



**CARBON CAPTURE CANADA**  
— CANADA'S NATIONAL CCUS CONVENTION —



## CARBON CAPTURE FEASIBILITY FROM COMPRESSOR EXHAUST STREAMS

FORREST CHURCHILL  
CANUSA EPC

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# AGENDA

Quantifying the Application

Capture Technology & Execution

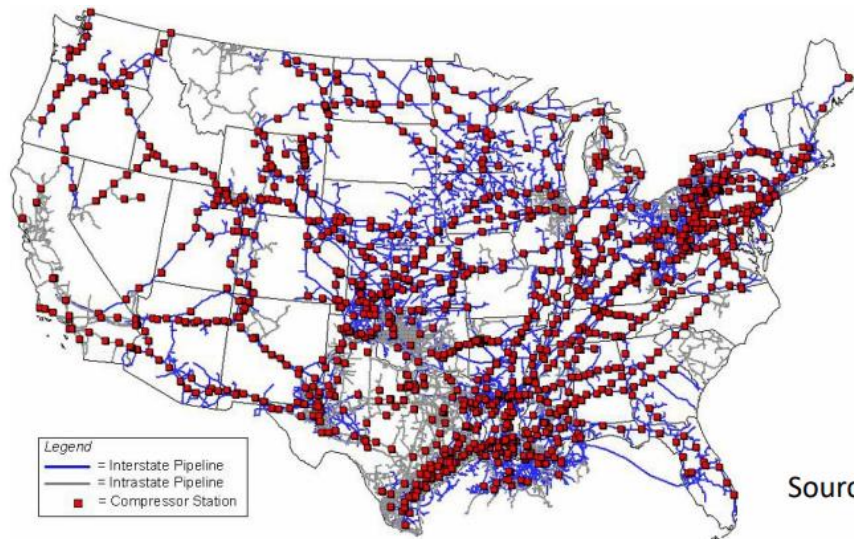
Generating Revenue

Next Steps

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US over 1700 midstream natural gas pipeline compressor stations;  
~20,000 units in the system

US produced **96.6 Bcf/d** of natural gas in 2022

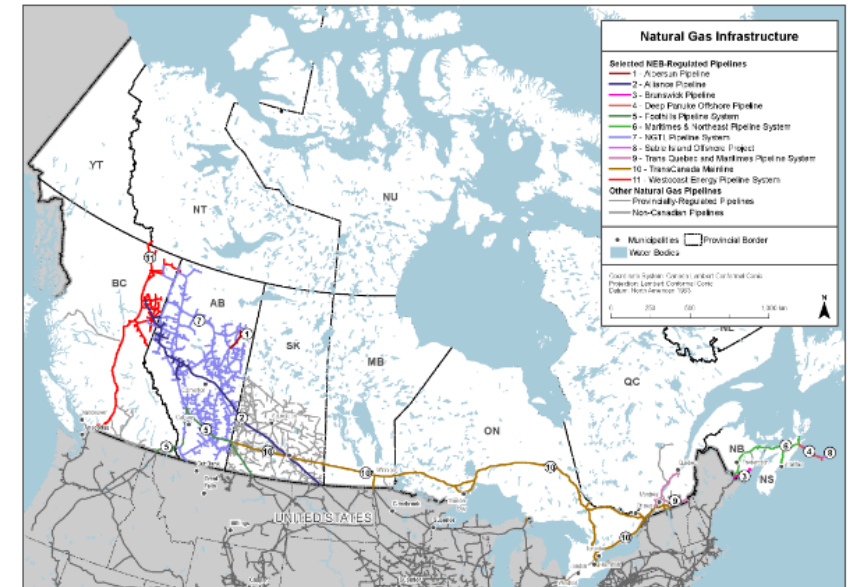


Source: US DOE EIA, Wood Mackenzie



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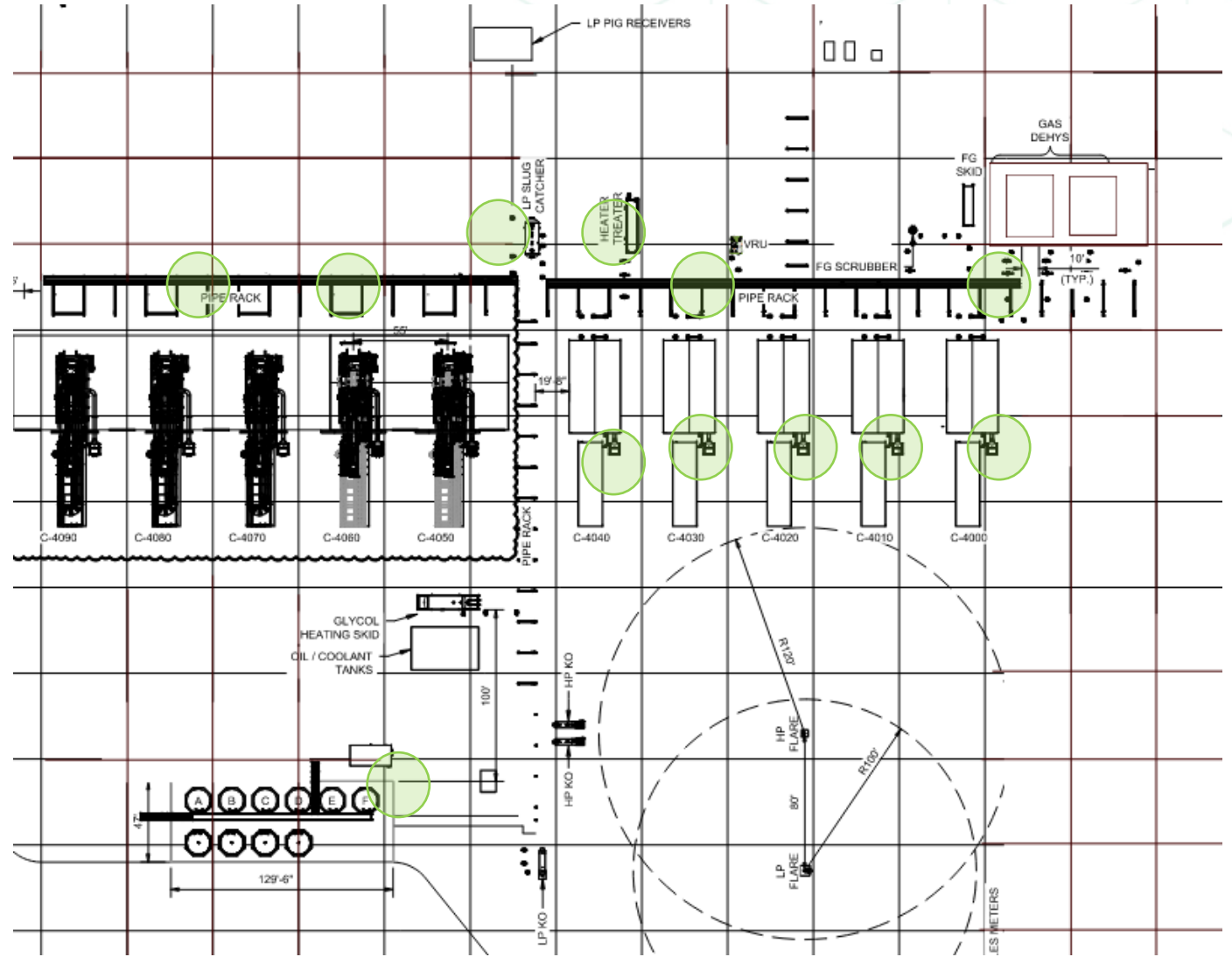
Canada produced **17.9 Bcf/d** of natural gas in 2022



