



Outlook and Challenges of Oil and Gas Markets

A horizontal bar composed of three colored segments: green on the left, orange in the middle, and blue on the right.

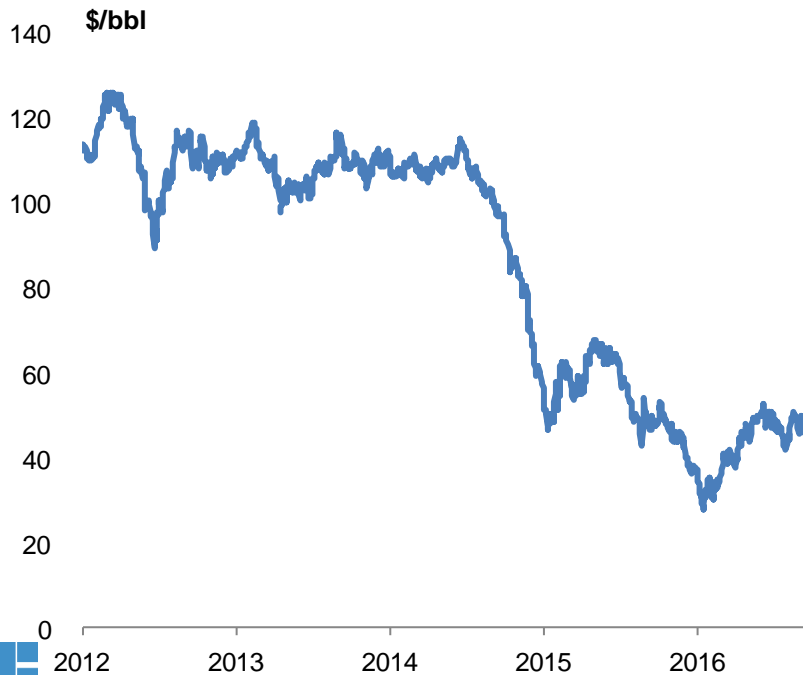
The 10th IEEJ/CNPC Research Meeting
9 November 2016

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Lower price level, but higher volatility of crude oil market

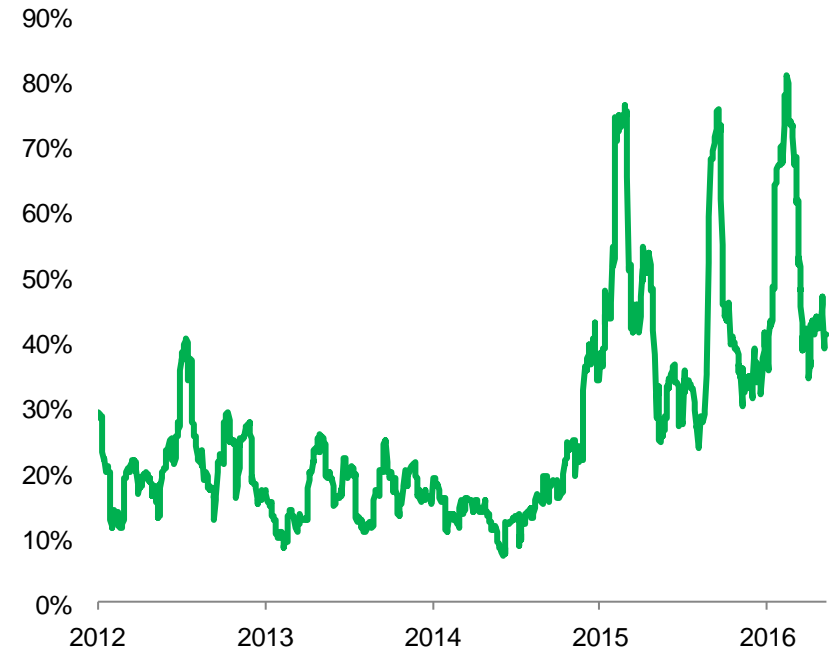
- Brent price recovered \$50/bbl thanks to unexpected agreement by OPEC for production cut.
 - Yet its effectiveness still remains to be seen and cannot expect a big price increase.
- Volatility, on the other hand, was heightened compared to the pre-2014 level.
 - The current crude oil market is susceptible to external shocks.

Historical Brent price since 2012



Source: ICE

Historical volatility of Brent market

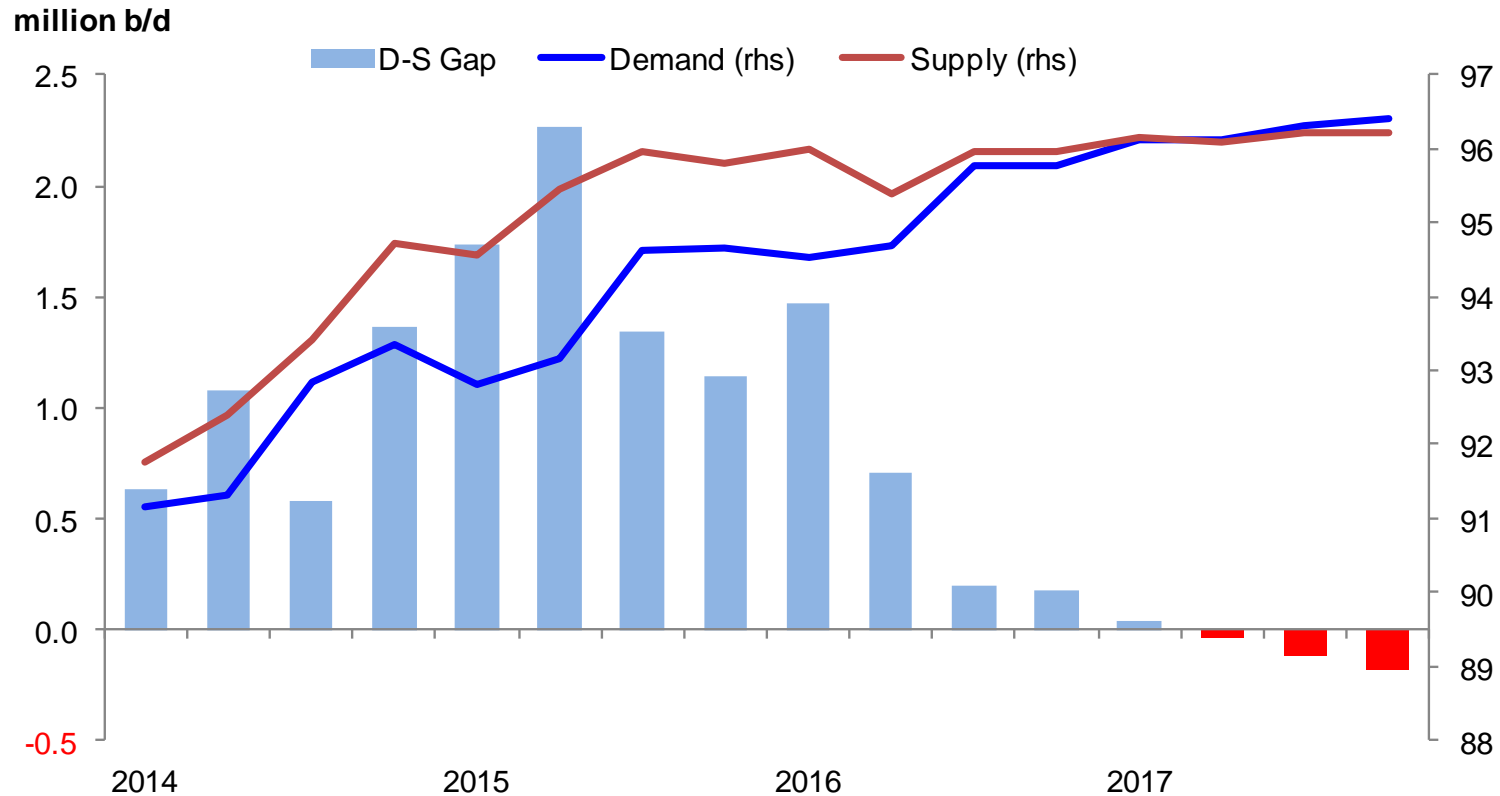


Source: ICE; EEJ

Outlook of Crude oil demand and supply

- Supply surplus will be reduced because of flattened supply and growing demand
- Market will be balanced in the beginning of 2017.
 - Effective production cut by OPEC will accelerate the balancing process.
 - Price level will be elevated to \$55/bbl.

