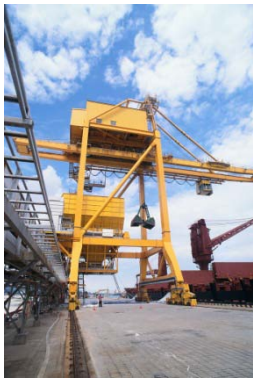
Japan as a coal-consuming nation: what we can do and what we must do



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Fuminobu Kawashima

Managing Officer; Chief Operating Officer,
Energy Business Unit I

Mitsui & Co., Ltd.

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Overview of Coal — Reserves, Location of Deposits and Consumption

- **Plentiful reserves: 1 trillion tons of confirmed deposits**
  Based on current annual production (= consumption) of around 5.4 billion tons, this is equivalent to 160 - 200 years of recoverable reserves.
  In comparison, oil has around 40 years of recoverable reserves and natural gas around 60 years.

- **Coal reserves do not tend to be concentrated in particular areas, but are widely distributed throughout the world. Many countries are both producers and consumers of coal. The majority of coals have been consumed in the home country.**
  The three main coal-producing nations—China, the United States and India—account for more than 60% of global consumption of coal.

- **Maritime trade in coal is estimated at 800 million tons, equivalent to approximately 15% of the total.**
  Australia is the world's biggest exporter of coal while Japan is the biggest importer. Japan, South Korea and Taiwan together account for around 40% of coal imports.

Around 85% of coal is consumed in the home country.

Overview of Coal - Price Competition -

- **Since coal reserves are fairly evenly dispersed throughout the world, coal provides an economical and reliable energy source in many countries.**
- **As a fuel for power generation, coal offers superior price stability and performance compared to crude oil and LNG. Accordingly, coal-fired power generation accounts for roughly 50% of all power generated in the world.**
- **Coal-fired power stations provide around 27% of Japan's power (in terms of the breakdown of generated energy).**

Coal accounts for roughly half of global power generation in the world.

Unit: ¥1,000/kcal

Source: EDMC (based on trade statistics from the Ministry of Finance)

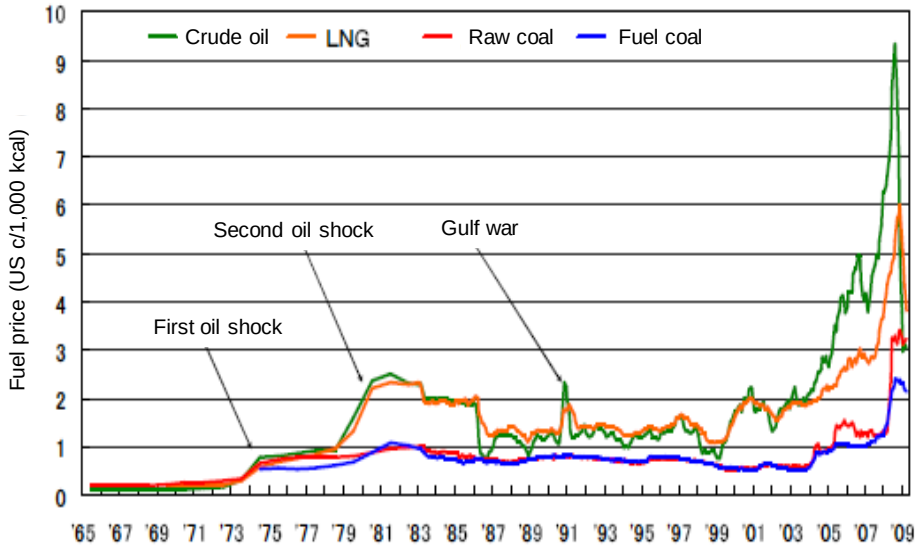
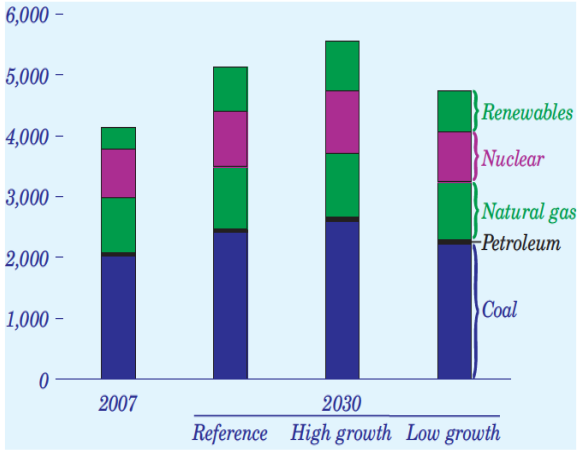


