CLOSED-LOOP GAS CAPTURE TRIALS IN THE MIDLAND BASIN

Aaron Kessler and Thomas Rebenack
Ovintiv

ABSTRACT

Closed-loop gas capture (CLGC) is a repeatable process that preserves oil and gas resources for later production. Instead of flaring gas during disruptions, this technology re-injects the gas for short-term storage until the issue is resolved. Recent trials in the Midland Basin demonstrated the feasibility and benefits of closed-loop systems, successfully storing and recovering significant volumes of gas. In this paper we will walk through Ovintiv's experience with the regulatory framework, candidate selection, trial results, and our learnings.

INTRODUCTION

Flaring is an unfortunate reality in the upstream oil and gas industry. While driving through West Texas at night it is not uncommon to see the distant glow from flare stacks lighting up the sky.

There are many reasons why operators are forced to flare, including:

- Safety (equipment malfunctions or emergencies)
- Midstream interruptions (lack of infrastructure, high line pressure, equipment failures, and necessary routine maintenance)
- Operational necessity (well testing or equipment maintenance)

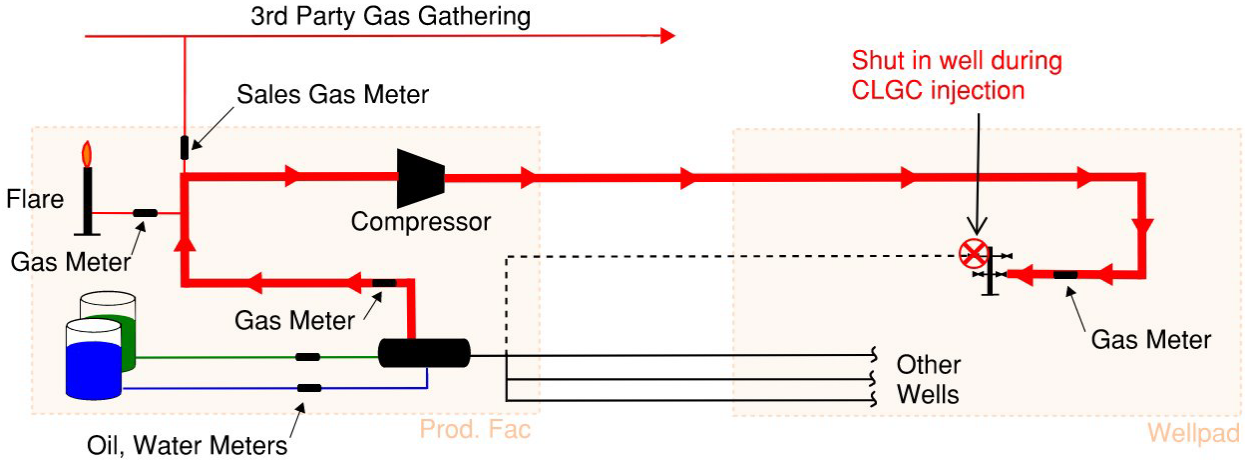
Some of the negatives associated with flaring are:

- Associated greenhouse gas emissions (natural gas emits carbon dioxide, methane, and VOCs)
- Wasted resources (natural gas is a valuable source of energy and flaring wastes a product that could be sold or for beneficial use including heating homes and generating electricity)
- Economic loss (companies lose revenue by not selling the gas)

Sustainability is a core value at Ovintiv, and this ultimately led us to explore alternatives to flaring. CLGC is a viable alternative to flaring and involves reinjecting gas, and temporarily storing it in the reservoir, instead of combusting it in a flare.

In mid-2024 Ovintiv received approval from the Texas Rail Road Commission (RRC) to trial the concept in 2 areas in the Midland Basin (Martin and Midland counties). The goal of the trial was to reduce flaring and keep more oil online.

Figure 1: Closed Loop Gas Capture well pad facility operational diagram



CANDIDATE SELECTION

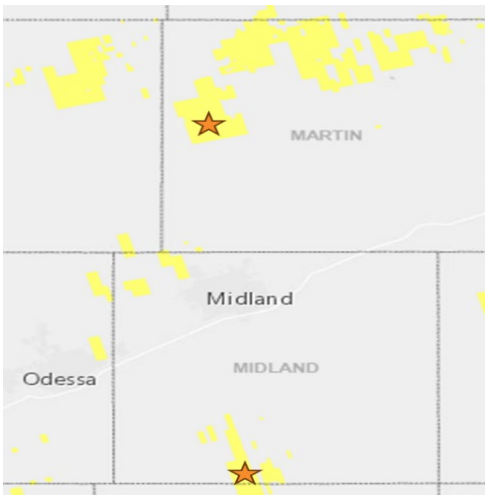
When we began our search for the ideal candidate wells for this trial we took into consideration the following criteria:

- Historical annual flared gas volumes at facilities
- Existing gas lift infrastructure
- Common mineral ownership
- Wellbore integrity
- Well age (depleted reservoir)
- Well testing equipment at facility

It was not a requirement by the RRC to conduct a CLGC trial in wells with common mineral ownership. However, for our first attempt we viewed common mineral ownership as lower risk if gas was communicated to adjacent wells.

