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EPA Biogas Tools Overview

ADB Circular Economy Working Group Webinar Series
20 October 2022

Nick Elger
Program Manager, AgSTAR Program and the Global Methane Initiative

Global Methane Initiative

Presentation Overview

- Introduction to EPA and Global Methane Initiative's Biogas Work
- Overview of Biogas Tools and Resources
- Opportunities for Collaboration
- Q & A and Discussion

Global Methane Initiative (GMI)

- GMI is an international public-private partnership launched in 2004 that **advances cost-effective near-term methane reductions**
- As a founding member, the **United States** provides in-kind support through the **U.S. Environmental Protection Agency (EPA)**:
  - **Provides technical support** to deploy methane-to-energy projects around the world
  - **Develops and maintains resources** for Partner Countries and Project Network members
- GMI focuses on **three major sectors**: Biogas, oil and gas, and coal mines

Global Methane Initiative

- 46 Partner Countries
- 700+ 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.

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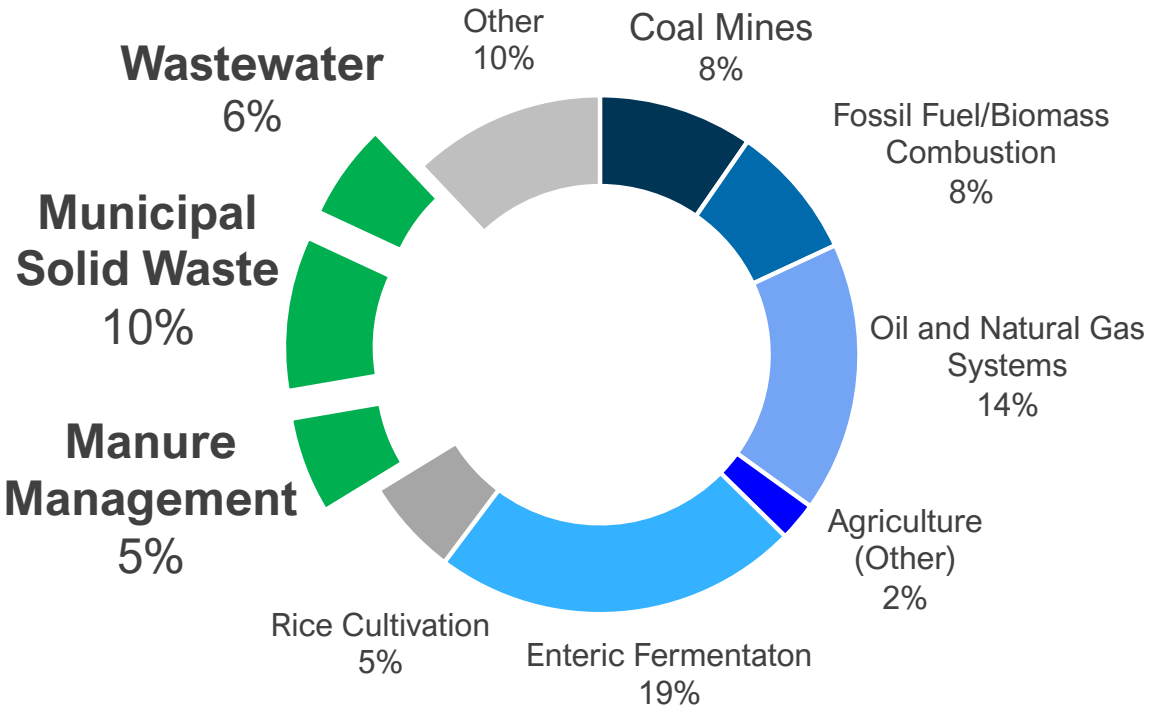
Role of Biogas Sector in Meeting Paris Goals

- Approximately 21% of anthropogenic methane emissions are from the biogas sector (agriculture, municipal solid waste, wastewater)
- Countries are beginning to include methane mitigation and biogas strategies in National Planning and Nationally Determined Contributions (NDCs).

2030 Projected Global Non-CO2 Emissions (14,031 MMTCO$_2$E Total)



Source: Global Anthropogenic Emissions of Non-CO_2 Greenhouse Gases: 1990-2050

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EPA Biogas Tools and Resources

EPA Biogas Toolkit

- **Centralized location for 38 tools and resources** to facilitate biogas project development
- **Roadmap for planning and implementing** biogas projects and **quantifying** economic and environmental impacts
- **Audience:** Project implementers, developers, financiers, and policymakers
- **Highlights:**
  - Appropriate for all knowledge levels
  - Guided search feature enables users to find exactly what they need

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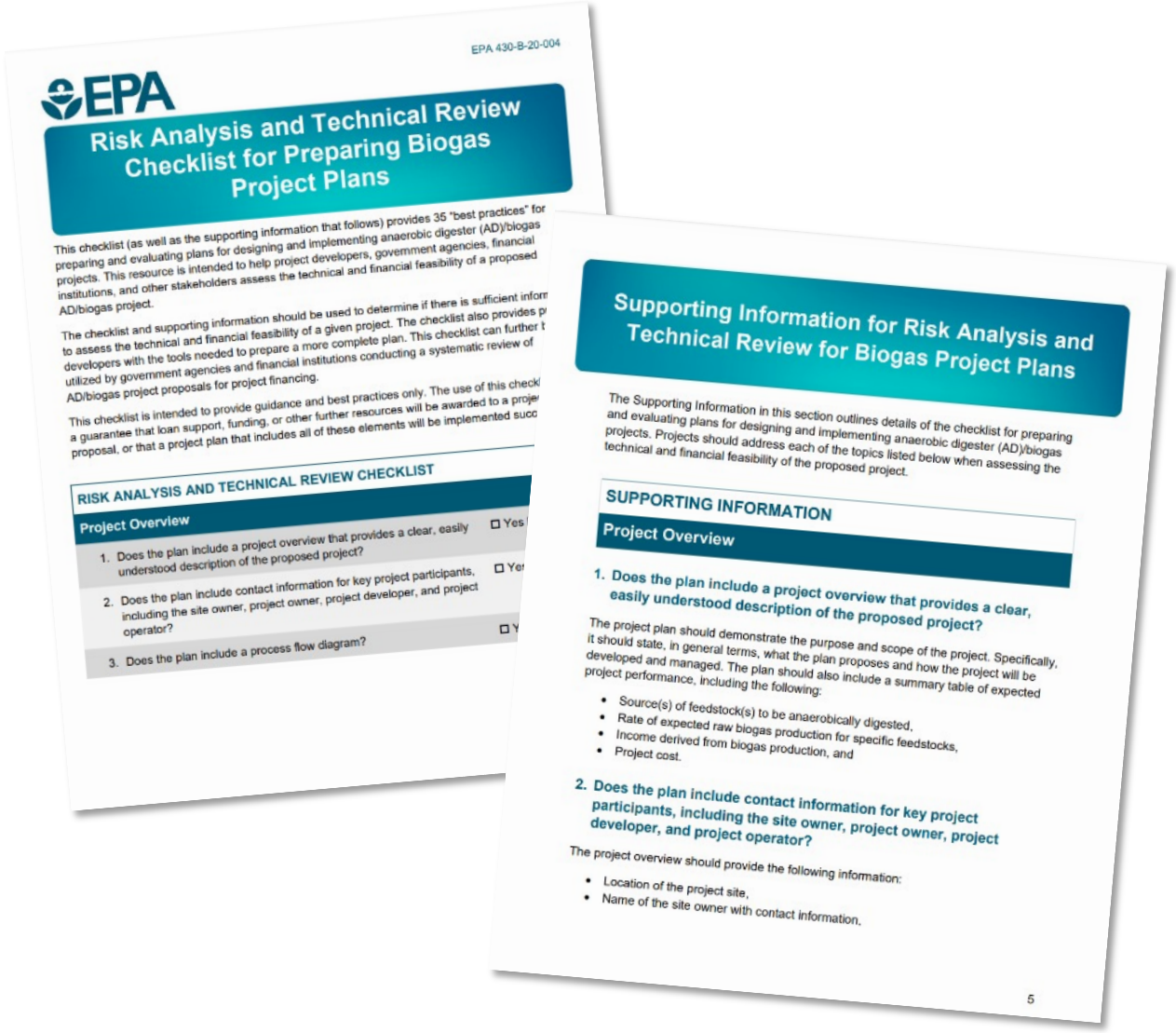
Financial Readiness Resources for Biogas Projects

