Developing Offshore Storage for Texas

Dr. Tip Meckel
Ramon Trevino
Dr. Susan Hovorka

Gulf Coast Carbon Center
Bureau of Economic Geology
The University of Texas at Austin

Texas-UK CCS Workshop

Monday, December 7
Houston, TX

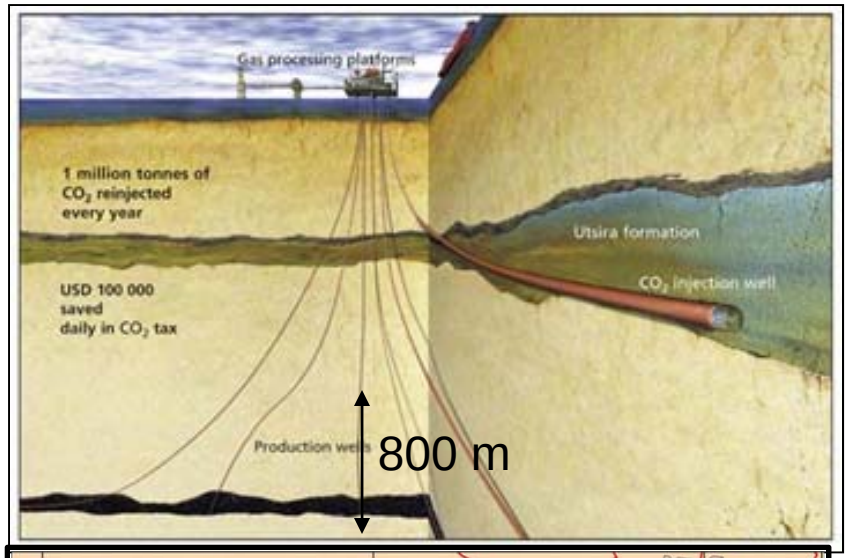
Texas Carbon Repository

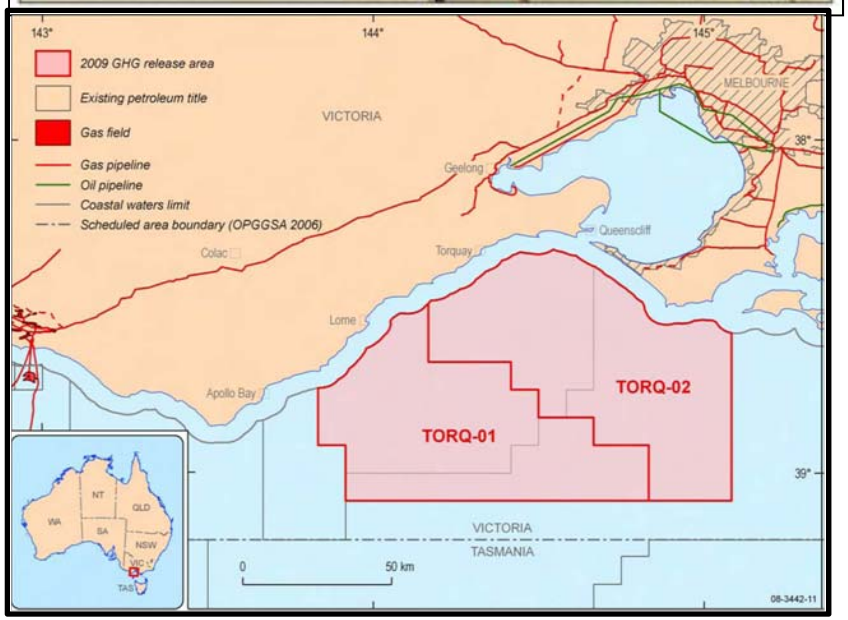
- **Texas is well-positioned to store billions of tons of CO_2 in offshore geologic formations**
- **Texas controls the surface and subsurface rights**
- **Texas could provide:**
  - **leases for CO_2 pipelines and injection**
  - **liability release for proper injection operations**
  - **streamlined regulatory and permitting**
  - **long-term Stewardship & MMV**