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# Methane Sources

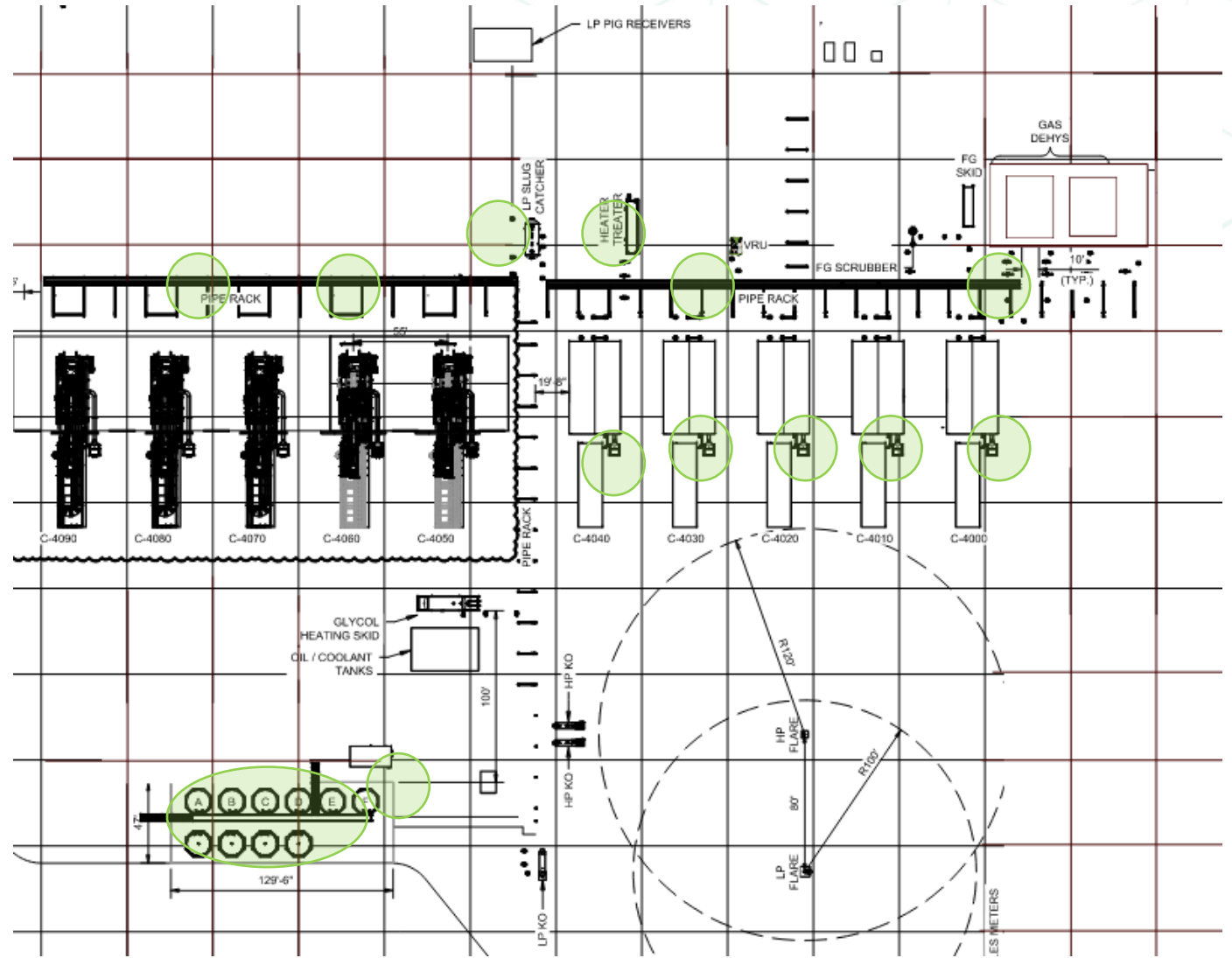
## Pneumatic Devices



# Methane Sources

Pneumatic Devices

Tank Vapors



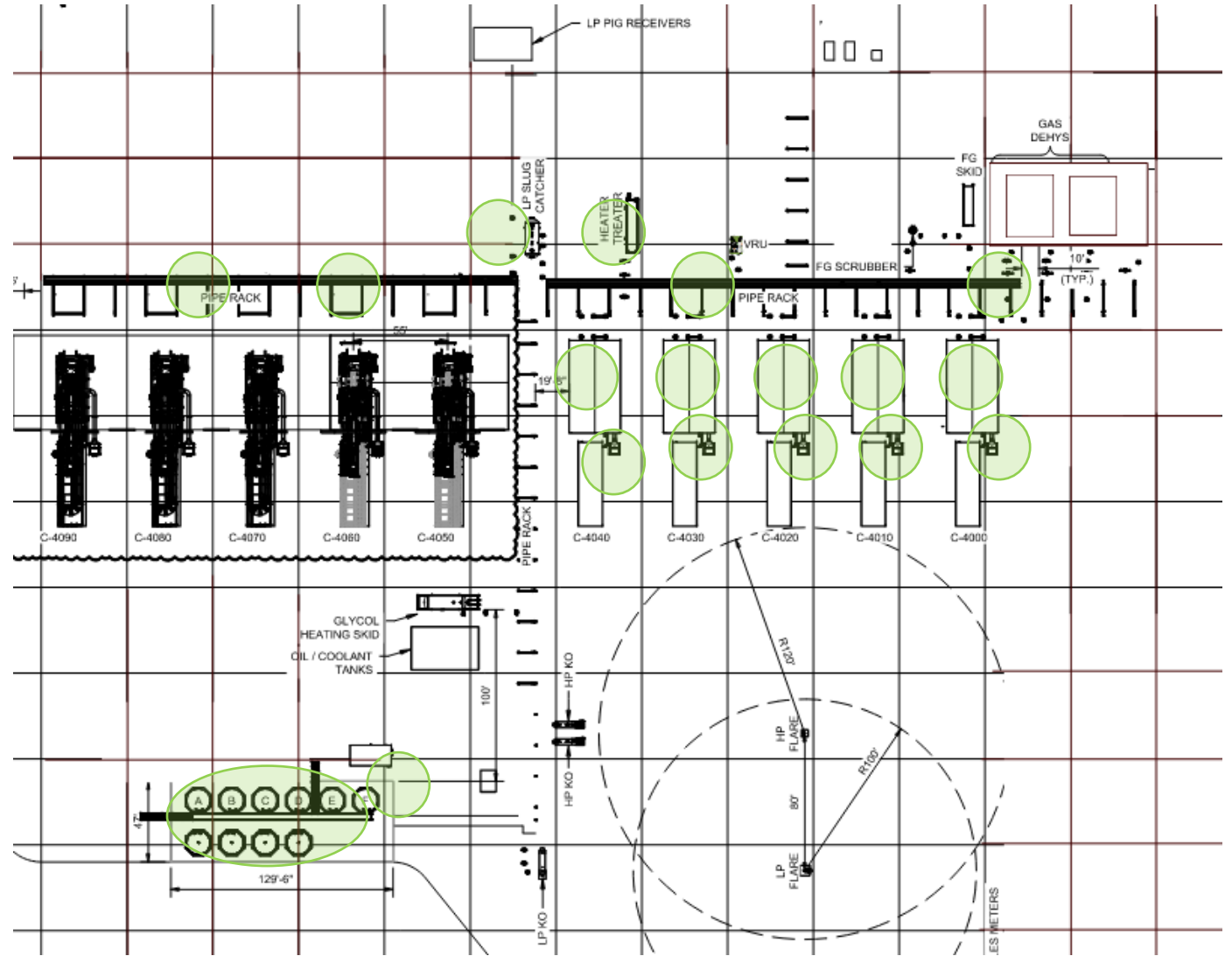
# Methane Sources

Pneumatic Devices

Tank Vapors

Compressor Seals

Compressor Starters



# Methane Sources

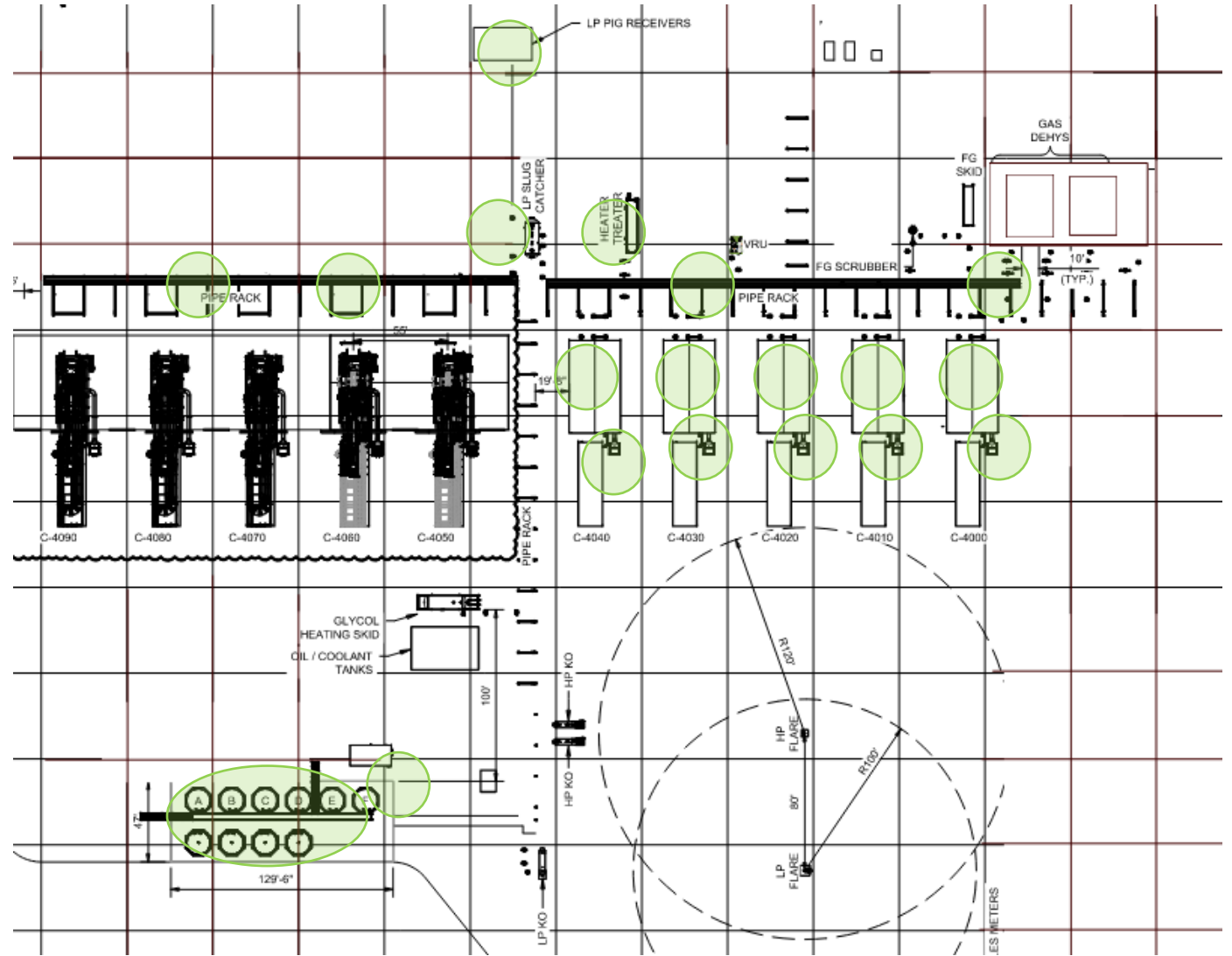
Pneumatic Devices

Tank Vapors

Compressor Seals

Compressor Starters