Ovintiv permitted 13 wells to trial this concept. Four of the wells are in Martin County and the others are in Midland County. These wells were producing from two different zones (Lower Spraberry and Wolfcamp).

Figure 2 - Ovintiv acreage position and CLGC trial location



PILOT TEST #1

The first pilot test was conducted in both areas in August 2024. We only injected into one well in each area at first, and the main goal of this first test was to determine the following:

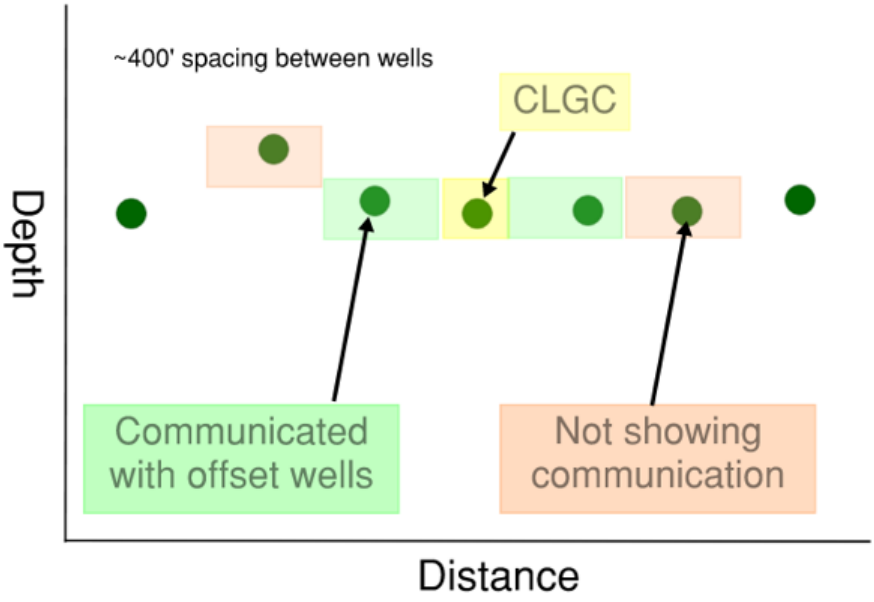
- Offset well communication, if any
- Maximum gas injection rate
- Achievable injected volume of gas

During this test we continued to produce offset wells while injecting into our permitted well. We monitored the offset well production levels for any obvious deviation from average production.

Martin County Pilot Test #1 Results:

- Injected into one well (Lower Spraberry)
- Injected for 9 days
- Injected 7 MMCF total (limited on production gas at this facility)
- Recovered 100% of gas injected in 30 days (did not subtract recycled gas from offset wells)
- Noticed offset well communication in 2 directly adjacent wells (same zone)

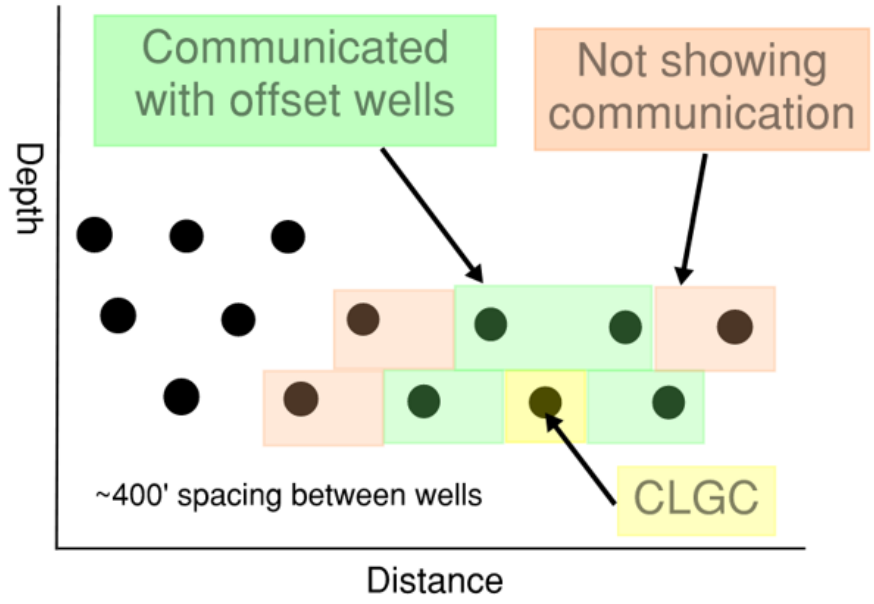
Figure 3: Martin County CLGC injection test #1 pilot gun barrel view



