

LMOP Special Session 2: LMOP Update and Technical Presentations

Kirsten Cappel

**U.S. Environmental Protection Agency
Landfill Methane Outreach Program**

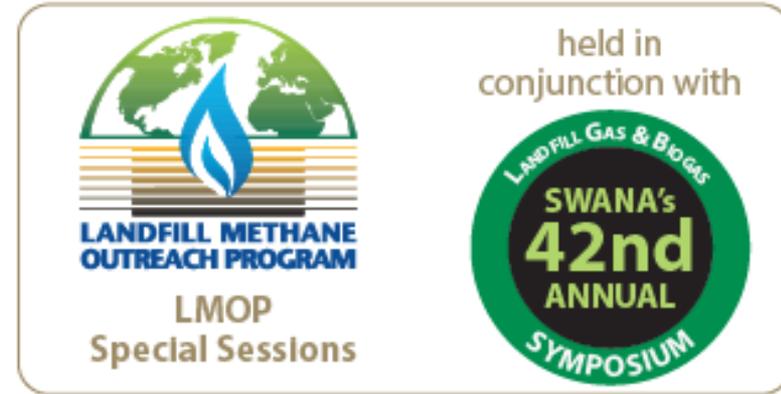


SWANA's 42nd Annual Landfill Gas & Biogas Symposium
Boston, MA • February 27, 2019

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
 - Overview of LFG energy projects
 - 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.

LMOP Partners (as of February 2019)

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

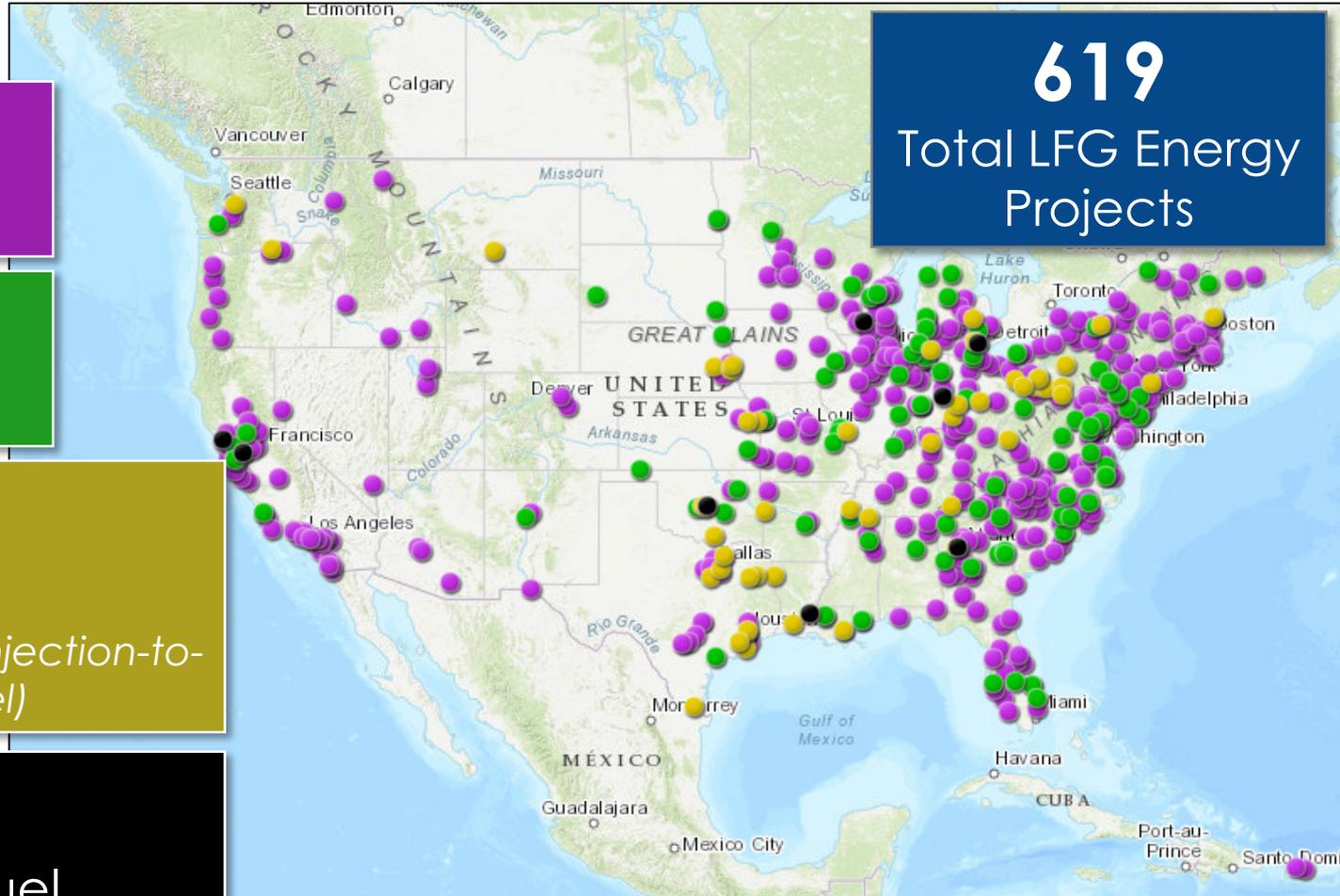
RNG

(Includes pipeline injection-to-vehicle fuel)

