

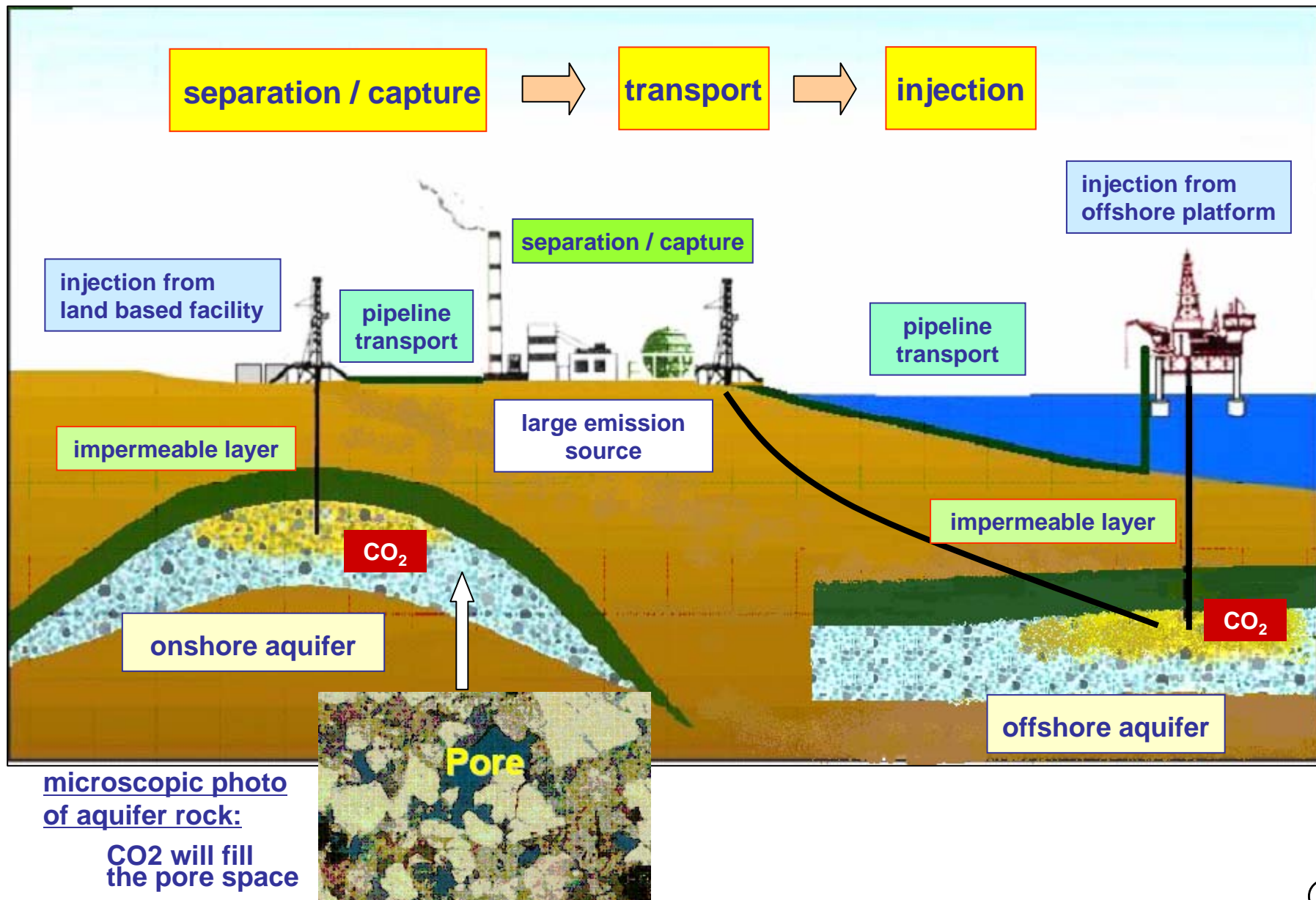
Developments on the Implementation of CCS in Japan

