PGCC2
"Implications of Expansion in unconventional gas"

Progress Report for the 2012-2015 Triennium

PGCC 4th Meeting
Seoul, South Korea
10-12 March 2014

Scope in IGU work program,

“Implications of Expansion in Unconventional Ga

- Identify the **supply potential** and **characteristics for unconventional natural gas** resources worldwide
- Analyse **changes in government policies, energy mixes** and **business strategies** in countries with abundant unconventional gas resources
- Identify the **issues and challenges** in relation to developing unconventional natural gas
- Analyse the **potential impat on the gas supply demand balances** in both regional and global gas markets

PGCC2 Group Structure, Focus Areas

Sub-Group	name	Focus Area
Asian Pacific	**Graeme Bethune***	Australia
	Jun Nagamine	China, LNG Imports
	KunHo Lee	impact of North American shale gas on Asia-Pacific markets
	Natalia Kaminskaya	Russia, Indonesia
	Dmitry Udalov	India
	Shigeki Sakamoto**	China
Europe, Africa Middle East	**Mohamed Fadhel Meddeb***	Africa
	Nedjma Benzaghou	Africa
	Magdalena Radziwonczyk	Europe
	Izabela Walczak	Europe
	Erik Houlleberghs	Europe
	Julian Bowden	Europe
Americas	**Mikhail Uchkin***	USA- Upstream～Markets
	Shigeki Sakamoto**	USA- LNG Exports
	Dmitry Udalov	South America
	*: sub-group leader	
	**: group leader	

Structure of Report

- **Part 1: Unconventional Gas in (Regions)**
  - History
  - (Specific to each country)
- **Part 2: Factors which Influence the Future of Unconventional Gas in (Region)**
  - Drivers
  - Challenges
- **Part 3: Conclusions**
  - Impact of Unconventional Gas in (Regions)

What We Discussed in This Meeting

- Review of Status of Developing Unconventional Gas through Presentations by Members
  - Australia
  - North America
  - South America
  - Implications of U.S. LNG Exports on Asian Gas Markets
- Discuss Implications of Unconventional Gas

Implications

U.S. Shale Gas

- There are significant implications on gas supply, and exports, etc.

Australia CSG

- Increase of CSG production will have a significant impact on LNG industry. They will supply over 20 million tonnes a year to Asia buyers.

The other Unconventional Gas regions

- Due to their small production, currently there is only limited impact on gas markets. China has the largest potential.

Impacts of Increase in Shale Gas Production in the U.S.

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UNION INTERNATIONALE DU GAZ

Natural gas

- Supply of cheaper fuel to US economy →revitalize US industries
- Decrease of LNG imports → ME LNG redirected to Asia
- LNG exports will have impacts on other new projects and markets
- New pricing schemes have been suggested based on hub prices
- Decrease of pipeline net imports from Canada

NGL

- Increase of production of NGL → supply cheaper feedstock to the US chemical industries
- Export of LPG/Ethane to South America, Europe, Asia

Coal

- Consumpton of gas for power generation has been growing during recent years, especially in 2012 due to low gas price
- Decrease of coal consumption → increase of US coal exports to Europe

