

# Encouraging the Recovery and Beneficial Use of Biogas Generated from Municipal Solid Waste

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Landfill Methane Outreach Program**



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# Agenda

- Introduction to Landfill Gas (LFG) Energy
- LFG Energy in the United States
- LFG Energy in North Carolina
- Trends in the U.S. Solid Waste Industry
- Key LMOP Resources

# Landfill Methane Outreach Program (LMOP)

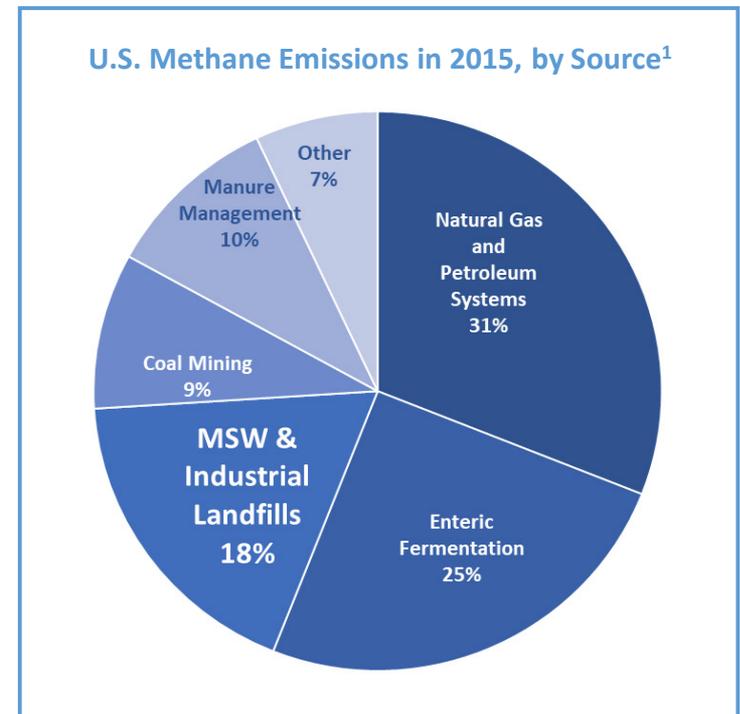
- Established in 1994
- Voluntary program that creates partnerships among landfill owners and operators, states, municipalities, energy users and providers, the LFG industry and communities

***Mission: To work cooperatively with industry and stakeholders to reduce or avoid methane emissions from landfills by encouraging the recovery and beneficial use of biogas generated from organic municipal solid waste (MSW).***

# Why LFG is Important

- LFG is a by-product of the anaerobic decomposition of MSW in landfills
- LFG is about 50% methane, and landfills are the third-largest human-made source of U.S. methane emissions<sup>1</sup>
- LFG also contains hazardous air pollutants and can cause odor or other health issues

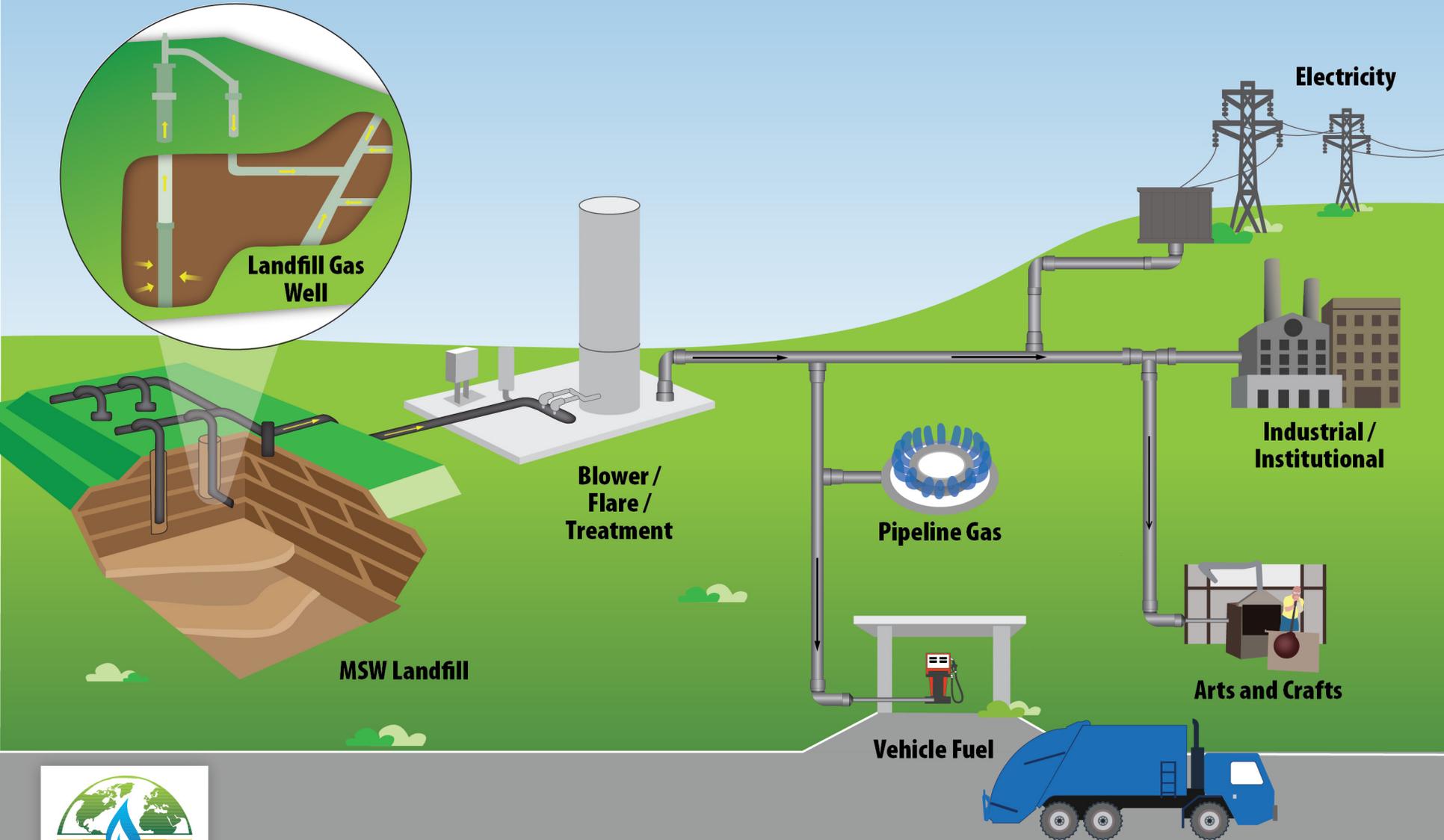
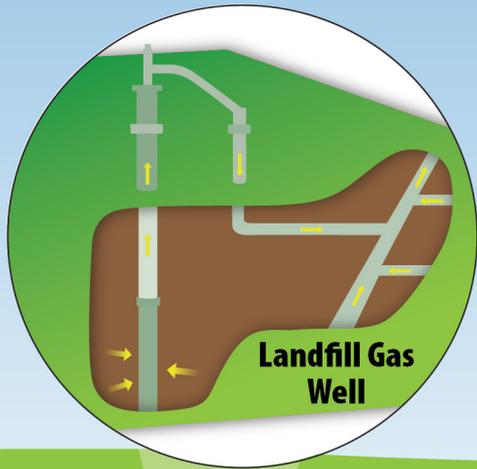
1. Inventory of U.S. Greenhouse Gas Emissions and Sinks. April 2017. U.S. EPA.  
<https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>.



