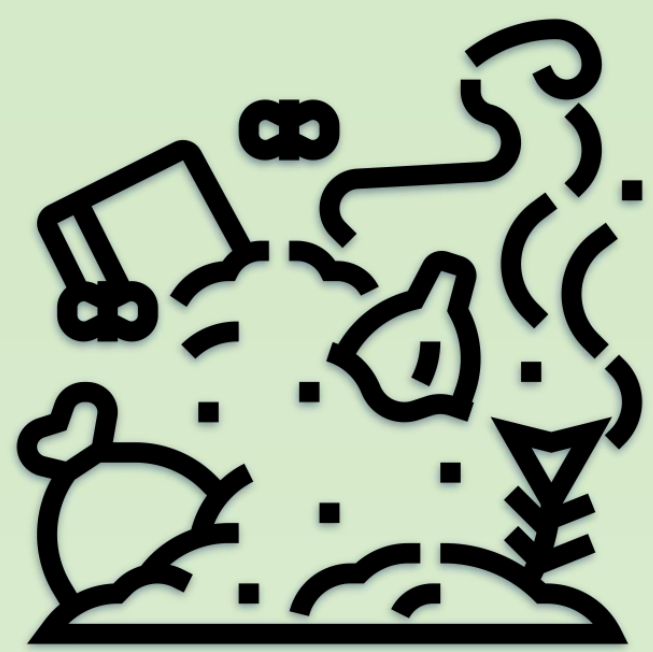


Introduction



Our plant utilizes landfill gas to produce high purity hydrogen through SMR and WGS and sell its byproduct to greenhouses to be used as their heat source.

Demand for hydrogen will increase to 266 Mt by 2030, in part due to increased demand for fuel cell vehicles, which offer zero tailpipe emissions, and are an essential part of BC's Zero-Emissions Vehicles Act.



Plant Location



Plant Location at Delta, BC

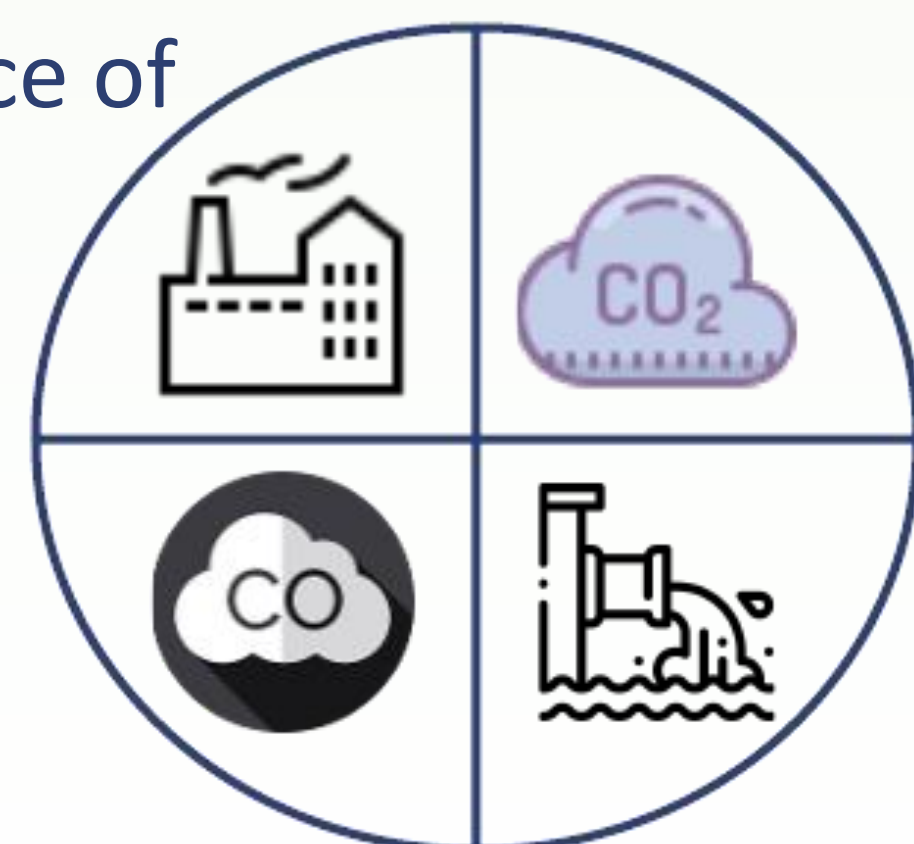
Between Vancouver Landfill and nearby Village Farms

