

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

Top 10 Nightmares



10) Missing a plane





9) Teeth falling out





8) Falling or Drowning





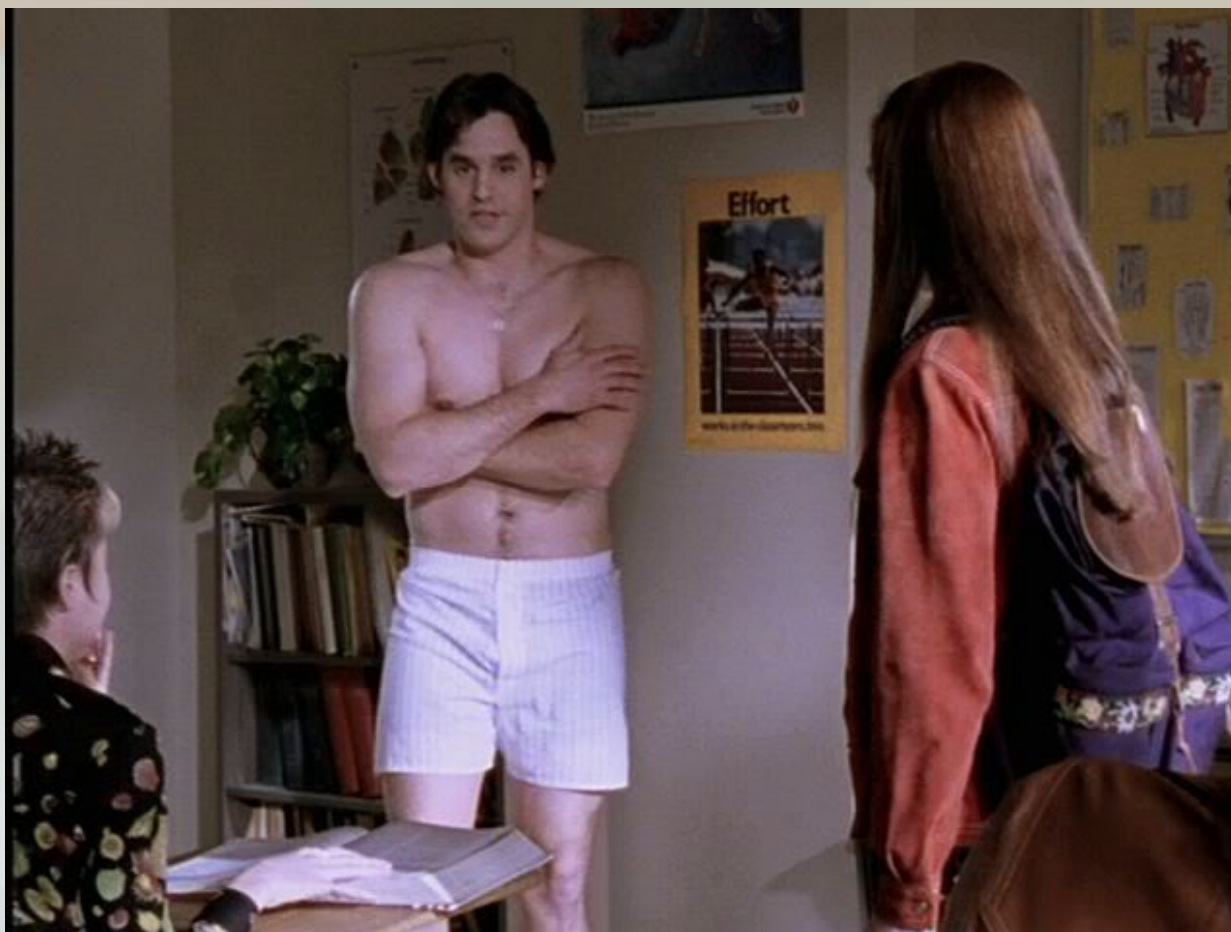
7) Being Trapped in a Small Space



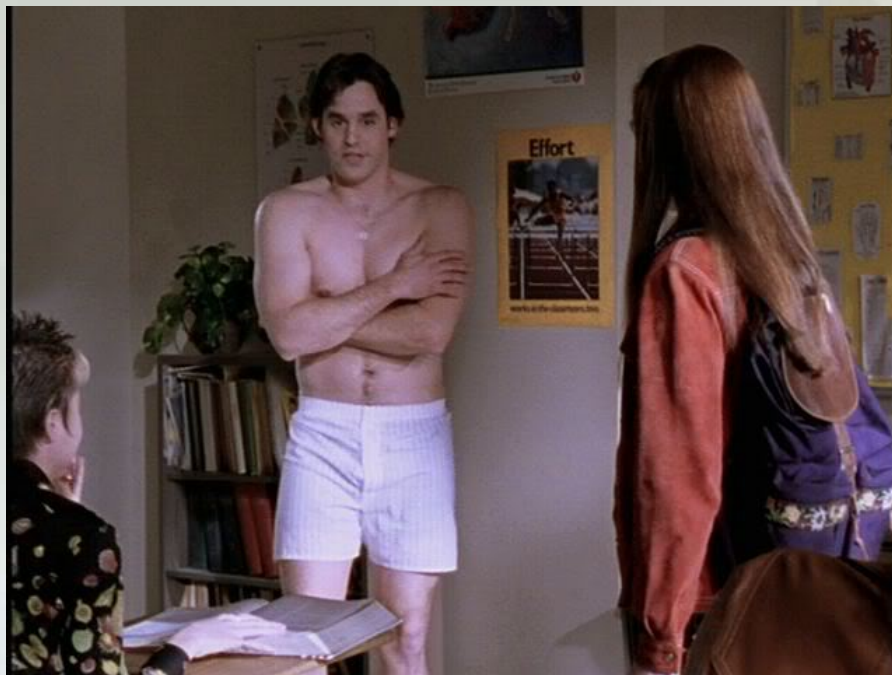


6) Seeing or Hearing Dead People





5) Being Naked in Public





THIS
WILL NOT END WELL

4) Finding your wife/girlfriend with your best friend / brother



THIS
WILL NOT END WELL



3) Final Exam Tomorrow for a class you forgot about, and never attended





2) Someone you previously fired becomes your boss





