Unconventional Oil and Gas
-Current Status and Issues-

Japan-China Joint Symposium on Asian Oil & Gas
-The 4th IEEJ/CNPC Research Meeting-

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Conventional Energy Resources

(End 2008)

	Proved Recoverable Reserves (End 2008)	Production (2008)			R/P Years	Reserves (Million TOE)	Production (2008) (Million TOE)
Oil (incl. NGL) ×Million BBL	1,238,834		Thousand B/D	Million BBL	41.2	179,744	4,349
		Total	82,120	29,974			
Natural Gas ×Billion ft^3	6,549,159	Gross Production		135,634	54.4	181,742	3,336
		Re-injected		15,426			
		Flared		4,718			
		Shrinkage		7,879			
		Net Production Billion ft^3		107,617			
Coal ×Million Tons						500,483	4,101
Bituminous (incl. Anthracite)	404,762	5,225			77.5		
Sub-bituminous	260,789	598			435.9		
Lignite	195,387	916			213.2		
Total Coal ×Million Tons	860,938	6,739			127.8		

Source :WEC、Survey of Energy Resources 2010

（Note）R/P for Natural Gas = （Gross Production－Re-injected）/ Production

There is no distinct definition of the difference between Conventional and Unconventional Resources. However, it is generally considered that the Resource is Conventional if it is obtainable using current or foreseeable technology and can be brought to market in an environmentally acceptable manner at an affordable cost

（Note）IEA：Oil is considered conventional if it is produced from underground reservoirs by means of conventional wells

Non-Conventional Oil Resources

×10^7BBL

（End 2008）

	Oilsand（Natural Bitumen）			Extra-Heavy Oil			Oil Shale	Conventional Oil		
	In-place resources	Cumulative Production	Reserves	In-place resources	Cumulative Production	Reserves	In-place resources	Reserves	Production × Thousand B/D	R/P
Africa	643	0	18	5	0	1	1,592	1,365	10,355	36.0
North America	24,886	64	1,704	30	2	0	37,221	629	13,307	12.9
Canada	24,342	64	1,704	0	0	0	152	218	3,201	18.6
U.S.A.	535	0	0	26	2	0	37,068	284	6,734	11.5
Latin America	0	0	0	21,136	148	580	824	1,198	6,515	50.3
Venezuela	0	0	0	21,115	147	579	0	994	2,566	>100
Asia・Oceania	4,268	0	424	177	9	9	4,161	737	10,806	18.7
Europe	3,489	0	286	151	12	2	3,682	937	14,748	17.4
Russia	3,468	0	284	2	0	0	2,479	790	9,886	21.8
United Kingdom	0	0	0	119	10	1	35	31	1,526	5.5
Middle East	0	0	0	0	0	0	382	7,521	26,389	77.9
Total World	33,286	65	2,432	21,499	171	591	47,861	12,388	82,120	41.2

Source ：WEC、Survey of Energy Resources 2010

Source ; The Oil Sands Developers Group, Canada

Source ; U.S. Department of State, Global Shale Gas Initiative

To obtain oil from Oil Shale, operators must apply heat to convert substances (kerogen and bitumen) into oil, either above ground or in situ. Though total world resources of Shale Oil are estimated at 4.8 trillion barrels, petroleum based crude oil is cheaper to produce today than Shale Oil because of the additional costs of mining and heating. Because of these higher costs, oil shale presents opportunities for supplying some of the fossil energy needs of the world in the years ahead.

Non-Conventional Gas Resources

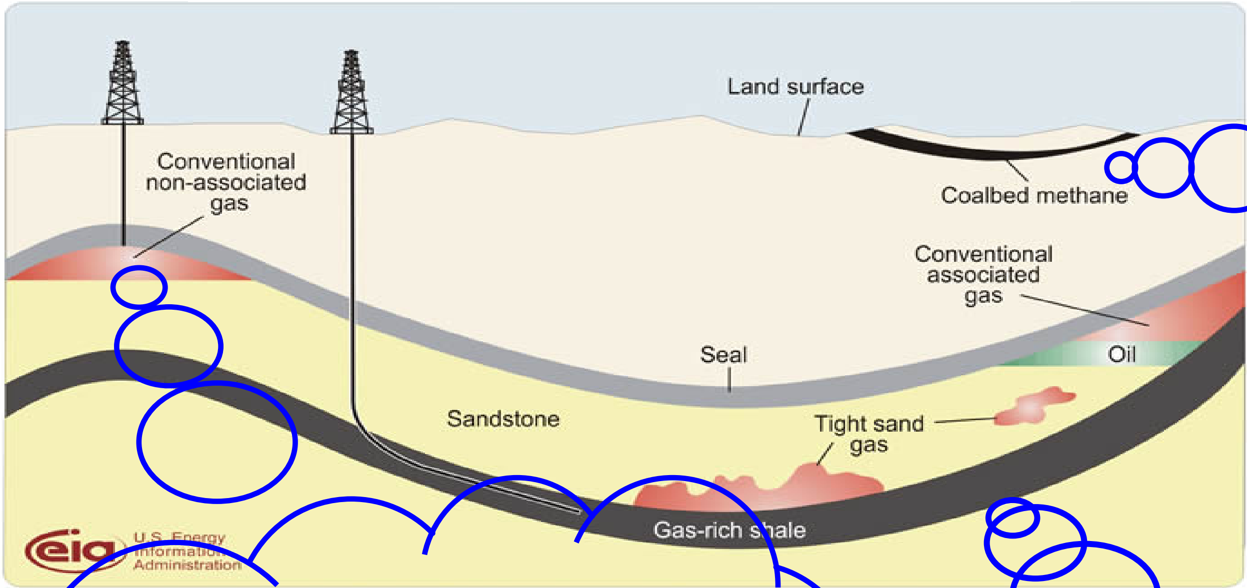
	Unconventional Natural Gas				Conventional Gas Tcf		
	Coalbed Methane	Tight Formation	Gas from Fractured Shales				
	IIASA（1996）			WEC (2010)	Reserves (End 2008)	Production(2008)	R/P Years
NORTH AMERICA	3,017	1,371	3,840	4,471	307	26	10.8
LATIN AMERICA & THE CARIBBEAN	39	1,293	2,116	373	274	7	30.8
WESTERN EUROPE	157	353	509	559	143	10	13.7
CENTRAL & EASTERN EUROPE	118	78	39	559	13	1	15.4
FORMER SOVIET UNION	3,957	901	627	5,402	2,134	28	71.7
MIDDLE EAST & NORTH AFRICA	0	823	2,547	1,305	2,969	19	128.8
SUB-SAHARAN AFRICA	39	784	274	1,017	220	2	74.6
CENTRAL PLANNED ASIA & CHINA	1,215	353	3,526	372	117	3	39.5
PACIFIC OECD	470	705	2,312	745	32	2	15.3
SOUTH ASIA & OTHER PACIFIC ASIA	39	744	313	1,307	341	10	32.9
Total World	9,051	7,405	16,103	16,110	6,549	108	54.4

Source： WEC、Survey of Energy Resources 2010

WEC、2010 Survey of Energy Resources: Focus on Shale Gas

IIASA、Hans-Holger Rogner、“An Assessment of World Hydrocarbon Resources”（May 1996）

Schematic Geology of Natural Gas



Coalbed methane does not migrate from shale, but is generated during the transformation of organic material to coal.

Conventional gas accumulations occur when gas migrates from gas rich shale into an overlying sandstone formation, and then becomes trapped by an overlying impermeable formation, called the *seal*. ***Associated gas*** accumulates in conjunction with oil, while ***non-associated gas*** does not accumulate with oil.

Gas-rich shale is the source rock for many natural gas resources, but, until now, has not been a focus for production. Horizontal drilling and hydraulic fracturing have made shale gas an economically viable alternative to conventional gas resources.

Source :DOE/EIA

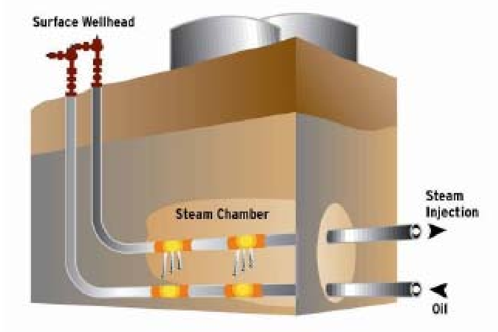
Oil-Sands Projects

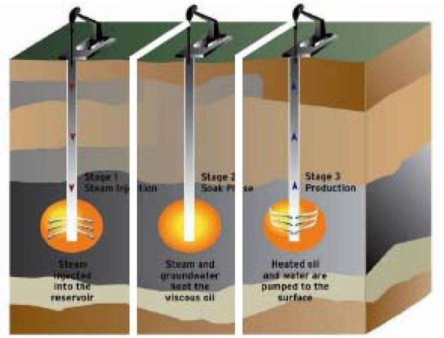
Oil Sands In-situ Projects

Project Status	Bitumen Production Capacity（B/D）
In Operation	833,500
Under Construction	217,300
With Regulatory Approval	825,500
Under Regulatory Review	906,455
Announced/Disclosed	2,439,000
Total	5,221,755

Oil Sands Mining Projects

Project Status	Bitumen Production Capacity（B/D）
In Operation	1,057,000
Under Construction	390,000
With Regulatory Approval	880,000
Under Regulatory Review	520,000
Announced/Disclosed	450,000
Total	3,297,000






Source：Alberta Department of Energy

Source：The Oil Sands Developers Group, Canada

- In 2005, Sinopec bought a 40% interest in the Northern Lights Partnership (NLP) from Synenco Energy Inc. In Apr. 2009, Sinopec bought a 10% stake from Total. The shareholding in NLP will now be a 50:50 venture owned by Total and Sinopec.
- In July 2006, KNOC has signed an agreement to buy a 100% stake in the Blackgold Mine oil sands field in the Cold Lake region of Alberta.
- In November 2007, INPEX acquired a 10% interest in the Joslyn Oil Sands Upstream Project in Alberta.
- In Sept. 2009, PetroChina announced to buy 60% of stakes in Athabasca Oil Sands Corp. (AOSC)'s MacKay River and Dover oil-sands projects for a US$1.7-billion.
- In April 2010, ConocoPhillips has entered into agreements with Sinopec to sell its 9.03 percent interest in Syncrude for $4.65 billion.
- In Nov. 2010, Thailand's PTT announced to pay Norway's Statoil $2.2 billion for a 40% interest in the Kai Kos Dehseh project in Alberta.
- In Nov. 2010, JAPEX has announced that the company's Canadian subsidiary, Japan Canada Oil Sands Ltd. (JACOS) seeks to upgrade to 35,000 b/d from current 7,000 to 8,000 b/d by the end of 2014.

