Methane to Markets

The U.S. Government's Methane to Markets Partnership Accomplishments





Fifth Annual Report
November 2010

USAID FROM THE AMERICAN PEOPLE
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Contents

November 2010

Methane to Markets

Dear Colleagues,

Climate change impacts are starting to be seen all around the world, and the science on methane's role in climate change is clear. Methane is a potent and short-lived greenhouse gas; its emissions currently contribute to more than one-third of today's atmospheric warming. Reducing methane is one of the best strategies for avoiding near-term impacts of climate change. In addition, commercially proven technologies and practices have tremendous potential for achieving reductions today while providing valuable benefits to the economy, clean energy, air and water quality, and human health.

For these reasons, the United States and 13 other countries came together in 2004 to form the Methane to Markets Partnership. Over the past 6 years, the Partnership has flourished; 38 governments and more than 1,000 private sector and non-governmental organizations have created a vibrant international community committed to fighting climate change and creating new sources of clean energy. The Partnership has shown that developed and developing countries can work together with the private sector to fight climate change while delivering valuable economic, environmental, and national security benefits.

All along, the United States has been a strong supporter of Methane to Markets. Through the combined effort of five federal agencies, the United States has allocated more than $50 million to develop projects in Partner Countries and is directly supporting more than 300 projects and activities around the world. As a result, methane emissions have been reduced by approximately 9 million metric tons of carbon dioxide equivalent ($MMTCO_2E$) in 2009 and by more than 40 $MMTCO_2E$ from 2007 to 2009.

Despite our success, the challenge of climate change demands that we must do more. The United States was proud to support the launch of the new Global Methane Initiative (GMI) at the recent Methane to Markets Ministerial meeting in Mexico City on October 1, 2010. GMI builds on the success and structure of Methane to Markets, broadens the scope to include additional emission sources and new approaches to methane abatement, advances the development of national action plans, and brings new resources to expand international collaboration. The United States believes that GMI is a critical component of the international response to climate change, and the Administration of President Obama intends to provide at least $50 million over the next 5 years to ensure its success.

As Chair of the Methane to Markets Steering Committee, and as a representative of the U.S. Environmental Protection Agency (EPA), I am very proud of our collective accomplishments. I look forward to leading our country's participation in the next phase of international action on methane and collaborating with our private and public sector partners.

Sincerely,

Gina McCarthy
Assistant Administrator, Office of Air and Radiation
U.S. EPA
Steering Committee Chair, Methane to Markets Partnership

The Methane

Climate change is an extremely challenging environmental problem that requires a global response. The science is clear: methane is a short-lived and potent greenhouse gas (GHG), reductions of which will slow near-term impacts of climate change while delivering valuable economic and environmental co-benefits. Recognizing the critical role of methane mitigation in the fight against climate change and the significant low-cost emission reduction potential, 14 countries came together in 2004 to launch the Methane to Markets Partnership.

to Markets Partnership

Methane to Markets is an international public-private partnership that advances cost-effective, near-term recovery and use of methane as a clean energy source. The Partnership seeks to reduce global methane emissions to fight climate change, enhance economic growth, strengthen energy security, and improve local environmental quality and industrial safety. Building on experience from the U.S. Environmental Protection Agency's (EPA's) highly successful domestic methane emission reduction programs, Methane to Markets brings together the public and private sectors to develop projects that reduce emissions from the agriculture, coal mine, landfill, and oil and gas sectors in Partner Countries around the world.

Thirty-six national governments, including the European Commission, are now members of the Methane to Markets Partnership, accounting for nearly 70 percent of the world's anthropogenic methane emissions. Through Methane to Markets, Partner Countries are working with more than 1,000 public and private sector organizations to advance methane recovery and use by providing project development support, training and capacity building, technology demonstration, and market development. The United States estimates that by 2015 these efforts will reduce annual methane emissions by more than 180 million metric tons of carbon dioxide equivalent ($MMTCO_2E$). This is equal to recovering more than 500 billion cubic feet of natural gas or the annual emissions from 33 million cars or 50 500-megawatt (MW) coal-fired power plants. If achieved, these reductions could help stabilize or even lower global atmospheric concentrations of methane.

70 percent

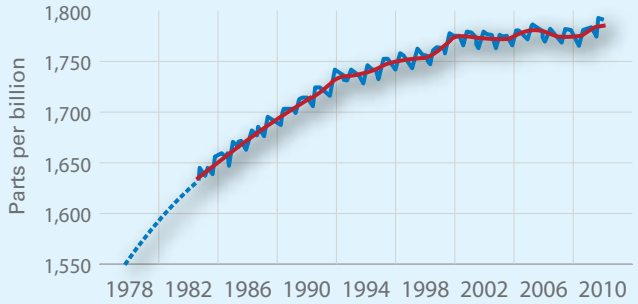
amount of the world's anthropogenic methane emissions generated by Methane to Markets Partners

The Importance of Methane

Methane (CH_4) is a hydrocarbon and the primary component of natural gas. Methane is also a potent and abundant GHG, which makes it a significant contributor to climate change, especially in the near term. Methane is emitted during the production and transport of coal, natural gas, and oil. Emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

Methane is the second most abundant GHG after carbon dioxide (CO_2), accounting for 14 percent of global emissions in 2005. Though methane is emitted into the atmosphere in smaller quantities than CO_2, its global warming potential (i.e., the ability of the gas to trap heat in the atmosphere) is 25 times greater. As a result, methane emissions currently contribute to over one-third of today's anthropogenic warming.

Figure 1: Growth in Global Methane Emissions



After about a decade of slow growth, beginning in 2007, global average methane concentrations started to increase.

Like emissions of other GHGs, emissions of methane from human activities (anthropogenic emissions) have increased markedly since pre-industrial times. The global atmospheric concentration of methane has grown from a pre-industrial value of about 715 parts per billion (ppb) to 1,782 ppb in 2007—nearly a 150 percent rise—which is far above the natural range of concentrations recorded during the last 650,000 years. Global anthropogenic methane emissions are projected to increase by 23 percent by 2020 compared to 2005 baseline levels.

33 percent

amount of anthropogenic warming attributed to methane emissions

While methane is more effective at trapping heat than CO_2, it has a much shorter atmospheric life, degrading in just 12 years. Because of the combination of its high potency and short lifespan, reducing methane emissions can significantly slow near-term impacts of climate change. In particular, methane reductions can help avoid potential climatic tipping points and reduce environmental impacts, especially in the Arctic (see below).

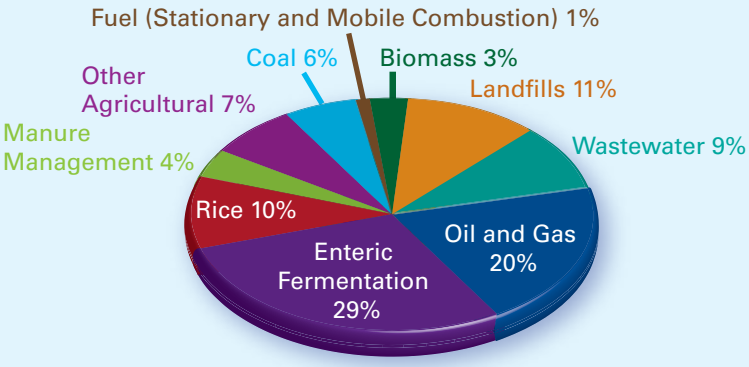
Methane and the Arctic

The Earth's poles are experiencing climate change sooner and more dramatically than other parts of the globe. Over the past 100 years, Arctic temperatures have increased at nearly twice the global rate. Alaska and Siberia have seen annual average surface air temperatures increase from 2 to 3°C between 1954 and 2003, with temperatures increasing by 4°C during winter months in that span.

