New Frontiers

Tapping the Unconventional Gas Sources

Gas hydrates is described as a very large global reservoir of natural gas, estimated to contain more organic carbon than all other known fossil fuel. The worldwide amount of methane in gas hydrates is about twice the amount of carbon held in all fossil fuels on earth and is considered to contain at least 1x104 gigatons of carbon in a very conservative estimate.

Fueled by the growth, energy demand has increased at alarming pace. Though there is much emphasis on exploring new oil and gas resources, nevertheless scientists are exploring new frontiers in hydrocarbons to meet with the escalating energy demand during the future years. Gas hydrates is one of the non-conventional source of energy and are rich in natural gas. These ice like compounds in which gas molecules, methane in most cases, are engaged in interstices for hydrogen bonded water lattices at low temperature (10 to 20°C) and high pressure (8-30 MPa). Although technically, it is feasible to produce natural gas from these sources, however there is great possibility of natural hazards associated with sea floor stability. Gas hydrates get disturbed during petroleum production and methane release in the ocean poses, potential serious threat to the marine environment and safety during drilling.

Exploiting these resources to fullest requires reliable data for techno economic studies to establish future commercial programs. This would require whole lot of scientific research at various fronts like detailed geophysical surveys, characterizing existing resources, sampling, coring and soil investigations, assessing sea

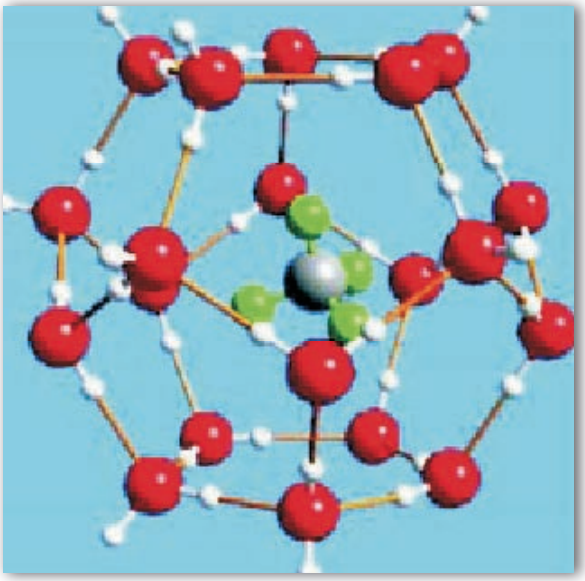
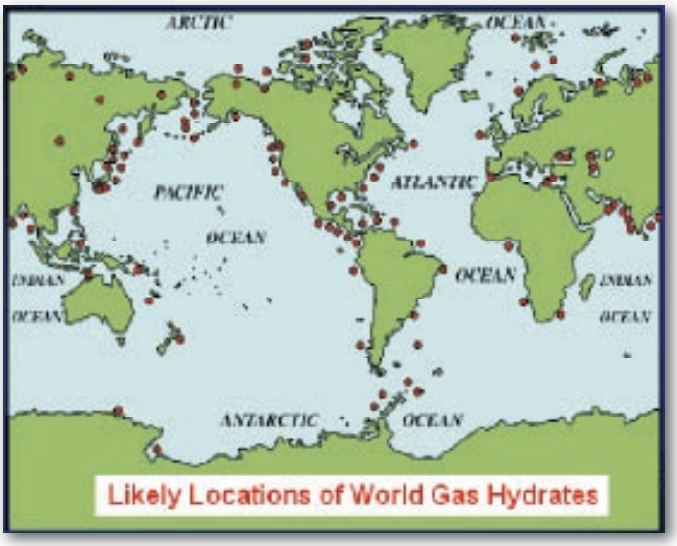


Fig. 1: The schematic drawing of a type of gas-hydrates structure in which methane molecules are caged in hydrogen-bonded watermolecules (after Mahajan et al., 2006)

floor stability, developing cost effective means for exploitation to recover gas hydrates from depths, safe transportation and environmental impact assessment.

Global Scenario

In USA, Joint Oceanographic Institutions Inc has been managing Ocean Development Program under contract with National Science Foundation USA and most of the offshore gas hydrates sites have been discovered under ODP. Gas resources found within the gas hydrates in USA are estimated in the range from 3000 to 19000 trillion cubic meters of gas at 95 percent and 5 percent probability levels. Though this indicates high degree of uncertainty, but the potential for enormous gas quantities stored can not be ignored. Statistics reveal that out of the estimated resources, almost 50 percent



Likely Locations of World Gas Hydrates

have already been explored that are close to 9000 trillion cubic meters and taking this as the basis amount of natural gas hydrates is almost 300 times larger than the estimated total remaining recoverable conventional natural gas resources in the USA.

