Gas Hydrates - Fuel of the Not So Distant Future

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Gas clathrates, also known as gas hydrates (GHs) are an important naturally occurring and man-made material that is variously, a promising potential source of petroleum supply, a source of real and potential hazards, both natural and industrial, a possible agent of global change, and a novel material with promising industrial applications, especially for the petroleum industry in Arctic regions.

One of the largest sinks of organic carbon globally, methane GHs occur in three general types of natural accumulations, below permafrost in sedimentary pore space and in deep water, both as GHs in sedimentary pore space and as sea floor outcrops. Canada has immense GH resources. In the Canadian Arctic GH accumulations are inferred and observed to occur widely, particularly in the Beaufort Sea-Mackenzie Delta Basin (BMB) and Sverdrup Basin (SB), but also on the continental margins of the Arctic and Atlantic ocean basins. Most occurrences in BMB and SB have formed by the seepage of thermogenic gas from underlying conventional petroleum accumulations. These types of occurrences depend strongly on geological factors and processes, especially the distribution of reservoirs and migration conduits, relative to thermal history. While the general model of GH occurrence in these two basins is similar, specific differences between them suggests that the natural environment, formation history and extraction potential may differ significantly. In addition, bottom simulating seismic reflectors (BSRs) are rare compared to indications of GH occurrence in wells, complicating seismic efforts to characterize the complete GH resource. The total technically and economically unburdened BMB GH resource is estimated to be between 10.23×10^{12} m^3 and 4.59×10^{12} m^3 raw natural gas in place although, the GH resource potential varies significantly as a result of gas saturation in the GH. In SB the GH resource is not as well

constrained, but it is estimated to be between 0.19 to 6.2 x 10^{14} m^3. While there are indications for GHs in other parts of the Canadian Arctic the resource volumes of those regions are speculative.

Processes of GH accumulation formation, geological setting and accumulation characteristics have important implications for natural GHs reservoir performance, such that only a fraction of the GH resource that may be economically recoverable. The most favourable accumulations for commercial development are permafrost GHs, especially where an associated free gas column or co-located underlying conventional petroleum accumulation provides both, improved reservoir energy or advantageous economics, respectively. Several independent preliminary reservoir models, based largely on the results of the multinational Mallik 2002 GH Production Well Program, suggest that GHs can be technically produced using existing technologies, and that the most favourable accumulations would currently be potentially commercial, if transportation to market was available. While much non-commercial research is being, and remains to be, done we have reached the point where it is time for GH technological development to be transferred to commercial research groups.

GHs have also been implicated as major agents of global change, especially with respect to the impacts of their destablisation on both climate and geohazards. Many of these hypotheses, while interesting conceptually, remain to be evaluated more carefully, especially since the Earth's thermal inertia is not typically considered when processes of their destablisation are proposed. Finally, people can learn and adapt this novel material to industrial processes. Efforts to use manufactured GHs for both water and gas purification, and as a mechanism for natural gas transportation, are promising and are especially relevant for Arctic applications, since the ambient Arctic environment favours GH stability and formation processes sometimes even at the surface.

To learn more visit:

Gas Hydrate Fuel Of The Future Website, (Natural Resources Canada),
http://ess.nrcan.gc.ca/2002_2006/ghff/index_e.php

GSC Bulletin 585: Scientific Results From The Mallik 2002 Gas Hydrate Production Well Program,
http://gsc.nrcan.gc.ca/gashydrates/mallik2002/bulletin585_e.php