Overview of Sector

Vietnam’s urban population is growing 4.4 percent annually, industry is growing 17 percent annually, and the agriculture sector continues its steady growth. As a result, Vietnam produces increasing quantities of waste in the form of solid waste from domestic and agricultural activities, wastewater from households and industries, and waste from livestock. Systems to manage this waste, such as wastewater treatment systems and landfills, are just beginning to be established and modernized.

Solid Waste

**Municipal solid waste.** Municipal solid waste generation is expected to reach 21 million tons per year by 2010, of which 63 percent will be generated in urban areas: five cities will be generating more than 1,000 tons per day, and six cities will be generating 500 to 1,000 tons per day. Although Vietnam is in the process of modernizing its municipal solid waste disposal sites by upgrading from open dumps to managed disposal sites, no regulations or standards have been established to control the methane in the landfill gas released by the decay of solid waste in these sites.

**Agricultural residues.** Agriculture produced an estimated 68 million tons of waste in 2006, of which byproducts from rice and sugar cultivation and processing formed the major part. These residues can serve a variety of purposes—household cooking fuel can be made from rice hulls and energy for sugar mills can be derived from bagasse, for example—but estimates indicate that only 26 percent of agricultural waste is put to such uses, and unutilized surplus crop residues release greenhouse gases during uncontrolled burning or decay. Management of agriculture residues is also important because of their potential use as a source of renewable energy to substitute for fossil fuels.
Domestic wastewater. In 2006, urban areas produced 2.0 million cubic meters per day of domestic wastewater, of which the two major cities, Ho Chi Minh City and Hanoi, produced 0.8 million cubic meters per day and 0.4 million cubic meters per day, respectively, or 60 percent of the total. The total domestic wastewater volume is expected to reach over 3.5 million cubic meters per day by 2010. Currently about 90 percent of urban households have access to hygienic septic tanks and latrines; typically, however, these are not maintained, and less than 30 percent of the resulting wastewater is treated in centralized facilities. Untreated domestic wastewater is discharged directly into sewer systems, rivers, and lakes, causing pollution and environmental degradation in many of the country’s canals and rivers. Domestic wastewater in rural areas is deposited through open defecation, septic tanks, or latrines or discharged directly into the rivers or open ponds. These common disposal methods are the major source of GHG emissions from municipal wastewater because methane is released as wastewater degrades in open anaerobic systems, such as polluted waterways (rivers or lakes), septic tanks, or open-pit latrines, or in open anaerobic treatment systems lacking biogas collection capability. The sludge generated by wastewater treatment plants is also commonly deposited in landfills, adding to the levels of methane emission.

Industrial wastewater. Industrial wastewater generation varies from one province to another, depending on the level of industrial development. The industry-intensive cities and provinces in Vietnam’s southeastern and Red River Delta regions generate the major part of the country’s industrial wastewater. Currently, only a portion of the nation’s total industrial wastewater is being treated, and untreated wastewater is discharged directly into already highly polluted rivers. Large quantities of organic wastewater are produced by the food and beverage and the fish and meat processing industries; tanneries, too, release large quantities of methane by discharging untreated wastewater into polluted rivers or by using open anaerobic treatment systems.
Livestock Waste

In 2006, the livestock population in Vietnam included about 27 million pigs, 6.5 million cattle, and 2.9 million buffalo. Livestock holdings in Vietnam are commonly found in small, individual household farms (5 to 20 animal heads), which account for close to 99 percent of the total livestock population (ENERTEAM 2003). The number of large livestock farms, accounting for just over 1 percent of the livestock population, was estimated at more than 16,700 in 2006. As with industrial and domestic wastewater, it is common practice to allow livestock waste to degrade in rivers, streams, or in open lagoons; as a result, it is a significant source of methane emissions.