One of the most effective strategies to slow or reverse this disproportionate warming is the swift and deep reduction of methane emissions. Because of its impact on near-term warming, reducing methane through proven and available technologies could have an immediate impact on arctic temperatures.

The Arctic Council, which was established in 1996 by eight founding countries to promote cooperation, coordination, and interaction among the Arctic states, has recognized the importance of methane reduction to address climate change and to protect the Arctic. At its 2009 Norway Ministerial meeting, the Council urged implementation of early actions on methane where possible and encouraged collaboration with the Methane to Markets Partnership.

Figure 2: Sectoral Sources of Anthropogenic Methane Emissions



Most importantly, methane presents unique opportunities because cost-effective mitigation technologies and practices to address methane emissions from the largest anthropogenic sources are already widely available and in use all over the world. EPA estimates that by 2020, reductions of more than 1,800 MMTCO$_2$E can be achieved at a low cost in the agriculture, coal, landfill, and oil and gas sectors. Over the long term, methane reductions can also deliver significant climate benefits.

A 2003 Massachusetts Institute of Technology study estimated that reducing methane emissions by 50 percent from a business-as-usual scenario by 2050 and maintaining those reductions through 2100 could help reduce global temperature by about 0.55°C—a comparable reduction to what similar decreases in CO_2 emissions would yield. While reducing CO_2 emissions is essential to fighting climate change, a methane reduction strategy must be part of the solution, as reductions can achieve near-term benefits and be carried out much more readily and cost-effectively with currently available technology.

In addition to mitigating climate change, reducing methane emissions delivers a host of other energy, health and safety, and local environmental benefits. Many technologies and practices that reduce methane emissions also reduce emissions of volatile organic compounds, hazardous air pollutants, and other local air pollutants. This yields health benefits for local populations and workers. Because methane is an important precursor of tropospheric ozone, reducing methane also reduces ozone-related health effects (see text box).

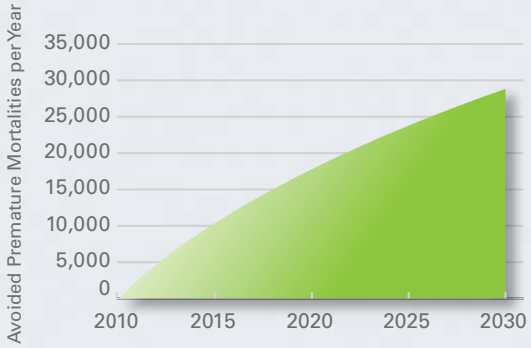
Methane reduction projects at landfills also reduce odors; in the agriculture sector, they control manure, protecting local waters and ecosystems. Capturing methane from gassy coal mines improves industrial safety by reducing the risk of explosions. The use of low-emission equipment and better management practices in oil and natural gas systems minimizes methane leaks, yielding health and safety benefits while increasing the amount of product that reaches the market, generating increased revenue.

For any project, producing energy from recovered methane provides a local source of clean energy that can spur economic development. It can displace higher CO_2 and pollutant-intensive energy sources such as wood, coal, and oil. Finally, recovered methane can serve as a new sustainable and abundant energy source for developing countries.

Methane and Human Health

In addition to being a potent and abundant GHG, methane is an important precursor for tropospheric ozone. Ozone, like methane, is a GHG that contributes to climate change; furthermore, tropospheric ozone impairs air quality and has been linked to higher premature mortality rates.

Figure 3: Reducing Methane Emissions Can Avoid Ozone-Associated Mortalities



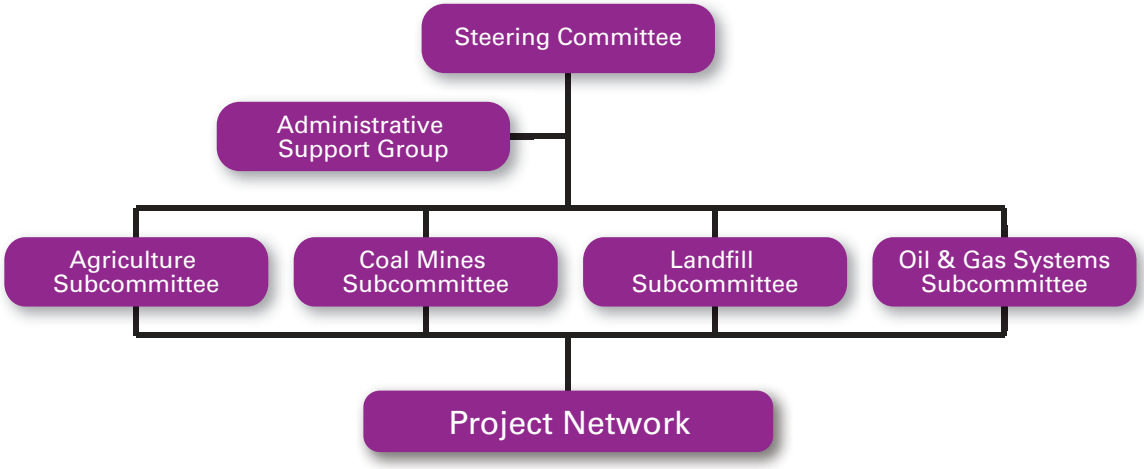
West, et al., 2006

Decreasing methane globally reduces the background levels of tropospheric ozone around the world. This, in turn, can help lower premature mortality rates associated with ozone, particularly in regions along the equator. In fact, reducing global anthropogenic methane emissions by 20 percent could prevent an estimated 370,000 premature mortalities worldwide between 2010 and 2030, with more than three avoided mortalities per million people in 2030 (and regional estimates ranging as high as almost six avoided mortalities per million in Africa).

Partnership Structure

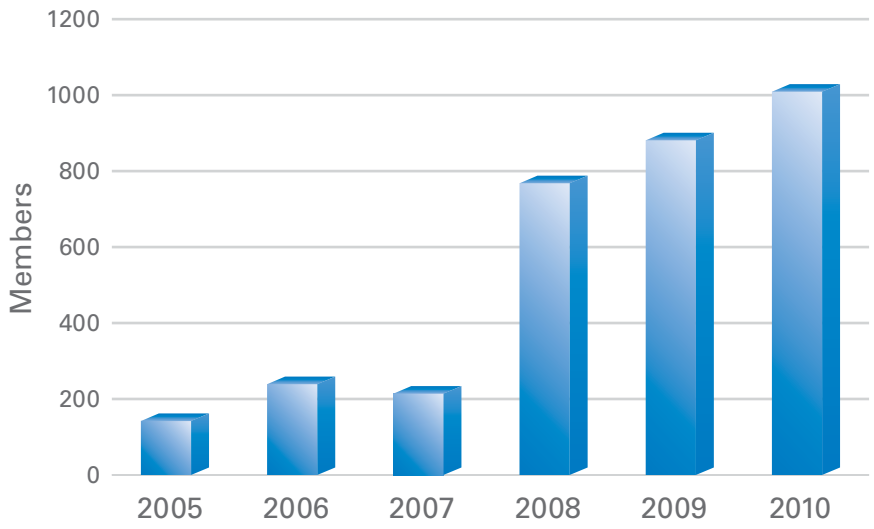
The Methane to Markets Partnership is made up of a Steering Committee, the Administrative Support Group (ASG), four technical subcommittees, and the Project Network (see Figure 4).

