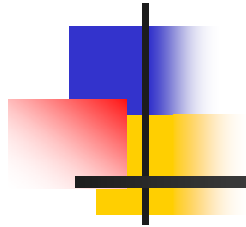




Energy Security and Challenges for Japan



14 February, 2012
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Contents

- (1) Japan's Energy Security Is Fragile**
- (2) Risks to Energy Security Are Increasing:**
 - 1) Contingent Risks**
 - 2) Structural Risks**
- (3) If Energy Security Is Not Ensured.....**
- (4) Actions for Energy Security and Status of Nuclear Power Generation**

(1) Japan's Energy Security Is Fragile

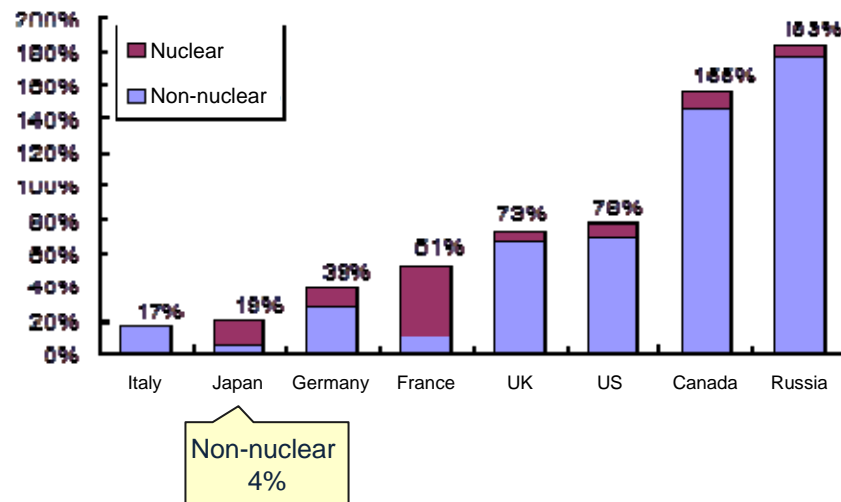
■ Energy security means:

"to secure adequate energy at reasonable prices necessary for the people's lives, and economic and industrial activities of the country."

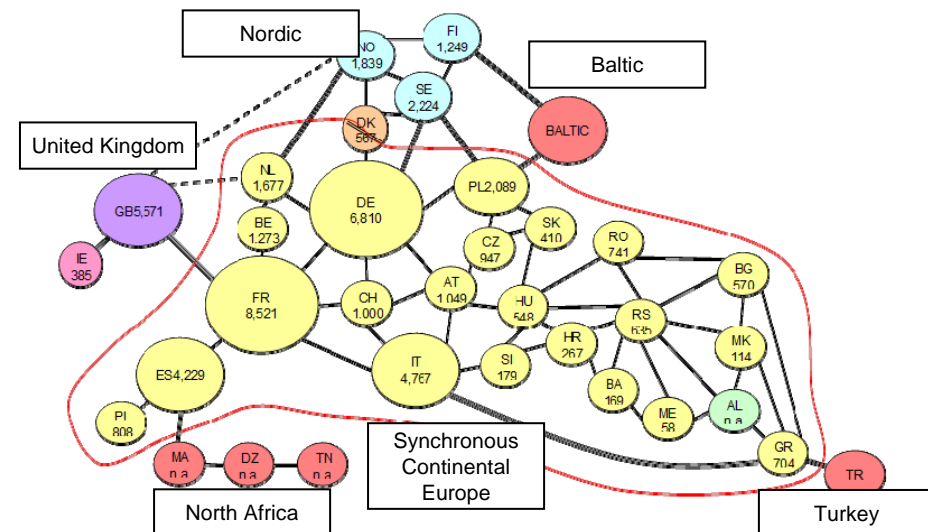
■ However, **Japan** is one of the weakest nations in terms of energy security:

- The lowest energy self-sufficiency rate (4%) among G8 members
- No northeast Asian network (power grid and pipeline) like that in the EU

Energy self-sufficiency rate of major countries (2010)

