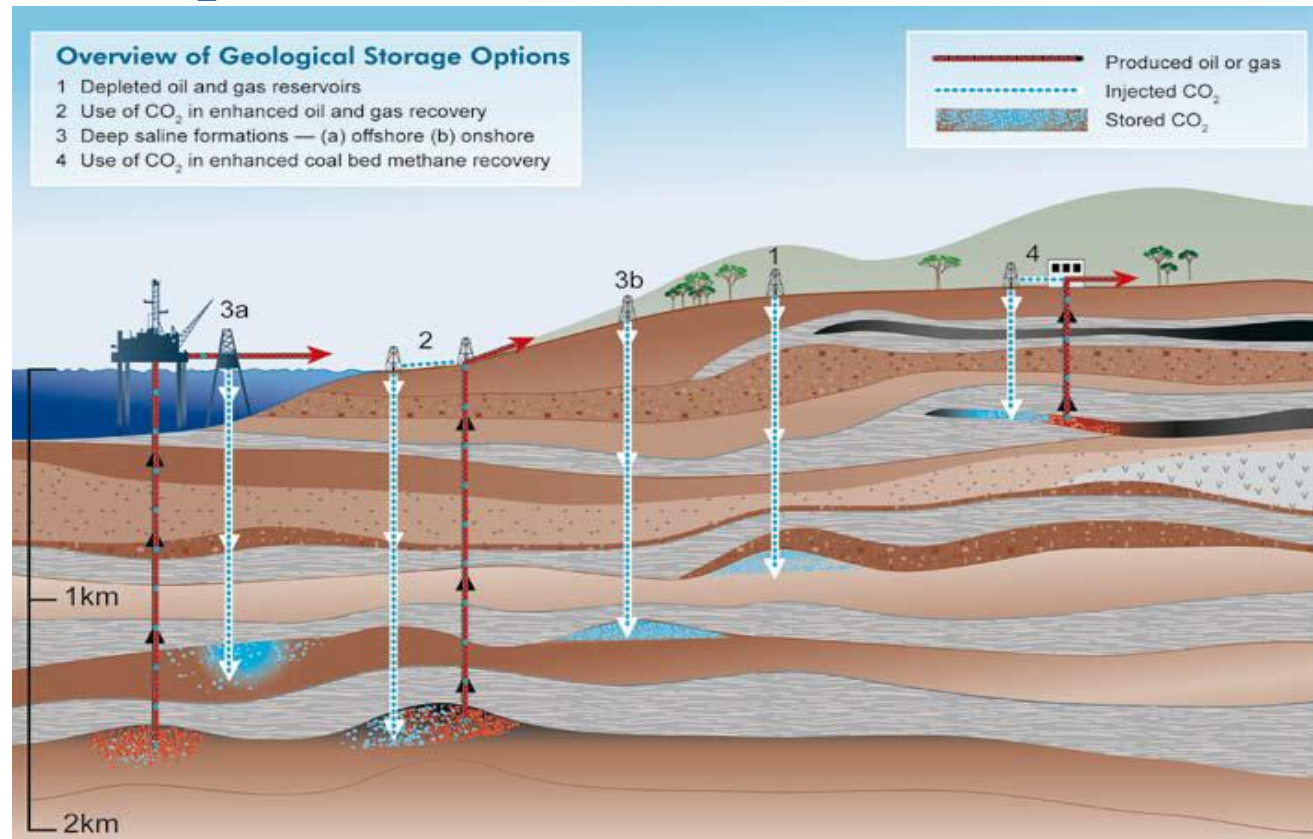


Carbon Capture and Storage: A technology overview

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Tsukasa Yoshimura
Carbon Capture and Storage Unit
International Energy Agency

CO₂ STORAGE (1)

CO₂ storage solutions (Source: IPCC)



- A variety of Storage solutions
- EOR and Deep saline formations in Oil/Gas Field is operating

CO2 STORAGE (2)

Capacity Estimates (Gt CO2)(Source:GHG)

