



American Experience on Landfill Biogas Recovery

Jerry Leone

General Manager – Renewable Energy



My Background

- B.S. Civil Engineering
- 16 Years Solid Waste Management Industry
 - Landfill Gas Management/Recovery
 - Landfill Engineering/Construction
 - Remediation
- 15 Years with Waste Management, Inc.
 - Director, Landfill Gas Programs
 - Director, Closed Sites – Southeast
 - District Engineer
 - Remedial Project Manager
 - Design Engineer
- Visited/Toured Landfill Across N. America and Europe



Ameresco, Inc. is an independent energy solutions company delivering long-term customer value through innovative systems, strategies and technology.

- ◆ **Core business focus: Energy Conservation, Risk Mitigation and Infrastructure**
- ◆ **Independence Permits Unbiased Application of Energy Solutions Best Suited to Each Customer**
- ◆ **Corporate Headquarters in Framingham, MA
18 regional offices in North America**
- ◆ **Over 40 registered professional energy engineers on staff**

SERVICES & SOLUTIONS

BASIC SERVICES

- Energy Auditing
- Energy Engineering
- Project Financing
- Project Management
- Construction Management
- Operation & Maintenance
- Measurement & Verification

SOLUTIONS

Energy Conservation

- Power Quality & Reliability
- Transformed Power
- Performance Contracting
- Demand-Side Management

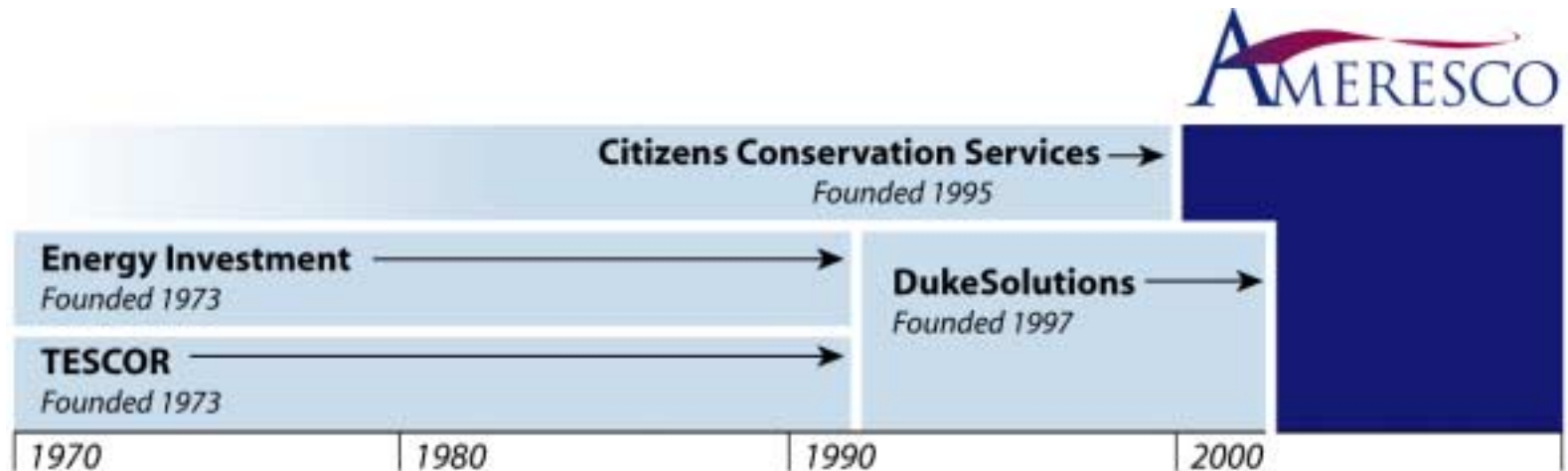
Energy Supply Management

- Commodity Procurement
- Rate Analysis & Negotiation
- Price Risk Management
- Billing Administration & Payment
- Market & Regulatory Analysis

Energy Infrastructure

- Asset Monetization
- Plant Rehabilitation
- Facilities Management
- On-Site Cogeneration
- Distributed Generation
- Clean/Renewable Power
- Outsourcing