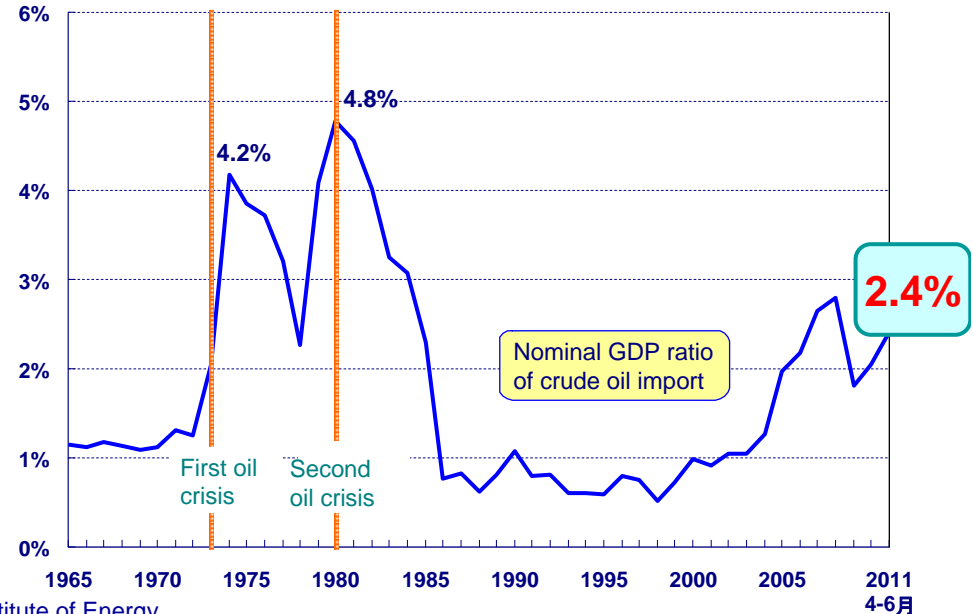
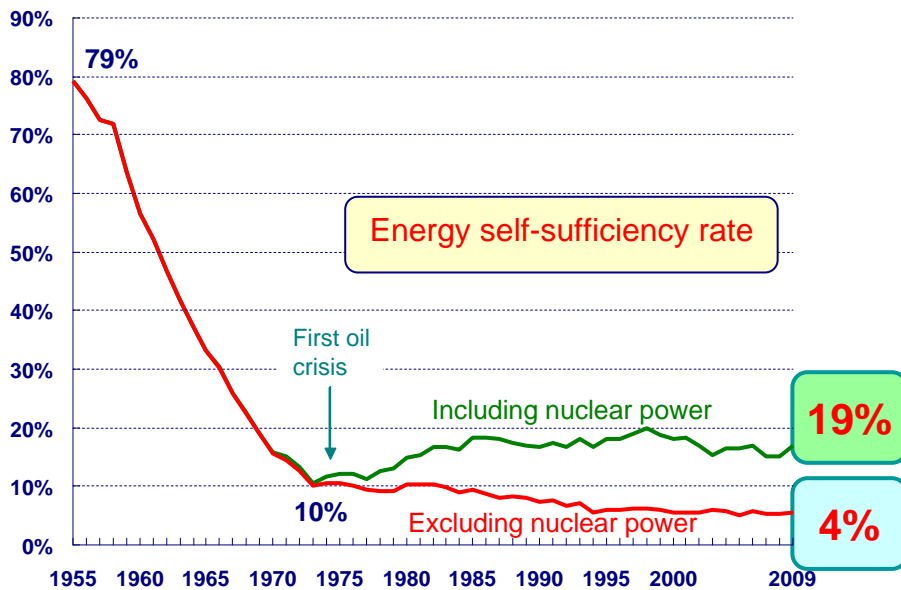
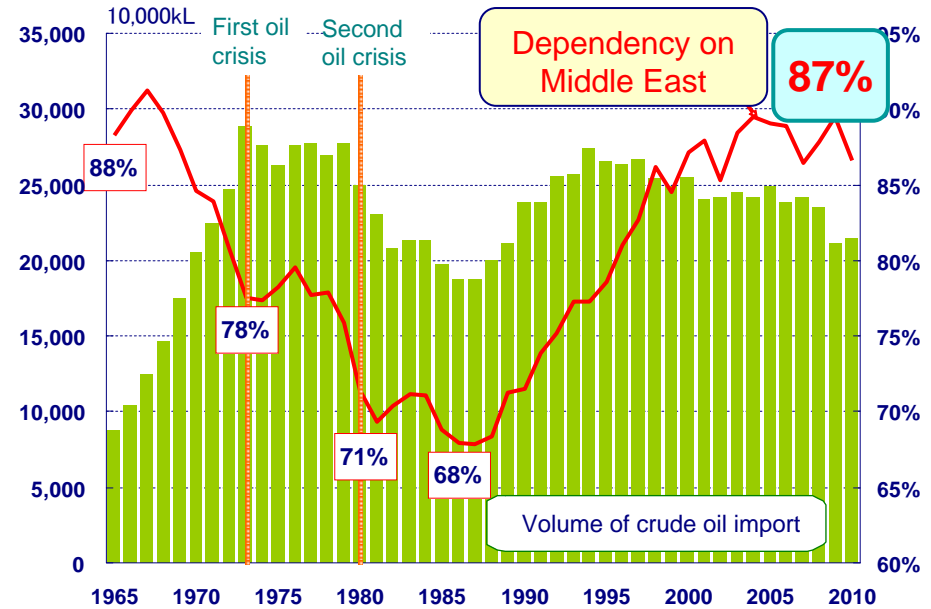
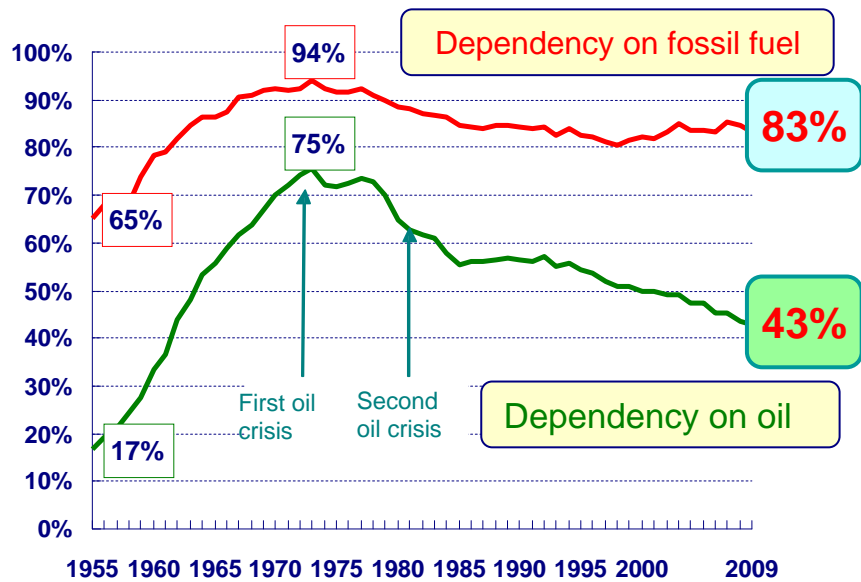


