Landfill Gas Energy Projects – Resources and Updates from EPA LMOP

September 18, 2024

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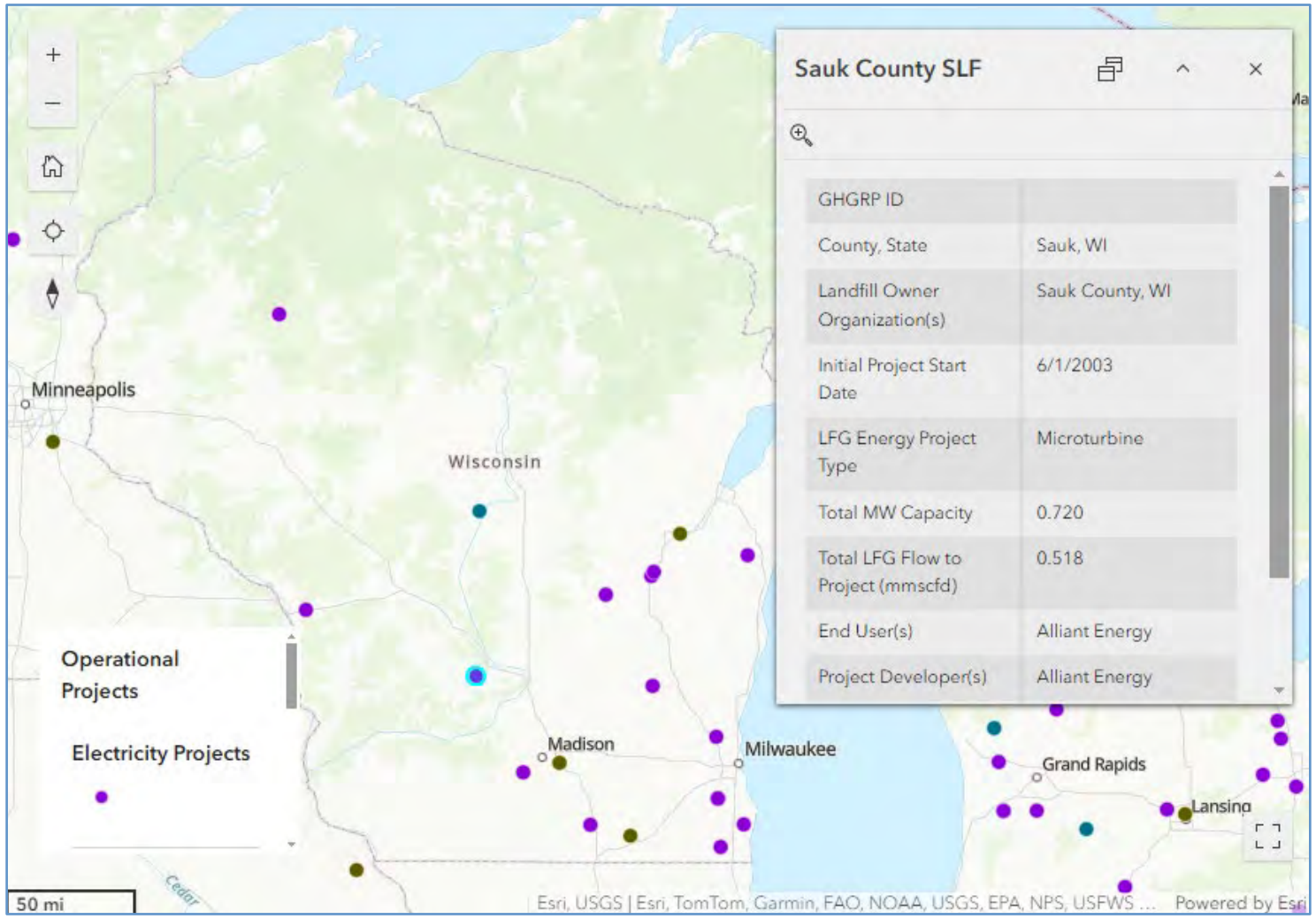
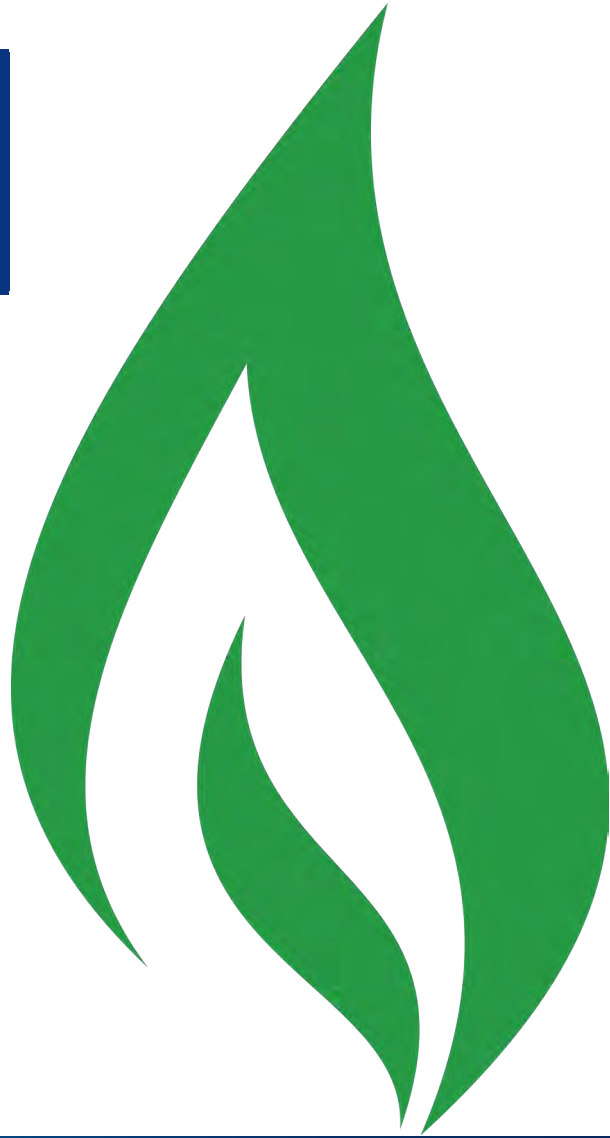
U.S. Environmental Protection Agency

