

# Encouraging the Recovery and Beneficial Use of Landfill Gas

April 27, 2017

SWANA Old Dominion Chapter Conference

Lauren Aepli

Landfill Methane Outreach Program

U.S. Environmental Protection Agency

# Agenda

- ▶ Introduction to LMOP
- ▶ Why LFGE Projects?
- ▶ LFG Applications
- ▶ Where are LFGE Projects?
- ▶ LFGE in Virginia
- ▶ Barriers to Project Development
- ▶ How Can LMOP Help?

# Landfill Methane Outreach Program (LMOP)

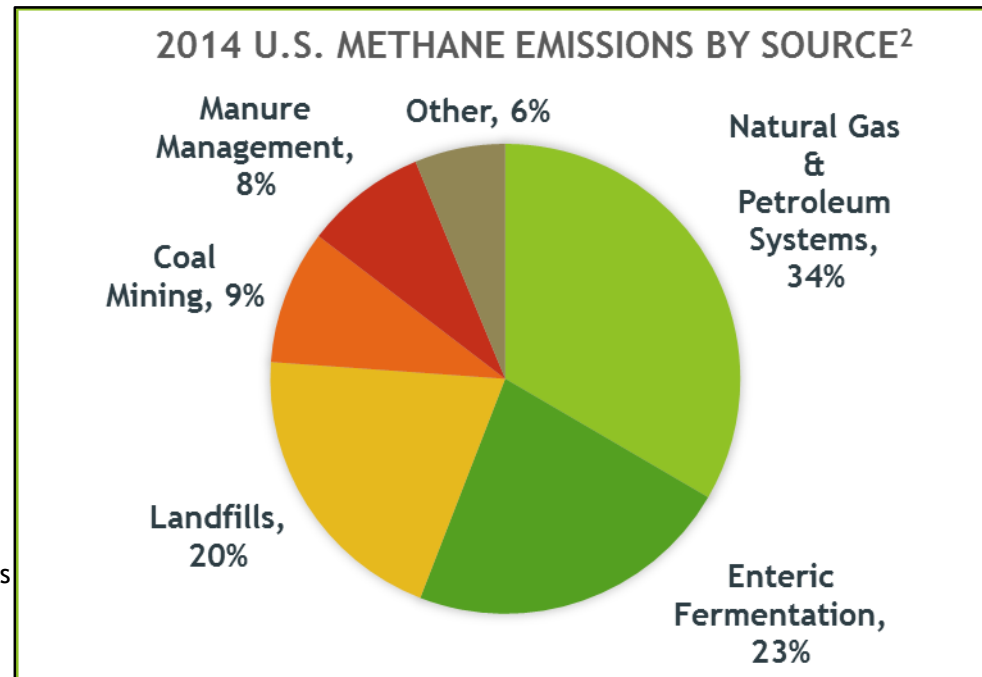
- ▶ Established in December 1994
- ▶ Voluntary program that creates partnerships among states, energy users/providers, the landfill gas (LFG) industry and communities

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

# Why LFG Energy (LFGE) Projects?

# Why the EPA is Concerned about Landfill Gas

- ▶ LFG is a by-product of the anaerobic decomposition of municipal solid waste (MSW)
- ▶ Landfill gas contains about 50% methane, 50% CO<sub>2</sub>, and a small amount of NMOCs
- ▶ Methane as a GHG is 28 to 36 times more effective than CO<sub>2</sub> at trapping heat in the atmosphere over a 100-year period<sup>1</sup>
- ▶ Landfills are the third largest human-made source of U.S. methane emissions, accounting for 20% of these emissions in 2014<sup>2</sup>