Collection

Processing

Methane Uses



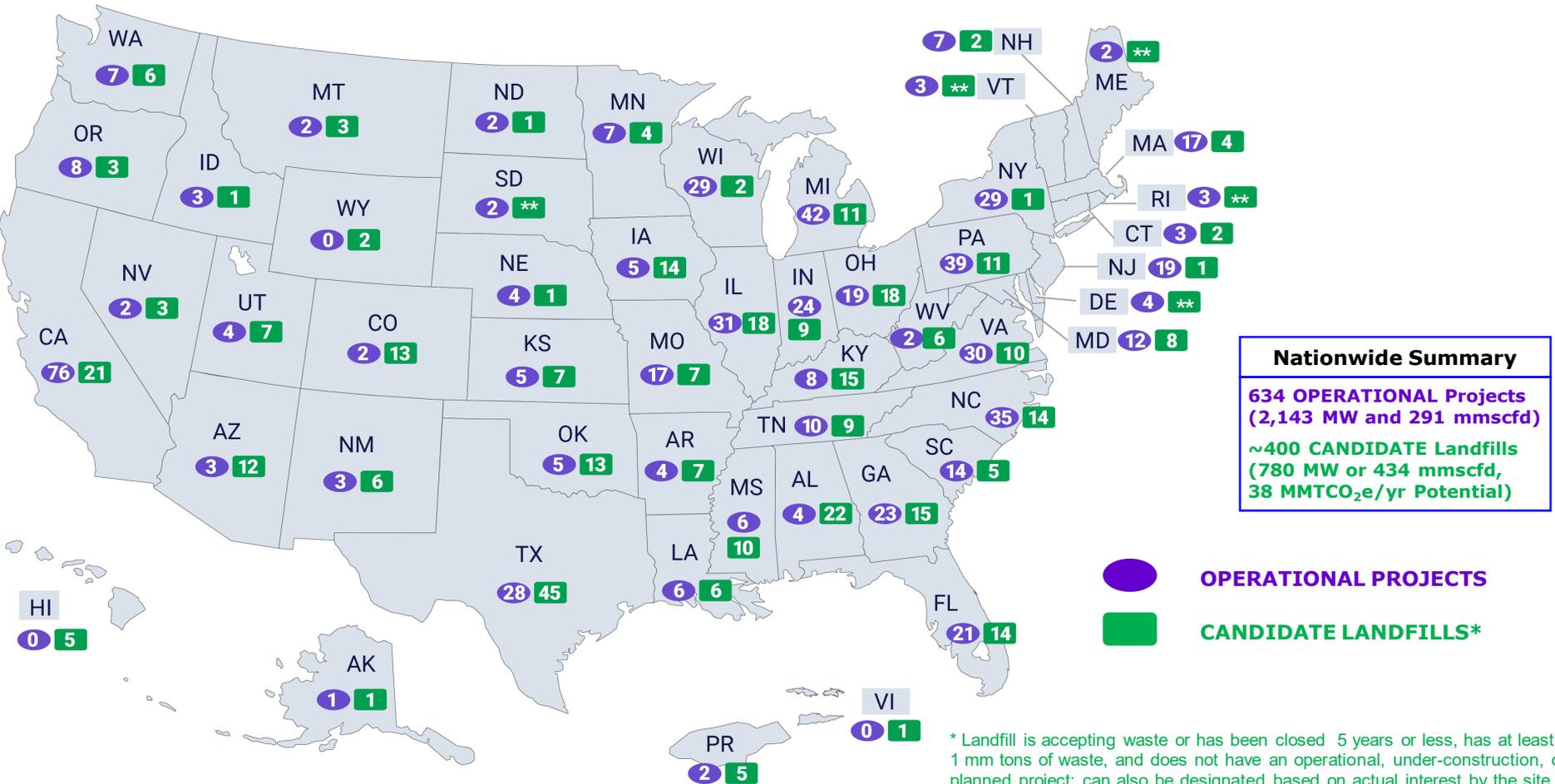
# LFG Energy Co-Benefits

Source of local, renewable and consistent energy

Offers local environmental and health benefits

Provides economic benefits in the community and beyond

# LFG Energy Projects and Candidate Sites

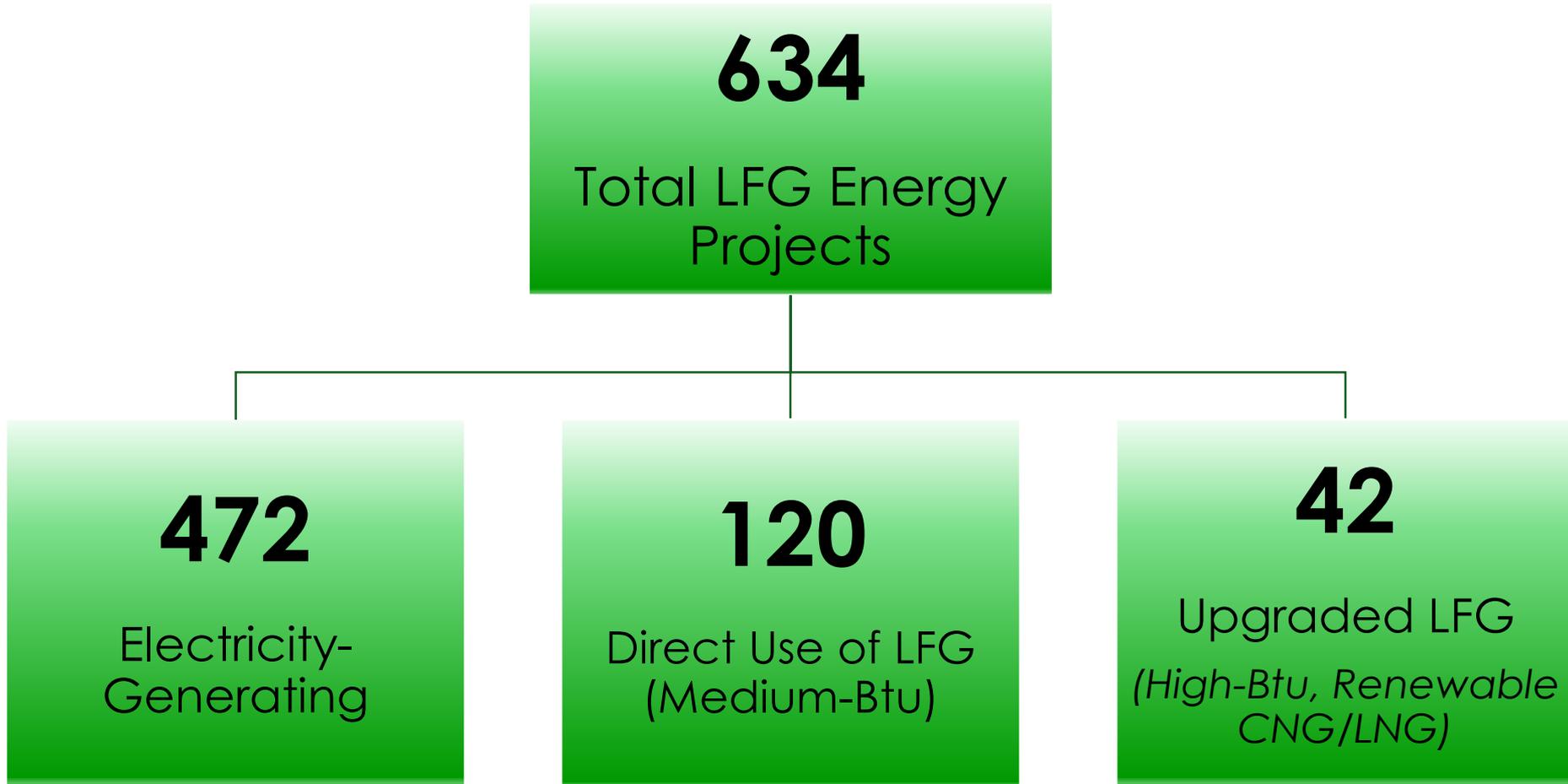


These data are from LMOP's Landfill and Landfill Gas Energy Database as of June 2017.

