



Landfill Gas Upgrade Technologies – Transportation Applications

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LFG as an Energy Source

- Contains methane (CH_4); also a major component of natural gas
- CH_4 is a greenhouse gas (GHG) with a high global warming potential
- Beneficial to capture and use LFG for landfill gas to energy (LFGTE) projects
- LFGTE examples – electricity, piped natural gas, transportation fuel, etc.

Need to Upgrade LFG

- **Typical LFG composition**
 - 50-55% Methane
 - 40-45% CO₂
 - Remaining - H₂S, organic compounds, nitrogen, oxygen, etc.
- **Need to upgrade LFG (remove impurities, improve energy density) for energy applications; particularly important for transportation fuel.**

Upgrade Processes

- **Upgrading/purifying LFG can be done by**

- Adsorption methods
- Absorption methods
- Chilling processes
- Catalytic Processes



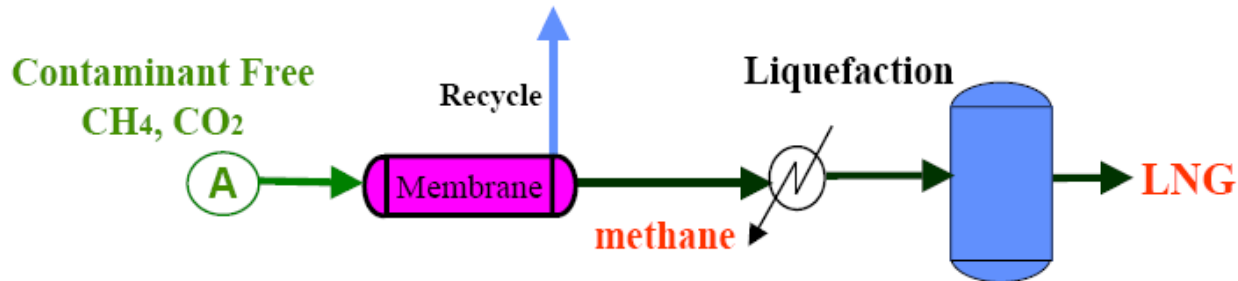
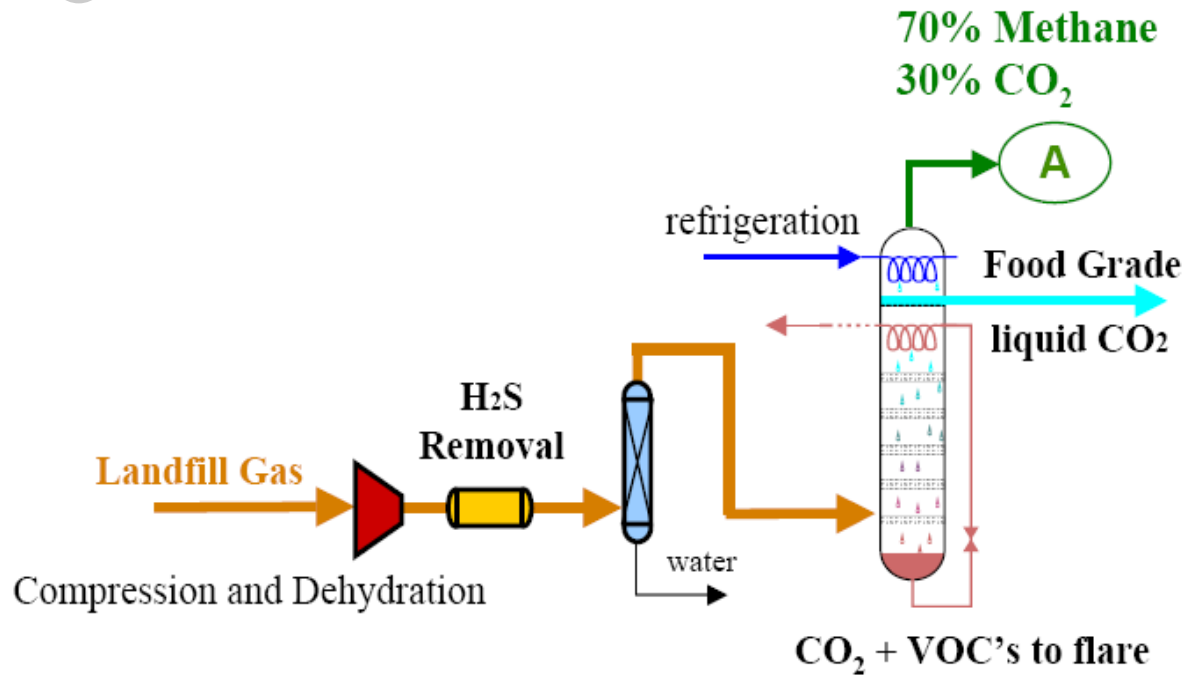
Conversion of LFG to Transportation Fuel

- **CO₂ Wash Process – developed by Acricon Technologies**
- **Technique that converts LFG to high-quality compressed natural gas (CNG) or liquefied natural gas (LNG) and food grade CO₂**

CO₂ Wash Process

- LFG is dried and compressed before entering vessel
- Liquid CO₂ washes down contaminants, incinerated with landfill flare

CO₂ Wash Process



CO₂ Wash Process

- Clean liquid CO₂ obtained
- CH₄, CO₂ mixture – purified to 99% CH₄ through membrane separation
- Compressed and converted to either LNG or CNG



CO₂ Wash Processor at EcoComplex



LNG Fueling Station



- **Burlington County Landfill (NJ)**
 - 2004-2005 – fueled 2 dedicated natural gas refuse trucks in service
- **Franklin County Landfill (OH)**
 - currently fuels smaller trucks
 - plan to expand plant for pipeline gas
- **Other applications – Similar application in Orange County, CA**

○ **Clint Landfill, El Paso, TX**

- Showed good return on investment for both LNG and CNG conversions

○ **Mumbai Landfills – EPA M2M Project**

- Showed promising results for CNG conversion at 3 Mumbai Landfills