Energy Sector Methane Recovery and Use Initiative

The IEA is undertaking a strategic initiative to improve global energy data and analysis by better incorporating energy sector methane emissions and recovery opportunities. The ultimate goal of this effort is to expand opportunities for cost-effective methane reductions from oil and natural gas facilities, landfills, and coal mines. Methane (CH_4) is a hydrocarbon that is the primary component of natural gas. It is also a potent greenhouse gas (GHG), meaning that its presence in the atmosphere affects the earth's temperature and climate system. As a result, efforts to reduce methane emissions by using methane for energy production can yield environmental, economic, and energy benefits.

In July 2005, the G8 heads of state asked the IEA to map out a "clean, clever, and competitive energy future." The IEA responded with a broad array of initiatives in the following priority areas:

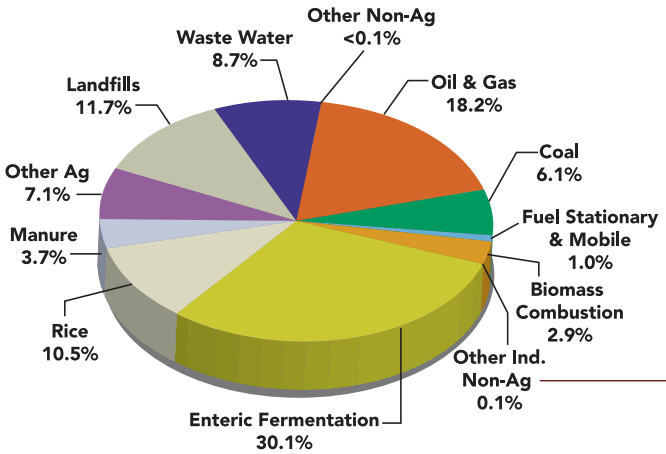
- Alternative energy scenarios and strategies
- Increased energy efficiency
- Cleaner use of fossil fuels
- Carbon capture and storage
- Renewable energy
- Enhanced international cooperation

The IEA's Energy Sector Methane Recovery and Use Initiative relates to these G8 initiatives by helping to reduce short-term greenhouse gas emissions cost-effectively. It also fosters international coordination on research and development, and promotes sound energy policies and practices on a global scale.

Why Focus on Energy Sector Methane Emissions?

- Methane is the **second largest** anthropogenic (i.e., human-made) **GHG** behind carbon dioxide (CO_2), but is over 20 times more effective than CO_2 at trapping heat in the atmosphere.
- Methane emissions from energy-related activities—primarily landfills, coal mines, and oil and natural gas systems—comprised approximately 36 percent of the global anthropogenic methane emissions in 2005. **Recovering methane** from these sources is often **cost-effective.**
- Energy sector methane emissions are concentrated in a few key countries, **offering opportunities** for **international collaboration.** In 2005, China, Russia, and the United States accounted for 32 percent of the world's methane emissions from landfills, coal mines, and oil and natural gas systems.*

Global 2005 Anthropogenic Methane Emissions by Source*



* Source: Global Anthropogenic Emissions of Non-CO_2 Greenhouse Gases 1990-2020, U.S. Environmental Protection Agency, June 2006.

Energy Sector Opportunities for Methane Recovery and Use

Oil and Natural Gas Systems

Methane emissions from the production, processing, transmission, and distribution of oil and natural gas primarily result from normal operations, routine maintenance, and system disruptions. Emissions vary greatly from facility to facility and are largely a function of operation and maintenance procedures and equipment conditions.

Current opportunities for reducing methane emissions include both procedural and hardware improvements. Methane emission reduction opportunities generally fall into one of three categories:

- Technologies or equipment upgrades that reduce or eliminate equipment venting or fugitive emissions.
- Improvements in management practices and operational procedures.
- Enhanced management practices that take advantage of improved technology.

In all cases, reducing methane emissions makes additional gas available for sale and use.

Table 1. 2005 Oil and Gas Industry Methane Emissions From the Top Emitting Countries and Regions

Country	2005 Oil and Gas Industry Methane Emissions ($MtCO_2e$)
Russia	172.7
United States	127.6
Ukraine	90.8
Mexico	77.2
Iran	58.7
Rest of Middle East	51.4
Nigeria	51.3
Turkey	50.9
Indonesia	48.6
Turkmenistan	46.2
Venezuela	45.4
United Arab Emirates	39.8
Uzbekistan	39.6
Canada	38.3
India	26.0
Rest of SE Asia	19.7
Algeria	15.1
Argentina	15.1
Romania	9.3
Kuwait	8.9

Source: Global Anthropogenic Emissions of Non-CO_2 Greenhouse Gases 1990-2020, U.S. Environmental Protection Agency, June 2006.

Landfill Gas Recovery and Use

Landfill gas is created as a natural byproduct of decomposing organic matter disposed of in landfills, and consists of about 50 percent methane.