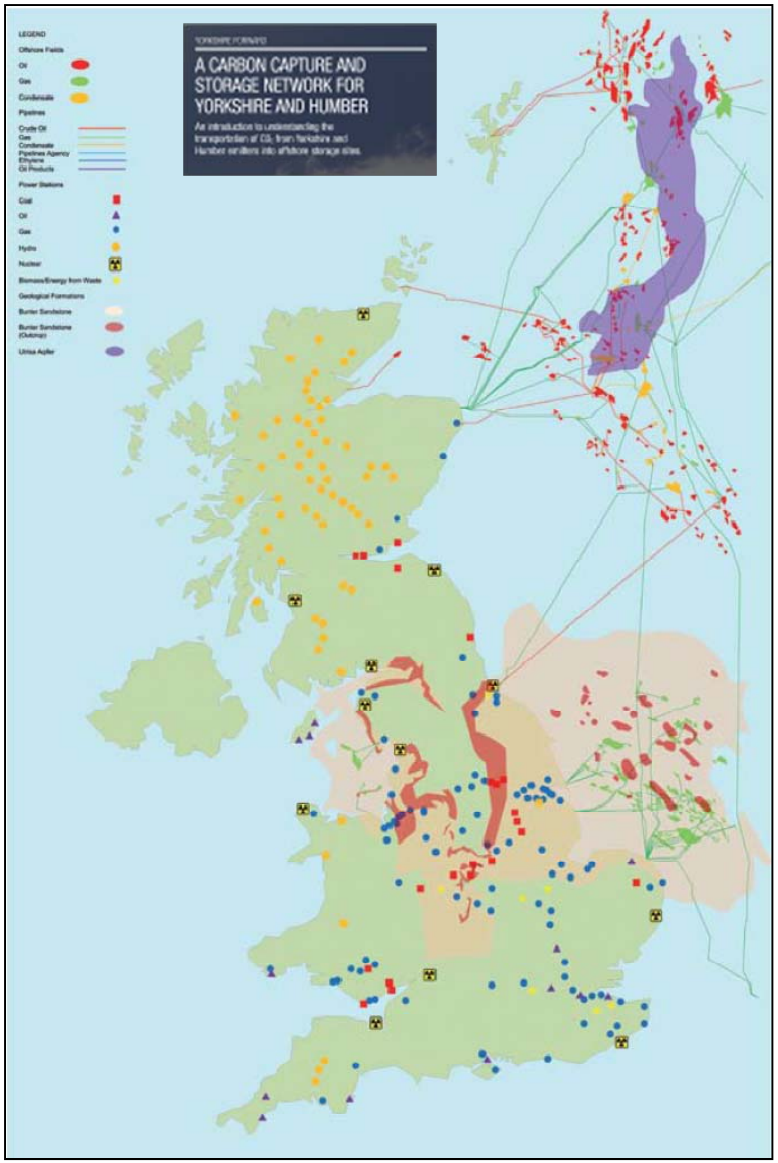
Texas Carbon Repository

- **Partners could include:**
  - **Oil operators in onshore and offshore waters**
  - **Major stationery source CO_2 emitters (electricity, refining, petrochemicals)**
  - **CO_2 transporting companies**
  - **State agencies (TCEQ, RRC, GLO)**
  - **Industries and governments needing carbon credits**
- **Benefits could include:**
  - **Level playing field for variety of industrial sources**
  - **A global leadership position in cleaner energy**
  - **A new carbon industry and associated jobs**
  - **Major revenues from sold carbon credits**
  - **Major revenues from enhanced oil recovery and associated increased oil production**