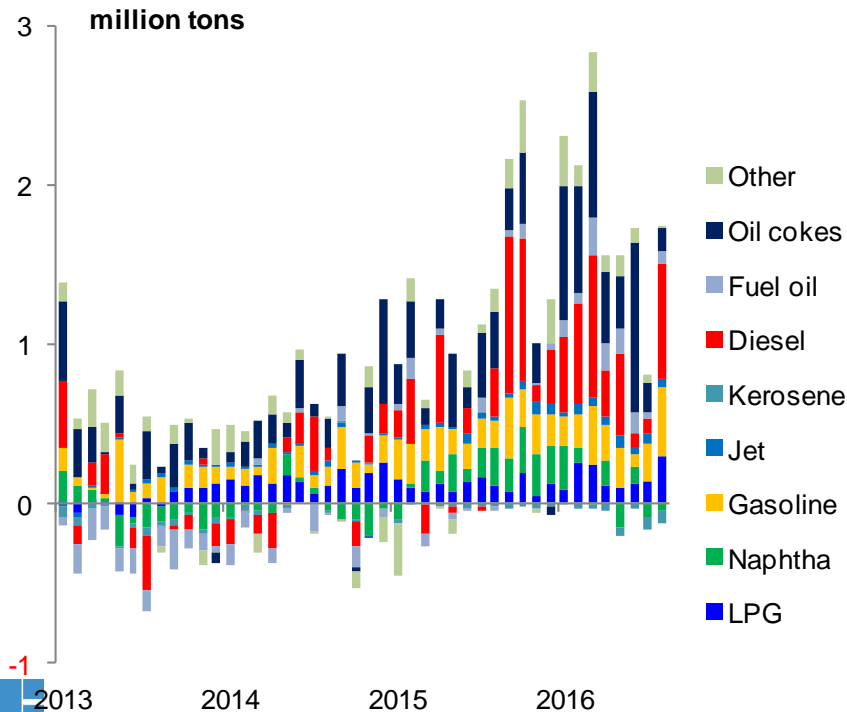
Demand and supply outlook of the world crude market



Growing oil demand in India

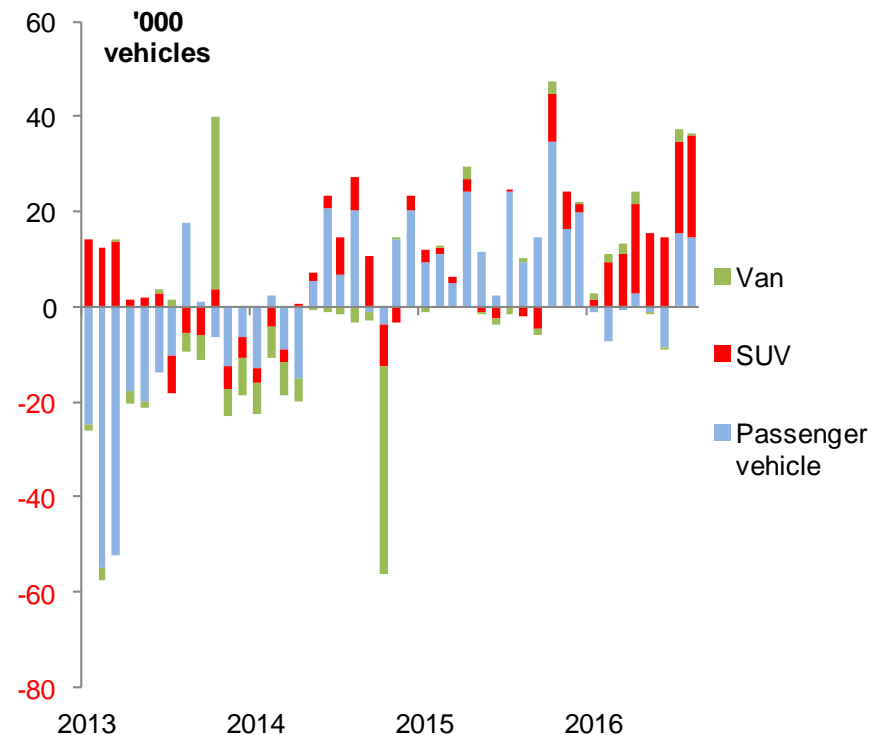
- Supported by strong demand growth of gasoline and diesel, Indian oil demand is growing rapidly.
 - Demand grew by 13% (y-o-y) in 1H 2016.
 - Vehicle sales also shows strong growth in all grades vehicles.
- India will become the third largest oil market surpassing Japan in 2016.

Oil product growth of India (y-o-y)



Source: PPAC

Vehicle sales growth of India (y-o-y)

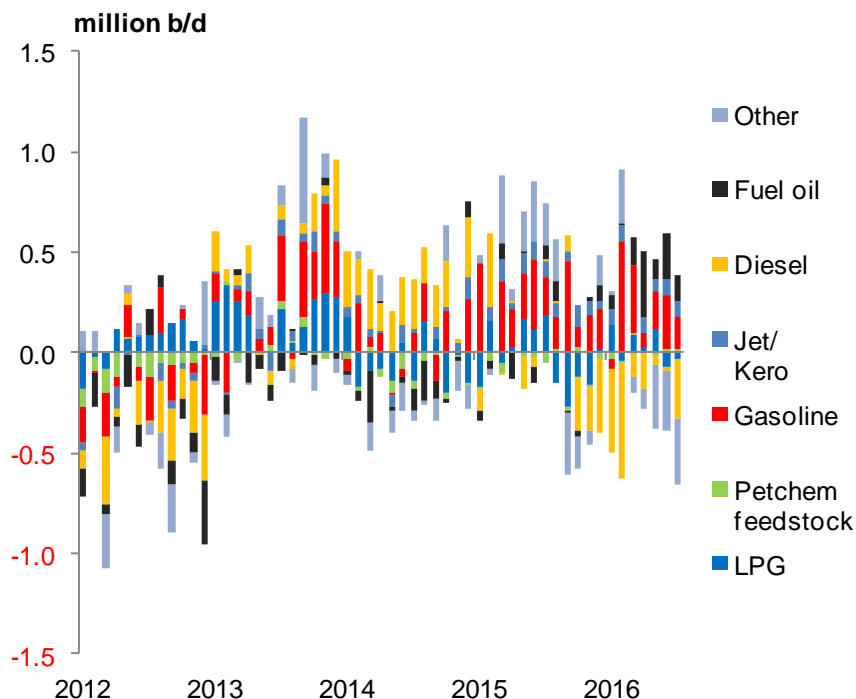


Source: SIAM

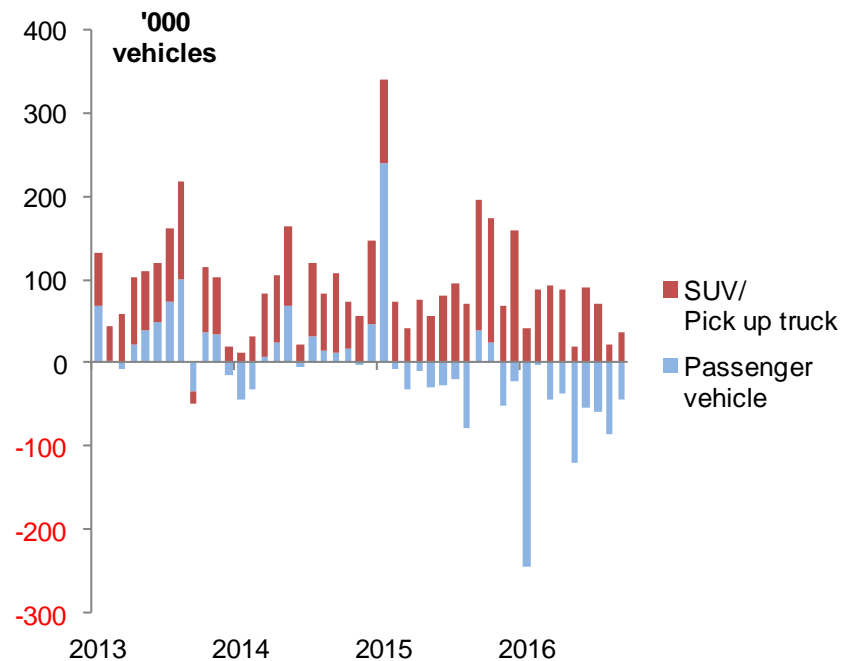
US oil demand

- ▣ Oil demand growth seems slowing down in the US.
 - Steady growth of gasoline and jet fuel is offset by falling diesel demand.
 - Sales of SUV and pick up truck grows while sales of passenger vehicles continues to decrease.