\* Landfill is accepting waste or has been closed 5 years or less, has at least 1 mm tons of waste, and does not have an operational, under-construction, or planned project; can also be designated based on actual interest by the site.

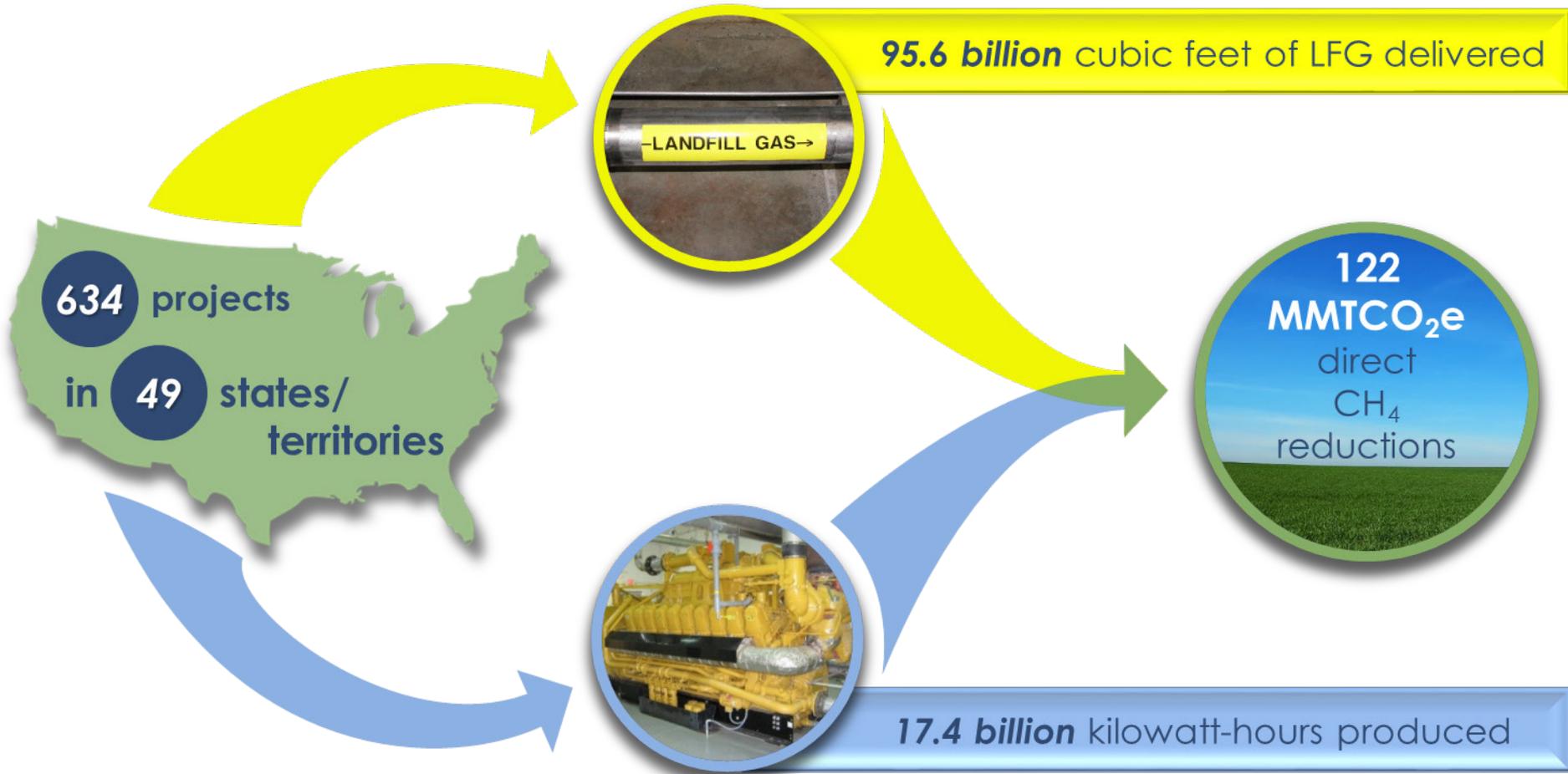
\*\* LMOP does not have any information on candidate landfills in this state.

