Methane to Markets

Accomplishments and

Possible Future Directions

NCGG-5 – Wageningen, The Netherlands

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July 1, 2009

Methane to Markets

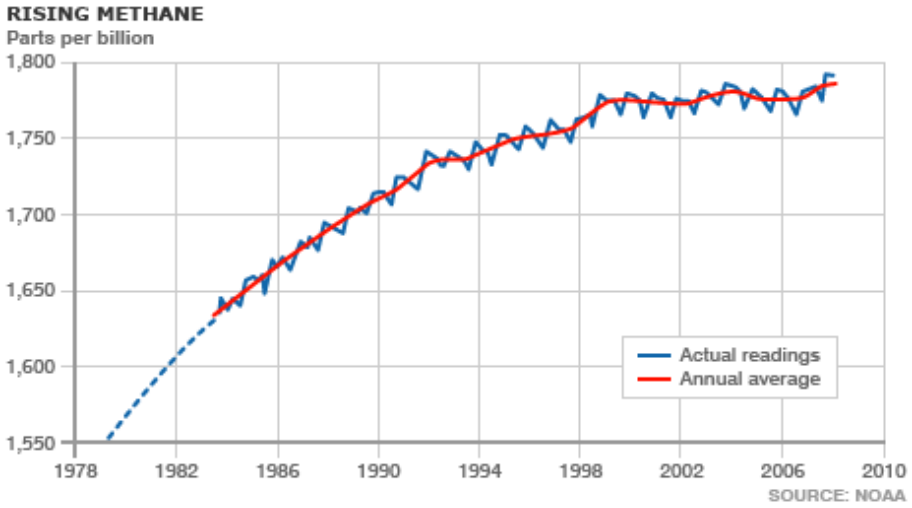
Overview

- Methane and Climate Change
- Methane to Markets Partnership
- EPA Experience and Activities
- Possible Futures for M2M

Methane to Markets

Methane (CH_4)

- Basic information
  - 100-year GWP = 25 - Lifetime = 12 years
- Primary component of natural gas.
- Many natural and anthropogenic sources
  - energy, agriculture & waste sectors
  - 50 - 70% of are anthropogenic
- Concentration of methane in the atmosphere has increased by 150% in the last 260 years
- After about a decade of slow growth – as of 2007 global average methane concentrations have started to increase



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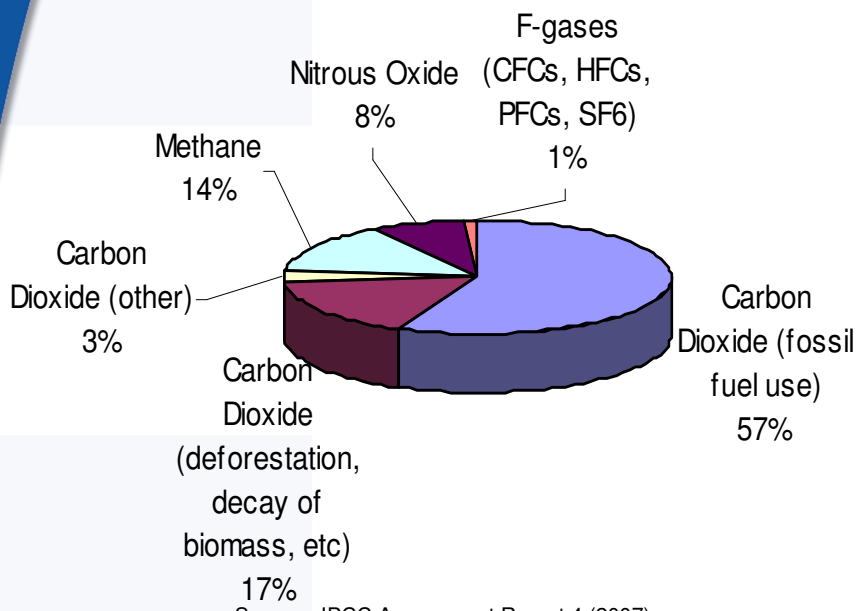
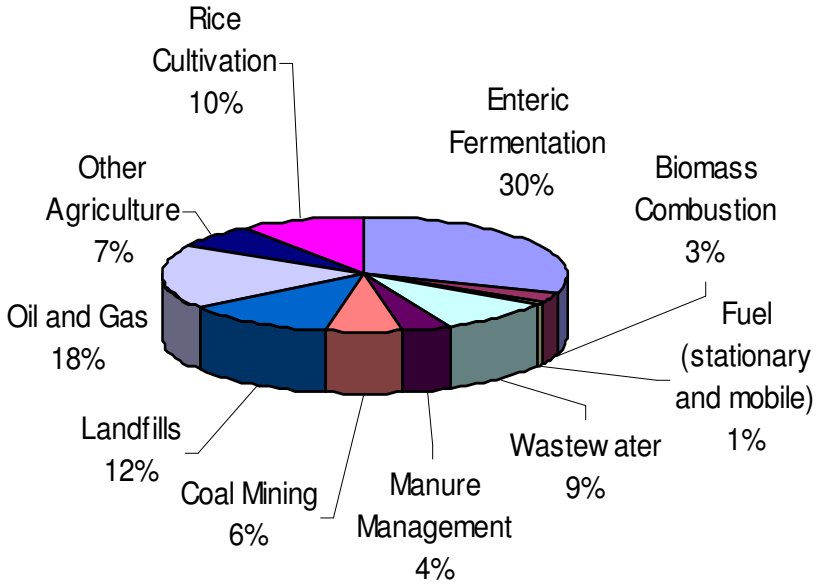
Methane Emissions Profile

Global Anthropogenic GHG Emissions by Gas (2004)



Source: IPCC Assessment Report 4 (2007)

Global Anthropogenic Methane Emissions by Source (2005)



Source: U.S. EPA Report (2006)