The principal approach to reducing methane emissions from landfills involves the collection and combustion or use of landfill gas. Landfill gas utilization technologies focus on renewable electricity generation and direct gas use. Electricity generation involves piping collected methane to reciprocating engines, combustion turbines, or other devices where it can be converted to electricity. Direct use technologies include combusting gas in boilers, furnaces, kilns, or other equipment to provide steam or heat, or processing the landfill gas for other beneficial uses such as vehicle fuels or chemical production. Many direct use projects use landfill gas directly as a medium-Btu fuel, while others require the gas to be upgraded and distributed to a natural gas pipeline.

Table 2. 2005 Landfill Methane Emissions From the Top Emitting Countries and Regions

Country or Region	2005 Landfill Methane Emissions ($MtCO_2e$)
United States	130.6
Rest of Africa	57.9
China	46.0
Rest of SE Asia	44.2
Russia	34.2
Mexico	33.3
Canada	25.3
Saudi Arabia	19.4
Poland	17.0
South Africa	16.8
Brazil	16.6
India	15.9
Rest of Latin America	14.7
Ukraine	13.4
South Korea	10.7
Rest of Non-EU Eastern Europe	10.4
Turkey	10.4
Israel	9.7
Indonesia	9.6

Source: Global Anthropogenic Emissions of Non-CO_2 Greenhouse Gases 1990-2020, U.S. Environmental Protection Agency, June 2006.

Coal Mines

Methane is produced from underground and surface mines, and as a result of post-mining activities including coal processing, storage, and transportation. Underground mines are the single largest source of coal mine methane emissions in most countries.

To reduce explosion hazards, methane is removed from underground mines either in advance of mining, during mining activities, or after mining has occurred. Instead of releasing this methane to the atmosphere, it can be used profitably in a number of ways. Among these are natural gas pipeline injection, power production, co-firing in boilers, district heating, coal drying, and vehicle fuel.

Table 3. 2005 Coal Mining Activities Methane Emissions From the Top Emitting Countries and Regions

Country or Region	2005 Coal Mining Activities Methane Emissions ($MtCO_2e$)
China	135.7
United States	55.3
Ukraine	26.3
Russia	26.2
North Korea	25.6
Australia	21.8
India	19.5
Poland	11.3
Germany	8.4
South Africa	7.4
United Kingdom	6.7
Kazakhstan	6.7
Czech Republic	4.8
Colombia	3.4
Romania	2.8
France	2.6
Mexico	2.5
Rest of Non-EU Eastern Europe	2.2
Turkey	1.8

Source: Global Anthropogenic Emissions of Non-CO_2 Greenhouse Gases 1990-2020, U.S. Environmental Protection Agency, June 2006.

CASE STUDY: Coal Mine Methane (CMM) Recovery and Use in Jincheng, China

The Jincheng Mining Group will be undertaking the world's largest CMM recovery and use project by adding a third CMM-generated power plant at the Sihe Mine in Jincheng, Shanxi Province, China. The project will recover CMM for use in Caterpillar internal combustion engines with 120 megawatts of power generating capacity.

The Sihe Mine project will cost $237 million U.S. dollars. Funding for the project consists of a $117 million loan from Asian Development Bank for project development; a $500,000 technical assistance grant from the United States Trade and Development Agency supporting project design, engineering, and procurement; other equity and debt sources such as Japan Bank for International Cooperation and various local entities; and an agreement with the World Bank Carbon Finance Unit to purchase carbon credits generated by the project.

What Is the IEA Doing?

The next steps for the IEA's Energy Sector Methane Recovery and Use Initiative include:

- Incorporating methane recovery and use into the IEA's energy models and analysis to improve analysis and help identify additional cost-effective energy recovery opportunities.
- Highlighting successful national policies, market activities, and lessons learned from countries with methane recovery activities underway.
- Coordinating IEA outreach efforts in key countries with the Methane to Markets Partnership, an international initiative focused on developing voluntary partnerships to advance cost-effective methane recovery and use projects internationally. For more information about the Methane to Markets Partnership, visit www.methanetomarkets.org.
- Working with the oil and gas and coal sectors to incorporate methane recovery into the investment and planning processes.

Benefits of Methane Recovery and Use

- Increase energy efficiency.
- Use an otherwise wasted resource to provide a convenient, cost-effective source of energy.
- Improve worker safety.
- Improve air quality.
- Reduce GHG emissions.
- Achieve progress toward sustainable development goals.
- Provide economic growth and energy security.

What Are the Challenges?

Several factors can impede the successful identification and implementation of methane recovery and use projects. These include:

- A lack of awareness of emission levels and the value of lost fuel.
- A lack of information and training in available technologies and management practices.
- Traditional industry practices.
- Regulatory and legal issues.
- Limited methane markets and infrastructure.
- An uncertain investment climate.

For more information

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