Grid interconnections in Europe



Source: International Energy Agency

Reference 1: Insufficient Development of Energy Security



Source: EDMC Handbook of Energy & Economic Statistics in Japan, the Institute of Energy Economics, Japan, IEA, etc.

(2) Risks to Energy Security Are Increasing

- The various risks that could trigger a crisis can be classified into two types:
 - Contingent Risks
 - Structural Risks

◎ Since the Oil Crisis in 1973, there have been many **supply disruptions and energy crises**. Risk factors are increasing in scale and complexity.

1) Contingent Risks

- **Political events in main supplier countries** including wars, revolutions, riots and terrorism
 - The 4th Yom Kippur war: led to the 1st oil crisis (1973)
 - Iran-Iraq war: led to the 2nd oil crisis (1979)

- **Political actions by consumer nations**
 - Sanctions against Iran

- **Accidents** in energy supply chains
 - Accidents at facilities that produce, import, ship and transport oil and gas
 - Accidents at transport bottlenecks (Strait of Malacca, Strait of Hormuz, etc.)
 - Accidents and troubles at power plants (nuclear power plants, etc.)

Reference 2: Sanctions on Iran: Scenarios and Influences



1. Policies of US and Future Scenarios

1) The US decided to impose sanctions on Iran including crude oil export to **hinder its nuclear program**.

Europe supported the decision, which influenced other countries including Japan and South Korea.

2) Possible Scenarios

a. Iran decides to compromise and abandons its nuclear program (uranium enrichment).

b. Iran blockades the **Strait of Hormuz** and **enters military conflict with the US and others**.

c. Uranium enrichment by Iran is accepted, but limited to peaceful use.

d. Regardless of moves by the US and Iran, what will **Israel** do?

2. Influences on Oil, LNG and LPG Trades

If Iran stops producing, **oil prices will soar and cause an energy crisis**.

(Note) **Approx. 80%, 25% and 85% of oil, LNG and LPG** of Japanese imports pass through the Strait of Hormuz. There are no **LNG** stockpiles or international interchange schemes. The inventory is equivalent to **approx. 20 days**. Since the nuclear power plant accident, it accounts for 40% of power generation.

Reference 3: Sanctions on Iran: Schematic View of Strait of Hormuz



- Amount of oil traffic: more than 17 million B/D
(Approx. 20% of world oil production)
(85% of oil imports of Japan)
- Amount of LNG traffic: more than 82.6 million tons
(Approx. 30% of world LNG production)
(18% of LNG imports of Japan)

* Figures for Japan are derived from trade statistics in 2010, assuming that imports from Iran, Iraq, Bahrain, Saudi Arabia, Kuwait, Qatar, and UAE passed through the Strait of Hormuz.

