

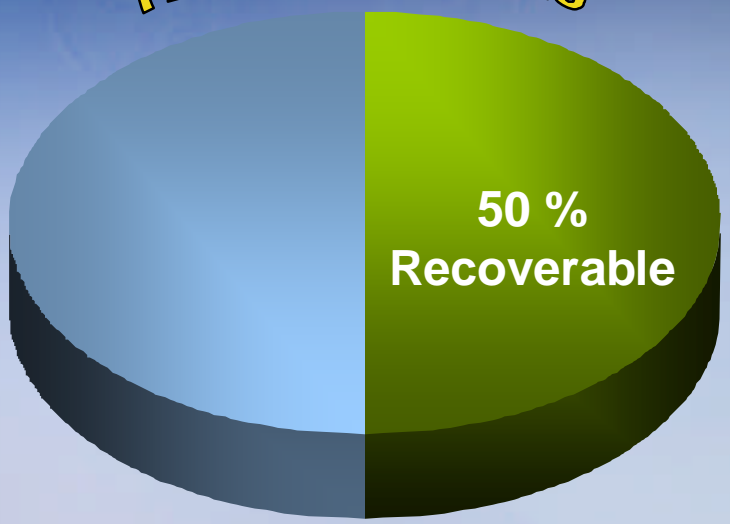


CO₂ EOR Research in Saudi Aramco

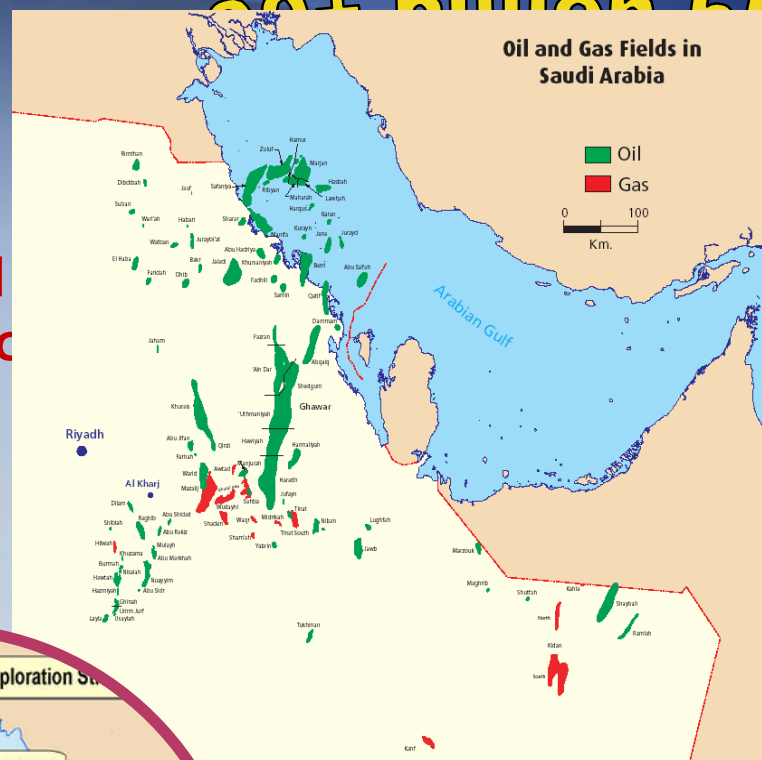
Nabeel Al-Afaleg, PhD
Saudi Aramco
3rd CSLF Workshop
January 27 - 29, 2008
Al-Khobar, Saudi Arabia

