



# Gas Hydrate Technology: A Malaysian Perspective



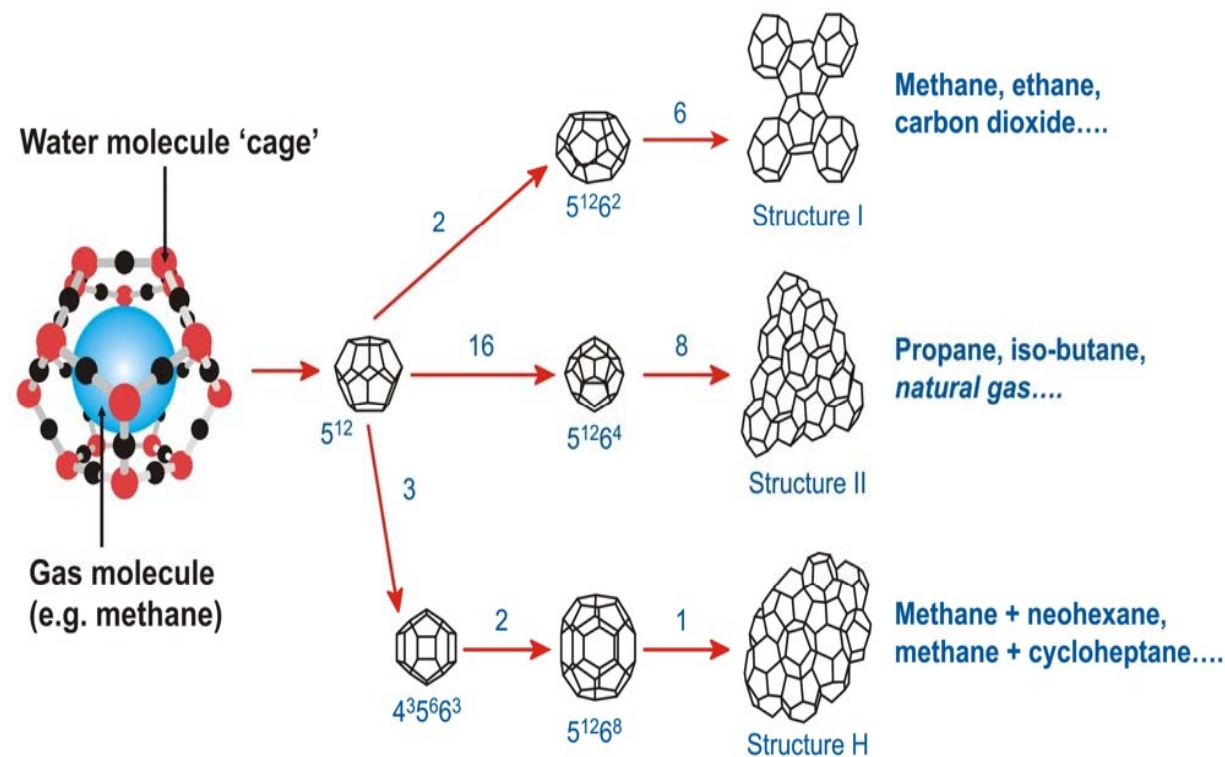
## Outline:

- Overview on gas hydrate
- Industry's perspective
- Global activities & key players
- Challenges on gas hydrate
- PETRONAS gas hydrate initiatives
- Way forward



## What is gas (clathrate) hydrate?

- non-stoichiometric crystalline inclusion compound formed from a combination of water and low molecular weight gas(es)/volatile liquid (s) when subjected to appropriate temperature and pressure condition