Agenda

- Introduction
- State of the Industry
- What's New
- Resources
- Questions



Introduction to LMOP



About LMOP

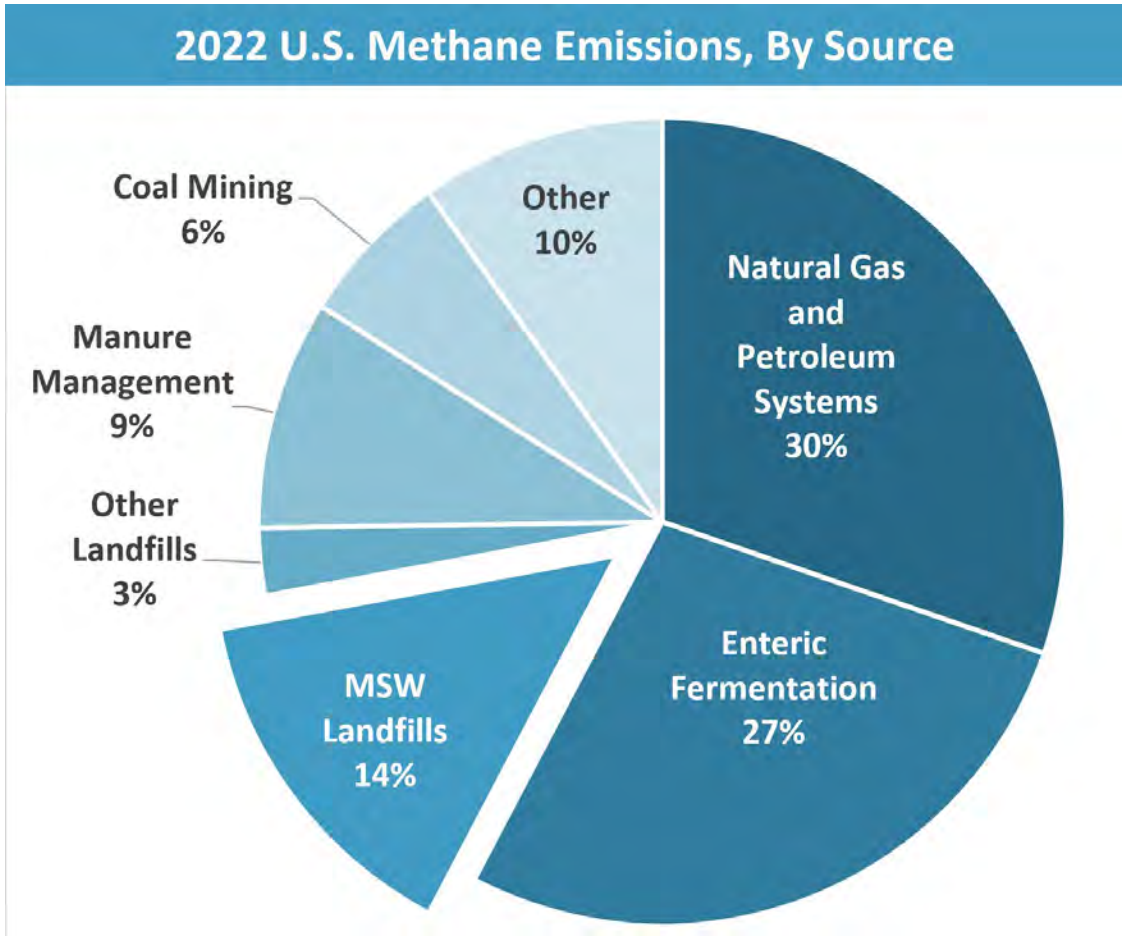
- Established in 1994
- Voluntary program that creates partnerships among states, energy users/providers, the landfill gas (LFG) industry and communities

Mission: Work cooperatively with industry & waste officials to reduce or avoid landfill methane emissions by encouraging the recovery & beneficial use of biogas generated from organic municipal solid waste.

