METI
Ministry of Economy,
Trade and Industry

CCS Policies in Japan

Takashi Kawabata
METI, Japan
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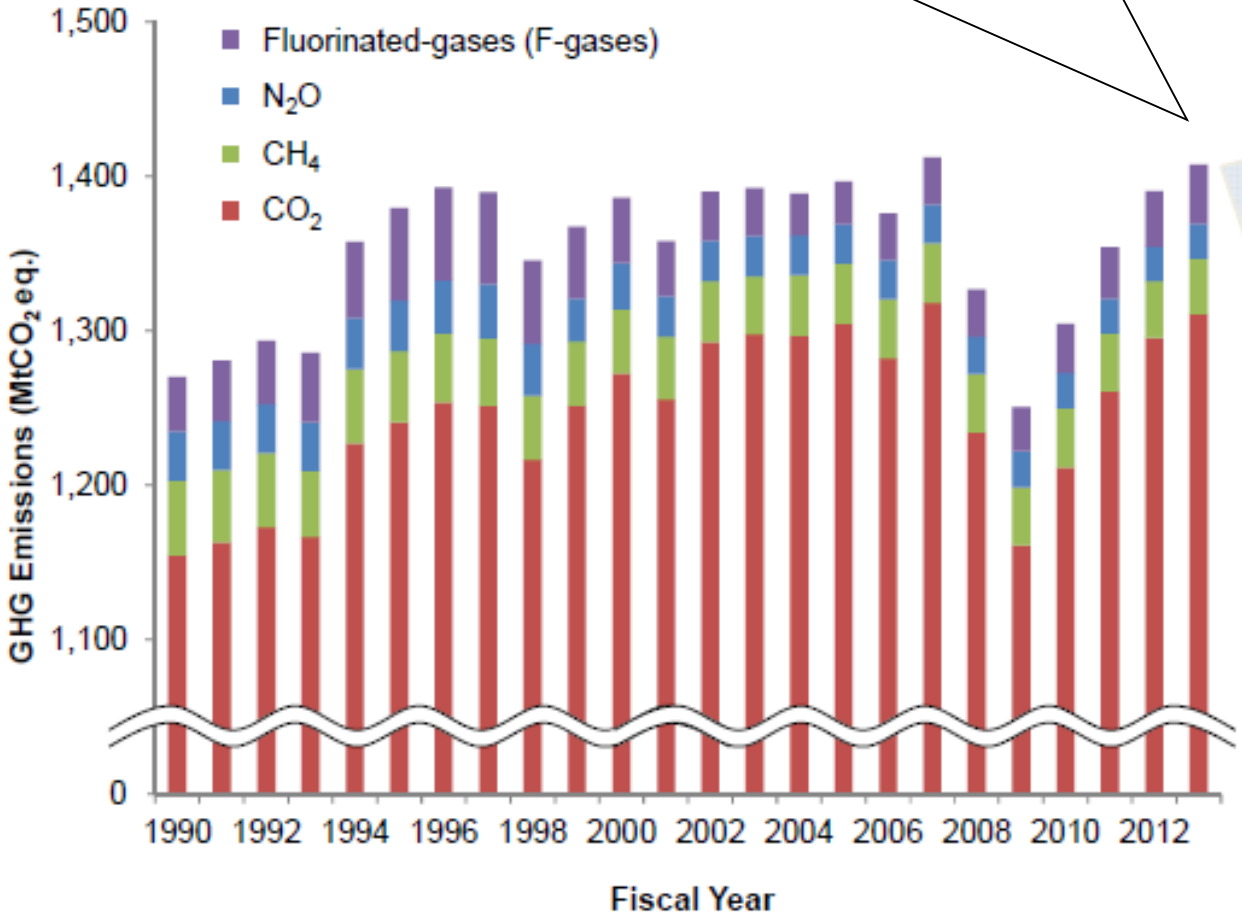
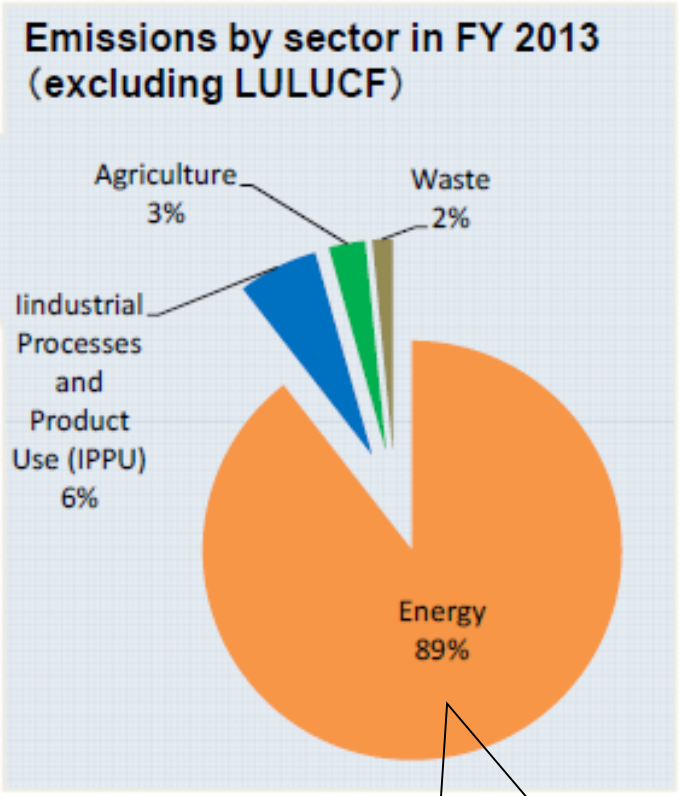
1. Climate Change Policy & CCS

Trend of GHG Emissions in Japan

Approx. 1400 MtCO2 eq. in 2013.





