

Nationwide Survey of Landfill Methane Generation/Recovery and Greenhouse Gas (GHG) Reduction Potentials in The People's Republic of China

Tsinghua-IESE, China, and EarthRes Group, Inc., U.S.A.

OVERVIEW OF MSW PROJECT

This poster presents the preliminary results from the Nationwide Survey of Landfill Methane Generation/Recovery and Greenhouse Gas (GHG) Reduction Potentials in China – one of the main components and tasks of the ongoing U.S. EPA-GMI granted project. To date, China's 661 large/medium cities collect more than **16 million tons** of MSW per year, of which about 79% is disposed of in sanitary landfills and/or unsecured dump-sites. The recent survey covers 372 centralized landfills for domestic waste disposal currently in operation, located in 297 Chinese cities. Using the country-specific LFG model recommended by the U.S. EPA, methane from LFG generated throughout China has been estimated based on the MSW quantity gathered in all the centralized, sanitary landfills annually as surveyed.

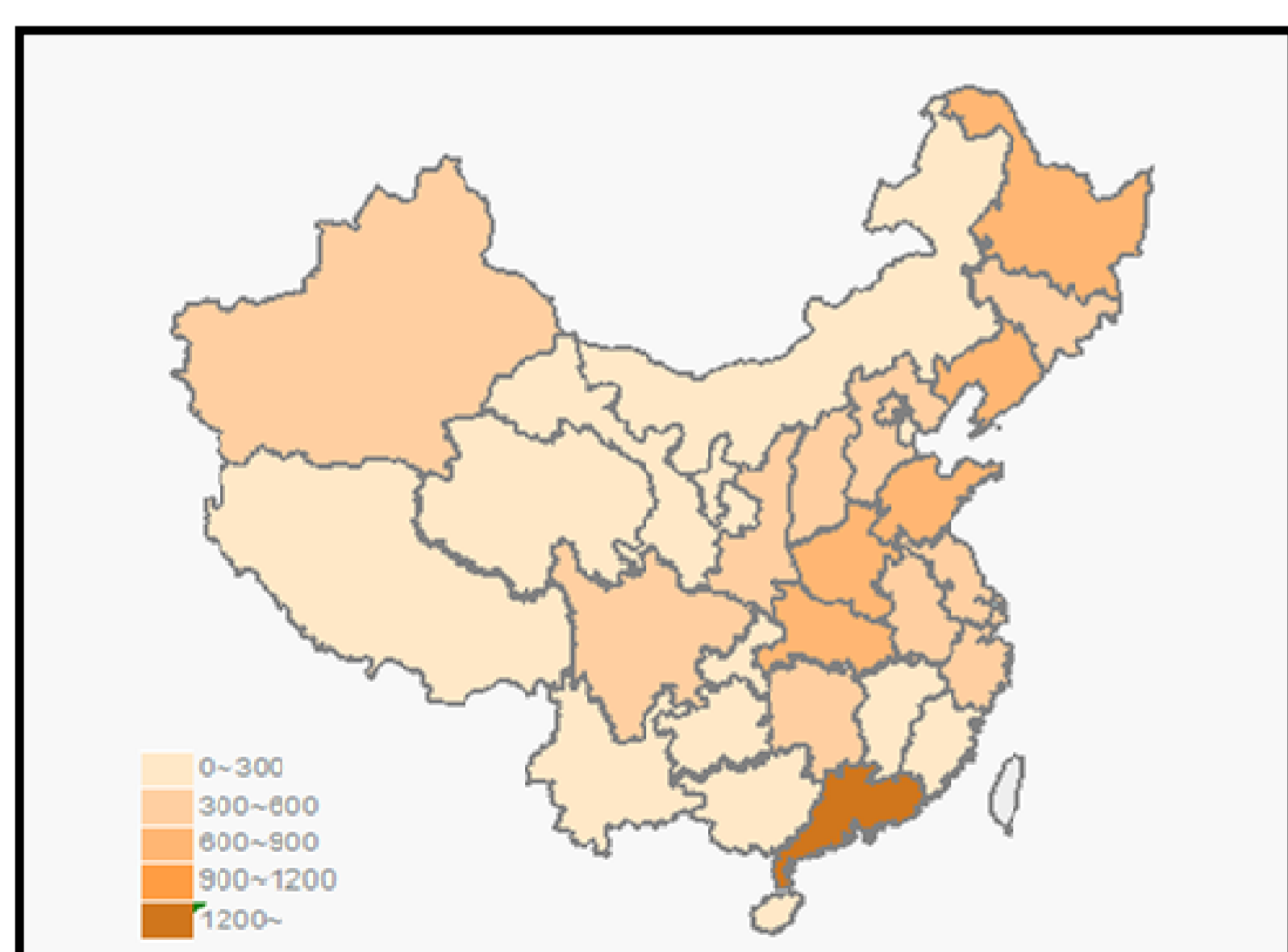
TYPE OF PROJECT: LFG generation potential survey

