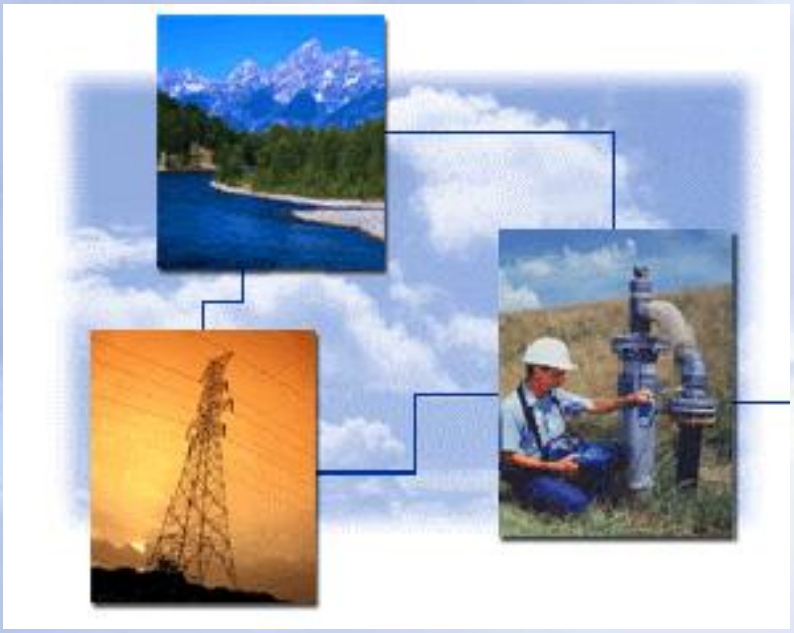
US EPA LMOP
Introduction and Overview



LANDFILL METHANE OUTREACH PROGRAM

Pacific Island Energy Conference

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U.S. Environmental Protection Agency

Landfill Methane Outreach Program (LMOP)

June 22, 2009

Presentation Outline

- LMOP/LFG 101
- LFG Project Costs & Revenues
- State of LFGE
- Case Studies
- Partnering with LMOP
- Other Energy Partnerships and Services from EPA

EPA's Landfill Methane Outreach Program

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

Mission: To reduce methane emissions by lowering barriers and promoting the development of cost-effective and environmentally beneficial landfill gas energy (LFGE) projects.

Landfill Gas 101

- Landfill gas (LFG) is a by-product of the decomposition of municipal solid waste (MSW):
  - ~50% methane (CH_4)
  - ~50% carbon dioxide (CO_2)
  - <1% non-methane organic compounds (NMOCs)
- If uncontrolled, LFG contributes to smog and global warming, and may cause health and safety concerns