1. IPCC (2014). Fifth Assessment Report.

2. U.S. EPA (April, 2016). Inventory of U.S. Greenhouse Gas Emissions and Sinks.

# LFG Energy Benefits



Create local, renewable, and consistent energy

Generate revenue and jobs in the community

Reduce local air pollution and GHG emissions



Lead to health benefits

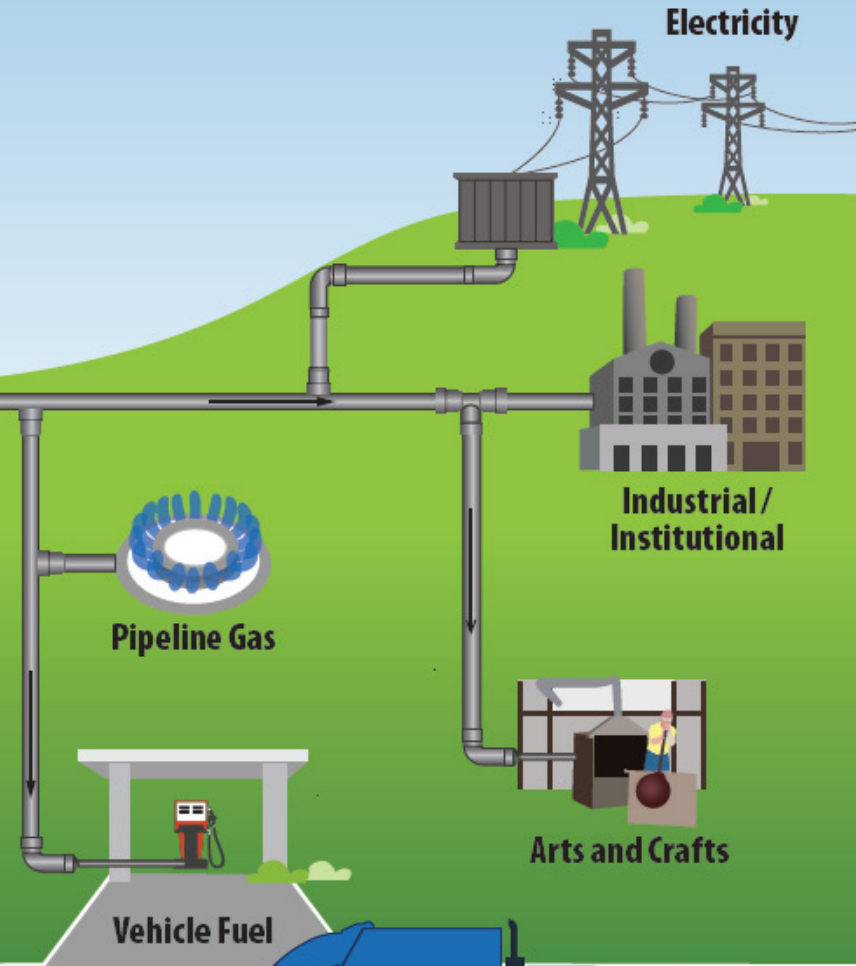
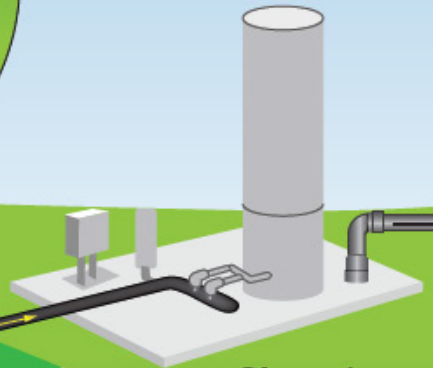
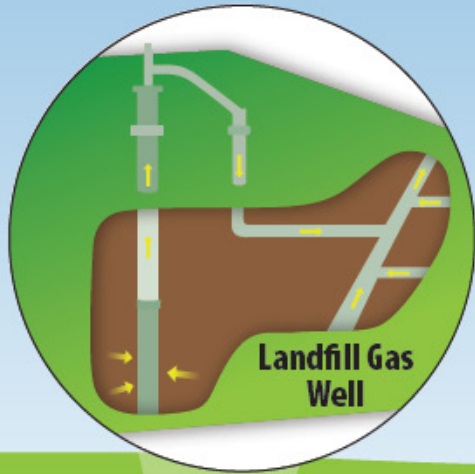
# LFG Applications

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the slide, creating a modern, layered effect. The text 'LFG Applications' is positioned on the left side of the slide in a clean, sans-serif font.