Maintenance Blowdowns



## Methane Sources

Pneumatic Devices

Tank Vapors

Compressor Seals

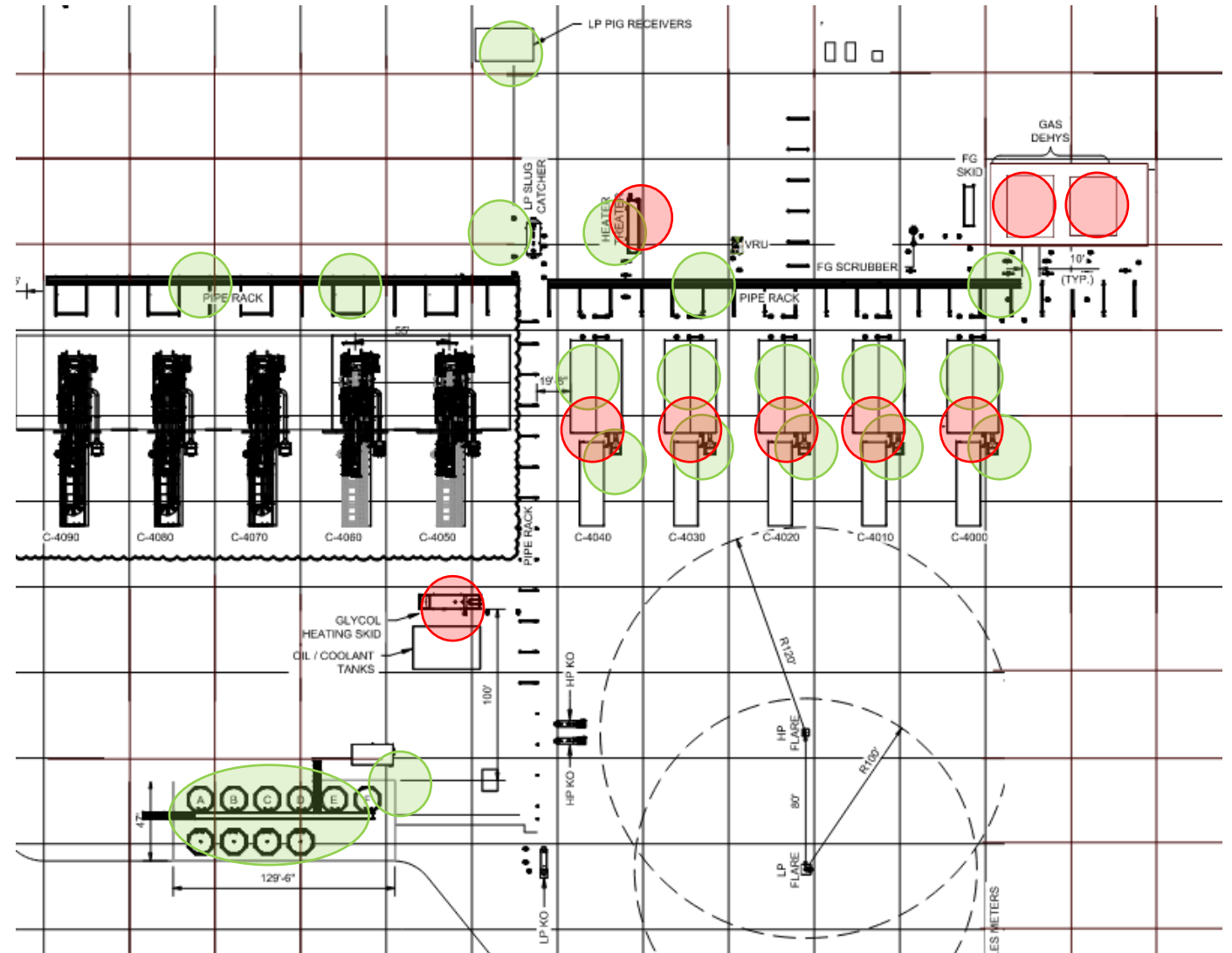
Compressor Starters

Maintenance Blowdowns

## CO2 Sources

Heaters

Engines





## Methane Sources

Pneumatic Devices

Tank Vapors

Compressor Seals

Compressor Starters

Maintenance Blowdowns

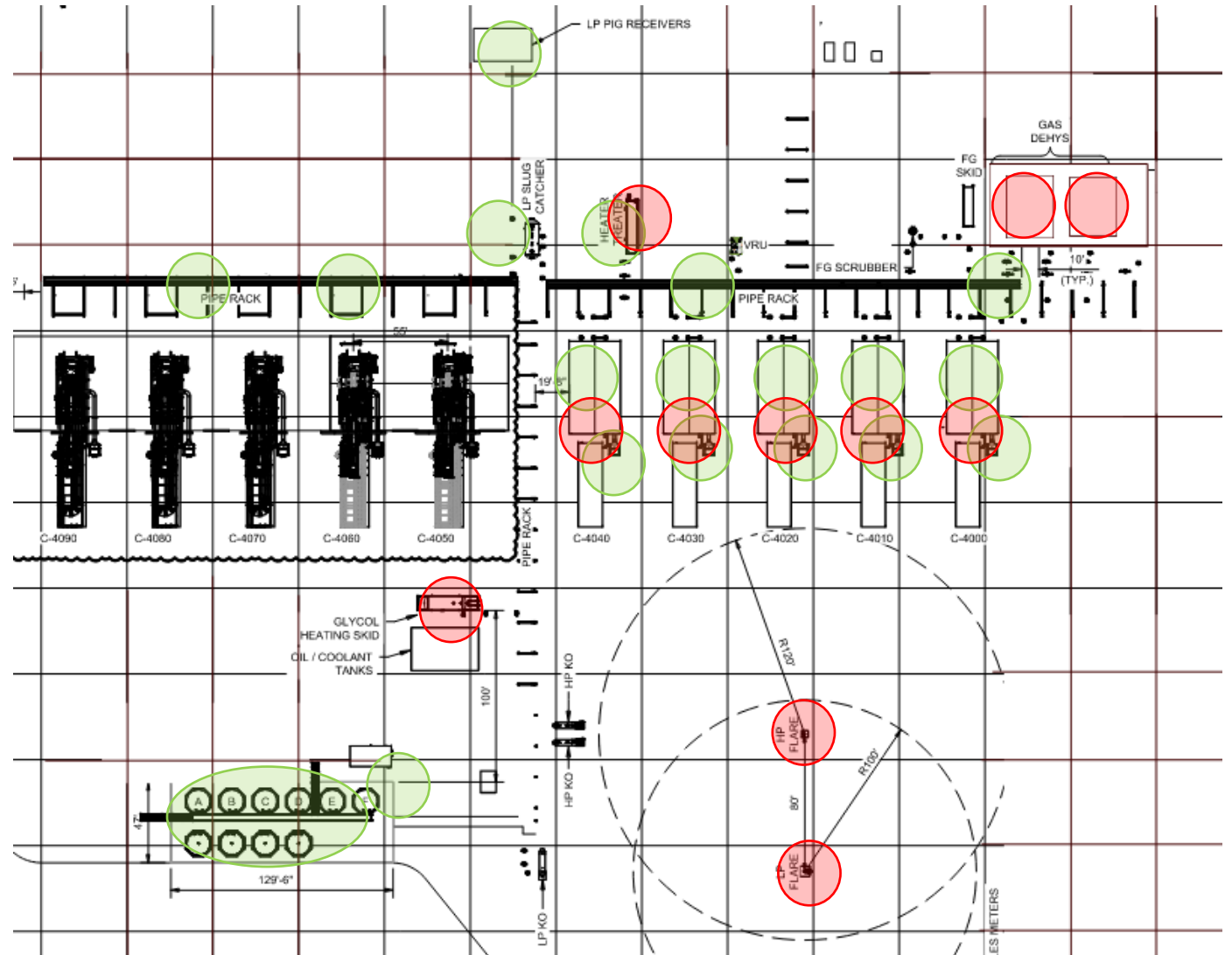
## CO2 Sources

Heaters

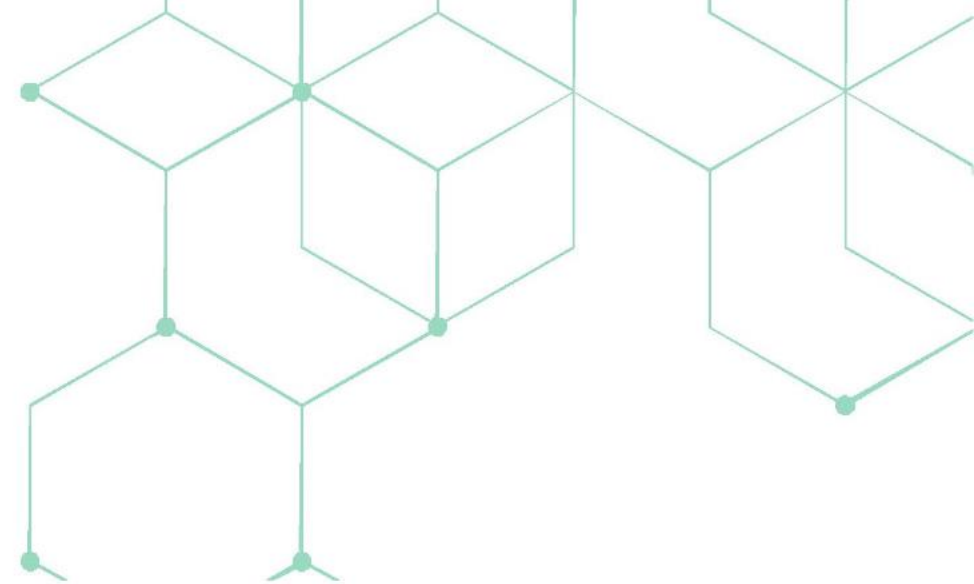
Engines

Flares/Combustors

