Evolution of World Gas Markets and Consideration on Development Strategies in China Natural Gas Industry

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October, 2011

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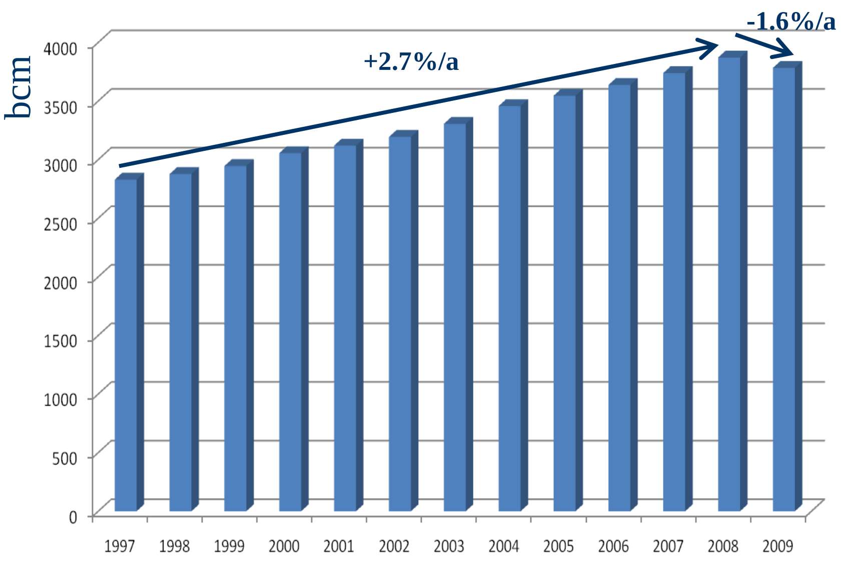
- Recent Evolution of World Natural Gas Markets
- China Gas Market under the Global Financial Crisis
- Prospect of China Natural Gas Market
- Strategies for Promoting the Natural Gas Development in China

Recent Evolution of World Natural Gas Markets

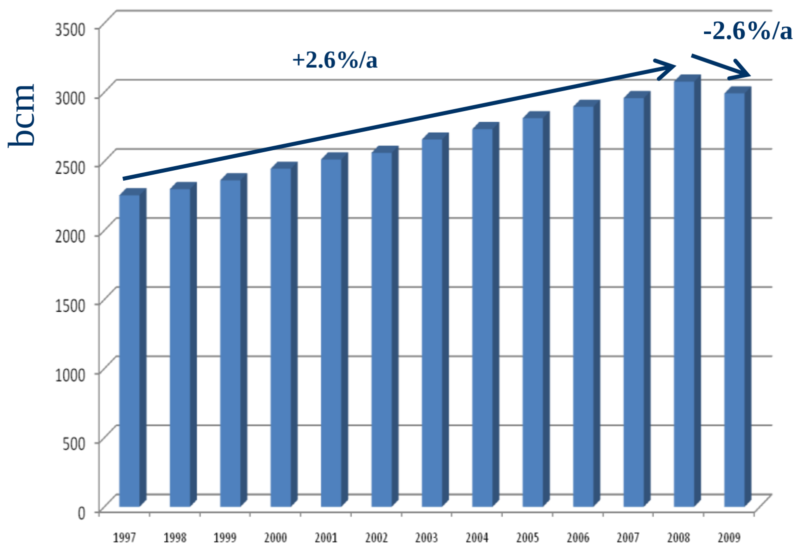
1. Historical recession of global natural gas production and consumption in 2009

- Gas gross production and marketed production declined respectively by 1.6% and 2.6%,comparing with 2008；



Source:CEDIGAZ

Evolution of world gas gross production, 1997-2009



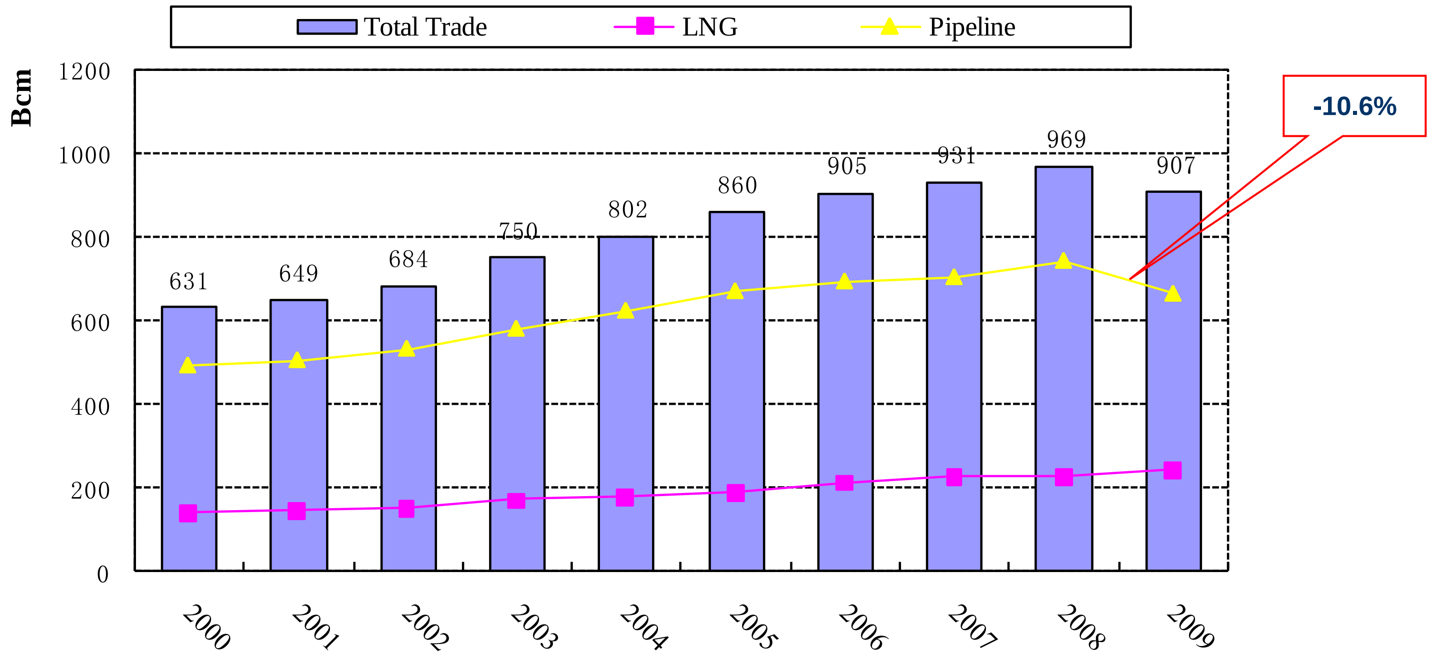
Source:CEDIGAZ

Evolution of world gas marketed production, 1997-2009

Marketed production=gross production-reinjection-flared-other losses

Recent Evolution of World Natural Gas Markets

- The international gas trade plunging 6.4% (first in last 24 years) to a volume of 907 bcm

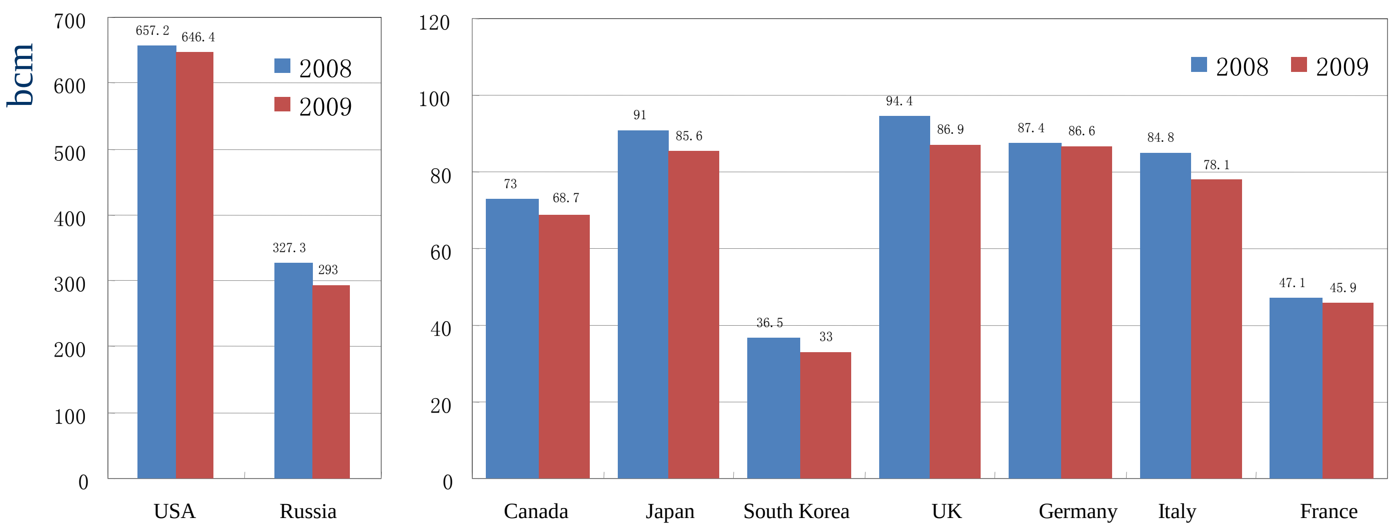


Source:CEDIGAZ

Trends in international gas trade, 2000-2009

Recent Evolution of World Natural Gas Markets

- A sharp drop of natural gas demand in developed countries and actual consumption down 3.1%



Source: CEDIGAZ

Actual consumption in major gas consuming countries, 2008-2009

Recent Evolution of World Natural Gas Markets

- Natural gas prices declined dramatically, spot price hits the lowest since 21st century

  - Spot price at Henry Hub hits $3.06/MBtu， yearly average price only at $3.89/MBtu.

