



3rd International Workshop on Offshore Geologic CO₂ Storage

Tim Dixon, IEAGHG

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CSLF Technical Group

17 October 2018

3rd Workshop



Hosted by RCN, Oslo, 3-4 May 2018

Aim: To address and build-on the recommendations and topics raised at the first two workshops to take offshore storage forward. Continuing theme of 'how to do'.

Scope:

- How to learn from learnings?
- Value Chains for Offshore
- Infrastructure (re-use)
- Monitoring offshore CO₂ storage/EOR
- Offshore CO₂ storage resource assessment
- Project updates
- Standards and Regulatory Frameworks
- Brainstorming towards an international collaborative project

CSLF Report on Offshore Geologic CO₂ Storage



- *“There is a growing wealth of research, development and practical experiences that are relevant to CO₂ storage offshore, but this expertise is familiar only to a few specific countries around the world. However there is also significant global potential for offshore CO₂ storage, and countries who are not yet active but may become interested in offshore storage, would benefit from knowledge sharing from these existing experiences and expertise. Such international knowledge sharing would be facilitated by international workshops and by international collaborative projects.”*
- *(CSLF Ministerial Nov 2015: CSLF-T-2015-06)*

Workshop Series

- **1st Workshop. 19-21 April 2016, at the BEG, University of Texas, Austin.** 50+ attendees from 13 countries.
- Organised by the Bureau of Economic Geology (BEG) at The University of Texas at Austin in collaboration with the South African Centre for CCS at SANEDI, IEAGHG and with support from CSLF and UNFCCC's CTCN
- To facilitate sharing of knowledge and experiences among those who are doing offshore storage and those who may be interested.
- [IEAGHG Report 2016-TR2](#)
- **2nd Workshop. 19-20 June 2017, at Lamar University, Beaumont, Texas.** 50+ attendees from 9 countries.
- To address and build-on the recommendations and topics raised at the first workshop to take offshore storage forward. Continuing theme of 'how to do'.
- [IEAGHG Report 2017-TR12](#)

Value Chains



- New interest in EU and Japan from Hydrogen as a fuel has the potential for significant emissions reductions and opportunities for CCS
- In USA the new 45Q is significant to stimulate projects.

2. Hydrogen supply Chains

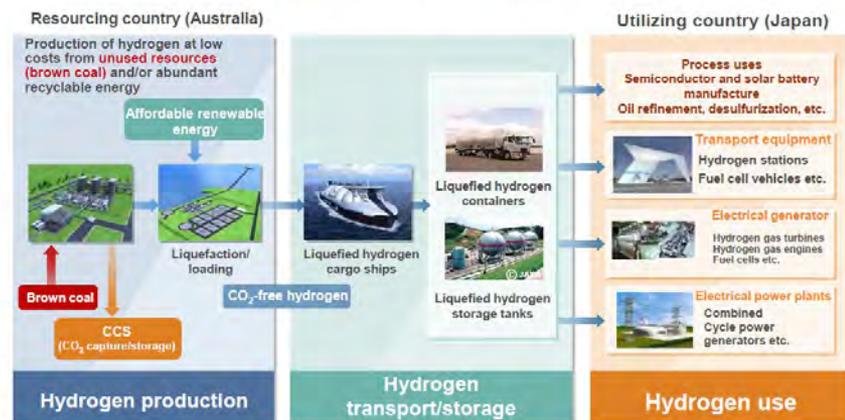
Statoil Hydrogen Portfolio



Steinar Eikaas Equinor

The Concept of CO₂-free Hydrogen Chains

Stably supplying energy while suppressing CO₂ emissions



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Infrastructure



- Re-use not necessarily easy. More likely to be able to re-use pipelines than platforms
- More R&D on legacy abandoned wells (learn to deal with). Different standards in time, region, purpose



Infrastructure Platforms

- Aims
 - Safe operations
 - Reduce development and operations cost
- Implications
 - Minimal facilities - receive CO₂ & distribute it to wells
 - Different operational hazards
 - Brown-field modifications project
- Considerations
 - Structural integrity
 - Life extension requirements
 - Equipment replacement & removal
 - Suitability of wells & well bay area



Monitoring



- Permanent Reservoir Monitoring benefits outweigh extra costs, but coverage inflexible
- Different methods informing each other, including trigger methods, so complimentary monitoring crucial
- Marine environment baselines – are learning more
- AUV proving successful for long term surveillance, temporal and spatial, public assurance
- Find anomaly and attribute
- HR4D seismic can be used for characterization of shallow leakage structures and for monitoring the plume during injection
- Microseismic needs background data