Production Cost of Oil Sand

Production Method	Product	Production B/D	Investment C$/BBL	Natural Gas Consumption tcf/BBL	CO2 Emissions KgCO2/BBL	Price at Plant Gate（2007Price）C$/BBL	
						Operating Cost	Supply Cost
Cyclic Steam (Cold Lake）	Bitumen	30,000	30,000～35,000	1.0～1.1	51.4～61.7	20	36-37
SAGD	Bitumen	30,000	30,000～35,000	1.0～1.1	51.4～61.7	19	34-35
Mining/Extraction	Bitumen	100,000	48,000	0.5	26.7	13	36-37
Mining/Extraction/ Upgrading（SCO Production）	SCO（Sythetic Crude Oil）	100,000	48,000 + 46,000	n.a.	51.4	23	72

（Note）

Source：WEC、Survey of Energy Resources 2010

1US$ = 0.95 C$

Operating Cost exclusive of taxes and fuel cost

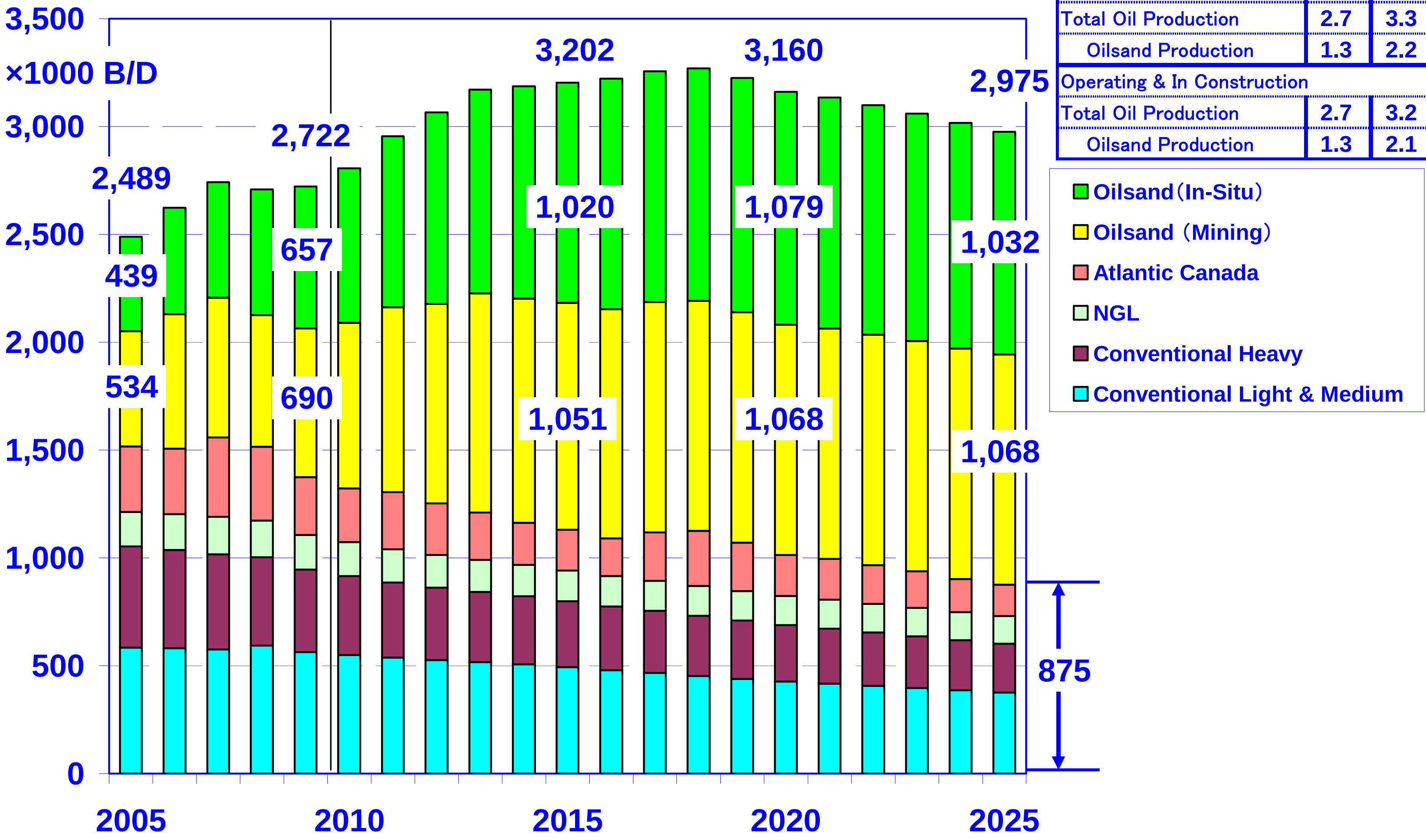
Supply Cost at Plant Gate assumes CO2 compliance cost of $15 per tonne for excess emissions over 100,000 tonnes /Year

Upgrading assumes 1 barrel SCO requires 1.15 barrels of Bitumen

Concerns about the volumes of gas consumed and generation of CO2 involved in the thermal recovery processes, along with availability of water and diluents, have been raised as critical environmental issues. The industry appears anxious to adopt technology to address these issues（WEC, Survey of Energy Resources 2010）.

Forecast of Oil Sand Production

Million B/D	2009	2015	2020	2025
Growth Case				
Total Oil Production	2.7	3.3	3.9	4.3
Oilsand Production	1.3	2.2	2.9	3.5
Operating & In Construction				
Total Oil Production	2.7	3.2	3.2	3.0
Oilsand Production	1.3	2.1	2.1	2.1



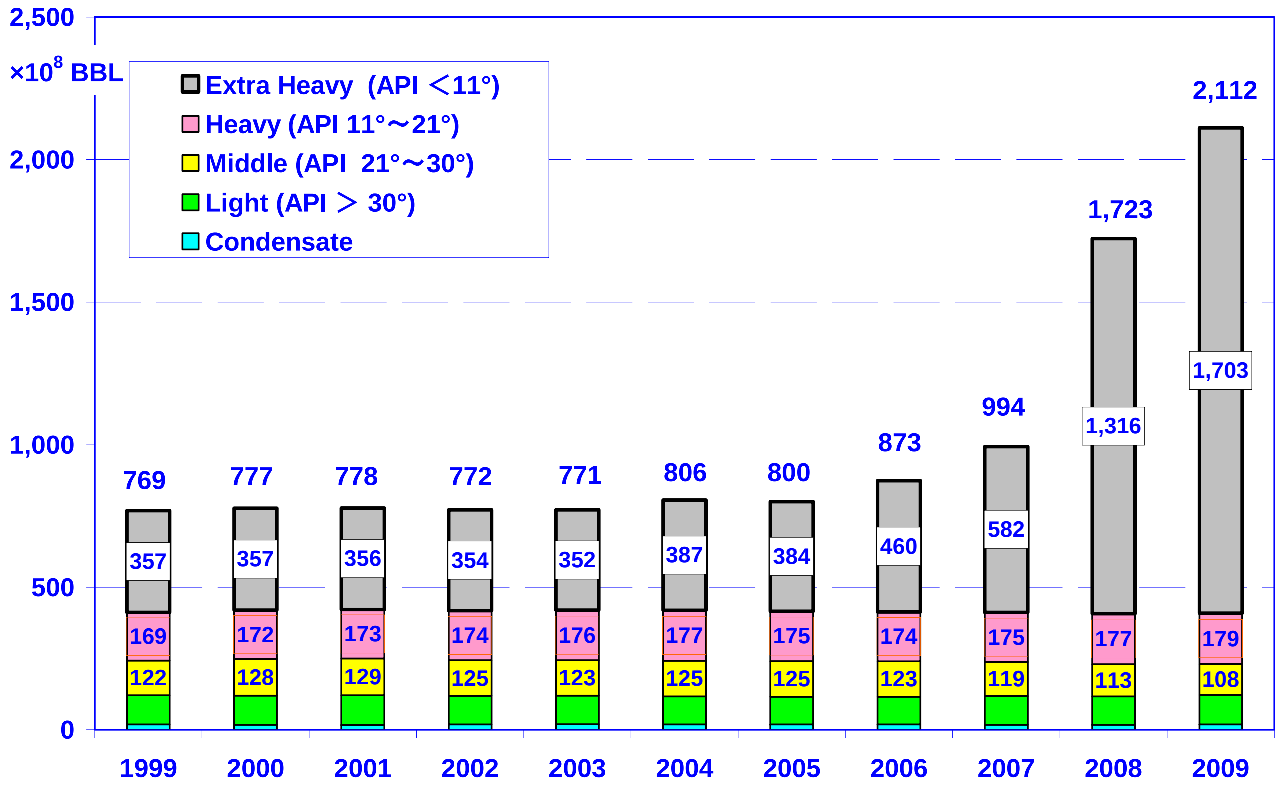
Source :CAPP、2009-2025 Canadian Crude Oil Forecast and Market Outlook、June 2010