Figure 4: Methane to Markets Organizational Structure



The Steering Committee directs the work of the Partnership and is supported by the ASG. The subcommittees—Agriculture, Coal Mines, Landfills, and Oil and Gas Systems—are responsible for implementing decisions made by the Steering Committee, coordinating sector-specific technical work, and engaging representatives of both Partner Countries and the Project Network. The Project Network is a community of industry stakeholders, nonprofit organizations, financial institutions, and others who supply important technical expertise and financial resources to catalyze the development of methane capture and use projects. The Partnership recognizes the critical role played by the private sector and established this unique structure to formalize their engagement in Methane to Markets activities. Today, more than 1,000 diverse organizations from six continents participate in the Project Network (see Figure 5).

Figure 5: Project Network Exceeds 1,000 Members



U.S. Government Leadership in Reducing Methane Emissions

U.S. government efforts under the Methane to Markets Partnership are led by EPA and involve the collective efforts of other federal agencies and departments, including the Agency for International Development (USAID); the Departments of Agriculture, Energy, and State; and the U.S. Trade and Development Agency (USTDA). In 2004, the United States pledged up to $53 million over a 5-year period to help facilitate the development and implementation of methane projects in developing countries and countries with economies in transition. In fiscal year (FY) 2009 alone, the United States provided $10.5 million to the Partnership, bringing the total U.S. financial commitment to the Partnership since 2005 to approximately $50.5 million. These resources support diverse activities, including pre-feasibility and feasibility studies at potential project sites and capacity-building through technology transfer and training, development of tools and resources, and the work of the ASG (see Figure 6) across more than a dozen Partner Countries and regions (see Figure 7).

Figure 6: FY 2009 U.S. Expenditures by Type of Activity

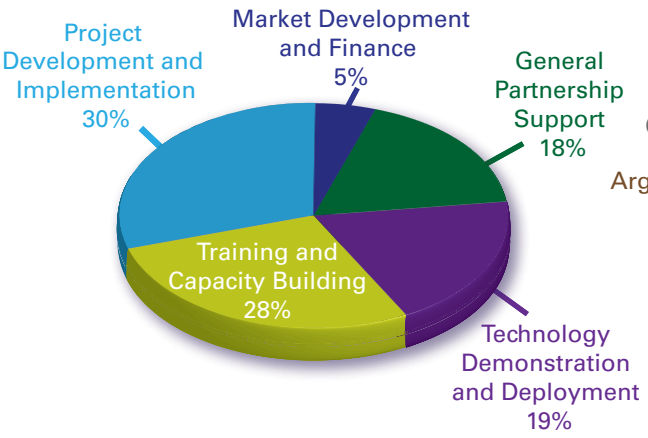
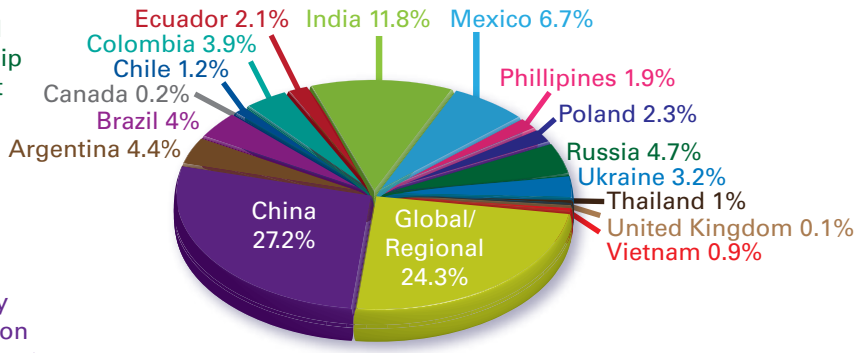
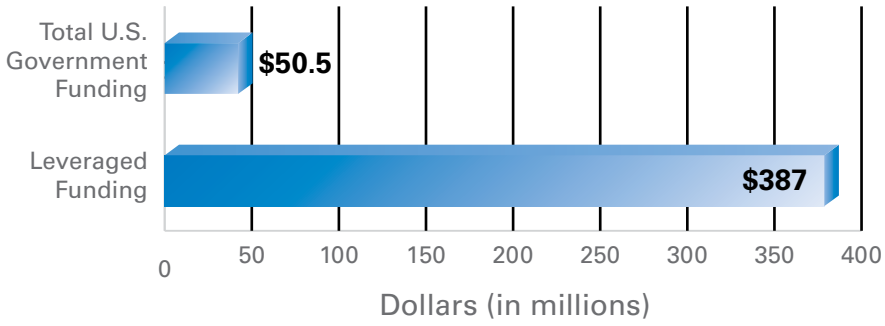


Figure 7: FY 2009 U.S. Expenditures by Recipient Country



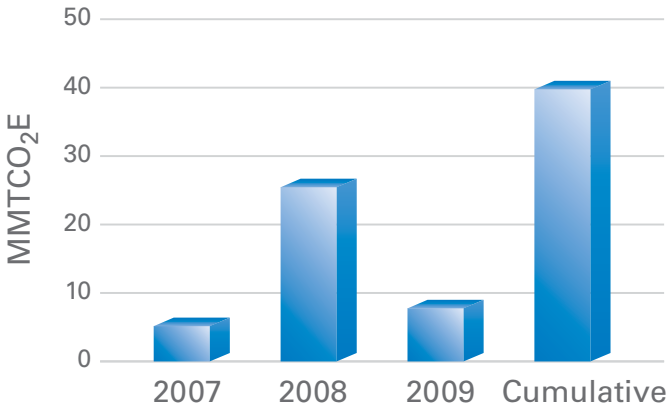
These funds were also instrumental in leveraging resources from other sources, dramatically increasing the reach and influence of U.S. financial support (see Figure 8).

Figure 8: U.S. Government Funding and Leveraged Funding, FY 2005–FY 2008



The consistently strong support provided by the U.S. government has been a major contributor to helping the Partnership grow in size, scope, and influence during its first 5 years. In 2009, U.S. support to the Partnership has helped achieve the following impressive results. (For additional information about these and other achievements, visit **www.epa.gov/methanetomarkets**.)

Figure 9: Annual Reduction of Methane Emissions from U.S.–Supported Projects, 2007-2009*



* 2007 was the first year that data on actual emissions reductions were available for projects supported by the U.S. government.

Projects Reducing Methane Emissions in Partner Countries

Direct financial support from EPA and the Department of State, made in the form of competitive grants, has been central to the U.S. government's support in catalyzing projects across all sectors.