# U.S. LFG Energy Projects by Category



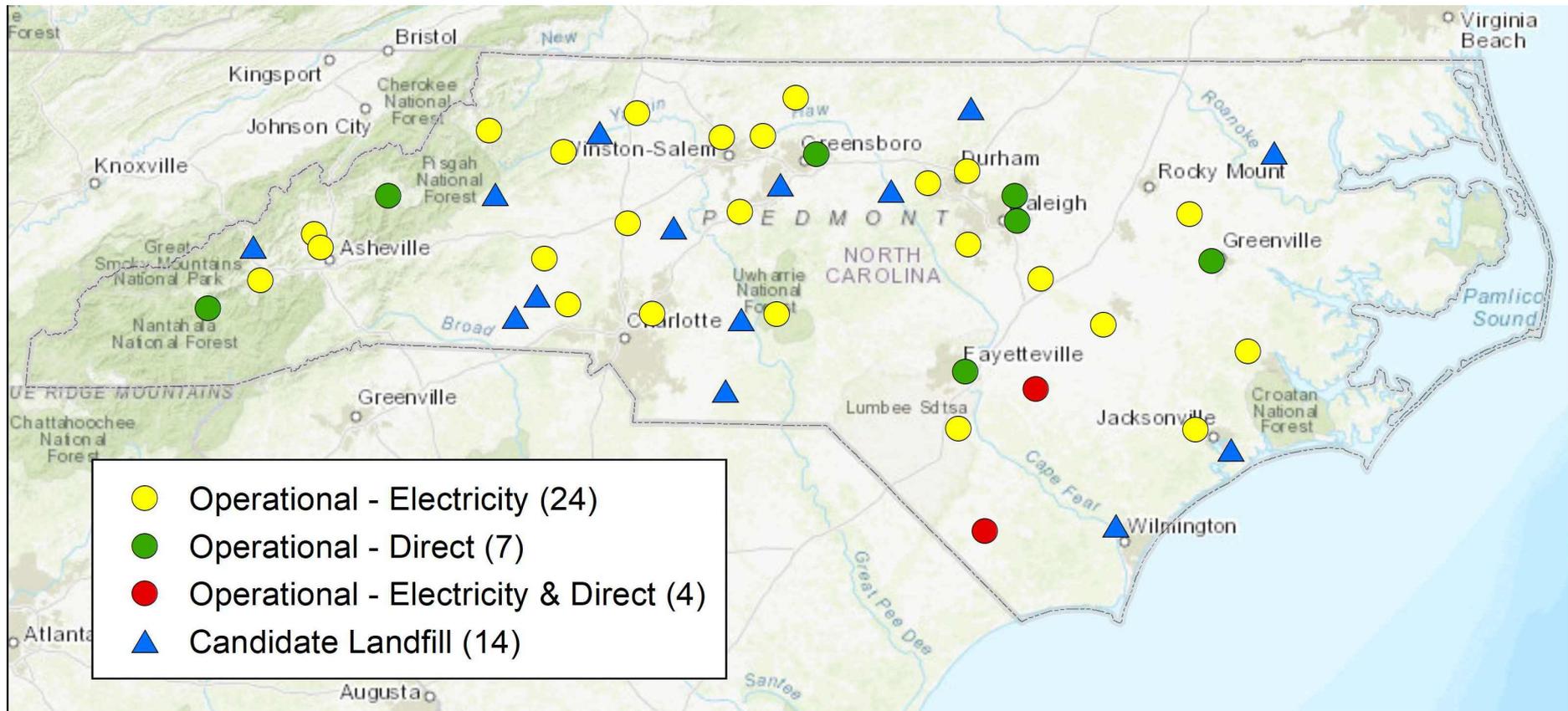
\*LFG energy project count from LMOP's Landfill and Landfill Gas Energy Database as of June 2017

# LFG Energy Project Snapshot for 2017



\*Estimated values are based on LFG energy projects operating in June 2017.

