**Abstract**

The Zama F Pool, located in the Zama subbasin of the Alberta Basin, Canada, is a large, complex, pinnacle reef structure. This case study investigates the potential of pinnacle reefs in the Zama subbasin, of CO₂ storage capacity and EOR opportunities in residual oil zones commonly found in pinnacle reef structures. Storage capacity for several modeled pinnacles ranged from 0.18 to 1.22 Mt of CO₂. The predicted EOR potential for Zama pinnacle reefs through acid gas EOR predicts an additional 6.2% to 15.6% of the OOIP. Water extraction from an underlying water zone (aquifer) can effectively be used for additional gain in both oil recovery and CO₂ storage capacity 480% in simulations using bottom structure water extraction.

**Keg River F Pool Characteristics**

- **Porosity**: 0.03 to 17%
- **Res. Pressure**: 14,445 kPa (2095 psi)
- **Permeability**: <0.001 to >1000 mD
- **Gas-oil ratio**: 52 m³/m³ (282 scf/bbl)
- **Original oil in place (OOIP)**: 6.10 x 10⁷ m³ (1.1 MMstb)
- **Cumulative Injected Acid Gas Volume at Reservoir Conditions**: 1.55, 2.00e+5, 4.50e+5 m³
- **Cumulative Extracted Water Volume at Reservoir Conditions**: 0.08, 2.00e+5, 4.00e+7 m³

**Scenario 1 – Storage Capacities with and Without Extraction**

- **Water extraction from an underlying water zone (aquifer)**
  - Extra gain in 6.2% to 15.6% of the OOIP
  - CO₂ storage capacity 480% in simulations using bottom structure water extraction.

**Scenario 2 – EOR Optimization**

- **One Injector (0.113 Mt/year)**
- **One Injector (0.227 Mt/year)**
- **One Extractor (Location Z)**
- **One Extractor (Location Y)**

**Conclusions**

- Water extraction from an underlying water zone (aquifer) can effectively be used for additional gain in both oil recovery and CO₂ storage capacity in a closed system like the Zama F Pool.
- A combination of top-gas and acid gas EOR coupled with bottom water extraction appears to provide a new way to increase overall recovery efficiency and storage capacity in such reservoirs, economically and with the potential to drastically improve CO₂ storage capacity through simulations using bottom structure water extraction.
- The predicted EOR potential for Zama pinnacle reefs through acid gas EOR provides an additional 2% to 6% of the OOIP. The predicted CO₂ sequestration results for modeled Zama pools averaged approximately 86 tonnes/year (31 MWh/tonne CO₂). Storage capacity for several modeled pinnacles ranged from 0.5 Mt to 1.2 Mt CO₂, with average storage capacities being nearly 1.0 Mt.
- Assuming the left as part of pinnacle reefs in the Zama Field have similar characteristics, the total storage capacity may be nearly 6 Mt of CO₂.
- This case study has implications for EOR opportunities in residual oil zones commonly found in pinnacle reef structures around the world.