Collection

Processing

Methane Uses





# Diversity of Project Types: Electricity Generation

**Internal  
Combustion Engine  
(range from 100 kW  
to 3 MW)**



**Gas Turbine  
(range from 800 kW  
to 10.5 MW)**

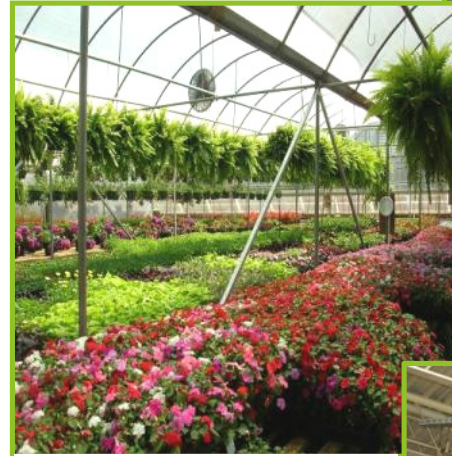


**Microturbine  
(range from 30 kW  
to 250 kW)**



# Diversity of Project Types: Medium- & High-Btu

- ▶ Boiler applications - replace natural gas, coal, fuel oil
- ▶ Direct thermal (dryers, kilns)
- ▶ Greenhouse
- ▶ Infrared heaters
- ▶ Leachate evaporation
- ▶ Glassblowing, pottery, blacksmithing, hydroponics, aquaculture
- ▶ Ethanol production
- ▶ Natural gas pipeline injection
- ▶ Vehicle fuel (CNG, LNG)



Greenhouse  
Jackson County, NC



Glassblowing  
Jackson County, NC



Infrared Heater - Lorton, VA

# Typical Electric Project: Costs & Benefits

- ▶ 3-MW, engine, 15-year project:
  - ▶ Total capital cost = ~\$5.25 million
    - ▶ Excludes gas collection and flaring system costs
  - ▶ Annual operation & maintenance cost = ~\$626,000/year
  - ▶ 6+ jobs
    - ▶ Additional during construction phase
  - ▶ \$1.8 million direct economic benefits

[\$2013 capital costs; O&M is the cost in the initial year of project operation (2014)]

# Typical Direct-Use Project: Costs & Benefits

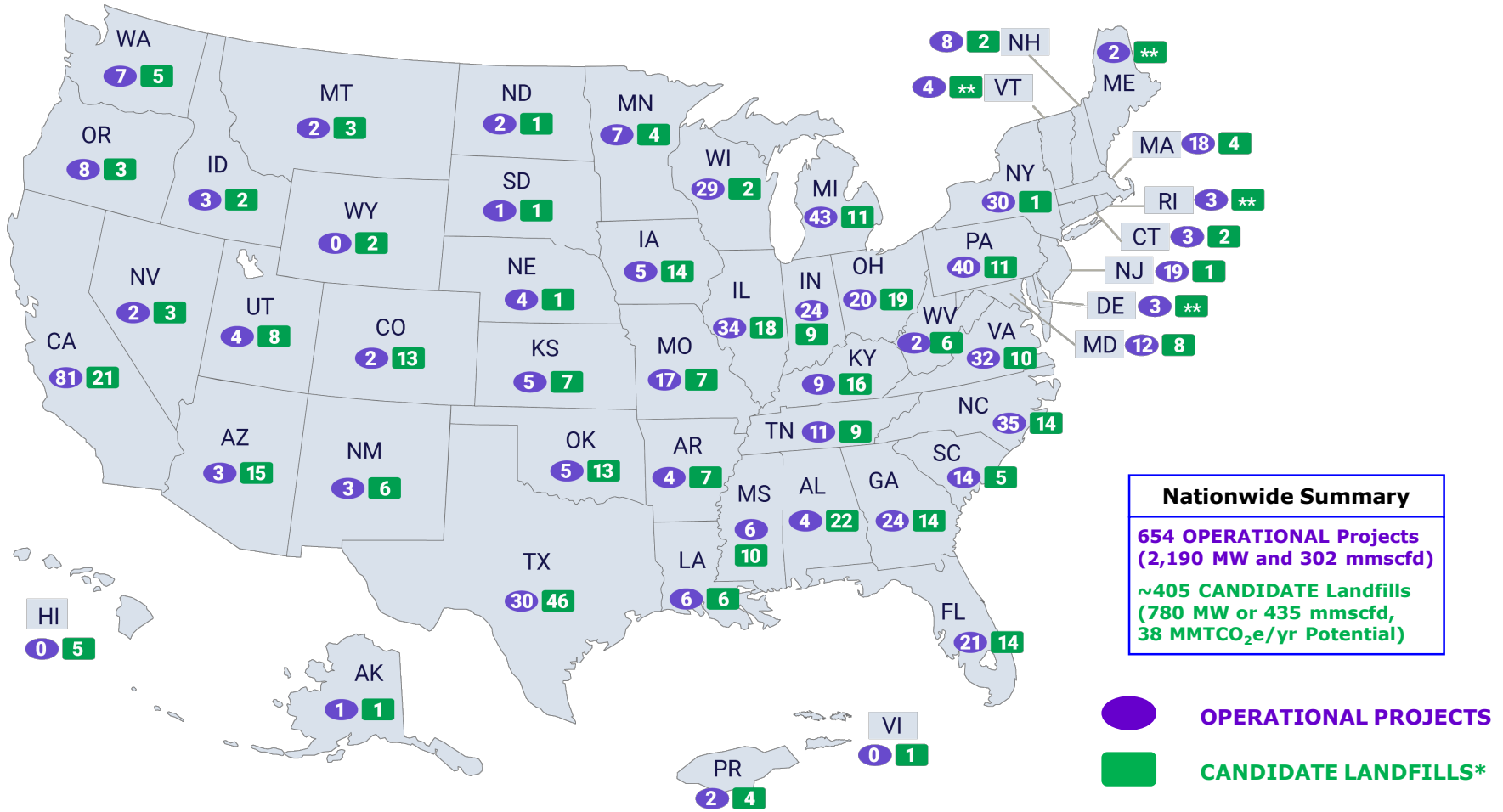
- ▶ 1000-scfm, 5-mile pipeline, 15-year project:
  - ▶ Total capital cost = ~\$3.5 million
    - ▶ Excludes gas collection and flaring system costs
  - ▶ Annual operation & maintenance cost = ~\$144,000/year
  - ▶ 9.5+ jobs
    - ▶ Additional during construction phase
  - ▶ \$1.3 million direct economic benefits