(Source) National Greenhouse Gas Inventory Report of Japan (April, 2015)

Energy Sector accounts for 89%.

Japan's Climate change policy in a post COP21 World

1. Domestic mitigation measures toward the INDC

Japan's GHG emission reduction target draft by 2030 (INDC)

- ✓ **26.0%** reduction below FY 2013
- ✓ **25.4%** reduction below FY 2005

Intended **N**ationally **D**etermined **C**ontribution

based on a bottom-up calculation of policies, measures, & technologies.
(CCS is not taken into account)

⇒**Policy on CCS**…Basic Energy Plan(2014)

accelerate technology development of CCS for the practical use of CCS technology around 2020.

2. Promotion of Innovation

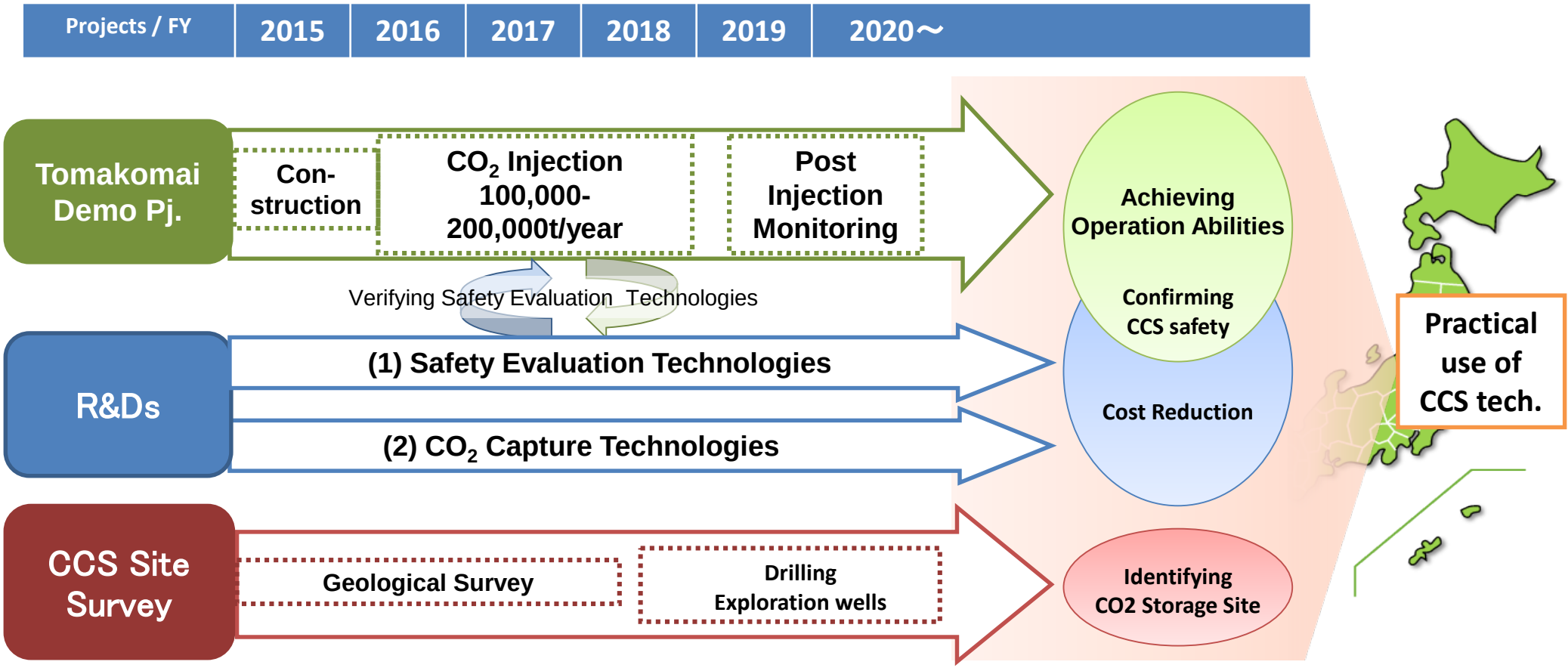
- ✓ Energy & Environment Innovation Strategy
- ✓ Innovation for Cool Earth Forum

3. Contribution to emission reductions in developing country

- ✓ Linkage between the Technology Mechanism & Financial Mechanism
- ✓ Joint Crediting Mechanism(JCM) & other international Contributions

