



# Note on Carbon Capture and Storage in Japan

Ryozo Tanaka  
Senior Science and Innovation Officer

Science and Innovation Section  
British Embassy Tokyo

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Contact: Tel. +81-3-5211-1100 Fax +81-3-3230-4800 e-mail [ryozo.tanaka@fco.gov.uk](mailto:ryozo.tanaka@fco.gov.uk)

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## **Overview**

Japan has a long history of research on Carbon Capture and Storage (CCS). Public research institutes and electricity companies started fundamental studies separately in the late 1980s. Nowadays, research in this area is led by the Research Institute of Innovative Technology for the Earth (RITE), which has a number of researchers seconded from industry. RITE was established in Kyoto in 1990 by the Ministry of Economy, Trade and Industry (METI) and is headed by Professor Yoichi Kaya, an influential figure on climate change issues in Japan. In industry, Mitsubishi Heavy Industries (MHI) is prominent with its technology to capture carbon dioxide, having successfully demonstrated the technology at three test facilities in conjunction with companies with large carbon emissions.

In 2006, METI formed a committee chaired by Professor Kaya to explore how to include CCS in its policies and the committee issued a report in 2007 containing recommendations for CCS promotion as a global warming countermeasure. METI is most likely to include CCS as one of a number of innovative technologies to be developed for cutting global warming gas emissions by half by 2050. This proposal is under discussion in another committee composed of Professor Yoshikawa of AIST as the chairman and the presidents of such leading companies as Toyota Motor, Nippon Steel, Sharp and Tokyo Electric (TEPCO).

METI is enthusiastic about international collaboration. Japan is a member of the Carbon Sequestration Leadership Forum (CSLF), an international scheme for CCS technology development. METI planned to participate in US DOE led FutureGen, which is a project on a coal-fuelled, near-zero emissions power plant, but has currently suspended its involvement due to recent doubts about the future of the project.

## **Outline of Carbon Capture and Storage technologies**

Carbon Capture and Storage (CCS) consists of four phases: carbon dioxide capture, transport, injection and storage. Its largest disadvantage is the lack of financial incentives when it is applied only to reducing carbon dioxide emissions. A limited number of commercially viable projects are aimed at enhancing oil production or avoiding climate taxation. Another downside is that power stations with CCS consume 10-40% more energy than those without CCS and as a result the depletion of fossil fuel would be accelerated.

Carbon capture technologies are commercially used for synthesis gases and liquefied natural gases which are under high pressure. These technologies, however, are not available for flue gases from large stationary sources such as power stations and steelworks. The development of efficient carbon capture is one of the issues to be addressed. The most promising carbon capture technology is chemical absorption. Japan is also examining how to apply their world leading membrane technologies for carbon capture.

## **Carbon Capture in Japan**

MHI is one of the world leading companies in this area with its chemical absorption using alkaline solvent. They are keen to participate in BERR's demonstration project, the bidding process of which was started in October last year. MHI has been conducting small-scale demonstration at different emission sources: a LNG thermal power station in Nanko Osaka with Kansai Electric (KEPCO); steelworks in Kimitsu, Chiba with Nippon Steel; and a coal-fired power station in Matsushima, Nagasaki with J-Power.

Among others, JGC (Nikki in Japanese) collaborates with a German company on chemical absorption and RITE is a leading organisation in membrane separation development. In electricity companies' projects in the 1990s, there was involvement of such companies as Chiyoda and Hitachi as well as MHI. Japan Coal Energy Centre (J-Coal), IHI and J-Power have developed a technology to increase the concentration of carbon dioxide in flue gas from coal-fired power plants by repeated flue gas combustion with dense oxygen. They are carrying out a demonstration project with Australia.

## **Carbon Injection and Storage in Japan**

Japan has conducted two geological storage test projects with support from METI: one in Nagaoka, Niigata and the other in Yubari, Hokkaido. In the project in Nagaoka, RITE took the lead and injected carbon dioxide into a saline aquifer at a depleted gas field in 2004 and the monitoring of stored gases is still under operation. The Yubari project was conducted from 2002 to 2007, led by Kansai Electric (KEPCO) and RITE. It was aimed at testing the injection and storage of carbon dioxide in coal seams and the recovery of methane gas from the site.

## **Commercialisation of Carbon Capture and Storage**

There are no commercial projects regarding CCS in Japan. MHI, however, has developed a plant with Royal Dutch Shell to capture carbon dioxide from a thermal power plant and use the gas to enhance oil production. They are marketing the system to customers at Middle Eastern oil fields where associated gas is used as fuel at thermal power stations.

## **Issues to be addressed and policy recommendation in METI CCS committee's report**

METI formed a committee in 2006 to explore how to include CCS in their policies. The committee chaired by Professor Yoichi Kaya, Director-General of RITE, had several meetings and issued a report next year. The report describes CCS as one of the options for global warming countermeasures but emphasises the downside – no financial incentives and high risk in most cases. The report includes issues to be addressed and policy recommendation for CCS promotion: the development of domestic legislation and international rules; the development of low-cost technology and the promotion of model projects; the promotion of international collaboration; and the reinforcement of industry-academia-government co-operation and support to Japanese companies.

## **Carbon Sequestration Leadership Forum (CSLF)**

The Carbon Sequestration Leadership Forum (CSLF) was established in June 2003 as an international scheme for CCS technology development. The Forum is composed of 22 nations and regions including Japan, UK, US, Germany, Netherlands, Norway, Canada, EC, China, India, South Africa and Brazil. One of its flagship projects is the CO<sub>2</sub> Capture Project (CCP)<sup>1</sup>, in which global energy giants participate.

## **FutureGen**

FutureGen was proposed by US President George W. Bush in 2003 as an international project to develop a coal gasification thermal power plant (so-called Integrated Gasification Combined Cycle – IGCC) combined with a capture and storage system for its emitted carbon dioxide. This is the so-called pre-combustion type, different from the post-combustion type, which is required in BERR demonstration project. The plant was originally planned to start in 2012 and it was expected that Japan, Korea, India and China would participate in the project. However, in January this year, US DOE announced that they would not invest in the construction of a power plant equipped with CCS. Instead, they intend to fund only the introduction of a CCS system to a currently-projected IGCC. METI was keen to participate in the original project, having assigned RITE as the head Japanese organisation, but is currently reviewing its involvement.

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<sup>1</sup> <http://www.co2captureproject.org/index.htm>