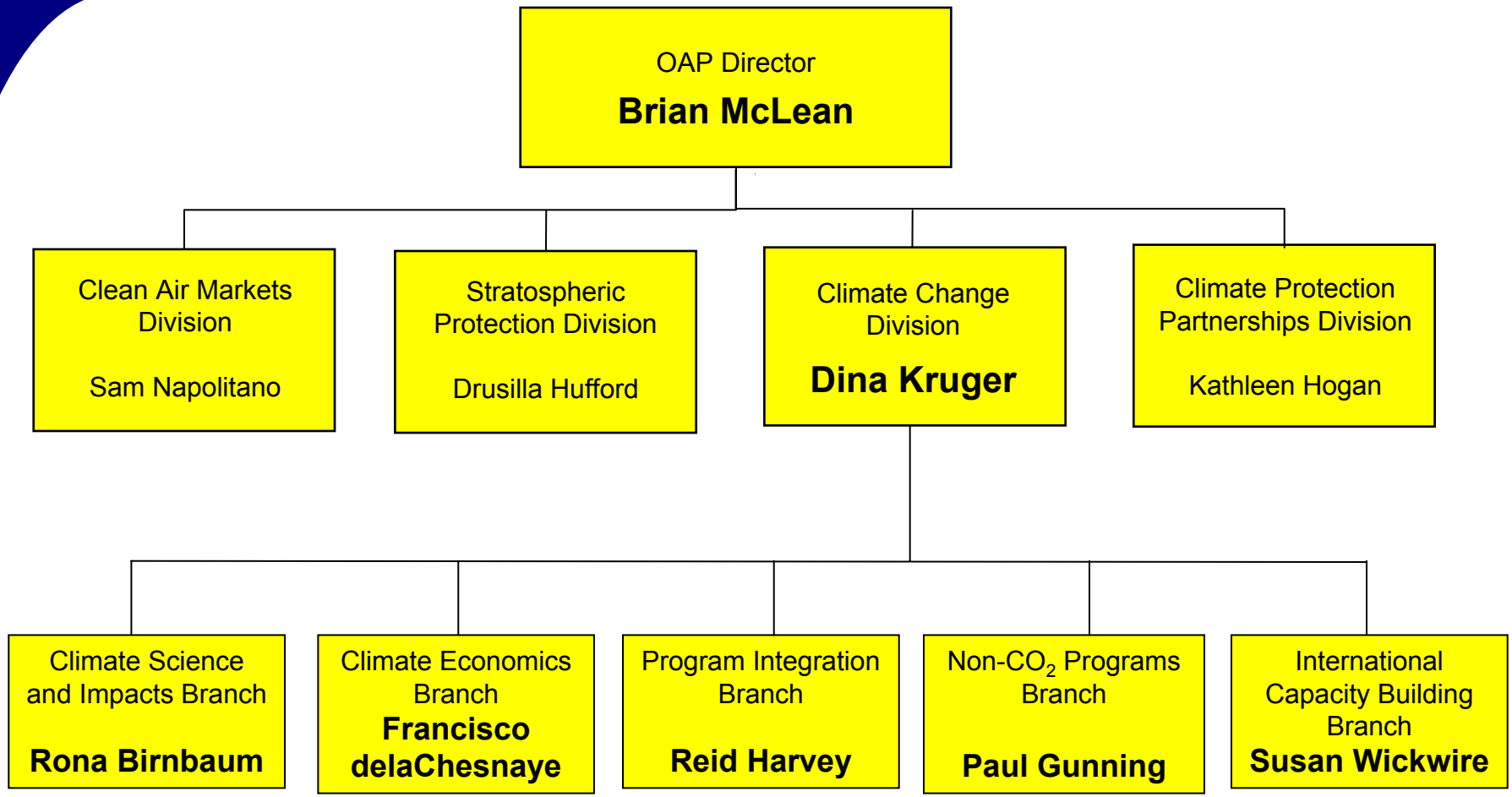
Voluntary Methane Programs as a Near Term Reduction Strategy

Chris Voell, Program Manager

Climate Change Division
Office of Atmospheric Programs
U.S. Environmental Protection Agency

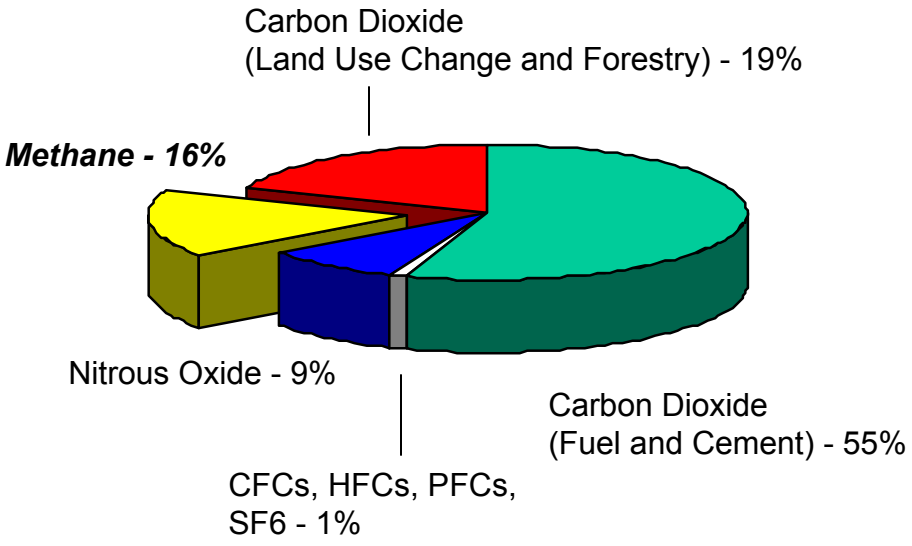
March 6, 2007

Climate Change Division In OAP Context



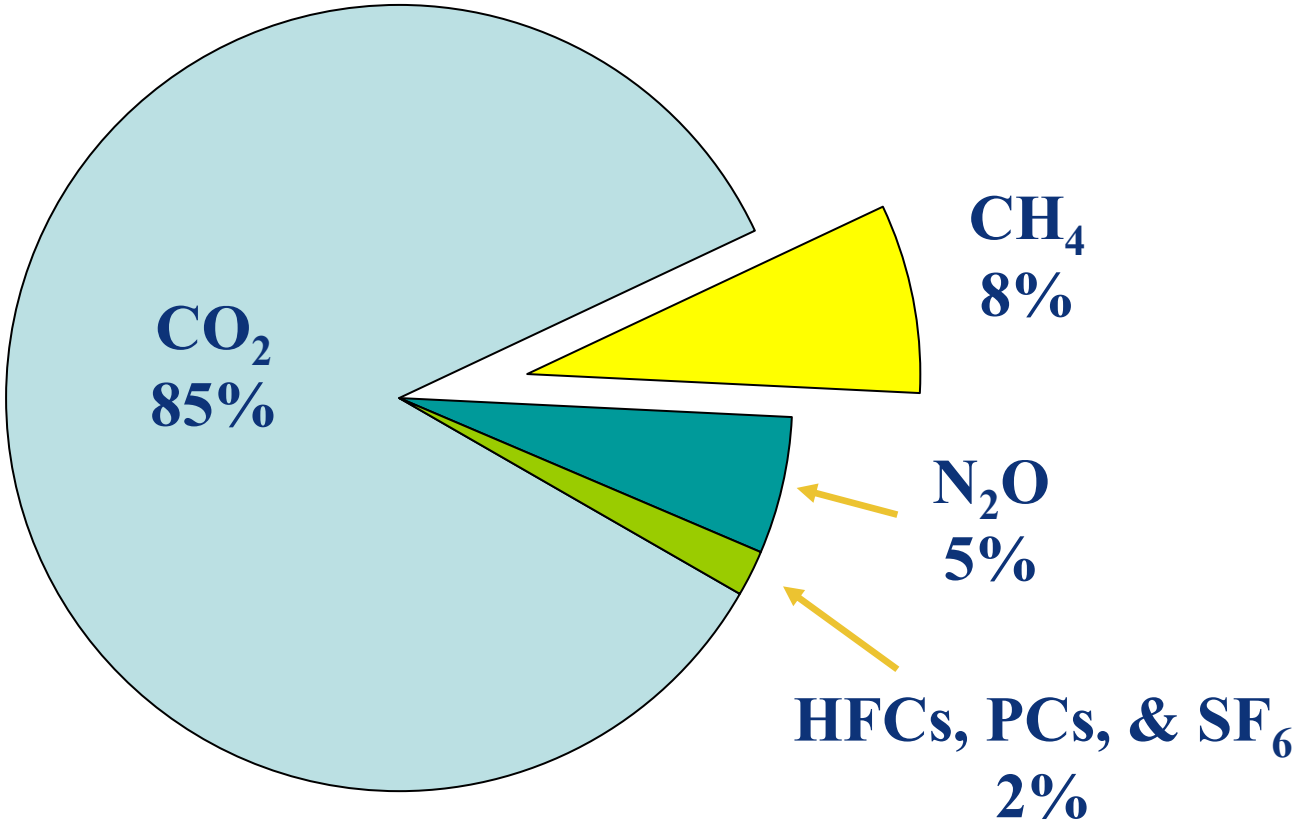
Methane

- A potent greenhouse gas (GWP = 23)
- 2nd most important GHG after CO_2
- Short atmospheric lifetime (~12 years)
- Many opportunities to reduce emissions



