World's First Development of Ultra-Low Cost CO_2 Capture and Storage Technology
– JFE's Original Hydrate Process Technology Cuts Cost by Half –

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JFE Engineering Corporation

JFE Engineering Corporation succeeded for the first time in the world in developing a CO_2 capture and storage technology which converts CO_2 to a hydrate under substantially atmospheric temperature and pressure conditions.

Being cooled to a low temperature under a designated pressure, CO_2 containing water can separate out the only CO_2 component as a sherbet-like solid called a "hydrate". This technology has long been known to enable capture and storage of the CO_2. However, practical application had been considered difficult due to the high operating cost of high pressure and low temperature conditions.[*1]

JFE Engineering discovered a phenomenon in which formation of the hydrate of CO_2 is produced under significantly eased conditions of pressure and temperature by adding a trace amount of JFE's "Clathrate Hydrate Slurry"[*2] into a mixture of water with microbubbled CO_2.

"Clathrate Hydrate Slurry" is a thermal energy storage medium for air-conditioning systems, which JFE Engineering developed jointly with Japan's New Energy and Industrial Technology Development Organization, NEDO. This is a new substance which forms a hydrate at around 7°C under atmospheric pressure. With development of this Clathrate Hydrate Slurry technology, JFE Engineering made it possible to control the conditions of pressure and temperature required for converting CO_2 to a hydrate. JFE Engineering conducted a bench scale experiment to produce CO_2 hydrate under substantially atmospheric pressure and temperature[*3] conditions, confirming the possibility of carbon dioxide capture and storage, CCS.[*4] under those conditions.

Operating costs of CCS will be significantly reduced with these results, being expected to drop to approximately 2,500JPY per t-CO_2 at an actual plant scale. In comparison with the conventional chemical absorption process, JFE's Hydrate process does not

require thermal energy to separate CO_2 from the liquid in which CO_2 is absorbed. As a result, the JFE process can be applied to a wide range of CO_2 emissions at about half the cost[*5] of conventional processes.

JFE Engineering expects to conduct larger scale tests in the future, preconditioned on a CCS plant for CO_2 capture of flue gas from thermal power plants, steel works, and similar industrial plants assumed CCS scale from 0.3 million to 1 million tons per year.

*1: For example, with a temperature of 5°C, a pressure of 2.2MPa or higher is required.

*2: Clathrate Hydrate Slurry is a thermal energy storage medium for air-conditioning systems which was jointly developed by JFE Engineering Corporation and the New Energy and Industrial Technology Development Organization, NEDO, being already commercialized. In contrast to the fact that water forms a solid that is ice below 0°C, Clathrate Hydrate Slurry forms a hydrate in a slurry state at 5-7°C, which is a temperature for suitable for air-conditioning applications. JFE Engineering already has an extensive record of deliveries of thermal energy storage (Clathrate Hydrate Slurry) air-conditioning systems in Japan and other countries.

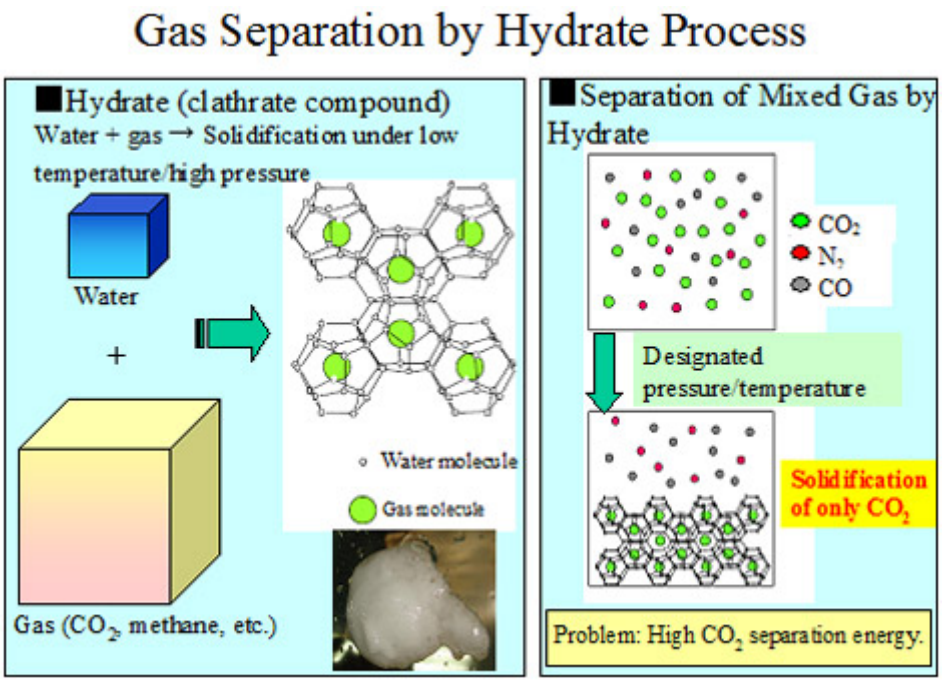
*3: Pressure = 0.11 MPa, temperature = 18°C.

*4: Confirmed with bench test equipment (photo shown below) at Tsurumi Works. Treatment capacity: 3 t/day.

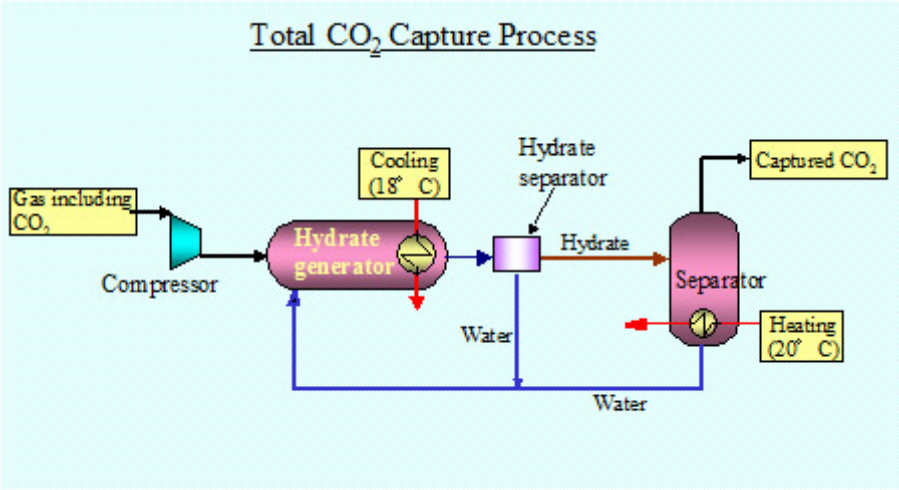
In the METI Strategic Technology Roadmap 2010, "Technology Map for CO_2

*5: Solidification and Effective Utilization Field (Technology List) (Capture/Storage)," gives values of "¥4,900-5,800/t- CO_2" and "¥4,200/t- CO_2."

【Conceptual Diagram of Hydrate】



【Process Diagram】



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