WOC-1 Plenary Session

SG 1.2 Assessment of global reserves and resources

SG Leader: Dr. Mohamed Kaced

IGU WOC 1 Meeting

Kota Kinabalu, Malaysia

6 September 2013

S.G 1.2 Report Structure

2- ASSESSMENT OF GLOBAL RESERVES AND RESOURCES

Executive Summary

2.1 Petroleum Resources Classification and Definitions

2.2 Conventional Gas: Remaining reserve and resource assessment

- 2.2.1 Definitions & characteristics
- 2.2.2 The global potential of Conventional gas

2.3 Unconventional gases (tight, shale gas, CBM, hydrates): reserve and resource assessment

- Introduction
- 2.3.1 Tight gas
- 2.3.2 Shale Gas
- 2.3.3 CBM
- 2.3.4 Gas Hydrates

S.G 1.2 Report Structure

2.4 Assessment of gas flaring: initiatives for reduction and enhancing supply

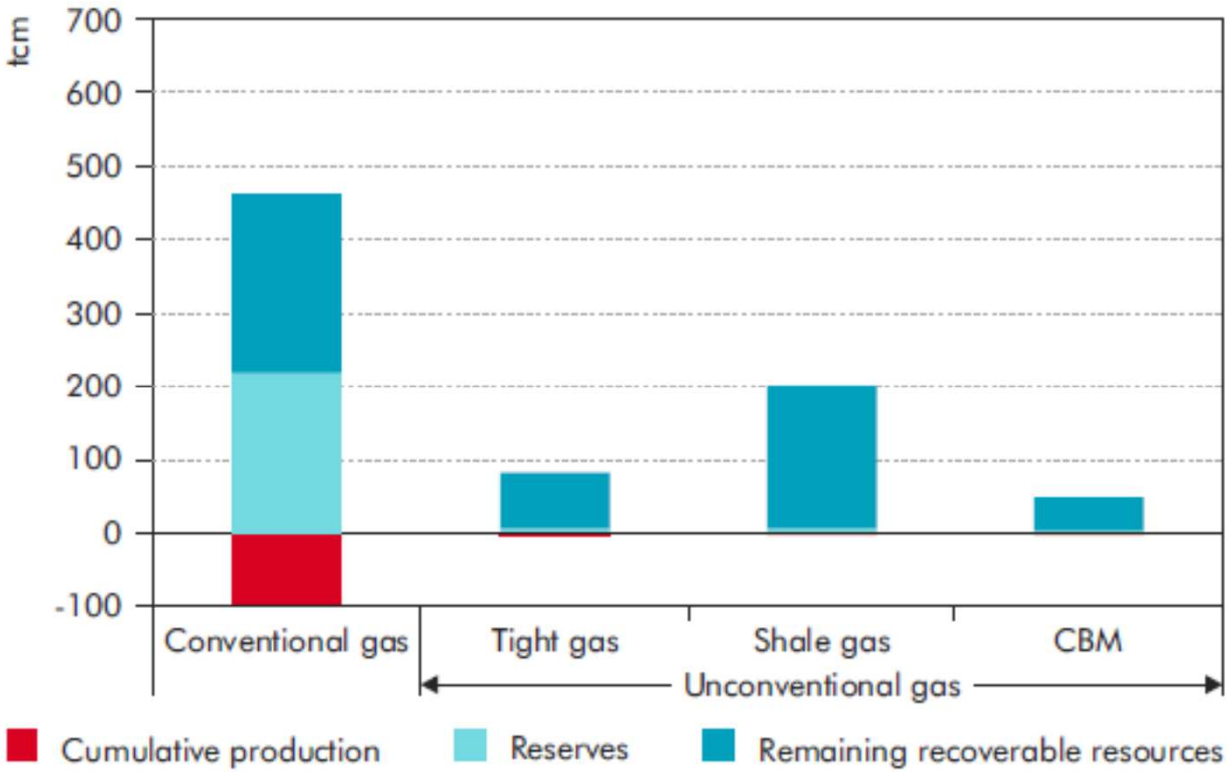
- 2.4.1 Assessment of global gas flaring
- 2.4.2 Initiatives for enhancing gas utilization

