Outlook and Challenges for the World Oil and LNG Market

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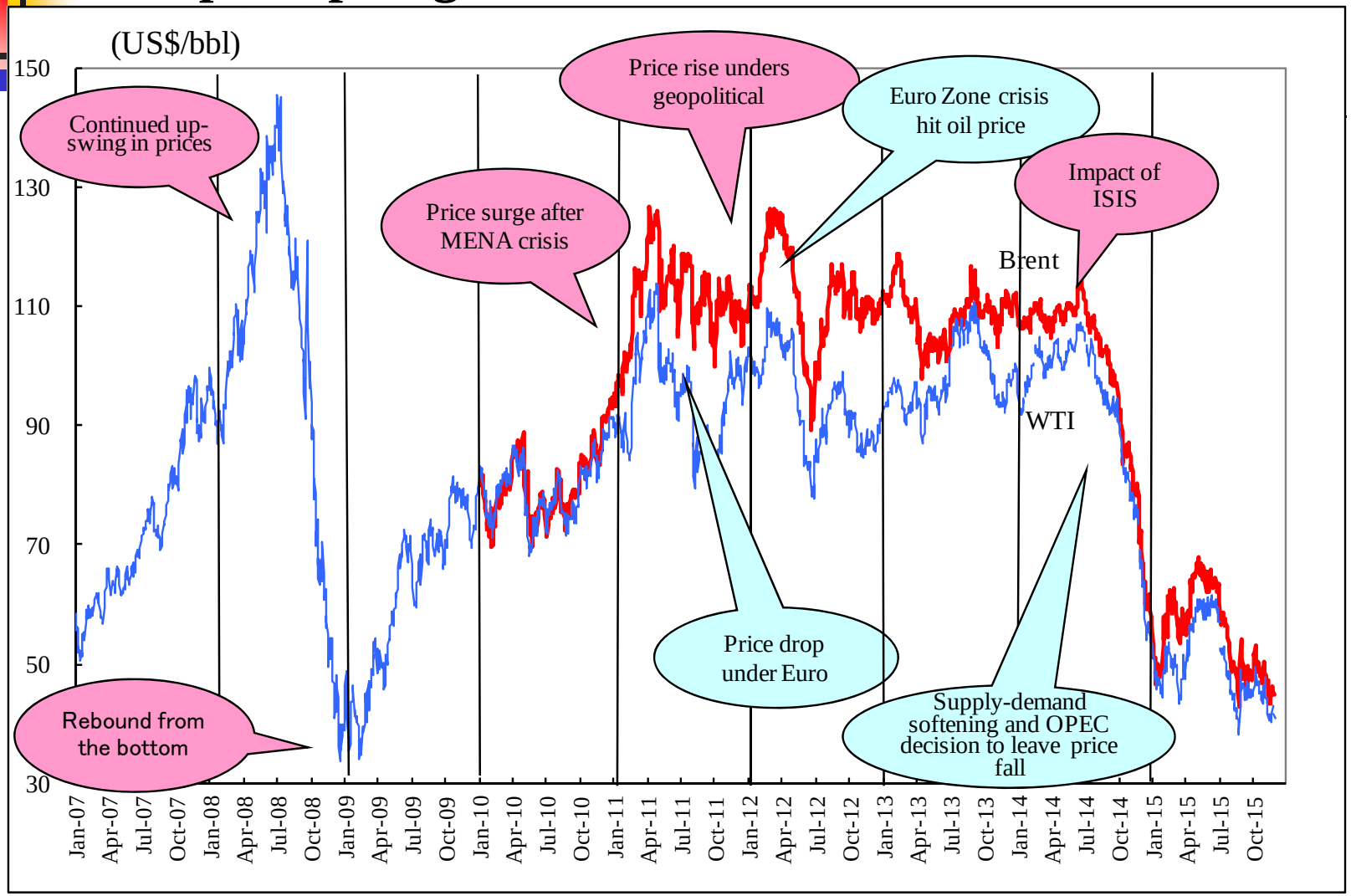
Emerging landscape with regard to global energy market

- Volatile crude oil price
- Impacts of Unconventional Oil & Gas Development
  - Impacts of US Shale Gas Revolution
  - Impacts of US Energy Independence
- Growing energy demand in Asia and its implication to global energy security
- Emerging concerns for energy supply constraints
  - Geopolitical risks, resource nationalism and issues of market power
    - Ongoing “MENA crisis”, “Iranian crisis”, Ukraine crisis, etc.
  - Lack of timely investment in resource development
  - Importance of stability of energy transportation
- Environmental challenges for sustainability
  - Climate change and global environmental problems
  - Local and regional environmental problems
- Impacts of “March 11th” and Japan’s Energy Policy Review

Crude Oil Price Volatility

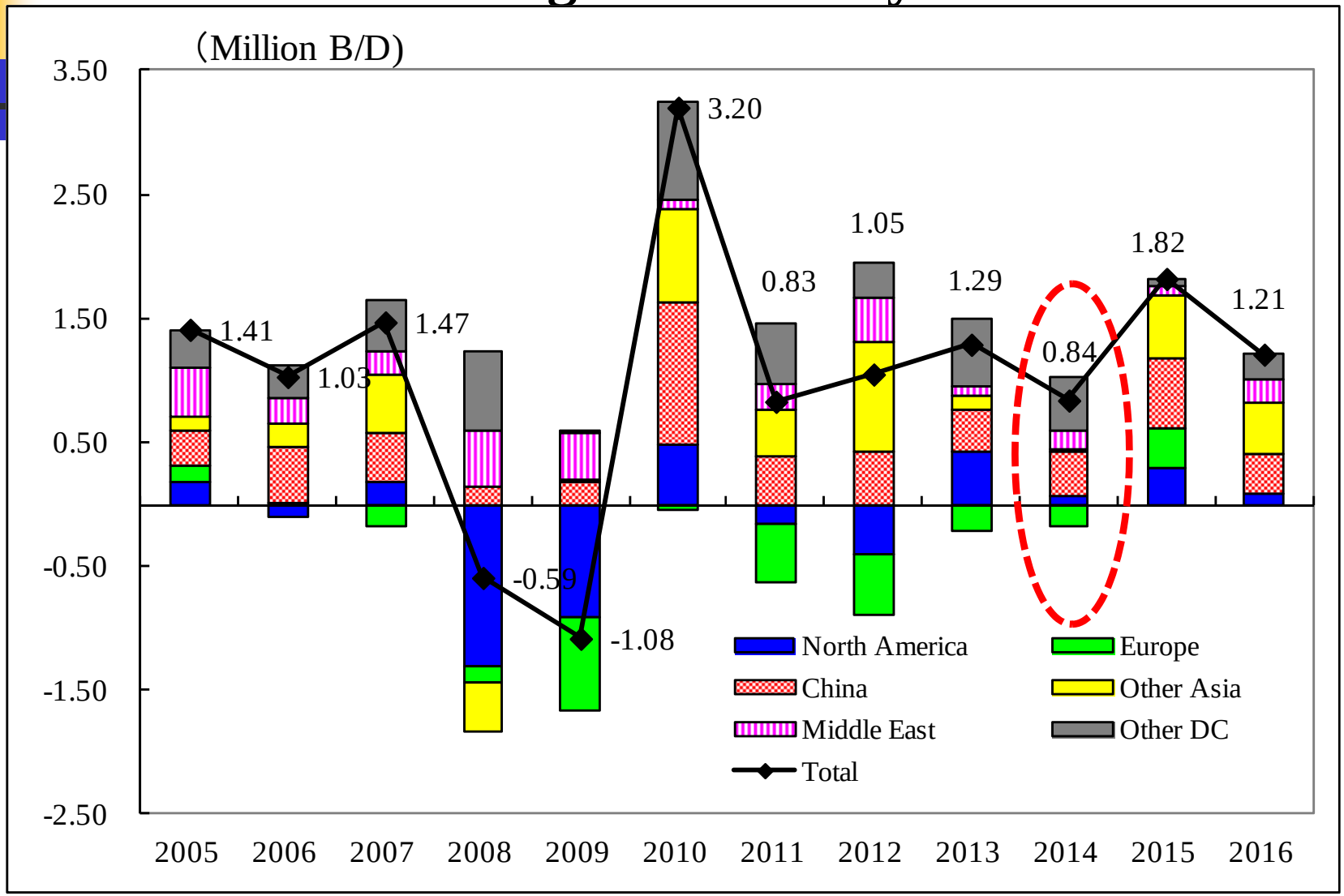
Crude oil price plunged from 100$, but continued to be volatile



Source: NYMEX data, etc.

World Oil Demand

2014 Demand growth is very low…

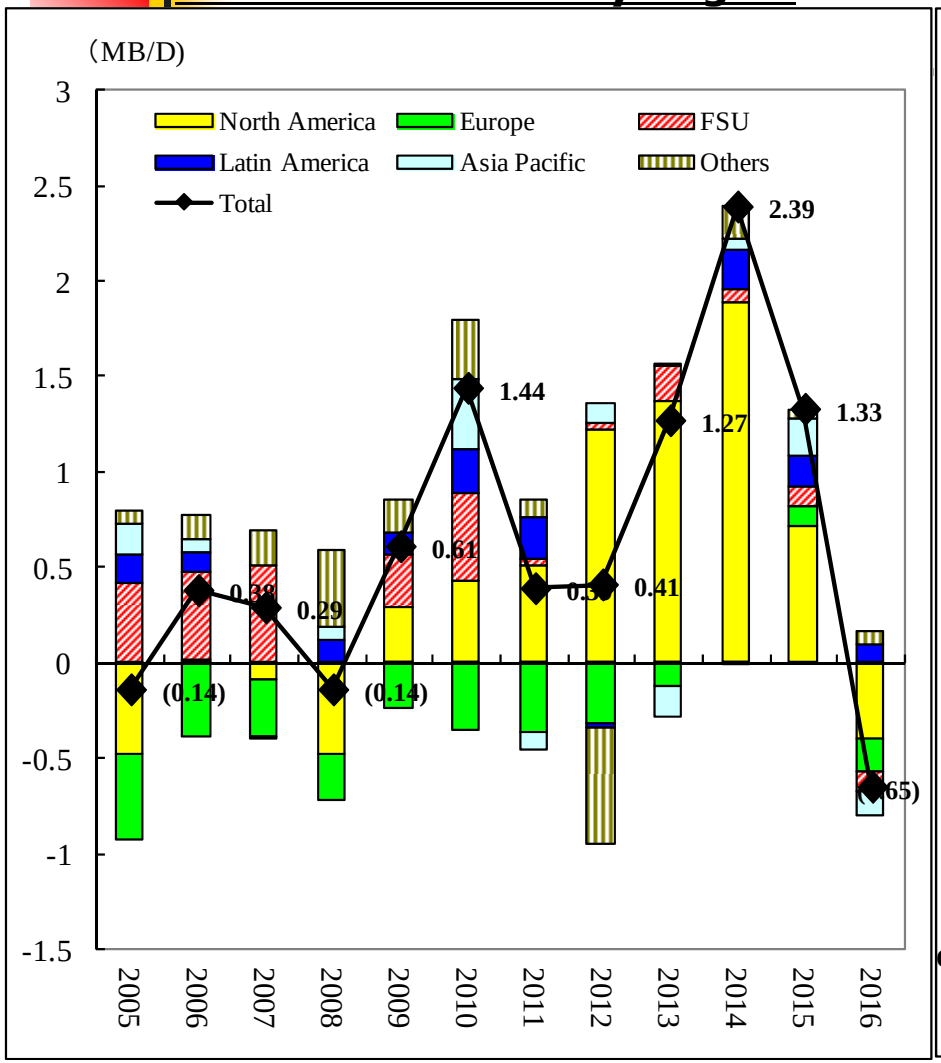


Source: IEA “Oil Market Report”