[\$2013 capital costs; O&M is the cost in the initial year of project operation (2014)]

The background features abstract, overlapping green geometric shapes in various shades, including light lime green, medium green, and dark forest green. These shapes are primarily located on the right side of the slide, creating a modern, layered effect. The rest of the slide is a plain white background.

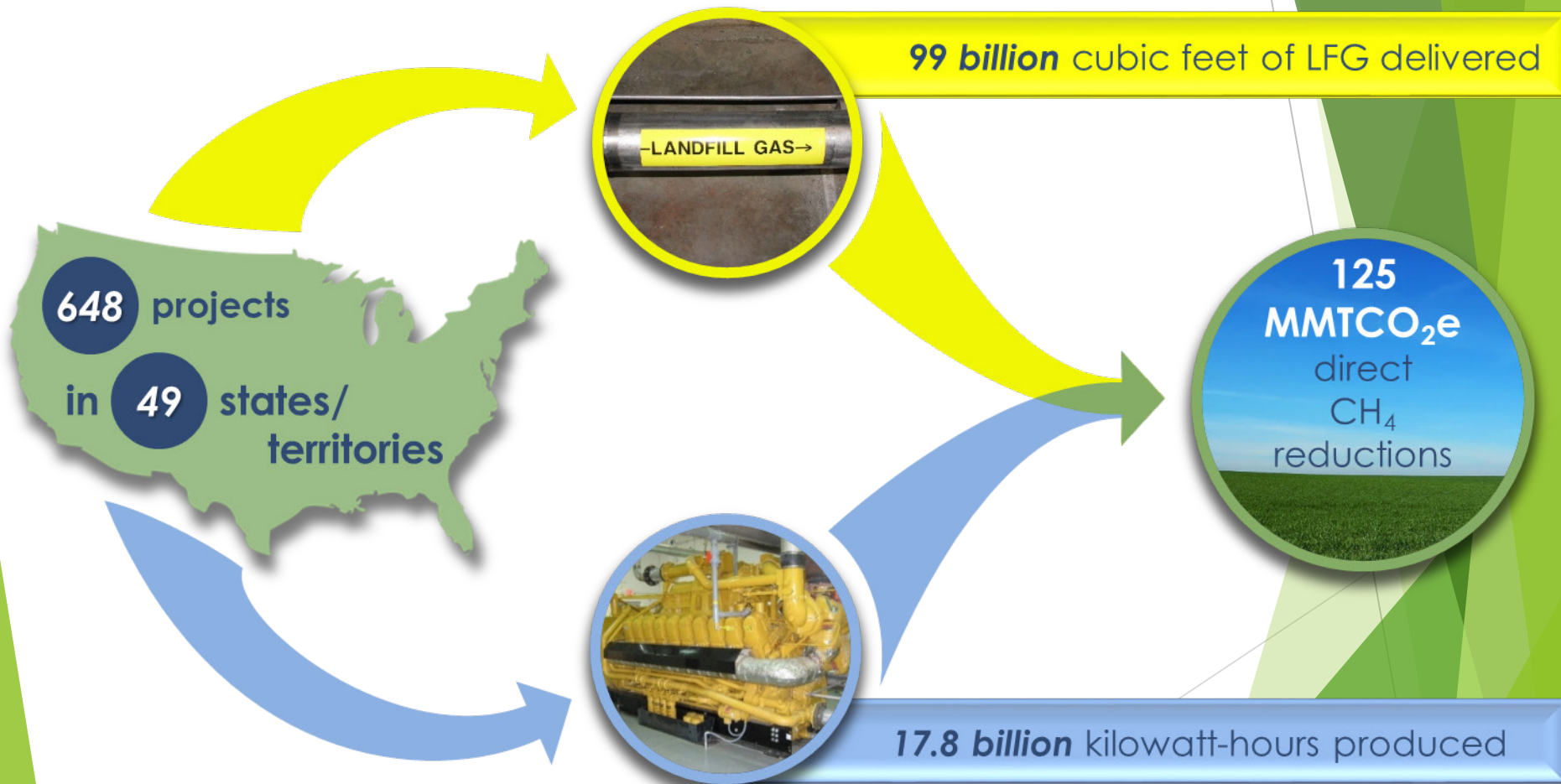
Where are LFGE Projects?