Oil Sand Pipeline

①Enbridge Alberta Clipper（April, 2010 450,000 B/D）
②TransCanada Keystone（July, 2010 435,000 B/D）
③TransCanada Keystone XL & Louisiana Access options（2013, 700,000 B/D）
④Enbridge Northern Gateway（May, 2010 Application 525,000 B/D）
⑤Kinder Morgan TMX2, TMX3（2015 80,000 B/D）（2016 320,000 B/D）
⑥Kinder Morgan Northern Leg Expansion（2015 400,000 B/D）

Source：CAPP、2009-2025 Canadian Crude Oil Forecast and Market Outlook、June 2010

Venezuela Petroleum Reserves



Source：PDVSA

- According to OPEC's Annual Statistical Bulletin 2009 published in 2010, Venezuela's proven oil reserves in 2009 stood at 211.2 billion barrels.
- This is the same figure announced by Venezuela's Ministry of Energy and Petroleum this year to take into account the incorporation of 39.9 billion barrels of new certified proven oil reserves from the Orinoco heavy oil belt and traditional areas during 2009.

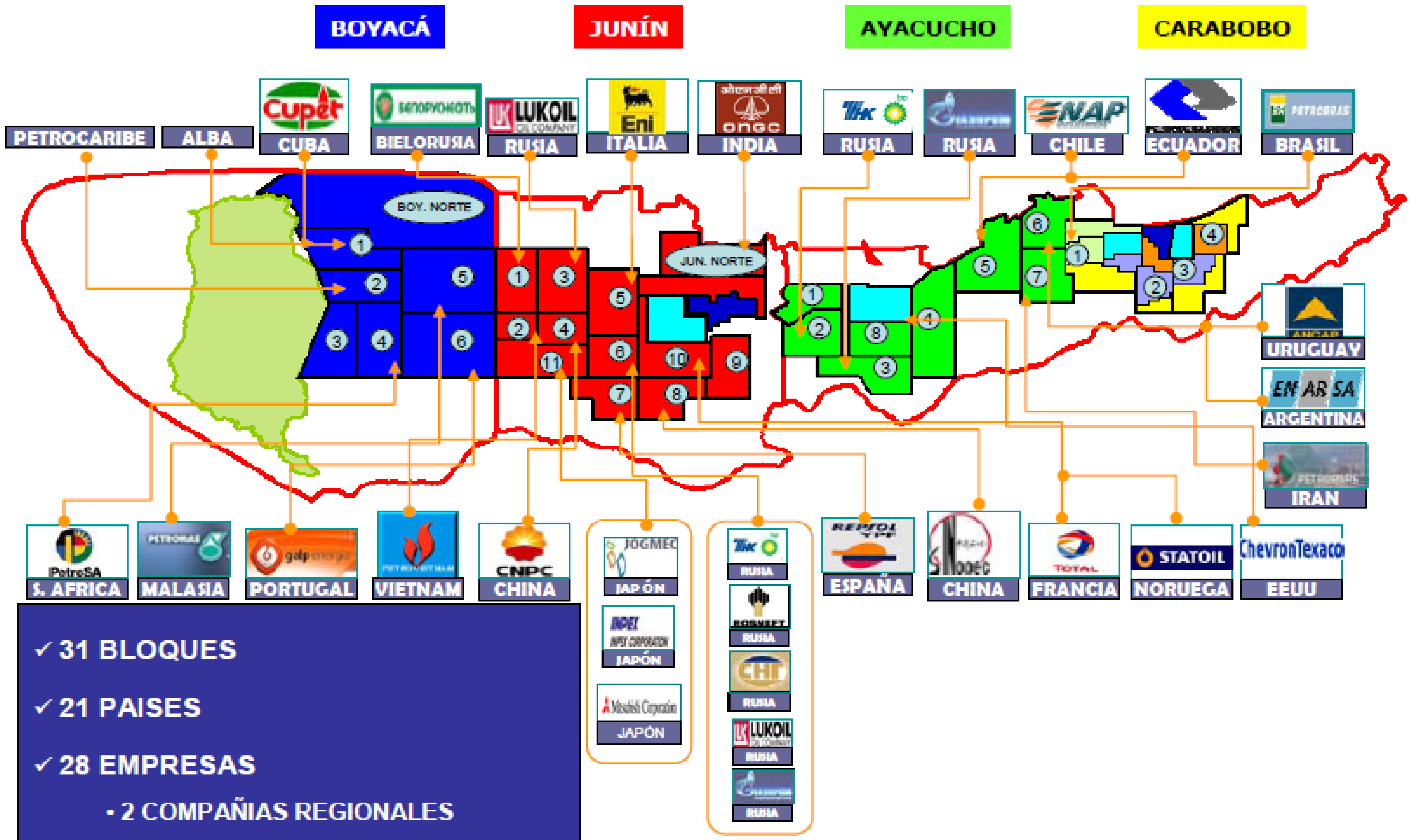
Note： BP Statistical Review of World Energy 2009: 99.4 Bil. bbls at end 2008
→ BP Statistical Review of World Energy 2010: 172.3 Bil. bbls at end 2008, 172.3 Bil. bbls at end 2009

Heavy Oil Upgrading Projects in Venezuela

- In Feb. 2007, Venezuela's President Hugo Chávez has signed a decree ordering the conversion of existing contracts for extra-heavy oil production to mixed companies, in which the state oil company PDVSA will have at least a 60% stake

Project Name (Original Name)	Junin (Petrozuata)	Carabobo (Cerro Negro)	Boyacá (Sincor)	Ayacucho (Hamaca)
Extra Heavy Oil Production B/D	120,000	120,000	200,000	200,000
API Gravity	9.3	8.5	8.0～8.5	8.7
Synthetic Oil Production B/D	104,000	105,000	180,000	190,000
API Gravity	19～25	16	32	26
Sulphur Wt%	2.5	3.3	0.2	1.2
Startup	August 1998	November 1999	December 2000	November 2001
Partner shares %	PDVSA 100%	PDVSA 83.33% BP 16.67%	PDVSA 60.00% TOTAL 30.32% Statoil 9.68%	PDVSA 70.0% Chevron 30.0%
Partner shares % (Original)	PDVSA 49.9% ConocoPhillips 51.1%	PDVSA 41.67% ExxonMobil 41.67% BP 16.66%	PDVSA 38.0% TOTAL 47.0% Statoil 15.0%	PDVSA 30.0% Chevron 30.0% ConocoPhillips 40.0%

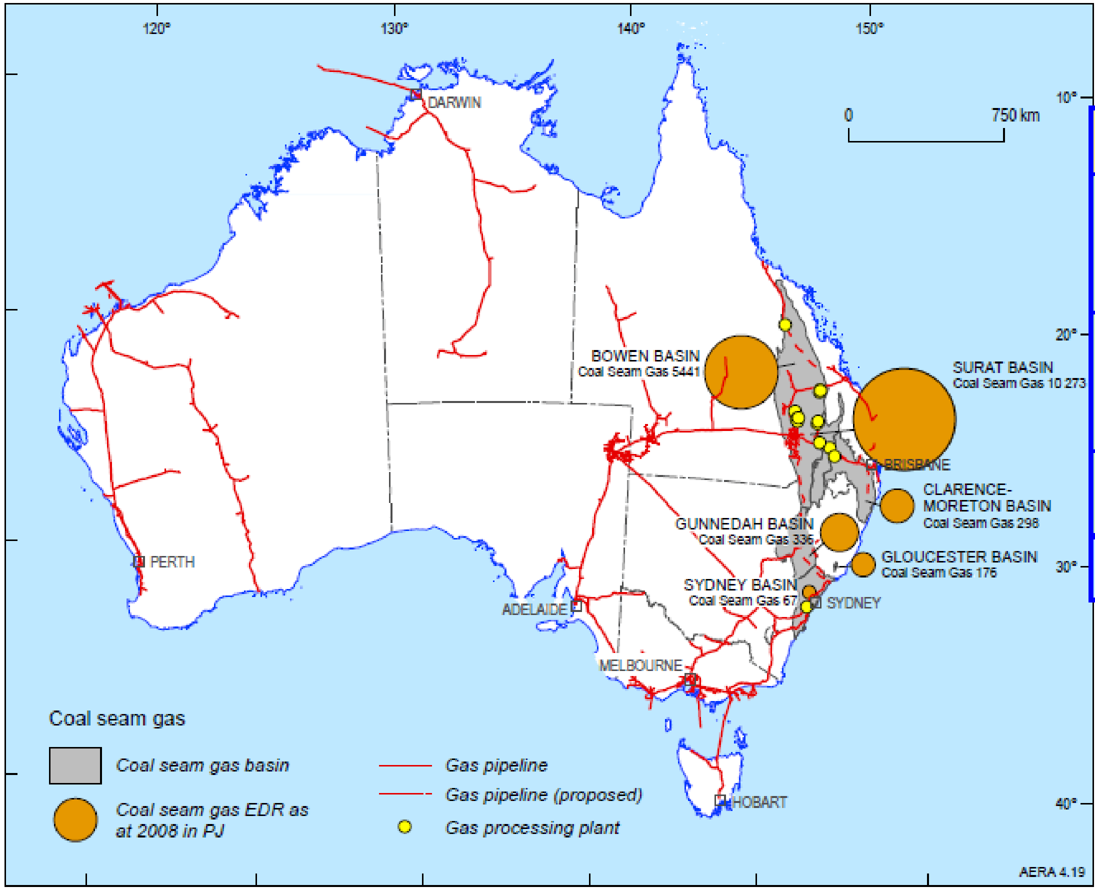
Development of Orinoco Resources



- ✓ 31 BLOQUES
- ✓ 21 PAISES
- ✓ 28 EMPRESAS
  - 2 COMPAÑIAS REGIONALES
  - 2 CONSORCIOS INTERNACIONALES

Source：PDVSA

CBM Resources in Australia



Source：Geoscience Australia

CBM Resources at December 2008

CBM Resources	PJ	tcf
Economic Demonstrated Resources	16,590	15.1
Sub-economic Demonstrated Resources	30,000	27.2
Inferred Resources	122,020	111.0
Total	168,610	153.0