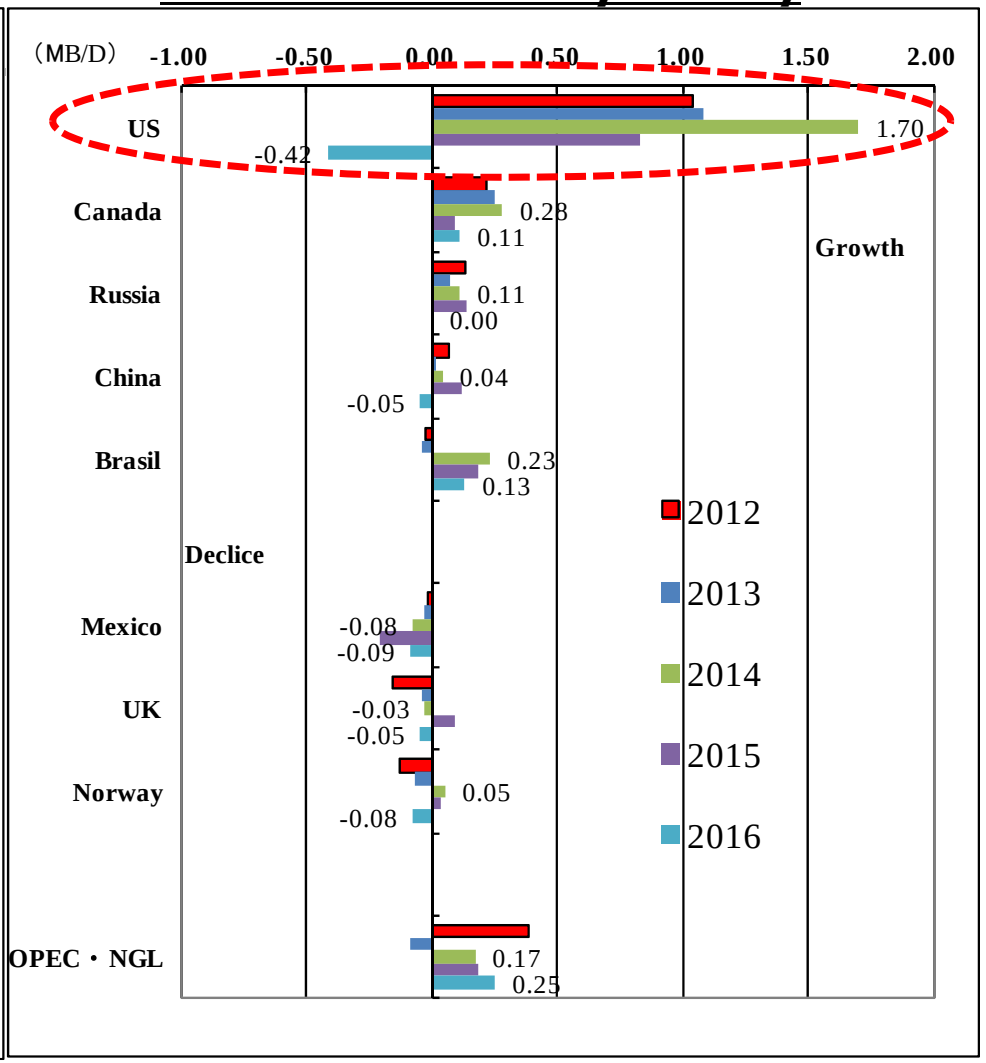
Non OPEC Production

Strong 2014 Non-OPEC growth lead by US

Non-OPEC Growth by Region

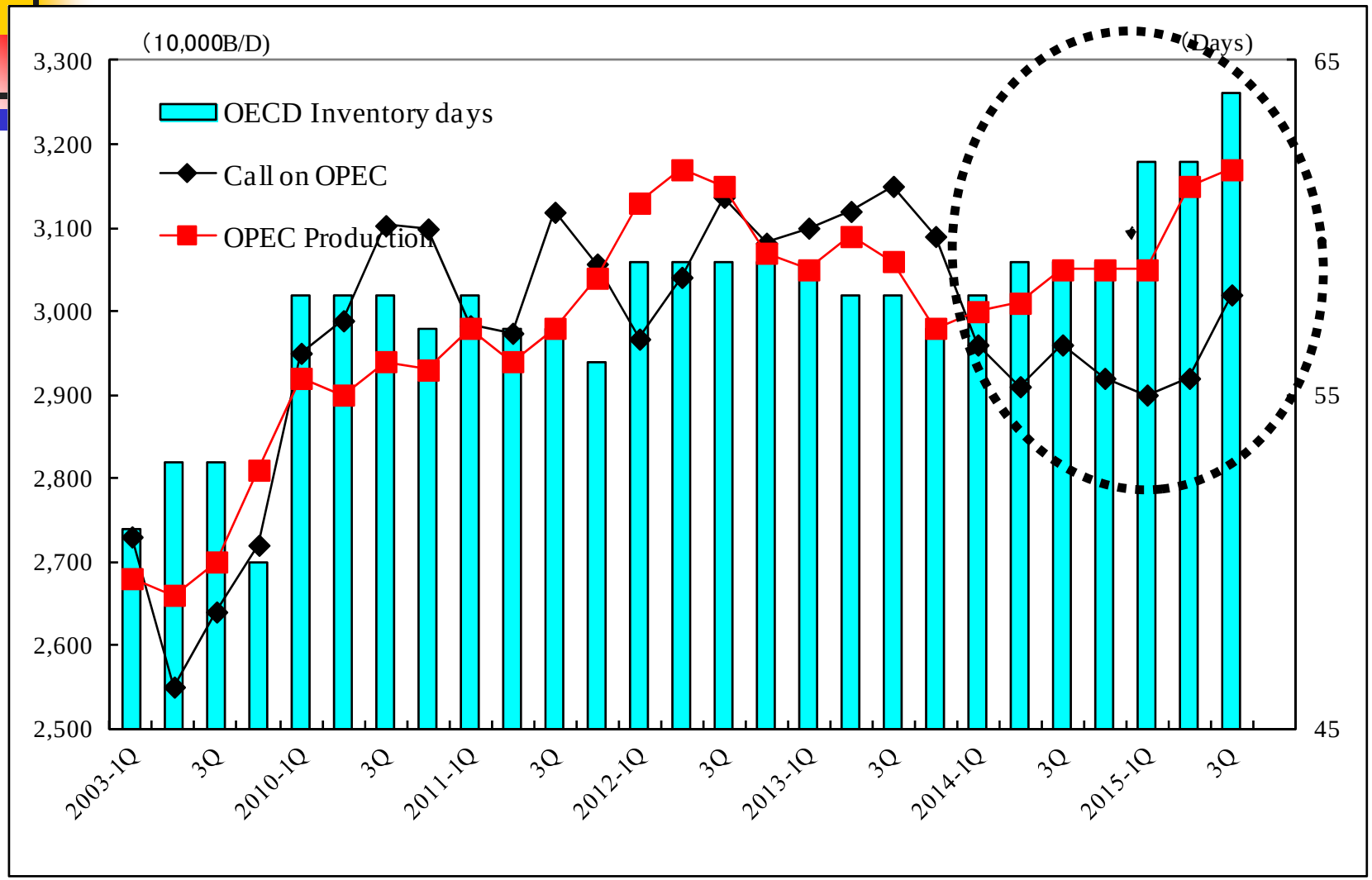


Non-OPEC Growth by Country



Source: IEA “Oil Market Report”

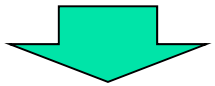
Call on OPEC vs. OPEC Production



Source: IEA “Oil Market Report”

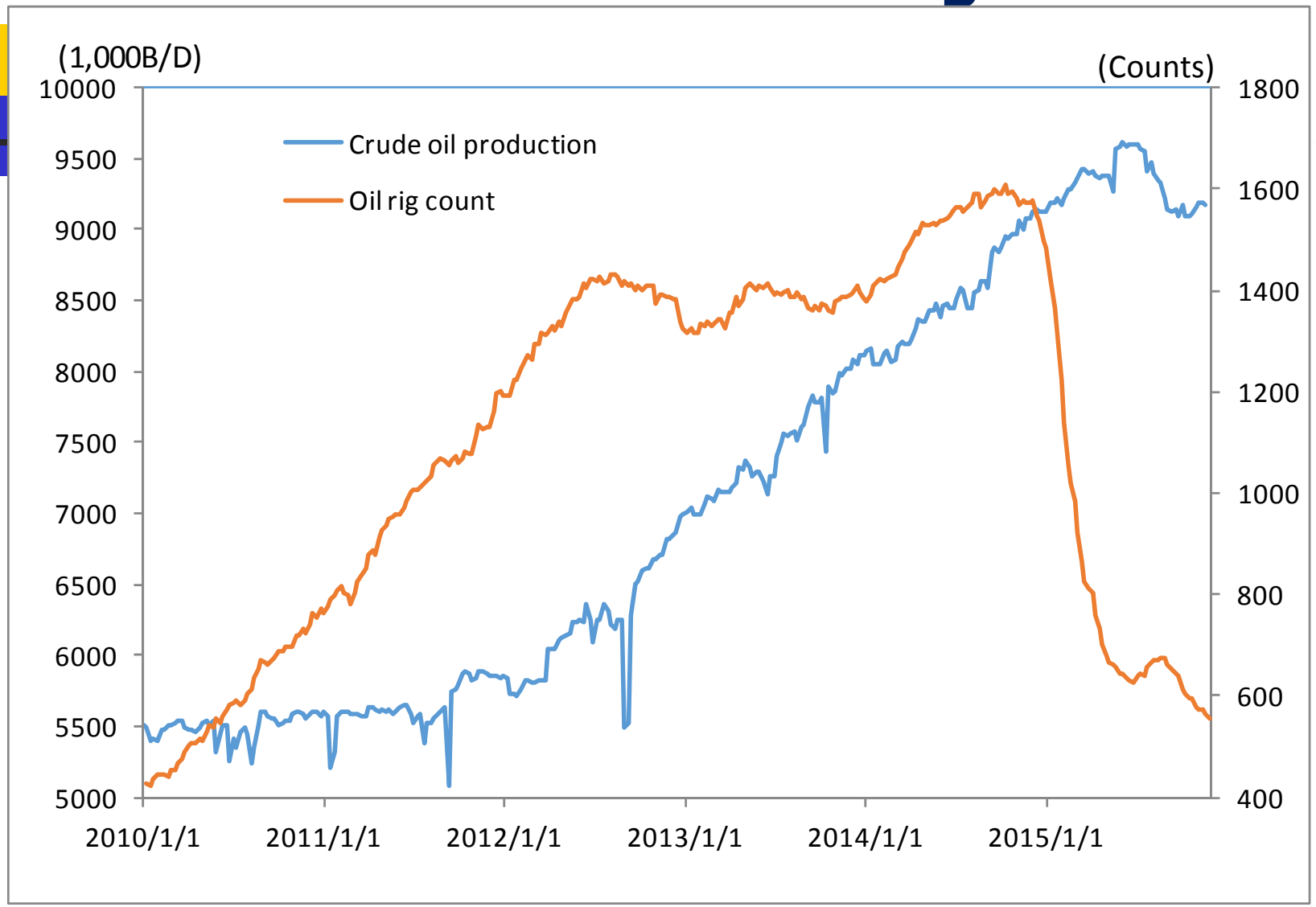
Background to Saudi's Decision

- Protecting prices by cutting production is self-defeating.
- Tough lessons from the swing producer experience
- "The market will naturally balance itself out."
- Various "strategic thoughts" ≠ "conspiracy theory"
- Robust financial resources to withstand low prices for some time
- Searching for new price equilibrium while maintaining its market share



- Market lost its foothold and plummeted.

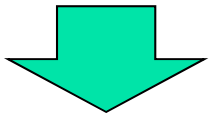
US Oil Production and Rig Count



Source: Data from EIA and Baker Hughes

Low Oil Price and US LTO

- US LTO, relatively high cost oil production
- But cost differs greatly by area, well and producer
- "Breakeven cost" vs "Short-run marginal cost"
- Rig counts decline dramatically, but shift to quality
- Financial problems of shale oil producers
- Low oil price results in lower production cost
- Existence of uncompleted wells

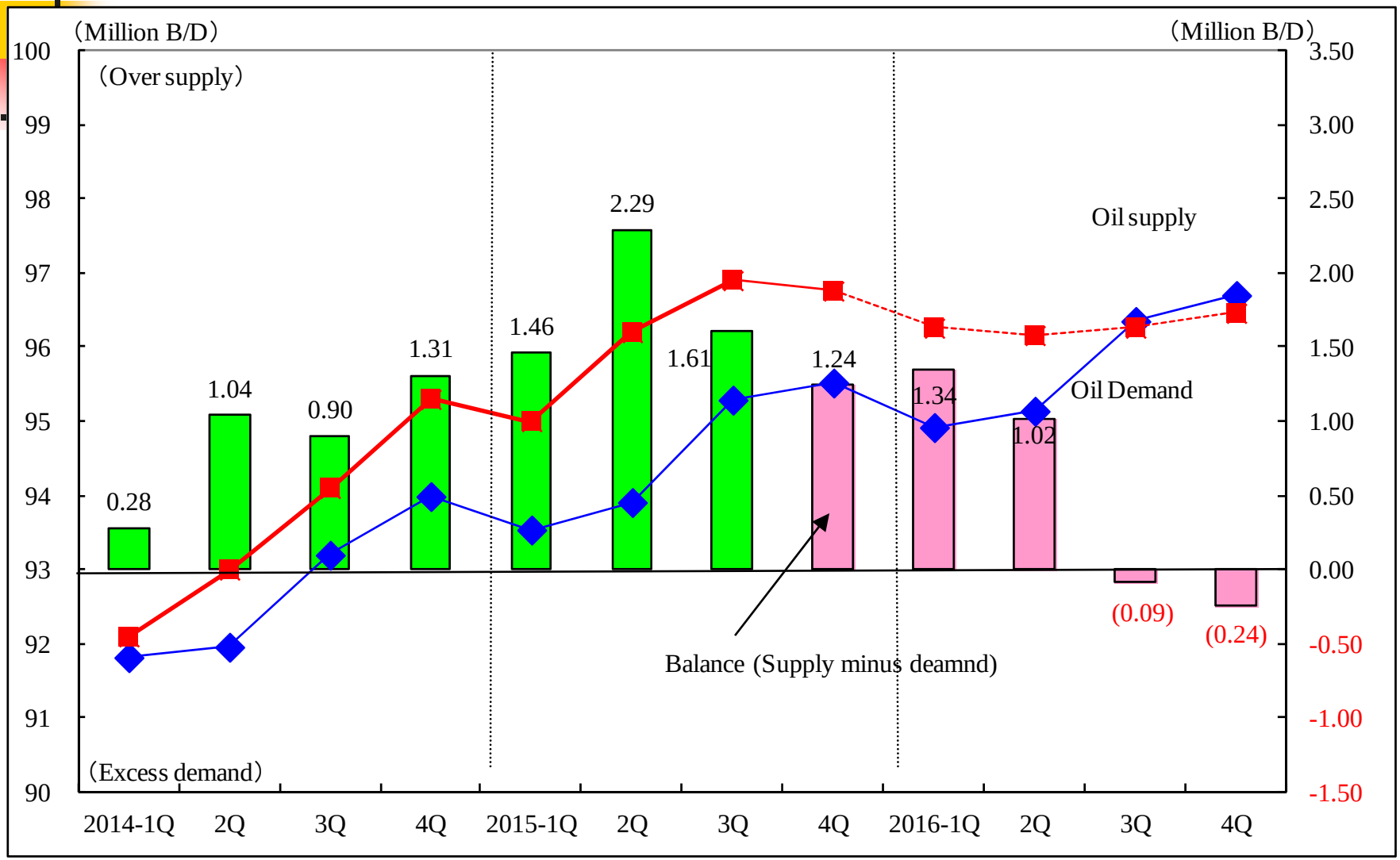


- US LTO shows resilience to low oil price
- LTO production may bounce back if price goes up