Amine Vents



# CAPTURE TECHNOLOGIES

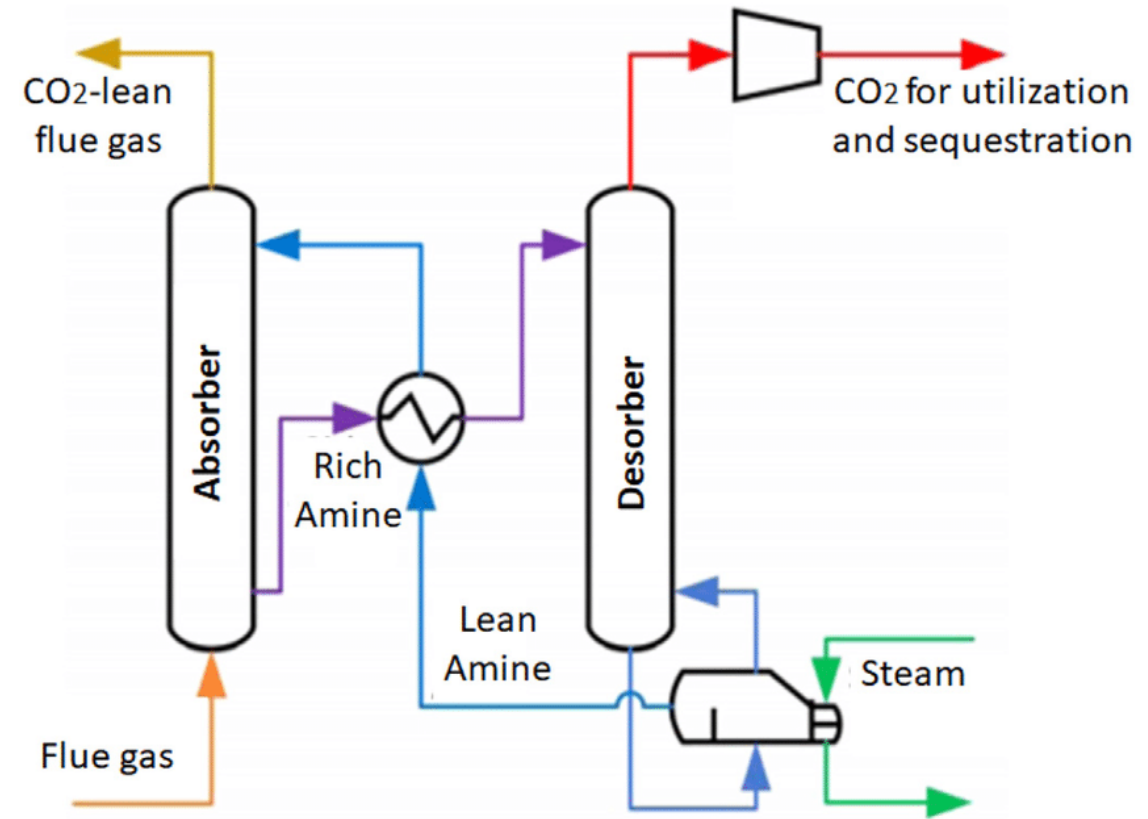


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# Amine Improvements

- Existing process and economics
- Operates with regeneration (NG or electric)
- Proprietary chemicals
- Rotating beds
- Pre-drying of flue gas

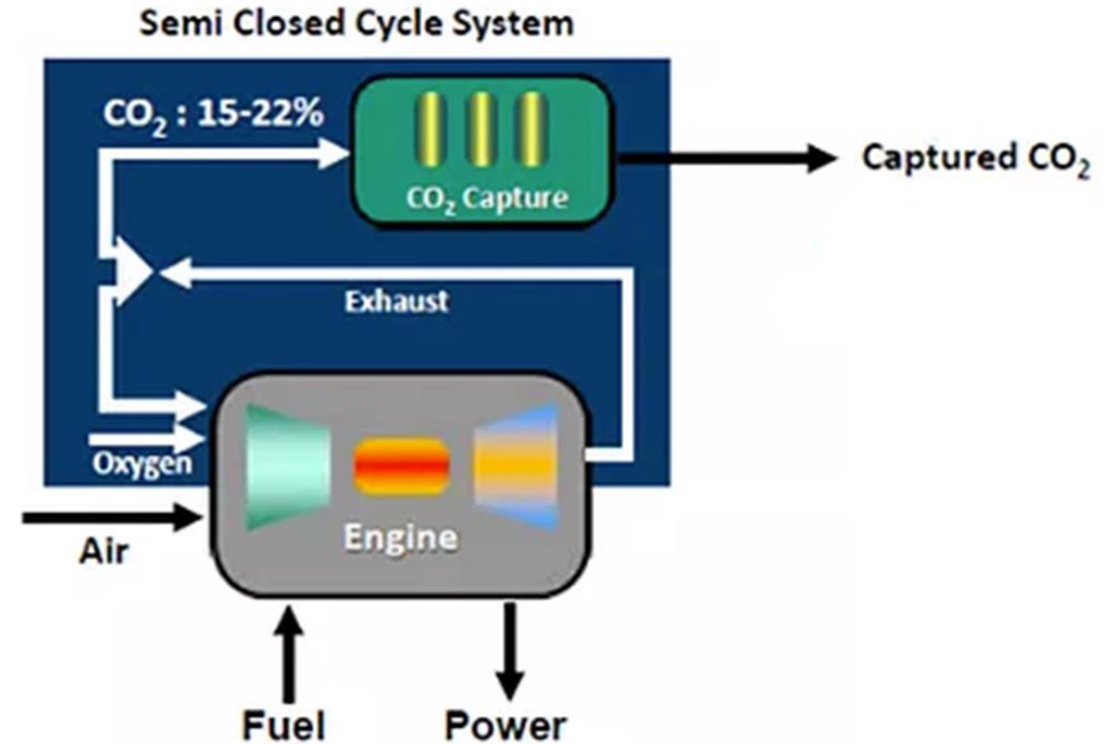


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# Engine Exhaust

- Traditional carbon capture solvent
