Japan – Australia Coal Workshop

NEDO's Coal-related Activities

- Past & Future Collaboration with Australia -

- Coal Resources Survey-related Activities
- CCT-related Activities

June 26, 2009

Coal Projects Department
Environment Technology Development Department

New Energy and Industrial Technology Development Organization

Coal Resources Survey-related Activities

Coal Projects Department

What is NEDO?

The **N**ew **E**nergy and Industrial Technology **D**evelopment **O**rganization is Japan's largest public R&D management organization for promoting the development of advanced industrial, environmental, new energy and energy efficiency technologies.

- **Established by the Japanese government in 1980**
- **Scope of activities expanded in 1988, 1990 and 1993**
- **Reorganized as an incorporated administrative agency in October 2003**

URL: http://www.nedo.go.jp/english/index.html

Past Coal-related Explorations, Research and Studies in Australia (excluding CCT, coal liquefaction, etc.)

- Joint research of new technology for geophysical exploration of coal resources
- Predevelopment studies for mine methane management & utilization
- Open-cut coal mine rehabilitation
- Studies regarding coal production/export potential in Australia

Past Coal Exploration-related Projects in Australia (1)

1. Joint research of new technology for geophysical exploration of coal resources

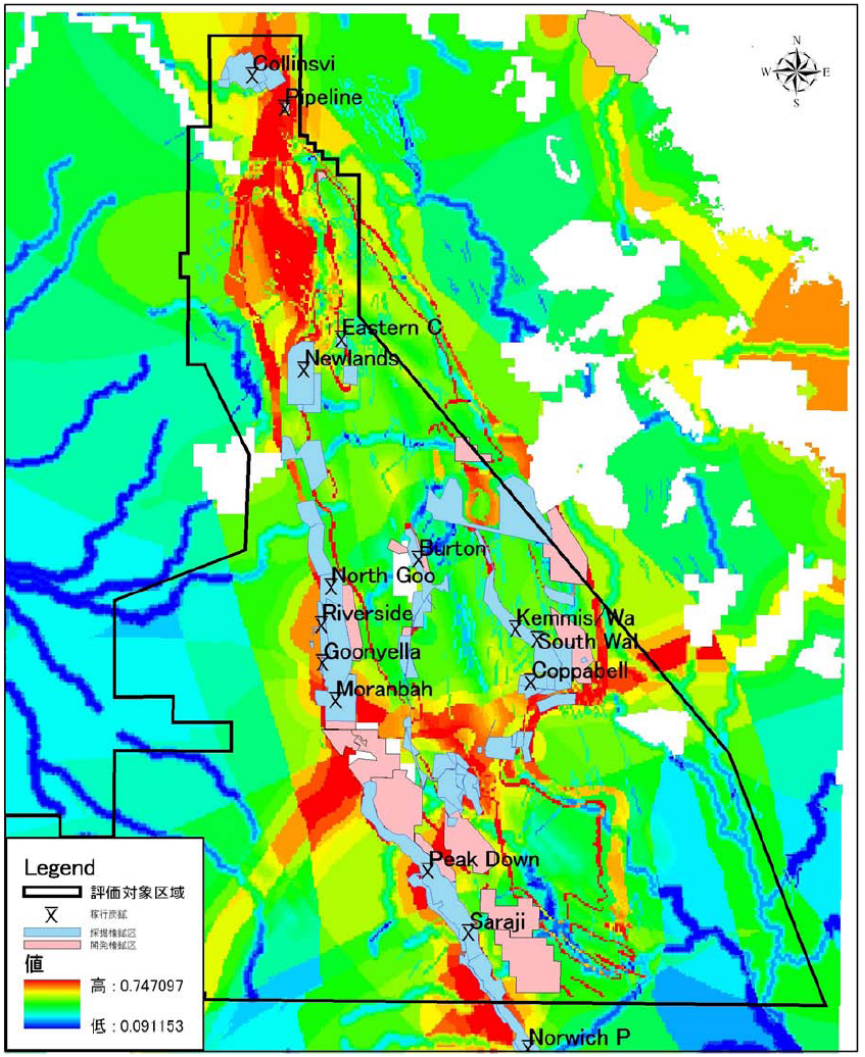
- To develop high precision and high resolution exploration technologies
- To develop technologies that provide resolution of 2-3 meters in coal seam thickness and 2 meters in faults at depths of 300-400 meters
- To be applicable directly to coal mine development and production planning

TARGET: Development of the Following:

1. **Seismic Reflection Survey System**
2. **High-efficiency Geophysical Logging System**
3. **GPS System**
4. **Integrated Coal Resources Evaluation System**
5. **Coal Potentiality System**

STAGE	PERIOD (JFY)	AREA or Coal Mine	COUNTERPART
Early development stage	1992-1996	Taraborah, QLD	QLD Department of Resource Industries (later, Department of Mines & Energy)
Field application stage	1997-1999	Caroona, NSW	NSW Department of Mineral Resources
Demonstration test stage	2000-2002	Coppabella, QLD	QLD Department of Mines & Energy (later, Department of Natural Resources & Mines)
	2003-2004	North Bowen Basin, QLD	

Photos from Joint Research of New Technology for Geophysical Exploration of Coal Resources Project



Past Coal Exploration-related Projects in Australia (2)

2. Predevelopment studies for mine methane management & utilization

- Joint study between NEDO and CSIRO (1993-2003)
- Sites: Wambo Mine (NSW) and Central Mine (QLD)
- Conducted research on recovery and utilization technologies for CMM generated in underground mines
- The results were useful for designing an optimal underground mining plan and effectively using CMM to successfully reduce the environmental impact

Past Coal Exploration-related Projects in Australia (3)

3. Open-cut coal mine rehabilitation

- Joint study between NEDO and CSIRO (2000-2004)
- Sites: Ensham Mine and Ebenezer Mine (QLD)
- Aim: to identify most effective method to rehabilitate open-cut mine sites

