# The Changes in the Global Energy Trends and their Implications on Businesses

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# Major Changes in the Global Energy Trends

1. The End of Cheap Oil under the Circumstances of Rising Oil Demand in Emerging Economies and Higher Geopolitical Risks in the Middle East

2. Intensification of Gas-to-Gas Competition due to the "Shale Gas Revolution"

3. China with Larger Impacts on Energy Security and Climate Change Mitigation

4. Nuclear and Renewable Energy Facing New Challenges

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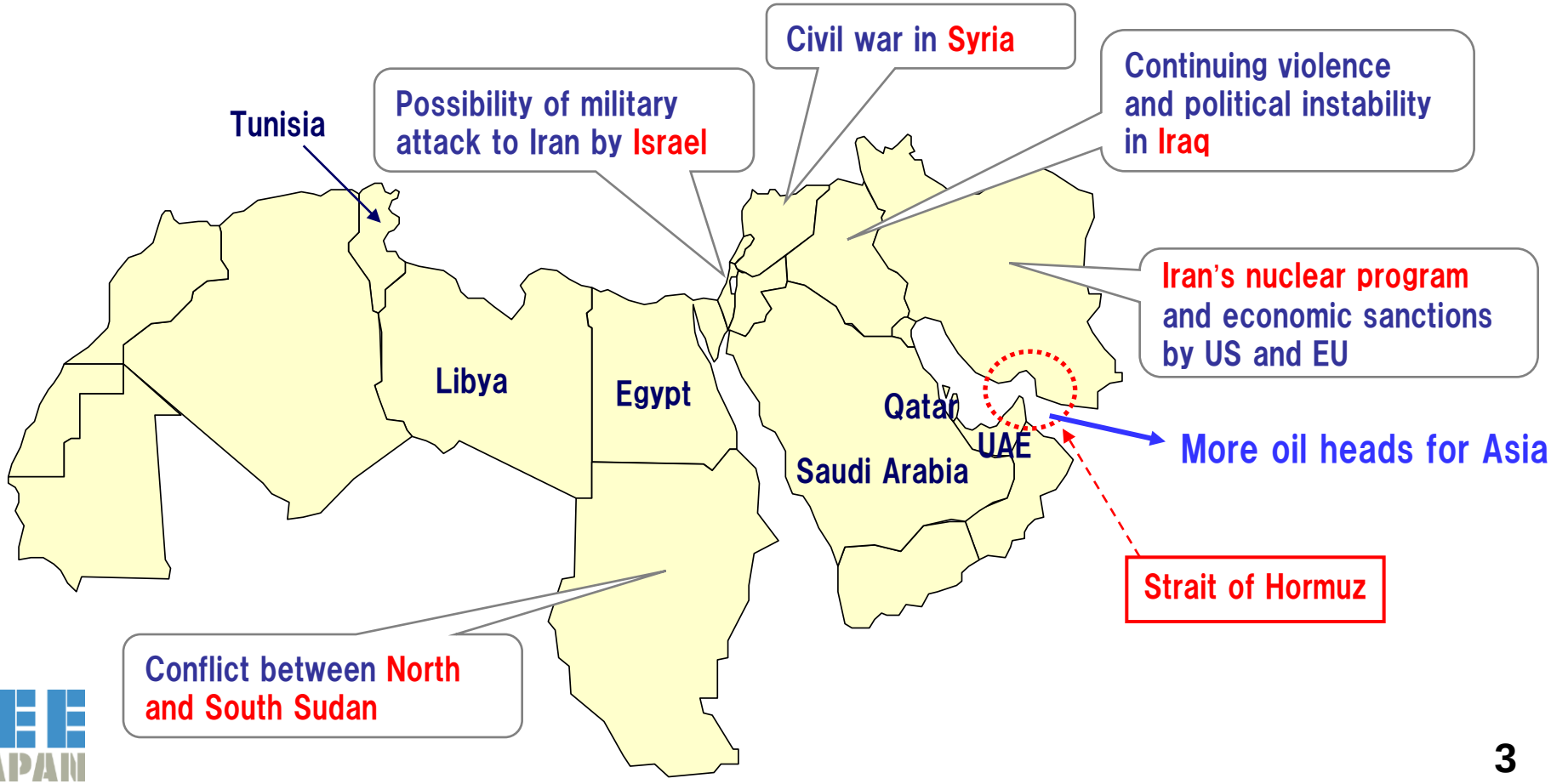
# Changes in the Global Energy Trends (1)

