Status of Offshore CO2 Storage in China

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Outline

1. CCUS status in China
2. Assessment of offshore storage potential
3. Towards storage demo offshore Guangdong
4. Knowledge gaps and future plan

1. CCUS status in China

(ADB, 2015, CCS roadmap for China)

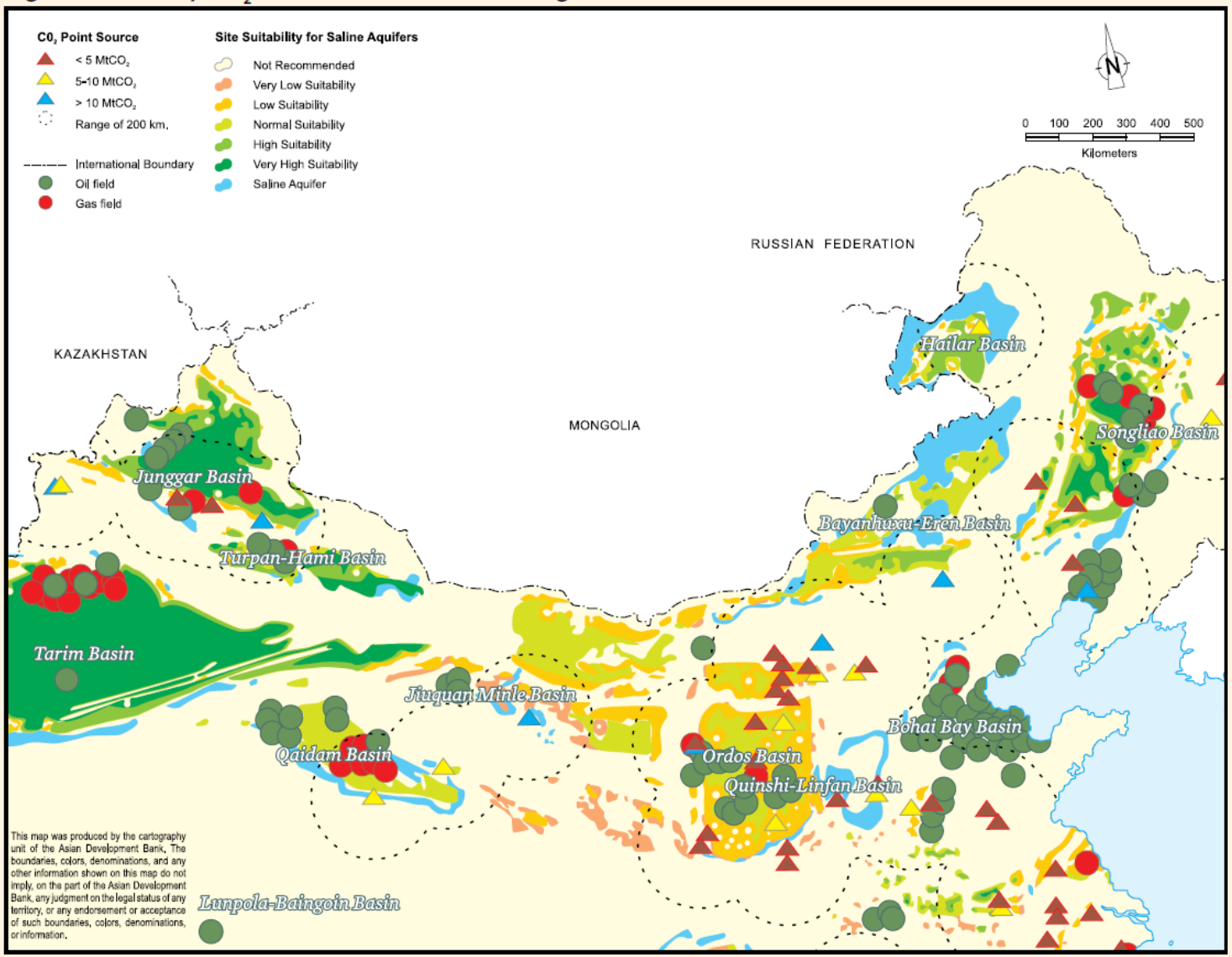
- 90% energy consumption in China is coal-based. By 2030 still >2/3 energy is expected from coal (Global average 24%).

- “Clean and efficient utilizations of coal” is listed as the 8th of the 100 key projects of the “13th Five-year Plan” of China .

- CCUS is featured in the “Greenhouse Gas Control Action Plan for the 12th Five-year Plan (2011-2015) ”

