August 2012

GLOBAL METHANE INITIATIVE

MUNICIPAL WASTEWATER SUBCOMMITTEE ACTION PLAN

I. Introduction

The Global Methane Initiative (GMI) is an international initiative that aims to reduce global methane emissions in order to enhance economic growth, strengthen energy security, improve air quality, improve industrial safety, and reduce emissions of greenhouse gases. In the municipal wastewater sector, methane recovery and use as a clean energy source can be a highly sustainable solution, contributing to a number of environmental objectives as well as providing social and economic benefits for communities.

The Terms of Reference for the Partnership broadly define the role of the subcommittees as being "responsible for guidance and assessment of area specific activities and engaging representatives of the private sector, development banks, researchers and other relevant governmental and non-governmental organizations." The subcommittees are charged with developing an action plan for these activities which should include:

- Overview of methane mitigation, recovery, and use opportunities and descriptions of available technologies and best practices.
- Identification of key barriers and issues for project development.
- Identification of possible cooperative activities to increase methane recovery and use in the sector.
- Outreach to engage Project Network members.
- Discussion of country-specific needs, opportunities and barriers.

The Municipal Wastewater Subcommittee recognizes that, under GMI, priority is given to activities that have the greatest chance to achieve emissions reductions in the near term. However, a number of important barriers to project development need to be addressed that are associated indirectly or in the longer-term with emissions reductions.

II. Origins of the Municipal Wastewater Subcommittee and Action Plan

The issue of methane recovery and use from municipal wastewater treatment and GMI involvement was initially raised by Chile at the Steering Committee Meeting in January 2009 (Monterey, Mexico). In September 2009, at the Steering Committee Meeting in Washington, D.C, USA, the Administrative Support Group (ASG) presented a municipal wastewater treatment sector scoping paper[1] which addressed the following topics:

- Overview of global methane emissions from wastewater.
- Description of aerobic and anaerobic wastewater treatment options and associated co-benefits.
- Current economically feasible mitigation technologies and practices during the wastewater treatment process, including barriers to deployment, mitigation potential, and associated costs.

[1] The municipal wastewater treatment scoping paper is available at: http://www.globalmethane.org/documents/events_steer_20090910_scoping.pdf.

- Key international organizations and efforts currently engaged in mitigating emissions in the wastewater sector and options for GMI to leverage these efforts.
- Examples of global wastewater methane project development.

Options for incorporating municipal wastewater into GMI were discussed further at the March 2010 Steering Committee meeting in New Delhi, India, and based on Steering Committee consensus it was decided that a Wastewater Task Force would be convened to assess Partner interest and engagement. The Wastewater Task Force held two teleconference meetings in July and October 2010, and met in-person in Venice, Italy in November 2010. Due to continued, strong Partner interest in this sector the Wastewater Task Force produced a recommendation to elevate the task force to a full subcommittee. In October 2011, at the GMI meeting in Krakow, Poland, Steering Committee delegates officially elevated the Wastewater Task Force to the Municipal Wastewater Subcommittee.

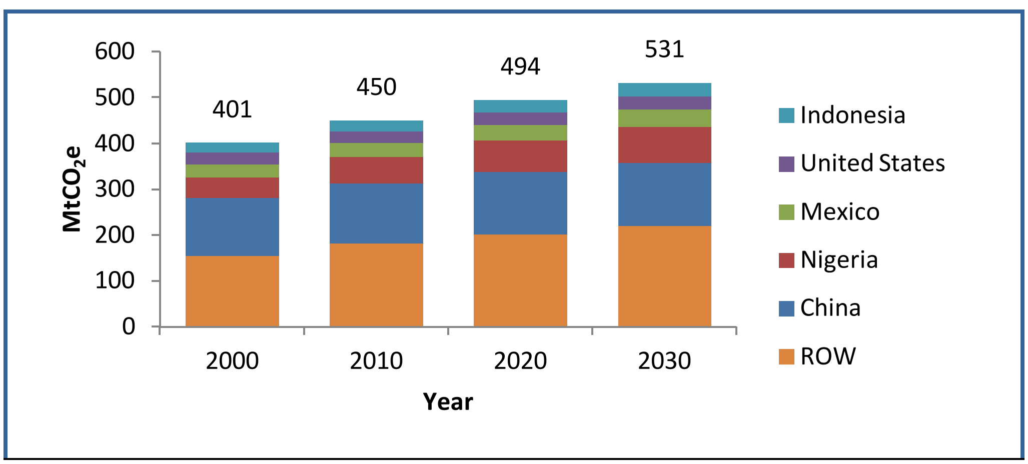
The work conducted by the task force provided useful background information for the work of the subcommittee and the development of this Action Plan. This Action Plan sets out the broad framework of activities for the Municipal Wastewater Subcommittee. The Action Plan is intended to be a living document that will be updated on an ongoing basis to reflect new projects and priorities as the work of the subcommittee develops.

