



4th International Workshop on Offshore Geologic CO₂ Storage

Emerging CCS country needs and progress - Taiwan

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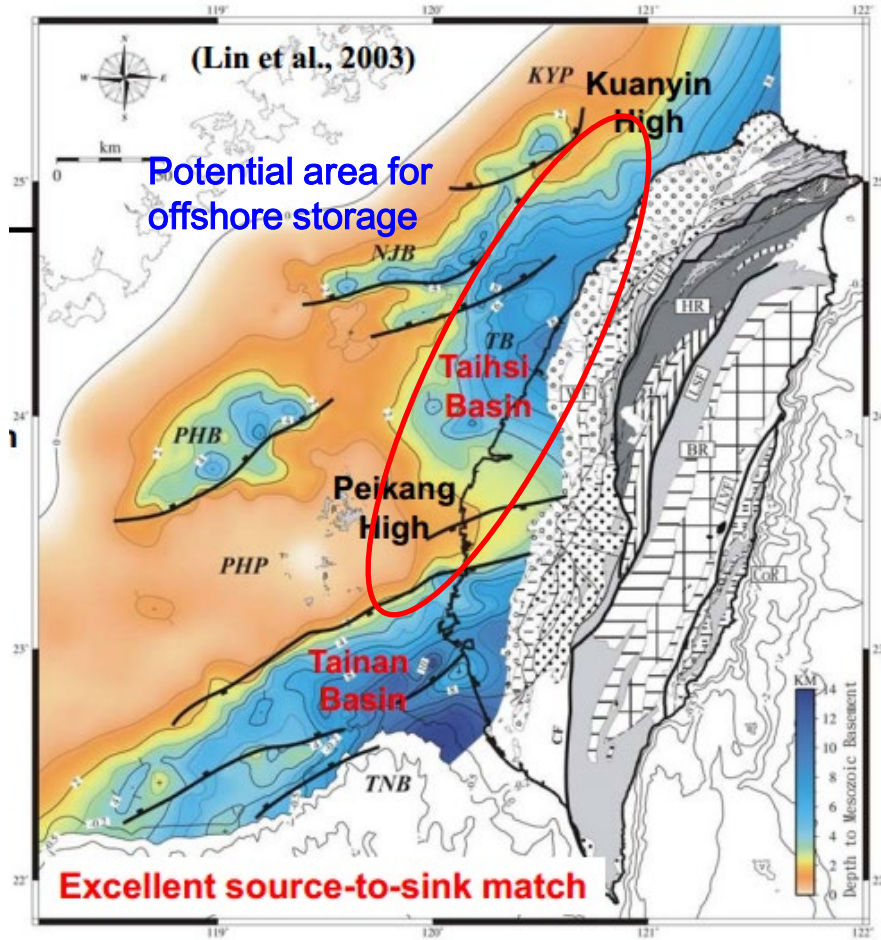
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Content

- Storage Potential in Western Taiwan
- Current Status of CCS Technology in Taiwan
- Recent Progress
- Need and Path Forward