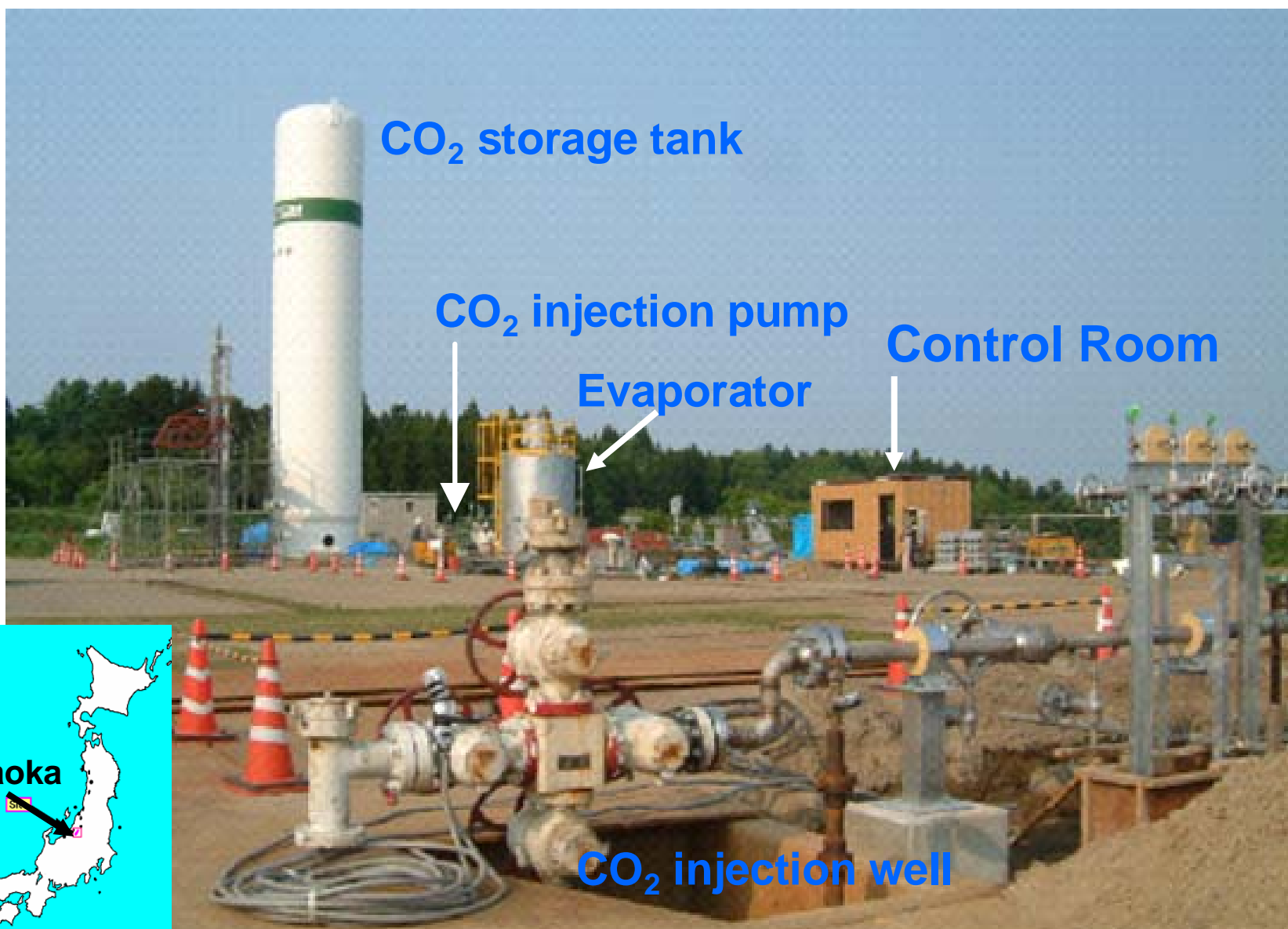


Shigeo Murai
RITE

CCS Workshop 2007 in Tokyo
19th November 2007
Japan

Image of CO₂ Geological Storage

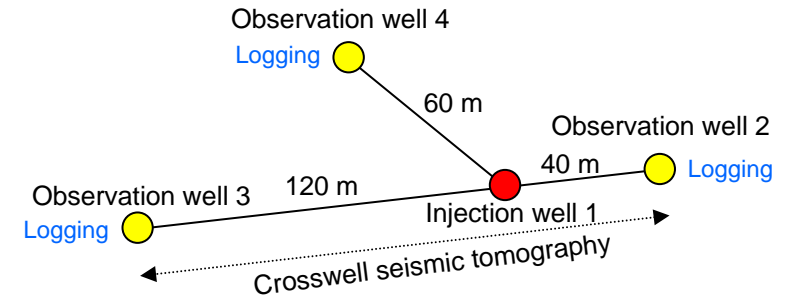




[Pilot test overview]

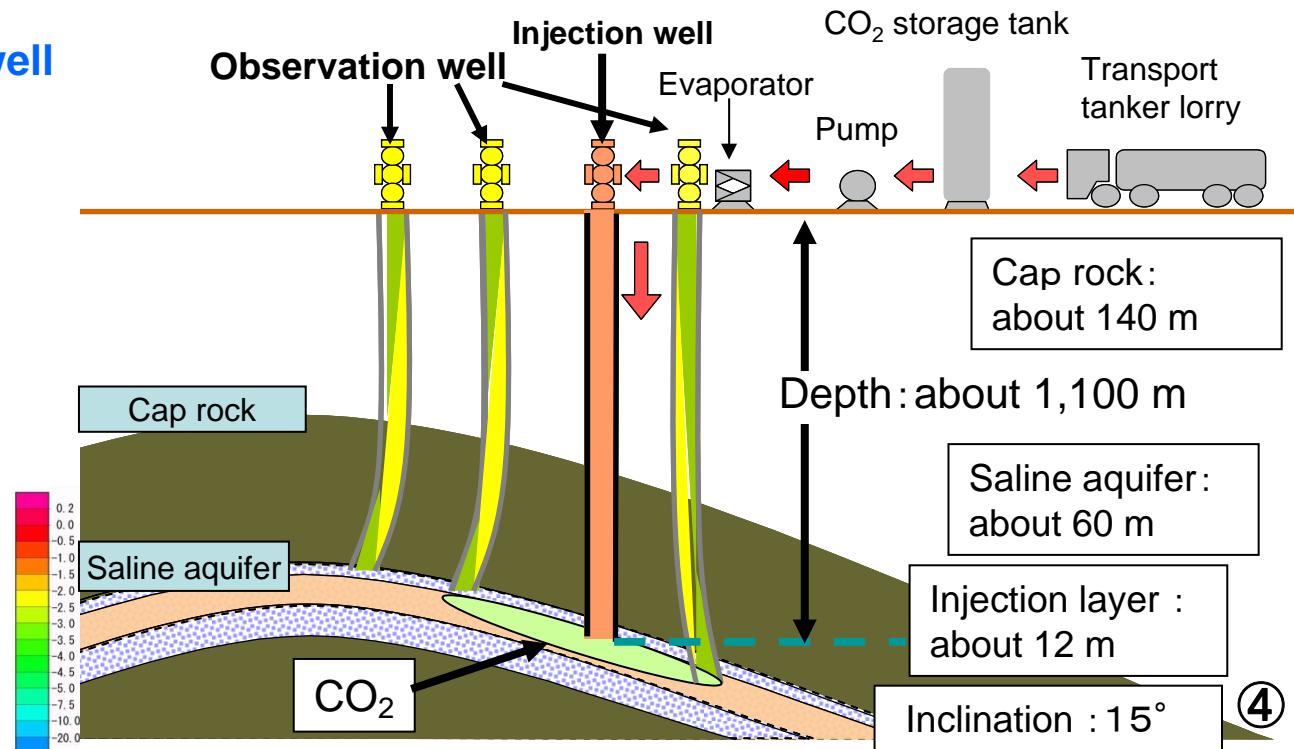
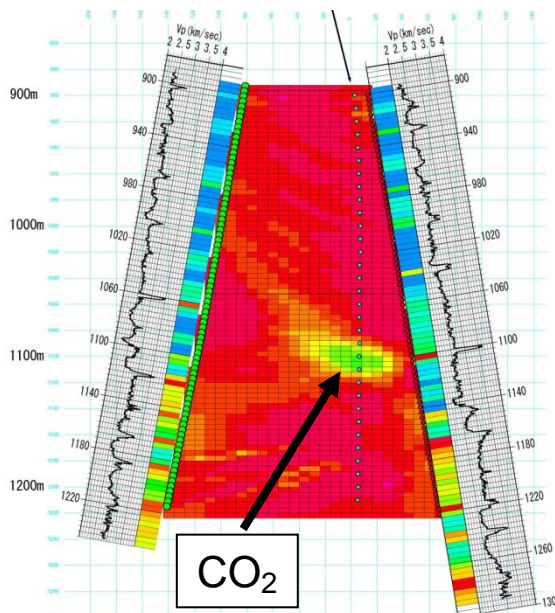
CO ₂ injection period	Jul. 2003 to Jan. 2005
CO ₂ injected amount	about 10,400 t-CO ₂
CO ₂ injection rate	20 to 40 t-CO ₂ /day
CO ₂ source	purchased commercial CO ₂
Monitoring	well logging, crosswell seismic tomography, microseismicity, formation water sampling, etc.