Figure 55. Electricity generation by fuel in three cases, 2007 and 2030 (billion kilowatthours)



Source: EIA Energy Outlook 2009

Overview of Coal - Environmental Impact -

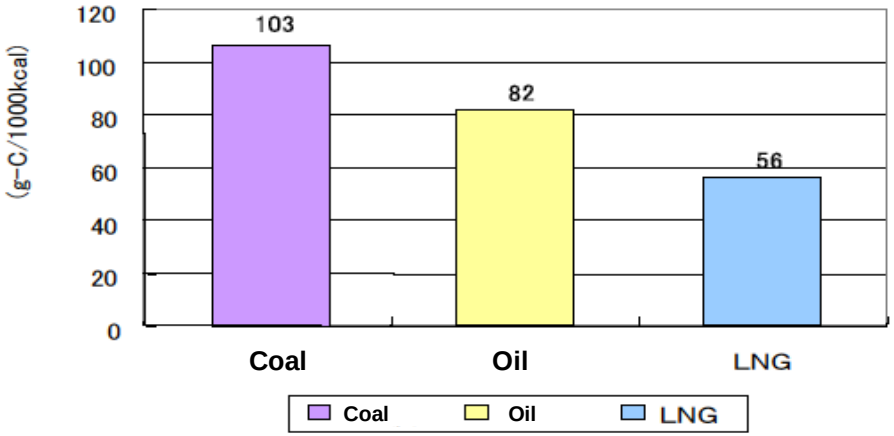
However, coal has the following problems from the viewpoint of negative environmental impact.

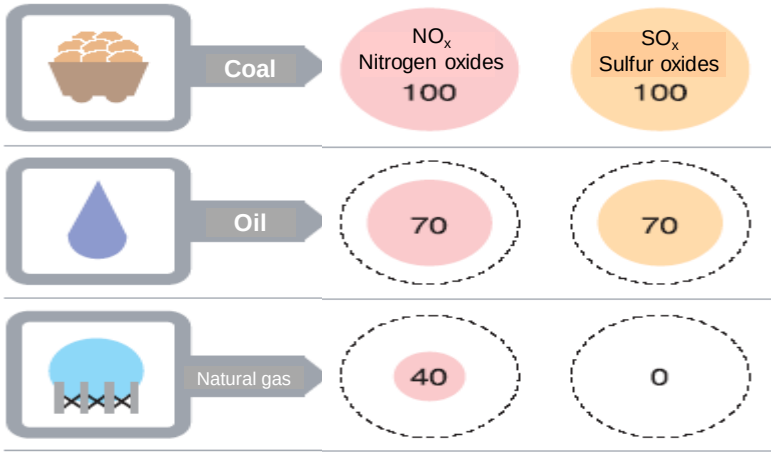
- **Coal exhausts a high level of CO2 emissions per unit of thermal energy — over 20% higher than oil and 80% higher than LNG**
- **Coal also exhausts more SOx and NOx emissions than other fossil fuels**
- **Coal combustion generates coal ash as a by-product**

Environmental considerations must be taken into account.