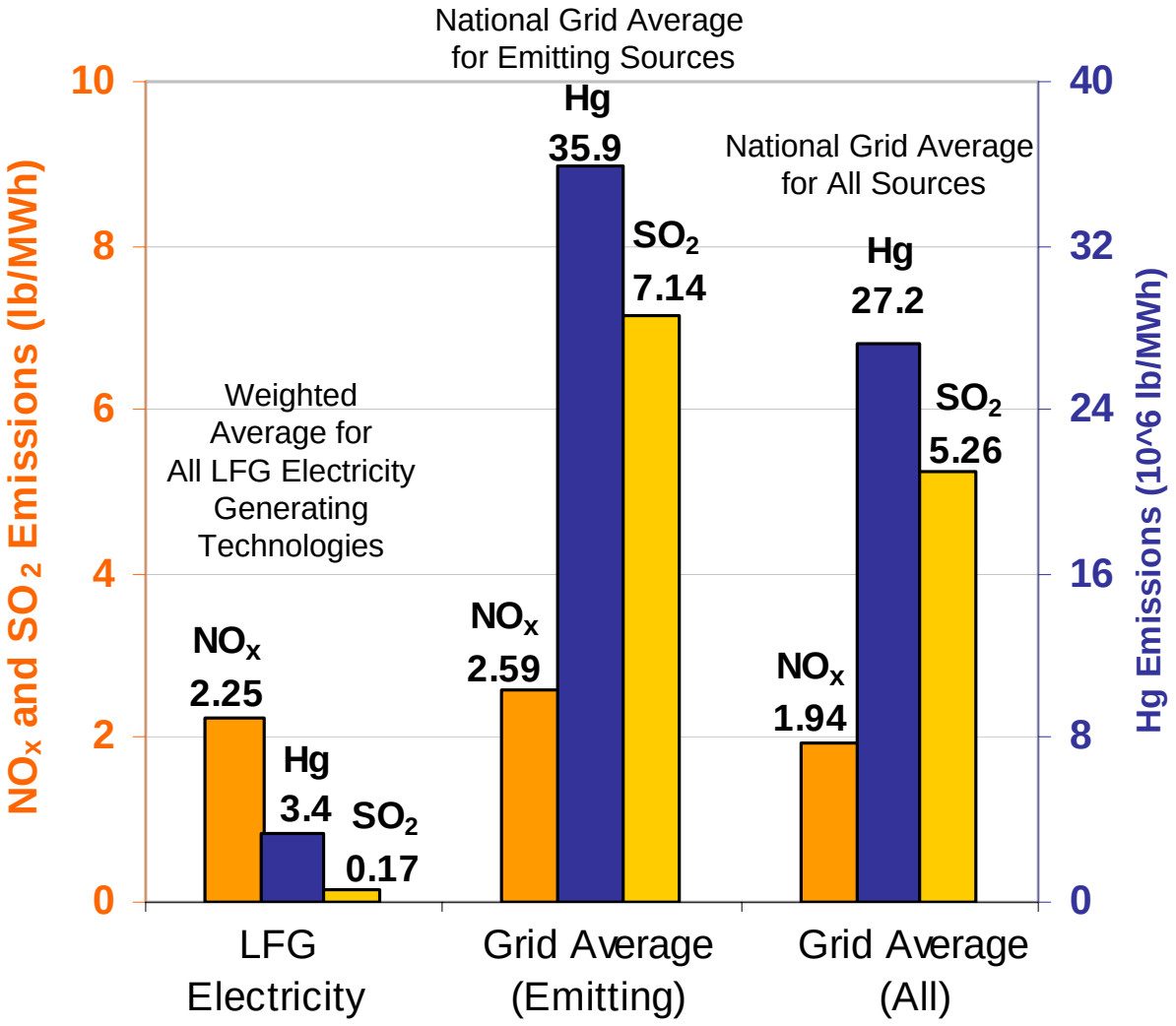
Why EPA is Concerned about Landfill Gas

- Why is methane a greenhouse gas?
  - Methane absorbs terrestrial infrared radiation (heat) that would otherwise escape to space (GHG characteristic)
- Methane as GHG is over 20x more potent by weight than CO_2
- Methane is more abundant in the atmosphere now than anytime in the past 400,000 years and 150% higher than in the year 1750
- Landfills were the largest human-made source of methane in the United States in 2005, accounting for 24% generated

Landfill Gas and Green Power A Winning Combination

- Dual benefit ➔ destroys methane and other organic compounds in LFG
- Offsets use of nonrenewable resources (coal, oil, gas) reducing emissions of
  - SO_2, NO_X, PM, CO_2
- LFG is a recognized renewable energy resource
  - Green-e, EPA Green Power Partnership, 28 states, Sierra Club, NRDC
- LFG is generated 24/7 and projects have online reliability over 90%
- LFG can act as a long-term price and volatility hedge against fossil fuels

LFG Electricity Emission Reduction Benefits



Sources: LFG from AP-42 (1998); Grid averages from eGRID2007 V1.1

File Last Updated: February 2009

Jobs and Revenue Creation

- A typical 3 MW LFG electricity project is estimated to have the following benefits (direct, indirect, and induced) during the construction year:
  - Increase the output of the national economy by ~$14 million ($3 million of which is a local benefit and mostly employee earnings)
  - Employ nearly 70 people nationally (expressed in full-time equivalents [FTE] per year)

Jobs and Revenue Creation (cont.)

- A typical 1,040 scfm LFG direct-use project is estimated to have the following benefits (direct, indirect, and induced) during the construction year:

	5-mile pipeline	10-mile pipeline
Increase output of national economy	$6 million	$12 million
Portion of national benefit at local level	$2 million	$4 million
People employed nationally (FTE)	43	80

Typical Electric Project Components & Costs

- 3 MW engine project for 15 years:
  - Installed engine and gas treatment skids
    - Installed capital cost = ~$5,100,000
  - Interconnect
    - ~$250,000 (approximate – many variables at play)
  - Annual operation & maintenance
    - Cost = ~$570,000/year
- Total capital cost = ~$5.35 million
- Total annual cost = ~$570,000

Typical Direct Use Components & Cost

- 800 scfm project for 15 years:
  - Gas compression & treatment
    - Installed capital cost = ~$1,040,000
  - Pipeline
    - Installed capital cost = ~$330,000/mile
  - Annual operation & maintenance
    - Cost = ~$50,000/year
  - End-of-pipe combustion equipment retrofits, if needed
- Total capital cost (5-mile) = ~$2.69 million
- Total O&M cost = ~$750,000

Potential LFG Revenue

- Electric projects
  - Sale of electricity (4 - 6 cents/kWh)
  - Sale of Renewable Energy Credits (RECs)
  - Premium pricing for renewables through RPS/RPG or voluntary green power markets
  - Tax credits & incentives
  - Clean Renewable Energy Bonds (CREBs)
- Direct-use projects
  - Sale of LFG ($/MMBtu)
- Both
  - Greenhouse gas emissions trading
  - Energy cost savings
  - Other federal incentives (EECBG)