1) Some idiot building a gas plant in your CO₂ Flooded Oil Field!

After all, isn't that why you choose to be on the oil side (as opposed to the gas side) in the first place?



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

Basis for Comparison

- 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%

Processing Options

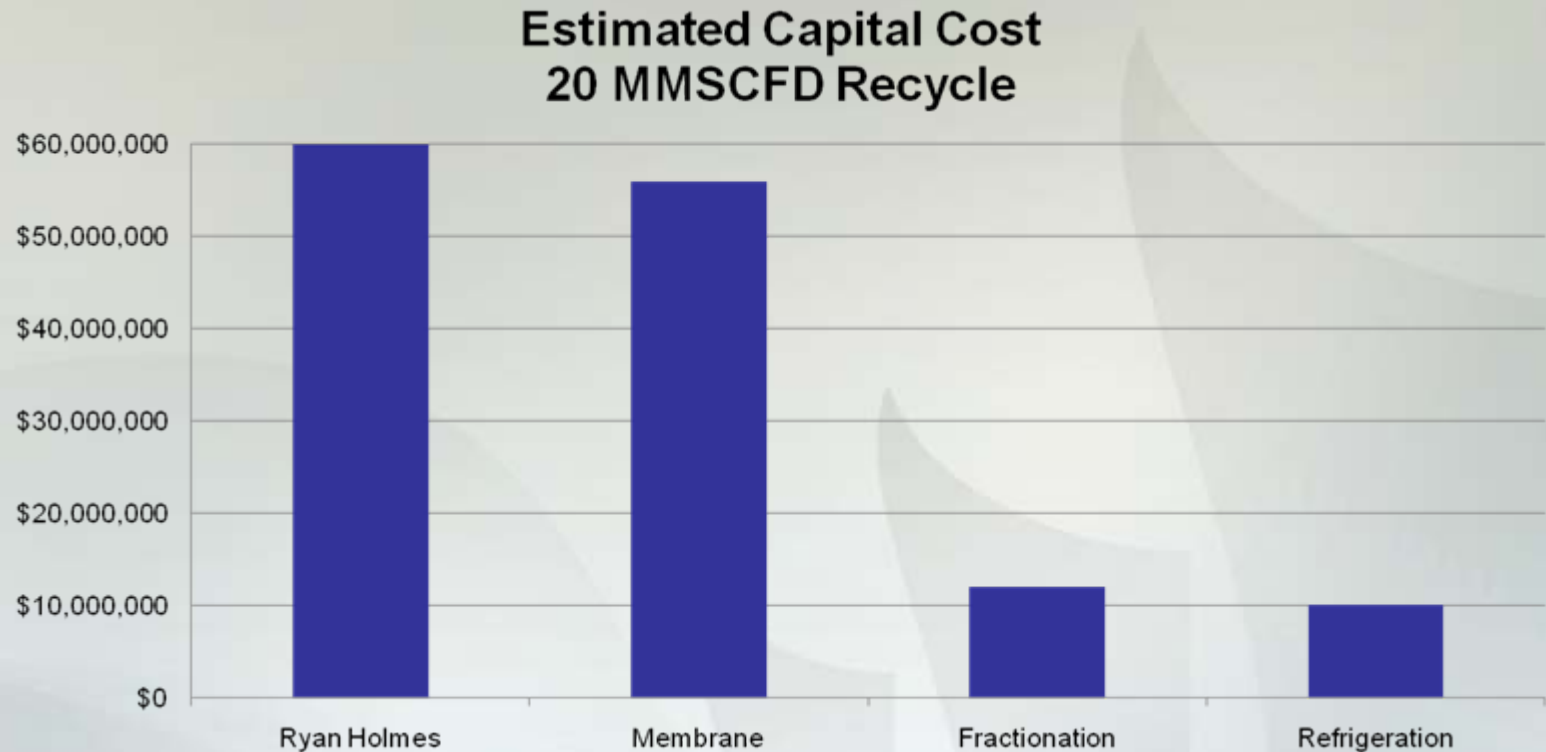
- Ryan Holmes – most expensive
 - Membrane/Amine – close to most expensive
 - Bulk Fractionation (Pilot)– way less expensive
 - Refrigeration – least expensive
-
- **All are more expensive than conventional gas processing**

