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SOLUTIONS FOR A SUSTAINABLE FUTURE
15 - 18 Sept | CTICC, CAPE TOWN

Waste Characterization Handbook: Understanding Municipal Waste Streams to Develop Data-Driven Methane Mitigation Strategies

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Global Methane Initiative
Leading methane action since 2004

Overview of Presentation

- Introduction to the Global Methane Initiative
- Overview of waste characterizations
- Examples
- GMI Waste Characterization Handbook and Tool

Global Methane Initiative (GMI)

- International public-private partnership focused on advancing:
  - Cost-effective, near-term methane abatement
  - Recovery and use of methane as a valuable energy source
- Provides in-kind technical support to deploy methane mitigation and methane-to-energy projects around the world
- Supports methane mitigation in three key sectors:
  - **Biogas (municipal solid waste, agriculture, wastewater)**
  - Coal mines
  - Oil & gas

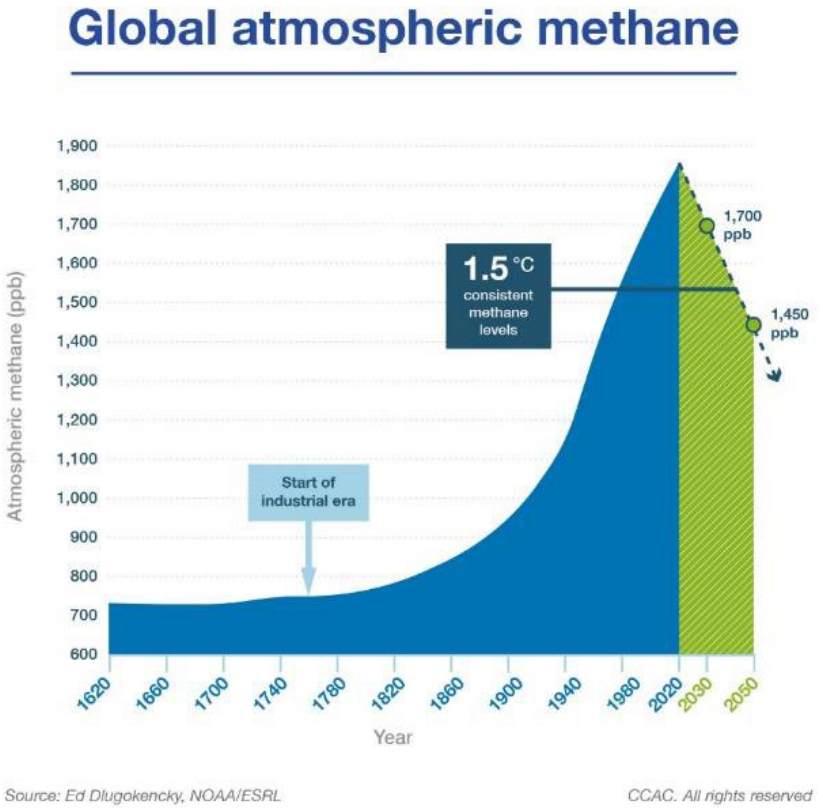
Global Methane Initiative

- 49 Partner Countries
- 100s of Project Network members
- Alliances with international organizations focused on methane recovery and use

GMI Partner Countries represent approximately 75% of methane emissions from human activities.