Natural Gas prices in major countries（$/MBtu）

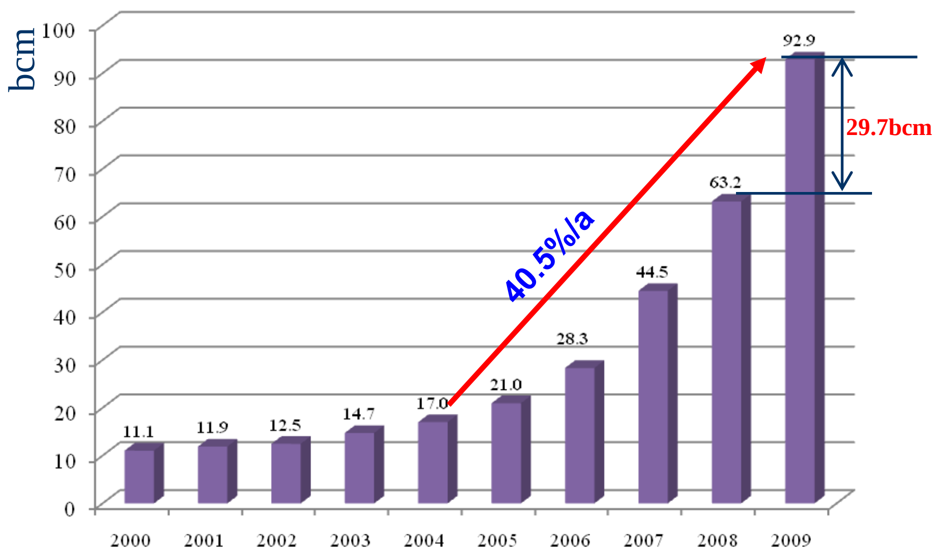
	LNG	Pipeling Natural Gas			
	Japan（CIF）	**EU**（CIF）	**UK**（Heren）	**US**（Henry Hub）	**Canada**（Alberta）
2000	4.72	3.25	2.71	4.23	3.75
2001	4.64	4.15	3.17	4.07	3.61
2002	4.27	3.46	2.37	3.33	2.57
2003	4.77	4.4	3.33	5.63	4.83
2004	5.18	4.56	4.46	5.85	5.03
2005	6.05	5.95	7.38	8.79	7.25
2006	7.14	8.69	7.87	6.76	5.83
2007	7.73	8.93	6.01	6.95	6.17
2008	12.55	12.61	10.79	8.85	7.99
2009	9.06	8.52	4.85	3.89	3.38

Source：BP Statistical Review 2010

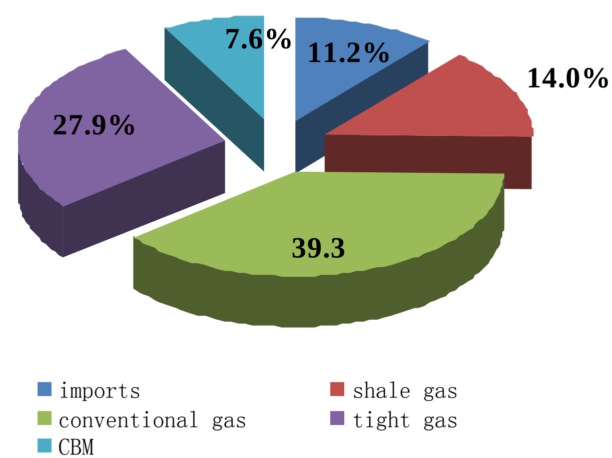
Recent Evolution of World Natural Gas Markets

Highlights

- The production costs for shale gas fell in US
- Shale gas production in US amounted to 92.9 bcm in 2009, took up 14% of its gas supply



Source:EIA



Source:EIA

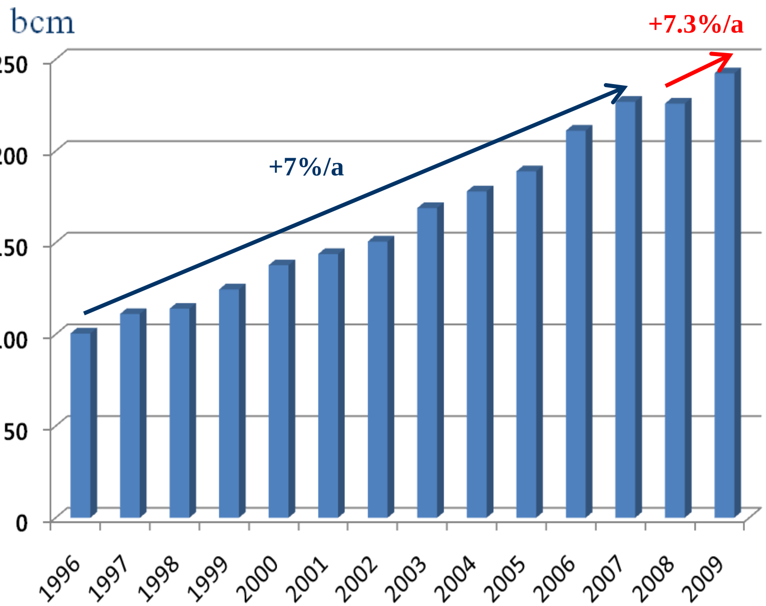
Shale gas production in US, 2000-2009

Gas supply breakdown in US, 2009

Recent Evolution of World Natural Gas Markets

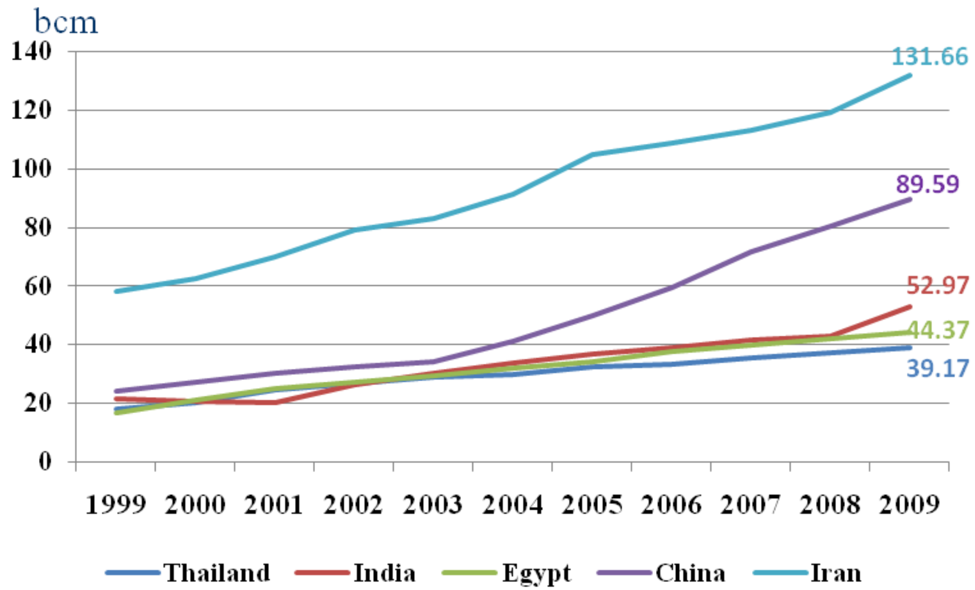
Highlights

- **Global LNG trade still in activity, trade volume up 7.3% over 2008**
- **Gas demand from emerging markets kept increasing**



Source:CEDIGAZ

Evolution in global LNG trade, 1996-2009



Source:CEDIGAZ

Evolution in gas demand from emerging markets, 1999-2009

Recent Evolution of World Natural Gas Markets

2. Gas demand rebound strongly in 2010

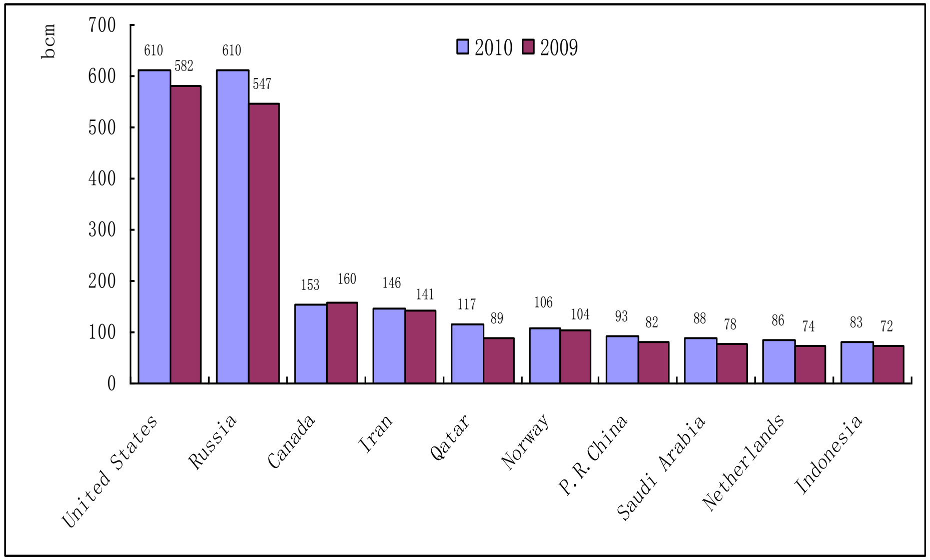
- Global gas gross production increased by 5.7% ,to 4040.5 bcm
- World natural gas marketed production grew 7.3% to 3215.9 bcm

Marketed gas production in 2009 and 2010

Region	2009 (bcm)	2010 (bcm)	change %	Breakdown 2009	Breakdown 2010
North America	790.3	811.0	2.60%	26.40%	25.20%
Latin America	144.8	154.8	6.90%	4.90%	4.80%
Europe	291.0	300.8	3.40%	9.70%	9.40%
CIS	714.6	784.9	9.80%	23.90%	24.40%
Africa	195.7	208.9	6.80%	6.50%	6.50%
Middle East	416.3	471.1	13.20%	13.90%	14.70%
Asia-Oceania	439.0	484.3	10.30%	14.70%	15.10%
Tatol	2991.7	3215.9	7.30%	100%	100%

Source: CEDIGAZ

Marketed gas production in top 10 countries



Source: CEDIGAZ

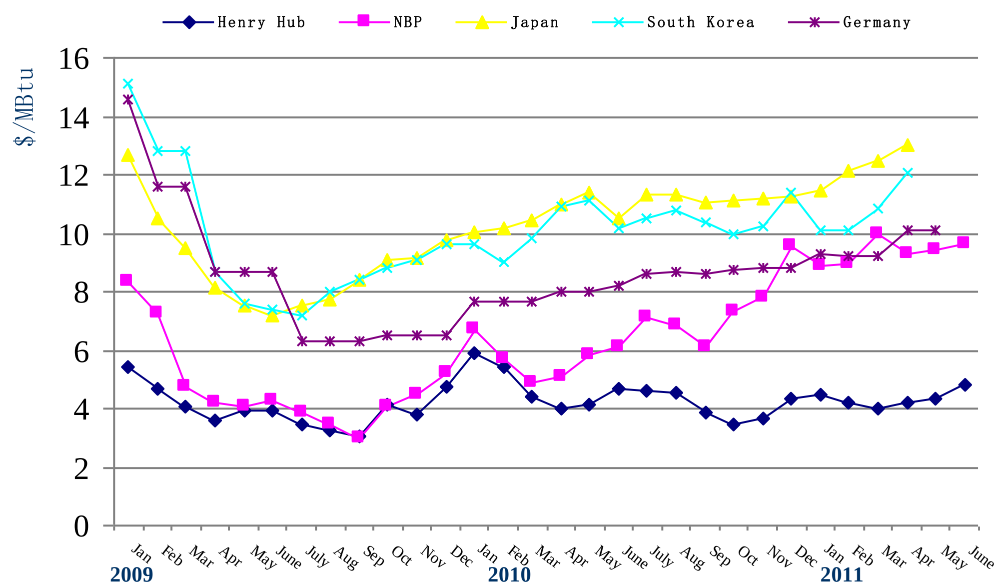
Recent Evolution of World Natural Gas Markets