Risk Analysis and Technical Review Checklist for Preparing Biogas Project Plans

- **A guide** for assessing the technical and financial feasibility of a biogas project
- **Checklist** for **project developers** to create a more complete project plan, and for **government agencies** and **financial institutions** to conduct a systematic review of biogas project proposals for project financing
- **35 best practices** for preparing and evaluating plans for designing and implementing biogas projects


EPA 430-B-20-004

EPA

Risk Analysis and Technical Review Checklist for Preparing Biogas Project Plans

This checklist (as well as the supporting information that follows) provides 35 "best practices" for preparing and evaluating plans for designing and implementing anaerobic digester (AD)/biogas projects. This resource is intended to help project developers, government agencies, financial institutions, and other stakeholders assess the technical and financial feasibility of a proposed AD/biogas project.

The checklist and supporting information should be used to determine if there is sufficient inform to assess the technical and financial feasibility of a given project. The checklist also provides p developers with the tools needed to prepare a more complete plan. This checklist can further t utilized by government agencies and financial institutions conducting a systematic review of AD/biogas project proposals for project financing.

This checklist is intended to provide guidance and best practices only. The use of this checkl a guarantee that loan support, funding, or other further resources will be awarded to a proje proposal, or that a project plan that includes all of these elements will be implemented succ

RISK ANALYSIS AND TECHNICAL REVIEW CHECKLIST

Project Overview

1. Does the plan include a project overview that provides a clear, easily understood description of the proposed project? ☐ Yes
2. Does the plan include contact information for key project participants, including the site owner, project owner, project developer, and project operator? ☐ Ye
3. Does the plan include a process flow diagram? ☐ Y

Supporting Information for Risk Analysis and Technical Review for Biogas Project Plans

The Supporting Information in this section outlines details of the checklist for preparing and evaluating plans for designing and implementing anaerobic digester (AD)/biogas projects. Projects should address each of the topics listed below when assessing the technical and financial feasibility of the proposed project.

SUPPORTING INFORMATION

Project Overview

1. Does the plan include a project overview that provides a clear, easily understood description of the proposed project?

The project plan should demonstrate the purpose and scope of the project. Specifically, it should state, in general terms, what the plan proposes and how the project will be developed and managed. The plan should also include a summary table of expected project performance, including the following:

- Source(s) of feedstock(s) to be anaerobically digested,
- Rate of expected raw biogas production for specific feedstocks,
- Income derived from biogas production, and
- Project cost.

2. Does the plan include contact information for key project participants, including the site owner, project owner, project developer, and project operator?

The project overview should provide the following information:

- Location of the project site,
- Name of the site owner with contact information,

5

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Municipal Solid Waste Financial Readiness Questionnaire

Provides a set of questions to help cities assess their readiness for financing, related to:

- Political Environment
- Legal Frameworks
- Regulatory Environment
- Revenue Streams
- Financial Modeling & Technical Expertise
- Bidding Process

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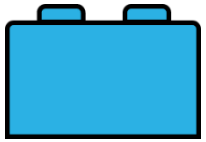
GMI Biogas Tools

Solid Waste Emissions Estimation Tool (SWEET) version 4.0.2
Quantifies emissions of greenhouse gases and other air pollutants from the municipal solid waste sector



Anaerobic Digestion (AD) Screening Tool version 2.2
Estimates the quantity of biogas and digestate produced by AD systems and methane emissions reductions

Organics Economics (OrganEcs) version 3.1
Estimates costs, revenues, and profitability with composting and AD projects

Landfill Gas (LFG) Screening Tool version 3.0
Estimates LFG recovery rate and provides potential project type and size

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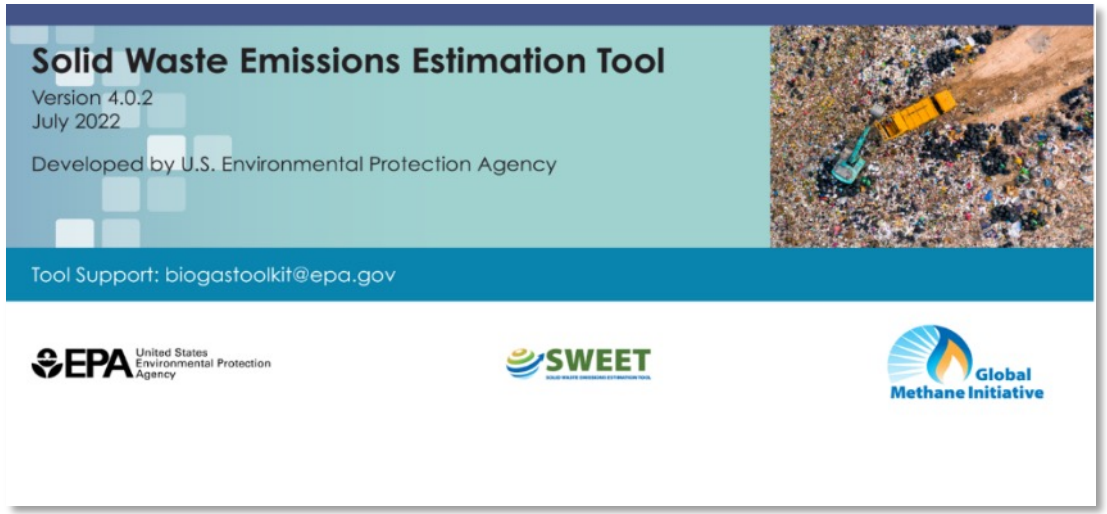
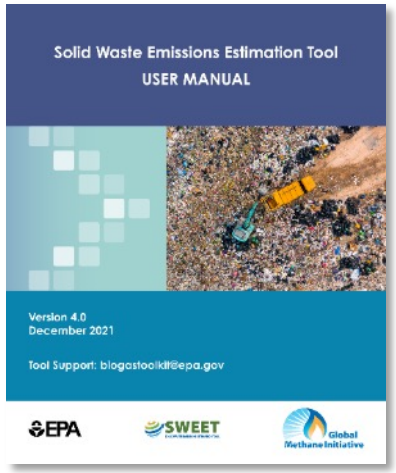
Solid Waste Emissions Estimation Tool (SWEET) Overview

What is SWEET?