<table>
<thead>
<tr>
<th>Livestock type</th>
<th>Livestock population (million heads)</th>
<th>Manure generation* (million tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pig</td>
<td>26.9</td>
<td>26.9</td>
</tr>
<tr>
<td>Cattle</td>
<td>6.5</td>
<td>16.3</td>
</tr>
<tr>
<td>Buffalo</td>
<td>2.9</td>
<td>13.3</td>
</tr>
<tr>
<td>Total</td>
<td>36.3</td>
<td>56.5</td>
</tr>
</tbody>
</table>

Greenhouse Gas Emissions

Estimates from the “Vietnam Initial National Communication” indicate that in 1994 greenhouse gas emissions from municipal, domestic, industrial, agricultural, and livestock waste amounted to 6.7 million tCO2-e, or 6.5 percent of Vietnam’s total emissions. Most emissions came from livestock waste (2.7 million tCO2-e); municipal solid waste and domestic wastewater (2.5 million tCO2-e); and field burning of agricultural residues (1.5 million tCO2-e). Emissions from these sources are expected to continue to increase in importance due to rapid industrial expansion, population growth, escalating urbanization, and intensifying demand for livestock, sugar, and rice. In addition, due to reliance on the detrimental common practices outlined above and other barriers, even as modernization moves forward adoption of wastewater and solid waste management and biomass energy technologies to reduce greenhouse gas emissions is unlikely to occur without CDM incentives.
Potential Mitigation Measures for 2010 to 2015

Wastewater management. Anaerobic digestion of untreated wastewater can reduce methane emissions through controlled extraction. The biogas thus recovered can be used for electricity and heat production, reducing on-site electricity use or on-site fossil-fuel consumption. Methane recovery in existing wastewater treatment systems is possible where sludge is currently untreated and discharged into open lagoons or sludge pits to undergo natural decay. Emission reduction is achieved by treating the sludge in a new anaerobic digester or under aerobic conditions; the recovered methane (biogas) can then be used for energy production. If a combination of these interventions is implemented in Vietnam’s cities over the next few years, the potential emission reduction would be 1.1 million tCO2-e per year; implementation in the five major cities could reduce emissions by 700,000 tCO2-e per year. Introducing aerobic sanitation systems in rural areas has the potential to reduce emissions by 1.6 million tCO2-e per year, a portion of which could be captured through a targeted intervention.

Solid waste management. Methane emissions from municipal solid waste landfills can be reduced through composting, which avoids the production of methane, and through landfill gas collection systems that recover and combust the gas. Vietnam has 19 cities with 27 landfills large enough to consider installing landfill gas facilities, for a potential emission reduction of 2 million tCO2-e per year. In its largest cities, initial estimates indicate, eight landfills could reduce emissions by more than 1.6 million tCO2-e per year. There is one registered CDM project for Landfill gas in Ho Chi Minh’s Dong Thanh landfill. Composting can be implemented in any town or city in the country, and if small- and medium-sized cities are targeted the emission-reduction potential is 1.7 million tCO2-e per year. Currently 74 percent of agricultural residues that could be used as sources of renewable energy go unexploited. The overall potential for energy from rice husk and sugar bagasse is 419 MW, which if transferred to the electricity grid would amount to 0.9 million tCO2-e per year in emission reductions.

Livestock waste management. Biogas wastewater treatment systems for animal wastes can recover and combust methane from animal manure. These systems have been introduced in only a small fraction of the sector (less than 5 percent), and scaling up adoption of the technology at the household level would be a significant step toward modernizing the sector’s waste management and reducing its methane emissions. The recovered methane could be flared or gainfully used as fuel for cooking and lighting (in households and on small livestock farms) and for thermal or electrical energy generation (on large livestock farms). With the huge population of livestock in the country, the potential reduction in greenhouse gases is 7.3 million tCO2-e per year, a significant portion of which could be captured using a sector-wide intervention.
Emission reductions from different interventions in waste management sector

- Piggery waste treatment (27 million head potential)
- Landfill gas to energy (19 city potential)
- Solid waste composting (718 town/city potential)
- Rural aerobic septic systems (10 million person potential)
- Urban wastewater (47 city potential)
- Industrial wastewater (1.2 million tCOD/yr potential)
- Agricultural waste to energy (419 MW potential)

Note: Estimates based on annual reductions during 2010 to 2015.

Contact Information
Ministry of Natural Resources and Environment (MoNRE)
83 Nguyen Chi Thanh
Dong Da - Ha Noi, Vietnam

Phone: Ph: (84-4) 3775-9385
E-Mail: vnccoffice@fpt.vn

References