Carbon emission coefficient by energy source

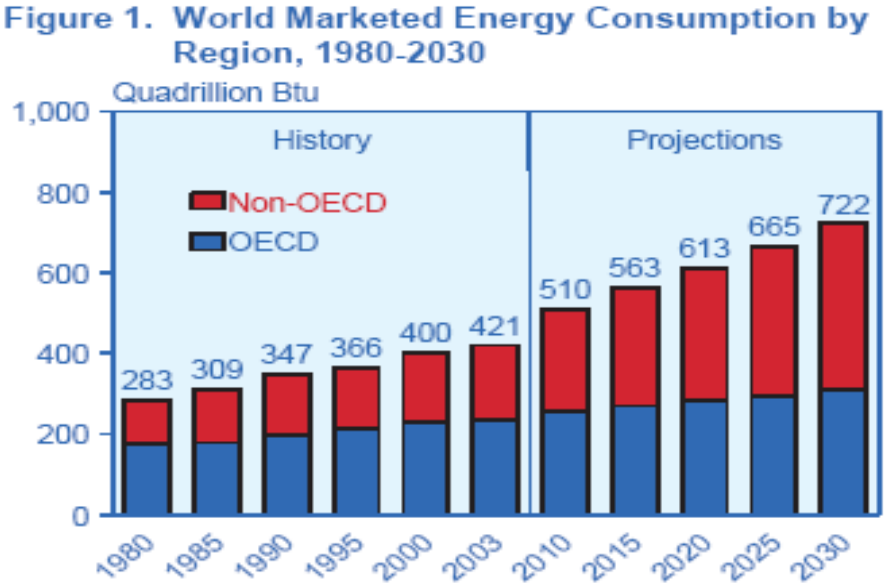
Fuel coal has a high level of carbon dioxide emissions per unit of thermal energy — over 20% higher than oil and 80% higher than PNG



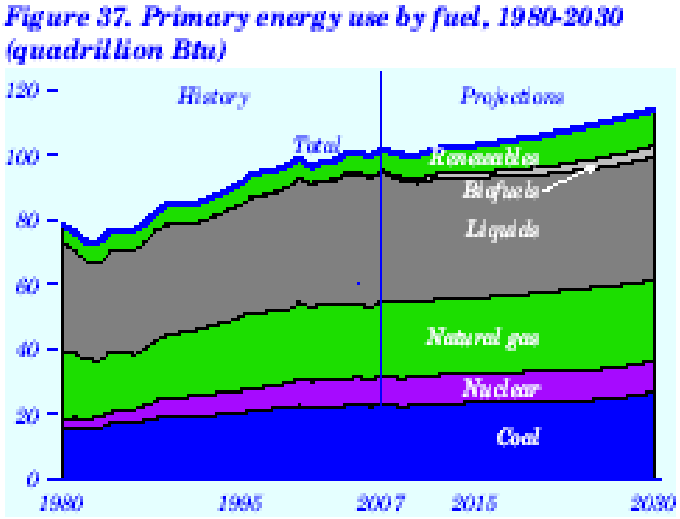


Sources: Graph: Japanese government report based on the "United Nations Framework Convention on Climate Change (UNFCCC)"
Diagram: "Energy in Japan 2006" (Agency of Natural Resources and Energy)

Coal Proportion of Future Global Energy Demand



Source: International Energy Outlook 2006

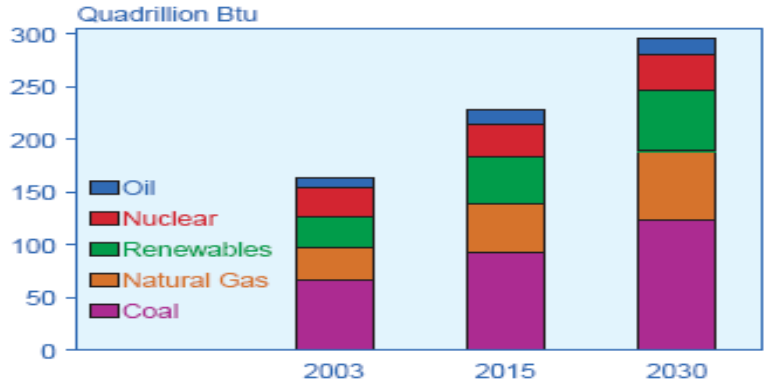


Source: EIA Energy Outlook 2009

Coal will remain an important energy source in the future

- Worldwide demand for energy will continue to increase.
- **Continued reliance on fossil fuels is unavoidable in the medium to long term.** (The relative proportion of fossil fuel consumption is expected to remain stable at 81% in 2005 to 82% in 2030.)
- Importantly, the dependency to coal will be continuously rising. (from 5.9 billion tons in 2005 to 12 billion tons in 2030).

Figure 5. World Energy Consumption for Electricity Generation by Fuel Type, 2003, 2015, and 2030



Sources: **2003:** Derived from Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea/. **2010-2030:** EIA, System for the Analysis of Global Energy Markets (2006).