International offshore CCS examples



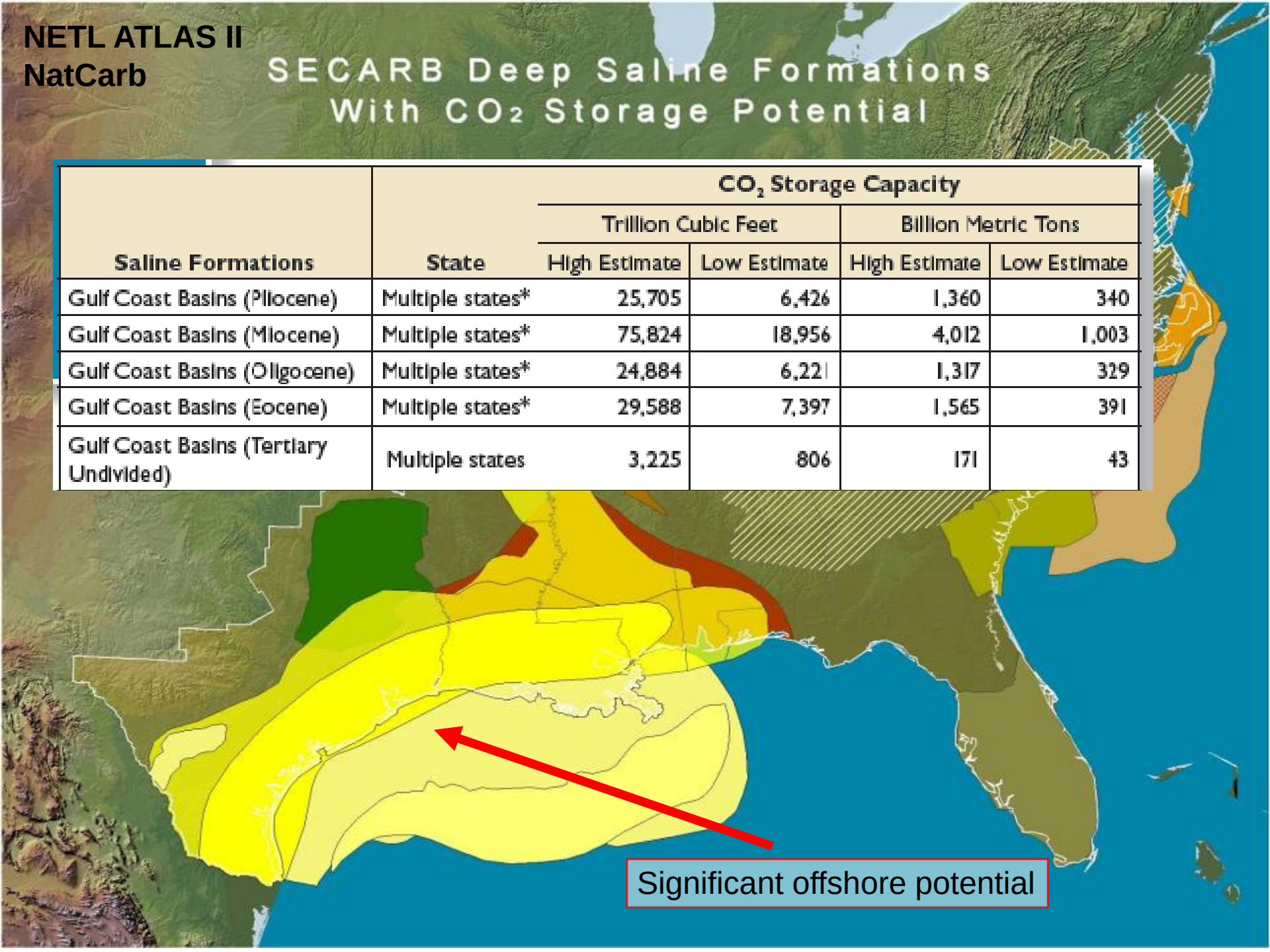




NETL ATLAS II
NatCarb

SECARB Deep Saline Formations With CO_2 Storage Potential

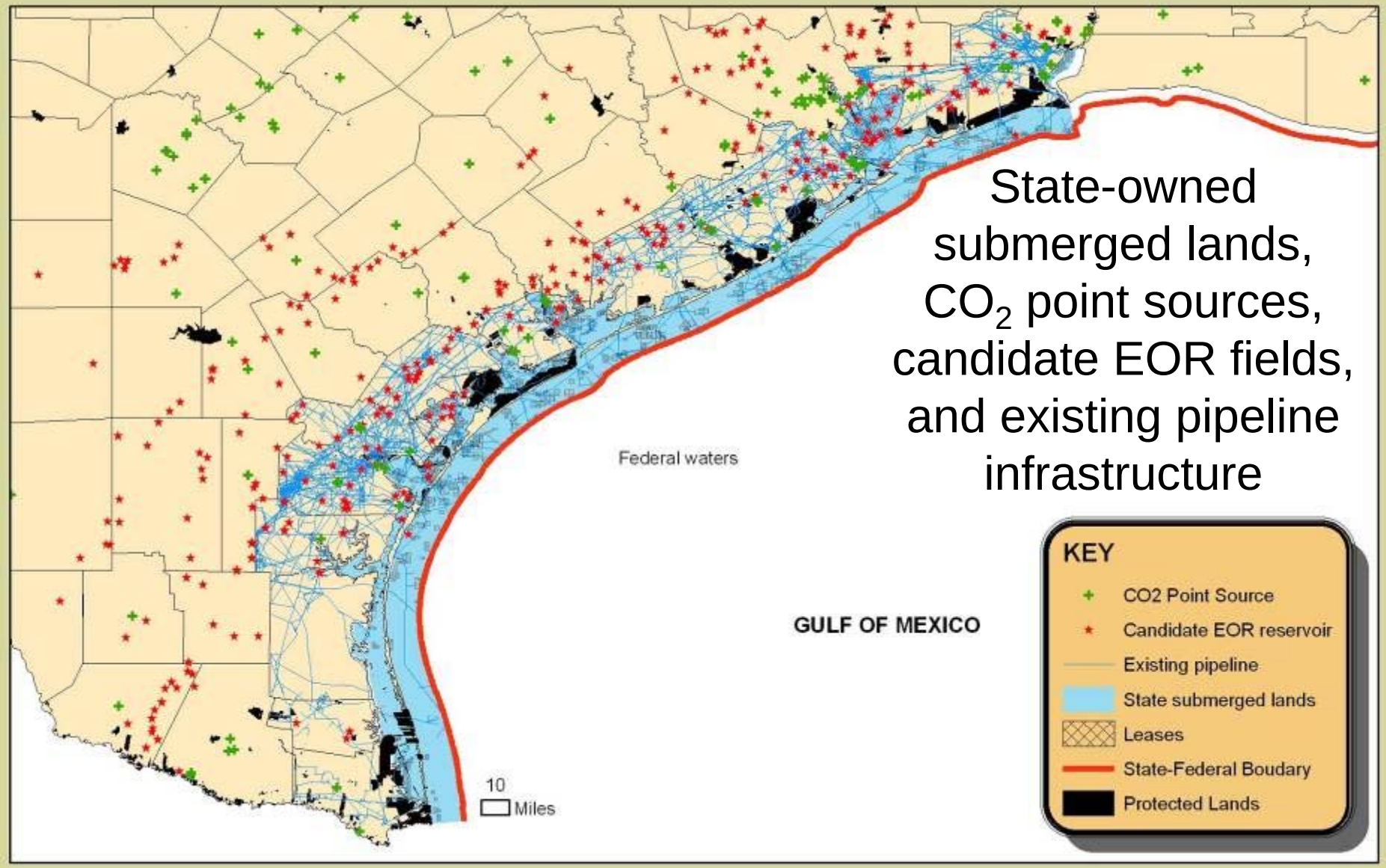
Saline Formations	State	CO_2 Storage Capacity			
		Trillion Cubic Feet		Billion Metric Tons	
		High Estimate	Low Estimate	High Estimate	Low Estimate
Gulf Coast Basins (Pliocene)	Multiple states*	25,705	6,426	1,360	340
Gulf Coast Basins (Miocene)	Multiple states*	75,824	18,956	4,012	1,003
Gulf Coast Basins (Oligocene)	Multiple states*	24,884	6,221	1,317	329
Gulf Coast Basins (Eocene)	Multiple states*	29,588	7,397	1,565	391
Gulf Coast Basins (Tertiary Undivided)	Multiple states	3,225	806	171	43



