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## Development Of Natural Gas Supply Chain By Means Of Natural Gas Hydrate (NGH)

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### Abstract

Mitsui Engineering & Shipbuilding Co., Ltd. (MES) has been conducting research and development on natural gas hydrate (NGH) technology since 1990s. Since NGH can be stabilized at 253K and is easy to handle, NGH is expected to be an alternative natural gas transportation medium against currently available system including liquefied natural gas (LNG), for the initial investment is considered lower under the certain conditions.

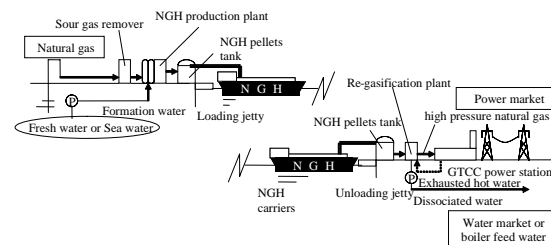
Based on the research and development, MES stepped further to practical stage and has been implementing a joint project, which involves an NGH production plant of 5 tpd (NGH)(under commissioning), together with The Chugoku Electric Power Co., Inc. (CEP) with assistance of New Energy Industrial Technology Development Organization (NEDO), a governmental institute of Japan since 2006. The purpose of the project is to demonstrate natural gas land transportation by means of NGH. In parallel, MES has been studying feasibility study of NGH ocean transportation chain together with Mitsui & Co., Ltd. (Mitsui) and their joint company named NGH Japan Co., Ltd. (NGHJ). The study has been conducted on certain cases in Southeast Asia in cooperation with six leading Japanese companies and with assistance of Japan Oil, Gas and Metals National Corporation (JOGMEC).

According to the study, NGH ocean transportation chain can be considered economical compared with conventional LNG system under some conditions including the capacity and distance of natural gas to transport. Furthermore, MES, Mitsui and NGHJ are drawing a plan of pilot marine transportation project with 100 to 200 tpd (NGH) production. If it could be materialized, NGH supply chain will take a step closer to commercialization.

NGH will provide a new option to monetize small to medium or stranded gas fields that are left undeveloped with existing technology due to its low economical efficiency, and the diversification of distribution method will also contribute to stably deliver low-cost natural gas to the districts where are isolated from current gas supply chains.

### Introduction

Since the idea of ocean transportation of natural gas by means of NGH utilizing so called “self-preservation effect” was advocated by Dr. Gudmundsson of Norwegian University of Science and Technology in 1996, various kinds of research on NGH ocean transportation chain have been made in all over the world, as in the case of Marathon Oil Corporation which constructed a test plant of NGH production and started its experimental operation in the United States. MES has been continuously investing in research and development for NGH technology, just like as it has been conducting its research and development on NGH production process, carrier ship, and re-gasification process, etc. since 2001, and as it constructed the experimental plant for process development (Process Development Unit: PDU) and the research and development facility for mixed gas based process incorporating a pelletizer (Bench Scale Unit: BSU) and continued their experimental operation.



**Figure 1: Natural gas ocean transportation chain by means of NGH pellets**