Gas Exploration, Production & Storage

National Energy Technology Laboratory

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Product Manager

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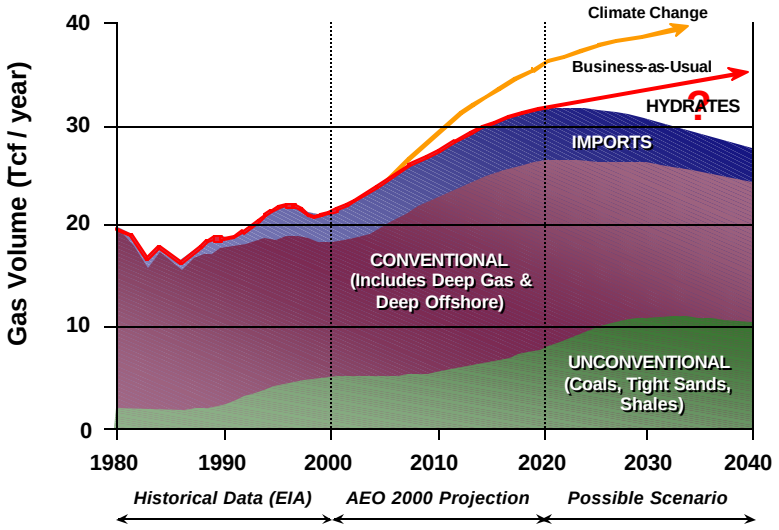
Enough Affordable Natural Gas to Meet Demand?



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Program Goals

- **Near-Term: Recover more from known fields.**
  - Using methods for locating by-passed zones and/or compartments in conventional reservoirs
- **Mid-Term: Develop E&P technologies to exploit low permeability formations**
  - Reducing costs to drill
  - Improving success rates in finding gas
  - Increasing recovery efficiency to achieve profitable wells
- **Long-Term: Develop knowledge base and advanced technology to encourage exploration from deep gas and gas hydrates**

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Partnership Approach

- **R&D is conducted with various partners**
  - Industry (Maurer, Union Pacific Resources, Burlington)
  - Other federal agencies (USGS, Energy Efficiency)
  - National labs, universities and industry associations
- **Cost shared projects are common**
  - Field tests (independent producers)
  - Development of technologies (service companies)
- **Technology transfer**
  - Cooperative Agreements with Commercializing Partner
  - Successful Field Demonstrations
  - Petroleum Technology Transfer Council

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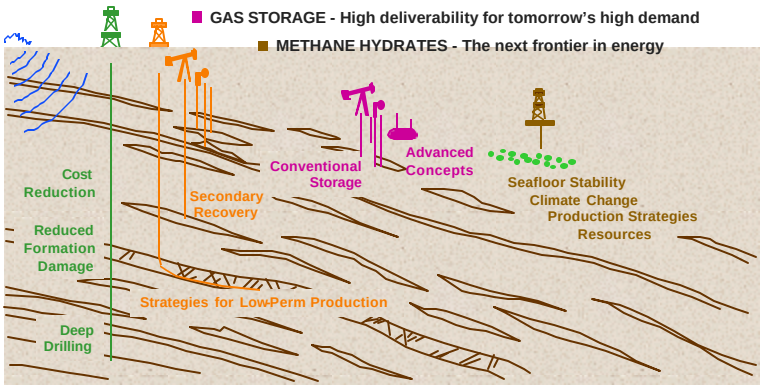
Gas Exploration, Production, and Storage

- RESOURCE ASSESSMENTS - Quantifying the nature and potential of gas resources
- EXPLORATION TECHNOLOGIES - Enabling effective natural fracture detection
- DRILLING, COMPLETION, & STIMULATION - Reducing the costs and risks of extracting natural gas
- PRODUCTION TECHNOLOGIES - Maximizing recovery of gas from discovered fields
- GAS STORAGE - High deliverability for tomorrow's high demand
- METHANE HYDRATES - The next frontier in energy



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NETL Hydrates Program

- Drivers and Issues
- History
- Elements, Goals, & Benefits
- Planning Efforts
- Current Activities
- Future Direction

