# Valorising Waste in Developing Countries Christina Andreadou, Doug Bray, Shazeb Chishti, Innes Deans

### Introduction

The rapid industrialization, increasing urbanization, and technological development has led to a significant rise of energy demand and Municipal Solid Waste (MSW) production in developing countries. Waste-to-Energy (WtE) technologies have been a significant solution to the management and disposal of MSW as well as sustainable energy recovery. However, the application of the appropriate WtE practice varies between the countries depending on the amount and composition of waste produced, the income and development level and consumers habits. The objective of this work is to determine the feasibility of valorizing (MSW) in four developing countries to useful (bio)energy sources.

## Ahmedabad

The largest city in the State of Gujarat 6.3 million population and with pronounced development in industrial and commercial sectors.

**Electricity Demand** by sector



Commercial

11%

Good grid connection with only 6% electricity poverty

MSW Management Stages in Ahmedabad

Generation	Collection	Processing/Treatment		
4,000 t/day	Door-to-door		Disposal	) 1
No segregation	collection & municipal bins	recovery facilities:10%	Open landfilling: 90%	
at source	Collection: 98%	Recycle: 0.1% of MSW	Scientific landfilling:	
		picked by waste pickere	2%	

## Johannesburg

Johannesburg relies on coal for 70% of its energy. 93% of its waste is landfilled. Policies seek to address widespread energy poverty and the limited access to waste services. Circumstances create opportunities for development of centralised renewable energy schemes including landfill gas recovery, and production of SRF to displace the use of coal. Local industries have expertise with the Fischer-Tropsch (FT) process that may enable biofuel production in the future. Significant opportunities exist for AD as a basis for community-scale projects which address energy poverty and also create sustainable waste management solutions.



## Delhi

With the recent trend in urbanization and industrialisation over the last 20 years and a population of 27 million people, Delhi's SWM has become outdated, resulting in an ever growing problem. Delhi produces 9620 metric tonnes of MSW daily where 90% ends up at landfills with only 9% of this composted. This has led to the closure of 3 landfills due to overfilling. Another recent issue for Delhi is that the electricity demand is not being met during peak times (up to shortfall of 15%) resulting in power cuts and blackouts. This has cost the local economy millions in revenue. Both these issues can be addressed with the treatment of MSW.

## Recife

Recife is Brazil's 9th largest city, receiving 83% of its GDP from services. Energy consumption has rapidly increased with affluences through car ownership and electrical appliances. Waste management is based on short-term private landfills, with low levels of recycling. Plans for long term management have been designed but are not being implemented (the PMRS). This aims to increase recycling, utilise landfill gas and develop sanitary landfills with composting. Waste generation is very high (576.7 kg/person/yr.) at 70% collection rate. The composition of the waste is predominantly putrescible, (75%), with a high moisture content (85%) and low calorific value (<7 MJ/kg).



Pyrolysis and gasification are Advanced Thermal Treatment (ATT) to give a comparison with the less advanced technologies. Anaerobic digestion is widely used to treat waste water and can be equally effective on organic wastes, Landfill gas is from the decomposition of organic materials mostly in the form of methane and CO2 (50:50). MSW to ethanol is the conversion of a carbon-based feedstock into an acid or alcohol and a nutrient rich residue under anaerobic conditions. Composting is not a WtE technology but as with landfill gas it is cheap and simple technology that is easily implemented in developing countries

Conclusions Based on the cities selected each technology was rated from 1-5. The score was based on the technologies potential within the city.

City Recife Johannesburg Ahmedabad Delhi



## **Technologies**

Pyrolysis	Gasification	Anaerobic Digestion	Landfill Gas	Co-Firing with Solid Fuel
2	3	3	3	2
1	2	4	2	3
2	4	4	3	3
2	2	3	4	3

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