Source: International Energy Outlook 2006

- **The expected increase in coal consumption is largely attributable to greater demand for power in many countries, most notably China and India. Even in 2030, the relative proportion of the world's energy supplies provided by coal will remain unchanged.**
- **Thus, the key issue will be how to continue using coal while reducing its environmental impact (particularly with respect to global warming).**

Can we continue to use coal while reducing its environmental impact in terms of CO2 emissions?

What can be done to reduce CO2 emissions?

Industry has a role to play — including Mitsui & Co.!

Changing personal habits

- Saving power
- Reducing car engine idling time
- Using public transport
- Public campaigns such as Cool Biz and Team Minus 6%

Not suited to global numerical targets

Atmospheric CO2 capture

- Promoting photosynthesis (afforestation and major landscaping projects)
- Desertification strategies
- Urban greening programs

No immediate large-scale capture benefit

Reducing CO2 emissions

- **Promoting energy-saving initiatives and efficient energy generation**
- **Promoting nuclear energy**
- **Utilizing renewable/natural energy resources: hydroelectricity, solar power, wind power, biomass power generation**

Medium to long-term industry solutions

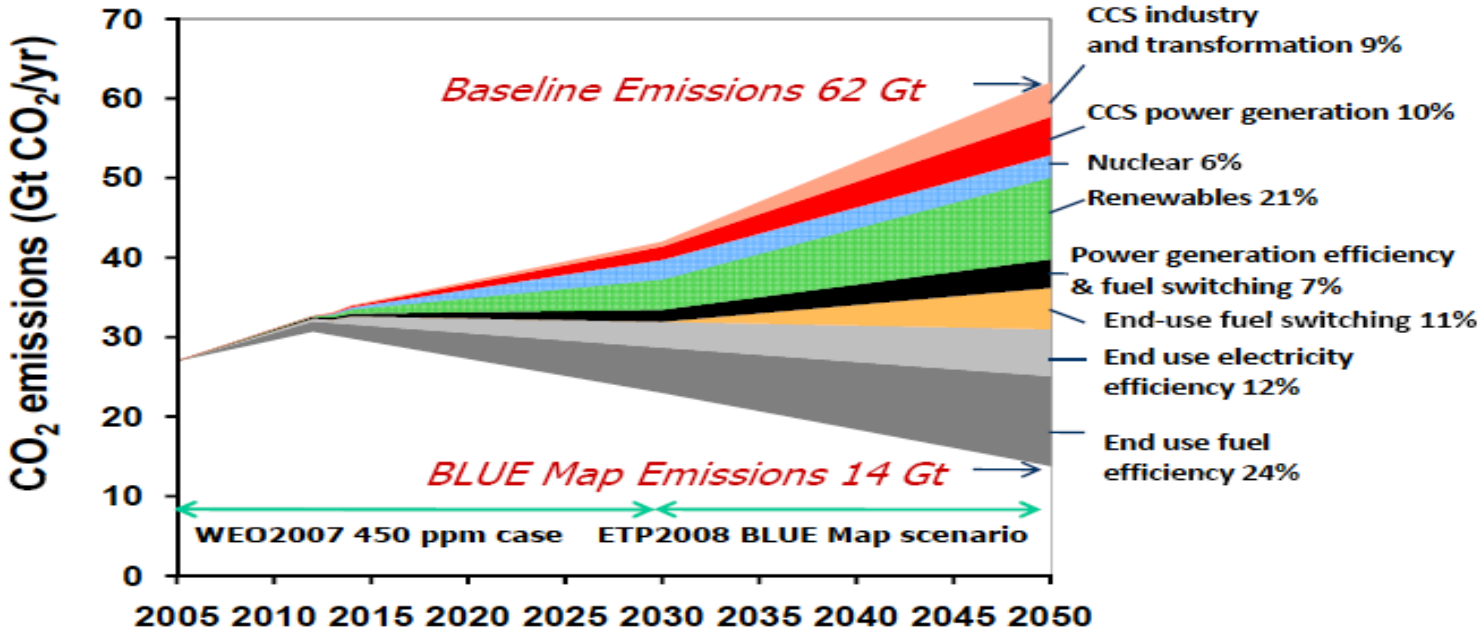
Capturing and isolating CO2 before it reaches the atmosphere

CCS (carbon dioxide capture and storage)

Short-term industry solutions

How far should we reduce CO2 emissions?

- The Hokkaido Toyako Summit in July 2008 released a joint agreement for a 50% reduction of global greenhouse gas emissions by 2050.



