



OTC 19414

The Research Path to Determining the Natural Gas Supply Potential of Marine Gas Hydrates

R.M. Boswell, K.K. Rose, and R.C. Baker, U.S. Department of Energy, National Energy Technology Laboratory

Copyright 2008, Offshore Technology Conference

This paper was prepared for presentation at the 2008 Offshore Technology Conference held in Houston, Texas, U.S.A., 5–8 May 2008.

This paper was selected for presentation by an OTC program committee following review of information contained in an abstract submitted by the author(s). Contents of the paper have not been reviewed by the Offshore Technology Conference and are subject to correction by the author(s). The material does not necessarily reflect any position of the Offshore Technology Conference, its officers, or members. Electronic reproduction, distribution, or storage of any part of this paper without the written consent of the Offshore Technology Conference is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of OTC copyright.

Abstract

A primary goal of the U.S. National Interagency Gas Hydrates R&D program is to determine the natural gas production potential of marine gas hydrates. In pursuing this goal, four primary areas of effort are being conducted in parallel. First, are wide-ranging basic scientific investigations in both the laboratory and in the field designed to advance the understanding of the nature and behavior of gas hydrate bearing sediments (GHBS). This multi-disciplinary work has wide-ranging direct applications to resource recovery, including assisting the development of exploration and production technologies through better rock physics models for GHBS and also in providing key data for numerical simulations of productivity, reservoir geomechanical response, and other phenomena. In addition, fundamental science efforts are essential to developing a fuller understanding of the role gas hydrates play in the natural environment and the potential environmental implications of gas hydrate production, a critical precursor to commercial extraction. A second area of effort is the confirmation of resource presence and viability via a series of multi-well marine drilling expeditions. The collection of data in the field is essential to further clarifying what proportion of the likely immense in-place marine gas hydrate resource exists in accumulations of sufficient quality to represent potential commercial production prospects. A third research focus area is the integration of geologic, geophysical, and geochemical field data into an effective suite of exploration tools that can support the delineation and characterization commercial gas hydrate prospects prior to drilling. The fourth primary research focus is the development and testing of well-based extraction technologies (including drilling, completion, stimulation and production) that can safely deliver commercial gas production rates from gas hydrate reservoirs in a variety of settings. Initial efforts will take advantage of the relatively favorable economics of conducting production tests in Arctic gas-hydrate bearing sandstones with the intent of translating the knowledge gained to later testing in marine sandstone reservoirs. The full and concurrent pursuit of each of these research topics is essential to the determining the future production potential of naturally-occurring gas hydrates.

Introduction

Gas hydrates are a naturally occurring substance that can be found in nature wherever water exists in combination with sufficient volumes of appropriately-sized gas molecules under specific high-pressure, low-temperature conditions (Sloan and Koh, 2007). These conditions are restricted primarily to arctic regions, deep lakes, and marine continental shelves in water depth of ~500 m or more. Additional factors that influence the occurrence and nature of gas hydrates include the mineralogy and petrophysical characteristics of the host lithology, and the chemistry of both the gases and the water.

Since the mid-1990s, there has been a general consensus that gas hydrates (predominantly hydrates of methane) likely occur at a vast scale within deep marine sediments. The volume of methane housed in global marine gas hydrates remains highly uncertain, and over the past two decades, there has been no convergence in the estimated volumes (Fig. 1). The most recent estimates (yellow dots on Fig. 1) have ranged from as low as $0.2 \times 10^{15} \text{ m}^3$ (700

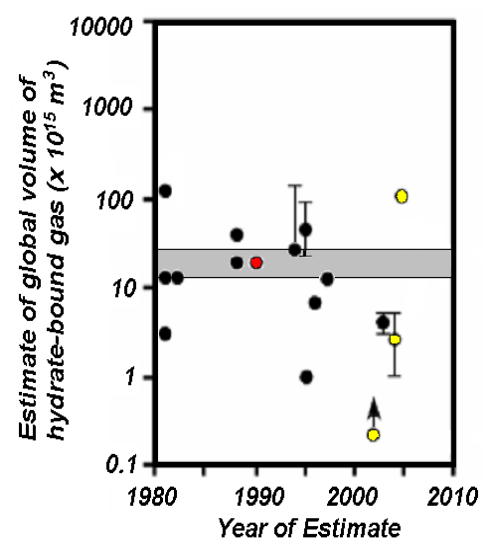


Figure 1: Published estimates of total gas-in-place housed in gas hydrate deposits since 1980. Great uncertainty remains, as estimates within the past decade continue to range over three orders of magnitude (modified from Milkov, 2004).