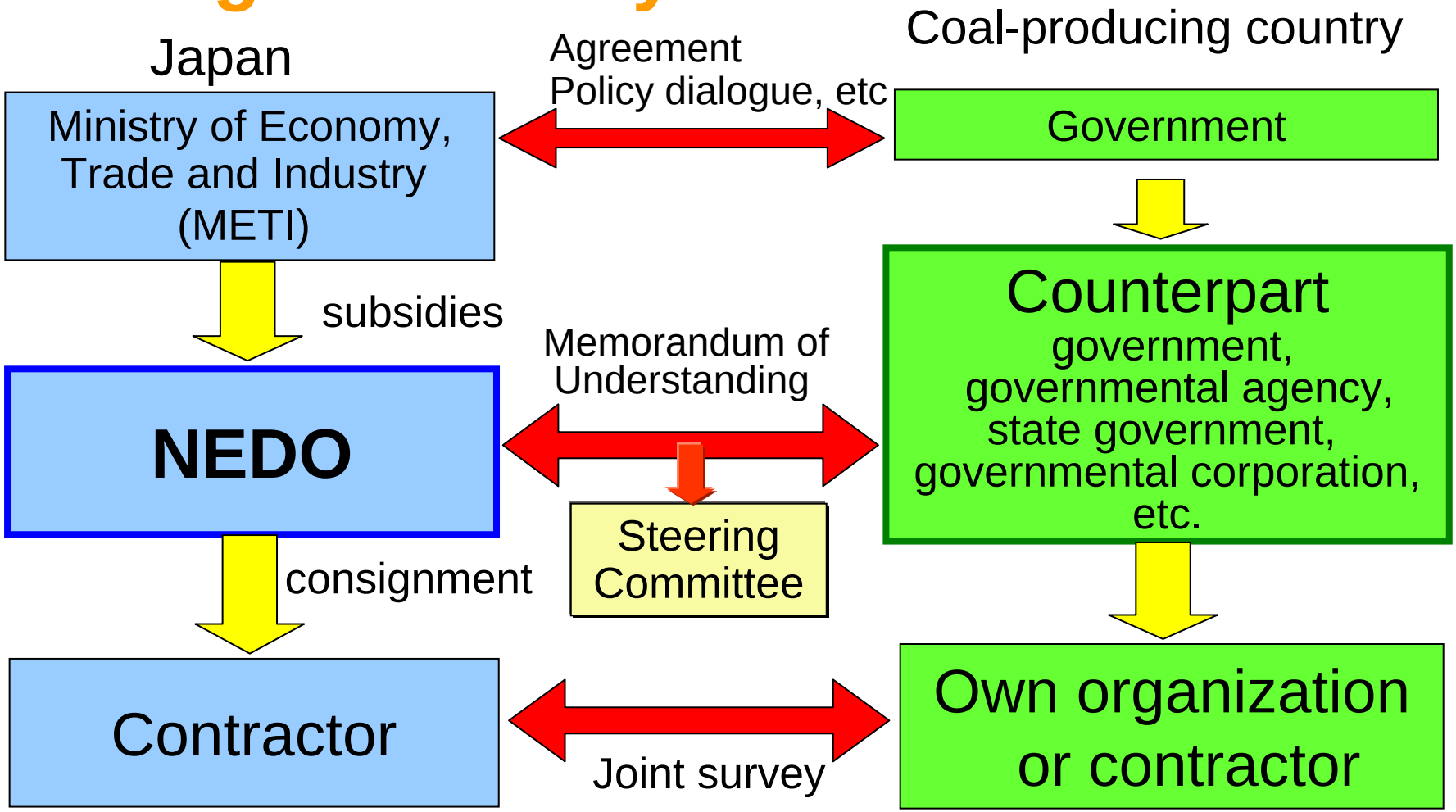
Photos from Open-cut Coal Mine Rehabilitation Project

Studies Regarding Coal Production & Export Potential in Australia

Objective: To secure an efficient and stable supply of overseas coal for Japan by collecting and exchanging information with governments of partner countries when private companies cannot independently collect sufficient coal resource information (These studies were conducted and will be conducted by NEDO.)

Subject	Implementation Year (JFY)	Study Area
Study of Coal Production & Export Potential	**2004**	**NSW**
Study of Coal Production & Export Potential	**2005**	**QLD**
Study of Improvement/Investment Plans & Issues for Port/Transport Infrastructure (Coal Supply Potential & Problems in Australia)	**2007**	**QLD & NSW**
Study of Current State and Future Prospects of Coal Production & Infrastructure Improvement/Investment in QLD and NSW	**2009**	**QLD & NSW**

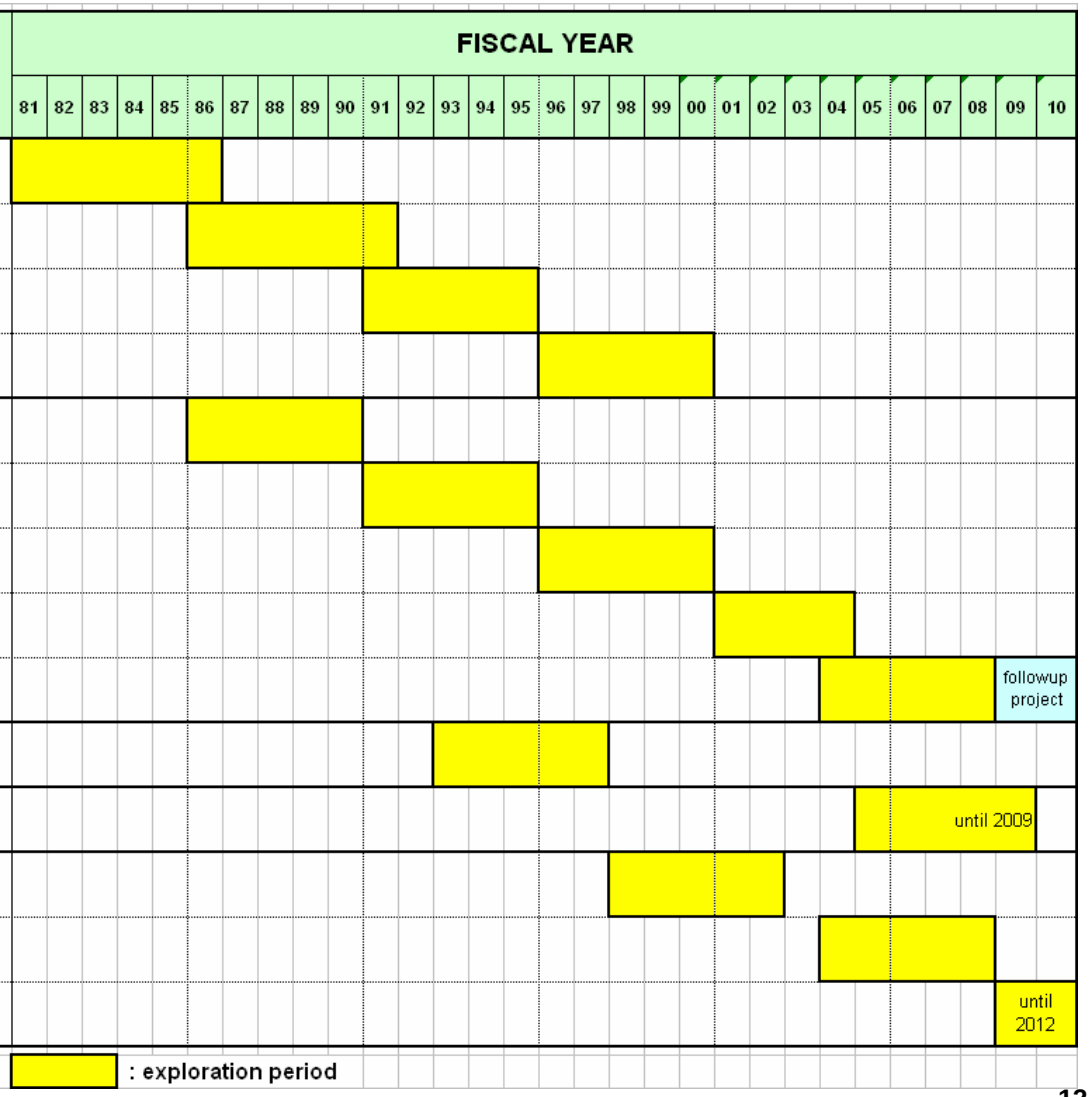
NEDO's Current Overseas Geological Survey Scheme