8

Vehicle Fuel
(Onsite or local use only)

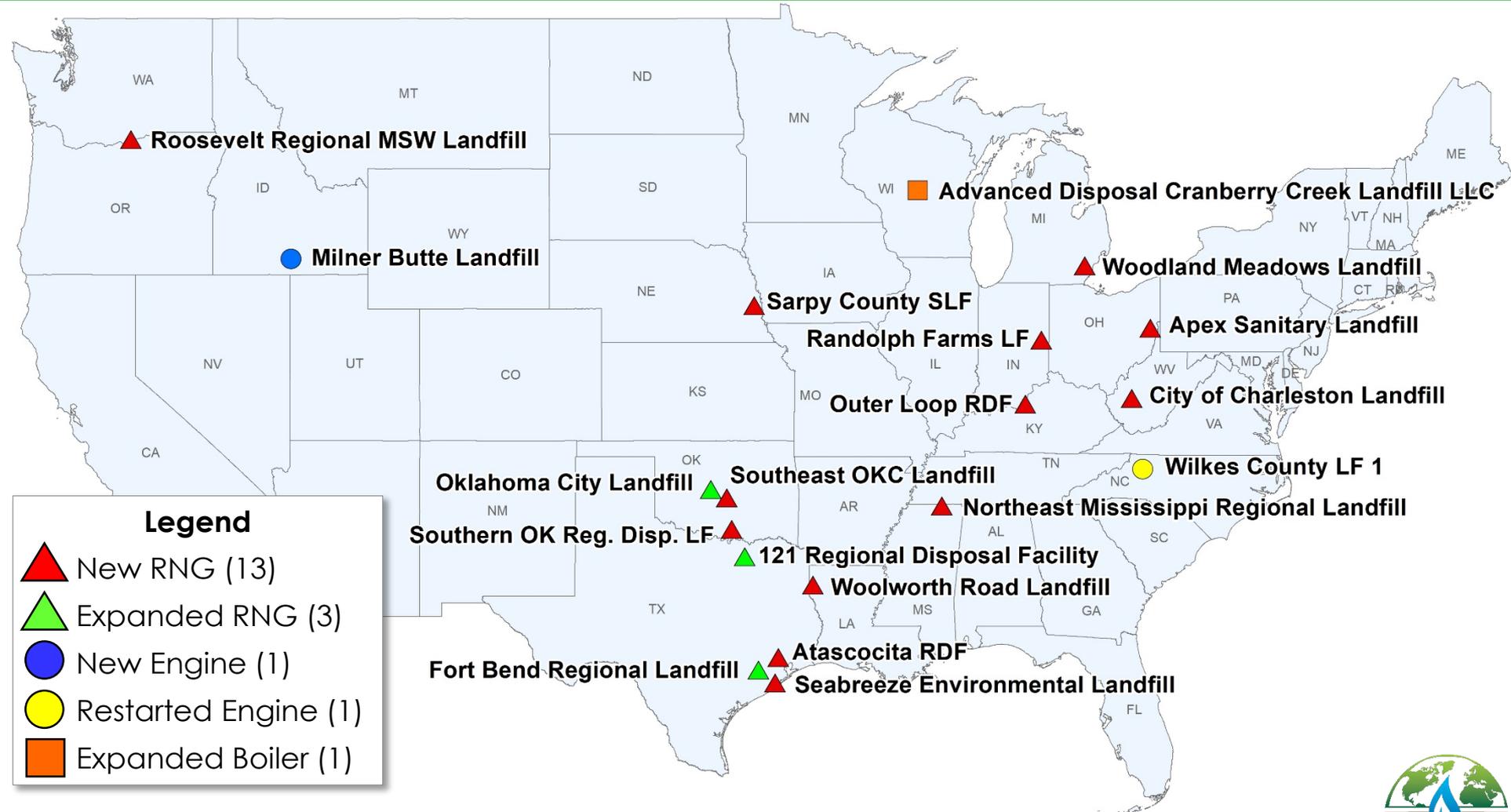
619
Total LFG Energy
Projects