PROJECT START DATE AND/OR SCHEDULE FOR COMPLETION: 06/01/2011 – 5/31/2013

ESTIMATED AVERAGE ANNUAL EMISSION REDUCTIONS: 6.033 MMTCO₂E

PROJECT HIGHLIGHT(S)

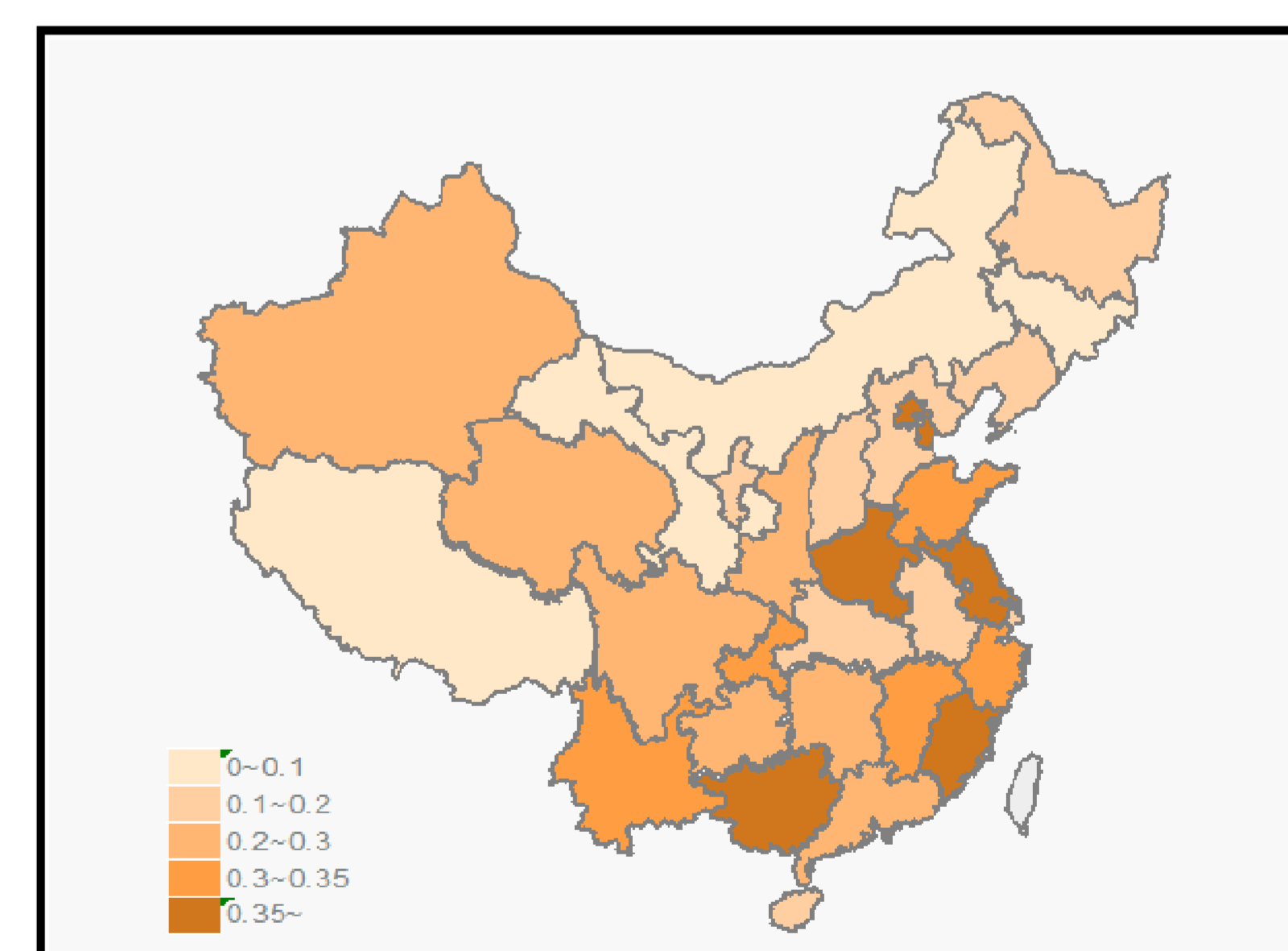
The total amount of landfill methane generated in China's centralized, sanitary landfills as recently surveyed is about 1.2 million tons/year, equivalent to about 1.6 million tons of standard coal. To date, most methane from the Chinese landfills or dump-sites is not recovered, thus representing a significant source of GHG emission and huge potential of renewable energy. Lack of technological and financial resources, as well as insufficient regulatory and technical guidelines, have been the major hurdles of LFG project development. Capacity building and technology transfer in this particular area are urgently needed and highly demanded in China.



