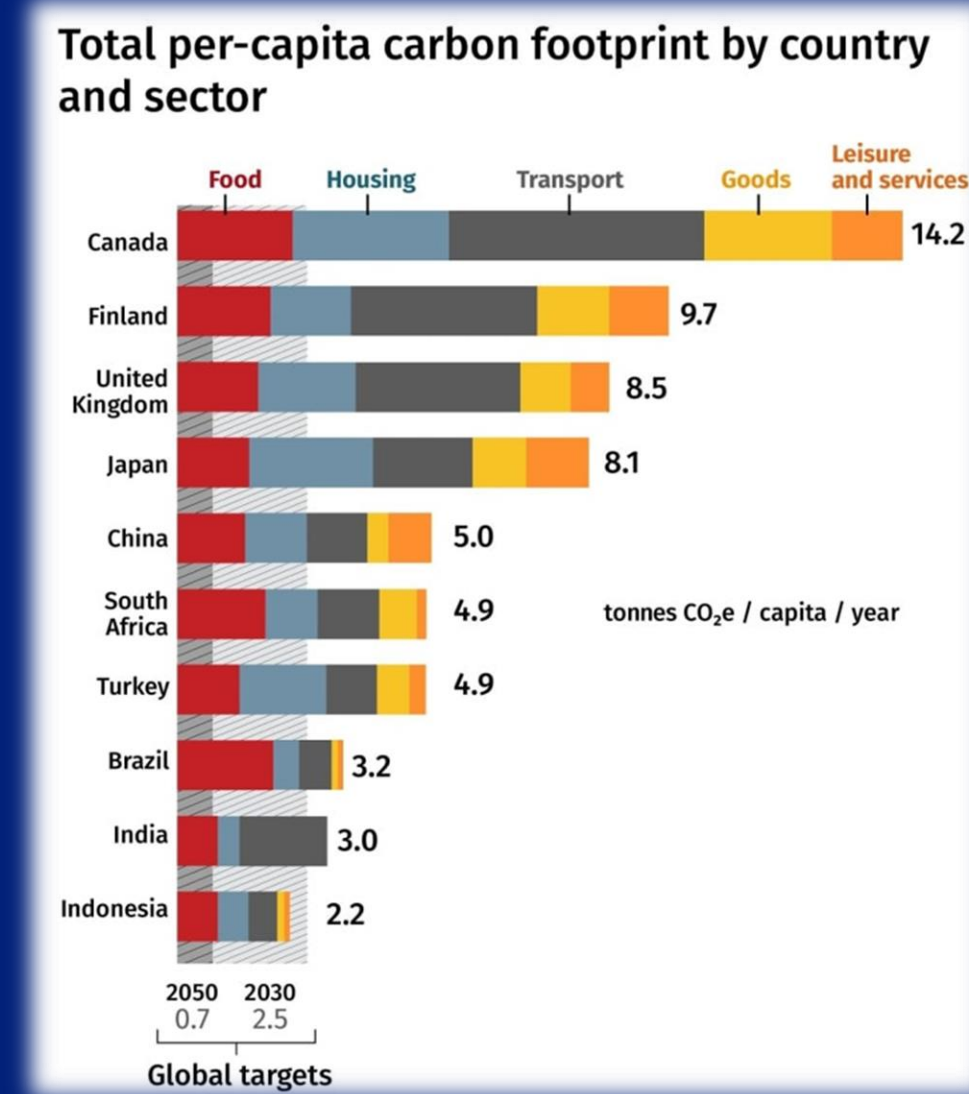


— WHAT'S THE ISSUE? —

Canadians are amongst the world's worst carbon emitters, with housing and transportation as the dominating sectors. The production of blue hydrogen as an energy source poses as a method to significantly reduce carbon dioxide emissions while maintaining a substantial output capacity. This aligns with the country's Net-Zero Emissions Accountability Act.