Japan's CCS Policy

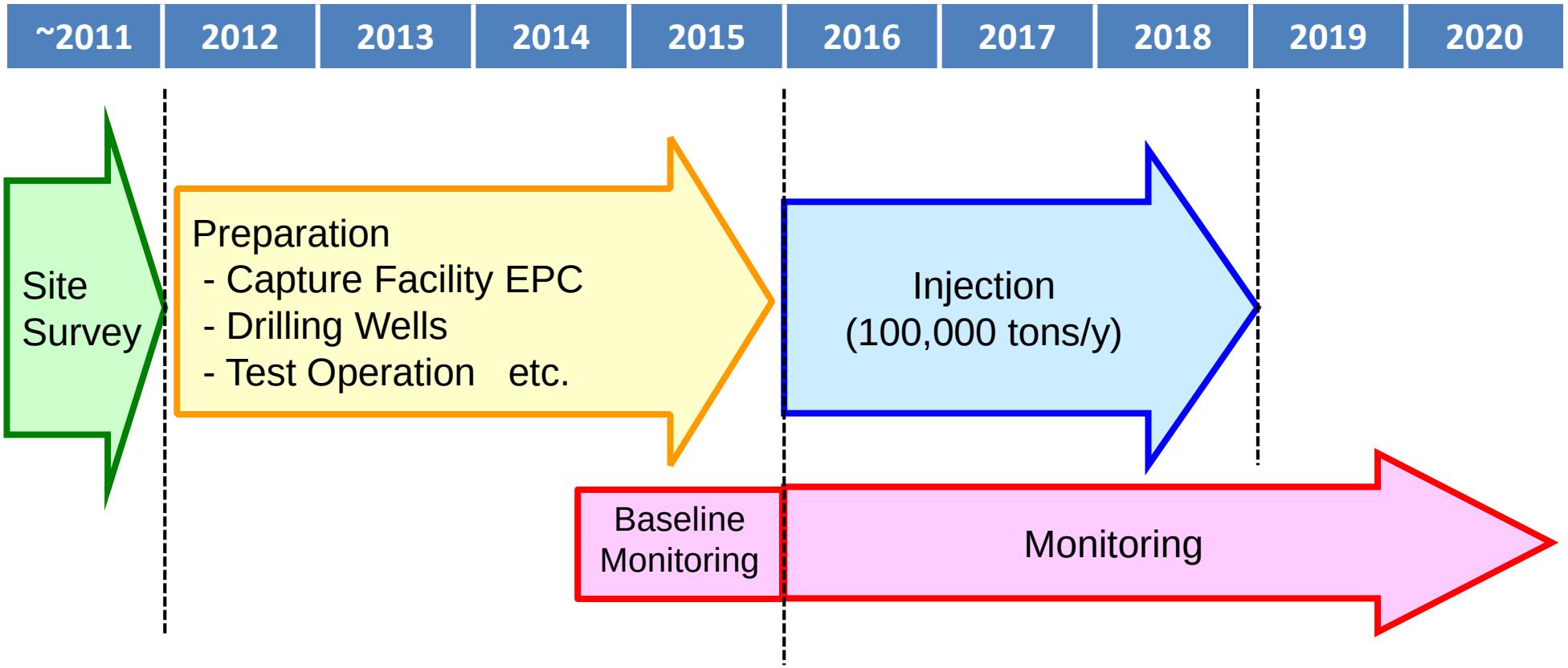
- To aim the practical use of CCS technology around 2020, METI conducts Tomakomai Demonstration Project, R&D projects of elemental technologies for CCS, and survey for potential CO2 storage site.



2. Projects Overview
(Demonstration, R&Ds, Site Survey)

Tomakomai Demonstration Project - Schedule

- The first large scale CCS demonstration project in Japan has started from April, 2016 in Tomakomai, Hokkaido
- Approx. 100,000 tons of captured CO_2 from gas emissions at an oil refinery will be injected annually, and demonstration will be conducted on such technologies as stored CO_2 monitoring technologies.



Tomakomai Demonstration Project - Site Selection

Screening from 115 original candidates (by JCCS) : 2009~11
- Onshore or Offshore
- Existing wellbore data
- CO2 source etc.

Oct, 2011: Reports
“Comprehensive Evaluation of Tomakomai Reservoir”
“Draft Demonstration Project Plan”

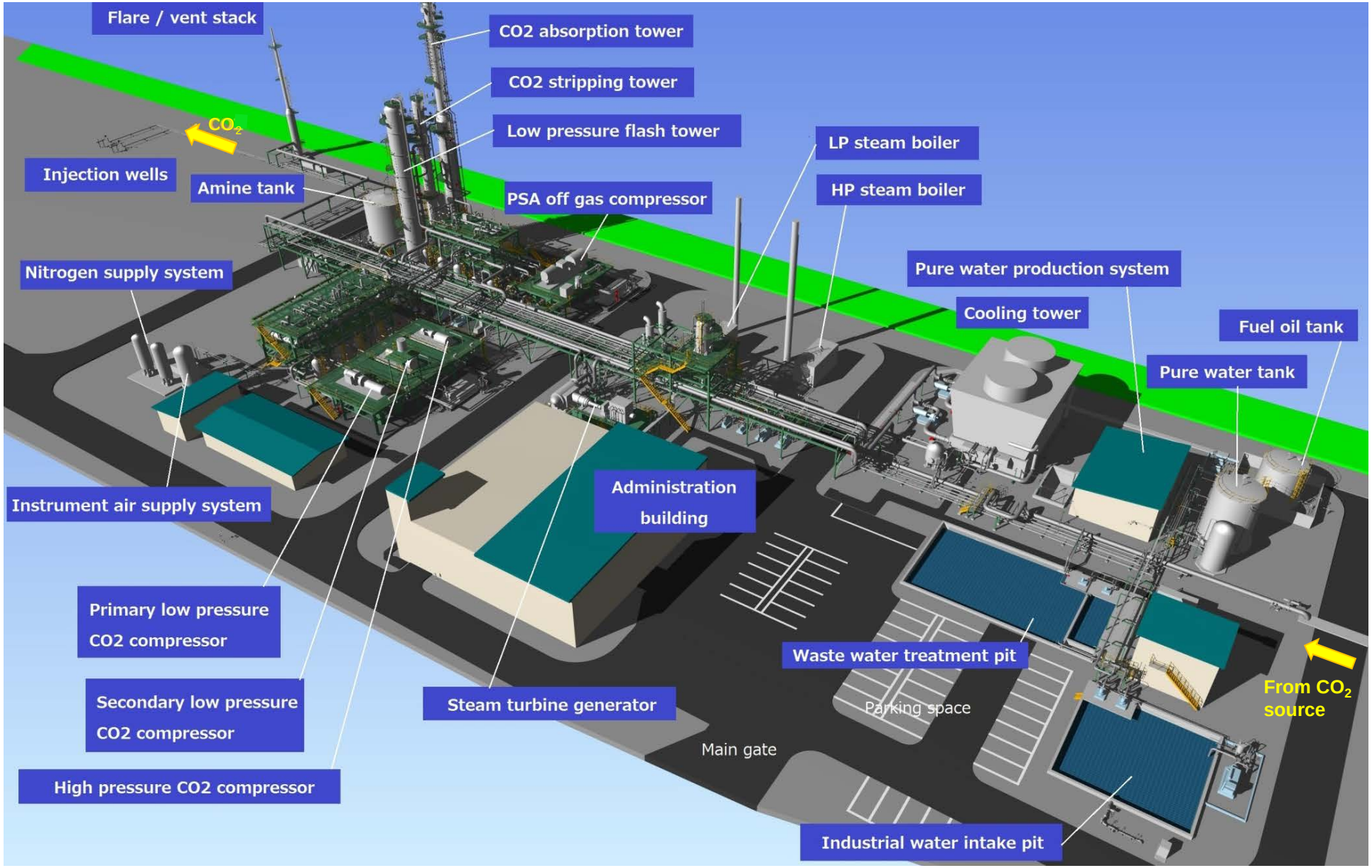
Specialists Council (METI) : Oct-Dec, 2011