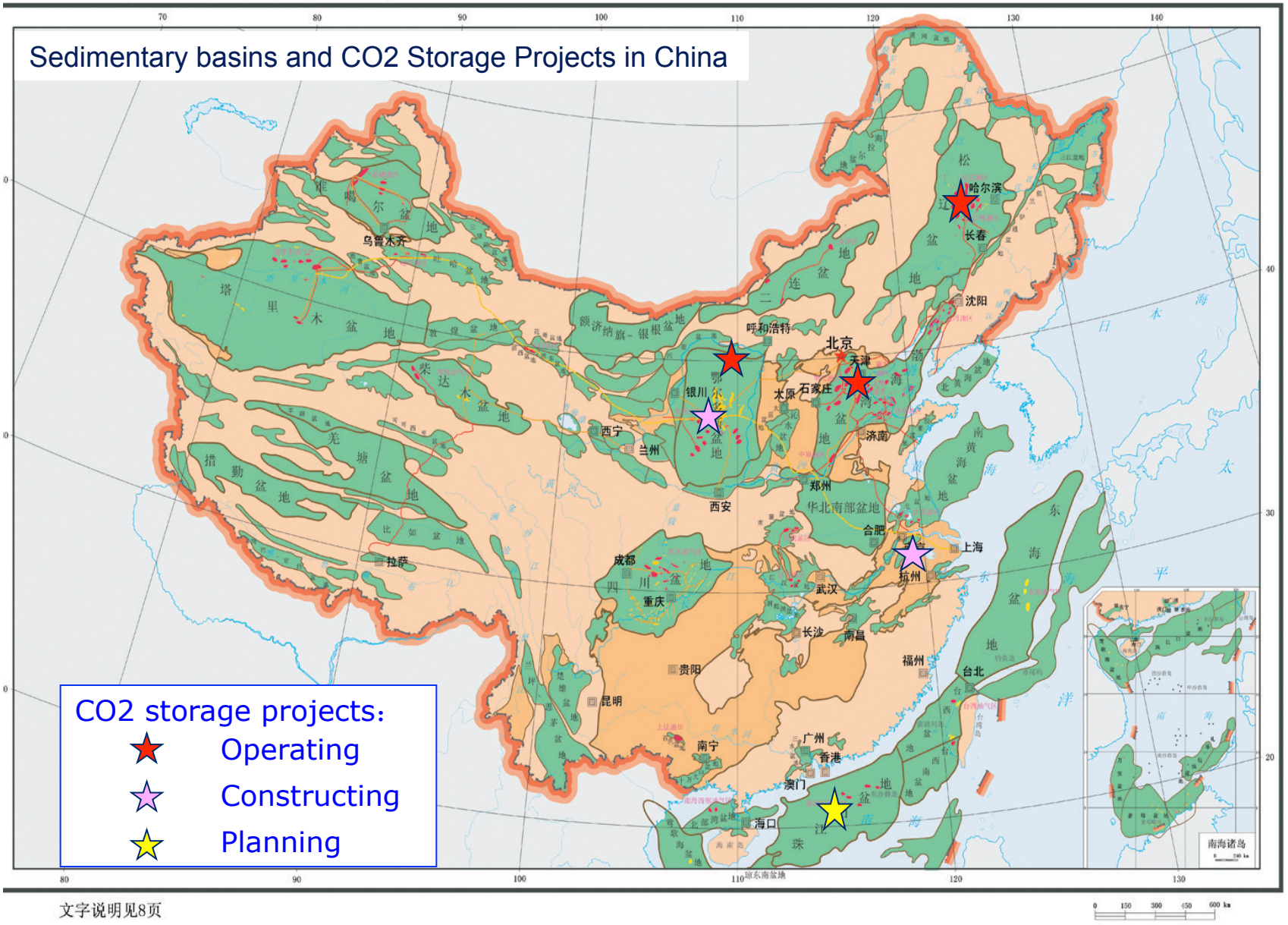
- A phased approach is suggested:
  - Low-cost CCS, coal-chemical capture + CO2-EOR;
  - Wider CCS deployment beyond 2030.

Figure A1: Priority CO_2 Emission Sources and Storage Sinks in the PRC



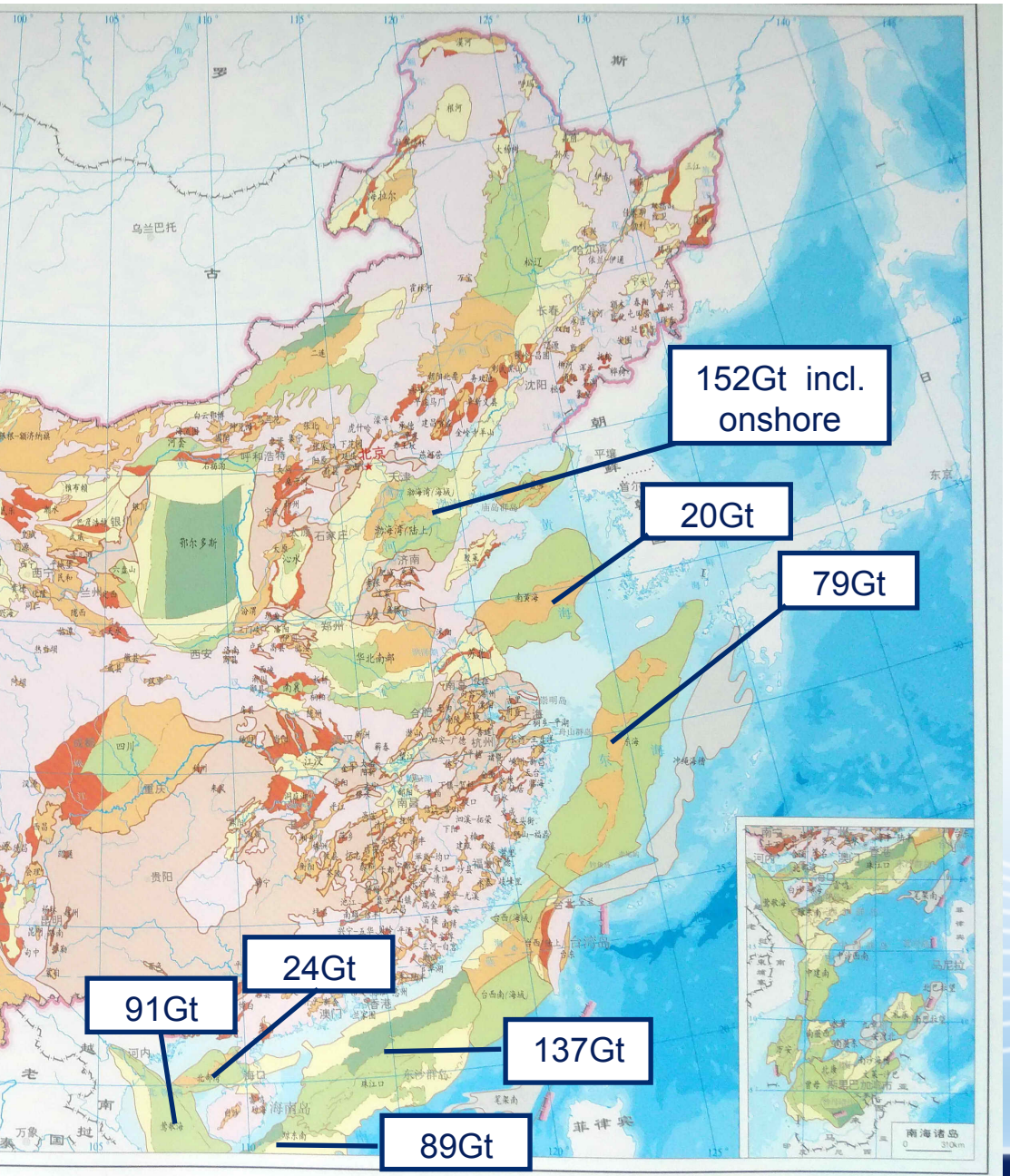
CO_2= carbon dioxide km= kilometers, $MtCO_2$= million tons of carbon dioxide.
Source: ADB (2014d).