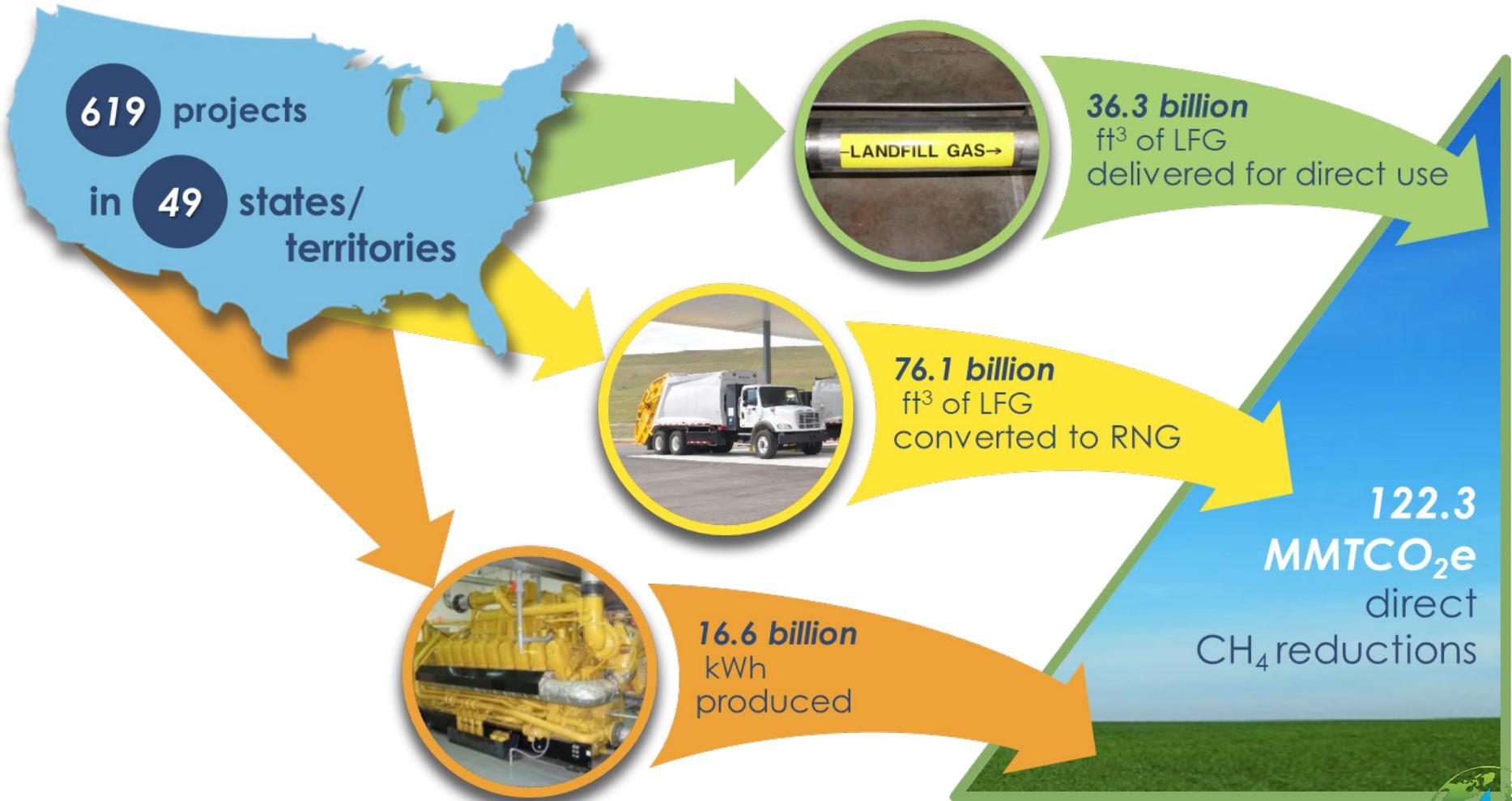
*LFG energy project count from LMOP's Landfill and Landfill Gas Energy Database as of February 2019



