



Abu Dhabi Carbon Capture, Usage and Storage Project

ESI CCS Project
and
Rumaitha / Bab CO₂ Projects

1. Drivers for CCUS in Abu Dhabi
2. Execution Strategy
3. Project Details of the ESI CCS Project
4. Future Opportunities

Abu Dhabi CCUS: Value Drivers

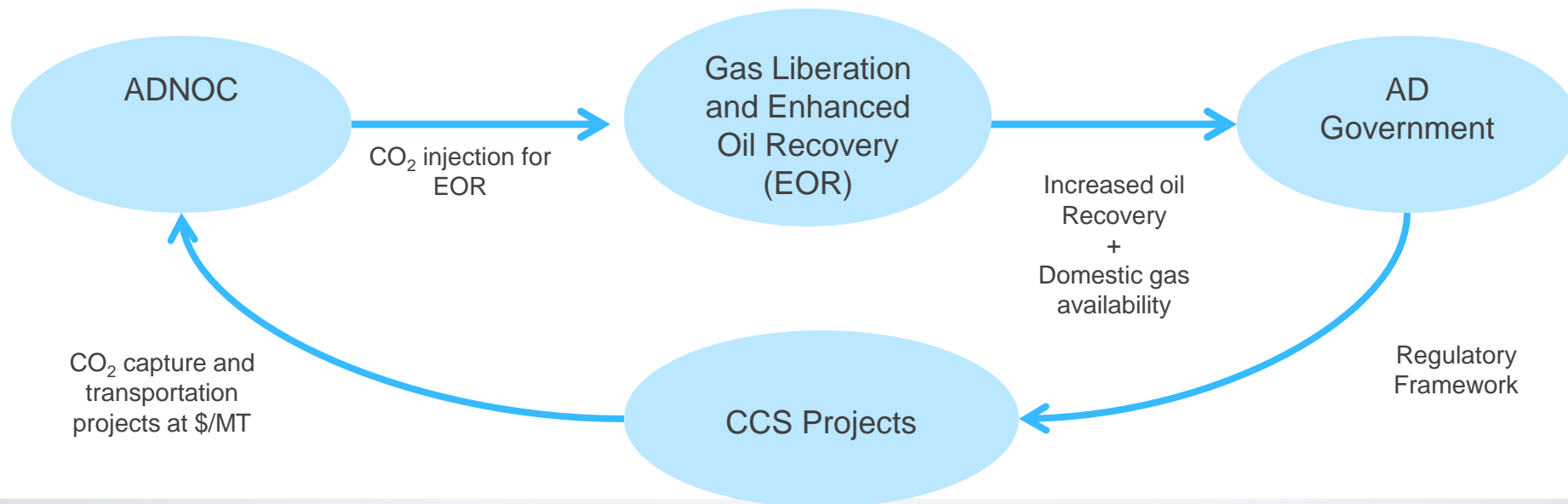
Strategic Gas
Demand
& EOR

Environmental

Commitment to
Abu Dhabi 30%
Clean Energy

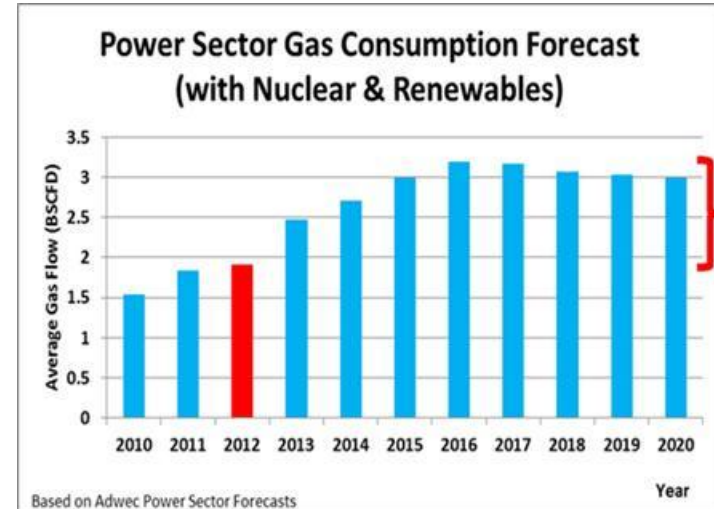
CCS Global &
Regional
Leadership

CCUS Project
Will enable future CCS Projects



CCUS Value Drivers: Hydrocarbon Gas Demand

- **Considering the power sector in Abu Dhabi alone:**
 - Growth in hydrocarbon gas demand is expected to be >1 BSCFD over next 10 years
 - Gas Supply sources to grow (domestic / imports) to meet the demand including LNG imports



