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Mitsubishi Hitachi Power Systems, Ltd.  
Mitsubishi Heavy Industries Engineering, Ltd.  
Mitsubishi Gas Chemical Company, Inc.

## **MHPS, MHIENG and MGC selected to conduct research on effective recycling of CO<sub>2</sub> to produce methanol**

### **-- The collaborative research project commissioned by NEDO aiming at developing carbon capture and utilization (CCU) technologies --**

Mitsubishi Hitachi Power Systems (MHPS), Mitsubishi Heavy Industries Engineering (MHIENG) and Mitsubishi Gas Chemical Company (MGC) were selected by the New Energy and Industrial Technology Development Organization (NEDO) to conduct joint research on the effective recycling of carbon dioxide (CO<sub>2</sub>) emitted from the refinery at Tomakomai City, Hokkaido Japan where the CO<sub>2</sub> is captured and stored by the existing demonstration plant. Further utilizing of the demonstration plant currently employed for CO<sub>2</sub> Capture and Storage (CCS), the three companies will collaborate on research activities for CO<sub>2</sub> Capture and Utilization (CCU) in order to produce methanol from captured CO<sub>2</sub>. The research is expected to run until February 2021.

MHPS, as a leader of the consortium proposed using captured carbon dioxide to synthesize methanol, which is well known as a key fuel and raw material in a wide range of industries. The process will combine captured CO<sub>2</sub> with hydrogen (H<sub>2</sub>) obtained either as a by-product from refineries or from water electrolysis within the existing CCS facilities. More information on the overall process is shown in Annex A.

The scope of the research includes performance assessment of key components of the proposed facilities with relevant technology survey, basic engineering for optimizing plant configuration, conducting an economic feasibility and its future outlook. The integration of CCU facilities with CCS facilities is expected to bring a benefit of sharing CO<sub>2</sub> recovery functions and enhancing the interoperability of both facilities.

The consortium will conduct a survey project based on the assumption that an additional 20 ton/day class carbon-recycled methanol synthesis plant will be installed adjacent to the existing CCS facility. MGC will provide supply chain expertise related to methanol production and synthesis catalysts, as well as process technology for methanol production in cooperation with MHIENG. MHIENG will leverage its track record of EPC\* for a number of large-scale methanol plants, while MHPS will deploy its experience with EPC for a variety of business. Combining the strengths of these three companies will ensure a smooth implementation of the project.

The insights from the research also can be applied to various sources of CO<sub>2</sub> emissions in the future. By studying technologies to capture, store and recycle carbon effectively, MHPS, MHIENG and MGC are actively contributing to the establishment of a carbon-free society and driving economic development while ensuring environmental conservation.

#### Note

\* EPC refers to Engineering, Procurement and Construction, which covers the design and procurement of equipment and construction of power plants and chemical plants

## **About Mitsubishi Hitachi Power Systems, Ltd.**

Mitsubishi Hitachi Power Systems, Ltd. (MHPS), headquartered in Yokohama, Japan, is a joint venture formed in February 2014 by Mitsubishi Heavy Industries, Ltd. and Hitachi, Ltd. integrating their operations in thermal power generation systems and other related businesses. MHPS today ranks among the world's leading suppliers of equipment and services to the power generation market, backed by 100 billion yen in capital and approximately 20,000 employees worldwide. The Company's products include GTCC (gas turbine combined-cycle) and IGCC (integrated coal gasification combined-cycle) power plants, gas/coal/oil-fired (steam) power plants, boilers, generators, gas and steam turbines, geothermal power plants, AQCS (air quality control systems), power plant auxiliary equipment and solid-oxide fuel cells (SOFC). For more information, please visit the Company's website at <https://www.mhps.com>  
Follow us at [https://twitter.com/MHPS\\_Global](https://twitter.com/MHPS_Global), or <http://www.linkedin.com/showcase/mhps>

## **About Mitsubishi Heavy Industries Engineering, Ltd.**

Mitsubishi Heavy Industries Engineering, Ltd. (MHIENG), headquartered in Yokohama, Japan, was founded as an engineering company of the Mitsubishi Heavy Industries Group on January 1, 2018. MHIENG takes over the engineering business of the chemical plants and transportation systems of Mitsubishi Heavy Industries and extends them with newly added environmental facilities. MHIENG has provided numerous Engineering, Procurement and Construction (EPC) projects covering large-scale infrastructure, such as chemical plants, environmental plants, and transportation systems, in many countries and regions around the world. The Company readily meet diversified customer expectations by undertaking all phases from project planning to basic design, detailed design, procurement, manufacture, construction, commissioning, after-sales service, and Operation & Maintenance (O&M), and capital participation in businesses. For more information, please visit the Company's website: <https://www.mhiengineering.com/>