Outlook for Near-Term Global Oil Market

- Current price level likely to remain in the near term due to prevailing over-supply situation.
- The impact on the production of high-cost oil (US shale, etc.) is "emerging", but full scale impacts will be felt later this year.
- But US LTO production may be resilient and start to pick up again if oil price goes beyond a certain level.
- What can be a "surprise"?
  - OPEC decision?
  - Supply disruption in oil producer countries?
  - Economic downside risks?
  - Return of Iranian oil?
- Current price level is not sustainable for mid-term. Market may head for 70-75$ in 2020

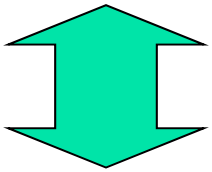
Outlook for Oil Supply-Demand



Source: Outlook by the Author based on data from IEA “Oil Market Report”

Pros and Cons of Low Oil Prices: Macro

- Positive for the global economy in general
- Great benefits for consumers (highly import-dependent) countries
- Also benefits for energy-importing companies and users
- Tax-break effect on people's lives

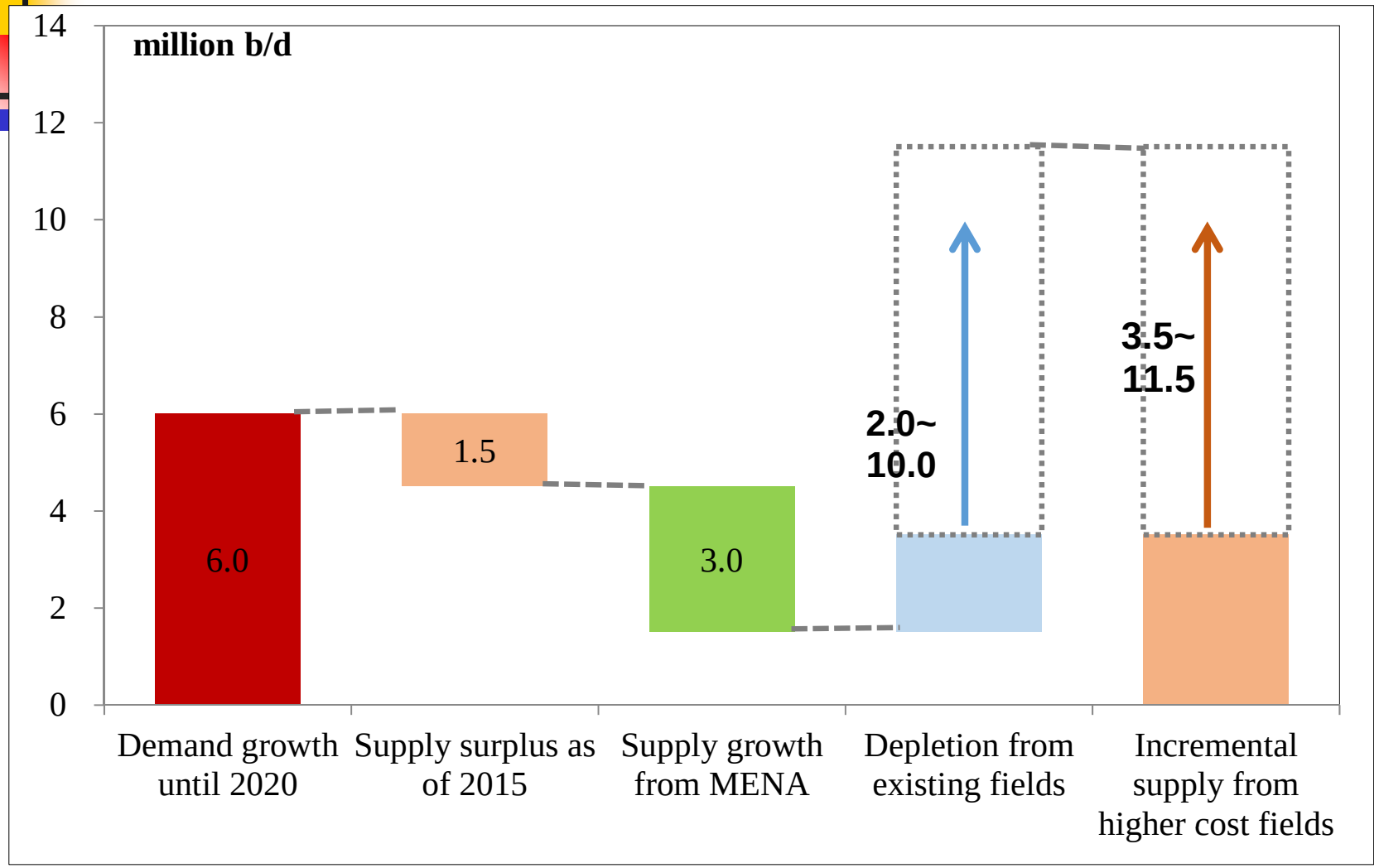


- Serious negative impact on resource-rich countries
- Economic instability of resource-rich countries could precipitate financial and credit crisis.
- Risk of economic and financial crises spreading internationally
- Most vulnerable: Russia, Venezuela, Nigeria, etc.

Impact of Low Oil Prices: Energy

- Crude oil prices: "the deeper the valley, the higher the peak"?
- Destabilizing oil-producing and resource-rich countries
- Adverse effect on investment in energy supply (high-cost PJs)
- Difficulty in decision-making on choice of energy, LNG price formula, etc.
- Restructuring and institutional issues of domestic and overseas energy industries (Corporate integration and asset reshuffling)
- Increased need for cost reduction and higher efficiency

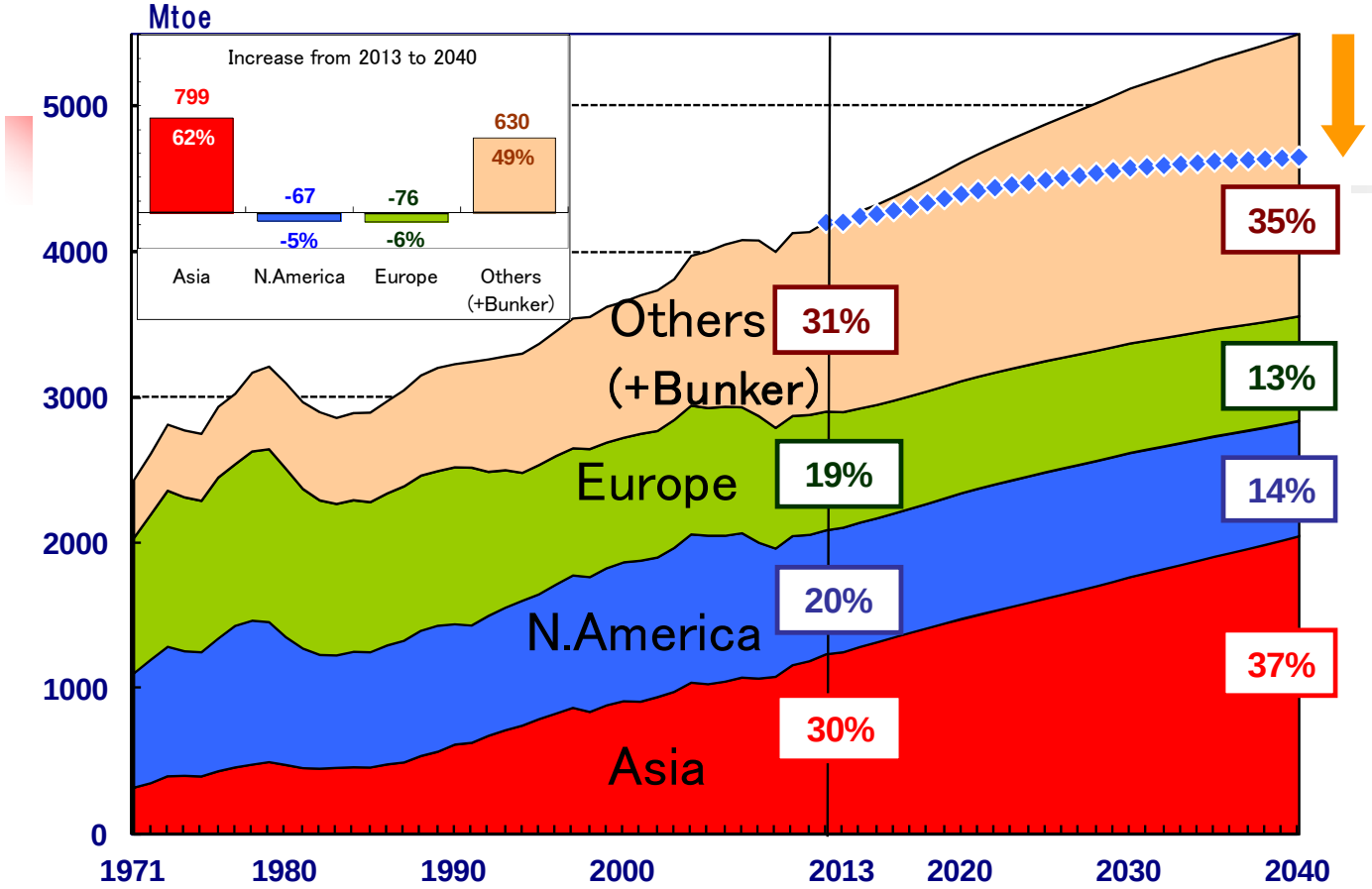
Need for Higher Cost Oil Production



Source: Prepared by IEEJ based on IEA data and others

Oil consumption by region

Reference Scenario (solid)
Advanced Technologies Scenario (dotted)



Saving:
839 Mtoe
(15%)

2013
4,210 Mtoe
(87 Mb/d)
↓
2040
Reference Scenario
5,496 Mtoe
(114 Mb/d)

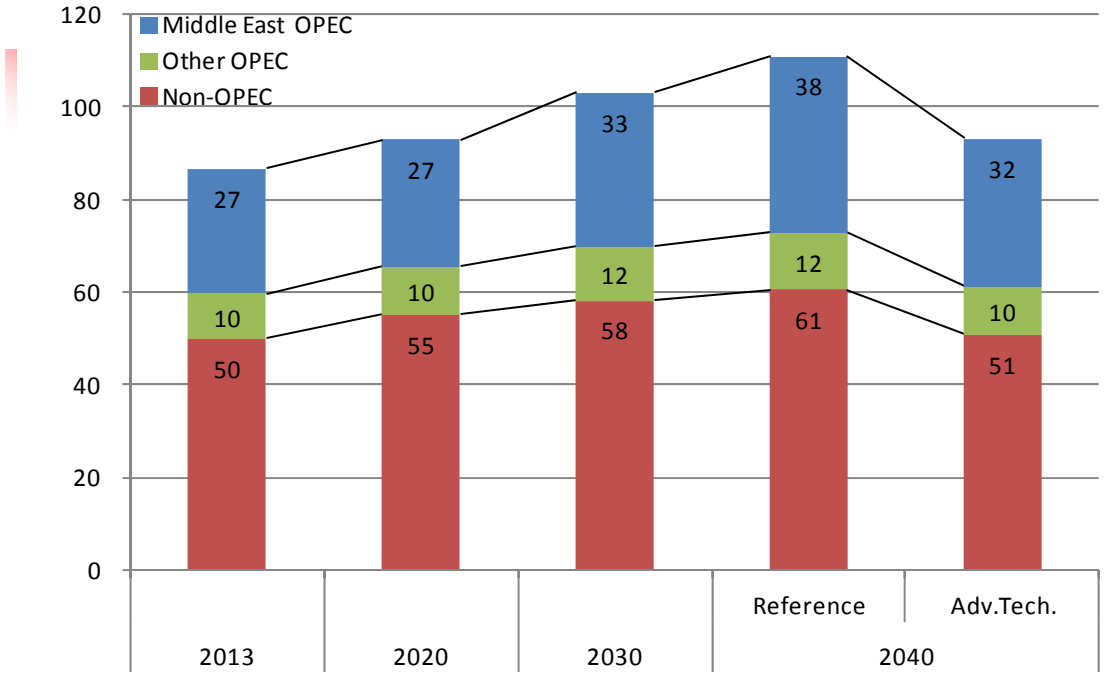
Advanced Technologies Scenario
4,658 Mtoe
(96 Mb/d)

- The share of Asia in the world oil consumption increases from 30% in 2013 to 37% in 2040. About 62% of the global oil growth takes place in Asia.
- In the Advanced Technologies Scenario, the world oil consumption is 840 Mtoe (15%) lower in 2040 compared to the Reference Scenario.

Source: IEEJ, "Asia/World Energy Outlook 2015"

Oil Production Outlook

Reference
Adv. Tech.



Share of the world oil production increase		Reference	Adv.Tech.
	Middle East OPEC	44%	68%
	Other OPEC	10%	7%
	Non-OPEC	42%	11%

OPEC

2013
37 mil. b/d
↓
2040

Reference	Adv.Tech
50 mil. b/d (14mil. b/d inc.)	42 mil. b/d (6mil. b/d inc.)

