DRIVE TO NET ZERO EMISSIONS in the Natural Gas Value Chain

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INTRODUCTION

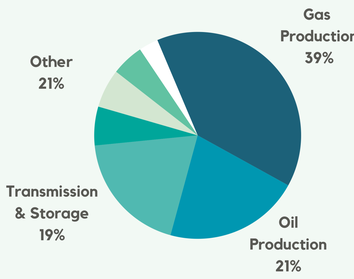
- Transport of Canadian natural gas to overseas markets in Asia
- By 2040 demand for LNG is expected to be 620 - 680 million metric tonnes/yr [2]
- 175% increase in CO_2 emissions from 1960 to 2022 [3]

LOCATIONS

1. **Remote Compressor Stations**
   Fort St. John, BC
2. **LNG Terminal**
   Kitimat, BC

OUR CARBON CAPTURE STRATEGY

WHY ARE WE CAPTURING CO_2?



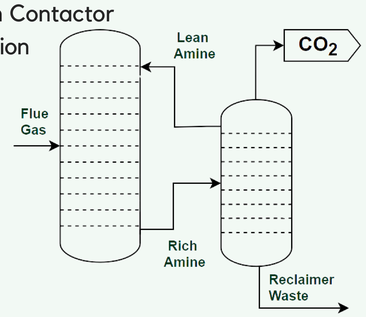
2021 O&G METHANE EMISSIONS [1]

- Significant GHG emissions from remote nat. gas compressor stations with limited infrastructure for power in BC & AB
- Obtaining cleaner energy needs to prove zero emissions
- CO_2 capture cost <$170/tonne a day to minimize carbon tax and support LNG production

HOW ARE WE CAPTURING CO_2?

- **CO_2 Contactor**:
  - Remove CO_2 from post-combustion flue gas
- **Amine Regenerator**:
  - Regenerated amine reused in Contactor
  - Captured CO_2 for sequestration
- **Amine Solvent**:
  - 30wt% MDEA, 14wt% PZ, 66wt% H_2O

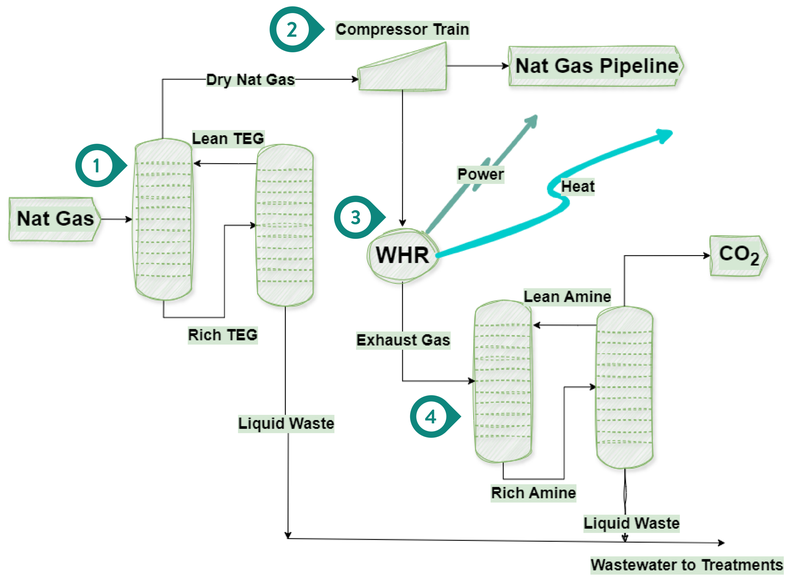
TARGET
- 90 mol% recovery
- 99 mol% purity



PROCESS OVERVIEW

Our processes design consists of:

1. **Dehydration Unit**
   → TEG Absorption
2. **Compressor Power Generation & Train**
   → Reciprocating Compressors + Engine
3. **Waste Heat Recovery Unit**
   → Direct Heat Recovery
   → Organic Rankine Cycle (ORC)
4. **CO_2 Capture Unit**
   → Amine Absorption

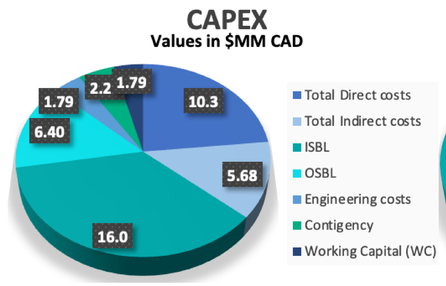


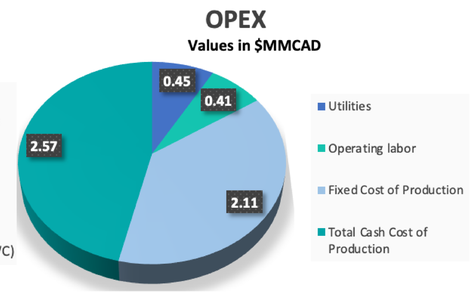
RESULTS

- Achieved < **4lbs** H_2O/MMSCF NG and **98.8wt%** TEG recovered
- **1560 tonnes** of natural gas transported / day
  - 54 g CO_2 emitted / kg of gas transported
- **Waste Heat Recovery** generates 1.6 MW of direct heat from exhaust and 156 kW of electricity from ORC, covering energy usage of:
  - **100%** of the Dehydration Unit
  - **49%** of the CO_2 Capture Unit
- Achieved **99 mol%** CO_2 purity and **80 mol%** CO_2 recovery
- **63 tonnes** / day of CO_2 sequestered

FEASIBILITY

CAN WE AFFORD TO DO IT (ECONOMICALLY)?





Levelized cost of capital:
$131 CAD/tonne CO_2 captured

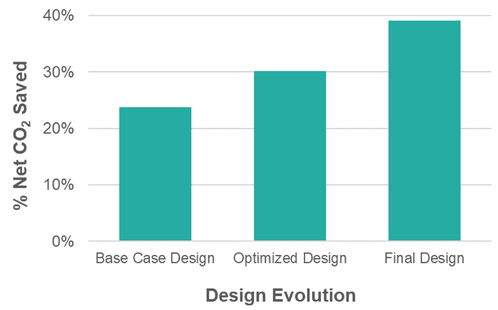
2030 Carbon tax rate:
$170 CAD/tonne CO_2 emitted

NPV : $11.7MM CAD

IRR : 22%

The cost of building this facility is **LESS** than the cost of paying taxes on CO_2 emitted hence project **IS** economically feasible

CAN WE AFFORD TO DO IT (ENVIRONMENTALLY)?



- **Good news**: Considering all CO_2 sources, up to 39% of CO_2 at the compressor station is captured with our final design
- **Bad news**: It's not enough — 4.08 tonnes of CO_2 per hour is still produced — *not net zero!*
- Most effective design change: addition of a **Waste Heat Recovery Unit**
  - Contributed to **67%** of additional CO_2 saved

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