Increase in Power Sector demand above 2012

This does not account for gas demand increase in Industry or other Emirates

- **ADNOC support CCUS strategy to enhance oil recovery (EOR) and potentially increase UAE gas availability**
- **Supported by the EAA “CCS Value Proposition Study” which forecasts a potential growth in CO₂ requirements over next 10-15 years, if CO₂ projects prove to be successful.**
- **The ESI CCS Project is a first commercial mover project which will establish the commercial principals for a CO₂ industry and further demonstrate the technical viability of CO₂ operations**

CCS Value Drivers: Environmental

- **CCUS or Low Carbon Power is a key strategy to reduce UAE's greenhouse gases whilst continuing to meet the country's growing energy demands.**
- **The ESI CCUS Project will capture ~800,000T of CO₂ per year:**
 - equivalent CO₂ from a 200MW CCGT1
 - equivalent CO₂ from ~170,000 cars
 - equivalent CO₂ from ~100,000 houses (US)
- **The project demonstrates the UAE's global and regional leadership in the deployment of CCUS and its support for climate change mitigation mechanisms.**



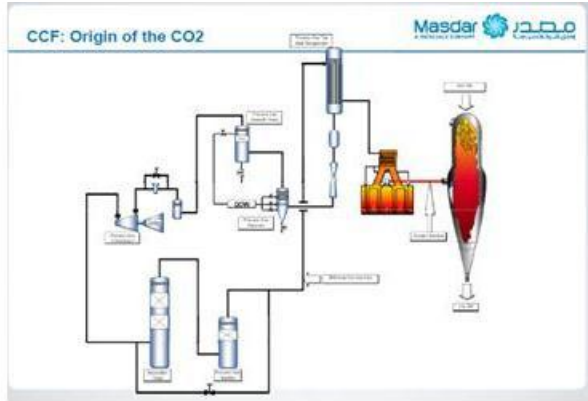
Project Execution Strategy and Status Update

- **ADNOC and Masdar are working together to develop the CO₂ Capture, Transportation & Injection components.**
- **This presentation principally deals with the ESI CCS Project.**
- **Masdar responsible to provide technology & project support for the CO₂ Capture, Compression and Pipeline facilities**
 - Pilot Injection program successfully implemented in Rumaitha (2009 -2011).
 - ESI Facility & Pipeline FEED completed in 2010.
 - ESI CCS Project Management support awarded to Rhead Group in 2012
 - ESI CCS Project awarded to Dodsai Engineering & Construction in July 2013 (<USD200 million)
 - 3 months into a 33 month schedule – Ready for Commissioning by Jan 2016

Project Execution Strategy and Status Update

- **ADNOC through its subsidiary ADCO is responsible to provide technology & project support for the CO₂ Injection facilities, and the treatment post production.**
 - Pilot Injection program successfully implemented in Rumaitha (2009 - 2011)
 - Rumaitha / Bab FEED completed in 2013.
 - Rumaitha / Bab Injection facilities in EPC Tendering Phase and forecast award by end 2013