III. Overview of Methane Emissions from Wastewater

Methane is emitted both incidentally and deliberately during the handling and treatment of municipal wastewater through the anaerobic decomposition of organic material. Most developed countries rely on centralized aerobic wastewater treatment to collect and treat domestic and commercial wastewater, resulting in small and incidental methane emissions. In developing countries with little or no collection and treatment of wastewater, however, anaerobic treatment systems such as lagoons, septic systems, open sewers, and latrines are more prevalent, resulting in greater methane emissions.

In 2010, worldwide methane from wastewater accounted for more than 450 MtCO2eq. Wastewater is the fifth largest source of anthropogenic methane emissions, contributing approximately 4 percent of total global methane emissions in 2010. China, Nigeria, Mexico, the United States, and Indonesia combined account for 60 percent of the world's methane emissions from wastewater (see Figure 1).[2]

Figure 1: Methane Emissions from Wastewater: 2000-2030 ($MtCO_2e$)



Source: U.S. Environmental Protection Agency (USEPA). 2011. Draft Global Non-CO2 Emissions Projections Report: 1990–2030. Washington, D.C.: USEPA, OAR, Climate Change Division. EPA 430-D-11-003. Obtained at: http://www.epa.gov/climatechange/EPAactivities/economics/nonco2projections.html.

[2] U.S. Environmental Protection Agency (USEPA). 2011. Draft Global Non-CO2 Emissions Projections Report: 1990–2030. Washington, D.C.: USEPA, OAR, Climate Change Division. EPA 430-D-11-003. Obtained at: http://www.epa.gov/climatechange/EPAactivities/economics/nonco2projections.html.

Global methane emissions from wastewater are expected to grow by approximately 18 percent between 2010 and 2030. Africa, the Middle East, Asia, and the Central and South American regions are projected to experience significant growth in methane emissions over the next 20 years. Excluding the top five emitting countries, methane emissions are projected to increase by approximately 48 percent, 36 percent, 24 percent, and 24 percent respectively from these regions (see Table 1).[3]

Table 1: Projected Methane Emissions from Wastewater: 2010–2030 ($MtCO_2e$)

Country	2010	2015	2020	2025	2030	% Growth (2010 2030)
Top 5 Emitting Countries						
China	132	135	137	138	138	4.5%
Nigeria	56	62	67	73	78	39.3%
Mexico	31	33	35	36	38	22.6%
United States	25	26	28	29	30	20.0%
Indonesia	24	25	26	27	28	16.7%
Rest of Region						
Africa	21	23	26	29	31	47.6%
Asia	58	62	66	69	72	24.1%
Central & South America	38	40	43	45	47	23.7%
Eurasia	27	26	26	25	24	-11.1%
Europe	26	27	27	27	28	7.7%
Middle East	11	12	13	14	15	36.4%
North America	0	0	0	0	0	0.0%
World Total	**450**	**473**	**494**	**514**	**531**	**18.0%**

Source: U.S. Environmental Protection Agency (USEPA). 2011. Draft Global Non-CO2 Emissions Projections Report: 1990–2030. Washington, D.C.: USEPA, OAR, Climate Change Division. EPA 430-D-11-003. Obtained at: http://www.epa.gov/climatechange/EPAactivities/economics/nonco2projections.html.

IV. Overview of Methane Mitigation, Recovery, and Use Opportunities and Descriptions of Available Technologies and Best Practices

There are several approaches to wastewater methane mitigation and recovery. There are also several options for the use of recovered methane. Table 2 identifies a number of methane mitigation and recovery approaches, and Table 3 presents the wastewater methane utilization options.

The primary focus of the Municipal Wastewater Subcommittee will be on identifying and promoting methane recovery and use opportunities and best practices at existing centralized municipal wastewater treatment facilities, with an emphasis on those parts of the system producing high concentrations of methane. In addition to identifying and promoting recovery and use opportunities and best practices at existing facilities, the subcommittee will also seek to identify a strategy for engaging global, regional and national entities involved in planning and execution of wastewater infrastructure as to how to integrate methane mitigation and utilization into new projects. The subcommittee will explore all technology and best practice opportunities that facilitate wastewater methane recovery and use.