Product demand growth in US (y-o-y)



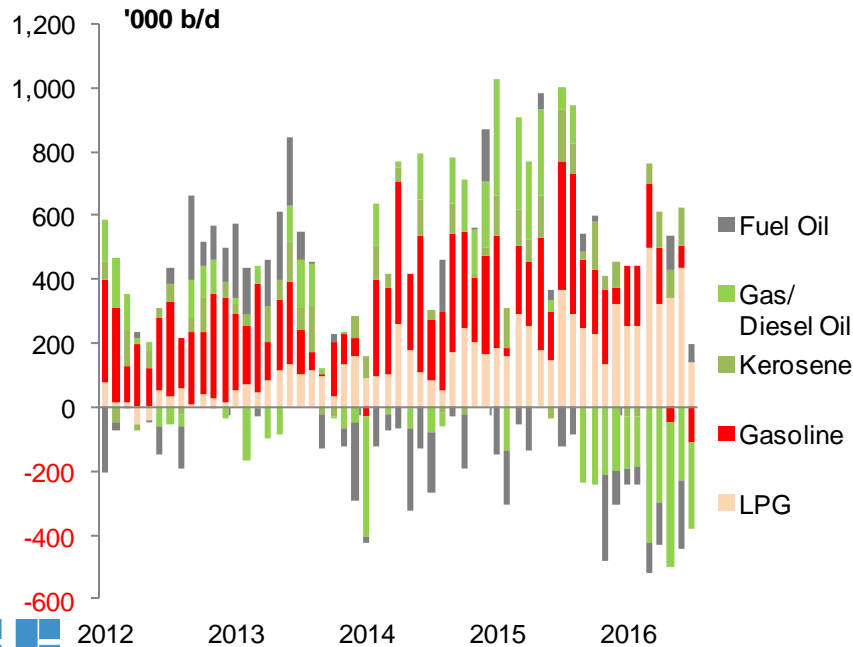
Vehicle sales growth in US (y-o-y)



Chinese oil demand

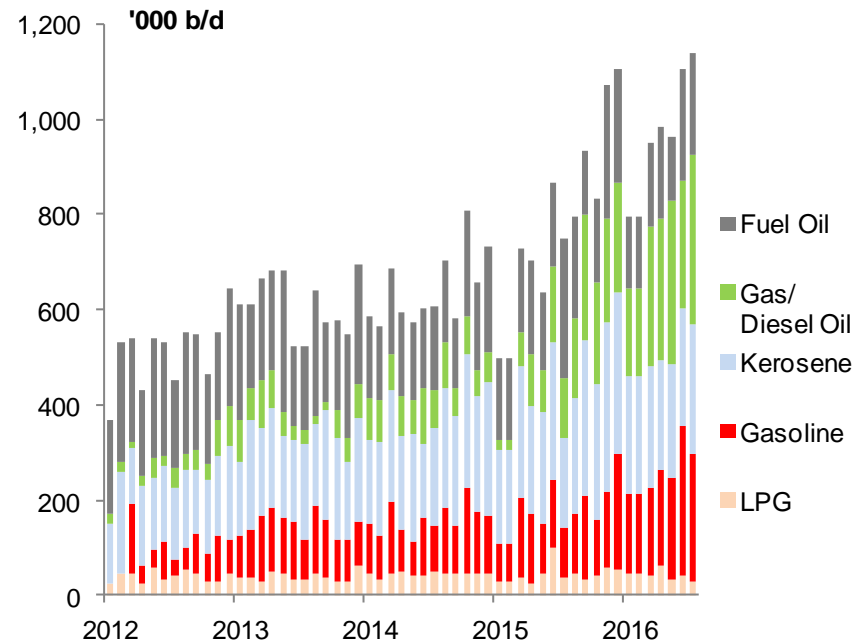
- China's oil demand growth also seems to be moderated.
 - Diesel and fuel oil demand continues to decline reflecting its sluggish economy.
 - LPG demand remains strong. How will gasoline demand behave?
- Production and export of refined products increases thanks to refining capacity expansion and liberalization of teapot refiners' operation.
 - Active exports by teapots are affecting oil product markets in Asia.

Product demand growth in China (y-o-y)



Source: APEC EGEDA; IEEJ

Oil product export from China

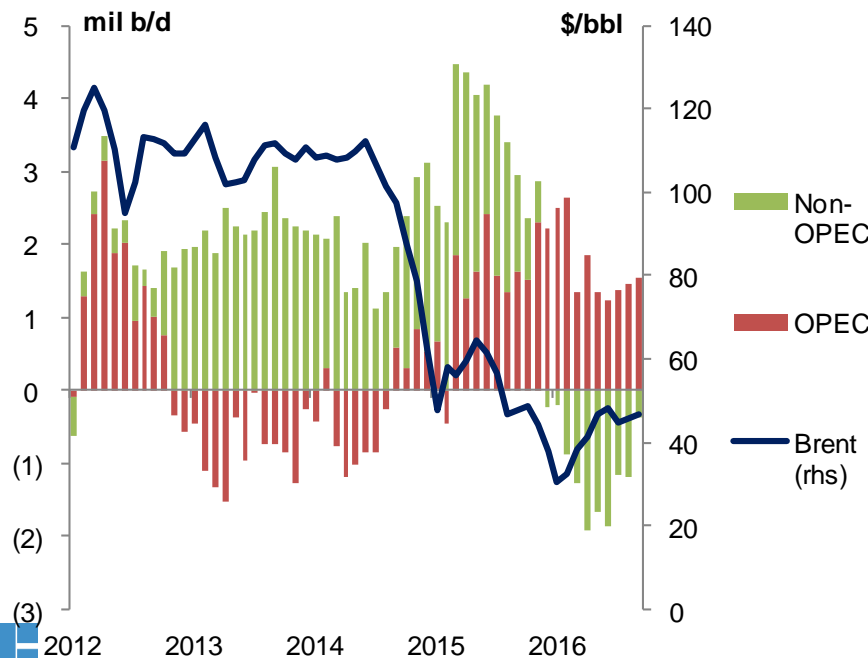


Source: APEC EGEDA

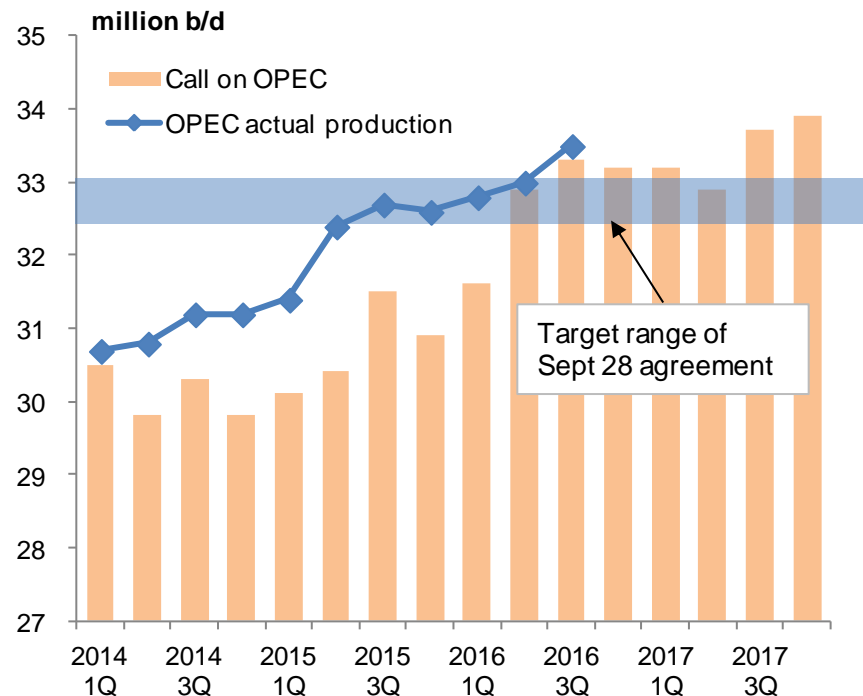
OPEC Production

- Non OPEC production growth triggered oil price collapse; OPEC production growth has extended lower price since then.
 - Collective production control, if not cut, would achieve balanced market sooner.
- OPEC announced its production cut on 28 September.
 - Will the targeted production level (32.5-33.0 mil b/d) be effectively achieved?