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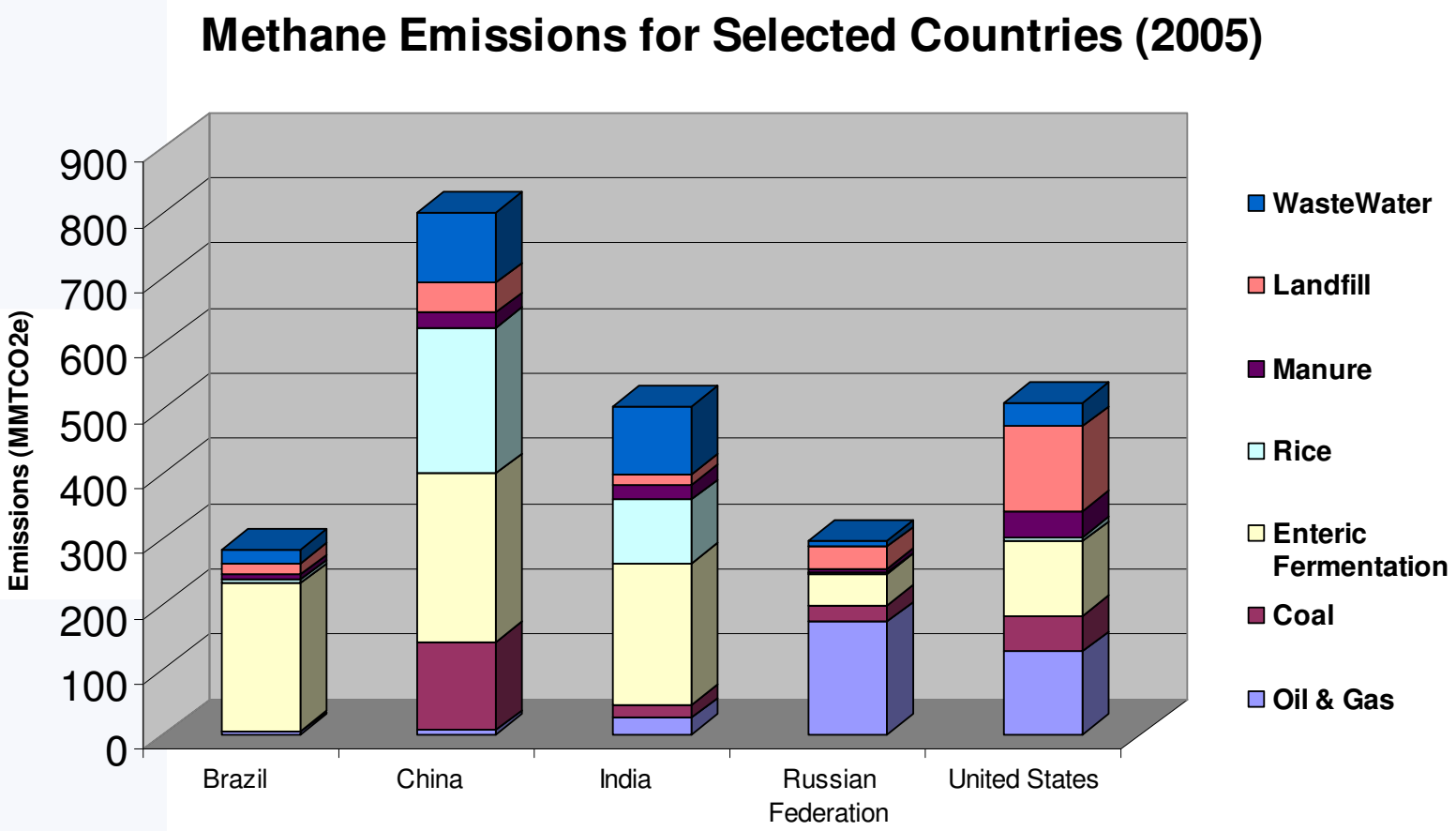
Sources and Strategies are Country-specific



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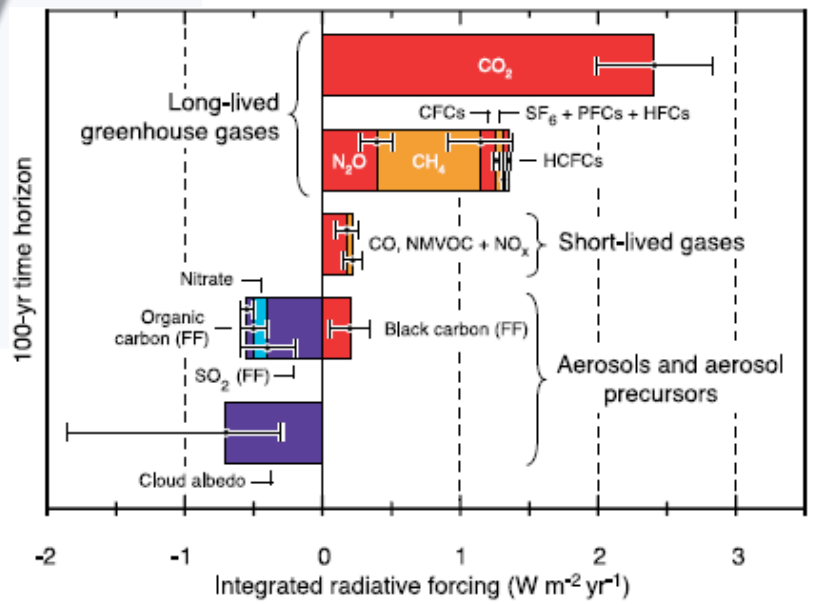
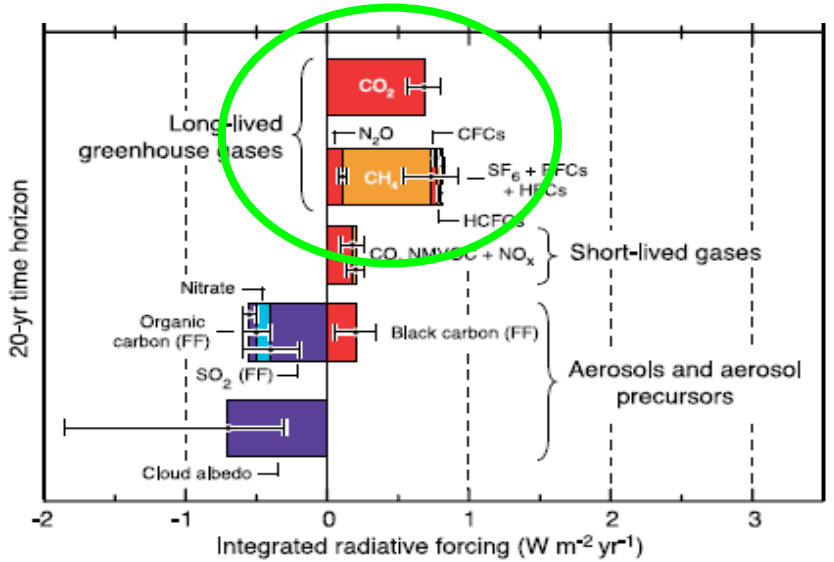
Comparative Effects of GHGs over 20 and 100 year time horizon



IPCC

Methane has a much larger influence on near term effects



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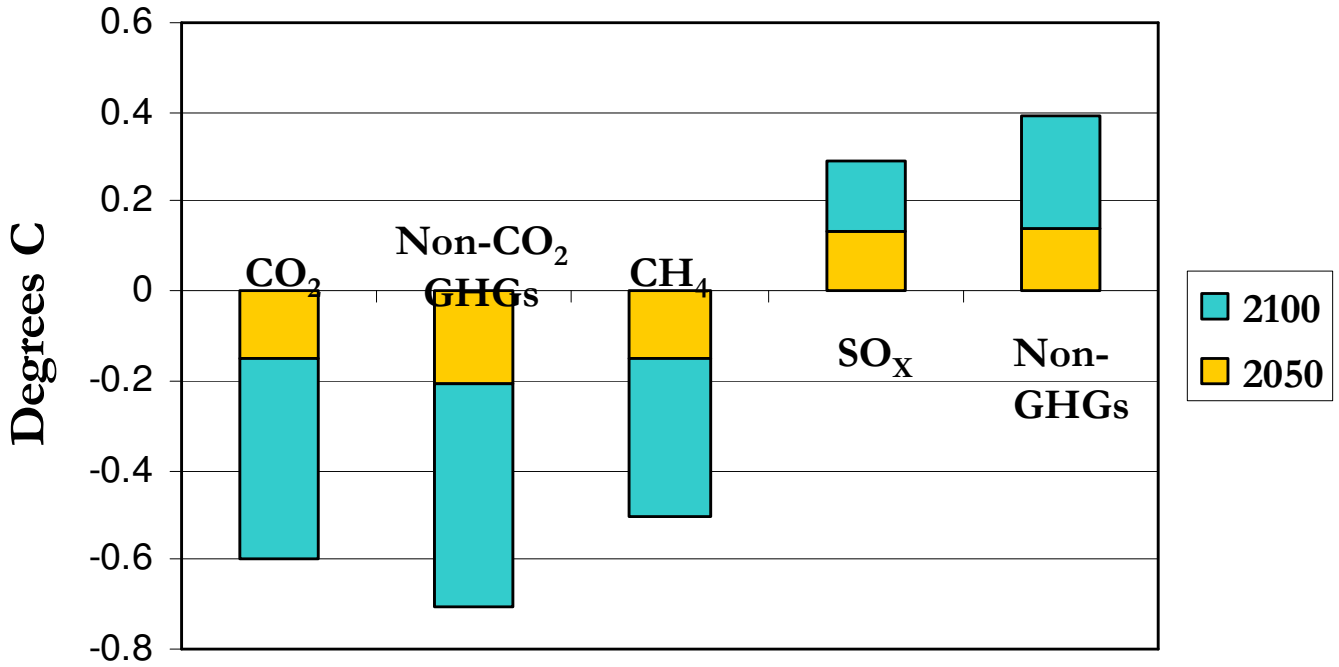
Climate Benefits of Methane Reduction

