NGL Recovery in CO2 Floods
Options and Reasons

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Pilot Energy Solutions

• Develops technology in the energy sector and implements this technology as a third party or J.V. partner
Pilot Energy Patents

- NGL recovery from LNG – Cold side
- CO2 fractionation for capacity increases
- HIREX – Extremely High C3+ Recovery with Low Vapor Pressure (Low C2 Recovery)
- NGL recovery from CO2 by Fractionation I and II
Primary Production

Oil + Gas + NGLs
Tertiary Production
Oil Only?? No Gas, No NGLs?
Why NGL Recovery

- Can add 25% to field production
- Increases recoverable reserves
- Additional revenue stream
- Increases CO2% in recycle (good/bad)
- Sequester more CO2
- Provides dehydration of recycle stream
Processing Options

- Ryan Holmes – most expensive
- Membrane/Amine – close to most expensive
- Bulk Fractionation (Pilot) – way less expensive
- Refrigeration – least expensive

- All are more expensive than conventional gas processing
Why is this so hard??
A simple analogy

- Methane = Baby Powder
- CO2 = Sugar
- Ethane = Salt
- Propane = BB’s
- Butane = Marbles
- Pentane = Golf Balls
- Crude = Basket Balls
Basis for Comparison

Case Study

- Flow Rate = 20 MMSCFD
- Interstage Pressure = 550 PSI
- H2S + N2 = 2.9%
- CO2 = 88%
- C1 = 2.8%
- C2 = 1.9%
- C3 = 2.0%
- C4 = 1.4%
- C5+ = 1.0%
“Typical” 20MM Plant

Estimated Capital Cost
20 MMSCFD Recycle

- Ryan Holmes
- Membrane
- Fractionation
- Refrigeration

Costs:
- $0
- $10,000,000
- $20,000,000
- $30,000,000
- $40,000,000
- $50,000,000
- $60,000,000
Ryan Holmes Process
Does anybody Remember Lean Oil Plants
Amine Membrane System

New Word: iatrogenic = suffering from a solution

Inlet Gas

- 100 MMSFD
- Pre-Treatment
- Refrig Sys
- Liquid 28 MMSCFD

1st Stage Membrane
- Vapor 72 MMSCFD
- LP CO2 from Treat
- NGL Liquid Treating
- HP Permeate 10 MMSCFD

LP Permeate

Compression

2nd Stage Membrane
- HP Permeate
- LP Permeate

CO2 Product
- Compression

Hydrocarbons
- Hydrocarbon
- LP CO2 from Treating
- Cryogenic Processing
- HP Treating

Hydrocarbon Product

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Hydrocarbon Product
Value of Products

- Ryan Holmes: $25,000/day
- Membrane: $25,000/day
- Fractionation: $10,000/day
- Refrigeration: $5,000/day
Just Because You Can, Doesn’t Mean You Should

- Methane content worth $600K/Yr, Most/all is consumed to extract. Payout = $\infty$
- Ethane: Worth more, but hard to market – Unless you have access to an NGL pipeline, you can’t keep it.
Estimated Annual EBITDA

- Ryan Holmes: $18,000
- Membrane: $14,000
- Fractionation: $12,000
- Refrigeration: $6,000
Fractionation Position #1

- Inlet Separation 50 PSI
- Compression Stages 1,2
- Compression Stages 3,4
- Processing Plant (250 PSI to 650 PSI)
- Oil/Water
- NGL Product
- Reservoir
Monell Under Construction
Monell Plant
Mentone Plant
Goldsmith Plant
Cenovus Weyburn Flood
Pilot Commercial

• Pilot will build, own, (operate), pay 100% of the cost, give Producer a share of $$ for no cost
  • Or
  • If the stream is too lean, Pilot will J.V.
    • Or
  • If the stream is really rich, Pilot will process for a fixed fee and give Producer all production
    • Or ????
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