LMOP Special Session 2: LMOP Update and Technical Presentations

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U.S. Environmental Protection Agency
Landfill Methane Outreach Program

SWANA’s 42nd Annual Landfill Gas & Biogas Symposium
Boston, MA • February 27, 2019
Welcome and Agenda

Three sessions today:

1. What’s Next for RNG?
   - Kenzie Schwartz, National Grid
   - David Mauney, The Hunter Group
   - Luke Morrow, Morrow Renewables

2. LMOP Update and Technical Presentations
   - Kirsten Cappel, U.S. EPA LMOP
   - Amanda Singleton, ERG (Contractor to U.S. EPA LMOP)
   - Elizabeth Connelly, U.S. Department of Energy

3. Materials Management and Effects on LFG Generation
   - Swarupa Ganguli, U.S. EPA
   - Daryl O’Dell, Tetra Tech
Presentation Overview

• Introduction

• LFG Energy in the United States
  o Overview of LFG energy projects
  o Trends in LFG energy project development

• LMOP Tools and Resources

• LMOP Voluntary Data Collection Through e-GGRT
LMOP & LFG Energy Project Trends
Introduction

U.S. EPA’s Landfill Methane Outreach Program (LMOP):

• Established in 1994

• Voluntary program that creates partnerships among landfill owners and operators, states, municipalities, energy users and providers, and 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.
There are more than 1,000 LMOP Partners

Benefits of LMOP Partnership:

• Opportunities to participate in LMOP events, webinars, etc.
• Recognition for commitment to renewable energy
• Use of LMOP logo on Partner website (within guidelines)
• LMOP support for groundbreaking or ribbon cutting
• Information about new developments, events, and other LFG related information

To join the Partnership, visit our website at: www.epa.gov/lmop/join-landfill-methane-outreach-program
New Partners Who Joined in 2018 or Late 2017

| LMOP INDUSTRY PARTNERS | Kobelco Compressors America, Inc.  
|                        | Live Oak Banking Company  
|                        | Novipax LLC  
|                        | Ultra Capital  
|                        | WachsField Technologies  
|                        | WorleyParsons Group, Inc. |

| LMOP ENERGY PARTNER | L’Oréal USA |
U.S. LFG Energy Project Types

- **449** Electricity
- **110** Direct-use
- **52** RNG *(Includes pipeline injection-to-vehicle fuel)*
- **8** Vehicle Fuel *(Onsite or local use only)*

*LFG energy project count from LMOP’s Landfill and Landfill Gas Energy Database as of February 2019*
New 2018 LFG Energy Projects & Expansions

*Based on data from LMOP’s Landfill and Landfill Gas Energy Database as of February 2019

Legend

△ New RNG (13)
▲ Expanded RNG (3)
○ New Engine (1)
■ Restarted Engine (1)
■ Expanded Boiler (1)
LFG Energy Project Snapshot

619 projects in 49 states/territories

36.3 billion ft³ of LFG delivered for direct use

76.1 billion ft³ of LFG converted to RNG

16.6 billion kWh produced

122.3 MMTCO₂e direct CH₄ reductions
LMOP Candidate Landfills

~ 480 Candidate Landfills*
(900 MW or 500 mmscfd, 45 MMTCO$_2$e/year Potential)

*Candidate Landfill Definition
- 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
- Or can be designated based on interest by the site

*Candidate count from LMOP’s Landfill and Landfill Gas Energy Database as of February 2019
Renewable Natural Gas – LMOP Working Definition

Renewable natural gas (RNG) is a “term of art” used to describe biogas that has been upgraded for use in place of fossil natural gas.

Raw biogas has 45-65% methane. Once upgraded to RNG, the gas has 90% or greater methane content. RNG injected into a natural gas pipeline typically has 96-98% methane.

RNG has many end uses: in thermal applications (e.g., heating, drying, steam, hot water), to generate electricity, for vehicle fuel, or as a bioproduct feedstock.

RNG can be used locally at the site where the gas is created, or it can be injected into natural gas transmission or distribution pipelines.
LFG energy projects have changed over the last decade

- Number of new projects per year has slowed in the last ten years
- LFG flow to RNG projects continues to increase

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<tr>
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<th>2008</th>
<th>2018</th>
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<tbody>
<tr>
<td>Total MW Capacity of</td>
<td>1,425 MW</td>
<td>2,072 MW</td>
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<tr>
<td>Electricity Projects</td>
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<tr>
<td>Total Raw LFG Flow to</td>
<td>62,250 scfm</td>
<td>160,140 scfm</td>
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<tr>
<td>RNG Projects</td>
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<td></td>
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<tr>
<td>Total Raw LFG Flow to</td>
<td>99,300 scfm</td>
<td>76,670 scfm</td>
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<td>Direct-Use Projects</td>
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*Based on data from LMOP’s Landfill and Landfill Gas Energy Database as of February 2019*
LFG Energy Project Growth: 2008-2018

Total Operating Projects (2008-2018)

- Electricity
- Direct-Use
- RNG


- New Electricity Projects
- New Direct-Use Projects
- New RNG Projects

*Based on data from LMOP’s Landfill and Landfill Gas Energy Database as of February 2019
The first known LFG-to-RNG project came online in 1975 at the Palos Verdes Landfill in CA.
End Uses of RNG from LFG

- As of February 2019, there are 60 operational LFG-to-RNG projects.

