

World Energy Council

Carbon Capture & Storage & Cleaner Fossil
Fuels strategies in MENA



CO₂ Management In The UAE

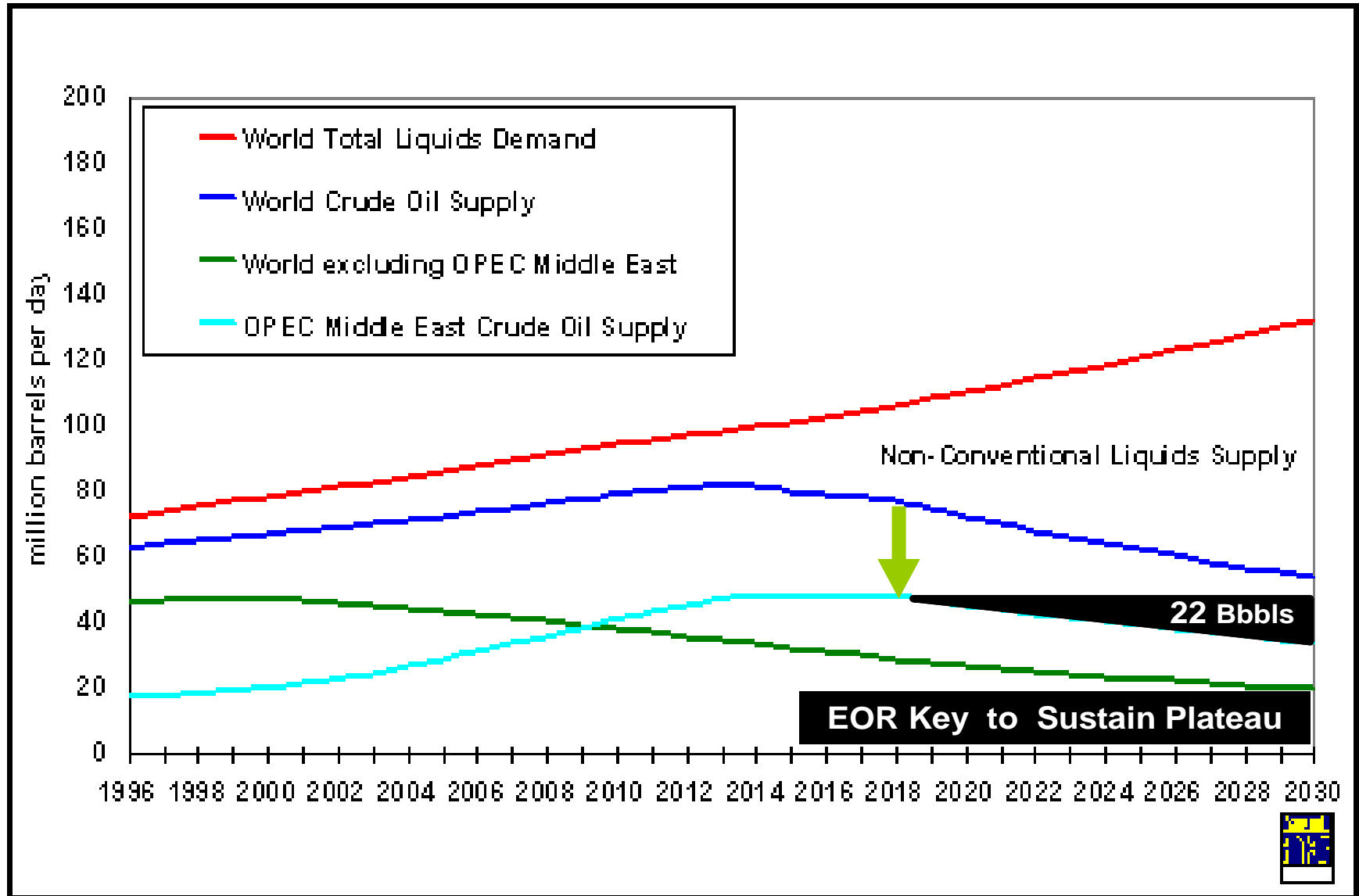
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ADCO-Team Leader Enhanced Oil Recovery Team

OUTLINE

- Introduction
- Drivers
- CO₂-EOR Value to UAE
- CO₂ Source: Carbon Capture
- Roadmap to CO₂-EOR implementation
- CO₂ Pilot & objectives
- Conclusions

