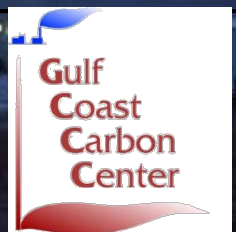


Northwest Gulf of Mexico CarbonSAFE

DE-FE0029487

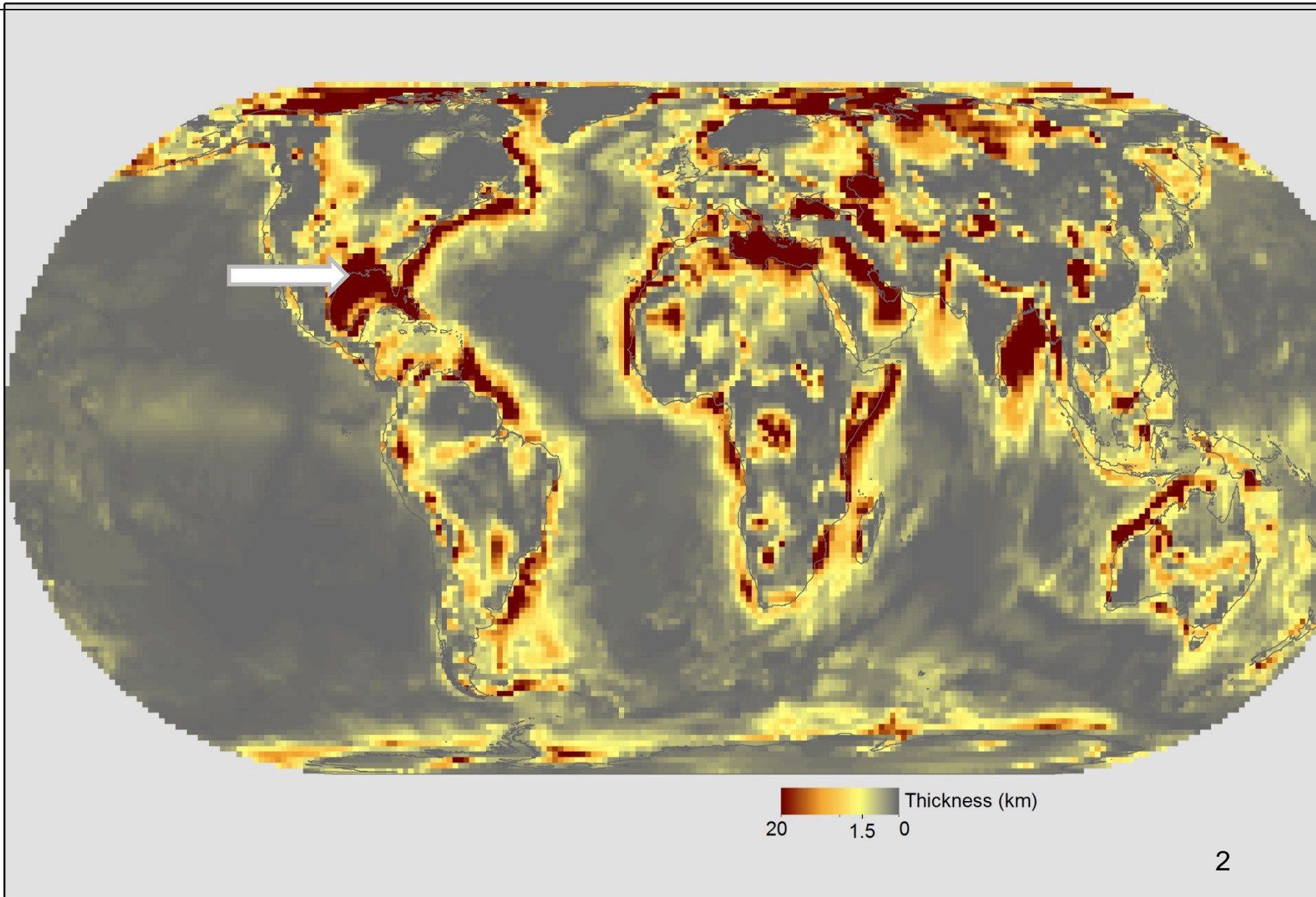
Susan D. Hovorka (presenter)
Tip Meckel and Ramon Treviño
Gulf Coast Carbon Center
Bureau of Economic Geology

**Mastering the Subsurface through Technology Innovation, Partnerships and Collaboration:
Carbon Storage and Oil and Natural Gas Technologies Review Meeting,
August 1–3, 2017, Pittsburgh, Pennsylvania**



