Translating US CO_2-EOR learnings from onshore to offshore

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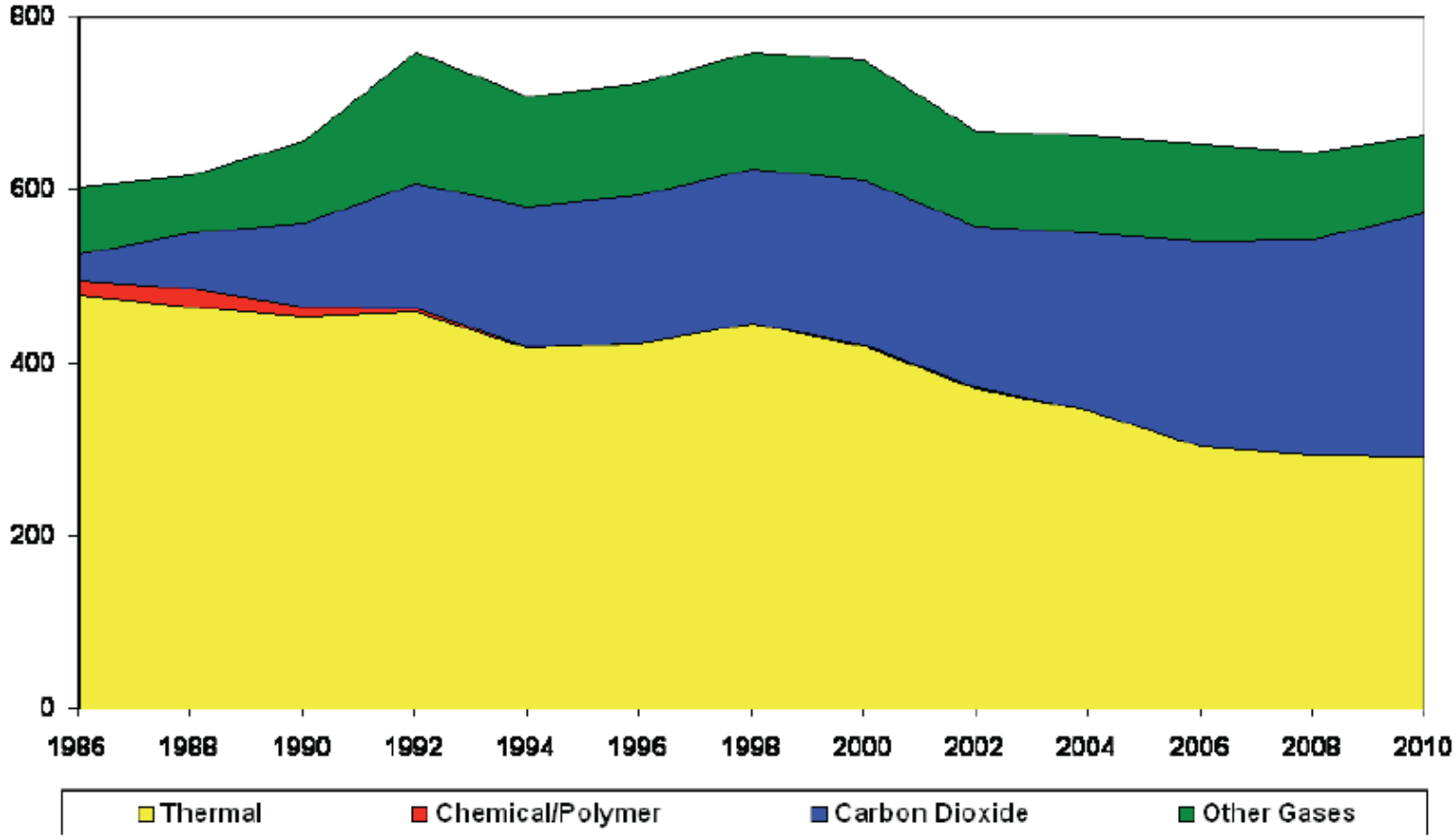
Second International Offshore Storage Workshop