Supply growth (y-o-y) and Brent price



Call on OPEC and actual production



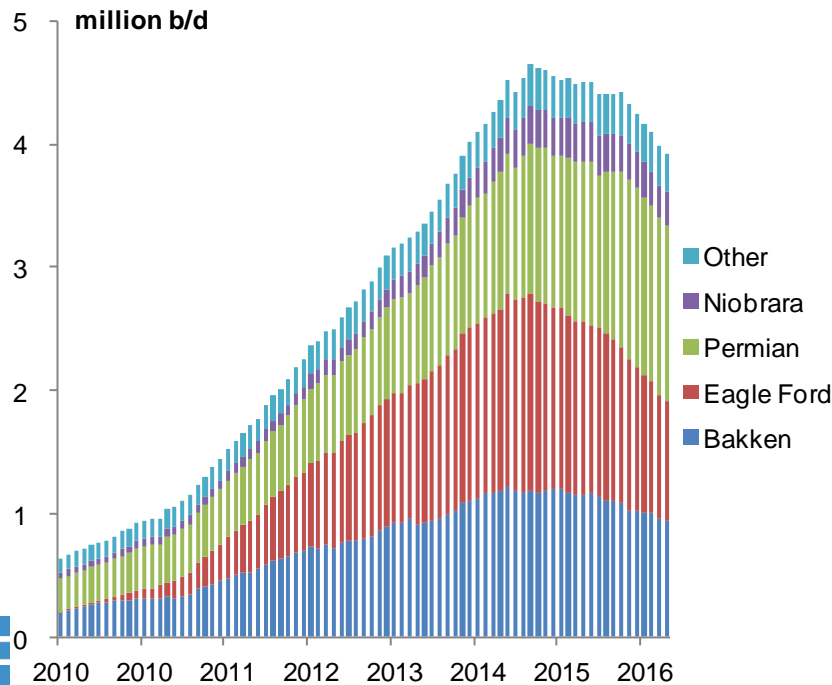
Source: OMI

Source: IEA

US oil production

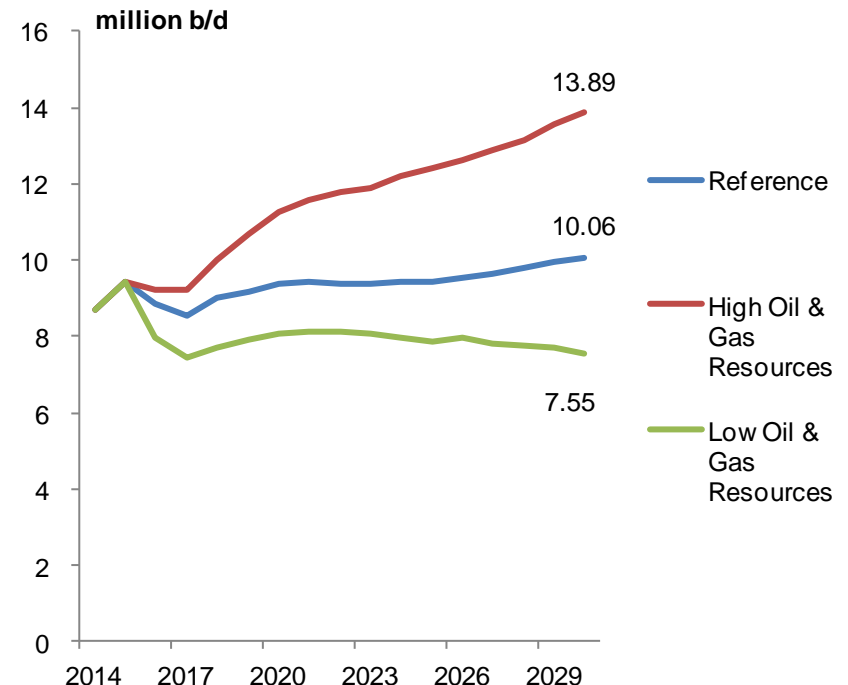
- Because of the lowered oil price, US tight oil production declined to 3.9 million b/d from its peak of 4.6 million b/d in March 2015.
- Rig number bottomed out and is continuing to grow.
 - It has increased from 318 in May 2016 to 432 in October 2016.
- Oil production in 2030 will vary from 7.6 to 13.9 mil b/d subject to resource size.

US tight oil production



Source: OMI

Crude oil production outlook

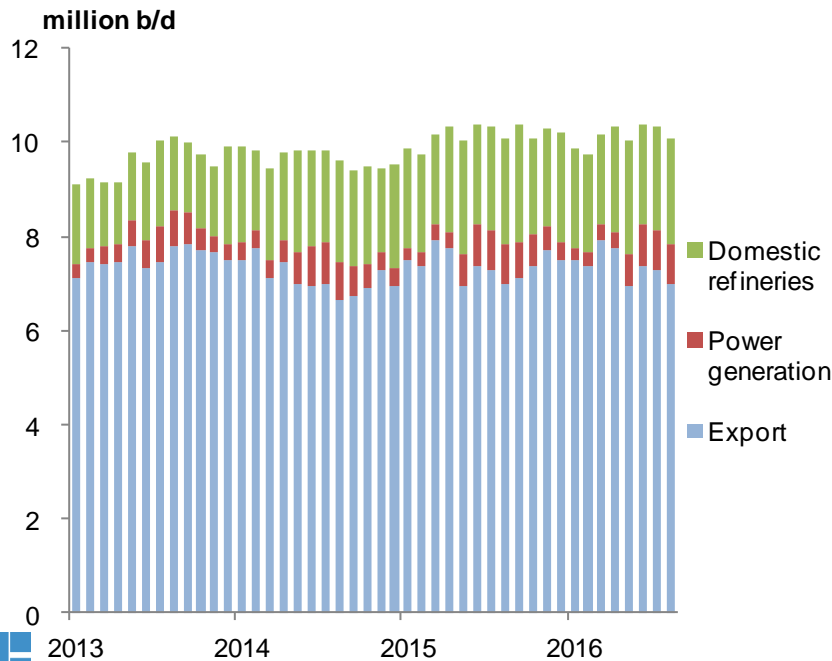


Source: EIA

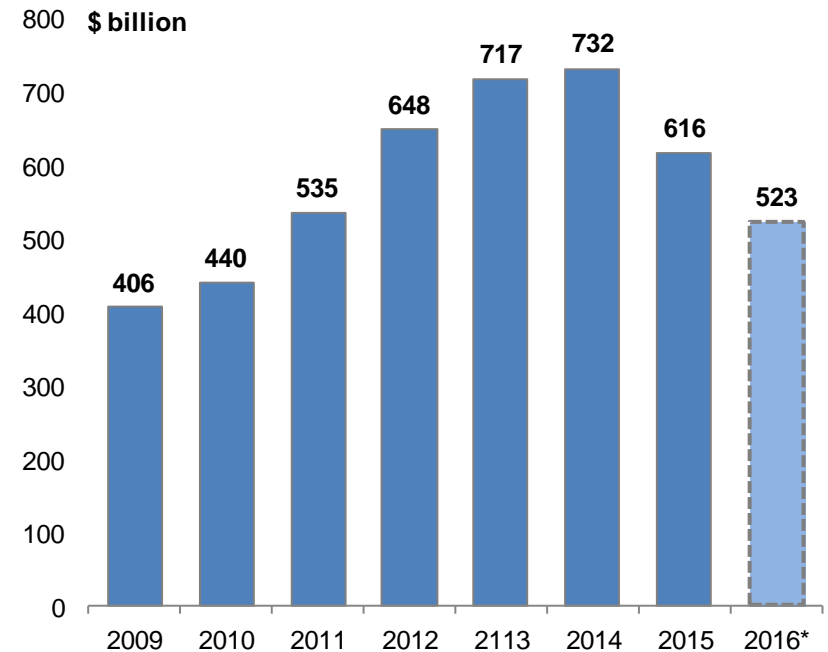
Saudi Arabia's oil production

- The kingdom has so far kept higher production level to maintain its market share.
- Foreign reserves are declining while it is still at high level ("Half full or half empty?")
- "Vision 2030," which includes various numerical targets, was announced.
 - Production capacity will be raised to 12.5 mil b/d; Natural gas production will be raised to 17.8bcf/d; refining capacity will be raised to 3.3 mil b/d; renewable generation capacity will be raised to 9.5GW initially.