- Natural gas demand recovery in OECD countries
- Natural gas prices turning to rising

Natural gas demand in OECD countries

Countries	2009 ($10^9 m^3$)	2010 ($10^9 m^3$)	Change (%)
United States	657.91	684.13	3.99
Canada	88.12	83.13	-5.66
South Korea	34.86	44.99	29.06
Japan	89.64	97.07	8.29
United Kingdom	88.05	94.28	7.08
Germany	91.6	90.77	-0.91
Italy	77.21	83.5	8.15
Netherlands	40.39	49.55	22.68
France	47.16	48.11	2.01
Turkey	33.1	36.02	8.82
Spain	35.15	35.35	0.57
Austrilia	28.34	29.89	5.47
Total	1311.53	1376.79	4.98

Source: CEDIGAZ



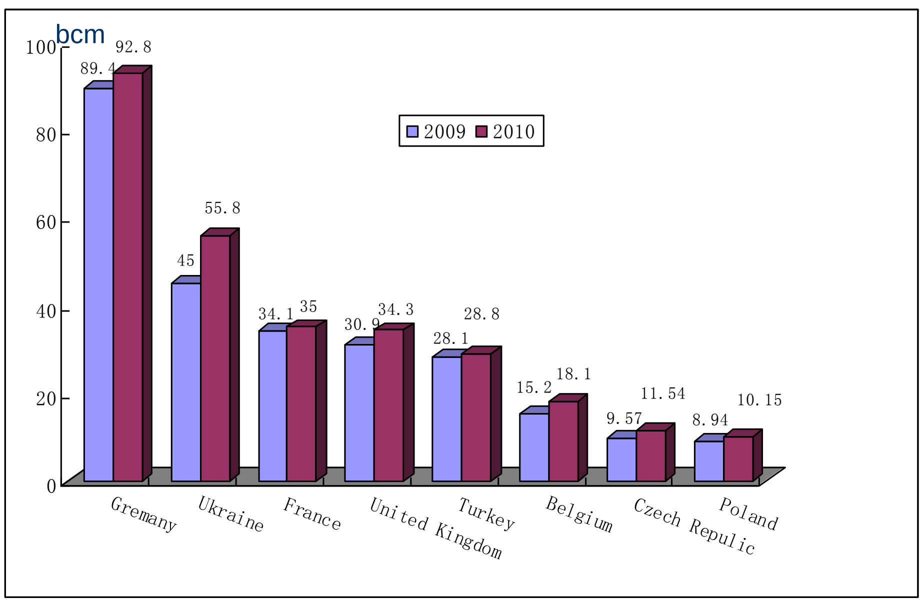
Source: WGI

Evolution of natural gas prices, 2009-2011.6

Recent Evolution of World Natural Gas Markets

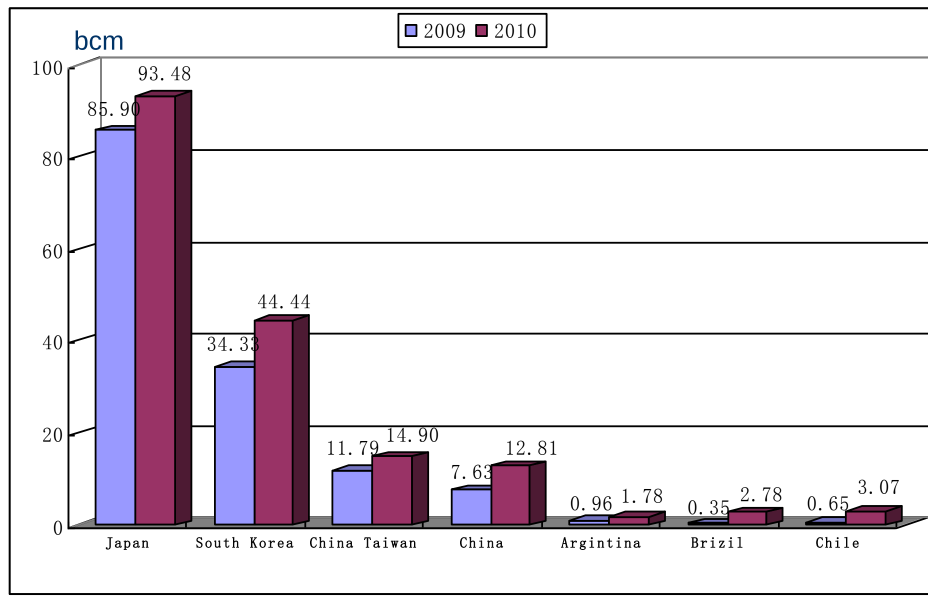
International gas trade returned to growing path

- Trade volume of pipeline gas grew up 7.3% over 2009
- The record increase in LNG trade volume by around 50 bcm(+20%)
- Total volume in international natural gas trade reach to 1015.2 bcm, about 11.2% of growth, sharp contrasting to -6.4% in 2009.



Source: CEDIGAZ

Natural gas imports by pipeline in some Europe countries



Source: CEDIGAZ

Natural gas trade by LNG in some importing countries

Recent Evolution of World Natural Gas Markets

3. Current Situation

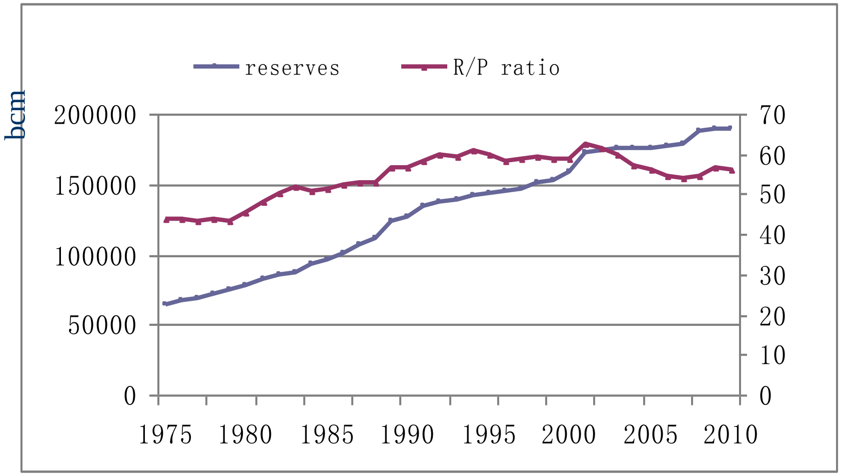
Several major incidents have happened worldwide into 2011, such as the strong earthquake in Japan, political unrest in northern countries in Africa, sovereign debt crisis in EU & US., which would affect global natural gas supply & demand:

- Nuclear leakage in Japan resulted the nuclear power crisis in the world, natural gas demand for power generation would be substantially increased.
- Promoting LNG demand of East Asia & Western Europe and the pipeline gas import volume of Western Europe.
- Natural gas export from Northern Africa to European countries may decline.
- Natural gas demand may decrease in some Western Europe countries.
- Global natural gas demand growth may slow down.

Recent Evolution of World Natural Gas Markets

4. Prospect: natural gas demand keeps increasing

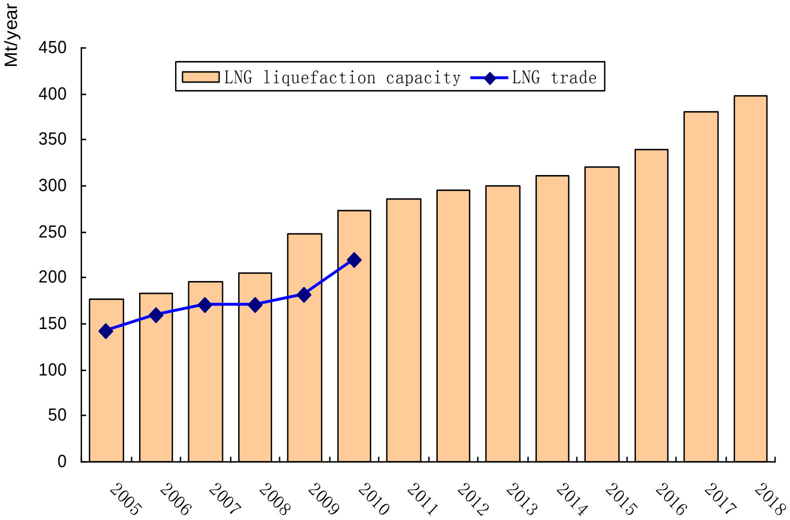
- Expanding gas proven reserves
- Increasing LNG liquefaction capacity
- Global economic recovery
- Gas price competitive rising with oil
- For environmental policy and emission reduction



Note: production in 2010 is estimated.