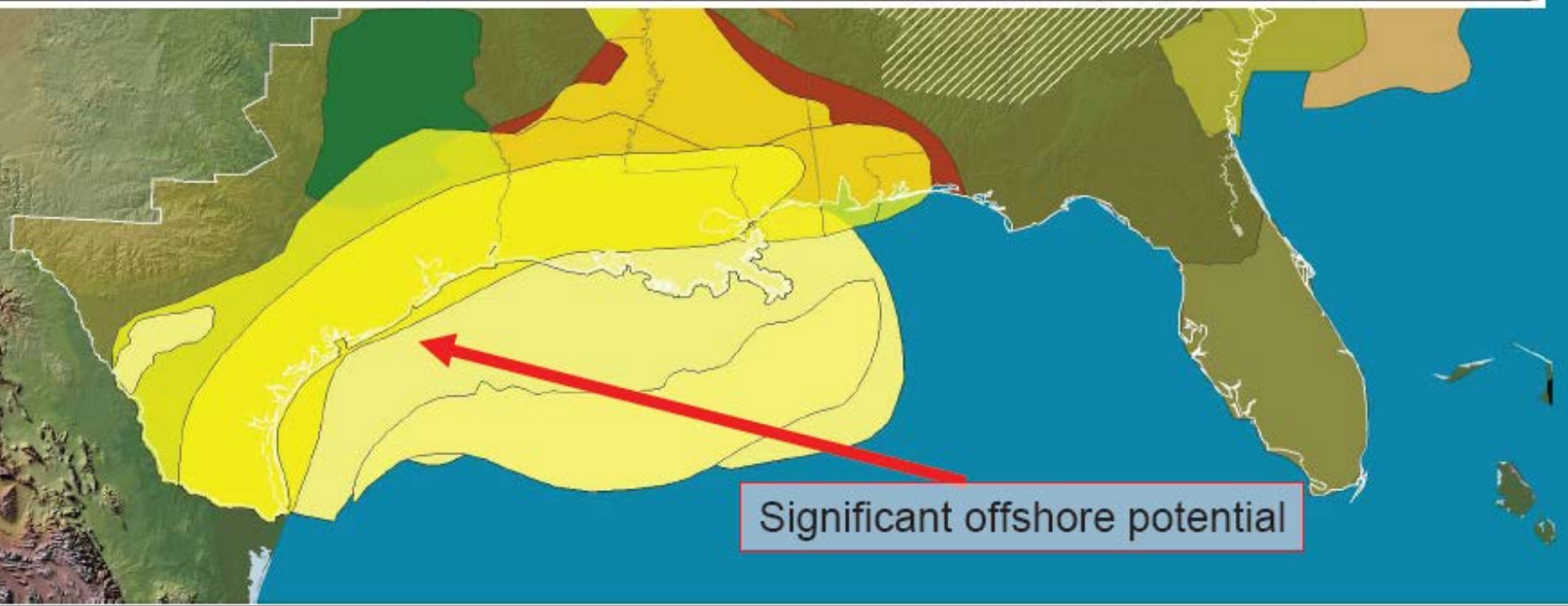
Point sources in Gulf Coast Area

Global Potential of Offshore Storage



SECARB Deep Saline Formations
With CO₂ 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

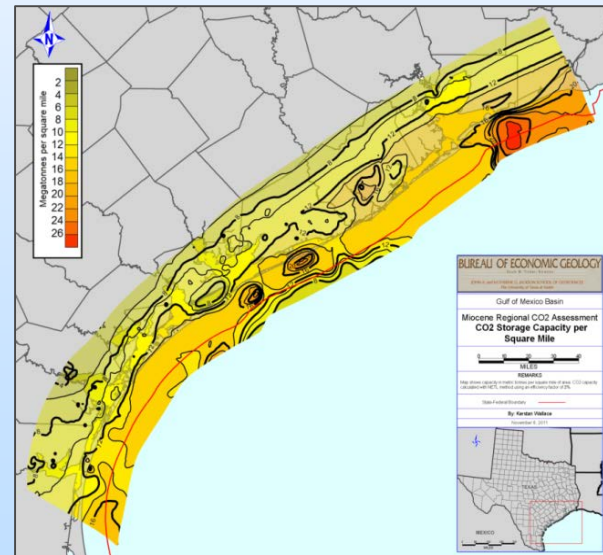
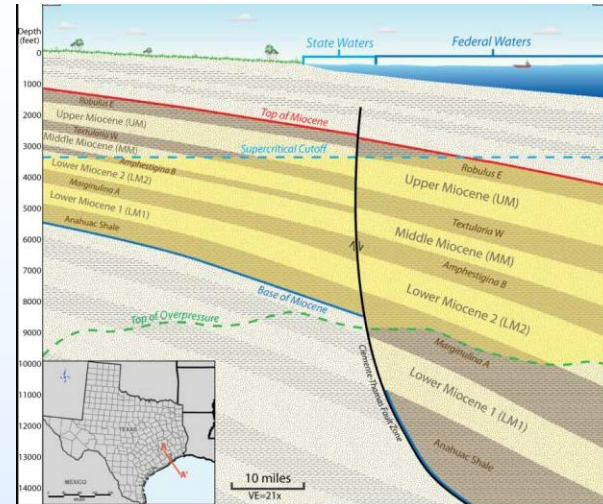
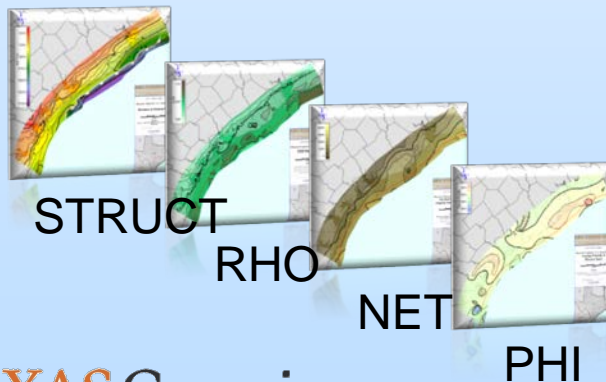