- **Excel-based tool** for quantifying pollutant emissions from sources across the waste sector
  - Project-, source-, or system-level emissions estimates
  - Methane, black carbon, particulate matter, and other pollutants
- **Increasing usage** among audience
  - Used in 50+ cities to date
  - Adopted by the International Solid Waste Association's Closing Dumpsites campaign
  - Incorporated into the United Nation's Habitat's Waste Wise Cities Tool
  - Used by World Health Organization as part of Urban Health Initiative





"SWEET can be considered a policy planning tool that requires less data input than the usual life cycle assessment-based tools."
World Health Organization

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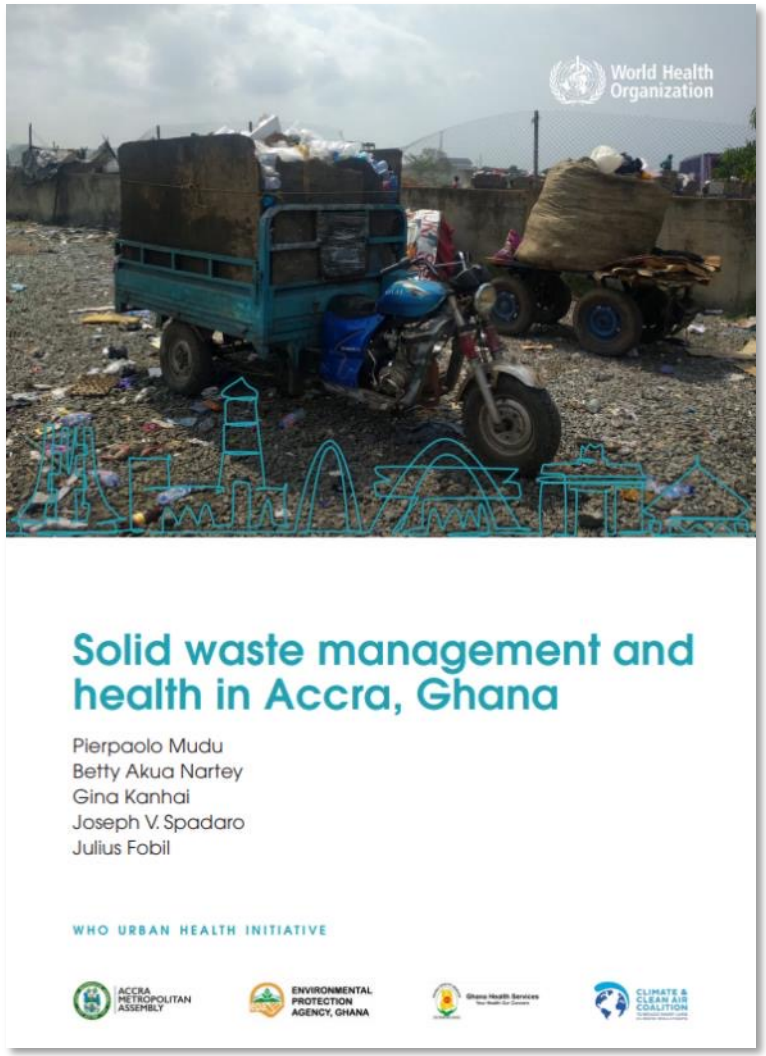
Example SWEET Applications

- Creating municipal **GHG inventories**
- Establishing **emissions baselines**
- **Comparing policy and project** choices for handling municipal waste
- Justifying waste management projects for **grant funding or financing**
- Supporting **quantification of public health impacts** of waste management choices
- **Measuring, reporting, and verification** of emissions reductions



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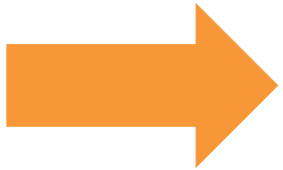
SWEET Inputs and Outputs

Inputs*

- Waste composition
- Collection transportation
- Disposal site information
- Open burning information
- Equipment (e.g., forklift, grader) information



Outputs

- Carbon dioxide equivalent
- Black carbon
- Methane
- Sulfur oxides
- Particulate matter
- Emissions changes from alternative scenarios versus the business-as-usual scenario

**SWEET provides default values for various inputs, which can be updated by the user*

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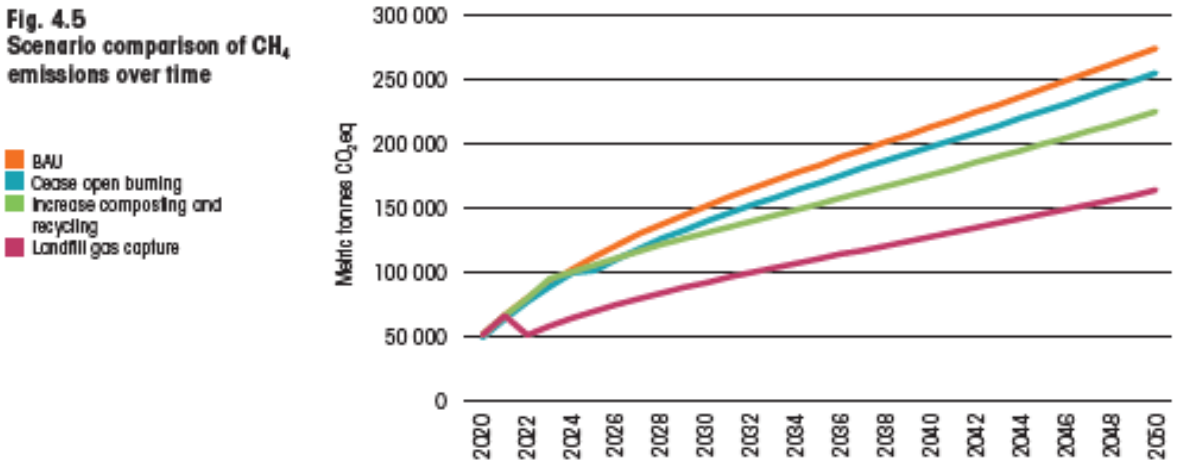
SWEET Past Uses by World Health Organization Case Study of Accra, Ghana

The assessment was conducted using SWEET & WHO AirQ+ Software.

The results of this health impact assessment indicate that, based on the emissions of PM2.5 from the waste sector in Accra, a change from the business-as-usual to more sustainable options would reduce air pollutants emissions and avert 120 premature deaths in 2030.

Methane (CH_4) emissions are reduced most in the landfill gas capture scenario, with a reduction of 40% compared with the BAU in 2050 (Fig. 4.5) followed by the scenario of increasing recycling and composting with only 18% reduction in the same timeframe.

Fig. 4.5
Scenario comparison of CH_4 emissions over time



The analysis is described in the following four steps:

1. Collecting data on the waste sector in Accra;
2. Modeling the emissions arising from waste management;
3. Transforming emissions to concentration values; and,
4. Estimating the burdens on health.

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Organics Economics (OrganEcs) Tool Overview

What is the OrganEcs tool?