- 2-mile wide passages each to the Persian Gulf and to the Indian Ocean
- 2-mile wide interference zone between the passages



Reference 4: Influences on Crude Oil Prices in 2012

- The two most important **factors** influencing the international oil market in **2012** are the situation of the world economy and international finance, and geopolitical risks.
- In the reference case with no major turbulence, supply and demand will remain almost in equilibrium. The actions of **OPEC** are the focus of attention in terms of supply and demand adjustments.
- Depending on how uncertainties in the world economy and oil supply/demand develop, crude oil prices (**WTI**) could vary dramatically from the second half of **2012**.
 - **Reference Case: around \$100 ± \$10** (annual average, same applies hereafter)
(Note) Saudi Arabia's Minister of Oil said in January that an oil price of \$100 was ideal. Conventional prices are \$60-80.
 - High Price Case: around \$120 ± \$10 assuming tensions with Iran
 - Low Price Case: around \$70 ± \$10 assuming worsening of the European economic crisis
 - Probability: around 60% for Reference Case; High Price and Low Price Cases are on an equivalent level.
 - **With an emergency in Iran, prices could soar above the High Price Case (beyond the previous maximum of \$147?)**
(Note) Brent price is about \$10 higher than WTI price. The CIF of Japan's crude oil is also about \$10 higher.
- **Large fluctuations in prices cannot be avoided this year.**
(Note) Average crude oil price (WTI) was **\$100** in 2008, **\$62** in 2009, **\$80** in 2010, and **\$95** in 2011. What will it be in 2012?

2) Structural Risks

Demand side

- Rapid increase in demand mainly in Asia
- Competition for resources
- Energy options for measures to address global warming; shift from coal and oil to LNG