（Source: IEA)

How Japan can contribute ?

- **Given that coal will remain a major energy source in the future, the development of clean coal technology is nothing less than our international duty and our responsibility to society**

  (1) Introduction of efficient coal-fired power generation technology and associated technology transfer (to reduce carbon dioxide emissions)

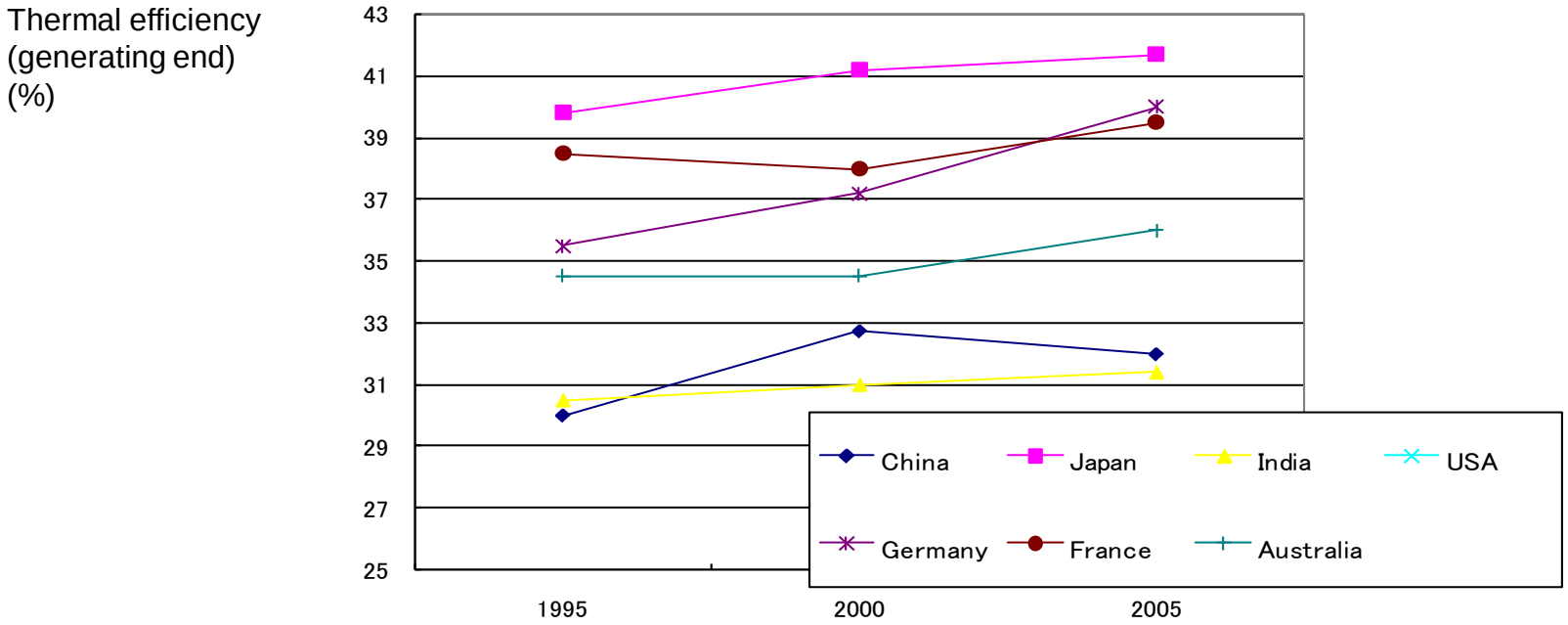
  (2) Capture and Storage of CO2 emitted (CCS) by coal-fired power stations (to recover and isolate carbon dioxide before it reaches the atmosphere)

  （CCS = Carbon Dioxide Capture & Storage）

- **As the world's biggest coal importer, Japan can share its experience and expertise in power generation and CO2 capture technology with coal producers (i.e., countries that consume and/or export coal) to address the areas identified above**

(1) Transfer of high efficiency coal-fired power generation technology

- **According to figures released by the Institute of Energy Economics in Japan, the introduction of high efficiency Japanese coal-fired power generation systems in the USA, China and India would reduce annual CO2 emissions by 1.3 billion tons, equivalent to Japan's total emissions.**



Source: Based on International Comparison of Fossil Power Efficiency 2008 (ECOFYS)

(2) Contribution of Japan for Technological Practical Use in CCS Systems

In particular, Japan can contribute technical experience and expertise in the area of CO2 capture at power stations to prevent their release into the atmosphere.