As the nation's largest natural gas producer and eighth largest globally, Alberta holds the potential to be an international leader in blue hydrogen production and exportation. Additionally, the Alberta Carbon Trunk Line (ACTL) is the largest carbon capture and storage project in the world, further solidifying blue hydrogen's viability for success in the province.



— HIGHLIGHTS —

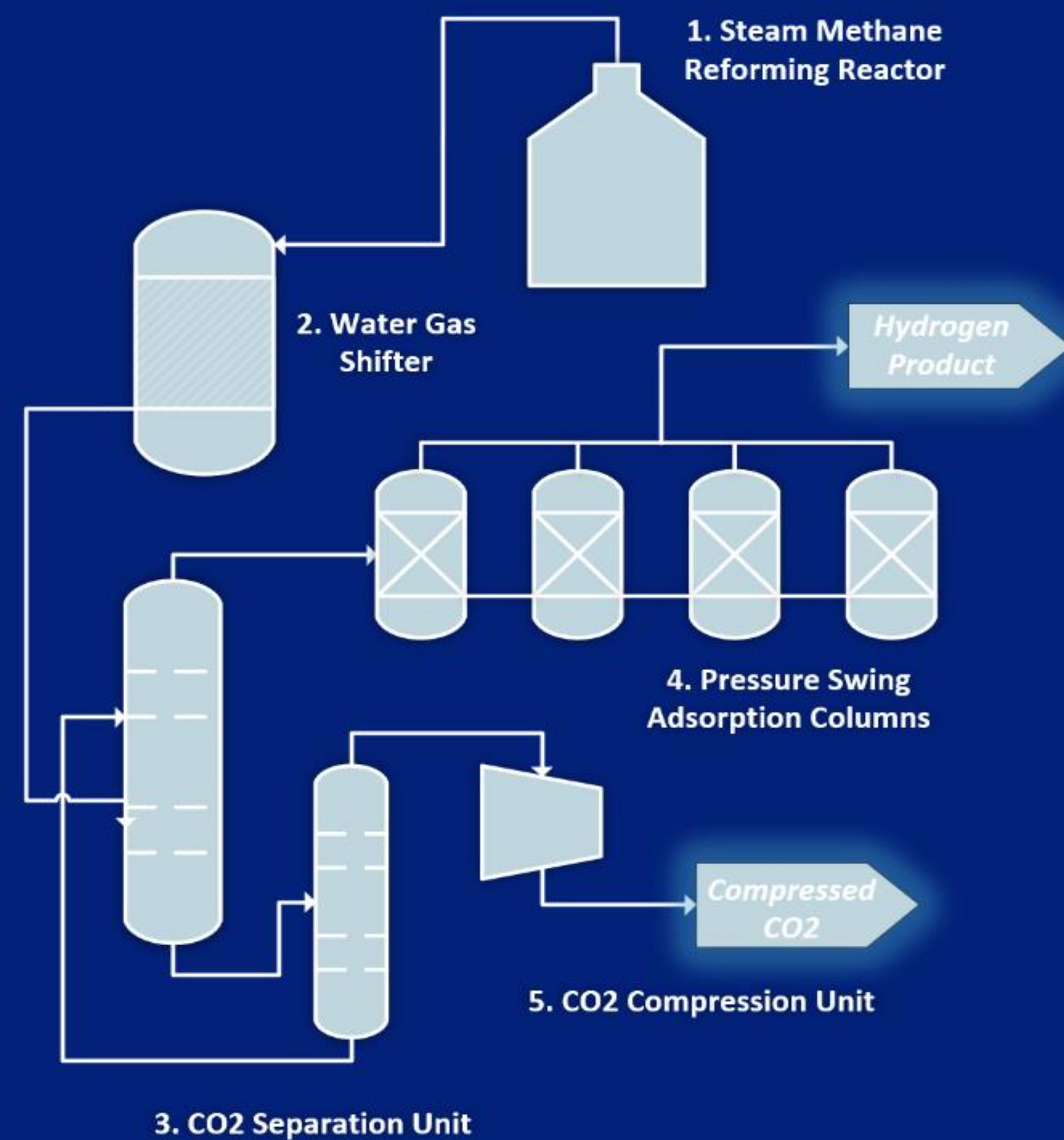
Integration of CO₂ Separation and Sequestration