Global mean temperature effect of a 50% reduction in greenhouse emissions from reference between 2000 – 2050, maintained through 2100.

★ *Reducing CH_4 emissions has nearly the same climate benefits as reducing CO_2 emissions.*



Source: MIT, 2003

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Other Co-Benefits of Methane Reduction

- New Energy Sources
  - Mitigation makes methane available for local energy purposes, thereby strengthening energy security
- Environmental Quality
  - Local water quality improvements due to improved management of agricultural wastes
  - Reduction of local emissions of VOCs from landfills, agriculture, and oil and gas systems
- Industrial Safety
  - Methane is explosive - improved worker safety in the coal and oil & gas sectors
- Odor reductions (landfills, agriculture)

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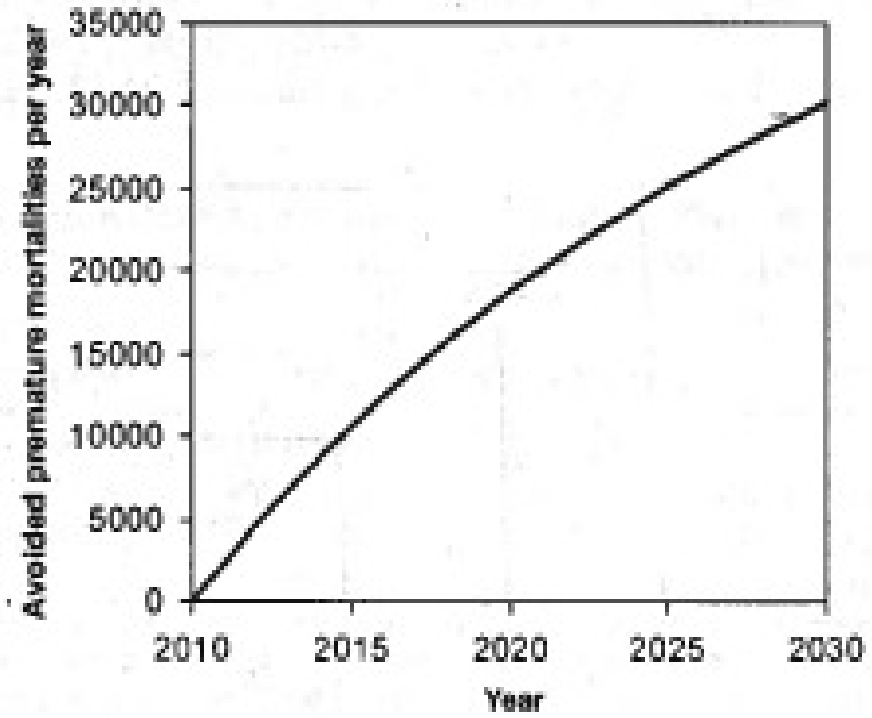
Methane - Air Quality Co-Benefits

- Methane contributes to background ground-level ozone levels by:
  - serving as an ozone precursor
  - increasing summer afternoon temperatures through climate change
- Reducing methane emissions reduces mortalities associated with ozone pollution



Avoided global mortalities based on a 65 Mt/yr reduction in methane emissions starting in 2010 (West et al, 2006)

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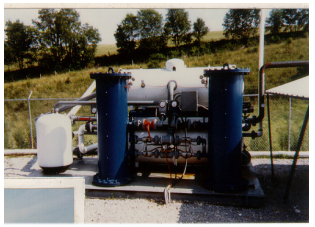
Methane Mitigation Opportunities

Source	Key Technologies
Landfills	Methane recovery and combustion (i.e., power generation, industrial uses, flaring)
Coal Mines	Methane recovery and combustion, flaring, ventilation air use
Gas/Oil Systems	Use of low-bleed equipment, and better management practices
Livestock Waste	Methane collection from anaerobic digestors and combustion (power, flaring)
Wastewater * Treatment	Methane collection from anaerobic digestors and combustion (power, flaring)
Ruminant * Livestock	Improved production efficiency through better nutrition and management
Rice Production *	Water management, organic supplements



** Sources not currently covered by M2M*

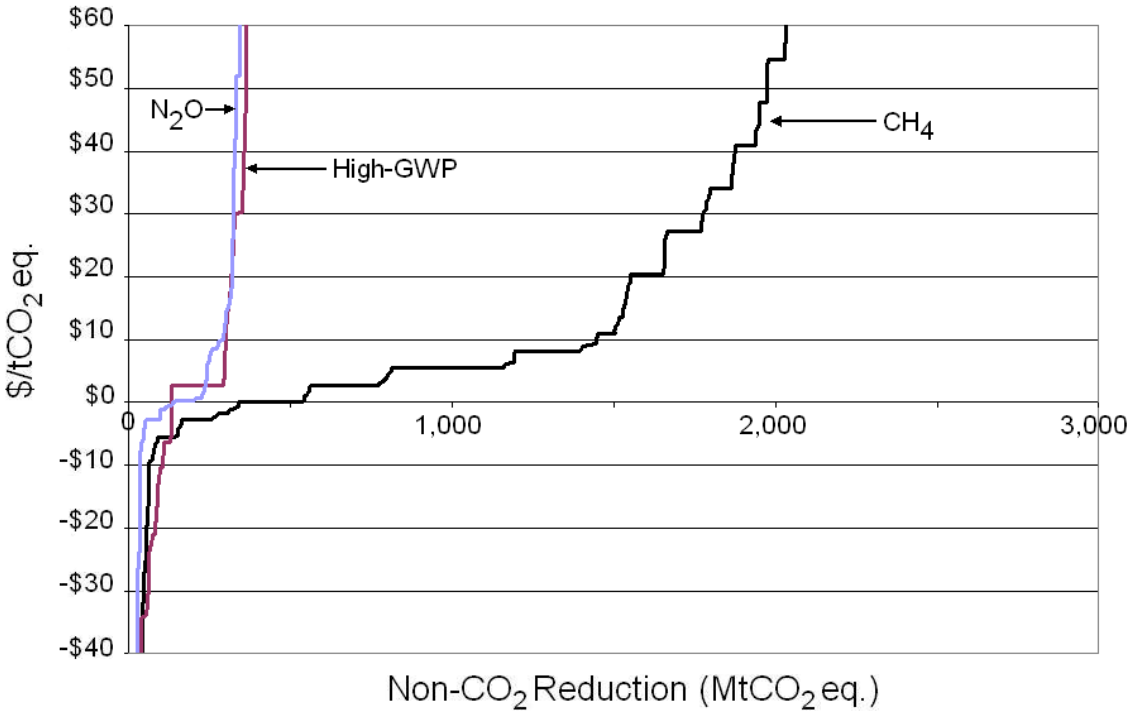
Methane to Markets

Global Mitigation Potential at Low Cost

Methane mitigation has the largest potential across all the non-CO2 greenhouse gases

- Worldwide, the potential for cost-effective non-CO_2 greenhouse gas abatement is significant (> 500 $MtCO_2eq$).
- At a cost-effective level, the potential for methane mitigation is the greatest
- At a breakeven price of $30/tCO2eq, reduction potential reaches nearly 1,800 MtCO2eq
- While less than that of methane, nitrous oxide and high-GWP gases exhibit significant cost-effective mitigation potential.