Why is this so hard??

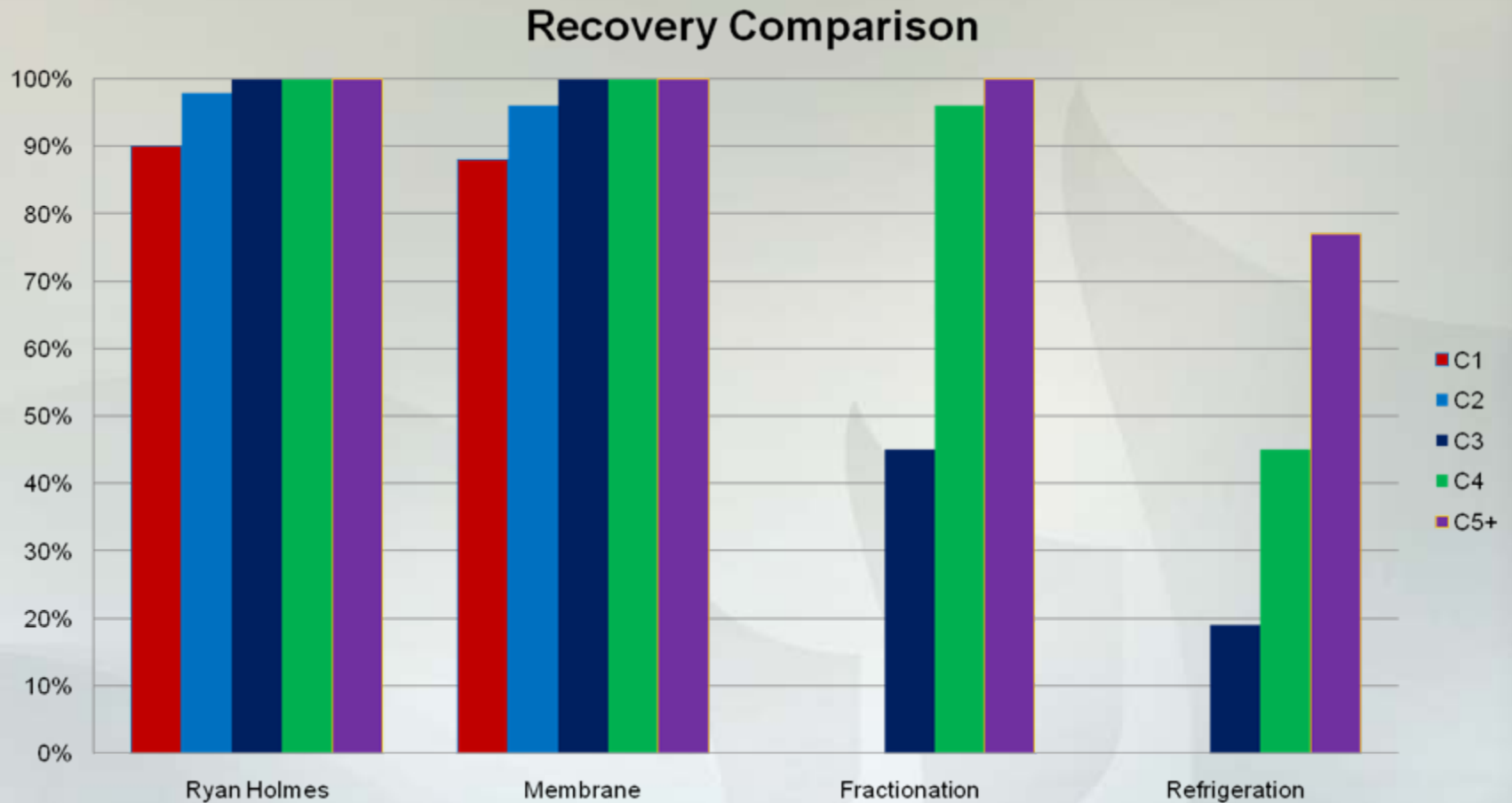
A simple analogy

- Methane = Baby Powder
- CO₂ = Sugar
- Ethane = Salt
- Propane = BB's
- Butane = Marbles
- Pentane = Golf Balls
- Crude = Basket Balls