Main Reaction: $CH_4 + H_2O \rightleftharpoons CO + 3H_2$

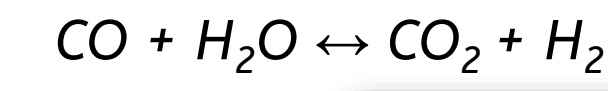
Capacity: 453,932 tonnes of hydrogen per year

Plant Location: Balzac, Alberta

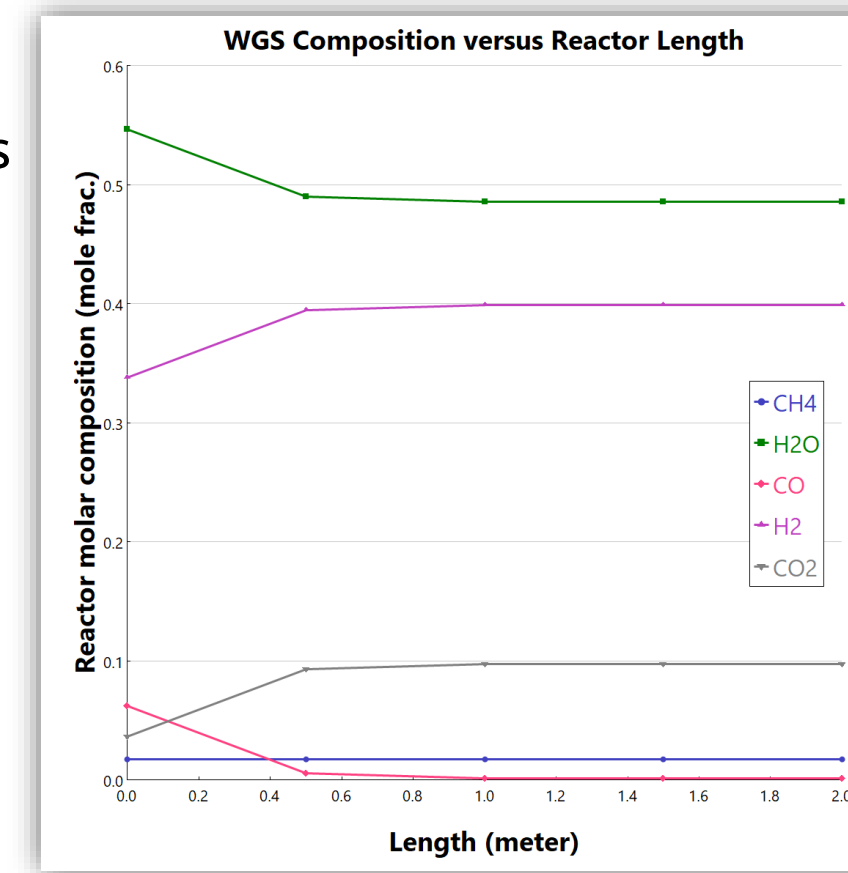
— PROCESS OVERVIEW —



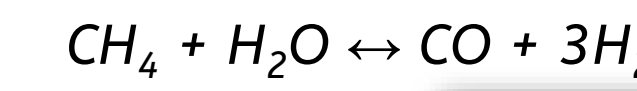
2. Water Gas Shifter



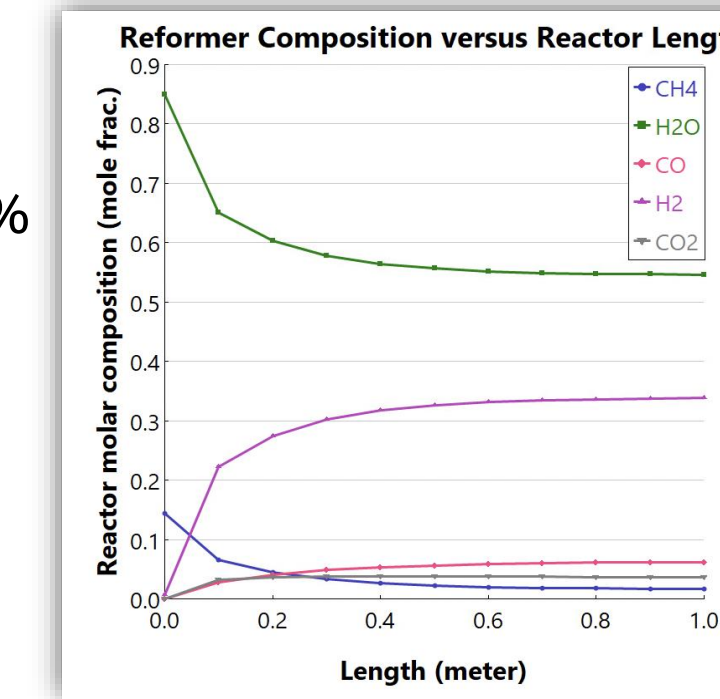
- Low-temperature WGS process
- Multi-tubular PBR
- Operating at 200°C & 29 bar
- 98% conversion of CO
- Packed with CuO/ ZnO/ Al₂O₃
- 100 tubes, with ID 0.13m & 1m in length



1. SMR Reactor

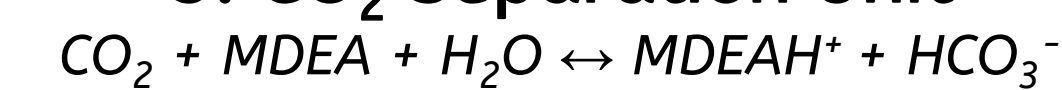


- Multi-tubular PBR
- Operating at 923°C & 25 bar
- Single pass conversion of 85%
- Nickel catalyst within tubes
- 101 tubes, with ID 0.1m
- Heated length of 1m