2.5 Exploration and discovery trends and new frontier exploration areas

- 2.5.1 Exploration and Discovery Trends
- 2.5.2 New Frontiers

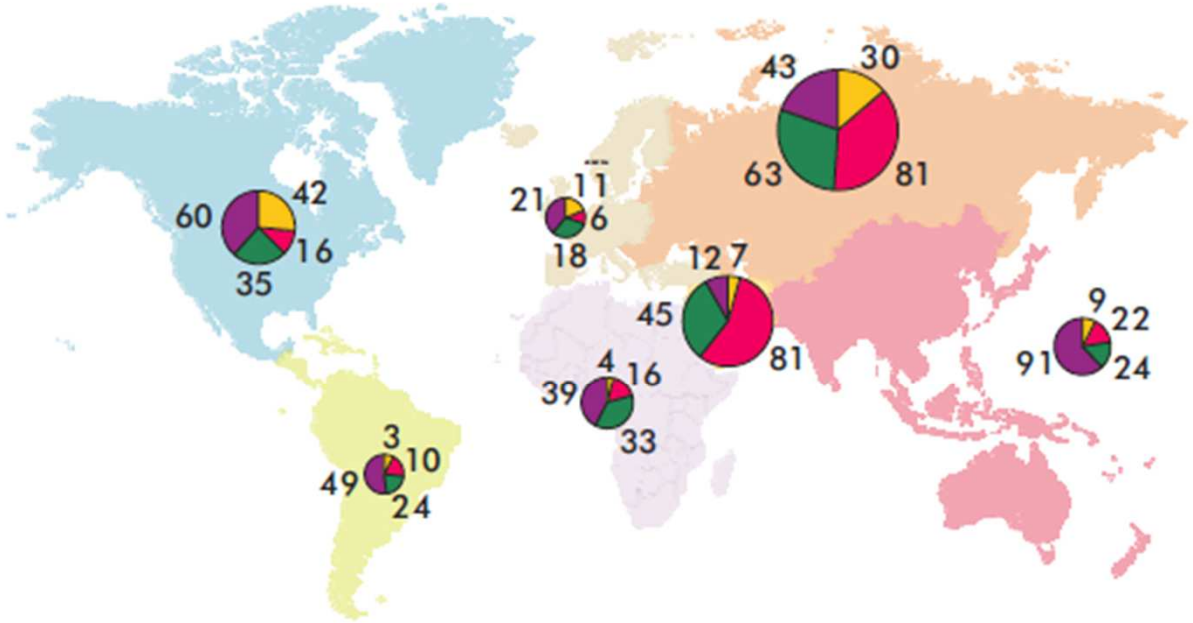
2.1 Natural Gas Resources

- The current mean assessments of conventional gas endowment quantify the ultimate recoverable resource at 475 TCM.
- The cumulative production is slightly above 100 TCM; consequently, the remaining recoverable resources are estimated at 400 TCM, which represents more than 100 times the current annual production.