Midland County Pilot Test #1 Results:

- Injected into one well (Wolfcamp)
- Injected for 23 days
- Injected 43 MMCF total
- Recovered 100% of gas injected in 23 days
- Noticed offset well communication in 4 directly adjacent wells (same zone)

Figure 4: Midland County CLGC injection test #1 pilot gun barrel view



The key takeaway we learned from this first pilot was offset wells will recycle gas if they remain producing during CLGC. Because we were monitoring the production of the

offset wells, we were able to quantify the severity and volume of injected gas produced from neighboring wells.

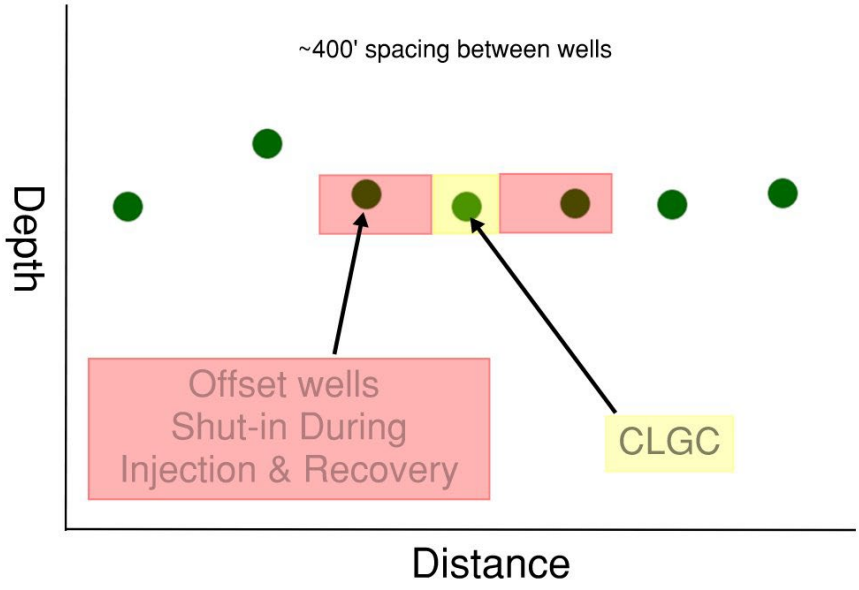
PILOT TEST #2

The second pilot test in both areas was performed in October of 2024. Because we realized offset wells were communicating in the first pilot test, we decided to shut in those wells while injecting the second time around. For the second pilot test, we injected into the same wells as the first round of testing. The goal of the second test was to capture the gas in the injection well and minimize communicating/recycling gas through the offset wells.

Martin County Pilot Test #2 Results:

- Injected into one well (Lower Spraberry)
- Injected for 3 days
- Injected 2.1 MMCF total
- Recovered 100% of gas injected in 7 days
- Offset wells were shut-in and did not notice any communication