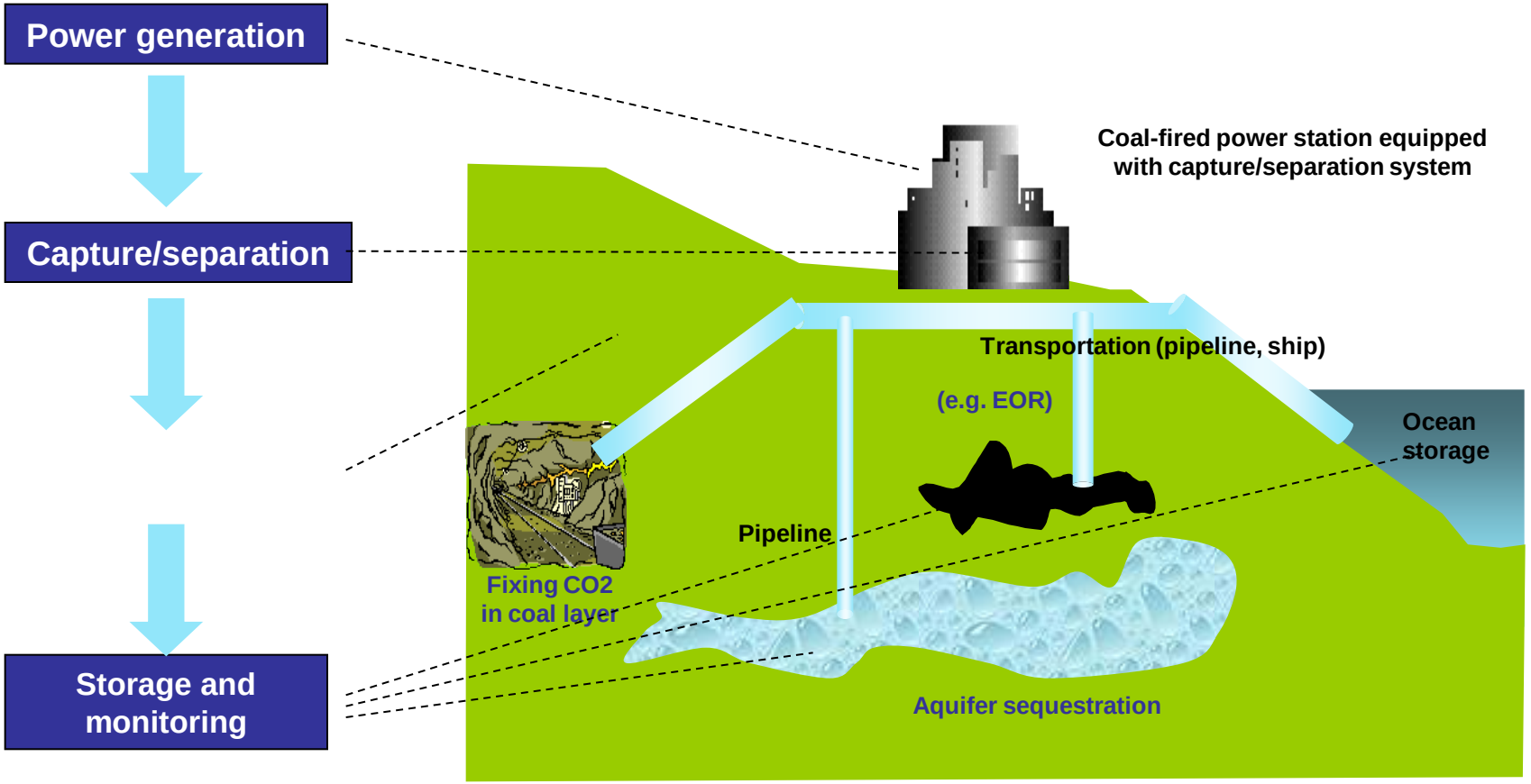
What is CCS?