Data acquisition, geologic mapping, drilling, geophysical logging, seismic reflection survey, geophysical exploration, etc. ➡ evaluation of coal deposits

Current & Past Overseas Geological Surveys

COUNTRY	AREA	CURRENT STATUS AS A DEVELOPMENT PROJECT
China – Anhui (安徽省)	Liu Zhuang (劉庄)	operating mine
China – Shandong	Tang Kou (唐口)	operating mine
China – Shandong	Liang Bao Shi (梁宝寺)	operating mine
China – Hebei (河北省)	Wei Xian (蔚県)	under development
Indonesia	Central Sumatra	pending
Indonesia	Ombilin (West Sumatra)	under development
Indonesia	Tanjung Enim (South Sumatra)	pending
Indonesia	Bunian-Kungkilan (South Sumatra)	pending
Indonesia	*Evaluation of Coal Resources and Reserves*	--
Malaysia	Central Sarawak	pending
Mongolia	East Gobi	exploration
Viet Nam	Red River Delta	exploration
Viet Nam	Deeper Levels of the Quang Ninh Coal Basin	exploration
Viet Nam	Pha Lai-Dong Trieu Area of the Quang Ninh Coal Basin	exploration



: current exploration project

: exploration period

Subsidies for Overseas Coal Development Feasibility Survey

- In order to facilitate the development of overseas coal resources and coal imports, NEDO subsidizes Japanese companies who undertake overseas geological explorations for coal development.

- In JFY2009, NEDO supported the following project in Australia:
  1. Site: Queensland, 2 areas
  2. Applicant: Taiheiyo Kouhatsu, Inc.
  3. Counterpart: New Hope Corporation (concession holder)

- This scheme is applicable to Japanese mining companies wishing to farm in overseas coal exploration projects.

  Maximum grant per project: 60 million JPY

Possible Future Upstream Cooperation with Australia

Our Proposals

1. Joint exploration with state governments
2. Joint construction of coal quality and combustion property database
3. Joint study on countermeasures for coal mine GHG emissions
4. Joint development/construction of coal resources and reserves evaluation system (CRRES)
5. Joint study on strengthening coal transportation infrastructure

Possible Future Upstream Cooperation with Australia

1. Joint exploration with state governments

   Collecting geological information through geological survey/exploration, geophysical survey/exploration, in governmental areas

2. Joint construction of coal quality and combustion property database

   Database of Australian coals will provide useful information for Australian coal users. This database would contain details on coal quality, combustion properties, etc.

Possible Future Upstream Cooperation with Australia

3. Joint study on countermeasures for GHG coal mine emissions

Evaluating the potential for reducing GHG emissions from coal mines in conjunction with Carbon Pollution Reduction Scheme.

Countermeasures would include greening of rehabilitation area, recovering methane, etc.

Possible Future Upstream Cooperation with Australia

4. Joint development/construction of coal resources and reserves evaluation system (CRRES)

   Adapting CRESS for Australian coal resources and reserves.

   (CRESS has been developed through a project with the Indonesian government.)

5. Joint study on strengthening coal transportation infrastructure

   Conducting a joint feasibility study on strengthening Australia's coal transportation system.

   As Japan is the largest buyer of Australian coal, the capacity and stability of Australia's coal transportation system is one of the major concerns of Japanese coal users.

CCT-related Activities

Bilateral collaboration between Australia and Japan

Environment Technology Development Department

Current R&D for reducing CO2 emissions from power gen.

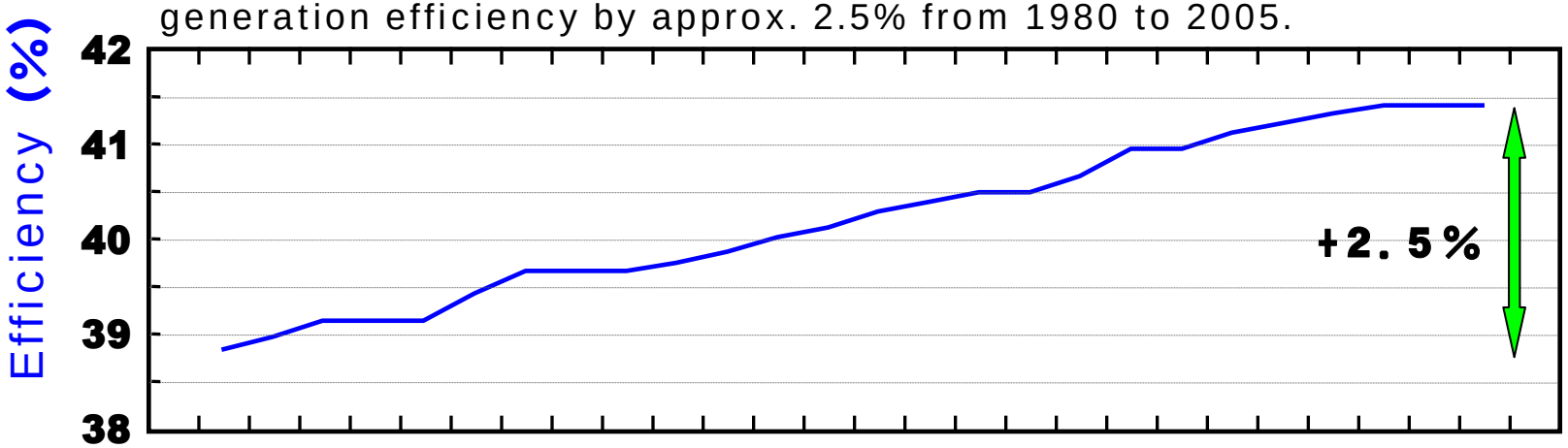
- Increasing efficiency of power generation

