

# MSW PROJECT OPPORTUNITY

## Zacatecas Municipal LFG Pilot Project

### Zacatecas, Zacatecas, Mexico

**The Municipality of Zacatecas, Mexico/EarthRes Group, USA**

#### OVERVIEW OF MSW PROJECT

Zacatecas Municipal Landfill, which began filling in 1993, is owned and operated by the Municipality of Zacatecas, Zacatecas, Mexico. Zacatecas Municipal Landfill is a partially-controlled open dump type of landfill with a designed area of waste placement totaling 16 hectares. Currently, there are approximately 2.55 million tons of waste in place with an average waste depth of 12 meters. The designed landfill capacity is 4.50 million tons and is expected to close in 2023 with an estimated 77 – 85 % of municipal wastes in place.

**TYPE OF PROJECT:** LFG Energy Recovery

**EXPECTED PROJECT SCHEDULE FOR COMPLETION:** 2016

**ESTIMATED AVERAGE ANNUAL EMISSION REDUCTIONS:** 55,882 MTCO<sub>2</sub>E

#### PROJECT HIGHLIGHT(S)

This project is planned for the development of a 1–3 MW landfill gas collection and power generation pilot facility in the Municipality of Zacatecas, State of Zacatecas, Mexico. To date, there have been only a few LFGTE projects under development or in planning in Mexico, but the potential needs are tremendous. The Zacatecas LFG project is the first of its kind to serve a medium-size municipality in the country. With much greater numbers of smaller landfills, this project can be a valuable proof of concept leading to hundreds of similar LFG beneficial projects throughout Mexico and thousands more in other developing countries. The Zacatecas LFG project will be developed in accordance with international standards and based on results of the feasibility study supported by a generous grant from the U.S. Trade and Development Agency (USTDA). The Municipality of Zacatecas is committed to diversifying its energy sources to meet the local growing demands by using renewable energy such as LFG. This project supports the Energy and Climate Partnership of the Americas, the U.S.–Mexico Bilateral Framework on Clean Energy and Climate Change, and Mexico's National Infrastructure 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