Worldwide Oil Demand and Supply



UAE is rapidly implementing

💧 **CO2-CCS: Masdar**

- ▶ Carbon Capture from HPAD, utilities and manufacturing plants....Aluminum, Steel, etc
- ▶ Infrastructure: Proposed Pipeline

💧 **Carbon Utilization: ADNOC and its OPCOs, Other Emirates:**

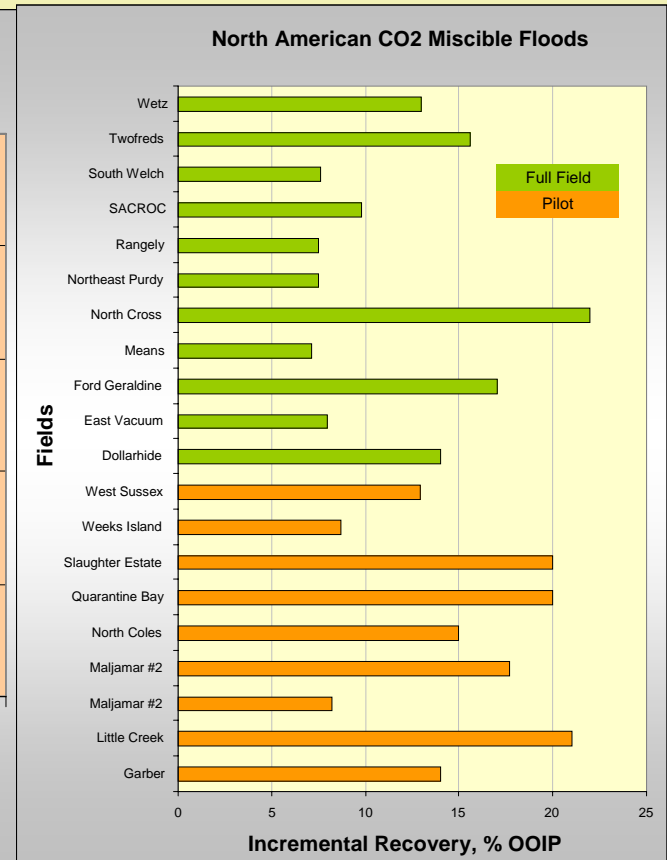
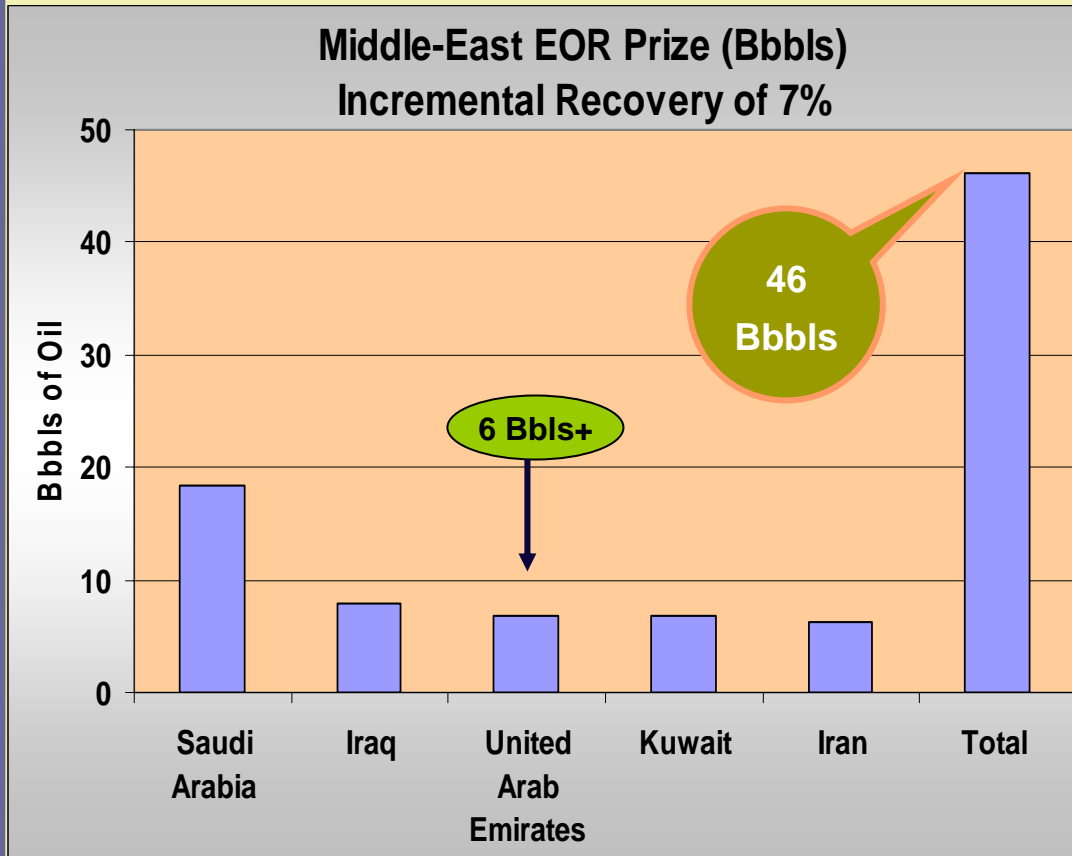
- ▶ Enhanced Oil Recovery- CO2-EOR
 - ▶ ADCO (Start pilot-Nov. 2009)
 - ▶ Other Operating Companies studying feasibility
 - ▶ Dubai announced plans for major CO2-EOR