[Well configuration]

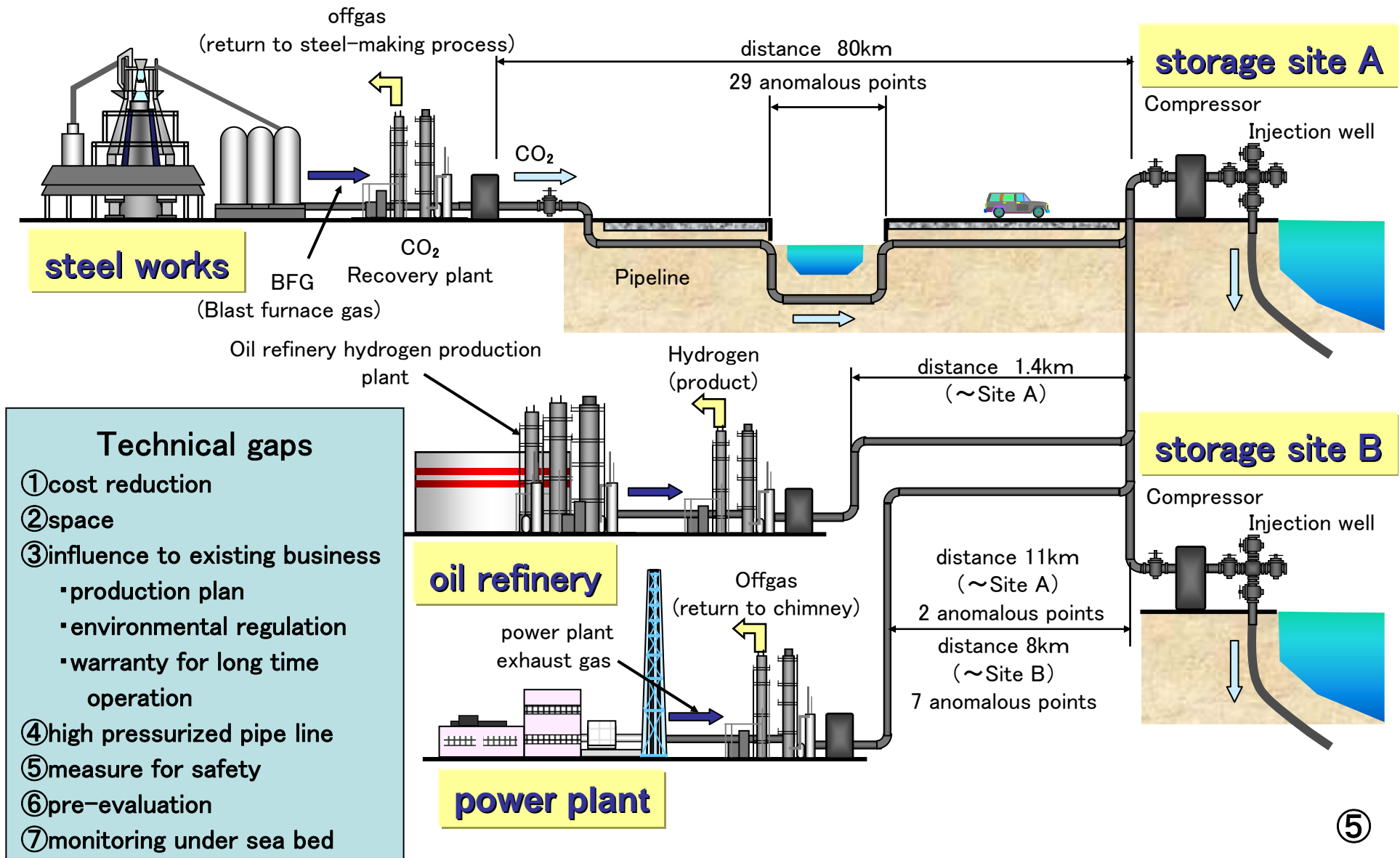


[Outline of injection experiment]

[CO₂ monitoring by crosswell seismic tomography]