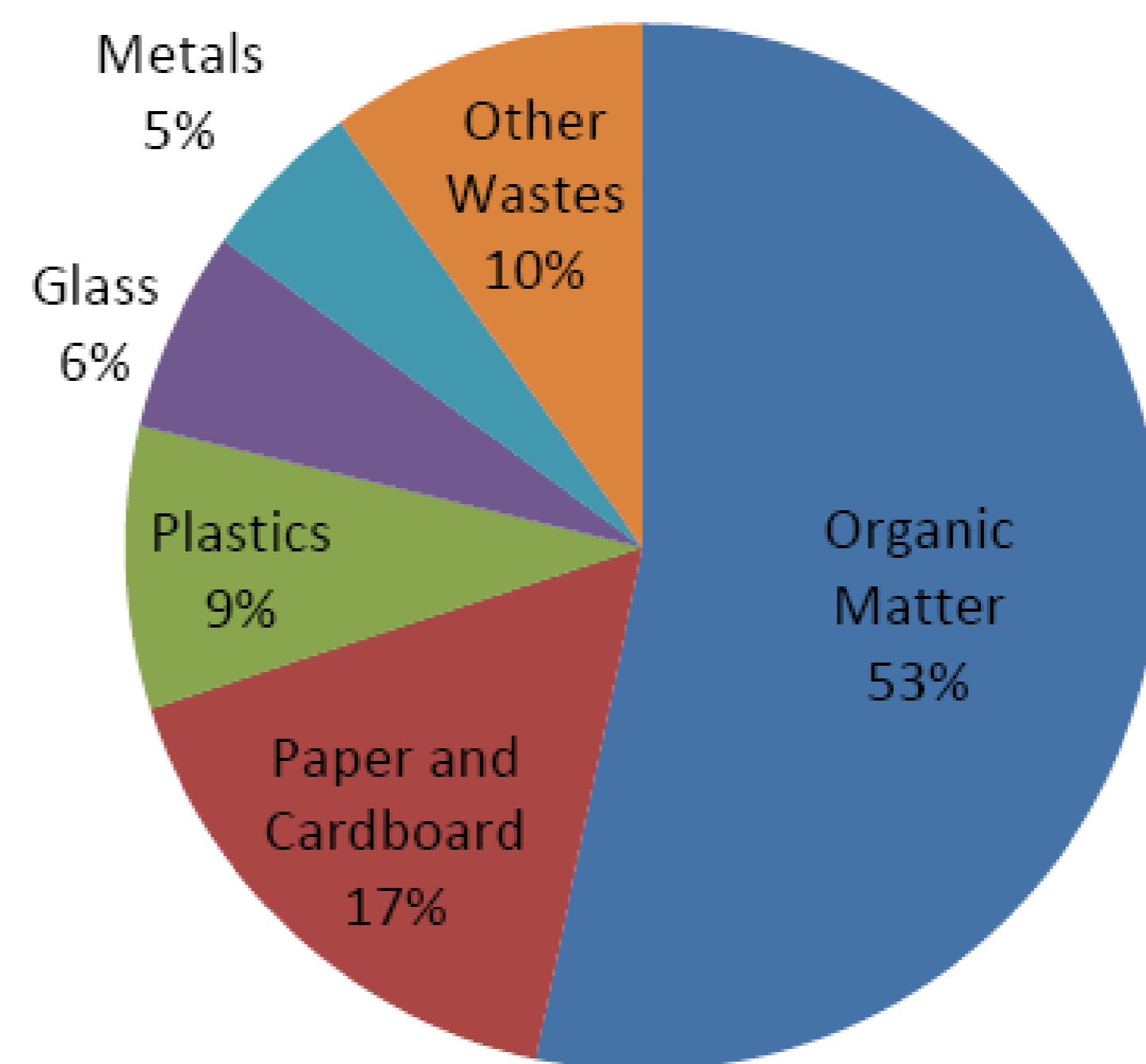
Under contract to the Municipality of Zacatecas, EarthRes Group, Inc. (EarthRes) – a U.S. environmental engineering firm, estimated the amount of biogas generated by the Zacatecas Municipal Landfill using the USEPA-GMI Mexico LFG model v2.0. Model input data for the preliminary assessment of this proposed landfill methane capture and use project were provided by the Project Owner – Municipality of Zacatecas.