Major emission sources are in NE, and inland storage sinks are in N China



Current storage projects are mostly in northern China

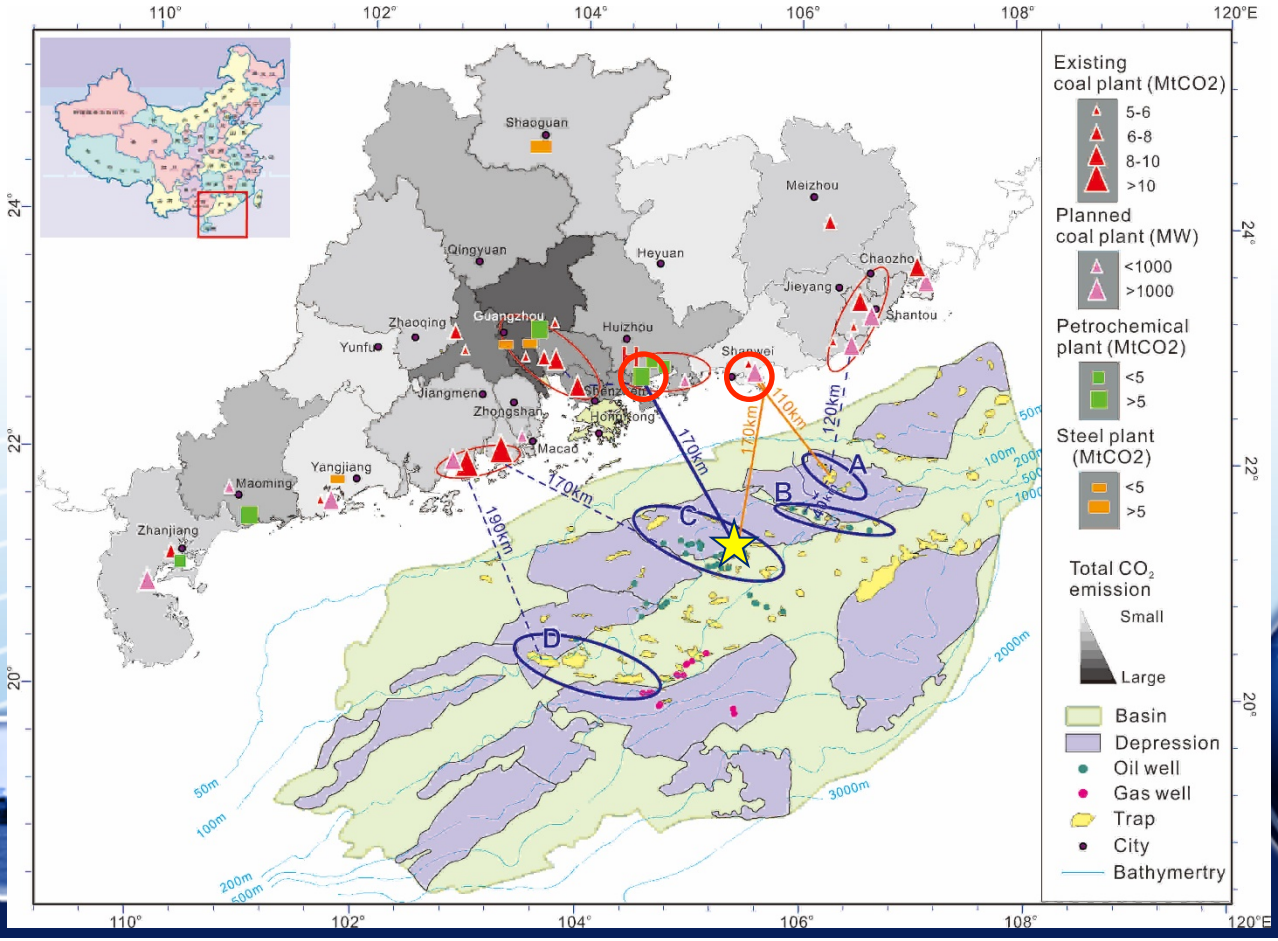
2. Assessment of offshore storage potential



- 2012 project: Assessment of CO_2 storage potential in China on a basin-level.
- The effective storage potential in China Seas are 1655$GtCO_2$, among which the 10 near-shore basins has potential of 656$GtCO_2$.

