Reporting and Review of Methane Emissions under the UNFCCC

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Who Reports Emissions under the UNFCCC?

«Forty Developed countries (Annex I) report annually
«Developing countries (non-Annex I) – report periodically as part of their national communications
What/how do Annex I Parties report?

« Six main GHG gases/species: CO2, CH4, N2O, HFCs, PFCs, SF6 and SO2, CO, NOx and NMVOCs
« All sectors – Fuel combustion, fugitive fuel emissions, industry, agriculture, waste, and forestry
« In accordance with IPCC guidelines and guidance
« Electronically using a detailed Common Reporting Format … 40+ tables, covering activity data and emission factors
« Methodological information and any changes in methods in a written report
The UNFCCC process includes an extensive peer review and quality control process of Annex I data

«Since 2000, all data are reviewed annually by individual experts, panels and “in country” reviews
«Over 100 experts participate every year
«30-40 new experts participate in UNFCCC expert training courses each year
«Annual reports and data are available on the secretariat’s web site
http://unfccc.int/national_reports/items/1408.php

The review process has led to more timely, complete and accurate Annex I data
Methane Emission have Declined in most Annex I Countries since 1990
Methane emissions have declined by approximately 20 Tg since 1990.

Fugitive (30%) and agriculture (15%) emissions have declined the most!
National Policies & Measures are Targeting Key Sources (Examples)

Fugitive
« Adoption of improved technologies and practices
« Shifts in coal production from deep mines
« Reductions in gas pipeline leaks

Agriculture
« Improvements in manure management

Waste management
« Landfill gas capture and use
« Municipal waste incineration
« Recycling of organic and other types of waste
Concluding remarks…

« Annex I Parties are providing high quality data suitable for scientific and policy uses
« Analyses using the MAGICC model suggests that the reductions in Annex I emissions are consistent with the slow growth in atmospheric concentrations over the last several years\(^1\), however…
« A lack of consistent data from Non-Annex I Parties limits scientific understanding of changes in atmospheric concentrations

1) Paper submitted to Journal of Climate Change
A Whirlwind Methane Tour -- Technologies, Economics and Policy

Dina Kruger, Director
USEPA Climate Change Division
April 4, 2005
Overview

- Technology Assessment
- Economic Assessment
- Policy Context for Methane Reductions

Is it feasible to achieve a global warming success story with methane?
Global Methane Emissions by Source, 2000

Total emissions in 2000 = 5,933 MtCO2e

- Manure: 4%
- Rice: 11%
- Enteric Fermentation: 28%
- Natural Gas Systems: 15%
- Coal Mines: 8%
- Oil: 1%
- Solid Waste: 13%
- Waste Water: 10%
- Fuel Stat. & Mobile: 1%
- Biofuel Combustion: 4%
- Biomass Burning: 5%
- Biofuel Combustion: 4%

Source: US EPA
Reducing CH$_4$ from Energy

« Coal Mines
  – Drill wells to recover CH$_4$ released by mining
  – Use in Pipelines, electricity, at the mine
  – Improve mine safety

« Oil and Gas Systems
  – Reduce leaks and improve practices at all stages of system
  – More product to sell
Reduce CH4 from Waste

« Landfills
  – Collect CH_4 generated by waste decomposition
  – Use for electricity, industry, communities, vehicles, flare
  – Improve safety and odors

« Livestock Manure
  – Collect CH_4 generated in large dairy/swine lagoons
  – Use on-farm, generate electricity, flare
  – Reduce odors, improve water quality
Reduce CH$_4$ from Agriculture

« Ruminant Livestock
  – Improve diet and nutrition
  – Improve overall animal health
  – Increased product (milk, meat, work) from animals
  – Lower emissions per unit product

« Rice Cultivation
  – Use different cultivars
  – Modify water management, fertilization practices
  – More research needed to ensure productivity maintained and no unintended effects (i.e., N$_2$O)
<table>
<thead>
<tr>
<th>Source</th>
<th>Near-Term Potential</th>
<th>Expanded Longer-Term Potential?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Mining</td>
<td>Strong</td>
<td>Yes (mine ventilation air)</td>
</tr>
<tr>
<td>Oil &amp; Gas Systems</td>
<td>Strong</td>
<td>Yes (better leak detection)</td>
</tr>
<tr>
<td>Landfills</td>
<td>Strong</td>
<td>Yes (recycling, advanced landfilling practices)</td>
</tr>
<tr>
<td>Livestock Manure</td>
<td>Good, but *</td>
<td>Yes (new technologies)</td>
</tr>
<tr>
<td>Ruminant Livestock</td>
<td>Limited</td>
<td>Yes, but*</td>
</tr>
<tr>
<td>Rice Cultivation</td>
<td>Limited</td>
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</tr>
</tbody>
</table>