Centralized Landfill Capacities in China (10⁴ t/y)



LFG Recovery/Utilization Projects in China



LFG Recovery Project Implement Ratio in China

This project received the following GMI support:

- Tsinghua-GMI 2010 Grant**

Capacity Building, Technology Transfer and Demonstration Project of Landfill Gas to Energy (LFGTE) Program in the People's Republic of China (2011-2013) – \$300,000 USD for two years, supported by the United States Environmental Protection Agency – Global Methane Initiative (USEPA-GMI) 2010 Grant Program.

DISCLAIMER: The information and predictions contained within this poster are based on the data provided by the site owners and operators and site visits conducted by U.S. EPA. The Global Methane Initiative (GMI) cannot take responsibility for the accuracy of these data. It should be noted that conditions on landfills will vary with changes in waste input, management practices, engineering practices, and environmental conditions (particularly rainfall and temperature). GMI does not guarantee the quantity or quality of available landfill biogas from the landfill site, which may vary from the values predicted in this report.

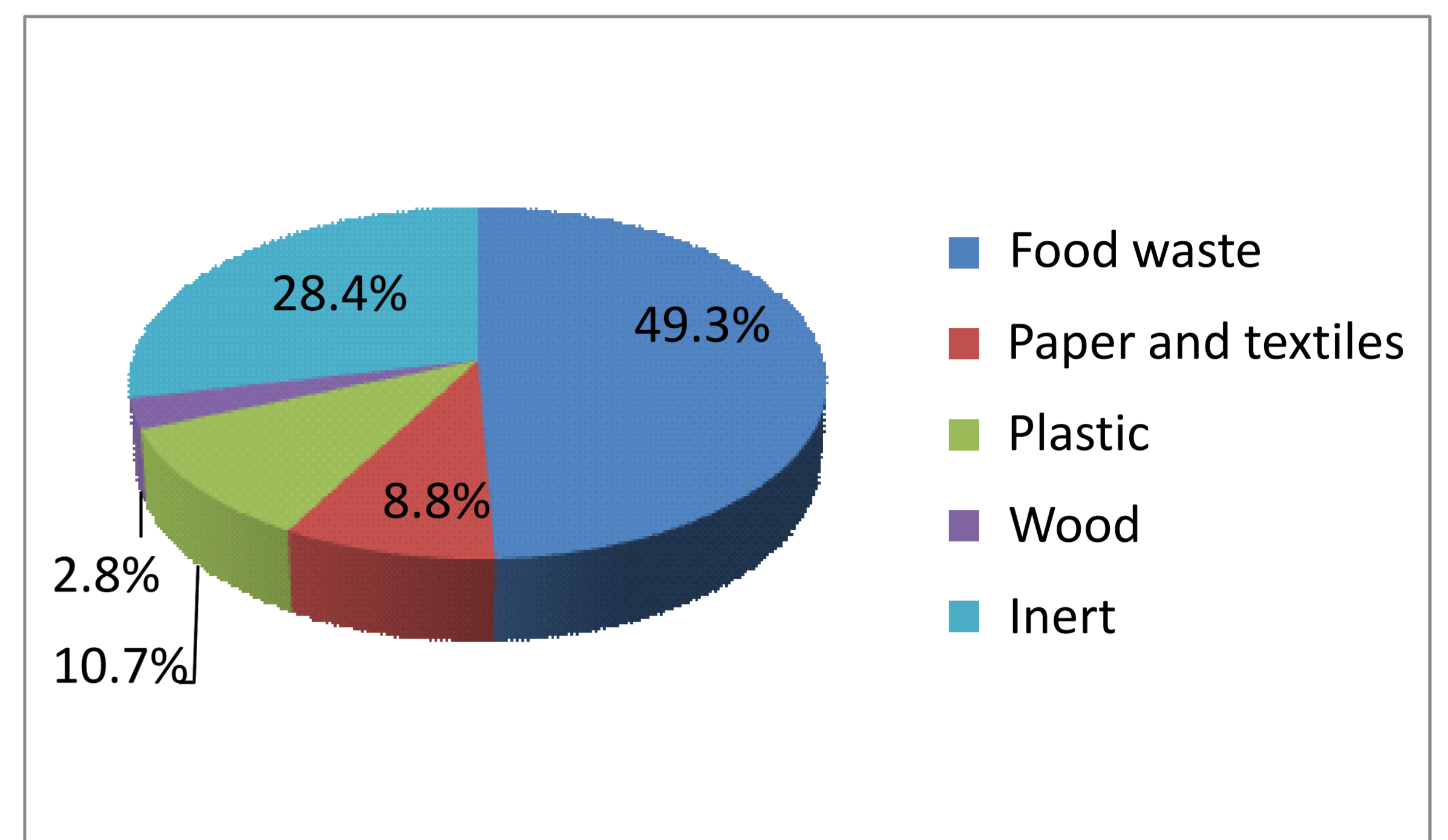
LANDFILL GAS AND ENERGY POTENTIAL

Supported by the U.S. EPA-GMI grant, Tsinghua-IESE estimated the amount of biogas generated by centralized, sanitary landfills in China using the EPA recommended country-specific LFG models. Model input data for the preliminary assessment of the landfill methane generation potential were provided by the user's manual prepared specifically for China by the U.S. EPA's Landfill Methane Outreach Program (LMOP) and the preliminary results of the on-going nationwide LFG survey in China.

Other Landfill Physical/Operational Data

- Quantity of waste collected annually: 1.6×10^8 tons
- Quantity of waste accepted in standard landfill: 6.8×10^7 tons
- Quantity of waste accepted in simple landfill: 5.9×10^7 tons
- For standard landfills
- Daily cover is applied
- Landfill site is capped with clay and/or plastic
- Landfill is lined with clay and/or plastic
- Waste compaction is performed