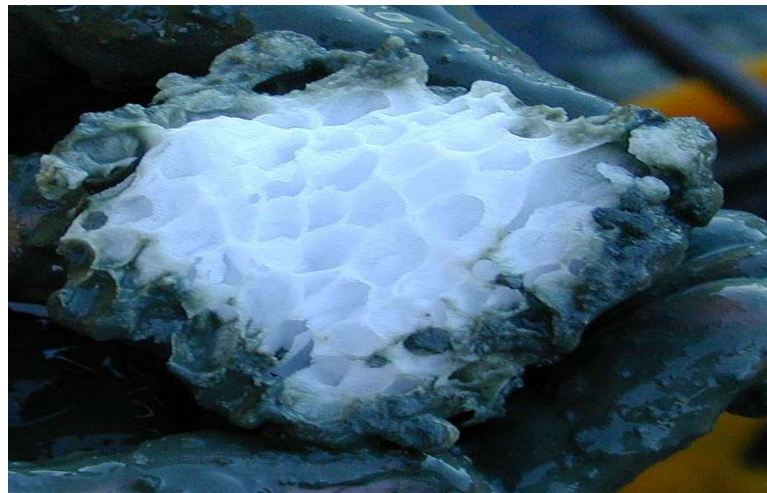
Interest in gas hydrate is mainly due to two main factors:

- challenges due to hydrate formation in deepwater and arctic production operations
- the discovery of naturally occurring gas hydrates



## Naturally occurring gas hydrates

- Deep ocean sediment
- Arctic permafrost region
- Deep lake/ oceanic seafloor



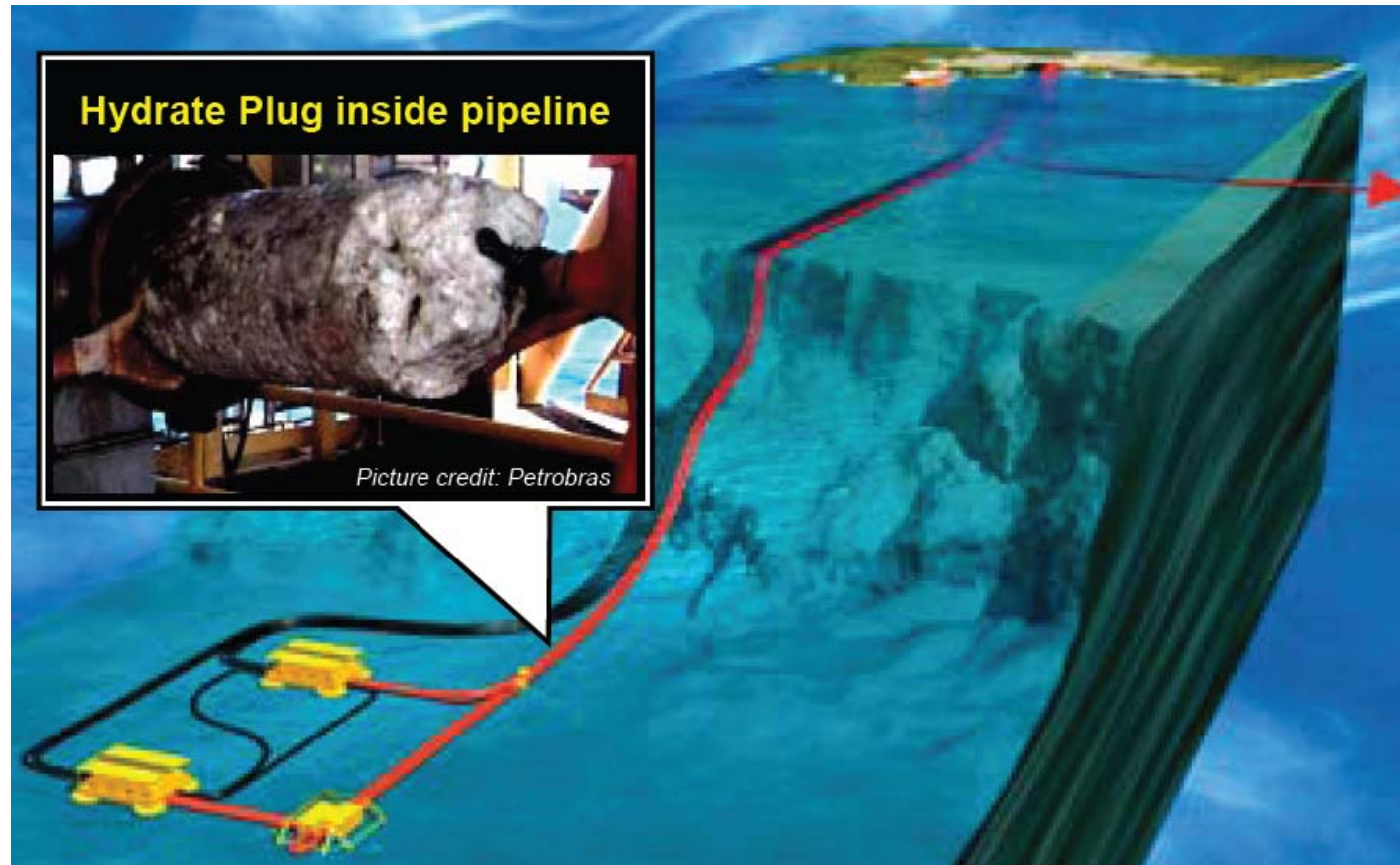
**Specific structure of a gas hydrate piece**