Talk Outline

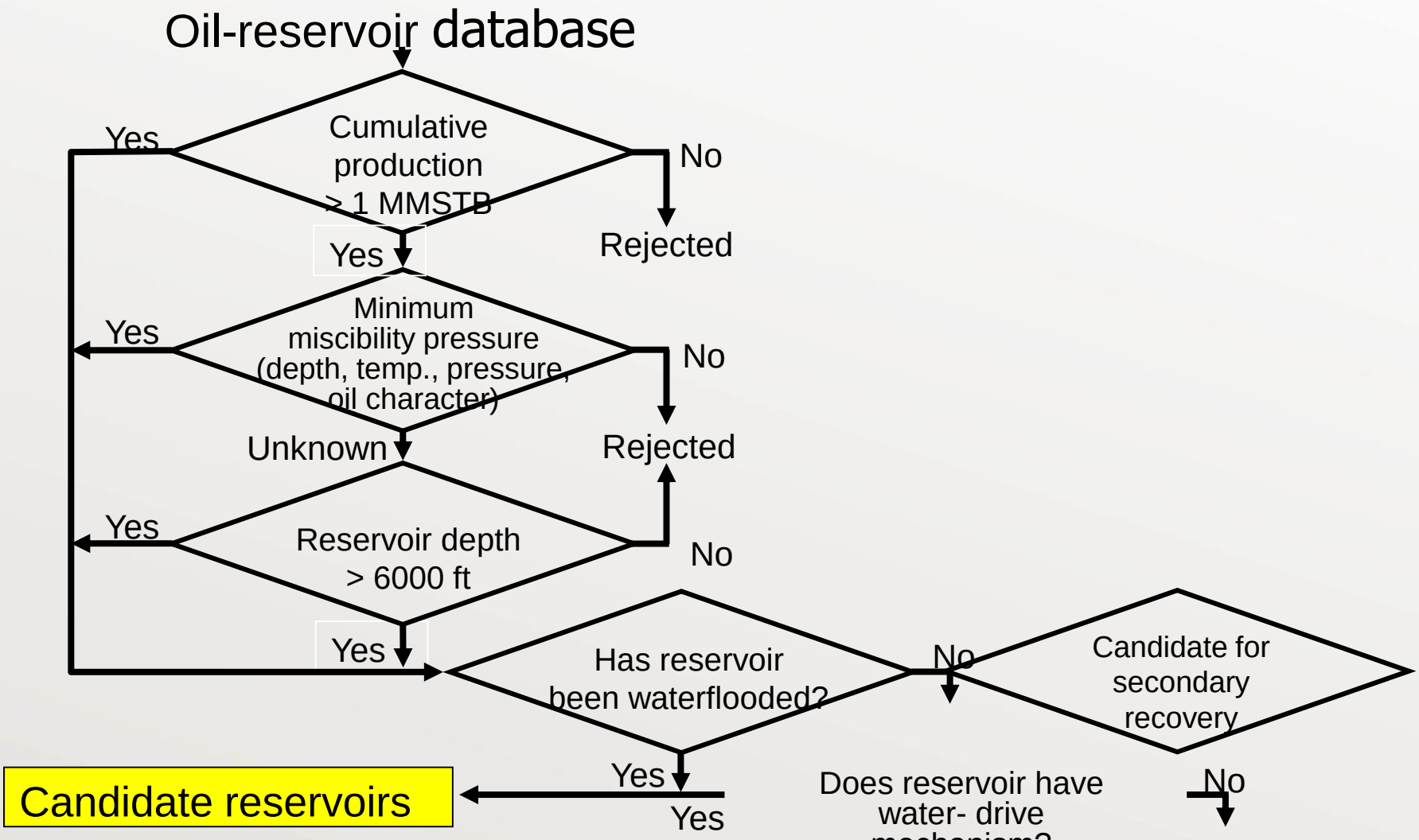
- CO_2 Enhanced oil recovery (CO_2-EOR) onshore is mature, safe, and economically viable
- What is needed to translate this to offshore?
- Monitoring storage and accounting as part of CCUS onshore – translation to offshore
- Lifecycle value of EOR as storage

Total United States Enhanced Oil Recovery Production, 1986 - 2010
(Thousand Barrels Per Day)