Engineering study of supposed site for CCS







Main Emission Sources and Reservoirs

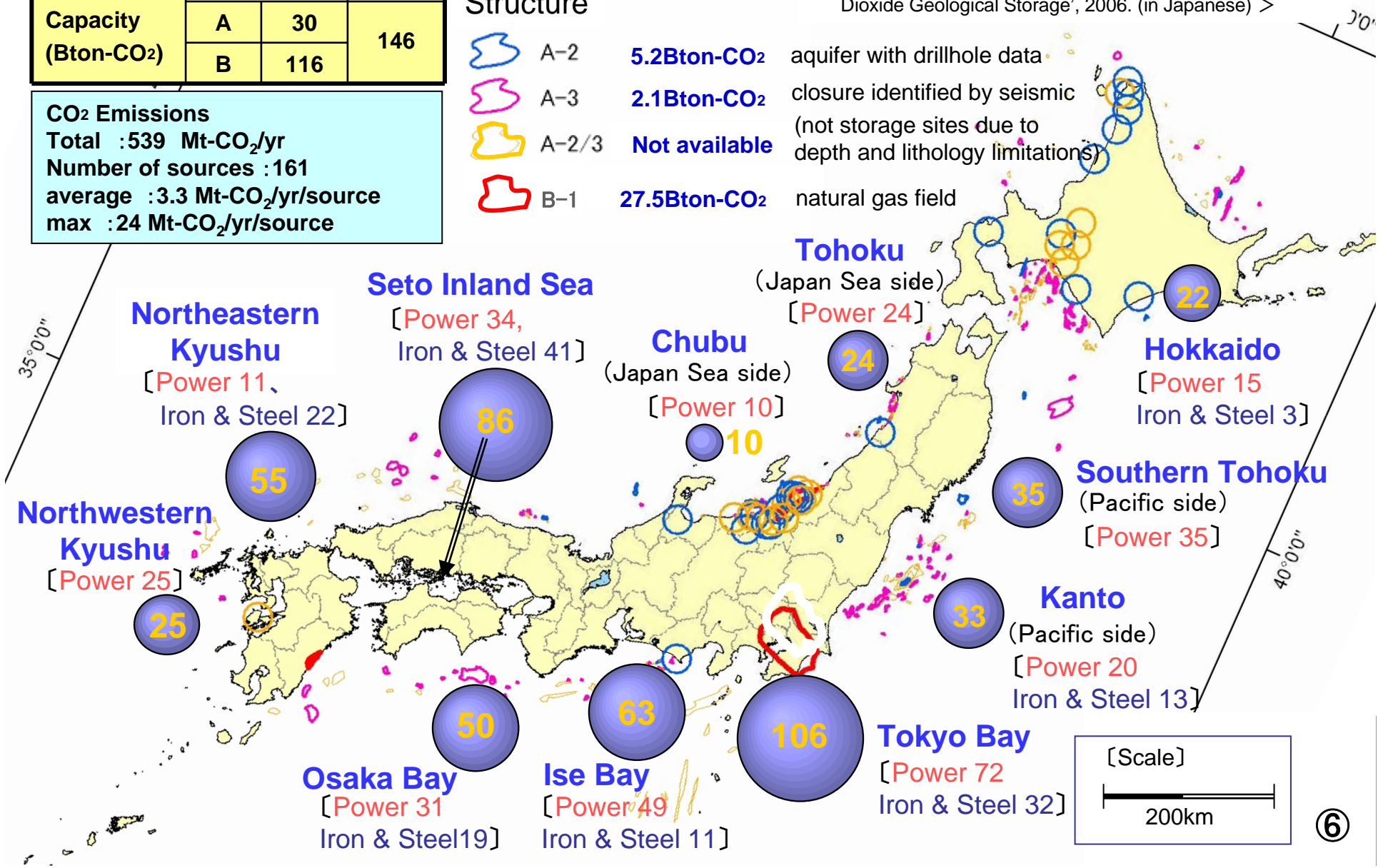
Storage Capacity (Bton-CO ₂)	Type		Total
	A	30	
B	116		