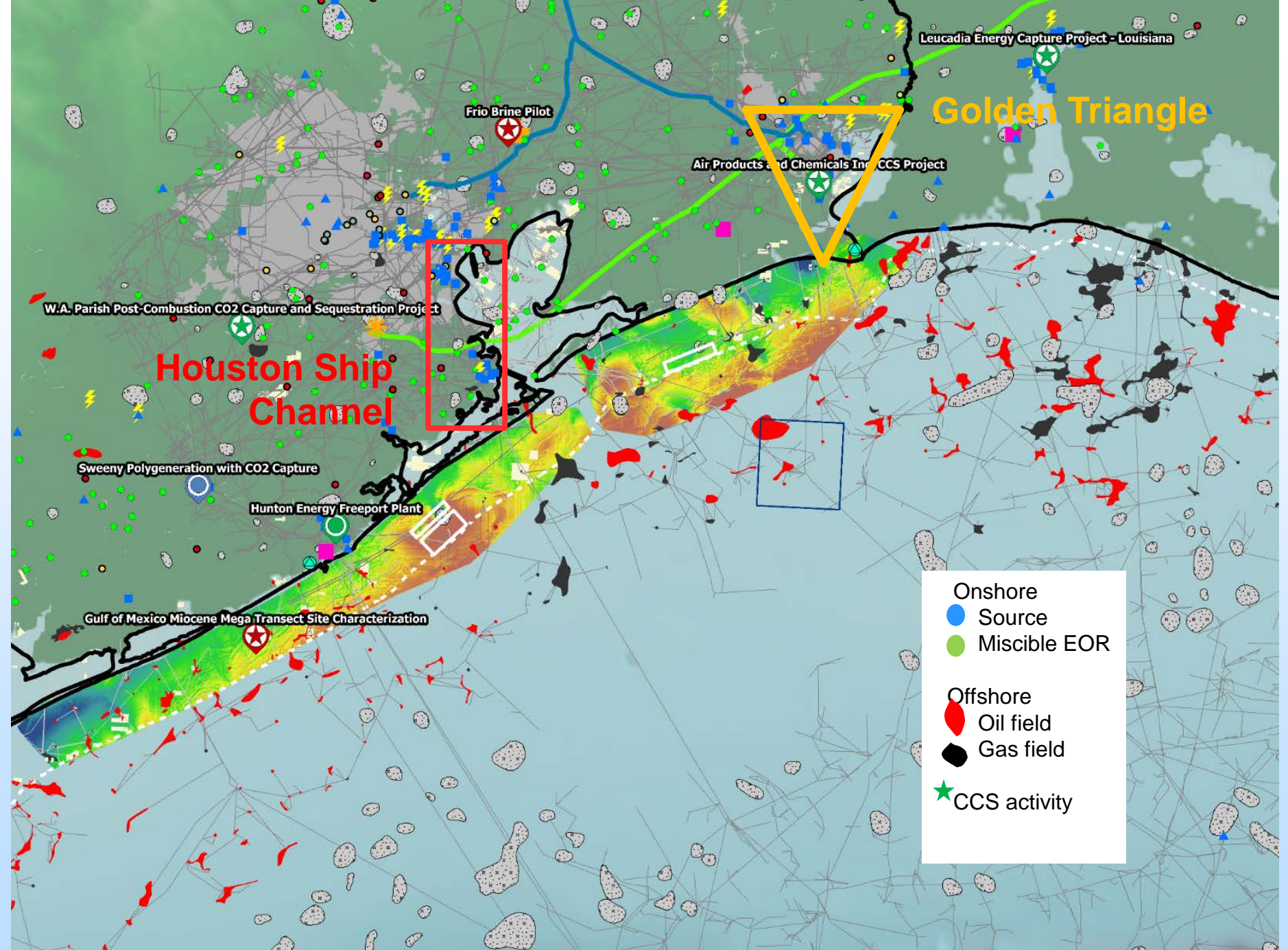
Significant offshore potential

Static Regional Capacity Texas Coast & Offshore

Meckel and others, 2017, Miocene offshore storage atlas.

- NETL Methodology
- 40,000 sq. km.
- 3,300 logs
 - Tops, net sand, porosity
- 172 Gt CO2 storage total
 - TX State Waters





Accomplishments to Date

Outreach

- Community leaders

June 2017 Field trip
CarbonSAFE/ International Offshore
workshop
(GCCC+IEAGHG+ CSLF)

- Industry
- Public

CO₂ Source analysis

Geotechnical analysis

Outreach

Paul Latiolais – Lamar University Center for Innovation, Commercialization and Entrepreneurship (*CICE*) – college of Engineering and Business



Lee Ann Kahlor- UT advertising and public relations: health and environmental communication – focus on information seeking



International Workshop on Offshore Geologic CO₂ Storage

Home

News

Oil & Gas Wrap

The Lamars

Scientists from around the world converge at Lamar to tackle CO₂ emission problems

“You have a lot of industry here and a lot of combustion devices here, a by product of refining crude oil. So you have a lot of CO₂ emissions,” .. “We knew this issue was coming ... Now we’re moving into that era of CO₂ and the beneficial aspects of capturing that — how we capture it, how we store, and also the benefits environmentally. This is the next era, not only as a commercial issue but also an environmental issue.

Dennis Isaacs, executive director of the Golden Triangle Business Roundtable



Ten nations were represented at the second International Workshop on Offshore Geologic CO₂ Storage held June 19-21 at Lamar University's Center for Innovation, Commercialization and Entrepreneurship (CICE).

Legislative preparation

Senate Bill 1387 establishes CCS regulatory framework: 2010 report: *“Injection and Geologic Storage Regulation of Anthropogenic Carbon Dioxide”*.

Senate Bill 184 list of "no regrets" greenhouse gas emissions reduction strategies for Texas.

House Bill 1796 program to develop an offshore geologic repository. expires August 31, 2019

House Bill 469 franchise tax credit to an entity implementing a clean energy project connected with the construction of a new facility.

House Bill 3732 amends the Government Code to establish an advanced clean energy project grant and loan program administered by the Comptroller's State Energy Conservation Office (SECO).

Senate Bill 483 establishes incentives for the implementation of certain projects to capture and sequester in geological formations carbon dioxide that would otherwise be emitted into the atmosphere.