Our Company History



- ◆ Incorporated April 2000 with company history dating back to 1973
- ◆ Largely employee owned; 190+ Employees
- ◆ Recently purchased LG&E EnerTech

We Understand Energy Services

- ◆ **Independent Energy Services Provider – Core Business is Providing Complete, Customer Focused Energy Solutions on Both Sides of the Meter**
- ◆ **Offer Comprehensive Energy Outsource Programs Wherein Ameresco Owns and Operates Customer Energy Assets**
- ◆ **Ameresco has Designed, Financed, Constructed and Managed Over \$800 MM in Diverse Energy Solutions Projects**
- ◆ **United States Department of Energy (DOE) Qualified Energy Services Company (ESCO)**
- ◆ **Accredited by National Association of Energy Service Companies (NAESCO) as an Energy Services Provider (ESP), Incorporating Full Accreditation as a Comprehensive ESCO**

Information Management: Bank of America



Now in the fourth year of a comprehensive energy management program, Ameresco is helping the nation's largest bank save on its annual energy expenses of more than \$110 million at 4,800 facilities, so Bank of America can focus more on its core financial services businesses.

- ✓ Created customized, web-based energy/utility billing information system integrating 6,000 accounts nationwide
- ✓ Competitive electricity and national gas supply management and risk management for properties in volatile markets (California, Illinois, Texas).
- ✓ Currently identifying facility renewal/efficiency improvement opportunities at major facilities
- ✓ Developmental engineering completed on projects in Maryland and California

Representative Projects



BOEING

- 20-year full service contract
- Own, upgrade, operate and maintain 5,500-ton central plant
- Provides chilled water and high-temperature hot water to shuttle operations support facility

**Eastman
Chemical
Kingsport, TN**

EASTMAN



- ✓ **Two projects at Kingsport, TN, one of largest chemical manufacturing sites in North America:**
 - **Process compressed air system upgrade**
 - **New raw water pumping system**
- ✓ **Third project converting ammonia-based refrigeration system to glycol-based under development at Kingsport**
- ✓ **Completed upgrade project at Columbia, SC for plant and instrument air-drying system**
- ✓ **Projects self-funded from energy savings**

**Charleston Air Force
Base
South Carolina**



- ✓ **960 units installed – the second-largest geothermal heat pump installation undertaken by the US Federal Government**
- ✓ **Innovative installation methods led to ahead-of-schedule completion**
- ✓ **Other projects: New demand-limiting receivers and lighting upgrades**
- ✓ **Annual savings of \$800,000 used to fund the projects**
- ✓ **Projects reduce energy consumption by 40%, exceeding Executive Order 13123**

**Clarkstown Central School
District
New City, NY**



- ✓ **\$7.5 million Energy Performance Contract covering 16 buildings**
- ✓ **Improvements include:**
 - ✓ **New energy efficient lighting**
 - ✓ **New Lighting Controls**
 - ✓ **New energy management systems**
 - ✓ **New boilers**
 - ✓ **New waste oil heater**
 - ✓ **New roofs and doors**
 - ✓ **New premium efficiency motors**
 - ✓ **Cogeneration**
- ✓ **\$432,000 in annual savings**

Renewable Energy Projects

- ◆ **Own and operate a 6-MW landfill gas plant near Middletown, NY**
- ◆ **Own and operate a 10-mile landfill gas pipeline in S.C. feeding BMW's 4.8-MW cogeneration plant (~1M DT/yr)**
- ◆ **Recently acquired 4-mile landfill gas pipeline project in Michigan (~600K DT/yr) to Fortune 100 customer, project will be expanded to include new 2-mile gas line to another Fortune 100 end-user**
- ◆ **In April '03, initiate construction on a 5.7-MW landfill gas plant near Springfield, MA**
- ◆ **In April '03, finalize construction of a 2.6-MW landfill gas plant in Wisconsin (expanded to 4.5 MW by 2005)**
- ◆ **Recently executed a contract with a Midwest power cooperative to provide design, build, operate services for 2 landfill bio-gas projects in Iowa and Wisconsin**