3. Towards storage demo offshore Guangdong

- Coastal sources match well with offshore storage sites
- The first CCUS Demo Project of Guagdong province:
  - 1 MtCO2/a from coal-fired power plant and petrochemical plant
  - Store in offshore oil fields for EOR and sequestration



華潤電力
CR Power

Unit 1: Testing platform
(10 tCO2/d generic and flexible solvent test unit)

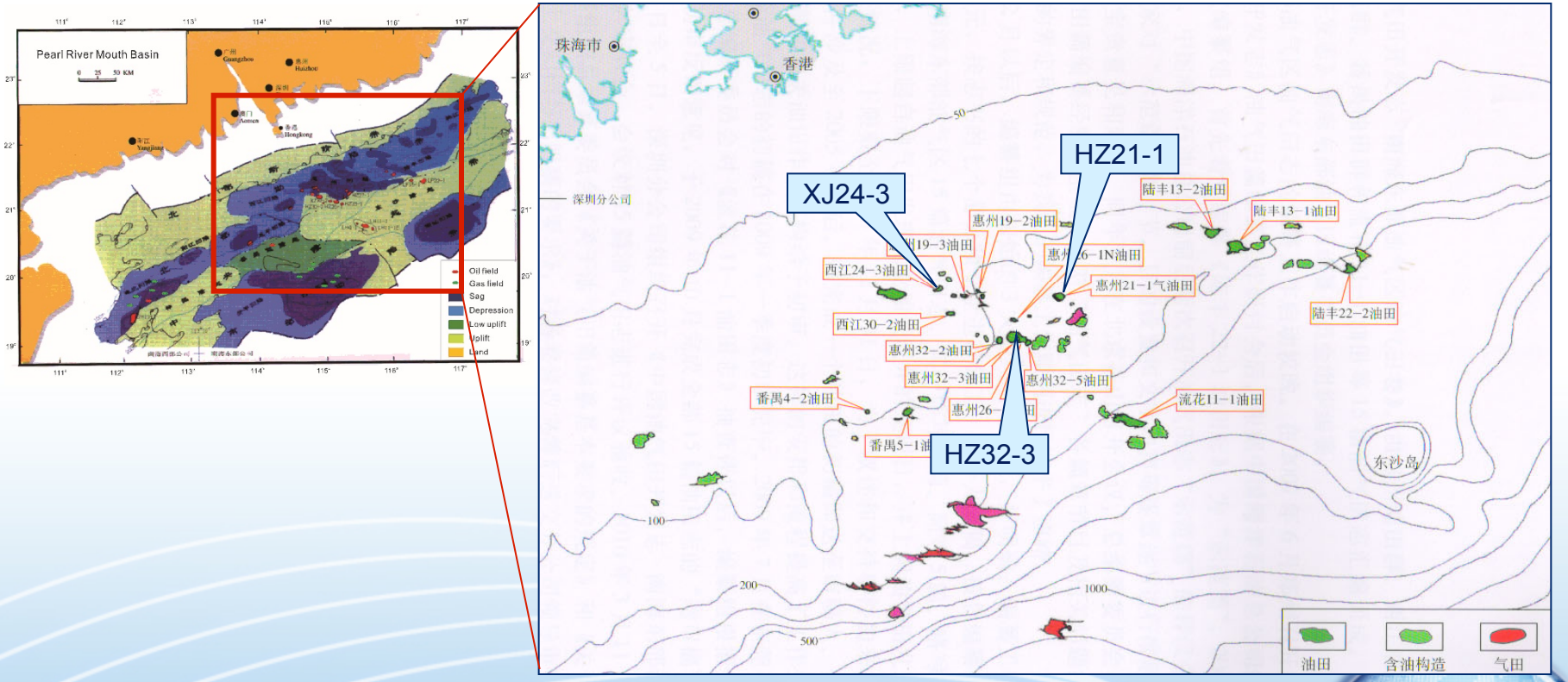
Unit 3 & 4: Capture Ready Design

Multinational Partners :

Guangdong CCUS Centre, UK CCS Research Centre

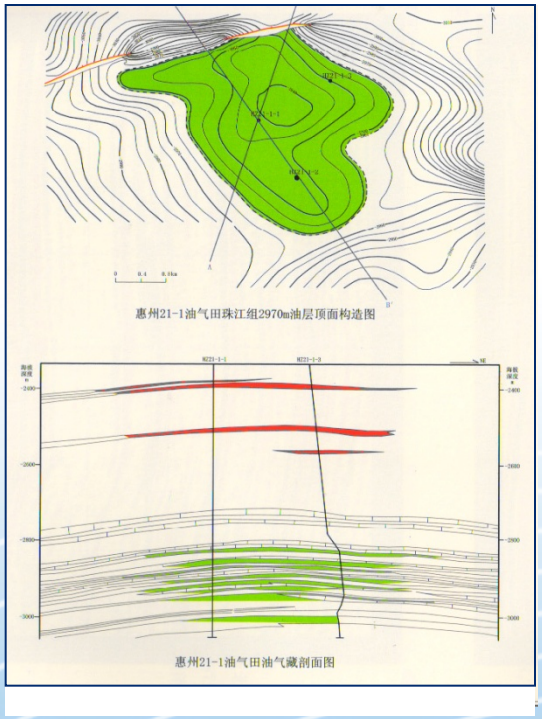
National Carbon Capture Center - NCCC (USA) , CO2CRC (Australia)

16 producing oil fields screened, three were selected as candidates.