New 2018 LFG Energy Projects & Expansions

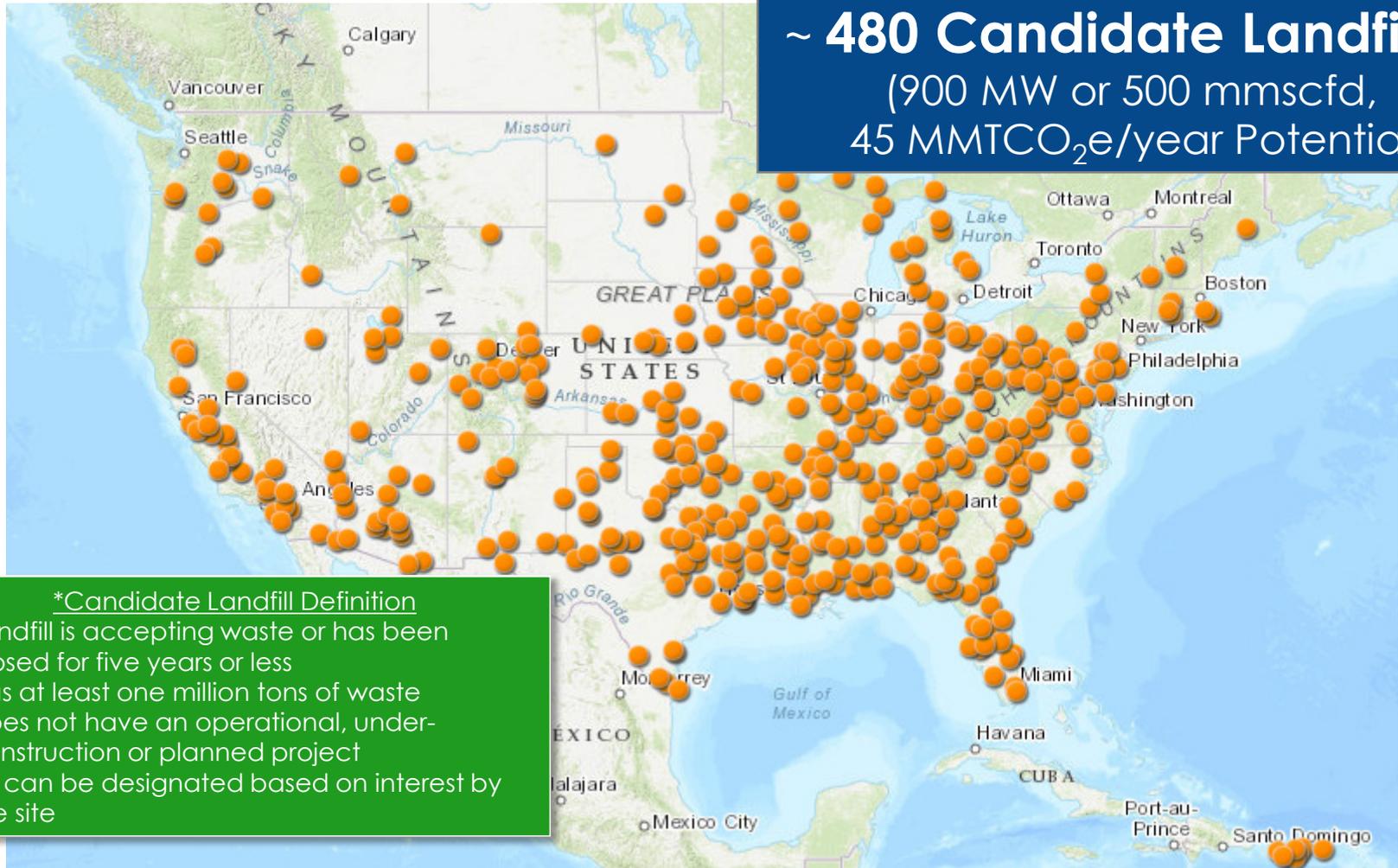


LFG Energy Project Snapshot



LMOP Candidate Landfills

~ 480 Candidate Landfills*
(900 MW or 500 mmscfd,
45 MMTCO₂e/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

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 bio-product 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

Trends in LFG Energy Project Development

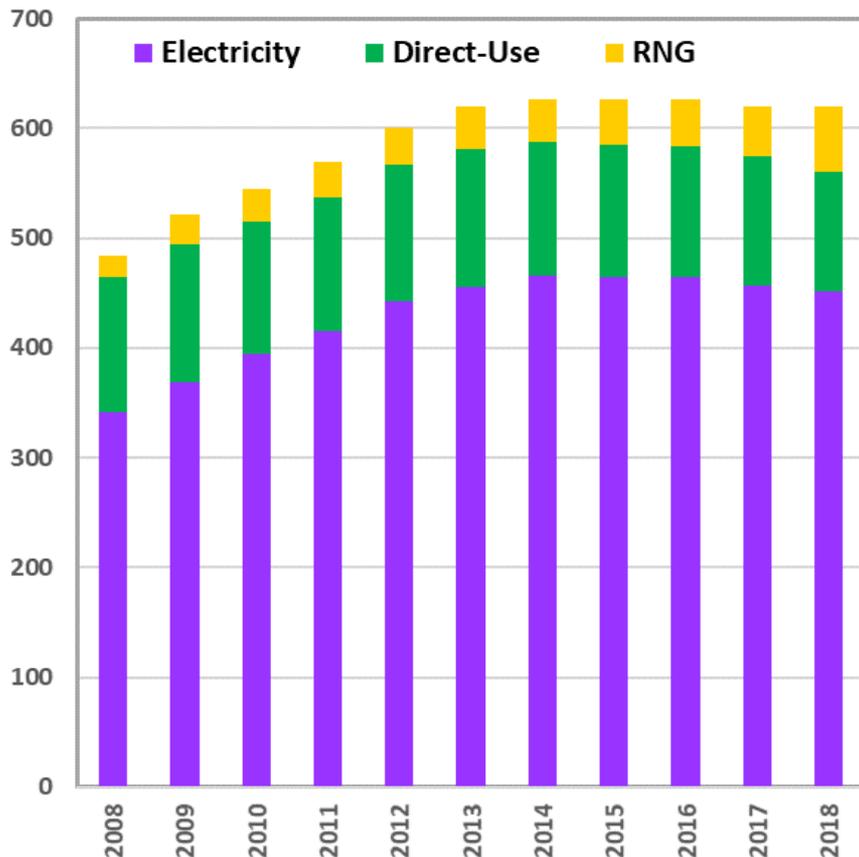
LFG energy projects have changed over the last decade