2.1 Conventional Reserves

Regional distribution of conventional gas

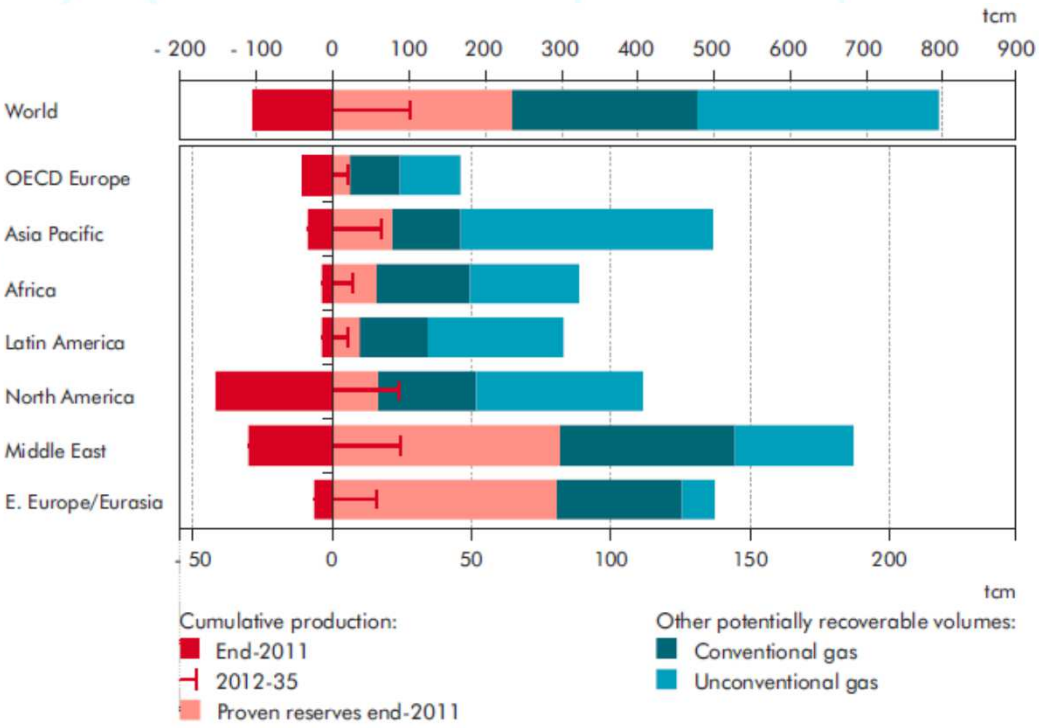


Cumulative production end-2011:	105 tcm
Proven reserves end-2011:	232 tcm
Other remaining recoverable resources - conventional gas:	243 tcm
Other remaining recoverable resources - unconventional gas:	315 tcm

- Even though N. America has a large volume of remaining conventional resources, proven reserves base is smaller than that of the CIS and M. East.