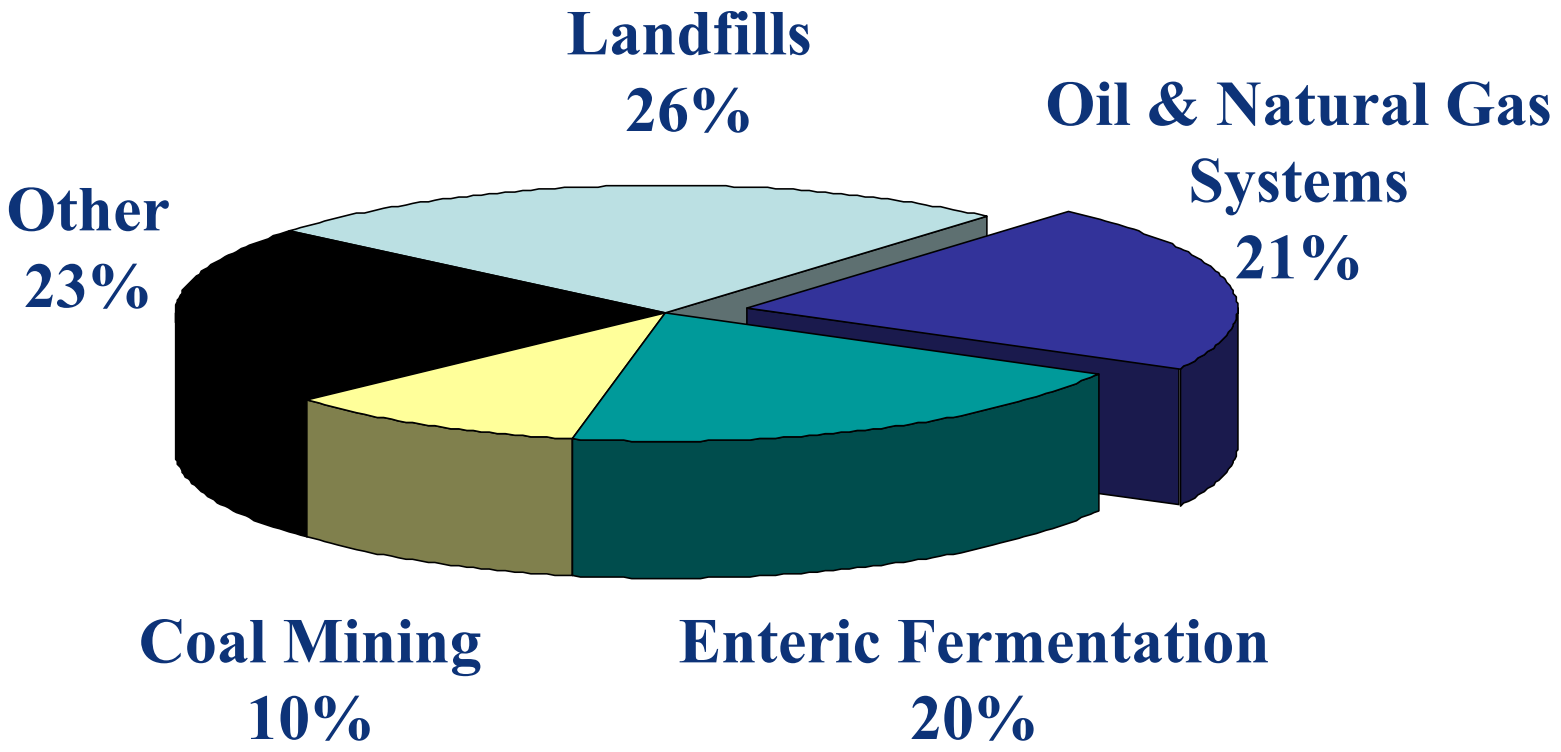
Global Greenhouse Gas Emissions

All Sources



Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2004, USEPA, April, 2006

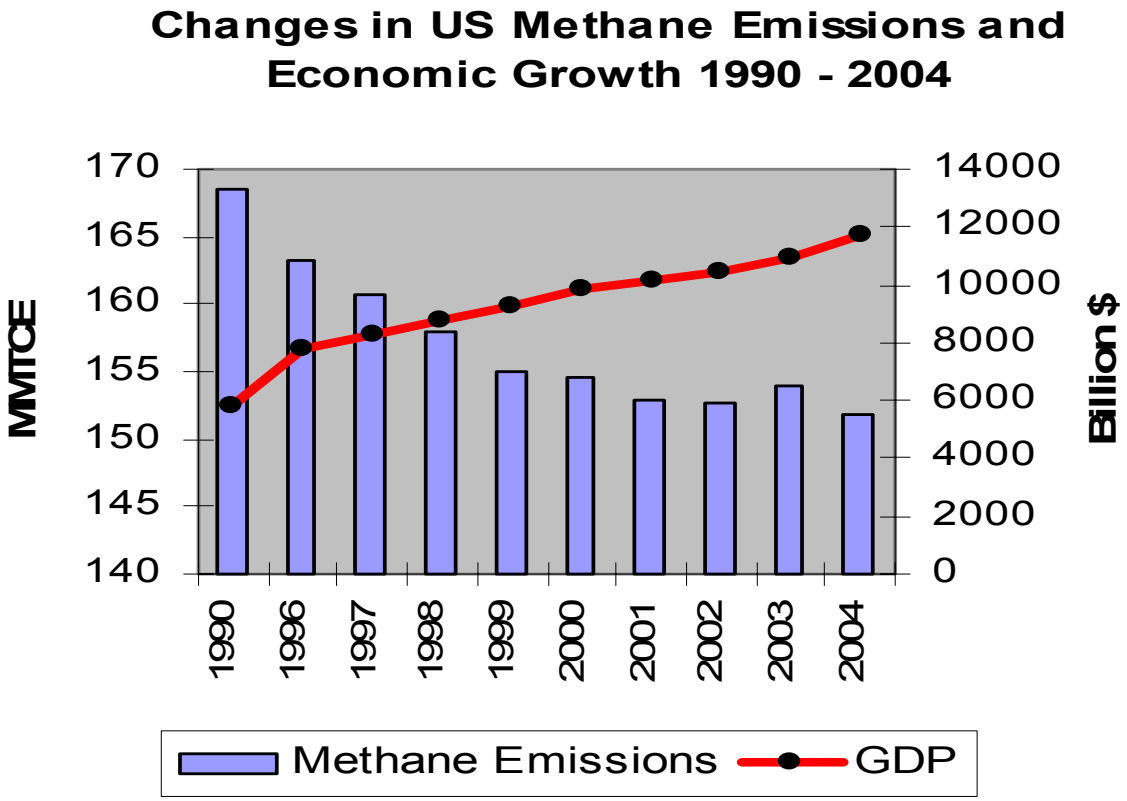
U.S. Methane Emissions



Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2004, USEPA, April, 2006

Trend in U.S. Methane Emissions

~11% decline since 1990



Opportunities to Reduce Emissions

Coal Mines

Oil and Gas Systems

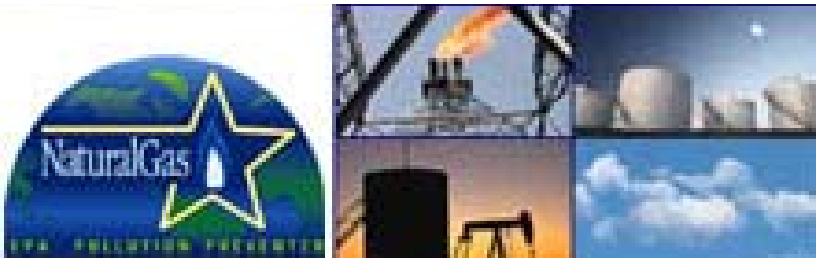
Landfills

Livestock Waste

Methane Partnership Programs

- **Natural Gas STAR**
  - Operations in all major industry sectors, ~ 57% of the U.S. industry
  - Natural Gas STAR International launch in September 2006
- **Landfill Methane Outreach Program**
  - Over 400 U.S. landfill projects – tripled since 1994
  - Strong corporate interest in landfill gas
- **Coalbed Methane Outreach Program**
  - 90% of mine degasification CH_4 is used (up from 25% in 1993)
  - industry effort to demonstrate use for ventilation air methane
- **AgSTAR**
  - Since 1994, the number of operational biogas recovery systems has doubled
  - Over 180 projects are generating about 400 million kWh of energy per year.