CO₂ Emissions
 Total :539 Mt-CO₂/yr
 Number of sources :161
 average :3.3 Mt-CO₂/yr/source
 max :24 Mt-CO₂/yr/source

Structure

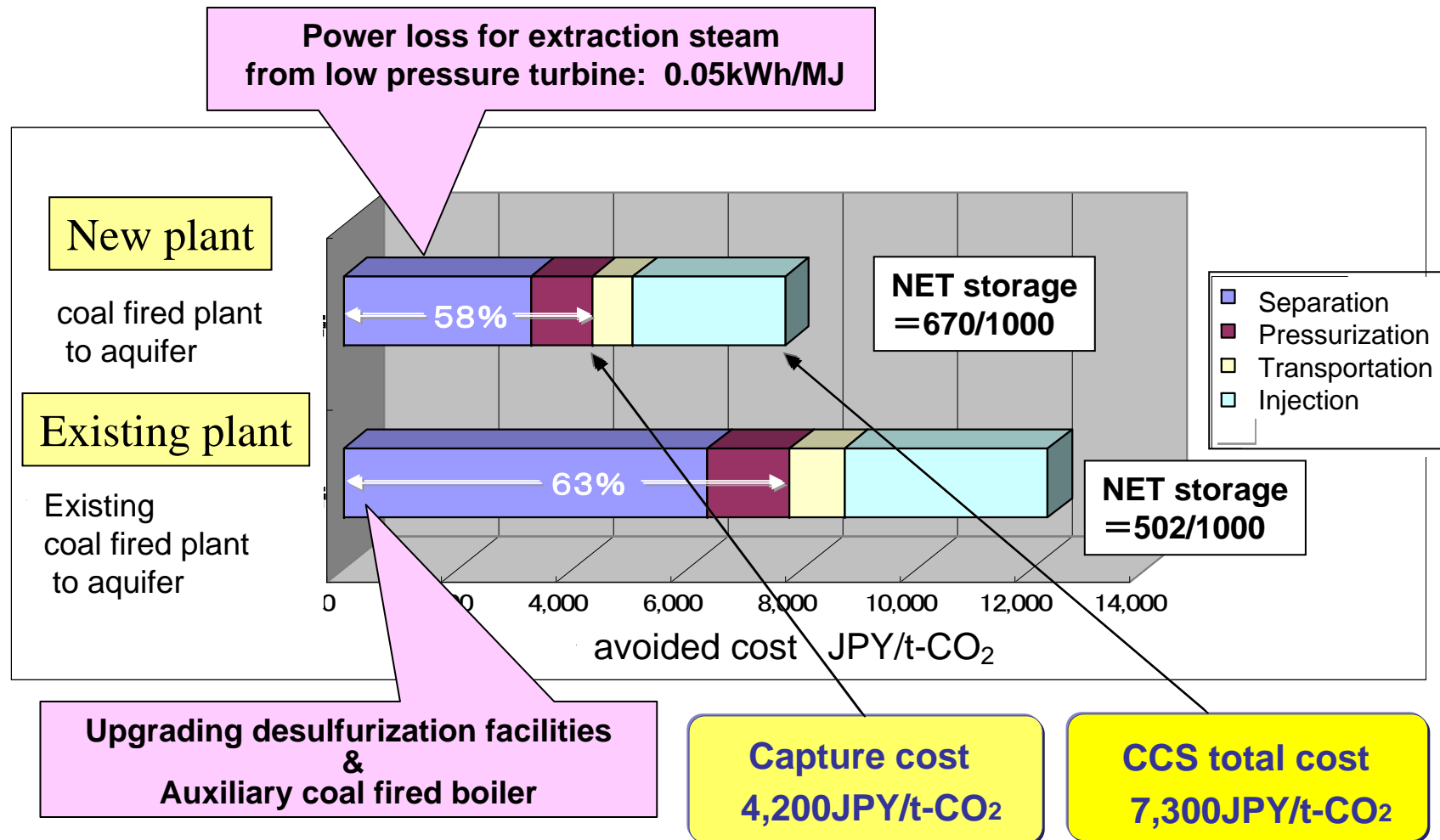
-  A-2 **5.2Bton-CO₂** aquifer with drillhole data
-  A-3 **2.1Bton-CO₂** closure identified by seismic (not storage sites due to depth and lithology limitations)
-  A-2/3 **Not available**
-  B-1 **27.5Bton-CO₂** natural gas field