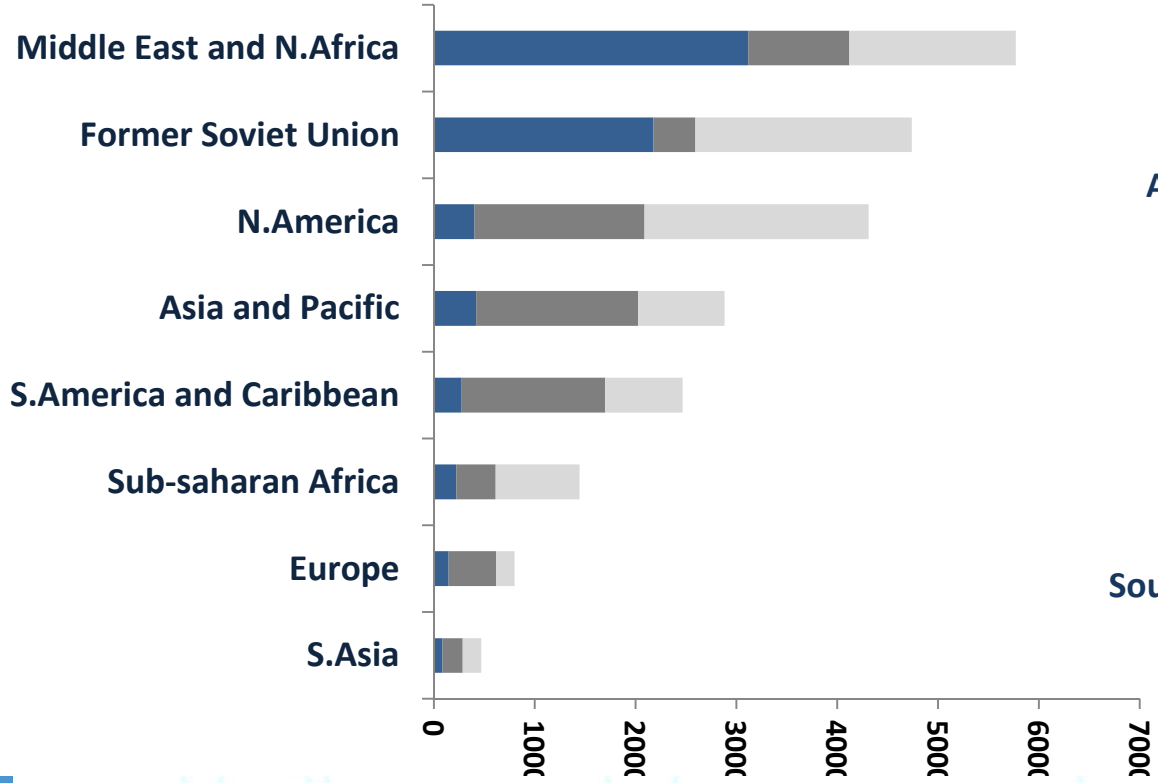
2.1 Conventional Reserves

- Proven remaining reserves amount 232 TCM. There is a clear consensus among different sources about quantifications.
- World natural gas proven gas reserves are concentrated in a rather small number of large accumulations.
- Around 310 fields with reserves of more than 100 BCM/field (giants) count for around 65% of world proven reserves.
- About 12 super-giants fields (holding reserves over 1 TCM) out of 20 were developed worldwide.
- Remaining recoverable resources of conventional natural gas, including proven reserves, reserves growth and undiscovered resources, could amount to some 475 TCM