- The majority (54) of these projects are producing RNG for use as vehicle fuel:
  - 46 inject the RNG into natural gas pipeline
  - 8 use the fuel locally (at or near the site)

Example uses of RNG as vehicle fuel:
- Waste hauling and collection trucks
- County vehicles
- City buses
LMOP Tools and Resources
LMOP Tools and Resources

Data
- Excel files and GIS map
- LFG energy projects
- Candidate landfills

Tools
- LFGcost-Web
- RNG Flow Rate Tool
- LFG Energy Benefits Calculator
- Conversion Tool

Technical Publications
- Project Development Handbook
- Fact sheets

Network
- Webinars
- 1,000+ Partners
- Listserv messages
Consolidated RNG Webpage (NEW)

- [www.epa.gov/lmop/renewable-natural-gas](http://www.epa.gov/lmop/renewable-natural-gas)
  - Basic information about RNG
  - Map and database of projects
  - Webinar and other event recordings
  - Links to papers
  - Links to EPA voluntary programs

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<tr>
<th>RNG Delivery Options</th>
<th>RNG End Uses</th>
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<tr>
<td>Local Use</td>
<td>Vehicle Fuel</td>
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<tr>
<td>Pipeline Injection</td>
<td>Electricity</td>
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<td></td>
<td>Thermal Applications</td>
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LMOP National Map

Filter view by project or landfill type

Search for and zoom to a location

Access at bottom of LMOP homepage or directly at https://www.epa.gov/lmop/lmop-national-map
LMOP Database of Landfills and Projects

• LMOP Database is the only one of its kind
  o Information on 2,500+ MSW landfills and ~620 operational LFG energy projects
  o These data are a key resource for the U.S. GHG Inventory

• Ensuring landfill and LFG energy project data are up to date and accurate is critical

Notably, the LMOP Database is used to:

• Recognize LMOP Partner accomplishments and leadership in LFG energy

• Highlight LMOP Partner achievements in generating renewable energy and reducing methane emissions
LMOP Voluntary Data Collection

Oct – Dec 2018

Partners provided data updates via voluntary LMOP module in e-GGRT

e-GGRT is a web-based system for annual reporting to the Greenhouse Gas Reporting Program (40 CFR Part 98)

- In 2018, LMOP transitioned to electronic reporting of voluntary data through the new LMOP Module in e-GGRT
  - Partners reviewed and updated their landfill and LFG energy project data
- Electronic reporting improves the quality and efficiency of collecting LMOP data
LMOP Partner Reporting 2018

• Outcome:
  o 94 LMOP Partners participated in 2018
  o LMOP received updates for more than 370 landfills and LFG energy projects
  o In the spring, LMOP will post data files on the LMOP website which will include these data updates

• Moving forward:
  o LMOP will request data updates from Partners annually
  o Information about 2019 LMOP reporting will be provided in late summer

• Partner reporting improves the quality of the LMOP Database – thank you for your participation!
New Data from LMOP Partner Reporting 2018

Legend:
- ▲ Operational Projects
- ● Candidate Landfills
- ○ All Other Landfills
Recognition of LMOP Partner Participation

Arundel County BWMS, MD  APTIM  Aria Energy  Atlantic County Utilities Authority, NJ
Bartholomew County SWMD, IN  Biogas Energy Solutions, LLC  Bio-Gas Technologies, Ltd.
Broadrock Renewables LLC  Brown County Port & SWD, WI  Buncombe County DSW, NC
Butler County LF, KS  California Energy Commission  Cape May County MUA, NJ  Casella Waste Systems
Catawba County, NC  Chautauqua County, NY  Chester County SWA, PA  City of Columbia, MO
City of Denton, TX  City of Flagstaff, AZ  City of Gary DEA, IN  City of Hopkinsville, KY  City of Lawton, OK  City of Los Angeles, Bureau of Sanitation, CA  City of Richmond, IN  City of St. Joseph, MO  City of Tucson, AZ  Clover Flat Resource Recovery Park, CA  Coastal Environmental Partnership, NC  County of Fairfax, VA  County of Frederick, VA  County of Orange – OC Waste & Recycling, CA  Dairyland Power Cooperative  Dalton-Whitfield RSWMA, GA  Decatur/Morgan County Regional LF, AL  DTE Biomass Energy
Dubuque Metropolitan Area SWA, IA  Emerald People’s Utility District  Ener-Core, Inc.
Enerdyne Power Systems  Escambia County, FL  Fauquier County DES, VA  Ford County, KS
G2 Energy, LLC  Gaston County, NC  Golden Triangle RSWMA, MS  Greenfield Energy, LLC
Greenwood County Public Works, SC  Gundersen Health System  Indiana DEM  INGENCO  Interface, Inc.  Jackson County Green Energy Park, NC  JEA  Johnson Controls, Inc.
Kimberly-Clark Corporation  Lancaster County SWMA, PA  Landfill Gas Technologies  Lee County SWD, FL
L’Oréal USA  Marion County, FL  Methane Power, LLC  Minnesota Pollution Control Agency
New Hanover County DEM, NC  Orlando Utilities Commission  PEI Power  PepsiCo, Inc.
Prince George’s County, MD  Prince William County, VA  Salinas Valley SWA, CA
Sanitation Districts of Los Angeles County, CA  Santa Cruz County, CA  Santee Cooper  Sarasota County, FL  Sarpy County, NE  SCS Engineers  Shasta County, CA  SWA of Central Ohio  Southeast Berrien County LF, MI  SECCRA, PA  Southern Oklahoma Regional Disposal, OK  Spotsylvania County, VA  TVA
Town of Windsor, CT  Trans-Jordan Cities, UT  University of Iowa  Vogel Disposal Service
W.R. Henderson Construction  Waste Connections – Central Region  Waste Industries
Waste Management, Inc.  Wilkes County, NC  Wood County SWMD, OH
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!
Thank you!

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On site at Brown Station Road Sanitary Landfill, Prince George’s County, MD

Visit our website at epa.gov/lmop