Non-OPEC

2013
50 mil. b/d
↓
2040

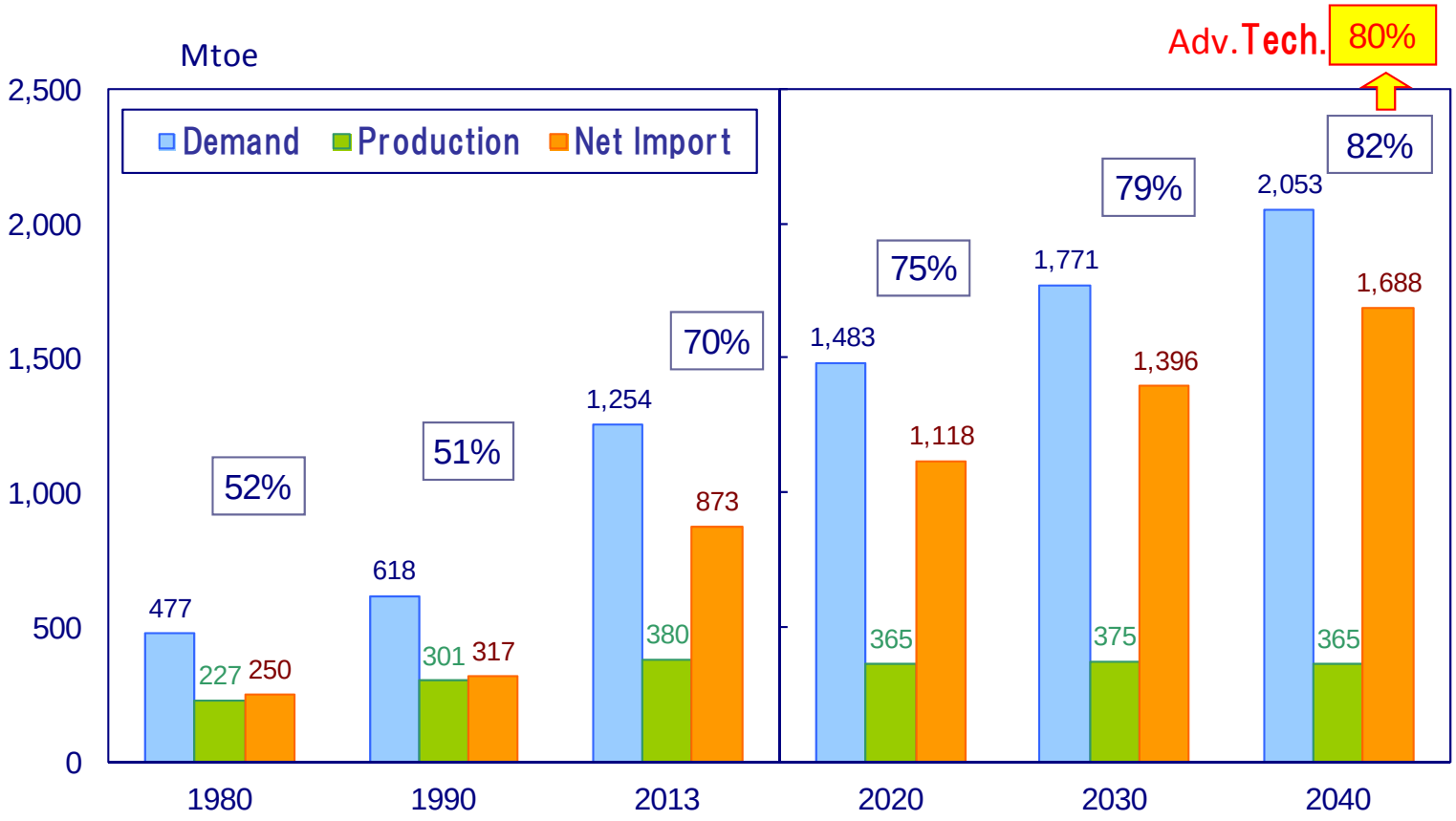
Reference	Adv.Tech
61 mil. b/d (11mil. b/d inc.)	51 mil. b/d (1mil. b/d inc.)

- 50% of the increases in world oil consumption is met by OPEC. OPEC`s share of world oil production in 2040 increase to 44%.
- However, the domestic oil consumption in the Middle East OPEC is also projected to increase significantly. Enhancement of production capacity and improvement of energy efficiency in the Middle East OPEC is necessary to ensure availability of oil supply to the world market.

Source: IEEJ, “Asia/World Energy Outlook 2015”

Oil Demand and Supply in Asia

Reference
Adv. Tech.



Net Oil Import

2013
18.06MB/D
↓
2040
Reference
34.91MB/D
(1.9times)

Adv. Tech.
29.52MB/D
(1.6times)

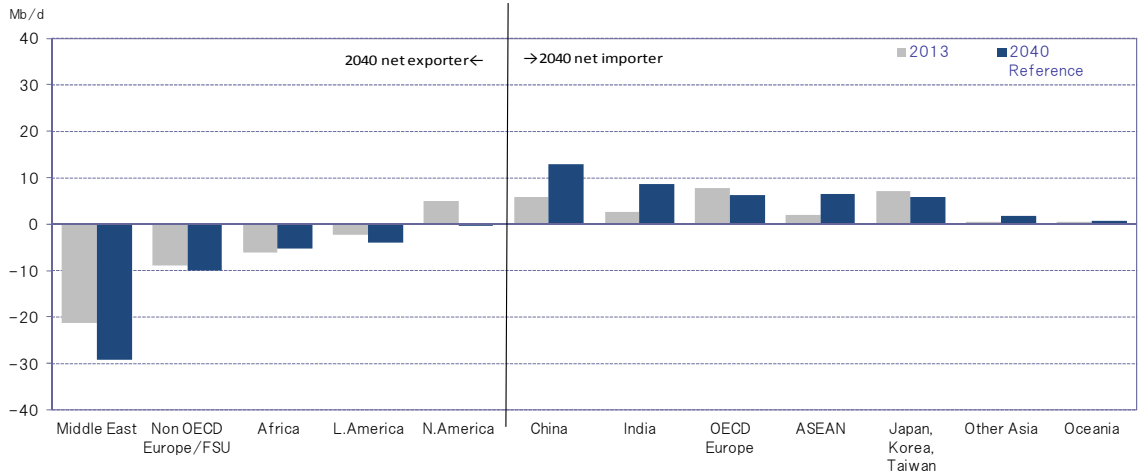
- In the Reference Scenario, net oil import is projected to expand to 1,688 million ton (34.91 mb/d) in 2040 from 873 million ton (18.06 mb/d) in 2013. With the sluggish oil production of in Asia area (China, India, Indonesia), net oil import ratio reaches 82% in 2040.
- In the Advanced Technologies Scenario, oil demand grows at a relatively slow rate, but net oil import ratio still increases to 80% in 2040.

Source: IEEJ, “Asia/World Energy Outlook 2015”

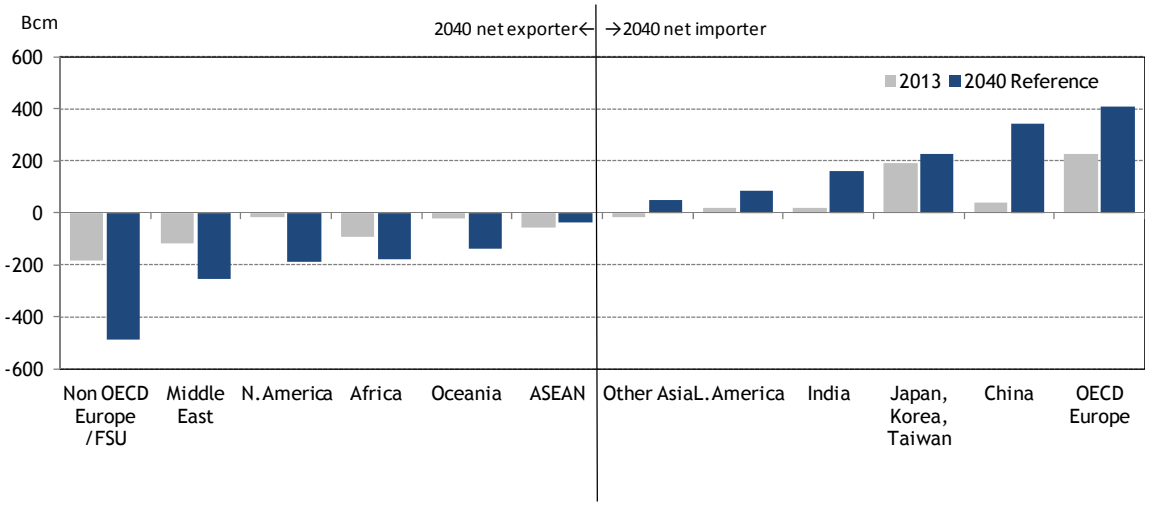
Oil and Natural Gas Net Import/Export

Reference Scenario

Oil



Natural Gas



- While oil consumption expands in Asia up to 2040, North America turns into an exporting region.
- Oil production increase in the Middle East is imperative in correspondence with Asian consumption increase.
- Asia also increases natural gas imports. Exports from North America increase largely.

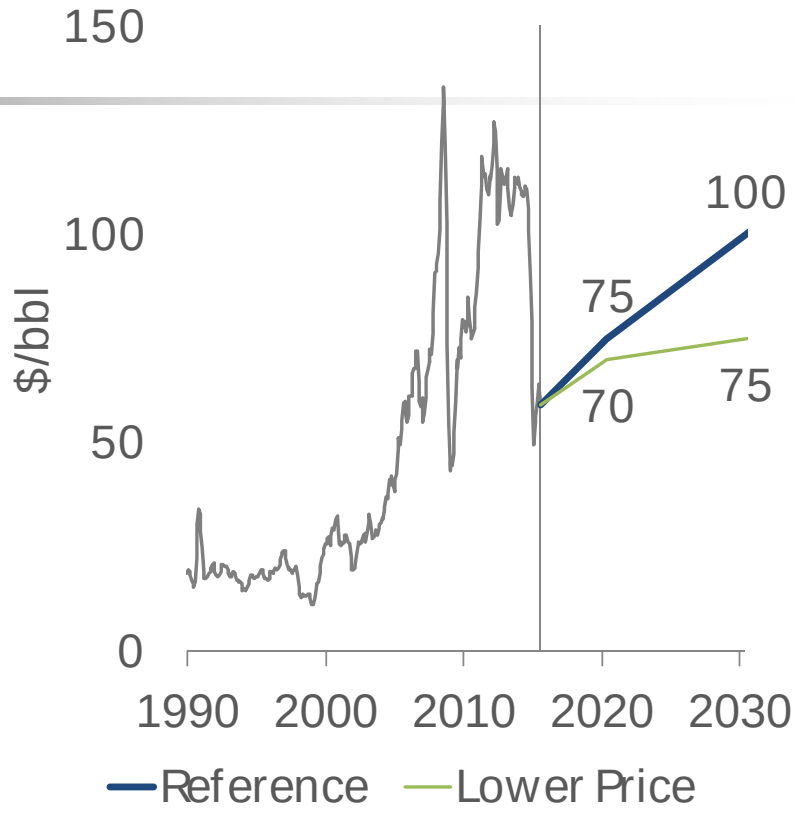
Source: IEEJ, “Asia/World Energy Outlook 2015”

We may see lower prices than in the Reference Scenario

❖ Background of the scenarios

	Reference	Lower Price
Demand	Energy conservation and fuel switching in transport sector progress along with the trend.	Strong energy conservation and fuel switching by non-fossil fuel progress.
Supply	**Conventional resources** Development in each country follows its historical trend. **Unconventional resources** Production growth in the United States declines in and after 2020s. Slow development is seen in other countries.	**Conventional resources** Competition among low-cost producers such as OPEC, Russia, etc. continues. OPEC effectively loses its power as a cartel organisation. **Unconventional resources** Reach the highest levels both inside and outside the United States.

❖ Assumption of oil price



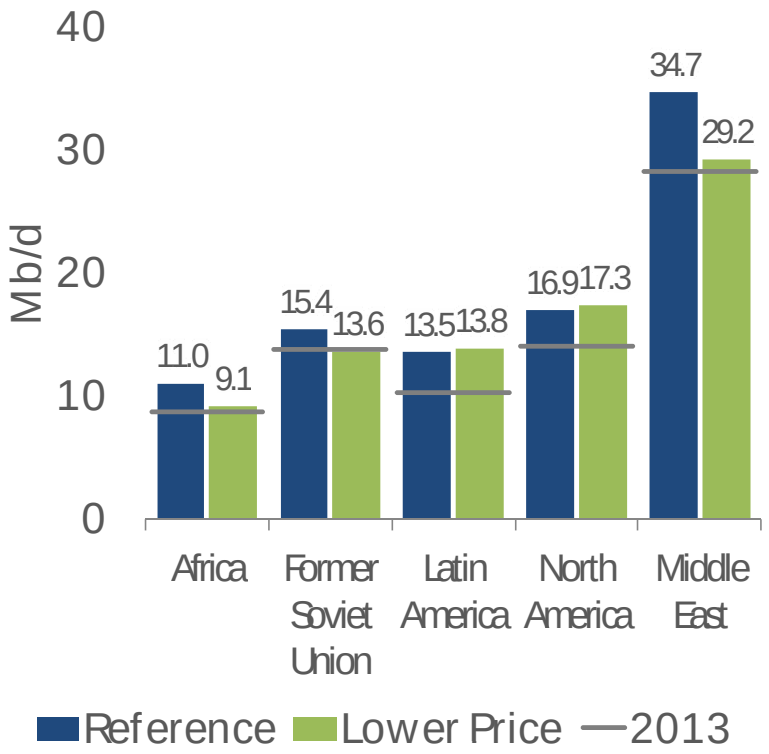
Note: Future prices are in $2014.

Easy supply-demand balance due to factors in supply and demand sides is assumed in the Lower Price Scenario. Real oil price in 2030 in the scenario is premised to be cheaper by 25% than in the Reference Scenario.