- Carbon capture and storage (CCS) from power plants

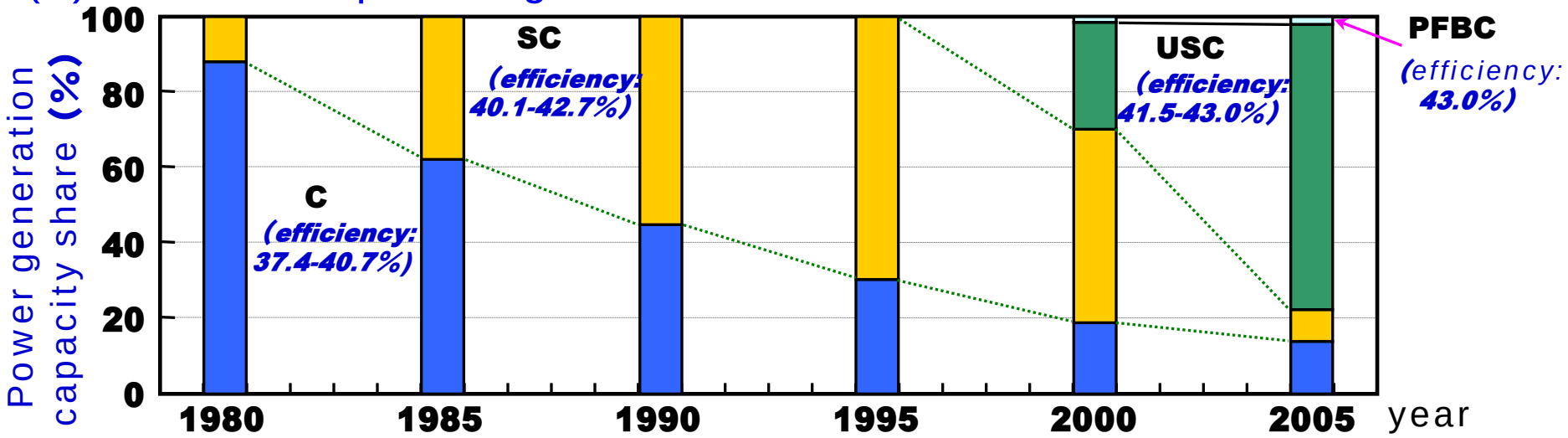
Improving Efficiency of Coal-fired Power Generation

(1) Advancement of power generation efficiency

In Japan, practical use of supercritical power generation **(SC) &** ultra supercritical power generation technologies (USC) increased power generation efficiency by approx. 2.5% from 1980 to 2005.



(2) Coal-fired power generation trends & efficiencies



(Ratio of C to SC, and SC to USC has changed drastically)

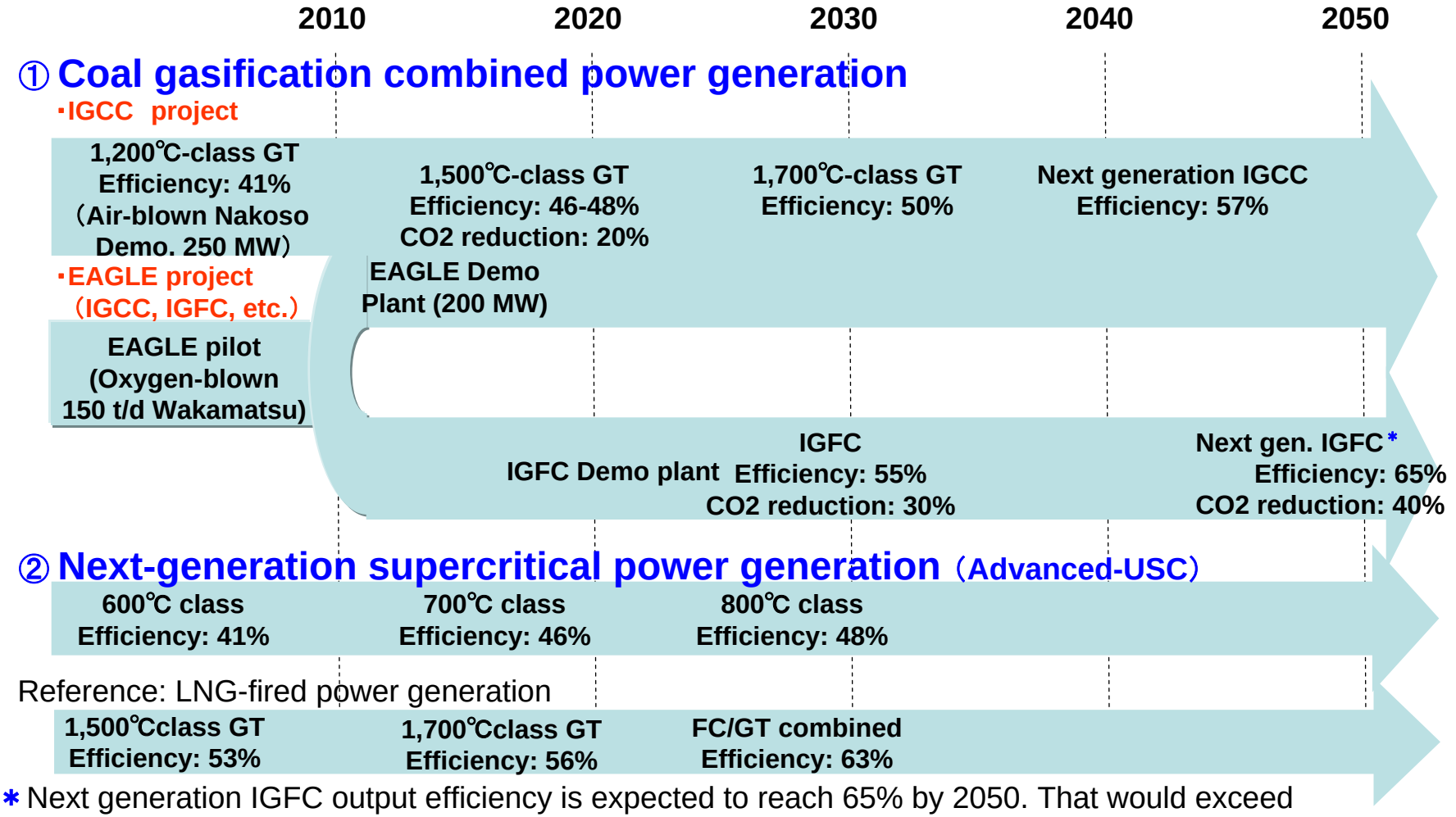
Coal-fired Power Generation Technology Development