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

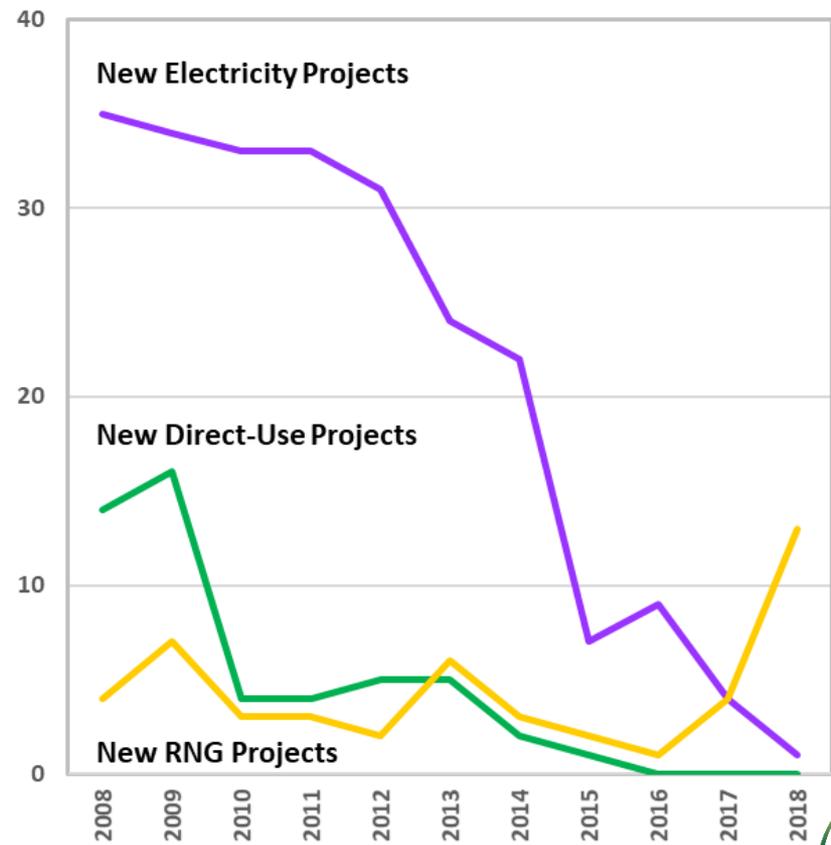
	2008	2018
Total MW Capacity of Electricity Projects	1,425 MW	2,072 MW
45% increase		
Total Raw LFG Flow to RNG Projects	62,250 scfm	160,140 scfm
157% increase		
Total Raw LFG Flow to Direct-Use Projects	99,300 scfm	76,670 scfm
30% decrease		

LFG Energy Project Growth: 2008-2018

Total Operating Projects (2008-2018)