Resources

722 billion bbls

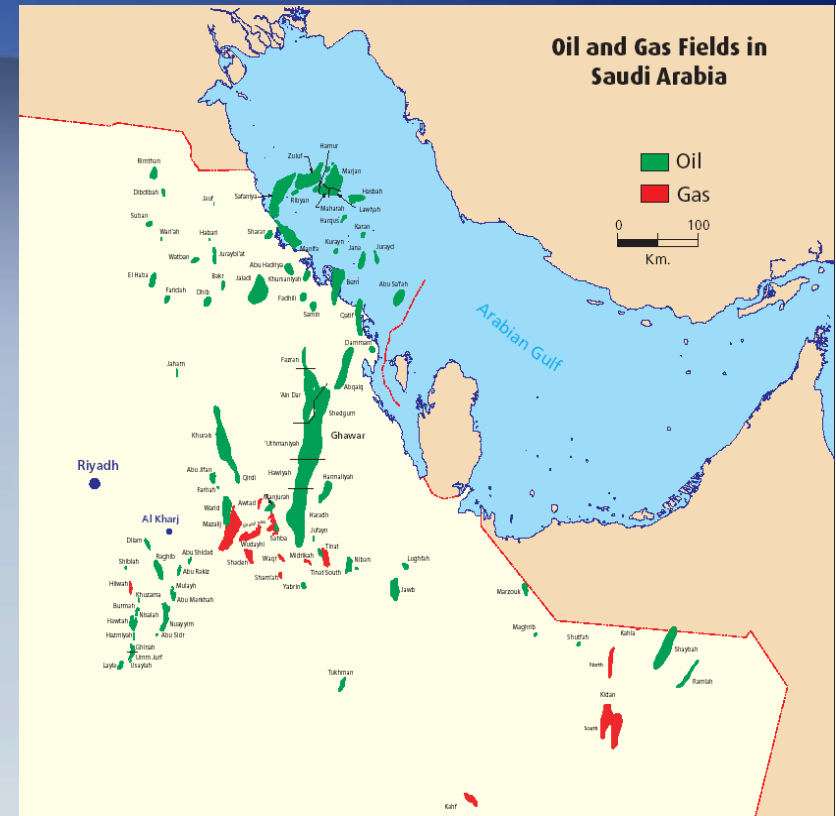
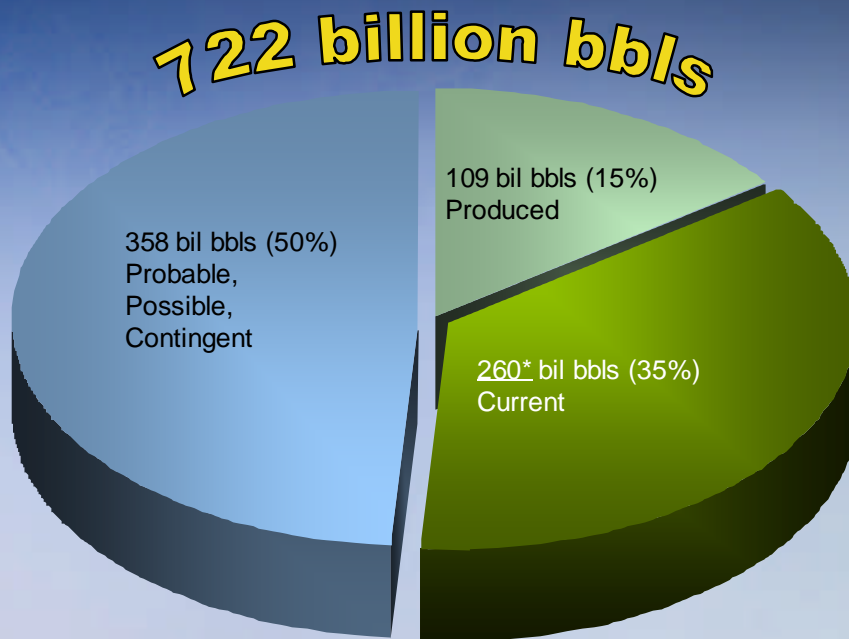