LANDFILL METHANE OUTREACH PROGRAM

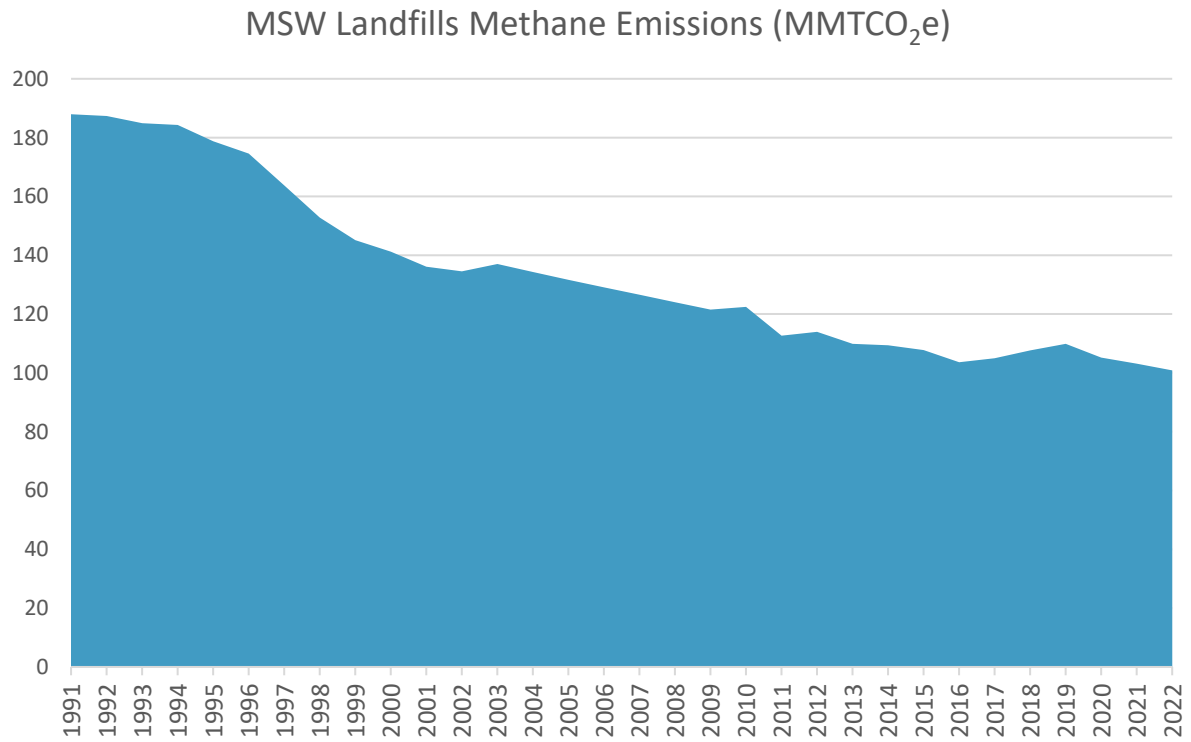
epa.gov/lmop

MSW Landfill Methane Emissions



From *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2022*

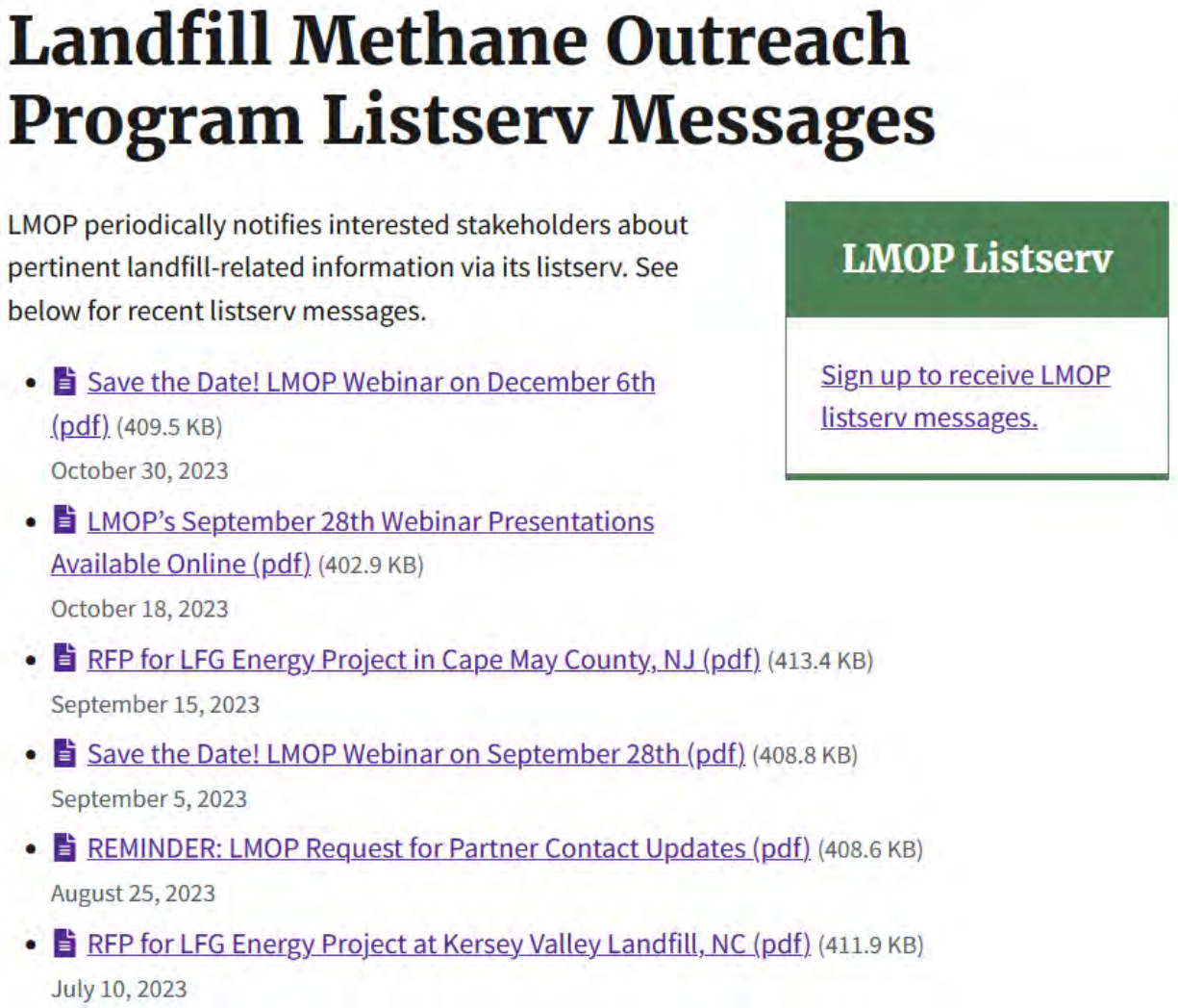
- Landfills remain third-largest source of anthropogenic methane in the United States



From *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2022*

Partnerships and Connections

- 1,000 Partners: Industry, Energy, Community, State, and Endorser
  - Online directory with description, service or equipment type (Industry only), and points of contact
  - Partners in Wisconsin: 16 Industry, 3 Energy, 1 State, 3 Community, and 2 Endorsers
- LMOP sends listserv messages about landfill RFPs for LFG energy, funding opportunities from EPA, and other topics related to LFG



Landfill Methane Outreach Program Listserv Messages

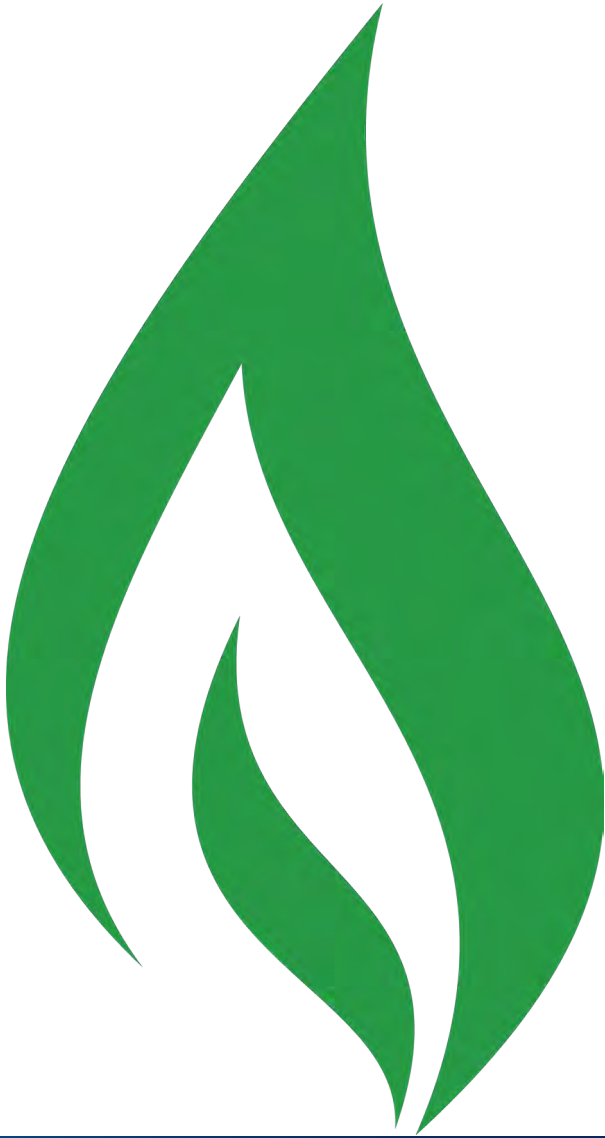
LMOP periodically notifies interested stakeholders about pertinent landfill-related information via its listserv. See below for recent listserv messages.

LMOP Listserv

Sign up to receive LMOP listserv messages.