EPA Natural Gas STAR



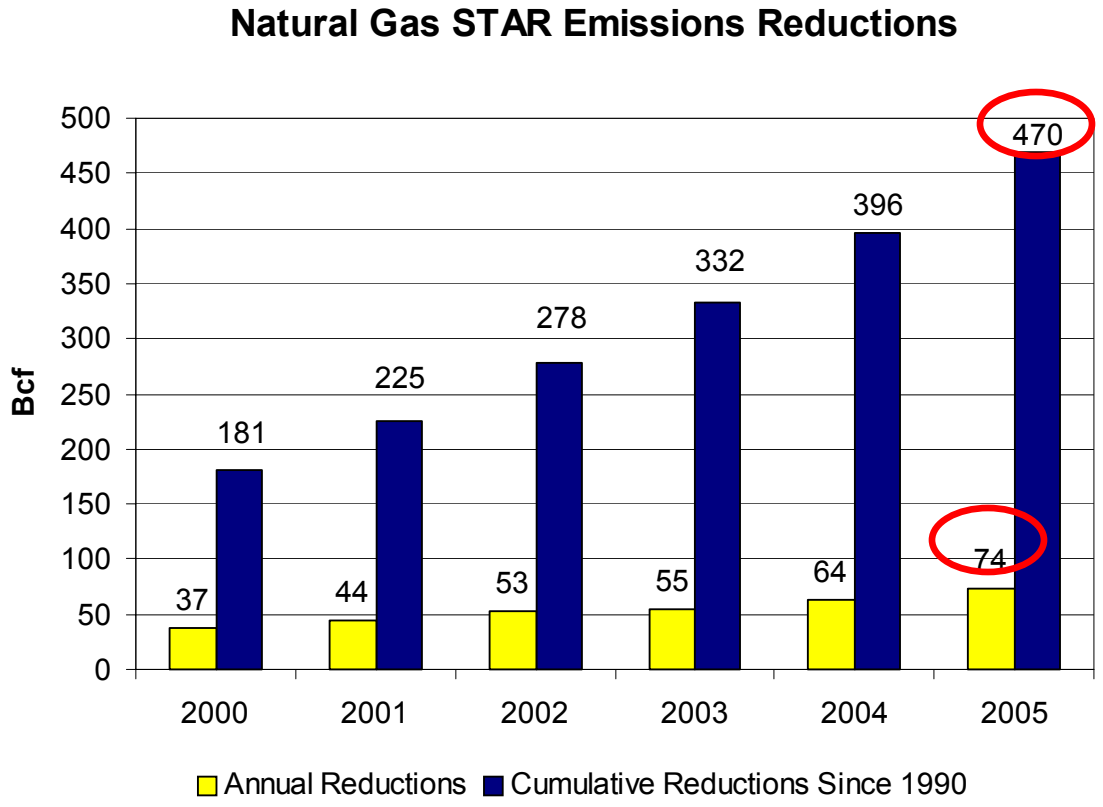
NaturalGas
EPA POLLUTION PREVENTER

- Partnership between EPA and the oil and natural gas industry since 1993.
- Identify and promote cost-effective technologies and practices to reduce emissions of methane, a potent greenhouse gas.
- Operations in all major industry sectors (production, processing, transmission, and distribution), representing 56% of the natural gas industry in the U.S., including 23 of the top 25 U.S. natural gas production companies.
- Natural Gas STAR International launch in September 2006

http://www.epa.gov/gasstar/

GasSTAR Emission Reductions

– Gas STAR Partners reduced methane emissions by 74 Bcf in 2005 (470 Bcf in cumulative reductions since 1990)



U.S. Oil & Natural Gas Opportunities

- **358 Bcf of methane emissions per year amounts to:**
  - $2.51B in lost revenue at $7/Mcf natural gas
  - Global warming equivalent of putting over 31 million additional cars on the road in the U.S.
  - Gas supply capable of heating over 5 million U.S. households for a year

- **U.S. oil and gas industry has an opportunity to cost-effectively reduce methane emissions resulting in:**
  - Increased profits
  - Increased gas supply for customers
  - Better public relations

Coaled Methane Outreach Program: Who We Are

- Voluntary climate change program since 1994
- Our mission
  - To promote the profitable recovery and use of CMM by working cooperatively with coal companies and related industries
- Our focus: CMM versus CBM
  - Greenhouse gas emission reduction opportunities

Coalbed Methane Outreach Program: What We Do

- Support CMM project development
  - Promoting recovery and end-use technologies
  - Identifying profitable opportunities for recovery
  - Conducting and sponsoring workshops
  - Offering technical assistance
- Act as a vital resource for the coal community
  - Website has valuable links, documents, contacts

CMM End-Use Opportunities

High-Quality Gas

- Natural gas pipelines
- Local distribution
- Vehicle fuel (LNG)

Medium-Quality Gas

- Power generation
- Combined heat & power
- District heating
- Coal drying
- Boiler fuel
- Industrial applications
- Fuel cells

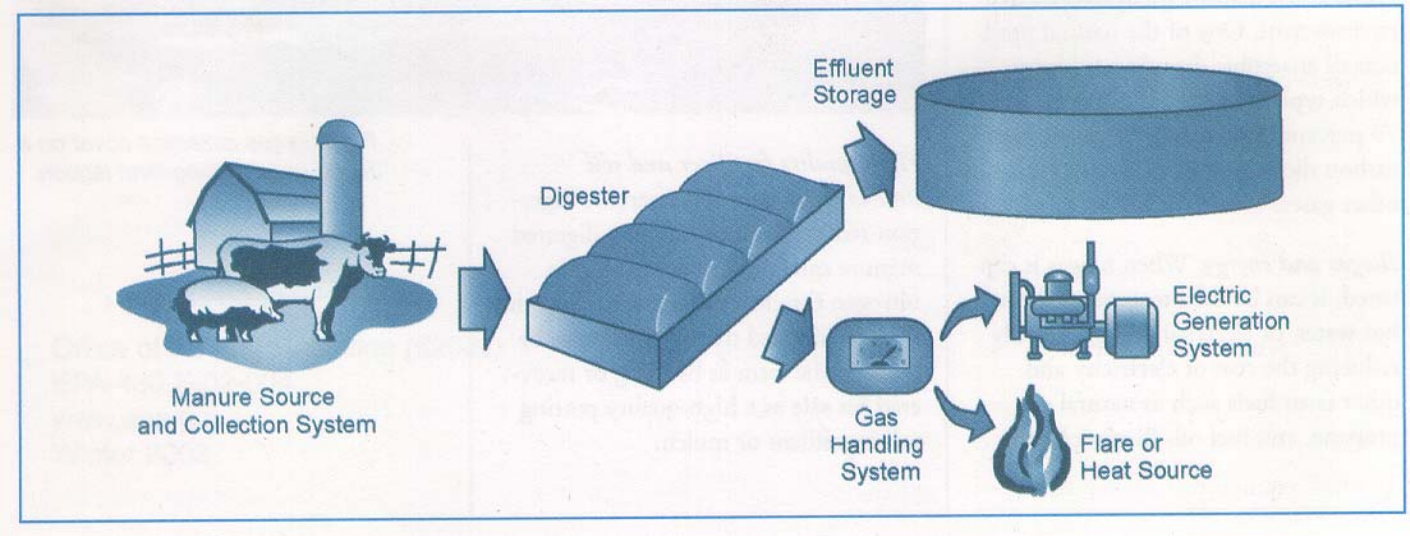
Summary

- US coal mining industry has achieved success in CMM recovery and utilization
  - US is world leader in CMM recovery
  - 34% decrease in CMM emissions since 1990
  - Over 70% of drained gas is used
- Focus of future efforts in US:
  - Continue to promote recovery and use of drained gas, especially in Western US
  - Advance recovery and use of abandoned mine methane
  - Evaluate potential for surface mine methane recovery
  - Research and promote ventilation air methane
- Internationally, CMOP continues long-standing tradition of outreach in developing countries through the Methane to Markets Partnership

What are Anaerobic Digesters?