For the last 25 years, Messoyakha gas hydrate field has been producing gas from gas hydrates (Permafrost), which is located in the North-East of western Siberia of Russia. The hydrate zone ranges from 250 to 870 m and the gas production zone is at a depth of 870m. The production of free gas augments, by the process of involving depressurization and injection of methyl alcohol. Five-year plan have been laid out, in Japan, for drilling of five offshore stratigraphic wells and geophysical reconnaissance. Surveys in 12 offshore areas have been included on the advice of Petroleum Council, and Ministry of International Trade and Industry (MITI). The budget is approximately USD 90 million. In 1998, a research well was drilled to a depth of 1150 meters, which was named as JAPEX/JNOC/GSC Mallik 2L-38 Research Well. With a total thickness of 16m , they have found the hydrate in three layers. The sandy layers contained methane gas hydrate of about 20 percent of total sediment volume. For drilling at 950 meters of water to target depth of 2800 meters, a conventional deep-water dynamically positioned drill ship was used. There were twin objectives that were planned to be fulfilled by JNOC/ JAPEX, ie to explore conventional hydrocarbon in miocene structure and unconventional hydrocarbons associated with methane hydrates.

Comprehensive analysis carried out at Makran in Pakistan using nonlinear full waveform inversion technique to investigate detail velocity structure on origin of Bottom Simulating Reflectors (BSR). The study showed a very low velocity zone like ODP Leg 164 at a depth 500 m below the sea bed, which might contain probably large quantities of free gas. While in the years 1991,1996, 1998, gas hydrates have been collected in 6-meter piston cores during Surface Geochemical Exploration (SGE) surveys in the deep and ultra deepwaters of Nigeria. Gas hydrates have been collected in 21 cores out of more than 800 core collections on the Nigerian margin. In the year 1995, there was joint collection by Korea Navy, Hawai Mapping Research Group and Naval Research Laboratory in the east of Japan, of approximately 12000 Sq. Km of side scan data and swath bathmetry data. Shell International E&P had processed three deep-water seismic lines, in the year 1999, from offshore Indonesia. All the lines had clear BSR typically 300 m sec below seafloor. The base of the hydrate BSR was interpreted, and it was manifesting a reverse polarity compared to seafloor. Through Shell's proprietary time migration algorithm Extended Pre Stack Imaging (EPSI), the seismic data was initially processed.

Indian Scenario

In the year 1985, in Andaman Offshore, ONGC was the first organization that found first gas hydrate work regarding identification of BSR. National research institute took the first round assessment of hydrate in the offshore areas of India. Under the Petroleum Ministry, Government of India , the results of the National Gas Hydrate Programme (NGHP) has been formulated. Directorate General of Hydrocarbons (DGH) has acquired multichannel data, in East Coast and in Andaman Offshore. Due to this data, the occurrence of BSRs for gas hydrates and associated free gas below it was manifested. At water depth of 850 and 1400 meters have been identified in Andaman offshore. Strong BSRs at approximately 1300 meters of water depth have been identified by ONGC,

in Krishna Godavari Offshore. In the demarcated area in Krishna Godavari Offshore, the company is also planning to collect sea bottom hydrates samples.

According to M V Lal, Chief Geologist, Directorate General of Hydrocarbons (DGH) said "the amount of gas hydrates in Indian deep waters, the rough estimates is 1894 trillion cu.m.The various methods that exist for exploitation of methane gas hydrates is depressurization, thermal association, carbon dioxide methane substitution, chemical destablization, and mining of hydrates. So far whatever steps have been carried out have been carried out in the field by depressurization or thermal association. Among these two depressurzation is found to be more useful."Apart from that he added " We have a National Gas Hydrate Programme (NGHP) which is steered by the Petroleum Minister of Natural Gas and secretary petroleum is the chairman of the NGHP. There are representatives from Oil and Natural Gas Corporatation (ONGC) , Oil Indian Ltd., Gas Authority of India (GAIL), Indian Oil Corporation (IOC), NIO of Goa, NGRI of Hydrabad and NIOT of Chennai."

On the other hand, Lal said, " Whenever we talk about hydrates, safety and environmental issues automatically comes in. Like for example if we drill any place wherein we are knowing gas hydrates will occur, we have the environmental and safety service carried out." On the policy front he further adds, " for exploration of gas hydrates there is no licensing policy so far. We don't have commerlization of hydrates anywhere in the world. We don't have that type of technology in the world to start exploitation of gas hydrates .By 2015 or 2020 when commercialisation takes place that time policies might be framed."

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Merly Simon

ONGC in Talks with ExxonMobil, Others For KG Basin Block

New Delhi: Oil and Natural Gas Corp (ONGC), an Indian public sector oil and gas company, is in talks with like ExxonMobil, an American multinational oil and gas corporation, to replace Norway's Statoil and Petrobras of Brazil who have decided to quit its KG basin gas block.

R S Sharma, Chairman and Managing Director, ONGC said, "We are talking to a lot of people." Dinesh K Sarraf, Director (Finance) ONGC said, "We are looking at firms for technology (to produce gas from ultra deep sea) and risk sharing." The two specialists in deep-sea production technologies decided to quit block KG-DWN-98/2 due to government delays in approving their participation in the deepwater acreage. Petroleo Brasileiro SA or Petrobras, Brazil's state-controlled oil firm, has offered ONGC its 15 percent interest in the Krishna Godavari basin block that sits next to Reliance Industries prolific KG-D6 fields without any cost.

ONGC now wants another foreign partner to share risks in developing the acreage, which is estimated to have an in-place gas reserve of 14 trillion cubic feet. The state-owned firm does not have the production technology to produce gas from such water depth in the geologically hostile KG basin. Sharma said gas production from the KG block would begin in 2015-16, instead of 2013 as anticipated earlier.