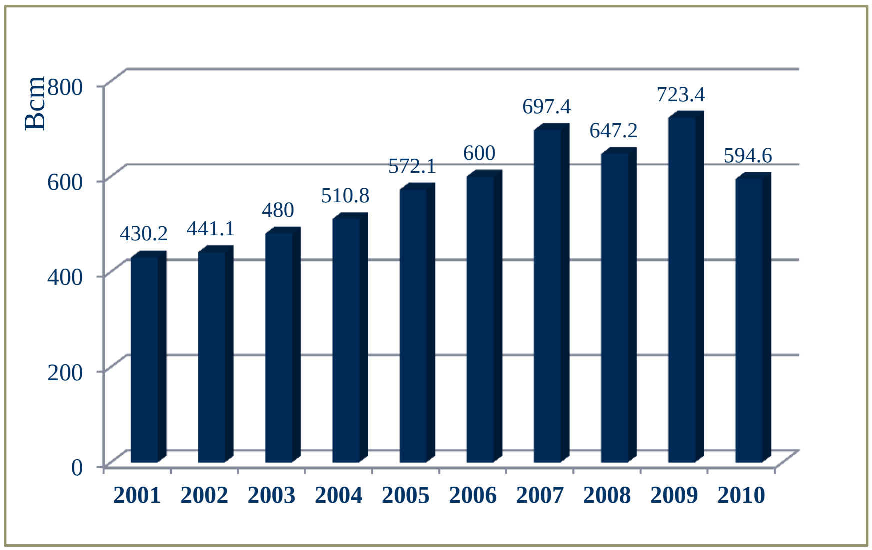
Production=gross production – rejection

Evolution of global gas proven reserves & R/P



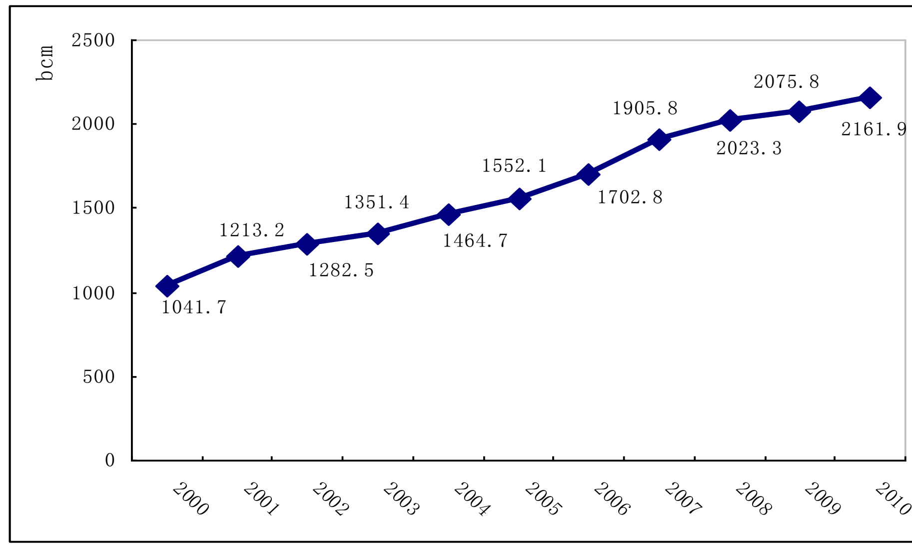
Global LNG liquefaction Capacity

1. Natural gas proven reserves in fast-growing track



Source：MLR of PRC

Evolution of proven reserves in China,2001-2010

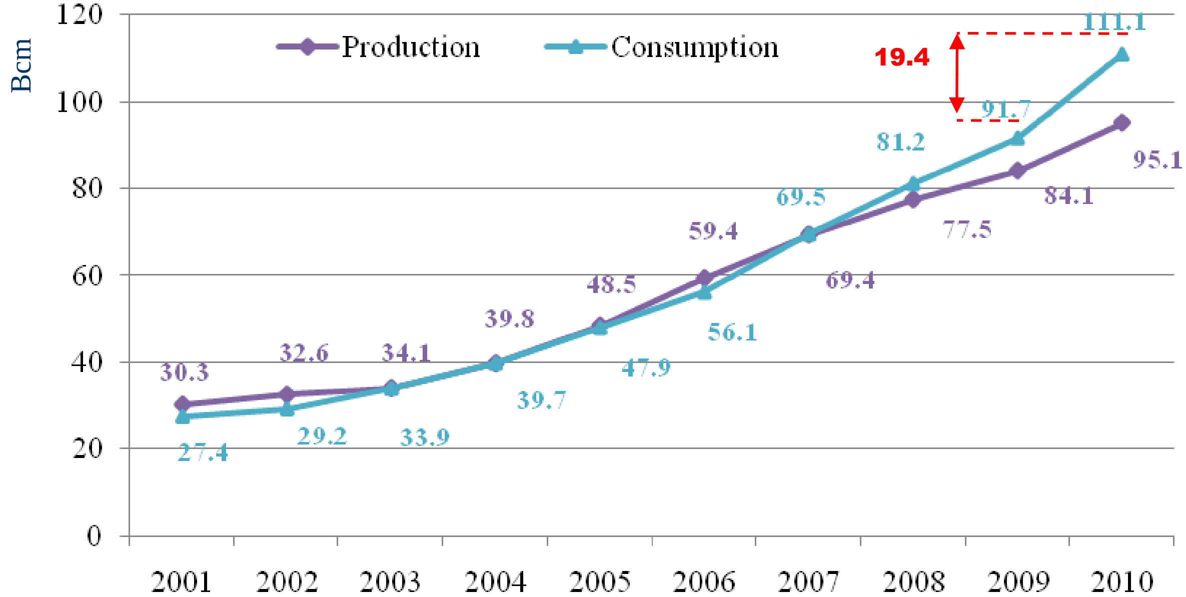


Source：Companies' annual reports

Evolution of remaining recoverable reserves by PetroChina, CNOOC and Sinopec

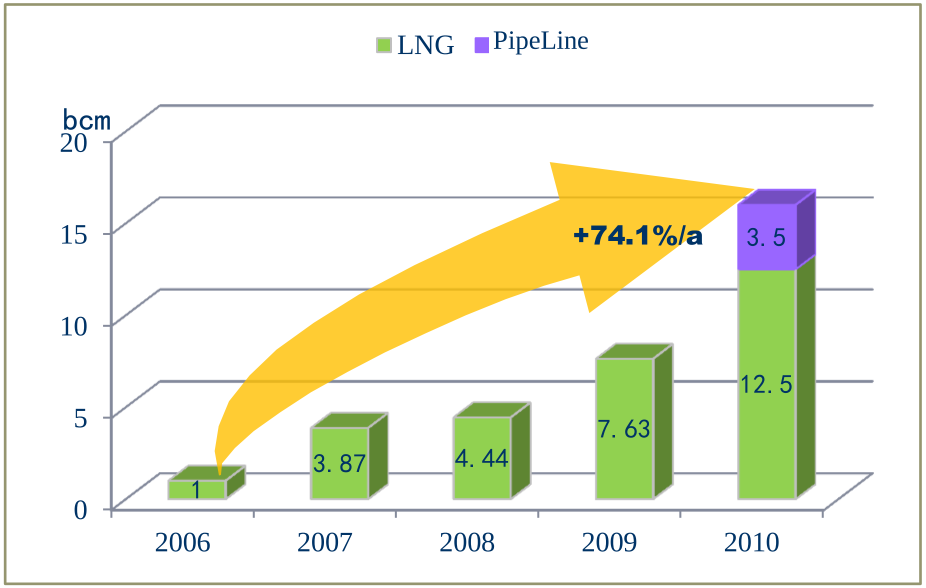
2. A firm boost in natural gas production and consumption

● **Natural gas apparent consumption at 111 bcm in 2010, becoming the forth in the world and the first in Asia**