Drivers

- 🔥 **UAE signatory to Kyoto protocol**
 - ◆ Commitment to reduce emissions and mitigate climate change
- 🔥 **Prize for UAE**
 - ◆ Increase National oil reserves by many billion barrels
 - ◆ Preserve hydrocarbon gases currently used for gas injection
- 🔥 **Pave the way for other implementations in the region**

The Prize

US Department of Energy 2004

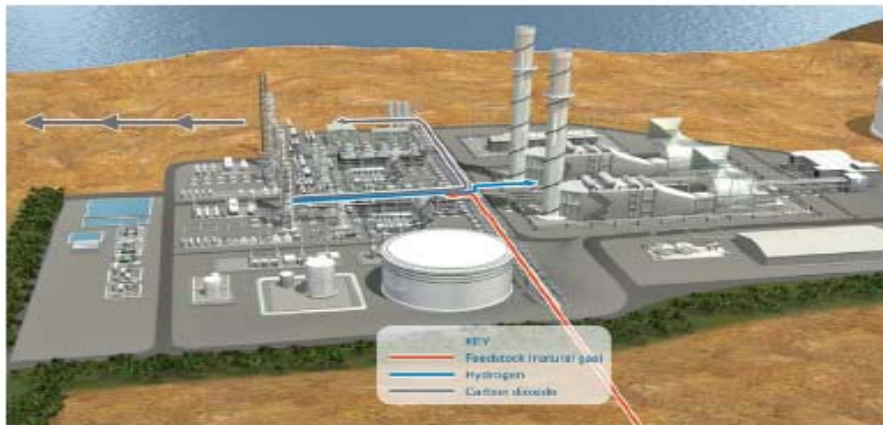


BP Statistical Review of World Energy June 2003, *OGJ Dec 2002

CO₂ EOR has potential to add significant reserves in the Middle-East

Pre-Combustion Capture HPAD –MASDAR (and other utilities and plants)

Hydrogen Power Project, Abu Dhabi



Project Milestones

Could be:

- World's first power plant powered by hydrogen derived from natural gas
- Delivered CO₂ could replace natural gas for Enhanced Oil Recovery