Senate Bill 2111 relates to the implementation of and incentives for projects involving the capture, transportation, injection

Emissions Source Database



- PRAXAIR PORT ARTHUR #379
 - Hydrogen
 - 1.0 Mtpy CO₂

- 231 Point Sources
- Current and future emitters
- Detailed breakdown of process emissions from high purity sources
 - Hydrogen
 - Natural Gas processing
 - Ethylene oxide manufacturing
- Historical emissions data



- PRAXAIR PORT ARTHUR FACILITY
 - Hydrogen
 - 0.7 Mtpy CO₂



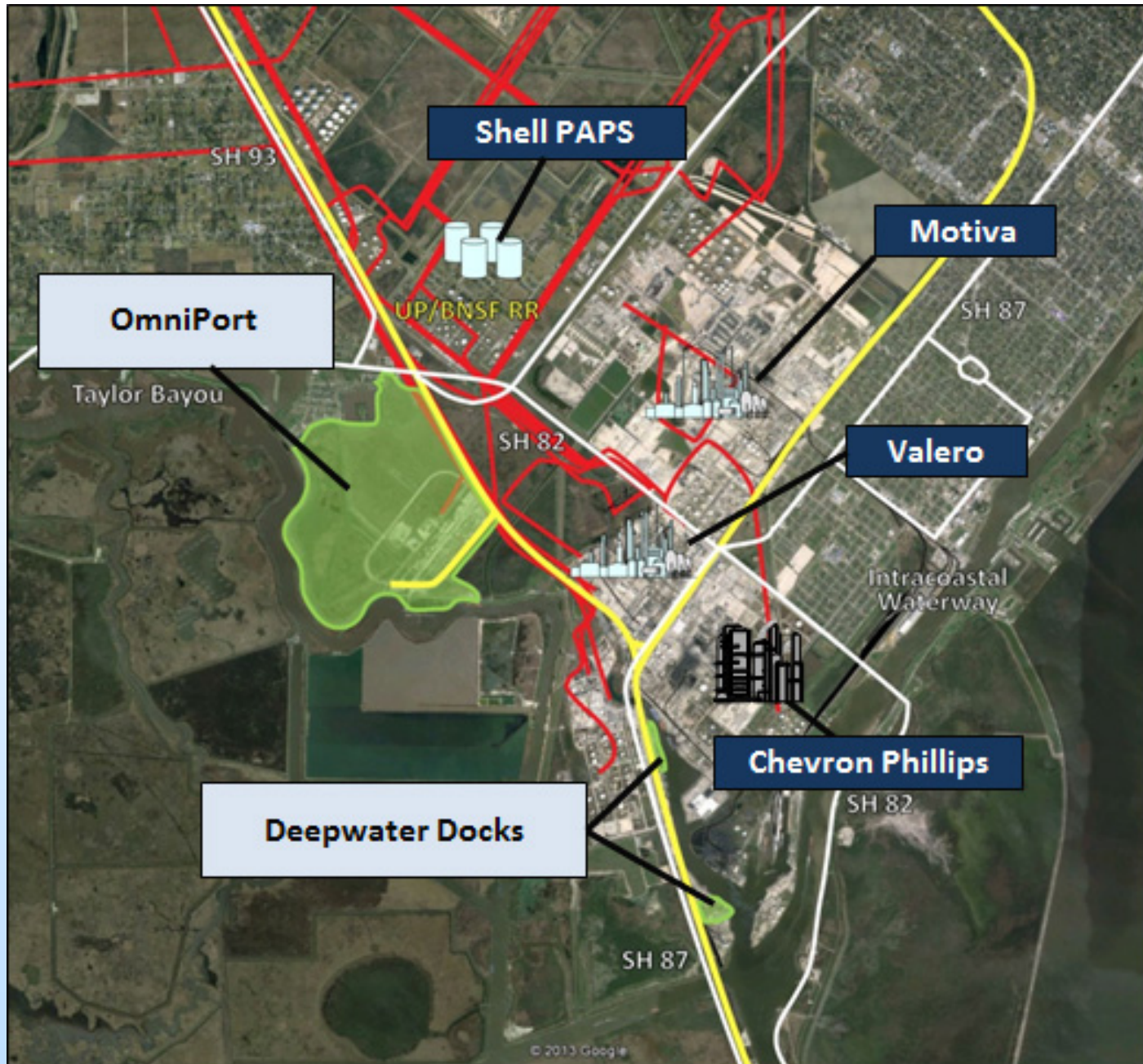
- HUNTSMAN PETROCHEMICAL
 - Ethylene oxide
 - 0.25 Mtpy CO₂