## Other Landfill Physical/Operational Data

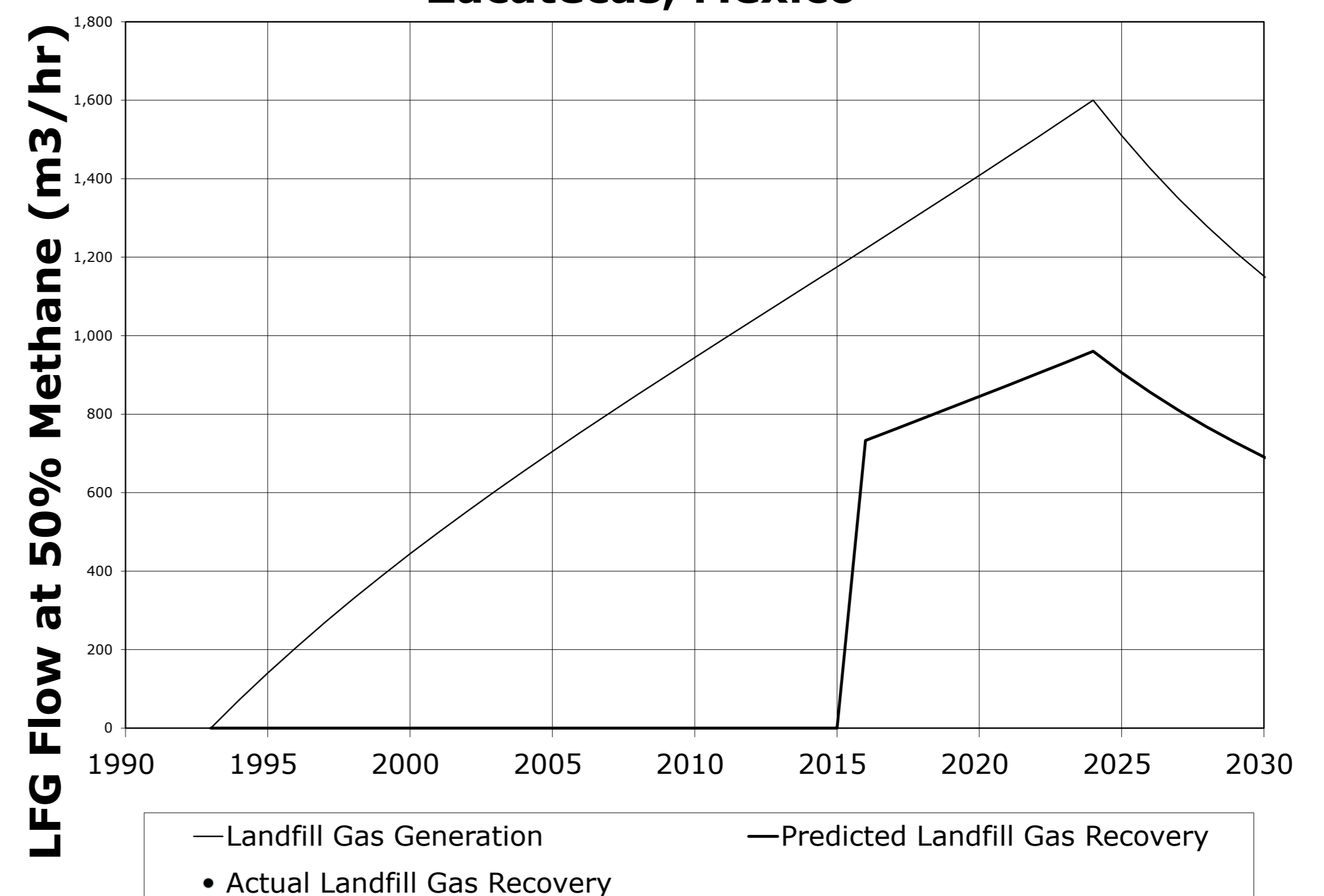
- Quantity of waste generated annually: 155,192 tons
- Quantity of waste collected per day: 425 tons
- Quantity of waste accepted annually: 130,000 tons
- Quantity of waste generated per capita: 1.2042 kg/day
- Daily cover is applied
- Landfill site is capped with soil
- Landfill is partially lined with clay
- Waste compaction is performed
- Landfill gas collection and control system: TBD\*
- Number of vertical or horizontal wells: TBD\*
- Average depth of wells: TBD\*
- Leachate management: N/A

\* based on results of the USTDA granted feasibility study

## Waste Characteristics



**Landfill Gas Generation and Recovery Projection Zacatecas Municipal Landfill, Zacatecas, Mexico**



### Biogas Modeling Inputs:

- CH<sub>4</sub> generation potential (Lo): 98.88 m<sup>3</sup>/Mg
- CH<sub>4</sub> generation rate constant (k):  
0.100 for fast-decay organic waste (e.g., food)  
0.039 for medium-decay organic waste (e.g., paper)  
0.010 for slow-decay organic waste (e.g., rubber)
- Percent methane: 50%
- Gas availability factor: 60%

Values for these modeling variables have been developed based on the waste composition data, and average annual precipitation at Zacatecas Municipal Landfill. 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 was estimated by applying a gas availability factor to the results of the biogas generation model.

**Recoverable Biogas = 90% Landfill Area Available for Gas Collection x 60% Gas Collection Efficiency = 54%**

## PROJECT ECONOMICS

Cost: TBD\*  
Operation & Maintenance: TBD  
Estimated electricity offsets: TBD

Estimated heating/other benefits (US\$/year): N/A  
Other revenue streams: N/A  
Estimated payback period (number of years): TBD\*