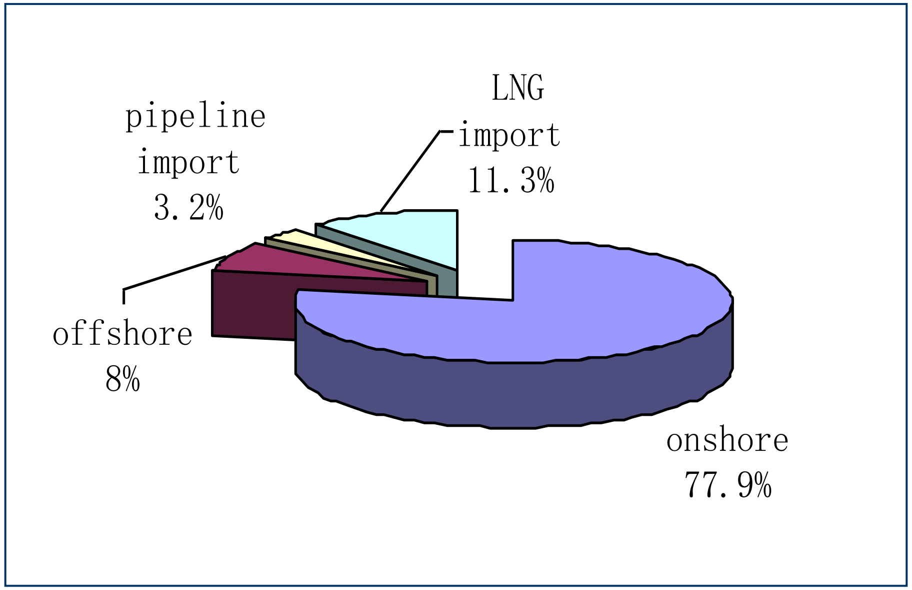


Evolution of gas production and consumption in China, 2001-2010

3. Natural gas imports increasing significantly, gas supply in diversification.



Evolution of natural gas imports in China,2006-2010

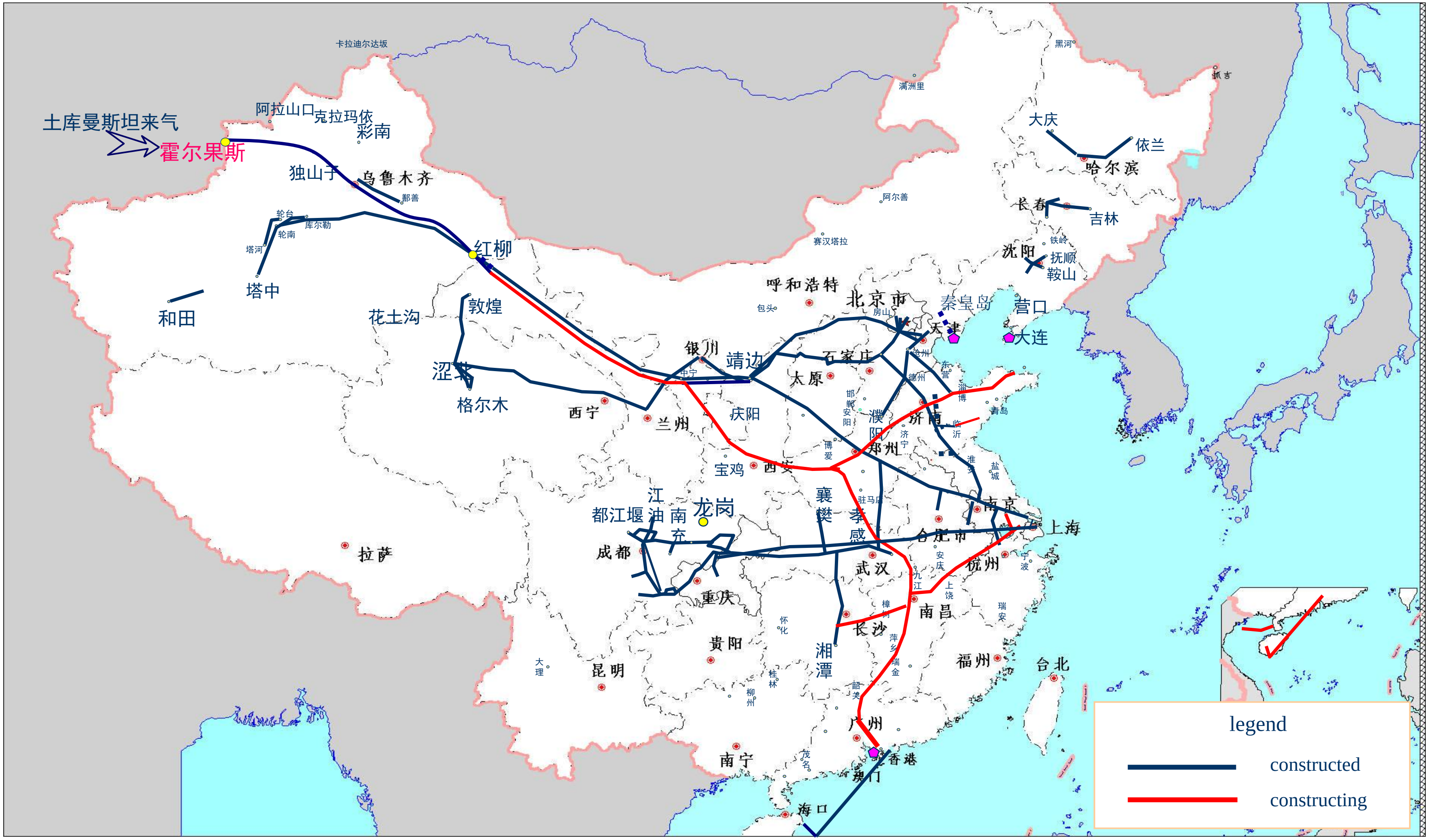


natural gas supply breakdown in China, 2010

China Natural Gas Market under the Global Financial Crisis

4. Natural gas infrastructure in great progress

- National main gas transportation pipelines established, total length at 38000 km



China Natural Gas Market under the Global Financial Crisis

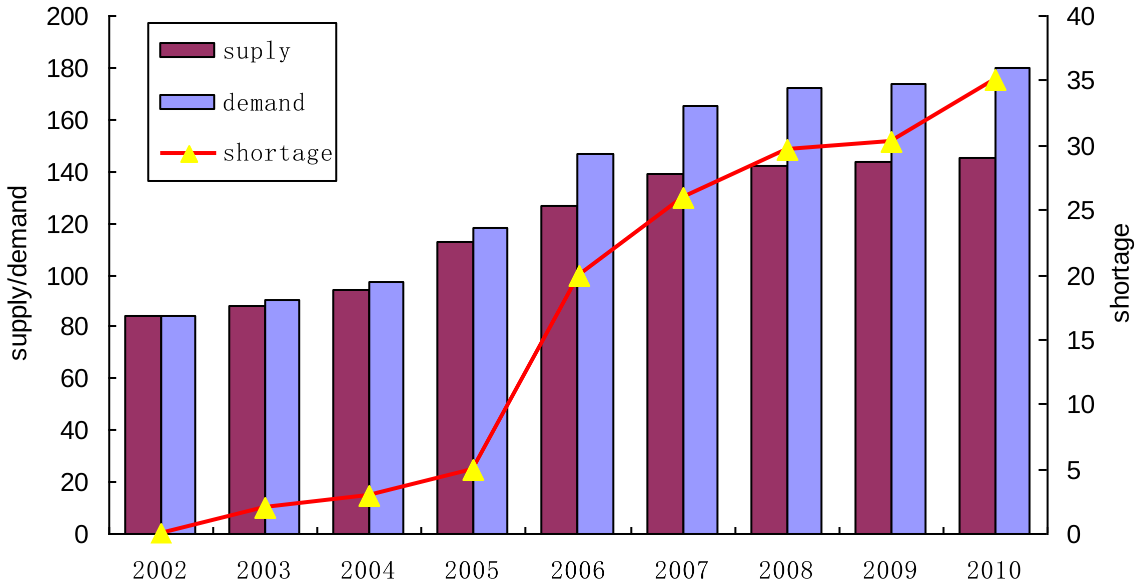
- **LNG import terminal construction in large scale**

  Four terminals in operation, regasification capacity: 12.95 Mt/a.

  Seven terminals under construction, regasification capacity : 21 Mt/a.

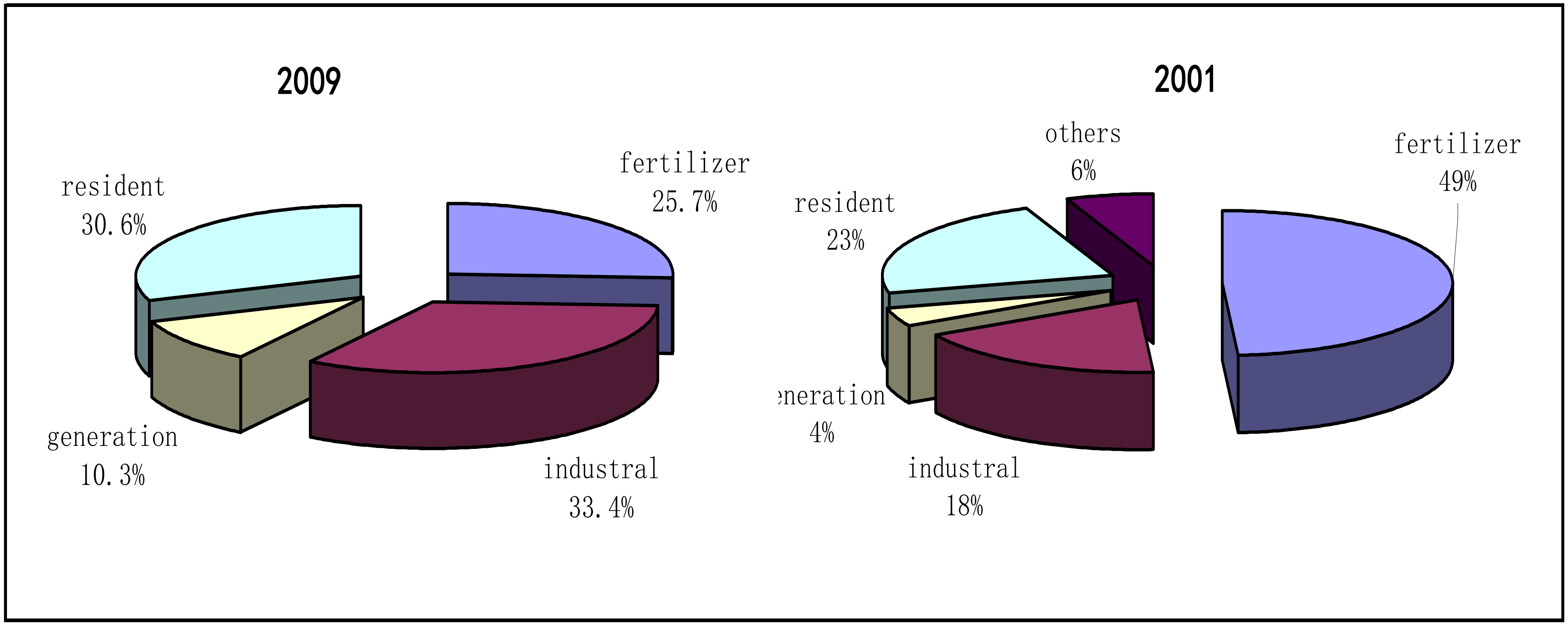
5. Consumption region expanding, gas demand bloom

- Natural gas consuming areas expanded to nationwide, including 30 provinces
- Shortage of gas supply and demand growing since 2003



Gas supply and demand in Sichuan-Chongqing region(10^8cm)

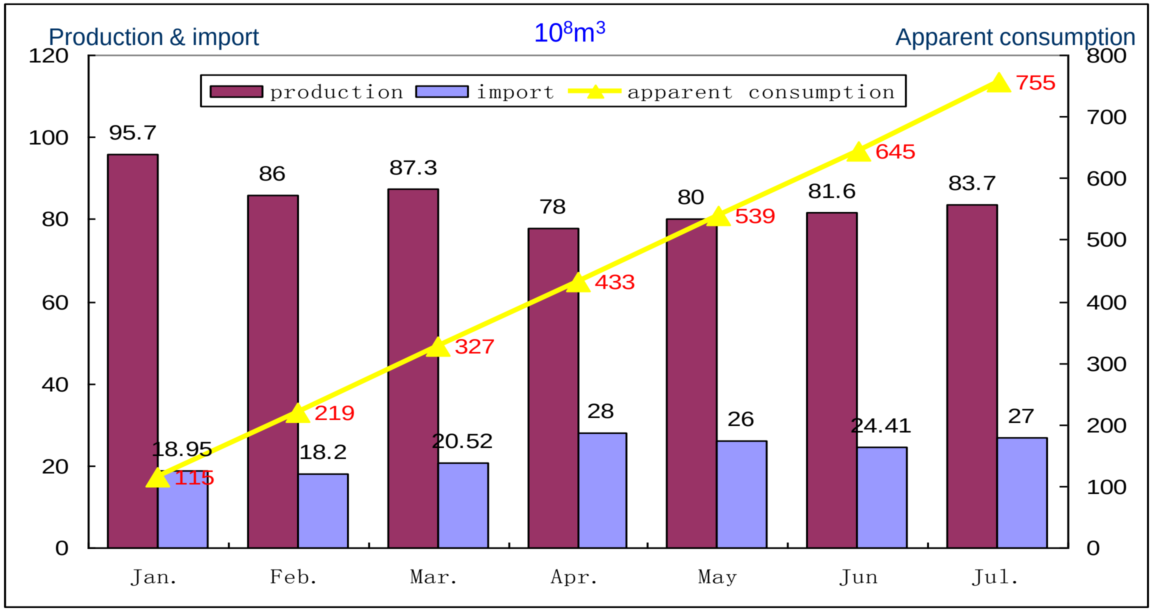
6. Gas consumption structure getting rational



Comparison of gas consumption structure between 2001 and 2009

7. Current Situation: keeping increasing in natural gas production, supply and demand sections.

- Gross domestic natural gas production (Jan-Jul): 59.8 BCM, an increase of 7.7% over 2010. Total natural gas imports: 16.8 BCM, doubled Year-on-Year
- Natural gas consumption (Jan-Jul): 73.4 BCM, an increase of 21.5% over 2010
- In 2011, total domestic production estimated at 104 BCM, 26 BCM in gas imports, 117 BCM in natural gas marketed production



Gross natural gas production and imports in China, Jan.-Jul.,2011

The Prospect of China Natural Gas Market

From 2011-2020, a great-leap-forward development will be made in China natural gas industry and market. Positive factors including:

1. Driving by government policy and market demand.

- **Requirement for energy conservation & emission reduction**
- **Developing Low-carbon economy**

A comparison of greenhouse gas emission for various fuels

Fuel	Tonne Carbon/ TJ	Tonne CO_2 /TJ	CO_2 Reduction by Natural Gas Substitution(%)	Carbon Reduction by Natural Gas Substitution(%)
Natural Gas	14	51.3		
LPG	16.4	59.4	13.6	14.63
Naphtha	18.2	66	22.3	23.08
Fuel Oil	19.2	69.7	26.4	27.08
Brown Coal	26.2	95	46.0	46.56
Black Coal	24.8	90	43.0	43.55

The Prospect of China Natural Gas Market

- **For optimizing energy consuming structure**

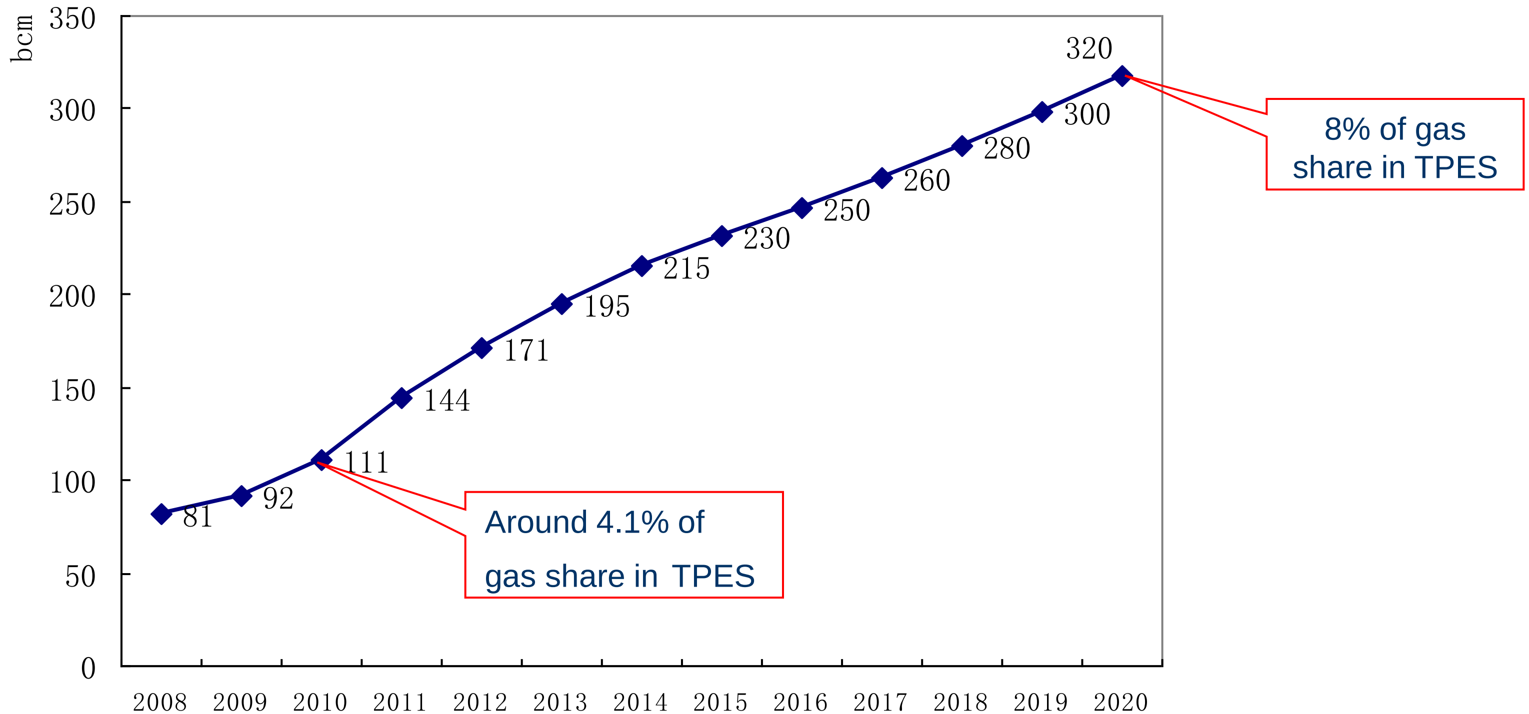
Comparison in energy consumption mix between China and others, 2010(%)

Countries	Oil	Natural Gas	Coal	Nuclear energy	Hydro-electricity	Renew-ables
United States	37.2	27.2	23.0	8.4	2.6	1.7
Brizil	46.0	9.4	4.9	1.3	35.3	3.1
Germeny	36.0	22.9	23.9	10.0	1.3	5.8
Italy	42.5	39.8	8.0	0.0	6.5	3.3
Iran	40.5	58.0	0.5	0.0	1.0	0.0
Idian	29.7	10.6	53.0	1.0	4.8	1.0
Japan	40.2	17.0	24.7	13.2	3.9	1.0
South Korea	41.4	15.1	29.8	13.1	0.3	0.2
Asia	27.7	11.2	52.1	2.9	5.4	0.7
World	33.6	23.8	29.6	5.2	6.5	1.3
P.R.China	17.6	4.0	70.5	0.7	6.7	0.5

Source: BP Statistical Review of World Energy 2011

The Prospect of China Natural Gas Market

- Rapid increase in residential demand promoted by townified construction
- Natural gas demand increased by 200 bcm in 2020 in China

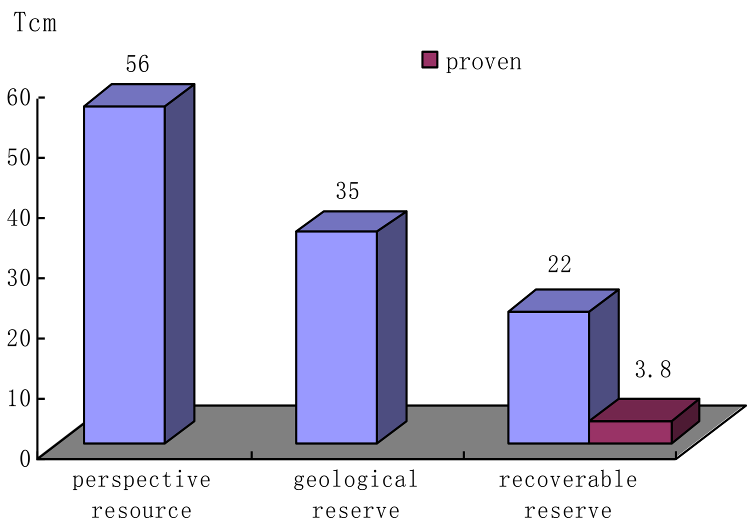


Natural gas demand predication in China

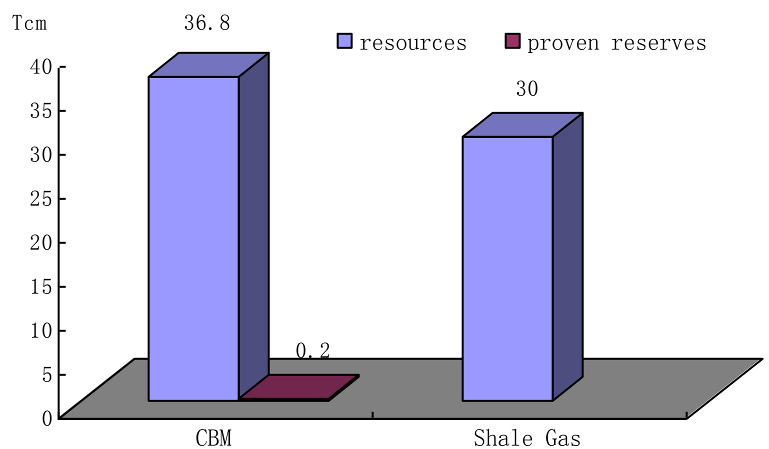
The Prospect of China Natural Gas Market

2. Lower proven ratio of natural gas resources, great potential of reserves and production growth

- Only 17.3% of proven ratio in conventional recoverable gas reserves
- CBM development in preliminary stage
- Shale gas exploration in initial stage



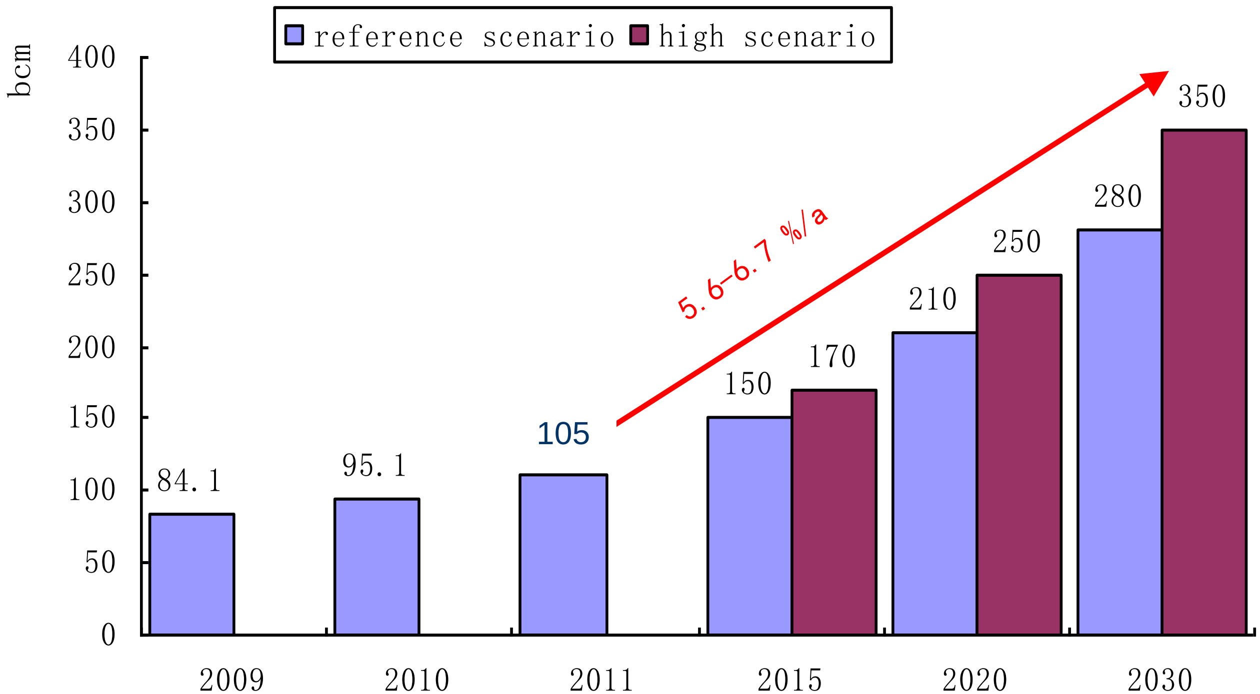
Conventional natural gas resources in China