<Source : RITE/ENAA, 'Report on Development of Carbon Dioxide Geological Storage', 2006. (in Japanese) >

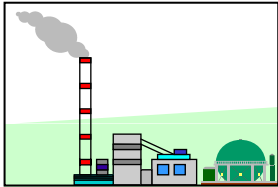
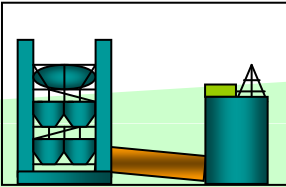
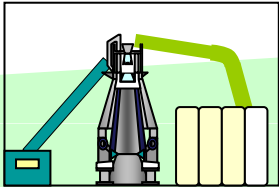



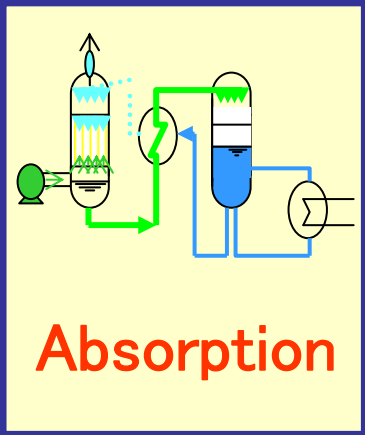
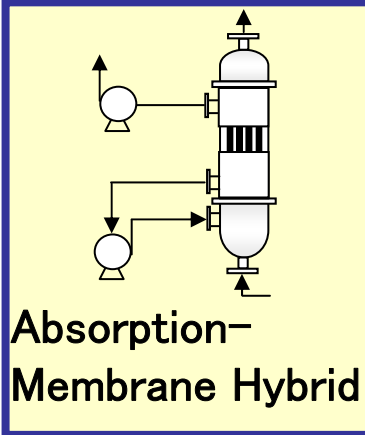
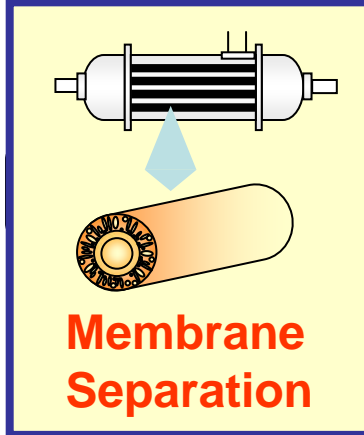
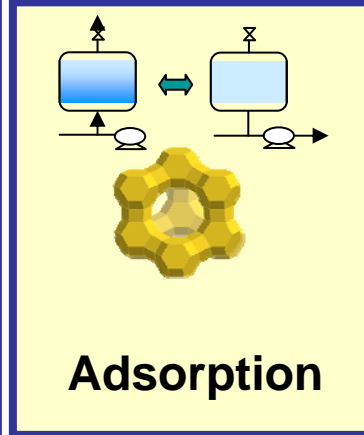
Present Cost of CCS (coal fired power plant)

recovery amount: 1Mt-CO₂/yr、 distance: 20km、 pressure: 7MPa
 injection method: ERD、 injection amount : 0.1Mt-CO₂/yr/well