Expand Resources



**with Condensates*

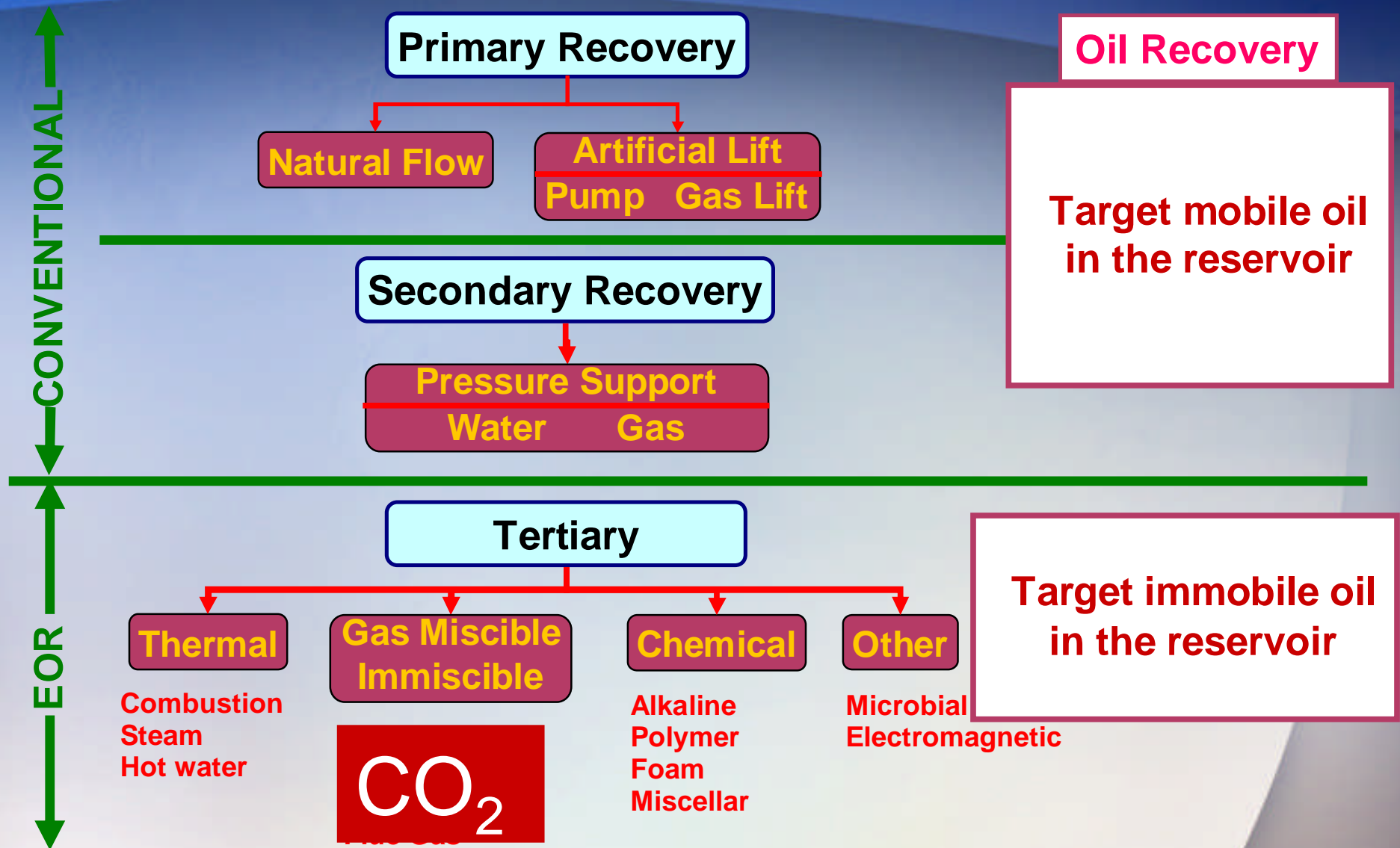
Interest in CO₂-EOR Research



- Environmental concern
- Win-win
- Promote capture and sequestration technologies
- EOR Production is not needed for very long time
 - Long lead time R&D, studies and planning