Source: Oil and Gas Journal, Biennial Enhanced Oil Recovery Project Surveys

What makes CO2- EOR succeed Screening Tree



Holtz BEG 2005

What makes CO_2- EOR succeed

(the hidden issues that may be barriers to offshore)

- Business model – investment for a delayed but sure payout
- Competition with other similar capital-intensive projects
- Non contamination of methane resources

Business model – investment for a delayed but sure payout

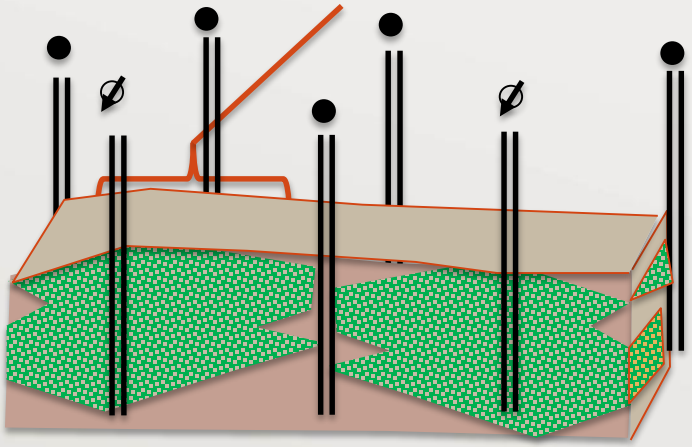
- Risk averse deployment (similar to last project)
- Fast deployment once investment decision is made
  - Fast permitting
  - Fast preparation of field and infrastructure
  - Fast processing of reservoir
- Required investment

Fast processing of reservoir

- Comparing onshore and offshore well spacing- link to rate of reservoir processing