(1) Present status in Japan

Efficiency of ultra supercritical power plant (USC): 40.6% (HHV) / 42.0% (LHV)

(2) Power generation technology development roadmap

Efficiency: HHV basis

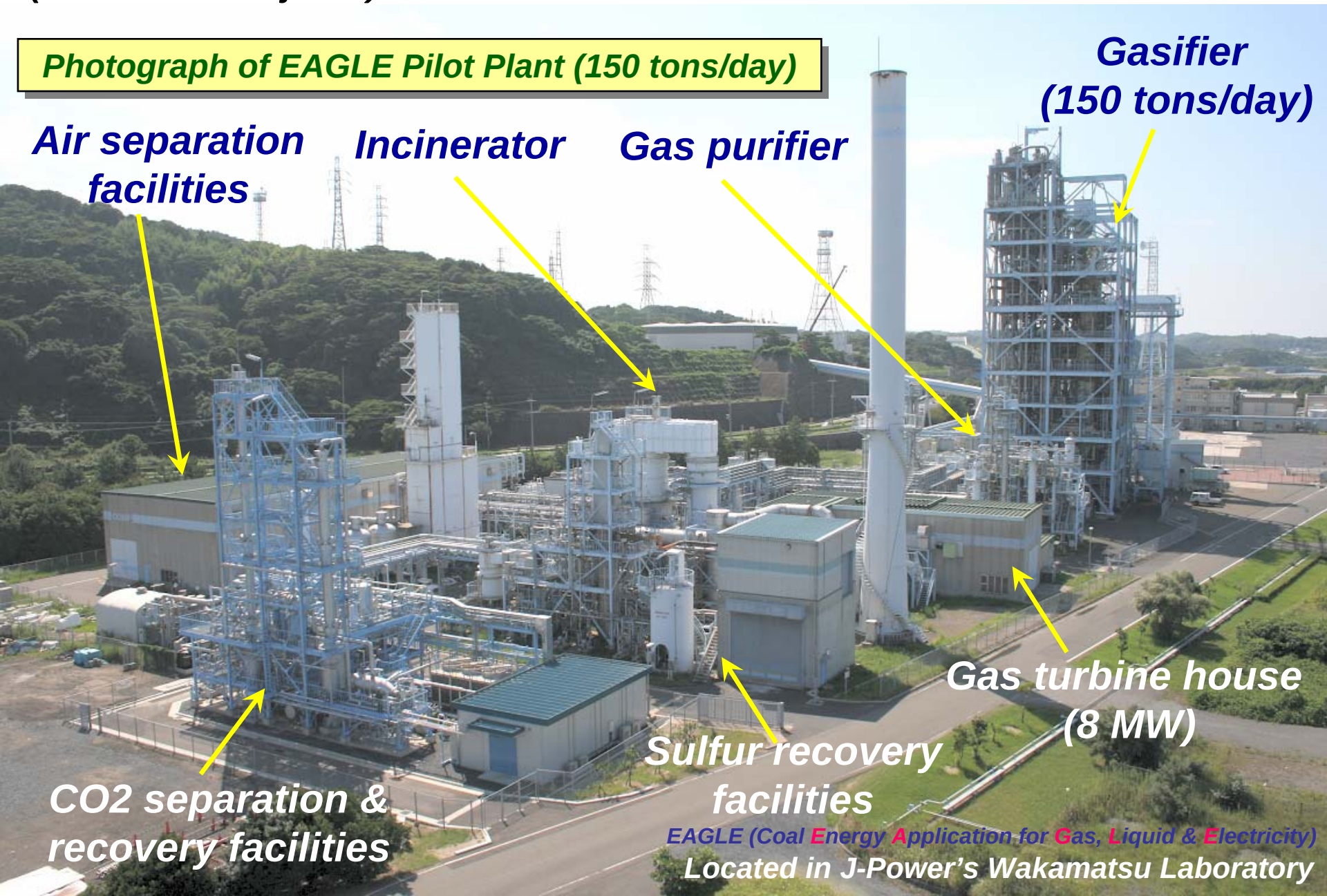


* Next generation IGFC output efficiency is expected to reach 65% by 2050. That would exceed the 63% FC/GT efficiency LNG-fired power generation is expected to reach in 2030.

Coal Gasification Technology Development (EAGLE Project)

NEDO

Photograph of EAGLE Pilot Plant (150 tons/day)



EAGLE (Coal Energy Application for Gas, Liquid & Electricity)

Located in J-Power's Wakamatsu Laboratory

Coal Gasification Technology Development (EAGLE Project)

NEDO

- Multi-purpose coal gasification technology development -

Objectives & Schedule of the EAGLE Project Phase 2 (2007-2009)