In coal mining operations, methane rich CBM was considered as a nuisance and a danger in the past. Therefore, it was vented into the atmosphere until when it was discovered that methane has 20 times the global warming potential as carbon dioxide.

Coal miners were encouraged to capture CBM by regulations and commercial CBM production has begun. Also, coal miners found if CBM extraction was conducted in advance of mining, it improves the quality of the gas, and miners could produce coal more efficiently.

CBM Projects Recently Completed

as at October 2009

Project	Company	Location	Start up	Capacity (PJ /Year)	Capital Expenditure (Million A$)
Berwyndale South CSM	Queensland Gas Company	Roma, Qld	2006	na	A$52
Argyle	Queensland Gas Company	Roma, Qld	2007	7.4	A$100
Spring Gully CSM project (phase 4)	Queensland Gas Company	Roma, Qld	2007	15	A$114
Tipton West CSM project	Arrow Energy/ Beach Petroleum/ Australian Pipeline Trust	Dalby, Qld	2007	10	A$119
Darling Downs development	APLNG (Origin/ ConocoPhillips)	North of Roma, Qld	2009	44 (includes wells from Tallinga)	A$500

Source：Geoscience Australia

With higher gas prices, tax incentives and improved technology, recovering CBM became attractive economically. Production of CBM in Australia has increased significantly in the past seven years with its share of total Australian gas production increasing from 2 % in 2002 to 9 % in 2008.

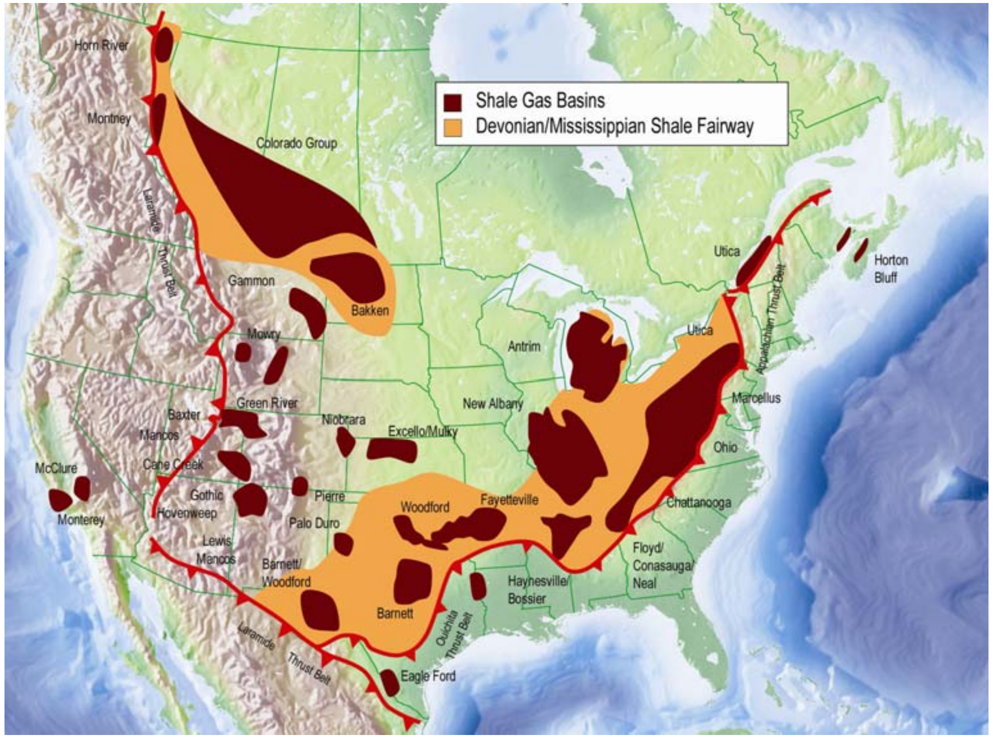
CBM Projects Planned

Project	Participants	Location	Targeted FID	Targeted start-up	LNG Capacity (mtpa)	Capital cost
Gladstone LNG	Santos, Petronas、TOTAL	Gladstone	2010	2014	3.5 initially 10 ultimately	$A7.7 (inc 1 train)
Curtis LNG	BG Group	Gladstone	Late 2010	2014	7.4 initially 12 ultimately	$A8
Australia Pacific LNG	Origin, ConocoPhillips	Gladstone	Late 2010	2014–15	7–8 initially, 14–16 ultimately	$A35 (inc 4 trains)
CS CSG	Shell, PetroChina	Gladstone	2011	2014	16	na

Note: FID, Final Investment Decision　　**Source：APPEA**

- **Australian domestic energy company Origin Energy and ConocoPhillips created a 50:50 joint venture in October 2008 called Australia Pacific LNG (APLNG) to develop Queensland's CBM. In Feb. 2010, APLNG agreed to supply CBM to UK gas major BG Group's Queensland Curtis LNG (QCLNG) project.**
- **In May 2009, CNOOC signed a deal to buy 3.6 million tons/year of CBM-LNG from QCLNG project (two-train, 8.5 million t/year plant) for 20 years from 2015**
- **In Aug. 2010, Shell and PetroChina completed the A$3.5 billion joint (50:50) acquisition of Australia-based coal seam gas company Arrow Energy. Arrow is proposing 16 million t/year LNG project at Fisherman's Landing in Gladstone on Australia's east coast.**
- **In Mar 2010, BG Group has signed a heads of agreement (HoA) to sell 1.2 million t/year of LNG to Tokyo Gas from its Curtis Project in Australia for 20 years from 2015.**
- **In October 2010, the 7.2 million t/year Gladstone LNG project (GLNG)—a joint venture between Santos, Petronas, and Total (joined in Sept. 2010) —gained government approvals for development of CBM resources in the Bowen and Surat basins around Roma, Queensland.**
- **In October 2010, Korea Gas Corp. (Kogas) declared that it is in talks to buy a 15% stake in Gladstone LNG project.**

Shale Gas Resouces in the US and Canada



Source :National Energy Board, Canada

- In August 2010, the US Department of State's Coordinator for International Energy Affairs hosted the first multilateral conference under the Global Shale Gas Initiative to promote global energy security and climate security around the world.
- Seventeen countries attended the conference. The conference aimed to provide an opportunity to share regulatory experience and help selected countries understand their shale gas potential and the related government responsibilities.
- As part of the State Department's initiative, two countries, China and India, have signed agreements allowing the US Geological Service to evaluate data on their potential shale plays to determine if their rock formations have recoverable gas.

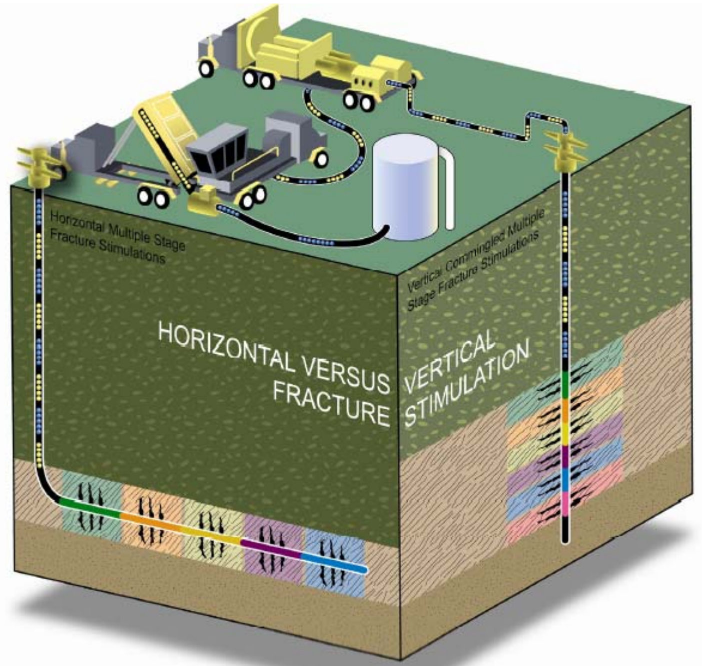
Current Producing and Prospective Gas Shales in the US