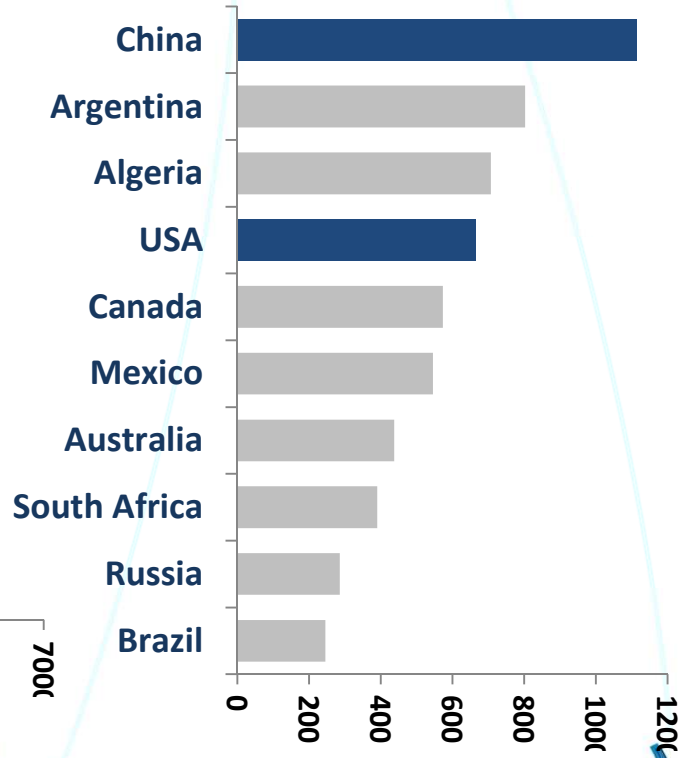


Shale gas resources and reserves

Global Gas Reserves



Top 10 countries with technically recoverable Shale Gas Reserves

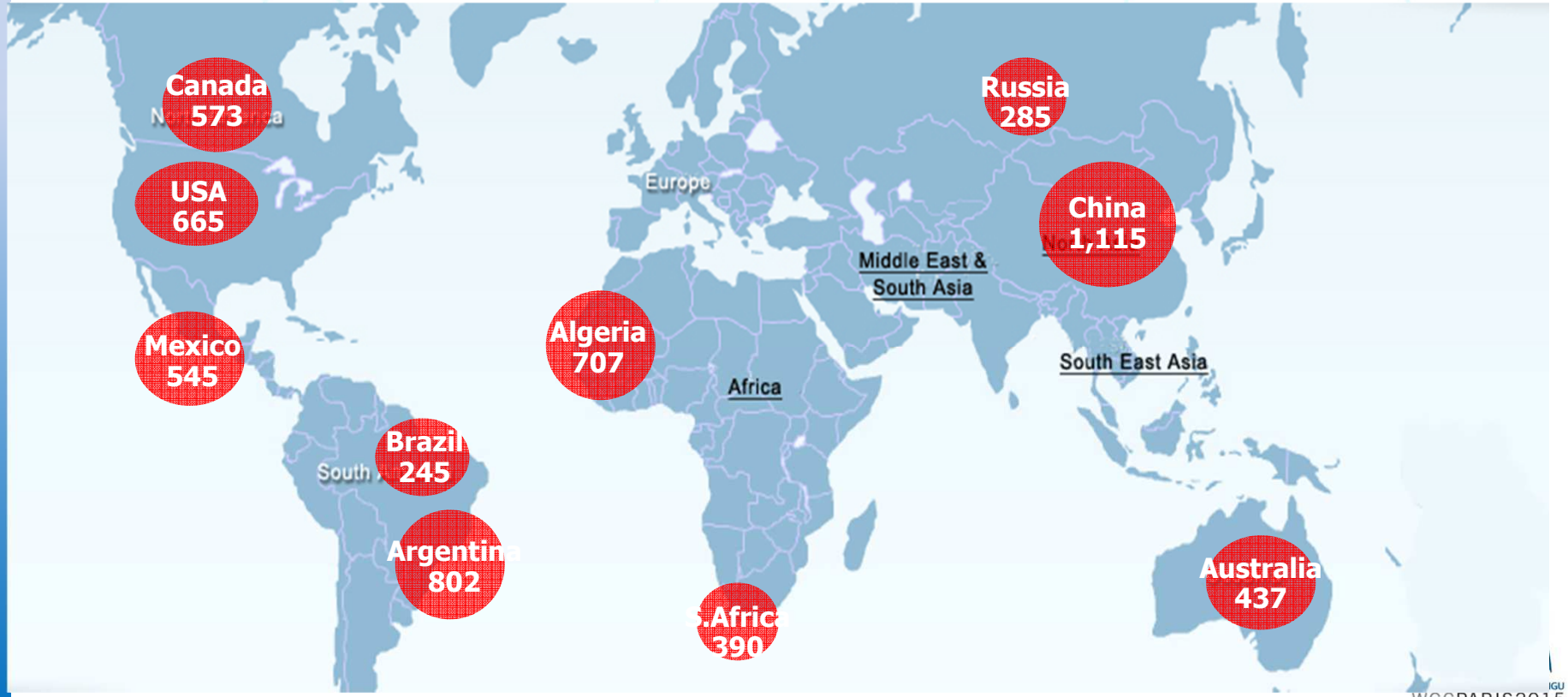


Total Global gas reserves 22,882 TCF

Total Global shale gas 7,299 TCF

Shale Gas

Shale Gas – Natural gas produced from ultra low permeability formations that may also be the source rock for other gas reservoirs. The natural gas volumes can be stored in fracture porosity, within the micropores of the shale itself, or stored in the sorbed state. Sorbed gas is predominately stored in the organic fraction.



