CO2 Storage in Saline Formations offshore China: Importance and Potential

中国海域咸水层CO2封存——重要性和潜力

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Basins inland Guangdong are small & with low storage capacity



CHINA Stationary CO₂ emissions and basins

Tentative ranking of prospectivity for CO₂ Storage

Higher Prospectivity

Intermediate / unresolved Prospectivity Lower Prospectivity

Bradshaw (2006, Beijing)

Offshore basins are of high prospectivity !







- Large oil/gas-bearing sedimentary basins exist in northern South China Sea;
- This implies large capacity for CO₂ storage in deep saline formations in the vicinity of the large emission sources in the Pearl River Delta.

Preliminary assessment of CO₂ Storage capacity in the Pearl River Mouth Basin



- Area of 20,000 km²
- Cenozoic sediment >500,000 km³
- Oil/gas reserve
 ~3 Gt
- Four sealreservoir assemblages





	Geochronolgy		Lithological strata		es	Sequence Cycles		Sequence	ooding	Relative sealevel	eflector	Pet ge	trole eolo	um gy			
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	60		Paleo					ТА 1		IVIA_		Carbonatite					
	65						Fluv			65 Ma			Tg				





Parameters of oil-tested sandstone segments from the wells in eastern PRMB (thickness-weighted averages)

Formation	Porosity (%)	Permeability	(mD)	Net/Gross	# of
romation	Range	Range Ave. Range Ave.		Ave.	ratio (%)	wells
Zhujiang	13.3~23.9	19.9	20.2~2027.9	916.5	92.6	10
Zhuhai	2.3~22.7	16.8	3.5~913	318.0	87.8	11
Enping	0.7~22.0	10.3	0.03~95	7.0	No data	14

Geothermal gradient & CO2 density curves



Effective capacity in saline formations of the Pearl River Mouth Basin

Param	ieter	LM. Miocene	Paleogene	Total
Volume below 80	0m, V (m ³)	187000×10^{9}	164000×10^{9}	
Net/Gross ratio, R		0.5	0.37	
Average porosity,	ϕ	0.2	0.1	
CO_2 density ρ_{CO}	$_{2}(t/m^{3})$	0.3~0.6	0.3~0.6	
	<i>E</i> = 0.01	86	32	118
Capacity (Gt), >800 m	<i>E</i> = 0.024	225	83	308
2000 m	<i>E</i> = 0.04	345	128	473
Capacity (Gt),	<i>E</i> = 0.01	71	10	81
800~2500 m	<i>E</i> = 0.024	184	26	210
	<i>E</i> = 0.04	284	40	324

Effective capacity in oil/gas fields of the Pearl River Mouth Basin

Parameter		Value	Data source		
Resource oil equivalent (Gt)	3.2	2.3	0.9	(MLR, 2008)	
Volume factor (B_0)	1.03	1.03	1.03		
CO_2 density (t/m ³)	0.566	0.566	0.566		
Storage coefficient S_{coeff}	0.25	0.25	0.25		
Capacity (Gt)	0.21	0.15	0.06		



Major conclusions

 If the total emission of from major point sources in Guangdong keeps the 2006 level of <u>160 Mt/a</u> (Bai et al., 2006), and If <u>10%</u> of the effective storage capacity may be used, then the Pearl River Mouth Basin are able to storing <u>190</u> years of those emissions.



- Promising area: Northern Lufeng & Hanjiang sags
- Possibility of source & reservoir clusters.



Case study



- Faulted dome
- Area ~160 km²
- 2 seal-aquifer assemblages
- - ~200 km of Hongkong
 - Capacity to be estimated.

Merits and defects of offshore storage

Merits:

- Saving land;
- No damage to ground water;
- Low environmental impact;
- Easiness in pressure management during injection.

Defects:

• High cost of infrastructure and operation.

Perhaps the only choice for CCS in Guangdong!