*with Condensates

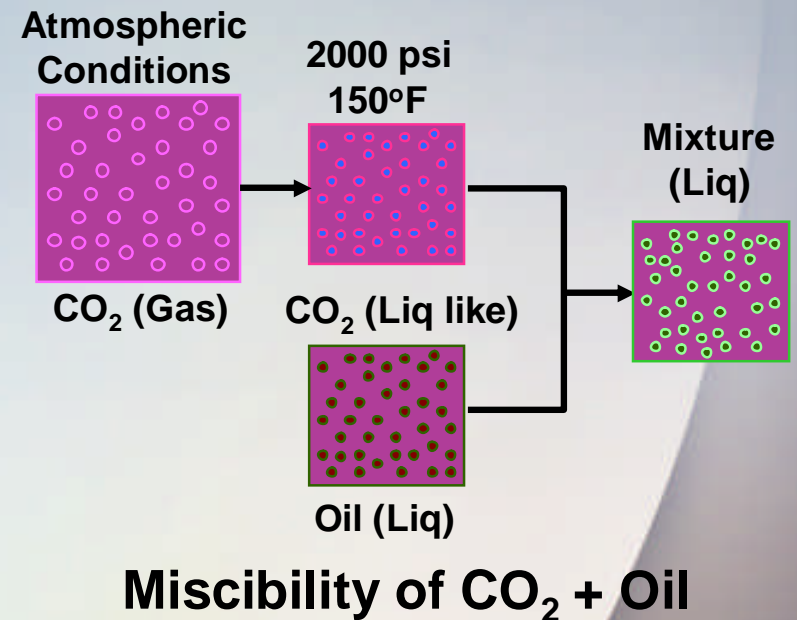
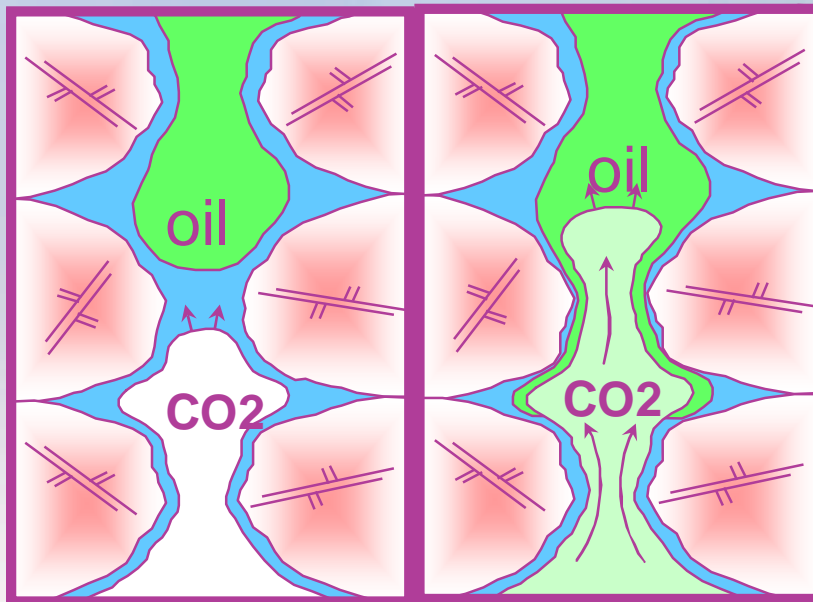
Recovery Methods



(From SPE-SPE-84908, 87864)

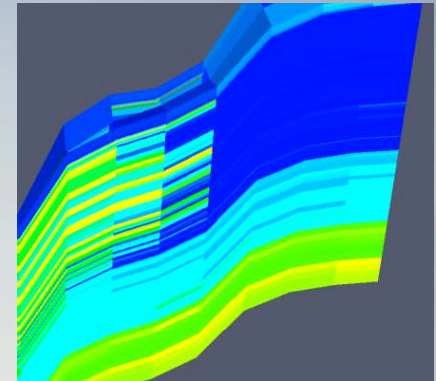
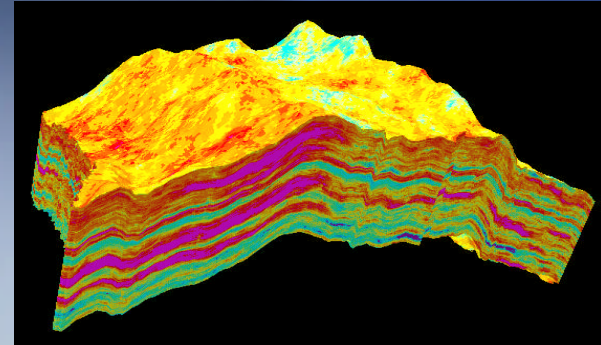
CO₂-EOR - Basics

- Inject dense CO₂ → ‘liquid’ like
- Swells oil and reduces viscosity
- Applicable to light oil reservoir (miscible)
- Proven: number of commercial projects
- Estimated incremental recovery: 5-20%

