「Japan's Methane Hydrate R&D Program」

Comprehensive Report of Phase 2 & 3 Research Results

Research Group for Field Development Technology

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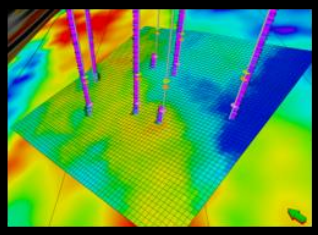

Research Group for Resources Assessment

Environmental Impact Assessment Team

February 2019

Research Consortium for Methane Hydrate Resources in Japan

JOGMEC
Japan Oil, Gas and Metals National Corporation

AIST

Cover Pictures:

Top: Second Offshore Production Test in 2017 (Research Group for Field Development Technology)

Bottom Left: Large-scale Apparatus for Evaluation of Sand Production (Research Group for Production Method and Modeling）

Bottom Middle: Reservoir Model (Research Group for Resources Assessment)

Bottom Right: Environment Monitoring System (Environmental Impact Assessment Team）

Abstract

During the Japanese fiscal years (FY) 2009-2018, MH21, the Research Consortium for Methane Hydrate Resources in Japan lead by Japan Oil, Gas and Metals National Corporation (JOGMEC) and the National Institute of Advanced Industrial Science and Technology (AIST) carried out Phase 2 and Phase 3 studies of Japan's Methane Hydrate R&D Program that was announced in July 2001 and funded by the Japanese Ministry of Economy, Trade and Industry (METI).

During the previous Phase 1 period, the concept of a "methane hydrate concentrated zone" that consists of highly-saturated methane hydrate deposits in sandy turbidite layers was established through exploration and drilling in the Eastern Nankai Trough. In addition, a possible energy-efficient depressurization method was proven to be an energy-efficient production technique as a result of onshore production tests.

During the following phase 2 and 3, the first offshore production test conducted in 2013 in the Eastern Nankai Trough area was the world's first attempt to extract gas from marine methane hydrate deposits. The test was terminated earlier than expected due to sand production, however, it verified the fact that the depressurization method can be applicable to offshore wells, and produced 119,000 ㎥ of methane gas during the six-day production period.

After development and implementation of certain advanced technologies aimed at enabling more stable operations, the second offshore production test was carried out in 2017 in the same region. Twelve days of flow was realized at the first well in spite of intermittent sand issues. In the second well, with reinforced sand mitigations, the flow period was extended to a total of 24 days despite being interrupted by rough weather conditions and series flow assurance issues. Total gas volume produced reached 263,000 ㎥.

During the production tests, a significant amount of data about gas and water production rates, solid and fluid samples, and pressure and temperature in the producer and monitoring boreholes was obtained in addition to geological and petro-physical information obtained from geophysical logging and pressure core sampling. This data was delivered to facilitate studies into reservoir responses and gas production in the reservoir.

Furthermore, the gas and water production results of the second test showed some discrepancies from the model-based predictions, a fact that highlighted that our knowledge and understanding of methane

hydrate reservoir characters and physics are not sufficient. The rate of gas obtained also did not meet economical demand, and as a result of the above, further studies focused on obtaining more accurate predictions and enhancing production are still necessary.

Along with the field trials, resource assessment of domestic waters progressed, and a number of potential methane hydrate concentrated zones were discovered after studying newly available seismic data. Moreover, studies into the field development system, pressure coring, and core analysis technologies that were used for domestic and a number of foreign samples and environmental impacts assessment were carried out.

During the study period, China performed an offshore production test in 2017, and India conducted an exploratory drilling campaign aimed at realizing offshore production tests with collaboration from Japan. Furthermore, the United States carried out a field trial of CH4-CO2 exchange with Japan. An extended-term production test planning and field survey was initiated in Alaska based on Japan-US collaboration. Other offshore surveys were carried out in many parts of the world. The field of study has spread from laboratories and computer studies into the real world, and as a result, researchers are now facing the actual characteristics and complexities of Mother Nature.

This report presents a summary of the progress of the study, resource assessments, information about gas production technology, results of production attempts, and other related fundamental and application study results.

The study was carried out by MH21 with the collaboration of many domestic and international corporations, universities, and research institutes, and realized by the cooperation of local Government and communities. MH21 members acknowledge this support and collaborative partnerships.

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Research Consortium for Methane Hydrate Resources in Japan

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