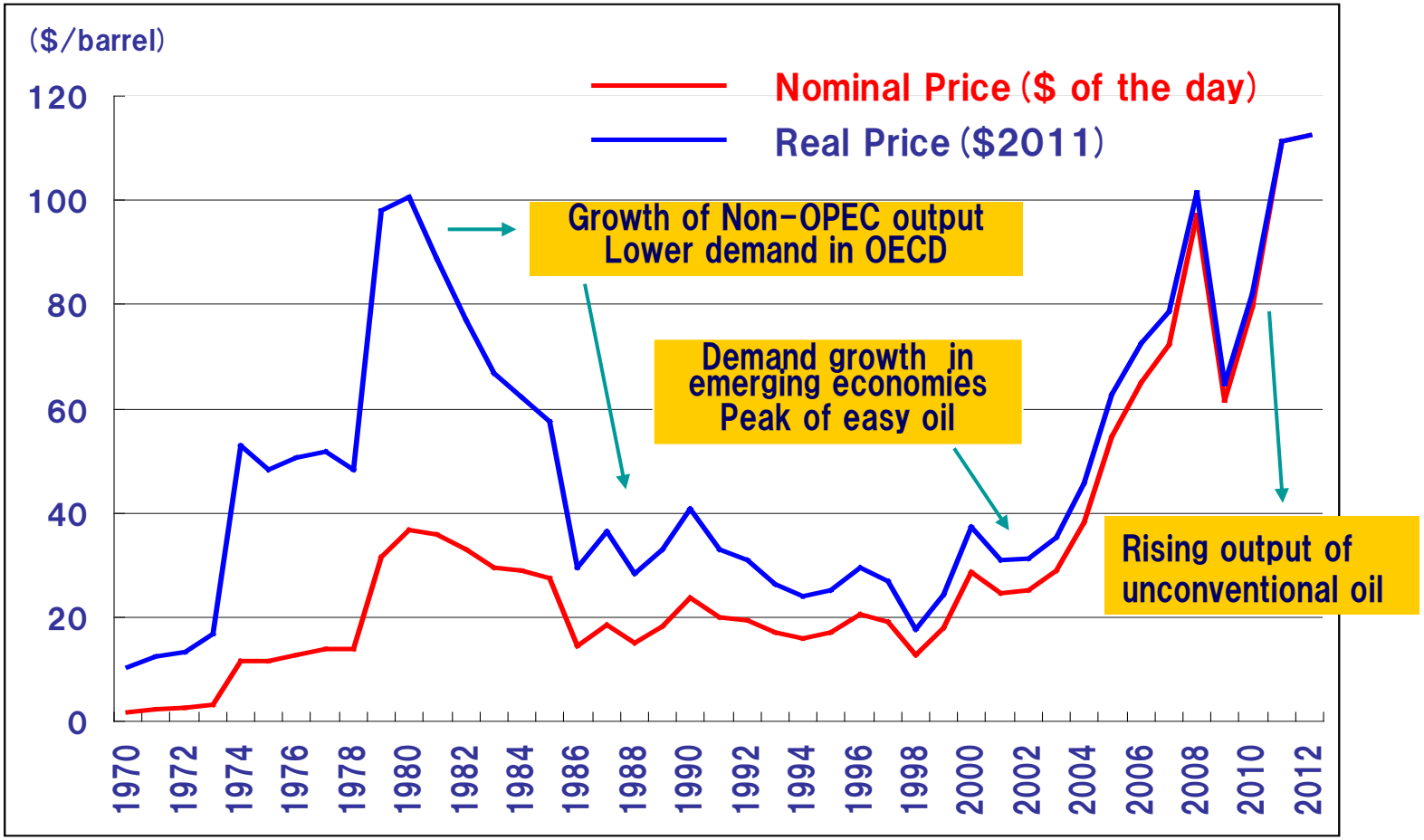
## Higher Uncertainties of Oil & Gas Supply from the Middle East

- -Spreading of "Arab Spring" from North Africa to the Middle East
- -Increasing geopolitical risks due to the Iran's nuclear crisis
- -Increasing concerns about energy security for Asian countries



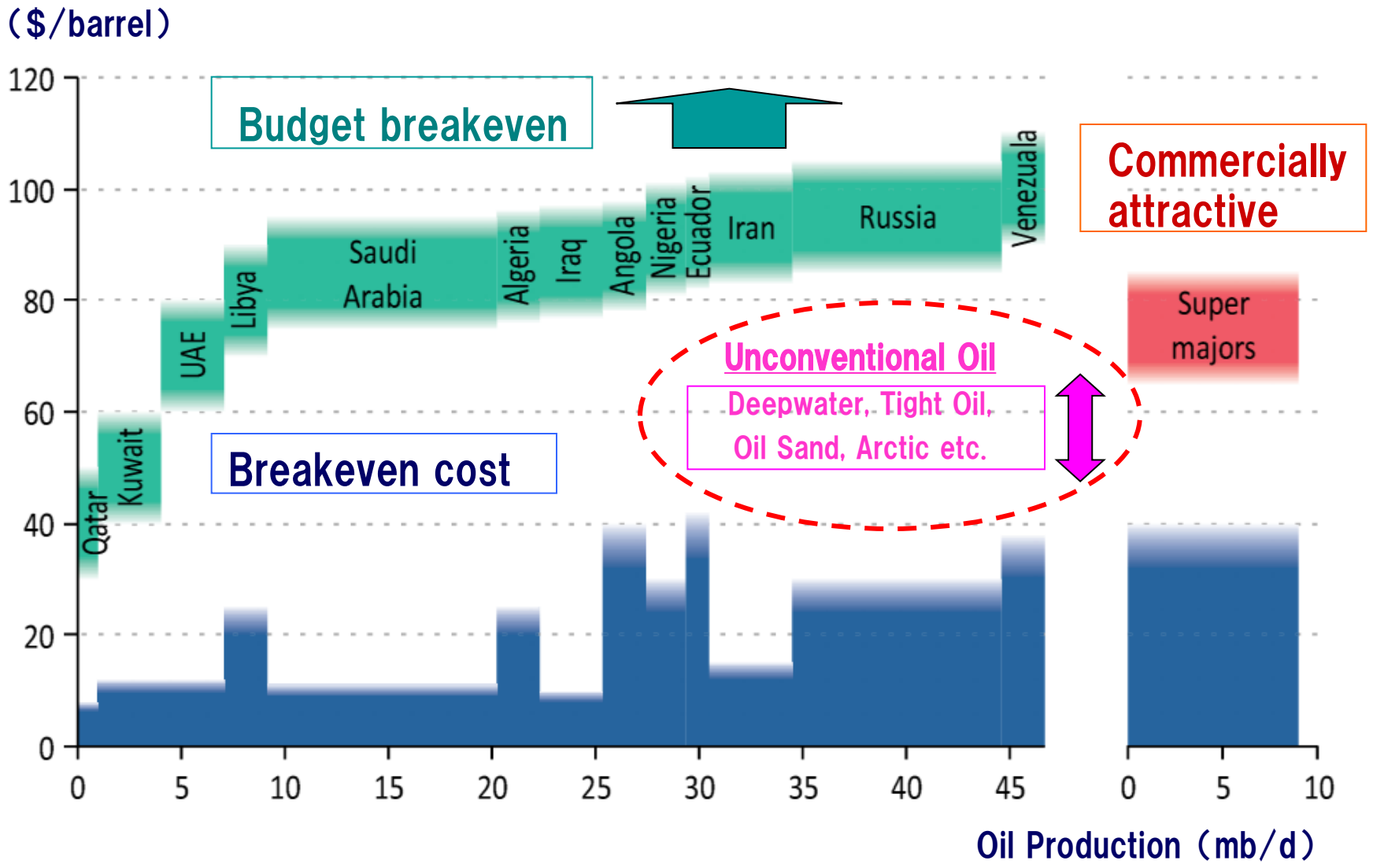
# Historical Trends of Crude Oil Price

- High oil price and technological innovation have promoted to develop unconventional resources of shale gas, tight oil, and oil sand as well as in the deepwater and Arctic frontier regions.