Crude oil demand and supply



Foreign reserves of Saudi Arabia



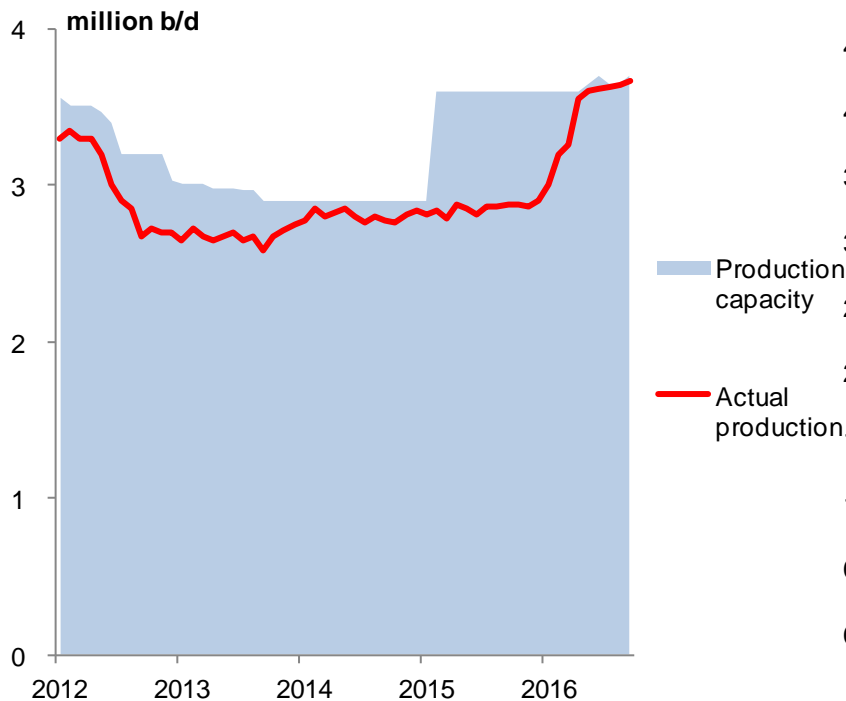
* Estimate by MEES
Source: MEES

Source: IEEJ

Production of Iran and Iraq

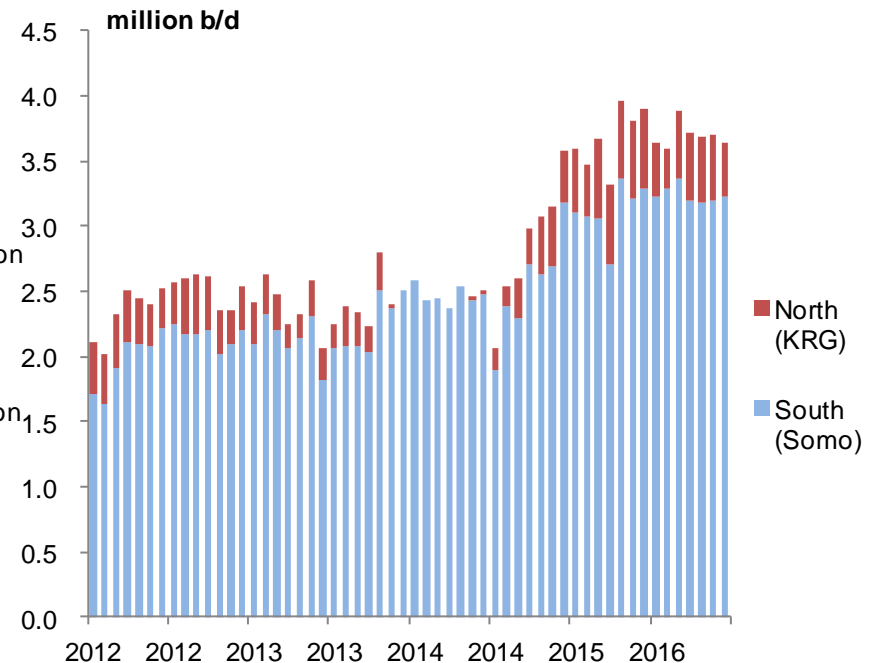
- Although Iran has almost recovered the production level of pre-sanction level, further production growth seems much more difficult.
 - Production level has reached the production capacity.
- Iraq also increased production, but due to reduced investments, export volume has stalled in recent month.

Iranian production and its capacity



Source: IEA

Iraqi crude oil export



Source: Ministry of Oil ; MMES; IEEJ

Japanese oil industry: “Shrink to grow”

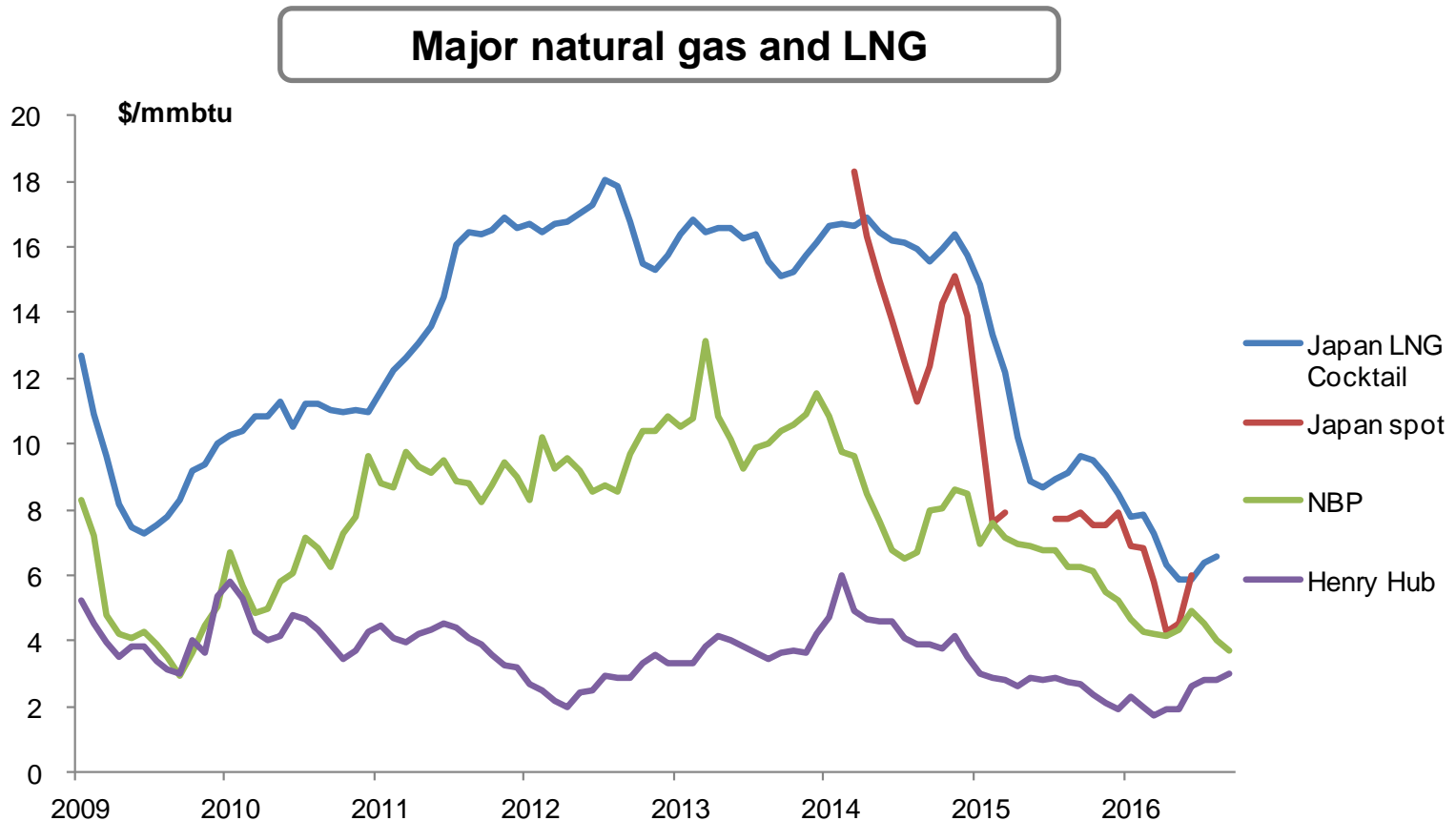
- Amid the declining domestic demand, corporate mergers and refinery closures are being implemented in the Japanese oil industry.
- Two rounds of government mandate accelerated rationalization of refining capacity and alliance among corporations, which is expected to create a competitive oil industry.
- How will the on-going industrial reform in China affect the Chinese and Asian oil markets?

Government mandate and expected refining capacity cut

Company	1 st round (~March 2014)	2 nd round (~March 2017)
JX	Transformed Muroran refinery to a petrochemical plant	Install PDA plant.
Idemitsu	Closed Tokuyama refinery	Reduce CDU capacity in Chiba
Showa Shell	Closed Kawasaki refinery	Rationalize CDU capacity in Yokkaichi jointly with Cosmo
Cosmo	Closed Sakaide refinery	Rationalize CDU capacity in Chiba with TonenGeneral Rationalize CDU capacity in Yokkaichi with Showa Shell
TonenGeneral	Expanded H-Oil capacity Reduced CDU capacities in Kawasaki and Wakayama	Rationalize CDU capacity in Chiba with Cosmo Reduce its CDU capacity

World Natural gas and LNG prices

- Differentials of the world natural gas / LNG prices has been narrowed down almost removing Asian premium.
- JLC and Spot price to Japan seems to have bottomed out.