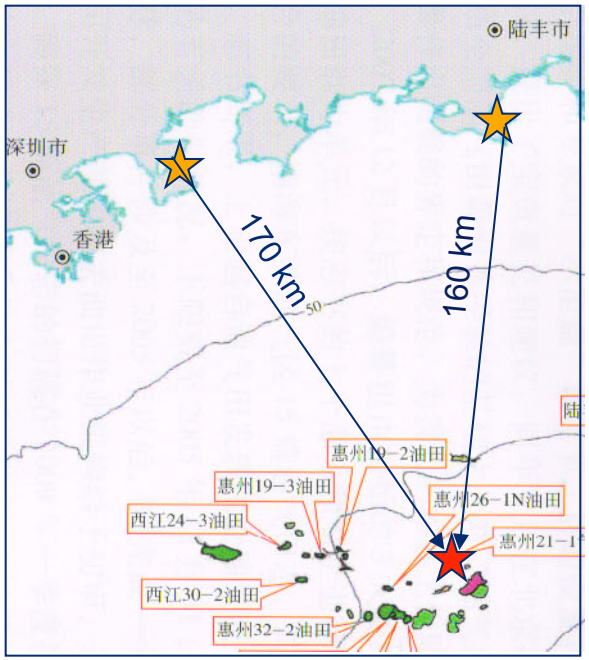


Near depleted field

HZ21-1

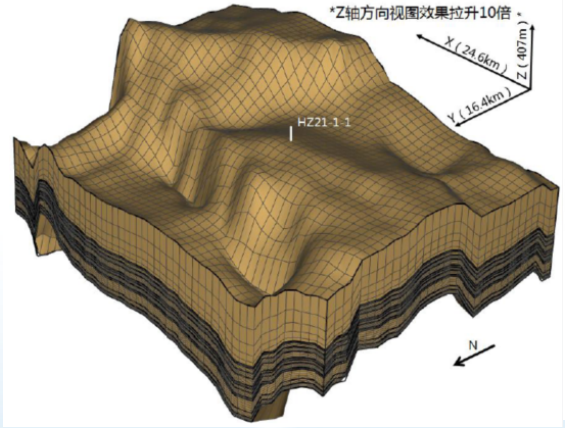


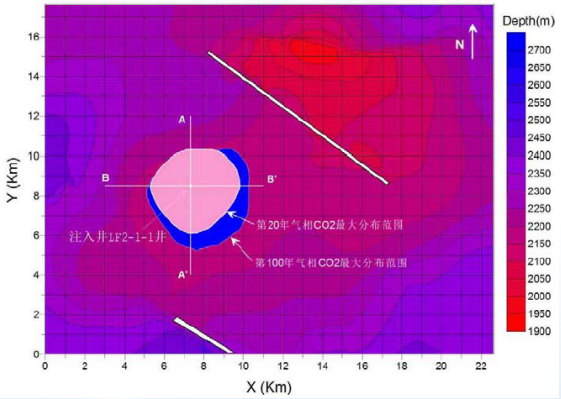
- Dome of 10.5 km^2
- OOIP ~16 Mt
- 8 oil reservoirs, 2820~3000m sub-seafloor
- Producing oil&gas since 1990; now oil production is small
- 4-leg platform with 15 well slots + gas processing platform
- A 233km 20”pipeline to coastal terminal