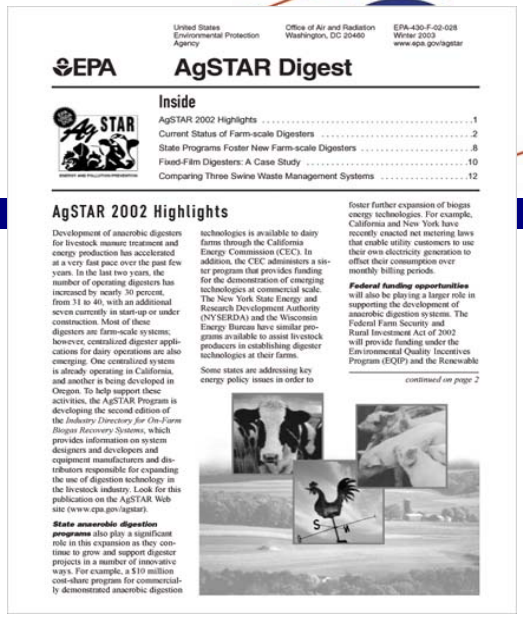
Biological treatment/stabilization systems applicable to liquid, slurry, and semi-solid waste that collect and combust off-gases.

Digesters separate manure treatment from storage functions which can result in lower initial installation costs for new or expanding farms



- ***AgSTAR Digest*** - Annual report
  - Highlights the year in animal waste digestion
  - Technologies, funding, national project listings
  - Next edition Fall 2007
  - Copies of latest edition at AgSTAR booth

- ***Managing Manure with Biogas Recovery Systems***
  - Introductory brochure on digester technology, costs, and environmental performance


United States Environmental Protection Agency | Office of Air and Radiation Washington, DC 20460 | EPA-430-F-02-028 Winter 2003 www.epa.gov/agstar

EPA **AgSTAR Digest**

Inside

AgSTAR 2002 Highlights 1
Current Status of Farm-scale Digesters 2
State Programs Foster New Farm-scale Digesters 8
Fixed-Film Digesters: A Case Study 10
Comparing Three Swine Waste Management Systems 12

AgSTAR 2002 Highlights

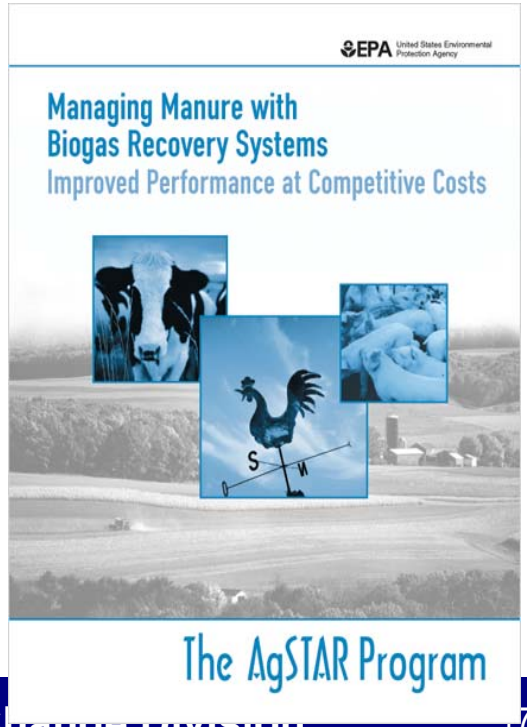
Development of anaerobic digesters for livestock manure treatment and energy production has accelerated at a very fast pace over the past few years. In the last two years, the number of operating digesters has increased by nearly 30 percent, from 31 to 40, with an additional seven currently in start-up or under construction. Most of these digesters are farm-scale systems; however, centralized digester applications for dairy operations are also emerging. One centralized system is already operating in California, and another is being developed in Oregon. To help support these activities, the AgSTAR Program is developing the second edition of the *Industry Directory for On-Farm Biogas Recovery Systems*, which provides information on system designers and developers and equipment manufacturers and distributors responsible for expanding the use of digestion technology in the livestock industry. Look for this publication on the AgSTAR Web site (www.epa.gov/agstar).

State anaerobic digestion programs also play a significant role in this expansion as they continue to grow and support digester projects in a number of innovative ways. For example, a $10 million cost-share program for commercially demonstrated anaerobic digestion technologies is available to dairy farms through the California Energy Commission (CEC). In addition, the CEC administers a sister program that provides funding for the demonstration of emerging technologies at commercial scale. The New York State Energy and Research Development Authority (NYSERDA) and the Wisconsin Energy Bureau have similar programs available to assist livestock producers in establishing digester technologies at their farms.

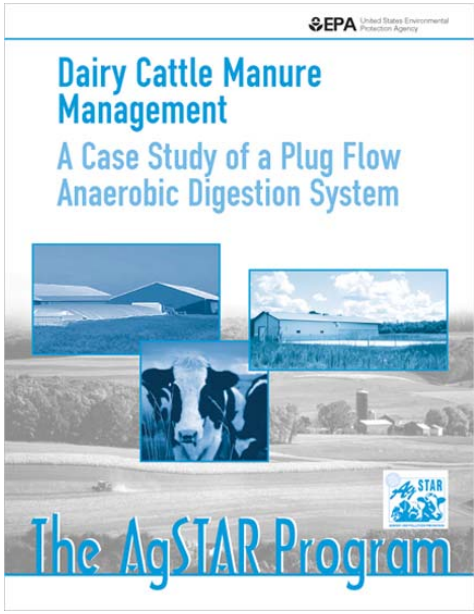
Some states are addressing key energy policy issues in order to foster further expansion of biogas energy technologies. For example, California and New York have recently enacted net metering laws that enable utility customers to use their own electricity generation to offset their consumption over monthly billing periods.

Federal funding opportunities will also be playing a larger role in supporting the development of anaerobic digestion systems. The Federal Farm Security and Rural Investment Act of 2002 will provide funding under the Environmental Quality Incentives Program (EQIP) and the Renewable

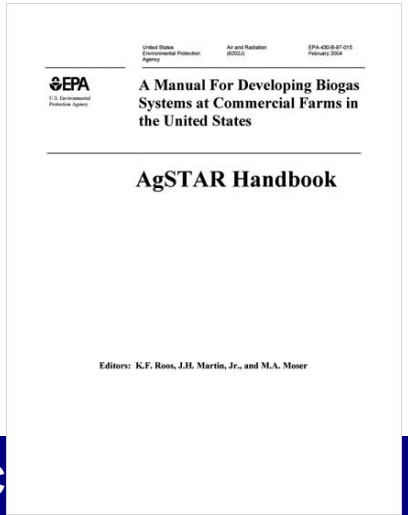
continued on page 2



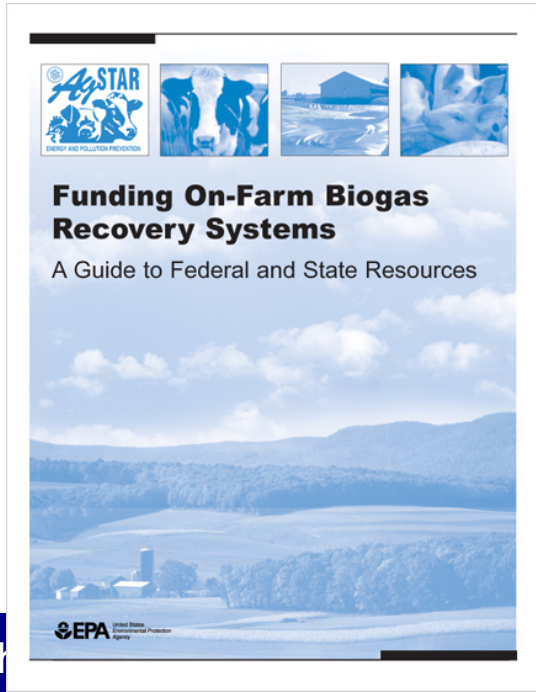
- ***A Protocol for Quantifying and Reporting the Performance of Anaerobic Digestion Systems for Livestock Manures***
  - Help standardize the process used to evaluate the performance of anaerobic digestion systems used to produce and capture methane (biogas) emissions from livestock manure
- ***Mass Balance Waste Management Evaluations*** (under way)
  - Economic and environmental process comparisons for pigs and dairy
- ***Technical Series*** (*under development)
  - *Dairy Case Study Scrape Manure
  - *Pig Case Study Flush Manure
  - *Other Digester system reports



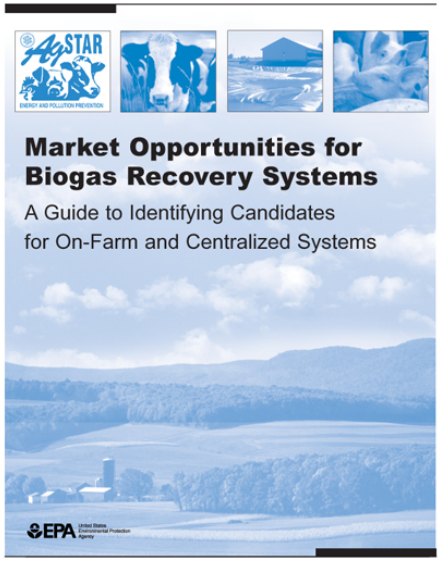
- ***Industry Directory*** (being updated)
  - Lists and provides description of designers, equipment suppliers, and consultant services.
- ***Second Edition AgSTAR Handbook*** - *A Manual for Developing Biogas Systems at Commercial Farms in the United States*
- ***FarmWare*** - develops project specific feasibility assessments
  - technology type, energy, environmental, and cost/benefit.