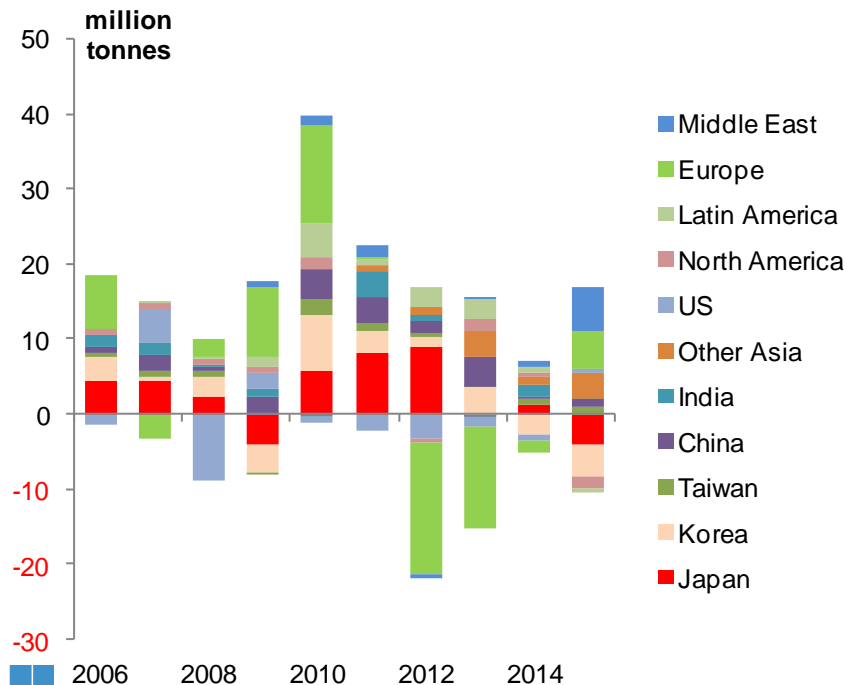
Note: Henry Hub and NBP is wholesale price while JLC and NE Spot are import price.

Source: EIA, ICE, MOF; METI

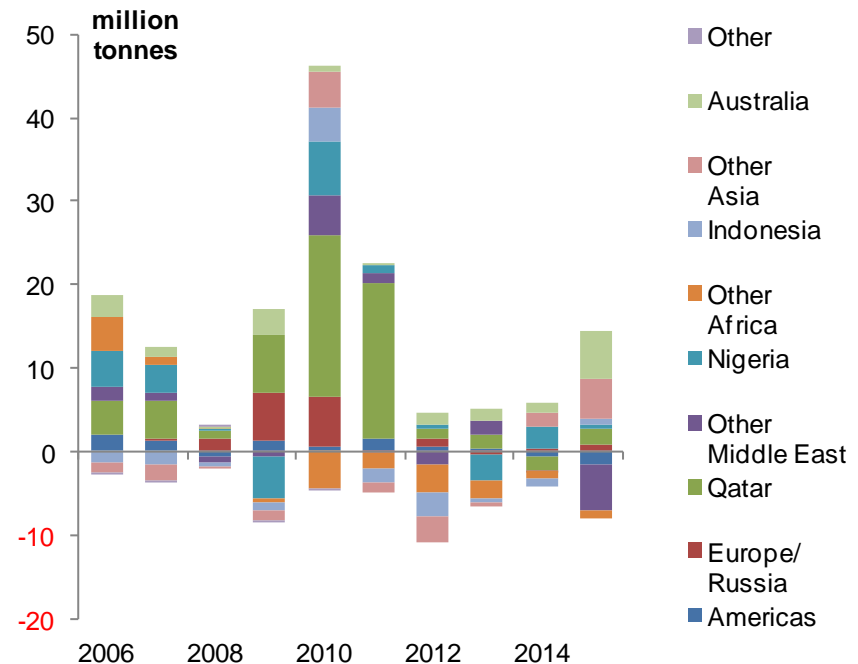
LNG demand and supply

- ▣ Demand decline in traditional markets (Japan and Korea) is offset by demand growth in emerging markets (India, Middle East, etc.).
 - Most of the emerging markets procure LNG on spot basis.
 - These emerging importers are very elastic to price and demand flexible supply.
- ▣ New wave of production growth from US and Australia has just begun.

LNG demand growth (y-o-y)



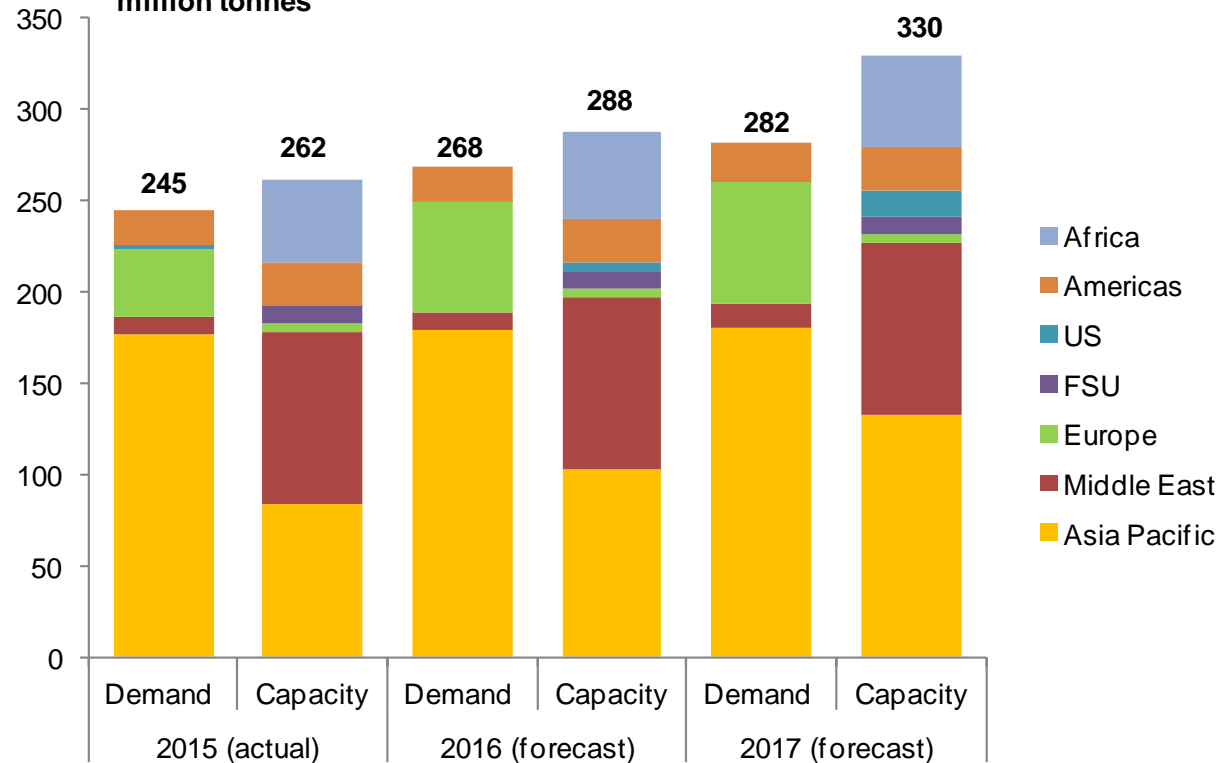
LNG supply growth (y-o-y)



LNG demand supply outlook

- Supply surplus is forecasted to grow.
 - Large and new capacities are planned to be on stream in US and Asia.
 - Some of them may be forced to reduce utilization or defer its start-up.
- European demand will grow due to “supply push” reason as the last resort market.
- Future demand growth is subject to macro economy in emerging countries, relative price competitiveness of LNG, and government policy factors.