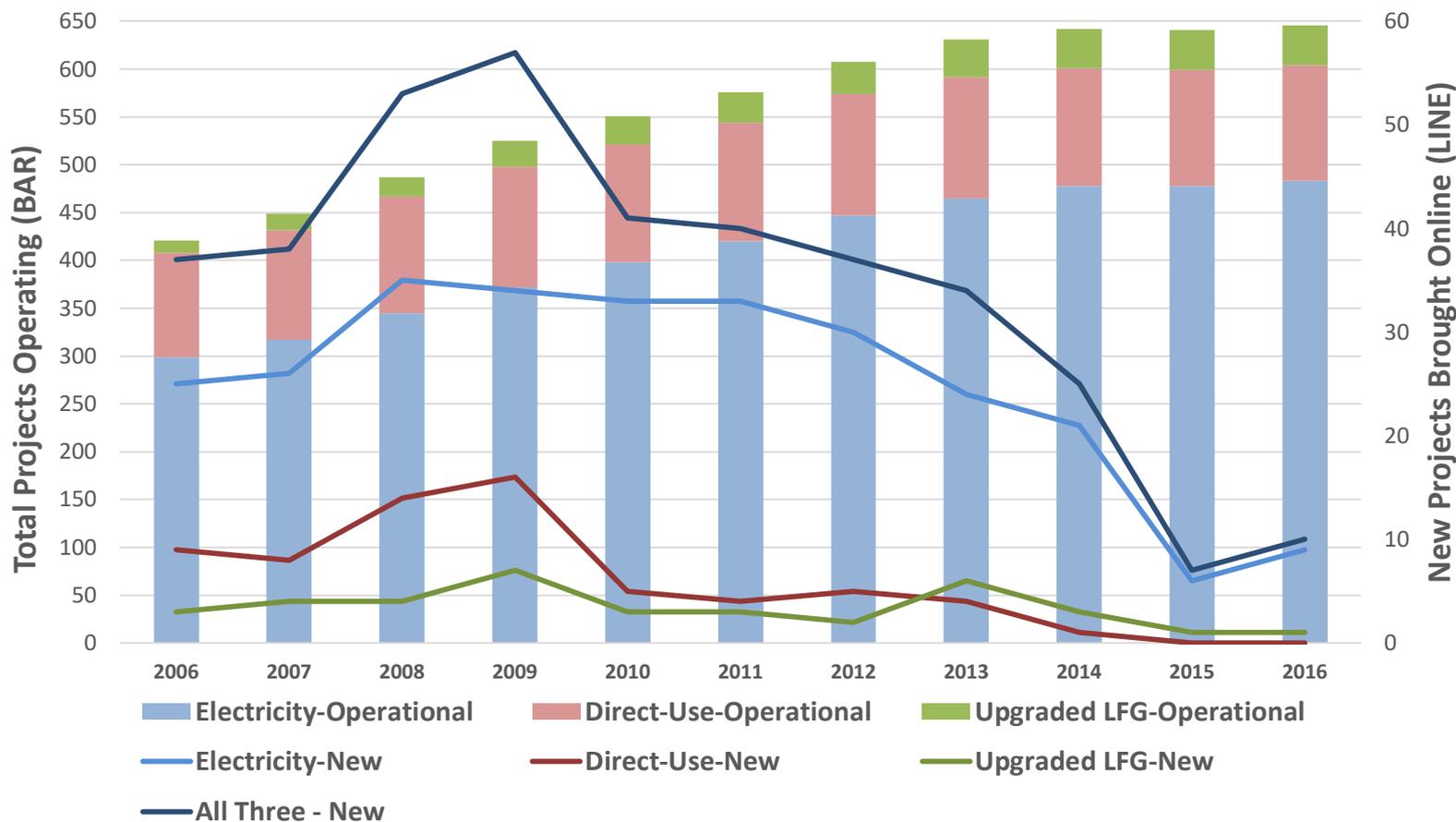
# Projects and Candidates in North Carolina



These data are from LMOP's Landfill and Landfill Gas Energy Database as of June 2017.

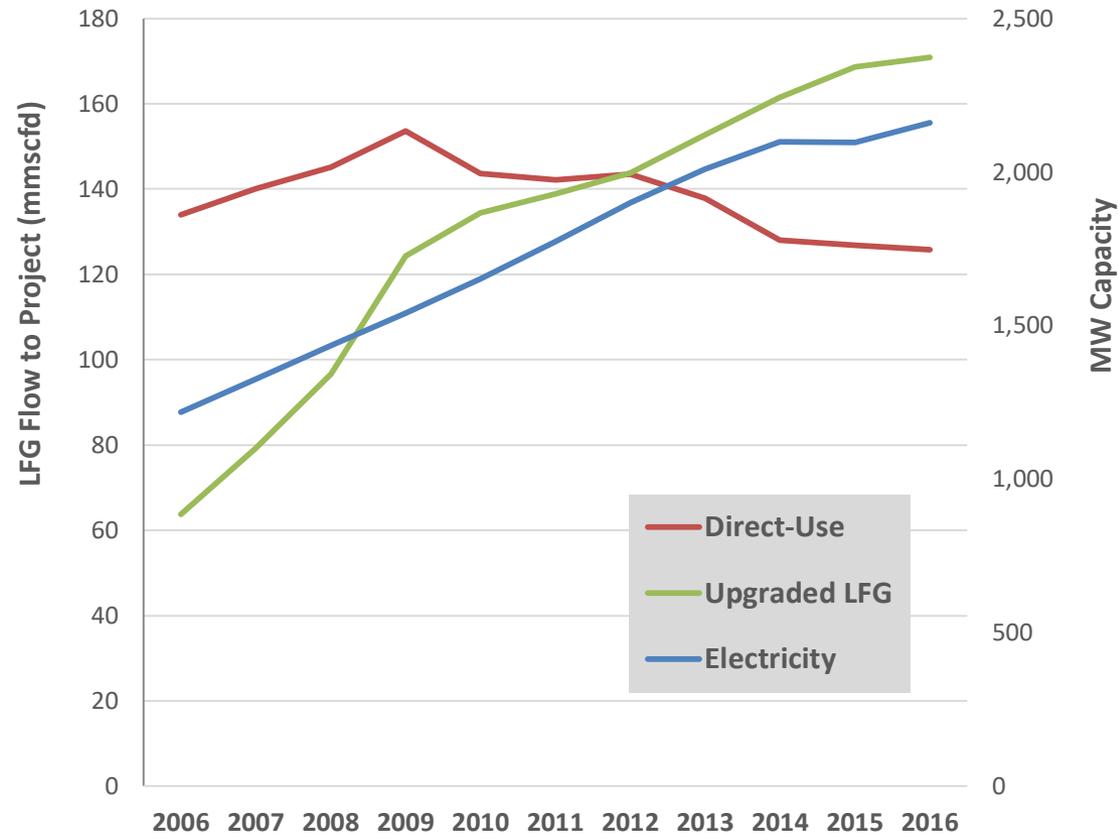
# Trends in LFG Energy Project Development