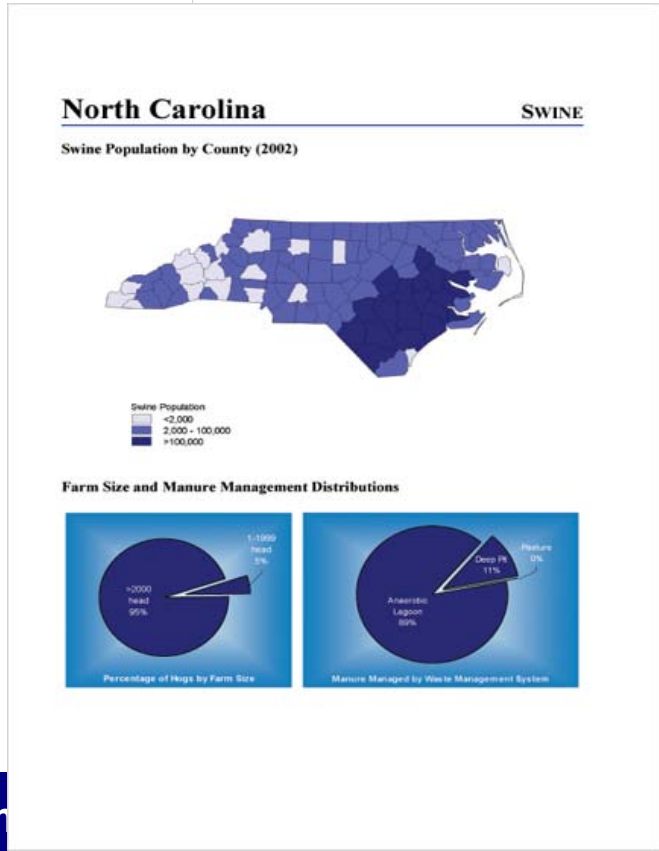


- ***Funding Guide for Federal and State Resources***
  - Summarizes federal and state animal waste digestion funding assistance
    - Grants, loans, energy production incentives
  - For each program type provides:
    - Program description
    - Eligibility requirements
    - Contacts

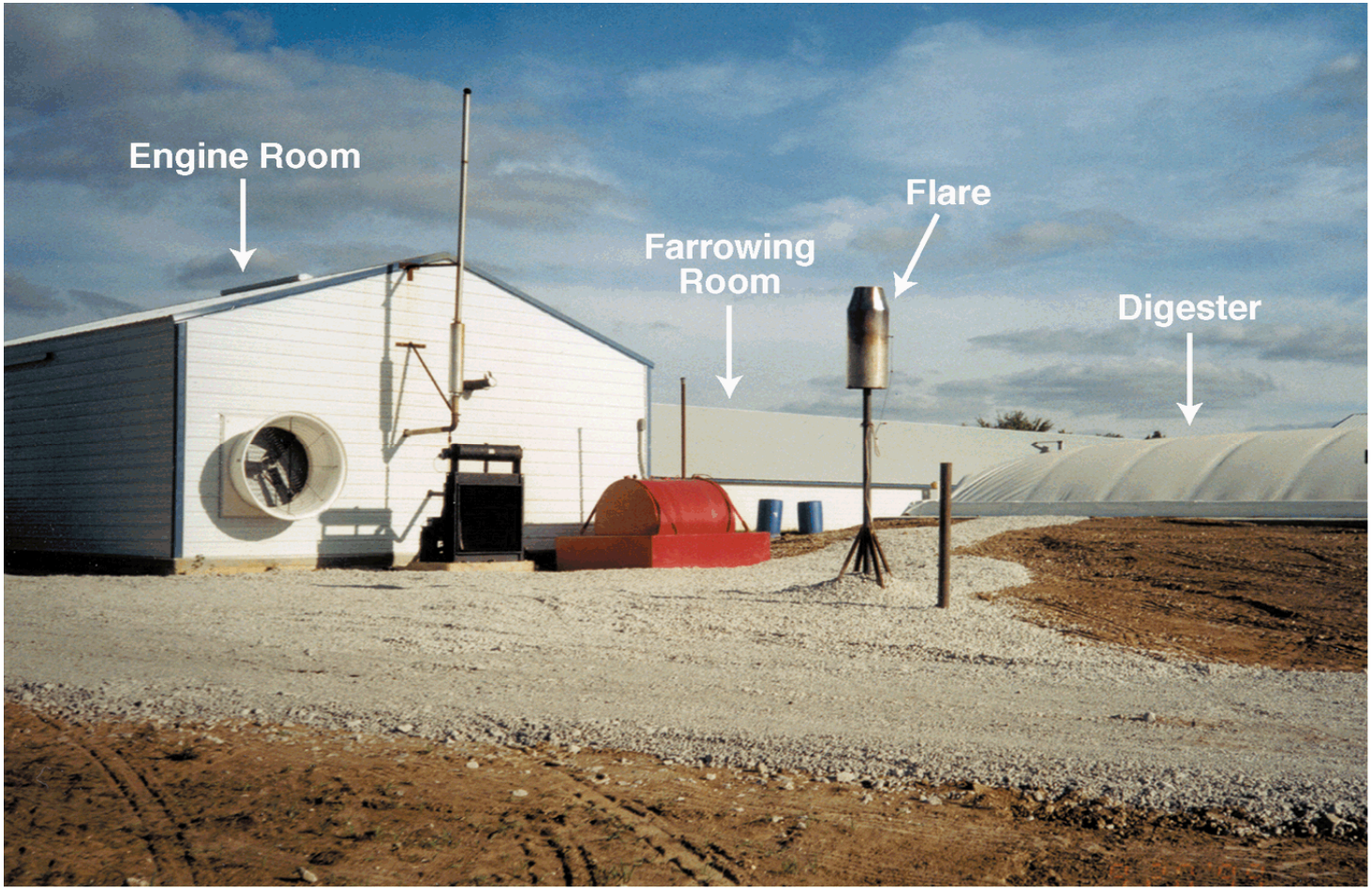


- *Market Opportunities for Biogas Recovery Systems*
  - Provides state-by-state profiles of numbers of farm candidates, renewable energy potential, and methane emission reductions.
  - Provides a summary of the national energy and digestion market potential