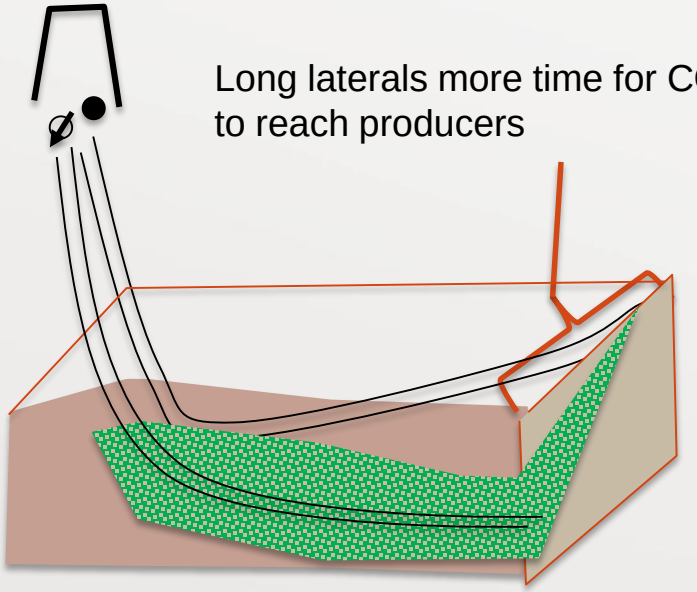
Typical 5-spot pattern

400 m 6- 15 months CO_2 + oil to producers



Well emplaced from a platform commonly use long laterals

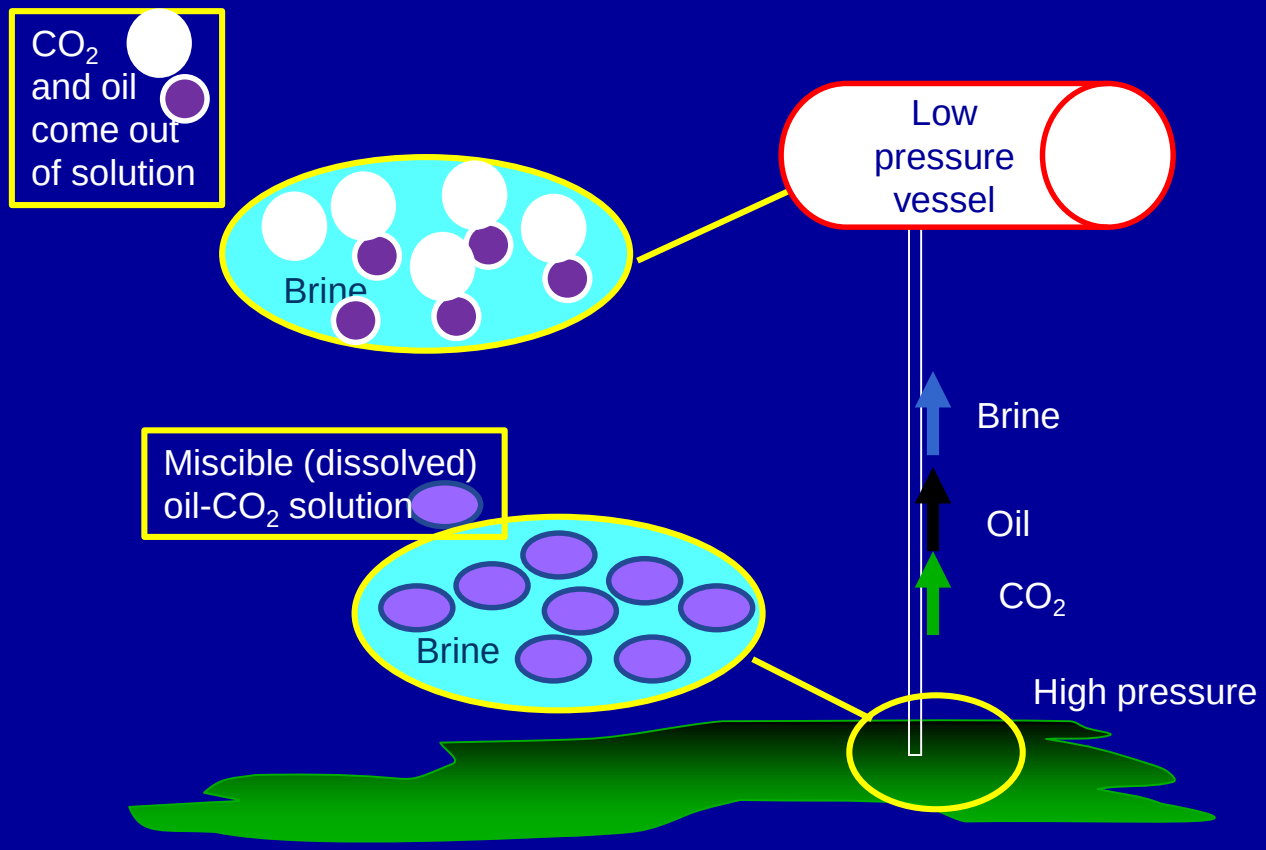
Long laterals more time for CO_2 + oil to reach producers



Competition with other similar capital-intensive projects

- Competition with other types of EOR
  - Methane reinjection
  - Cantarrell N_2 flood
- Other types of investments
- Note that this competition can be mitigated via financial market structure
  - US CO_2 EOR incentives for tertiary recovery