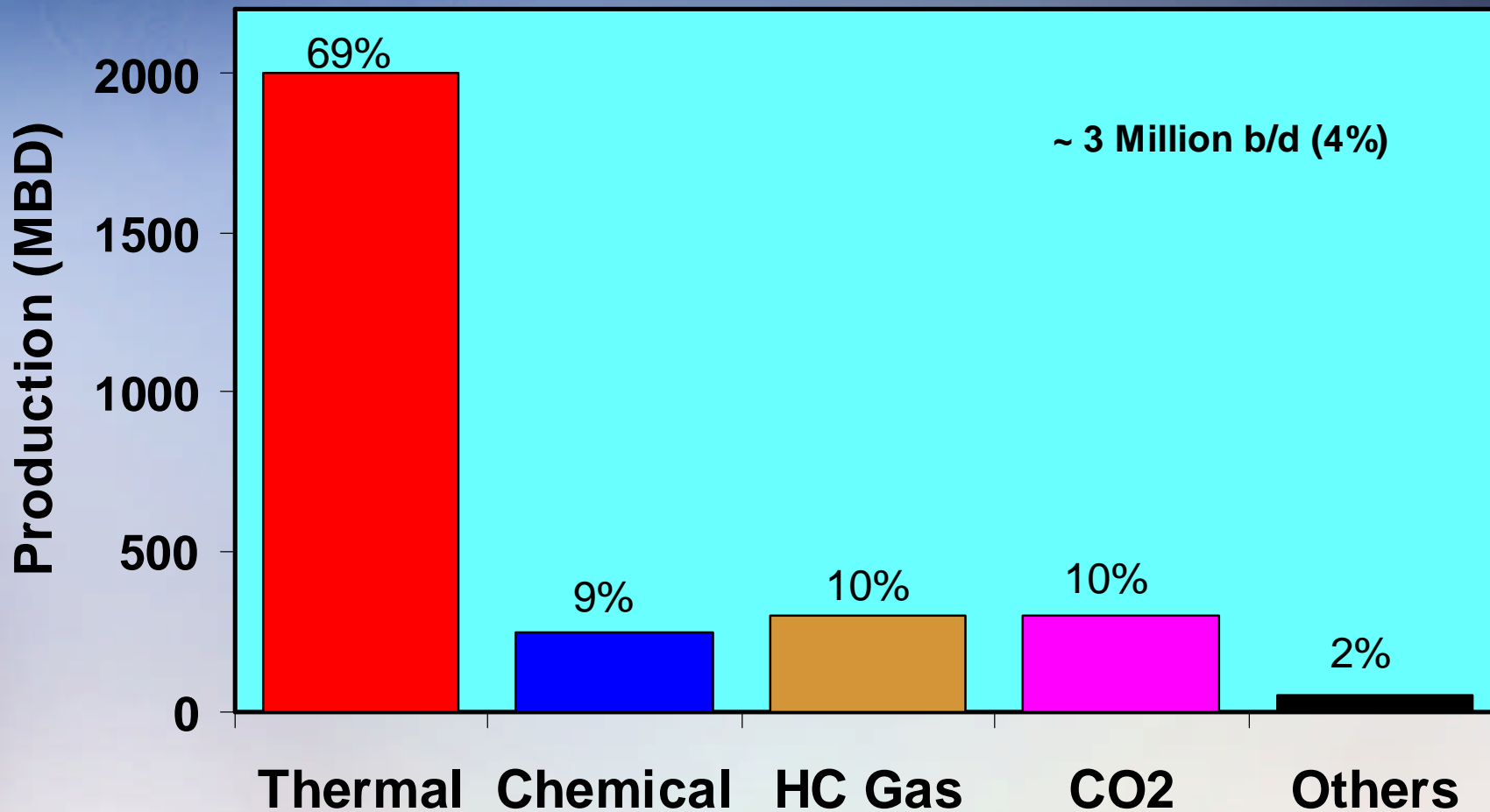


CO₂-EOR: Technical Challenges

- Geological complexities
- Viscous fingering
- Gravity segregation
- Conformance , i.e. Placing CO₂ into the 'right' zones
- Monitoring technologies
- Corrosion and metallurgy
- Cost: CAPEX & OPEX