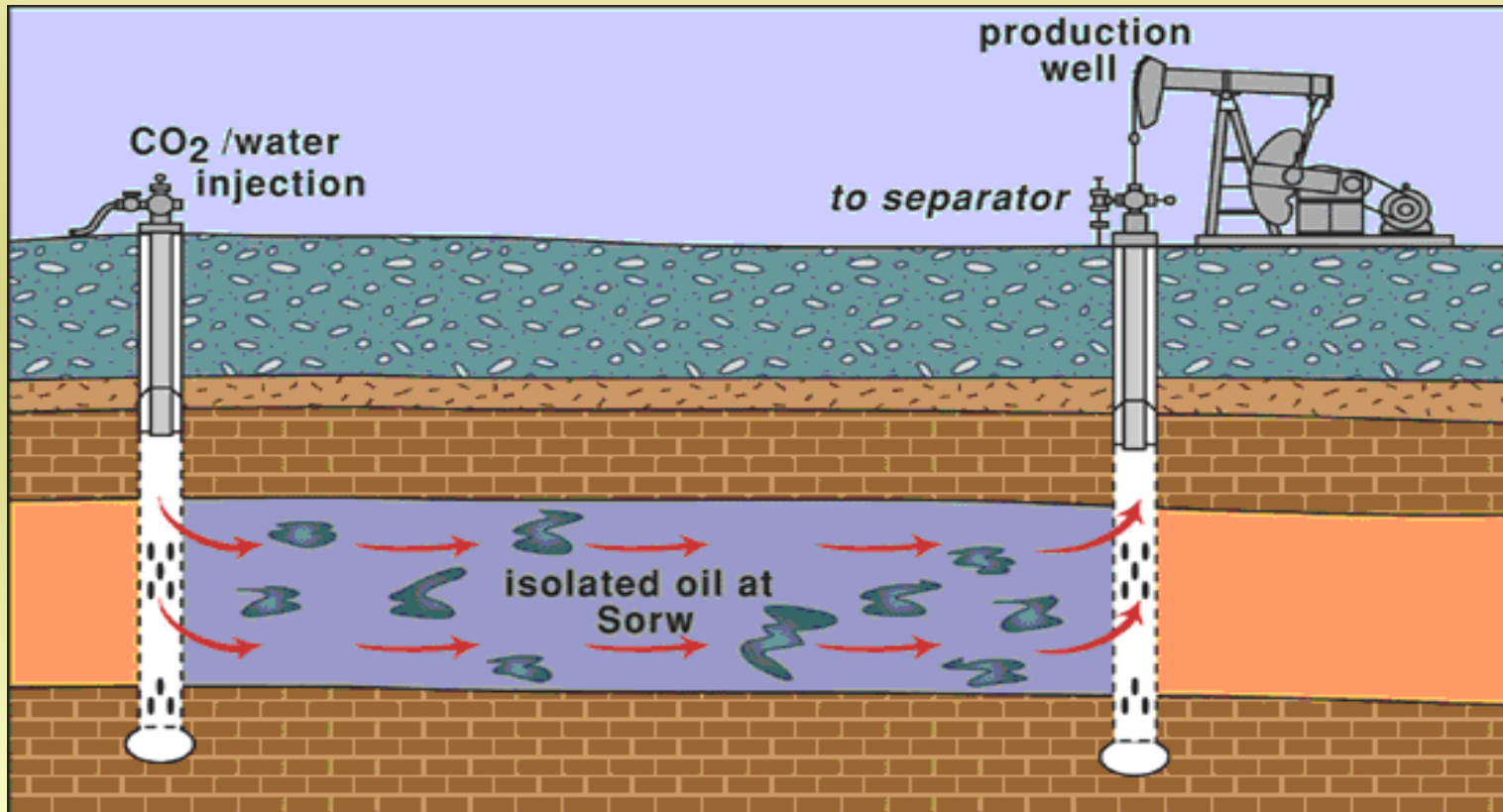
Climate Change Milestones

- **420 MW** of low-carbon electricity = 5% of Abu Dhabi's capacity
- **1.7 mmtpa CO₂** avoided = decarbonizing Abu Dhabi's transport sector
- Secure geological storage of CO₂