# LFG Energy Project Development in the U.S.





# Project Snapshot for 2016



# LMOP Accomplishments

## Landfill Methane Outreach Program

CUMULATIVE

**22 years**  
(1995-2016)

~ **648** LFG  
energy  
projects  
assisted

~ **425 million** metric tons of  
carbon dioxide equivalents  
reduced or avoided

Environmental benefit of the  
carbon sequestered by  
about **401 million** acres of  
U.S. forests in one year



2016

**9** new LFG  
energy  
projects  
assisted

**4** LFG energy  
**project**  
**expansions**  
assisted

**1.0 million** metric tons of  
carbon dioxide equivalents  
reduced or avoided

Environmental  
benefit of the  
carbon  
sequestered by  
more than **943,000**  
acres of U.S.  
forests in one year





# LFGGE Projects in Virginia

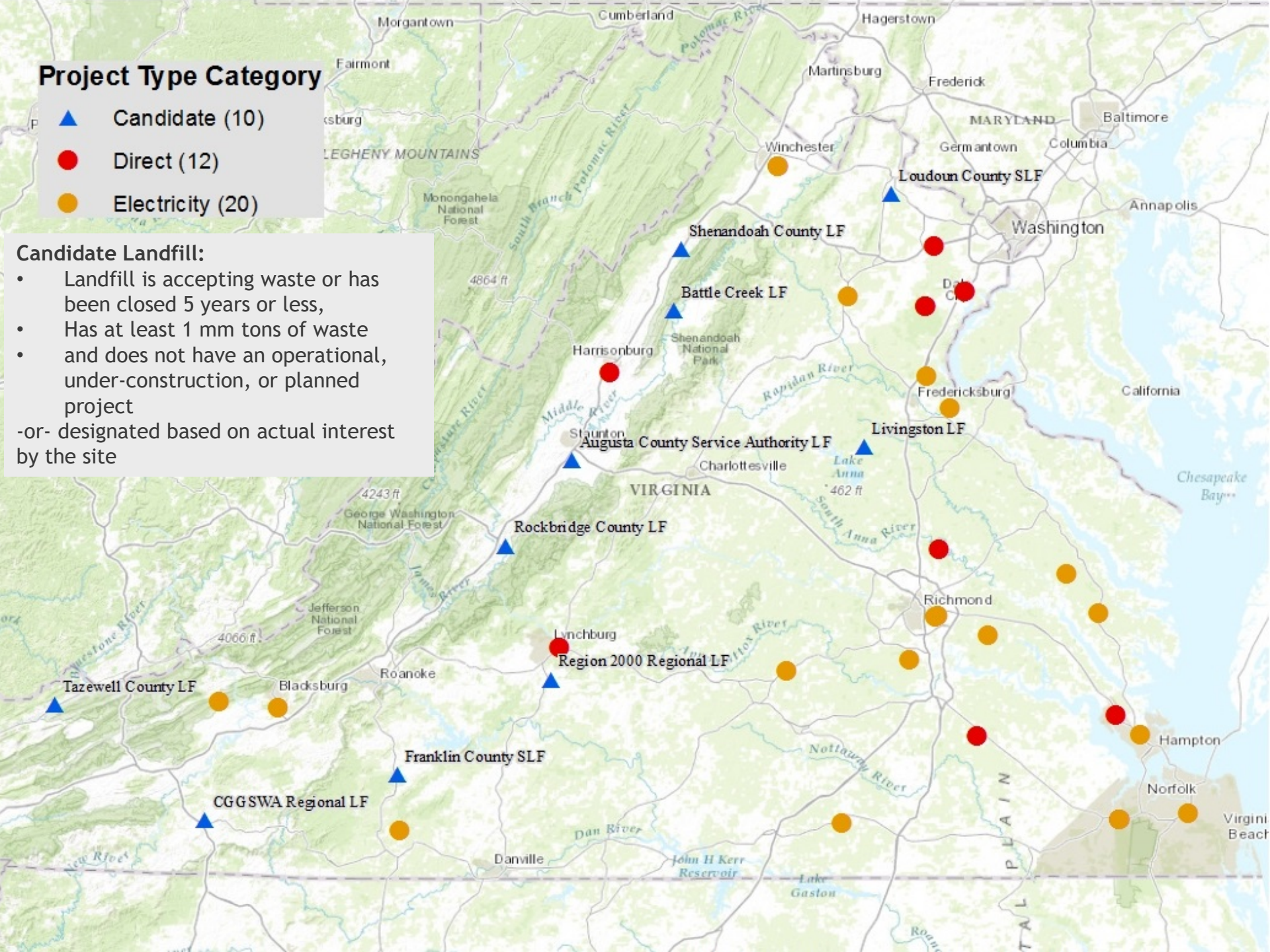
The slide features a white background with abstract, overlapping green geometric shapes on the right side. These shapes include various shades of green, from light to dark, forming a dynamic, modern design. The text 'LFGGE Projects in Virginia' is centered on the left side in a bold, green, sans-serif font.

## Project Type Category

- ▲ Candidate (10)
- Direct (12)
- Electricity (20)

### Candidate Landfill:

- 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
- or- designated based on actual interest by the site



# LFGE Projects in Virginia (2016)



# Barriers to Project Development

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the slide, creating a modern, layered effect. The text is positioned on the left side of the slide, set against a plain white background.