Global 2020 MACs by Greenhouse Gas Type



Methane to Markets

Policy Instruments for Methane

- Partnership programs aimed at overcoming market barriers
  - Successful strategy in US with coal, landfill & oil/gas
  - Focuses on capacity building, information sharing, and technical asssistance
- Regulatory programs
  - US Landfill Rule (Clean Air Act-NSPS) or EU Landfill Directive
- Financial Incentives
  - Tax credits (i.e., coalbed methane, landfill gas, renewable energy)
  - Can encourage energy recovery
- Market Mechanisms
  - Emissions trading or offsets (CDM/JI)

Methane to Markets

Methane in the Kyoto Protocol

- Methane included in “basket of gases”
- Domestic methane reductions targeted by many Annex I countries
  - CH4 not currently included in the EU Trading System
- Strong international interest in methane through the Clean Development Mechanism (CDM)
  - Primarily landfills, coal mines, and livestock manure, a few oil and gas projects
  - Methane recovery and use projects comprise almost 8% of projects in the pipeline – accounting for almost 69 MtCO2e
  - Projects have been slow – ie. CMM – only 10 of 72 have been registered, Landfills – 72 of 146 projects

Methane to Markets

What is Methane to Markets?

•International public-private partnership to reduce greenhouse gas emissions by increasing the capture and use of methane.

•Estimated to reach 180 MMTCO2 reductions annually by 2015.

OBJECTIVES

- Advance the recovery and use of methane while:
  - Enhancing economic growth
  - Promoting energy security
  - Improving local air quality and public health.

BENEFITS

- Stabilization/Decline in Methane Concentrations will result in:
  - Sustainability
  - Energy security
  - Health and safety
  - Profitability

Methane to Markets

M2M Partners

- Grown from 14 to 29 Partner governments
- Represent more than 62% global anthropogenic methane emissions
- 9 of the 10 top methane emitting countries
- Encourages development of ***cost-effective*** methane recovery and use opportunities -landfills, coal mines, agricultural, and oil and gas systems

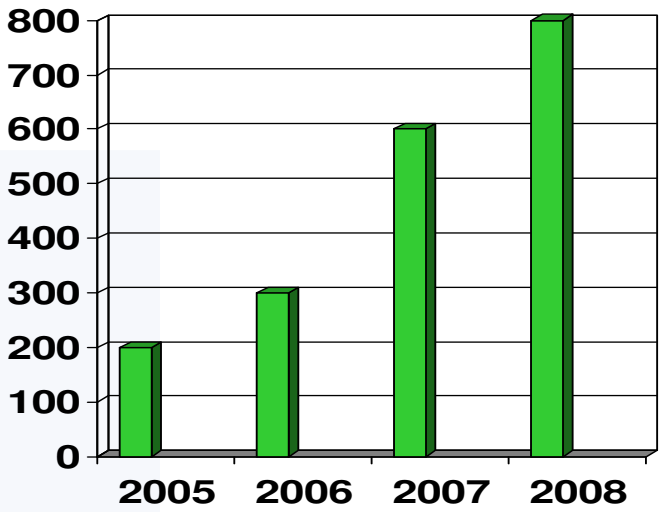
Argentina
Australia
Brazil
Bulgaria
Canada
Colombia
Chile
China
European Comm.
Ecuador
Finland
Germany
India
Italy

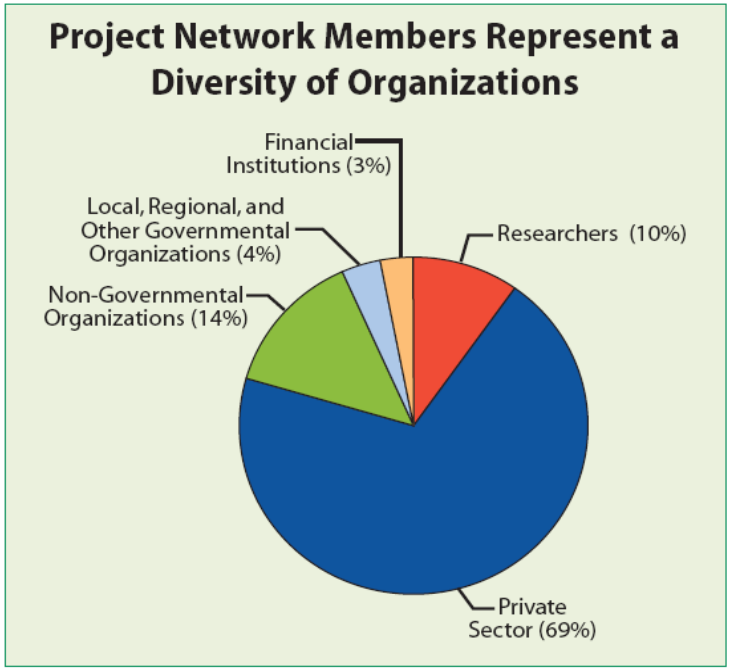
Japan
Korea
Kazakhstan
Mexico
Mongolia
Nigeria
Pakistan
Philippines
Poland
Russia
Thailand
Ukraine
United Kingdom
United States
Vietnam

Methane to Markets

M2M Project Network

- Brings necessary actors together to implement reduction projects
- Over **900** organizations
- Project Network members can:
  - Expand business and increase profits
  - Distinguish themselves in the marketplace
  - Identify financial and technical support for potential projects
  - Build capacity
  - Fulfill strategic goals
  - Mitigate climate change