Overview

Methane Hydrate Program Drivers

- **Near-term: Hydrates pose a significant hazard to oil and gas drilling and recovery operations**
- **Long-term: Hydrates are a potentially large worldwide resource of natural gas**

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Hydrate Resource Estimates

- **Worldwide:**
  - Oceanic: 30,000 to 49,100,000 Tcf
  - Continental: 5,000 to 12,000,000 Tcf
  - Compare to Conventional Gas Resource: 13,000 Tcf
- **Domestic:**
  - **If 1% of hydrates are recoverable: 3,200 Tcf**
  - Conventional Natural Gas Technically Recoverable Resource: 1,301 Tcf

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Historic NETL Gas Hydrates R&D 1982 - 1992

- Established the existence of hydrates in Kuparuk Field, Alaska
- Completed studies of 15 offshore hydrate basins
- Developed preliminary estimates of gas in-place for gas hydrate deposits
- Developed preliminary production models for depressurization and thermal production of gas from hydrates
- Sponsored the first two International Conferences on Methane Hydrate R&D, in 1991 and 1994

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National Gas Hydrates Program Multi-Agency Planning Effort

- Program planning was initiated in 1997
- Two workshops in 1998 defined program goals and activities
- *A Strategy for Methane Hydrate Research and Development* published August 1998
- *National Methane Hydrate Multi-Year R&D Program Plan* published June 1999
- Internet site www.hydrates.org managed by the International Centre for Gas Technology Information started August 1999

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Program Participants

- DOE: FE & Office of Science
- DOI: USGS & MMS
- DOD: NRL & CRREL
- DOC: NOAA
- NSF: ODP

- Academia
- University Consortia
- Industry
- National Labs

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Program Goal

Produce the knowledge and technology necessary for commercial production of methane from hydrates and address the associated environmental and safety issues

- The program will answer four questions:

Quantity, Location & Properties? ***(Resource Characterization)***

How to ensure safety? ***(Safety & Seafloor Stability)***

What is the environmental impact? ***(Global Change)***

How to produce it? ***(Production)***

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Expected Program Benefits

- Improved U.S./global resource assessments
- Expanded natural gas supply to meet increased demand for cleaner fuels in the 21st century
- Improved safety in Arctic and deepwater petroleum operations
- More accurate global climate models
- Improved E&P technologies

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Funding Levels

- FY99: $500K
- FY00: $2,960K
- FY01 President's Request: $2,000K
- FY01 House Mark: $2,960K
- FY01 Senate Mark: $5,960K

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FY 1999 Activities

- Arctic and Gulf of Mexico resource characterization by USGS
- NRL database on gas hydrates
- Gas Hydrates Consortium at Colorado School of Mines

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FY 2000 Activities

- Program Solicitation -- $1,200K
  - Center for Marine Resources and Environmental Technology (CMRET)
    - Gulf of Mexico Sea Floor Stability and Gas Hydrates Monitoring Station
  - Clarkson University
    - Fundamentals of Natural Gas and Species Flow from Hydrates Dissociation Applications to Seafloor Safety and Stability
  - University of Wyoming
    - 3-D Structure and Physical Properties of a Methane Hydrate Deposit and Methane Gas Reservoir, Blake Ridge

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FY 2000 Activities

- **Well of Opportunity -- $500K**
  - **Mallick Hydrates Research Well 3L-38**
    - Resource characterization/coring/production test
    - Multinational effort involving Japan, Canada, Germany and the U.S.
  - **NOAA GOM Alvin Cruise (October 2000)**
    - Joint venture between NOAA thru National Undersea Research Program (NURP), MMS, and academic partners
    - Explore the edge of the Gulf using a deep submersible, *DSV Alvin*
    - NETL working with Texas A&M & Woods Hole Oceanographic to add a couple days effort to the project

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FY 2000 Activities

- **Basic Activities -- $650K**
  - Arctic and Blake Ridge resource characterization by USGS
  - NRL database on gas hydrates
  - Gas Hydrates Consortium at Colorado School of Mines
  - NETL Onsite Research
- **National Lab Solicitation -- $500K**
  - Proposals received and evaluations proceeding

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Methane Hydrate Legislation
P.L. 106-193 Highlights
May 2, 2000