- Save the Date! LMOP Webinar on December 6th (pdf) (409.5 KB)
  October 30, 2023
- LMOP's September 28th Webinar Presentations Available Online (pdf) (402.9 KB)
  October 18, 2023
- RFP for LFG Energy Project in Cape May County, NJ (pdf) (413.4 KB)
  September 15, 2023
- Save the Date! LMOP Webinar on September 28th (pdf) (408.8 KB)
  September 5, 2023
- REMINDER: LMOP Request for Partner Contact Updates (pdf) (408.6 KB)
  August 25, 2023
- RFP for LFG Energy Project at Kersey Valley Landfill, NC (pdf) (411.9 KB)
  July 10, 2023

State of the Industry



National View of LFG Energy Projects

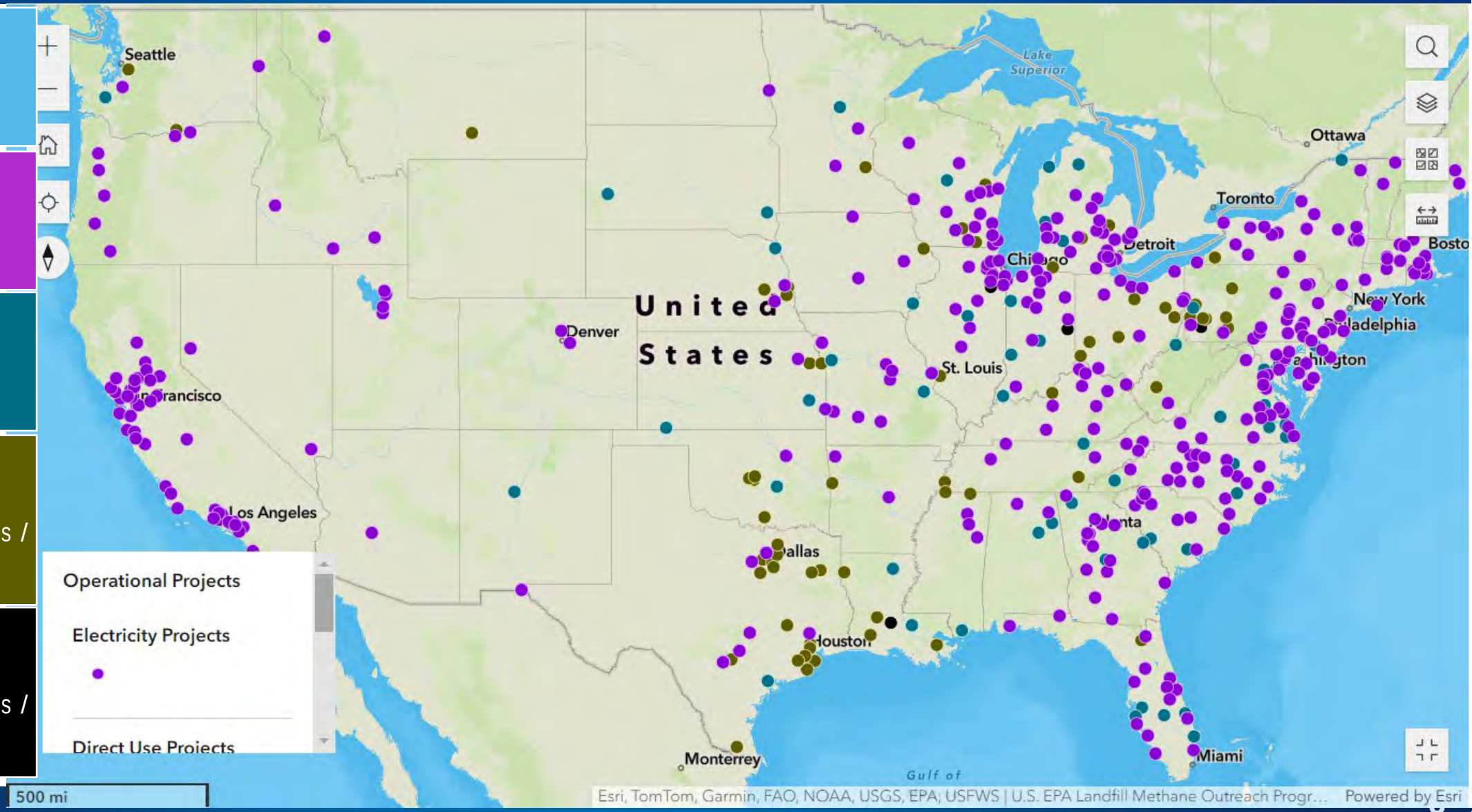
536
All Project Types

346
Electricity

89
Direct-Use

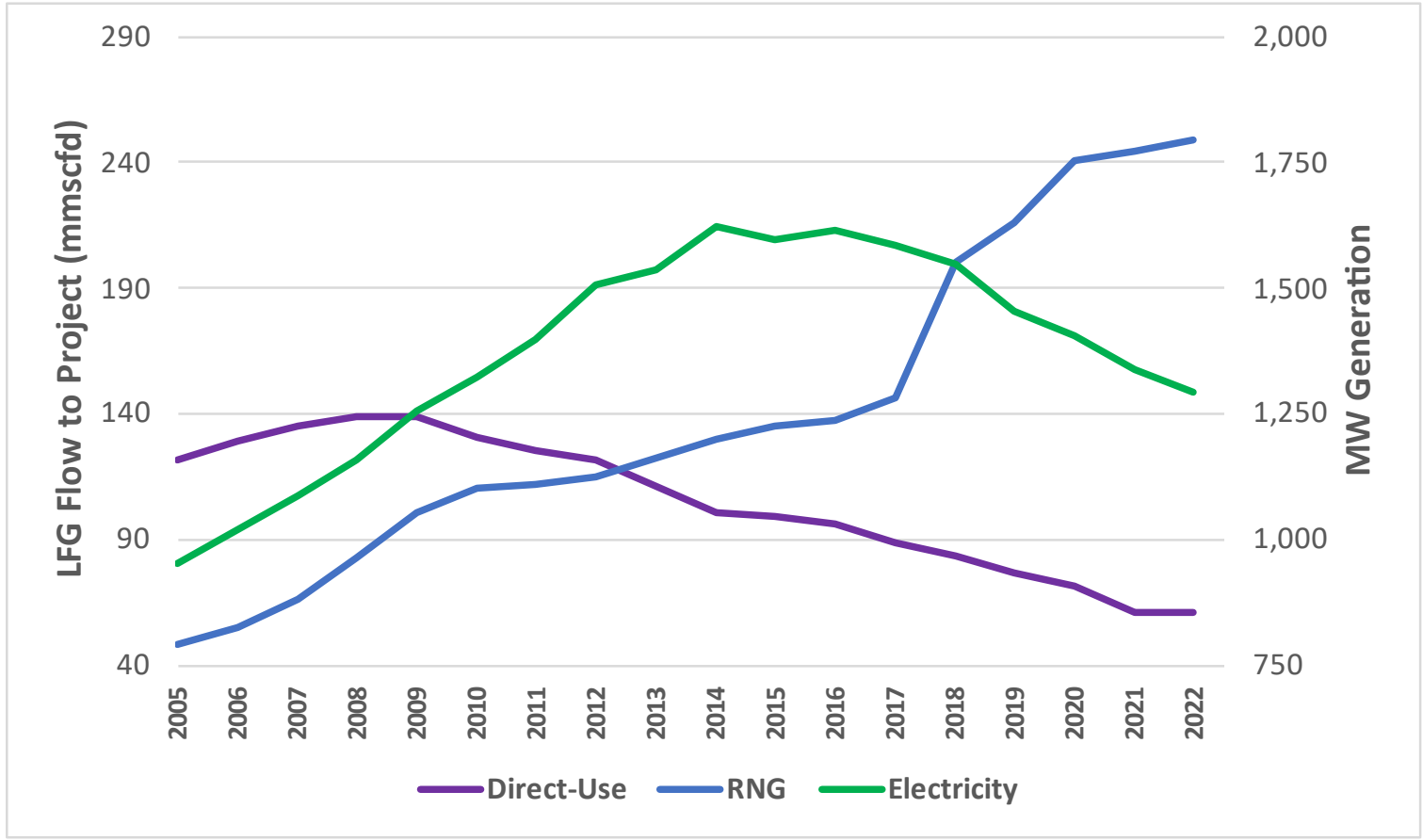
92
Renewable Natural Gas / Pipeline Injection