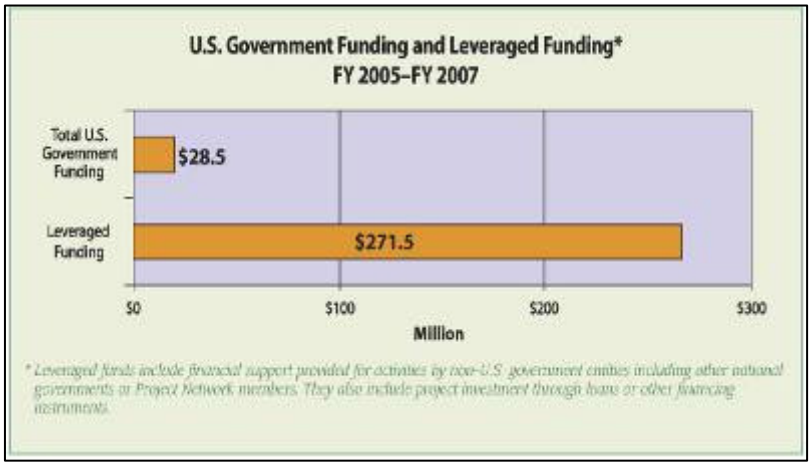


Methane to Markets

USG Experience

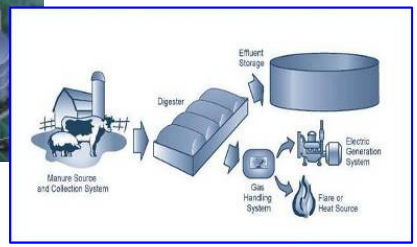
- EPA is USG-lead and architect of M2M
- Provided $38 million over four years since Partnership launch in 2004. To date:
  - Supporting a wide range of projects and activities
  - Leveraged over $270 million in public and private sector contributions

- Providing significant support to the Partnership through the ASG and technical support in all 4 sectors
  - Supporting projects in Argentina, Brazil, China, Colombia, Ecuador, India, Korea, Mexico, Mongolia, Nigeria, Poland, Philippines, Russia, Thailand, Ukraine and Vietnam.



Strategic Approach to Project Development

- Strategic Focus
  - Target technical assistance and services to countries with greatest project potential
  - Initiate capacity building and outreach efforts w/ all M2M countries
  - Leverage relationship with PN to advance projects (World Bank, ADB, ISWA)



- Key Activities
  - Technical Assistance and Project Identification
    - Data collection, assessment reports, pre-feasibility studies
  - Tool Development and Technology Transfer
    - LFG generation model, CMM and Landfill database
  - Training and Capacity Building
    - Clearing houses, training workshops, study tours, peer matching

Key M2M Accomplishments

- Brought high-level focus specifically on methane
  - Raising awareness within governments of the multiple benefits of methane recovery
  - Demonstrate importance of near-term climate benefits at low cost
- Directly involving the private sector and financing organizations
- Good complement to Kyoto – provides technical assistance and capacity building necessary to ensure long-term project success

合作机会 Methane to Markets Partnership Expo
BEIJING, CHINA
30 OCTOBER – 1 NOVEMBER 2007

- Successful engagement of key developing countries
  - China, India, Brazil, Mexico
- 150 projects and activities in countries across the globe
- Achieving real reductions – Ongoing projects and activities are expect to achieve annual emission reductions of 50 MMTCO2E

Methane to Markets

The Future of Methane to Markets

- Terms of Reference up for renewal in 2009/2010
- Growing interest in accelerating global methane efforts due to impacts in the Arctic and near-term benefits (economic-energy-climate) of methane
- Opportunities in expanding scope and commitments
  - New emission sources (wastewater, ruminants, rice)
  - New and increased commitments (financial, policies and measures)
  - Enhanced monitoring and reporting
- Possible linkages to a post-2012 agreement
- M2M Steering Committee has developed a process for moving forward
  - Steering committee will meet in September 2009 to discuss future directions

Methane to Markets

Possible Sector Expansion

Waste Water

- 9% of global emissions
- Demonstrated capture and use technologies available – consistent with existing M2M charter
- Large potential in Partner countries
- Significant environmental, energy and development co-benefits
- M2M undertaking assessment of potential opportunities

Agriculture

- Rice cultivation and enteric fermentation are large sources of emissions, 10% and 30% respectively
- Requires expanding scope of M2M – beyond capture and use
- Significant potential in developing countries
- M2M has performed an initial assessment and is now conducting further work to identify future role for Partnership in these areas
  - Attended the UNFCCC AWG-LCA
  - Developing recommendations for Steering Committee consideration

Methane to Markets

Possible New Commitments

National Methane Action Plans

- M2M country-specific action plans outline needs, issues, barriers, policies essential to driving project development and directing Partnership efforts
- Formalized action plans could include new forms of commitments
  - Developing methane emission and project opportunity inventories
  - Assessing project development needs and barriers
  - Identifying and implementing specific policies and measures
  - Mechanisms and provisions for reporting progress
- Action plans could be formally linked to receipt of technical and financial assistance
- Policy and measure commitments could be linked to other future international arrangements

Methane to Markets

Possible New Commitments (cont.)

Financial and Technical Support

- Financial and in-kind support provided to developing country partners is critical for wide-scale project development success
  - Overcoming technical, institutional, legal and other barriers
  - Building in-country capacity to facilitate long-term progress
  - Necessary complement to financial incentives (i.e. CDM)
- Outside of the US, commitments from Partner countries have only occurred on an ad-hoc basis
- Significant opportunity exists for developed country partners and Project Network members (ADB, World Bank) to make explicit and strong commitments to address methane
- New resources could provide leverage to secure policy/ measure commitments from developing country partners
- Different models exist for managing new financial commitments
  - Decentralized approach (current path)
  - Centralized (countries pooling resources), i.e., Renewable Energy Efficiency Partnership

Methane to Markets

Key Messages

An enhanced global commitment to reducing methane emissions offers a significant opportunity to achieve climate change and clean energy goals in the near-term

- Impacts in the Arctic are focusing global attention on short-term drivers to fight climate change
- Reducing global methane emissions can have a significant near-term climate impact
  - 50% reduction from BAU in 2100 could reduce global temperature by .5˚C, comparable to reductions from a CO_2 only approach
- Reductions can be accomplished with existing, cost-effective technology, and offer significant co-benefits
  - $30/tCO2eq, reduction potential of 1,800 MtCO2eq in 2020
- M2M has already mobilized a global methane community
  - 29 countries and 850 public and private sector organizations
  - Strong complement to UNFCCC – CDM/JI mechanism

M2M Upcoming Meetings/Events

- **Upcoming Methane to Markets Working Meetings:**
  - Agriculture Subcommittee Meeting – 9/3/2009 Guongzhou, China
  - **Steering Committee Meeting** – 9/10/2009 Washington, DC, USA
  - Oil and Gas Subcommittee Meeting – 9/14/2009 Lake Louise, Canada
  - Landfill Subcommittee Meeting – 9/21/09 Long Beach, CA, USA
  - Coal Subcommittee Meeting – 10/12/2009 Geneva Switzerland

- **Methane to Markets India Partnership Expo**
  - March 2-5, New Delhi, India
  - See: www.methanetomarkets.org/expo

Methane to Markets Partnership Expo

New Delhi, India • 2–5 March 2010

- Premier international forum for promoting methane recovery and use project opportunities and technologies.
- Provides participants with opportunities to:
  - Showcase and learn about methane mitigation projects and technologies.
  - Meet with potential project partners and financiers.
  - Explore key technical, financial, and policy issues.
  - Interact with high-level government agencies from 30 countries.