State of the LFG Industry February 2009

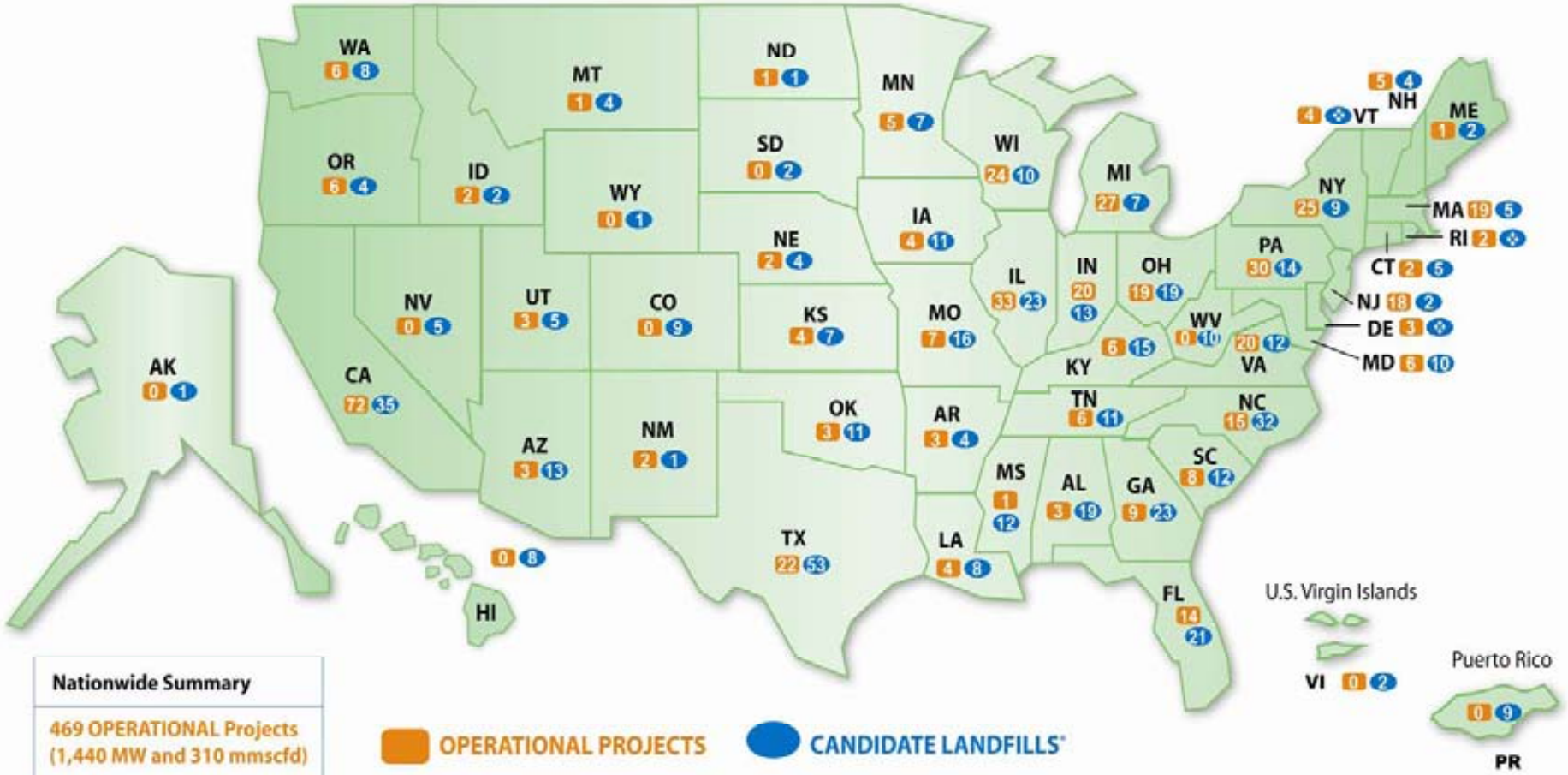
- At least 470 operational projects in 44 states supplying:
  - 12 billion kilowatt hours of electricity and 82 billion cubic feet of LFG to direct-use applications annually
- Estimated **Annual** Environmental Benefits
  - Carbon sequestered annually by **~19,000,000 acres of pine or fir forests**, or
  - CO_2 emissions from ~**195,000,000 barrels of oil consumed**, or
  - Annual greenhouse gas emissions from ~**15,400,000 passenger vehicles**
- Estimated **Annual** Energy Benefit
  - Powering more than **936,000 homes** and heating more than **567,000 homes**

Many Untapped LFG Resources

- Currently 520 candidate landfills with a total gas generation potential of 610 million standard cubic feet per day OR electric potential of 1,200 MW
- If projects were developed at all these landfills, estimated
  - **Annual** Environmental Benefit =

    Planting 1.70 million acres of forest OR removing the emissions from 1.2 million vehicles on the road, and
  - **Annual** Energy Benefit = Powering 763,000 homes per year

LFG Energy Projects and Candidate Landfills



Nationwide Summary

469 OPERATIONAL Projects (1,440 MW and 310 mmscfd)

~ 520 CANDIDATE Landfills (1,200 MW or 610 mmscfd, 14 MMTCE Potential)

* Landfill is accepting waste or has been closed for 5 years or less and has at least 1 mmtons of waste and does not have an operational/under construction LFGE project; or is designated based on actual interest/planning.

These data are from LMOP's database as of December 22, 2008.
❖ LMOP does not have any information on candidate landfills in this state.

Federal Financial Incentives

- Section 45 Tax Credit
  - Electricity generation – 1.0 cent/kWh
  - Placed in service by 12/31/13
  - 10-year payout period
- U.S. Treasury Grant Program
- EECBG Program
  - National allocation of $3.2 billion in FY'09