9
Renewable Natural Gas / Local Use



LFG Energy Project Trends

- Upward trend of creating renewable natural gas (RNG) from LFG is expected to continue
- LMOP database lists 100 under-construction or planned RNG projects for 2024–2026
- Most RNG projects provide at least some of the produced RNG for vehicle fuel down the line
- Several landfills have switched from electricity to RNG production in the last five years



LFG Energy Projects in Wisconsin

Electricity

- Dane County LF #1-Verona
- Emerald Park Landfill LLC
- Glacier Ridge Landfill LLC
- Janesville City/Rock County Landfill
- Kestrel Hawk Landfill
- La Crosse County Landfill
- Metro RDF (2 projects)
- Orchard Ridge RDF
- Pheasant Run Recycling and Disposal
- Ridgeview RDF
- Sauk County SLF
- Timberline Trail Recycling & Disposal
- Valley Trail Recycling & Disposal
- Winnebago Co. Sunnyview (2)

Direct-Use

- Cranberry Creek
- Valley Trail Recycling & Disposal
- Winnebago County Sunnyview

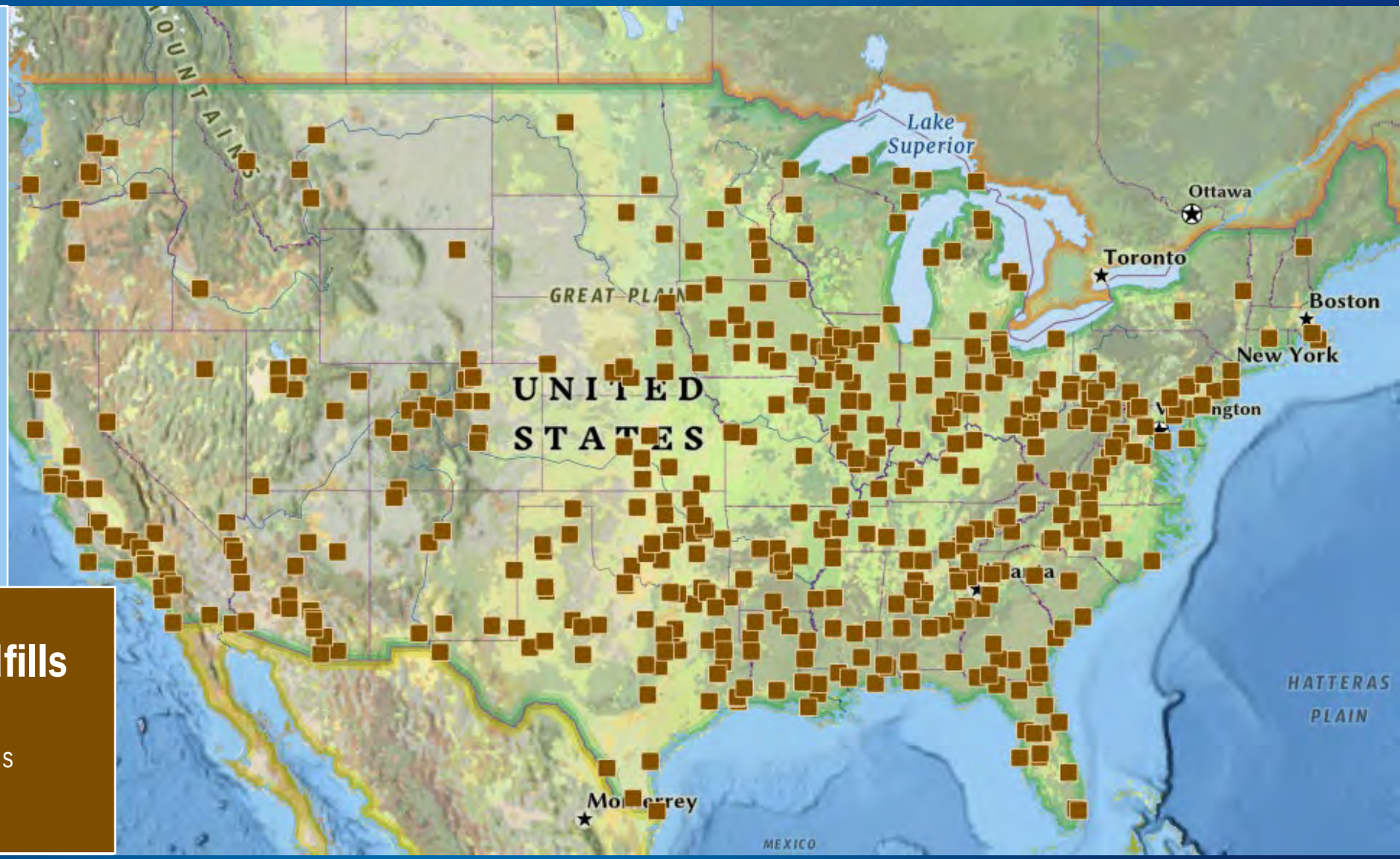
Renewable Natural Gas

- Dane County LF #2-Rodefeld (2 projects)
- Glacier Ridge Landfill LLC
- Mallard Ridge Landfill Inc.
- Outagamie County LF

Candidate Landfills

What is a candidate landfill?