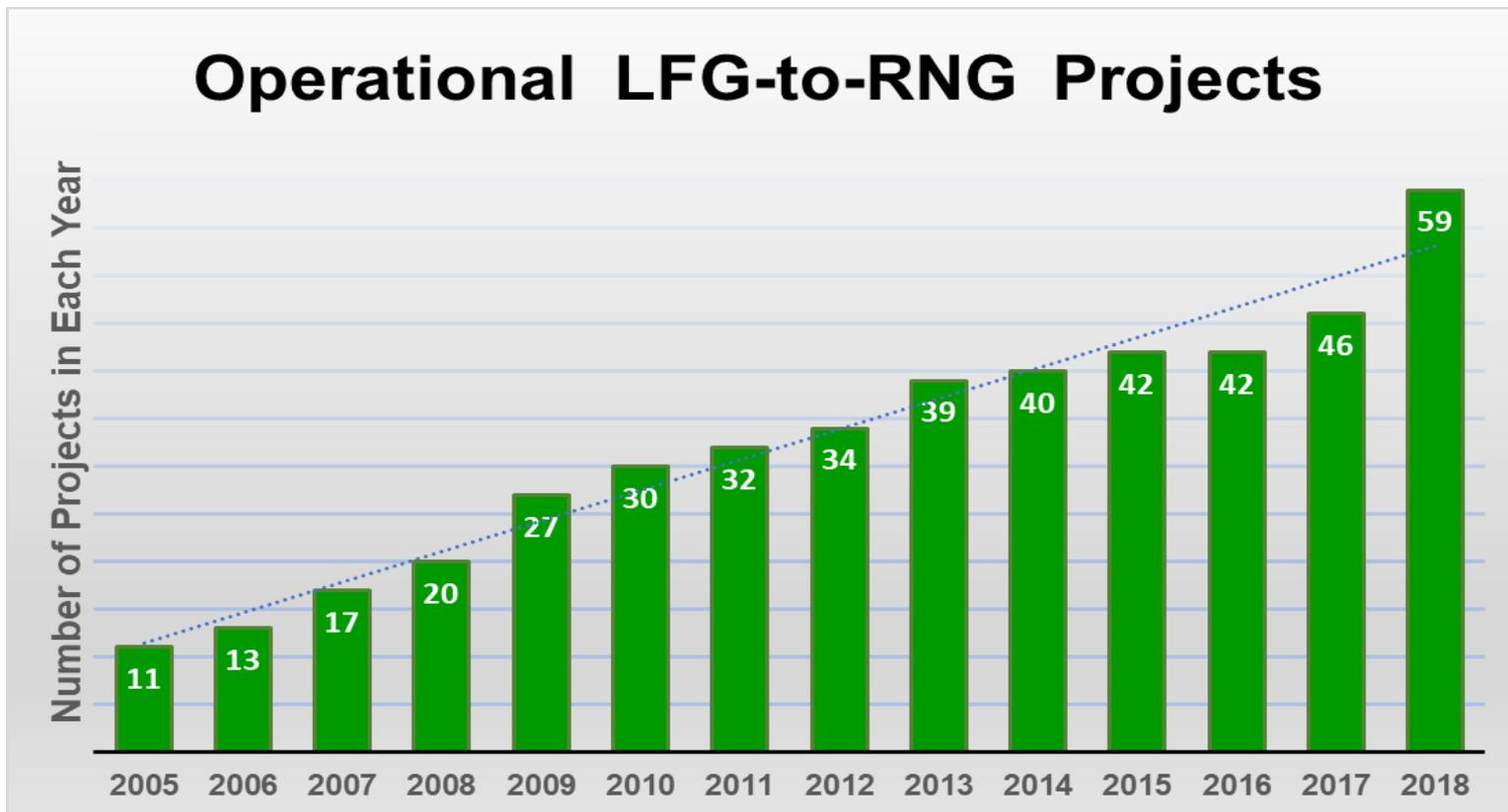


New Projects Brought Online (2008-2018)



LFG-to-RNG Projects Over Time

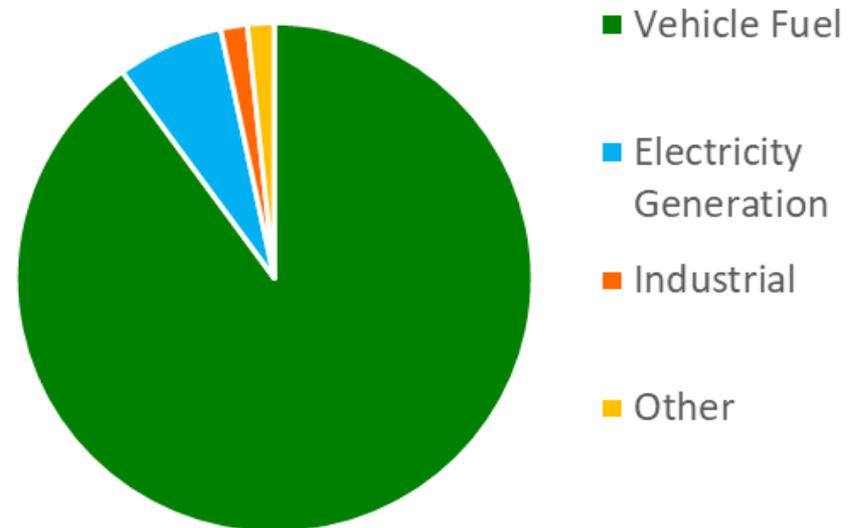
The first known LFG-to-RNG project came online in 1975 at the Palos Verdes Landfill in CA



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)