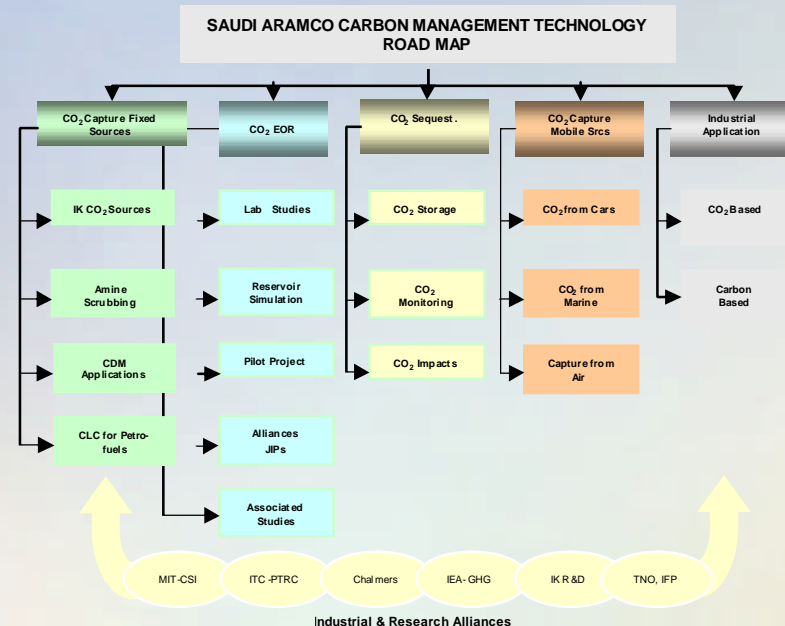
EOR Production: World



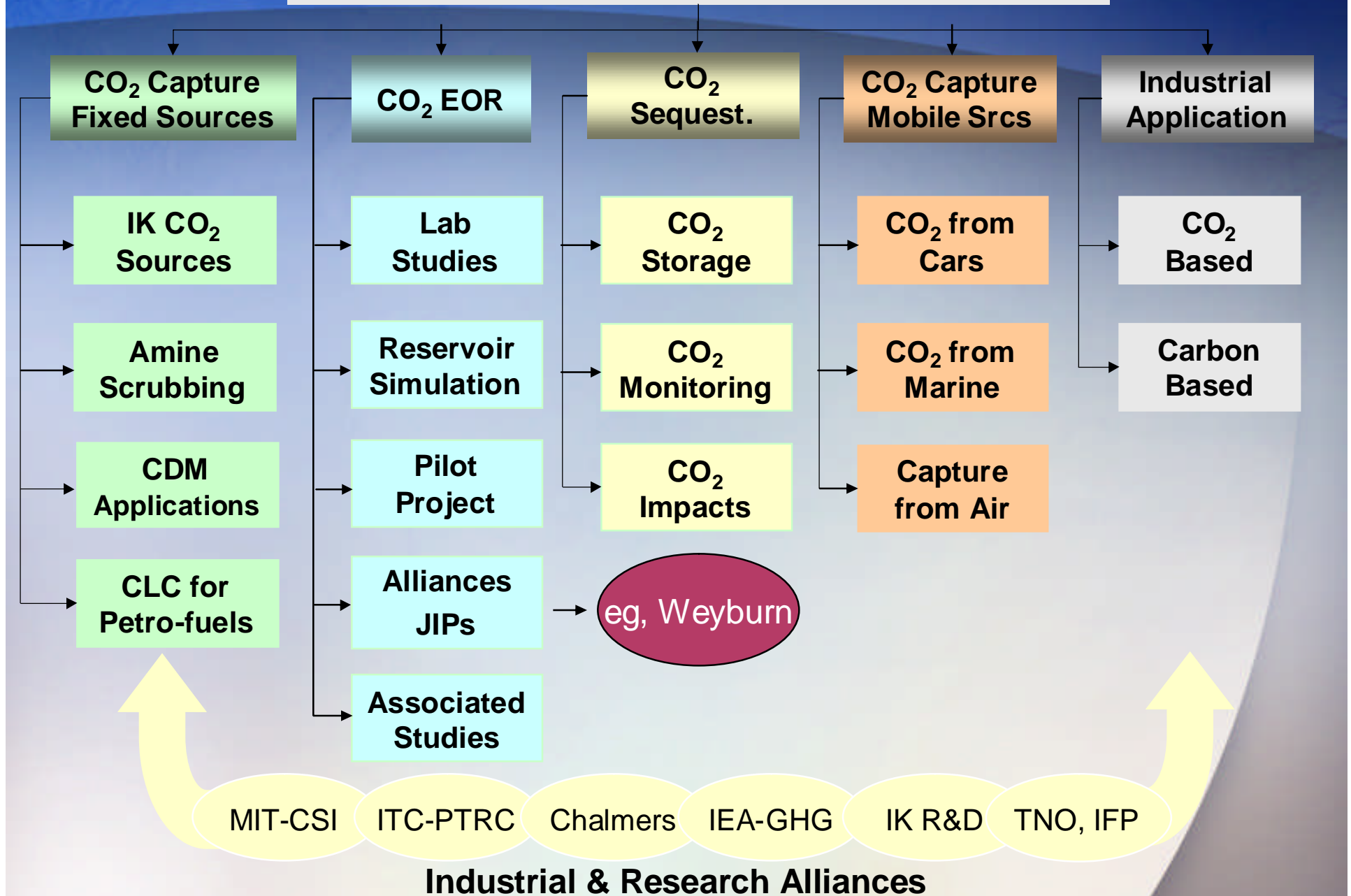
(Data from Oil & Gas J, SPE, and other sources)