		Barnett	Fayetteville	Haynesville/ Bossier	Marcellus	Woodford	Antrim	New Albany	Total U.S.
States		Texas (Fort Worth Basin)	Arkansas, Oklahoma (Arkoma Basin)	Louisiana, Texas (North Louisiana Salt Basin)	New York, Pennsylvania, others (6 States) (Appalachian Basin)	Oklahoma, Texas (Arcoma, Anadarko, Ardmore Basin)	Michigan (Michigan Basin)	Illinois, Indiana, Kentucky (Illinois Basin)	
Estimated Basin Area	Km^2	12,950	23,300	23,300	246,000	28,500	31,100	112,700	
Depth	m	1,980-2,590	300-2,130	3,200-4,120	1,220-2,590	1,830-3,350	180-670	150-610	
Net Thickness	m	30-180	6-60	60-90	15-60	37-67	21-67	15-30	
Gas Content	ft^3/ton	300-350	60-220	100-330	60-100	200-300	40-100	40-80	
Original Gas-In-Place	TCM	9.3	1.5	20.3	42.5	0.7	2.2	4.5	
	tcf	327	52	717	1,500	23	76	160	
Technically Recoverable Resources	TCM	1.2	1.2	7.1	7.4	0.3	0.6	0.5	
	tcf	44	41.6	251	262	11.4	20	19.2	
Reserves	2008	22,492	3,833	1,031	102	3,845	2,894	n.a.	34,428
(bcf)	2009	26,493	9,070	10,468	4,478	6,389	2,499	n.a.	60,644
Production	2008	1,501	279	25	2	168	122	n.a.	2,116
(bcf)	2009	1,745	527	321	76	249	132	n.a.	3,110
Companies (Domestic)		Chesapeake Energy, Devon Energy, EOG Resources, XTO (ExxonMobil), Pioneer Resources, RAM Resources	Chesapeake Energy (BP), Southwestern Energy, XTO (ExxonMobil), Petrohawk Energy, Storm Cat Energy	Chesapeake Energy, Encana, Petrohawk Energy, EXCO Resources, EOG Resources, Mainland Resources, Ellora Energy (ExxonMobil)	EOG Resources, EXCO Resources, Williams Cos., Range Resources, Chesapeake Energy, Seneca, Atlas Energy (Chevron), Pennsylvania General Energy (ExxonMobil)	Devon Energy, Apache Corp., Chesapeake Energy (BP), Continental Resources XTO (ExxonMobil) Marathon Oil, Woodford Shale	Atlas Energy (Chevron), Whiting Petroleum, Breitburn Energy	Atlas Energy, Baseline Oil and Gas, Rex Energy	
Companies (Foreign)		TOTAL-Chesapeake Energy		BG-EXCO Resources Shell-Encana	BG-EXCO Resources Mitsui-Anadarko Reliance-Atlas Energy Reliance-Carrizo Oil & Gas Statoil-Chesapeake Shell-East Resources Atinum (Korea)-Gastar Sumitomo-REX Energy		Reliance-Atlas Energy		

Foreign Companies Participating in Other Gas Shale Basins

- CNOOC-Chesapeake (Eagle Ford Shale, South Texas)
- Statoil & Talisman Energy (Eagle Ford Shale, South Texas)
- Reliance-Pioneer Natural Resources (Eagle Ford Shale, South Texas)
- TOTAL-Chesapeake Energy (Eagle Ford Shale, South Texas)
- BP-Lewis Energy (Eagle Ford Shale, South Texas)
- Itochu-MDU Resources Group (Niobrara Oil Shale, Wyoming)

Shale Gas Production（Water Fracturing）



Source：National Energy Board, Canada

Estimated Water Needs for Drilling and Fracturing Wells in Selected Shale Gas Plays

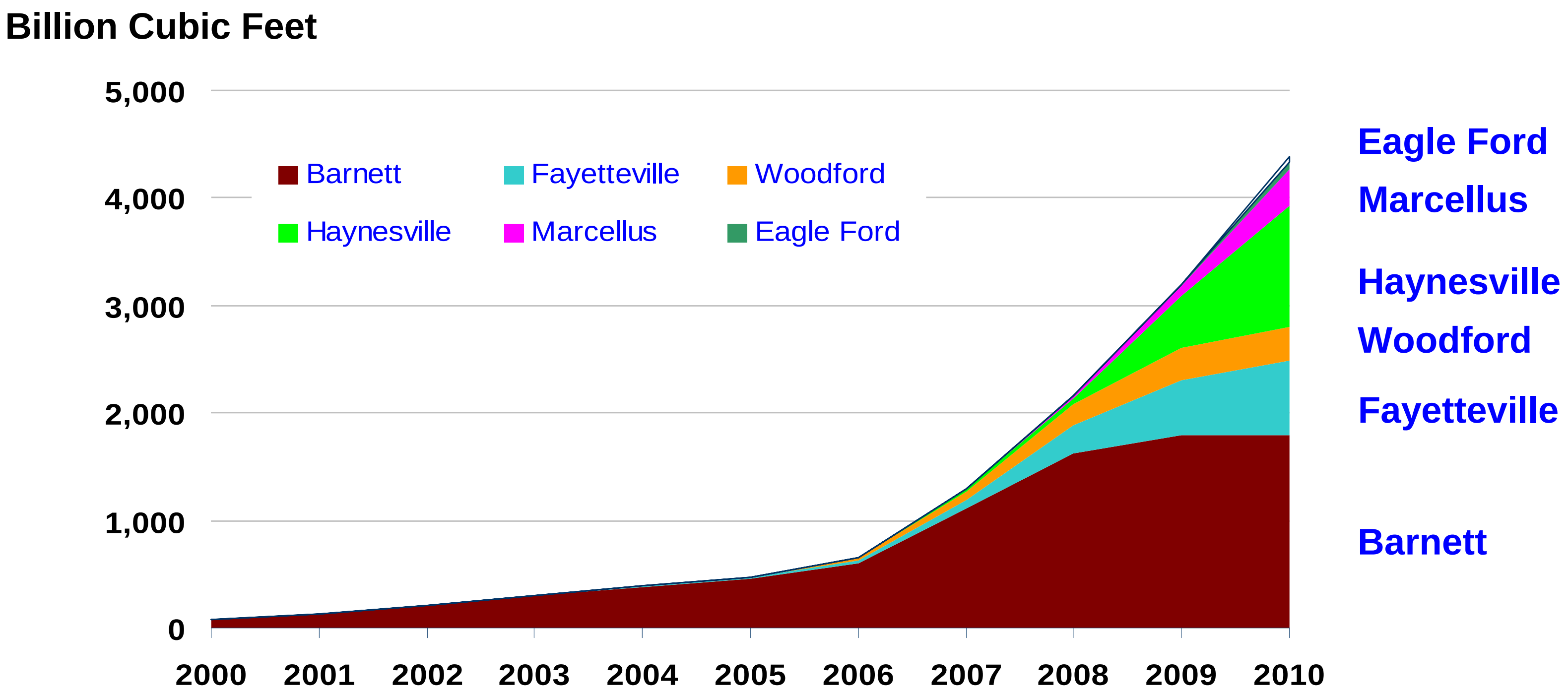
Shale Gas Play	Volume of Drilling Water per well (m^3)	Volume of Fracturing Water per well (m3)	Total Volumes of Water per well (m3)
Barnett Shale	1,510	8,710	10,220
Fayetteville Shale	230 *	10,980	11,210
Haynesville Shale	3,790	10,220	14,010
Marcellus Shale	300 *	14,390	14,690

* Drilling performed with an air “mist” and/or water-based or oil-based muds for deep horizontal well completions.
Source：DOE, Modern Shale Gas Development in the United States: A Primer, April 2009

- According to the survey conducted by the Tokyo Municipal Government, a one-person household consumed 7.7 m3 of drinking water a month and a four-person household 25.1 m3 a month in 2009

- Some states and municipal authorities where significant shale gas deposits exist raised environmental concern about the hydraulic fracturing process which involves hazardous chemicals that can contaminate drinking water supplies.
- In 2009, Congress directed the U.S. Environmental Protection Agency (EPA) to conduct a study to determine whether the process has an impact on drinking water and the public health of nearby residents.