Discussion & Evaluation of the reports above from the technical viewpoint by third-party specialists

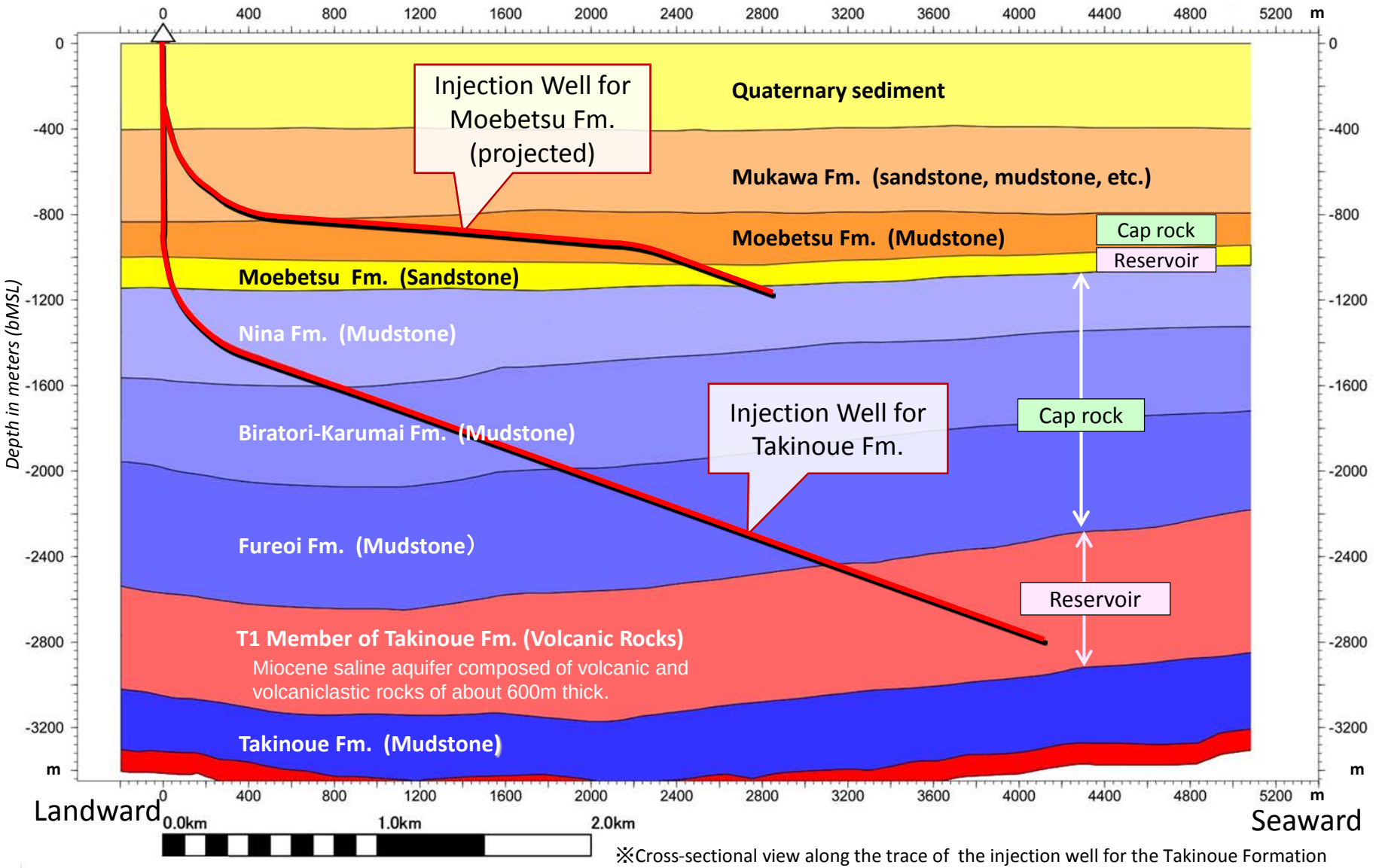
Feb 2012: Final Decision @ Tomakomai

Capture Facility (Outlook)

Capture Facility (Bird's Eye View)



Schematic Geological Design



※Cross-sectional view along the trace of the injection well for the Takinoue Formation

CCS Site Survey Project

- This project is cooperatively conducted by METI & MOE. Both ministries will identify Japan's potential CO2 storage site through geological survey, etc.