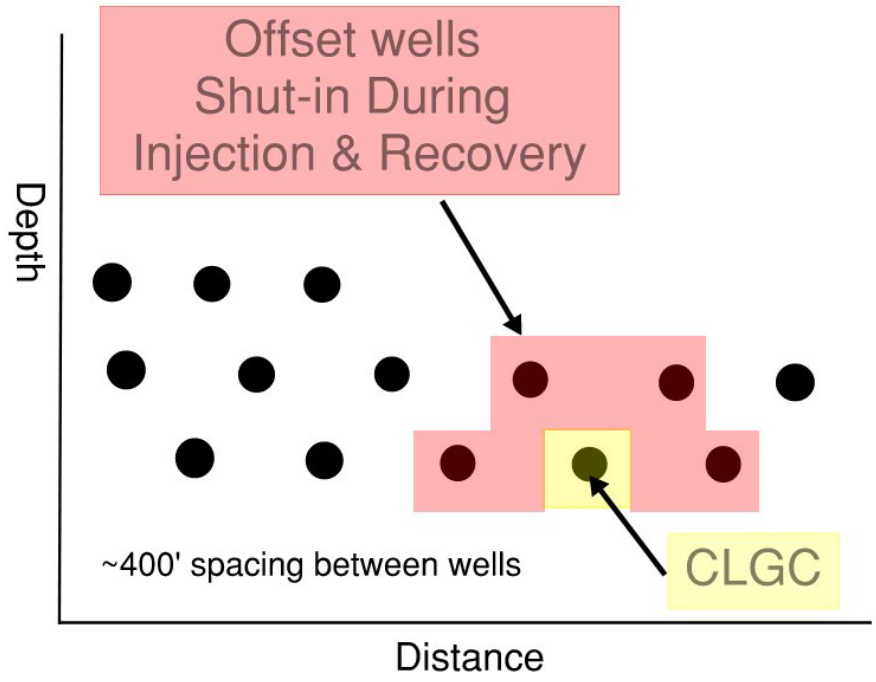
Figure 5: Martin County CLGC injection test #2 pilot gun barrel view



Midland County Pilot Test #2 Results:

- Injected into one well
- Injected for 3 days
- Injected 9.4 MMCF total
- Recovered 100% of gas injected in 18 days
- Offset wells were shut-in and did not notice any communication

Figure 6: Midland County CLGC injection test #2 pilot gun barrel view



The key takeaway we learned from this second pilot test was that offset wells no longer communicated if they were shut-in. We were able to recover the gas from the injection well faster as a result.

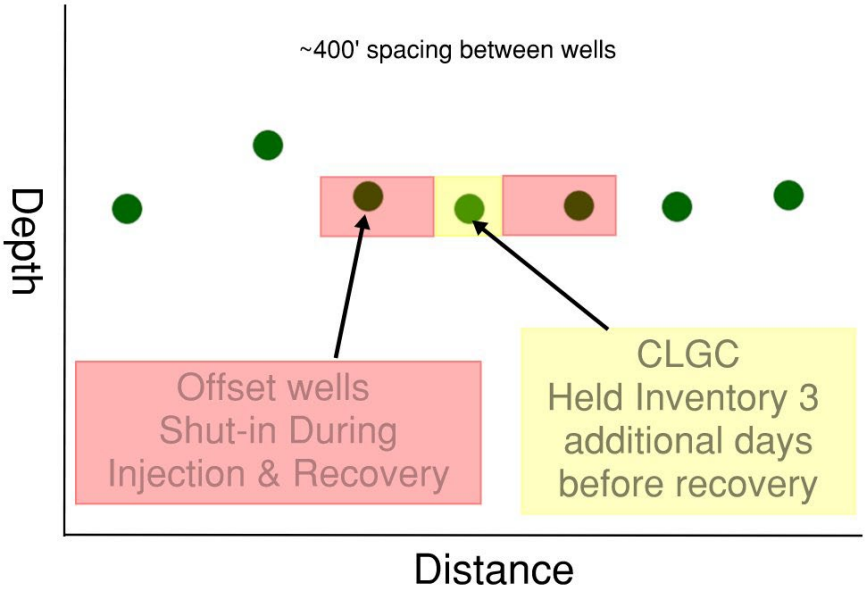
PILOT TEST #3

The third pilot test in both areas was performed in December of 2024. This time each location had separate goals. In Martin County the goal was to inject, capture, hold and then recover gas. In Midland County the goal was to help manage a 6-day midstream outage without flaring and keep higher oil producing wells online.

Martin County Pilot Test #3 Results:

- Injected into one well (Lower Spraberry)
- Injected for 3.5 days
- Injected 2.9 MMCF total
- Held injected gas in well for 3 days
- Recovered 100% of gas injected (13 days)
- Offset wells were shut-in for injection, hold and recovery