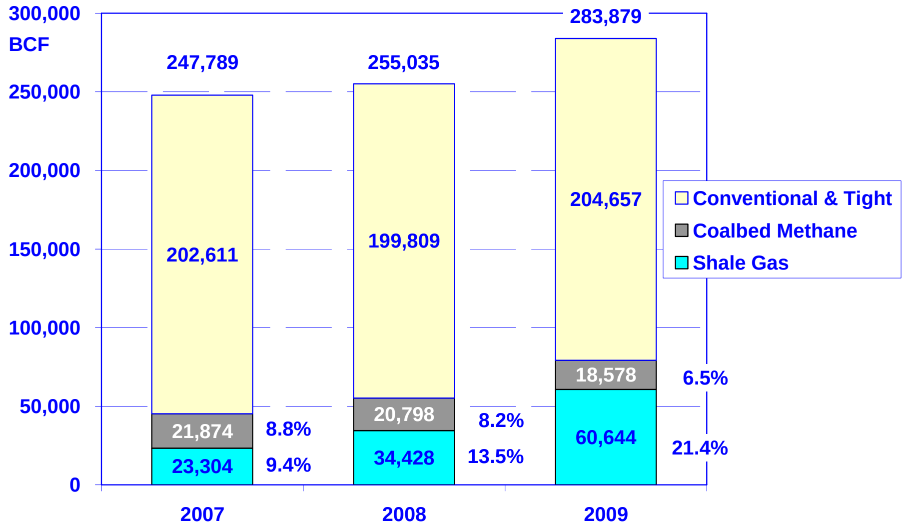
Production of Shale Gas

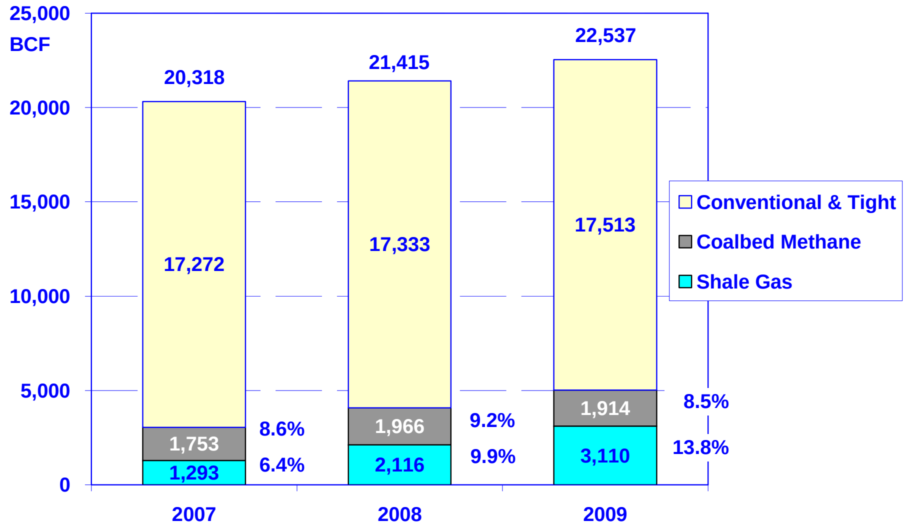


Source: DOE/EIA, James M. Kendell, October 19, 2010

- DOE/EIA's Annual Energy Outlook 2010 estimates for total technically recoverable natural gas resources in the United States as of January 1, 2008 at 2,119 Tcf.
- This estimate includes proved reserves, inferred reserves, and undiscovered technically recoverable resources.
- The Annual Energy Outlook 2010 includes an estimate of 347 Tcf for unproved technically recoverable shale gas.
- Proved reserves of natural gas have grown significantly over the past several years, further indicating an expanding resource base.

Natural Gas Proved Reserves and Production, 2007-2009

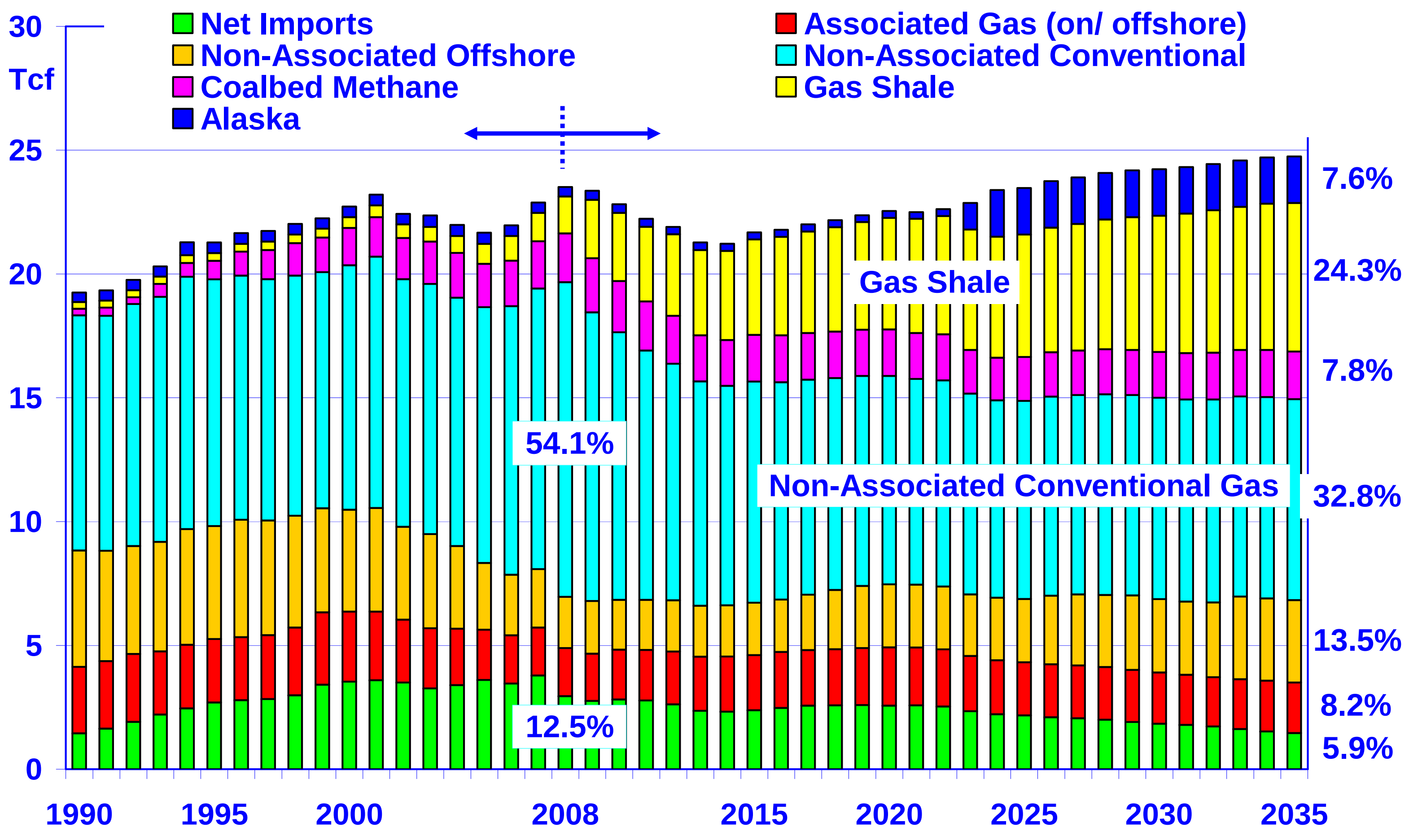




Source：DOE/EIA、U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Proved Reserves

- Natural gas from shale represented 21 % of U.S. gas reserves and 14% of U.S. gas production in 2009, with the majority coming from 6 major shale areas. These are the Fayetteville Shale (Arkansas), the Haynesville (Louisiana), the Woodford (Oklahoma), the Marcellus (Pennsylvania), and the Barnett and Haynesville/Bossier (Texas).
- Shale gas accounted for more than 90 percent of total net additions of U.S. recoverable reserves.
- The 11 percent increase in U.S. proved natural gas reserves took place during a low-price environment that resulted in negative revisions to existing (conventional) reserves.

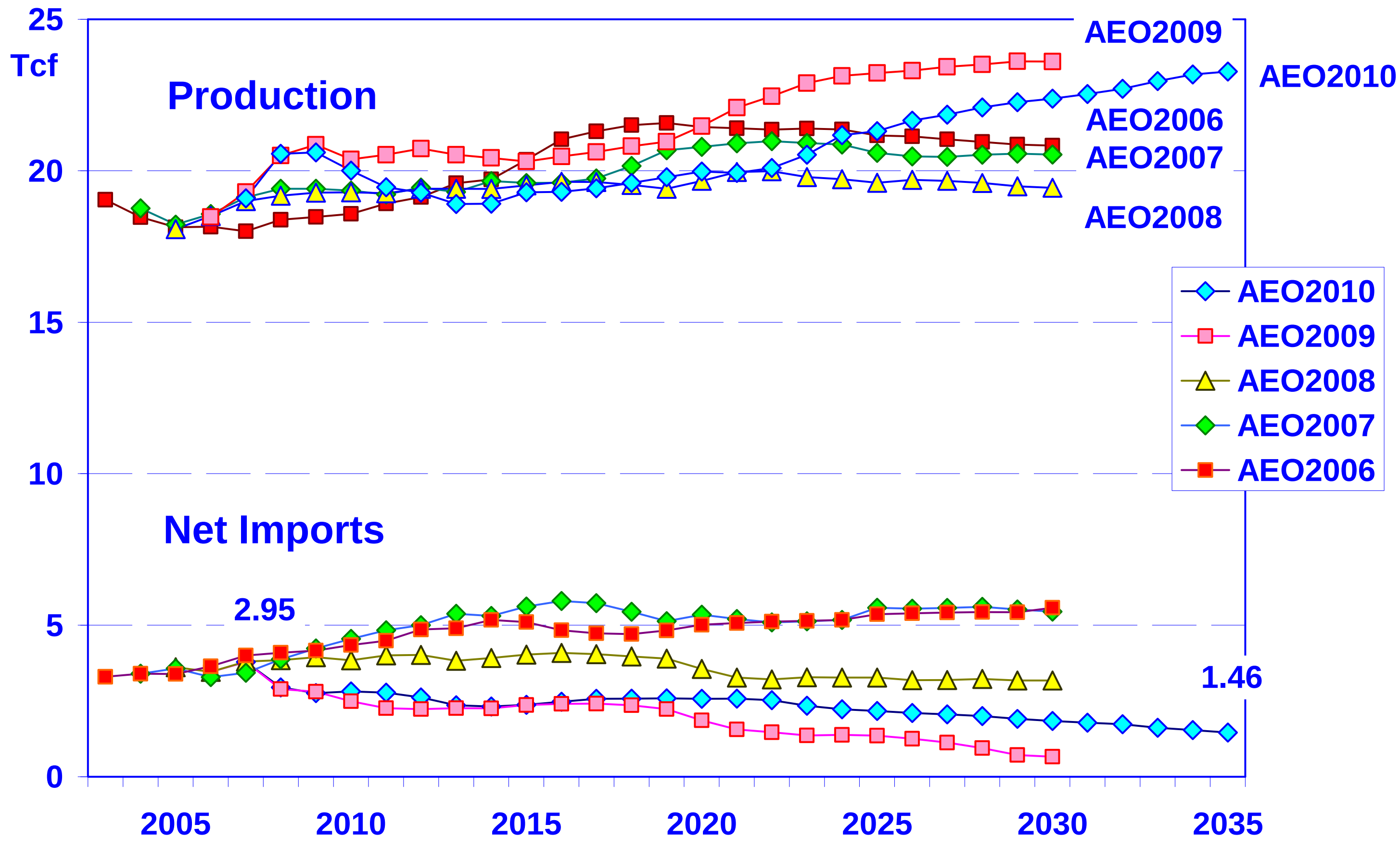
U.S. Natural Gas Supply, 1990-2035



Source：DOE/EIA、Annual Energy Outlook 2010

- Total domestic natural gas production grows from 20.6 tcf in 2008 to 23.3 tcf in 2035.
- In 2035, shale gas provides 24 % of the natural gas supplied in the United States, up from 6 % in 2008