Overview of CO_2 Recycle



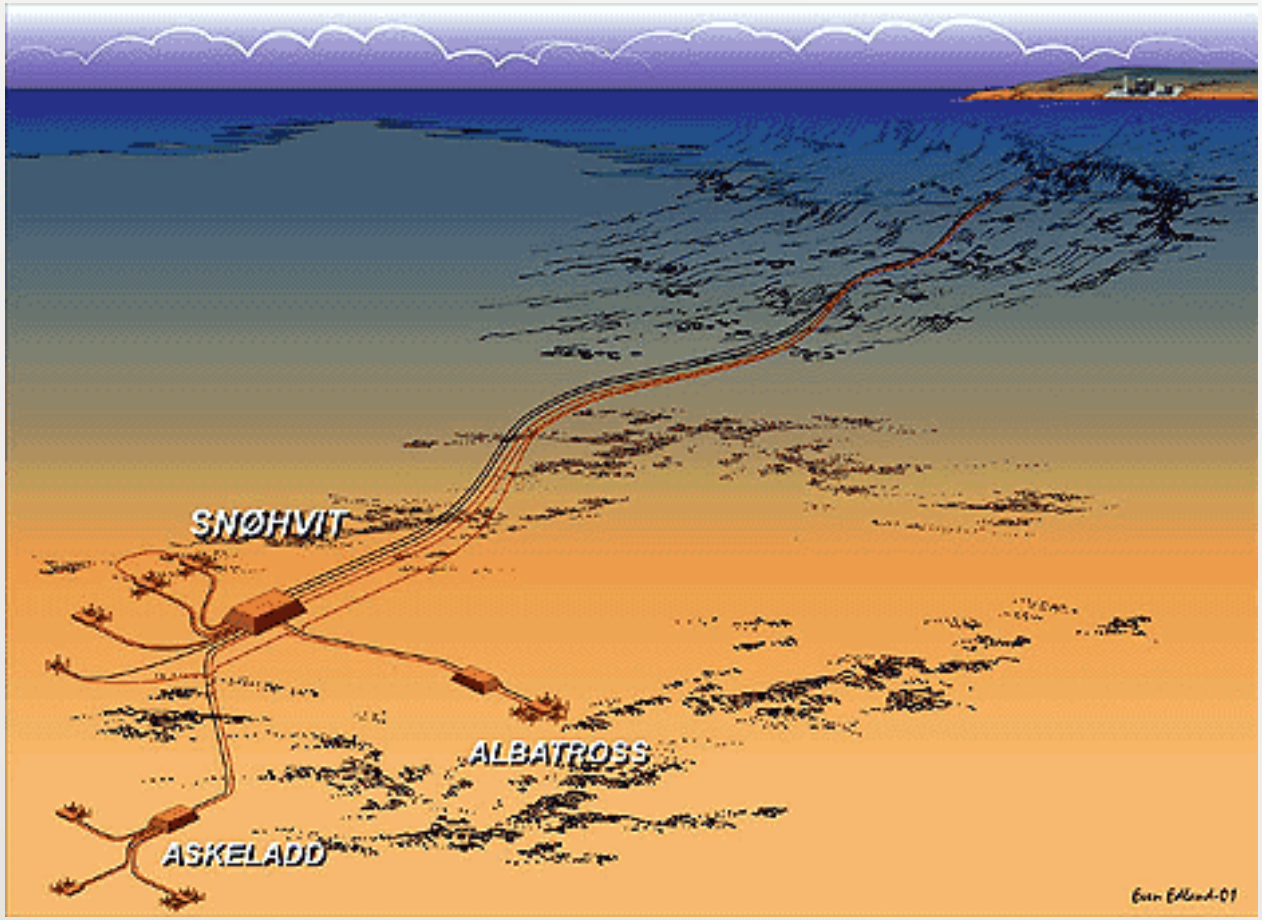
Recycle

- Onshore field has space for CO_2-oil- water separation and CO_2 recompression.
- Space and weight on platform is much more limited than onshore

Core Energy facility, Michigan

Or Aker Solutions, seafloor facility

Snøvit solution- applied to CO_2 EOR?