To date, the United States has awarded nearly $13 million in grants to 70 methane emission reduction projects. In 2010, during the fourth Methane to Markets grant solicitation, 115 proposals were received for work in 23 different countries. From these proposals, EPA plans to award nearly $5 million to support cooperative agreements for methane capture and use projects in Partner Countries. (For the most recent list of grants and awards, visit **www.epa.gov/methanetomarkets/grants.htm**.)

These and other efforts are successfully bringing more than 300 methane emission reduction projects online in 18 Partner Countries around the world. In 2009, these projects delivered reductions of 9 $MMTCO_2E$ per year (see Figure 9), and, when fully implemented, they will yield approximately 61 $MMTCO_2E$ annually.

Increased Institutional and Technical Capacity

U.S. expertise has helped develop institutional capacity and deliver technical skills to many Partner Countries. By sponsoring subcommittee meetings, technical workshops, site visits, trainings, and other events, the United States has transferred vital knowledge and expertise to international counterparts to facilitate the development of methane capture and use projects. In 2009, U.S. agencies held 26 workshops in more than 14 Partner Countries throughout the world, training approximately 2,000 people in all four sectors. In addition, EPA, along with the government of India, organized the second Methane to Markets Partnership Expo in New Delhi in March 2010 (see text box).

40 $MMTCO_2E$

amount of methane emissions reduced from U.S.-supported Methane to Markets projects

2010 Methane to Markets Partnership Expo

In March 2010, EPA and the government of India hosted the second International Methane to Markets Partnership Expo in New Delhi, India. This 4-day event brought together investment, project development, and government professionals to network and collaborate on advancing new methane capture and use projects. The Expo attracted more than 500 participants from 36 countries and nearly 20 corporate sponsors from a cross section of industries and trades.

One of the most significant aspects of the Expo was the "Methane Marketplace," which showcased more than 150 international projects from 15 countries across all four sectors. The Marketplace provided participants with an opportunity to demonstrate their latest technologies and opportunities for project development. The projects exhibited have the combined potential to reduce GHG emissions by 17 MMTCO$_2$E annually.

The Expo also featured presentations and roundtable discussions on issues relevant to international methane project development as well as concurrent technical tracks for the agriculture, coal mines, landfill, and oil and gas sectors. For each track, breakout sessions gave attendees the opportunity to review and discuss case studies of methane projects, technological advances, financing, and country-specific policy and regulatory barriers and solutions. The Steering Committee and subcommittees also met in conjunction with the Expo to discuss the implementation of subcommittee action plans and other Partnership business.

Mr. Y.K. Modi, past president of the Federation of Indian Chambers of Commerce and Industry, delivered opening remarks, while high-level representatives from the government of India, the Asian Development Bank, EPA, and the U.S. Embassy in India formally opened the Marketplace.

For more information on the Expo, including speakers and presentations, see the special Expo edition of *Methane International* at **www.methanetomarkets.org/news-events/mi18.aspx**.

Sharing Critical Project and Program Information

EPA chairs the Steering Committee and houses the ASG. As host of the ASG, EPA has helped support many of the Partnership-wide communications and outreach activities. Some key accomplishments in this area include:

- **The Methane to Markets website**, **www.methanetomarkets.org**. This website serves as the Partnership's central tool for facilitating cross-disciplinary communication and exchanging information on international project development.
- **EPA-supported online tools.** The Project Tracking Database, International Landfill Database, and International Coal Mine Methane (CMM) Projects Database provide targeted information to catalyze project development.
- **The first Methane to Markets *Partnership Accomplishments Report*.** This report draws on contributions from each Partner Country to highlight their achievements as well as those of the Partnership as a whole from 2004 to 2009.
- **Technical resources.** These include fact sheets, scoping papers, and the Partnership's quarterly newsletter, *Methane International*.

The following sections of this report outline some of the most notable projects supported by the U.S. government in the four sectors over the past year.

Agriculture: Livestock Manure and Food Processing Wastes

Globally, agricultural sources of methane emissions include enteric fermentation, rice cultivation, and livestock manure. Methane to Markets' agricultural activities focus on emissions from livestock manure and agro-industrial waste, although the Partnership is currently exploring opportunities to expand to additional agricultural methane sources.

Methane is produced and emitted during the anaerobic decomposition of livestock manure and waste. This methane can be reduced, captured, and used as clean energy with anaerobic digestion technology. In 2010, the total amount of global methane from livestock manure that could potentially be used in this manner was estimated to be more than 240 $MMTCO_2E$.

Through Methane to Markets, the United States spent more than $1.1 million in 2009 to advance the recovery and use of methane at agricultural operations. Dozens of U.S. government-supported projects are now operational, and resource assessments (RAs) have been completed in 10 countries. A few of these activities are presented in this section.

$1.1 million

amount the U.S. government spent in 2009 on methane projects in the agricultural sector

Identifying Project Opportunities

In many countries, livestock manure is often neglected; typically, farmers use only the most basic waste management approaches. Individually, farms are mostly small emitters of methane, but collectively they emit on a large scale and represent a substantial number of potential project opportunities. To address these challenges, the United States supports a strategic approach to reducing methane from livestock manure on small farms. The first step in this approach is to develop country-specific RAs to identify and rank the livestock and waste processing sectors and subsectors where emission reductions can be achieved. EPA has supported the development of RAs in 10 Methane to Markets Partner Countries. An example of RA findings from Argentina is presented in Figure 10.

Figure 10: Summary Table of the Findings for Argentina

Subsector	Sector Overview	Direct Emissions ($MTCO_2E/yr$)	Indirect Emissions* ($MTCO_2E/yr$)	Total ($MTCO_2E/yr$)
Sugar mills and distilleries	23 sugar mills, 30 million metric tons sugarcane, ~ 2 million metric tons sugar, 11 distilleries	864, 600	162,800	1,027,400
Swine	~ 3 million pigs; ~ 2% confined with pull-plug pits, anaerobic lagoons, and facultative lagoons	412,000	77,600	489,600
Dairy	11,500 dairy farms, ~ 10,000 million liters per year; farms with > 4,000 head were considered to have confined systems and lagoons	353,000	66,500	419,500
Slaughter-houses	38,000 swine and cattle slaughtered per day; considered facilities with capacity > 400 animals per day	196,900	37,000	233,900
Citrus processing	Tucumán processes 5.5 million metric tons of citrus per year (~ 75% of total production); most plants use lagoons	87,800	16,500	104,300
Total		**1,914,300**	**360,400**	**2,274,700**

* Indirect emissions reduction potential: the emissions that would be reduced by fuel replacement through the use of biogas.

International Guidance

Interest in anaerobic digestion as a livestock manure management option has expanded rapidly in recent years, accompanied by a proliferation of commercial anaerobic digester system designs. However, without standardized performance data, it is difficult to compare these different designs with respect to biogas production, waste stabilization, and cost-effectiveness. To address this situation, the Methane to Markets Agriculture Subcommittee members, supported by EPA, recently developed international guidelines for evaluating and reporting the performance of anaerobic digestion systems for livestock manure. EPA is now helping Argentina, China, and Thailand to use the guidance to undertake evaluations of their domestic anaerobic digestion systems.