○ Rate of new projects coming online each year is declining

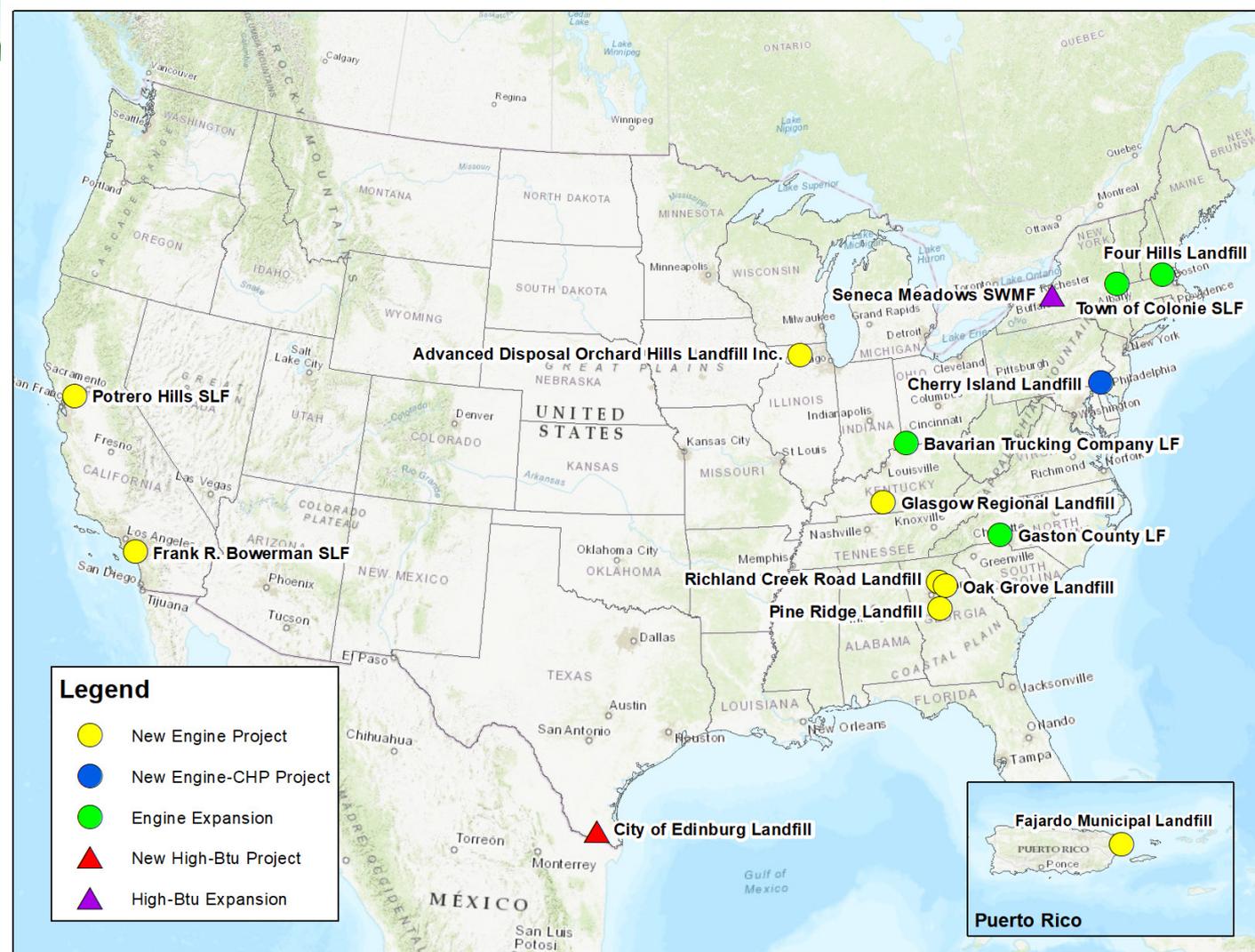


# Trends in LFG Energy Project Development (cont.)

- Total MW capacity of LFG electricity projects still increasing
- Decreasing direct use of medium-Btu LFG (e.g., boilers)
- More upgraded LFG to pipelines and vehicle fuel projects



# New 2016 LFG Energy Projects/Expansions



# Factors Affecting New LFG Energy Projects

- Low natural gas prices / low electricity rates
- Permitting challenges and gas quality requirements
- Expiration of Section 45 production tax credit
- Interconnection logistics and costs
- Uncertainty about future LFG generation rates (e.g., organic waste diversion)

# Trends in Biogas to Vehicle Fuel

## Growing and sustained interest in LFG to vehicle fuel

### ○ Currently:

- 6 operating onsite LFG-to-vehicle fuel projects and 6 planned
- 34 of the 38 operating high-Btu pipeline projects provide cleaned gas for creating vehicle fuel at other end of pipeline

### ○ Potential opportunities to grow:

- Landfills with operational project and excess LFG
  - ~65 have 100-1,000 cfm excess
  - ~20 have > 1,000 cfm excess
- Candidate landfills (with or w/o a collection system in place)
  - ~270 have 100-1,000 cfm LFG
  - ~80 have > 1,000 cfm LFG

\*Data from LMOP's Landfill and Landfill Gas Energy Database as of July 2017

# Drivers for Vehicle Fuel Projects

- Federal and state incentives: Renewable Fuel Standard (RFS) program and CA Low Carbon Fuel Standard (LCFS)
- Corporate and municipal sustainability goals and county mandates can include CNG fleet conversions (e.g., UPS, San Diego (CA), Atlanta (GA))
- Fuel cost savings (compared to diesel/gasoline)
- Local air quality benefits (e.g., reduces criteria pollutants)
- Local NG distribution companies seek low-carbon feedstocks in 20+ states with economy-wide GHG reduction targets
- Voluntary renewable natural gas credits (RNGCs)
- Technology efficiencies and advancements

# LFG Energy Projects – New High-Btu

## Hamm Landfill, KS

- 1,800 cfm LFG initially, designed for 4,000 cfm LFG
- ~5 million gals vehicle fuel annually
- BP buying RNG for vehicle fuel market

## Pine Hill Landfill, TX

- 1,500 cfm LFG initially, can generate 404 million cf RNG/year
- Shell buying RNG for vehicle fuel market

**Congratulations LMOP Partners!**

By developing a landfill gas energy project, Enerdyne Power Systems and Hamm Waste Services are:

- Reducing emissions and improving local air quality
- Developing a local, renewable source of energy
- Encouraging economic development and job creation

The U.S. EPA congratulates the following LMOP Partners who collaborated on the completion of a new high-Btu renewable natural gas (RNG) facility in Lawrence, Kansas named Renewable Power Producers, LLC.