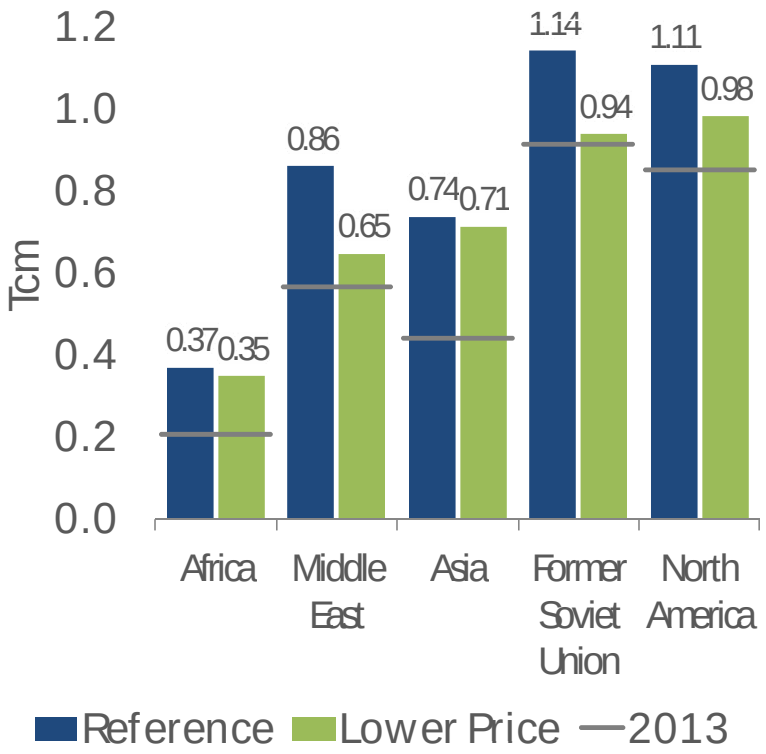
Source: IEEJ, "Asia/World Energy Outlook 2015"

Depressed production in traditional exporting regions

❖ Crude oil production in selected regions [2030]



❖ Natural gas production in selected regions [2030]



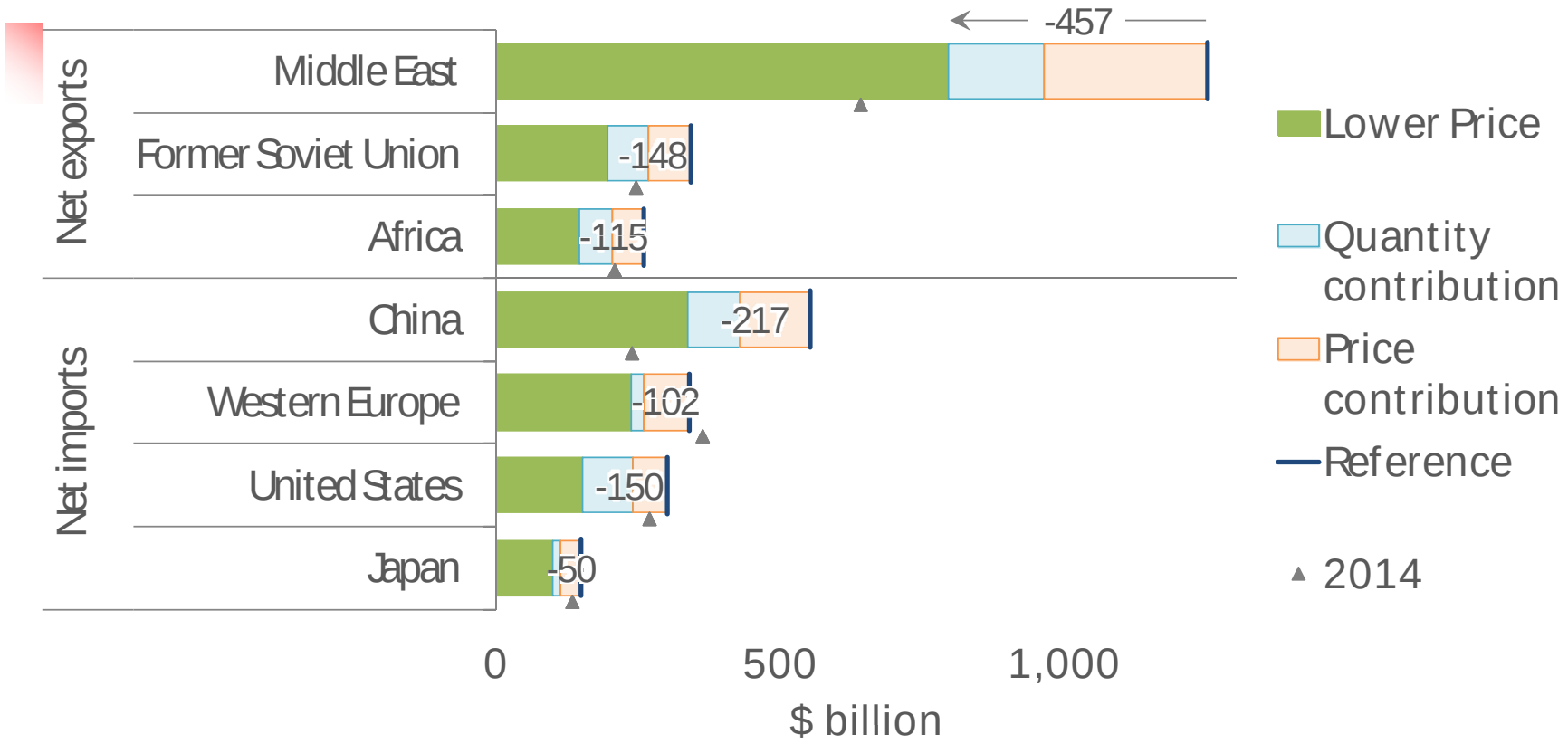
Global oil supply in 2030 is 96.5 Mb/d, increased by just 7.7 Mb/d from today, due to the assumed strong energy conservation and fuel switching to other energies.

Production growth in the Middle East is only 1.0 Mb/d, squeezed by large increases in unconventional oil production in North America and others. Russia faces production reduction by 0.8 Mb/d.

Source: IEEJ, "Asia/World Energy Outlook 2015"

Low oil price impact on exporter and importer

Crude oil net imports/exports in selected regions [2030]



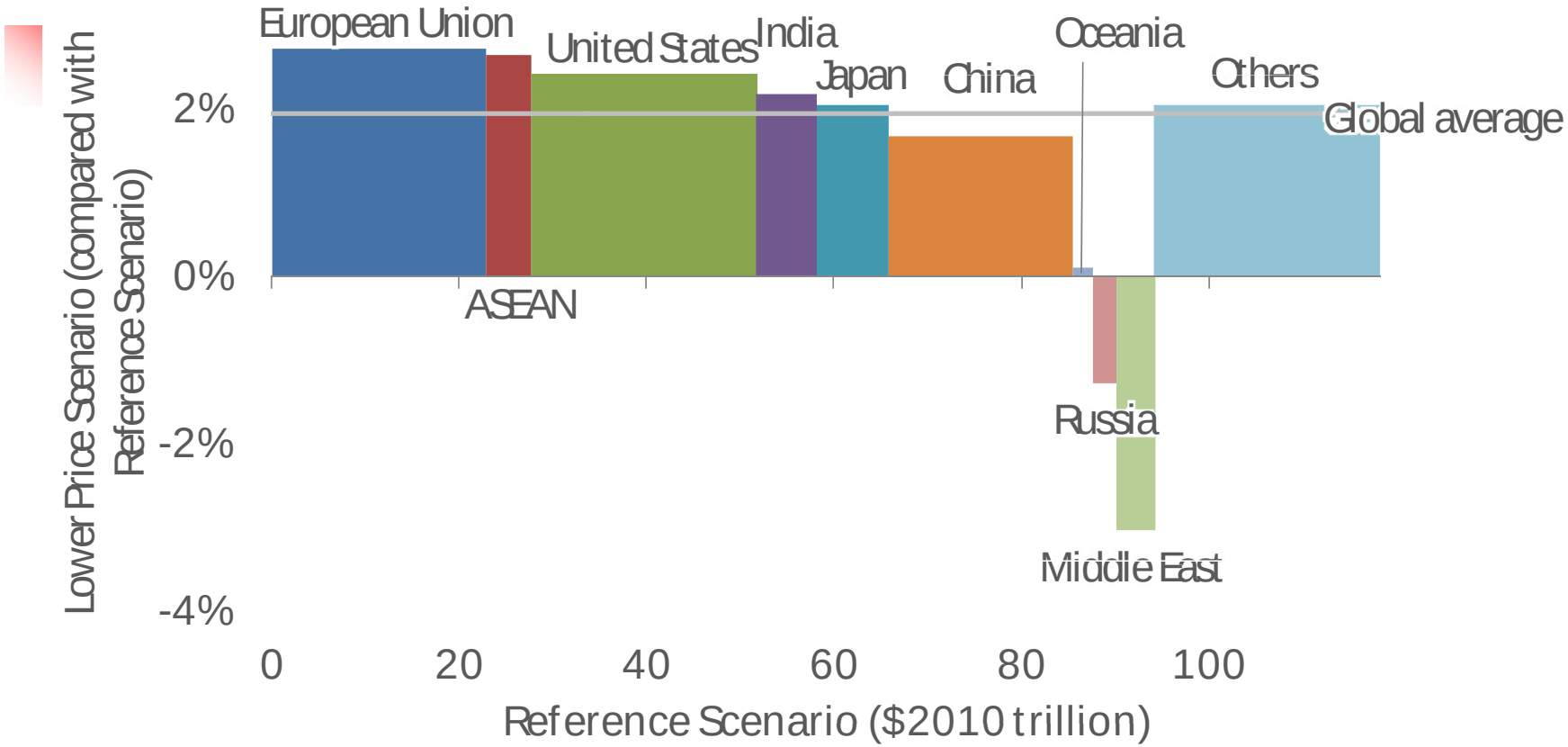
Oil saving, lower oil price and wider use of unconventional resources make international trade of crude oil* 36% less, to $2.8 trillion from $4.4 trillion, in the Reference Scenario. * Among the modelled 15 regions. Nominal value.

China is the biggest winner in terms of saving of net import spending, acquiring $217 billion. The United States follows with $150 billion. Net export earning of the Middle East decreases by $457 billion.

Source: IEEJ, "Asia/World Energy Outlook 2015"

Lower oil price impact on global GDP

❖ Changes in real GDP [2030, compared with the Reference Scenario]



Lower prices and consumption of oil and natural gas vitalise importing countries' economies through less outflow of national welfare and improvement of real purchasing power. The global economy expands by 1.9%.

The situation exerts downward pressure on oil producing countries in the Middle East and others, whose revenue depends heavily on energy exports.

Source: IEEJ, "Asia/World Energy Outlook 2015"

Instability in the Middle East

Terrorist Attacks In Paris

Uncertainty over Middle East Peace issues

Iraqi situations after the war

Tensions on Iran Nuclear development

Rising energy demand and its impacts

Immigrants to Europe

Post-sanction Iran?

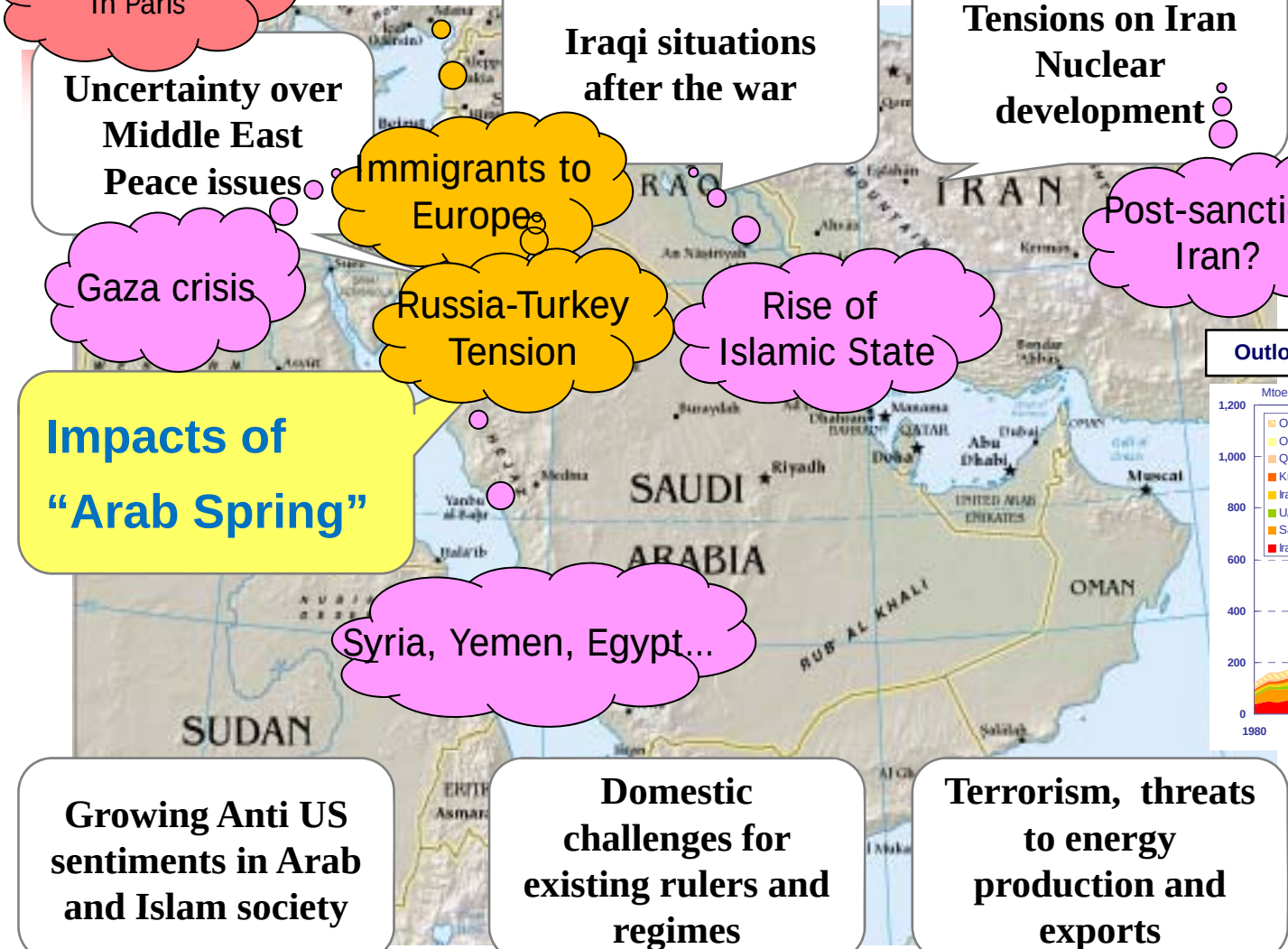
Gaza crisis

Russia-Turkey Tension

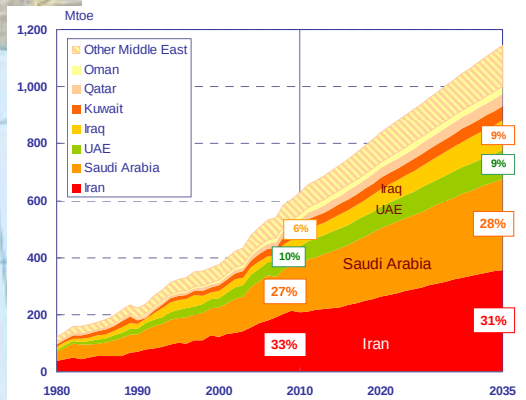
Rise of Islamic State

Impacts of "Arab Spring"

Syria, Yemen, Egypt...