* Significant deployment challenges (i.e., number of actors, markets)
Several economic assessments of methane available since late 1990s

Stanford Energy Modeling Forum just completed study of non-CO2 GHG abatement potential
- International teams developed unified data sets (EPA, AEA, Ecofys) for methane and other non-CO2 GHGs
- Economic assessment disaggregated by methane source and by country or region
- These data used by over 19 international climate modeling teams (MIT, EPRI, PNNL, AIM, RIVM, etc)
- Special Issue of Energy Journal in Summer 2005
- Data available on the EPA website: www.epa.gov/methane
2010 Coal Mining Cost Curve (for selected countries)
2010 Aggregate Cost Curve (by Region; coal, gas & solid waste)
New Work: Cost Curves will Change over Time
U.S. Cost Curve for Coal Mining Sector
## Barriers beyond Economics

- Lack of awareness of emission levels and value of lost fuel
- Lack of information on and training in new technologies and practices
- Traditional industry practices
- Regulatory and legal issues
- Limited methane markets and infrastructure
- Uncertain investment climate
Policy Instruments for Methane Recovery

« Voluntary programs aimed at overcoming market barriers
   – Successful strategy in US with coal, landfill & oil/gas
   – Focuses on cost-effective reduction opportunities

« Regulatory programs
   – Ex: US Landfill Rule, EU Landfill Directive, flash tanks
   – Generally motivated by other environmental concerns

« Financial Incentives
   – Tax credits (i.e., coalbed methane, renewable energy)

« Market Mechanisms
   – Emissions trading or offsets

All policy instruments are not appropriate for all methane sources!
Methane in the Kyoto Protocol

« Methane included in “basket of gases”

« Domestic methane reductions targeted by many Annex I countries
   – However, CH$_4$ not currently included in the EU emission Trading System

« Strong international interest in methane through the Clean Development Mechanism (CDM)
   – Primarily landfills and livestock manure
   – CDM is off to a “slow start” administratively
Methane to Markets Partnership

« Launched in November 2004 through US leadership
« Promotes near-term development of cost effective methane projects
« Will provide targeted assistance to developing and transition countries
« Focuses on coal, oil & gas, landfills, and manure
« 15 Countries have joined
  – Argentina, Australia, Brazil, China, Colombia, India, Italy, Japan, Korea, Mexico, Nigeria, Russia, Ukraine, United Kingdom, and the United States
  – Canada, Germany have stated intent to join
  – ~55% of global emissions covered already
Methane to Markets 
Plays a Unique Role

« Ensures high-level focus specifically on methane
  – Overcomes the neglect that goes with being the “second most important GHG”
  – Raises awareness within governments of the multiple reasons for methane recovery
« Directly engages the private sector and financing organizations in methane recovery
« Creates opportunities for exchange and action between all participants with a role in project development

Methane to Markets supports the goals of the UN Framework Convention.
It is not an “alternative” to the Kyoto Protocol
Methane is essentially “natural gas”
- Technologies for methane recovery and use are available
- Favorable economics due to the market value of natural gas

Many methane projects can be readily “added on” or integrated into ongoing operations
- Issues like premature retirement of capital are rare

The non-climate reasons for reducing methane are frequently more important to the involved parties
- Safety issues
- Productivity
- Quality of life – odors, clean fuel supplies
So, is there potential for a “success story” here?

« It depends…
  – Technically: significant, near-term reduction potential
  – Economically: many profitable opportunities and more at comparatively low-cost (in climate terms)

« But what level of CH$_4$ reduction is “success”? 
  – Methane to Markets & the Kyoto Protocol will result in emission reductions
  – Are these approaches “enough”?

« In 2002, we examined the feasibility of the methane component of the “Hansen scenario”
  – Could we stabilize methane emissions over the period 2000 to 2050?
  – The analysis has not been updated but main findings hold true
Global CH4 emissions and stabilization at 2000 levels

Global Methane Emissions & Stabilization at 2000 Levels

Source: Courtesy H. Pitcher MiniCAM B2 run

Tg Methane

1990 2000 2010 2020 2025 2030 2040 2050 2060 2070 2080 2090 2100

Difference
138Tg or ~35%

Difference
69Tg, ~20%
Global and Regional Anthropogenic Methane Emission Projections (Tg-CH$_4$)
Conclusion

« Stabilization could nearly be achieved in 2025 based on the emission reduction potential associated with four major methane sources: landfills, coal mines, natural gas and oil systems, and manure management systems.

« Maintaining stabilization through 2050 would necessitate emission reductions across a wider array of sources, particularly ruminant livestock and rice production.

« But success is also dependent on
  – A willingness to pay
  – Ability to achieve global participation in reducing emissions