Emission Source and Capture Technologies of CO₂

	Power plant	Cement plant	Steel works	Chemical plant
Source				
amount CO ₂ /y	0.37Bton-CO ₂	0.03Bton-CO ₂	0.18Bton-CO ₂	0.01Bton-CO ₂
Concentration of CO ₂	7%–14%	about 20%	about 25%	30–50%
Concentration of SO ₂	0–10ppm	3ppm	50ppm	0ppm

Separation & Capture				
	Absorption	Absorption-Membrane Hybrid	Membrane Separation	Adsorption

Storage

Geological

Ocean

Issues on the implementation of CCS in Japan (1)

- **Development of the technologies for cost reduction**
 - Reduction of CCS system cost
 - Monitoring technology
 - Model simulation of CO₂ behavior
 - Innovative technology of capture and separation
- **Promotion of the large-scale demonstration project**
 - Run the large-scale demonstration project
 - CO₂ capture from the large scale emission source
 - Evaluation of high-efficiency CO₂ capture technologies
 - Effective use of Early Opportunities
 - Exploitation of R&D infrastructures for the implementation
- **Academic, business and governmental cooperation**

Issues on the implementation of CCS in Japan (2)

- **Development of the domestic system for CCS**
 - Promotion for the survey of CO₂ storage potential
 - Scheme for the verification of stored CO₂ amount
 - Amendment of Marine Pollution Prevention Law
 - Confidence Building and Public Acceptance
 - Frameworks of the financial supports
- **Development of the International standard for CCS**
 - Effectuation of IPCC Inventory Guideline
- **Promotion of the international cooperation for CCS**
 - Development and accumulation of CCS technology
 - Building of the frameworks for post Kyoto protocol

Roadmap of CO₂ Capture and Geological Storage in Japan

	2007	2020~
Milestone	<ul style="list-style-type: none"> • CCS will get into full swing in the world • IGCC will be in practical use 	
CO ₂ Capture Technology	<p>• Capture cost is 4,200JPY/t-CO₂ → • Capture cost will be expected to be comparable to ET price Target: 1,000JPY/t-CO₂ for 1Mt-CO₂/y</p> <p>• Expansion of application area</p> <p>→ • Cost reduction → • low-cost separation process →</p> <p>→ • High-selectivity membrane → • CR and scale-up →</p> <p>→ • Basic research of new technology → • application →</p> <p>COCS* project 2004~2008FY Membrane** project 2006~2010FY COURSE*** project 2008~2012FY</p>	<p>→ • Seeking lower cost</p> <p>* Cost Saving CO₂ Capture System ** Molecular Gate Membrane *** CO₂ Ultimate Reduction in Steel making process for cool Earth</p>
CO ₂ Storage Technology	<p>• CCS total cost is 7,300JPY/t-CO₂ → • Start of large-scale CO₂ storage → • Expansion of CCS implementation</p> <p>• Pilot test of CO₂ injection (10Kt-CO₂)</p> <p>→ • Study on trap mechanism and CO₂ behavior →</p> <p>→ • Improve efficiency and cost of CCS system →</p> <p>→ • Management technology of stored CO₂ →</p> <p>→ • Technique for environmental assess. and safety →</p> <p>→ • Field study of storage potential and it's exploitation →</p> <p>→ • Analysis of pilot test → Test of CCS process →</p> <p>• Basic study → Full-scale demonstration project →</p> <p>Nagaoka* project 2004~2012FY FutureGen** project 2007~2011FY</p>	<p>→ • Increasing use of CCS</p> <p>→ • Seeking lower cost</p> <p>* CO₂ geological storage technology ** Exploitation of coal gasification technology</p>



財団法人 地球環境産業技術研究機
Research Institute of Innovative Technology for the Earth
URL : <http://www.rite.or.jp>