Mexico Develops National Technical Standards

The U.S. government has actively supported Mexico's effort to accelerate wide-scale deployment of anaerobic digesters in its agricultural sector. Building on work supported by USAID in 2004 through 2006, a 2008 EPA grant to Mexico's federal environmental agency, Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT), supported projects dedicated to improving agricultural systems. With this grant, SEMARNAT developed technical standards for the design, construction, and installation for covered-lagoon-type anaerobic digesters. This work involved reviewing U.S. technical standards for covered lagoons, as well as the operational status and vendor qualifications for covered lagoons currently in use in Mexico. The Mexican standard—called the Covered Anaerobic Lagoon National Standard—is establishing guidelines and criteria for design, materials, construction, safe operation, and maintenance. As a follow-up activity, EPA awarded another grant in 2009 to Fideicomiso de Riesgo Compartido, a government entity that supports Mexican agriculture and is similar to the U.S. Department of Agriculture. The objective of this work is to develop a database of operational projects in Mexico, which will be linked to the Methane to Markets international database of commercially operational livestock and food waste systems.

Technology Transfer to China

The Haidong Ecological Agriculture Company is a 1,089-sow, farrow-to-finish swine production facility in Yueyang County, Hunan Province, China. With a large concentration of swine farms and a limited number of operating methane recovery systems, the province has the potential to launch many projects to demonstrate innovative technologies to reduce methane emissions and improve rural sanitation. Haidong was selected to demonstrate the potential for reducing emissions from conventional anaerobic lagoons with an unheated covered anaerobic lagoon. This technology is new in China and offers an alternative to constructed tank-type digester systems typically used at medium to large-scale livestock facilities.

The Haidong project collects biogas and combusts it in an enclosed flare. The project includes a gas metering system that complies with Clean Development Mechanism (CDM) program reporting requirements. The farm is currently considering the addition of an electricity-generating component to the gas handling system. The covered lagoon will reduce methane emissions by approximately 4,300 $MTCO_2E$ per year. If the facility implements an electricity generation project, it could generate an average of 2,800 kilowatt-hours per day and offset an additional 1,000 $MTCO_2E$ per year from a typical coal-burning generation plant in China.

Philippines Develops Carbon Reduction Program

In conjunction with the World Bank, EPA has helped the Philippines to implement a carbon reduction Program of Activities (PoA) under the CDM. The PoA approach was developed to give smaller emission sources, such as livestock farms, a way to participate in CDM activities by reducing the often complex and burdensome requirements and costs that represented barriers to their participation. Created for the swine and landfill sectors, this program has an initial set of projects underway. It is being administered by the Land Bank of the Philippines, a bank owned by the Filipino government that focuses on serving the needs of farmers and fishermen.

EPA is playing a key technical role in the program to expand the private sector's ability to develop CDM-compliant technologies and reporting requirements. EPA has transferred enclosed flare technology design from Mexico to Philippine stainless steel fabrication shops to provide reliable flares at lower costs. It also hosted an anaerobic digester tour of Guongdong (China) farms to evaluate their interest in transferring the low-cost reciprocating engines to the Philippines and identified a number of demonstration farms to train government and private sector entities in the design and technical aspects of appropriate anaerobic digesters, gas uses, and reporting requirements of the Philippine PoA.

In April 2010, EPA organized a training workshop for the Land Bank of the Philippines in Bohol, Philippines. The workshop was aimed at familiarizing Land Bank personnel with the process of methane formation and methane's significance as a GHG, the practice of swine production, options for reducing methane emissions from swine and other livestock manures, and the CDM process and requirements. A follow-up workshop, held in June 2010 in Davao and Tagatay, introduced swine farm owners and managers to the PoA program, the technologies involved in the PoA approach, and the economic effect on farms participating in the PoA. More than 300 farmers participated in both of these events; 25 farms signed onto the PoA, and 50 others showed their intent to participate.

Coal Mines

Methane released from coal mining activities can be captured and used as a clean energy source, which reduces GHG emissions, improves air quality, and enhances mine safety. In 2010, global methane emissions from coal mines were estimated to be approximately 407 $MMTCO_2E$. By 2020, the world's coal mines are expected to produce annual emissions of 450 $MMTCO_2E$.

The United States is a leader in CMM recovery and continues to work with international partners through Methane to Markets to share information, expertise, and technology to promote CMM project development. In 2009, the U.S. government supported these initiatives with $2.5 million, including funding seven grants for projects in China, India, and Poland. Major activities from this sector are summarized in this section.

450 $MMTCO_2E$

annual emissions that are expected to be produced by the world's coal mines by 2020

Feasibility Studies Lead to Project Development in China

EPA is supporting five comprehensive feasibility studies at Chinese coal mines to assess the technical and economic viability of implementing methane recovery and use projects. Three of these full-scale CMM project feasibility assessments were recently completed for the Liuzhuang Coal Mine in the Huainan Coal Field of Anhui Province, the Hebi Mining Group in Henan Province, and the Songzao Coal and Electricity Company Coal Mines in Chongqing. By the end of 2010, EPA will have completed two additional studies in the Inner Mongolia and Guizhou provinces. The project feasibility studies are already achieving significant benefits. In the case of the Songzao Coal Mines in Chongqing, the study resulted in the state-owned Chongqing Energy Investment Group moving forward with the project. The investment group has selected Towngas, a Hong Kong–listed company, as a joint venture partner to implement the world's largest CMM purification and liquefaction project. Ultimately, the project will purify and liquefy 110 million cubic meters of CMM annually, with expected liquefied natural gas sales to equal $40 million. Total investment for this project is expected to equal $78 million. Land agreements have already been negotiated; the project construction began in 2010, with Phase 1 to be completed by the end of 2011.

Evaluating Project Potential in India

EPA, USTDA, and the government of India have continued collaboration on technical and business development projects to reduce the release of CMM. For example, in 2009, EPA funded a mission based on a potential project opportunity identified at the launch event for the India Coalbed Methane (CBM)/CMM Clearinghouse. Based on the findings of that mission, USTDA awarded a $500,000 grant to conduct a feasibility study evaluating capture and use of CBM/CMM from a coal mine block in Chattisgarh, India. The study will determine the best uses for the recovered methane and establish the technical, economic, and financial feasibility of the project. It will also define optimal gas drilling plans and equipment and technology specifications for project execution based on proven designs and practices.

Ukraine Builds on Successes

As the world's fourth largest emitter of methane from coal mining activities, Ukraine is working with the support of EPA to raise awareness about the benefits of capturing and using CBM and CMM. Efforts have focused on addressing legislative, regulatory, and financial barriers to project development. In April 2009, EPA sponsored a roundtable held by the Ukrainian Parliament Committee on Fuel to discuss issues associated

Promoting Global Ventilation Air Methane (VAM) Projects

EPA has been promoting the mitigation of VAM for a number of years, including co-sponsoring a technology demonstration project in the United States with the U.S. Department of Energy and providing information about VAM opportunities and technologies through multiple international studies and grants.

In the United States, a VAM mitigation project at the Jim Walter Resources No. 4 Mine in Alabama began operating in 2009. This demonstration project uses a thermal flow reversal reactor technology manufactured by Biothermica. During its first year, the project reduced emissions by approximately 26,000 TCO_2E.