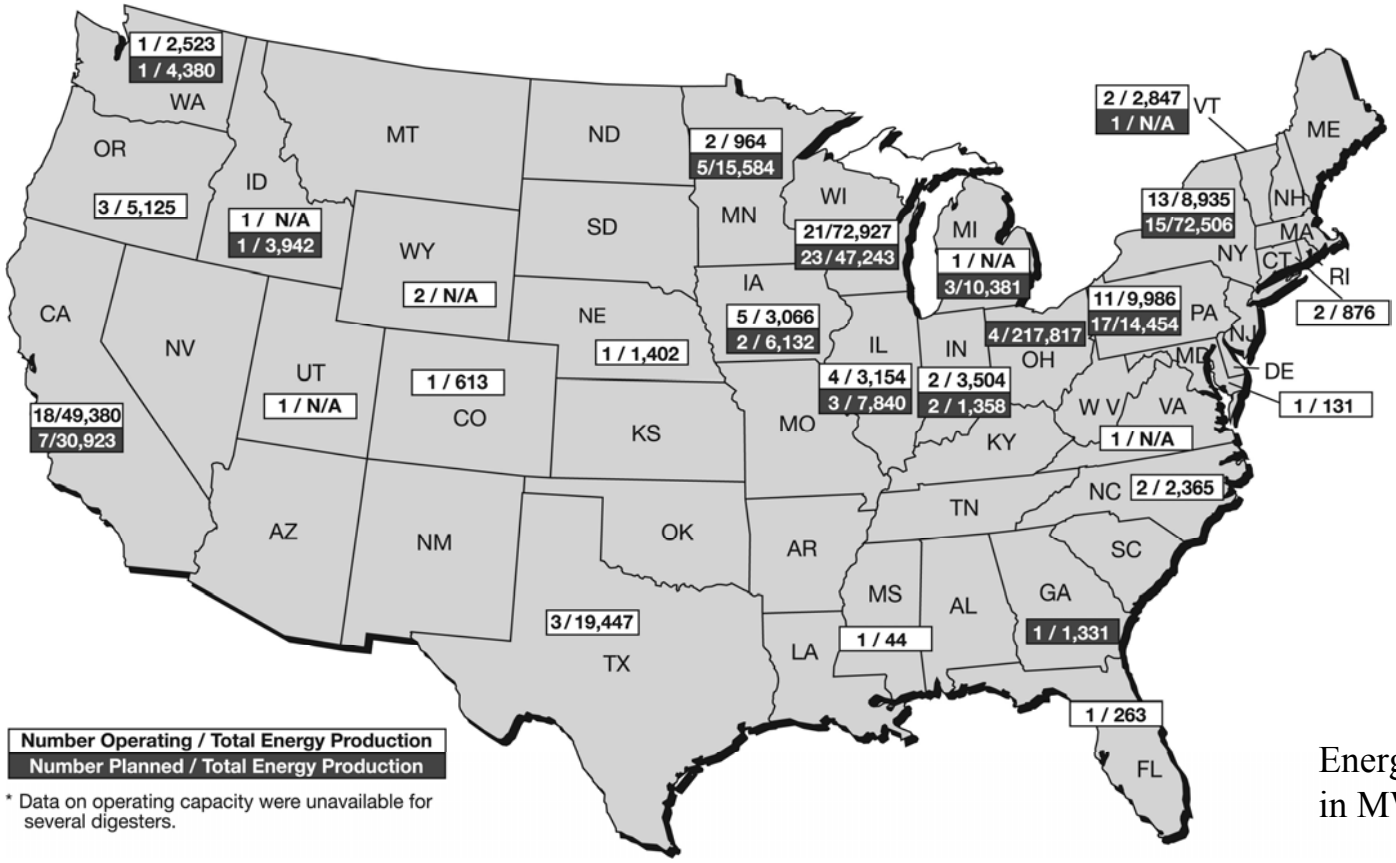




Typical Digester Configuration



Digester Distribution 2006



Energy values are in MWh

Candidate Sectors/States

Top 10 States for Electricity Production from Dairy and Swine Manure

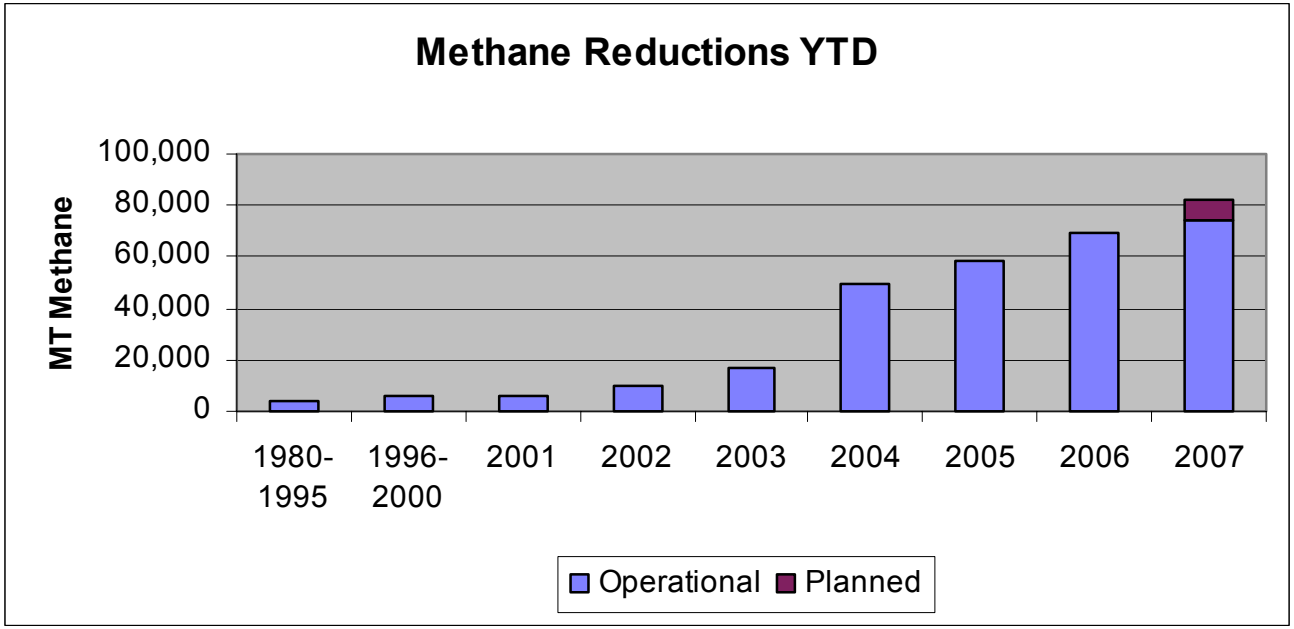
[# of Candidate Farms , Methane Emissions Reduction (000 Tons), Methane Production Potential (billion ft3/year), Electricity Generation Potential (000 MWh/year)]

SWINE FARMS				
NORTH CAROLINA	1,179	247	11.5	766
IOWA	1,022	126	10.2	677
MINNESOTA	429	40	3.5	234
OKLAHOMA	52	54	2.9	196
ILLINOIS	267	36	2.8	184
MISSOURI	200	53	2.7	177
INDIANA	234	28	2.2	145
NEBRASKA	148	25	2.0	134
KANSAS	91	29	1.6	109
TEXAS	13	21	1.1	75
Remaining 40 States	646	113	7.3	487
Subtotal	**4,281**	**773**	**48**	**3,184**
DAIRY FARMS				
CALIFORNIA	963	263	18.1	1203
IDAHO	185	61	4.0	267
NEW MEXICO	123	62	3.9	259
TEXAS	149	32	2.3	154
WISCONSIN	175	8	2.1	138
NEW YORK	157	6	2.0	132
ARIZONA	73	35	1.9	126
WASHINGTON	122	22	1.9	126
MICHIGAN	72	6	1.9	73
MINNESOTA	60	3	0.7	46
Remaining 40 States	544	75	9.4	624
Subtotal	**2,623**	**573**	**48**	**3,148**
U.S. Total	**6,904**	**1,346**	**96**	**6,332**

U.S. Estimated Livestock Potential

	MW	MWh/year	MT CH_4	Farms
Pigs	301	2,636,760	660,000	4,000
Dairy	256	2,242,560	466,500	2,500
Total	557	4,879,320	1,126,500	**6,500**

Current Digester Status



In 2006

All 'operating' projects ~275 million kWh equivalent.

~200 total projects: ~135 operating or in start-up and ~65 planned or in construction.