Note: 1970-83 Arabian Light Posted price, 1984-2012 Brent dated
Source: BP "Statistical Review of World Energy 2012"

# The End of Cheap Oil, but Very Volatile



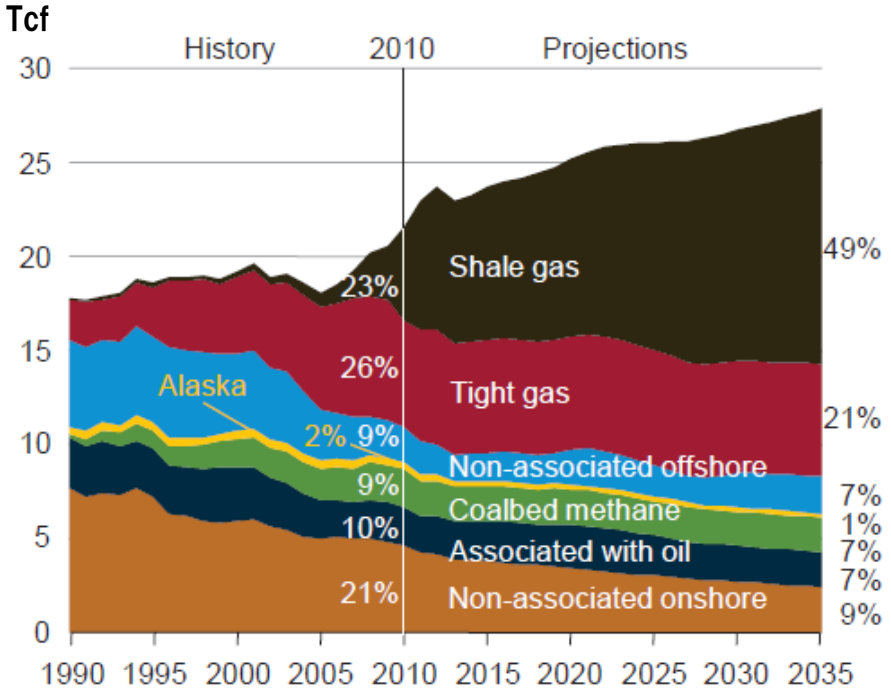

Source: IEA, "World Energy Outlook 2011", Other sources

# Changes in the Global Energy Trends (2)

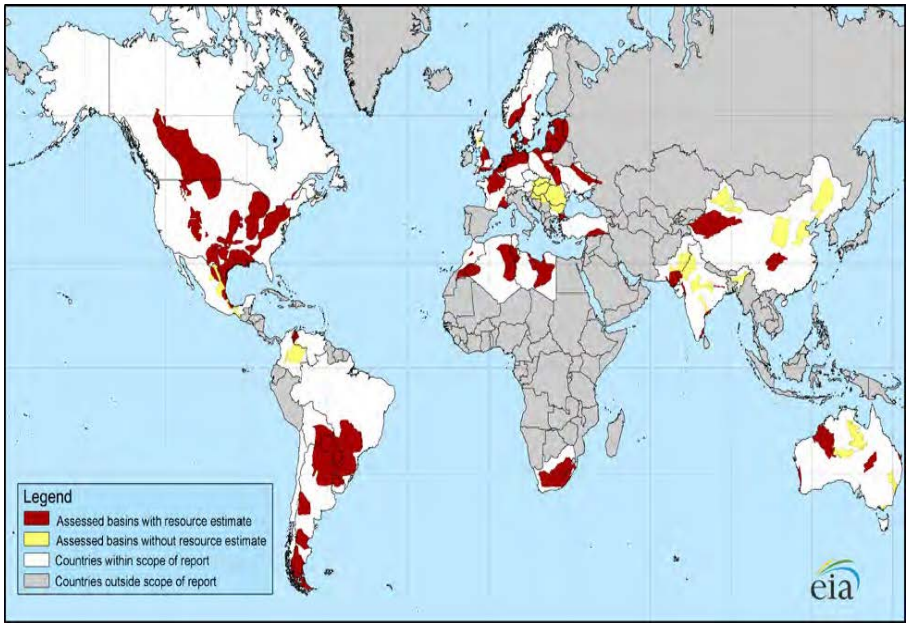
## Shale Gas Revolution in the U.S.

- -U.S. and Canada are to be major LNG exporters after 2015.
- -North America could achieve self-sufficiency of oil in the next decade.