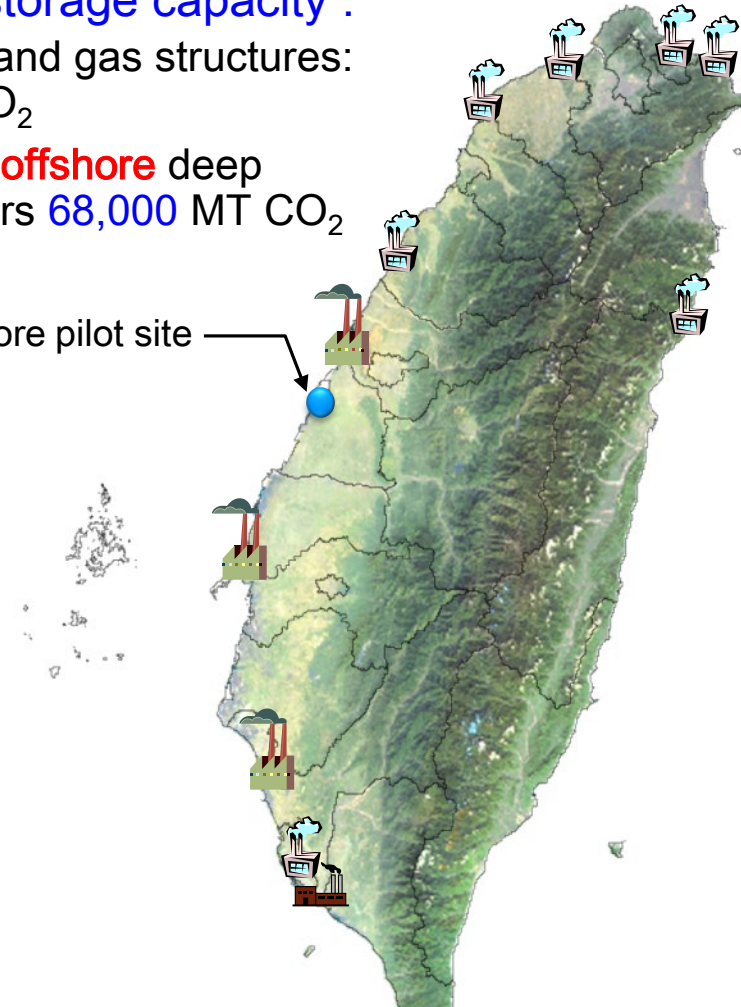
Storage Potential in Western Taiwan



Estimated CO₂ storage capacity :

- Onshore oil and gas structures: 2,800 MT CO₂
- Coastal and **offshore** deep saline aquifers 68,000 MT CO₂

Proposed near-shore pilot site



- ✓ Up to 8 km thick sediment
- ✓ Taiwan strait and coastal area (saline)
- ✓ Western foothills (oil/gas structure)

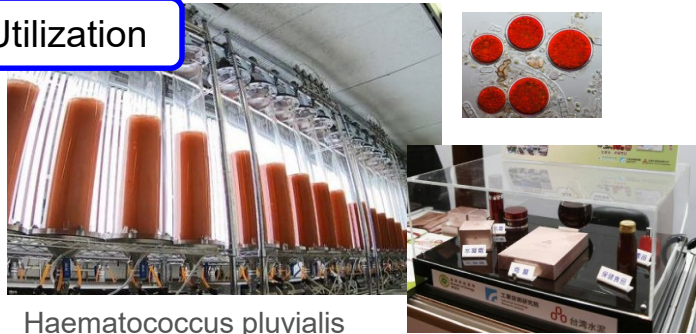
- Most **power plants and industrial parks** are located in the western part of Taiwan, where **suitable sedimentary basins** and rock formations for CO₂ storage are available

CO₂ Capture: Calcium looping

- 1.9MWt and 500kWt pilot trials in eastern Taiwan (*Taiwan Cement Corporation, ITRI and Bureau of Energy, Taiwan*)
- Preparing for scale-up and demo plant construction (10MW_t, 55,000t-CO₂/yr)
- Utilizing the captured CO₂ to grow microalgae for valuable products at the end of the process



Utilization



CO₂ Capture: Solar-assisted post-combustion carbon capture

- Testing solar-assisted post-combustion carbon capture for an existing coal-fired power plant in Taichung (*Taiwan Power Company*)
- Planning a pilot scale capture test facility and the establishment of carbon reduction technology park

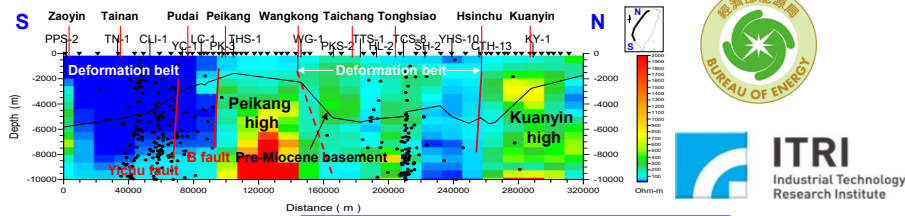
Solar-assisted post-combustion carbon capture test unit



Current Status of CCUS Technology in Taiwan

CO₂ Storage:

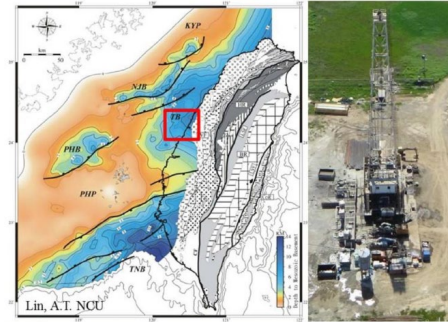
- Capacity building on site characterization, monitoring, and numerical simulation (*ITRI and Bureau of Energy, Taiwan*)



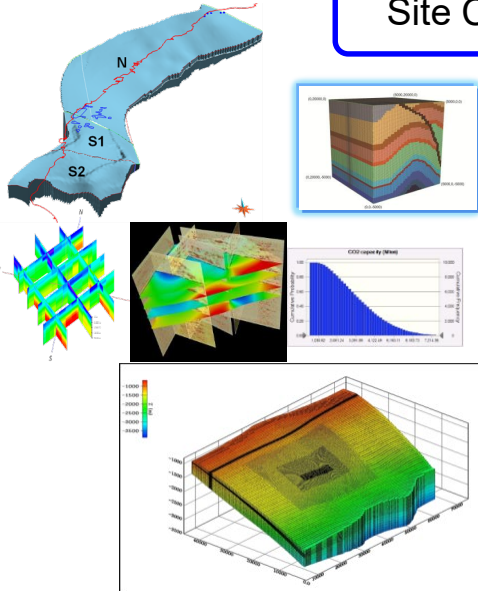
Site Characterization

CO₂ Storage:

- Geological drilling, site characterization, and baseline data collection (*Taiwan Power Company*)

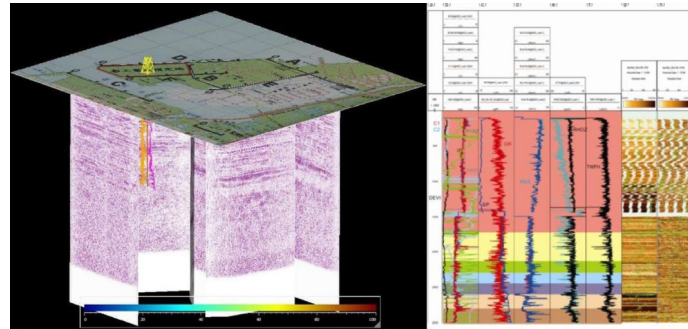
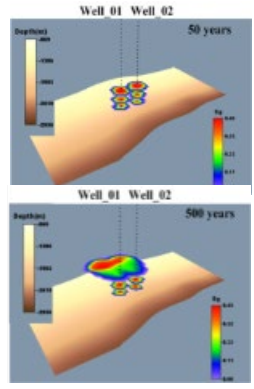


A 3,000 meters geological characterization well (completed)

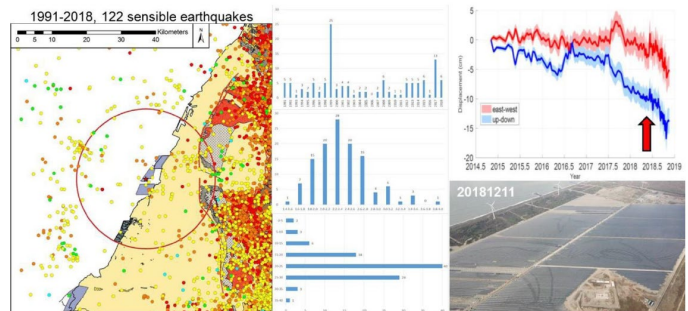


3D Geological Modeling and Capacity Estimation

Numerical simulation of CO₂ injection



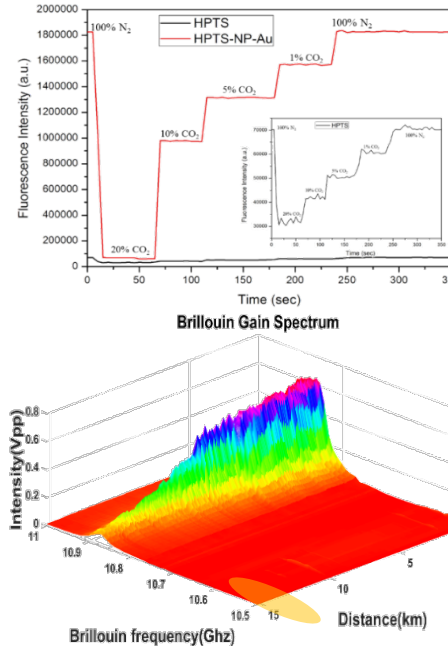
Site characterization and geological modeling