Two other U.S. mines recently announced their plans to install VAM mitigation technologies. The CONSOL Energy Enlow Fork Mine in Pennsylvania is planning a VAM mitigation project to be operational in the second half of 2010. This project will reduce emissions by an estimated 190,000 TCO_2E annually. CONSOL Energy also operates the McElroy mine in West Virginia. It will install a thermal oxidizer technology manufactured by Durr at that mine, which is estimated to reduce GHG emissions by 230,000 TCO_2E annually when it becomes operational in 2011.

In China's Henan Province, the Zhengzhou mining group has operated a VAM mitigation project using the MEGTEC Vocsidizer, a thermal oxidizer, since 2008. This project was the world's first VAM mitigation project with carbon reduction credits formally approved by the UN Framework Convention on Climate Change's CDM Executive Board. The project mitigates methane emissions and recovers hot water for local use. Its VAM mitigation component reduces GHG emissions by about 50,000 TCO_2E annually. This technology has been used since 2007 at the West Cliff Colliery in Australia to generate 6 MW of electricity from VAM, the world's first VAM-to-power installation.

The world's largest VAM abatement project was recently announced to be hosted by the Datong mine, owned by the Songzao Coal mines in Chongqing, China. This project will also use the MEGTEC thermal oxidizer technology. It is expected to reduce up to 200,000 TCO_2E annually and recover energy to heat water for nearby buildings.

$2.5 million

amount the U.S. government spent on CMM projects in 2009

with CMM. EPA also funded development of a white paper analyzing international best practices for CMM recovery and use and helped support the passage of Ukraine's new CMM law. New coal degasification modernization projects planned at the Stakhanova, Yuzhno-Donbasskaya No. 3, Skochinsky, and Bazhanov mines are evidence of Ukraine's increasing technical expertise.

Developing and Disseminating Best Practices With the United Nations Economic Commission for Europe (UNECE)

In collaboration with EPA, UNECE developed a paper titled "Best Practice Guidance for Effective Methane Drainage and Use in Coal Mines" to provide guidance on effective methane drainage from coal mines to encourage mine safety and promote more effective usage of CMM. Several technical experts from around the world contributed to the report, which was distributed at the 2010 Expo in New Delhi, India. The UNECE Ad Hoc Group of Experts on Coal Mine Methane is planning workshops and seminars on strategies to reduce risks and best practices for using CMM, as outlined in these guidelines, for 2010 and 2011 in China, Kazakhstan, and Ukraine.

Supporting Technology Demonstration Projects in Poland

With support from EPA, the Central Mining Institute of Katowice is conducting an assessment of VAM at 10 gassy mines in Poland. This study will characterize the VAM emissions and explore the potential to mitigate or recover energy from these mine emissions.

In 2009, EPA awarded a grant to support the development of a pre-feasibility study for degasification and methane capture ahead of mining at the Pawlowice 1 coal field. This project includes the cost-effective degasification and capture of methane in advance of mining activities at the coal field in Upper Silesia, Poland. The Central Mining Institute is working with the Akademia Górniczo-Hutnicza, EurEnergy Resources LLC, and the JSW Pniowek mine to investigate the possibility of combining profitable CBM production with methane emission reductions from coal seams during mining operations.

Landfills

Methane is one of the byproducts produced from landfills when organic matter decays under natural anaerobic conditions. Landfill gas (LFG) is a source of clean energy, as it is typically composed of about 50 percent methane. It can be used to substitute for fossil fuel consumption in industrial boilers, to generate electricity, or it can be refined and injected into the natural gas pipeline or used as vehicle fuel. Capturing and using LFG in these ways can yield substantial energy, economic, environmental, air quality, and public health benefits.

In 2010, global methane emissions from landfills were estimated to be nearly 761 $MMTCO_2E$. The United States has been a leader in the recovery and use of LFG and has spent more than $2.2 million in 2009 to expand the productive use of LFG through Methane to Markets. Highlights of these efforts are summarized in this section.

761 $MMTCO_2E$

estimated global methane emissions coming from landfills in 2010

Projects Are Becoming Operational Around the Globe

The first operational landfill project in Ukraine went online in January 2010. Ukraine's Renewable Energy Agency installed four infrared heaters in an outdoor landfill garage for bulldozers in the city of Khmelnitsky. The Khmelnitsky Landfill is a sanitary landfill owned by the Khmelnitsky City State Administration and operated by Municipal Enterprise Spetskomuntrans. EPA provided both grant and direct support to purchase equipment and assess the gas potential landfill.

In 2009, India's first landfill flare became operational at the Gorai Landfill in Mumbai. The project will reduce emissions by 2 MMTCO$_2$E over the estimated lifetime of the project (2009 to 2028). USAID funded the initial feasibility study for this project, and EPA provided additional technical support to the municipality. The municipal corporation of Mumbai signed an emission reduction purchase agreement with the Asian Development Bank for future delivery of carbon credits, worth approximately $5.2 million. Although the LFG is currently flared, local officials plan to use it to generate electricity in the near future.

In China, EPA assessments of the LFG potential for two landfills helped advance recovery projects. EPA helped landfill operators at the Chengdu City Landfill in Chang'an Village and Mentougou Landfill in Jiaojiapo to determine the potential of using the LFG as a local energy source. EPA's assessment estimated that the Chengdu City Landfill could recover approximately 4,440 cubic meters per hour of LFG with a gas collection system. Using the results of this assessment, the city issued a Request for Proposals to develop a LFG collection and beneficial use project. At the Mentougou Landfill , after EPA's initial site assessment, the owners installed a 65-kilowatt microtubine and are planning to expand the electric generation capacity at the site.

International Workshops Raise Awareness of the Benefits of LFG Projects

In the past year, EPA has collaborated with 11 Partner Countries, including Argentina, Brazil, China, Colombia, Kazakhstan, Mexico, the Philippines, Russia, Serbia, Thailand, and Ukraine to hold workshops on LFG recovery and use. These workshops, which have been attended by more than 700 people, provide a range of information for participants, including LFG energy system components and the fundamentals

and benefits of LFG recovery and use as an energy source. Presentations have taught landfill managers, government officials, and private companies how to create viable LFG energy projects, plan projects, and finance the costs as well as develop projects using carbon financing. Workshops have also helped landfill operators with project operations, maintenance, and management. Many workshops featured local case studies or a site visit to local landfills, all of which had operational flares and/or energy projects.

Improved Data on Landfills Communicate Potential for LFG Recovery and Use

700 participants

number of participants who attended U.S. government-sponsored technical workshops on LFG recovery and use in 2009

The U.S. government is working with several Partner governments to improve the collection and analysis of landfill data, which will help catalyze project development at those landfills that have greatest potential to support energy generation or other applications. For example, in Poland, EPA provided financial support to Instytut Nafty i Gazu (INIG), which completed a major data collection effort on all medium to large landfills to identify the best opportunities for LFG energy projects. With the completion of the data-gathering, INIG conducted its first feasibility assessment (at the Mielec Landfill, a municipal site) and featured the project at the 2010 Methane to Markets Project Expo.