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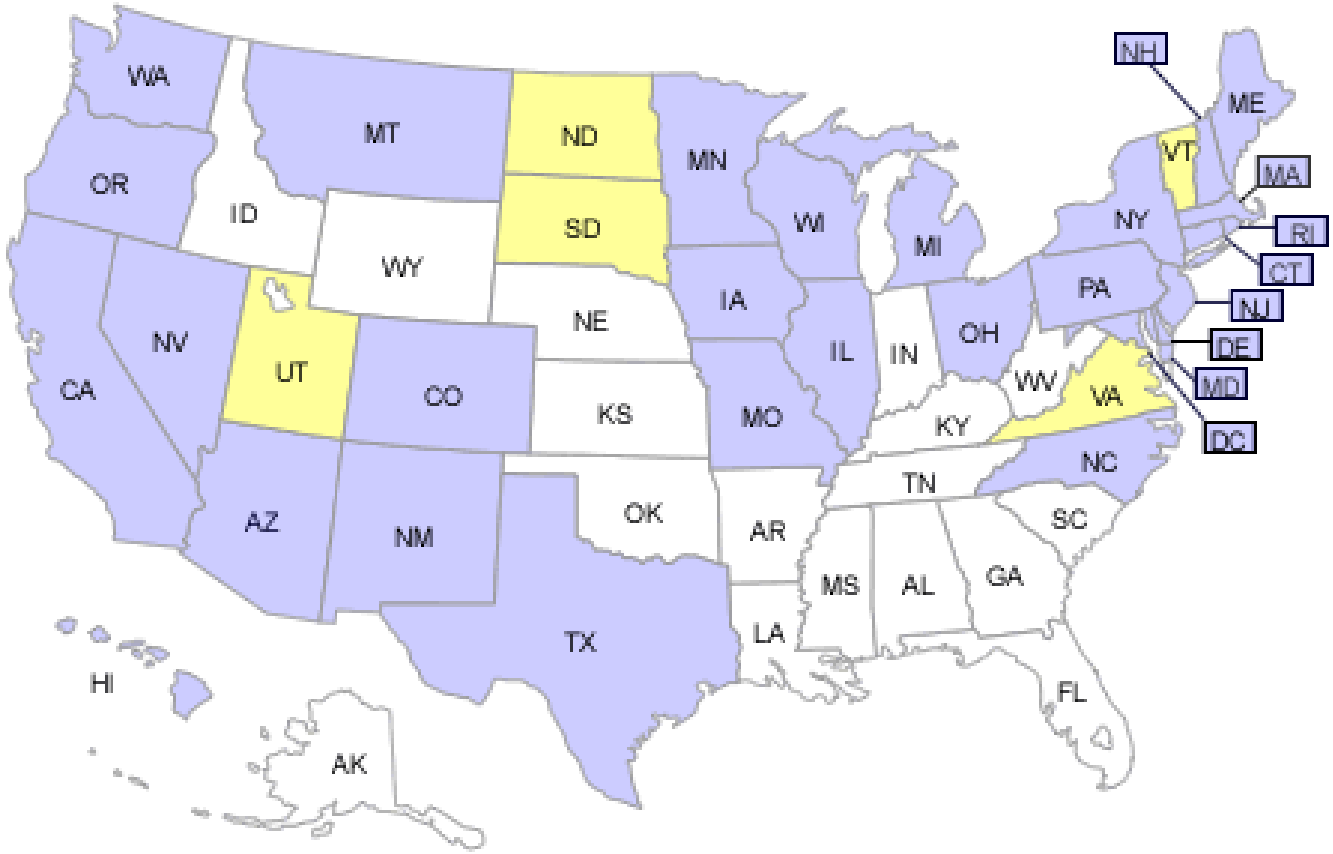
States with RPS or Goal



- States with RPS
- States with RPS Goals

Public and Private Entities Moving to Reduce GHG Emissions

- Voluntary Markets
  - Currently where most GHG activity occurs
  - Examples – CCX, VCS
- Compliance Markets
  - Rapidly evolving, will become the dominant market
  - Led by RGGI and CCAR (note Nov. deadline registering your project!)

Tracking Trends

- GHG trading markets continually evolve and mature….. new entries into the market- GE-AES, VCS, etc.
- State/regional initiatives taking the lead- RGGI did first auction September 08, went into effect January 2009; second auction planned
- Impacts of Congressional legislation and potential landfill CH_4 regulation – particularly cap and trade
- Three year tax credit extension and new CREBs allocation as part of American Recovery & Reinvestment Act
- New state RPSs include LFG
- Corporate sector interest in LFG continues to grow
- Consolidation in the waste sector

LANDFILL METHANE OUTREACH PROGRAM

Diversity of Project Generation Types

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

Microturbine (range from 30 kW to 250 kW)

Gas Turbine (range from 800 kW to 10.5 MW)

Direct Use

- Direct-use projects are growing!
  - Boiler applications – replace natural gas, coal, fuel oil
  - Combined heat & power (CHP)
  - Direct thermal (dryers, kilns)
  - Natural gas pipeline injection
    - Medium & high Btu
  - Greenhouse
  - Leachate evaporation
  - Vehicle fuel (LNG, CNG)
  - Artist studio
  - Hydroponics
  - Aquaculture (fish farming)

Greenhouse Burlington, NJ

LFG-fired Boiler Ft. Wayne, IN

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Emerging Technologies: LFG for Vehicle Fuel

- Los Angeles, CA converts LFG into CNG to fuel landfill equipment (Puente Hills LF)
- Franklin Co, OH convents LFG to CNG to fuel 2 sedans and 4 pick-ups with plans to build commercial CNG facility in coming years
- Central LF, CA plans to convert LFG to CNG to fuel Sonoma County school buses
- Waste Management in CA plans to produce 10-20K gal LNG per day for garbage trucks


Honeywell
NUCOR
HILL AIR FORCE BASE, Utah
OGDEN AIR LOGISTICS CENTER
DART
CYTEC
Rolls-Royce
SENECA Foods.com
"A World Leader In Agribusiness"
Owens Corning
Cargill
Ford
The Ultimate Driving Machine
The Solae Company
Frito Lay
GM
LAFARGE
Look Who's Using Landfill Gas!
Jenkins Brick Company
AJINOMOTO
CONE
corporatedenimfinishingjacquards
Nestlé
Makes the Very Best
INTERNATIONAL PAPER
From innovation to results.
INTERFACE
NASA
MALLINCKRODT
DUPONT
The miracles of science
Lucent Technologies
Bell Labs Innovations
SUNOCO
SC Johnson
CHRYSLER
TURKEY HILL

Look Who's Talking about LFG!