Baseline data collection (ongoing)

● Monitoring

- High sensitivity fiber-optic CO₂ sensing material based on HPTS (8-Hydroxypyrene-1,3,6-trisulfonic acid trisodium salt, a fluorescent pH indicator)
- Distributed down-hole monitoring based on BOTDA (Brillouin Optical Time Domain Analysis) technology (*Tsai et al., 2019*)



CO₂ sensing material
S/N ratio improvement by
90-fold after nano gold
modification

Distributed sensing based
on BOTDA technology:
spatial resolution ~ 4m /
15km fiber (lab work)

● Risk Assessment

- Capacity building on quantitative risk assessment with NETL - National Risk Assessment Partnership (NRAP)
- Case study on onshore and offshore storage site using NRAP IAM-CS (*Liao et al., 2018*)
- Use case under development using NRAP Open-IAM



ITRI
Industrial Technology
Research Institute



NETL
NATIONAL
ENERGY
TECHNOLOGY
LABORATORY



14th International Conference on Greenhouse Gas Control Technologies, GHGT-14

21st -25th October 2018, Melbourne, Australia

Preliminary Leakage Risk Assessment for Geologic Carbon Storage
Site Selection: A Case Study

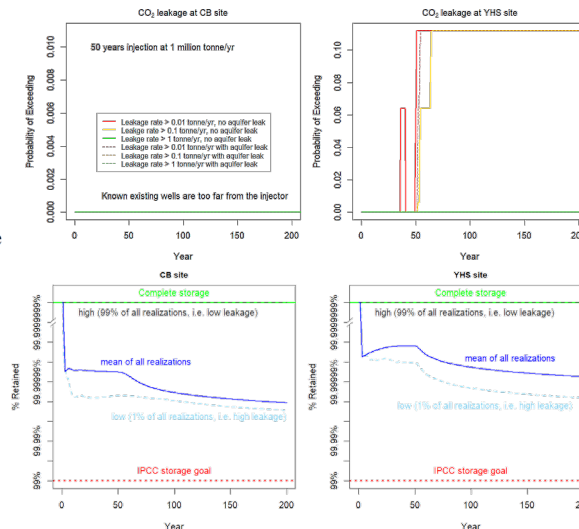
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Quantitative Risk Assessment:
Risk profiles and CO₂ retained
under different scenarios



● Public outreach

- Barriers remain to be overcome for geological storage – public acceptance
- Public Outreach Forum for Geologic Carbon Storage on Feb. 6, 2020
 - Understand the stakeholders' attitudes towards and awareness, perceptions, interests and concerns of CCS
 - Facilitate the dialogue among the experts in public communication, the experts in CCS technologies and the local NGO groups
 - Propose a workable plan to facilitate the public communication and engagement of geologic carbon storage



Negative report from the media (June 15, 2013)



Opposition from the local communities

● Adaptation of ISO standard

- Efforts on adaptation of standards to increase public awareness
- Promoting and drafting national standards in collaboration with Taiwan CCSU association (adaptation of ISO27917 Vocabulary — Cross cutting terms – recommendation draft submitted to Bureau of Standards, Metrology and Inspection)

- **Alternatives to onshore geologic CO₂ storage**
 - Transboundary CO₂ transportation if domestic storage is not available
 - Possibility for regional offshore CO₂ hub (collect / re-distribute / storage)
- **Public communication and engagement of geologic carbon storage**
 - Practical solutions for effective public outreach and engagement
- **International collaboration and knowledge exchange**
 - Capacity building of offshore site characterization and monitoring technologies



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