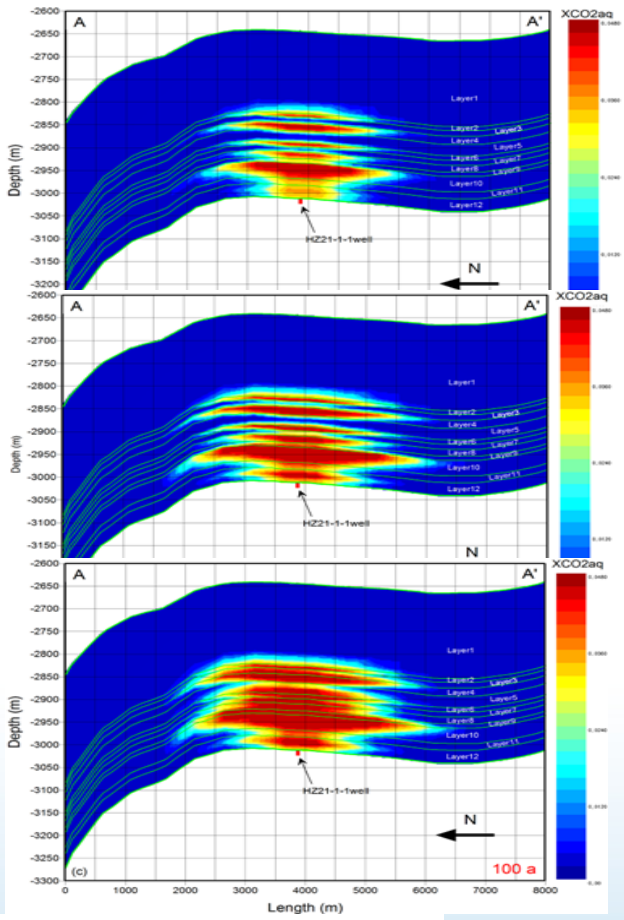


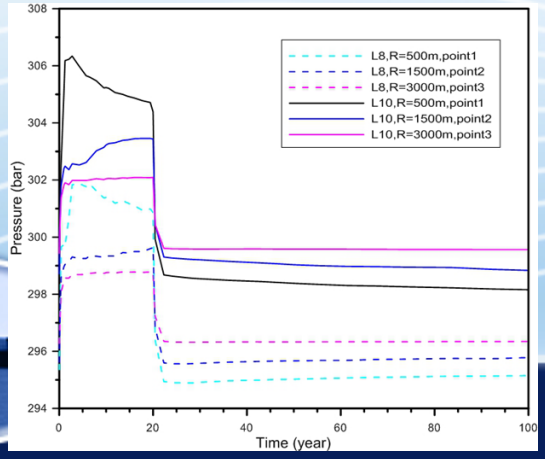
Injection modeling

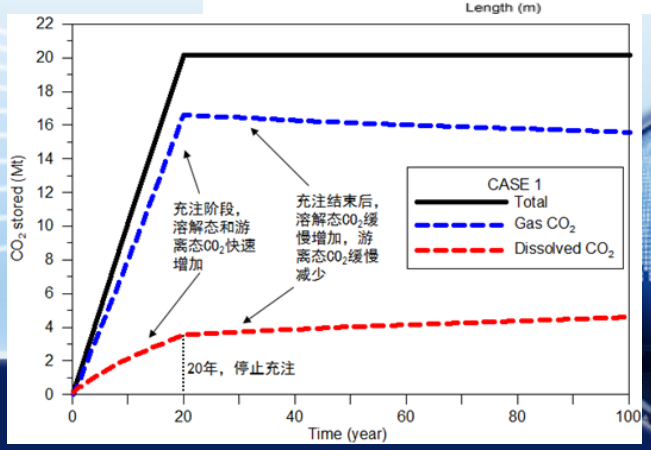
- Primary modeling indicates it is capable of injecting CO2 at 2MtCO2/a for 20 years
- Maximum CO2 dispersion <3km
- Maximun pressure buildup <1% of original reservoir pressure





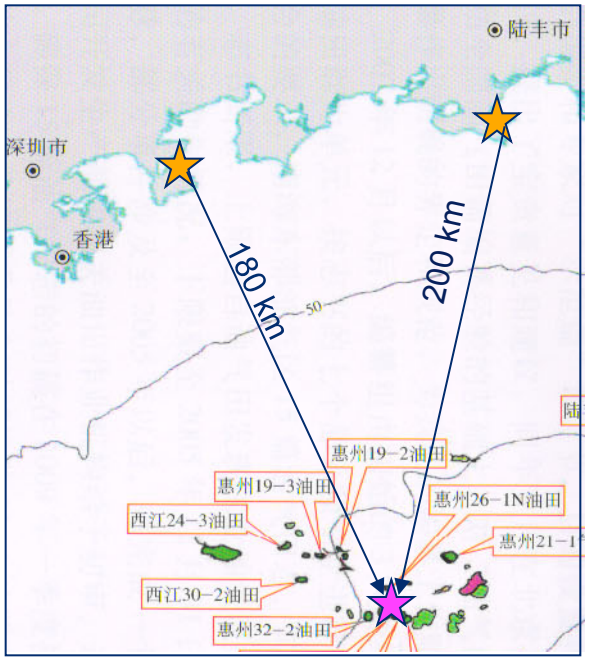






HZ32-3 Oil Field

- Structural & lithological trap of 24 km^2
- OOIP 30 Mt, recoverable 20 Mt
- 8 oil layers, with one major layer with 43m oil column height
- 1955~2522m sub-seafloor
- 4-leg platform with 12 well slots
- Producing oil since 1995 at high rate