(Unit: Billion Yen)

Fiscal Year	2014	2015	2016	2017	2018	2019	2020～
METI budget	1.0	1.0	1.25				
MOE budget	0.7	1.3	2.4				

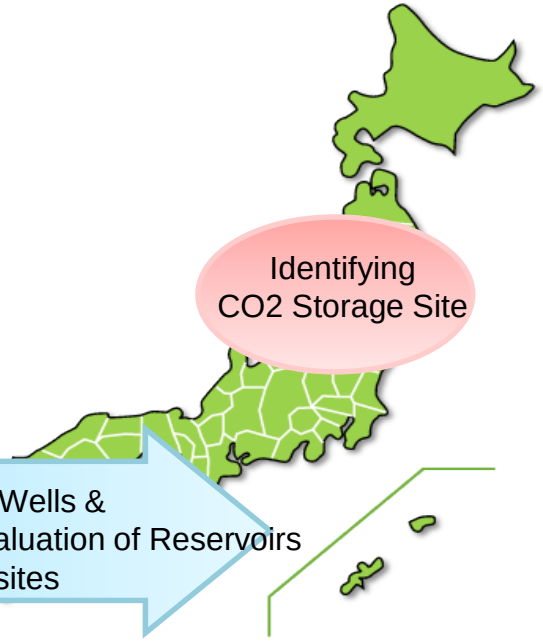
Assessment of

Potential CO2 Storage Site & Potential Storage Capacity

2D seismic survey & Data Analysis
approx. 15 sites

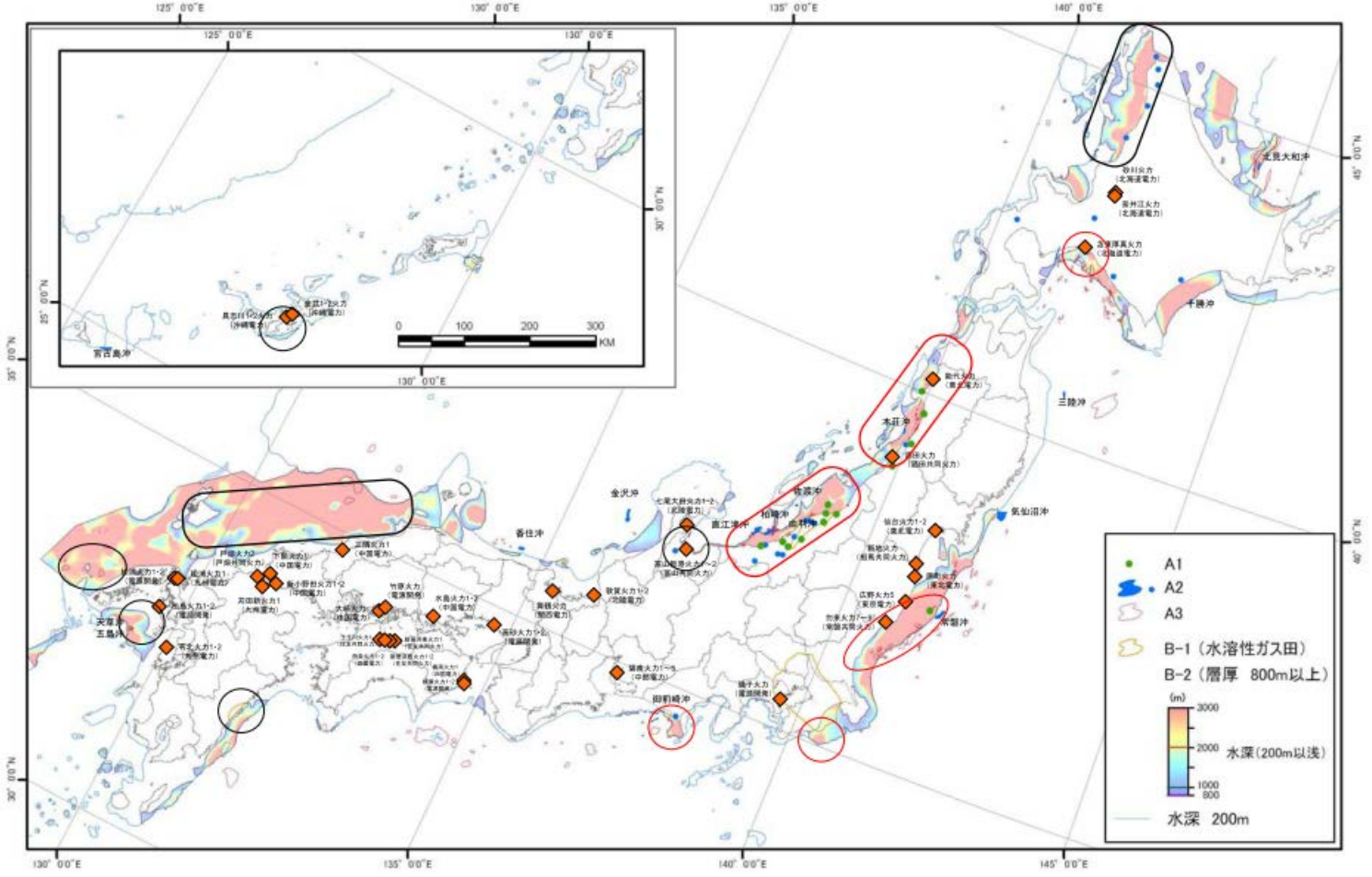
3D seismic survey & Data Analysis
approx. 9 sites

Drilling Exploration Wells & Comprehensive Evaluation of Reservoirs
approx. 5 sites



Potential Storage Site in Japan

- Estimated CO2 storage capacity in Japan is about 146 billion ton (RITE, 2005).
- Potential CO2 storage sites are expected in Japanese coastal waters.
- More precise surveys are required for future CCS deployment in Japan.



