Landfill Gas as a Fuel Source for Refuse Trucks: Study of Economic Feasibility

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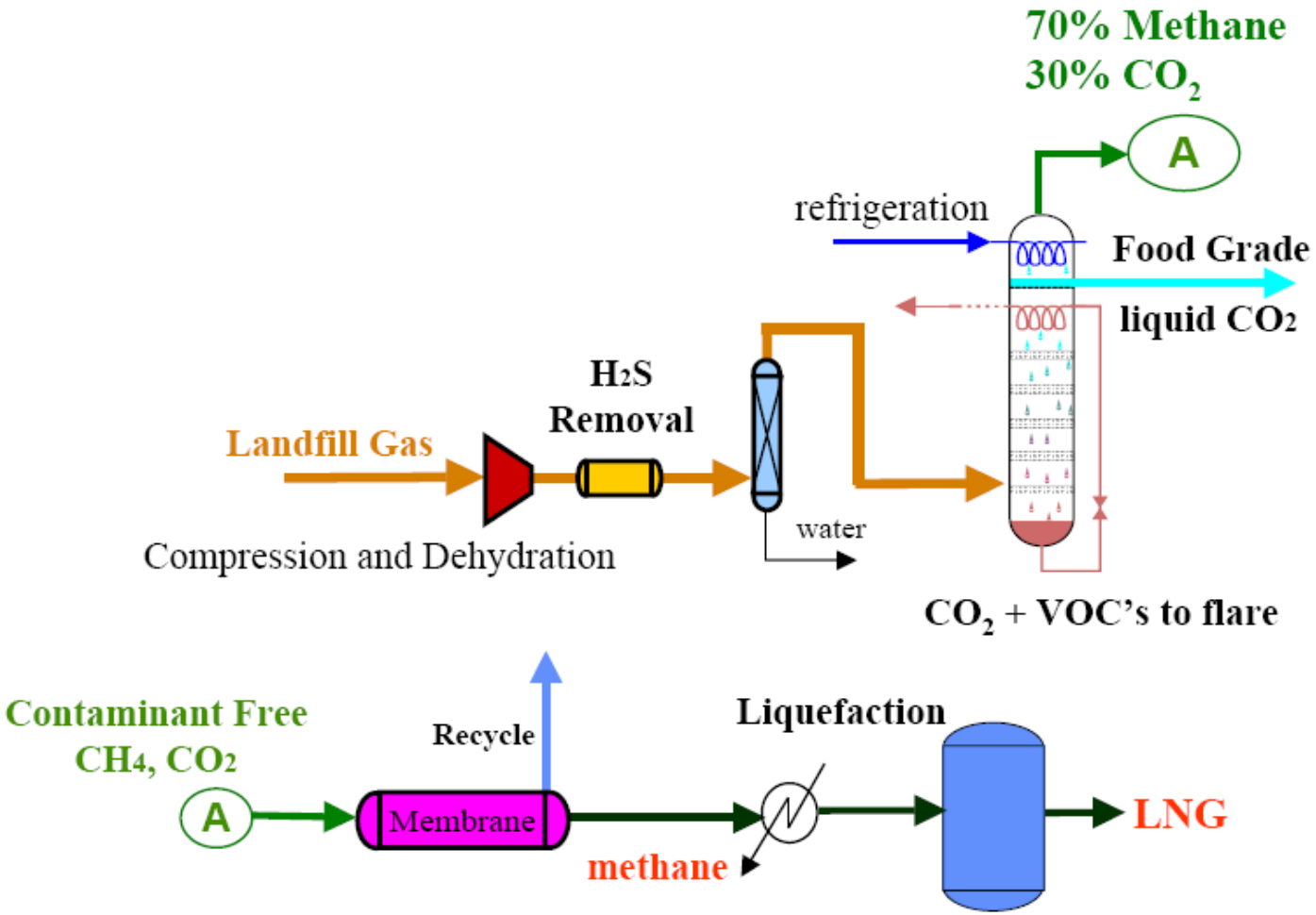
Funded by US EPA Methane to Markets Partnership

LFG Composition

Component	Percent (dry volume basis)
Methane	47.5
Carbon dioxide	47.0
Nitrogen	3.7
Oxygen	0.8
Paraffin hydrocarbons	0.1
Aromatic and cyclic hydrocarbons	0.2
Hydrogen	0.1
Hydrogen Sulfide	0.01
Carbon monoxide	0.1
Trace compounds	0.5
Total	**100.0**

CO_2 Wash Process



CO_2 Wash Processor at EcoComplex

Project Goal

- **Perform a "pre-feasibility" analysis**
- **Converting LFG to CNG to be used as fuel for refuse trucks in India**
- **Also assess other LFGTE options**

Mumbai Case Study Landfills

Deonar

Mulund

Gorai

Landfill Site Details

Data	Site		
	Deonar	Mulund	Gorai
Landfill size	132 Ha	25 Ha	20 Ha
Waste in place	8.0 MT	1.0 MT	2.0 MT
Year opened	1927	1968	1972

Analysis Scenarios

- **Landfill Management Options:**
  - Do Nothing;
  - Cap the landfill and flare; or
  - Flare from an active landfill.
- **LFGTE Options:**
  - Convert the LFG to CNG as fuel;
  - Convert the LFG to pipeline grade natural gas; or
  - Convert the LFG to electricity.