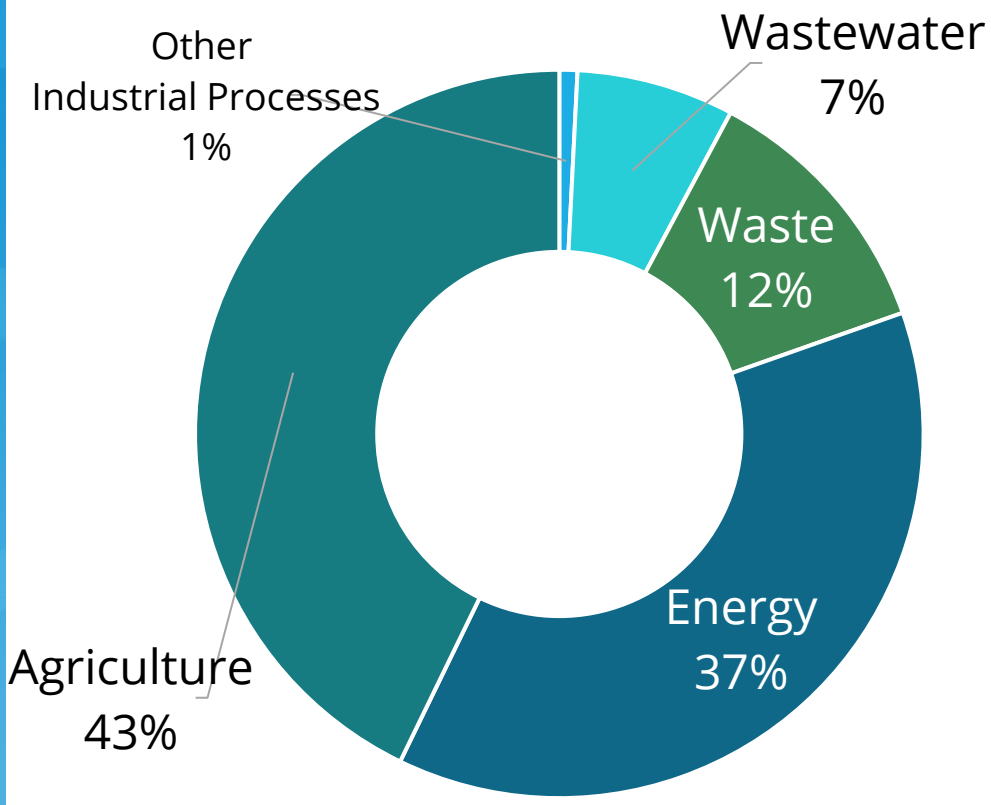
Why Methane?

- **Powerful greenhouse gas (GHG).** One ton of methane can trap at least 28 times mor heat than one ton of carbon dioxide over a 100-year period
- **Precursor to tropospheric ozone**, an air pollutant and GHG
- **Short-lived climate pollutant** with an atmospheric lifetime of 12 years
- **Opportunity for fast climate action**
  - Cutting methane now delivers substantial, immediate climate benefits
  - Capturing and converting methane into clean energy can enhance energy security



Source: UNEP and Climate and Clean Air Coalition. Global Methane Assessment.

Importance of Waste Methane Mitigation



Source: U.S. EPA's Global Non-CO2 Emissions Database

- Waste is the third largest source of global anthropogenic methane emissions, contributing to roughly 12% of all methane emissions.
- The source of these emissions is decomposition of organic waste in landfills and dumpsites.
- A variety of solutions are available to reduce methane from landfills and dumpsites:
  - Reduction of food waste
  - Diversion of organic waste to composting or anaerobic digestion
  - Collection and use of landfill gas

What is Waste Characterization?

- Identifies the **specific types of materials** in a waste stream
- Samples, weighs, and sorts municipal solid waste (MSW) according to material and product type to calculate the material proportion
- Can range in scope and duration from one facility at one time or may include multiple sites/locations over multiple seasons
- Outputs include the composition of the waste, for example, fraction of the waste in various categories (e.g., organic, metal, recyclable) from various sectors (e.g., residential, commercial)

Why are Waste Characterizations Important?

- **Optimized Management:** Tailors waste handling strategies to the specific types and amounts of waste generated.
- **Regulatory Compliance**: Ensures adherence to environmental laws and standards.
- **Enhanced Material Recovery and Valorization:** Improves recycling efforts, including organics.
- **Cost Savings:** Reduces disposal costs and improves overall waste handling efficiency.
- **Monitoring and Evaluation:** Assess the progress of the programs and projects.
- **Estimation of greenhouse gases:** Obtain better estimate of the methane emissions from the business-as-usual scenario (baseline).