- **Two Excel-based tools** to estimate the financials of organic waste management projects:
  - Composting
  - Anaerobic digestion
- Primary audience:
  - Local governments
  - Waste professionals
  - Policymakers
  - Facility operators
  - Project developers

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OrganEcs Applications

- Evaluate the **economic feasibility** of a proposed composting or anaerobic digestion project
- Evaluate the effect of gate or tipping fees on **project profitability**
- Evaluate **optimal financial management** of an organics project
- Estimate project **net present value** or **internal rate of return**
- Evaluate the **financial sustainability** of existing composting or anaerobic digestion projects

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OrganEcs Inputs and Outputs

Inputs*

- Facility inputs
- Waste inputs
- Economic inputs

Outputs

- Capital investment costs
- Operations & maintenance costs
- Total annual biogas and digestate, or compost production
- Total revenues (e.g., compost sales, net electricity from AD system)
- Profitability (internal rate of return)

**OrganEcs provides default values for various inputs, which can be updated by the user*

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OrganEcs Past Uses by University of Novi Sad Case Study Establishing a Baseline in Novi Sad, Serbia

- Novi Sad and surrounding municipalities produce approximately 214,000 tons/year (t/year) of MSW, over half of which is organic.
- EPA team used OrganEcs to evaluate the financial feasibility of three options for **expanding the existing Novi Sad composting operation**.
- Results:
  - Scenario 2 and 3 estimate total revenues higher than total expenses, suggesting economic viability
  - Gate fees should be $6/t and $4/t for Scenarios 2 and 3 respectively for the facility to remain economically viable
  - Revenues from bulk compost sales should be about $5/t for both Scenario 2 and 3

Table 1: Novi Sad Composting Facility Costs by Scenario

Scenario	Capacity (t/year)	CAPEX (USD)	Operations & maintenance costs per ton in year one
Scenario 1 – *Green waste*	5,528	$806,700	$36
Scenario 2 – *Green and garden waste*	15,384	$1,578,700	$30
Scenario 3 – *Green waste, garden waste and food waste from commercial sector*	41,467	$3,025,500	$30

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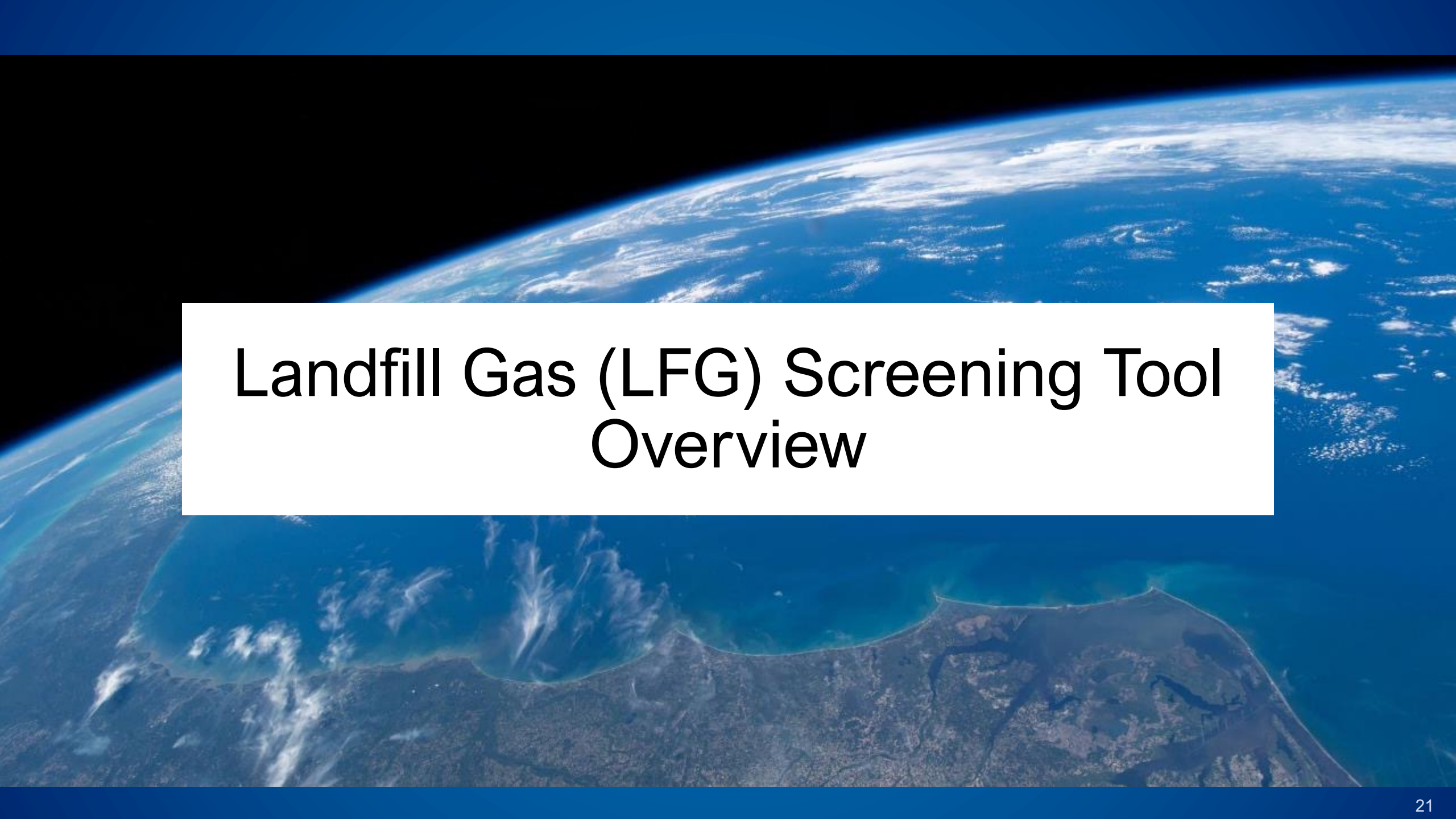
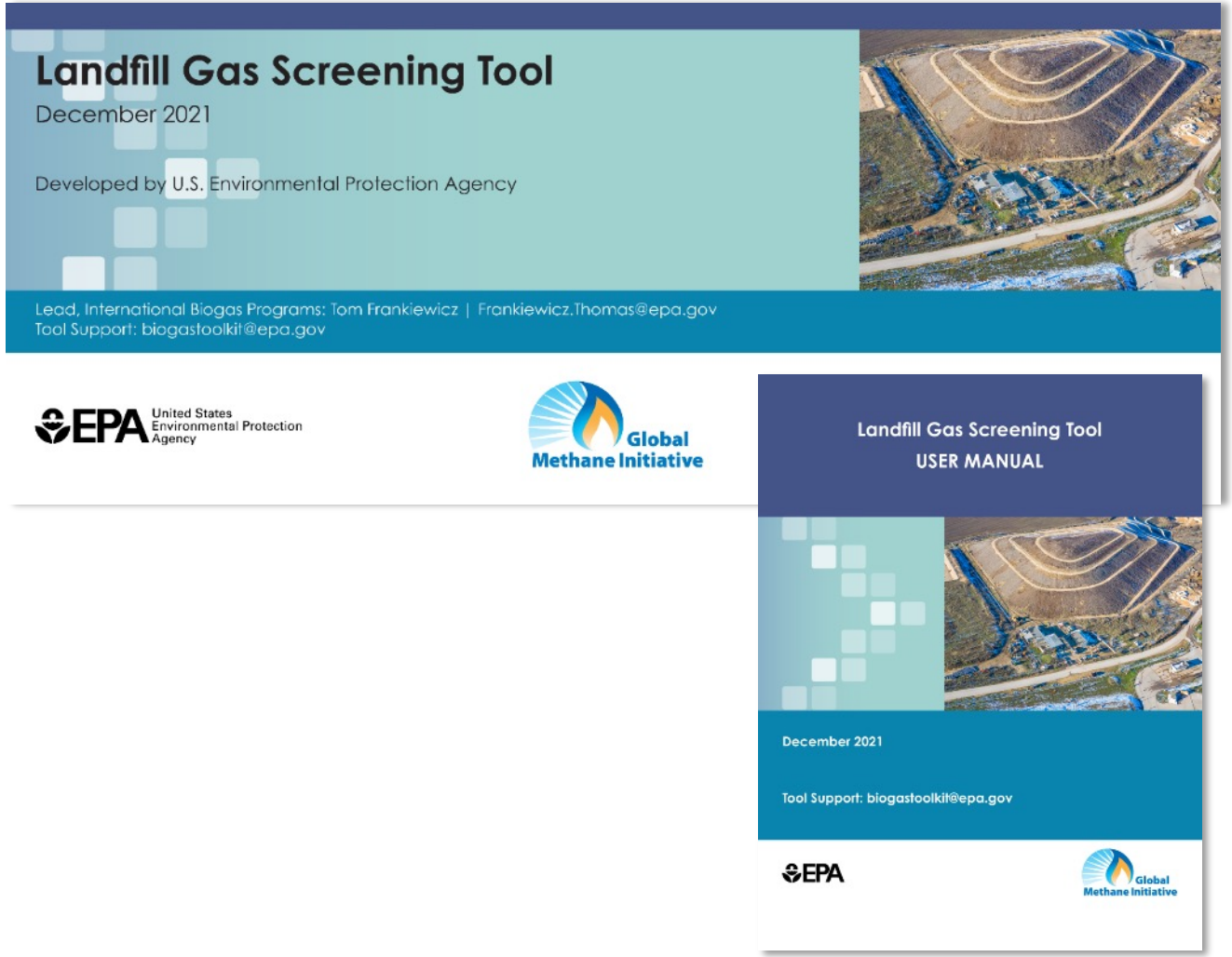