### U.S. Natural gas production by source




### Potential Shale Plays in the World

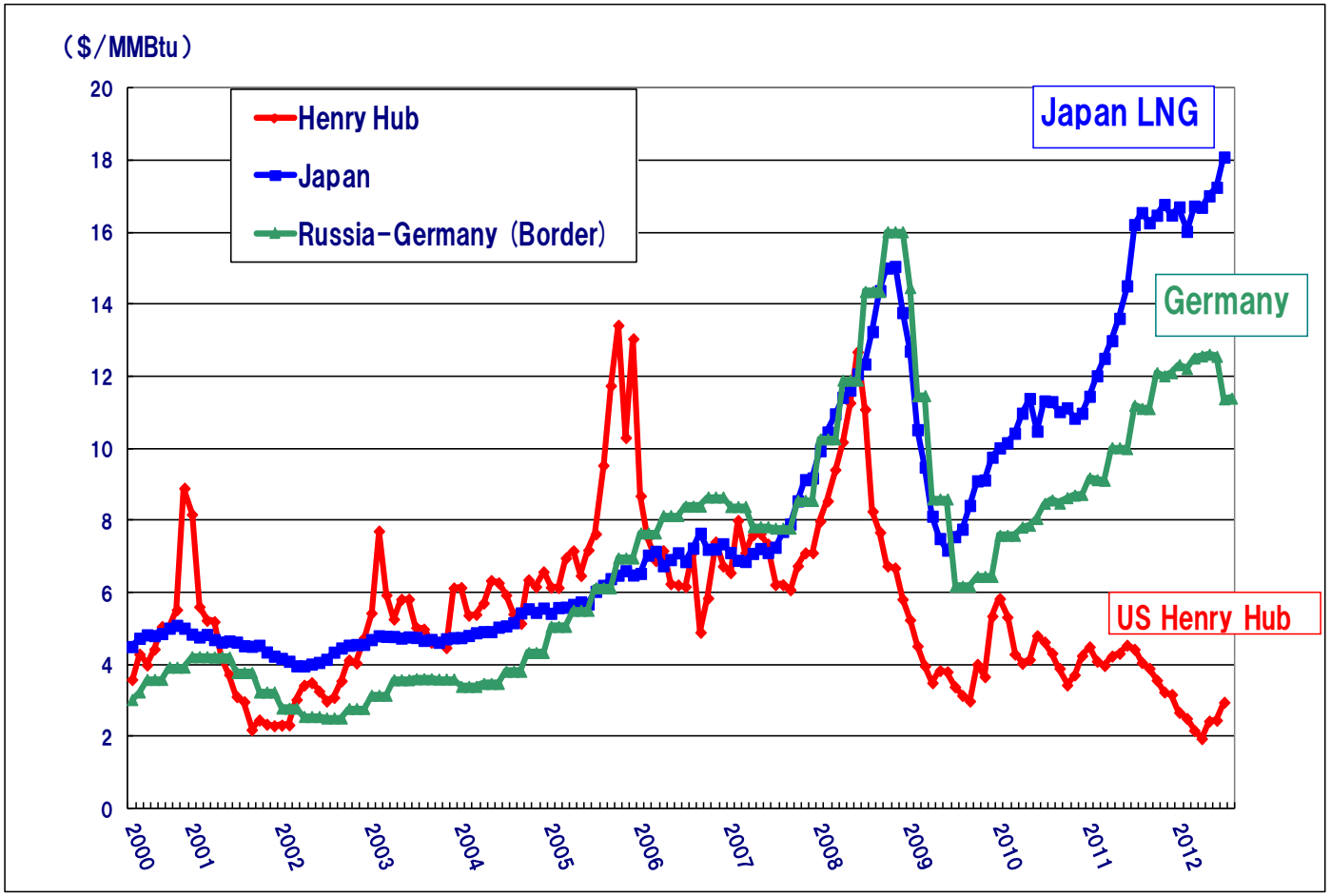



Note: Estimated reserves of shale gas: 6,626Tcf
Proved reserves of conventional gas: 7,361Tcf

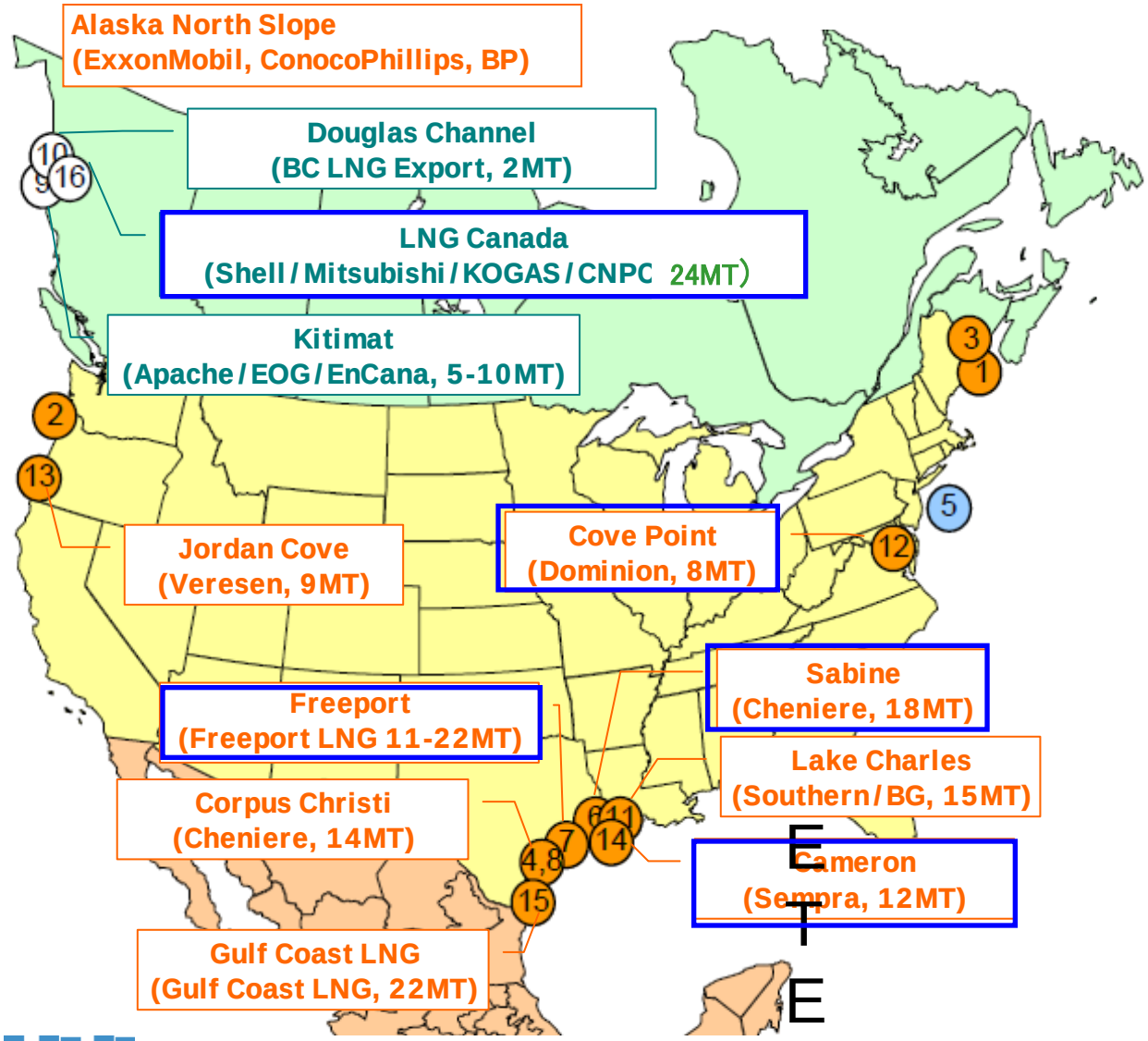
Source: U.S. Energy Information Agency, May 2012

# Natural Gas Prices in Japan, EU and US

- Japan: LNG imported prices are linked to the Japan crude cocktail
- Germany: Border gas price from Russia is linked to prices of heating oil and heavy fuel
- US: Spot prices at the Henry Hub in the Gulf coast