Unconventional gas resources in China

The Prospect of China Natural Gas Market

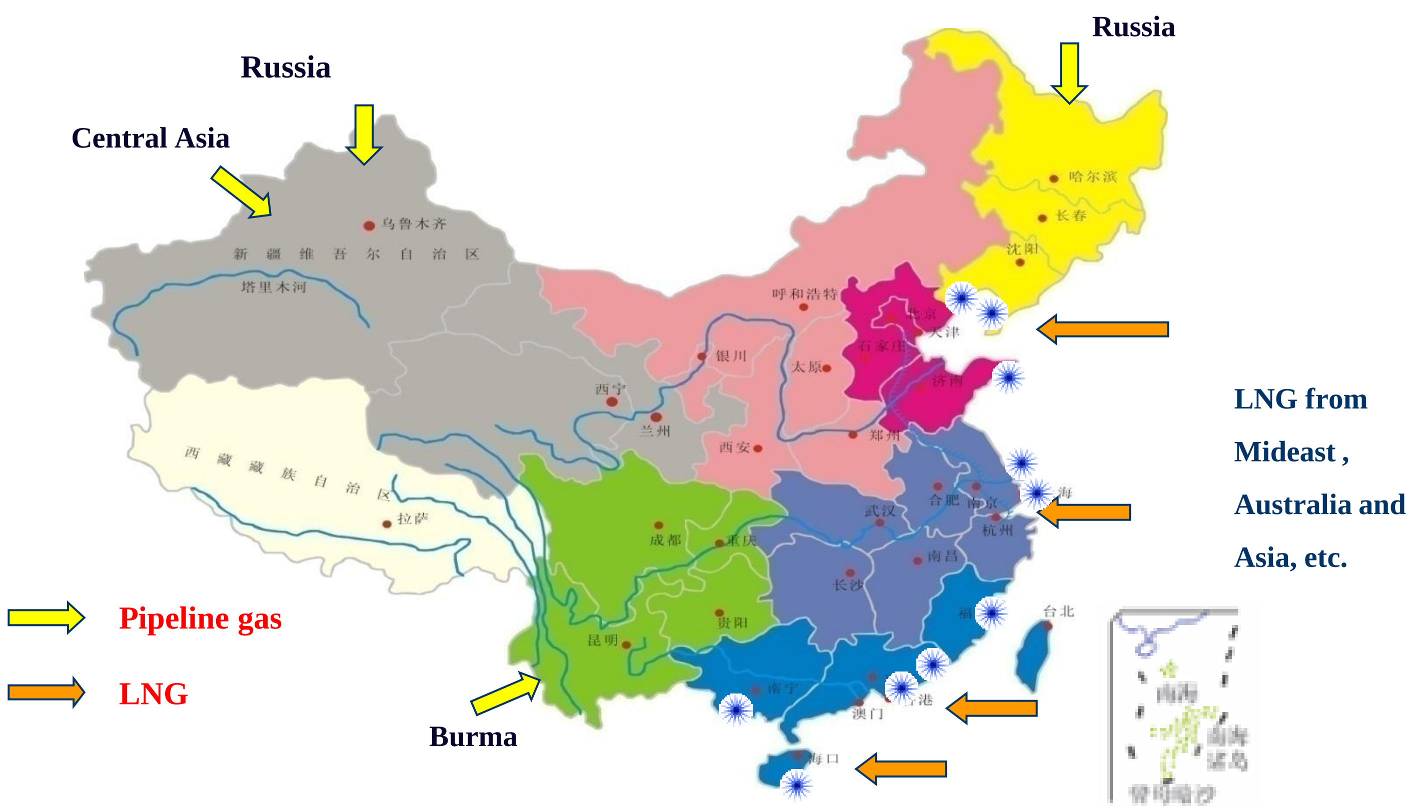
- **Growth in natural gas production by 5.6-6.7%/a until 2030**



Outlook of natural gas production in China, 2011-2030

3. Capacity-to-import promoted, diversification in import gas sourcing

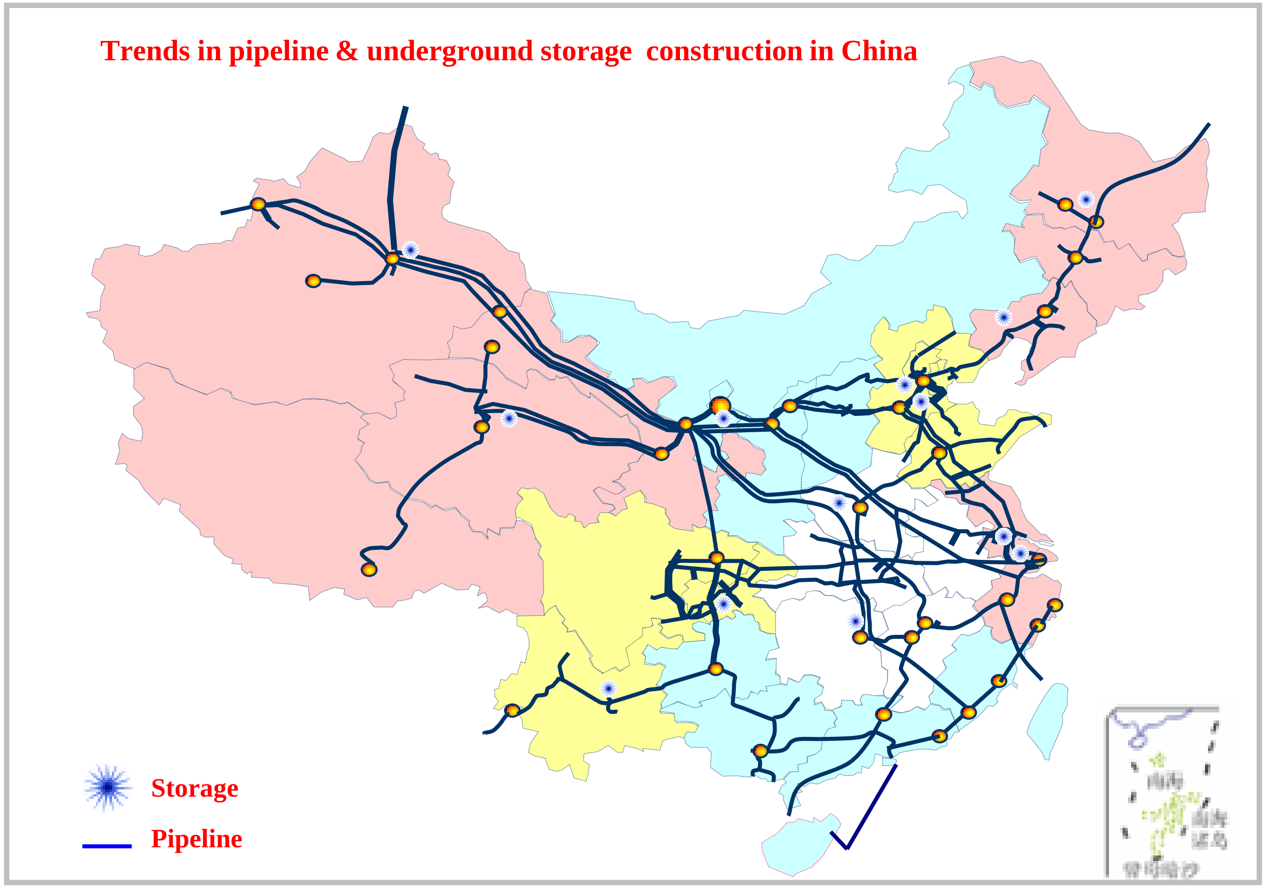
- Four main gas import routes formulated
- Total import capacity predicted to account for 106 and 180 bcm by 2015 and 2020



The Prospect of China Natural Gas Market

4. Natural gas supply infrastructure going to perfection

- Nationwide pipeline network completed
- Local & provincial pipeline network in active building
- UGS in programming & constructing



Strategies for Promoting Natural Gas Development in China

1. Supply strategy: domestic resources-centered, imports supplement

- Gas reserves & production growth being able to over expectation by combining with favorable policies, advanced technologies and strong investment
- For ensuring natural gas supply security
- Natural gas import prices higher, real GDP per capita in China lower
- Helpful for price-negotiation related to imports

GDP/per capital and import dependency of consuming countries, 2010

	GDP/ per capital ($)	rank	imports (bcm)	importing / consuming
Germany	40875	16	78.06	86%
Italy	35435	21	75.2	90.1%
France	42747	15	47.36	98.4%
Poland	11288	50	10.15	70.5%
United States	46381	9	73.49	10.7%
UK	35334	22	37.98	40.3%
Japan	39731	17	93.48	96.3%
Korea	17074	38	44.44	98.8%
China	3678	100	16.0	14.5%

in 2010

2. Establishing natural gas storage system

- **Severe shortage in UGS capability in China, tight gas supply demand in winter**

A comparison of UGS between China and other countries

	UGS	working gas capacity ($10^6 m^3$)	capacity/ consuming(%)
US	399	113933	17.62
Canada	50	20647	22.28
Germany	47	20502	22.13
France	15	12349	27.75
Italy	10	13370	17.13
Czech	8	2891	35.33
Russia	25	65501	15.25
Ukraine	13	32130	54.46
North America	450	134680	16.83
Europe	130	85586	16.29
World	642	333362	11.14
China	6	30	3.03

Supply shortage of some cities in China, Nov,2009

Strategies for Promoting the Development of Natural Gas in China

- Constructing UGS needed in large scale for gas supply security
- Gas storage system:

◆Setting relative law and policies to regulate the responsibility and obligation on gas storage among market participants