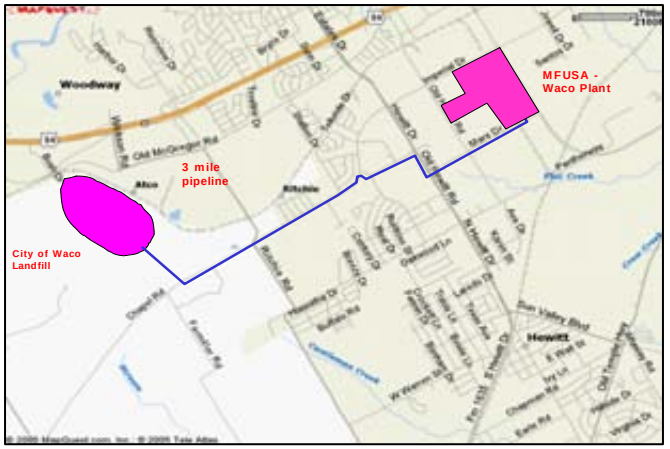
LANDFILL METHANE OUTREACH PROGRAM

Direct-Use Case Study

MARS Snackfood USA and City of Waco Landfill

LFG from city landfill is piped to MARS for use in boiler

- Replaces natural gas
- LFG replaced 60% of plant's boiler fuel – 600 mmBTU/day
- Saves plant over $600,000/year
- Project lifetime of at least 25 years
- Reduced CO2 emissions by 10,000 tonnes
- Equivalent to 3% of MARS total energy use for U.S. factories