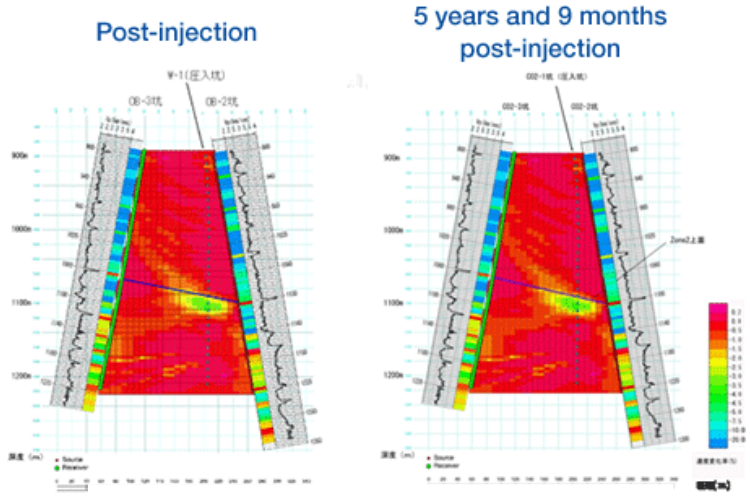
R&D on CO2 Storage Technologies

- Behavior analysis of injected CO2 is a basic technology for CCS operation.
- The environmental effect of CCS should be evaluated for practical use.
- Target : Establishing the effective & practical monitoring system by 2020

R&D on CO2 storage technologies

Issues for R&D

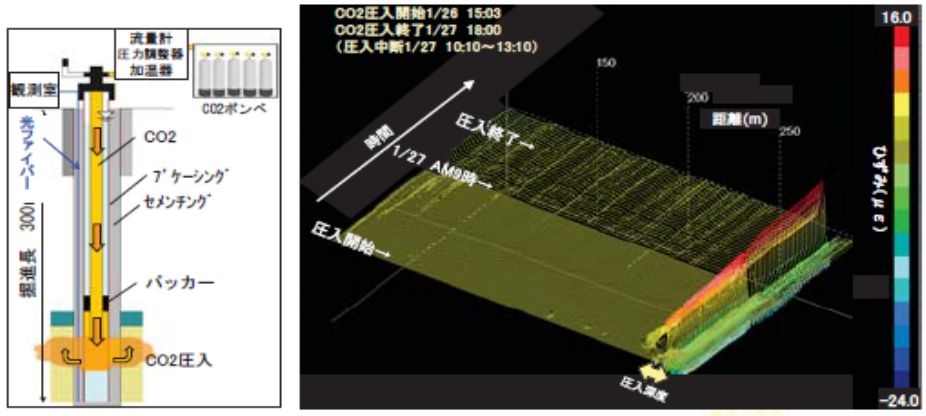
- ✓ Accurate geological modeling
- ✓ Analysis of long term behavior of CO2
- ✓ Deployment of monitoring system



Analysis of CO2 storage status

Achievements & Future Task

- ✓ METI has developed fundamental technologies on monitoring & simulation by 2015.
- ✓ Cost effective & accurate monitoring system should be developed for practical use.



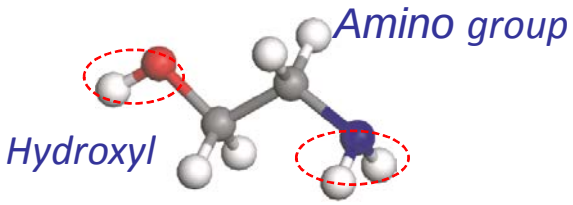
Monitoring technology by the use of optical fiber

R&D on CO2 capture process –Solid Sorbent-

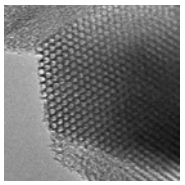
- Current CO2 capturing cost accounts for 60% of total cost of CCS in Japan.
- METI promotes R&D of low-cost capture technologies with low energy consumption and low cost.
- Target : Capture cost… 4200 JPY/tCO2 in 2005 ⇒ 2000 JPY/tCO2 by 2020

R&D on innovative Solid Sorbent

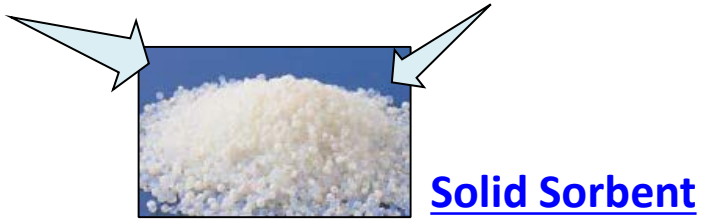
- ✓ Energy consumption for conventional liquid amine scrubbing method is high.
- ✓ Novel amine solid sorbents is expected to save energy & cost.