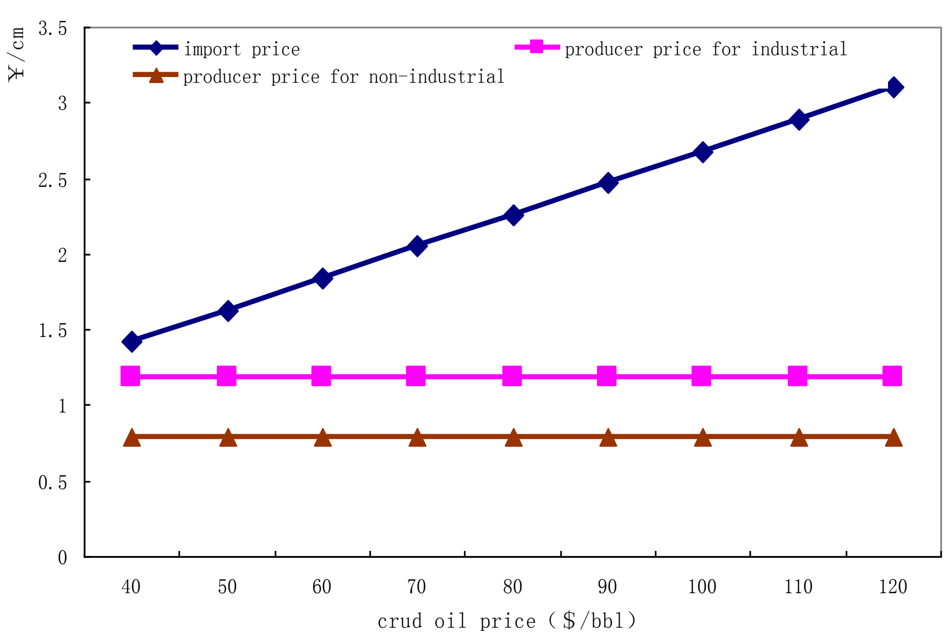
◆ Government's investment on strategic & emergency UGS

◆ Natural gas producers, industry consumers and city gas companies investment on seasonal & peak shaving UGS

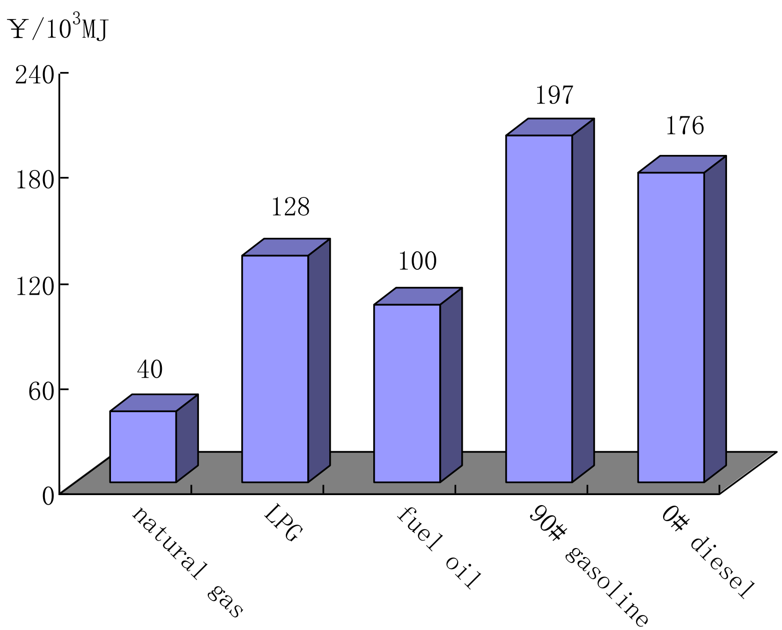
◆ Encouraging third-party's investment on commercial UGS

3. Deepen reform of natural gas pricing

- Problems existed in natural gas pricing in China:
  - Import natural gas sold in domestic gas prices
  - Natural gas prices lower than substitute fuel prices
  - Lack of rational pricing mechanism
  - Incomplete price structure



c.i.f of Central Asia gas and producer price of “w-e” pipeline



Comparison of producer gas price and fuel prices in China

3. Deepen the reform of natural gas pricing

- Suggestions of natural gas pricing reform:
  - Deregulation in natural gas prices
  - Properly raising producer gas prices
  - Establishing the linkage mechanism of gas and substitute fuel prices

3. Deepen the reform of natural gas pricing

- Suggestions:

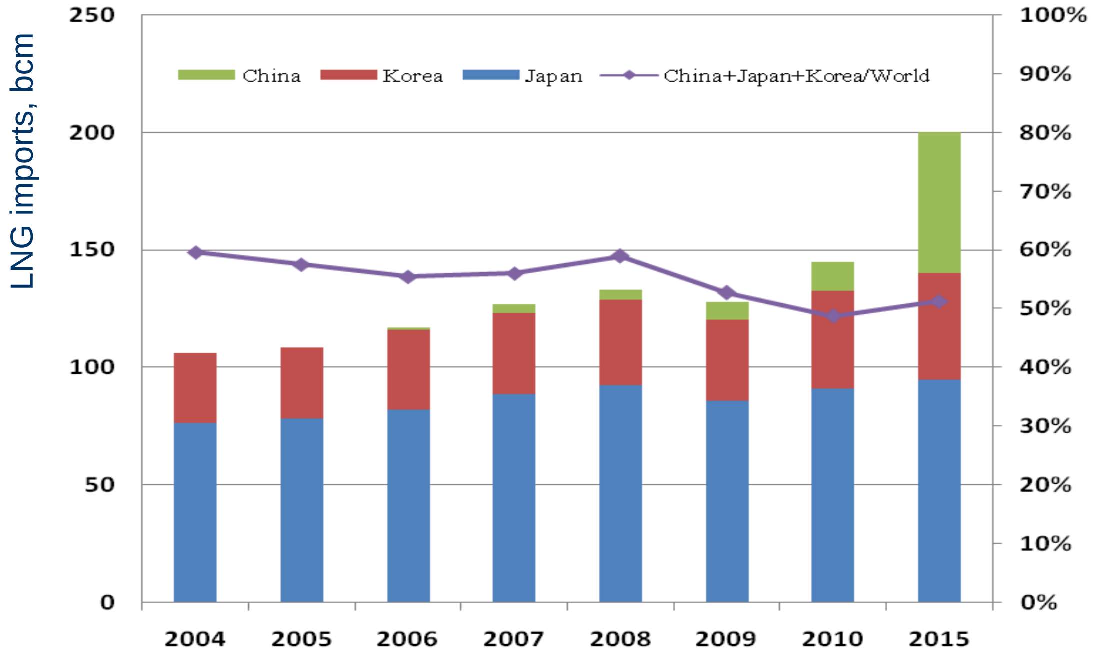
  - **Carrying differential gas prices (seasonal prices, peak shaving prices and interruptible prices)**
  - **Raising storage fees**
  - **Trying out spot prices**

4. Diversities and flexibility in natural gas imports

- Diversification in imported gas sourcing
- Diversification in gas trade contracts (combining long, medium and short-term)
- Flexibility in LNG imports
- Cooperation with gas-exporting countries in natural gas E&P

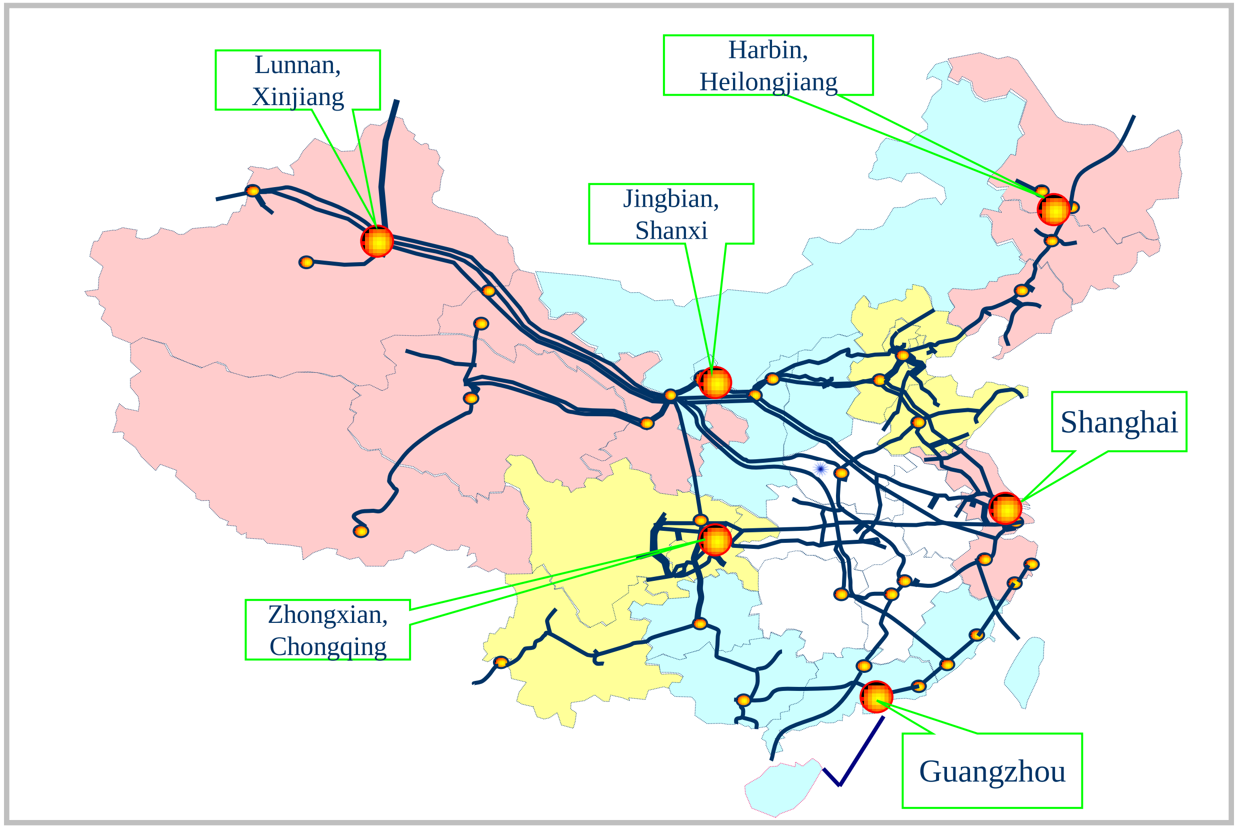
5. To reinforce cooperation in Northeast Asia region

- To take geological advantage of the biggest LNG import area in the world.
- To establish coordination mechanism of LNG imports with Japan & South Korea
- To manage with LNG pricing and lower LNG import prices



Trend in LNG imports in Northeast Asia

6. Developing gas market hubs, gradually formulating benchmark prices of China natural gas market



Option of natural gas market hubs in China

Conclusion

- Global natural gas industry & markets is rapid recovering after hitting by the past economic crisis.
- Sustainable development trend of world gas markets is unchanged.
- Natural gas supply and demand in China is firm boosting.
- Making synthetically use of policies, economic and market mechanism promote the healthy development of China natural gas industry , ensuring the security, demand, economical efficiency and stabilization of natural gas supply.


Thanks for Attention