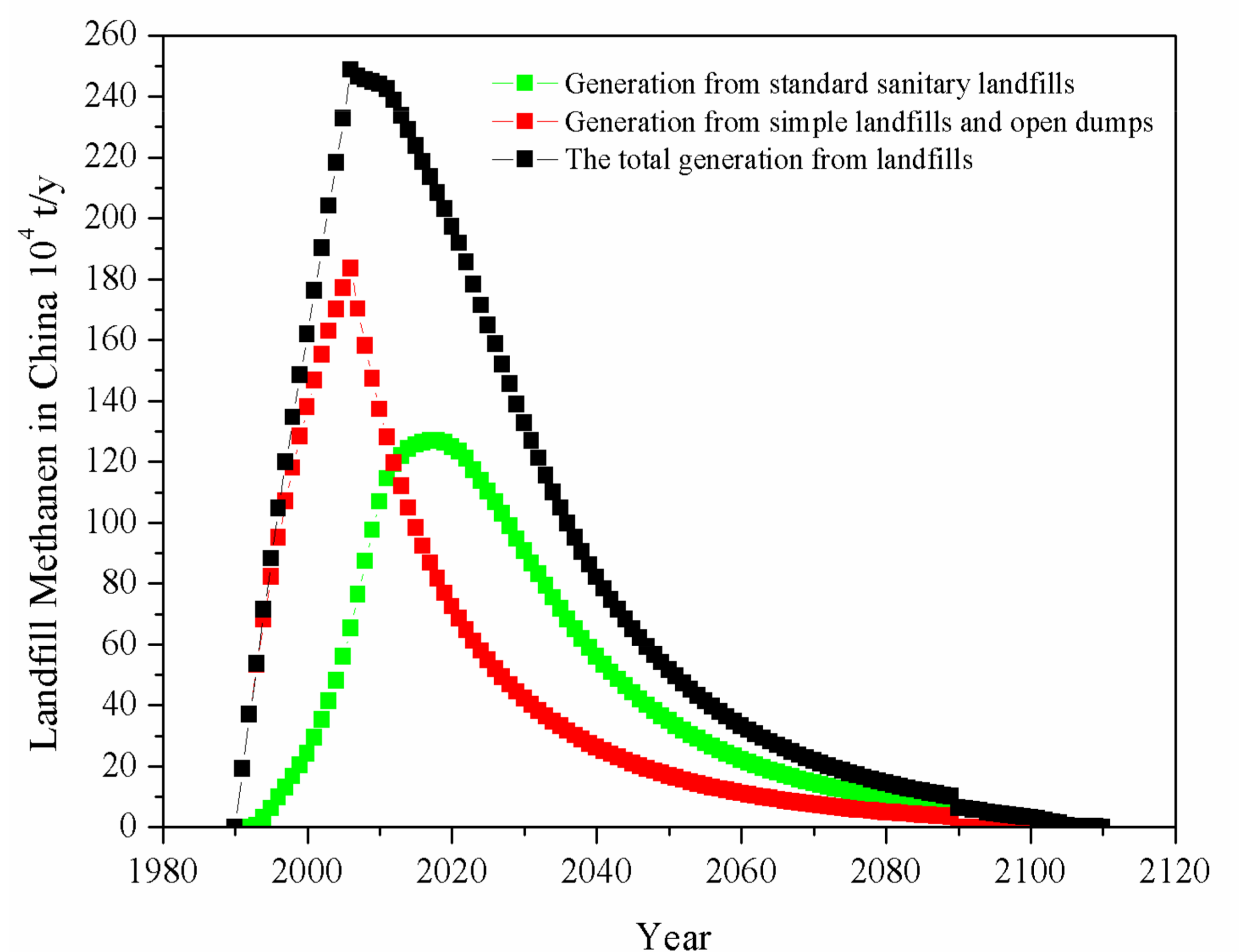
Waste Characteristics



Biogas Modeling Inputs:

- **CH₄ generation potential (Lo):**
 70 m³/Mg for Cold and Dry
 56 m³/Mg for Cold and Wet
 56 m³/Mg for Hot and Wet
- **CH₄ generation rate constant (k):**
 0.04 m³/Mg for Cold and Dry
 0.01 m³/Mg for Cold and Wet
 0.18 m³/Mg for Hot and Wet

Landfill Methane Generation Potential



Values for these modeling variables have been developed based on the waste composition data, average annual precipitation in different regions of China. It is not feasible to collect all the gas generated at the site for flaring or energy recovery, given site conditions and collection system limitations. Therefore, the amount of recoverable biogas potential was estimated by applying a gas availability factor to the results of the biogas generation model.

Recoverable Biogas Potential = 60% Landfill Area Available for Gas Collection x 40% Gas Collection Efficiency = 24%

PROJECT ECONOMICS

Estimated cost (US\$): TBD*
Operation & maintenance (US\$/year): TBD*
Estimated electricity offsets (US\$/year): TBD*

Estimated heating/other benefits (US\$/year): TBD*
Other revenue streams: CNG for alternative vehicle fuel, etc.
Estimated payback period (number of years): TBD*