Resource Assessment



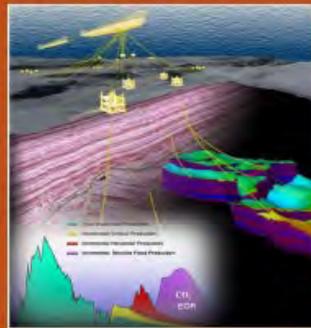
- Can spend too much time on refining broad static assessments – can leapfrog from regional to more local assessment including dynamic, eg SRMS. Resource qualification and quantification will become more important

Storage resource assessment for offshore CO₂-EOR in Norway



3rd International Workshop on Offshore Geologic CO₂ Storage, Oslo May 3-4 2018

Eva Halland, Project Director, Norwegian Petroleum Directorate



The Norwegian CO₂ Storage Atlas was launched by the Minister of Petroleum- and Energy Department May 20th 2014

Eva Halland NPD

<https://store.beg.utexas.edu/reports-of-investigations/2441-ri0263-atlas.html>

Report of Investigation No. 263

Geological CO₂ Sequestration Atlas of Miocene Strata, Offshore Texas State Waters

Edited by R. H. Treviño and T. A. Meckel



2017

Bureau of Economic Geology
Scott W. Tinney, Director
The University of Texas at Austin



CHAPTERS

1. Regional Geology of the Gulf of Mexico and the Miocene Section of the Texas Near-offshore Waters
2. Implications of Miocene Petroleum Systems for Geologic CO₂ Storage beneath Texas Offshore Lands
3. Evaluation of Lower Miocene Confining Units for CO₂ Storage, Offshore Texas State Waters, Northern Gulf of Mexico, USA
4. Capillary Aspects of Fault-Seal Capacity for CO₂ Storage, Lower Miocene, Gulf of Mexico
5. Regional CO₂ Static Capacity Estimate, Offshore Saline Aquifers, Texas State Waters
6. Field-scale Example of Potential CO₂ Sequestration Site in Miocene Sandstone Reservoirs, Brazos Block 440-L Field
7. Estimating CO₂ Storage Capacity in Saline Aquifer Using 3D Flow Models, Lower Miocene, Texas Gulf of Mexico
8. Appendix A: Regional Cross Sections, Miocene Strata of Offshore Texas State Waters

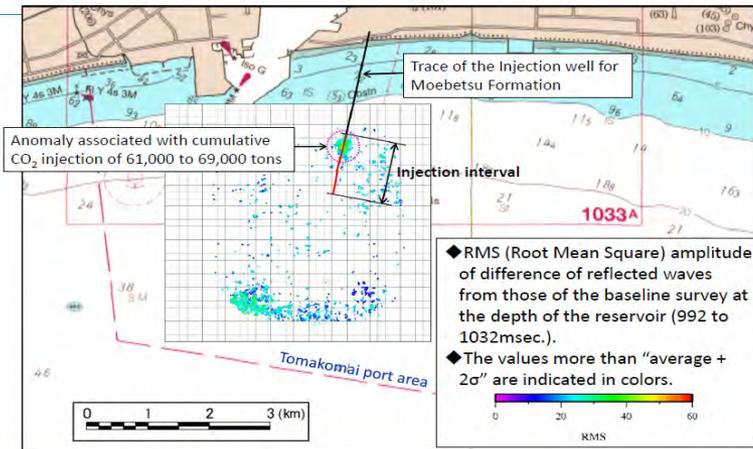
Tip Meckel BEG

Projects



- Norway is developing a full scale project on industry and the US is developing a robust offshore research and development program. Japan and Brazil have mature projects ongoing
- 4D seismic very encouraging at Tomakomai – first imaging of CO₂ at 60,000t at 1km depth.

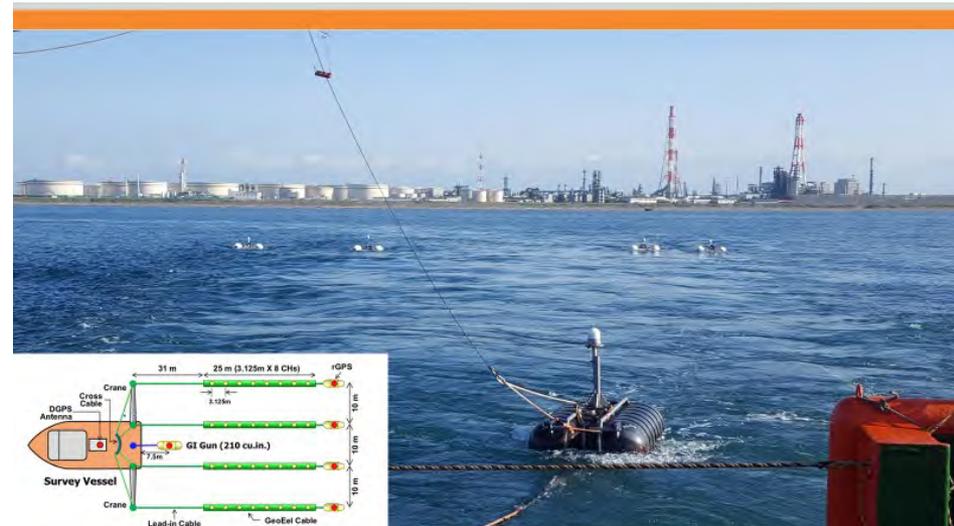
4D seismic survey : Preliminary result of the first monitor survey