- Increase CO<sub>2</sub> concentration with recycle into the combustion cycle
- Private deployment tests in the US



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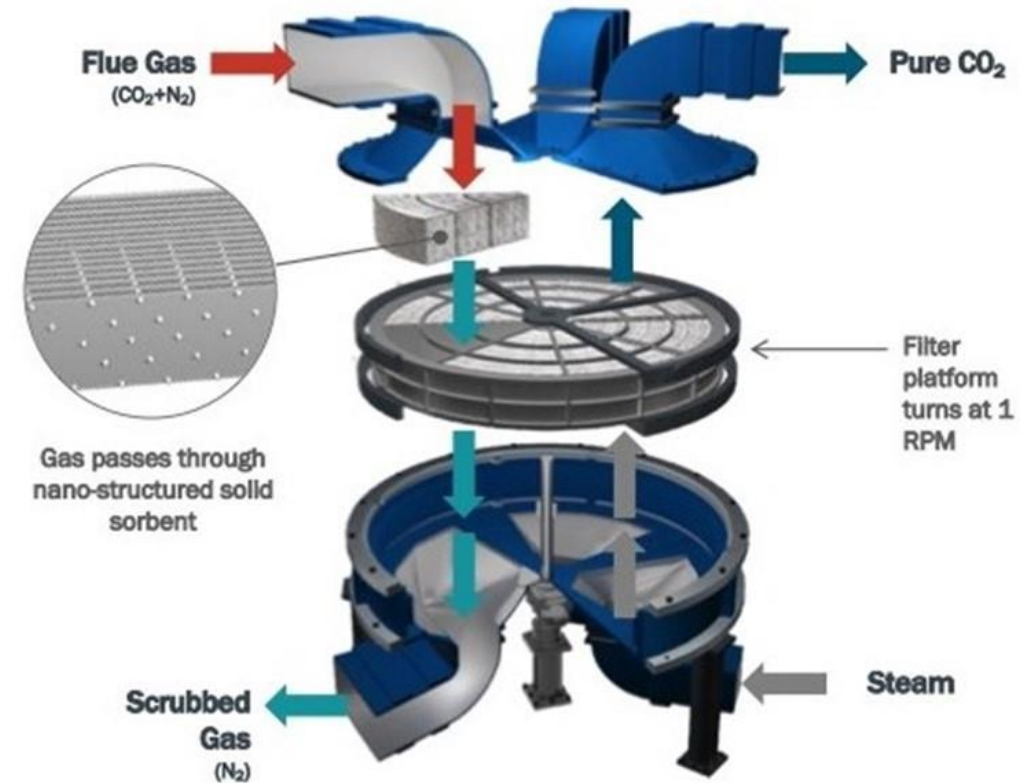
carbonpoint  
SOLUTIONS



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# Metal Organic Framework

- Temperature swing adsorption
- 3-step process as adsorption, regeneration and conditioning
- Requires adsorbent beds and utilities