- Landfill is accepting waste or has been closed for five years or less
- Has at least one million tons of waste
- Does not have an operational, under-construction or planned project
- Can also be designated based on interest by the site



~ 459 Candidate Landfills

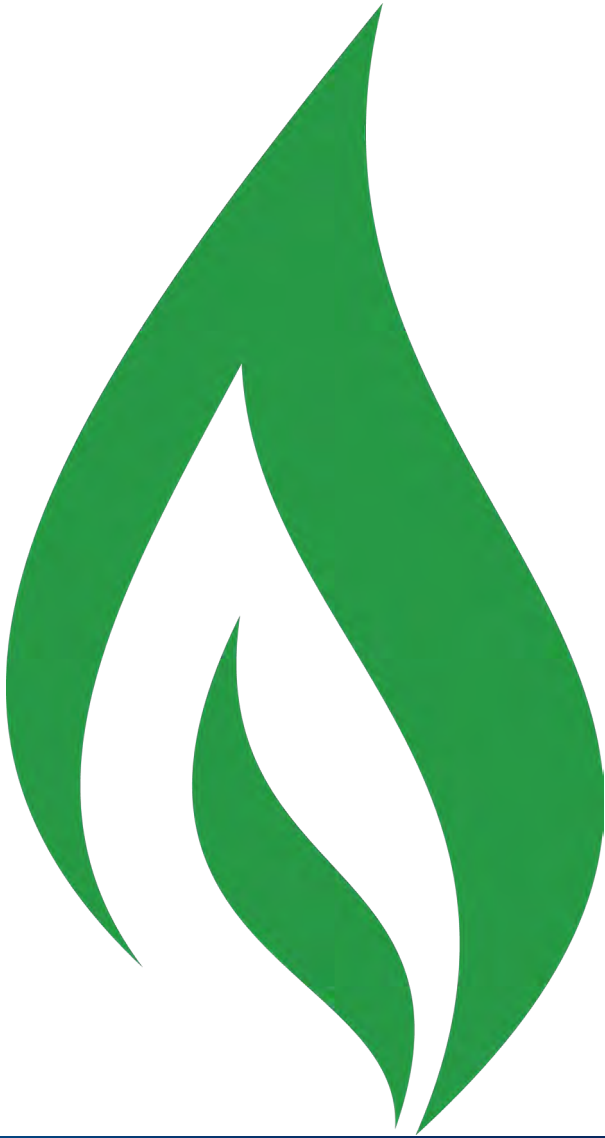
913 MW or 507 mmscfd

Potential Direct CH_4 Reductions of 51 MMTCO_2e/year

Candidate Landfills in Wisconsin

Landfill	Owner Type	Gas Collection?	Waste In Place in 2022 (short tons)
Lake Area Landfill	Private	Yes	7.4 million
Seven Mile Creek Landfill	Private	Yes	11.2 million

What's New



Funding Opportunities

- The **Bipartisan Infrastructure Law** and **Inflation Reduction Act** allocated money for grants and other funding mechanisms for a variety of project initiatives including clean energy and methane reductions
  - Solid Waste Infrastructure for Recycling (SWIFR) – NEW!
- New programs under the Inflation Reduction Act include:
  - Climate Pollution Reduction Grants
  - Low Emissions Electricity Program
  - Greenhouse Gas Reduction Fund
  - Environmental & Climate Justice Block Grants
- USDA Rural Energy for America Program (REAP)

Innovative Technology Options

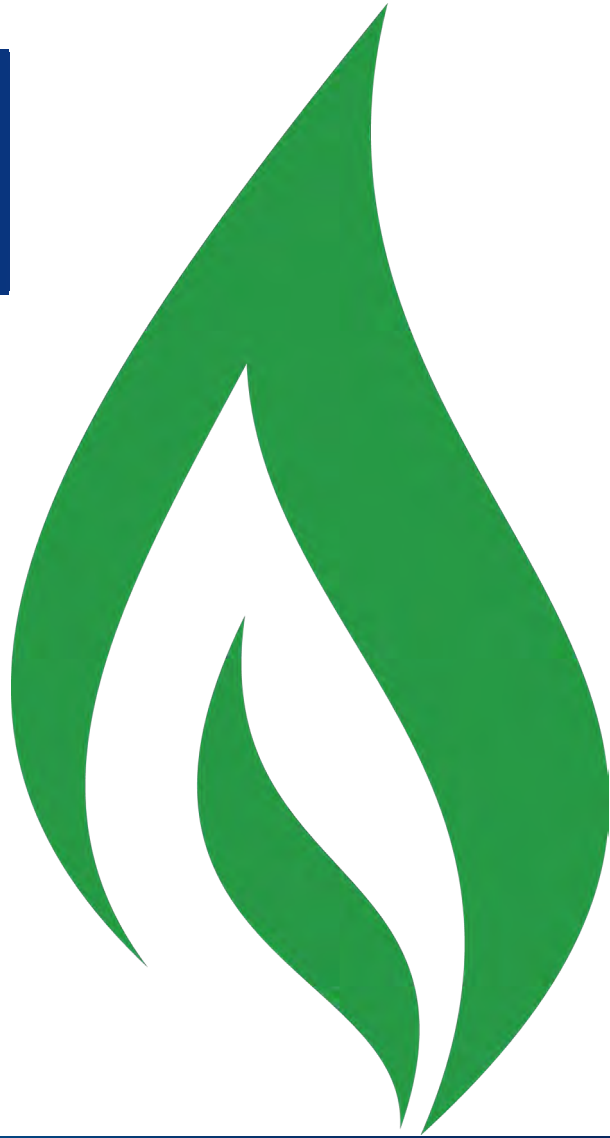
- Onsite electricity:
  - Microgrid (powered by engines) including a data center
  - Linear Engine (Free piston Stirling engine) for low flow rates / low methane
- RNG project options for smaller landfills
- Hydrogen creation from LFG
- Leachate evaporation using waste heat
- Methane mitigation without energy recovery (e.g., biofilters)
- RNG upgrading technologies
- Methane emissions monitoring with drones

Organic Waste Management

- *Quantifying Methane Emissions from Landfilled Food Waste*
  - EPA report estimates methane emissions from food waste for 1990 to 2020
  - Food waste comprises ~24% of landfilled MSW
  - An estimated 58% of fugitive landfill methane emissions are from food waste
- *National Strategy for Reducing Food Loss and Waste and Recycling Organics*
- *Excess Food Opportunities Map*

epa.gov/sustainable-management-food

LMOP Resources



Data and Information Sharing

Data

- Downloadable spreadsheets of LFG energy projects or MSW landfills that may have energy potential
- National map of landfills and projects with layers for environmental justice demographic data and Tribal lands