## **About Mitsubishi Gas Chemical Company, Inc.**

Mitsubishi Gas Chemical Company, Inc. (MGC), headquartered in Tokyo, is a unique technology-oriented manufacturer producing more than 90% of its products using proprietary technologies. Committing itself to creating new technology and value, MGC boasts a broad range of products, from basic chemicals such as methanol, xylene, and hydrogen peroxide to high-performance products such as engineering plastics, foamed plastics, materials for printed wiring board and oxygen absorbers. MGC will continue to societal growth and harmony by creating a wide range of value through chemistry. For more information, please visit MGC's website: <https://www.mgc.co.jp/eng/>

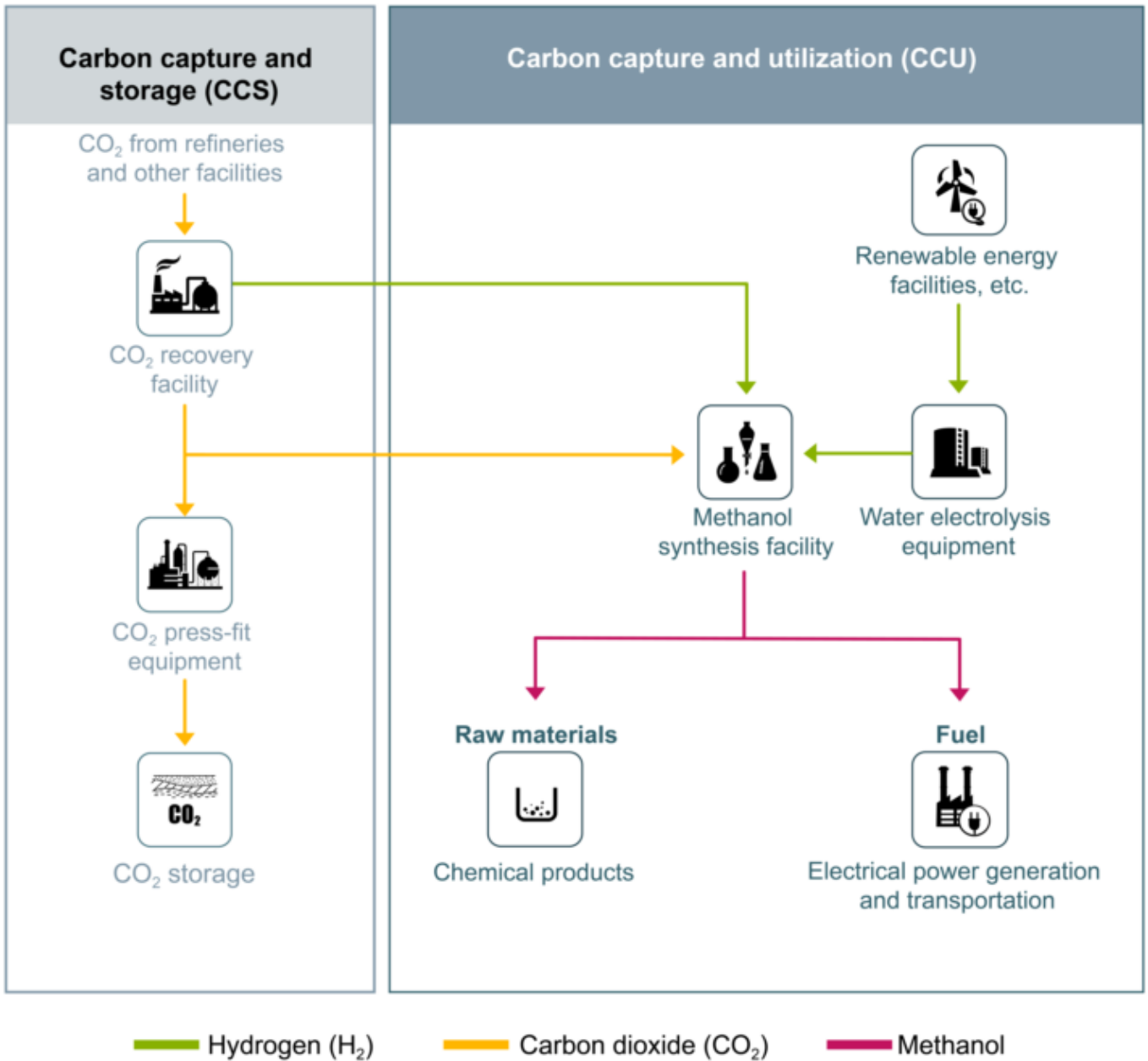
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■ ANNEX A: The process of CCS and CCU



CO<sub>2</sub> captured from refineries, power plants and other power generation-related facilities can be combined with hydrogen (H<sub>2</sub>) to generate methanol. H<sub>2</sub> can be processed either from water electrolysis or as a by-product of the refineries and other facilities. The methanol can then be used as raw material for chemical products, as well as fuel for electric power generation and transportation. Since methanol is used as an important basic raw material in a wide range of chemical and energy applications such as chemical products and fuels, stable growth in methanol demand is expected.