In Colombia, EPA entered into an agreement with the federal government to expand its national landfill database and improve data quality. Under this agreement, EPA worked with the Federal Public Services Agency to add data fields related to LFG energy potential and also provided recommendations for improving the quality of the data collected by the agency. The result will be detailed reports of individual disposal sites that will allow potential developers and investors to assess their viability for an LFG energy project.

In the state of Espirito Santo, Brazil, EPA grantee Fundação Promar completed an inventory of landfills focused on identifying the potential for LFG energy projects. The report also will serve as a valuable resource as the state plans a series of new regional landfills while working to close illegal dump sites.

In Mexico, SEMARNAT, the Secretariat of Environment and Sustainable Development (SEMADES) of the state of Jalisco, and Guadalajara Autonomous University in Guadalajara showcased the Mexico LFG model v2.0 at a LFG workshop. Approximately 100 professionals attended the workshop to learn about the new model, which provides Mexico-specific values for methane generation rate and methane generation potential. EPA updated the model using precipitation data, waste composition data, and site-specific LFG recovery data gathered from representative landfills in Mexico. The data enable users to produce typical LFG generation and recovery rates for landfills located in various regions of Mexico.

EPA also created LFG models for the Philippines, Thailand, and Ukraine to provide general estimates of LFG generation and recovery potential. The models provide recommended values for input variables based on climate data, waste characteristics, and disposal practices as well as

$2.2 million

amount spent by the U.S. government in 2009 to expand the productive use of LFG through Methane to Markets

estimated effects of these conditions on the amounts and rates of LFG generation. In September 2009, with support from EPA and Ukraine's Ministry of Environmental Protection, Ukraine's Scientific Engineering Center Biomass introduced the Ukraine LFG model at its landfill workshop in Kiev.

Brazilian and Indian Representatives Gain First-Hand Knowledge of U.S. Landfills

Through two grants, EPA conducted study tours for international landfill representatives to visit operational projects in the United States. Under a grant held by Appalachian State University, Brazilian elected officials, municipal waste management officials, and renewable energy officials for the State of Ceara visited small-scale, community-based projects in western North Carolina. The Federation of Indian Chambers of Commerce and Industry organized a delegation of municipal representatives to attend a national solid waste management conference and tour operational projects in North Carolina.

Oil and Gas Systems

Methane emissions from oil and gas systems can result from routine operations and maintenance or system disruptions. Keeping more natural gas in the system can help reduce methane emissions and thus GHG emissions and can also enhance energy security, improve efficiency, and increase revenues. EPA estimated that as of 2010, global methane emissions from oil and gas systems were nearly 1,355 $MMTCO_2E$.

The United States has participated in the Methane to Markets Partnership to encourage Partner Countries to implement proven, cost-effective technologies and practices that can minimize methane losses. In 2009, the U.S. government has spent more than $2.5 million to support the deployment of these measures. Some of the U.S. government's notable 2009 accomplishments and ongoing activities in this section are discussed in this section.

$2.5 million

amount spent by the U.S. government in 2009 to minimize methane losses in the oil and gas sector

Collaborating With Russia's Gazprom on Methane Emission Reductions

With financial support from EPA, the Pacific Northwest National Laboratory (PPNL) and the Environmental Defense Fund are working with Gazprom, the world's largest natural gas company, to identify and reduce methane emissions from its operations. This work is supporting a series of projects, including compressor station measurement studies, a methane mitigation evaluation of the West Siberian natural gas transmission system, and inventory refinement. The data will allow Gazprom to evaluate cost-effective methane mitigation options at specific facilities and consider other system-wide methane mitigation options. This work builds off a successful technology transfer workshop EPA organized for Gazprom staff in November 2008.

Improving Leak Detection and Repair in Ukraine

In 2009, Naftogaz, Ukraine's national oil and natural gas company, joined Natural Gas STAR International and committed to taking measures to detect and reduce methane gas losses. Naftogaz engages in a full range of upstream, midstream, and downstream operations in the oil and gas sector, and its subsidiary, Ukrtransgaz, operates Ukraine's natural gas transmission system.

In collaboration with EPA and the PNNL, Naftogaz, Ukrtransgaz, and the Ministry of Fuel and Energy have explored several strategies for reducing methane leaks. In particular, Naftogaz has begun work to develop a corporate GHG monitoring system with an integrated methane leak detection and repair program. Such a system could also help identify and monitor other GHG mitigation projects, thereby facilitating future investments. EPA also supported the installation of sealants as part of a project to further reduce methane emissions from valves in Cherkasytransgas, a branch of Ukrtransgaz. Through this collaboration, Cherkasytransgas has been working toward its goal of reducing methane emissions by 3.7 million cubic meters by 2010.

In 2009, Cherkassytransgaz reduced fugitive methane emissions by 123.6 million cubic feet by reducing leaks from 174 valves in 23 compressor stations using sealants, flanges, and other equipment components. In addition, Cherkassytransgaz replaced older valves, as needed, where sealants were no longer adequate to address the leaks. The volume of methane emission reductions was measured using a Hi-Flow Sampler.

Additionally, with assistance from both EPA and PNNL, Ukrtransgaz and Cherkassytransgaz co-led the second methane mitigation technology transfer seminar for six of the company's subsidiaries. The seminar was well attended and generated high-level recommendations to promote methane mitigation projects. For example, Cherkassytransgaz will be conducting a feasibility study to analyze the effectiveness of its Direct Inspection and Maintenance Program, holding training sessions for staff from its parent company, Ukrtransgaz, on the program, and generating more specific guidance on reducing fugitive methane emissions at its facilities.

Helping Chile Identify Emission Reduction Opportunities

In 2009, Empresa Nacional del Petroleo de Chile (ENAP), the Chilean state-owned oil and gas company, began working with EPA to evaluate opportunities to reduce methane emissions by joining Natural Gas STAR International. EPA and ENAP collaborated to conduct pre-feasibility studies, which used ENAP-supplied operational data to estimate methane emissions from select ENAP operations. These were followed by onsite measurement studies, in which methane emission identification and quantification

equipment was used to locate and measure methane emissions from ENAP operations. The results of these studies provided real data that ENAP is using to evaluate cost-effective options for reducing emissions from such sources as leaking components, centrifugal compressor wet seal de-gassing vents, reciprocating compressor rod packing, and condensate storage tank vents at its natural gas gathering and processing operations around the Strait of Magellan region. It is estimated that ENAP can significantly reduce emissions by installing storage tank vapor recovery units and running a directed inspection and maintenance program to reduce leaks.

Collaboration Among Oil and Gas Companies Yields Award-Winning Research

Methane to Markets recently released a report titled, "Methane's Role in Promoting Sustainable Development in the Oil and Natural Gas Industry," which was awarded "Best Paper" at the 2009 World Gas Conference in Buenos Aires. The study discusses projects undertaken by Petroleos Mexicanos (PEMEX), Pluspetrol, Gazprom, and EnCana to cost-effectively reduce methane emissions from a variety of equipment and processes in oil and natural gas production, processing, and transmission facilities. Case studies covering mitigation activities in Argentina, Mexico, Russia, and the United States illustrate how companies are using commercially available, cost-effective technologies and practices to reduce their methane emissions. Results depend on specific operating circumstances, but paybacks based on the value of the gas saved range from a few months to 3 years and strategies apply across the industry and the globe.