# North American LNG Exports to Asia




- Export ranges of 70-100 Mt/year in 2020
- Asian market targeted due to price difference
- Export authorization as an uncertainty

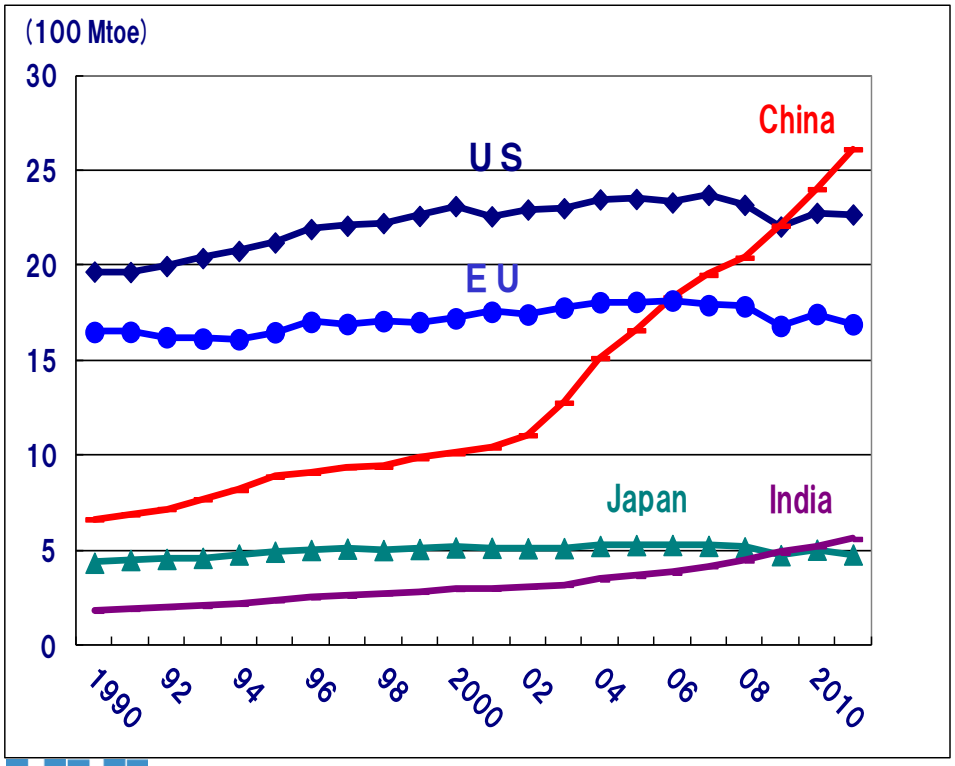
Project participated by Japanese companies

# Changes in the Global Energy Trends (3)

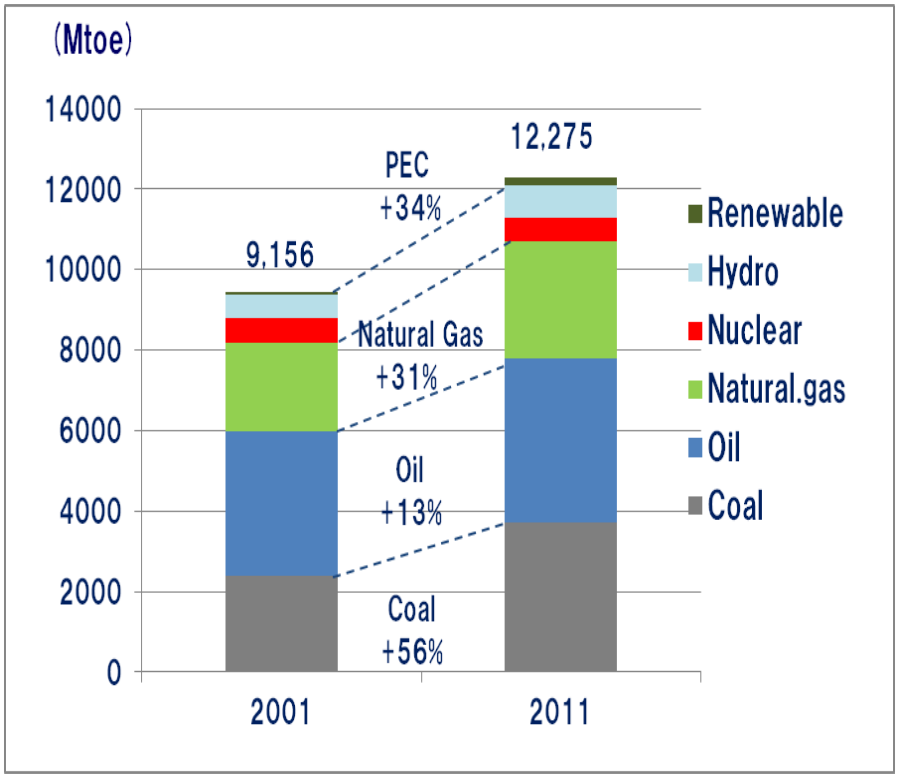
## China as the Largest Energy Consumer and Power Generator

- –Her coal consumption has increased by 2.5 times in the last decade and accounts for 50% in the world.
- –Second largest oil importer after the U.S. and rapid development of nuclear energy even after the Fukushima accident.