[3] USEPA, 2011

Table 2: Wastewater Methane Mitigation and Recovery Approaches

Recovery Approach	Description
Installation of anaerobic sludge digestion (new construction or retrofit of existing aerobic treatment systems)	Many facilities in the developed world effectively use anaerobic digesters in tandem with aerobic treatment processes to process wastewater biosolids, producing biogas that is used onsite to offset the use of conventional fuel that would otherwise be used for energy at the wastewater treatment facility. In addition to producing a "free fuel" that can be used to generate energy, anaerobic digesters can improve water quality, isolate and destroy disease causing organisms that might pose a risk to human and animal health, and can provide additional revenue streams, such as soil fertilizers that can be produced from digester effluent. The greatest potential for installation of anaerobic sludge digesters is either through the construction of new centralized aerobic facilities driven by increasing population growth, or through the retrofit of existing centralized aerobic treatment facilities.
Installation of biogas capture systems at existing open air anaerobic lagoons	Biogas capture systems for anaerobic lagoons are the simplest and easiest method of biogas implementation, and have been used around the world as a manure management practice at livestock farms. Many parts of the world currently rely on open air anaerobic lagoons to treat wastewater. Rather than investing in a new centralized aerobic treatment plant, covering an existing lagoon and capturing the biogas can be the most economically feasible means to reduce methane emissions. This is especially true in regions of the world that do not have the resources to invest in new infrastructure or cannot support and maintain a centralized aerobic treatment facility. However, several barriers exist that have prevented widescale use, including lack of need to install covers, lack of experience applying the technology to municipal systems in developing countries, and a lack of capacity in developing countries to support design, construction and installation of covered lagoons.
Installation of new centralized aerobic treatment facilities or covered lagoons	Installation of new centralized aerobic treatment systems or new covered lagoons to treat wastewater in place of less-advanced de-centralized treatment options (or no treatment at all) can also greatly reduce current and future methane emissions associated with wastewater. This option is most viable in areas with expanding populations that have the infrastructure and energy available to support such systems. Although conversion of anaerobic systems to aerobic systems can be quite costly for existing communities, it is less so for a new community under development or experiencing high growth. For these communities, installation of a centralized aerobic treatment system can avoid increases in future emissions due to the increasing population, and may in fact result in decreases to overall methane emissions even while populations increase.
Optimize existing facilities/systems that are not being operated correctly and implement proper operation and maintenance (O&M)	Optimization of existing facilities and wastewater systems that are not being operated correctly to mitigate methane emissions is a viable alternative to installing new facilities or wastewater treatment processes such as anaerobic digesters. Proper O&M also ensures that facilities continue to operate efficiently with minimal methane emissions.

Table 3: Wastewater Methane Use Options

Methane Use Option	Description
Digester gas for electric and heat generation with combined heat and power (CHP)	Facilities can use recovered methane as fuel to generate electricity and heat in a CHP system using a variety of prime movers, such as reciprocating engines, microturbines, or fuel cells. Power production onsite can offset purchased electricity, and the thermal energy produced can be used to meet digester heat loads and for space heating.
Digester gas for electricity or heat only	Facilities can use recovered methane as fuel to generate electricity and heat in a CHP system using a variety of prime movers, such as reciprocating engines, microturbines, or fuel cells. Power production onsite can offset purchased electricity, and the thermal energy produced can be used to meet digester heat loads and for space heating.
Digester gas purification to pipeline quality	Facilities can market and sell properly treated and pressurized biogas to the local natural gas utility.
Direct sale of digester gas to industrial user or electric power producer	Facilities can treat, deliver, and sell biogas to a local industrial user or power producer where it can be converted to heat and/or power.
Digester gas to vehicle fuel	Facilities can treat and compress biogas on site to produce methane of a quality suitable for use as fleet vehicle fuel.

V. Identification of Key Barriers and Issues for Project Development

There are many barriers that confront wastewater methane abatement, recovery and use. In general, regardless of the methane abatement, recovery, or use technology or process approach the following barriers are encountered:

- **Lack of data on emissions produced within the wastewater sector**. In many circumstances there is a lack of data available on the methane emissions produced by an individual facility or within a region. Without accurate estimates of methane emissions it can be difficult to identify the best recovery and use technologies and practices.
- **Lack of expertise or awareness of recovery and use technologies and practices**. In many countries, there is very little local capacity to support design, construction, installation, and operation of methane recovery and use technologies.
- **High costs of recovery and use technologies and lack of access to financing**. Design, construction, and installation of methane recovery and use technologies can be high cost, and is often exacerbated by a lack of access to project financing.
- **Unfavorable energy or utility policies**. Some countries have policy barriers such as standby rates and interconnection rules that make cost effective use of recovered methane difficult. Even in the developed world, recovered methane must compete with established infrastructure, and without proper government support and policy, biogas recovery and use projects can often fail or not be cost effective.