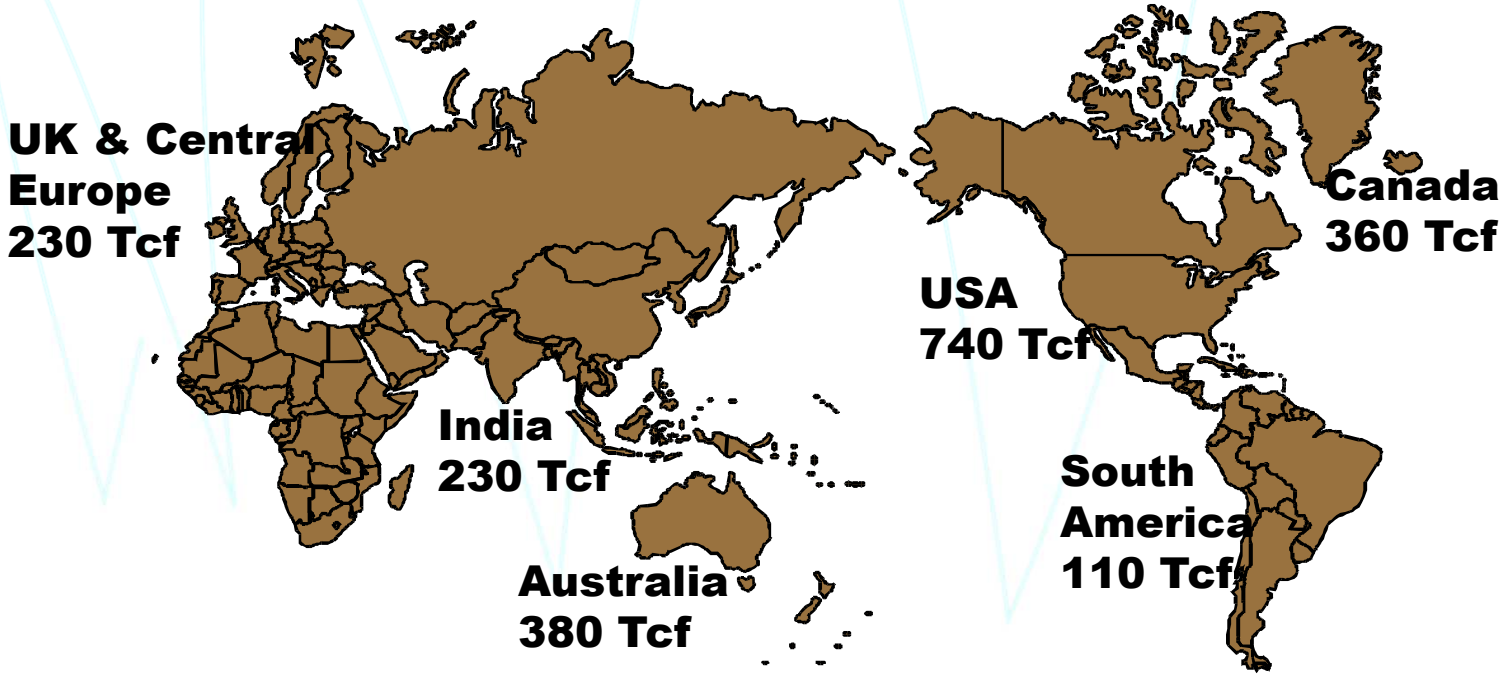
Tight Gas

Tight Gas : Natural gas produced from reservoir rocks with such low permeability that massive hydraulic fracturing is necessary to produce the well at economic rates. The gas is sourced outside the reservoir and migrates into the reservoir over geological time. Some Tight Gas reservoirs have also been found to be sourced by underlying coal and shales source rocks, in the so-called Basin Centred Gas (BCG) accumulations.

	Total gas, tcm		Unconventional by type, tcm		
Region	Conventional	Unconventional	Tight gas	Shale gas	CBM
Eastern Europe and Eurasia	160	43	10	12	20
Middle East	132	12	8	4	0
Asia Pacific	44	93	20	57	16
OECD Americas	81	82	16	57	10
Latin America (non-OECD)	27	48	15	34	0
Africa	41	38	8	30	0.1
OECD Europe	35	22	4	17	2
World	**519**	**337**	**78**	**210**	**48**