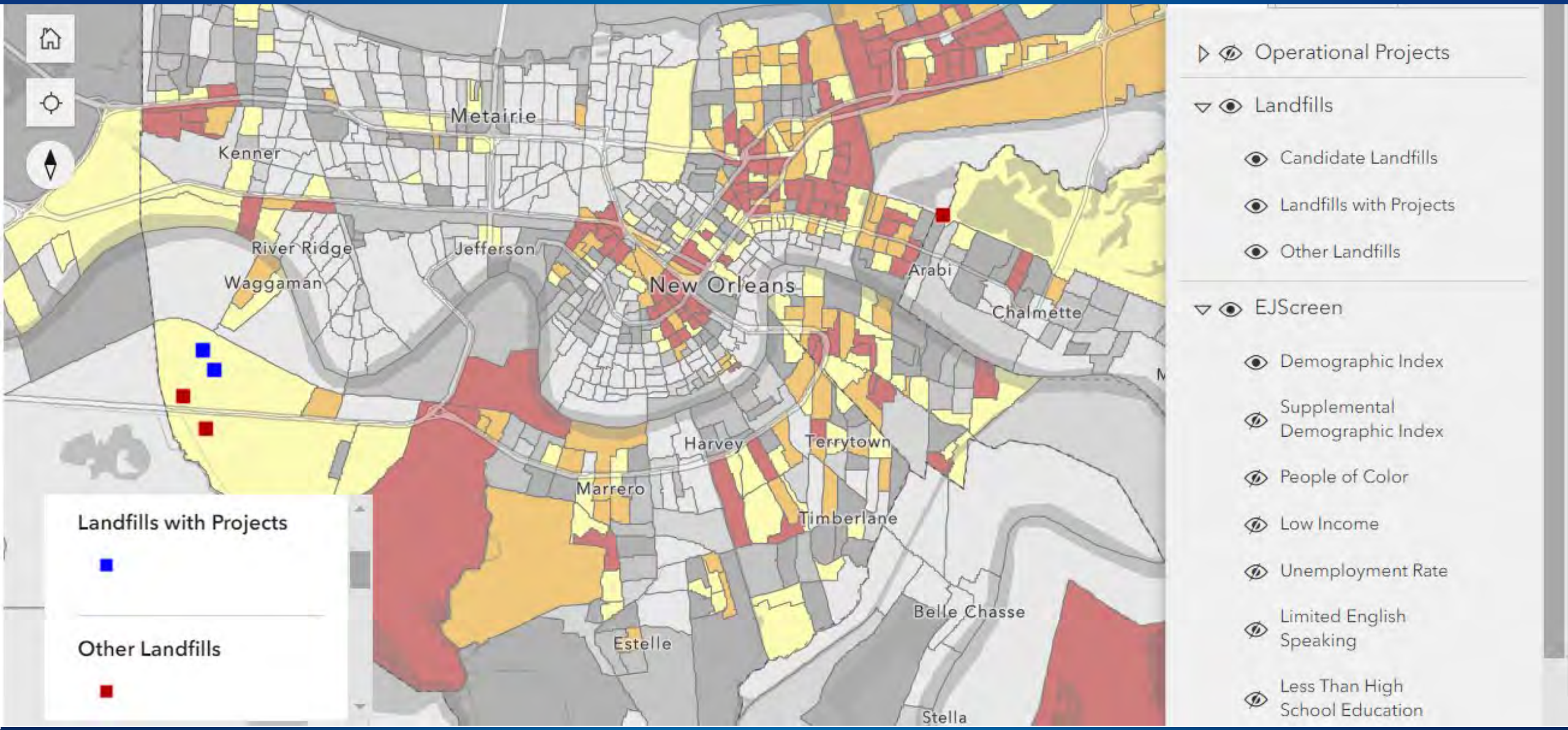
Documents

- *LFG Energy Project Development Handbook*
- *An Overview of Renewable Natural Gas (RNG) from Biogas*
- *RNG: Facility Operation Best Practices to Create a More Climate-Friendly Project*

Webinars

- Projects for remote locations or low LFG flow; detecting landfill methane emissions with drones; options when power purchase agreement is ending
- Planning one or two webinars for 2024

LMOP Interactive National Map



Technical Assistance and Cost Model

- LMOP offers technical assistance to landfills and end users seeking LFG
  - Please contact us if interested in evaluation of cost and feasibility for voluntary LFG collection and energy recovery
  - We use our gas production and project cost estimate model

LANDFILL METHANE OUTREACH PROGRAM

U.S. EPA Landfill Methane Outreach Program

Landfill Gas Energy Cost Model

LFGcost-Web, Version 3.6

Summary Report

Landfill Name or Identifier: Example Landfill, USA

LFG Energy Project Type: Direct-use

Date: Monday, February 19, 2024

Outputs: *Go to Report*

Type of Output		Output Data
Economic Analysis:		
Design project size (ft3/min LFG)		1,200
Generating capacity for projects generating electricity (kW)		--
Average project size for projects NOT generating electricity: [based on actual LFG use]	(million ft^3/yr LFG)	567.65
	(ft^3/min LFG)	1,080.00
Average project size for projects generating electricity (kWh/yr)		--
Average project size for CHP projects producing hot water/steam (million Btu/yr)		--
Total installed capital cost for year of construction ($)		$4,730,149
Annual costs for initial year of operation ($)		$216,462
Internal rate of return (%)		-6%
Net present value at year of construction ($)		($953,098)
Years to Breakeven*		None

Expiring Power Purchase Agreements (PPAs)

- Electricity projects from the early 2000s are shutting down as PPAs expire and are not renewed; presents financial challenges
  - Over 75 projects shut down since 2018
- LMOP's toolkit provides options for next steps: criteria for alternative projects, pros and cons, economic considerations, project examples and more
- New options are added as needed
- Examples: generate electricity for a microgrid, capture waste heat, switch to another project type, or install biofilters / biocover

If conditions are feasible for LFG energy project operations:

Continue to generate electricity

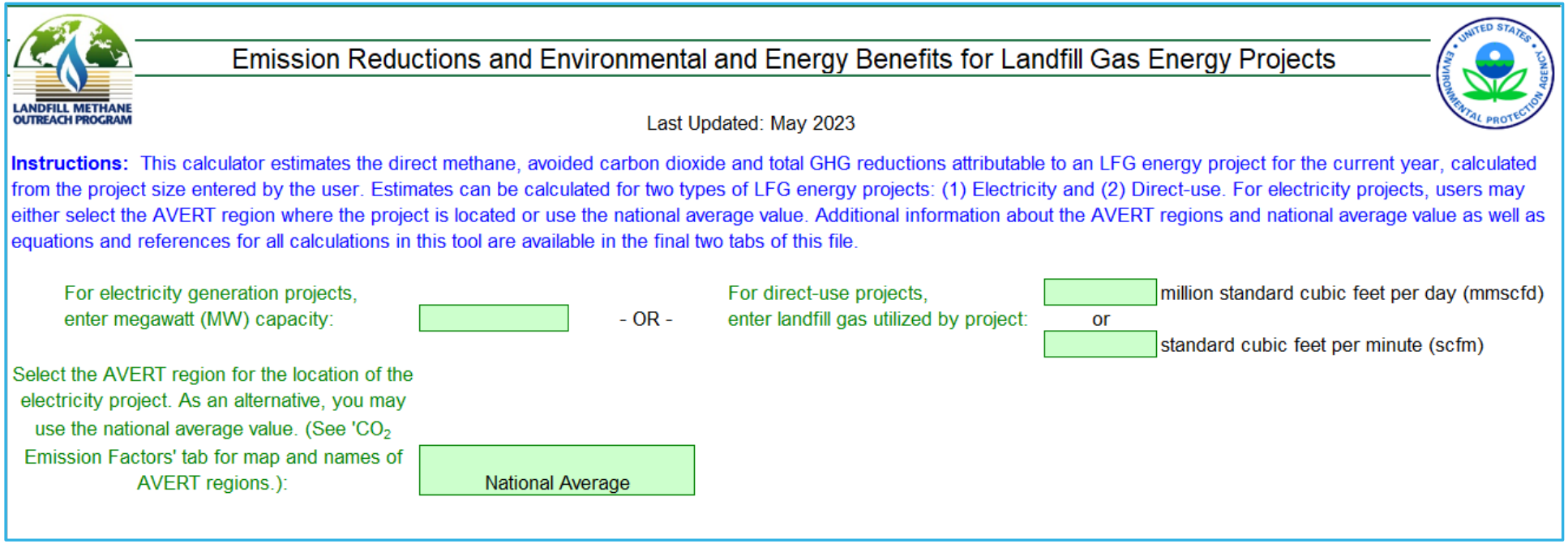
Develop new LFG energy project type

Or, if conditions are not feasible for LFG energy project operations:

Shut down your LFG energy project

Other Tools and Resources

- Benefits Calculator
- RNG Flow Rate Estimation Tool
- Interactive Conversion Tool
- LFG to Vehicle Fuel fact sheet
- Example Procurement Files
- Resources for Funding Projects
- Project Profiles
- Frequent Questions and Answers



LANDFILL METHANE OUTREACH PROGRAM

Emission Reductions and Environmental and Energy Benefits for Landfill Gas Energy Projects

Last Updated: May 2023

Instructions: This calculator estimates the direct methane, avoided carbon dioxide and total GHG reductions attributable to an LFG energy project for the current year, calculated from the project size entered by the user. Estimates can be calculated for two types of LFG energy projects: (1) Electricity and (2) Direct-use. For electricity projects, users may either select the AVERT region where the project is located or use the national average value. Additional information about the AVERT regions and national average value as well as equations and references for all calculations in this tool are available in the final two tabs of this file.

For electricity generation projects, enter megawatt (MW) capacity: - OR - For direct-use projects, enter landfill gas utilized by project: million standard cubic feet per day (mmscfd) or standard cubic feet per minute (scfm)

Select the AVERT region for the location of the electricity project. As an alternative, you may use the national average value. (See 'CO_2 Emission Factors' tab for map and names of AVERT regions.): National Average

Connect with Us

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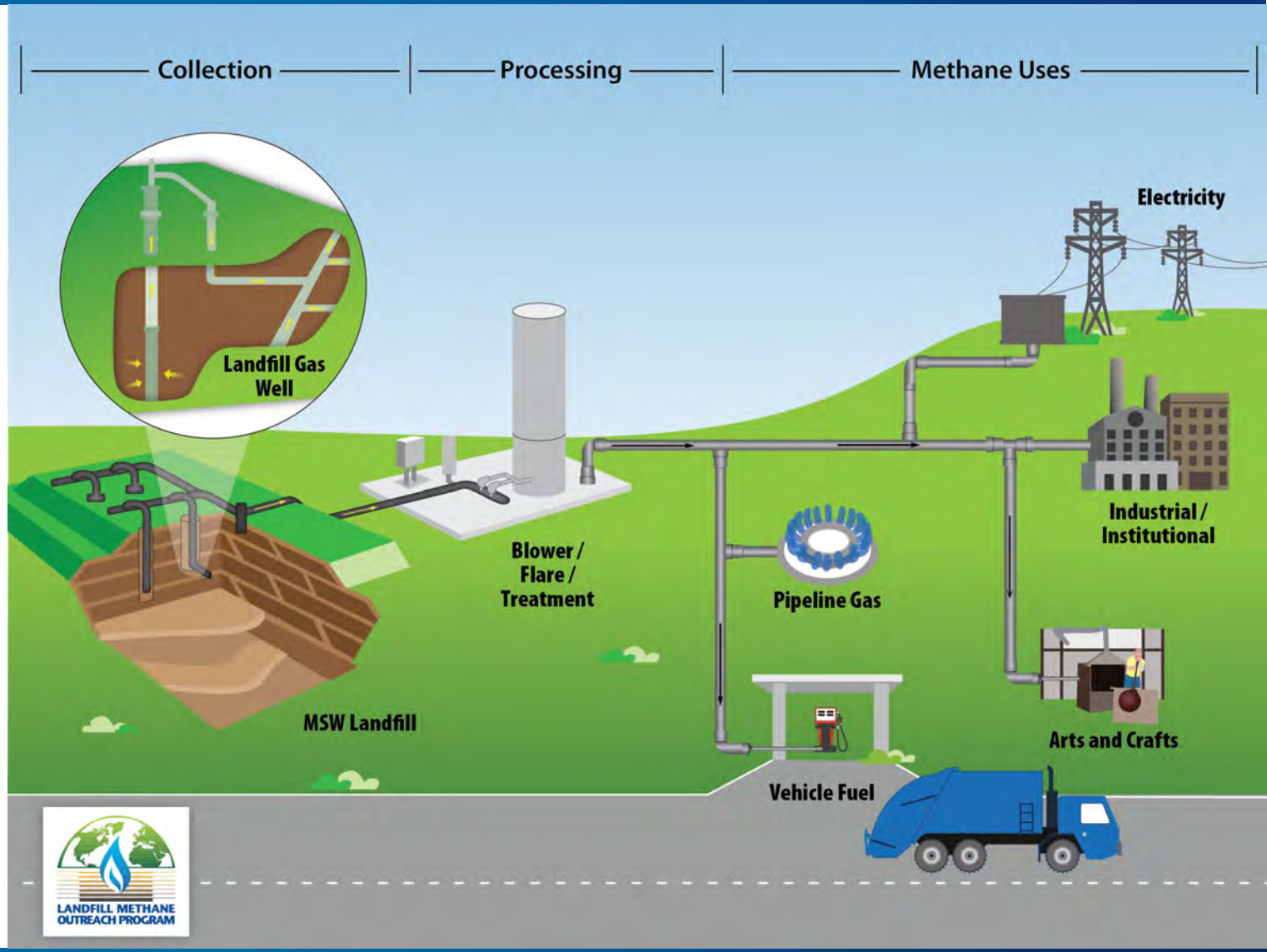

Questions