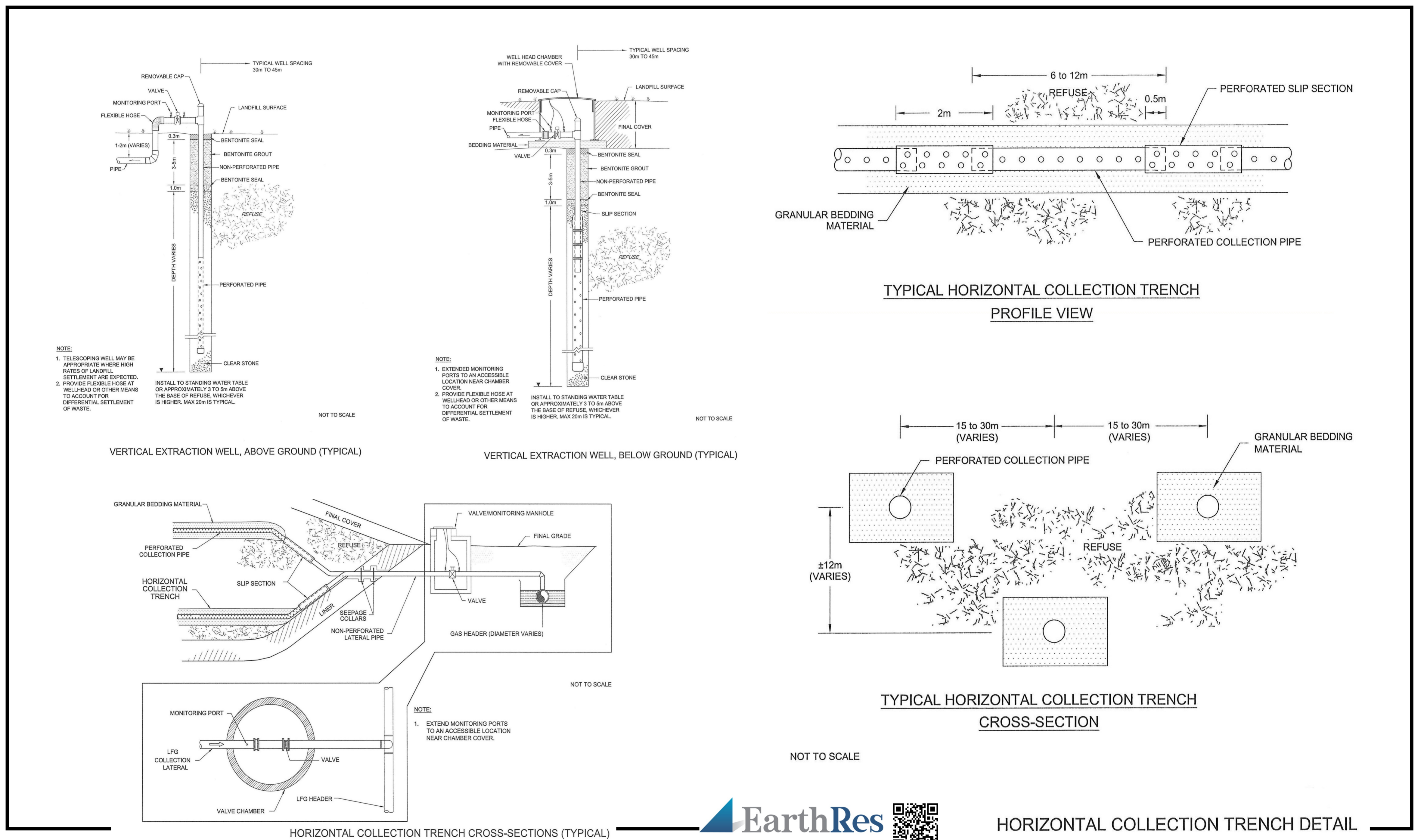
* based on final results of the overall Tsinghua-GMI Grant Project

ENVIRONMENTAL BENEFITS

Assuming that a gas collection and flaring or other LFGTE system is installed in a good portion of these Chinese landfills, landfill methane capture projects in China have tremendous opportunities to collect and destroy an average of at least **1.2×10⁶ tons** of methane annually over the next 15 years. This is equivalent to emission reductions of **5.1 – 6.4 million tons of CO₂ annually**.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Emission reductions potential MMTCO ₂ E from LFGTE Activities	6.1	6.3	6.3	6.4	6.4	6.4	6.4	6.3	6.2	6.1	5.9	5.7	5.5	5.4	5.1

PROPOSED LANDFILL BIOGAS COLLECTION SYSTEM



FOR MORE INFORMATION

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