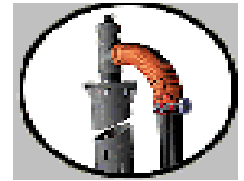


Landfill Gas 101

- Landfill gas is formed as a by product of the decomposition of municipal solid waste
- Comprised of approximately 50% methane, 45% carbon dioxide, 3% nitrogen, 1% oxygen, 1% non methane organics
- Contains approximately ½ of the heating value of natural gas or ~520 BTU/ft³
- Most landfills will produce landfill gas for 15-20+ years



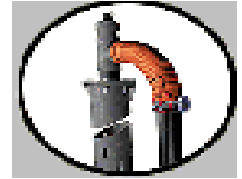
Landfill Gas Well



- Landfill gas is collected through vertical wells that are drilled deep into the waste mass (~ 1 per acre)



Landfill Gas Collection

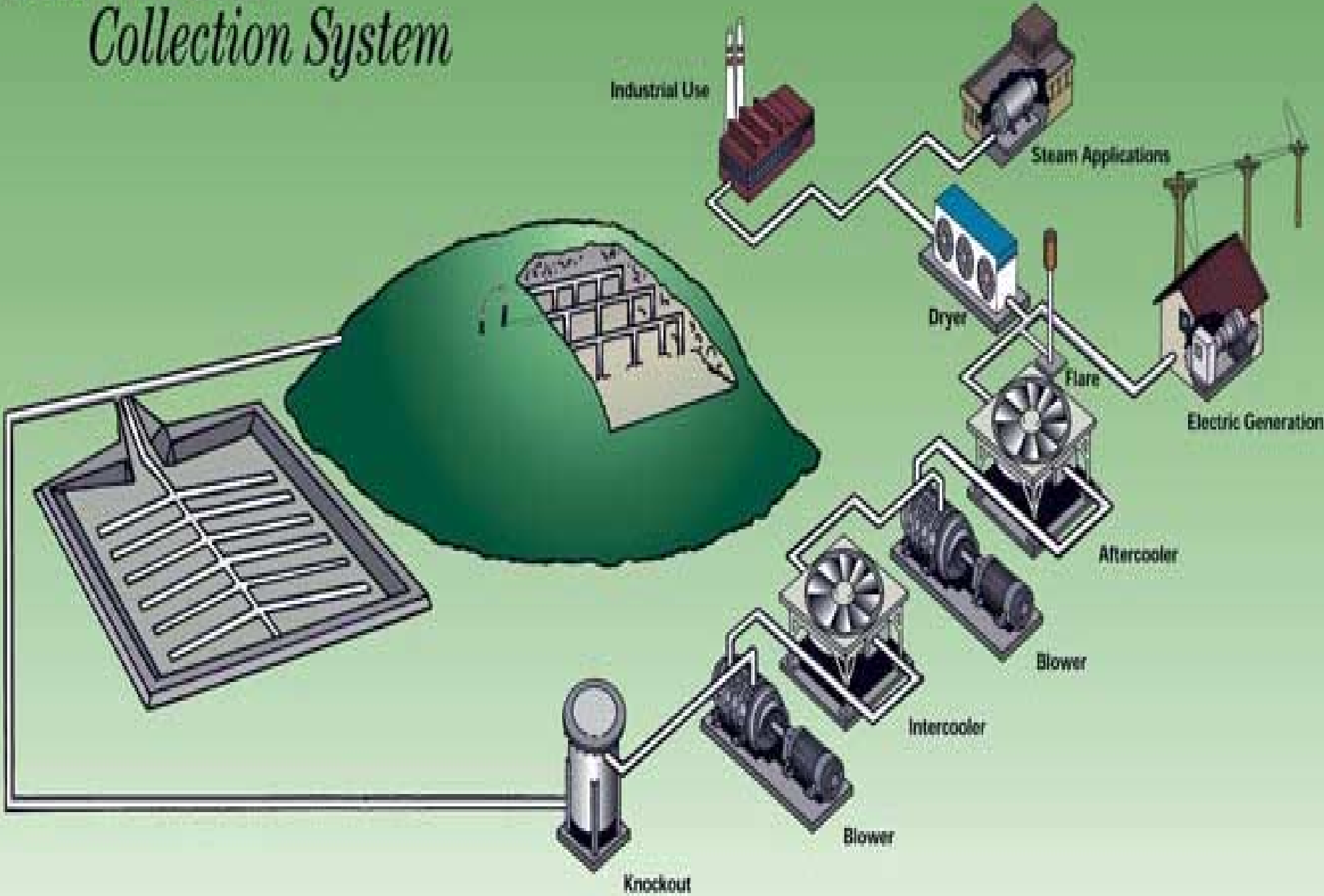


- The vertical wells are connected via a common header line that is buried into the waste mass