Waste characterization improves understanding of methane emissions from waste management

- How much organic waste and/or recyclables are in being disposed in the landfills?
- Would a composting project be feasible in my city?
- Which sectors are responsible for the generation of organic waste?
- What type of anaerobic digestion process/technology would be best suited for the organic waste generated in the city?
- Is the organic waste generated in the city appropriate for black soldier fly technology?
- How much contamination is in the segregated waste stream going to the treatment facilities?

Waste Characterization is Key to Organic Waste Management

Steps in GMI Policymaker Framework	Applications
1 Understand Context	Conduct field activities to collect and analyze data
2 Engage Stakeholders	Engage on strategies, projects and policies to reduce and divert organic waste.
3 Establish Baseline	Establish waste management system baseline.
4 Set Goals	Evaluate potential waste segregation, treatment and disposal scenarios and set methane reduction goals.
5 Develop Policies and Programs	Develop strategies and policies to achieve methane reduction goals.
6 Implement Policies and Programs	Implement based on waste characterization studies.
7 Evaluate, Report, and Adapt	Evaluate and improve waste programs by continual assessments

Waste Characterization Examples

National Level: Canada's National Waste Characterization Program

Objective

- Obtain data on biodegradable portion of the national waste stream to:
  - Support modeling of landfill methane generation
  - Track success in reducing disposal of biodegradable waste

Results

- Biodegradable portion varies by sector
- Helped develop models and

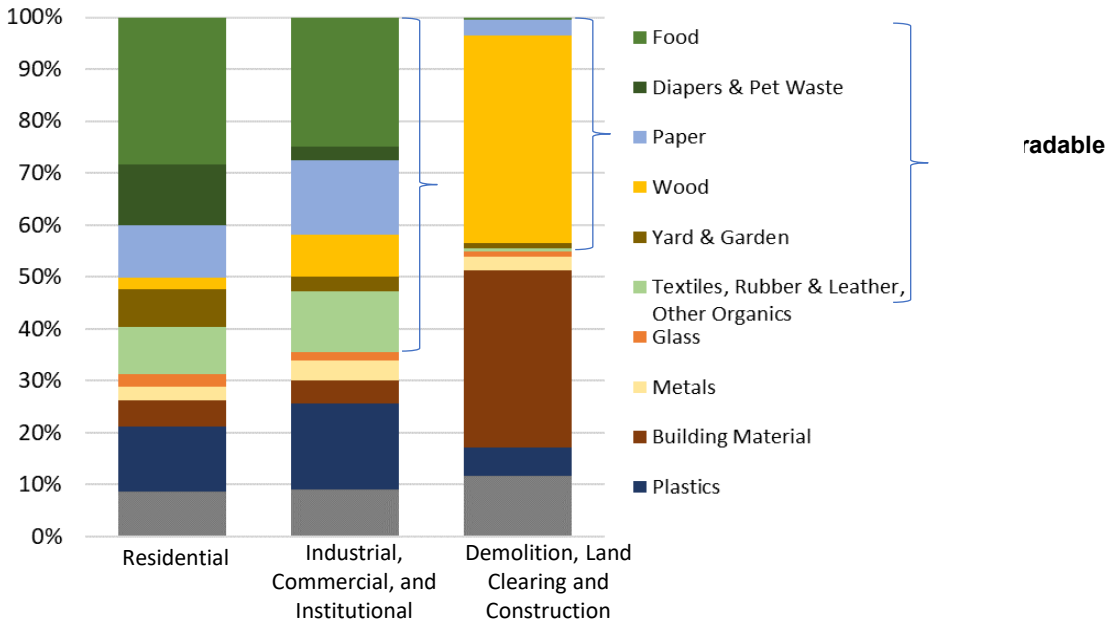


Figure 1. National Average % Composition of residual MSW, by sector (2016)