Schedule for finalizing the Group Re

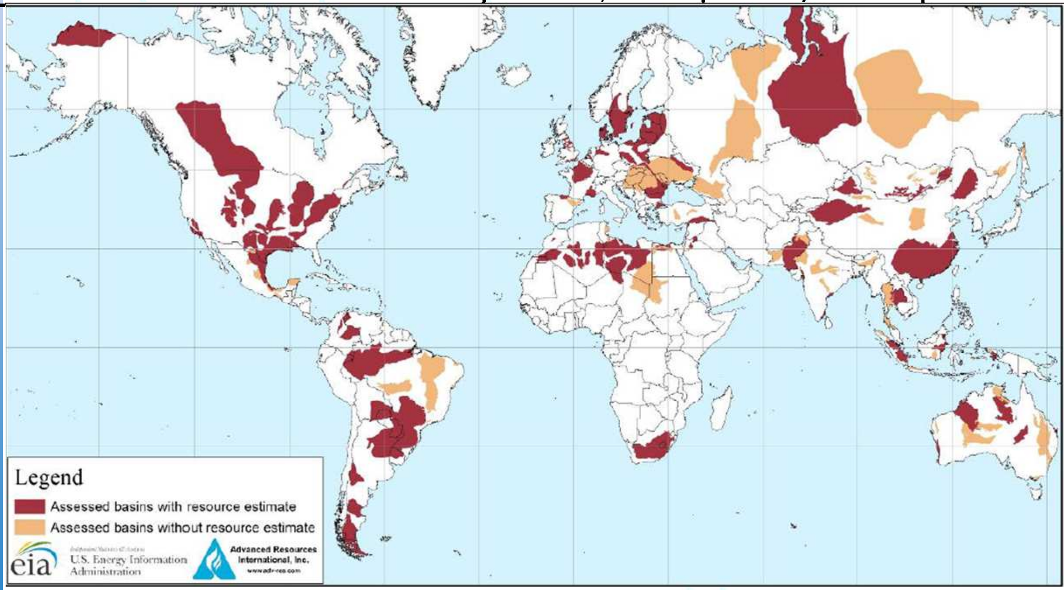
- Mar. 2014 (4th meeting)
  - Review the current status through presentations by members
  - Discuss on the implications of developing unconventional gas
- Sep. 2014 (5th meeting)
  - Completion of the draft of sub-group basis (before the meeting)
  - Continue to discuss the conclusion (implications)
  - Select WGC papers
  - Preparation for the session at WGC2015
- -Dec. 2014 prepare the final draft to the Committee
  - Finalizing the session at WGC2015
- Feb. 2015 (6th meeting) Completion of the draft
- Mach 2015 submission of the report
- Jun. 2015 WGC2015 at Paris

EIA: assessment of Shale Formation (June 2013)

Revision of shale gas resources & initial assessment of shale oil

Change of the assessment for shale gas resources by region

	2,011	2013	change	major change
	Tcf	Tcf	Tcf	
Europe	578	470	-108	France-43, Poland-39, Norway-83
North America	1,931	1,685	-246	Canada+185, USA-295, Mexico-136
Former Soviet Union	46	425	379	Russia+287(initial assess), Ukraine+86
Asia Pacific	1,785	1,808	23	Australia+41, China-160
Middle East, Africa	1,057	1,393	336	Algeria+476, Libya-168, S.Afria-95
South Central America	1,225	1,430	205	Argentina+28, Brazil+19
	6,622	7,211	589	