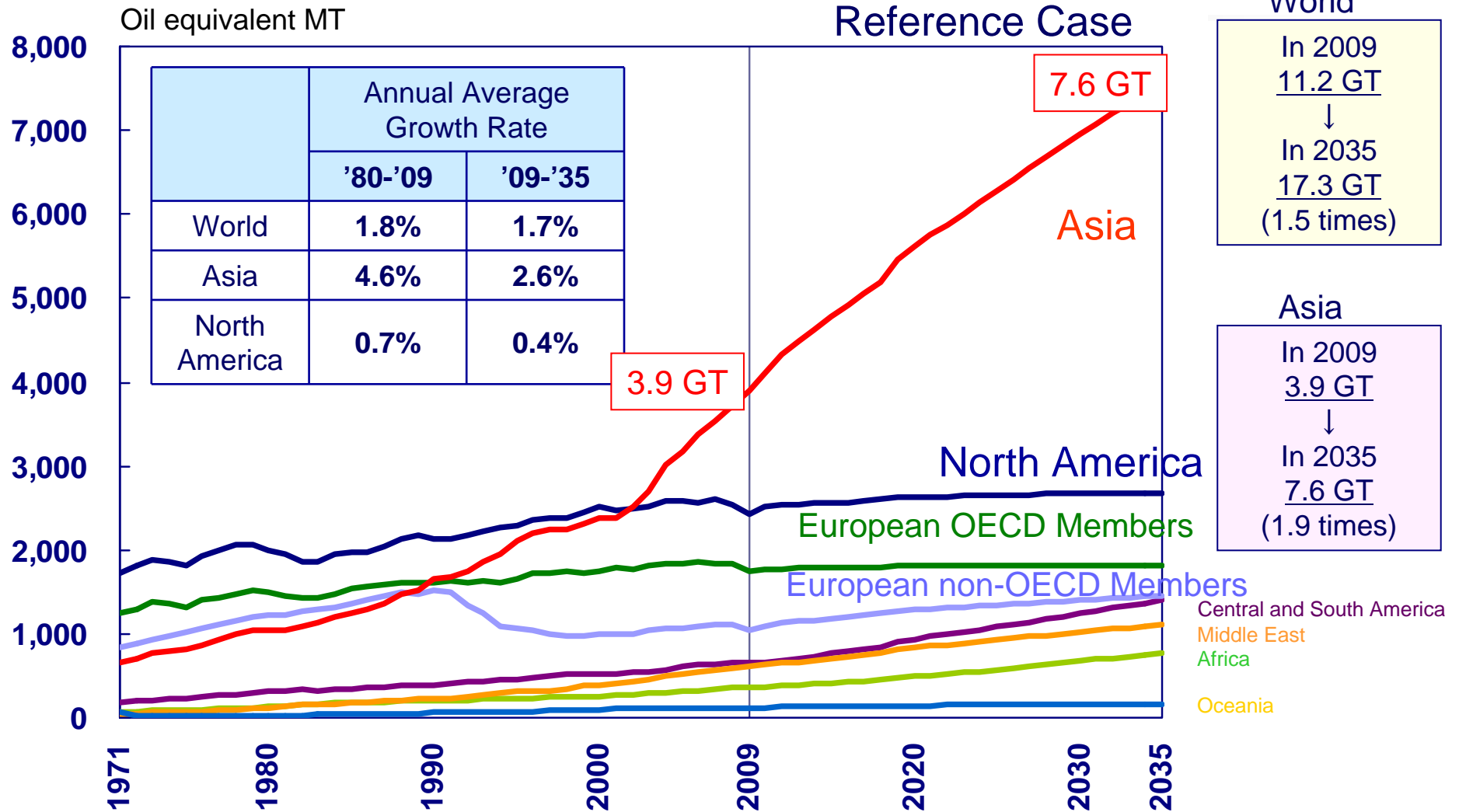
Supply side

- Embargo imposed by supplier with political tension (resource nationalism, etc.)
- Use of market power by supplier (state-owned companies and oligopolistic system)
- Depletion of resources and chronic lack of energy (shale gas and environment?)
- Lack of investment in supply due to environmental controls, deregulation of market, etc.

Political issues

- Uncertainty caused by the **Arab Spring**
- Regional instability resulting from declining influence of US hegemony

Reference 5: Outlook for World Energy Demand (by Region)



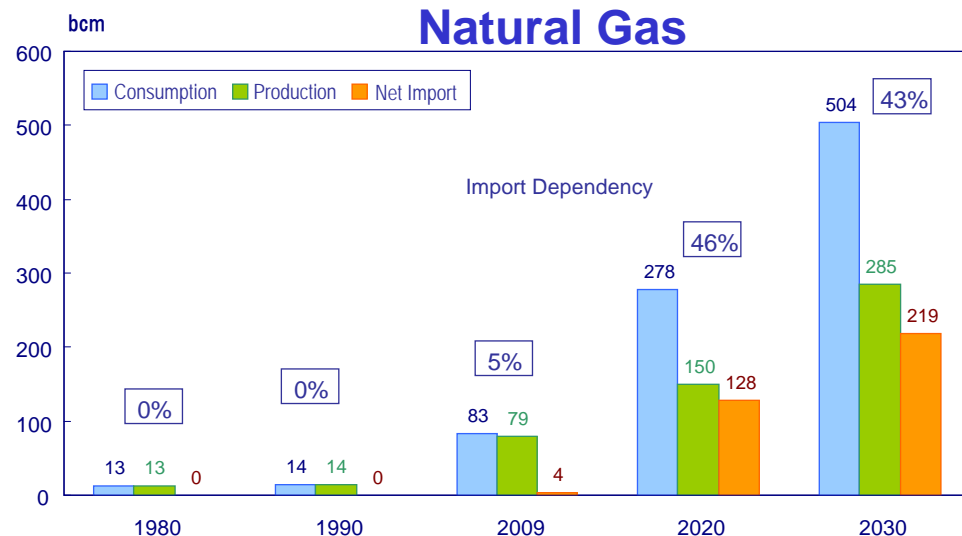
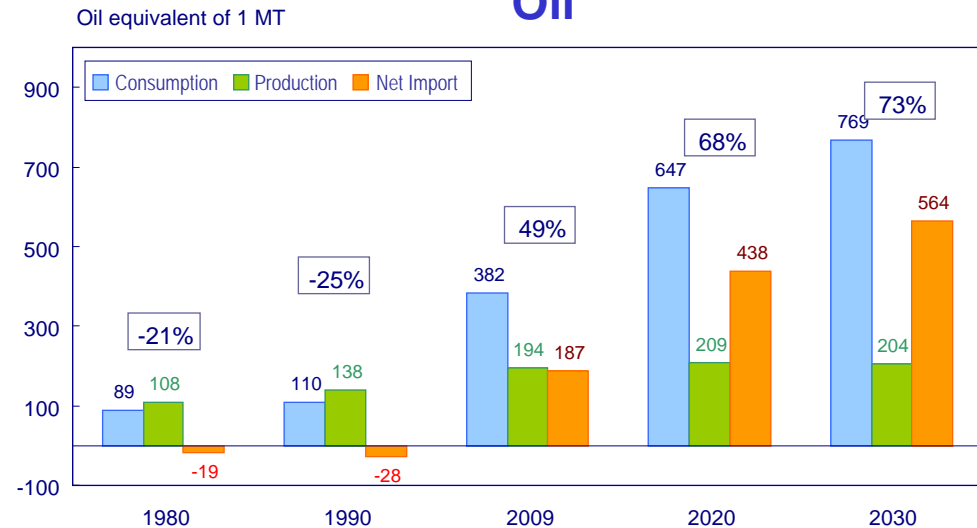
Under steady economic growth, energy consumption in Asia in 2035 will be nearly double the current volume (3.9 GT in 2009 → 7.6 GT in 2035). Non-OECD countries account for approx. 90% of the increase in world energy consumption from 2009 to 2035.