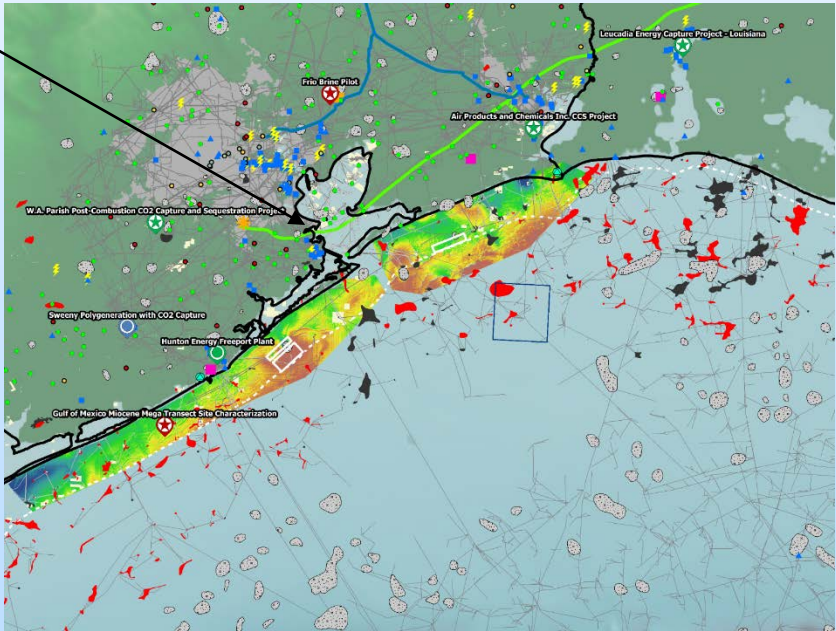


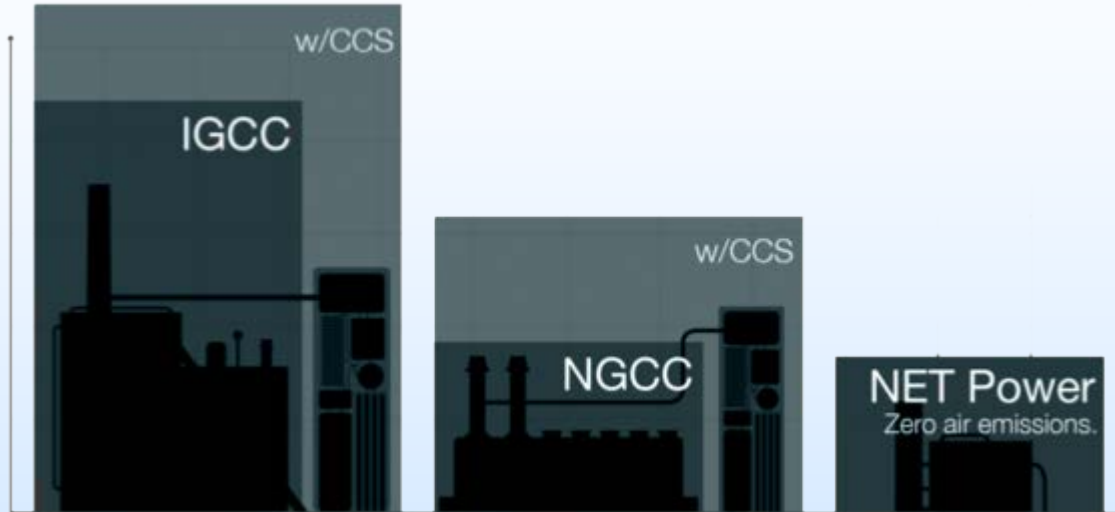
- PRAXAIR TEXAS CITY HYDROGEN COMPLEX
 - Hydrogen
 - 1.4 Mtpy CO₂



- PRAXAIR TEXAS CITY
 - Hydrogen
 - 0.4 Mtpy CO₂







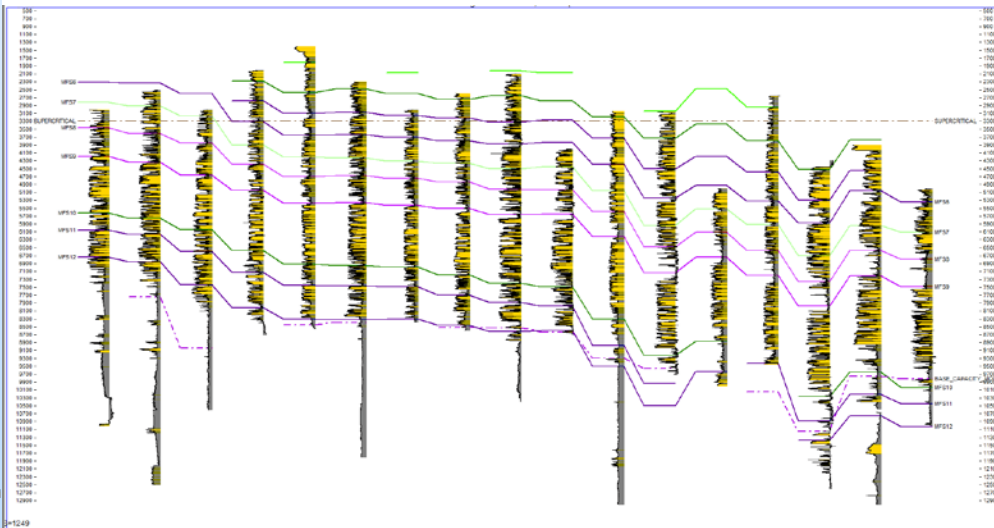
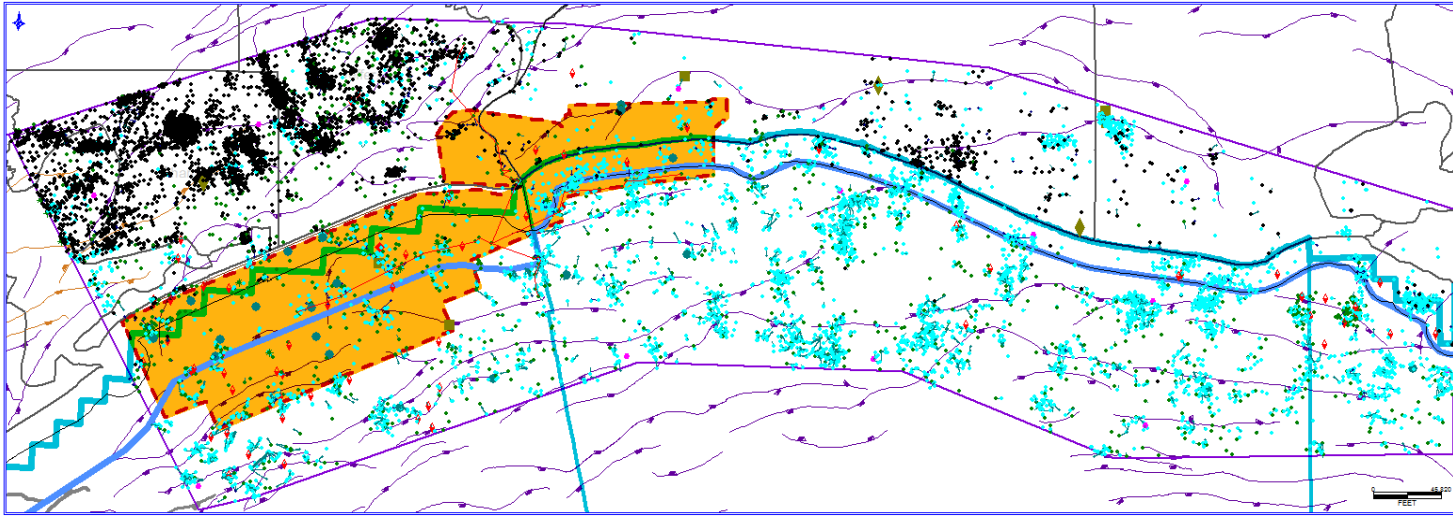
Plants at scale with the same power capacity