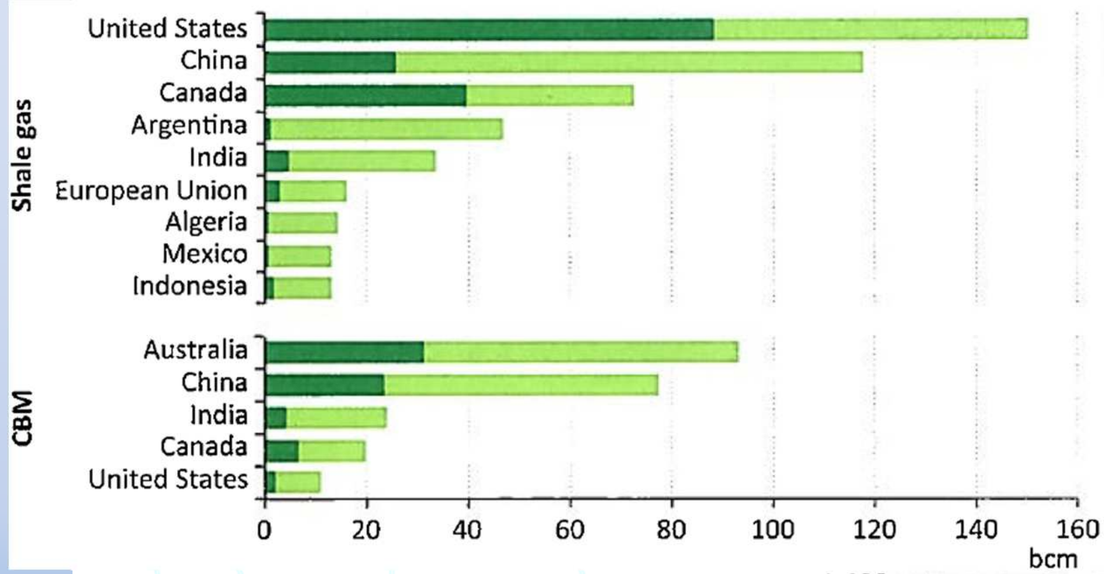


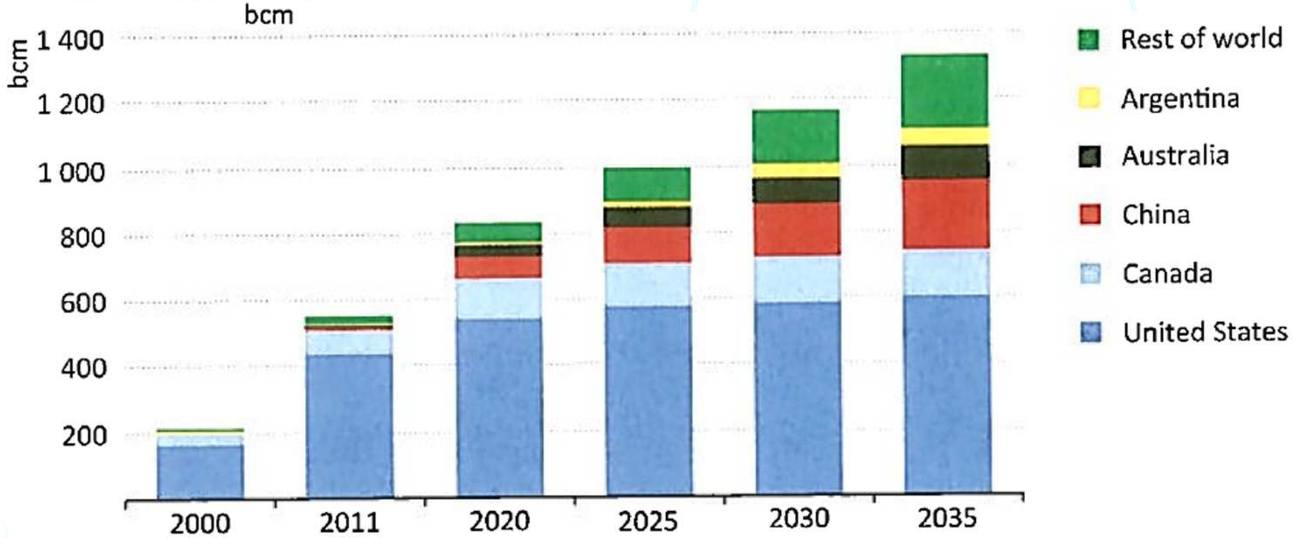
Assessment of shale gas in 2013

	Top 7 countries	Tcf
1	China	1,115
2	Argentina	802
3	Algeria	707
4	USA	665
5	Canada	573
6	Mexico	545
7	Australia	437
	Totao in the world	7,299

・If more accurate evaluation is conducted in hydrocarbon-rich Middle East and Caspian region may change the status of shale gas resources in the world.