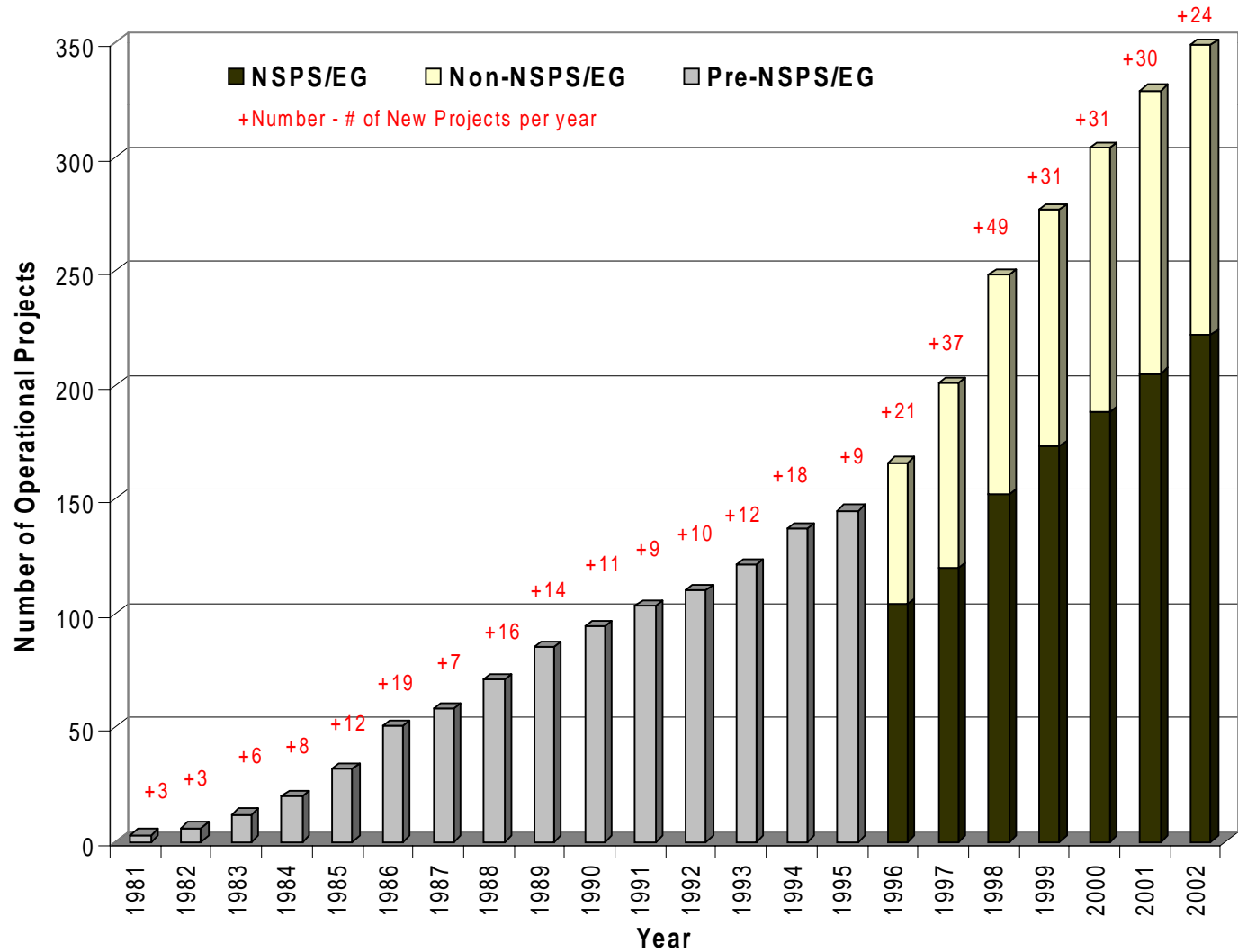


- The end of the header line is connected to a blower which is used to physically extract the gas from the wellfield (~50" w.c.)
- Gas that is not beneficially used is burned in a flare