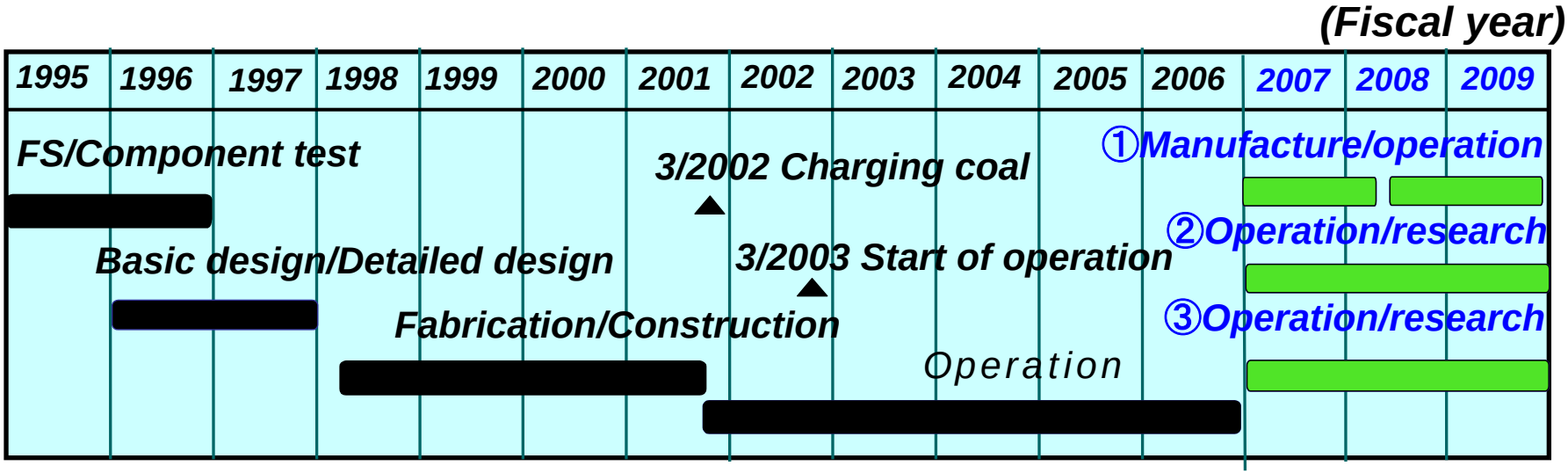
Objectives of Phase 2

①Demonstration of CO2 capture technology

Purity of recovered CO2: 99% or greater

②Expanding applicable types of coal

③Survey on behavior of trace elements



EAGLE (Coal Energy Application for Gas, Liquid & Electricity)

Innovative Zero-emission Coal Gasification Power Generation Project

Feasibility study (on total system from power generation to CCS)

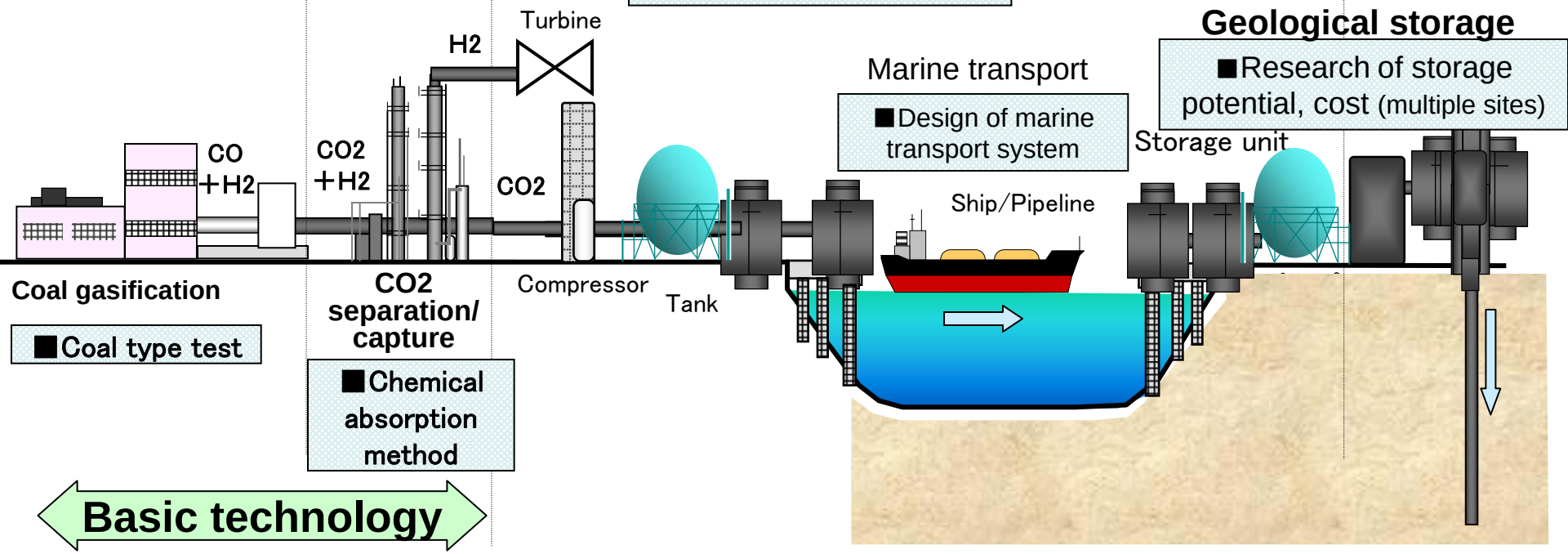
(1) Coal gasification/ Power gen.

Capture/ Storage

(2) Transport

(3) Storage

■System design



Basic technology

- **Next-generation IGCC technology with CO2 recovery (effective use of CO2)**
- **Hydrogen gas-turbine technology development**

Overview of Nakoso IGCC Demonstration Plant

● Summary

- Combined-cycle IGCC (Gas turbine + Steam turbine)
- Air-blown IGCC

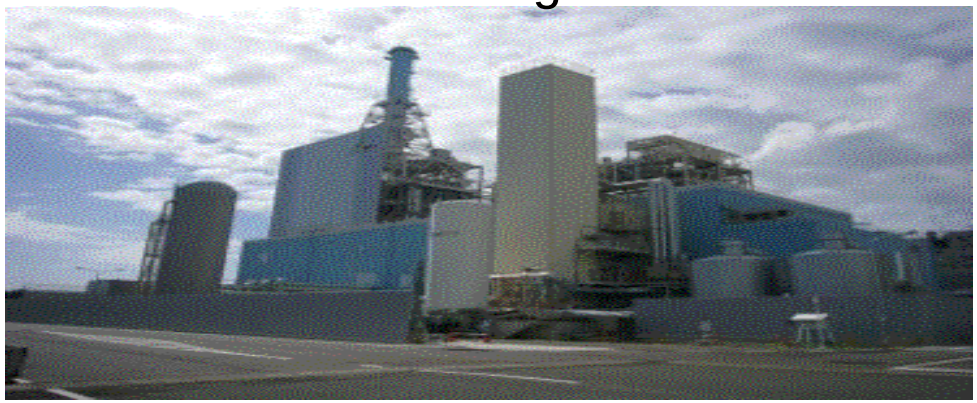
● Specifications

Power	250 MW		Method	Gasifier	Air-blown dry feed gasification
Use of coal	1,700 tons/day			Gas treatment	Wet gas treatment (MDEA)+ gypsum collection
Target efficiency	net	42%		Gas turbine	1200℃

● Progress

Construction began in September 2004 and demonstrative testing started in September 2007 and will be carried out through 2009.