For more information please visit: www.methanetomarkets.org/expo

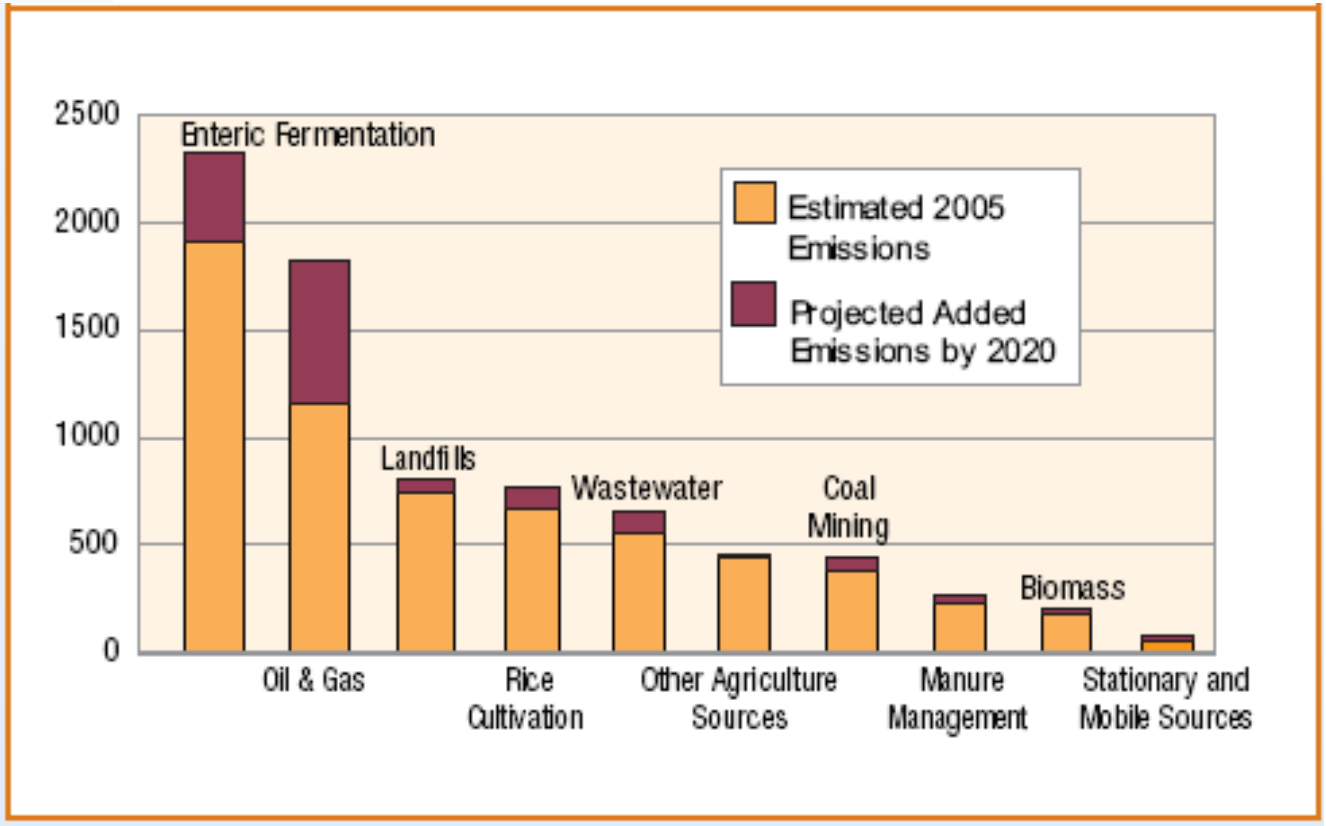
Methane to Markets

OTHER SLIDES - BACKGROUND

Methane to Markets

Projected Methane Increase to 2020

Global anthropogenic methane emissions are projected to increase by 23 percent to 7,904MMTCO$_2$E by 2020



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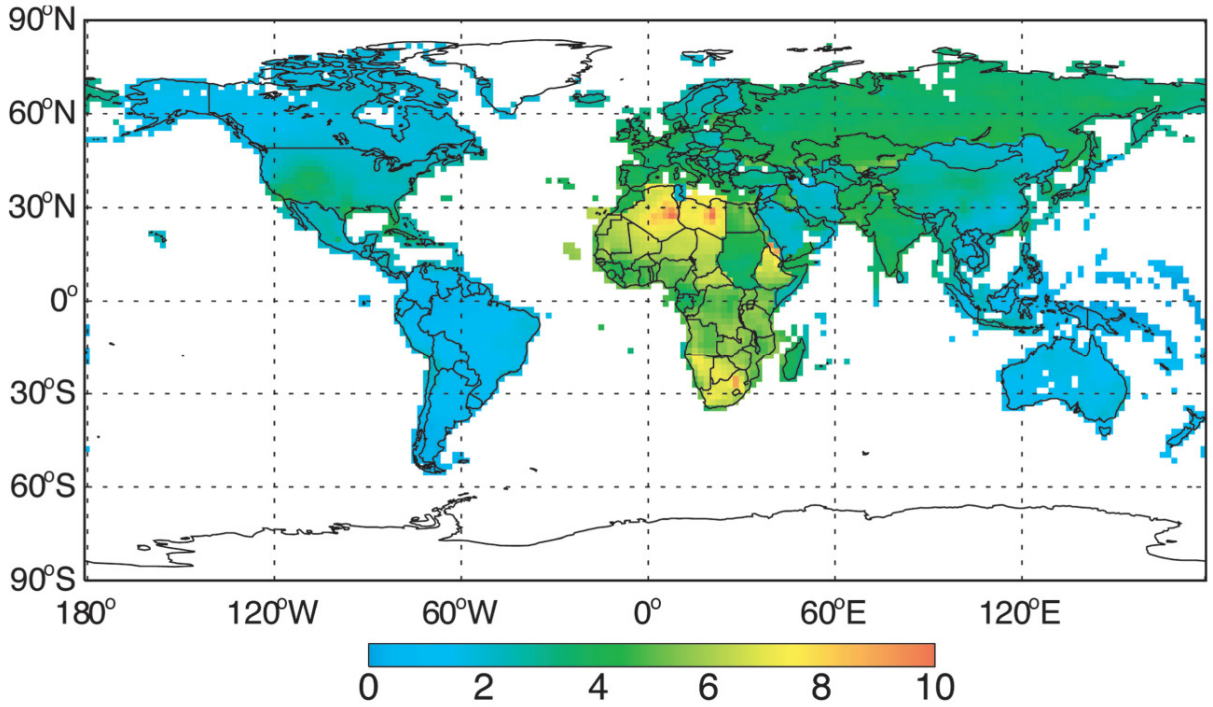
Air Quality Benefits