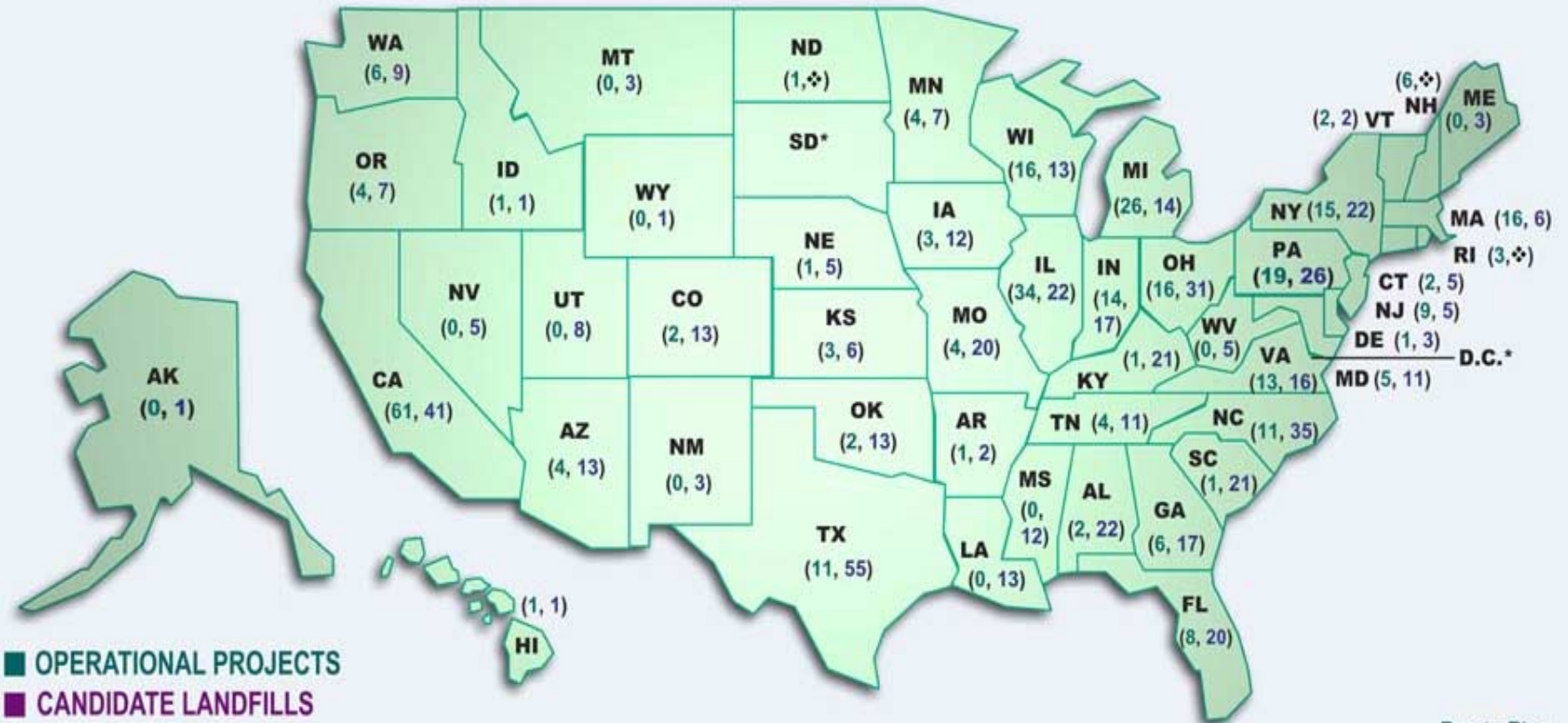
Landfill Gas *Collection System*



Growth in US LFG Industry



Status of US LFG Industry and Candidate Landfills By State



■ OPERATIONAL PROJECTS
■ CANDIDATE LANDFILLS

These data are from LMOP's database as of March 12, 2003

*LMOP does not have any information on landfills or landfill gas energy development in this state or territory.

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

Nationwide Summary

339 Operational Projects

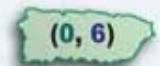
>600 Candidate Landfills
 have 17 MMTCE Potential