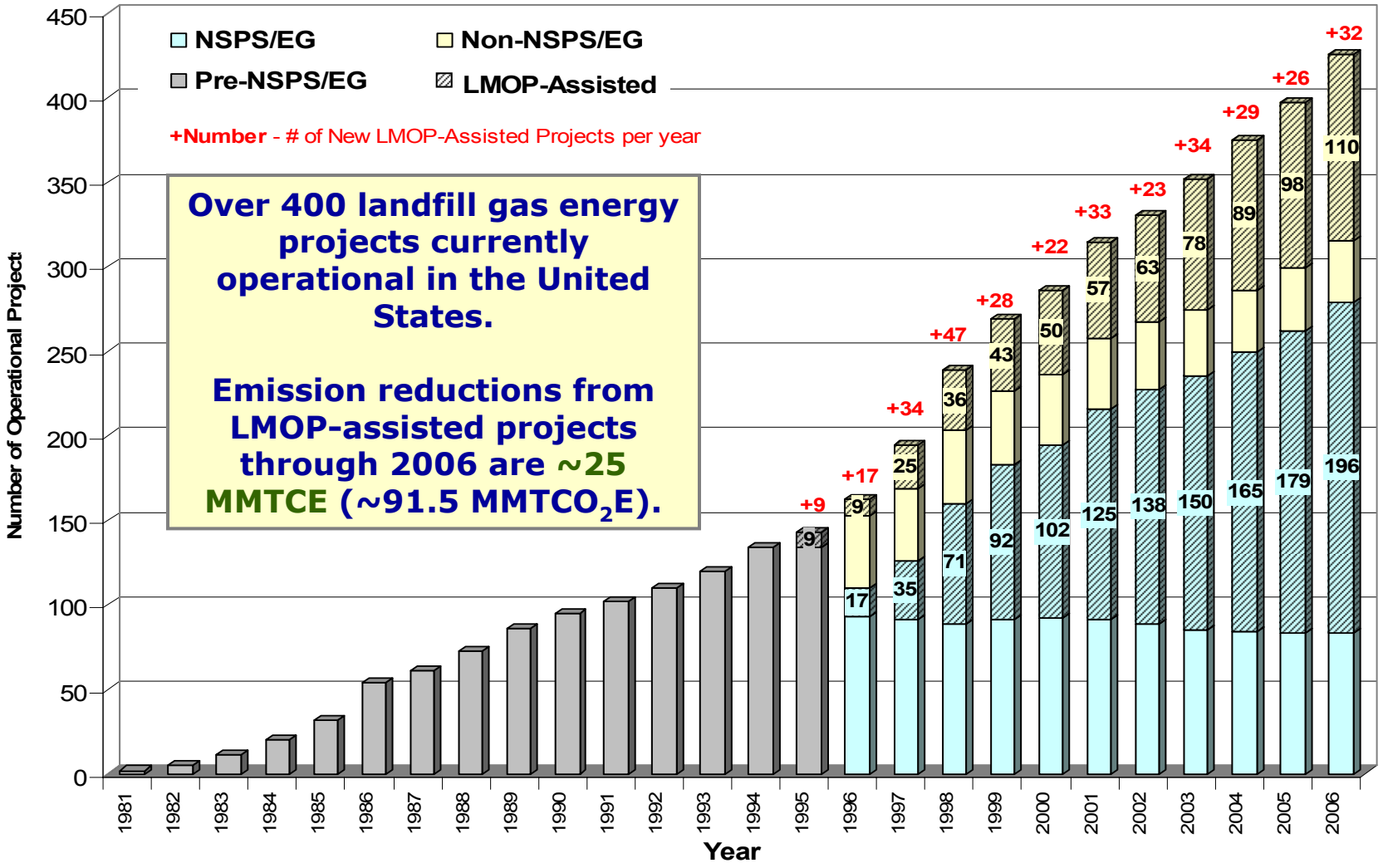
*** *Projects are estimated, currently updating database.*

Landfill Methane Outreach Program

- Partnership between EPA and the landfill gas energy industry since 1994.
- Identify and promote cost-effective technologies and practices to reduce emissions of methane, a potent greenhouse gas.
- Operations in all major industry sectors (production, processing, transmission, and distribution), representing 56% of the natural gas industry in the U.S., including 23 of the top 25 U.S. natural gas production companies.
- Natural Gas STAR International launch in September 2006

http://www.epa.gov/gasstar/

Growth in Landfill Gas Utilization Project Development

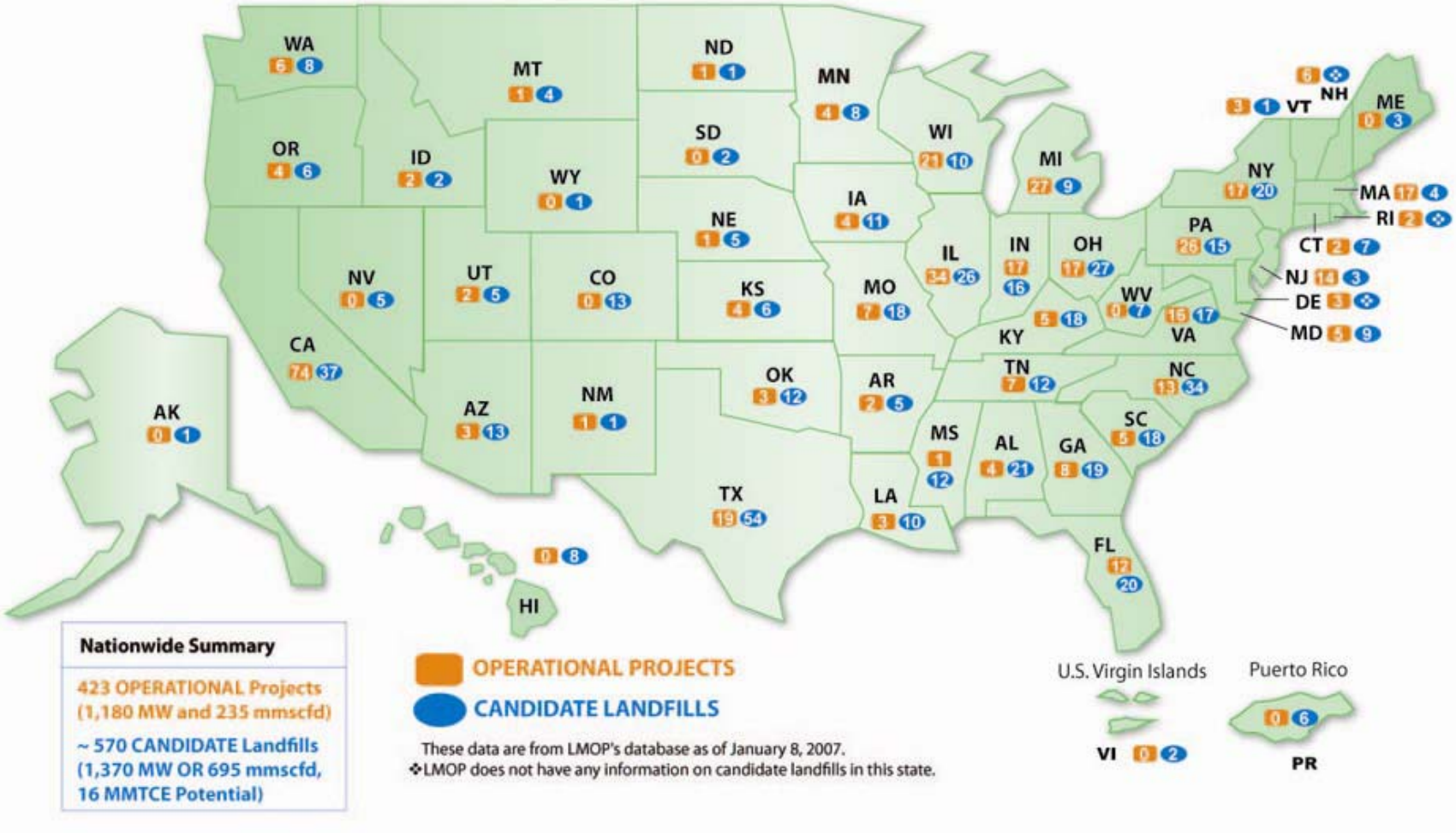


State of the LFGE Industry

(February 2007)

- **425 operational projects**
  - **10 billion kWh of electricity produced and 75 billion cubic feet of gas delivered in '06**
- **At least 30 projects under construction for 2007 & more in the advanced planning stages**
- **At least 560 candidate landfills with 1,350 MW of potential capacity *or* 250 billion cubic feet/yr of LFG for direct use and ~16 MMTCE potential emissions reductions**