Landfill Gas (LFG) Screening Tool Overview

What is LFG Screening Tool?

- **Excel-based screening tool** to assess the potential feasibility of landfill gas (LFG) to energy projects
  - Estimates LFG recovery rate
  - Provides potential project type and size
- Primary audience:
  - Landfill/dumpsite operators
  - Project developers



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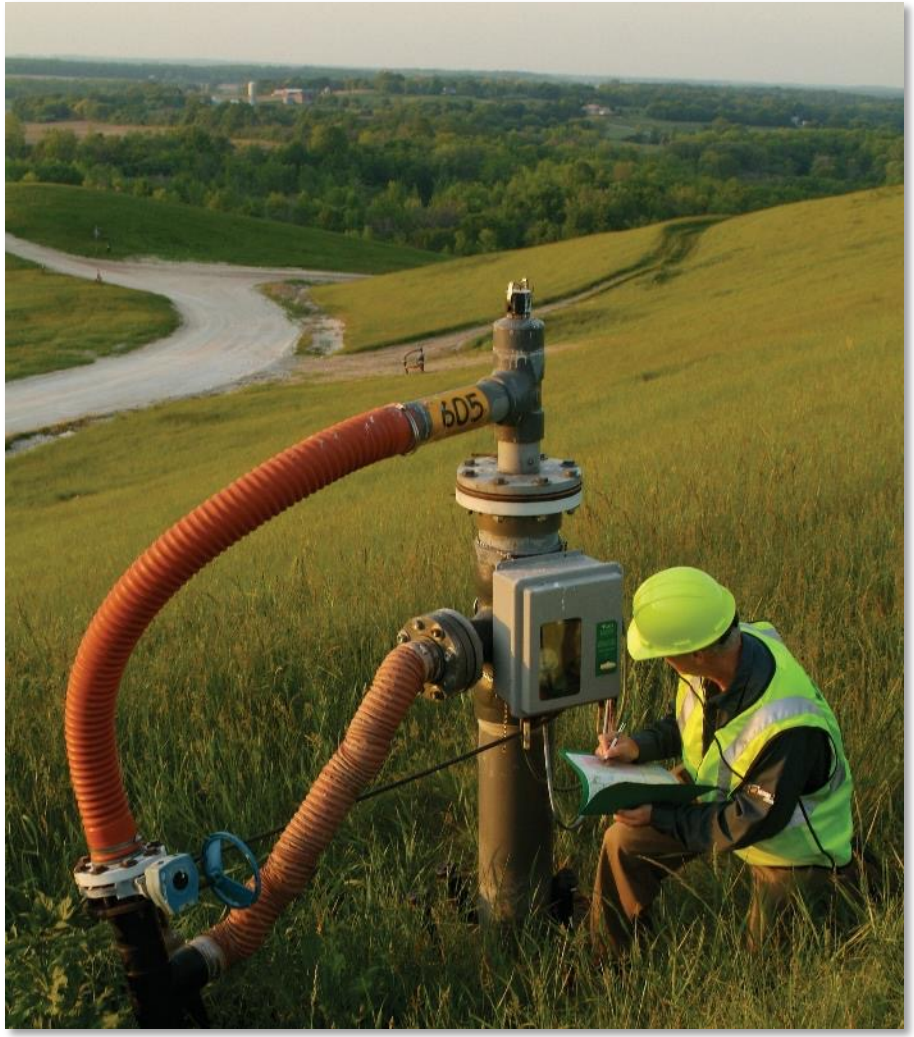
LFG Screening Tool Applications

- Generate a preliminary estimate of how much landfill gas (LFG) a site could collect
- Determine whether biogas production is likely sufficient to support a modest-sized landfill gas-to-energy project
- Determine what type of landfill gas-to-energy project would be most



Source: Waste Management

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LFG Screening Tool Inputs and Outputs

Inputs

- Opening Year of Disposal Site
- Closing Year of Site (Actual or Projected)
- Annual Disposal Rate (Metric Tons/Year)
- Climate
- Landfill Category (I.e., dump site, controlled dump site/landfill, sanitary landfill)

Outputs

- Estimated LFG Recovery Rate (m^3/h)
- Feasible Project Types, based on LFG Recovery Rate
- Feasible Project Sizes, Based on LFG Recovery Rate