Inherent CO₂ Capture

NET Power is designed to capture carbon as a function of how it most-efficiently operates, not as an afterthought. This means expensive, add-on carbon capture systems are not required to virtually eliminate carbon emissions. In addition, unlike traditional carbon capture technologies, NET Power is able to capture almost 100% of its carbon

<https://netpower.com/technology/>

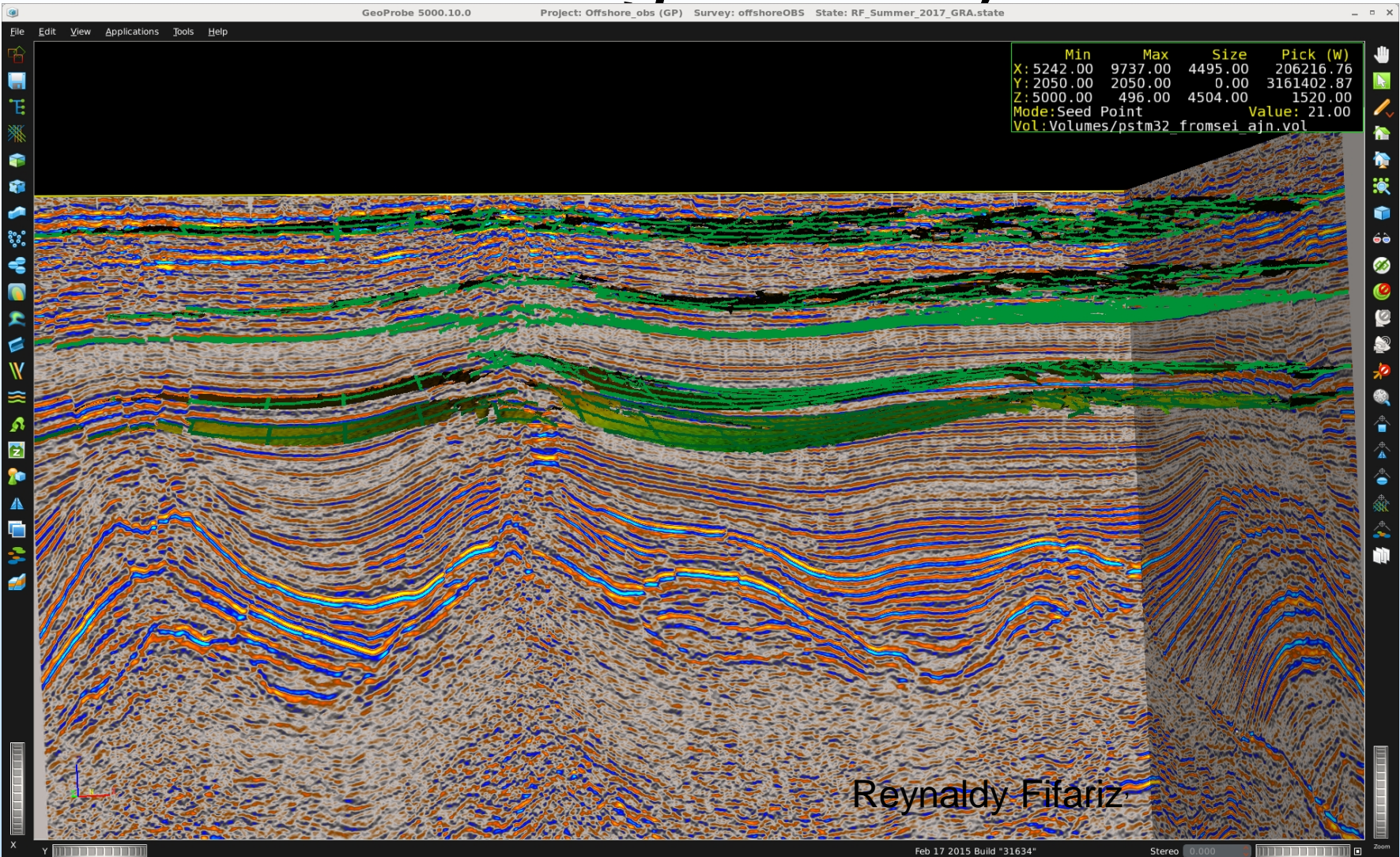
Geologic mapping progress



Iolia Olario



Geologic analysis



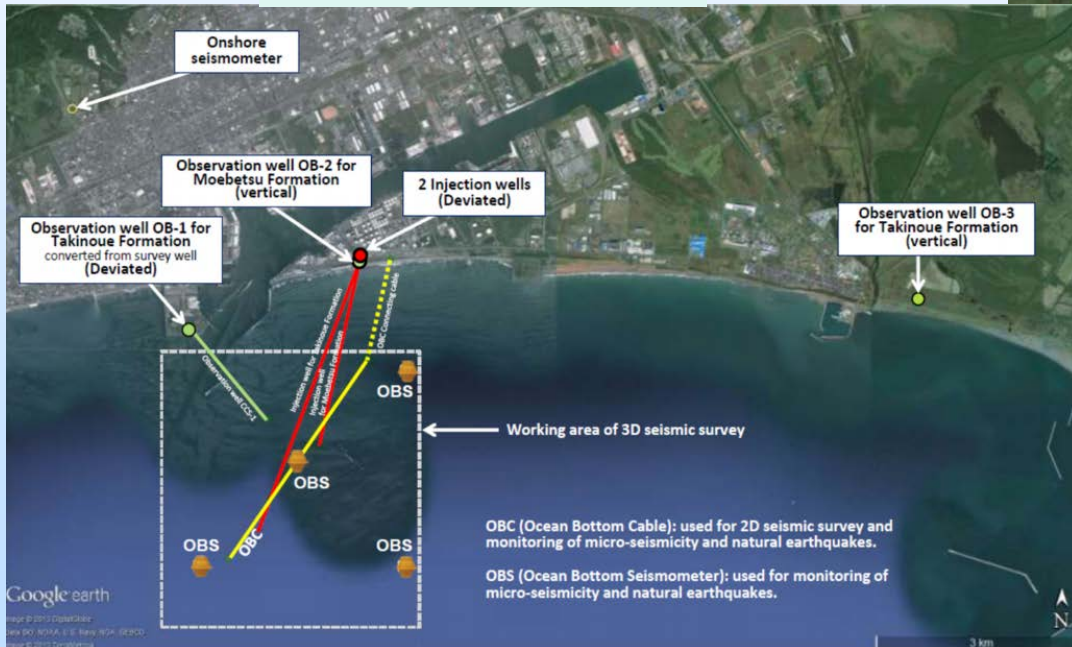
Synergy Opportunities

- Collaboration with international experts from Norway, UK, Netherlands, Japan, China, South Africa, Mexico
 - SubTER-funded project at Tomakomai
 - Contributions for CSLF reports
- Collaboration with other offshore projects SOSRA and Mid-Atlantic
- Input from previous and current characterization projects
- Collaboration with other CarbonSAFE
- Collaboration with NetPower

PORT ARTHUR, TX



TOMAKOMAI, JAPAN



Romanak and Meckel collaboration under SubTER funding

Lessons Learned

- Too early for many lessons and conclusions
- Warm reception by local decision makers and job interests
- Policy support to carbon reduction investment is low
- Limited community outreach during tropical storms



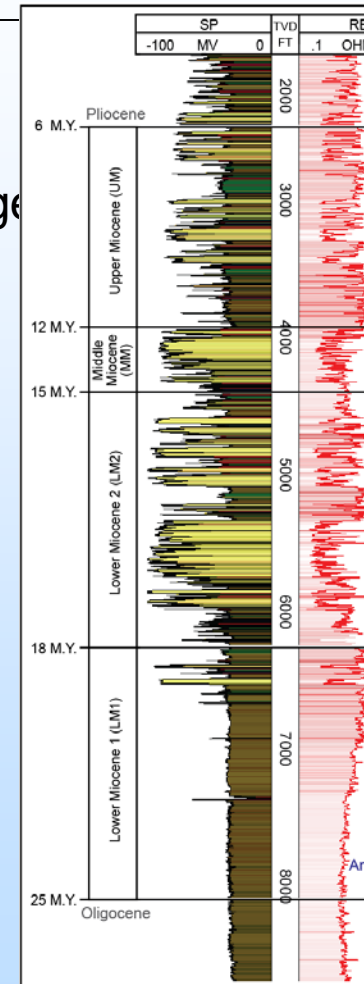
Next Steps

- Source/sink/public acceptance data
 - Geomechanics - LLNL
- Build business case(s)
- Visualize integrated projects connecting the cases



Project Overview: Goals and Objectives

- Commercial-scale characterization of a near-offshore storage complex on the inner shelf of the Gulf of Mexico
- Future permitting of a 50+ million metric ton CO₂ geologic storage complex with at least one specific storage site.