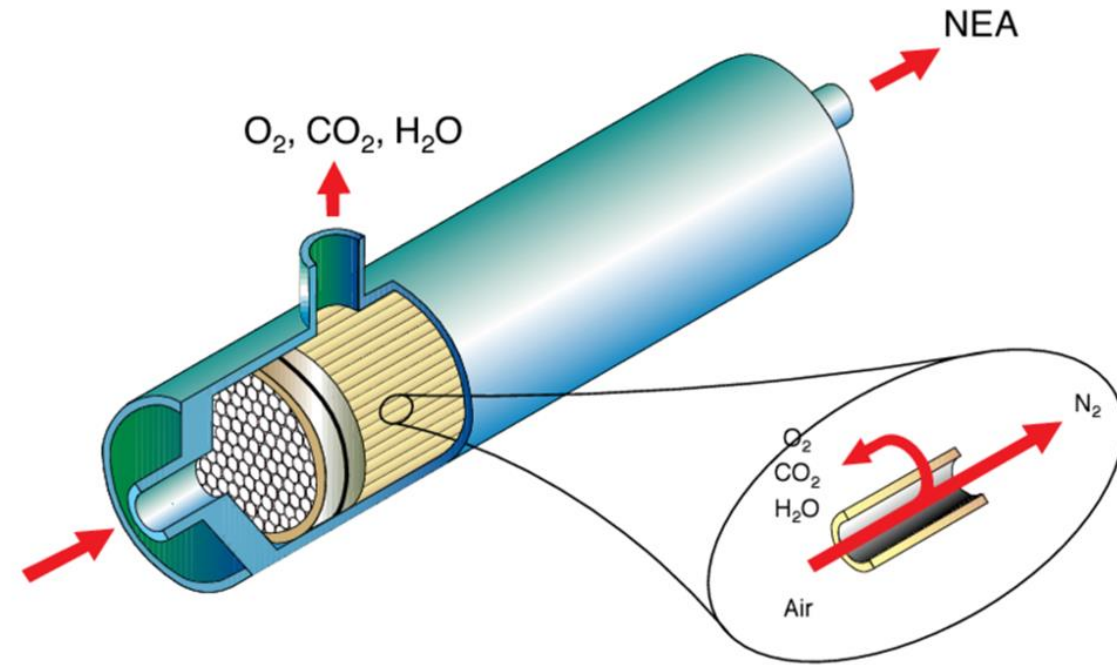
**Svante**



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# Membrane Technology

- Poly fibrous strands
- Bulk concentration applications
- In use and have known limitations
- Ceramics membranes developing



**FUJIFILM**  
Value from Innovation

**Nitto**  
Innovation for Customers

**MTR**  
MEMBRANE  
TECHNOLOGY & RESEARCH

**Air Liquide**

**slb**

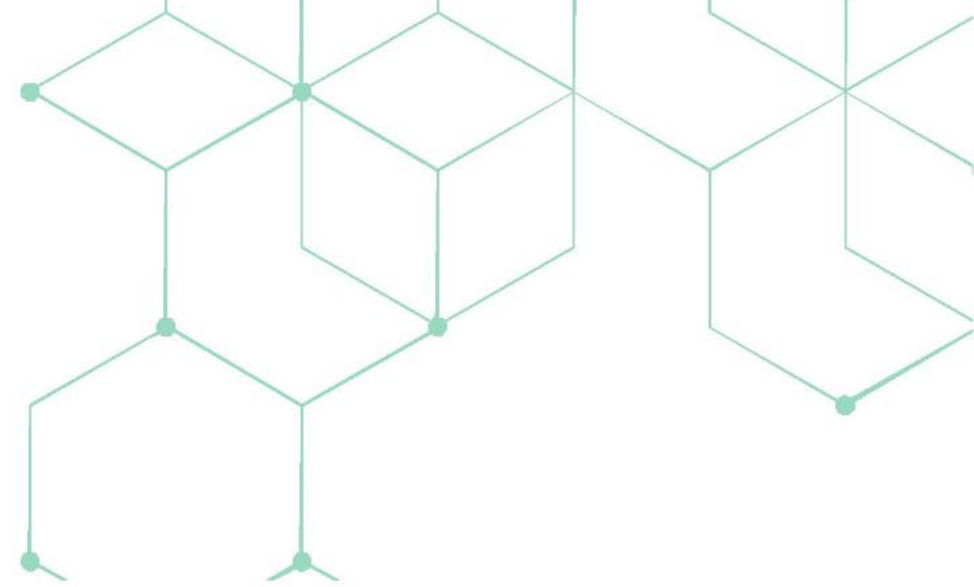
**EVONIK**  
Leading Beyond Chemistry

**Linde**



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# CAPTURING CO2 FROM COMPRESSION