Carbon Management at Saudi Aramco

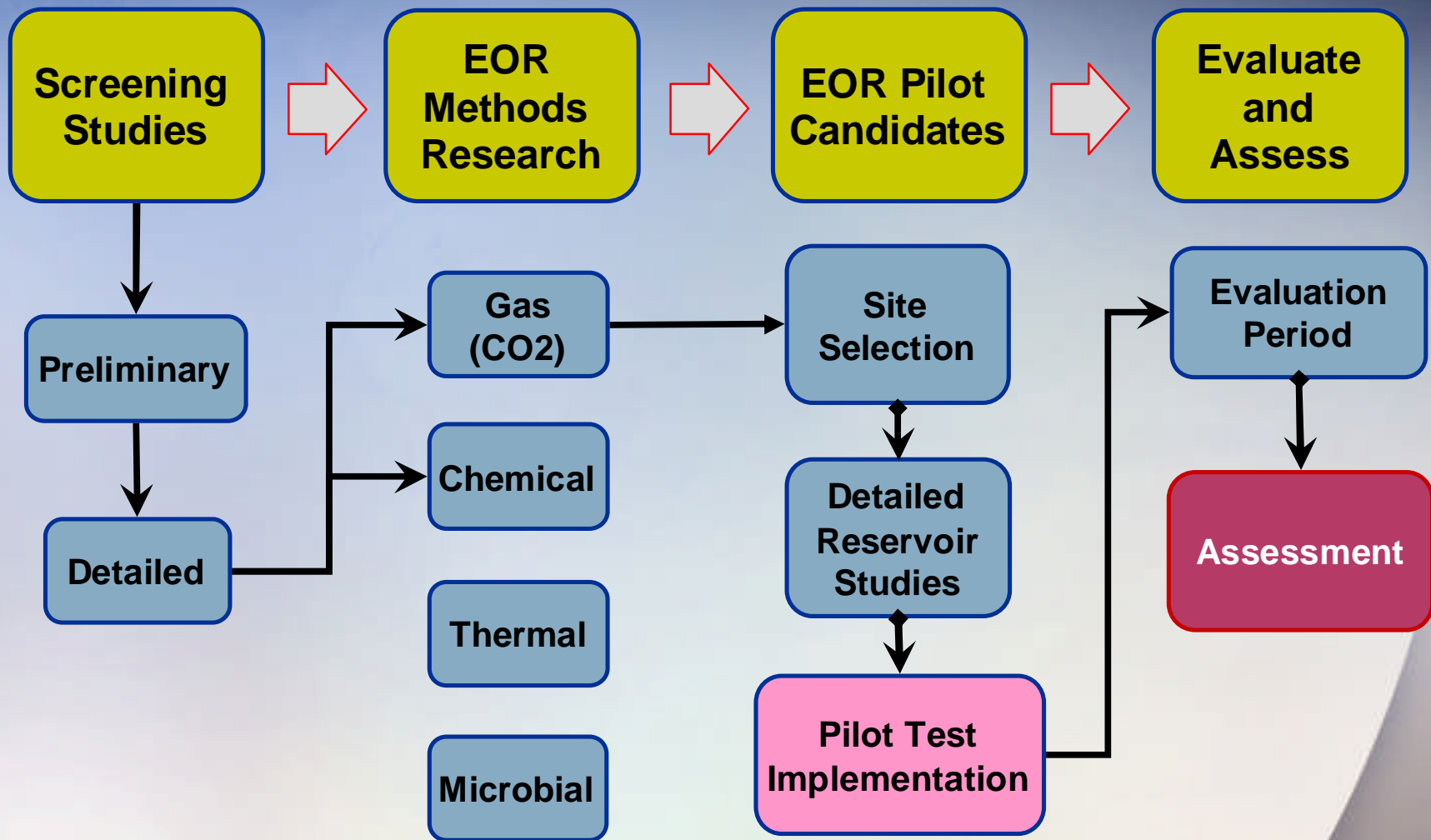
- Established a multidisciplinary team
- Developed carbon management technology Roadmap
- Engaged with industry to increase awareness
- Enhanced collaboration