**Gas hydrate-bearing sediment**

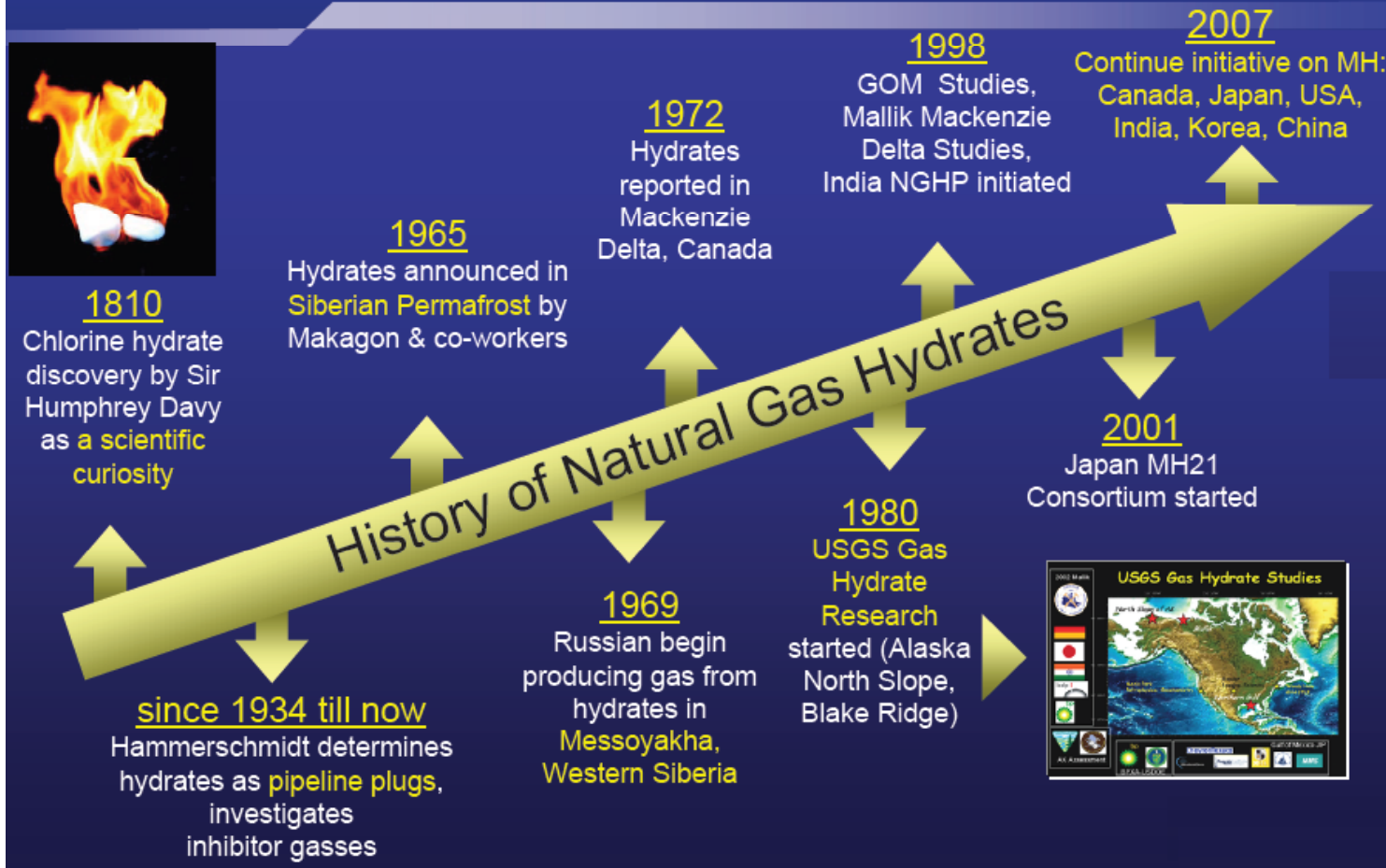


## Plugging of pipeline due to gas hydrate formation





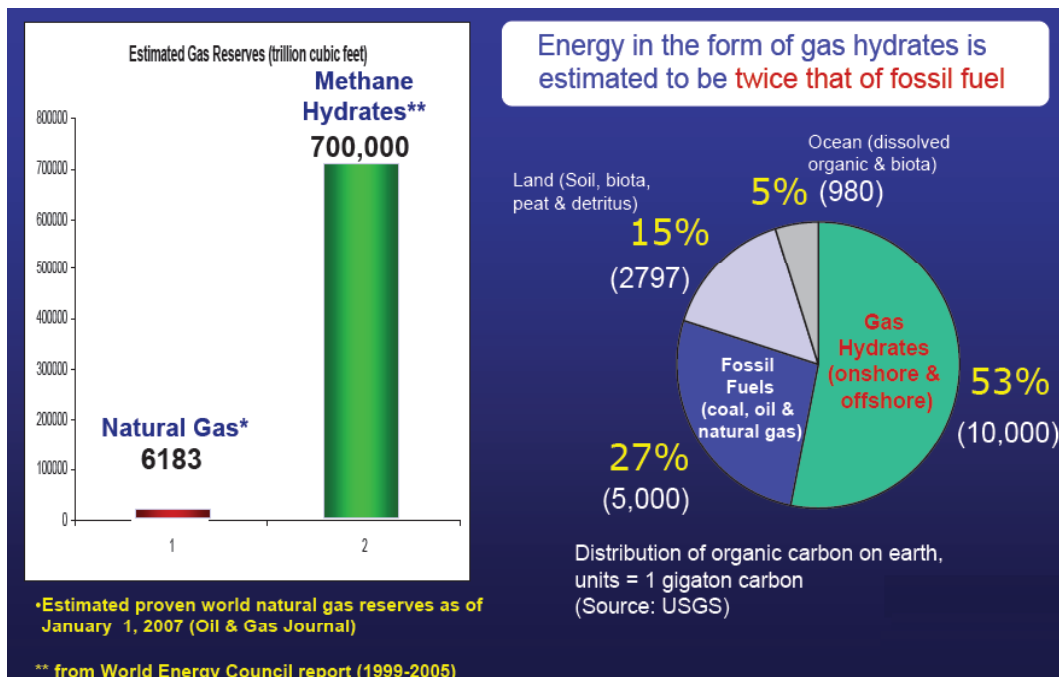
## Gas Hydrates historical development



Extract from: Zahidah, M.Z. Methane Hydrate Technology: Presentation to PETRONAS Management Committee



# Gas hydrate as potential energy source ?



**NATIONAL/REGIONAL ESTIMATES OF THE AMOUNT OF GAS WITHIN HYDRATES (cubic feet)**

<b>UNITED STATES</b>	317,700 x 10 <sup>12</sup>	Collett 1995
<b>INDIA</b>	4,307 x 10 <sup>12</sup>	ONGC 1997
<b>BLAKE RIDGE, USA</b>	635 x 10 <sup>12</sup>	Dillon & others 1993
	2,471 x 10 <sup>12</sup>	Dickens & others 1997*
	2,824 x 10 <sup>12</sup>	Holbrook & others 1996*
	2,012 x 10 <sup>12</sup>	Collett 2000*
	1,331 x 10 <sup>12</sup>	Collett 2000
<b>NANKAI TROUGH, JAPAN</b>	1,765 x 10 <sup>12</sup>	MITI/JNOC 1998
<b>ANDAMAN SEA, INDIA</b>	4,307 x 10 <sup>12</sup>	ONGC 1997
<b>NORTH SLOPE, ALASKA</b>	590 x 10 <sup>12</sup>	Collett 1997

\* Includes associated free-gas

**Huge Potential !**

Source: Collett et. al., Hart energy's commercializing methane hydrate conference, Houston, TX, 2006.