The Municipal Wastewater Subcommittee will work to remove all barriers to methane recovery and use in the wastewater sector. Specifically, the subcommittee will work to better understand, identify, and quantify the methane emissions produced by individual wastewater treatment facilities and regions; enhance local capacity to design, implement, and operate methane recovery and use technologies; identify ways and means to support investment in methane recovery and use technologies and projects; support implementation of effective policy frameworks; and facilitate collaborative project development and implementation.

VI. Identification of Possible Cooperative Activities to Increase Methane Recovery and Use

Cooperative activities to mitigate methane emissions and encourage active recovery and utilization are key objectives of GMI across all sectors. The Municipal Wastewater Subcommittee will explore all cooperative opportunities to increase wastewater methane recovery and use. These opportunities include:

- Two or more Partner countries working together on a specific initiative(s).
- Forming working groups to identify and recommend subcommittee and country-specific actions.
- Ensuring regular contact with Partner countries and their private sector counterparts.
- Engaging international wastewater organizations, professional organizations, academia, multilateral banks, and the private sector.

A key collaborative activity of the subcommittee will be to identify appropriate contacts in relevant international, regional and national level professional organizations, financial institutions and academia focused on wastewater management that could be leveraged to facilitate discussion and better position GMI to promote the implementation of methane projects within the wastewater sector. These contacts should be identified based upon their ability to facilitate implementation of the wastewater sector action plan.

Organizations with which the subcommittee will pursue collaboration opportunities, and possible activities to pursue, include the following:

International Wastewater Organizations, Research Institutions, and Professional Organizations

Collaborations with international wastewater organizations, research institutions, and professional organizations such as the Water Environment Federation (WEF), Water Environment Research Foundation (WERF), the International Water Association (IWA), and the Global Water Partnership (GWP) will be pursued. Specific activities to undertake together with these institutions might include:

- Organizing data on system designs, costs, and most importantly, actual installation experiences to date.
- Participating in pilot installations, possibly sharing costs of measurement and documentation of performance.
- Promoting anaerobic digestion in the sector. GMI could access its already established network of water and sanitation professionals, local institutions, utilities, and others to transfer knowledge and technologies.
- Facilitating policy and regulatory reform where required, as well as developing national standards and norms for anaerobic digestion in the wastewater sector.
- Facilitating the retrofitting of current wastewater treatment facilities through its affiliates and networks.
- Knowledge transfer to and from GMI.

Multilateral Banks

Collaborations with multilateral banks such as the World Bank (WB), the Asian Development Bank (ADB), and the Inter-American Development Bank (IADB) will be pursued. The reach of multilateral banks and their commitments to environmentally sustainable projects, makes them good potential partners to promote methane reduction projects internationally, even more so because of their in-country offices around the world and their lending to country governments and local project implementers. Specific activities to undertake together with these institutions might include:

- Providing programmatic and technology expertise to include anaerobic digestion in future infrastructure investments.
- Developing wastewater methane reduction efforts as climate change projects.
- Participating in pilot installations and sharing costs and data.
- Providing technical advice on potential impacts of anaerobic digestion at local, national, and regional levels.
- Serving as a repository of data on wastewater emissions reduction projects, technologies, applications and experiences.

- Providing a forum for the coordination of investment programs and donor assistance at the country level.

VII. Outreach to Engage Project Network Members

A key activity of the Municipal Wastewater Subcommittee will be to engage national and international professional organizations that comprise companies and service providers actively engaged in the planning and design of wastewater treatment infrastructure. Manufacturers and developers of methane recovery and use technologies will also be engaged by the subcommittee.

Encouraging private-sector organizations to join the Project Network will be a vital component of the Subcommittee's activities. Each Partner country should open the lines of communication with relevant private-sector parties to ensure their active participation in the ongoing activities of the Partnership, and should actively recruit organizations for the Project Network to increase awareness of project opportunities and barriers in their respective countries.

VIII. Country-Specific Needs, Opportunities, and Priorities

Country-specific needs, opportunities, priorities, and specific activities to undertake will be identified through country-specific action plans. After the subcommittee develops its overarching action plan, each country will use the guiding concepts identified to develop its own country-specific action plan.[4] Besides providing a roadmap for country-specific activities, country-specific action plans can also be used as a convening mechanism for developed countries to help developing countries with their efforts.

As discussed in Section III of this Action Plan, China, Nigeria, Mexico, the United States, and Indonesia constitute the largest emitters of wastewater methane, and thus present the greatest opportunities for methane recovery and use. However, opportunities for methane recovery and use exist in every country. A key goal of the subcommittee will be to identify and promote the emissions reduction and use opportunities achievable in all countries and regions.

[4] Country-specific action plan guidance is available on the GMI website at: http://www.globalmethane.org/documents/partners_actionplan_guidance_sectors.pdf.