Reference 6: Intensified Competition for Energy Resources

Outlook for Supply and Demand of Oil and Natural Gas in China

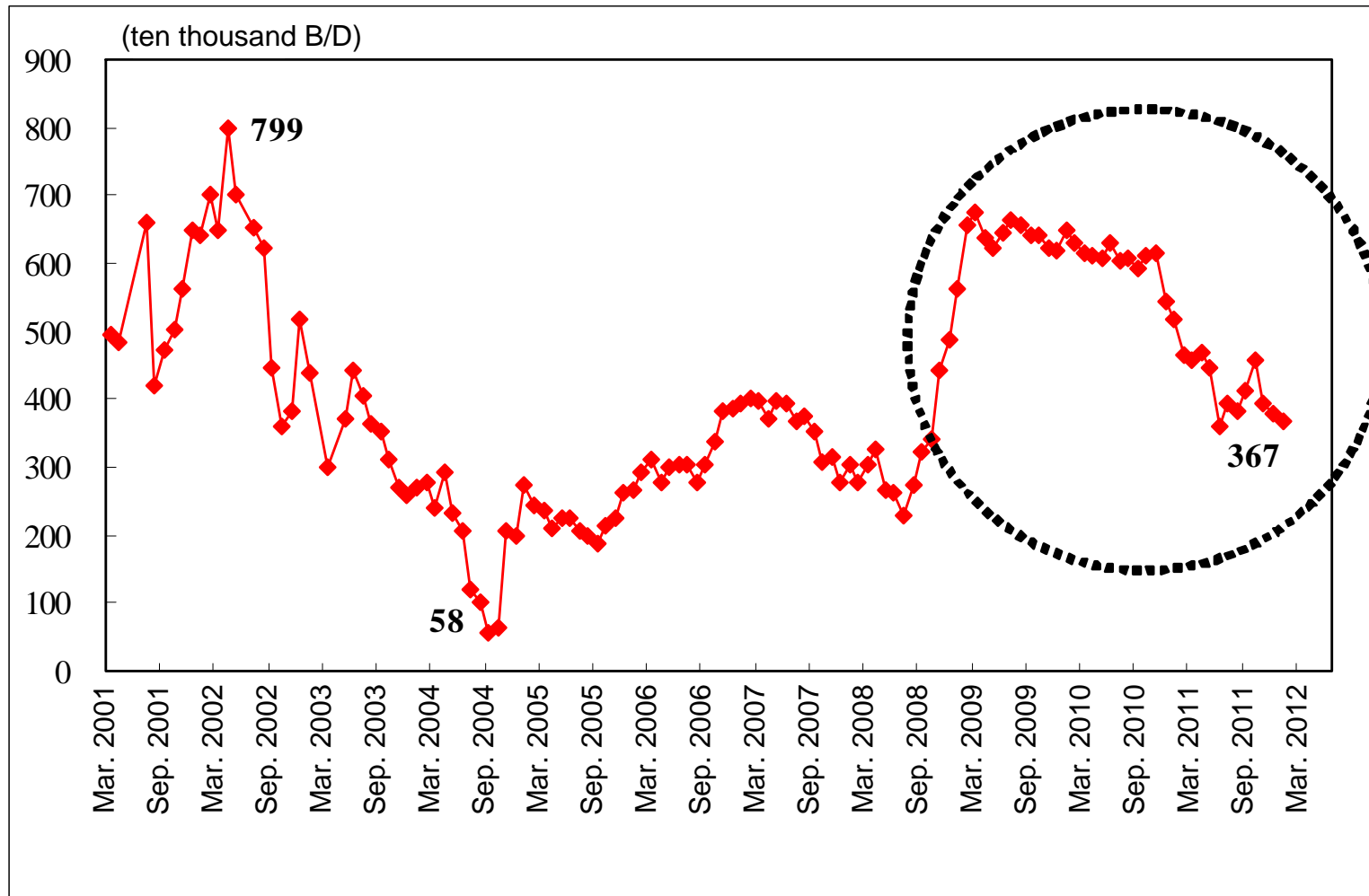
- **Increase in dependency on energy imports** means greater fragility (especially in China).
- **To address this, strategies** including development of domestically produced energy, diversification of supply sources, independent development overseas, and strengthening of companies as players will be **fully implemented**.
- If such actions become excessively exclusive, **protection of or competition for resources may intensify**, leading to instability in the international market.