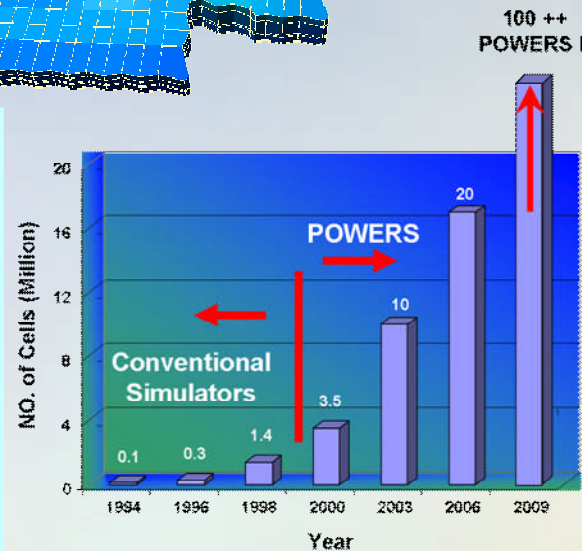
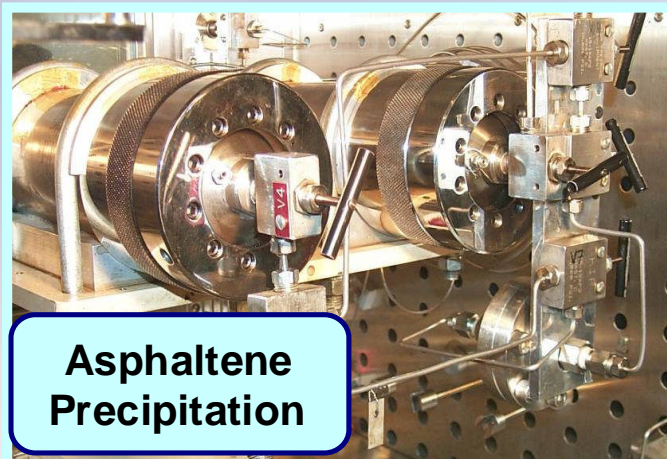
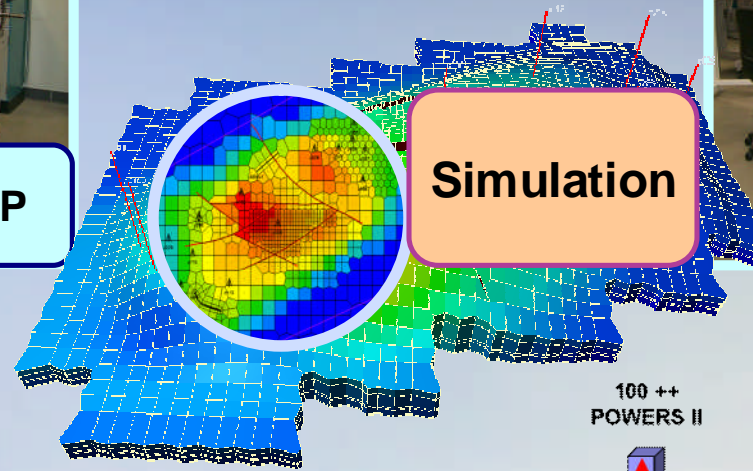
SAUDI ARAMCO CARBON MANAGEMENT TECHNOLOGY ROAD MAP



EOR Research Program



CO₂-EOR: Research Plan



CO₂-EOR: Research Topics

- Fluid-fluid and fluid-rock interactions
 - Complex CO₂-oil-water phase behavior
 - CO₂ interaction with reservoir rock
 - CO₂ interaction with cements
 - Cap rock integrity
- Corrosion
- Viscosity and miscibility controls
- Increase capacity to inject more CO₂
- Flood performance monitoring, diagnostics surveillance and surveillance technologies
- Field studies and pilots -- Weyburn

Concluding Remarks

- ◉ Saudi Aramco is addressing concern over global climate change by promoting R&D in carbon capture and storage
- ◉ Established a Carbon Management team with a technology road map
- ◉ Active in conducting R&D studies in CO₂-EOR