Amino Compounds



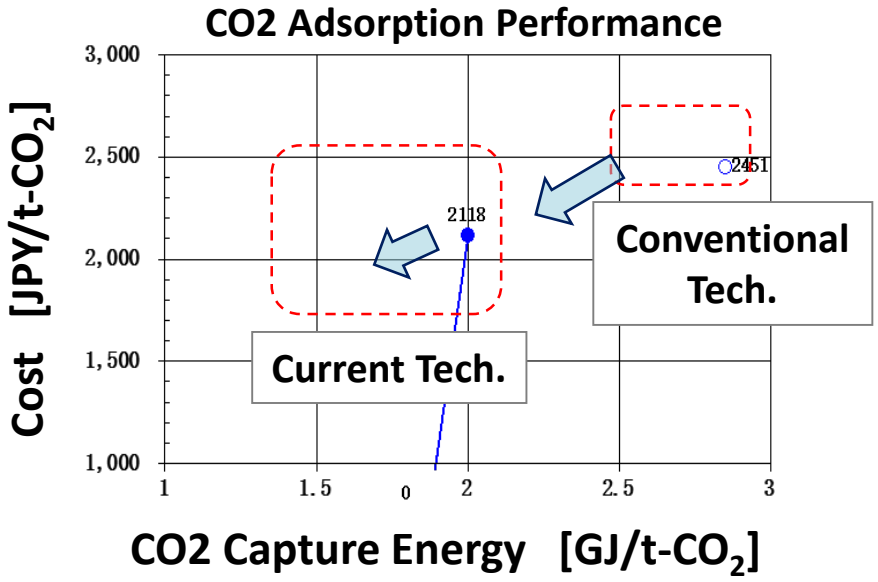
Porous Support



Solid Sorbent

Achievements & Future Task

- ✓ METI developed one of the most efficient solid solvent in laboratory.
- ✓ Demonstration test is necessary.



R&D on CO2 capture process - Membrane Separation -

- Membrane is applicable to high pressured gas (Natural gas and IGCC, etc.) and expected as a cost effective capture technology.

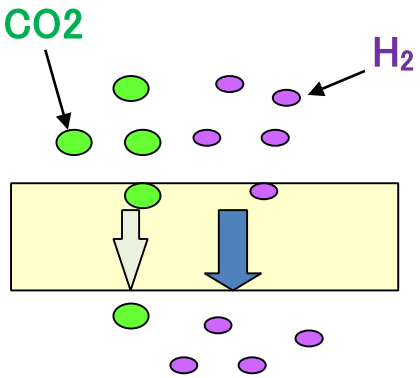
* IGCC : Integrated coal Gasification Combined Cycle

- Target : CO2 capture cost … 1500 JPY/tCO2 for practical use by 2020.

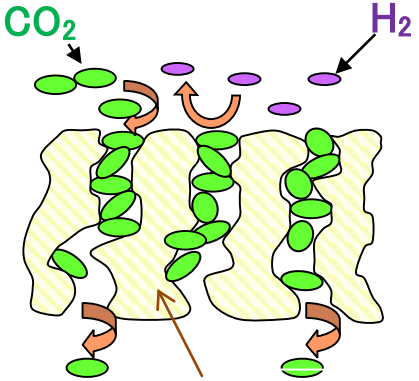
R&D on Molecular Gate Membrane (MGM)

✓ Only CO_2 molecules can pass through MGM, because dendrimer with CO2 prevents H2 from passing through the membrane.

Conventional membrane



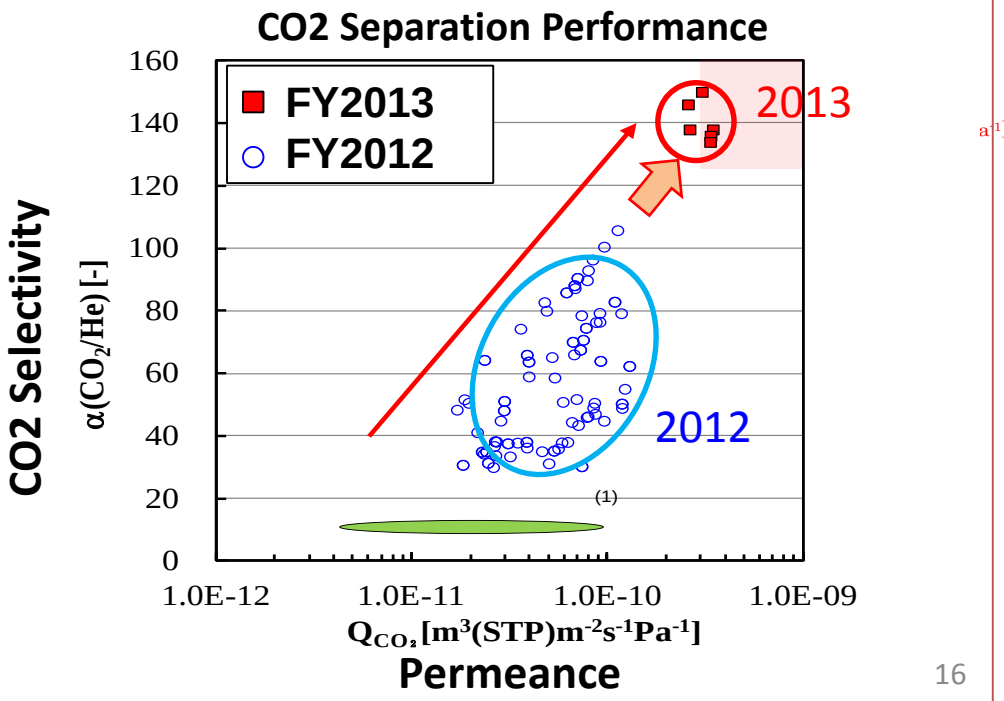
Molecular Gate Membrane



Small size of H2 molecular decreases separation performance.