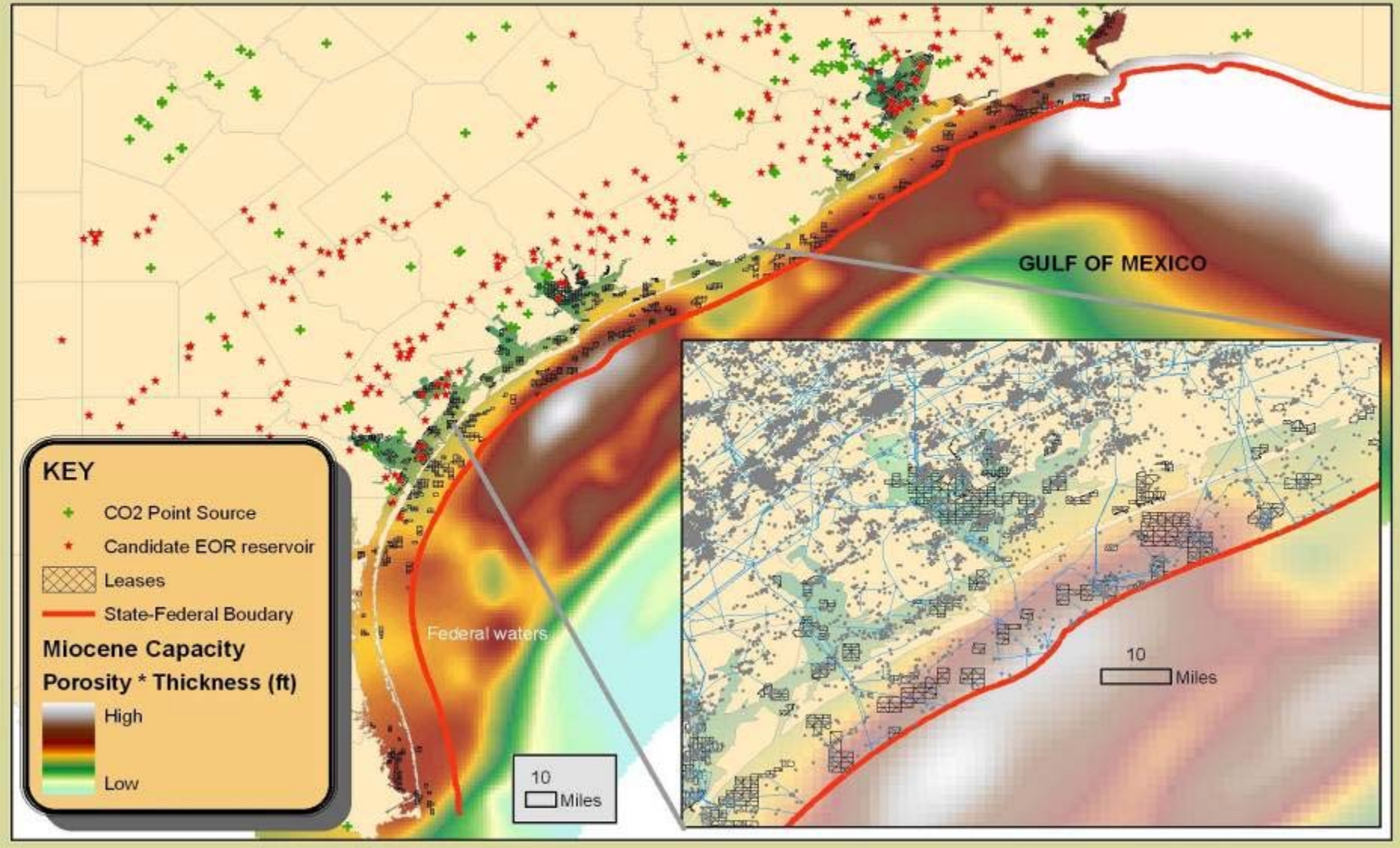
Texas State Offshore Lands

- HB 1796 – GLO: $1.2M
- DOE/NETL: ($4.8M awarded, starts Dec 2009)
- GLO lands: Revenues to Permanent School Fund (lower taxes) - $11B since 1854
- Single land owner avoids NUMBY, pore space ownership, trespass, and liability issues
- Reduced risk to USDW (groundwater)
- Monitoring simplified?
- **GOALS**: Refine capacity estimates; Characterize and rank target reservoirs and seals; Collect data to reduce barriers to near-term utilization.