Forecast of unconvebtonal gas production by IEA

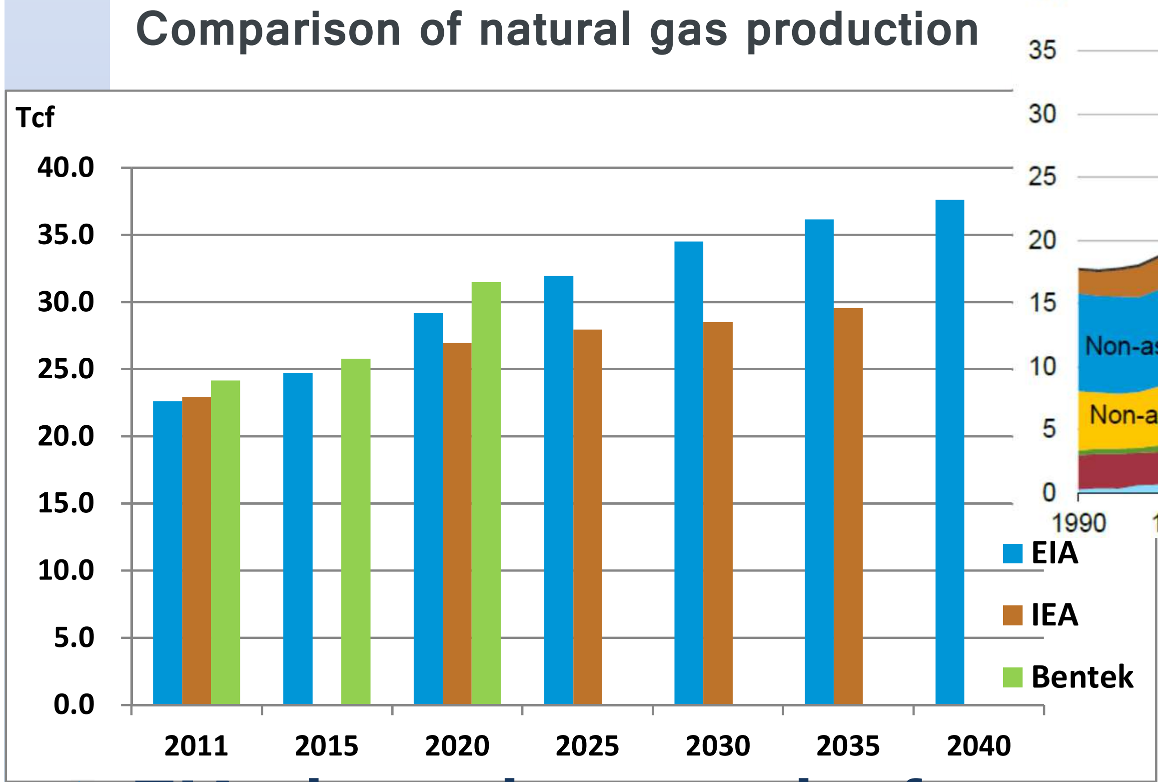


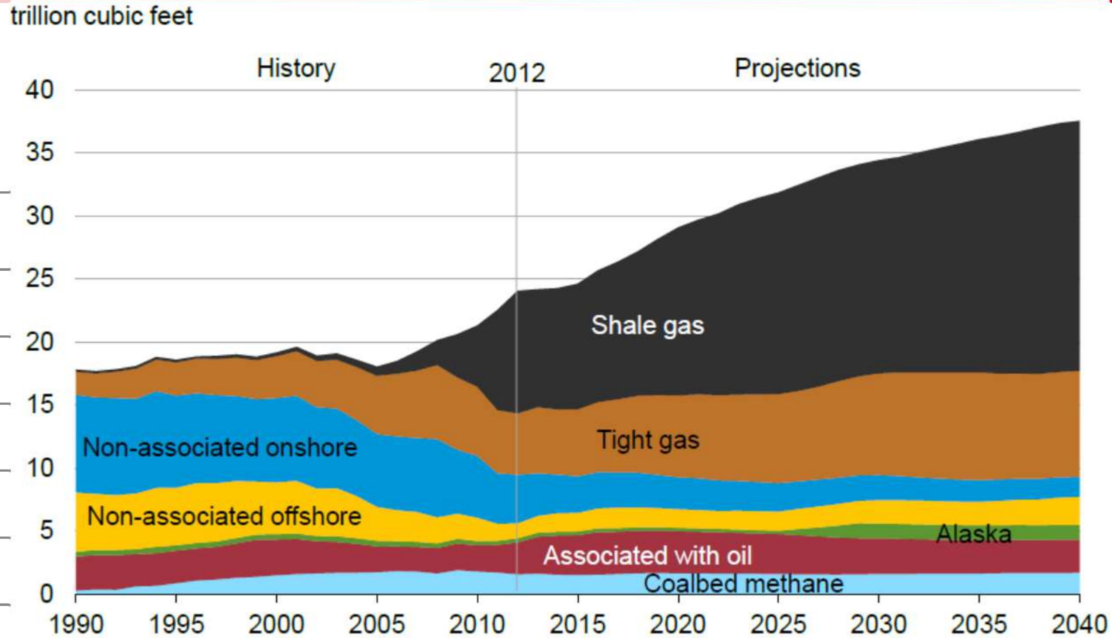


IEA notes:

- **USA will be the largest unconventional gas producer through 2030.**
- **Increase of production in the other areas including China will be after 2020.**

Unconvebtonal gas production in US





(source) EIA AEO 2014
IEA WEO 2013

EIA views the growth of gas production in the U.S.

- **Production of natural gas increases due to continued growth in shale gas production resulting from the dual application of horizontal drilling and hydraulic fracturing.**
- **The impact of increase in shale gas & oil on US economy will be significant.**
- **LNG export projects are progressing with 8.47 Bcf/d to non-FTAs.**