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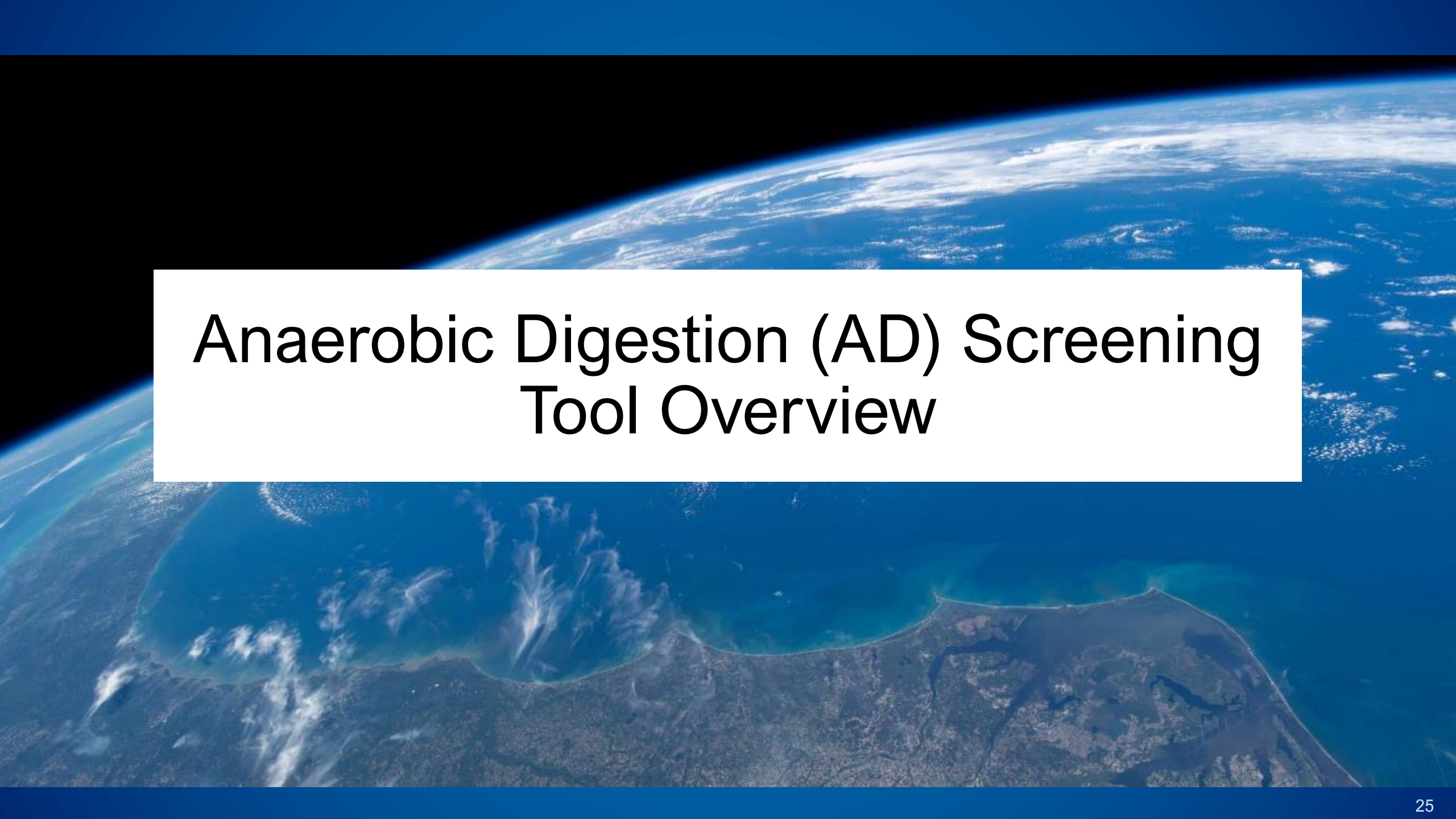
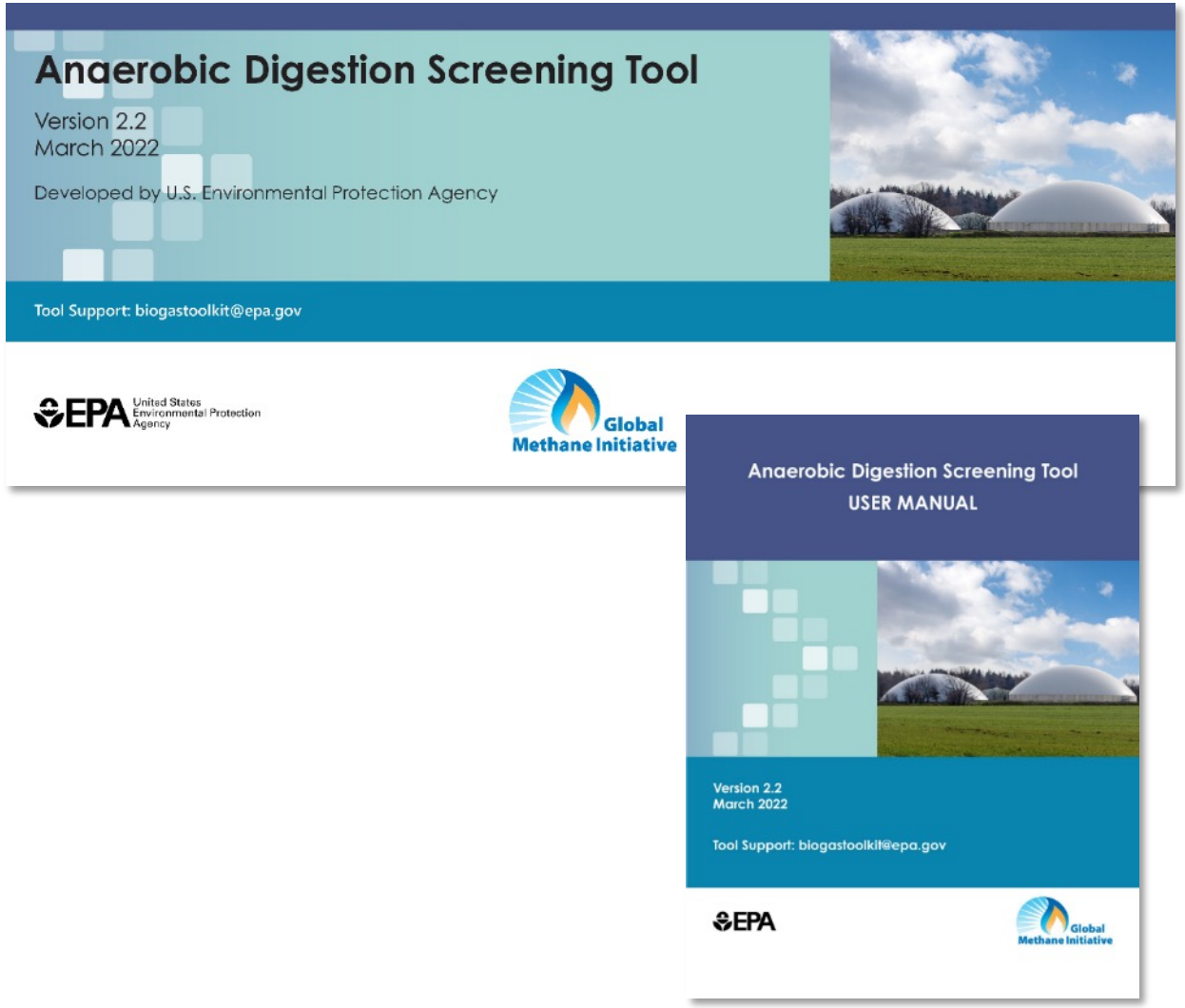


Anaerobic Digestion (AD) Screening Tool Overview

What is the AD Screening Tool?