Landfill Gas Energy Projects and Candidate Landfills

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Landfill Methane an Alternative Source of Power
Listen
by Jessica Jones
Day to Day, February 1, 2006 · With rising oil and natural gas prices, alternative energy sources are getting another look -- including the prospect of generating electricity from methane. The gas is created naturally by landfills, and power plants all over the United States are now burning it to make electricity. Jessica Jones of North Carolina Public Radio reports.
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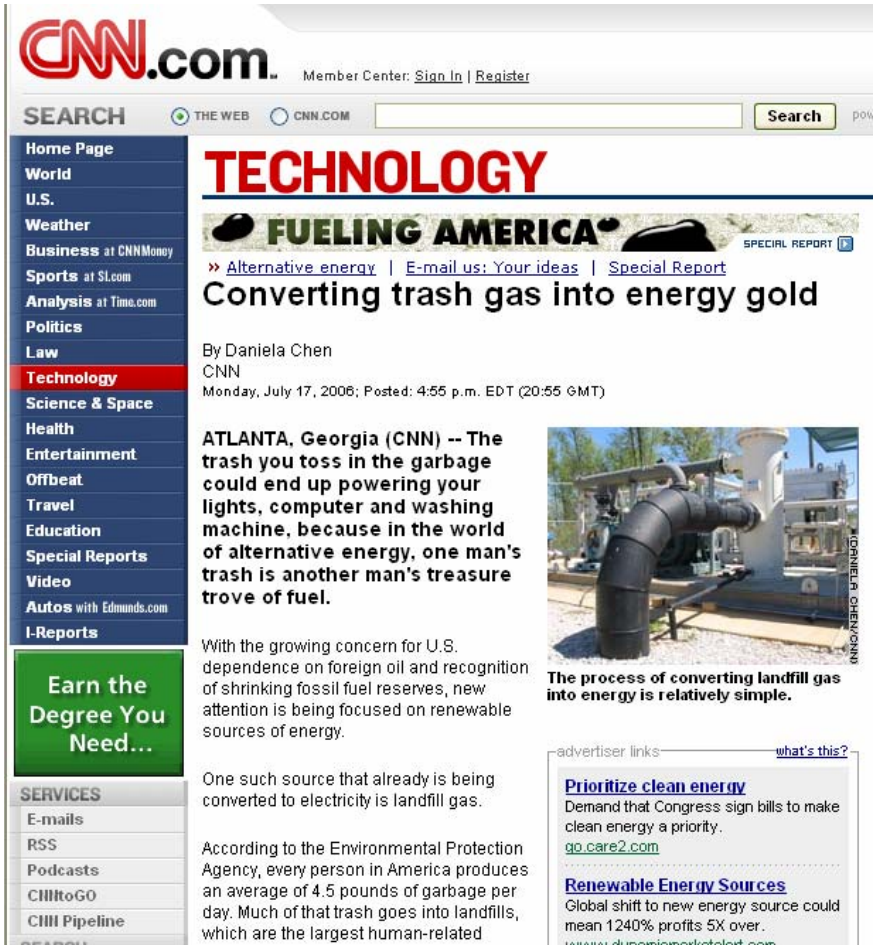
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Converting trash gas into energy gold
By Daniela Chen
CNN
Monday, July 17, 2006; Posted: 4:55 p.m. EDT (20:55 GMT)
ATLANTA, Georgia (CNN) -- The trash you toss in the garbage could end up powering your lights, computer and washing machine, because in the world of alternative energy, one man's trash is another man's treasure trove of fuel.
With the growing concern for U.S. dependence on foreign oil and recognition of shrinking fossil fuel reserves, new attention is being focused on renewable sources of energy.
One such source that already is being converted to electricity is landfill gas.
According to the Environmental Protection Agency, every person in America produces an average of 4.5 pounds of garbage per day. Much of that trash goes into landfills, which are the largest human-related
The process of converting landfill gas into energy is relatively simple.
advertiser links
what's this?
Prioritize clean energy
Demand that Congress sign bills to make clean energy a priority.
go.care2.com
Renewable Energy Sources
Global shift to new energy source could mean 1240% profits 5X over.

Partners tapping gas from landfills

By SHAWN PIATEK
TRIBUNE-DEMOCRAT BUSINESS WRITER

Johnstown's selling points to business have included cheaper labor, outdoor recreation and low crime.

Now, another distinction will be added to that list: Discount natural gas.

Rising natural-gas bills have become a nuisa... alike and t... ity a... Th... have ner i... able proc... duce natu... Jo... brin... to w... owns... Peop... bills Th... John... town... Ro... men... tive town... He... Oppo... in m... natu... muc... "V... thro... "T... busi... part... the ... "I... uni... tool for drawing new business," he said.

The involved parties met Wednesday at Sunnehanna Country Club in Westmont and announced that the plan isn't just a

Please see GAS, A5

"Johnstown's selling points to business have included cheaper labor, outdoor recreation, and low crime. Now, another distinction will be added to that list: Discount natural gas."

FROM PAGE A1

GAS

Continued from A1

vision, but a reality that is under way.

The presentation delivered during the meeting received high marks from Kathleen McGinty, secretary of the state Department of Environmental Protection.

"God gave us in Pennsylvania an incredible amount of indigenous energy resources," McGinty said. "It's our job today to make those resources work for us."

Representatives from the four ...anizations detailed ... natural-gas prices ...red their ability to ...aid the new source ...ve natural gas not ...otect the job ... but should ...nd.

Wire Techn... said natu... egun cuttin... any's botton... nnual natu... reased from ... in 1993 to $3...

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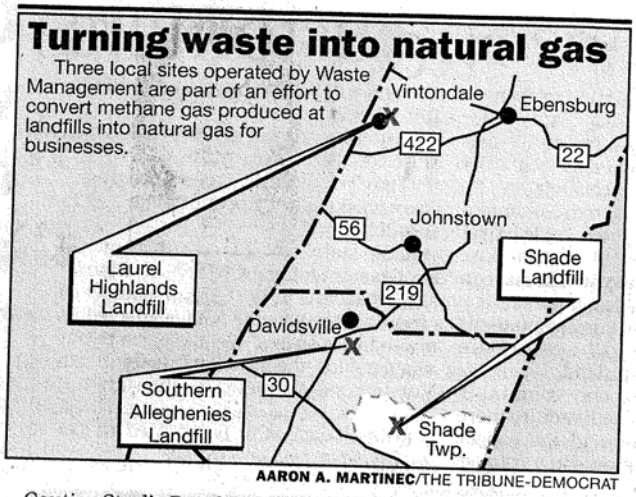


AARON A. MARTINEC/THE TRIBUNE-DEMOCRAT

Gautier Steel's Daryl DiOrrio said the new gas supply will help ... Landfill in Shade Township, near Central City, is still in the ...hase.

...r the Som- ...s is expect- ...beginning ...r.

...e wells are ... will pro- ... fuel the ...000 house- ...duction is ...s the land-

...e win-win Polacek, executive Welding ...g able to ...r cost is a ...dvantage. to have

...eached at ...dem.com.

"We think this is a tremendous opportunity that will not only allow us to save jobs, but create new ones. When you look at our balance sheet, after labor, gas is our second-greatest expense. "

Gautier Steel

"... annual natural-gas costs have increased from roughly $1 million in 1993 to $3.2 million in in 2005. 'This initiative could get us back down into the $1(million) to $1.5 million range.'"

Johnstown Wire Technology

Methane to Markets: Taking Our Approach Global

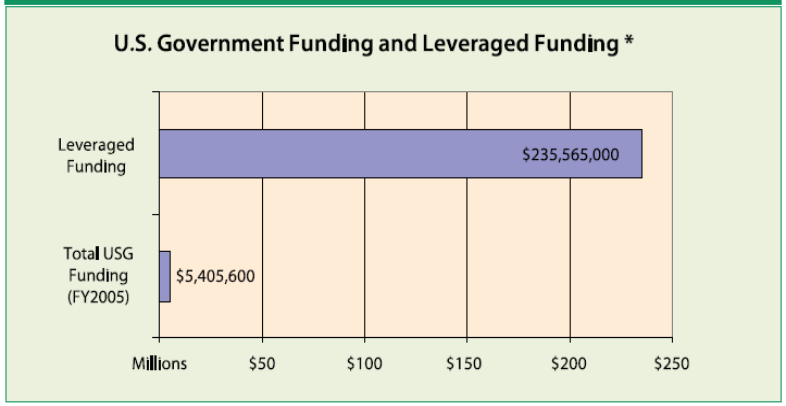
An international initiative, uniting public and private interests, ***to advance the capture and use of methane as a clean energy source****, cost-effectively and in the near-term*

- EPA is USG lead; we coordinate with State, CEQ, AID, DOE, USDA, and USTDA.
- Goals: enhance economic growth, strengthen energy security, improve air quality, improve industrial safety, and reduce emissions of greenhouse gases.
- Current focus on four sources of methane emissions: (1) oil and gas systems, (2) landfills, (3) livestock waste, and (4) and coal mines.
- 19 Partner countries; nearly 500 Project Network Members, including private sector entities, development banks, non-governmental organizations, financial and technical experts, and others.

International: Methane to Markets Partnership (cont.)

- Concrete projects underway; potential annual reductions of CH_4 emissions totaling 50 MMTCE by 2015.
- U.S. contributions have leveraged over $235 million in M2M investment.

Figure 1



- Ongoing U.S.-supported projects already expected to achieve annual reductions of approximately 5 $MMTCO_2E$.
- *Partnership Expo planned for Fall 2007 in Beijing.*

- **U.S. GHG Inventory:** produce annual inventory report; estimate emissions for key sectors; develop inventory data management system

Contact Information

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Web Sites:

http://www.epa.gov/climatechange

LMOP – epa.gov/lmop
AgSTAR – epa.gov/agstar
CMOP – epa.gov/cmop
GasSTAR – epa.gov/gasstar