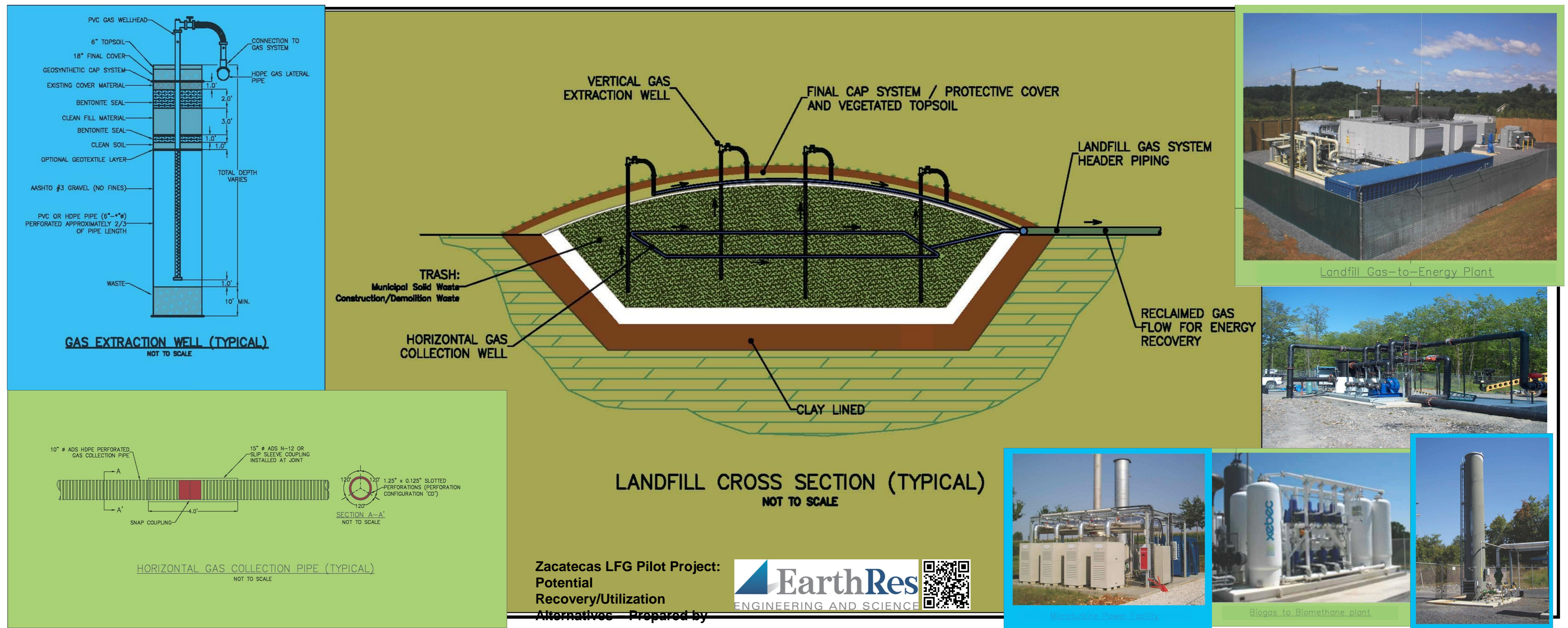
\* based on results of the USTDA granted feasibility study

# ENVIRONMENTAL BENEFITS

Assuming that a gas collection and IC Engine system is installed in 2016, this landfill capture project has the opportunity to collect and destroy an average of 5.75 million cubic meters of methane annually over the next 30 years. This is equivalent to average emission reductions of 55,882 tonnes of CO<sub>2</sub> annually.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Tonnes CO <sub>2</sub> eq from LFG Energy Recovery Activities	0	0	0	48,269	50,099	51,938	53,785	55,643	57,515	59,403	61,309	63,234	59,669	56,378	53,337

## PROPOSED LANDFILL GAS COLLECTION/UTILIZATION SYSTEM



## FOR MORE INFORMATION

### Project Owner:



**Gobierno Municipal de Zacatecas, Mexico**  
**Kattia Trejo Cardenas, Ing. Quimico**  
**Jefe Unidad de Ecologia y Medio Ambiente**  
**PHONE NUMBER: +52 492 9239421 ext. 1640**  
**E-MAIL: [ktrejo@municipiozacatecas.gob.mx](mailto:ktrejo@municipiozacatecas.gob.mx)**

### Project Management:



**EarthRes Group, Inc.**  
**Hong, Ph.D., P.E.**  
**Senior Project Manager of Int'l Consultant Team**  
**PHONE NUMBER: 001-215-766-1211**  
**E-MAIL: [hsima@earthres.com](mailto:hsima@earthres.com)**