## Industry's perspectives on gas hydrate as potential energy source

### Old view

- Not commercial for 20 -30 years
- Expensive
- Entirely New Technology required
  - "Not what our company does"
- "Not in my life time"

### New view

- Commercial in ~10 years
- More expensive, but not prohibitive
- Existing technology can be leveraged
- Needs to be considered



2002 - Canadian gas production test from MH  
2008 - World's first sustainable gas flare of methane from hydrate source

Source: Art Johnson on "Myths and Realities", Hart Energy's Commercializing Methane Hydrates Conference, Houston, Tx, 2006

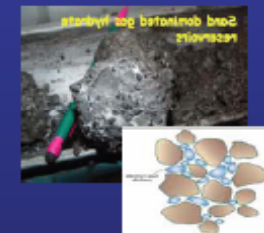
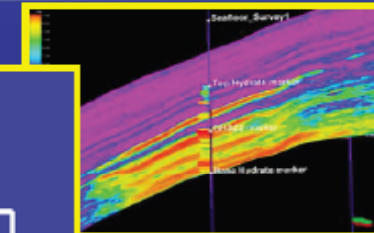
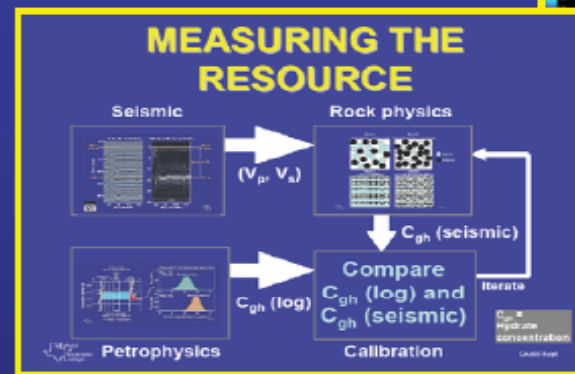
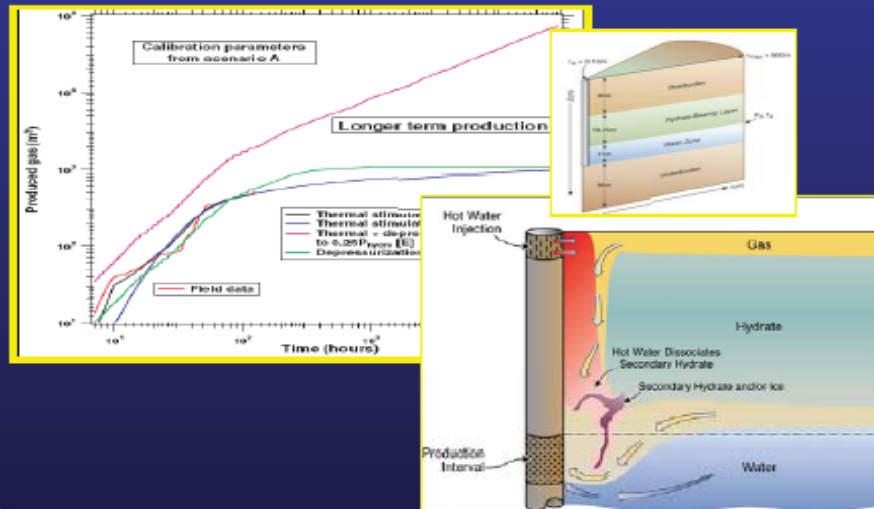
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# Challenges

Technical challenges...

- Identifying/Quantifying MH Prospects
- Exploitation of MH (Recovery/Production Technology)
- Produced Water Management



Other challenges...

- Economic Viability
- Transporting Gas
  - Ultimate Recovery per Well
  - Flow Rates
  - Operating Expenses

Extract from: Zahidah, M.Z. Methane Hydrate Technology: Presentation to PETRONAS Management Committee

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