- **Excel-based screening tool** to assess the potential feasibility of an anaerobic digestion project
- Primary audience:
  - Project proponents to understand the biogas potential of a proposed project
  - Lending institutions/banks to determine if a project application is feasible



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AD Screening Tool Applications

- Project implementers can:
  - Estimate **biogas and digestate production potential** from a variety of feedstocks
  - **Evaluate end uses** like electricity, RNG, and cooking gas
  - Estimate **emissions reductions**
- Financial institutions can assess **project viability and risks**
- Project developers, analysts, and local stakeholders can calculate **emissions reductions** to justify climate goals

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AD Screening Tool Inputs and Outputs

Inputs*

- Digester inputs (e.g., feedstock type & amount, AD system type)
- Emissions inputs (e.g., baseline waste management practices, electricity consumption)

Outputs

- Annual biogas production
- Annual methane production
- Annual digestate production
- Estimated emissions reductions
- Potential end uses for biogas

**AD Screening Tool provides default values for various inputs, which can be updated by the user*

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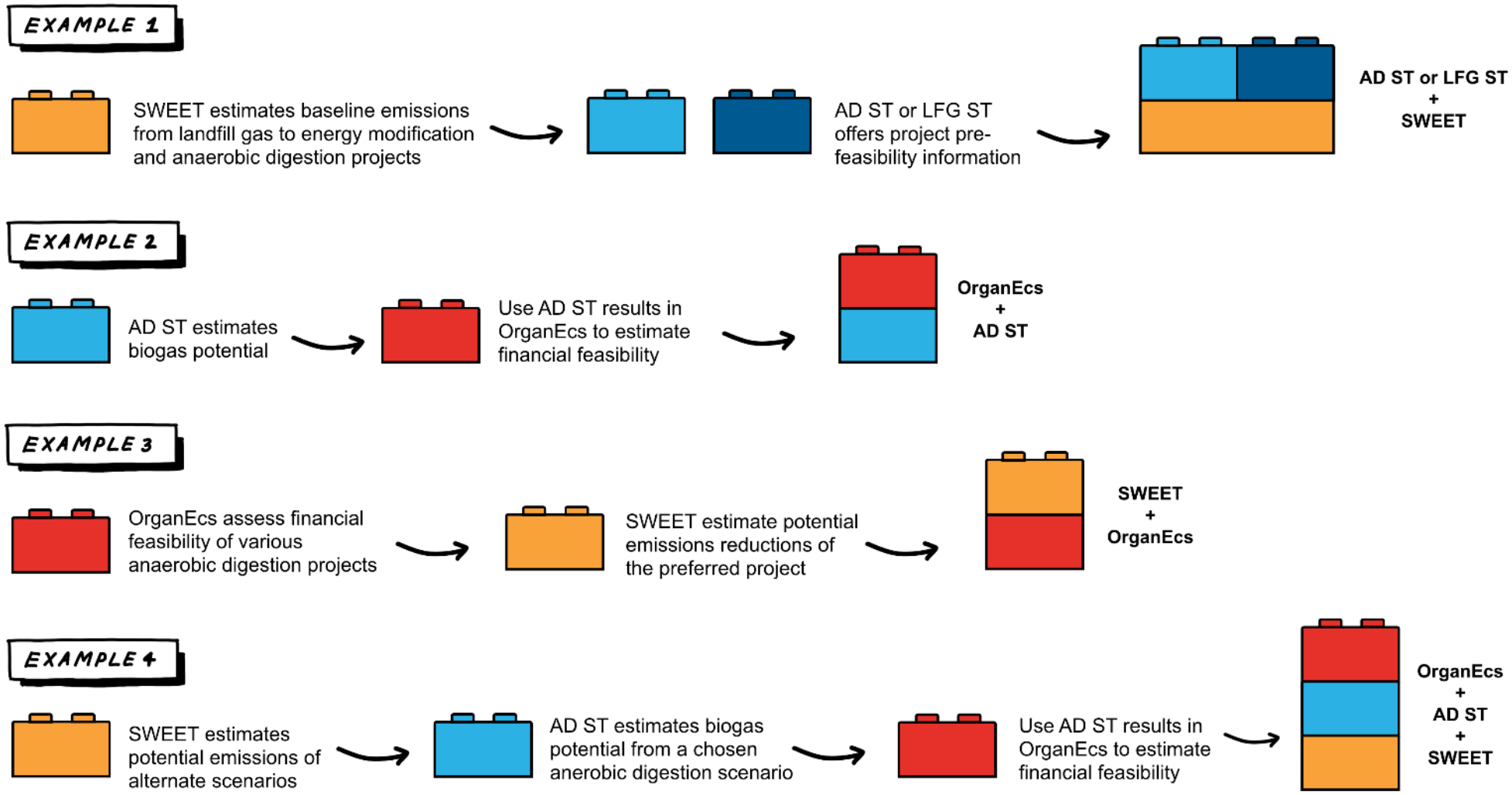
Various Ways Biogas Tools Can Work In Tandem



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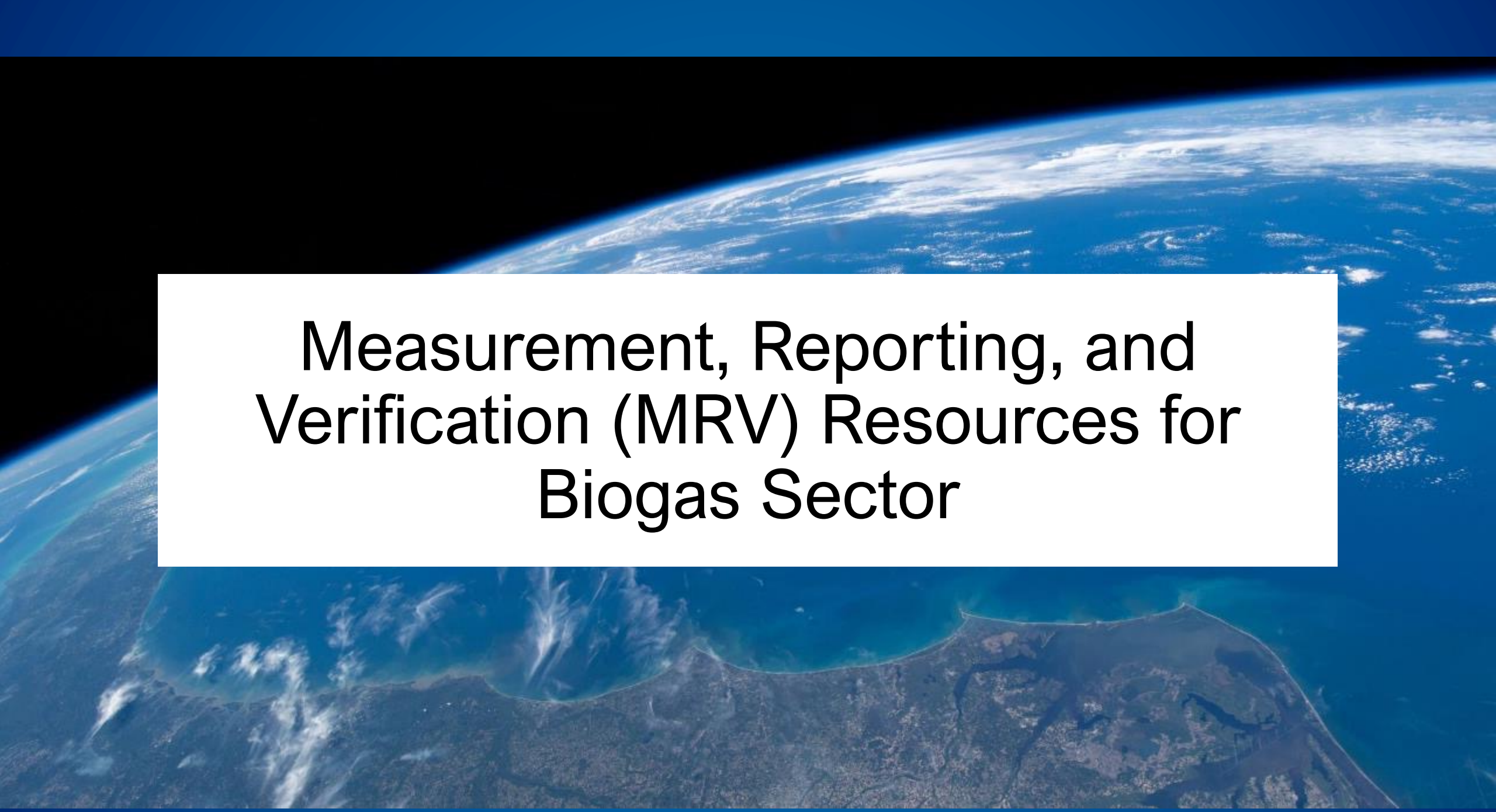