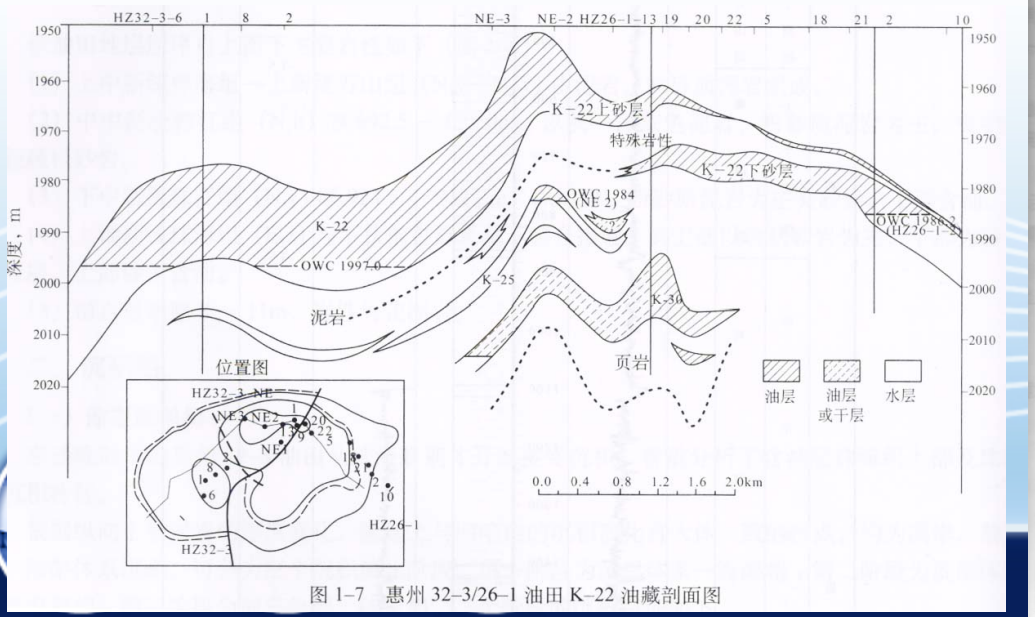


图 1–7　惠州 32–3/26–1 油田 K–22 油藏剖面图

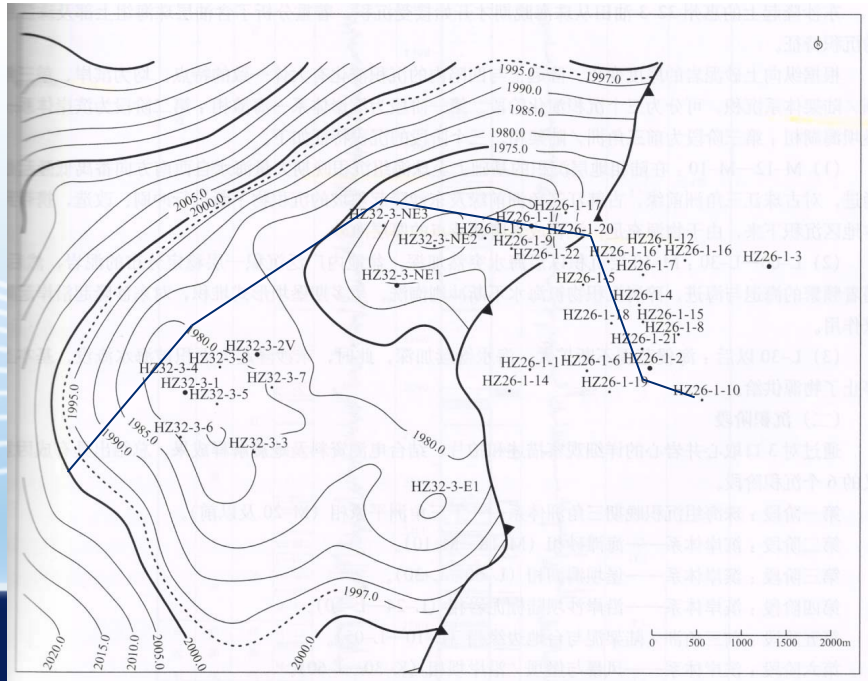
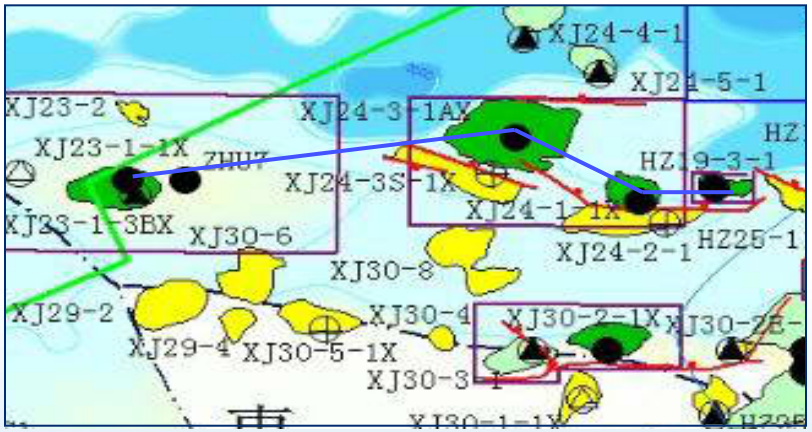


