to download a data guide
- A list of sources used to develop this user manual



 Download the **SWEET User Manual**

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**Congratulations! You have completed
Module 2.**



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