Outlook for energy demand in Middle East



Growing Anti US sentiments in Arab and Islam society

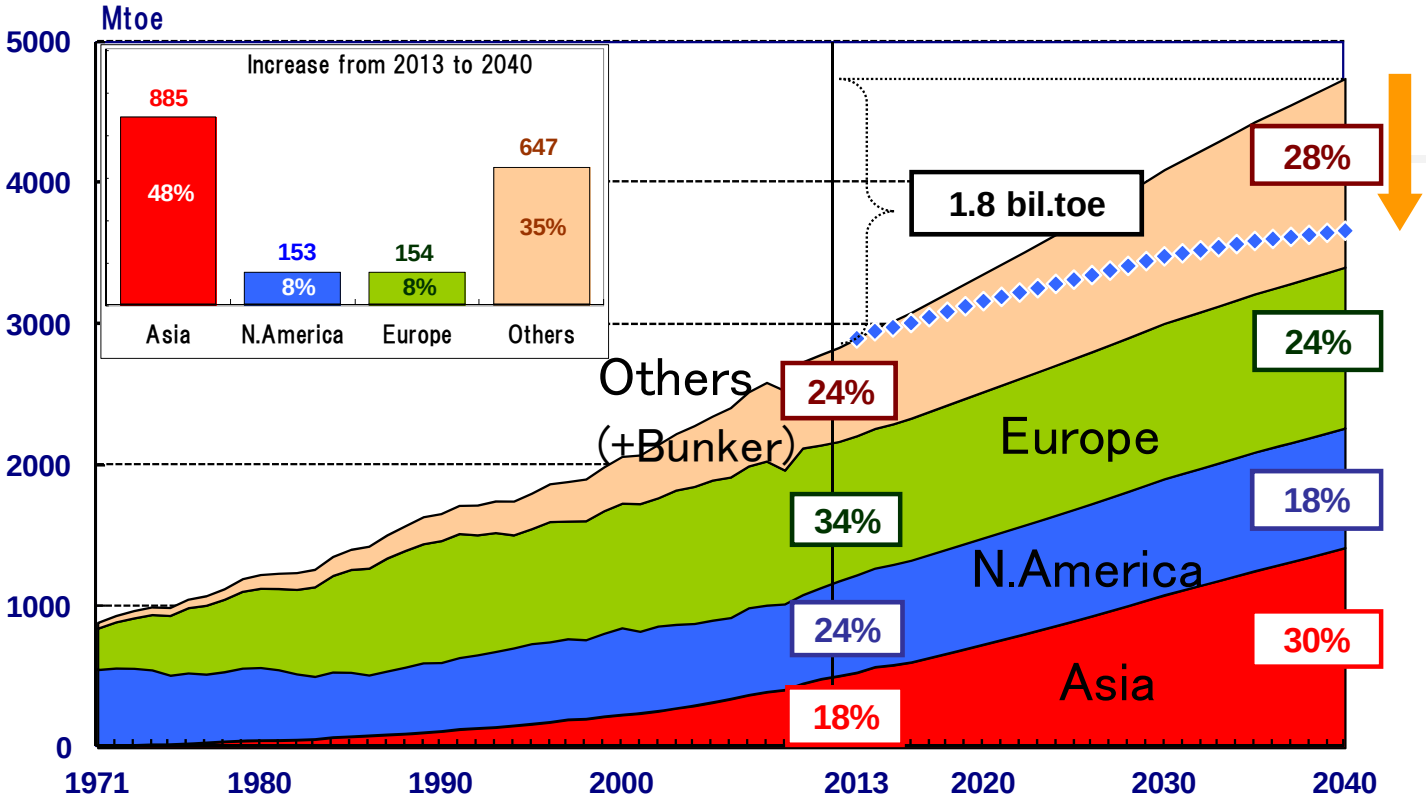
Domestic challenges for existing rulers and regimes

Terrorism, threats to energy production and exports

Source: Prepared by IEEJ

Natural Gas Consumption by Region

Reference
Adv. Tech.



1.08 bil. toe
(23%)
Reduction

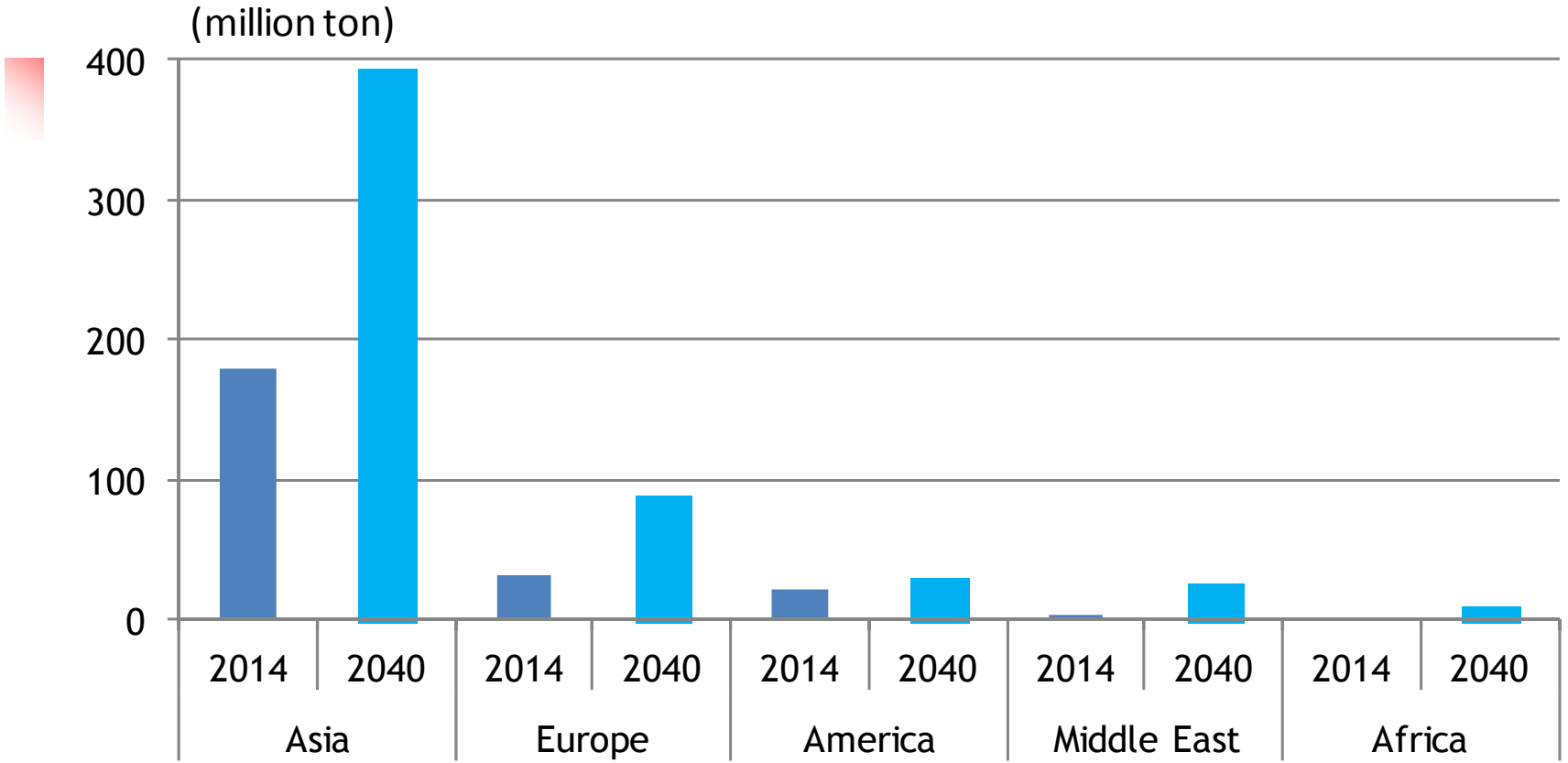
2013
2.9 billion toe
(3.5 trillion m³)
(2.4 bil. tons LNG)
↓
2040
Reference
4.7 billion toe
(5.8 trillion m³)
(3.9 bil. tons LNG)
Adv. Tech.
3.7 billion toe
(4.4 trillion m³)
(3.6 bil. tons LNG)

- The world natural gas consumption is expected to increase from 3.5 trillion cubic meters (tcm) in 2013 to 5.8 tcm in 2040, a 1.6-fold increase.
- In the Advanced Technologies Scenario, natural gas consumption is 1.4 tcm lower than the Reference Scenario. Despite projected savings, natural gas consumption continues to grow in the Advanced Technologies Scenario suggesting further needs of energy resources development.

Source: IEEJ, “Asia/World Energy Outlook 2015”

LNG imports Outlook

Reference Scenario



- World LNG demand expands from 239 million tons in 2014 to 547 Mt in 2040 (2.3 times).
- Asia's LNG demand increases by 214 Mt, accounting for about 70% of the world's LNG demand growth, whereas the growth in Europe (56 Mt) accounts for around 20%. LNG import from North America to Latin America increases by 6 Mt.
- LNG supply capacity is sufficient to meet demand if new LNG projects starts on schedule in the future.

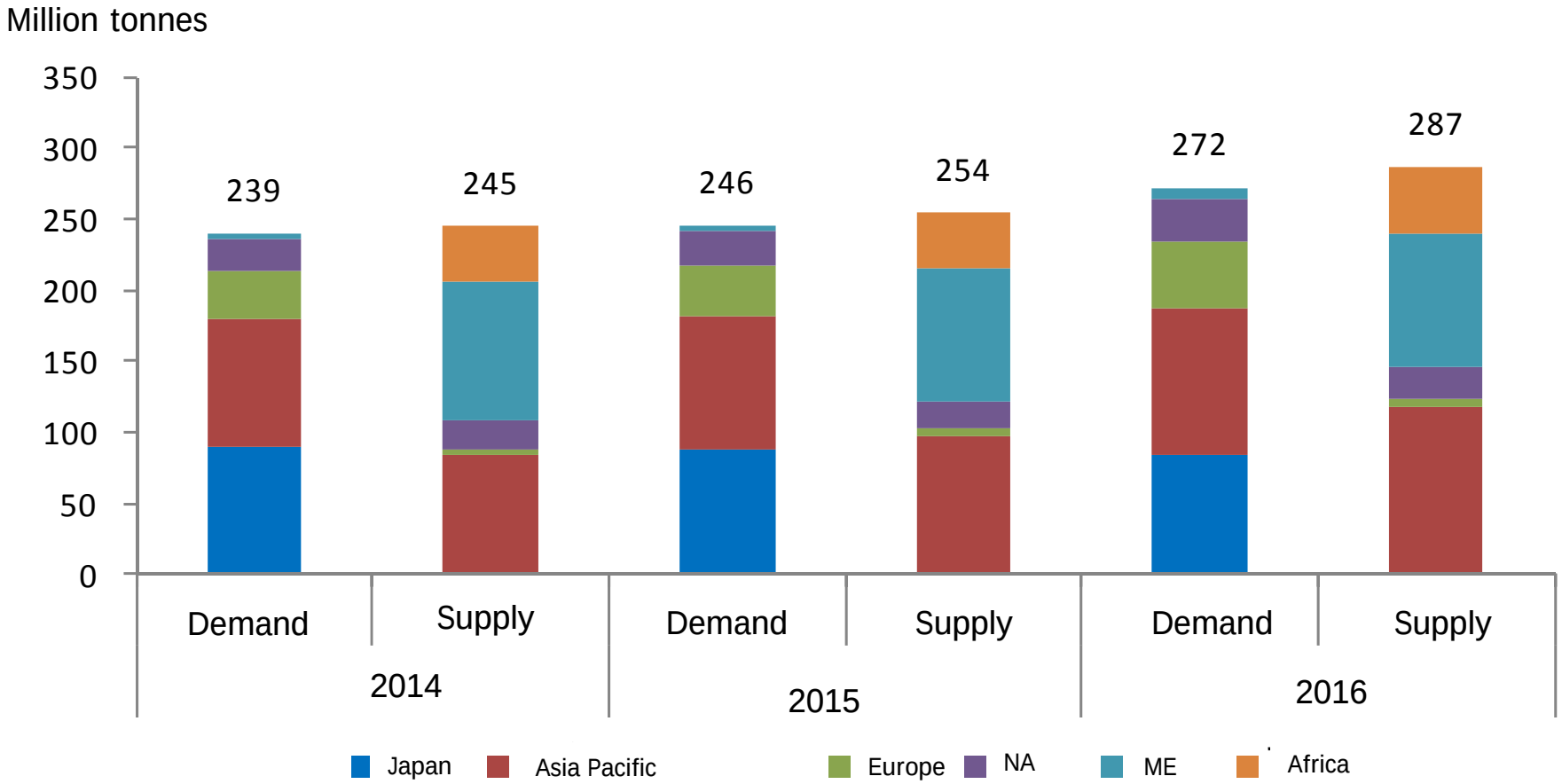
Source: IEEJ, "Asia/World Energy Outlook 2015"

Factors to affect LNG Demand in Asia

- Economic growth
- Lower price
- Future of nuclear power
- Competition against coal
- Need to protect environment
- Pipeline vs. LNG