### Trends of Energy Consumption in Major Countries



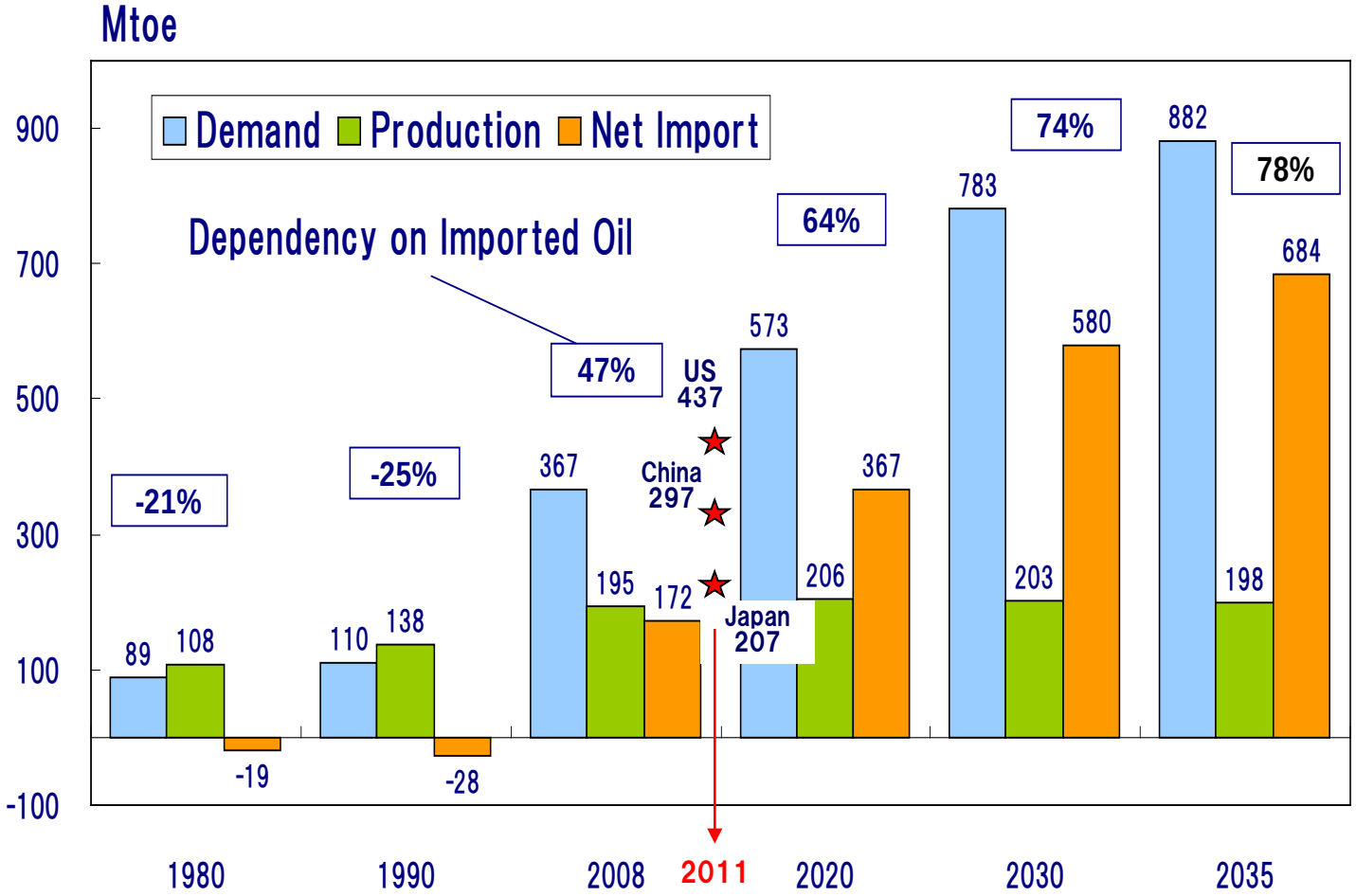

### World Primary Energy Consumption by Fuel




Source: BP "Statistical Review of World Energy 2012"

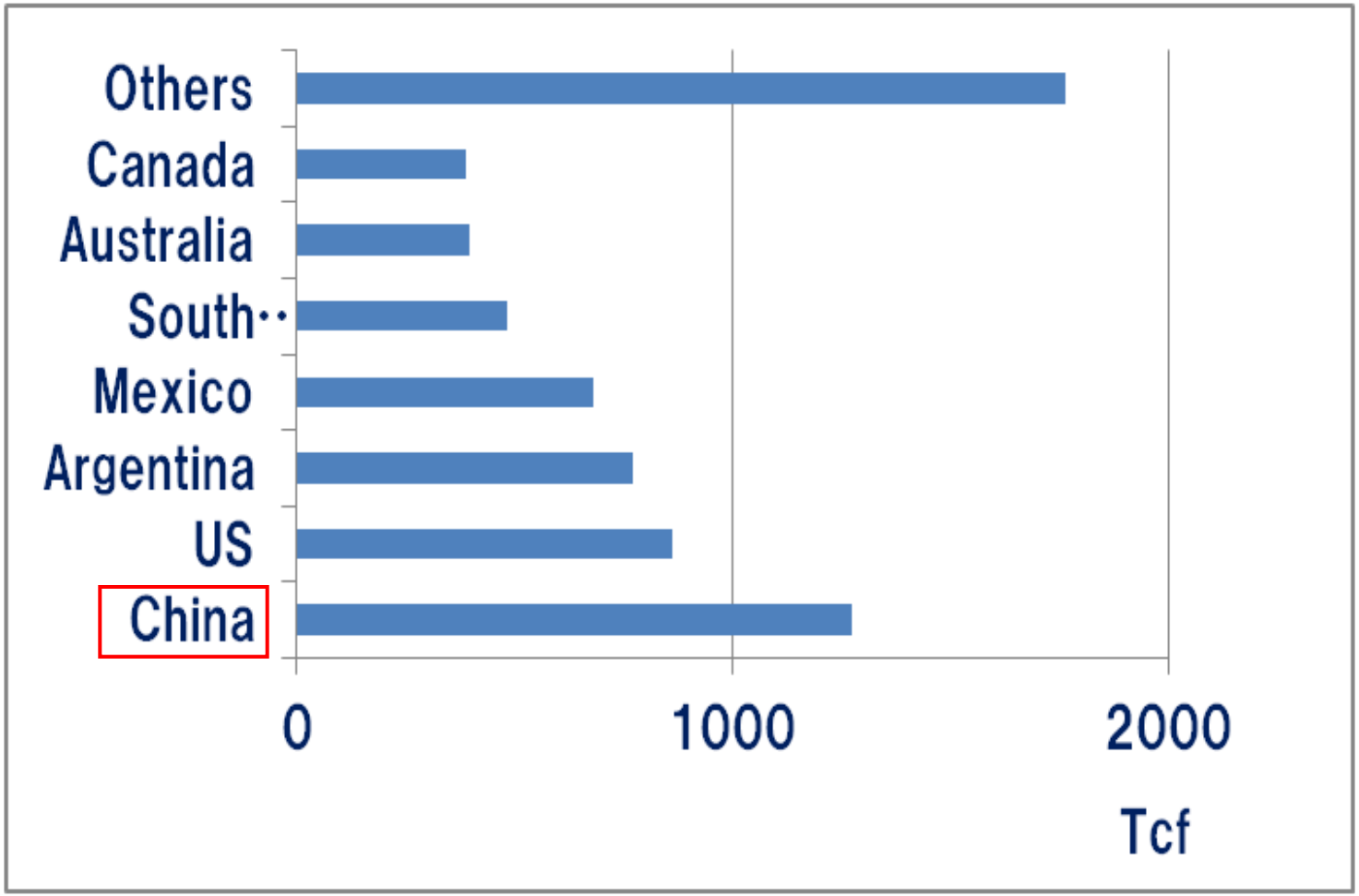
# China's Dependency on Imported Oil

- China's oil import from the Middle East continues to increase and energy security will become major concerns for China.
- Chinese NOCs are making every effort to access to oil and gas resources oversea with the strong government support.