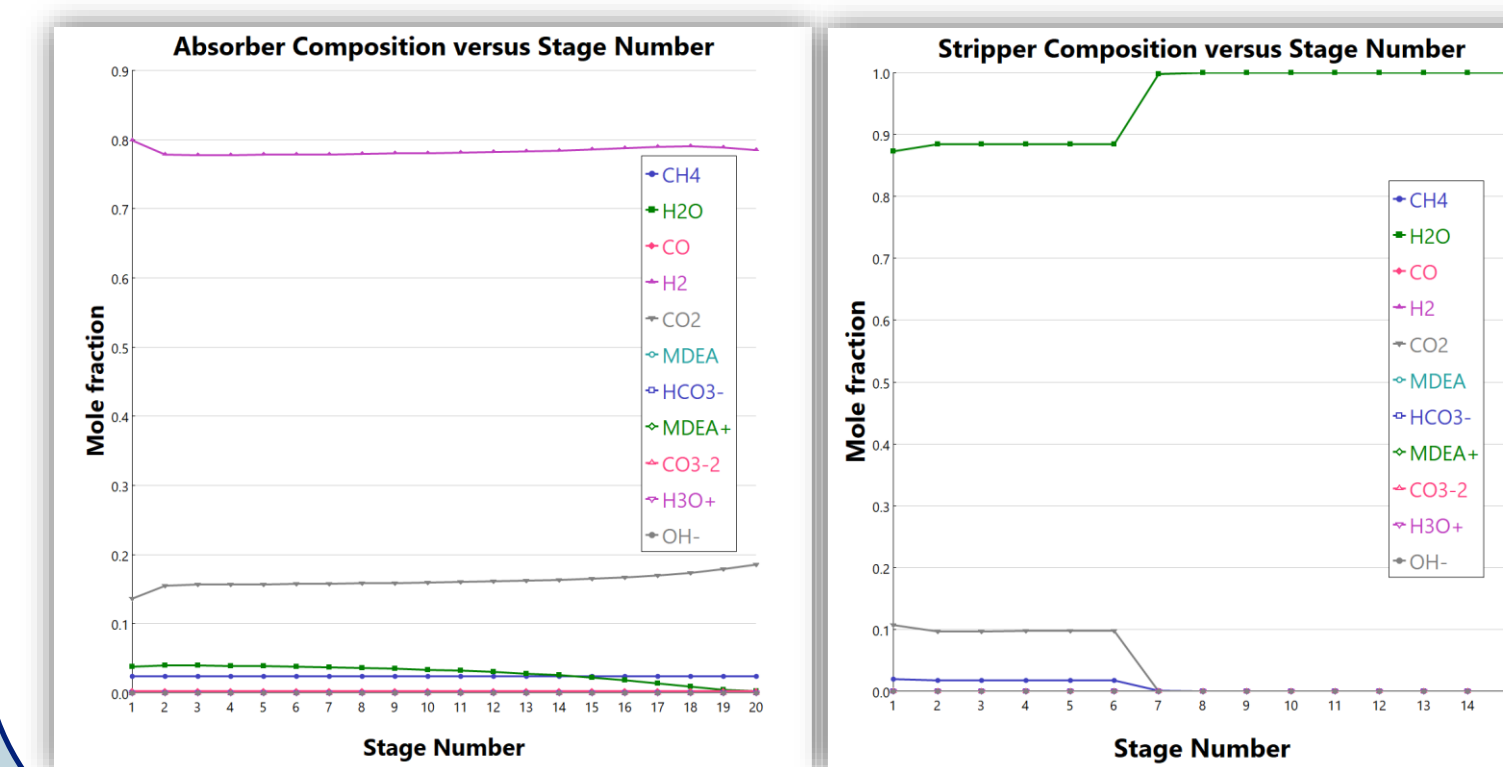


CO₂ to ACTL for Sequestration

3. CO₂ Separation Unit



- Absorption tower with 20 stages, utilizing a blended MDEA/MEA solvent (ratio of 30/20).
- Subsequent 15 stage stripping tower to regenerate amine solvent.



4. Pressure Swing Adsorption Units

- Four PBR, operating at 30°C & 26 bar
- Adsorber bed material composed of Zeolite 5A
- H₂ purity and recovery rate at 99%
- Length of 10m and internal diameter of 2m
- Can be purged when saturated

5. CO₂ Compression Unit

- A 4-stage compressor will be equipped to liquify and ensure the carbon dioxide stream meets the required conditions of the ACTL.
- The system also consists of intercoolers to remove the heat of compression.

Number of Compression Stages Required:

$$P_2 = P_1 (R_{comp})^n$$

$$180 \text{ bar} = 1.8 \text{ bar} (3.5)^n$$

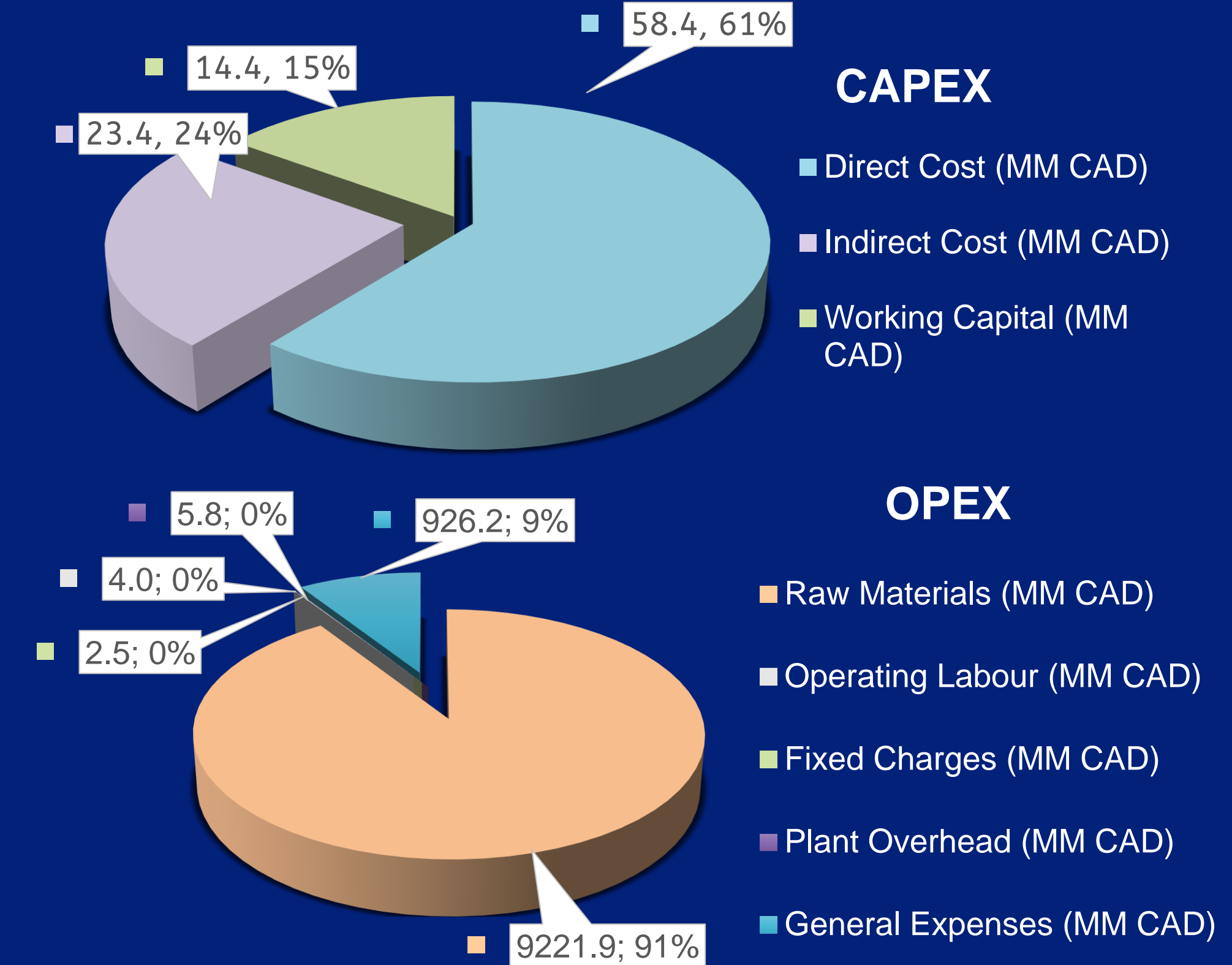
$$n = 3.68 \rightarrow 4 \text{ stages}$$

Interstage Cooler Sizing:

$$A = \frac{Q}{U \cdot LMTD}$$

— FEASIBILITY —

CAPITAL AND OPERATIONAL COST BREAK DOWN



ENVIRONMENTAL & SOCIAL BREAK DOWN



- 16,694 tonnes CO₂ captured per annum
- Blending 20% hydrogen with natural gas reduces consumer emissions
- Action plan to educate the public on hydrogen blending

— WHY HYDROGEN BLENDING? —

Innovative method for reducing emissions while cornering the hydrogen market

Alberta's NG infrastructure is already rated for a 20% by volume of hydrogen blend

Encourages new hydrogen research & projects

Stimulate healthy economic growth & provincial employment opportunities

ACKNOWLEDGEMENTS

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