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# Engine Exhaust Summary

**LOW VOLUME**

**HIGH COUNT**

**ELECTRIC CONVERSIONS  
ARE COST PROHIBITIVE**

**LOCALIZED NEAR  
DISPOSAL WELLS  
AND PIPELINE**

**WILL REQUIRE  
PRICE OF INCREASE  
TO \$160/TON\***

**WELL KNOWN  
EMISSION PROFILES**

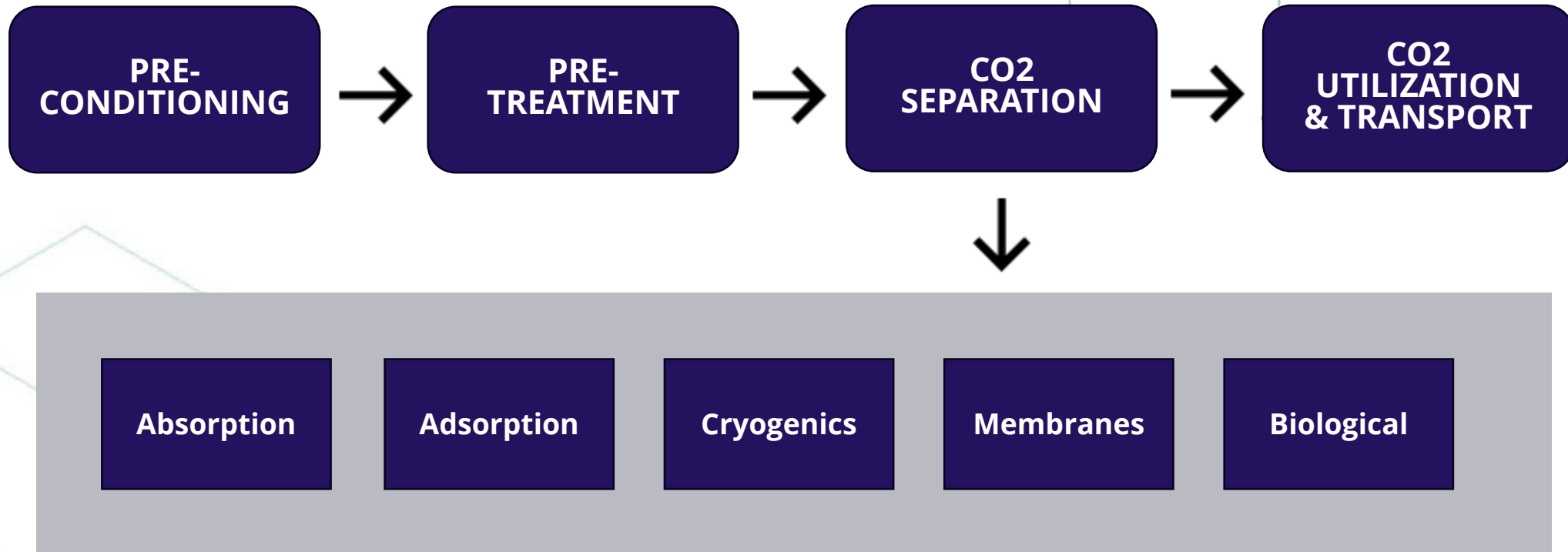


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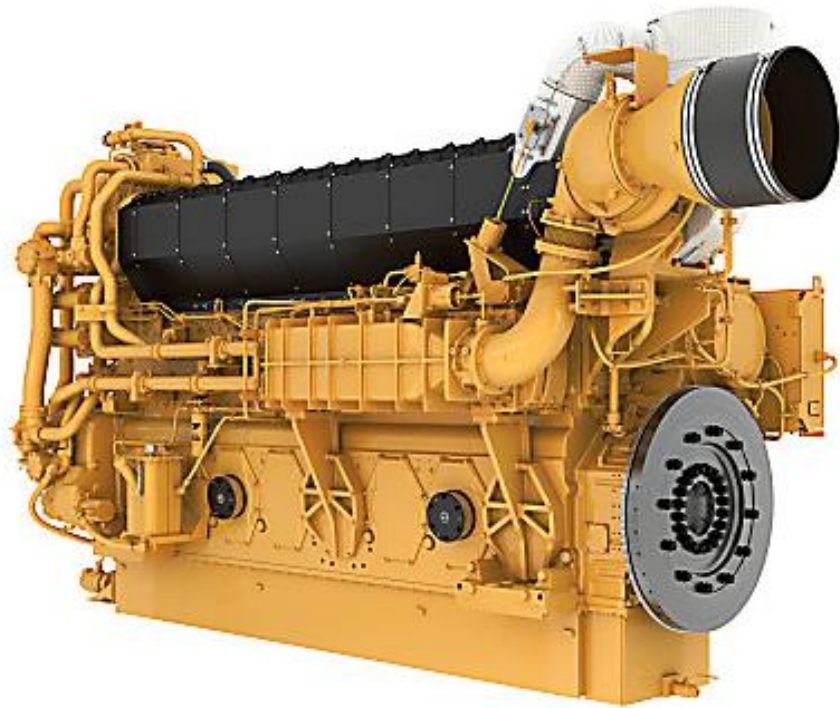
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# Carbon Capture Process

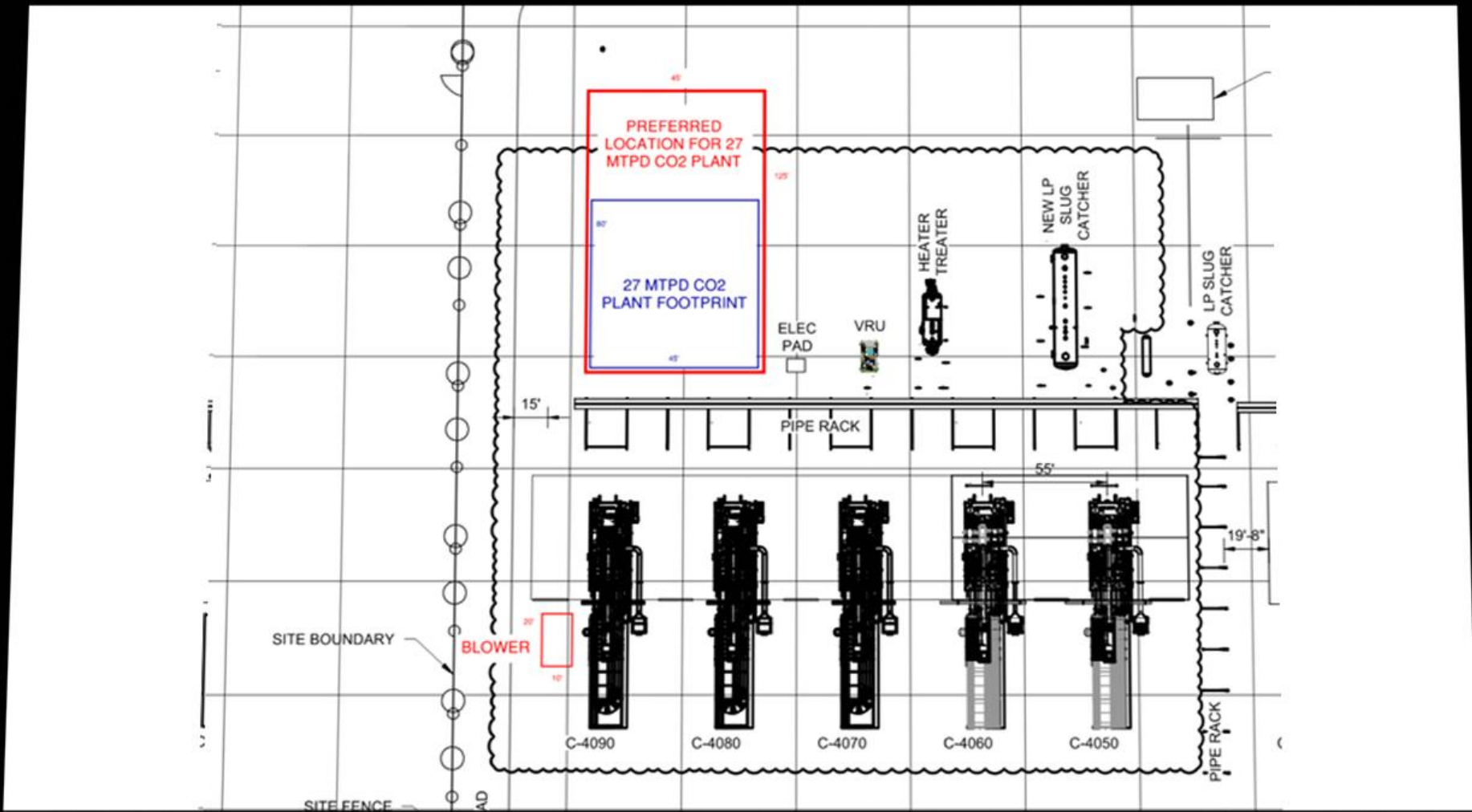


# Emissions of a CAT 3608



NUMBER OF ENGINES	CO2 TPD	REQ'D \$ CARBON
1	27 TPD	\$307
7	189 TPD	\$165





# Pilot Projects In Process



Tourmaline is seeking small-scale (10,000 – 100,000 tonnes CO<sub>2</sub>e/year) Carbon Capture and Storage / Utilization (CCUS) solutions that could be implemented at facilities  
-Low Carbon Business Action Canada



carbonNEXT and FortisBC, sought solutions that could **remove small amounts of CO<sub>2</sub> from areas all across Canada** while contributing to Foresight Canada and FortisBC's ultimate goal—moving the needle to a more sustainable future



ESG Clean Energy, a developer of power generation and carbon capture systems, announced that its carbon capture system had achieved 100% capture from a combustion exhaust stream.

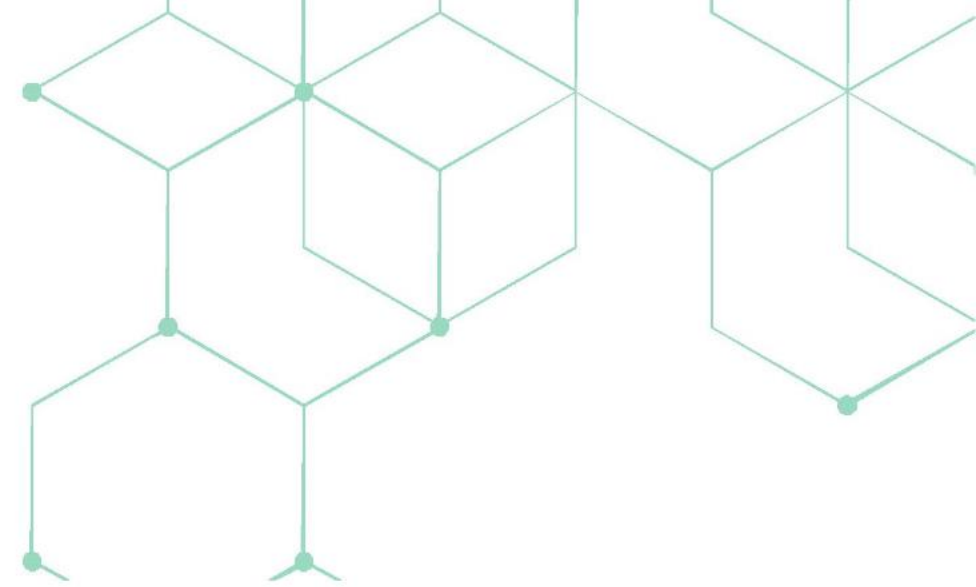
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# PATHWAY TO REVENUE