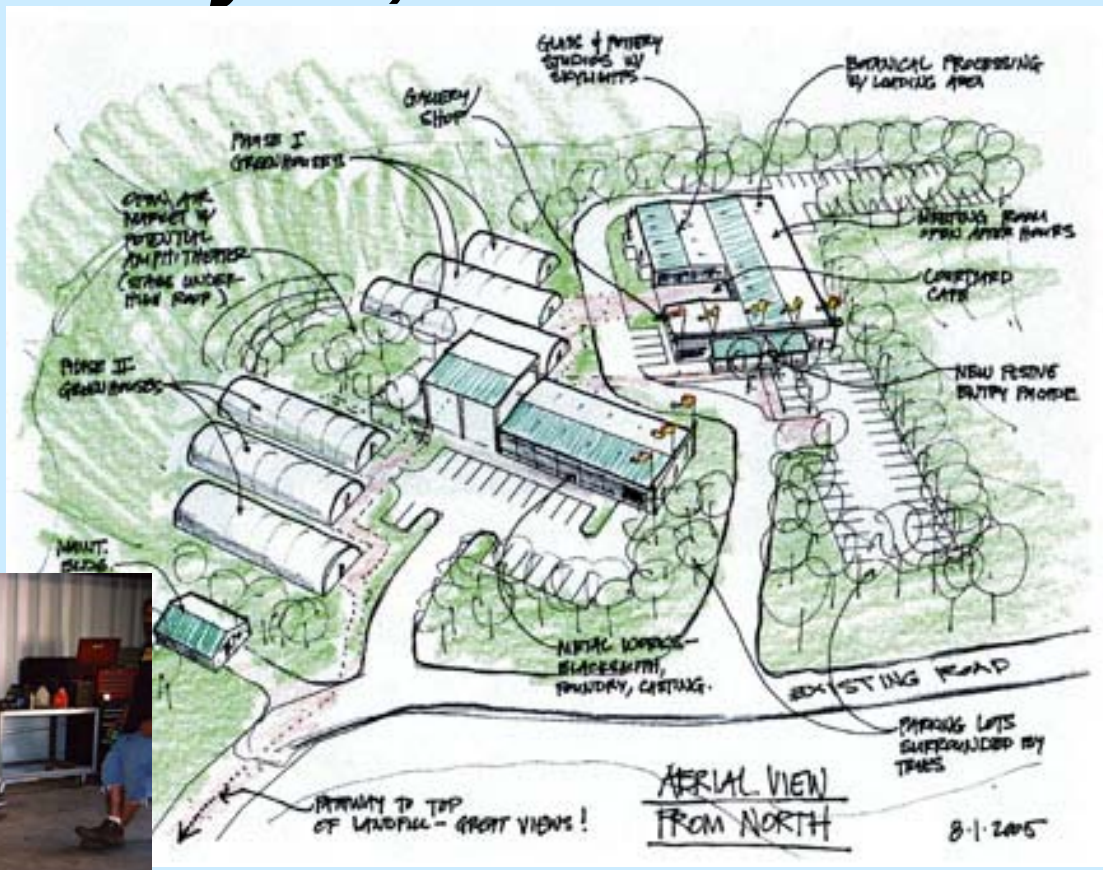
2008 LMOP Award Winner

LANDFILL METHANE OUTREACH PROGRAM

Direct-Use Case Study

Jackson County Green Energy Park Sylva, NC

LMOP 2006 Project of the Year



LMOP Tools and Services

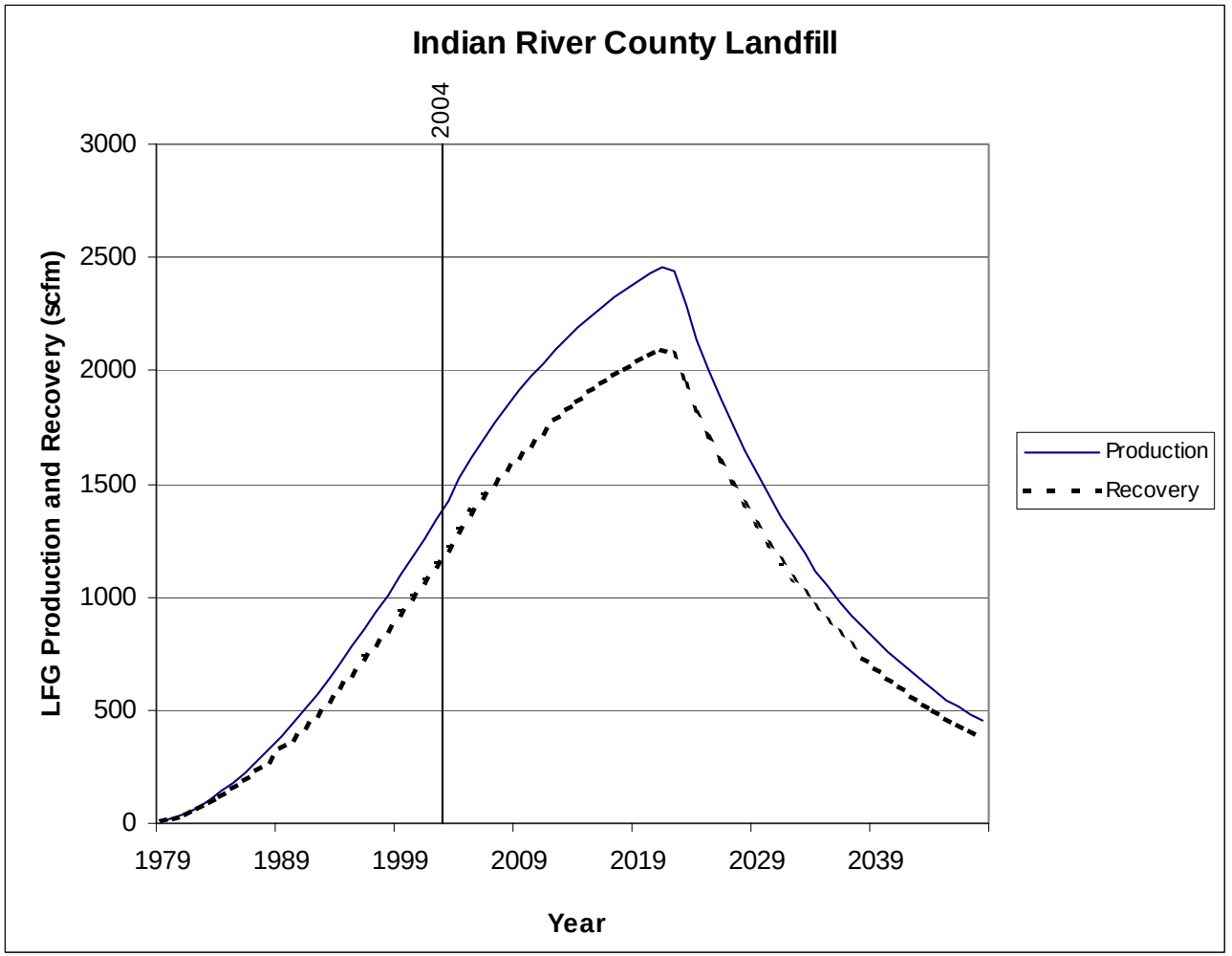
- Network of 800+ Partners (and growing)
- Newsletter and listserv
- Direct project assistance
- Technical and outreach publications
- Project and candidate landfill database
- Support for ribbon cuttings and other public relations
- Presentations at conferences
- State training workshops
- LMOP Annual Conference & Project Expo

How Can We Work Together?
Direct Project Assistance

- Analyze landfill resource – gas modeling
- Identify potential matches – *LMOP Locator*
- Assess landfill and end user facilities
- Look at project possibilities
  - Direct-use (boiler, heating, cooling, direct thermal)
  - Combined Heat & Power (engine, turbine, microturbine)
  - Electric (engine, turbine, microturbine)
  - Alternative Fuels (medium or high Btu, LNG, CNG)
- Initial feasibility analyses – *LFGcost*