million tonnes



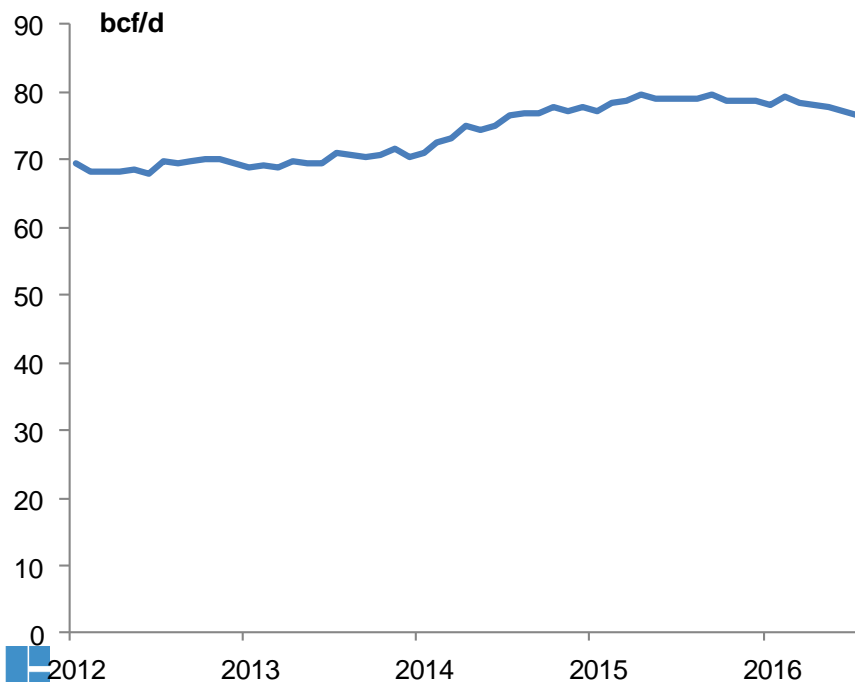
World LNG demand and supply outlook

Source: IEEJ

Shale gas production in US and its LNG export

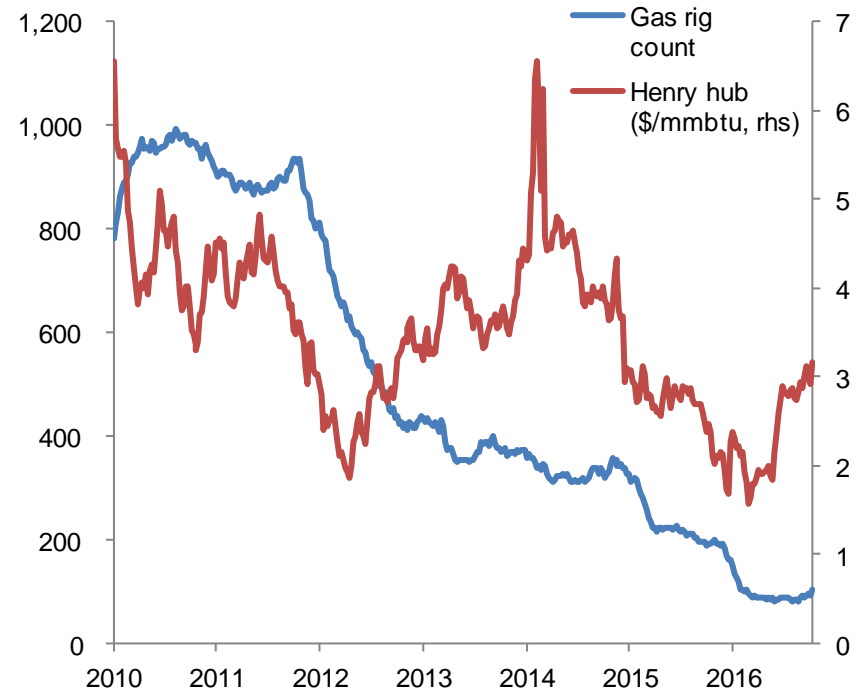
- Low price environment forced the domestic production to turn into a declining trend... but not so evident.
- Sign of price recovery seems to affect the rig count number. Production may soon bottom out in the near future.

US natural gas production



Source: EIA

US Henry Hub price and rigs for gas

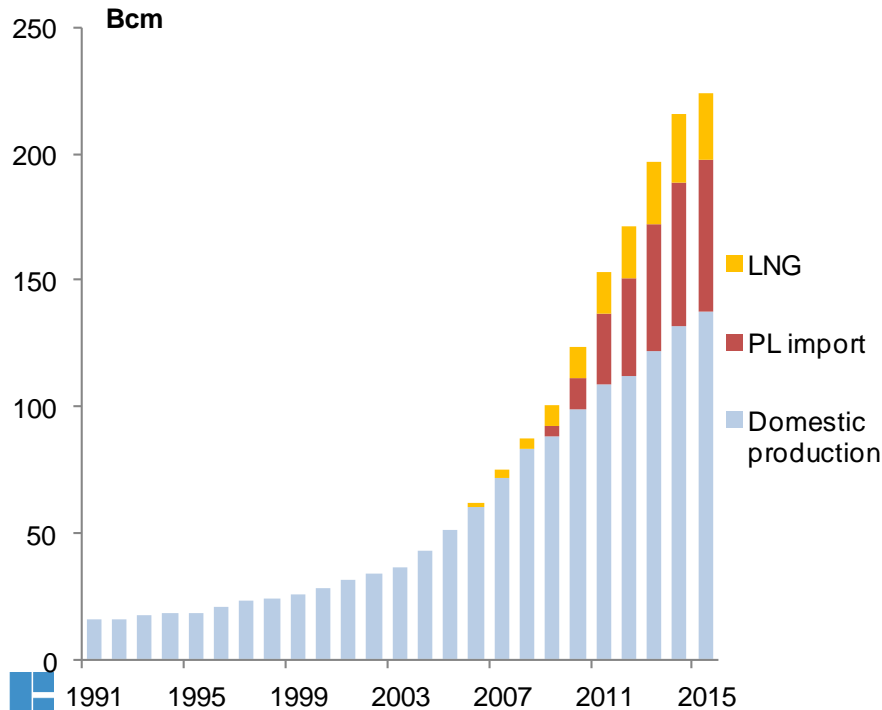


Source: Baker Hughes, EIA

Natural gas in China

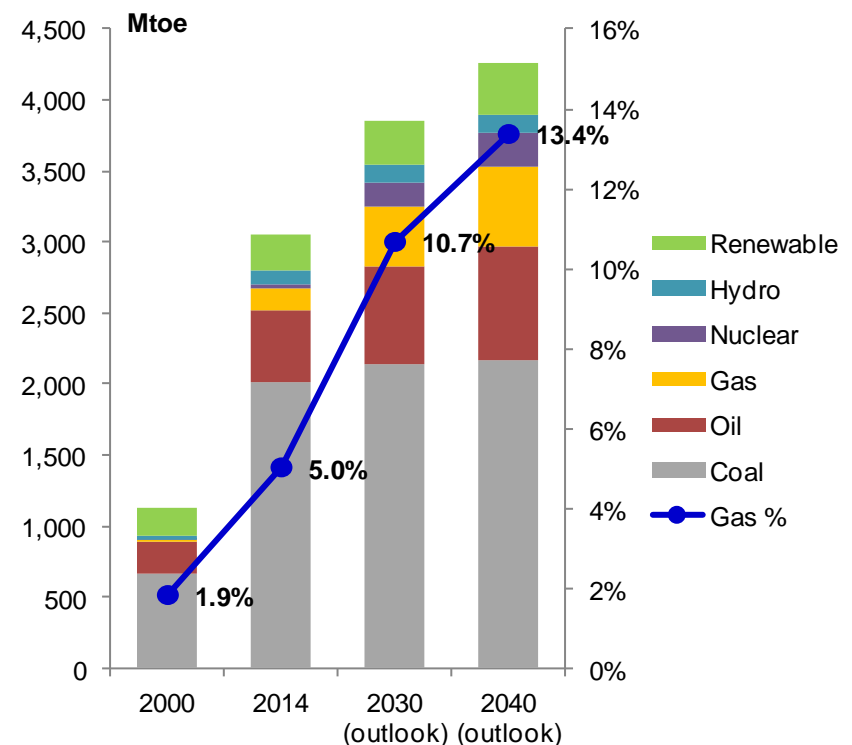
- China's natural gas demand has grown pushed by domestic production growth and infrastructure developments.
 - LNG has been secondary source of natural gas so far.
- How will China treat natural gas in its energy supply and energy policy?
 - What is the policy goal about natural gas utilization in China?