Advance One Development	Enerdyne Power Systems	Wilter Manufacturing
Advanced Biogas Systems	Kansas Department of Health and Environment	Xebec Adsorption
BP Energy Company		

The project is designed to capture landfill gas from the Hamm Landfill in Lawrence, Kansas and convert it into RNG. Through Renewable Power Producers, LLC, Enerdyne has developed a state-of-the-art high-Btu project designed by ES Engineering, constructed by Advance One Development, and fabricated by Advanced Biogas Systems. BP will buy the RNG from this facility with intent to sell it as renewable vehicle fuel through the U.S. EPA Renewable Fuel Standard program. The facility is designed to process up to 2,500 cubic feet per minute of raw landfill gas and is expected to produce the equivalent of ~5 million gallons of vehicle fuel annually.

These organization logos are presented to show their involvement in this landfill gas energy project. Use of these logos does not imply any official endorsement by the U.S. EPA.



# Trends in Organic Waste Management

## States and municipalities are increasingly interested in diversion of organic waste from landfills

- Many yard waste bans went into effect in late 1980s/ early 1990s, but there is a more recent focus on diverting food waste
  - ~26 states have laws that address landfilling organic waste\*
    - 5 states (California, Connecticut, Massachusetts, Rhode Island and Vermont) ban food waste from landfills
    - 3 more states (Maryland, New Jersey and New York) are considering similar food waste bans
  - Local initiatives emerging to address/minimize food waste
    - ~200 communities offering source separated organic waste collection programs

*\*Represents states with any organic waste ban – yard waste, food waste, or other*

# Organic Waste Management Treatment

- Options for treatment of organic waste include:
  - **Compost:** aerobic decomposition by microorganisms into humus, a usable, soil-like byproduct
    - ~350 to 500 U.S. composting sites accept food waste
  - **Anaerobic Digestion:** decomposition process in the absence of oxygen releases biogas that can be captured and beneficially used and leaves an organic residue called digestate (also a usable byproduct)
    - ~100 to 150 U.S. AD facilities accept some sort of food waste (pre- or post-consumer)
- Examples of AD and composting co-located at landfills – some of these landfills also have LFG energy projects\*
  - Crapo Hill Landfill, MA\* and Prince William County Landfill, VA\* [both AD]
  - Lee/Hendry County Landfill, FL [composting]

# Landfill & LFG Energy Impacts of Organic Waste Diversion

- Extent of impact varies depending on a number of factors, but includes:

- Reduction in LFG generation rates and associated energy potential
- Extension of landfill life by saving valuable space
- Reduction in the amount of leachate generated

***Knowledge of organic waste management trends is important to better understand how it may affect landfill operations and existing/future LFG energy project development***

# LFG Energy Project Examples – LFG / AD

## Crapo Hill Landfill, MA

- Expected state food waste disposal ban to affect LFG production
- Co-located food waste AD facility at landfill
- Biogas ties into existing LFG generating facility

## Monterey Peninsula Landfill, CA

- Integrated approach to waste management
- Existing engine project since 1983 (now 5 MW)
- Dry AD project piloted, then fully launched in 2013
- Processes ~400 tons/month food scraps to produce 100 kW

# Food Waste Anaerobic Digestion in NC

- Stand-alone: Blue Sphere facility in Charlotte
  - Inputs: organic wastes from grocery stores, food processors and restaurants
  - Input capacity: 156,000 tons/year [500 tons/day]
  - Started up November 2016 (currently running 25% capacity)
  - Output:
    - Electricity (5.2-MW design): sold to Duke Energy
    - Generator waste heat: warm digesters and dry solids
    - Digestate: soil amendment

# LMOP Resources

- Landfill and LFG Energy Project Database
- Tools: *LFGcost-Web*, benefits calculator, conversion tool
- Technical and outreach publications
- Webinars and other events
- Network of 1,100+ Partners
- Listserv – sign up to receive and view message archive

# LMOP Resources: LMOP Database

Available at [epa.gov/lmop](http://epa.gov/lmop)

## Landfill and LFG Energy Project Data

Download details about projects and landfills

**Includes data for more than 2,400 U.S. landfills**

- Excel files cut the LMOP data in various ways to help you find what you are looking for
- Cross-references EPA's greenhouse gas reporting program (GHGRP)

	A	B	C	D	E	F	G	H	I	J	K
	GHGRP ID	Landfill ID	Landfill Name	State	Physical Address	City	County	Zip Code	Latitude	Longitude	Ownership Type
2	1007341	1994	Anchorage Regional Landfill	AK	15500 E. Eagle River Loop Road	Eagle River	Anchorage	99577	61.293281	-149.60214	Public
3	1007341	1994	Anchorage Regional Landfill	AK	15500 E. Eagle River Loop Road	Eagle River	Anchorage	99577	61.293281	-149.60214	Public
4	1010389	11941	Capitol Disposal Landfill	AK	5600 Tonsgard Court	Juneau	Juneau	99801	58.3528	-134.4947	Private
5		10980	Central Landfill - MatSu Borough	AK	1201 N. 49th State Street Just off the Palmer-Wasilla Highway	Palmer	Matanuska-Susitna	99645	61.59	-149.21	Public
6	1005349	12216	Central Peninsula Landfill (CPL)	AK	46915 Sterling Highway	Soldotna	Kenai Peninsula	99669	60.44714	-151.10369	Public
7		10960	Kodiak Island Borough Landfill	AK	1203 Monashka Bay Road	Kodiak	Kodiak Island	99615	57.80874	-152.40761	Public
8	1004380	11020	Merrill Field Landfill	AK	800 Merrill Field Drive	Anchorage	Anchorage	99501	61.21266	-149.84012	Public
9	1006806	10961	South Cushman Landfill	AK	455 Sanduri Street	Fairbanks	Fairbanks North Star	99701	64.80476	-147.70085	Public
10		11000	Unalaska Landfill	AK	1181 Summer Bay Road	Unalaska	Aleutians West	99685	53.88463	-166.50657	Public
11		27	MSWLF Athens/Limestone County SLF	AL	Strain Road off Highway 31	Athens	Limestone	35611	34.7634	-86.9399	Public
12		16	Bishop Landfill Company	AL	379 Pleasant Grove Cutoff Road	Albertville	Marshall	35950	34.27823	-86.33707	Private
13	1004245	2005	Black Warrior Solid Waste Facility	AL	3301 Landfill Drive						
14		2006	Blount County/Nectar/Hayden LF & TS	AL	2390 Armstrong Loop						
15	1004415	2408	Brundidge Landfill	AL	515 Cleanwater Drive						



flight  
Facility Level  
Information on  
GreenHouse gases  
Tool  
[Refresh View](#)