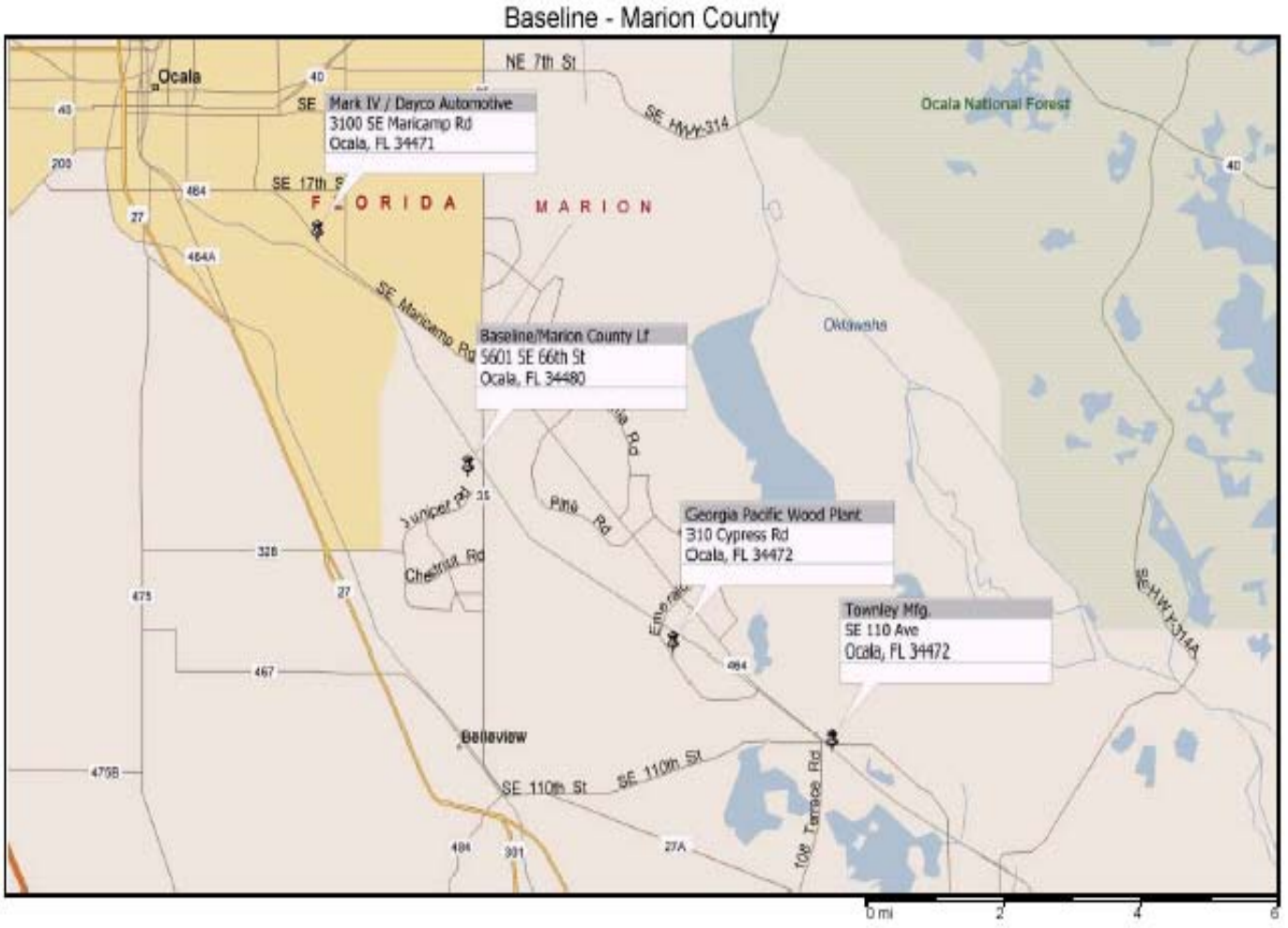
LANDFILL METHANE OUTREACH PROGRAM

Analyze Energy Potential from Landfill



LANDFILL METHANE OUTREACH PROGRAM

Identify Potential Matches



EPA Project Expo

- Interested in an LFGE Project?
- EPA features a select number of landfills at the Annual LMOP Conference in January.
- LMOP will develop a “resume” for your landfill to feature at the conference.
- Contact me if interested!

Methane to Markets Partnership

- Encourages development of ***cost-effective*** methane recovery and use opportunities in
  - coal mines
  - landfills
  - oil and gas systems and
  - agriculture (manure waste management)
- Private companies, multilateral development banks and other relevant organizations participate by joining the ***Project Network – over 790 organizations now participating***
- **29 Partner Governments**

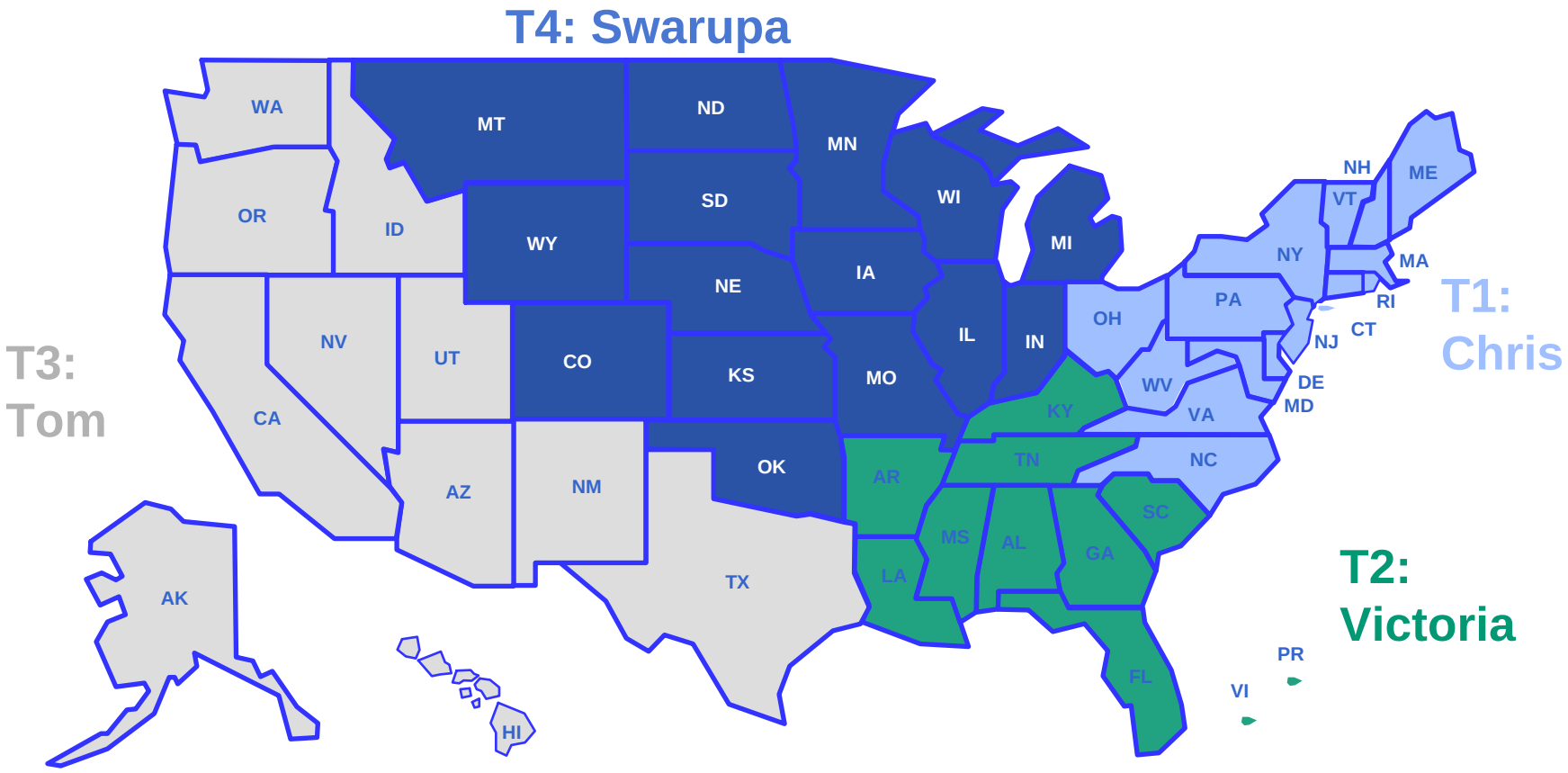
Argentina
Australia
Brazil
Bulgaria
Canada
Chile
Colombia
China
European Comm.
Ecuador
Finland
Germany
India
Italy
Japan
Kazakhstan
Korea
Mexico
Mongolia
Nigeria
Pakistan
Philippines
Poland
Russia
Thailand
Ukraine
United Kingdom
United States
Vietnam