LFG-to-RNG Project Counts by End Use



- 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



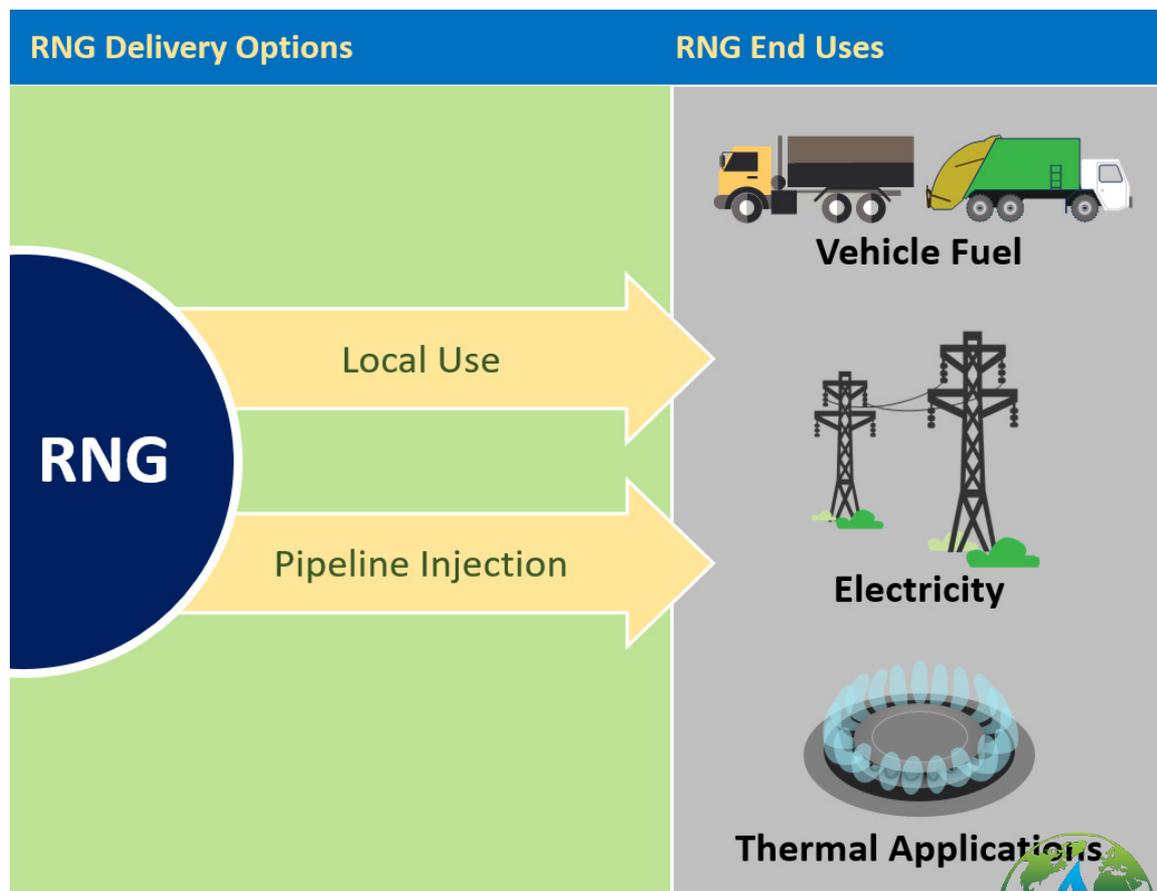
Network

- Webinars
- 1,000+ Partners
- Listserv messages

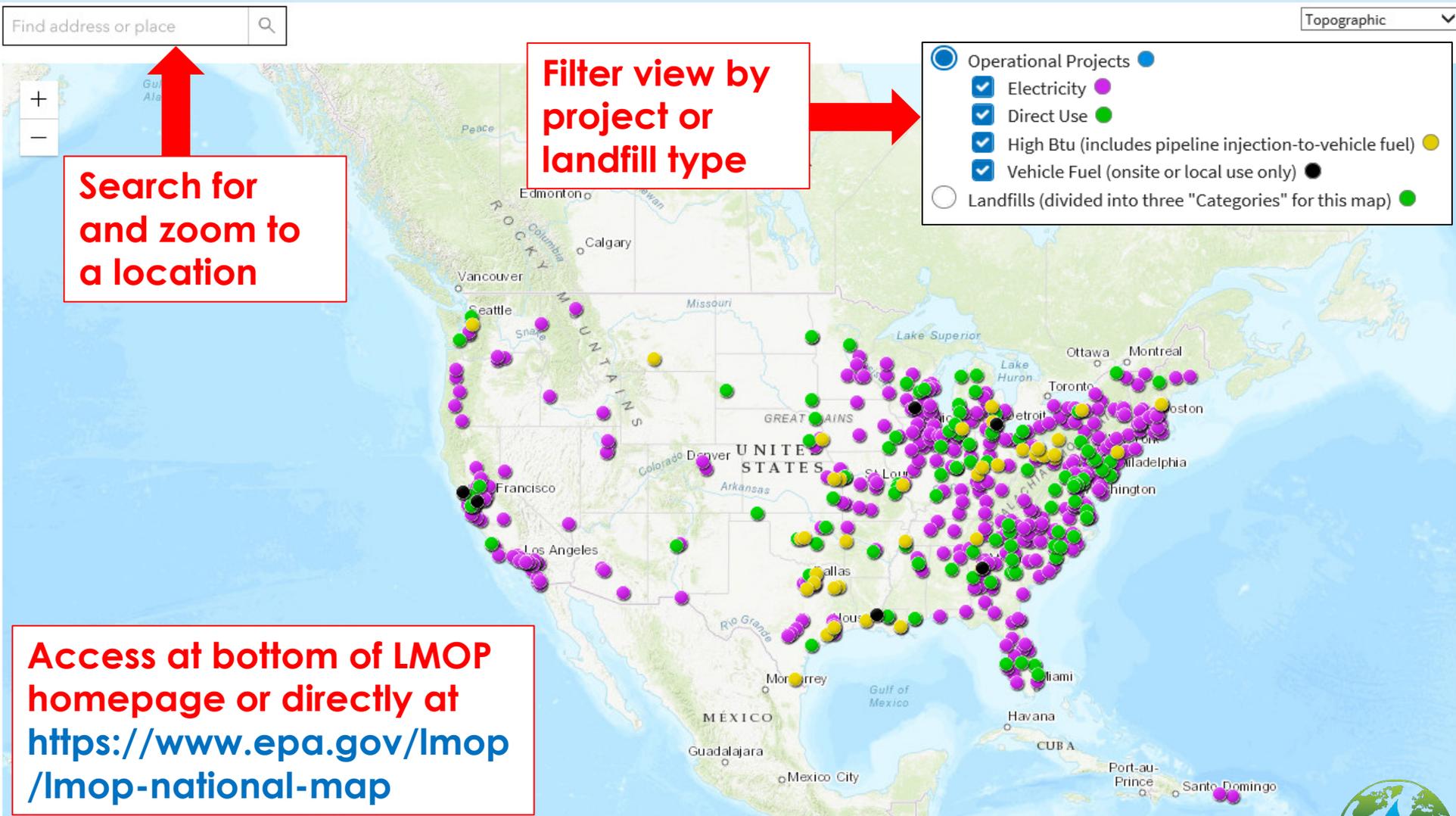


Consolidated RNG Webpage (NEW)

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



LMOP National Map



LMOP National Map

Switch to satellite imagery



Imagery with Labels

Find address or place



See details in pop-up

Click on a project

Denver Regional Landfill (North); Front Range Landfill; Denver Regional Landfill (South)