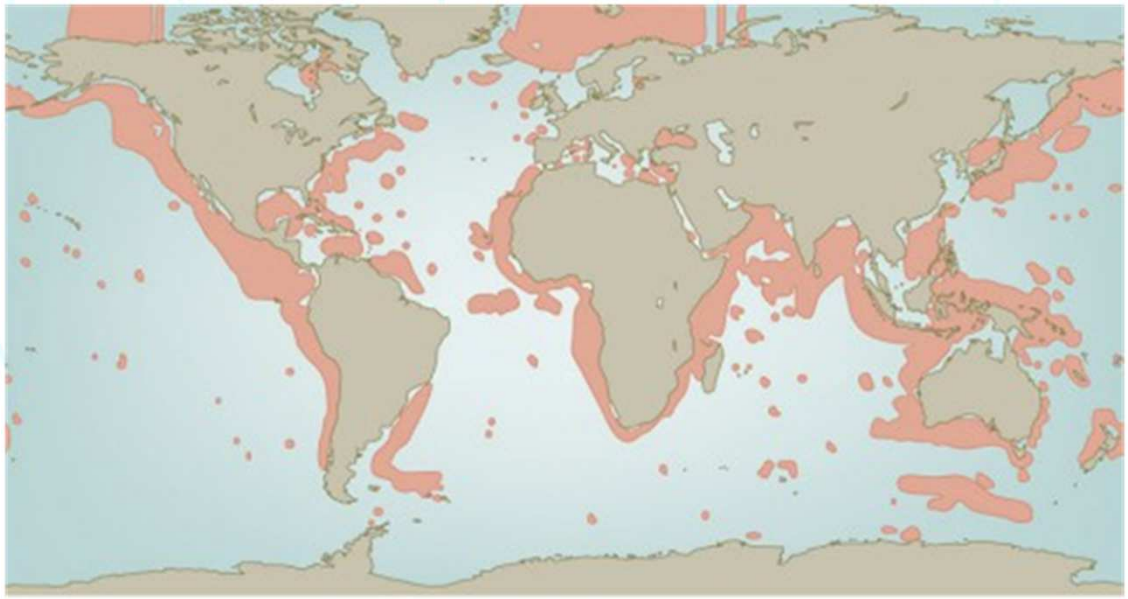
Coalbed Methane

Coal Bed Methane (CBM) : Gas associated and produced from coalbeds, its composition is predominately methane, but can also include other constituents, such as ethane, carbon dioxide, nitrogen and hydrogen. Coal seams act as source and reservoir of the natural gas and majority of gas is stored in sorbed state (coal defined as deposit comprised of greater than 70% by volume or 50% by wt. organic matter). The wells often produce water in the initial production phase, as well as natural gas. Economic CBM reservoirs are normally shallow, as the coal matrix tends to have insufficient strength to maintain porosity at depth.



Natural Gas Hydrates

Gas Hydrates – also called methane hydrate, methane clathrate, or natural gas hydrate Gas hydrate – is an ice-like crystalline solid consisting of gas molecules (usually methane, but also ethane, carbon dioxide, etc.) each surrounded by a cage of water molecules (clathrate). The gas molecules are densely packed in a crystalline structure so that hydrate deposits can store vast quantities of methane. Estimates of the amount of carbon bound in gas hydrates are almost twice the amount of carbon found in all known fossil fuels on Earth; hence, hydrates represent a dominant unconventional energy resource.



Occurrences of methane hydrates

2.5 Exploration & discovery trends and new frontier exploration areas

- ***Gas pricing mechanisms and exploratory risk***
- ***The role of the IOCs, NOCs and independent producers***
- ***Discovery trends***
- ***New frontiers and exploratory areas***

New Exploratory Frontiers

- Most attractive resource potentials

Wood Mackenzie's Future of Exploration Survey (2013)

Committee Session 1.2 Proposal

Natural gas available everywhere? An assessment of global resources and reserves

- Chaired by Denis Krambeck Dinelli （Petrobras, Brazil） and Fernando Jorge Bado （Tenaris, Argentina）

Objectives:

- In the middle of the so called unconventional gas revolution, one of the most important challenges is the development of reliable estimates for both conventional and unconventional gas reserves and resources.
- The objective of this session is to provide an updated global assessment of both conventional and unconventional gas reserves and resources, as well as to analyse the most important trends, uncertainties, opportunities and threats to be faced by the upstream segment of the gas industry.

Topics of interest include:

- Assessment of conventional and unconventional gas reserves and resources;
- Conditions for successful development of unconventional resources;
- Exploratory hotspots and new frontiers for natural gas;
- Gas flaring reduction as a means of enhancing gas supply.

Session form: Presentation and discussion of the triennial report, performed by the members of SG 1.2, complemented by invited guests and authors selected from the call for papers.

Keywords: Reserves and resources, unconventional gas, North American gas boom, shale and tight gas developments, new exploratory frontiers, gas flaring.

Terima kasih!

WGCPARIS2015
WORLD GAS CONFERENCE