International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 4, April - 2014

Fire Ice-An Energy Resource Extracted From Seabed

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Abstract: - There has been an enormous increase in the global demand for energy in recent years as a result of industrial development and population growth. Every country is taking efforts for invention of new energy resources which will survive their nation against the energy crisis. Recently Japan had successfully extracted methane hydrate, known as "fire ice", from its seabed, possibly unlocking many years' worth of gas for the resource-starved country. Fire ice is nothing but a fossil fuel that looks like ice but consists of very densely-packed methane surrounded by water molecules, one kilometre (3,300 feet) below sea level. Japan is claiming that it is equivalent to Japan's consumption of the gas for 11 years. It is the world's first offshore experiment producing gas from methane hydrate. It had also claimed that stocks of methane hydrate trapped ice are present on the seashore of every country.

I. INTRODUCTION

The current energy resources available on the earth are depleting and non-renewable
.There is a possibility of a serious energy crisis in the upcoming decades. Developing and developed countries in the world are making efforts for inventing new energy resources that will meet the growing energy demand. So we feel it important to introduce a new Japanese trial of extraction of fire ice from sea bed.
Recently, on 8th march 2013, Japan had successfully extracted Methane Hydrate, known as 'Fire Ice', from seabed. Japan Oil, Gas andMetals National Corporation officials claimed that a huge layer of methane hydrate is believed to lie in the ocean floor off the coast of Shikoku island, western Japan.

This NASA satellite image[1] received on April 7, 2005 shows Shikoku Island (bottom, left) western Japan.

This paper will give us a full idea about Fire Ice formation, location, extraction, estimations, and environmental effects of the same.

II. METHANE HYDRATE FORMATION:

Molecules of methane gas are trapped within a cage of solid water molecules. The cage does not form in everyday conditions. To make the hydrate, both the methane and water need to be in an environment with right pressure and temperature. These conditions exist naturally either buried under arctic soil or as with the Shikoku deposit, buried in a marine basin.

Methane hydrate is formed within marine sediments or beneath permafrost where chemical reactions or microbes break down organic matter. The gas then works its way up to the seabed where sediments tend to be much cooler. The cooling allows methane molecules to form weak chemical bond with surrounding water molecules, producing solid methane hydrate. These bonds require very high pressure. So methane hydrate forms only in deep water.

III. EXTRACTION OF FIRE ICE:

Japan's Oil, Gas and Metals National Corporation set up a small scale production test in the Pacific Ocean off the coast of Japan near Nankai trough.

Fire ice extraction plant(small scale)

The extraction of fire ice is carried out at the center of the sea using modern equipments. The Japanese team sunk a pump through more than half a mile of water and another 1000ft of marine sediment. Suction in the system reduced the pressure in the gas hydrate, causing the ice to melt and liberate its gases. The mixture of water and gases was pumped to the surface and separated.

Leakage of methane gas from the seafloor

In the depressurization method, the pressure is low in the production well, and it is high in the layers. Consequently, methane gas dissociated from methane hydrate flows into the well. When heat is applied, as in the heating method, pressure in the layers increases, thereby potentially allowing methane gas to move into various directions. The depressurization method, however, is not subject to this problem. Thus, the environmental risk of methane gas leakage from the seafloor during production is estimated to be minimal[2].

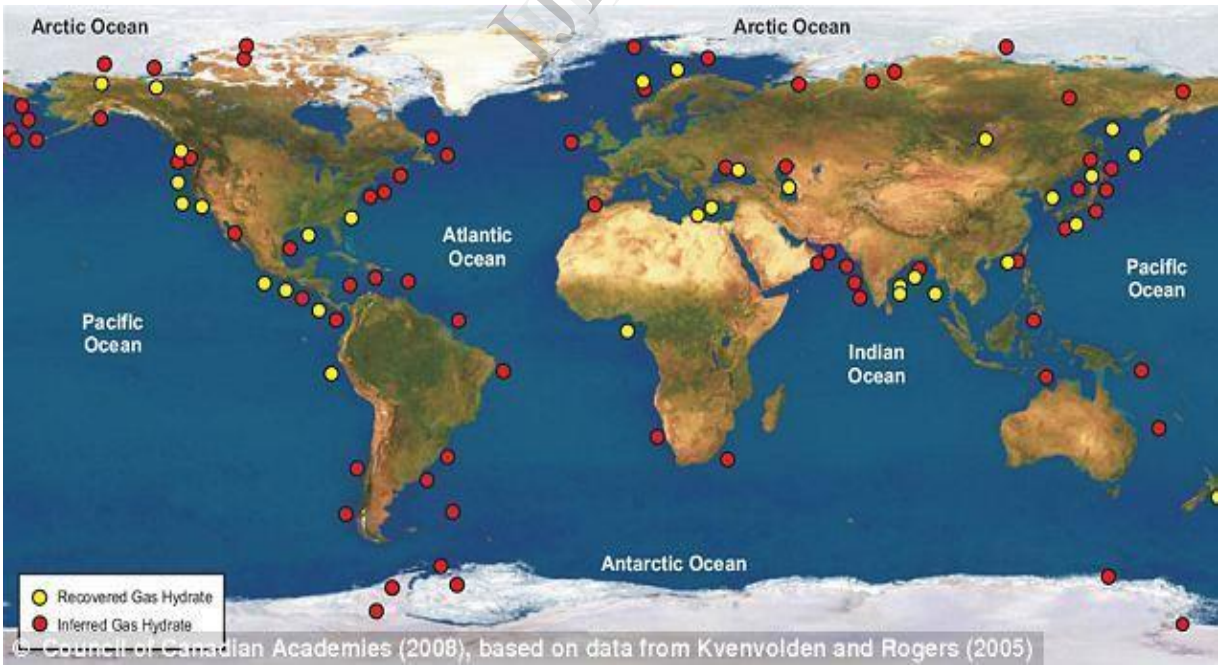
V. ACCUMULATION OF FIRE ICE AROUND THE GLOBE:

In total, the operation retrieved about 4.2 million cubic feet of methane over 6 days according to Japanese Ministry of Economy Trade and Industry. When taken outside

Methane Hydrate doesn't last for long. It would dissociate within minutes, maybe an hour.

IV. ESTIMATION/SCOPE:

A huge layer of methane hydrate containing 1.1 trillion cubic meters (38.5 trillion cubic feet) in natural gas equivalent to Japan's consumption of the gas for 11 years is believed to lie in the ocean floor off the coast of Shikoku island, western Japan, the officials said[3]. Fire Ice is potentially a game changing technology because Carbon from Methane Hydrate worldwide is believed to be double than that found in all earth's fossil fuels. The seas around Japan alone are thought to have enough to satisfy the domestic consumption anywhere from 10 to 100 years[4]. They believe that by 2018, they will be able to develop the technology to safely extract enough fuel to satisfy the entire country's energy needs[5].



Distribution of known and suspected methane hydrate accumulations around the globe is demonstrated in the above picture[6]. It has been tipped by energy experts to be the world's next major energy resource. The resources of fire ice are very much dense in the Arctic Ocean regions. There is an enormous amount of frozen methane hydrate all over the planet. Most of these methane hydrates are found within the ocean, where their quantity is estimated at 10,000 - 20,000 billion metric tons. There's also a substantial amount in permafrost soils. Methane hydrates form wherever methane and water are present at a proper low temperature and high pressure conditions. These conditions can be found in depth, from around 300-500 meters down (200 meters in the Arctic since it's colder) and usually no deeper than 2000m. They also exist in Indian oceans on the western side.

VI. METHANE HYDRATE DEVELOPMENT AND ENVIRONMENTAL IMPACT:

Tapping methane hydrate for natural gas might have a positive impact on global energy production, but critics say the potential fuel source could have a negative impact on global warming. The trillions of cubic feet of methane hydrates contained in the ocean's floor are in geologically unstable areas. The fear: One wrong move and an undersea landslide in the muddy sediment containing the methane hydrates could send massive amounts of a particularly potent greenhouse gas to the ocean's surface and into the atmosphere. Although methane remains in the atmosphere for a shorter time than carbon dioxide, "pound for pound, the comparative impact of methane on climate change is over 20 times greater than carbon dioxide over a 100-year period," according to the U.S. Environmental Protection Agency.

Processing of production water:

The dissociation of methane hydrate produces water as well as methane gas. The depressurization method produces water, as a result of methane hydrate dissociation. The volume of the production water is estimated to be significant and it needs to be processed. Potential processing methods include transporting the production water to land, discharging it into the sea, and injecting it into the layers. Cost-wise, the best method is to discharge the water into the sea. When future methane hydrate development is taken into consideration, the best way would be to discharge the water into the sea.

Submarine Landslide:

It is known that ground characteristics such as the strength of methane hydrate-bearing layers change if methane hydrate is dissociated. However, no conclusion has yet been drawn anywhere in the world as to whether methane hydrate dissociation may possibly trigger landslides.

VII. CONCLUSION:

In this paper we have introduced 'Fire Ice', a new energy resource buried under the seabed. Methane hydrates, when and if extracted out commercially from the seabed, will be the world's next major energy resource. Some estimates take us to a consensus that methane hydrates could potentially provide more energy than all of the fossil fuel reserves put together. But it will not be easy to get it out, particularly without methane leakage to the atmosphere. Methane is a powerful greenhouse gas much more potent than CO_2 although it tends to degrade to CO_2 and water vapour in a few years. On controlling this emission of excess CO_2 in the atmosphere, methane hydrate can be the best energy resource for the future.

REFERENCES:

1. http://phys.org/news/2013-03-japan-ice-gas-seabed.html [2]
2. http://www.mh21japan.gr.jp/english/mh21-1/5-2/
3. www.dailymail.co.uk/.../Japanese-
4. breakthrough-country-extract-fuel-ice-...
5. www.youtube.com/watch?v=-psqIZbVv3k
6. http://www.newser.com/story/164295/in-a-first-japan-turns-fire-ice-into-natural-gas.html
7. http://www.dogonews.com/2013/3/17/fire-ice-the-new-source-of-green-energy-japan-certainly-seems-to-think-so