GHGRP ID	1007700; 1003911; 10
County, State	Weld; Boulder, CO
Landfill Owner Organization(s)	Republic Services, Inc.; Waste Connections Inc. - Central Region
Initial Project Start Date	10/31/2011
LFG Energy Project Type	Reciprocating Engine
Project Type Category	Electricity
Total MW Capacity	3.20
Total LFG Flow to Project (mmsfd)	
End User(s)	United Power Cooperative
Project Developer(s)	Aria Energy
Project Owner(s)	Aria Energy

Zoom to



LMOP Database of Landfills and Projects

- LMOP Database is the only one of its kind
 - Information on 2,500+ MSW landfills and ~620 operational LFG energy projects
 - 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

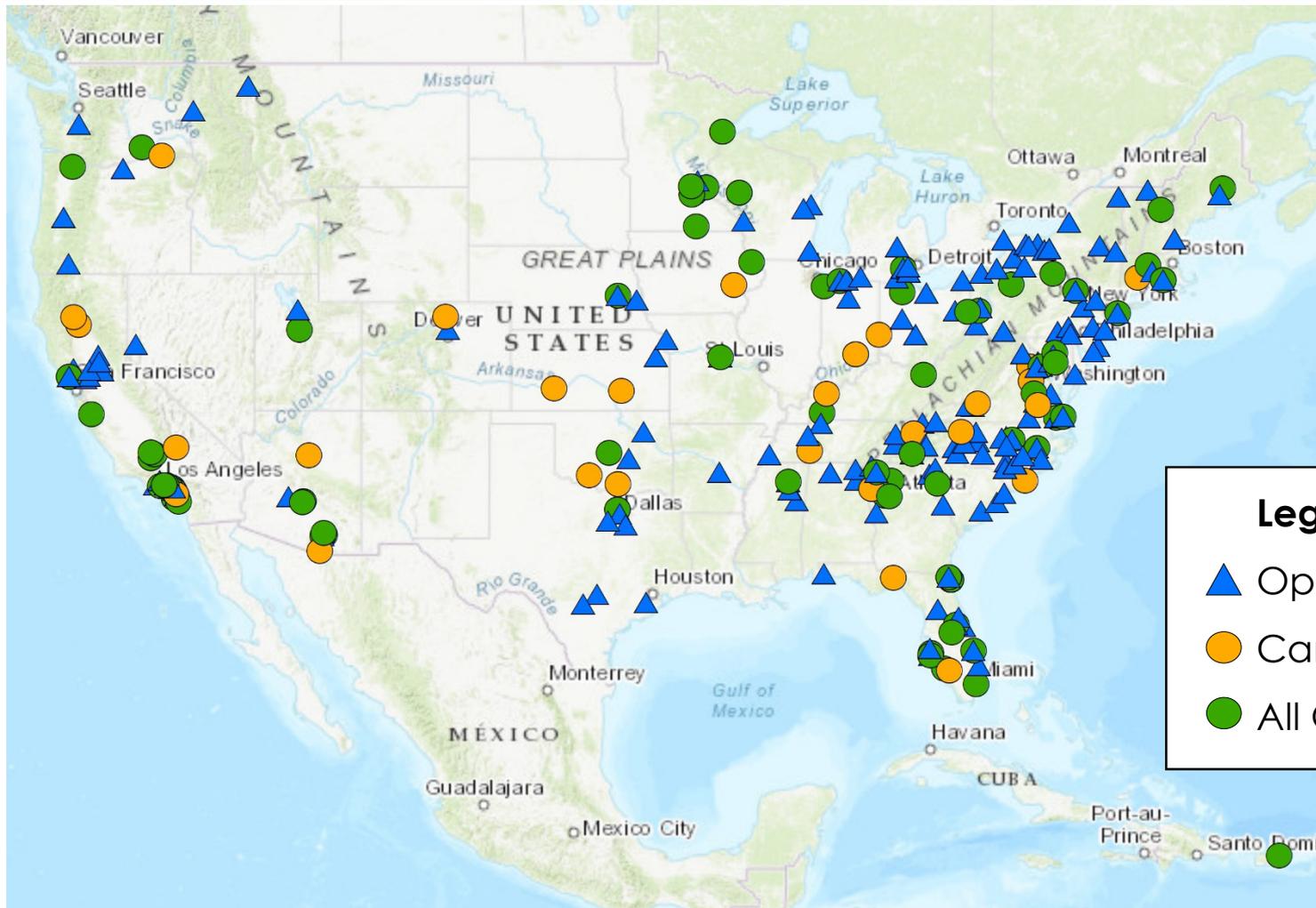
e-GGRT is a web-based system for annual reporting to the Greenhouse Gas Reporting Program (40 CFR Part 98)

- 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:
 - **94 LMOP Partners** participated in 2018
 - LMOP received updates for **more than 370 landfills and LFG energy projects**
 - In the spring, LMOP will post data files on the LMOP website which will include these data updates
- Moving forward:
 - LMOP will request data updates from Partners annually
 - 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. ♦ Joyce Engineering, 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**