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Unconventional Gas Technology Roadmap Workshops

Shale Gas	October 14, 2005
CBM/NGC	October 17, 2005
Tight Gas	October 20, 2005
Gas Hydrates	October 25, 2005
Summary Session	November 4, 2005

Unconventional Gas Technology Roadmap Background

- Western Canada's gas production recently peaked at 6 TCF (16 BCF/day) and is not expected to grow significantly in the medium term
- In the long term, gas supply is forecast to decline to about 4 TCF by 2020. Added conventional supplies from the East Coast and MacKenzie delta may help maintain a national production level up to about 7 TCF per year, but without added reserves from other quarters, the long term position is clear; natural gas supply in Canada, and consequently our contribution to North American energy supply, and valuable exports, will decline in the next two decades unless new supplies from unconventional sources are developed and brought on stream.

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Why a Roadmap?

Technology development holds the key to unlocking reserves, to improve recovery and reduce costs. The development of a "Technology Roadmap" similar to one published for the "oil sands" and "clean coal" industries, is a way to increase awareness of the opportunity offered by unconventional gas, and bring the future development opportunity under the review of a wide stakeholder base. In this way, the industry can gain consensus on the technical challenges, help legislators understand those challenges, and where necessary make an appropriate response to encourage further development of particular resources.

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Unconventional Gas Technology Roadmap Workshop
October 25, 2005, 11:30 am – 4 pm,

Alberta Research Council, Calgary, Alberta

GAS HYDRATES

The attached notes are from the Gas Hydrates workshop. This Workshop consisted of a single group, owing to the longer term and specialized nature of the work.

List of Registered Attendees

Chris Podetz	Advanced Geotechnology Inc.
Bill Kauffman	AERI Alberta Energy Research Institute
Roy Hyndman	Alberta Geological Survey
Dean Rokosh	Alberta Geological Survey
Hongqi Yuan	Alberta Research Council
Steve Hancock	APA Petroleum Engineering Inc.
Homer Spencer	Canitron Systems Inc.
Padgett V. Eastman	Champion Technologies Ltd.
George Rhodey	Corrillio Resources Limited
Wayne Redecopp	Halliburton Energy Services
Len Flint	Lenef Consulting Ltd.
Kirk Osadetz	Natural Resources Canada (NRCan)
Denis Gaudet	PTAC
Leah Lawrence	Real Data Analysis Inc.
Duncan Stanners	Shell Canada Limited
Mehran Pooladi-Darvish	University of Calgary
John Van Ham	Van Ham Resources

Breakout Group Operations

There was a single working group that considered the Gas Hydrates needs under 4 categories:

1. **Resource Definition**
2. **Non-Environmental Challenges to development**
   (*not restricted to those with technology development needs*)
3. **Environmental Challenges to development**
   (*not restricted to those with technology development needs*)
4. **Future Technology Developent Needs / Opportunities in:**
   - Geosciences / Characterization/Modeling
   - Drilling / Completions and Stimulation
   - Lift Mechanisms and Surface Infrastructure

RESOURCE DEFINITION

Gas Hydrates are crystalline compounds that belong to a group of solids called “clathrates”. They are formed from mixtures of water and low molecular weight gases at low temperatures and high pressures. The gases that are trapped in the clathrates include methane and other hydrocarbons up to iso-butane, as well as carbon dioxide, hydrogen sulphide, nitrogen and oxygen. (*U of Calgary website*)

Comments:

-Three classes ..with unique challenges…
-Methane dominates
-Needs some pressure...at least 11 metres
-Some idea of the size of the prize needed … v. large but often stranded
-Need to refer to world reserves as well
-Technology leadership opportunity in Canada
-Economic (more or less) today…but not as attractive as conventional

NON- ENVIRO DEVELOPMENT CHALLENGES

Points raised:

- Stranded gas….pipeline access .v. the size of the prize
- Aboriginal interests
- Climate limitations …hostile environment
- The cost of the R&D and who pays
- Regulatory access to the resource …BC moratorium
- Lack of understanding of the opportunity …communicating the opportunity
- Myth .v. reality re. the commercial opportunity
- Co-mingling from other zones

ENVIRO-BASED DEVELOPMENT CHALLENGES

Points raised

- Destabilization .v. containment when the resource is breached (Kyoto?)
- CO2 dimension…possible sequestration opportunities in conjunction with production
- In areas that may have environmental challenges … but not necessarily different from conventional gas
- Water co-production and how to handle … more than conventional gas … …but if fresh it may have different “value”
- Noise from compression … required from day one
- Sea floor disturbance if mined
- The use of e.g. methanol for stimulation
- More energy intensive than conventional or other unconventional
- Methane fugitive emissions (greater in offshore)

RECOVERY TECHNOLOGY

GEOSCIENCES / RESOURCE CHRACTERIZATION / MODELLING

Points raised:

- What is understanding of intrinsic kinetics of CO2-CH4 substitution
- Imaging re. sweet spots
- Data collection opportunities (e.g. from drilling cuttings) being missed
- Production and depletion modelling still requires history matching as basis
- Tools for reservoir characterization still not adequate
- NMR techniques developed for hydrate identification
- LWD and MWD logging tools attached to bits need improvement
- Need to develop models based on underlying science and geomechanics
- Seismic tools that can help “see the top” of the hydrate zones
- Need an optimal reservoir model
- Lot of theoretical data and modelling capability in US/Canada and Japan, but based on history matching of 5 days of Mallik testing on a single well
- Longer test could be self sustaining in cost if p/l available for pilot production
- Need to broaden the knowledge base

RECOVERY TECHNOLOGY

DRILLING / COMPLETION / STIMULATION

Points raised:

- We know the properties of hydrates well, but not yet how to apply that knowledge to downhole situations
- Many resources (long, narrow) amenable to application of Horizontal drilling
- Energy equivalent for recovery
- Liquid loading if co-produced water
- Drilling with chilled DFs helps t limit the water production
- Drilling relatively routine adjustments of know-how
- Stimulation techniques big area for future R&D
- Borehole stability during production an issue…especially in marine setting and unconsolidated reservoirs
- Seafloor completions
- Near wellbore stimulation by electrical induction to heat the local zone and promote hydrate dissociation (average Delta T increase may be small)
- Downhole combustion opportunities
- Mining options need investigation for sea floor and near seafloor high concentration accumulations

RECOVERY TECHNOLOGY

LIFT MECHANISMS / SURFACE INFRASTRUCTURE

Points raised

- Lift: the possible interference with co-produced water, but nothing very different from what we already know
- Surface infrastructure will depend on transportation method
- Gas hydrate transportation methods for stranded resources, e.g. pellets and associated shipping developments under way in Japan
- Possible role for gas hydrates in separation technology (e.g purification)
- Mackenzie Delta development and infrastructure may provide a springboard for gas hydrates development