



# CARBON CAPTURE and Sequestration





# Carbon Capture



Equinox Engineering Ltd. is a world class provider of EPCM services to the global oil and gas marketplace.

Equinox has industry leading expertise in natural gas processing, with a specialization in carbon capture.

Founded in 1997, Equinox has successfully executed over 7,000 significant projects around the world.

Equinox has a worldwide presence with offices in Calgary (Canada), Houston (USA), Pittsburg (USA), Brisbane (Australia) and Pune (India) with projects executed in fourteen countries and three continents.

We provide complete EPCM services for facilities and pipeline design and installation. This includes Conceptual and Front End Engineering Design (FEED), Detailed Engineering Design, Procurement, Construction Management through to Start-Up and Commissioning.

## Moomba Carbon Capture Project

Equinox successfully executed the Concept, FEED and Detail Design for the Moomba Carbon Capture project. The CCS project will permanently store 1.7 million tonnes of CO<sub>2</sub> per year. Equinox provided the engineering for the CO<sub>2</sub> capture, CO<sub>2</sub> compression and dehydration, CO<sub>2</sub> pipeline and CO<sub>2</sub> sequestration.



# CO<sub>2</sub> Capture

Carbon capture is the process of capturing CO<sub>2</sub> formed through power generation combustion processes and industrial processes like gas processing, cement production and ammonia production. Common CO<sub>2</sub> sources include:

- Post combustion of fossil fuels – utilize air for the combustion process
- Post combustion of oxygen enriched fuels – utilize pure oxygen for the combustion process
- Pre combustion – first convert fuel to a syngas (H<sub>2</sub>) for the combustion process
- Natural gas treating and industrial processes – gas processing facilities, cement production, etc.

There are several technologies currently utilized to capture CO<sub>2</sub> from these processes, including Membranes, Absorption, Adsorption and Cryogenics.

Low pressure absorption with amines is the most widely utilized process for high volume applications. The absorption process removes CO<sub>2</sub> from the other combustion products at a purity of greater than 99.5% CO<sub>2</sub>.

Equinox is a world leader in CO<sub>2</sub> capture process technology having completed hundreds of designs and studies over our 25-year history. We have an industry leading cost database and template design library for the most cost-effective CO<sub>2</sub> Capture Processes.



# CO<sub>2</sub> Compression, Dehydration, Pumping

Once the CO<sub>2</sub> has been captured and processed to remove N<sub>2</sub>, O<sub>2</sub>, SOx, NOx - the CO<sub>2</sub> is in a low pressure, water saturated state that will require compression and dehydration to transport the mixture safely via pipeline.

Typically, the CO<sub>2</sub> will be compressed above its critical point (supercritical fluid) which ensures a low viscosity fluid state (reduces pipeline pressure drops), high density (minimizes reservoir injection pressures) and allows for fluid pumping if additional pressure is required (more cost effective than compression).

The CO<sub>2</sub> compression will typically utilize 4-5 compression stages to reach the supercritical phase and will typically utilize centrifugal

compression depending on the volumes. To avoid acidic, corrosive environments downstream of compression along pipelines and wellbores, dehydration will be installed interstage to remove H<sub>2</sub>O. The most common dehydration process is a stainless-steel TEG dehy.

Equinox is a world leader with all compression and dehydration processes and technologies specifically with corrosive/acid gas applications that exist with carbon capture.





# CO<sub>2</sub> Pipeline

Equinox has significant experience with supercritical phase CO<sub>2</sub> pipeline projects – from engineering to installation.

Distribution and transportation of supercritical phase or gas phase CO<sub>2</sub> requires consideration of numerous factors for the pipeline system regarding throughput, pipeline diameter, pressure as well as water content monitoring, material selection, metallurgy, corrosion mitigation and process safety overview.

CO<sub>2</sub> behavior and phase transition especially in the injection / sequestration wellbore, requires transient modelling expertise. Equinox will manage process modelling for the analysis of dynamic operating cases throughout the project.

The CO<sub>2</sub> product transported via pipeline has the potential to create a highly corrosive environment. A key design consideration with a supercritical phase CO<sub>2</sub> pipeline is to prevent formation of free water in the pipeline. Equinox brings the expertise and experience to manage all critical pipeline design issues.



# CO<sub>2</sub> Sequestration

The most common method of storing carbon from industrial/combustion processes is geological sequestration.

Once the CO<sub>2</sub> has been captured, processed, and compressed to a supercritical phase it will typically be pipelined to a sequestration wellsite/wellpad. At the wellpad the CO<sub>2</sub> fluid is injected downhole through a wellbore to the geological formation. These formations are typically saline formations or depleted oil and gas reservoirs.

The sequestration reservoir characteristics ideally will have high porosity and high permeability typically found within sandstone and limestone reservoirs. The injection formation must be capped by a low permeability layer (shale) and does not contain faults to ensure no CO<sub>2</sub> egress.

The sequestered CO<sub>2</sub> remains locked in the formation in a supercritical phase indefinitely.







Equinox delivers focused and experienced

## **Premium Teams**

customized with the best

## **Technical Expertise**

to align with

## **Client Culture**

to ensure repeatable and

## **Successful Projects**



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