2030 Avoided Mortalities per Million People



Global average: 3.29 per million people

West et al, 2006

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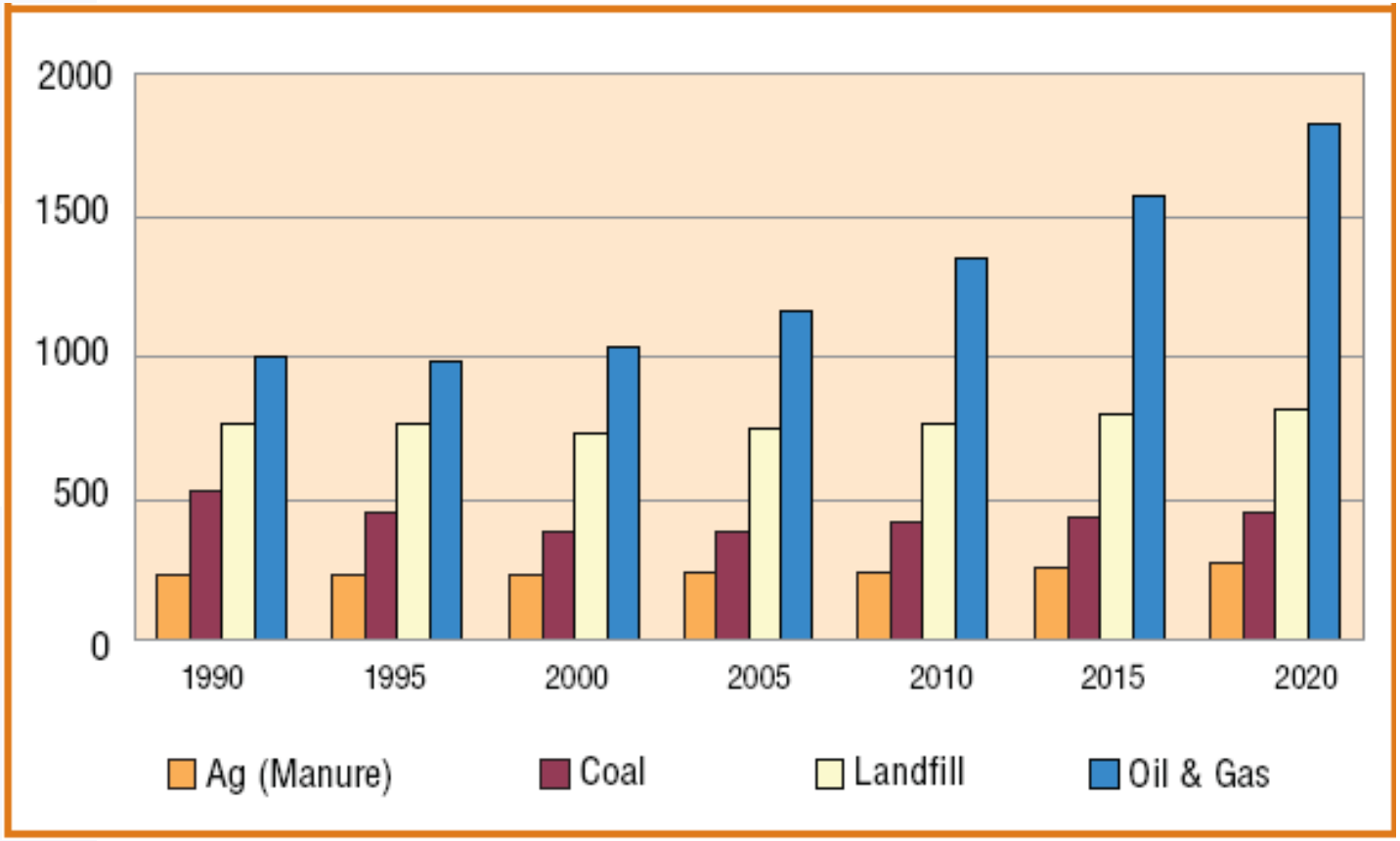
20-Year Methane Emission Growth

Growth in Global Methane Emissions by Sector



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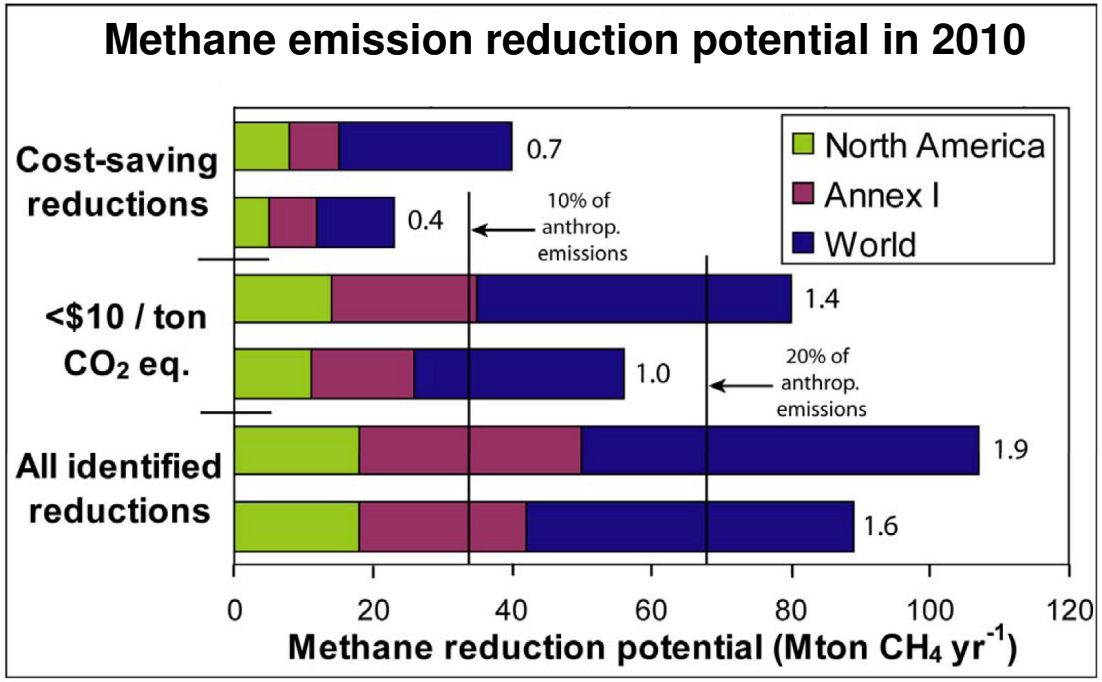
Large Mitigation Opportunities Available at Low Cost



Top Bar- IEA

Lower Bar- EPA

(IEA and EPA data as presented in West & Fiore, 2005)

- 10% of anthropogenic methane emissions could be reduced at a net cost savings by 2010
- More than 50% of all identified reductions can be reached at less than $10/ton

Methane to Markets

Large Potential in M2M Sectors

- Methane can be relatively inexpensive to reduce compared to CO_2 Based on the value of recovered gas.

- 500 $MMTCO_2e$ could be reduced at or below a $0 cost per ton of carbon.

Cost per $MTCO_2E$	$0	$15	$30	$45	$60	Baseline ($MMTCO_2E$)
Agriculture	13%	21%	30%	34%	36%	269.3
Coal Mines	15%	80%	80%	80%	80%	449.5
Landfills	12%	41%	50%	57%	88%	816.9
Oil & Gas	10%	25%	33%	38%	54%	1,695.8

Source: *Global Mitigation of Non-CO_2 Greenhouse Gases: 1990–2020* (EPA Report 430-R-06-005)

Methane to Markets

Coal Mine Methane

Project Development Support

EPA is supporting 3 major project feasibility studies in China. EPA, Trade & Development Agency, Asian Development Bank, and World Bank (WB) collaborated to develop the world's largest CMM power project (120 MW) in China.

Training and Capacity Building in India

EPA, TDA and the Government of India have established a coal mine methane (CMM) information center. The clearinghouse is managed by India's Ministry of Coal and the Ministry of Petroleum and Natural Gas and facilitates and promotes the development of CMM/CBM projects in India.

Addressing Financial Barriers

EPA is working with the UNECE to address financial barriers to CMM recovery and use in Russia and Eastern Europe. This project will also encourage investor interest in the region and help mine owners identify international investment opportunities

Overcoming Key Information Barriers

EPA has developed and International Project Database and as well as several key technical resources – i.e., CMM Global Overview, project case studies

Methane to Markets

Oil and Gas Systems

Ukraine

EPA is working with Cherkasytransgas, a Ukrainian branch company of Ukrtransgas, and the Ukrainian government to support methane reduction projects in the Ukrainian natural gas transmission and distribution sectors.