Plotted on Japan Coast Guard Nautical Chart

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Jiro Tanaka JCCS



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Regulations



- Should adapt to learnings
- ISO useful for trust with different actors and stakeholders
- London Protocol scope needs clarification – projects can help test applicability wrt export prohibition

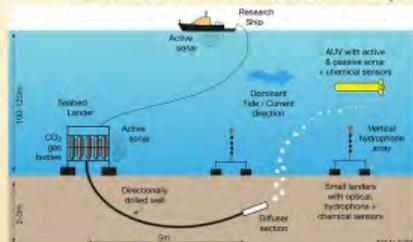
Approach: Leakage detection, localisation and quantification

Aim: better understand fluid and gas flow in operational conditions, leading to efficient and economic monitoring strategies.

- **Controlled release experiment (2019):** Injection of CO₂ into shallow sediments at Goldeneye – comprehensive monitoring programme based on chemical and acoustic methods for both detection and quantification.



Goldeneye Field location



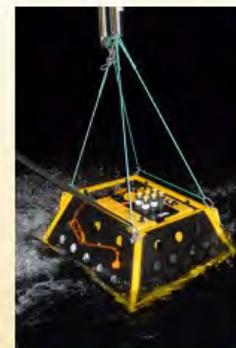
Schematic of the shallow sub-surface release of CO₂ gas in sediments (< 5 m depth) that will be conducted at the Goldeneye field in the North Sea.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 654462

Establishing baselines

Geochemical Field Experiments – August 2017



Baseline Lander. Image courtesy Peter Linko

Baseline lander deployment and geochemical sampling, benthic boundary layer experiments (e.g. gradient flux techniques)

Lander equipped with:

1. Commercial instruments
 - Upward looking ADCP
 - Seabird CTD
 - Hydrophones
 - Deep SeapHOx
2. Lab on chip sensors developed at the National Oceanographic Centre to measure nitrate, phosphate and pH



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Criteria for International Collaboration



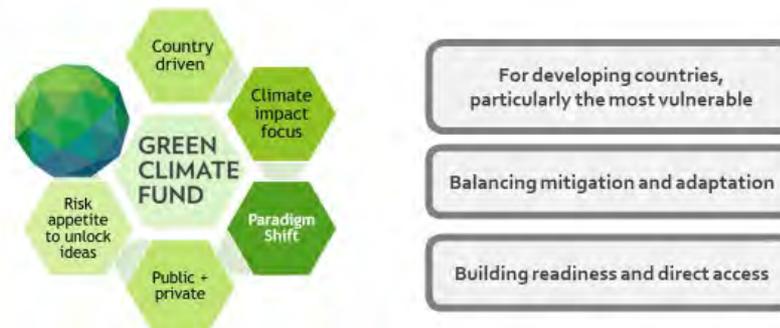
- (the what and the how, not the where)
- Objective is to share learning by doing from the real projects
- Need roadmap to info sources
- Can we learn from the International Space Station or the International Ocean Discovery Program, for CCS
- The ACT initiative could be used for projects, not just R&D
- Develop ACT to operationalise Mission Innovation
- Could OGCI fund a real project?

Funding



- Some major international funders keener on non-fossil fuel technologies
- CCS value needs better advocacy to funders
- Norwegian project seeking international collaboration
- Green Climate Fund will use SDGs as one of 6 criteria – CCS lacking evidence-base to support it in SDGs (IEAGHG addressing this)

Green Climate Fund (GCF) – A catalyst for paradigm shift



Recommendations



- Explore models for international collaboration project
- Eg An ACT good for R&D (US joining), so an ACT for projects
- Joint funding between countries has started and should continue
- Consider how to build knowledge sharing from hands-on operational projects , including international collaboration project
- Provide a roadmap to existing info sources
- Complimentary monitoring to be build into MVA plans - different monitoring methods informing each other, including trigger methods
- To survey which Developing Countries would be attracted to offshore storage
- Getting Developing Countries to these meetings. Identify key persons.
- More advocacy to funders on CCS – future NDCs will need CCS, how to make countries aware of their potential. Research community is ready to inform.

Steering Committee



Tim Dixon, IEAGHG (Chair)

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The presentations are available at
<http://www.beg.utexas.edu/gcc/research/goi>

The report is available at
<https://ieaghg.org/publications/technical-reports>
as IEAGHG 2018/TR02