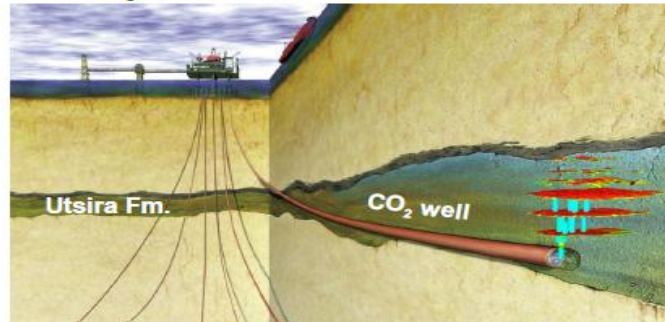
Storage Type	Global (IPCC 2005)	Global (IEAGHG)	USA	Europe	Russia (IEA2008)
DSF	1,000 – 10,000		3,300 – 13,000	90 – 330	2000
Depleted Gas		160			
CO2-EOR	680 – 900	65	140	20 - 32	150-200

- A big uncertainty and different estimation method
- Standardization for CO2 storage capacity estimation

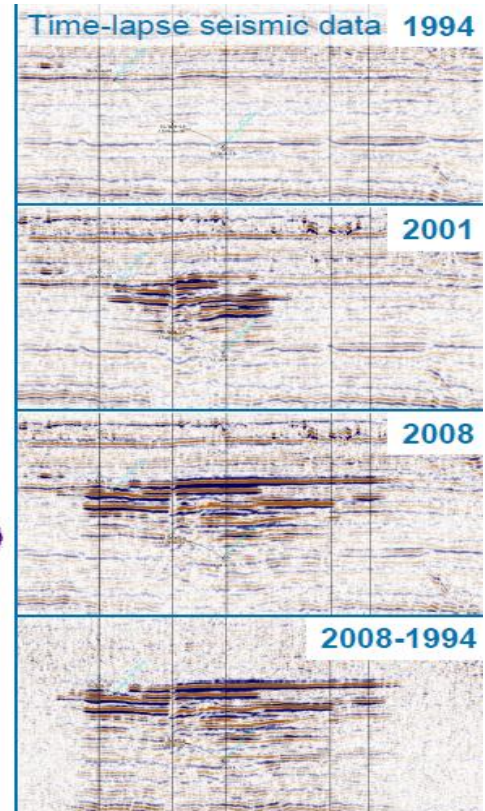
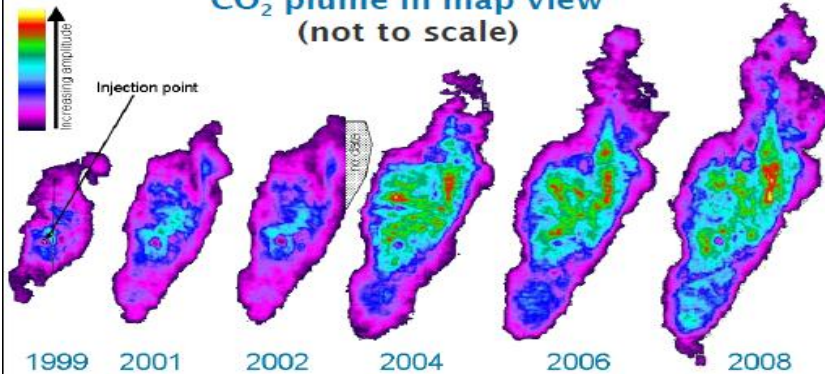
CO2 STORAGE (3)

Monitoring : Seismic Survey (Source: STATOIL)

Sleipner: An Overview



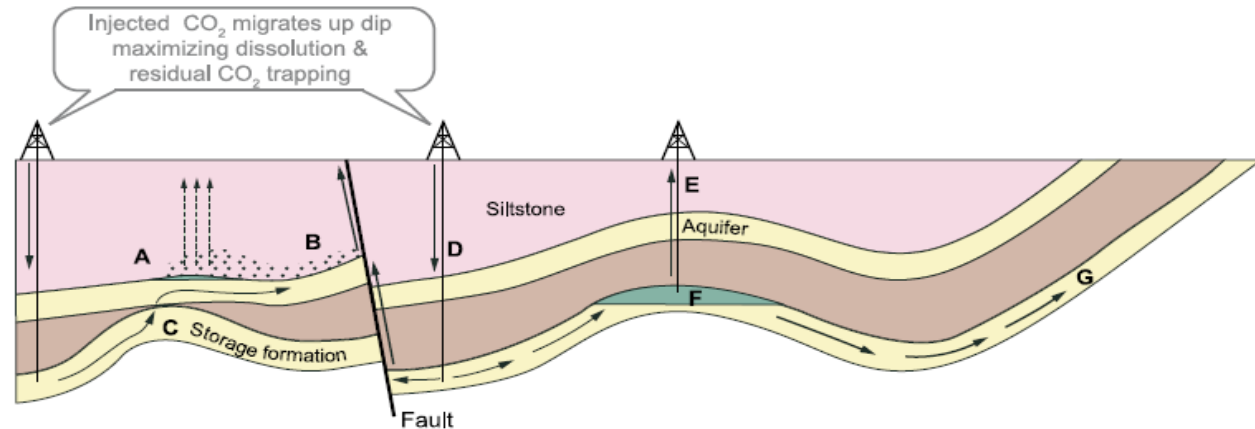
CO2 plume in map view (not to scale)