India

Through Natural Gas STAR International EPA is working with India's Oil and Natural Gas Company Ltd. and the Ministry of Petroleum and Natural Gas to conduct measurement studies, provide training and project development support

Russia

EPA is working with Gazprom to share information on methane reduction practices and technologies – a joint technology transfer workshop was held in Fall 2008

Mexico

EPA and USAID are working with PEMEX to identify and implement large-scale methane-reduction projects at their production facilities. PEMEX invested $1.3 million in methane emission-reduction efforts through 2006 and is now evaluating a $22 M effort to install dry seals on compressors

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Agriculture (Manure-Waste)

Southeast Asia

EPA and the World Bank are supporting livestock waste management projects in Southeast Asia; 2 operational projects, 6 under construction, 100 more in planning stages (China, Thailand, and Vietnam) – Reductions of 500,000 MTCO2e

Mexico

EPA and USAID are working throughout Mexico to capture and use methane from livestock waste management systems by promoting technology transfer and demonstration projects; strengthening capacity of local institutions; and developing supportive policies to nurture the methane capture industry

Colombia

EPA is analyzing current livestock waste management practices to determine the livestock sector and regions with the greatest opportunity for emission reduction project opportunities.

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Landfill Gas to Energy

Project Identification and Assessment

EPA has identified and analyzed over ***40 potential landfill gas energy projects*** across the world. These analyses were presented at the 2007 Partnership Expo in Beijing.

Tools to Advance LFG Project development

EPA is developing a suite of tools that will help landfill owners and operators collect the data they need to determine the feasibility of their sites and market them more efficiently to project developers.

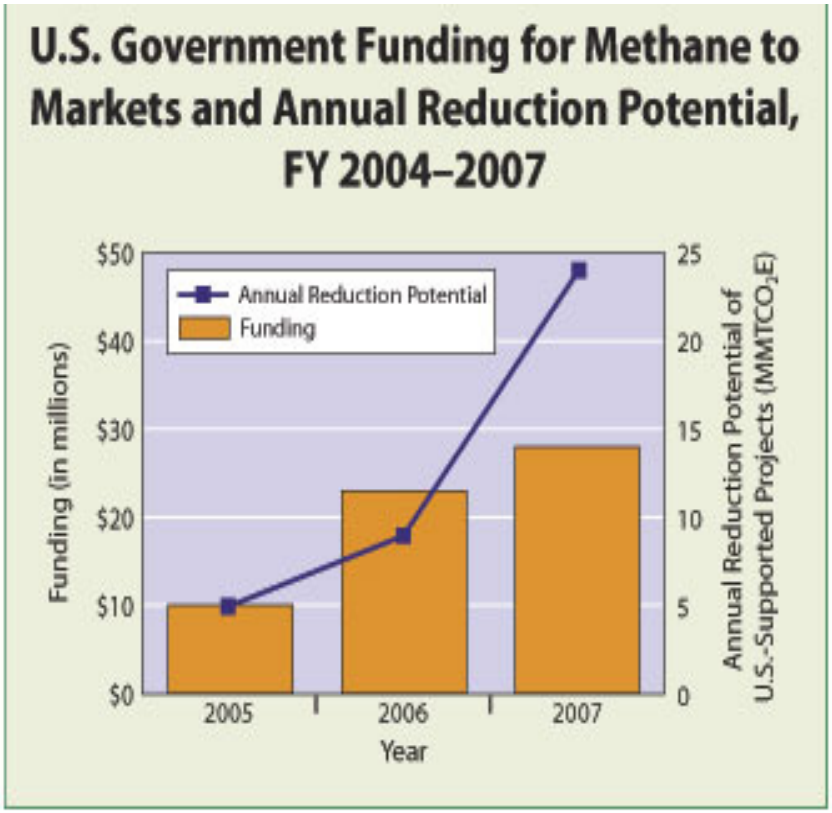
- Country Specific LFG Recovery Models (Mexico, Ecuador, C. America, Argentina)
- International Landfill Database.

Training and Capacity Building

EPA and its Partners held capacity-building workshops in Brazil, China, Colombia India, Russia, Ecuador and Turkey. EPA offers technical support and training focused on landfill operations and maintenance, LFG collection systems, gas modeling, and project development

USG M2M Accomplishments to Date

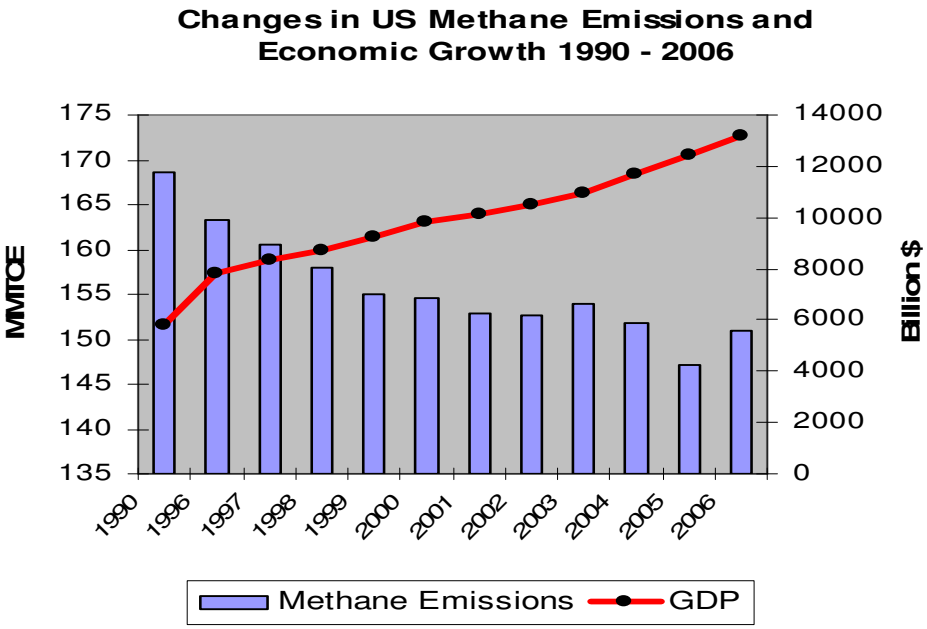
- Ongoing projects and activities are expect to achieve annual emission reductions of 24 MMTCO2E.
- Government funds leverage significant investment and engagement from the private sector



Methane to Markets

EPA Domestic Experience

- **Natural Gas STAR**
  - over 100 companies (57% of industry) in program
  - Since 1993, companies have reported reductions of 63 MMTCE, valued at over $4.2 billion USD.
- **Coalbed Methane Outreach Program**
  - 86% of mine degasification CH4 is used (up from 25% in 1993)
  - industry effort to demonstrate use for ventilation air methane
- **Landfill Methane Outreach Program**
  - Over 445 US projects -- tripled since 1994
  - Strong corporate interest in use of landfill gas
- **AgSTAR**
  - Since 1994, the number of biogas recovery systems has doubled; over 180 projects - generating about 300 million kWh per year.



AgSTAR ENERGY AND POLLUTION PREVENTION

LANDFILL METHANE OUTREACH PROGRAM

NaturalGas EPA POLLUTION PREVENTER

COALBED METHANE OUTREACH PROGRAM

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