Global LNG Balance up to 2016

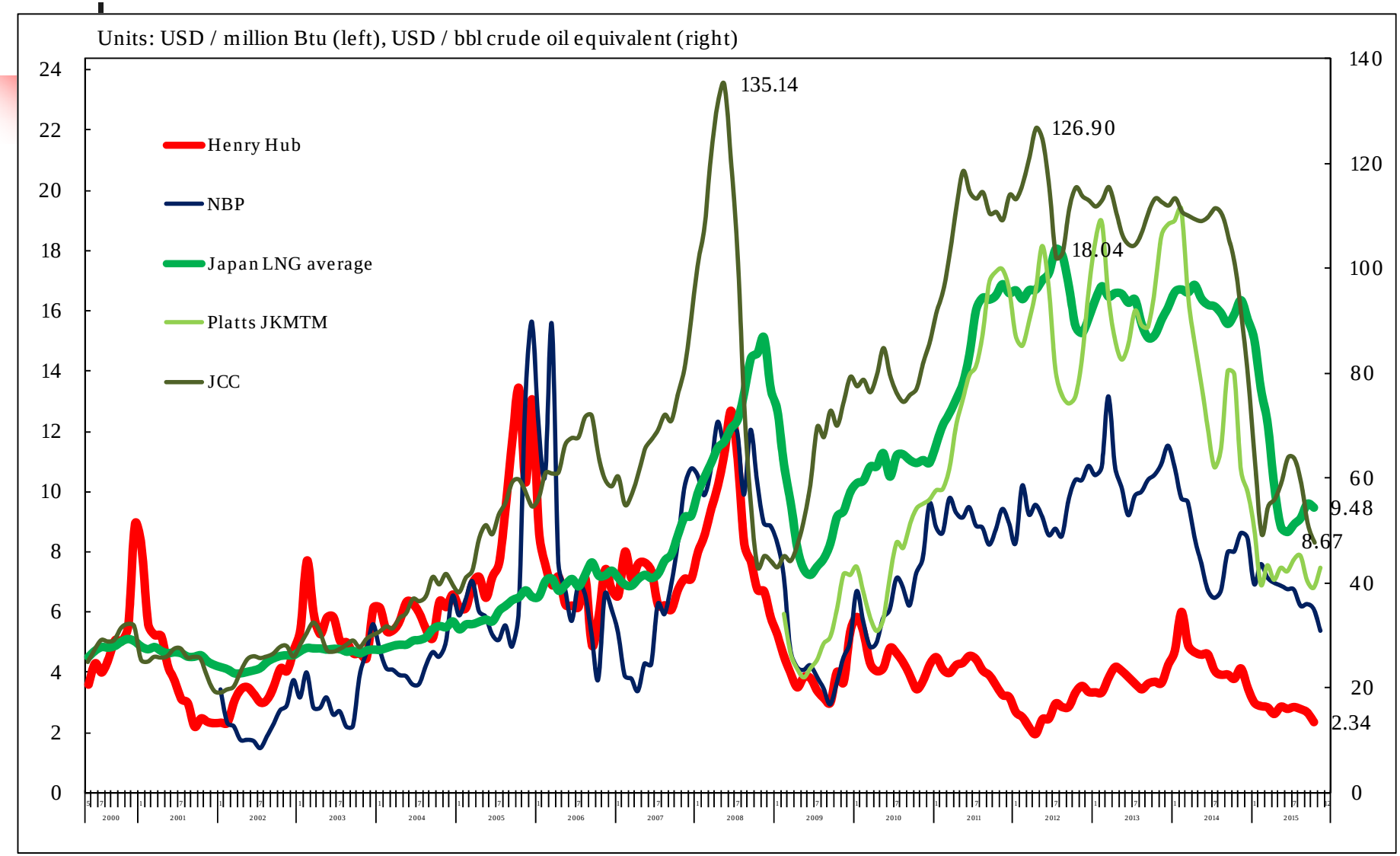
Ample supply continues to exist in the short term



Source: IEEJ, July 2015

World gas prices by region

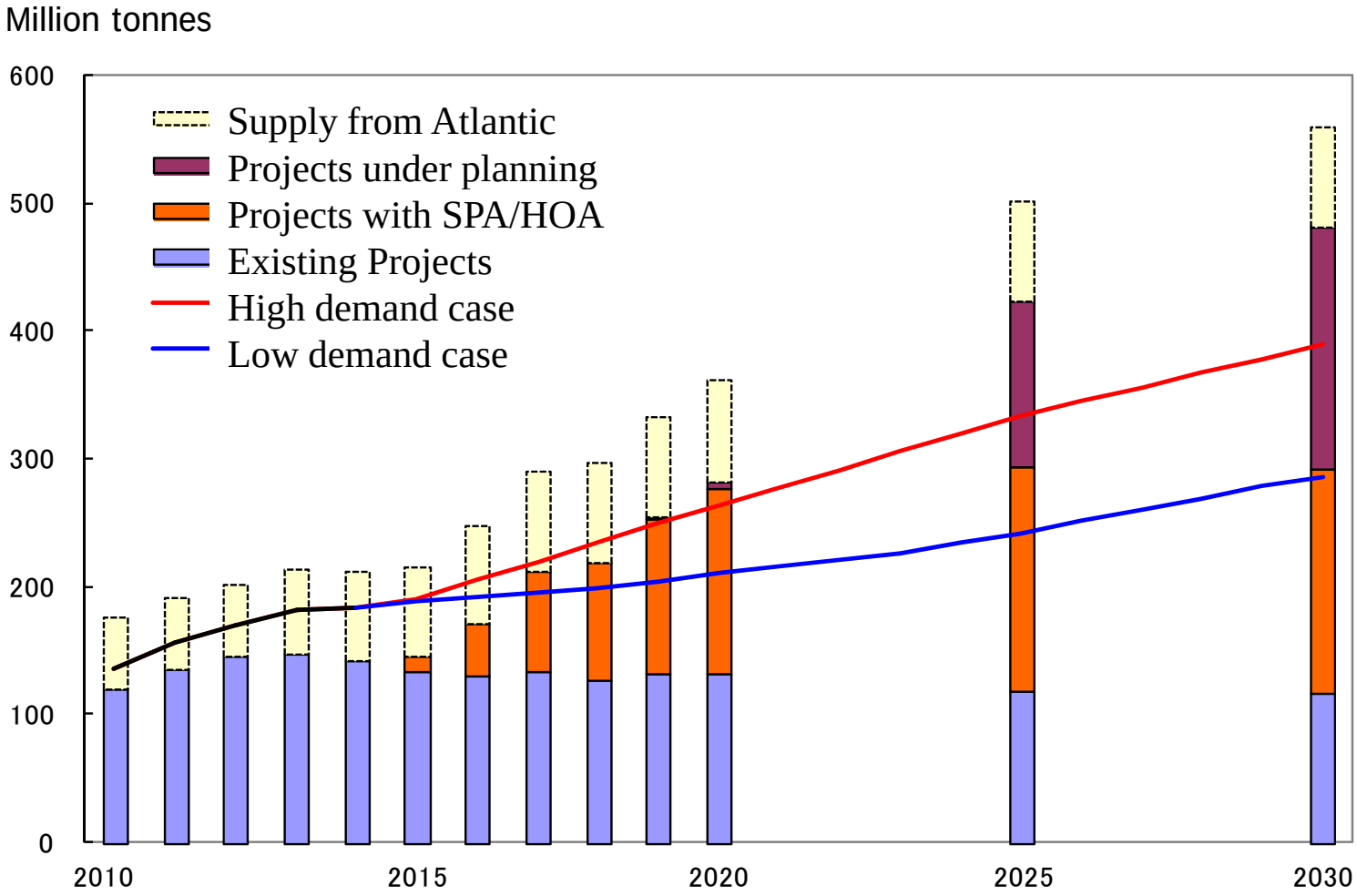
Price gaps by regions significantly narrowed



Source: US EIA and IEA

LT LNG Supply-Demand Outlook for Asia

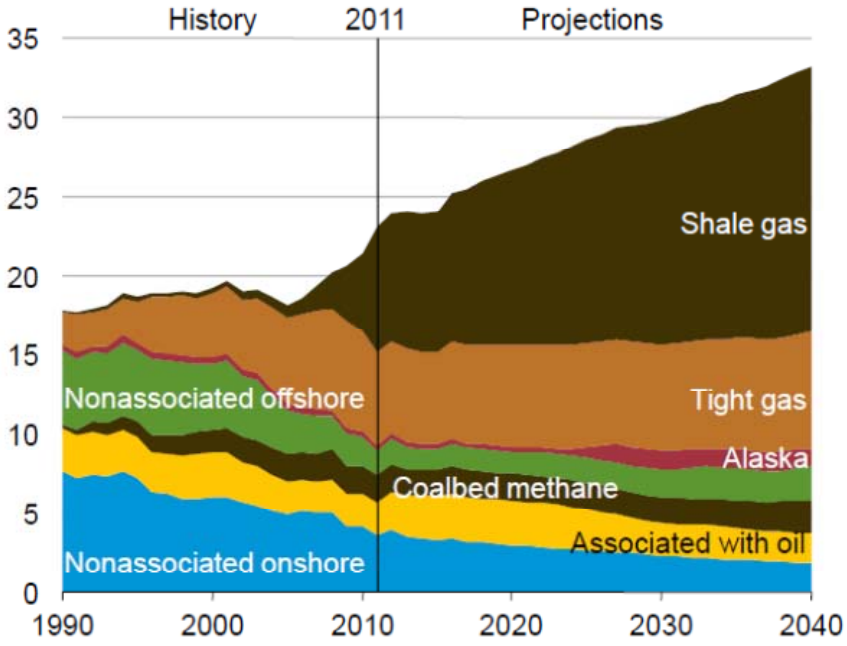
Supply potentials can continue to exceed demand



Growing expectations for US LNG exports

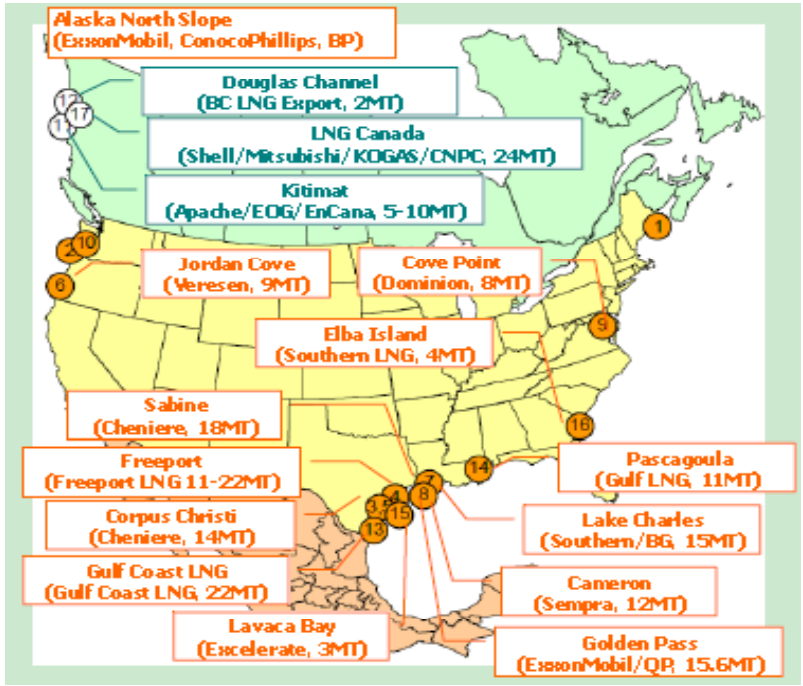
- Export projects with total capacity of more than 200 mil tonnes are on the list.
- Government export permission over 80 million tonnes.
- FERC permission exceeded 50 million tonnes.