Source: *Asia/World Energy Outlook 2011*, the Institute of Energy Economics, Japan



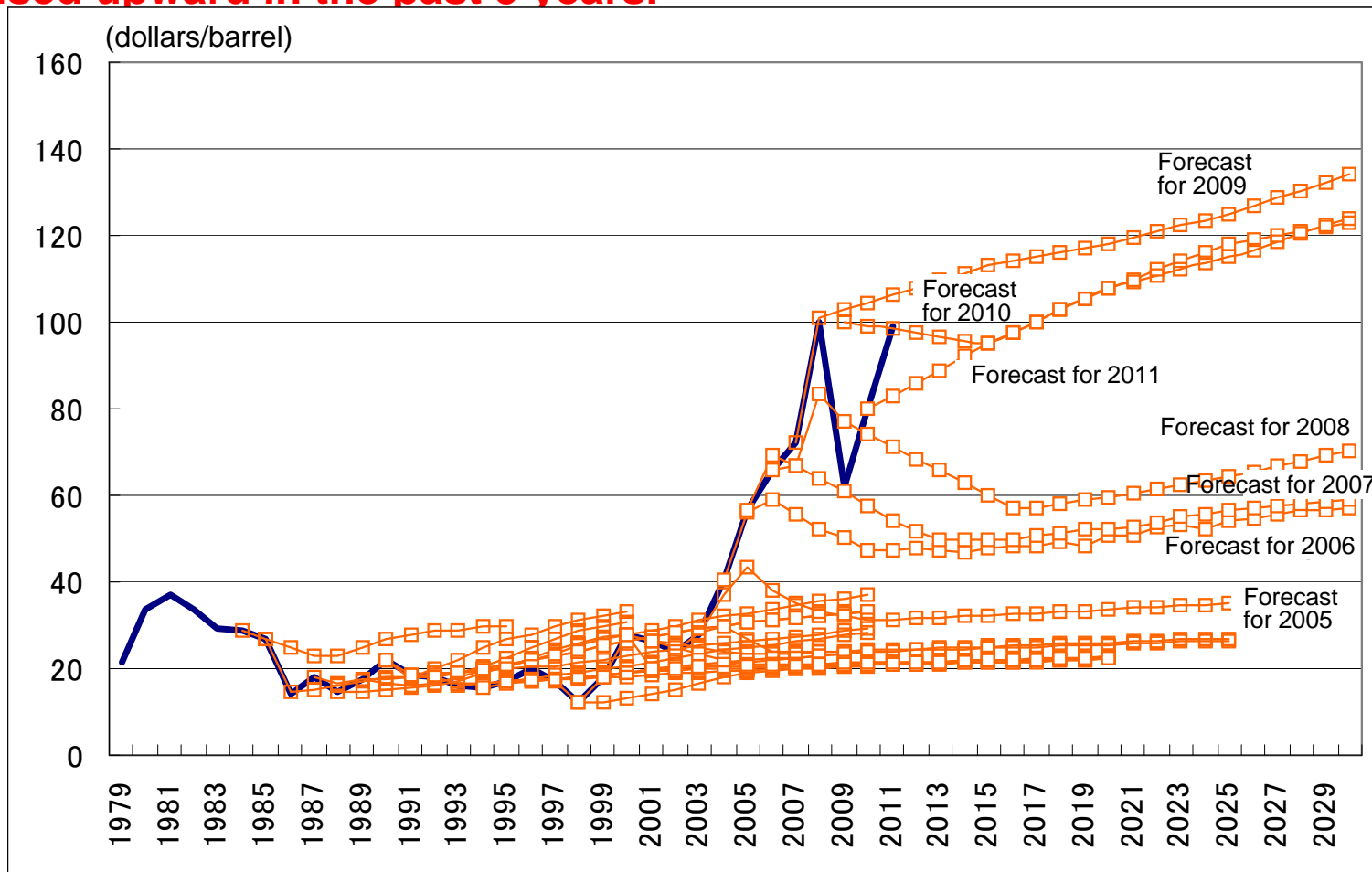
Reference 7: Shift of Surplus Production Capacity of OPEC

- **Causes of lowered surplus production capacity** include decreased production in Libya. The level as of January 2012 was 3.67 million B/D.