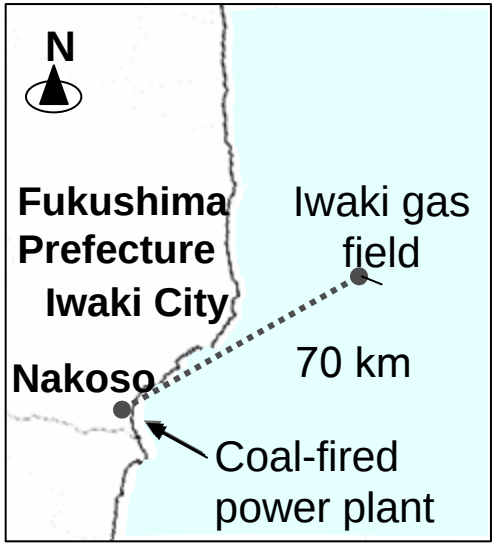
*Demo plant in Iwaki City, Fukushima Prefecture

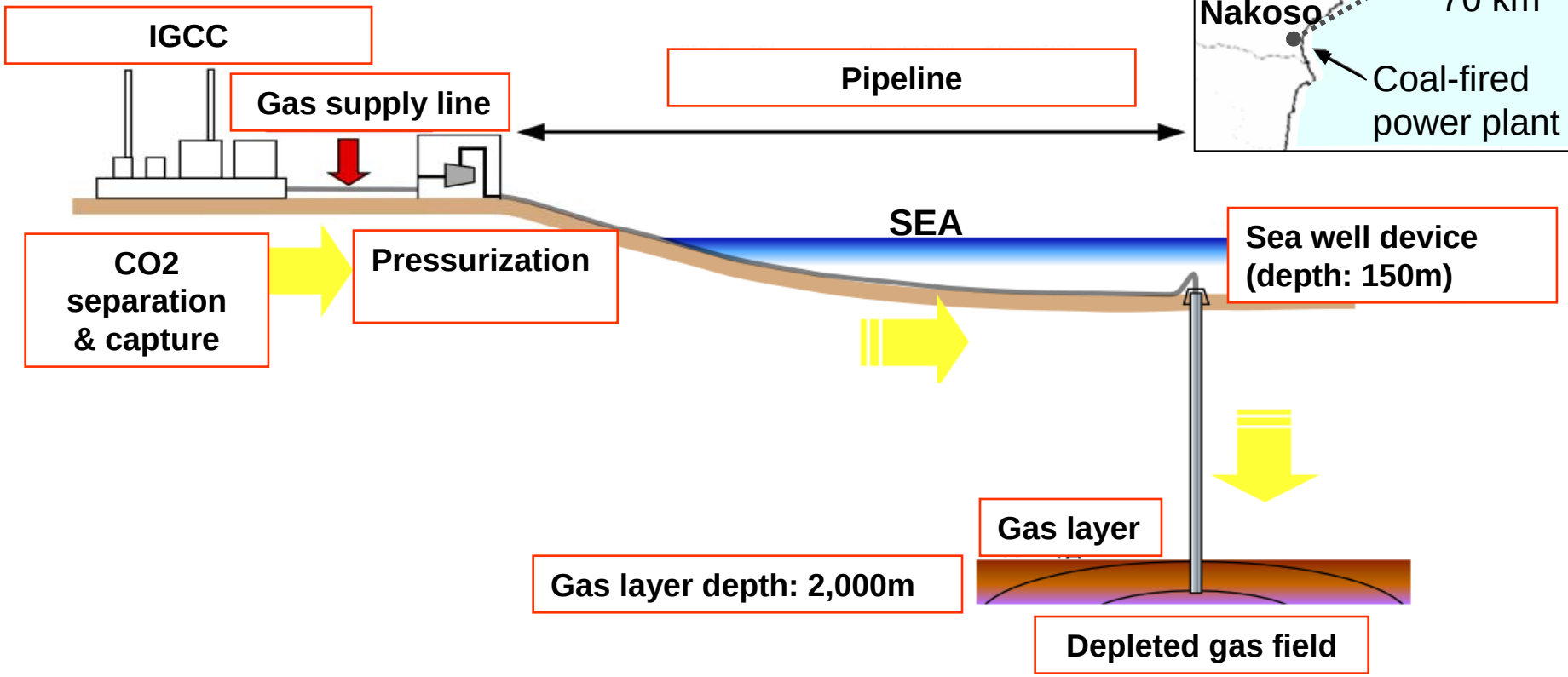


Feasibility Study of IGCC with CO2 Storage

CCS storage: Nakoso—Iwaki offing

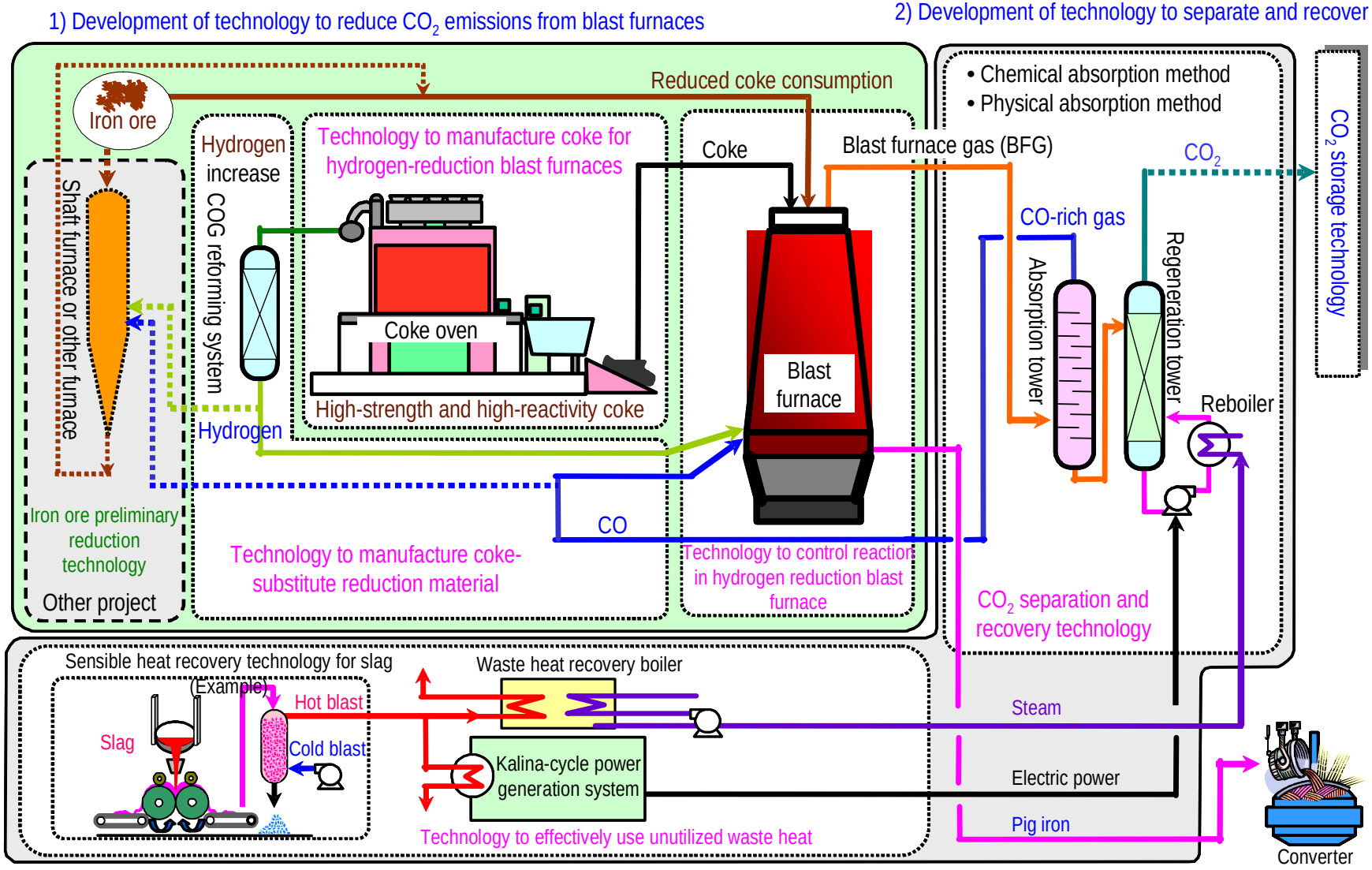
CO2 separated and collected from Nakoso IGCC plant will be transported through a pipeline and stored in a depleted natural gas field (Iwaki gas field) 70 km from Nakoso.





Innovative Steelmaking Technology Development (Course50)

1) Technology development to reduce CO2 emissions from blast furnaces
2) Technology development to separate and recover CO2



Past Clean Coal Technology Collaboration between Australia and NEDO

1. Brown Coal Liquefaction Project (BCL)

Period: 1980-1994
Location: Morwell, Victoria
Subject: Construction & operation of 50 t/d pilot plant
Counterpart: Australian Government
Victorian Government

2. Hyper-coal-based High-efficiency Combustion Technology (Hyper-coal)

Period: 2005-2007
Location: Melbourne, Victoria
Subject: Hyper coal utilisation technology
(for reduction of metal oxides)
Counterpart: HRL

Bilateral Collaboration between Australia and Japan