Tools and Services Offered to M2M Partners

- **Hands-on Technical Assistance – assisting partners to identify and assess potential landfill energy projects**
- **Training and Outreach – reaching out to and training government officials, landfill owners and operators, and project developers**
- **Developing Tools and Resources – to identify, assess, and develop projects in partner countries**

For More Information

www.epa.gov/lmop



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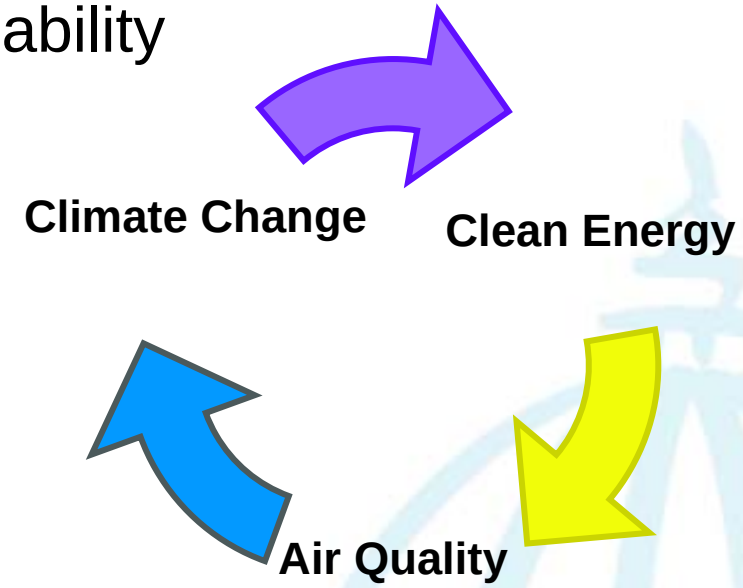
Climate – Clean Energy Framework: Multiple Benefits

- **Territorial Governments are looking for:**
  - Air quality improvements
  - Greenhouse gas emission reductions
  - Energy security and reliability
  - Economic development
  - Public health
  - Quality of life



EPA Clean EnergyEnvironment STATE AND LOCAL PROGRAM

Clean Energy: Energy Efficiency, Renewable Energy, Combined Heat and Power

Roles for State / Local Governments in Addressing Climate Change

- **State / Local experience to date includes:**
  - Clean Energy/Climate Action Plans (32 states)
  - Regional cap-and-trade (RGGI, WCI, MWA)
  - Energy efficiency programs
  - Renewable Portfolio Standards (RPS) / RE promotion
  - Transportation
- **Regulatory authority will continue in areas critical for climate:**
  - Utility regulation
  - Building code development and enforcement
  - Appliance efficiency standards
  - Land use decisions (incl. siting)
  - Transportation

EPA

Clean EnergyEnvironment
STATE AND LOCAL PROGRAM

State Government Work is Dispersed; Local Gov’ts Range from Complex to All-in-One

Territorial Government Legislature/Governor

- *Utility Commissions (PUCs)*
- *Energy Offices*
- *Economic Development*
- *Environ Agencies*
- *Public Infrastructure*

EPA

Clean EnergyEnvironment STATE AND LOCAL PROGRAM

Leverage EPA's Climate / Clean Energy Programs

CPPD

CCD

Clean EnergyEnvironment STATE PARTNERSHIP

Clean EnergyEnvironment MUNICIPAL NETWORK

ENERGY STAR

CHP EPA COMBINED HEAT AND POWER PARTNERSHIP

EPA GREEN POWER PARTNERSHIP

HEAT ISLAND REDUCTION INITIATIVE

CLIMATE LEADERS U.S. Environmental Protection Agency

Help State and Local Governments:

- Learn from Best Practices
- Emphasize Co-Benefits
- Integrate Planning
- Prioritize EE as a Resource

Offer:

- Direct Technical Support
- Peer Exchange
- Tools and Guidance

OW

EPA WASTE WISE

OTAQ

Tomorrow's Buses for Today's Children

CLEAN SCHOOL BUS USA

NaturalGas EPA POLLUTION PREVENTER

COALBED METHANE OUTREACH PROGRAM

LANDFILL METHANE OUTREACH PROGRAM

AgSTAR

SmartWay Transport Partnership U.S. Environmental Protection Agency

EPA

Clean EnergyEnvironment STATE AND LOCAL PROGRAM

Contact Us

State Climate - Clean Energy Programs

www.epa.gov/cleanenergy/energy-programs/state-and-local/state

Local Climate - Clean Energy Programs

www.epa.gov/cleanenergy/energy-programs/state-and-local/local

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EPA

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STATE AND LOCAL PROGRAM

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Useful Links for More Info.

U.S. EPA LMOP

www.epa.gov/lmop

LMOP Funding Guide

http://www.epa.gov/landfill/res/guide/

LMOP Database of Projects

http://www.epa.gov/lmop/proj/index.htm

Database of State Incentives for Renewable Energy (DSIRE)

www.dsireusa.org

DOE – Energy Efficiency & Conservation Block Grants Program

http://apps1.eere.energy.gov/wip/block_grants.cfm