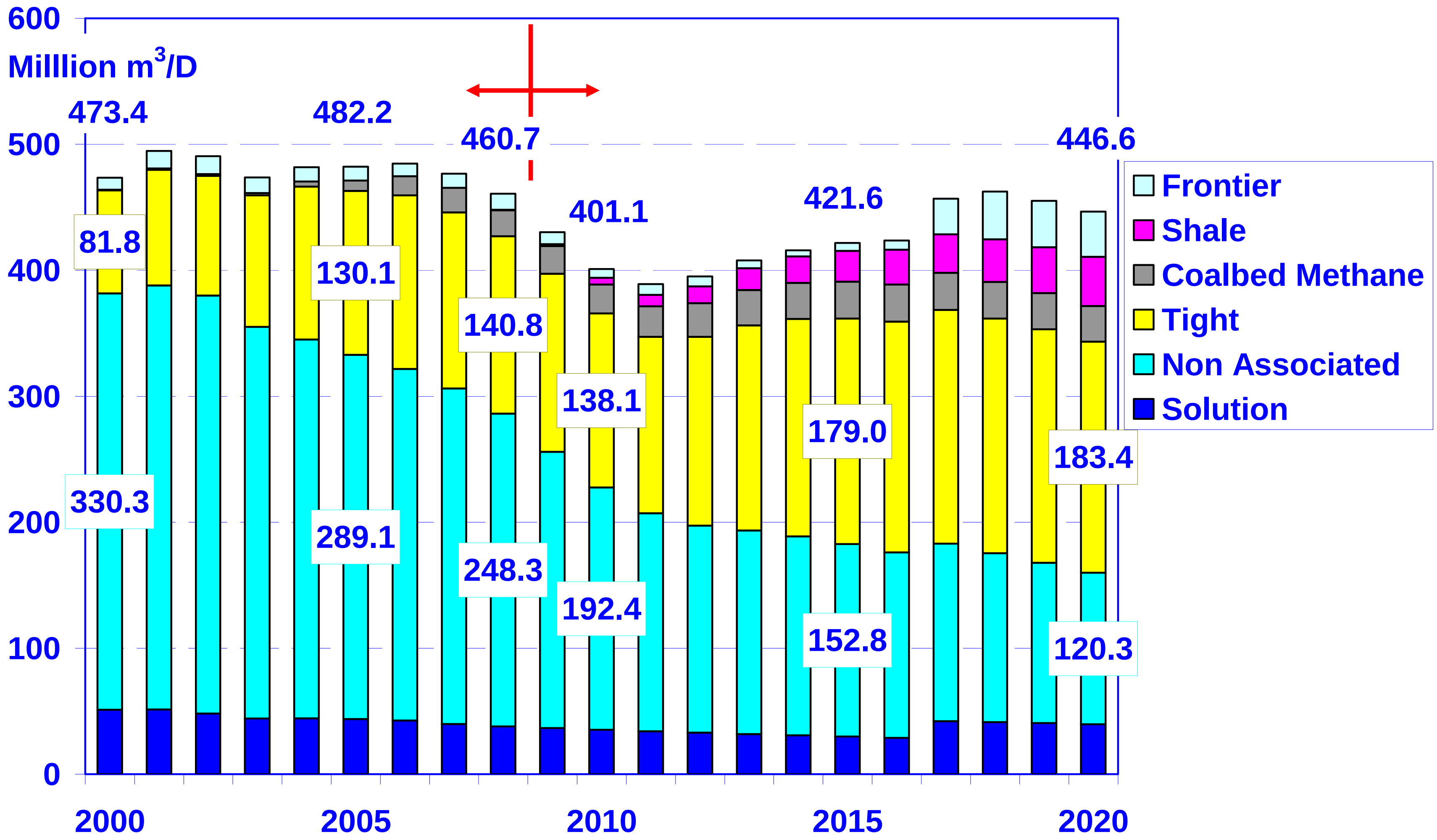
U.S. Natural Gas Imports



Source：DOE/EIA 、Annual Energy Outlook

- **A few years ago, significant increase of the U.S. reliance on imported natural gas was forecasted and investments were being made in re-gasification facilities for imports of (LNG).**
- **In 2035, net imports make up 5.9 % of total U.S. natural gas supply, down from 12.5% in 2008**

Canada Natural Gas Supply



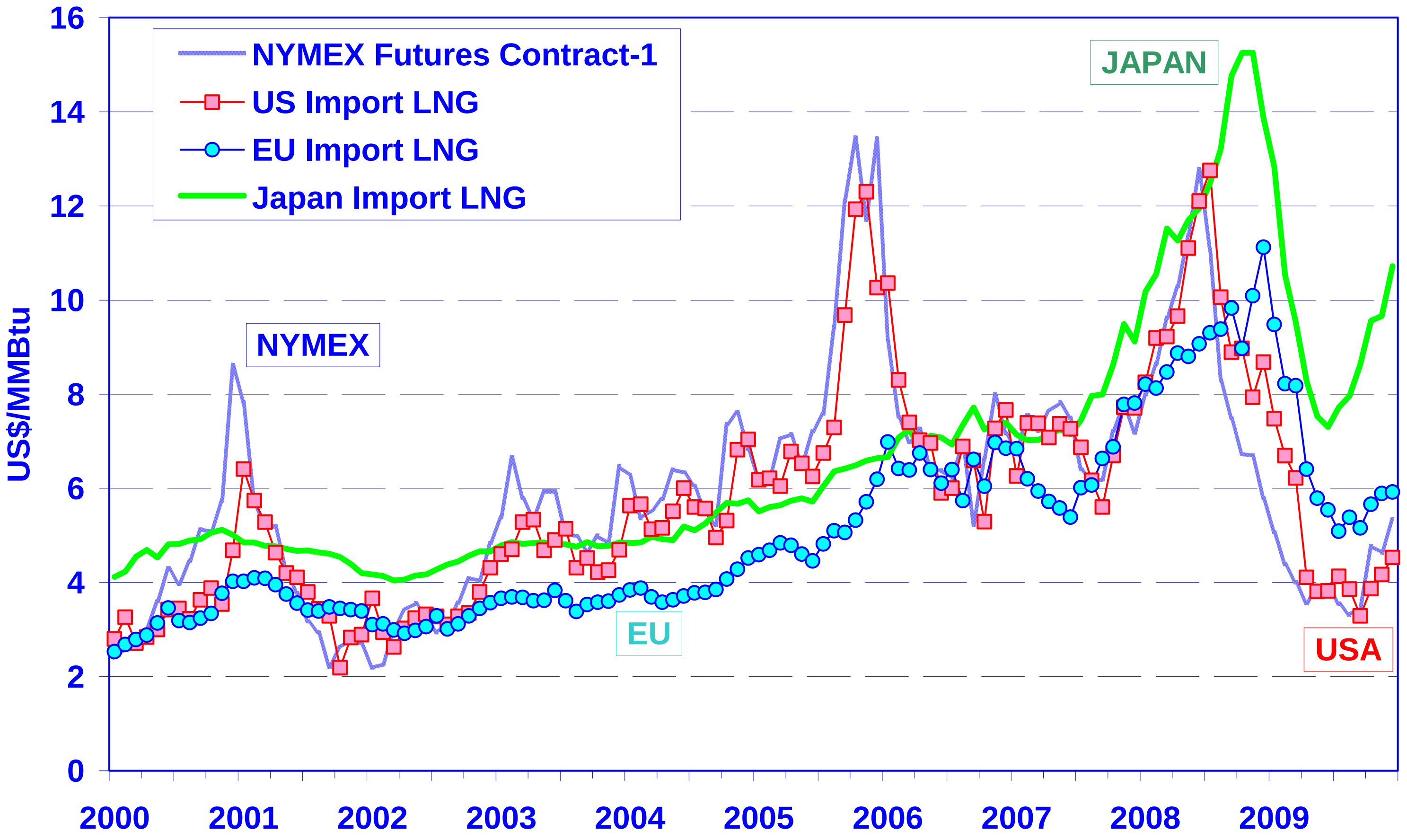
Source：National Energy Board、2009

Foreign Companies Participating in Gas Shale Projects

●KOGAS-EnCana（British Columbia）

●Mitsubishi-Penn West Energy Trust（Cordova Embayment Shale Gas, British Columbia）