# Revenue, Funding & Incentives

for the development of LFG energy

- ▶ Direct sale of LFG
- ▶ Sale of power generated from LFG
- ▶ Renewable Energy Certificates (RECs)
- ▶ RINs under Renewable Fuel Standard (RFS)
- ▶ California Low Carbon Fuel Standard credits
- ▶ Greenhouse gas reduction credits
- ▶ Renewable Electricity Production Tax Credit (PTC)
- ▶ Federal or state grants
- ▶ Low-cost bond programs
  - ▶ Clean Renewable Energy Bonds (CREBs)
  - ▶ Qualified Energy Conservation Bonds (QECBs)
- ▶ Loans
  - ▶ U.S. DOE Loan Guarantee program

# Trends in the U.S. Solid Waste Industry

- ▶ States and municipalities are increasingly moving towards diversion of organic waste from landfills
  - ▶ ~26 states have laws that address landfilling organic waste
- ▶ Federal and local initiatives emerging to address/minimize food waste
- ▶ Growing and sustained interest in LFG to vehicle fuel
- ▶ LFG energy project development growth has slowed in recent years
  - ▶ 9 new projects and 4 expansions in 2016
  - ▶ Economic factors continue to challenge project financial feasibility

The slide features a white background with abstract, overlapping green geometric shapes on the right side. These shapes include triangles and polygons in various shades of green, from light to dark, creating a modern, layered effect. The text 'How Can LMOP Help?' is positioned on the left side of the slide.

How Can LMOP Help?