Source: IEEJ, November 2011

# Recoverable Reserves of Shale Gas by Country




Note: Conventional natural gas reserve of China is 108Tcf in 2011.

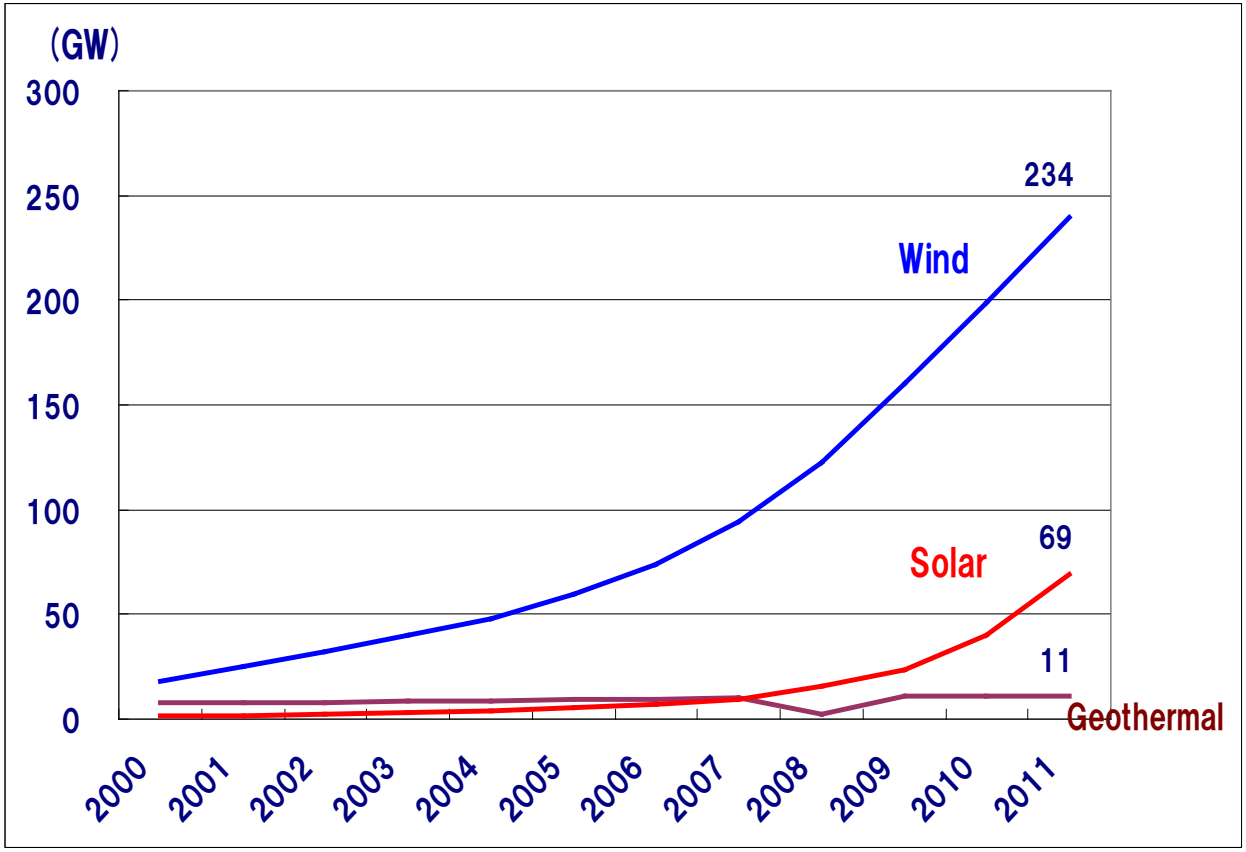
Source: USDOE

# Changes in the Global Energy Trends (4)

Renewable energies face new challenges

- -Spain and Germany as top-runners of renewable energy development have to reduce the government support and subsidy due to heavy burdens on users.
- -The green industry could not create new jobs as expected in OECD countries.

Cumulative Installed Capacity of Renewable Energy




Source: BP,2012

# Recent Development of the Global PV Industry

■ Bankruptcy, crash of stock prices and withdrawal of foreign capital

## Top 15 of PV Companies in 2008 and 2011

| 上位15社(2008年) | | |
|---|---|---|
| 順位 | 企業・国 | MW |
| 1 | Q-Cells (ドイツ) | 570.4 |
| 2 | First Solar (米国・ドイツ・マレーシア) | 504.0 |
| 3 | Suntech Power 尚徳電力(中国) | 497.5 |
| 4 | シャープ (日本) | 473.0 |
| 5 | Motech (台湾) | 384.0 |
| 6 | 京セラ (日本) | 290.0 |
| 7 | Boading Yingli (中国) | 281.5 |
| 8 | JA Solar (中国) | 277.0 |
| 9 | Sun Power (フィリピン(米国)) | 236.9 |
| 10 | Solar World (Shell) (ドイツ・米国) | 221.0 |
| 11 | Trina Solar (中国) | 210.0 |
| 12 | 三洋電機 (日本) | 210.0 |
| 13 | Gintech (台湾) | 180.0 |
| 14 | Solarfun (中国) | 172.8 |
| 15 | Cabadian Solar (中国) | 167.5 |

| 上位15社(2011年) | | |
|---|---|---|
| 順位 | 企業・国 | MW |
| 1 | Suntech Power (中国) | 2,070 |
| 2 | JA Solar (中国) | 1,775 |
| 3 | YingLi Green Energy (中国) | 1,684 |
| 4 | Trina Solar (中国) | 1,604 |
| 5 | Motech (台湾) | 1,120 |
| 6 | Canadian Solar (中国) | 1,058 |
| 7 | Sun Power (フィリピン、米国) | 922 |
| 8 | Gintech (台湾) | 882 |
| 9 | Hareon Solar (中国) | 855 |
| 10 | Jinko Solar (中国) | 840 |
| 11 | Neo Solar (台湾) | 806 |
| 12 | Hanwha Solar One (中国) | 788 |
| 13 | REC (ノルウェー) | 765 |
| 14 | Q-Cells (ドイツ) | 717 |
| 15 | Changzhou Eging PV (中国) | 700 |