State Level: State of Wisconsin, USA, 2020-21 Study

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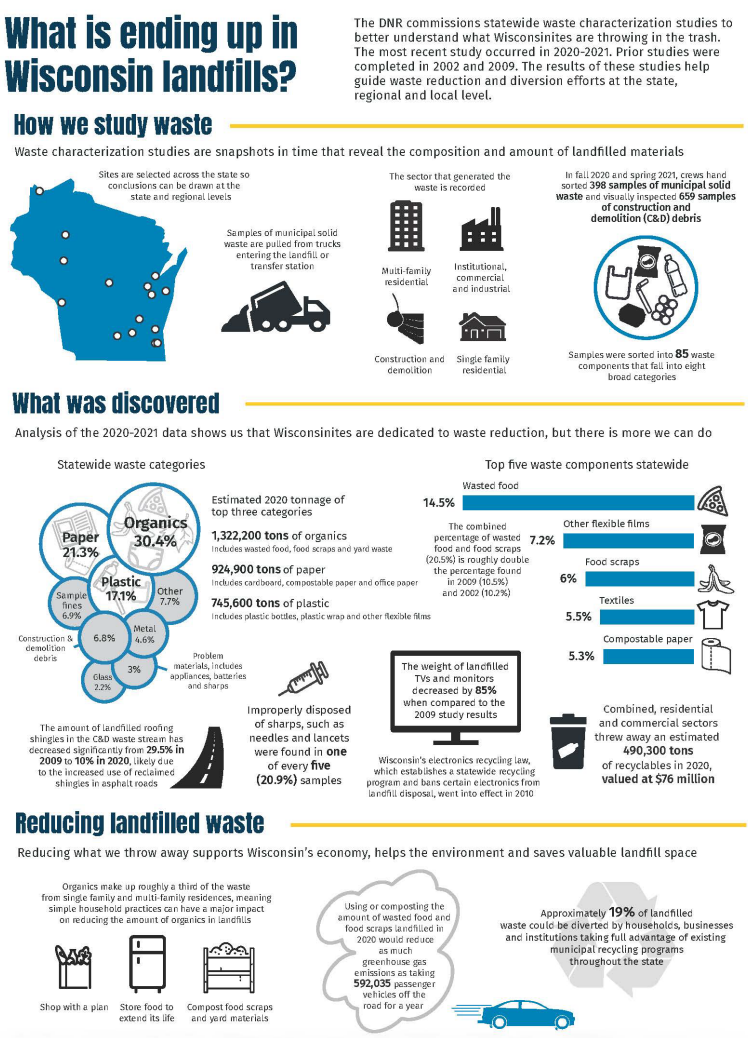
Objectives

- Understand what is in the waste stream and guide waste reduction/diversion
  - Assess the amount and types of organic waste sent to landfills.
- Collect baseline data and see trends overtime
- Bring awareness to waste
- Study included 85 sort categories to assist with
  - Standardizing terms
  - Comparing across past studies

Results



Local Level: U.S. EPA/GMI Study in Gurugram, India

Objective

- Collect waste data to plan appropriate treatment facilities
- EPA conducted a 5-day study sorting 30 samples into six broad materials categories

Results

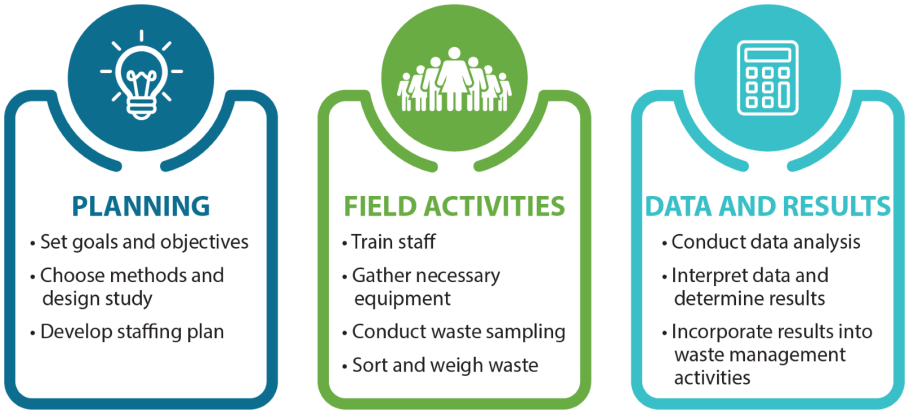
- The study found that 32% by weight of waste disposed at landfill was organic waste
- Results demonstrate the need for organics treatment rather than the construction of new recycling plants or incineration facilities