Measurement, Reporting, and Verification (MRV) Resources for Biogas Sector

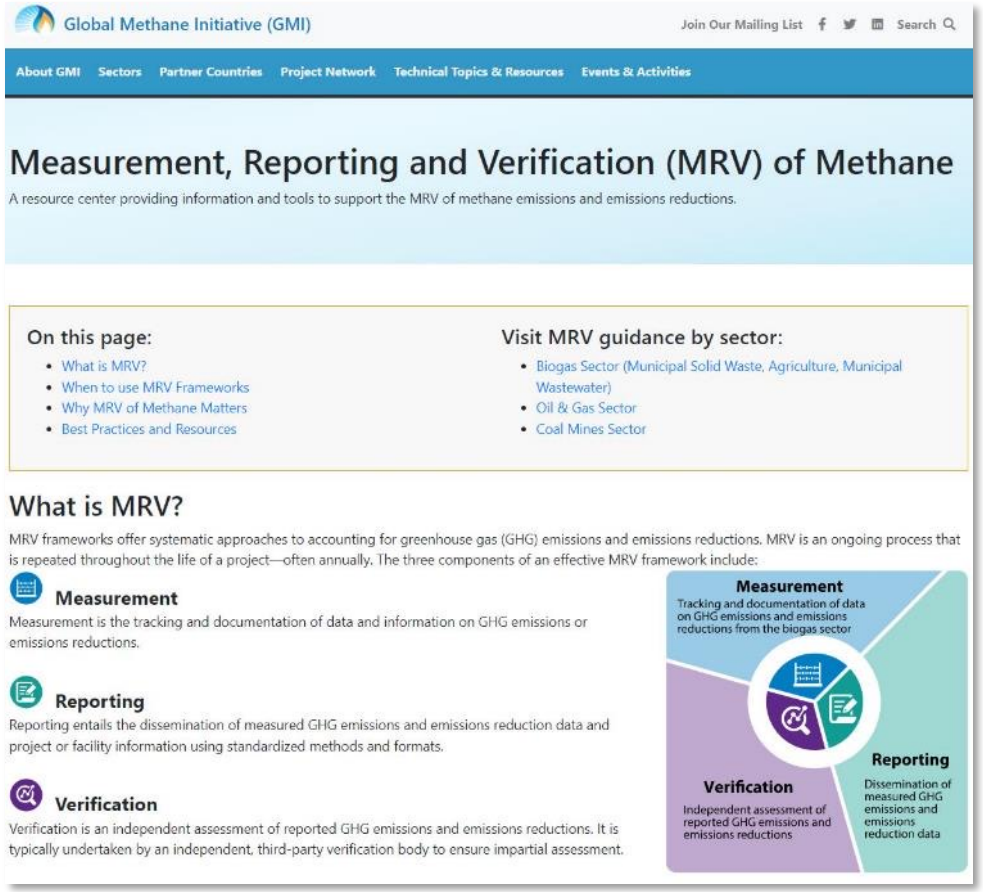
MRV Handbook

- **High-level resource** on guiding principles for conducting emissions MRV for the biogas sector
- **Support decision-makers** in incorporating project-level MRV into national-level frameworks and objectives
- Scope:
  - **Biogas sector**, including agriculture, municipal solid waste, and wastewater
  - **Project-level activities** (e.g., anaerobic digestion projects and landfill gas projects) rather than broader-scale MRV
- **Approach:** Technical guidance and tools from existing protocols (e.g., IPCC, EPA AgSTAR, California Air Resources Board) and knowledge from an expert review process

MRV Resource Center

- **Centralized location** of all GMI MRV resources
- **Multi-sector information** for agriculture, waste, oil and gas, and coal mines MRV
- **Background information** on what MRV is, when to use MRV frameworks, why MRV of methane matters

Go to: globalmethane.org/mrv



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MRV Resource Center Applications

- **Learn about the benefits of biogas project MRV** in developing national inventories and enhancing mitigation targets in NDCs
- **Review the best practices** for the biogas sector MRV
- **Access MRV tools and resources** for the biogas sector (previously discussed)
- **Access other MRV Resources** from the World Resources Institute, United Nations Framework Convention on Climate Change, etc.

Potential Areas for Collaboration

Areas for Collaboration

Type of Support		Past Examples	
Needs Assessments	• Engage stakeholders and identify priorities • Develop a work plan specific to stakeholder needs	•	Developed a work plan to mitigate short-lived climate pollutants from the waste sector in East Delhi
Technical Support	• Leverage GMI/EPA tools to identify and evaluate biogas projects • Conduct feasibility and technical analyses of biogas projects	•	Conducted a pre-feasibility study on establishing biogas-powered cold storage in rural India for methane mitigation and sustainable food systems. The study used the OrganEcs and AD Screening Tool

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Areas for Collaboration

Type of Support		Past Examples	
Workshops, Trainings, and Outreach	• Conduct trainings and workshops on the use of GMI/EPA tools • Disseminate best practices guides and findings from technical analyses	•	In 2020, EPA hosted a workshop on enabling biogas projects in India, which brought together stakeholders to discuss challenges and opportunities in developing biogas projects in the agriculture and solid waste sectors
Policy Support	• Analyze existing policies and initiatives and identify opportunities for improvements	•	EPA examined how inventories are developed in the agriculture, waste, and wastewater sectors (relevant to biogas projects) in India and identified potential improvements, particularly in MRV

Workshop on Enabling Biogas
Delhi, India, 2020

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Q&A

Thank you!

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Resource Links

- SWEET v4.0.2
  - Excel Tool and User Manual: https://globalmethane.org/resources/details.aspx?resourceid=5176
  - Webinar: https://www.waste.ccacoalition.org/seminar/introduction-solid-waste-emissions-estimation-tool-sweet
  - Fact Sheet: https://drive.google.com/file/d/1A_3CNgL1mPjZnZYEuorTtxfsdJfkQV1r/view
- Anaerobic Digestion Screening Tool v2.2
  - Excel Tool and User Manual: https://globalmethane.org/resources/details.aspx?resourceid=5170
- OrganEcs v3.1
  - Excel Tools and User Manual: https://globalmethane.org/resources/details.aspx?resourceid=5225
- Landfill Gas Screening Tool v3.0
  - Excel Tools and User Manual: https://globalmethane.org/resources/details.aspx?resourceid=5225
- EPA Biogas Toolkit: https://www.epa.gov/agstar/biogas-toolkit
- MRV Resource Center: https://globalmethane.org/mrv/
- Risk Analysis Checklist: https://www.epa.gov/agstar/risk-analysis-and-technical-review-checklist-biogas-projects
- Financial Readiness Questionnaire: https://www.waste.ccacoalition.org/document/financing-readiness-questionnaire

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