 - Advance beyond the storage site characterization completed
 - Specific injection reservoirs in detail
 - Matching sources and sinks
 - Engaging deeply with significant industrial sources
 - Engaging with the key stakeholders
 - Evaluating the evolution from EOR to saline formations
 - Concrete and detailed plans to mature the storage resource.



Milestones

Task	Milestone Title	Planned Completion Date	Verification method
1	M1: Project Kickoff Meeting	3/31/2017	Attendance at meeting; Presentation file
3	M2: Letter report documenting data used for geologic study	3/31/2017	Submit letter report to DOE documenting data used for geologic study
2	M3: Convene 1st Coordination Team meeting	6/30/2017	Submit to DOE letter report of Coordination Team members & meeting attendees
2	M4: Identify technical challenges for continued project development	9/30/2017	Quick look report summarizing findings of the CCS Coordination Team.
4	M5: Summarize outreach activity conducted in Year 1 and planned for remainder	9/30/2017	Submit to DOE letter report listing the outreach activities
2	M6: Identify non-technical challenges	12/31/2017	Submit to DOE letter report containing identified non-technical challenges for continued project development
3	M7: Detailed plan for additional characterization	12/31/2017	Submit to DOE letter report of a detailed plan for additional characterization of the storage complex and specific site(s)
2	M8: Convene 2nd Coordination Team meeting	3/31/2018	Submit to DOE letter report of Coordination Team members & meeting attendees

Benefit to the Program

1. Develop and validate technologies to ensure 99 percent storage permanence.
2. Develop technologies to improve reservoir storage efficiency while ensuring containment effectiveness.