U.S. Virgin Islands



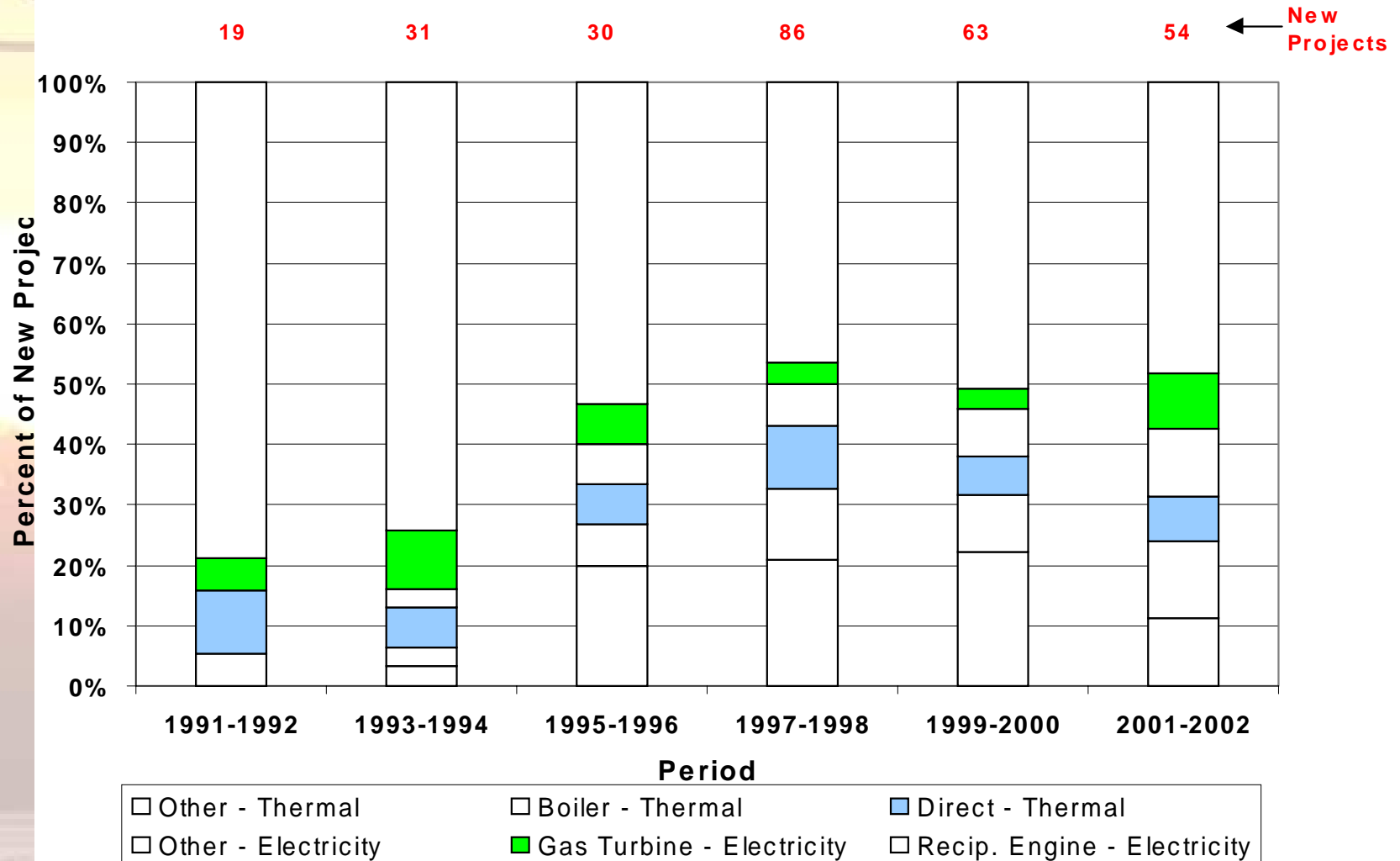
VI*

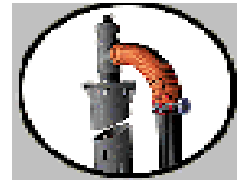
Puerto Rico



PR

Changes in US LFG Technology





U.S. Project Breakdown

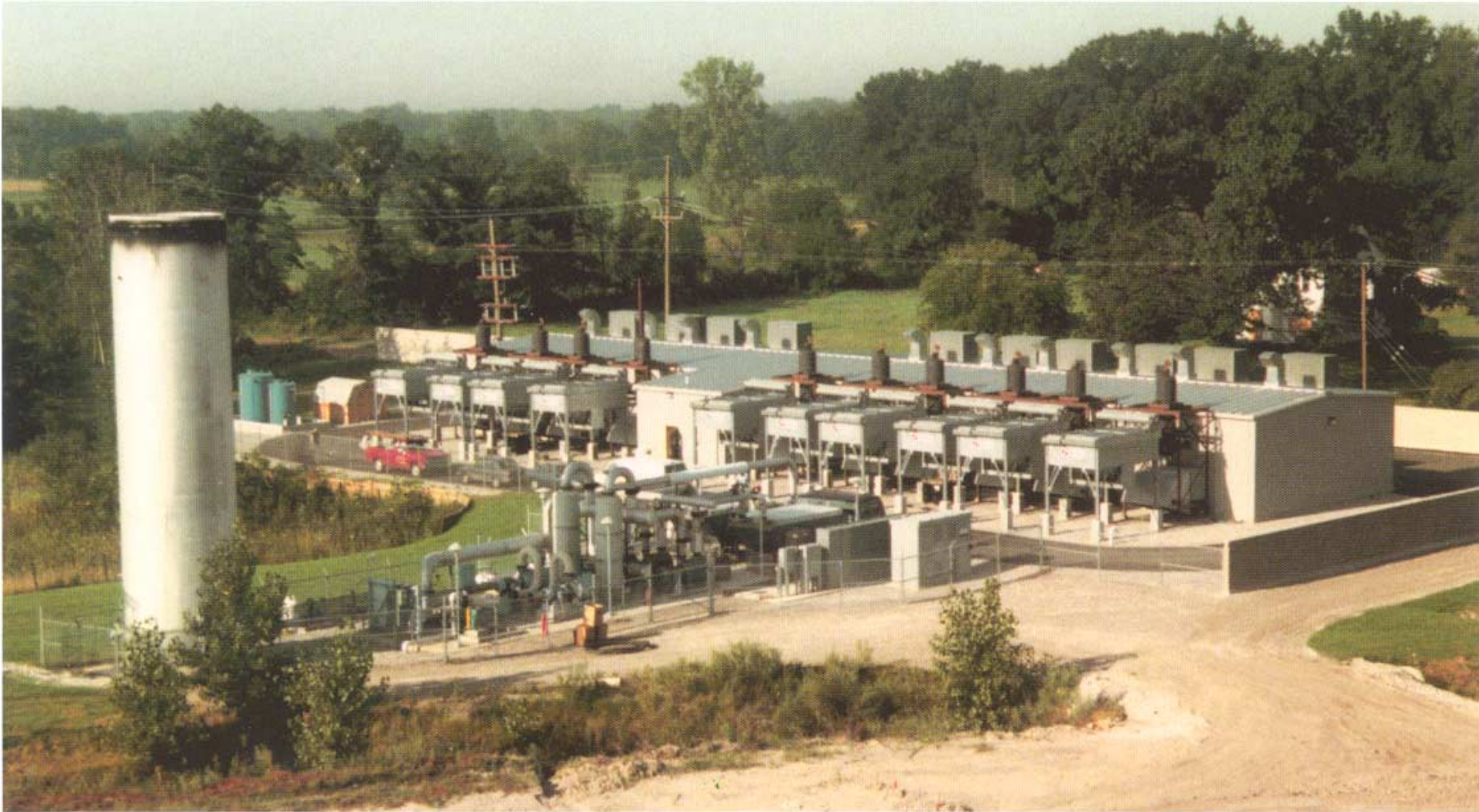
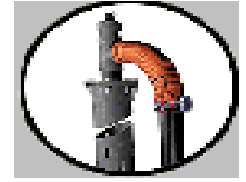
Utilization Technology	Operating Projects		Projects Under Construction		Planned Projects	
	Count	Capacity (MW)	Count	Capacity (MW)	Count	Capacity (MW)
Reciprocating Engine	176	568	39	176	64	202
Gas Turbine	29	173	2	21	3	15
Steam Turbine	8	119	-	-	-	-
Combined Cycle	4	67	-	-	-	-
Cogeneration	3	9	-	-	1	1
Microturbine	3	2	-	-	3	5
Fuel Cell	1	<1	-	-	1	2
Combined Solar/Stirling Cycle Engine	1	<1	-	-	-	-
TOTALS	225	938	41	197	72	226