ESI CCS Project Technical Overview



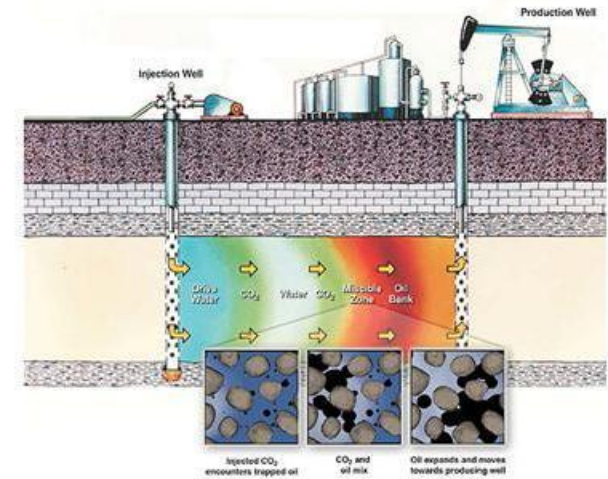
CO2 Source (ESI) and Capture



CO2 Transportation



CO2 Compression & Dehydration



CO2 Injection in Rumaiha & Bab fields

أدنوك
ADNOC
شركة بترول أبوظبي الوطنية

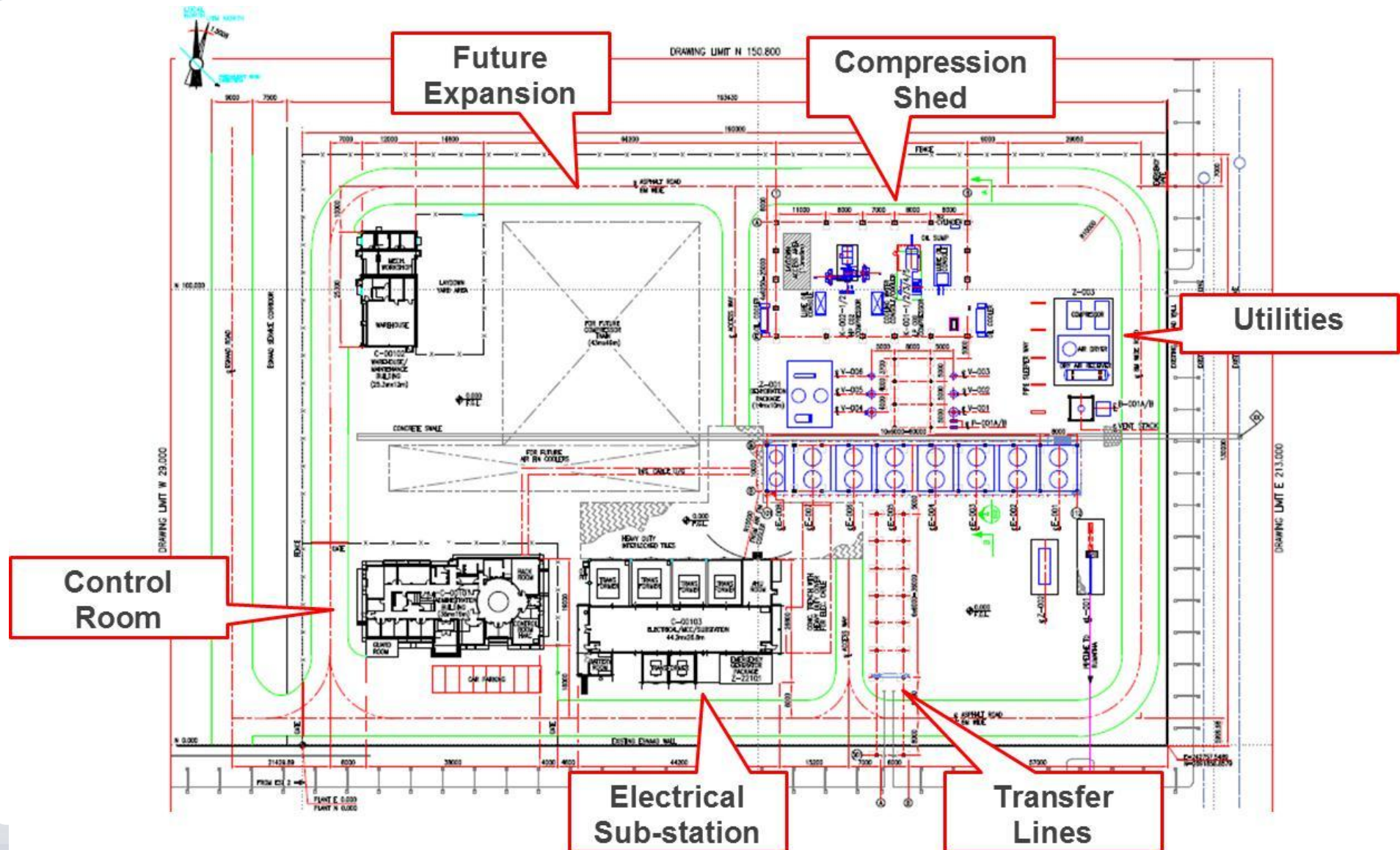
CO₂ Compression and Dehydration Facility