# LMOP Resources

- ▶ Technical publications and tools
- ▶ Landfill and LFGE Project Database
- ▶ Network of 1,100 Partners
- ▶ Webinars and other events
- ▶ Listserv messages - upcoming events, news, RFPs

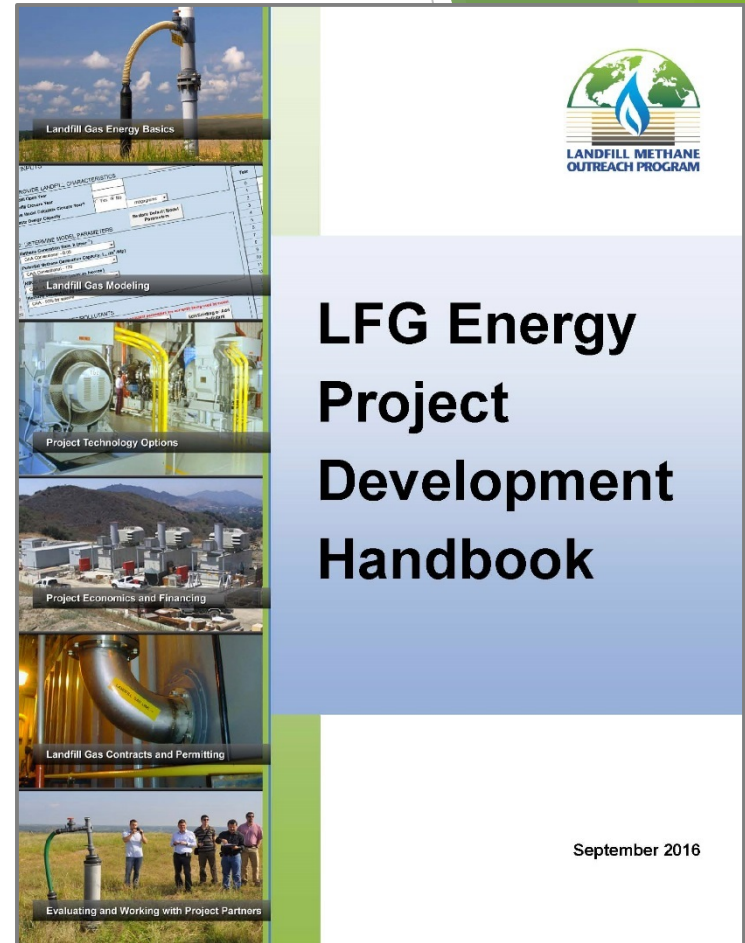


# Key LMOP Resources

## Project Development Handbook (PDH)

*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



# Key LMOP Resources

## LFGcost-Web

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

**Version 3.1 released November 2016**

*Updated based on a 2015 peer review as well as other revisions*

- Updated approach for calculating electricity revenue and avoided CO<sub>2</sub> grid factors based on regional electricity grids
- Added ability to enter user-defined project sizes without entering landfill waste data



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

# Key LMOP Resources

## LMOP Landfill and LFG Energy Project Database

*Download details about projects and landfills*

*Includes data for over 2,400 landfills in the U.S.*

- 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 Athens/Limestone County SLF MSWLF	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

**Help us keep this up to date!**

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

# LMOP Activities for 2017

- ▶ Provide new technical materials
- ▶ Release new version of *LFGcost-Web*
  - ▶ Job creation estimates
- ▶ Host webinars on topics of interest to stakeholders
  - ▶ May 23 - LFG to vehicle fuel webinar

# 1,100 LMOP Partners

## ▶ Benefits of LMOP Partnership

- ▶ Recognition of your commitment to renewable energy
- ▶ Identification on LMOP website
- ▶ Access to Partner network
- ▶ Technical support

## ▶ Interested?

- ▶ Fill out and submit an MOU (available on our website)
- ▶ Sign up for LMOP listserv messages

- Industry Partners: **766**
- Community Partners: **145**
- Energy Partners: **111**
- Endorser Partners: **39**
- State Partners: **39**



# How Can We Work Together?

- ▶ Facilitating information sharing
- ▶ Providing technical information
- ▶ Analyzing resource availability through LFG modeling
- ▶ Performing initial feasibility analysis using *LFGcost-Web*



# LMOP Contact Information

**Lauren Aepli**

aepli.lauren@epa.gov

[www.epa.gov/lmop](http://www.epa.gov/lmop)



**LANDFILL METHANE  
OUTREACH PROGRAM**