- **CCS is a technique that utilizes natural phenomena to isolate the greenhouse gas CO2 on a semi-permanent basis**
  - **- Underground geology has the capacity to store CO2**
  - **- Oceans have the capacity to absorb/dissolve CO2**
- **The four main processes in CCS are:**
  - **- Capturing CO2 at the source**
  - **- Transporting captured CO2 (normally via pipelines)**
  - **- Injecting into land and/or marine storage reservoirs**
  - **- Fixing CO2 in the ground**

CCS enables us to “continue using fossil fuels” while also “reducing CO2 emissions”

CCS System

CCS is an integrated processing system consisting of several processes: CO2 capture and separation, transportation and storage



Source: "Solutions for the 21st Century, Zero Emissions Technologies for Fossil Fuels", International Energy Agency 2002

Key Issues with CCS
(1) CO2 capture technology and associated costs

Capture

CO2 capture technology at present
Three CO2 capture and separation technologies are viable for coal-fired power stations:

- Pre-combustion capture
  CO2 is separated and captured during the coal gasification process
- Post-combustion capture (MHI)
  CO2 is separated and captured from post-combustion exhaust gases
- Oxygen combustion (IHI)
  Coal is burned in oxygen to increase the CO2 concentration in exhaust gases and facilitate CO2 capture

70% of total cost

Storage

CO2 capture has already been used successfully in Enhanced Oil Recovery (EOR) and underground natural gas storage applications.
Thus, the technology is well established.

30% of total cost

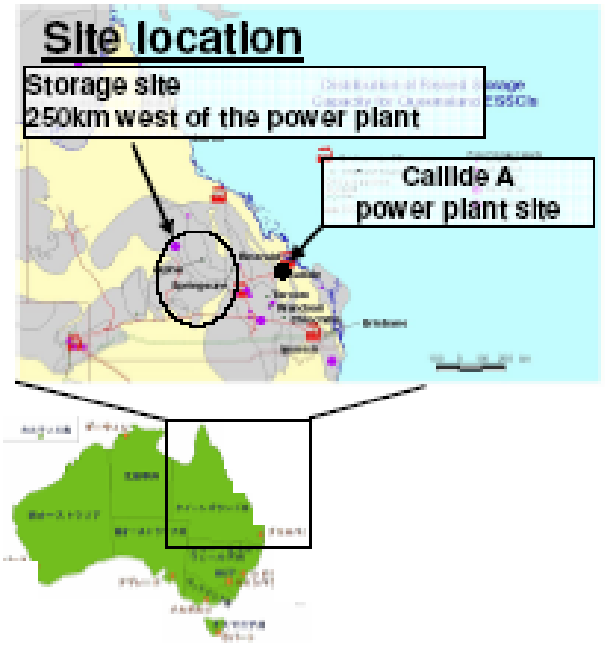
Key Issues with CCS
(2) CO2 storage and associated risks

- Will CO2 leak from the ground?
- Impact on marine ecosystems
  — marine storage
- Inadequate legislation
- Public acceptance of CO2 storage

Need for further demonstration

Programs underway at Mitsui & Co.
Japan-Australia oxygen combustion and CCS proving project

- Overview
  - An IHI oxyfuel combustion system has been installed in an unused 30 MW boiler at the Callide power station in Queensland, Australia.
  - CO2 captured from the power station is stored in a depleted gas field located approximately 250 km to the west.
- Partners
  - Australia: CS Energy, Xstrata, Schlumberger
  - Japan: J-Power, IHI, Mitsui & Co.
    With financial support from the Japanese and Australia governments and the Australian Coal Association.
- Timetable
  - March 2008: JVA signing
  - Second half of 2011: commence oxyfuel combustion and CO2 capture/storage



Conclusions

If we accept the evidence that:

- **Global energy demand will continue rising, and**
- **Coal will play a major role in supplying this demand**

Then our mission at Mitsui & Co. is to:

- **Ensure the stability of global energy supplies by**
- **Continuing to develop new forms of coal technology.**

But this is not enough; we must also play an active role in the development and promotion of new technologies designed to:

- **Reduce the adverse environmental impact of coal, and**
- **Develop more environmentally-friendly ways to use coal.**

- **No other energy source has such an important bearing on both global economic "growth" and "environmental health"**
- **This is why coal producers and coal importers need to understand the urgency of working together to address environmental issues and secure the future of the coal industry predicated on economic and environmental considerations.**