- A various kind of methods for monitoring
- Best practice guidelines for storage monitoring

CO2 STORAGE (4)

Potential Escape Mechanism (Source: IPCC)



Potential Escape Mechanisms

<p>A. CO₂ gas pressure exceeds capillary pressure & passes through siltstone</p>	<p>B. Free CO₂ leaks from A into upper aquifer up fault</p>	<p>C. CO₂ escapes through 'gap' in cap rock into higher aquifer</p>	<p>D. Injected CO₂ migrates up dip, increases reservoir pressure & permeability of fault</p>	<p>E. CO₂ escapes via poorly plugged old abandoned well</p>	<p>F. Natural flow dissolves CO₂ at CO₂ / water interface & transports it out of closure</p>	<p>G. Dissolved CO₂ escapes to atmosphere or ocean</p>
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Remedial Measures

<p>A. Extract & purify ground-water</p>	<p>B. Extract & purify ground-water</p>	<p>C. Remove CO₂ & reinject elsewhere</p>	<p>D. Lower injection rates or pressures</p>	<p>E. Re-plug well with cement</p>	<p>F. Intercept & reinject CO₂</p>	<p>G. Intercept & reinject CO₂</p>
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- A various kind of leakage mechanism
- Develop safety regulations and criteria

CO2 storage: estimates, challenges, needs

Review key gaps in storage data coverage and knowledge, and progress with storage explanation and capacity assessment



- Significant uncertainty regarding estimates of viable capacity
- Uncertainty regarding the distribution of this storage capacity

CO2 storage:

Further storage assessment are needed urgently.
Critical at the project level, where this data is required
for projects to be able to proceed.



- Countries can understand their national CCS potential
- and the global level of CCS development envisaged can be realized

CO₂ storage:

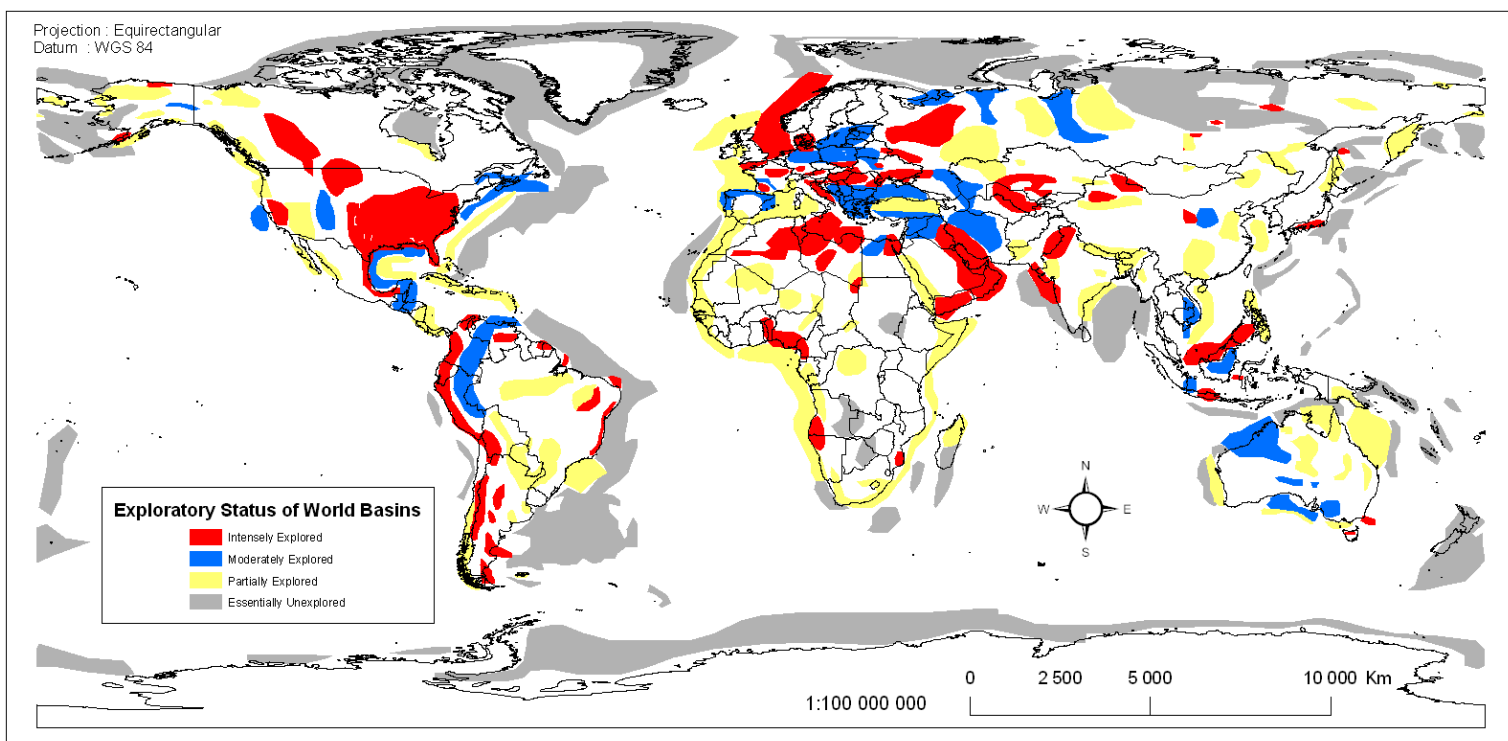
- Produce a national CO₂ storage atlas, identifying focus areas for potential CO₂ storage and mapping potential storage against CO₂ sources.
- Identify key gaps in storage data coverage, and actions and resources to fill those gaps. This should include establishing regional priorities and programs for storage data acquisition, and commencing exploration to obtain this data where required.