Natural gas supply in China



Source: BP

Primary energy supply of China

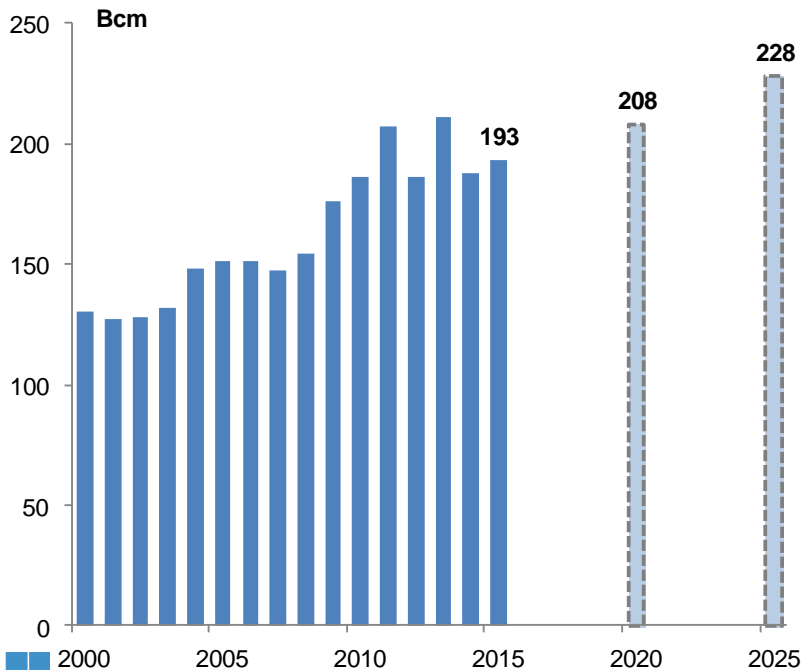


Source: IEA; IEEJ

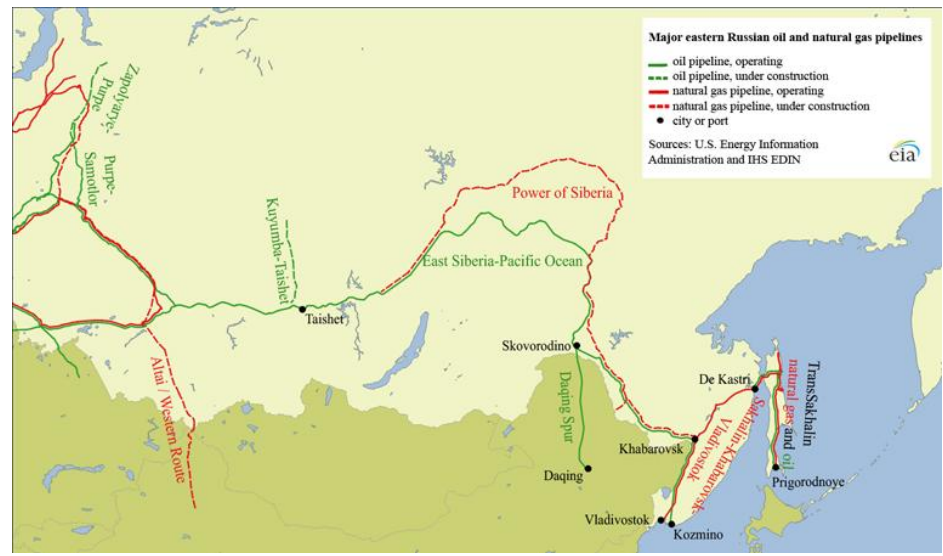
Russia's natural gas and LNG

- Russia as a highly important source of natural gas for Northeast Asia
 - Russia is already an established LNG supplier for Japan.
 - China has agreed with Russia for future pipeline supply.
- Will “Eastern Shift” by Russia be really realized? What is need to realize actual supply expansion from Russia?

Russian natural gas supply and outlook



Eastern pipelines in Russia



Towards Asian price benchmark and natural gas hub

- Two approaches to realize Asian LNG price benchmark and trading hub
 - International approach seems to be more realistic based on the existing supply infrastructure and development of the region's LNG market.
- What is the Chinese views on this issue?

Domestic approach

Gas market liberalization

Domestic wholesale trading hub

Discrepancy b/w domestic wholesale price and imported price

Abandonment of oil price linked formula

International approach

Removal / relaxation of destination clause, unbalanced market

Creation of spot LNG market

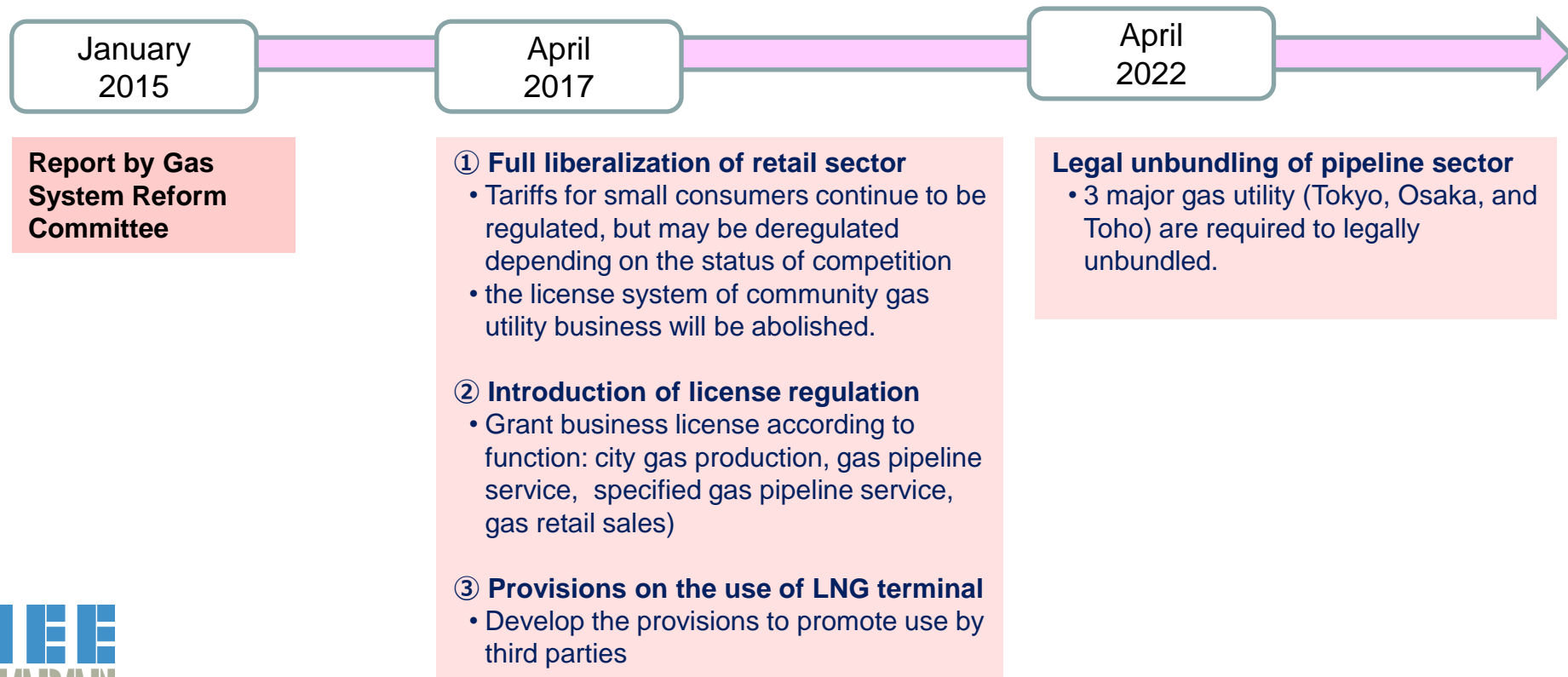
Widened difference b/w spot price and oil price linked price

Increased influence of spot LNG price

Creation of Asian price benchmark

What will the system reform bring to Japanese market?

- ❑ Two thirds of the Japanese gas market has been liberalized and 11.7% of the liberalized market was supplied by non-gas utility companies in FY 2014.
- ❑ Retail market will be liberalized in April 2017, and major 3 gas utilities will be legally unbundled in April 2022.
- ❑ How will China's liberalization of natural gas market affect the Chinese market?



Summary

- Besides oil demand response in major consuming countries to the current oil price environment, supply factors such as OPEC's production policy and US production are becoming more significant as a trigger to revive the lowered oil price level.

- Amid the drastic changes in international LNG market, an opportunity to improve the existing LNG market structure is emerging. Both government and industry should pursue their efforts to create a more flexible LNG market by utilizing new supply sources such as US or Russia.

- Restructuring or liberalization of oil and gas industry are expected both in Japan and China. How these processes will affect each country's oil and gas market will be a key item to watch.