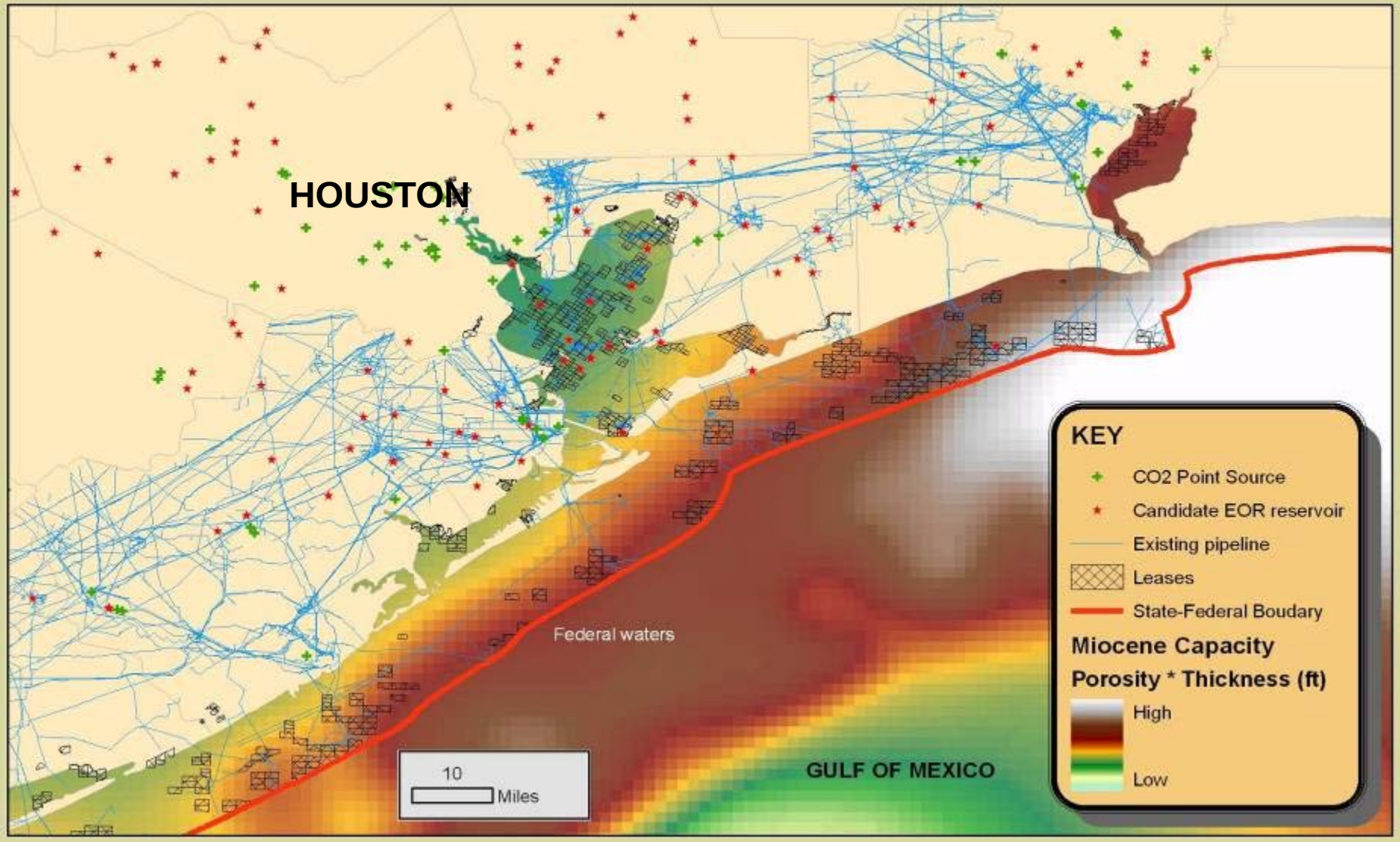
CO_2 Sequestration in Texas



CO_2 Brine Storage Capacity



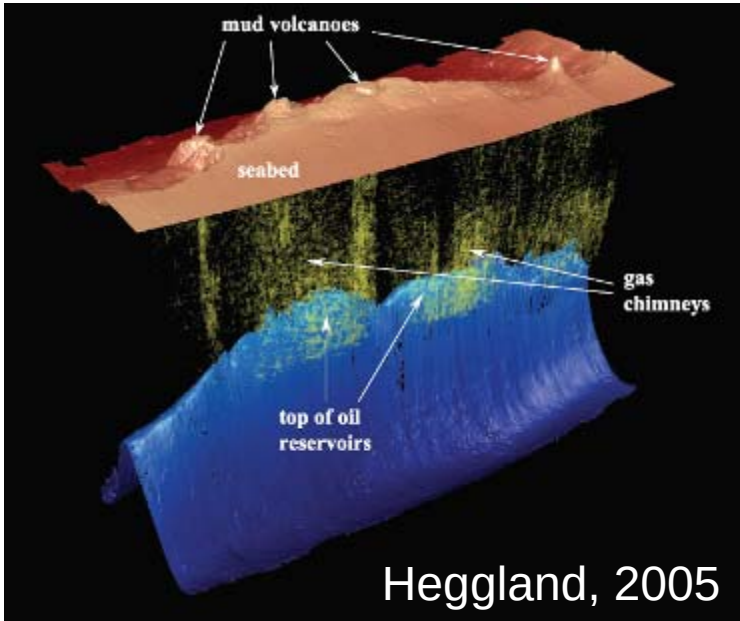
CO_2 Brine Storage Capacity



Geologic Characterization & Geophysical Monitoring Essential

Offshore CCS monitoring design in infancy

- 4D-MCS +/- Ocean Bottom Cables
- Shallow seismic for long-term risks
- Microgravity (Sleipner)
- Surface/water column detection of seeps
- Performance of faults
  - Long-term pressure impact
- Environmental concerns
  - Marine pH