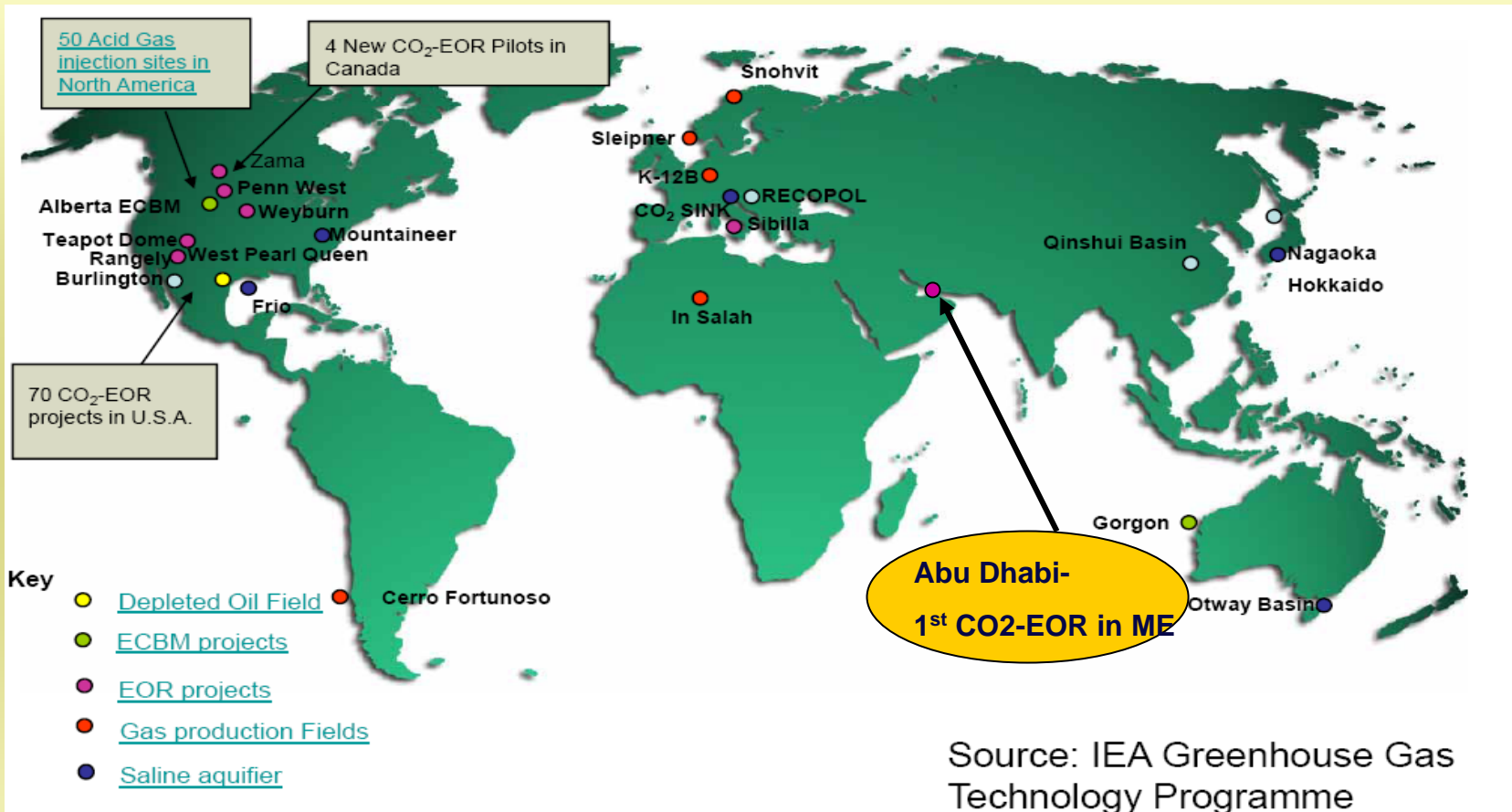
alternativenergy
Powered by OPEX

What is CO₂-Enhanced Oil Recovery?

Enhanced Oil Recovery (EOR) is recovery of oil using means other than natural depletion or secondary methods. EOR can obtain significant additional reserves by mobilizing oil that would otherwise be left behind in reservoir rock by conventional oil recovery methods.