- Currently 2/3 of operational projects generate electricity
- Operational projects represent over 900 MW capacity
- Does not account for direct sale projects
- Table is outdated

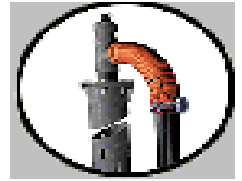
US LFG Industry

- ◆ **The LFG Industry is thriving**
 - 340 Operational Projects
 - Over 60 Projects Under Construction
 - Over 150 Planned Projects
- ◆ **Great potential for continued project development**
 - Approximately 520 (includes planned) landfills could economically develop a landfill gas energy recovery project

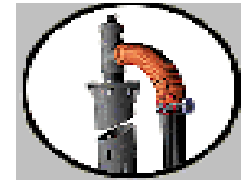
Reciprocating Engines



Combustion Turbines

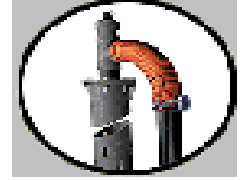


Containerized Engine

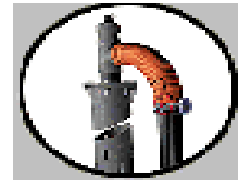


8/30/2001

Direct Sale Application



US LFG Industry – The Past

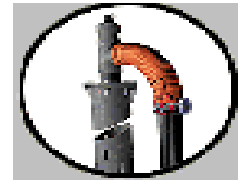


- ◆ **Tax Credit Proliferation**
 - Currently \$1.10/ mmBTU
 - 10 year period
 - Tied to cost oil

- ◆ **High Natural and Electric Costs**
- ◆ **Pre ENRON/California Energy Crisis**
 - Long term contracts easy to obtain

- ◆ **Generation (Supply) Shortfalls**
- ◆ **Renewable Energy Production Incentive (REPI)**
 - Non-Profit Entities
 - 10 year period

US LFG Industry – The Future



- ◆ **Tax Credit Extension**
- ◆ **Emission Credits**
- ◆ **Continued Landfill “Regionalization”**
- ◆ **Renewable Portfolio Standards**
- ◆ **Industry Consolidation**
- ◆ **Continued Emission Requirements**
- ◆ **Technology Advances**
- ◆ **Green Power Demand**
- ◆ **Bioreactor Technology**
 - Recirculation of landfill liquids (leachate)