Achievement on Separation Performance

✓ METI achieved the highest performance of the world in laboratory.



“Osaki CoolGen” Project

Project Details

- To establish oxygen-blown coal gasification technology (oxygen blown IGCC) which makes it efficient and easy to capture CO_2
- At the later stage, to establish IGFC, “triple-combined cycle technology” by the combination of oxygen blown IGCC and fuel cell utilizing hydrogen from oxygen blown gasification process
- The Project is now Implemented by OSAKI Cool Gen Co. (Joint Venture of J -POWER and Chugoku Electric Power Co.)

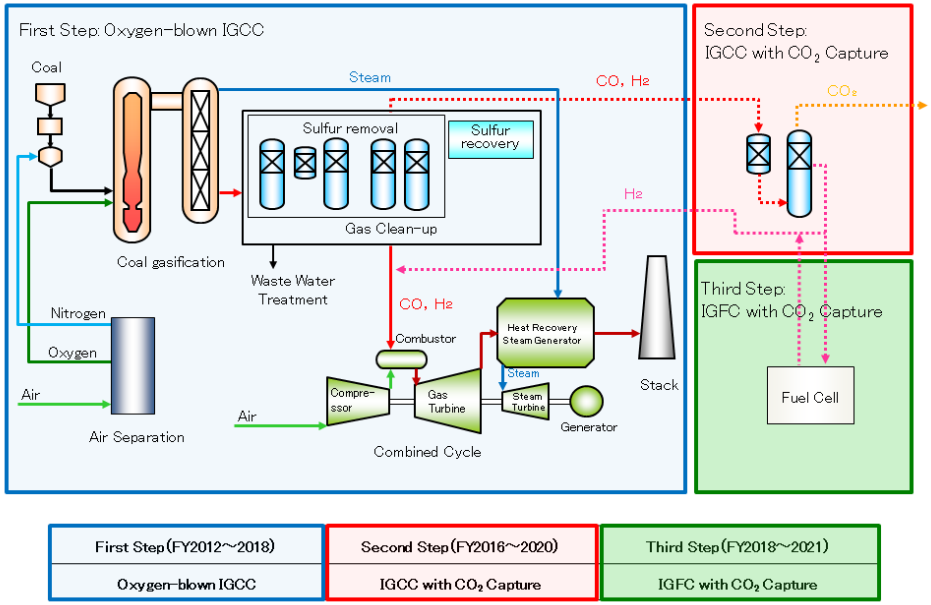
(1) Technical Characteristics of IGFC:

- Net thermal efficiency: Up to 55% (← currently 40% by Ultra-Super Critical (USC) coal-fired power generation)
- Use of sub-bituminous coal (low-rank coal), which can be easily gasified
- Easy CO_2 capture by oxygen blown gasification
- Use of hydrogen from oxygen blown gasification for fuel cell

(2) Project Period: 2012-2021

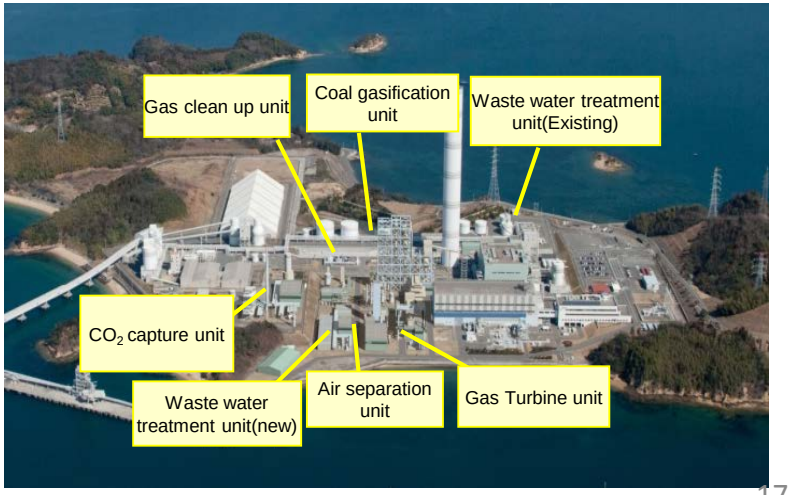
The total project costs for the 1st stage will be about 90 billion Yen, 1/3 of which will be funded by Japanese Government. The 2nd stage will be about 28 billion Yen,2/3 of which will be funded by Japanese Government. (The costs for the 3rd stage have not yet been estimated.)

Project Overview



Project Schedule

FY	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<1st stage> Oxygen blown IGCC Demonstration	Oxygen blown IGCC Design, Manufacturing and Construction					Demonstration test				
<2nd stage> CO2 Capture with IGCC Demonstration			Feasibility study		CO2 Capture Design, Manufacturing and Construction		Demonstration test			
<3rd stage> CO2 Capture with IGFC Demonstration					Feasibility study		CO2 Capture with IGFC Design, Manufacturing and Construction			Demonstration test



Project Site: Osakikamijima cho, Toyota gun, Hiroshima

3. Future Challenges

Future Challenges

☐ Demonstration and R&Ds

- ✓ Scaling up the CCS demonstration
- ✓ Further cost reduction on Capture, Storage & Monitoring
- ✓ Establishing the effective risk management system

☐ Framework

- ✓ Scheme to drive private projects
- ✓ Legislation for safety operation

☐ Condition for CCS deployment

- ✓ Enhancing Public Acceptance
- ✓ Identifying CO2 storage sites & evaluating its potentials