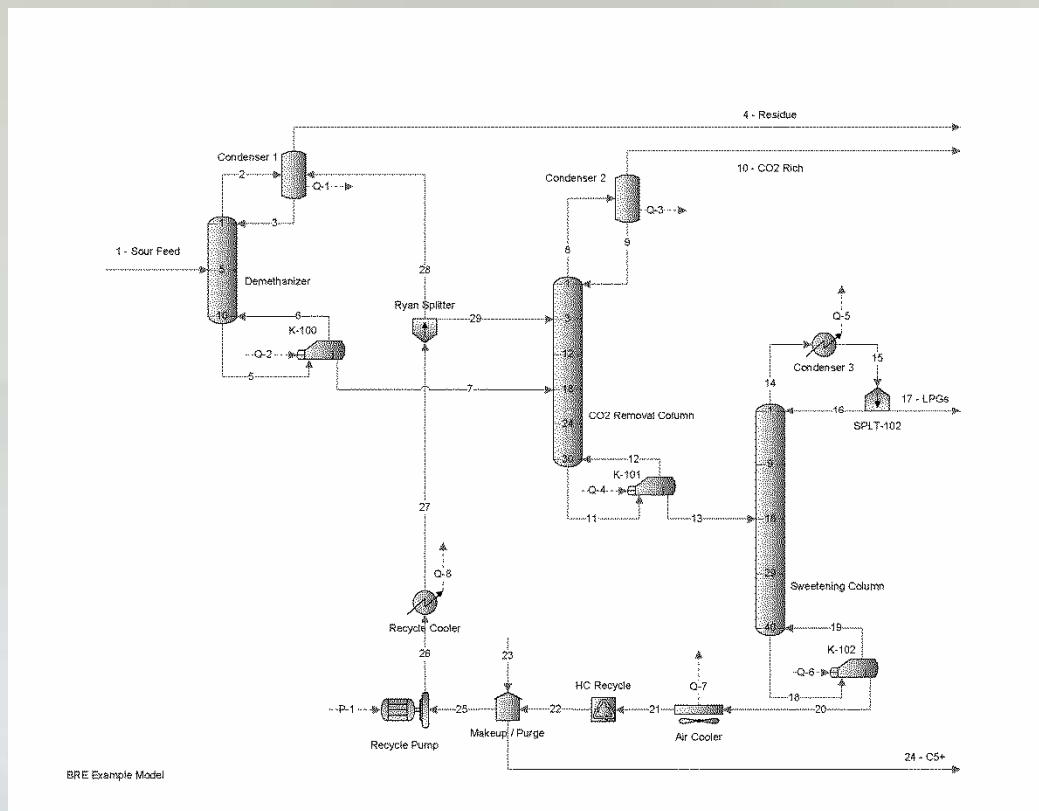
“Typical” 20MM Plant



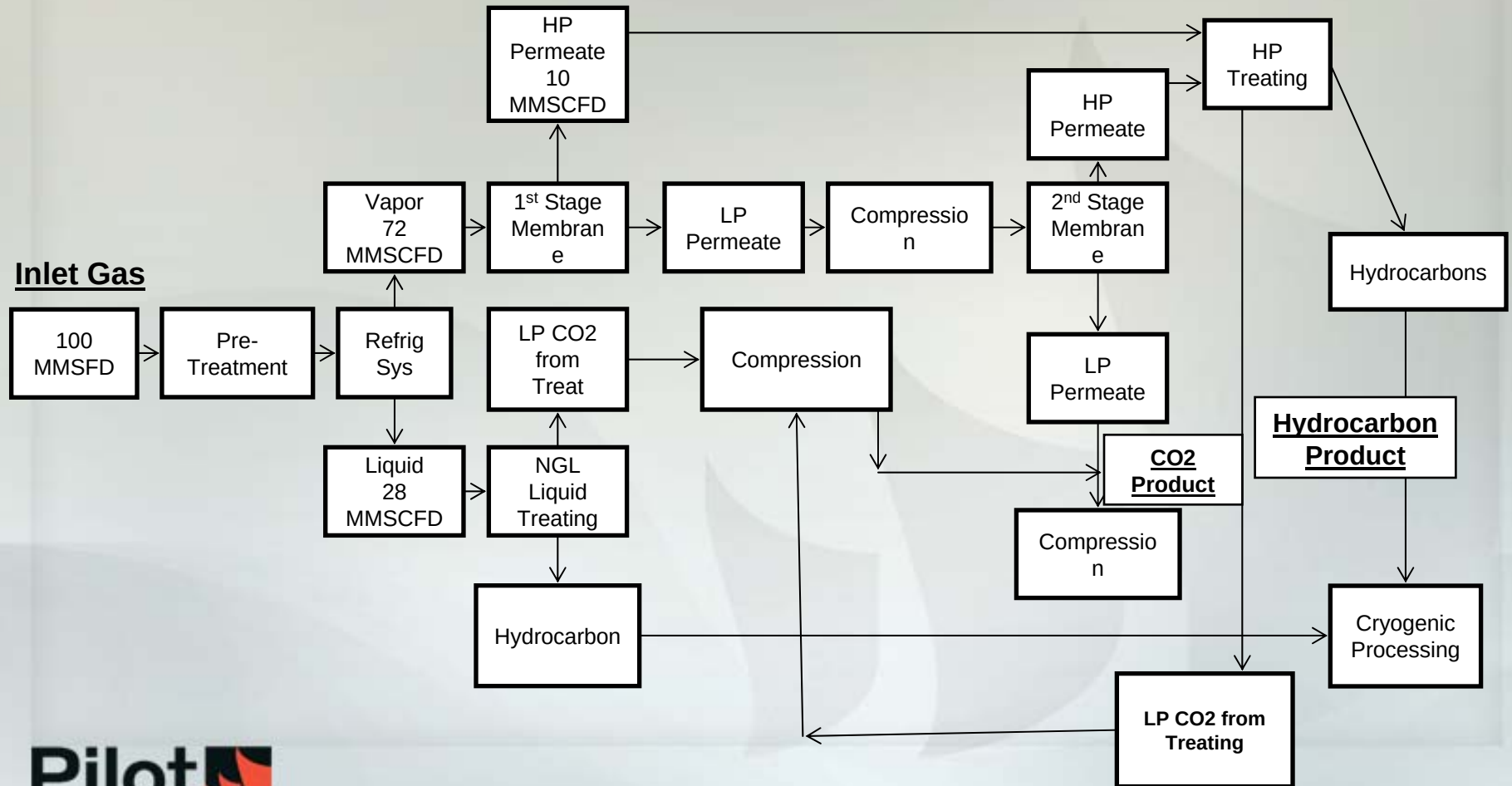
Recoveries



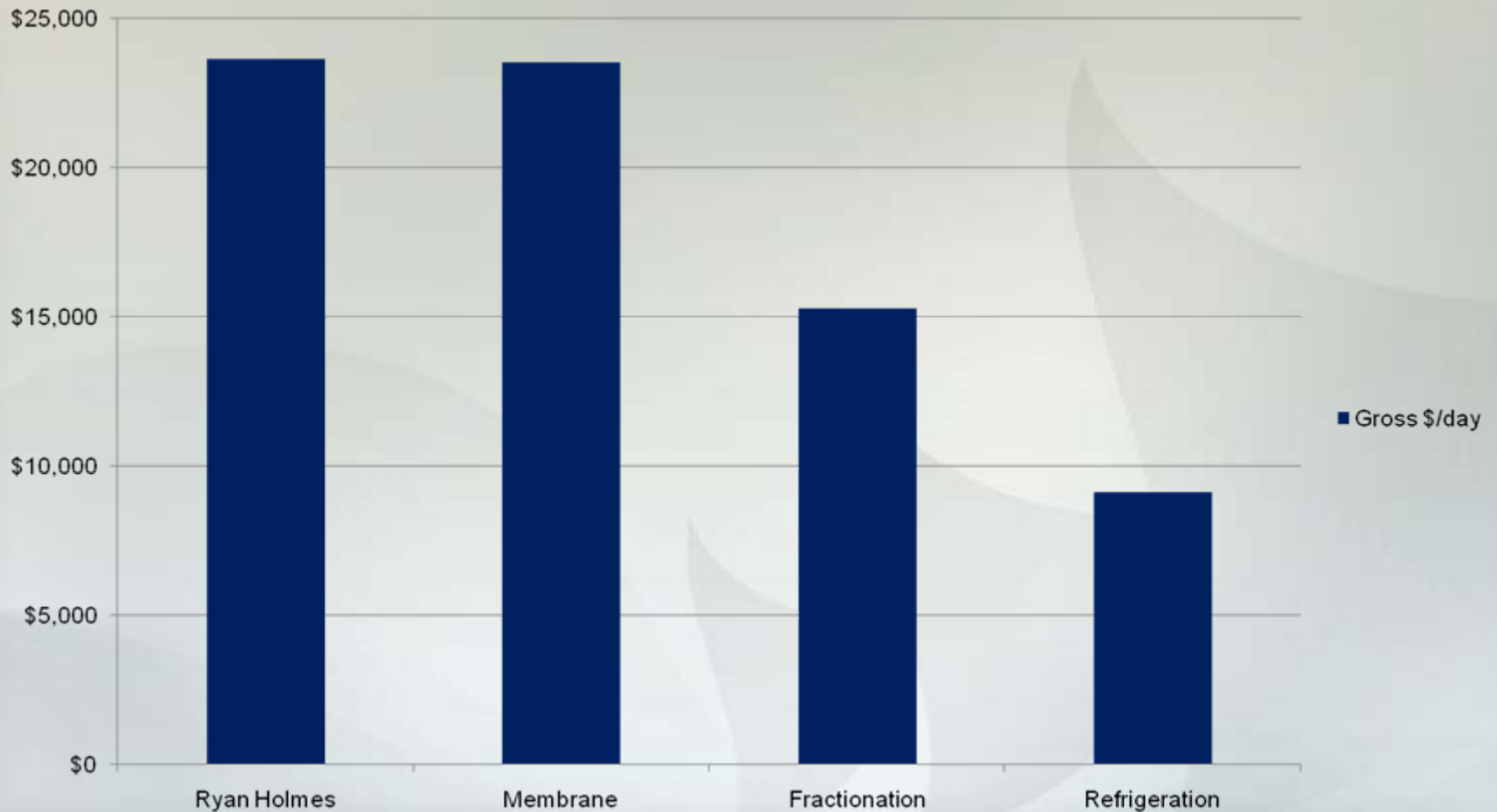
Ryan Holmes Process



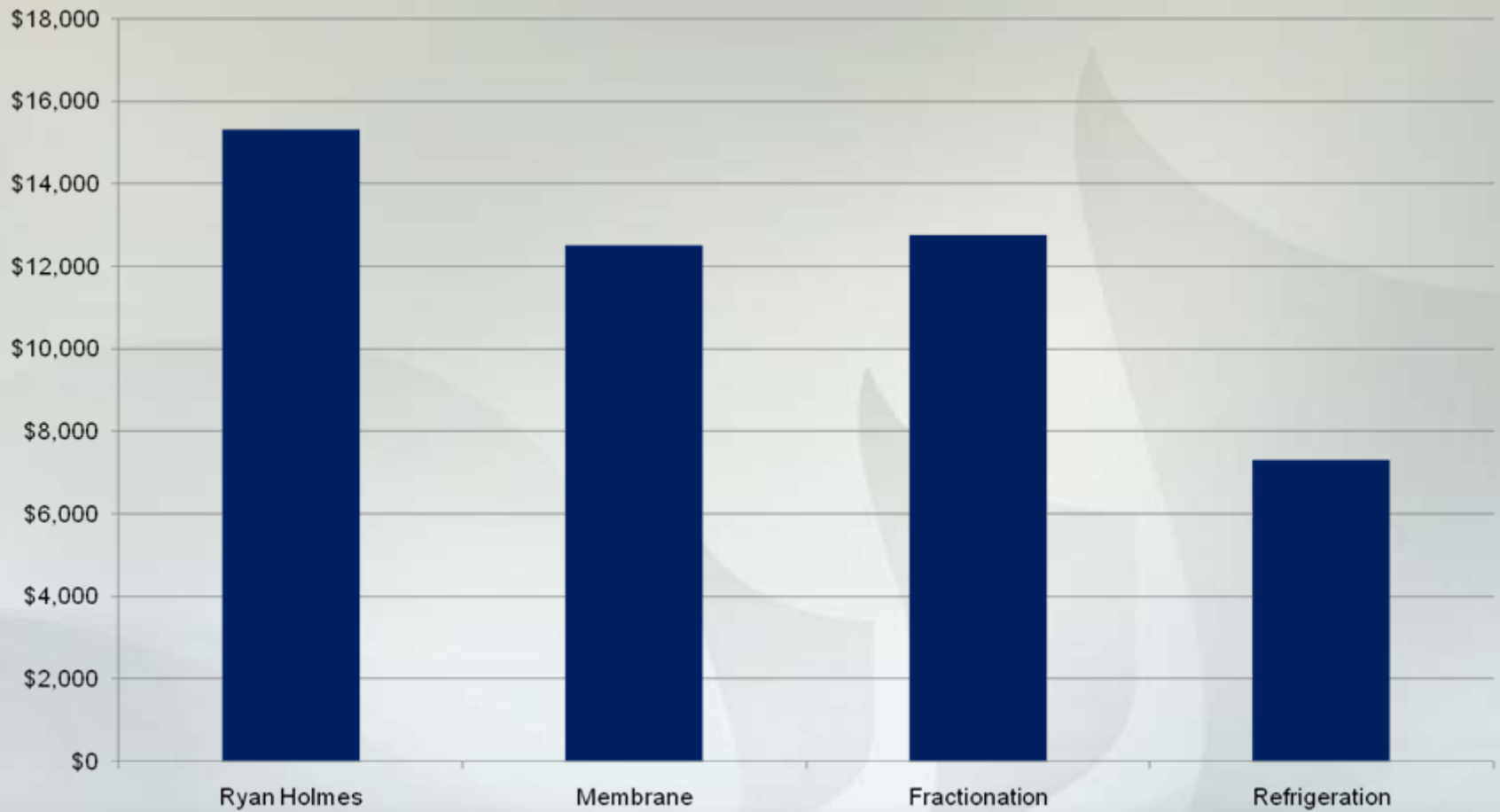
Amine Membrane System



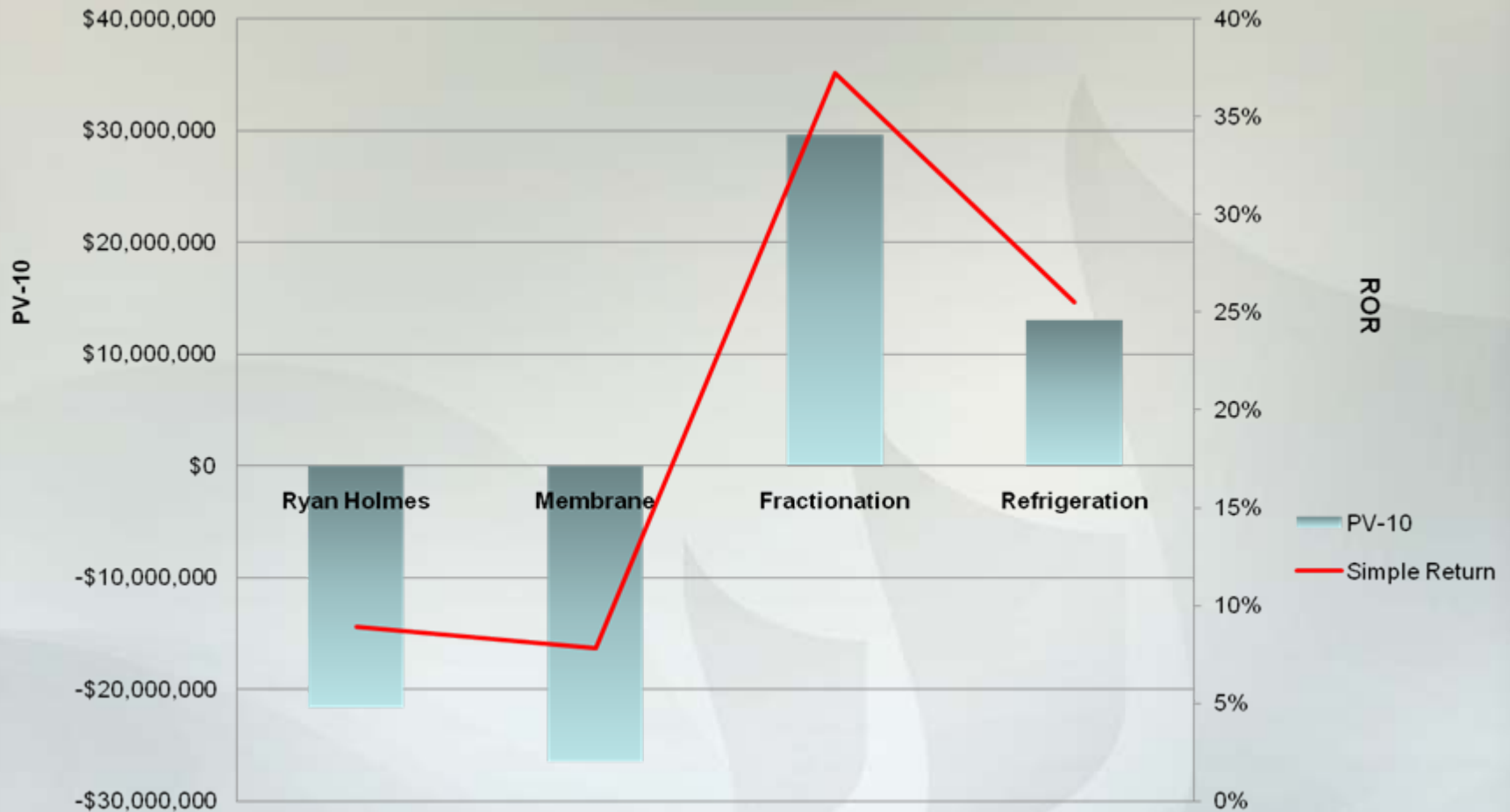
Value of Products



Estimated Annual EBITDA