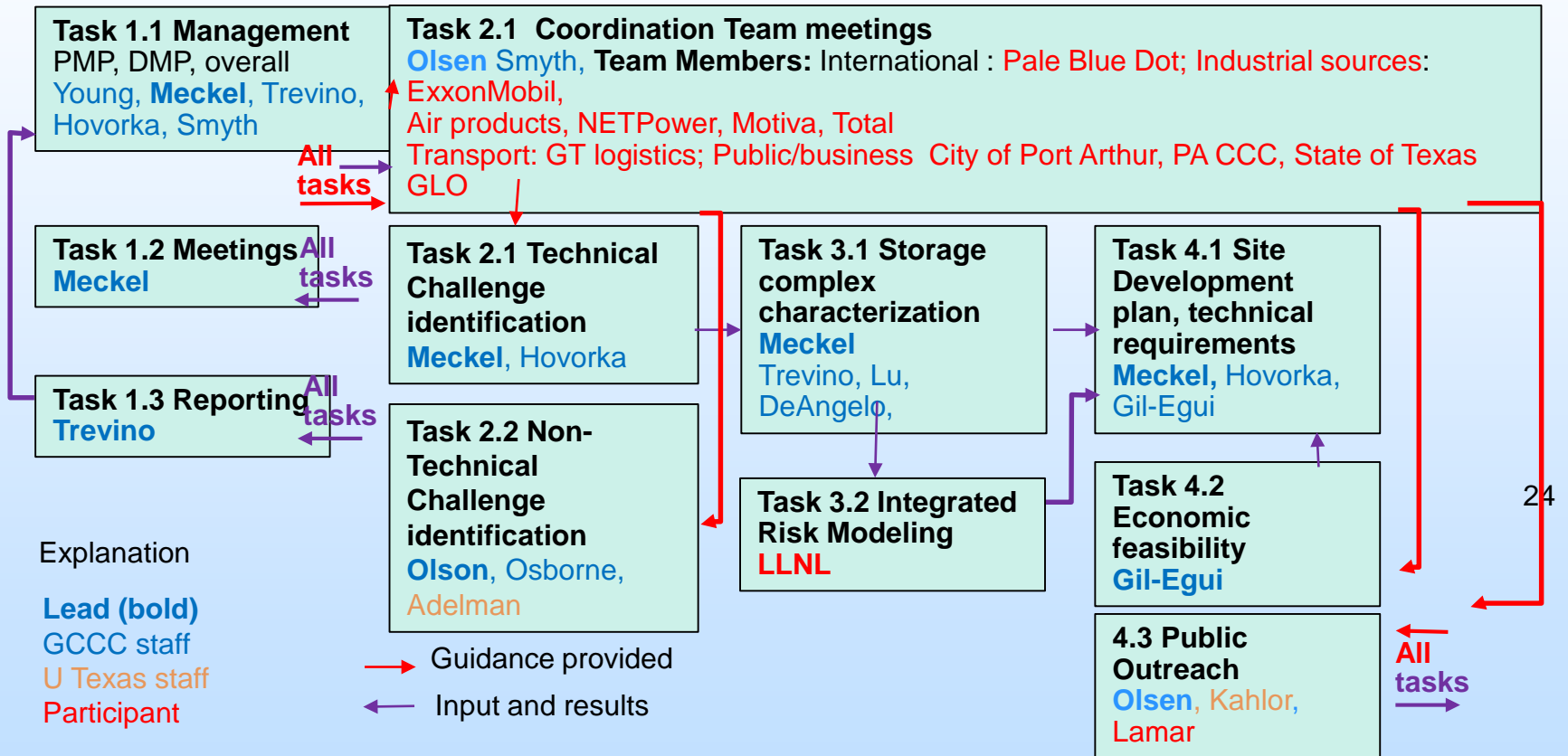
Novel offshore approaches

3. Support industry's ability to predict CO₂ storage capacity in geologic formations to within ± 30 percent.

Access to very large capacity areas in geology of continental shelves

4. Develop best practice manuals.

Organization Chart



Gantt Chart

		BUDGET PERIOD 1						
		YEAR 1				YEAR 2		
Task Numbers	Task Titles	qtr 1	qtr2	qtr3	qtr4	qtr 1	qtr2	
		J-F-M	A-M-J	J-A-S	O-N-D	J-F-M	A-M-J	
		2017				2018		
CarbonSAFE Phase II: Storage Complex Feasibility - Northwest Gulf of Mexico		Q = Qtr Report; A = Ann Report; M = Milestone D = Deliverable; DP = Decision Point; F = Final Report						
1	Project Management, Planning, and Reporting							
1.1	Revision and Maintenance of Project Management Plan	M1, D1, D2					D8	
1.2	Meetings							
1.3	Reporting	Q	Q	Q	Q/A	Q	Q/F	
2	CCS Coordination Team Formation							
2.1	Coordination Team Meetings	M3					M8	
2.2	Technical Challenge Identification						M4	
2.3	Non-Technical Challenge Identification						M6	
3	High-level Technical Evaluation of sub-basinal storage and Integrated Risk Assessment							
3.1	Storage Complex Geologic	M2					M7	D4
3.2	Integrated Assessment Modeling						D5	
4	Site Development Plan							
4.1	Technical Requirements						DP1	
4.2	Economic Feasibility							
4.3	Public Outreach						M5	

Bibliography

No CarbonSAFE – only publications yet submitted

- . Miocene offshore storage atlas from regional characterization study will be published by BEG 2017

Related recent GoM papers:

- Carr, D. L., Wallace, K. J., Yang, Changbing, and Nicholson, A. J., 2016,
- Carr, D. L., Wallace, K. J., Nicholson, A. J., and Yang, Changbing, in review
- CSLF
- Lu, Jiemin, Carr, D.L. Trevino, R.T., Rhatigan, J.T, and Fifariz· Reynaldy
- Meckel, T., and Mulcahy, F., 2016.
- Meckel, T. A. and Rhatigan, J.T. , in review,
- Meckel, T. A. (PI) and Trevino, R. H. (co-PI), 2015a
- Meckel, T. A. (PI) and Trevino, R. H. (co-PI), 2015b“Nicholson, A.J, 2012,.
- Texas General Land Office, Texas Commission on Environmental Quality, and Texas Railroad Commission, Bureau of Economic Geology, 2010, Injection and Geologic Storage Regulation of Anthropogenic Carbon Dioxide, 103 pages <http://www.rrc.state.tx.us/forms/reports/notices/SB1387-FinalReport.pdf>
- Yang, C. B., R. H. Trevino, T. W. Zhang, K. D. Romanak, K. Wallace, J. M. Lu, P. J. Mickler, and S. D. Hovorka, 2014

First and second International Offshore storage workshop

Pearl River Mouth Basin, Guangdong