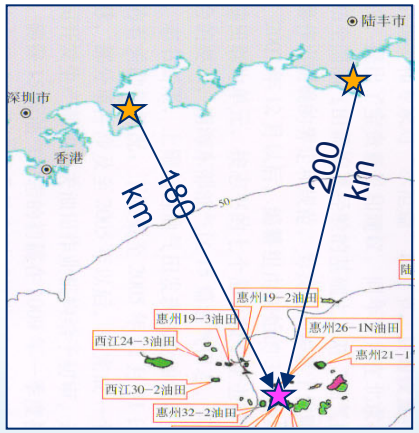
图 1–5　惠州 32–3 油田 K–22 深度构造图

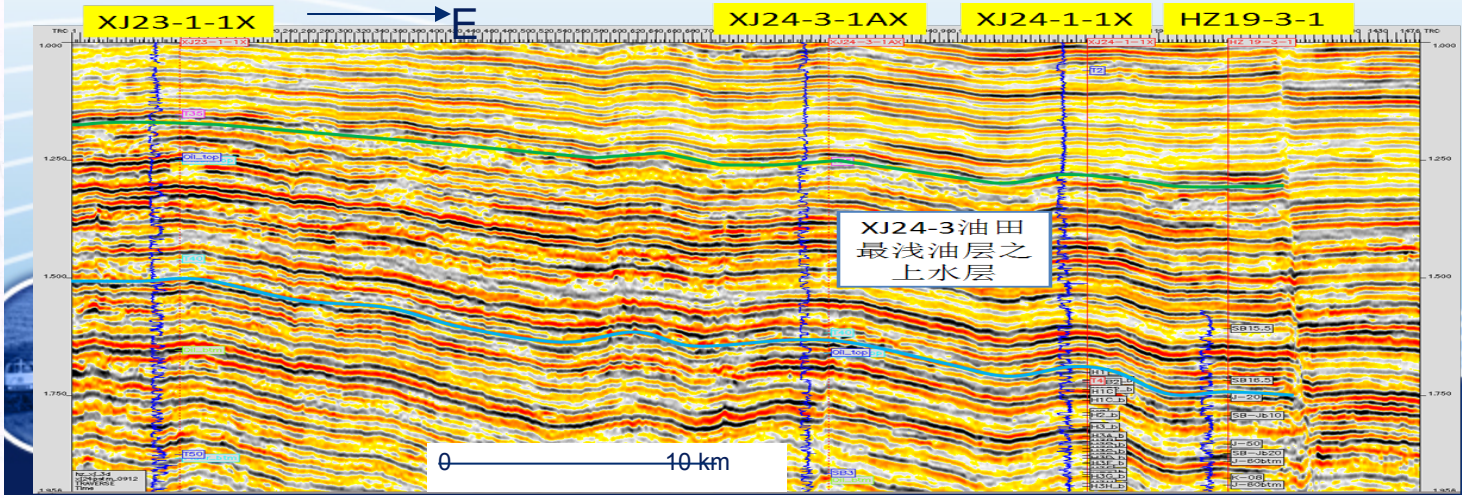
Overlying Saline Formations

XJ24-3

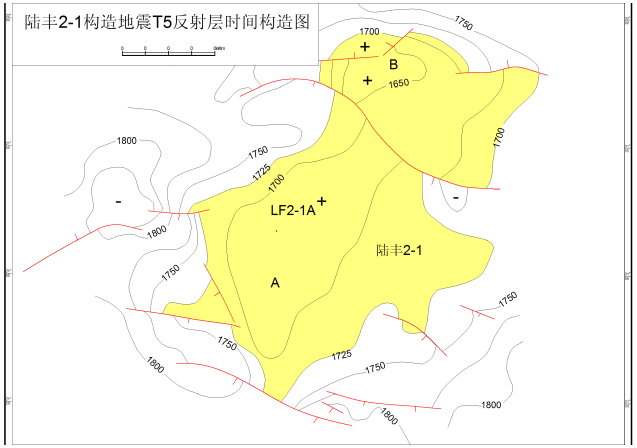
- Saline aquifers above reservoirs:
  - Depths1300-1700m
  - Total aquifer thickness ~280m
- Large lateral extension >40 km
- Overlain by 200m thick regional seal

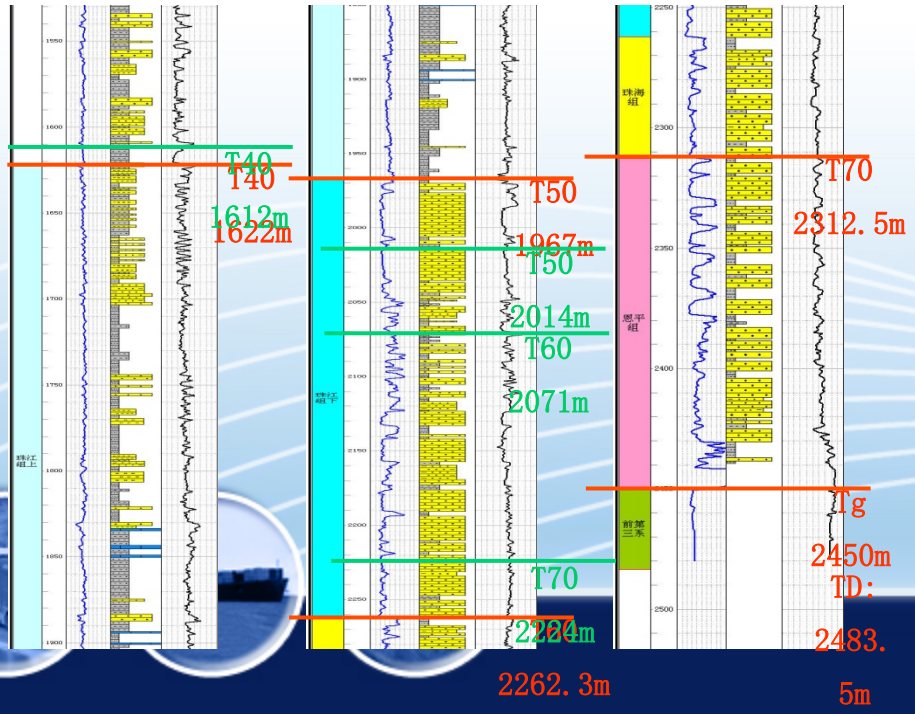






The LF2-1 stracture





- A large dome structure of >200km² trap area and >200m aquifer thickness.
- Good aquifer-seal combinations.
- An effective storage capacity of 360MtCO2 is estimated based on estimated gas resource.
- Only one well drilled; detailed data are lacking.

4. Knowledge gaps and future plan

Next Step: Focused studies of ZH21-1 (ZH32-3 as backup)

1. Potential of CO2-EOR, collaboration with BEG, UT-Austin
2. Storage capacity and injectivity modeling
3. Containment quality
4. Conceptual design of test injection (including transport and monitoring)
   - Engineering flow chart
   - Preliminary cost estimation
5. Suggested timetable
   - Test injection (by 2020)
   - Demo project design (by 2025)
   - Demo project operation (by 2030)

Major knowledge gaps:

1. Offshore CO2-EOR, techniques (pattern, CO2 separation, platform retrofitting) and economics
2. Offshore CO2 transportation, techniques (shipping, underwater devices, retrofitting existing pipelines) and economics
3. Incentive policies, regulations for cost and liability sharing

Thank you for listening !

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