Model Development

Landfill Gas Generation → Refuse Truck Operations → Economic Feasibility

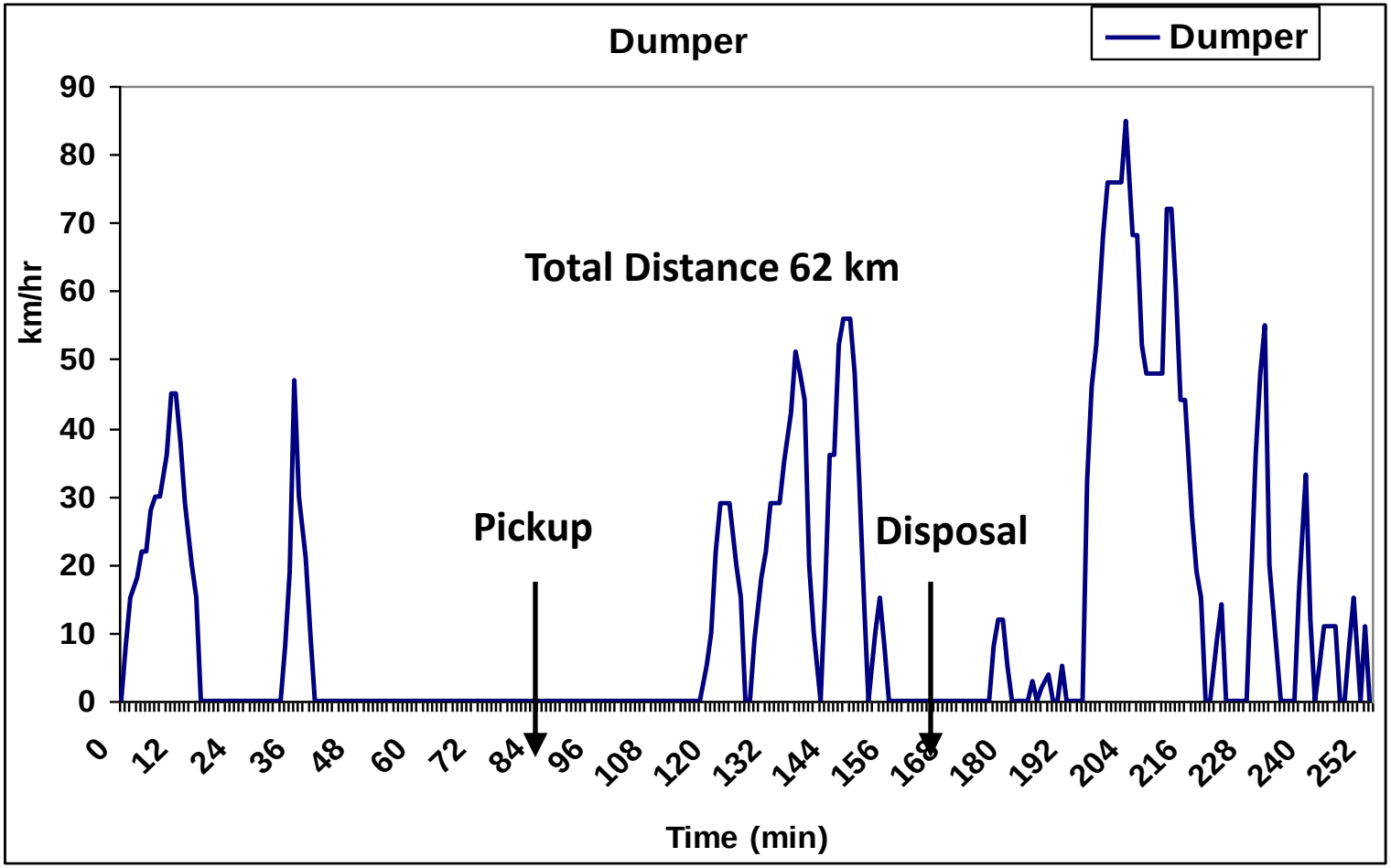
MSW Collection Fleet

Compactor

Placer

Dumper

Speed Profile



Costs Considered

- **As applicable:**
  - Landfill capping costs
  - CNG conversion facility cost
  - Pipeline natural gas facility cost
  - Electricity plant costs
  - Flaring system costs
  - System and landfill operational costs
  - Truck fleet operational costs
  - Truck fleet replacement costs
  - Costs of emissions

Benefits Considered

- **As applicable:**
  - Diesel fuel savings
  - Earnings from sale of natural gas
  - Earnings from sale of electricity
  - Earnings form sale of CO2
  - Carbon credit earnings
  - Emissions reductions
  - Tax credits

Analysis Results

Scenario	Gorai	Deonar	Mulund
	Return (%)	Return (%)	Return (%)
Scenario 1: Do Nothing	N/A	N/A	N/A
Scenario 2: Cap the Landfill and Flare the LFG	-31%	-30%	42%
Scenario 3: Flare the LFG from an Active Landfill	-16%	-48%	80%
Scenario 4: Convert LFG to CNG for Use as a Transportation Fuel	-33%	1%	54%
Scenario 5: Convert the LFG to Pipeline Grade Natural Gas	-51%	-33%	6%
Scenario 6: Convert the LFG to Electricity	-29%	-40%	-9%

Additional Analysis –Without Capping Costs

Scenario	Gorai	Deonar	Mulund
	Return (%)	Return (%)	Return (%)
Scenario 4: Convert LFG to CNG for Use as a Transportation Fuel	-10%	135%	130%
Scenario 5: Convert the LFG to Pipeline Grade Natural Gas	-29%	70%	67%
Scenario 6: Convert the LFG to Electricity	28%	33%	46%

Concluding Remarks

- **Several LFGTE options**
- **Pre-feasibility study based on conservative assumptions**
- **Methodology can be applied to different landfills**
- **LFG to CNG shows feasibility**
- **LFG to Fuel is a Sustainable Option**