Waste Characterization Handbook & Excel Tool

Waste Characterization Handbook & Excel Tool

The **Handbook** includes recommended activities and resources to:

- Plan an appropriate study for specific site conditions
- Conduct field activities to collect the data
- Analyze the data to help make informed solid waste planning decisions

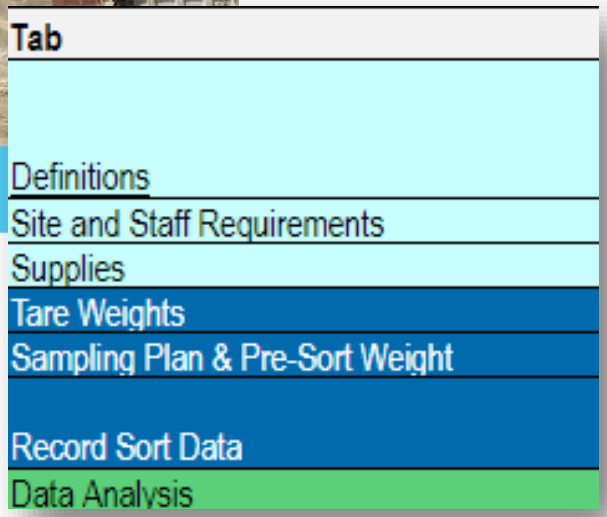


Excel-based tool that streamlines data entry and analyzes the composition of waste streams

- Designed for field use
- Analyzes material types and amount

Visit GMI's Tools and Resources Library to download the Handbook and tool:
https://www.globalmethane.org/resources/details.aspx?resourceid=5399

Overview of the Excel Tool



Excel Tool – Data entry

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Site and Staff Requirements

Instructions: Use this tab to prepare site and staff requirements for the waste characterization. Use the Status column to track the progress of each requirement before starting the waste characterization.

Type	Item	
Site Preparation	Security	A work area separa operational hazards animals away from t
Site Preparation	Work area characteristics	The work area surfa and the perimeter of other barriers for saf
Site Preparation	Access to Washroom	A place where proje hot water, easily acc Contains the necess contact numbers or
Site Preparation	Break Area	An area away from (important to avoid f fan to cool off if work

Record Data

Instructions: Enter all waste characterization data into this tab by following these steps:
1. Enter the Characterization Date to document the day the waste characterization is performed. The unit of measurement is automatically populated from the Tare Weights tab. Enter the number of samples sorted and recorded in the data sheet. For multiple days of waste sorting, copy this sheet and start a new day of data collection.
2. Select the source of the waste from the drop-down in the Source column.
3. Select the waste type from the drop-down in the Waste Type column.
4. Select the material or product type from the drop-down in the Material or Product Type column.
5. Type in any additional notes or details in the Notes column.
6. Enter the weight in the Total Weight column.
7. Select the container type that the waste was sorted and weighed into from the drop-down in the Container Type column.
8. The Container Tare Weight is automatically calulcated based on the selection of the Container Type and the weight entered for that container in the Tare Weights tab. The Net Weight column is automatically calculated by subtracting the Container Tare

Characterization Date	
Study Day	Day 1
Unit of Measurement	0
Number of Samples Sorted	