- **Sized for 800,00 TPA CO₂ (98% min purity) = 41.5 MMSCFD**
- **LP Compression:**
 - Integrally geared 5/6 Stage Centrifugal Compressor (0 – 41barg)
- **Mol Sieve dehydration system**
 - Reduce water content to 20lb/MMSCF
- **HP Compression:**
 - Reciprocating 2 Stage Compressor (35 – 238barg)
- **Mass Transfer Custody Transfer Meter (Coriolis Meter) complete with GC and Moisture Analyzers**
- **Utilities:**
 - Electrical transformers/switchgear for 25MW
 - Utilities such as N₂, Cooling Water, Instrument Air
 - Control Room for Facility and Pipeline

CO₂ Compression Facility - Location



CO₂ Compression Facility Layout



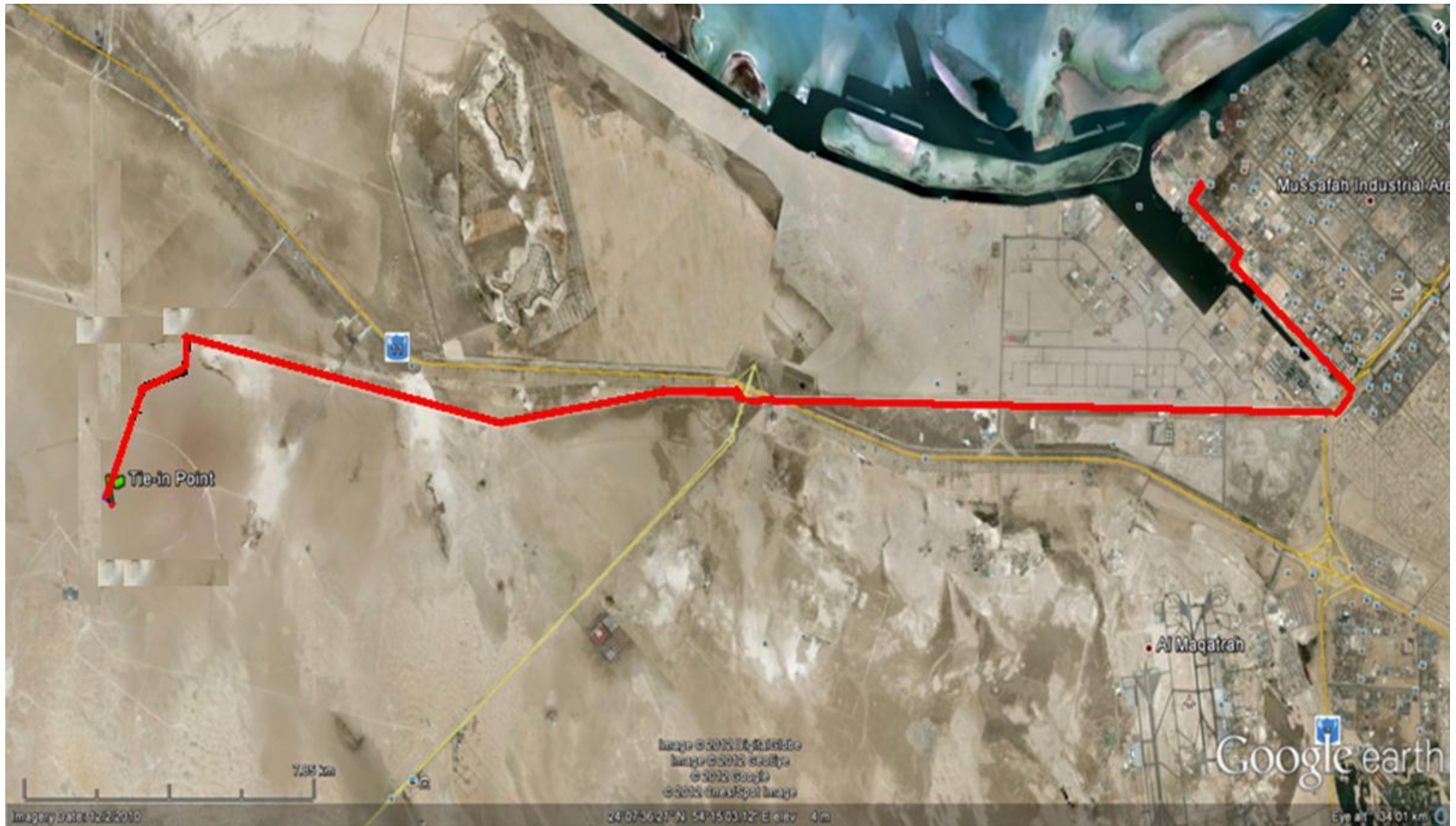
■ Pipeline:

- 8" X65 API5L carbon steel buried pipeline designed for 245barg
- 2 Block Valve Stations
- Remote isolation and maintenance blowdown facilities
- Launching / Receiving facilities for Pipeline Scraper
- Telecoms, SCADA, CCTV and leak Detection running over buried fiber optics

■ Rumaitha Metering Station:

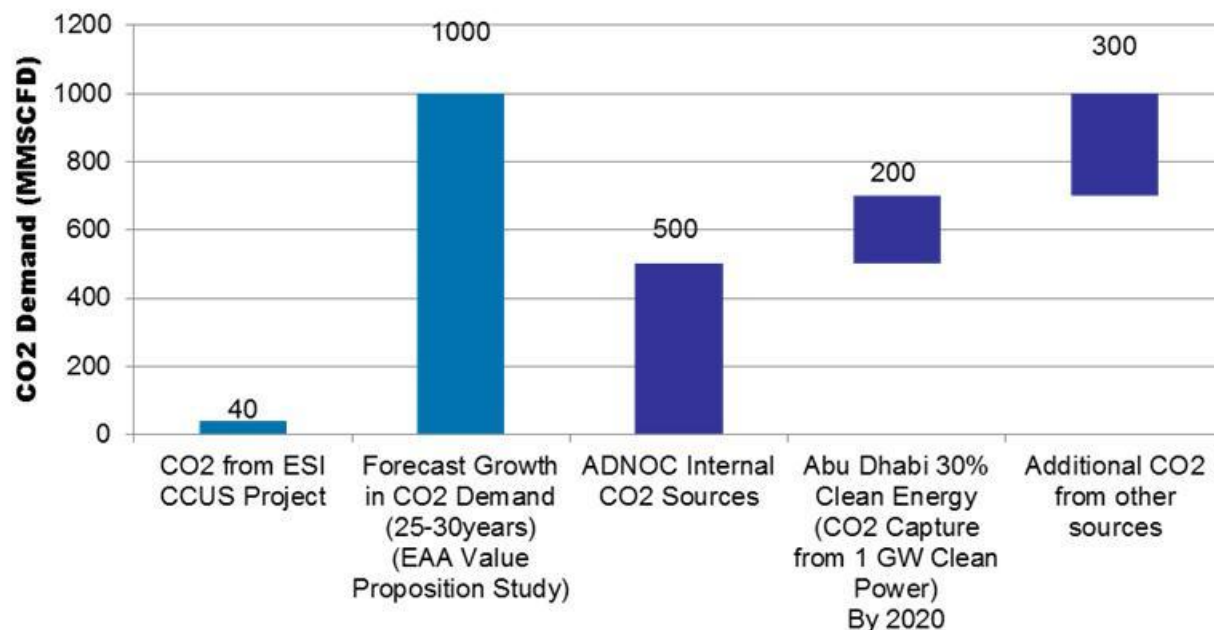
- Mass Transfer Custody Transfer Meter (Coriolis Meter), complete with GC and Moisture Analyzers
- CO₂ transferred to ADCO

CO₂ Transmission Pipeline - Location



Abu Dhabi CCS: Future Potential

- **CO₂ as an EOR agent has been endorsed:**
 - Success of the ESI CCS Project and Rumaitha / Bab Injection are key to future development.
- **Changing landscape in Abu Dhabi with potential CO₂ targets for field testing and development:**
 - CO₂ capture linked to ADNOC field demand and performance;
- **Whilst preliminary, the EAA CCS Value Proposition study forecast a growing CO₂ demand in the next 25-30 years, based on ADNOC estimations.**



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Thank You