CO2 STORAGE

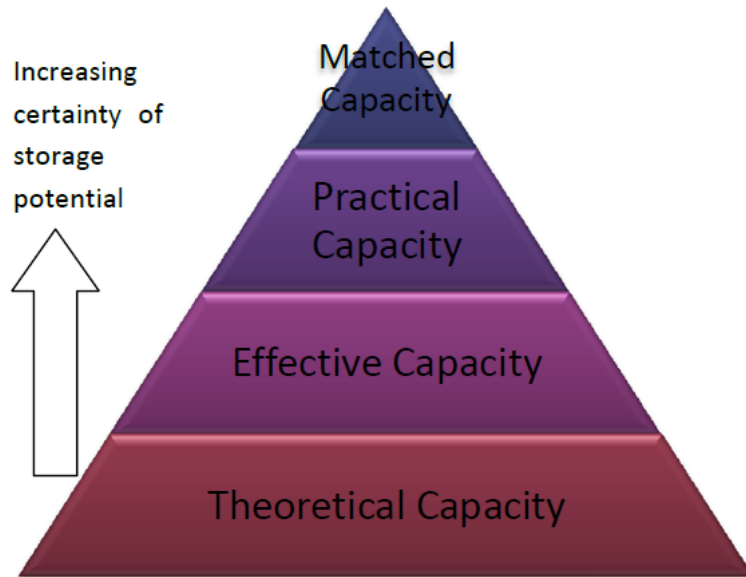
Capacity Estimates in China (Gt CO2)

Storage Type	DOE PNNL 2009	IEA 2008 Lu Xuedu 2006	IEA 2008 Li Xiaochun 2005	IEA 2009 Technology Roadmap	Yanfeng Liu 2009
Saline Formation	3,067	1000-2000	150-2000	Max. Theoretical Capacity: 2020 Viable capacity 202	145
Depleted oil field	4.8	7			10
Depleted gas field	5.1				30
Unminerable Coal field	12	12			12

CO2 storage: Global Atlas (GHG)



CO₂ storage



Description	Oil & Gas Equivalent
<ul style="list-style-type: none"> - Storage matching adequate large stationary CO₂ sources nearby - Detailed study of one reservoir. 	Proved Marketable Reserves
<ul style="list-style-type: none"> - Considers technical, legal and regulatory, infrastructural and general economic barriers 	Reserves
<ul style="list-style-type: none"> - The part of the theoretical capacity that can be physically accessed by CO₂ - Meets a range of geological and engineering criteria 	Recoverable Resources
<ul style="list-style-type: none"> - Limit of geologically acceptable - Full trapping capacity - Net Pore Volume 	Oil In Place