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Unconvebtonal gas development in China

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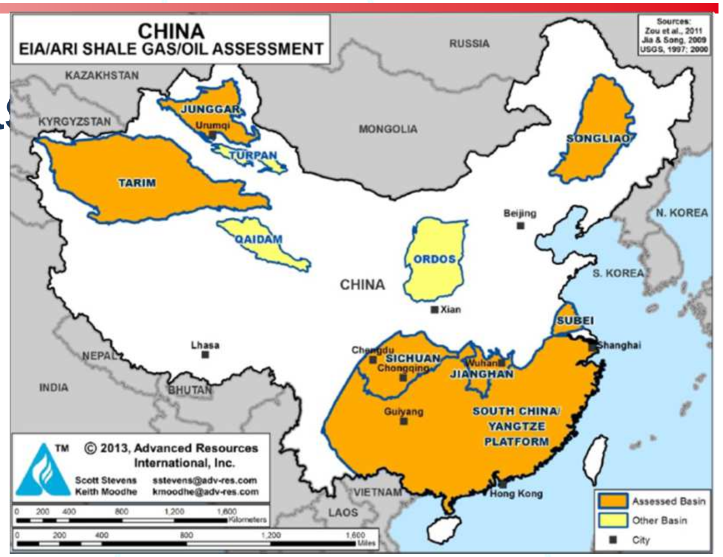
Shale gas resources

- Area:Tarim, Junggar, Ordos, Songliang ba



technically recoverable reserves

China	Tcf
EIA	1,116
(June 2013)	
Government	883
(Mar. 2012)	

Players:

- NOCs (PetroChina, Sinopec) in cooperation with IOCs

Target of production

- 2015: Government; 6.5bcm, companies; 4-5bcm
- 2020: Government; 60-100bcm, PetroChina; 20bcm

Joint Studies are on going by NOCs & IOC investors

- With Shell, ExxonMobil, Chevron, Hess , ConocoPhillips, BP, Dart
- The first PSC: Fushun-Yongchuan with Shell

Challenges:

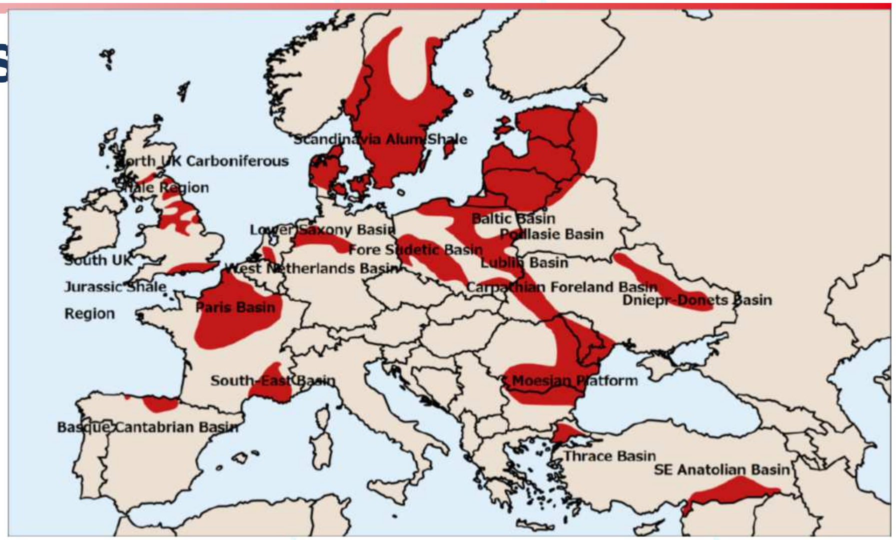
- geological difficulties, land access, lack of water,
  lack of pipeline network

Shalel gas development in Europe

Technically recoverable reserves

Europe	Tcf
Poland	148
France	137
Ukraine	128
Romania	51

(source) EIA



EU policy on development of unconventional gas:

- No specific regulations so far.
- EU's issue: development should be in compliance with environmental standards, and it relates to enhanced security of gas supply.

Status on shale activities are different country by country

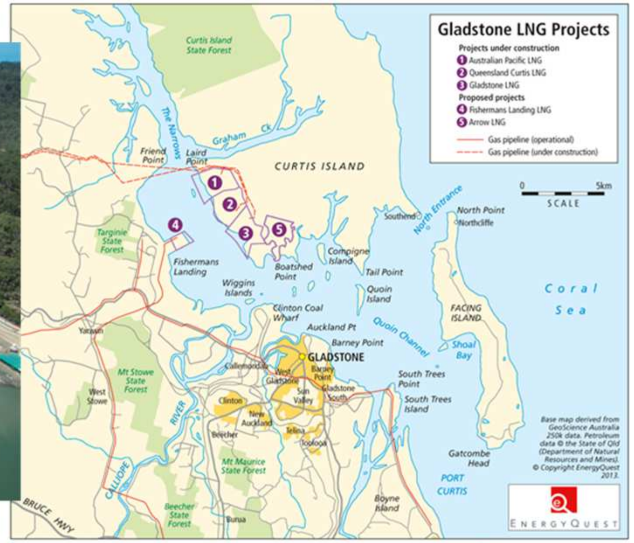
- France, Bylgaria: Hydraulic fracturing has been banned.
- Several countries set moratotium.
- Poland supports development. UK Government is supportive.

No favorable exploration results so far

Unconvebtonal gas development in Australia

- **CSG to LNG projects are progressing in QLD**
  - **QCLNG by BG**
  - **GLNG by Santos**
  - **APLNG by Origin/CP.**

  All are in Curtis Island,
  Gladstone
  First LNG: 2014-2015



- **Opposition to develop CSG in NSW:**
  - **By rich farmers and the media for fear of environmental issues**
- **Shale gas develpment, still in its early stage**
  - **region: Cooper, Canning, Perth basins Northern Territory**
  - **Cooper basin, most advanced**

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PGCC2 progress report

Thank you for your attention