Clean coal technology (CCT) is expected to become standardized worldwide, satisfying both economic and environmental objectives by facilitating GDP growth while reducing CO2 emissions.

Through bilateral technical collaboration, Australia and Japan can more effectively utilize coal.

Clean Coal Technology Systems

- Low rank coal utilization
- Carbon capture & storage

Bilateral Collaboration between Australia and Japan

Expected cooperative research opportunities

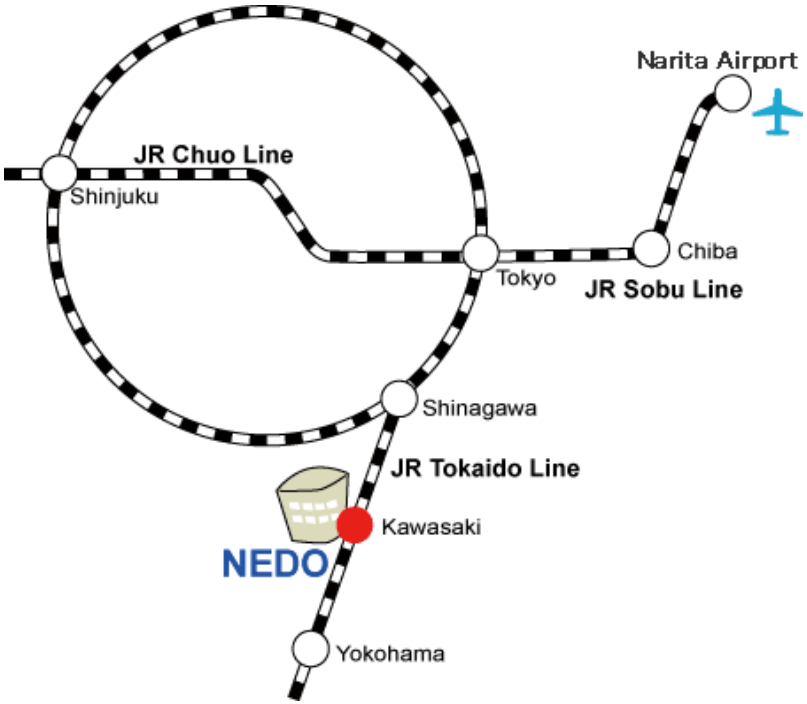
1. Surveys

- Low rank coal utilization
- Responding to climate change
  - Carbon capture and storage (CCS)

2. Basic research

- Dewater (Upgrading brown coal)
- Coal reforming technology
- Conversion technology (Syngas, Reduced iron, Liquid fuel)
- CCS
  - Pre-Combustion: Next generation separation technology (Membrane CO2 & air separation)
  - Post-Combustion: Amine absorption technology

Thank you for your attention!



NEDO Kawasaki Head Office
MUZA Kawasaki Central Tower
1310 Omiya-cho, Saiwai-ku,
Kawasaki City, Kanagawa 212-8554, Japan
http://www.nedo.go.jp/english/index.html