Source (drop-down)	Waste Type (select drop-down)	Material or Product Type (select drop-down)	Notes (write-in additional information)	Total Weight (write in number)	Container ID (select drop-down)	Container Tare Weight (do not edit)	Net Weight (do not edit)
	Organics						

Cover | Contents | Definitions | Site and Staff Requirements | Supplies | Tare Weights | Sampling Plan & Pre-Sort Weight | Record Sort Data Day 1

View Results Using the Excel Tool

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Table. 1 Waste Weight (kg) and Composition by Waste Type							
Waste Type	Weight (Day 1)	Weight (Day 2)	Weight (Day 3)	Weight (Day 4)	Weight (Day 5)	Total (All Days)	% Composition (All Days)
Organics	365	231	252	253	254	1,355.0	13%
Paper	54	36	46	46	46	228.0	2%
PlasticsDense	104	68	93	93	93	451.0	4%
PlasticsFilms	16	11	11	16	26	80.0	1%
Metals	662	617	642	603	603	3,127.0	31%
Glass	421.5	376.5	401.5	401.5	401.5	2,002.5	20%
Textiles	55	46	51	51	90	293.0	3%
Wood	7	3	3	42	3	58.0	1%
Others	0	13	0	0	0	13.0	0%
Electronics	99	180	290	95	1594	2,258.0	22%
Hazardous	73	64	69	69	71	346.0	3%
Total	**1,856.5**	**1,645.5**	**1,858.5**	**1,669.5**	**3,181.5**	**10,211.5**	**100%**

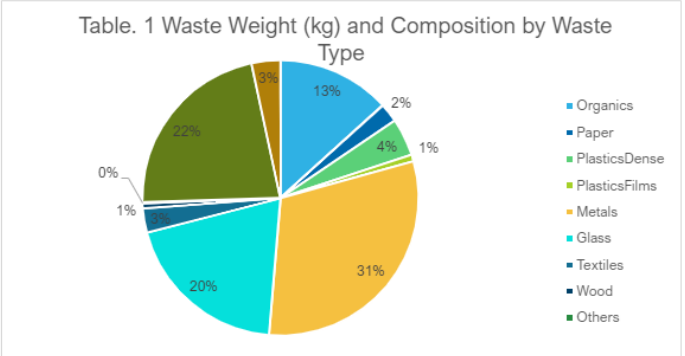
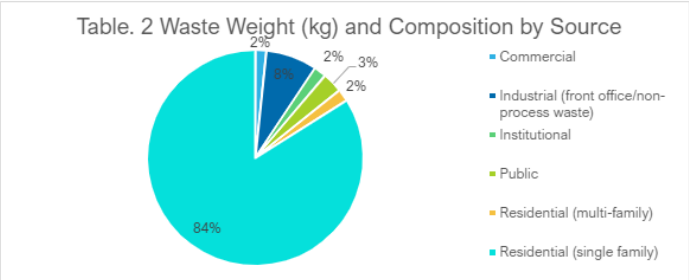


Table. 2 Waste Weight (kg) and Composition by Source							
Source	Weight (Day 1)	Weight (Day 2)	Weight (Day 3)	Weight (Day 4)	Weight (Day 5)	Total (All Days)	% Composition (All Days)
Commercial	55.0	50.0	0.0	0.0	63.0	168.0	2%
Industrial (front	180.0	470.5	69.0	3.0	62.0	784.5	8%
Institutional	54.0	0.0	39.0	95.5	2.0	190.5	2%
Public	57.0	0.0	243.0	0.0	7.0	307.0	3%
Residential (multi-family)	73.0	0.0	0.0	115.0	0.0	188.0	2%
Residential (single family)	1,437.5	1,125.0	1,507.5	1,456.0	3,047.5	8,573.5	84%
Total	**1,856.5**	**1,645.5**	**1,858.5**	**1,669.5**	**3,181.5**	**10,211.5**	**100%**