U.S. Building a Partnership With China National Petroleum Corporation (CNPC)

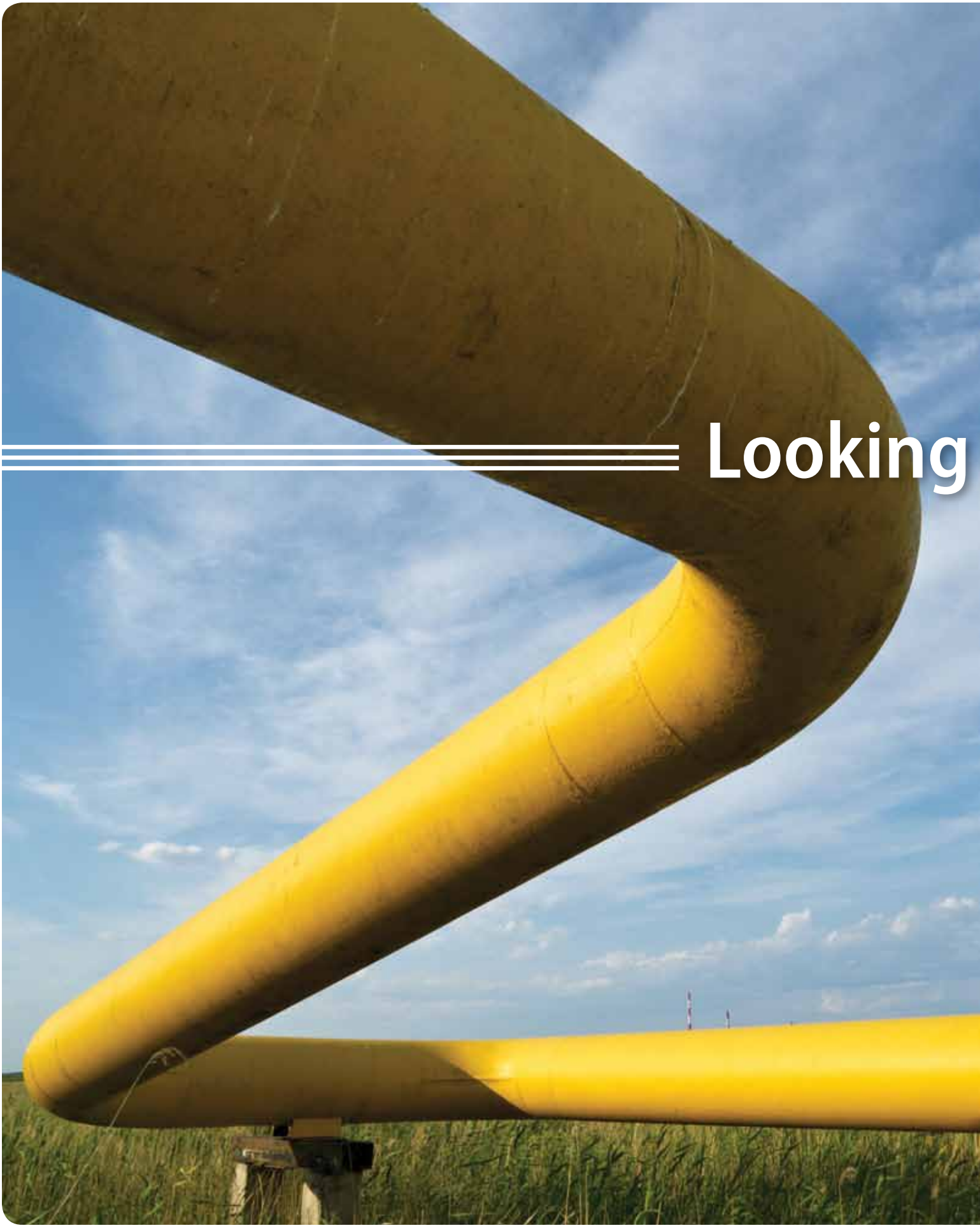
In China, EPA has been working to raise awareness of cost-effective opportunities to reduce methane emissions at oil and natural gas facilities and share lessons learned to achieve significant cost-effective emission reductions and build long-term institutional capacity.

Since 2007 CNPC's Research Institute for Safety and Environmental Technologies (RISE), CNPC subsidiary companies, and EPA have been collaborating on conducting field measurements at facilities in three different regions of China. Engineers are now conducting technical reviews to determine next steps, which, if implemented, could reduce methane emissions by more than 250,000 $MTCO_2E$ annually (excluding potential waste heat recovery opportunities).

EPA and RISE have also developed a formal corporate emissions management program with a complete set of supportive guidelines. In 2010, experts from CNPC subsidiary companies participated in a study tour to meet with North American technology vendors and clarify their needs and interests. CNPC's RISE is also gearing up to address new domestic regulations. Its most recent plan is to implement a company-wide program to conduct and document an emissions inventory.

Over the next 3 years, RISE will be committing significant financial resources to reduce emissions throughout the company. This will ensure ongoing EPA support for activities such as additional site audits, training on data analysis methods, refining and implementing management guidelines, evaluating measurement and testing equipment for possible purchase, and proposing specific implementation project ideas.

Additional funding for these activities has come from Environment Canada through its commitments to the Methane to Markets Partnership.



Looking

The cooperative efforts to reduce methane emissions through the Methane to Markets Partnership are having a significant impact on climate change in the near-term while delivering valuable long-term economic and environmental benefits to developing countries. The Methane to Markets Partnership Expo, held in March 2010 in New Delhi, India, showcased the successes achieved by more than 300 projects around the world. With fewer market barriers and access to additional information and technology, more and more communities in Partner Countries are fighting climate change while gaining new sources of clean energy, improving local environmental quality, and increasing safety at industrial facilities. These efforts have made the Partnership one of the most successful and well-respected international climate change initiatives.

Forward

The United States recognizes that more action must be taken to combat climate change, with methane being an essential part of the solution, given the significant cost-effective reduction opportunities throughout the world. Under the Obama Administration, the United States is urging more robust global action toward reducing methane emissions. This includes stronger financial commitments, continued engagement of the private sector, and support for Partner efforts under the United Nations Framework Convention on Climate Change.

With this international view, on October 1st, 2010, the United States joined the Partnership's 38 Partners in Mexico City to launch a new Global Methane Initiative (GMI). GMI builds on the existing structure and success of Methane to Markets, supported by a revised Terms of Reference. The key elements of this initiative include:

300 projects

number of projects underway around the world to reduce methane emissions

- **Expanded scope** to include methane abatement and avoidance from existing and new sectors, such as municipal waste water.
- **Methane action plans** by all Partner Countries to coordinate methane reduction efforts at home and abroad. Developed countries will provide assistance to developing-country Partners.

- **New resource commitments** from developed-country Partners and others in the broader international community to accelerate global methane abatement.

The United States has committed at least $50 million over the next 5 years to ensure that the success begun under Methane to Markets will deepen and broaden through GMI, and it will encourage other Partners to do the same. The next phase of international cooperation on methane mitigation can and must do more to address the challenge of climate change. The U.S. government will work actively with its public and private sector Partners to advance this important new initiative.

Methane to Markets

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