# LMOP Resources: *LFGcost-Web*

Available at [epa.gov/lmop](http://epa.gov/lmop)

## *LFGcost-Web*, Version 3.2

### *Evaluate the initial economic feasibility of an LFG energy project*

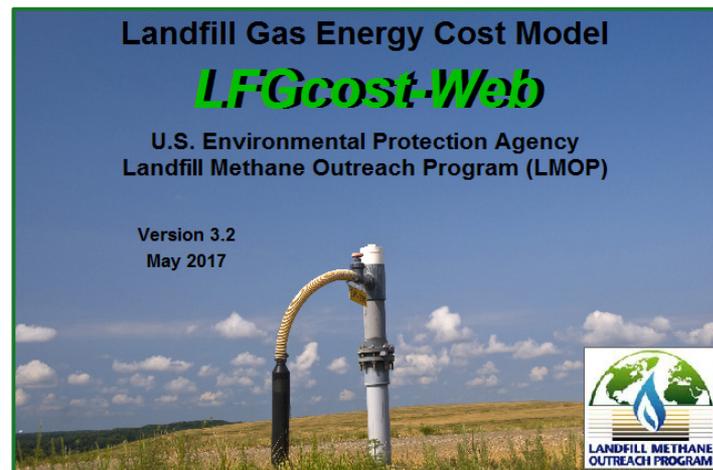
Analyze 12 LFG energy project types with or without costs for a new LFG collection and flaring system

**Released May 2017**

*User-friendly Microsoft® Excel platform*

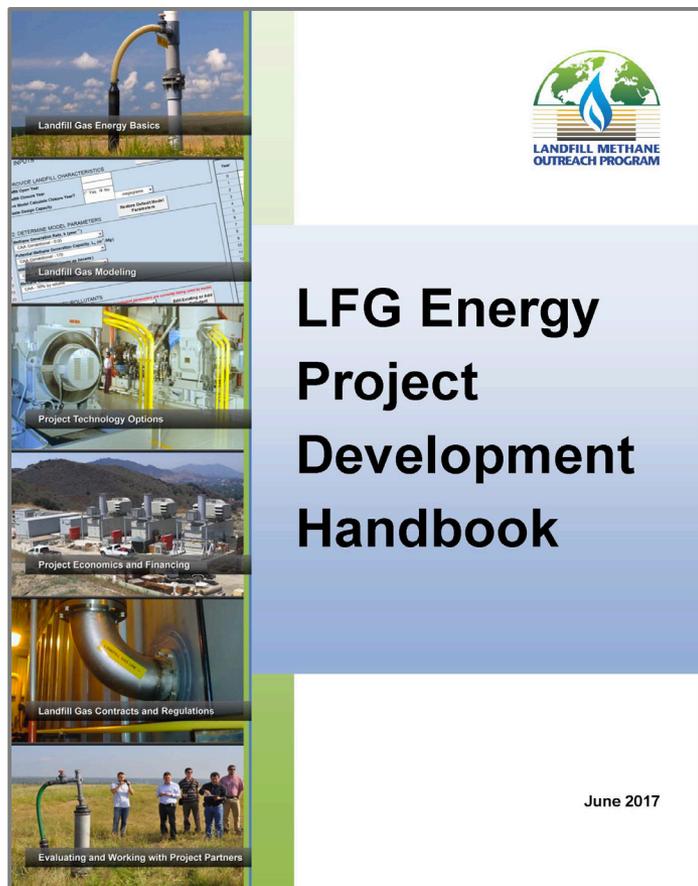
- Added ability to estimate job creation and regional economic ripple effects
- Updated reference sources for calculating electricity prices and avoided CO<sub>2</sub> grid factors
- Updated default user inputs

***LFGcost-Web* is available online to all stakeholders and transparent, allowing users to edit optional inputs**



# LMOP Resources: Handbook

Available at [epa.gov/lmop](http://epa.gov/lmop)



## LFG Energy Project Development Handbook

*Improve understanding to develop successful projects*

- Provides project-specific considerations
- Helps stakeholders who are new to LFG energy projects
- Highlights useful online resources and successful LFG energy projects

# Upcoming LMOP Events



## LMOP Webinar on Wellfield Operations and Technologies for Upgrading LFG

**November 16, 2017, 1:00 pm ET**

**No cost to attend – register via link on LMOP website**

## LMOP National Landfill Gas Energy Special Session

**March 2018**

(in conjunction with SWANA's LFG Symposium)

Denver, CO

**See [www.epa.gov/lmop](http://www.epa.gov/lmop) for more information**

# LMOP Partners (September 2017)

- Industry Partners: **776**
- Community Partners: **145**
- Energy Partners: **109**
- State Partners: **39**
- Endorser Partners: **39**

**More than 1,100 Partners**

## Benefits of LMOP Partnership:

- Recognition for commitment to renewable energy
- Identification on LMOP website
- Use of LMOP logo on Partner's website (within guidelines)
- LMOP support for groundbreaking or ribbon cutting
- Keep informed about new developments, events, and other LFG-related information

To join the Partnership, visit the LMOP website at [epa.gov/lmop/join-landfill-methane-outreach-program](http://epa.gov/lmop/join-landfill-methane-outreach-program)

# How Can We Work Together?

- Facilitating information sharing – LMOP Database, webinars, listserv
- Providing technical information about LFG energy project development and opportunities to reduce emissions from MSW landfills more broadly
- Analyzing resource availability through LFG modeling
- Performing initial feasibility analysis using *LFGcost-Web*

**We welcome your feedback on our resources, website, etc.**

# Contact Information

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