Economic Comparison



Monell Under Construction



Monell Plant



Mentone Plant



Goldsmith Plant

under construction

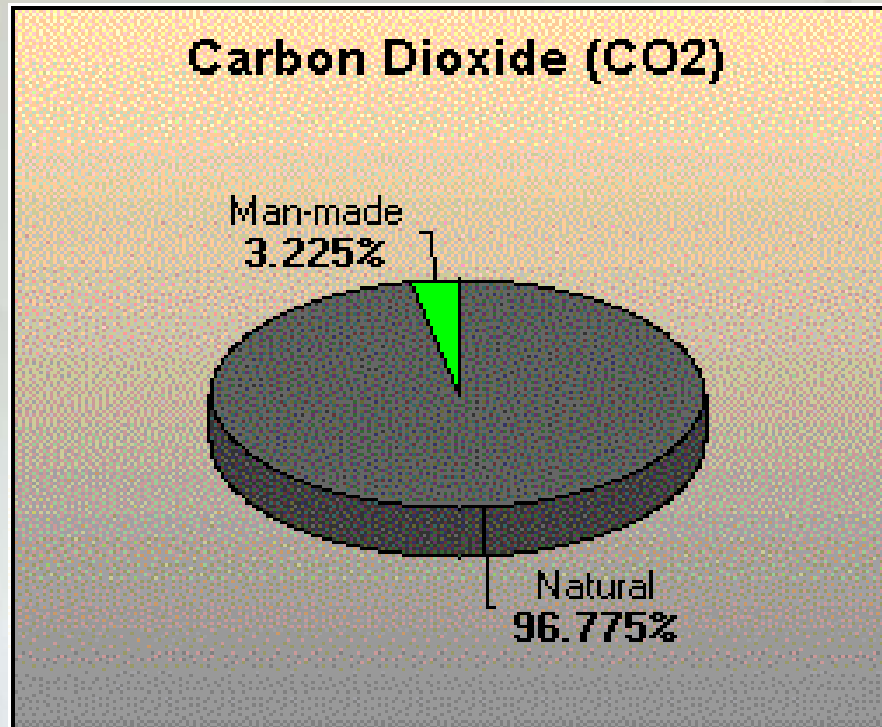


Percentage of CO₂ Emissions by Country

R a n k	Country	Annual CO2 emissions ^{[8][9]} (in thousands of metric tonnes)	Percentage of global total
	<i>World</i>	29,888,121	100%
1	China^[10]	7,031,916	23.33%
2	United States	5,461,014	18.11%
-	European Union (27)	4,177,817.86 ^[11]	14.04%
3	India	1,742,698	5.78%
4	Russia	1,708,653	5.67%
5	Japan	1,208,163	4.01%
6	Germany	786,660	2.61%
7	Canada	544,091	1.80%
8	Iran	538,404	1.79%
9	United Kingdom	522,856	1.73%
10	South Korea	509,170	1.69%

Source – IEA Database 2009

Fraction of Man-Made vs. Naturally Occurring CO₂



Dr. S. Fred Singer, atmospheric physicist
Professor Emeritus of Environmental Sciences at the University of Virginia, former director of the US Weather Satellite Service;
in a Sept. 10, 2001 Letter to Editor, *Wall Street Journal*

US Reduction Targets

- 17% by 2020
- 80% by 2050

Just the Numbers

- For 2020

3.225% (Man Made) X 18.11% (US Share) X 17% (Target Reduction)
= 0.099% Reduction in Total CO₂

- For 2050

3.225% (Man Made) X 18.11% (US Share) X 80% (Target Reduction)
= 0.467% Reduction in Total CO₂

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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