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Hydrate Research

Recent surveys indicate that hydrogen-rich methane hydrates, found in undersea basins, are enormous energy resources. The geoacoustic properties of hydrate-containing sea floor sediments must be characterized for naval operations. Methane hydrates also present a potentially formidable environmental hazard. The unintentional release of the methane--a potent greenhouse gas--sequestered in these solids, either through offshore oil recovery or outgassing induced by ocean warming, could affect global climate and the local marine environment.

THe Hawaii Natural Energy Institute's (HNEI's) methane hydrate research is being pursued in partnership with the U.S. Naval Research Laboratory. Funding support is coming from the Hawaii Energy and Environmental Technology Initiative (HEET). This partnership offers extensive technical resources and expertise that is being applied in complementary laboratory and field studies on a host of science and engineering topics.

The long-term goal of the HNEI methane hydrate research program is to develop environmentally benign technologies to utilize the enormous energy potential of methane hydrate deposits. A secondary goal is to understand the role these natural hydrates play in the carbon cycle and the impact that resource exploitation and large outgassing events could have on the marine environment and global climate.

Research is focusing on the evaluation of methane hydrates as an in situ energy source for naval and other subsea applications. Laboratory and engineering investigations of hydrate destabilization phenomena (to release methane for subsequent energy conversion steps) and benthic fuel cells are underway.

International research and development collaboration has always been an important component of HNEI's activities. Toward this end, significant effort is being expended to establish international research partnerships on methane hydrates. Scientists and engineers from government agencies, universities, and companies in the United States, Korea, Japan, Norway, and Chile have agreed to work together with HNEI and the Naval Research Laboratory.

Methane Hydrates Workshops

The 8th International Workshop on Methane Hydrate Research & Development was held in Sapporo, Japan on 28 May - 1 June 2012. HNEI organized the 1st Workshop in Honolulu in 2000 and has been a sponsor and member of the International Steering Committees of all subsequent workshops. Contact Stephen Masutani [1] for additional information.

Future Work

A hydrates synthesis facility to produce uniform hydrate samples for laboratory analysis and testing is near completion.

A biological benthic fuel cell [2] for long-term, low-level (of the order of 1 watt) subsea electrical power generation is being developed. Low-pressure (atmospheric) tests are underway utilizing sediment collected at the Blake Ridge hydrate field and graphite and platinum electrodes. Sediment bacteria that play the key roles in the operation of the biological fuel cell are being cultured for analysis. Tests at conditions representative of the deep ocean will be conducted later this year in several pressure chambers that have been constructed specifically for this program.

An engineering design study will be performed to assess underwater solid oxide fuels cells, employing methane hydrates as the energy source, for higher level in situ power generation applications.

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