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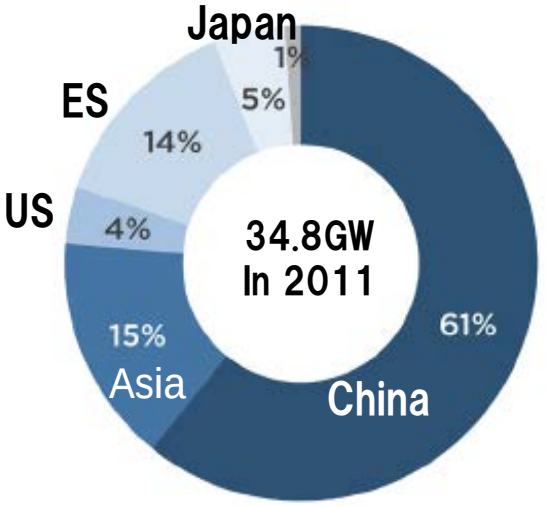
## Production Share of PV Module

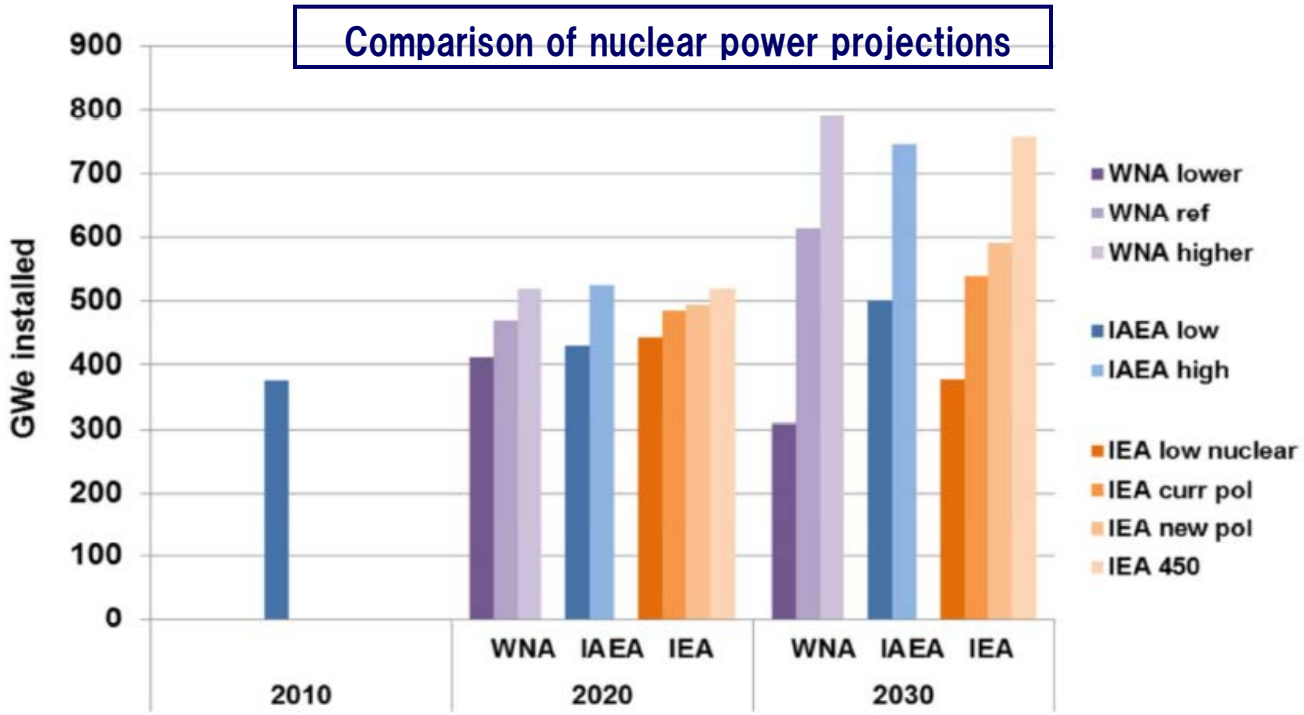



Source: PV News May 2012

Source: PV News Vol.30, No.5

# Global Reaction to the Fukushima Accident

- Germany and Switzerland decided a gradual shutdown, and Italy abandoned a plan to build new reactors.
- P5 nations, India and S. Korea announced to continue nuclear development. China is promoting an ambitious nuclear program and catch-up France by 2020.
- Newcomers such as UAE, Vietnam and Turkey pursue to build new nuclear plants by introducing foreign investments.
- Prospects of nuclear power are very divided subject to the public acceptance as well as economic competitiveness.



# Implications on Japanese Businesses (1)

1. In order to cope with geopolitical risks of oil and gas supply, diversification of supply sources is most effective, and Japan has to establish a national flag company that is more competitive in the global oil and gas market.

2. The shale gas revolution is changing the rule of the game in the global energy market. In order to correct the "Asian premium of LNG price", Japanese buyers should challenge to introduce new business models of gas imports including North American LNG and Russian pipeline gas.

3. Dynamic changes in China's energy situation will increase opportunities and risks for Japanese businesses in terms of access to resources, nuclear safety, green energy technologies and climate change mitigation.

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# Implications on Japanese Businesses (2)

4. Japan's energy future is increasingly influenced by the public perceptions after the Fukushima accident. Energy businesses should make larger efforts to gain the public acceptance by enhancing transparency and accountability of their activities.

5. Regulatory reform of Japan's electric power industry is to create various business opportunities for newcomers as well as to promote innovations. Technological innovations could play a vital role to transform the energy supply-demand systems over the next couple of decades.