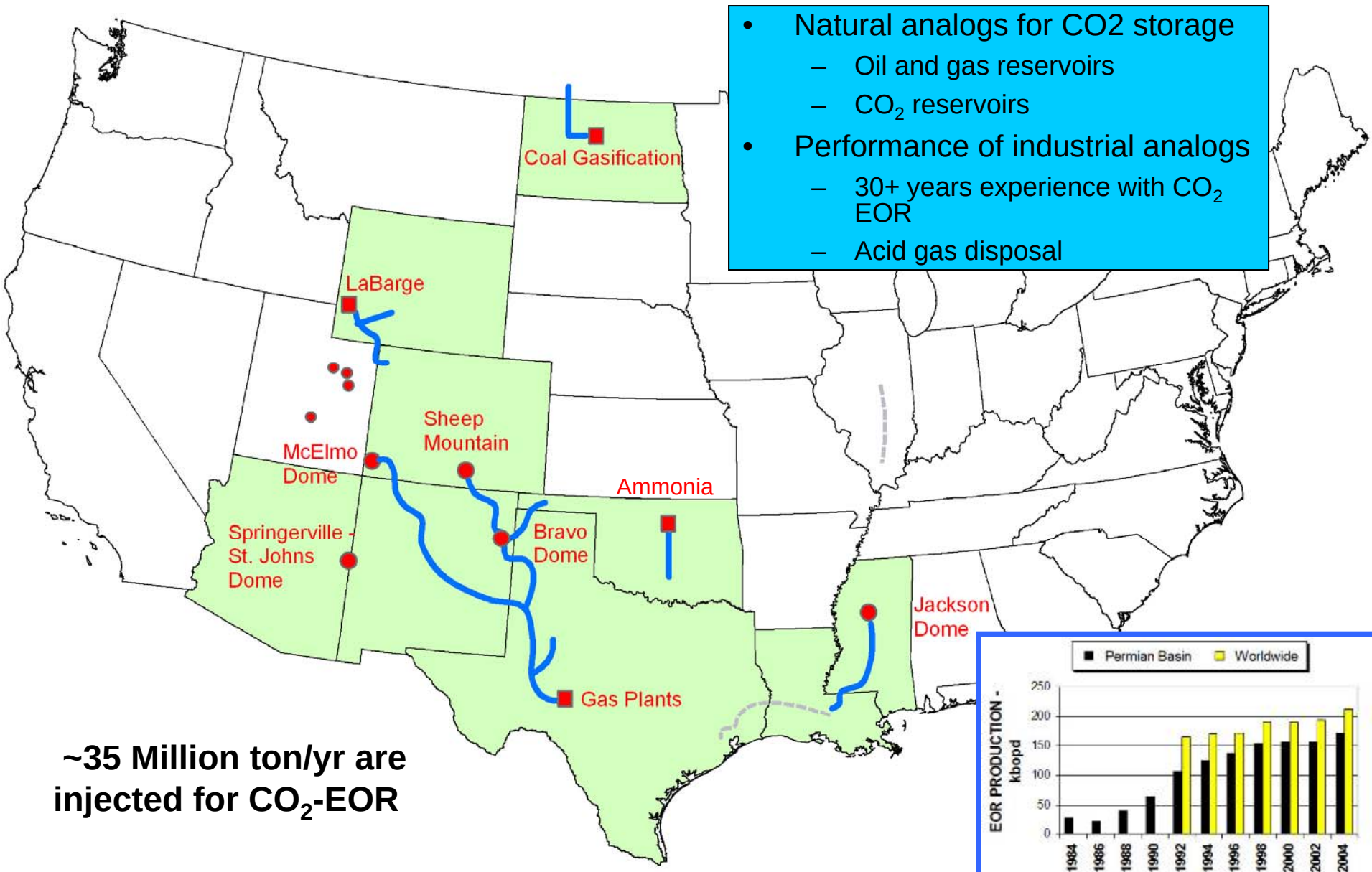
Heggland, 2005

•Texas offshore carbon repository talking points

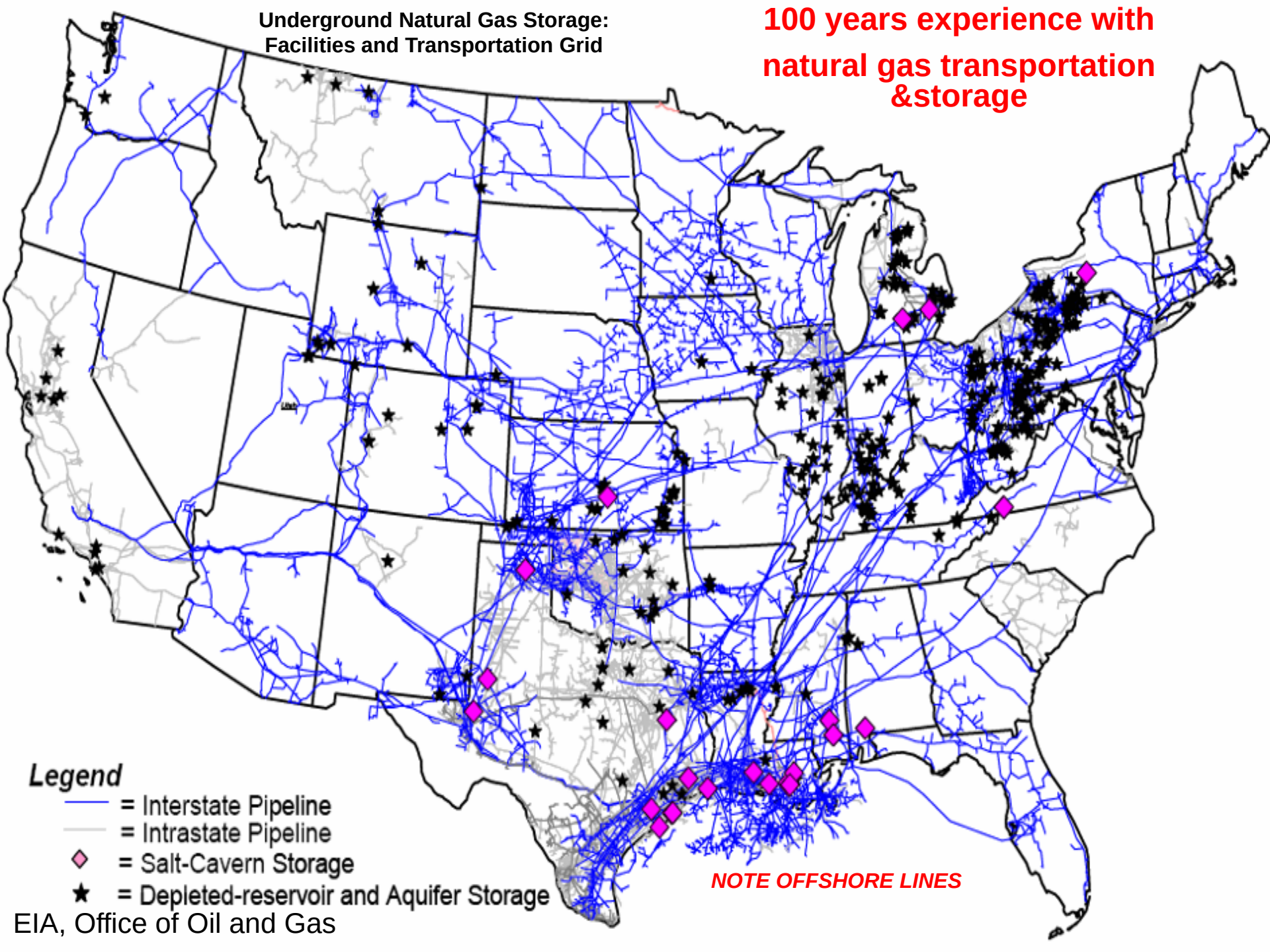
•Initial capacity estimates for offshore State lands are extremely high, but need further refinement which may reduce those estimates.
•GLO management avoids lengthy unitization agreements and legal issues that onshore projects will face.
•The State offshore option provides a repository for the diversity of affected industries Statewide, and distributes benefits Statewide in well defined procedures.
•Reduced potential impact to USDWs (underground sources of drinking water) in offshore environments. (eliminated where USDWs do not exist)
•Native industry experience with existing monitoring techniques, such as 3D seismic, that has demonstrated performance for monitoring CO2 injections (e.g. at Sleipner in the North Sea).
•Texas has a diverse and strong educational and industrial background in the geoscience and engineering disciplines needed in the field of CCS. Increased CCS activity may eventually provide for an expansion of (dare I say, stimulate) that educational capacity and workforce.
•Australia and UK, as well as other EU members, are aggressively pursuing offshore storage.
•Potential for Enhanced Oil Recovery (EOR) with CO2 can be considered.
•Potential to provide carbon offset mechanism allowing Texas industries to earn credits sought by industries in states that are less prospective for CCS or in need of carbon reductions.
•State acquires CO2 ownership at specified (but currently undetermined) time in the life-cycle of the project. This creates need for long term monitoring program and perhaps a restitution fund/bond (you can probably think of a better mechanism or term).

Current CO_2 Infrastructure EOR dominant

- Natural analogs for CO2 storage
  - Oil and gas reservoirs
  - CO_2 reservoirs
- Performance of industrial analogs
  - 30+ years experience with CO_2 EOR
  - Acid gas disposal



~35 Million ton/yr are injected for CO_2-EOR


Underground Natural Gas Storage:
Facilities and Transportation Grid
100 years experience with
natural gas transportation
&storage
Legend
= Interstate Pipeline
= Intrastate Pipeline
= Salt-Cavern Storage
= Depleted-reservoir and Aquifer Storage
NOTE OFFSHORE LINES
EIA, Office of Oil and Gas