US natural gas production outlook



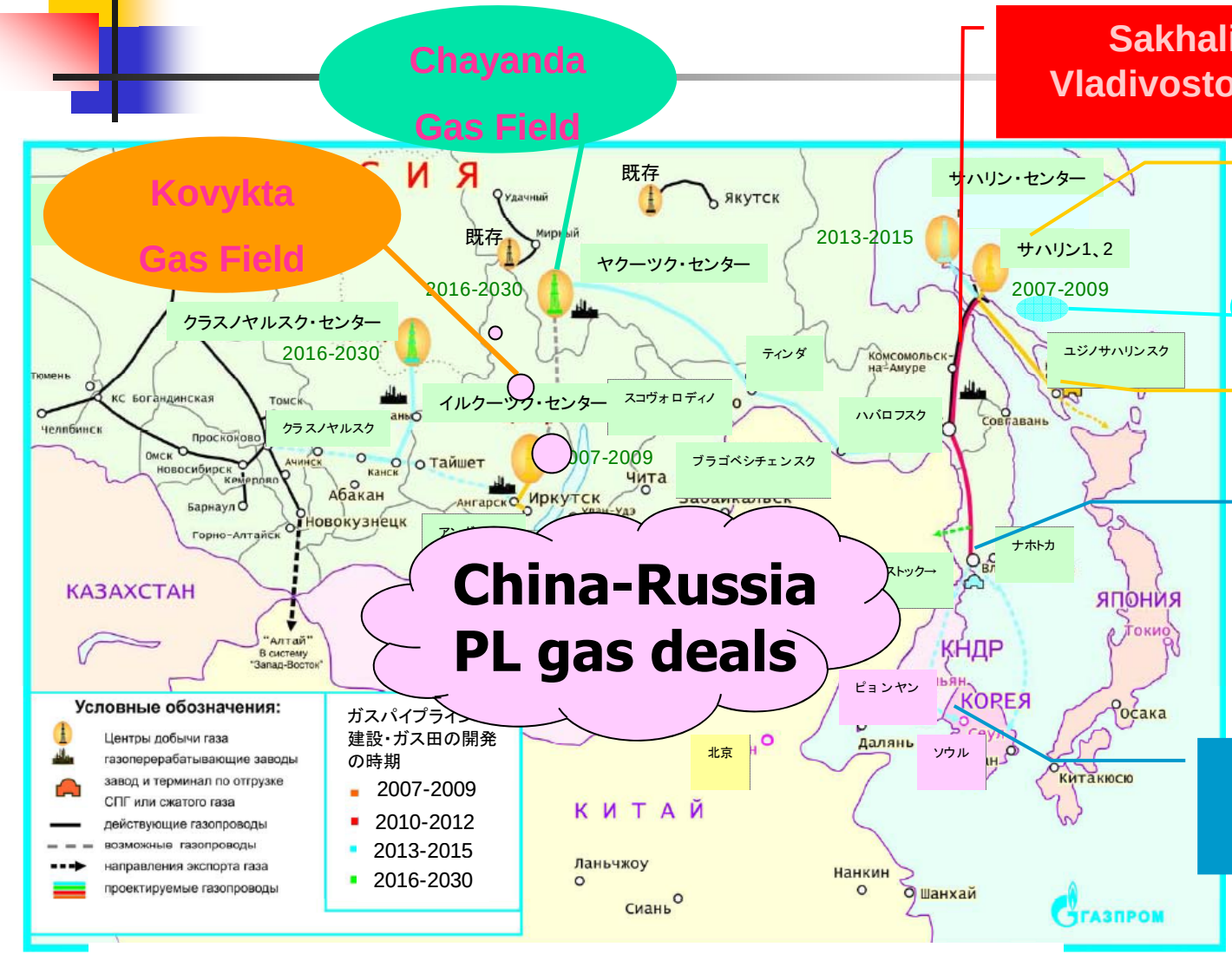
Source: EIA

LNG exports projects in North America



Source: FERC; DOE

Gas development PJs in East Siberia and Sakhalin



（Source）Prepared by IEEJ based on Eastern Gas Program of Gazprom

Key Points for the Asian LNG Market
Up to 2020 and beyond

■ Demand side

- Demand in Japan will decline subject to the degree of restart of nuclear power plants.
- Demand in Korea (and Taiwan) will depend on nuclear, competition with coal and economy.
- China's gas demands may grow, spurred by action to curb air pollution. But key question is economic growth trend. LNG demands will basically expand, but economy, Russian PL and domestic supplies could slow growth.
- **Overall, Asia's LNG demand will see some growth** **← The impact of the fall in LNG price? Competitive and flexible procurement of LNG will be a key.**

■ Supply side

- US LNG export permission will exceed 80 million tonnes.
- New LNG projects are to be launched in Australia, possibly in Canada and East Africa as well.
- Russian gas exports (PL) to China may expand. Russia will try to reinforce sales in Asian markets, depending on the Ukraine situation.
- Risk factors on the supply side include geopolitical situation and others.
- **Overall, there is enough (or more than enough) supply potential to cover the increase in demand.**

→ The impact of the fall in oil and LNG prices?

The 4th LNG Producer- Consumer Conference

- More than 1,000 participants from more than 50 countries, regions, etc. including Ministers, top executives of LNG related industries.
- The first occasion to discuss the sound development of LNG market under lower oil and Asian LNG prices.
- Issues which attracted the participants' attention include: Japan's long term energy mix; China's economic slowdown and lower LNG demand; forthcoming LNG supply growth from US and Australia; and impacts of low oil price on both supply and demand of LNG.
- Under the prevailing uncertainties, LNG buyers highlighted the importance of LNG procurement at competitive price and greater flexibility.
- Both producers and consumers of LNG agreed the importance to overcome the challenges to realize the sound development of LNG market in Asia.

Rationale of JCC pricing questioned

- The rationale for JCC pricing existed at the time of its introduction (gas, competing with oil in power sector)
- However, the past market development made the rationale diminishing, as oil is already replaced by alternative energy in power sector and thus not competing with oil
- Periodical price reviews in JCC contracts not quick enough to reflect demand/supply of gas
- JCC pricing determines the level and volatility of Asian LNG price, not in relation to gas supply-demand situation
- Thus, Asian buyers started to explore new ideas for gas pricing that can better reflect gas market fundamentals particularly after 2011
- But recent low oil price environment made things more complicated.

LNG Pricing Options for Asia

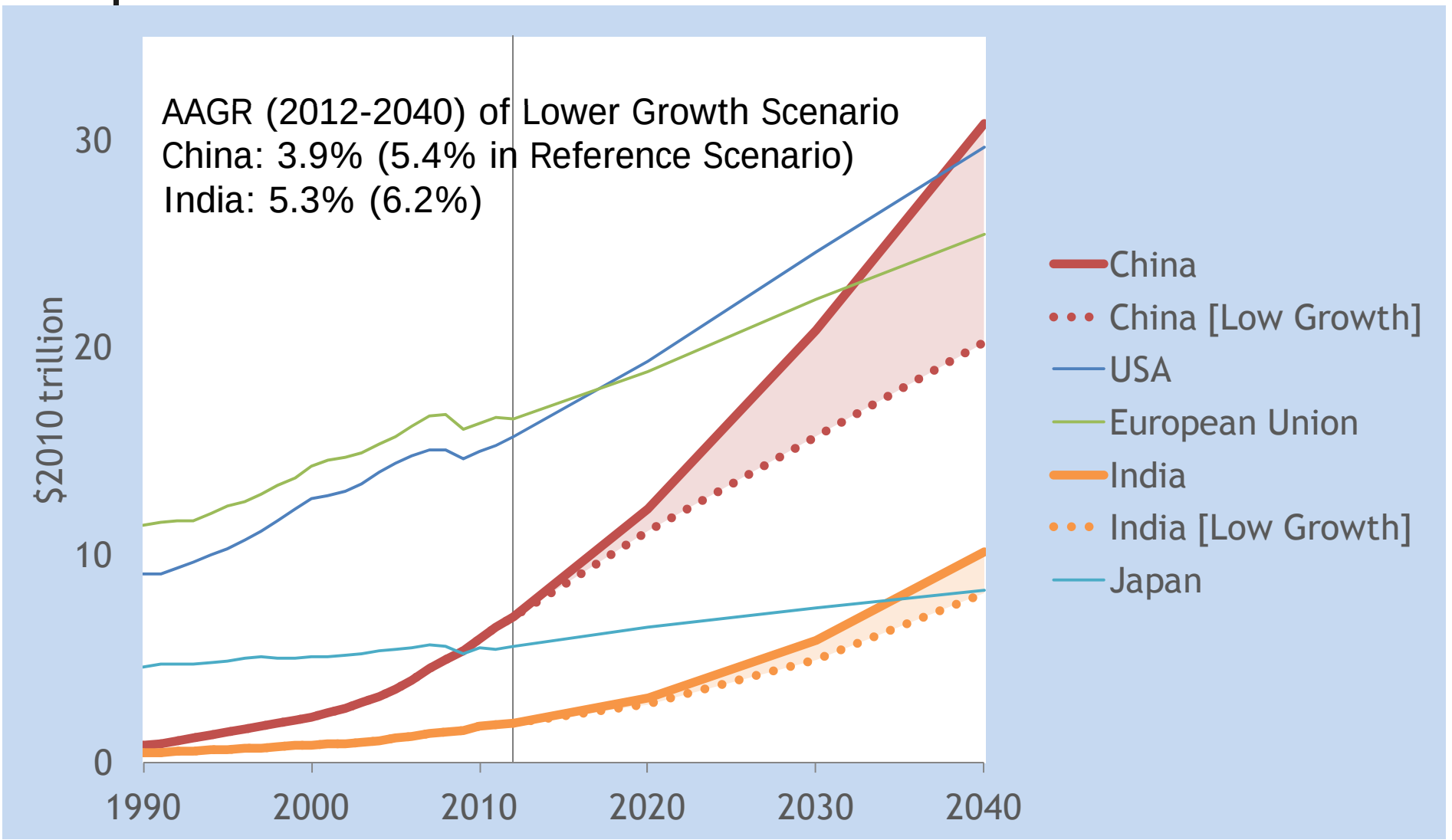
	Gas on gas competition pricing **Hybrids**			Indexation	
	Domestic Hubs in Asia	Henry Hub, NBP	Spot LNG	Oil	Other fuels (Electricity, Coal)
Advantages	• Possible to reflect regional market balance	• Already available • Possible lower prices at high oil price period	• Already available	• Possibly the quickest solution through modification of slope, S-curve, etc.	• Rational for power generation
Disadvantages	• Not yet available • Higher volatility	• Higher volatility • Asia market balance not reflected	• Higher volatility • Limited liquidity (so far)	•Gas market balance not reflected	• Lack of power market liquidity

- Rationality of JCC pricing being questioned
- Low oil price environment, a new complicated factor
- Establishing benchmark pricing(s) through hubs in Asia and/or spot LNG pricing most rationale for Asia in the long run

Diversification of pricing likely to evolve

- Given the dominance of the existing contracts, JCC pricing likely to remain dominant mechanism in Asia at least up to early 2020s
- But tide is changing:
  - ✓ Prevailing over-suppled market
  - ✓ Inflow of US LNG with HH pricing will increase in Asia
  - ✓ Spot/short-term trading continue to grow
  - ✓ Initiatives to create hubs in Asia
  - ✓ Power and gas market reforms in Japan and Asia
- Major Asian buyers such as JERA have a strategy to diversify pricing
- Buyers continue to search for alternatives to JCC and the share of JCC pricing will be reduced
- So far there is no clear answer as to what is the best alternative, and various options will be tested by buyers and sellers

GDP Growth Trajectories



Source: IEEJ, "Asia/World Energy Outlook 2014"

Impacts of Low Growth (1)

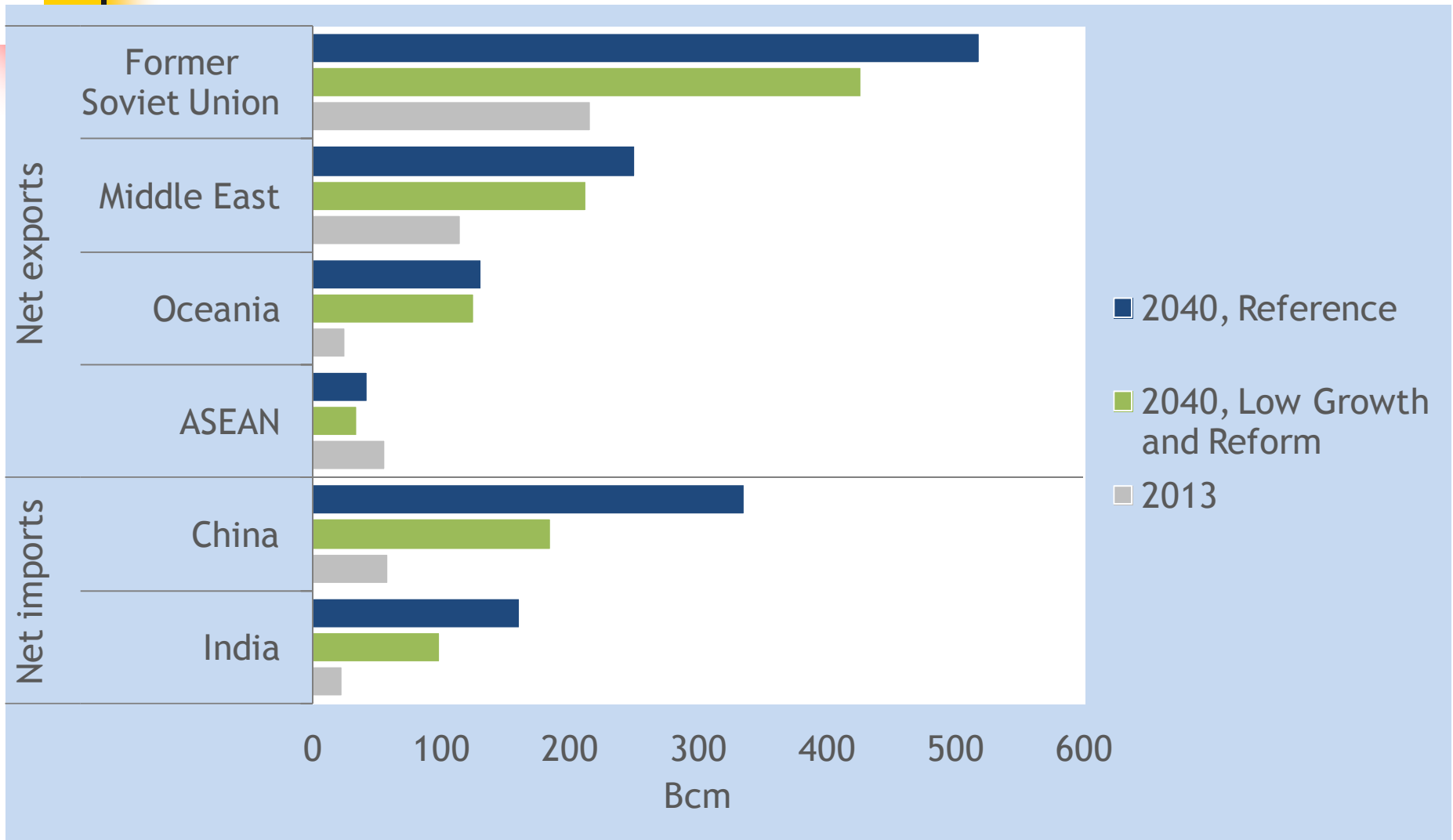
❖ Net Export (Import) of Crude Oil

Middle East exports will be affected most seriously, reduced by 2.5-6.9 MBD in Reference Scenarios in 2040.

Source: IEEJ, “Asia/World Energy Outlook 2014”

Impacts of Low Growth (2)

❖ Net Export (Import) of Natural Gas



FSU export will be affected most seriously, reduced by 18% from Reference scenario in 2040.

Source: IEEJ, "Asia/World Energy Outlook 2014"

Conclusion

- **Oil price likely to remain volatile, while oil market may continue to see over supply in the short term**
- **Asia LNG market also sees over supply situation in the short/medium term. But uncertainties emerging under low oil price environment.**
- **But in the medium and long term, both oil and LNG market have multiple uncertainties. The pendulum may swing back.**