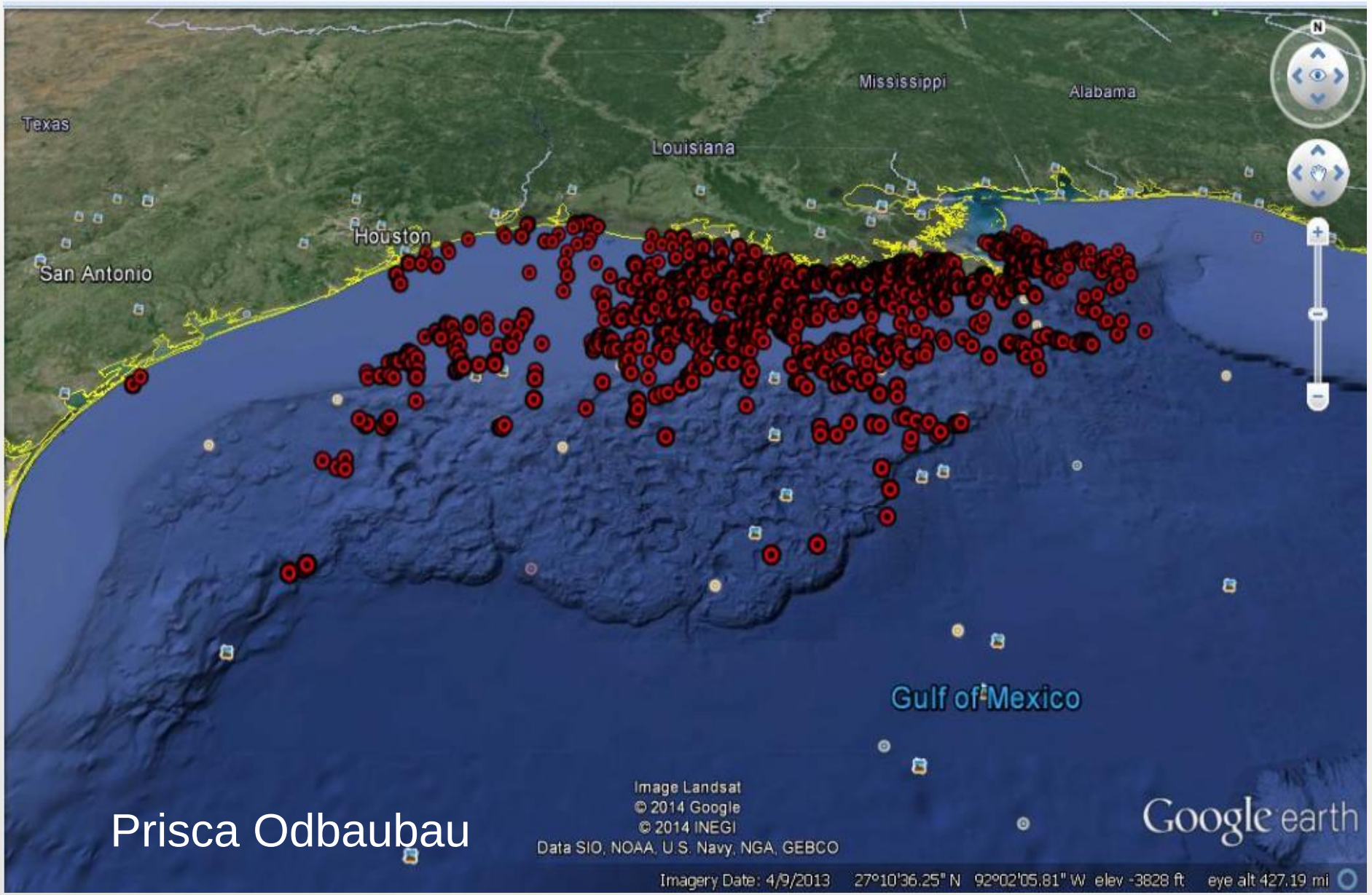


Double pipeline, processing done onshore

Competition with Methane Resources

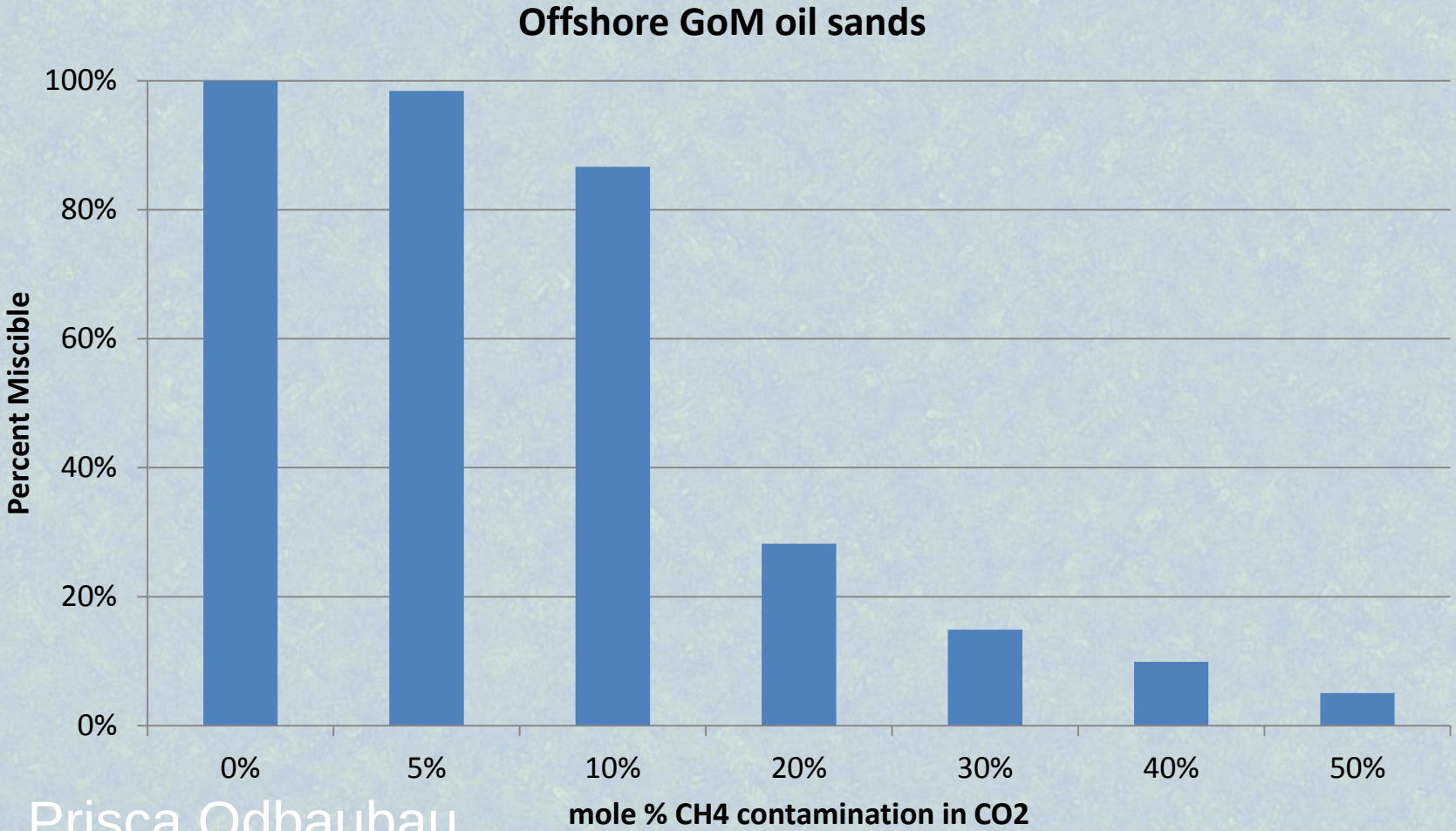
- Methane abundant in offshore reservoirs
- Methane stranded offshore recycled into reservoir for pressure support
- Value of methane avoid damage by contamination by CO_2
- Methane damages miscibility

Case study fields: Offshore Gulf of Mexico



Prisca Odbaubau

Decreasing miscibility in oil sands



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Examples of Integrated CCS Projects

Storage type \ Capture from	Power production	Industry	Gas Separation
For disposal	SECARB- Plant Berry Alabama	ADM Ethanol, IL	Sleipner – North Sea
	AEP Mountaineer, West Virginia	Tomakomai-Hokkaido Japan	Snøvit – Barents Sea
	Aquistore, Sask.	Shell QUEST, Alberta	Otway Australia
For EOR	Boundary Dam, Saskatchewan	Air Products-Port Arthur TX	Many fields in Permian Basin sourced from Val Verde Basin gas, TX
	Kemper - Alabama	Yanchang Ordos, China	Bell Creek, Lost Cabin, WY Multiple midcontinent US projects
	NRG/PetraNova-Houston TX	Coffeeville and Enid OK	Lula Field offshore Brazil
			Uthmaniyah Saudi Arabia

Offshore storage

Completed

Extensive inventory

https://www.globalccsinstitute.com/projects/large-scale-ccs-projects

Conclusions – needs to incentivize Offshore EOR

- Detailed FEED study on infrastructure
  - Move facilities to sea floor
- Additional research on geometry optimization – sweep improvement options
- Reduce risk by support of investment

www.gulfcoastcarbon.org

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