# Japanese R&D Studies for Methane Hydrate Development: Past Results and Current State

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In 1995, a 5 years R&D project to exploit methane hydrate launched by JNOC (Japan National Oil Corporation; later JOGMEC) and ten Japanese private companies under the MITI (Ministry of International Trade and Industry; later METI). In 1996, Satoh et al. (1996) estimated the methane hydrate reserves around Japan and pointed out that Japan had a large amount of methane hydrate reserves. By the estimation, methane hydrate attracted a lot of attention as a national unconventional energy resource. In 1999 to 2000, exploratory test wells named 'MITI Nankai Trough' were drilled in the eastern Nankai Trough, and methane hydrate-bearing layers in sandy sediments were acquired. Because the occurrences of acquired methane hydrate-bearing sediments resemble in oil and gas reservoirs, the possibility of the development of methane hydrate was strongly expected.

Encouraged by these results, the METI (Ministry of Economy, Trade and Industry) established the 'Research Consortium for Methane Hydrate Resources in Japan (MH21) ' in 2001. This project is divided into three phases, extending over 16 years. The period of Phase 1 ends in 2008 from 2001. The main current results in Phase 1 are as follows.

In 'Exploration' studies, a series of 2D/3D seismic surveys and exploratory test wells were carried out in the eastern Nankai Trough which is a model area of MH21. By interpretations of acquired data, MH21 created new concept named 'methane hydrate concentrated zone'. Furthermore MH21 established to identify 'methane hydrate concentrated zone' by seismic surveys and calculated methane hydrate reserves in the eastern Nankai Trough by new resource assessment method in 2007. Total amount of methane gas in place was 40TCF, and its half of 20TCF was within methane hydrate concentrated zone in the eastern Nankai Trough.

In 'Development Technology' studies, two production tests were carried out in the Mackenzie Delta, Canada, where methane hydrate exists in permafrost region. Japan succeeded in 'extracting methane gas from methane hydrate reservoirs for the first time in the world' at the first production test in 2002, and also 'extracting methane gas from methane hydrate reservoirs by depressurization method for the first time in the world' at the second production test in 2007.

In 'Production and Modeling' studies, MH21 was able to get much experimental data about properties of unidentified methane hydrate (also in natural/artificial sediments) till now. To establish production method, MH21 carried out various experiments of dissociation of methane hydrate in core size level and input the data to a 'MH Production Simulator' which had been developing in Japan. This simulator has received the high appraisal from the world.

In 'Environmental Impact Assessment' studies, MH21 extracted requirements related to the environmental impacts by methane hydrate development, and has been developing sensors and monitoring systems to measure environmental conditions at the deep-water where methane hydrate exists, and a simulator to predict sediment deformation during production. Furthermore MH21 has continued 'Marine Environment Surveys' every year in the eastern Nankai Trough and compiled the acquired data to a data base. Environmental impact assessment study related to methane hydrate development is a Japanese unique study and is not seen in another country.

As for the topics excluding the MH21 studies, discoveries and detailed studies of massive methane hydrate on seafloor off Joetsu (or Sado Island) by the University of Tokyo are given. This study will greatly contribute to R&D study for methane hydrate development in the area other than the eastern Nankai Trough.

Japanese R&D studies for methane hydrate development are top-level in the world, and further studies after Phase 1 are expected.