CCS PROJECTS WORLDWIDE

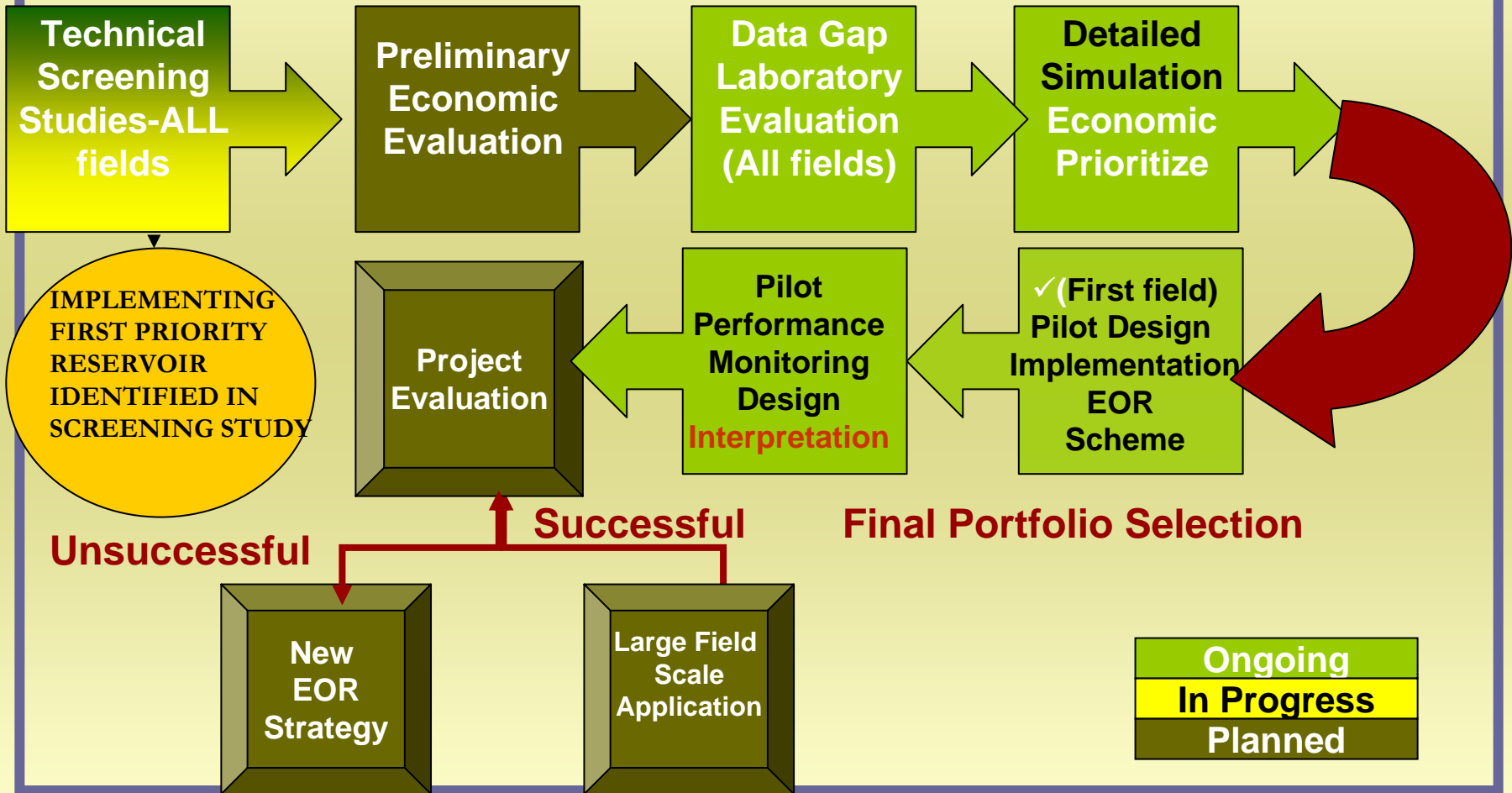


CO₂-EOR in the Region

CO2-EOR ROADMAP

Portfolio Development

Portfolio Validation



Laboratory studies

💧 **CO2 PVT/Advanced PVT studies**

- ▶ Slim Tube-MMP determination
- ▶ CO2-Swelling, Multiple contact..
- ▶ EOS modeling
- ▶ CO2 solubility in Brine (Variable salinity/P/T)

💧 **CO2 core flooding (SCAL)**

- ▶ Secondary/WAG/Tertiary CO2 Flooding
- ▶ Rock fluid interaction studies
- ▶ Ultimate Recovery

💧 **Asphaltene**

- ▶ CO2-Asphaltene flocculation studies
- ▶ Asphaltene envelope

Pilot designed to resolve uncertainties associated with CO2 injection

◆ Subsurface

- ▶ Recovery Efficiency (displacement and vertical and aerial sweep), MMP, EoS Description and Asphaltene Deposition..
- ▶ Recovery Factor, Rock/Fluid Interactions, Carbonate/CO2-Brine Interaction
- ▶ Ultimate Recovery Factor (Bypassed Oil, etc.)

◆ Surface

- ▶ Well Integrity
- ▶ CO2 handling Facilities (Injection, Production, Separation, etc.)
- ▶ Phased Development Pilots

◆ Others

- ▶ CO2 source and supply options
- ▶ Organizational capability

CONCLUSIONS

- ◆ UAE has a well defined Carbon Management strategy which is rapidly coming into fruition
- ◆ EOR required to delay impending Hydrocarbon supply decline
- ◆ CO2-EOR is a well established concept in the industry and necessary to sustain long term production
- ◆ UAE is utilizing CO2-EOR for incremental recovery and mitigation of climate change by controlling GHG emissions
- ◆ First CO2 pilot launched in Nov. 2009. Its progress is monitored for learning required for major field implementations.
- ◆ Success will sequester captured CO2 while adding value to UAE.

THANK YOU