GMI Tools and Resources to Support Methane Reductions from the Waste Sector

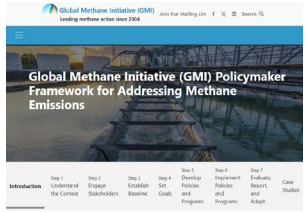
Tools

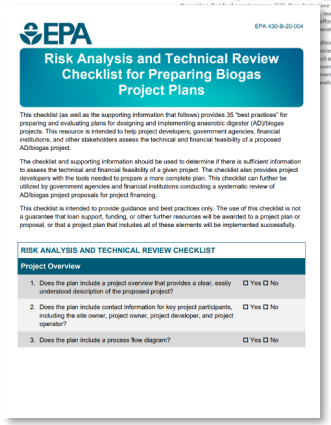
- Solid Waste Emissions Estimation Tool (SWEET)
- Anaerobic Digestion Screening Tool
- Organics Economics (OrganEcs)
- Landfill Gas Screening Tool

SWEET
SOLID WASTE EMISSIONS ESTIMATION TOOL

Resources

- Waste Characterization Handbook
- Policymaker's Framework for Addressing Methane Emissions
- Policy Maker's Handbook for Measurement, Reporting, and Verification (MRV) in the Biogas Sector
- Risk Analysis Checklist for Biogas Projects





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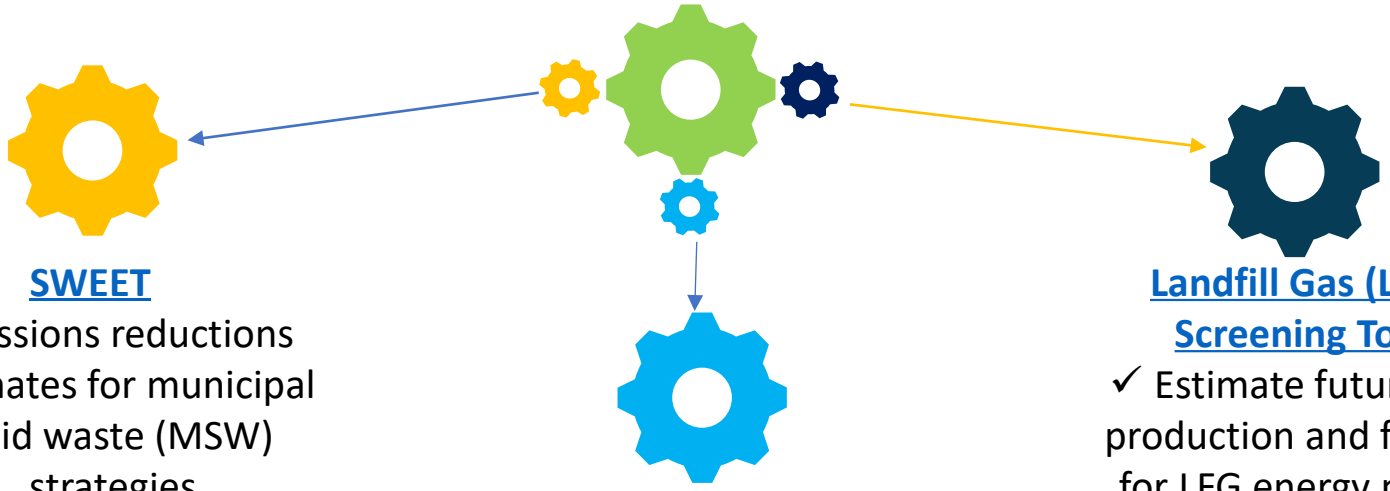
Using Study Data with GMI Resources

Waste Characterization Tool



SWEET

✓ Emissions reductions estimates for municipal solid waste (MSW) strategies

Anaerobic Digestion (AD) Screening Tool

✓ AD project feasibility for organic materials (feedstocks)

Landfill Gas (LFG) Screening Tool

✓ Estimate future LFG production and feasibility for LFG energy projects.

Thank You!

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