Environmental Impacts

Strict OEL* for H₂S : <10 ppmv

- Annual maintenance of reactor catalysts
- Carry H₂S sensor

*Occupational Exposure Limit



CO₂ produced from SMR and WGS is collected through MMMs, sent to greenhouses

Wastewater collected through water knockout vessel, need a permit to discharge

Potential CO leakage from SMR reactor

- Install CO alarms
- Carry CO sensor

Hazardous Area Classification: Class I Div II Group B or D

Process Description

LANDFILL GAS FEED

4590 kg/h

Contains H₂S upto 1000 ppmv

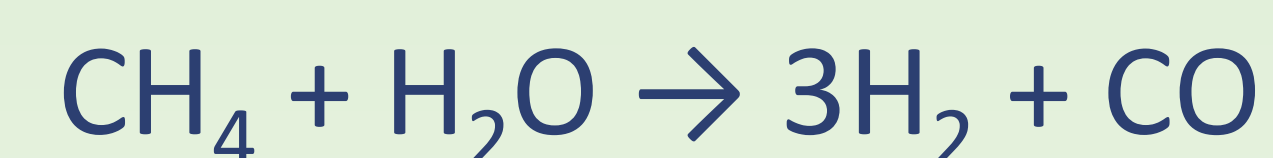
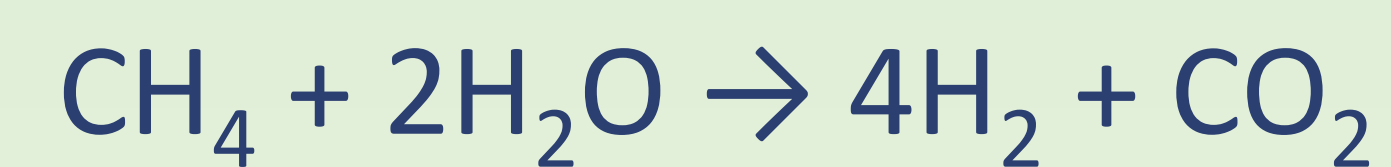


DESULFURIZATION

Bio-desulfurization is used
H₂S < 10 ppmv



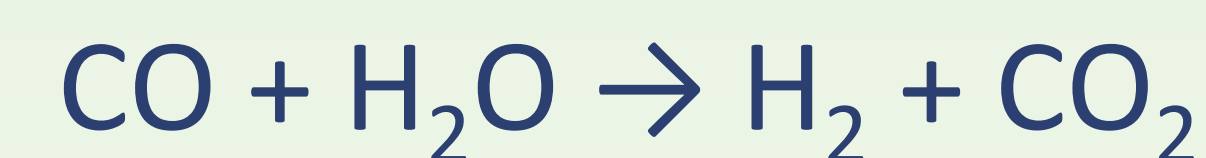
STEAM-METHANE REFORMER



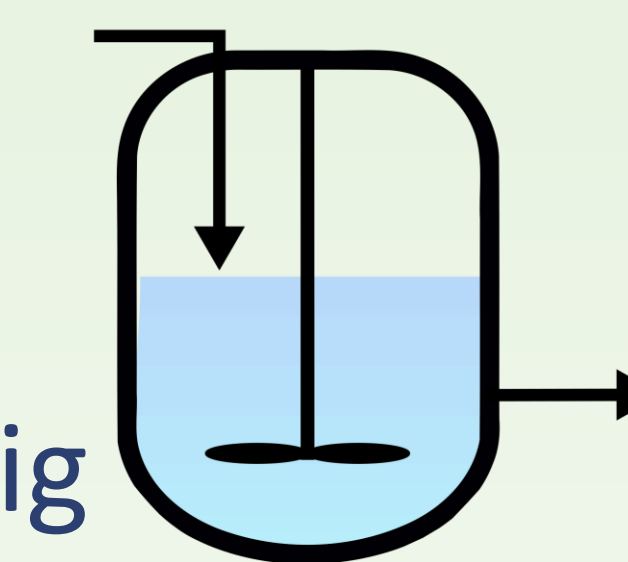
Operating condition: 750 °C, 300 psig



WATER GAS SHIFT



Operating condition: 200 °C, 260 psig



DEWATERING

Water removal from syngas

Prevent damages to adsorbents in PSA



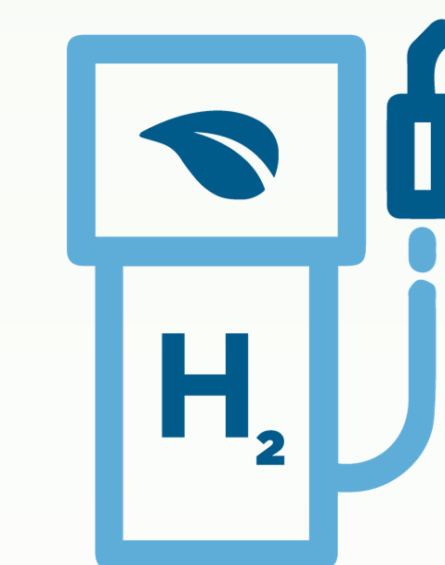
HYDROGEN PRODUCTION

Adsorbents in PSA:

Activated Alumina, 13X, CMS

Hydrogen produced: 395 kg/h

Purity: 99.999%



MEMBRANE RECYCLING

MMM for CO₂ extraction

Flue gas recycling

Byproduct: 4137 kg/h CO₂



Economics

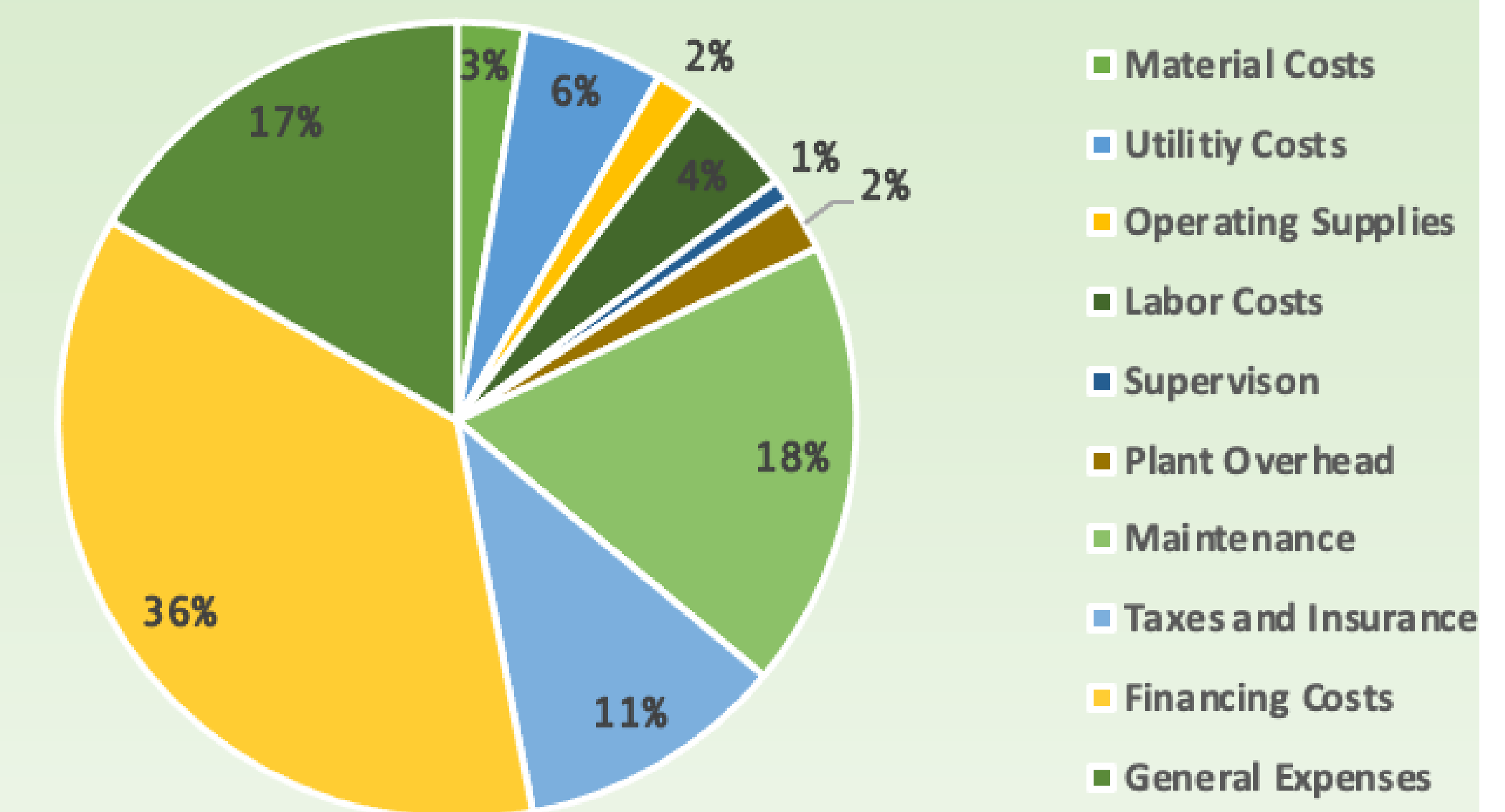
H₂ PRICE: \$ 10.13 USD/kg

H₂ REVENUE: \$ 33.6 Million/yr

TOTAL PROFIT: \$ 1.6 Million/yr

CAPEX: \$ 111 Million

OPEX: \$ 32 Million/yr



Government Funding



1. Clean BC Industry Fund can support up to 90% of eligible costs for qualified projects that reduce emission in B.C.

1. Provide financial support for centralized and semi-centralized hydrogen production

Acknowledgements

We would like to thank professor Jim Lim and Sergio Berretta, as well as the rest of the CHBE 454 instructor team for their guidance and support throughout the past year.