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# CO2 Revenue Options

**INJECTION FOR  
SEQUESTRATION**

**PIPELINE SALE IN DENSE  
PHASE**

**LIQUEFACTION FOR SALE TO  
LOCAL MARKET**



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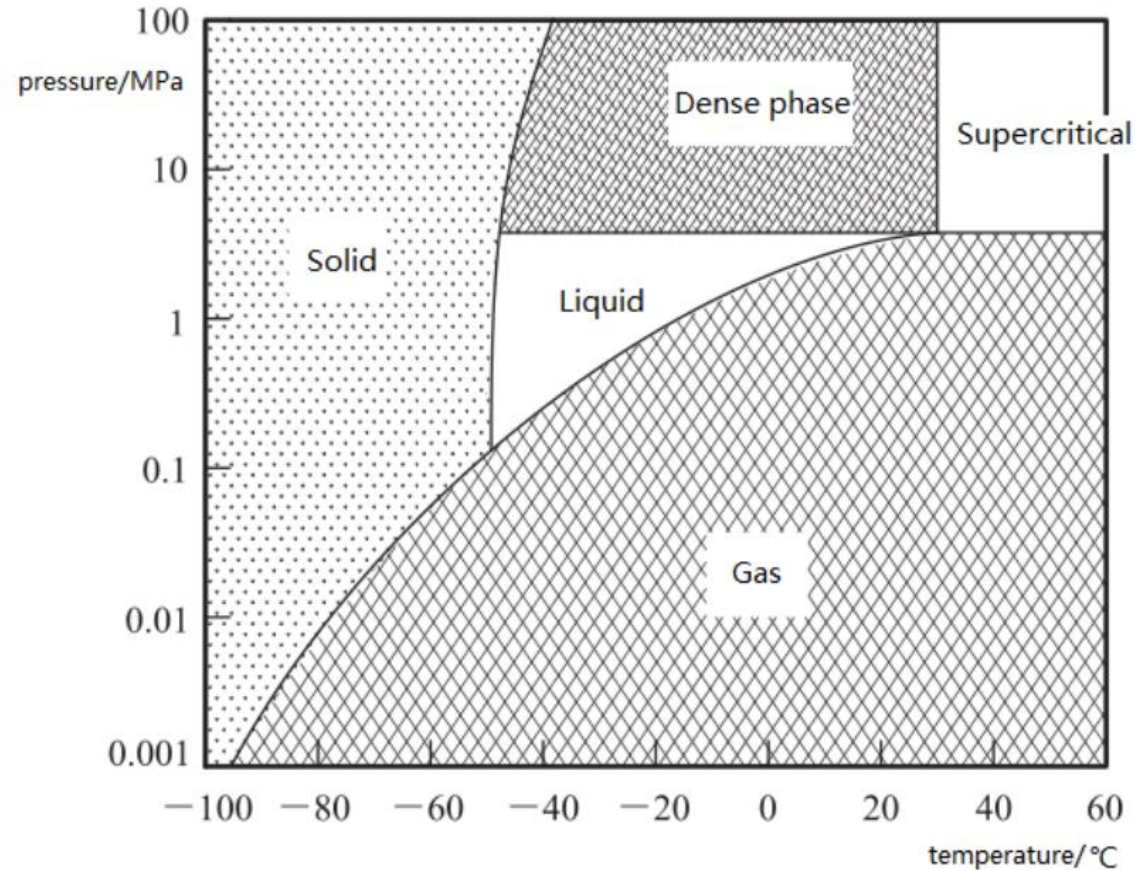
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# CO<sub>2</sub> Phase Diagram

**COMPRESSION FOR  
SUPERCRITICAL**

**PUMPING FOR  
SUPERCRITICAL OR  
DENSE PHASE**

**PIPELINES OPERATE WITHIN  
DENSE PHASE DUE TO  
GROUND TEMPERATURE**

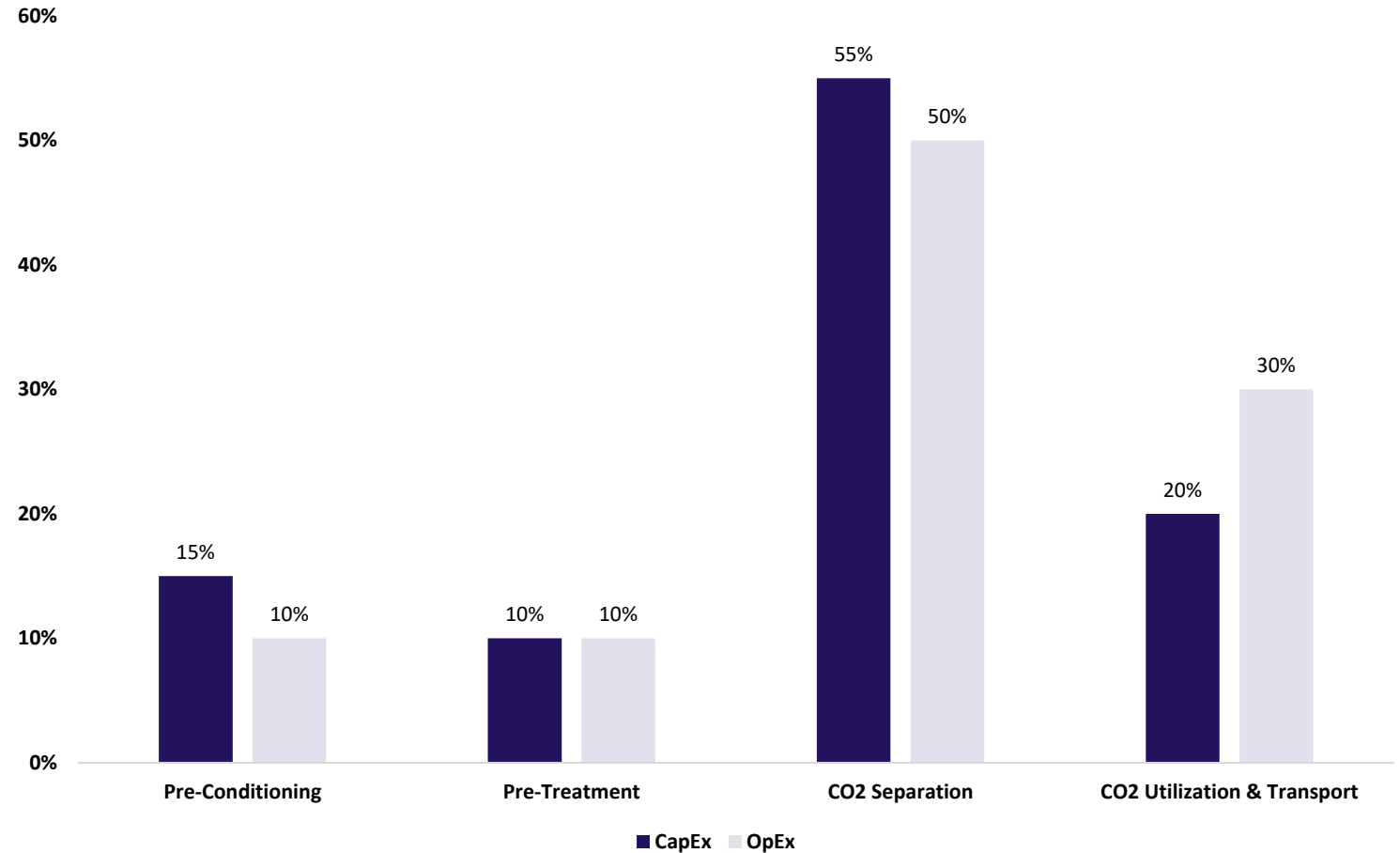


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**COST TO CAPTURE WITH  
PROVEN AMINE-BASED  
TECHNOLOGIES =  
\$130 / METRIC TON**

**COST TO  
TRANSPORT APPROX. =  
\$35 / METRIC TON**

**Costs Based on Processing CO2 from Exhaust**







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