- **Authorizes Funding**
  - $5.0M FY01; $7.5M FY02; $11M FY03; $12M FY04-FY05
  - Administration Expenses < 5% of total allocated.
- **Requires Coordination among Five Agencies**
  - Energy, Interior (USGS & MMS), Defense (NRL), Commerce (NOAA), and National Science Foundation
- **Establishes Advisory Panel of Experts from Industry, Universities and Federal Gov't (<25%)**
  - Advise on applications of gas hydrates; set research priorities; and, report to Congress

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FY2001 Activities

- **Depends on final appropriation of funding**
- **Solicitation targeted for specific technology developments focusing on industry's needs in the GOM**
- **Possible Workshop focusing on Methane Hydrates in Alaska**

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NETL Hydrates Program Summary

- **National Hydrates Plan Completed**
- **Four Program Elements**
  - Resource Characterization, Safety & Seafloor Stability, Global Climate Change, & Production.
- **Authorization Legislation**
  - Coordinated effort with industry, academia, and other agencies.

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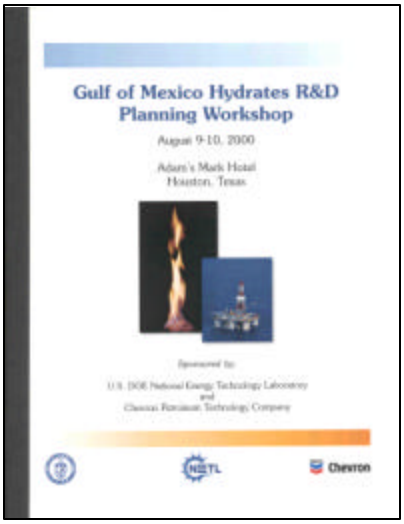
GOM Hydrates R&D Planning Workshop



- **Activities:**
  - **Industry Perspective**
  - **Ongoing Research**
  - **Action Plan**
  - **Form JIP**
- **Focus**
  - **Gulf of Mexico**

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Significance of GOM

- Potential supply base to fuel 30TCF market
- Industry activity level is high
- Oil and gas infrastructure exists
- Hydrates affect recovery of conventional hydrocarbon resources
- Significant amount of hydrates present
  - Mean estimate is 38,000 Tcf

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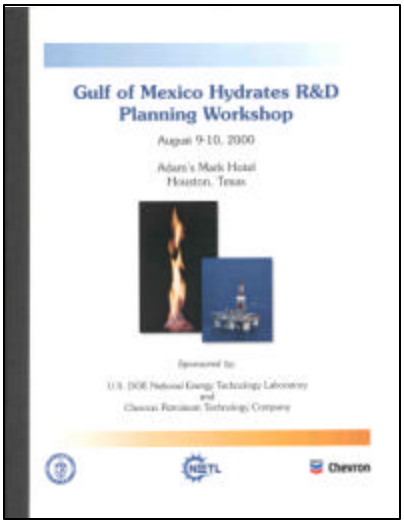
GOM Hydrates R&D Planning Workshop



- Breakouts:
  - Drilling Safety
  - Long-Term Production Through Hydrates
  - Sea Floor Stability
  - Resource Characterization
  - Production Technology

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R&D Challenge

- **Meets industry need**
- **Fast and Efficient**
- **Driven by Vision but focused on today**
- **Product focused**
- **Goal oriented**
  - start & stop when appropriate
- **System mindset**
- **Collaborative in nature**

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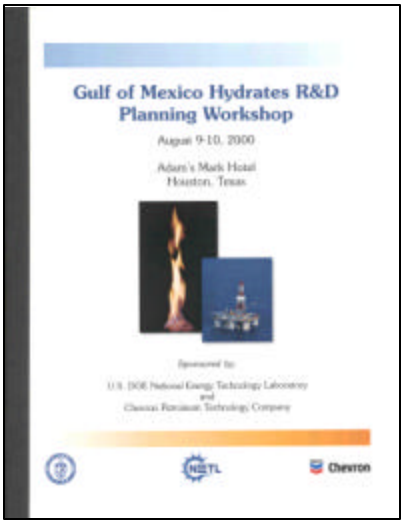
GOM Hydrates R&D Planning Workshop



Thank You For Participating

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