Figure 7: Martin County CLGC injection test #3 pilot gun barrel view



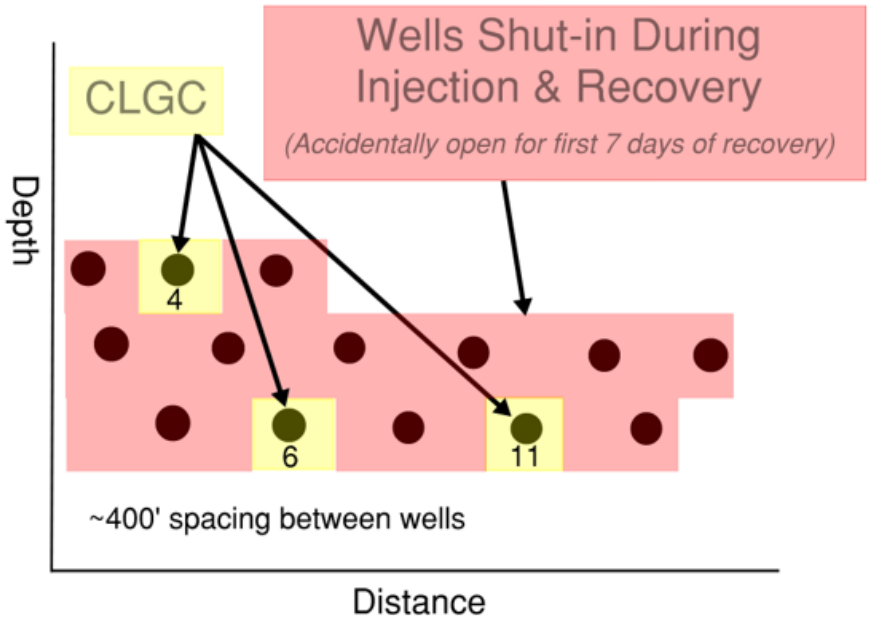
The Martin County pilot test was successful, showing similar results to the second test and providing further evidence indicating CLGC is a predictable and repeatable process.

Midland County Pilot Test #3 Results:

The third test in Midland County was focused on applying CLGC to offset the impact of a planned midstream upset condition. There was a planned midstream constraint for a 3rd party gathering station upgrade, and at the same time we were peaking gas production from several newer wells in the area. With the midstream outage and newer wells, we were limited on gas take away capacity. We needed to reduce sales gas temporarily to avoid flaring and shutting in a large number of wells. Using CLGC, and shutting in a few higher GOR wells, we were able to manage sales line pressure without flaring during the midstream constraint. This turned out to be a great real-life opportunity to test our business case, and showed we could reduce flaring and keep more oil online when a midstream issue arose.

- Injected into 3 wells
- Injected for 7 days
- Injected 46 MMCF total
- 6-day midstream outage
- Avoided flaring & additional well shut-ins
- Kept ~1200 BOPD online
- Recovered 100% of gas injected
- Offset wells shut-in for injection
- During recovery all wells opened for 1st 7 days (this was procedure error, we intended to keep offsets shut for recovery)
- Offset wells shut-in in after 7 days and for remaining of recovery

Figure 8: Midland County CLGC injection test #3 pilot gun barrel view



This pilot test was highly successful and demonstrated a business case example of keeping several wells online that would have otherwise been shut-in for 6 days because of permitted flaring limits.

OVERALL KEY LEARNINGS

The testing done to date has provided proof of concept that we can successfully inject, capture, and recover gas utilizing our existing wells. Below are several lessons learned throughout our initial testing:

- Tighter well spacing (~400') results in gas communication with adjacent wells
- Offset wells should be shut-in during injection and recovery
- Injection gas can be fully recovered and properly accounted for, preserving the natural gas resource and ensuring landowner royalties remain whole
- Reservoir capacity is large (never hit limit, casing pressure plateaued ~750 psig)
- 1200 psig surface injection pressure is sufficient
- Recent well tests are important for inventory draw down allocation
- CLGC well candidates are older depleted horizontals
- No obvious production uplift

CONCLUSIONS

As we move forward with CLGC we will continue to test and gain confidence with repeatable and predictable results for injection, capture, and recovery. We see CLGC becoming one of our standard midstream upset mitigation procedures at locations which have the correct conditions for technical and economic success. Identifying strategic locations will be an important next step, and some of the key criteria we will consider include existing gas lift infrastructure, midstream system hydraulics, appropriately depleted wells, and mineral ownership/lease language. Another key test will be to automate our CLGC process vs the current manually operated pilots.

We presented our 6-month results to the RRC in March 2025, and they are supportive of extending our pilot an additional year. We are also working in conjunction with the RRC to permit additional CLGC pilot locations to gather more learnings and continue to show repeatable and predictable response for injection, capture and recovery.

CLGC is not a solution to eliminate all flaring. It is merely a temporary solution to a problem that has plagued the industry for a long time. It is also not a solution for all operators nor all wells because it requires an established gas infrastructure to be feasible. Flaring will continue to be a topic of discussion in the future due to ongoing government regulations, and we hope that by sharing our journey we can collaborate with other organizations and continue to improve energy sustainability within our industry.