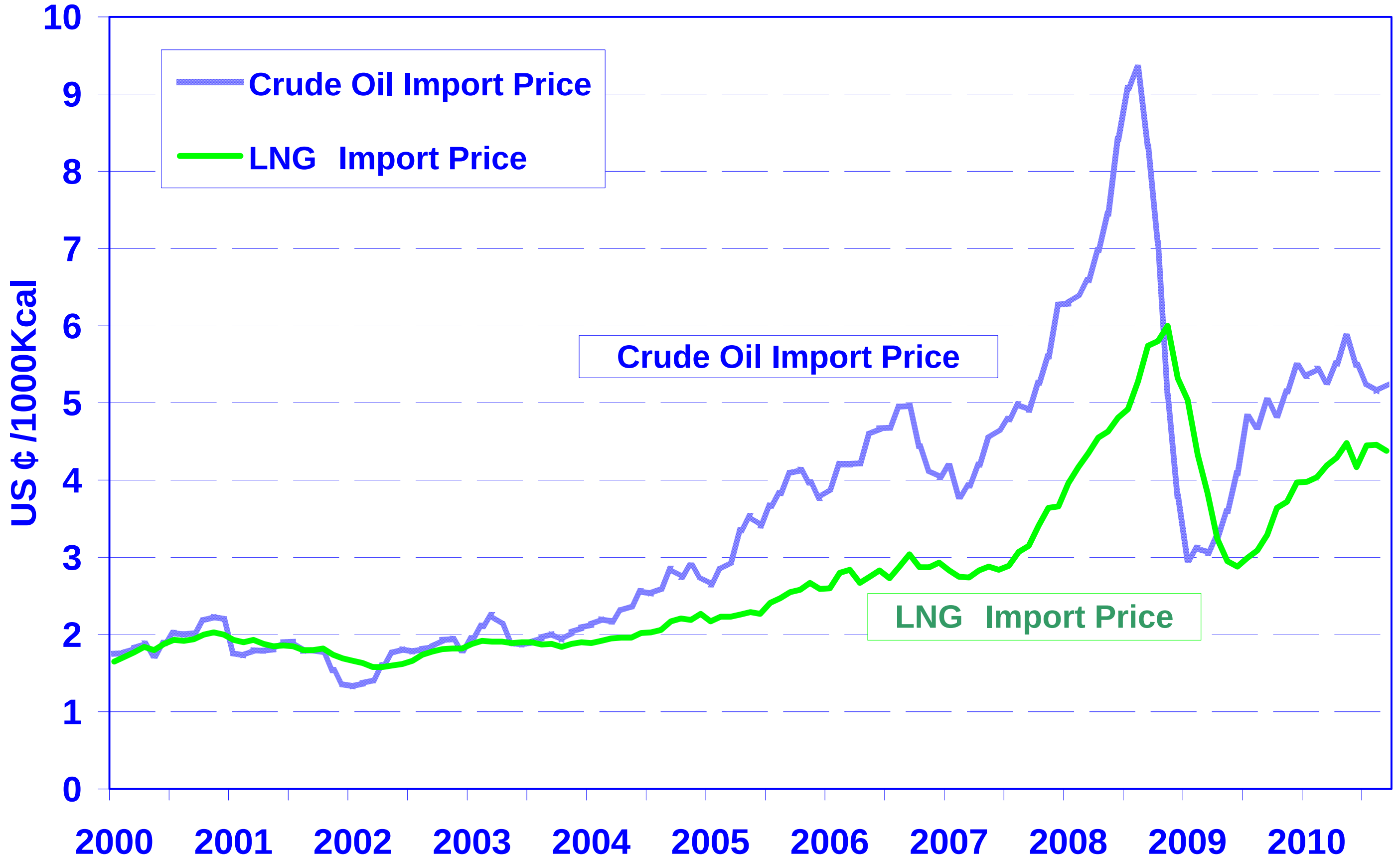
LNG Import Prices in the US, EU, Japan



Source：IEA、Natural Gas Information

The impact of the global economic crisis after 2008 came in the form of lower LNG import prices in the U.S. and European countries. Price differentials between Japan and these countries are expanding in these years.

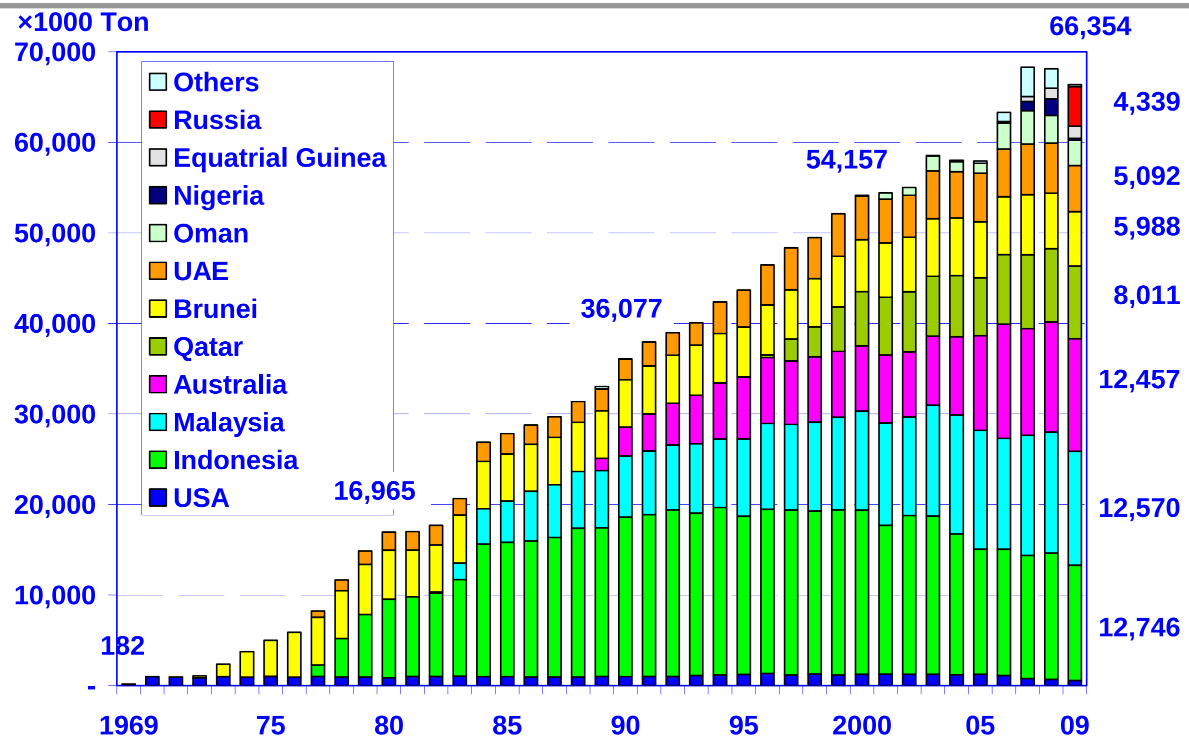
LNG Import Prices in Japan



Source：EDMC、Energy Databank

- **To date, Japanese LNG importers have to use oil-indexed pricing based on the Japan Crude Cocktail (JCC) oil basket price.**
- **Because the crude oil prices are hovering at relatively high level, japan's LNG import prices are also kept higher than foreign importers.**

日本のLNG輸入量の推移



Source：EDMC、Handbook of Energy & Economic Statistics in Japan 2011 (Draft)

- **Japan has begun importing Russian LNG from Sakhalin Island in 2009. Canadian West Coast states such as British Columbia and Alberta, and the U.S. companies are also investigating opportunity to export their unconventional gas as LNG.**
- **Japan's LNG importers states that the oil-linked cost of LNG is too expensive and are seeking to re-negotiate their contract pricing formula with suppliers.**
- **Their idea include a partial linkage to spot traded LNG prices and an element of pricing from the Henry Hub in the U.S. where the shale gas boom intensifies downward pressure on prices, and from the National Balancing Point（NBP）in the United Kingdom.**

Conclusions

- Oil Sand (Natural bitumen) and Extra-heavy Oil are characterised by their extremely high viscosity, high density (low API gravity), high TAN (Total Acid Number) value and high concentrations of nitrogen, oxygen, sulphur, and heavy metals.
- These result in higher costs for extraction, transportation, and refining than conventional oil. However, large in-place resource volumes of Oil Sand and Extra-heavy Oil can make an important contribution to provide a reliable long-term flow of liquid hydrocarbons.

- The US and Australia are currently major CBM producers with their abundant coal basins, thick coal seams and existence of dense infrastructure. The technology and experience acquired in these countries can be readily applied to those countries where coal resources are abundant such as Indonesia, China, and India.
- The generation of emissions reduction credits can provide potential for CDM projects and act as an economic driver in the developing countries.

- The potential volumes of Shale Gas are thought to be enormous and long-term growth in Shale Gas production in the world is expected to play an important role in shaping North American, European and Asian natural gas demand and likely to change the natural gas markets and pricing mechanism significantly.
- Shale Gas is also important as a lower-carbon fuel option and its contribution to ensuring energy security and economic development. However, there are many underlying uncertainties including growing environmental concerns, technology challenges, water availability, and land issues.
- In particular, regulators and policy makers are concerned about possible threats to local water supplies and public health as a result of hydraulic fracturing. An effort to eliminate toxic chemicals and recycling of fracturing water, chemicals in the fracture fluid will be necessary. Abundant supply and favorable carbon emissions relative to oil and coal should help to attract favorable regulation.

Thank you for your time

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