Reference 8: Expected Trend of Long-term Oil Prices

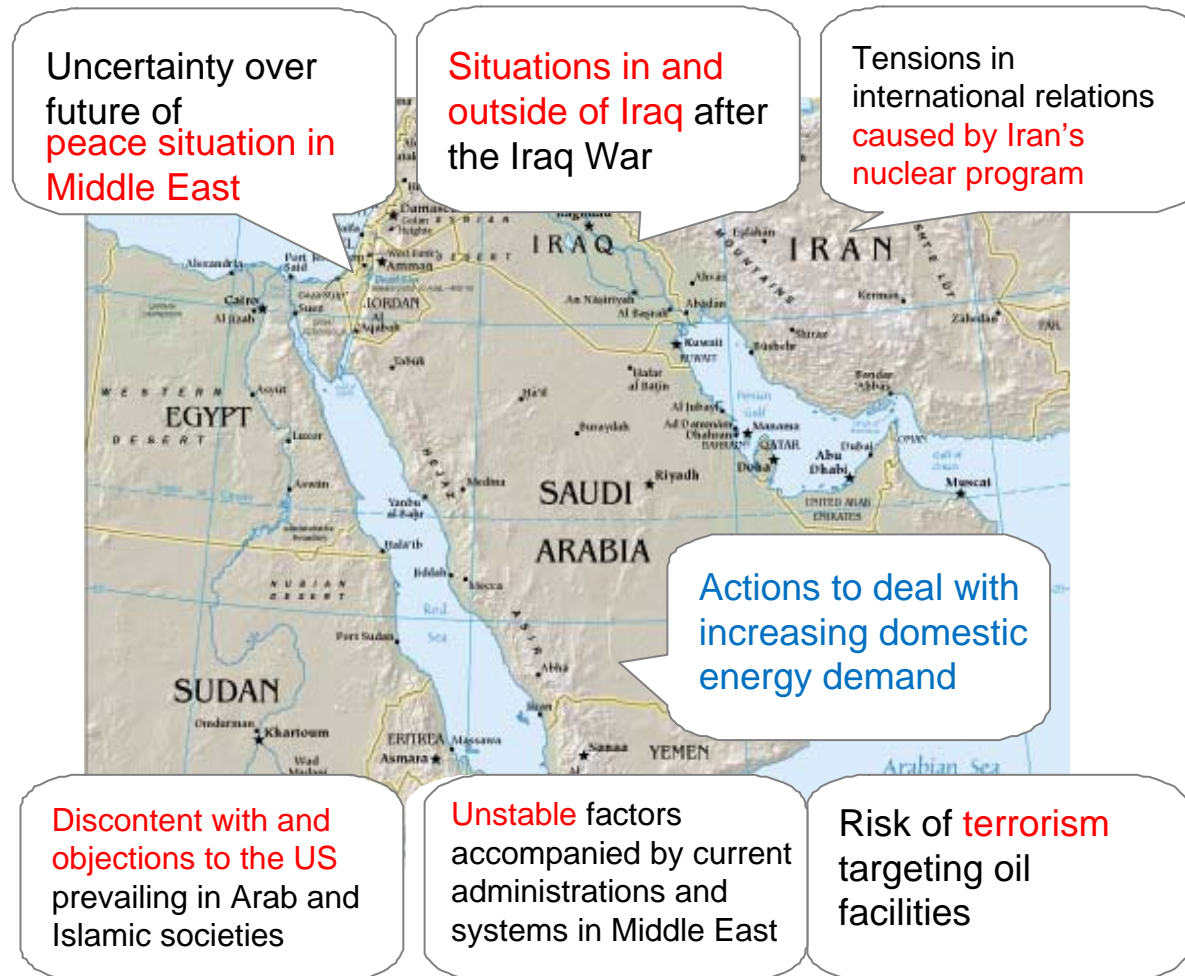
- Due to the recent soaring crude oil price, the **price outlook has been revised upward in the past 5 years.**



Sources: Annual editions of the *International Energy Outlook*, Energy Information Administration (EIA)

Reference 9: Emerging Concerns over Limited Energy Supplies + Arab Spring + Lower Influence of US

Unstable factors and issues in Middle East



Source: Developed by the Institute of Energy Economics, Japan based on various documents and materials

Reference 10: Uncertainty over Supply of Natural Gas



- While worldwide demand for natural gas is expected to increase, **supplies of unconventional natural gas are likely to increase. Will the benefit to Japan be limited?**
 - Where will the effect of the US "shale gas revolution" extend in the world including Asia?
 - The pipeline market is different from the LNG market.
 - After the surge in gas demand in Asia following the Great East Japan Earthquake and the nuclear accident, the Asia premium was raised.
(US: \$2-3/MMbtu, spot LNG price for Asia: \$14-15/MMbtu)

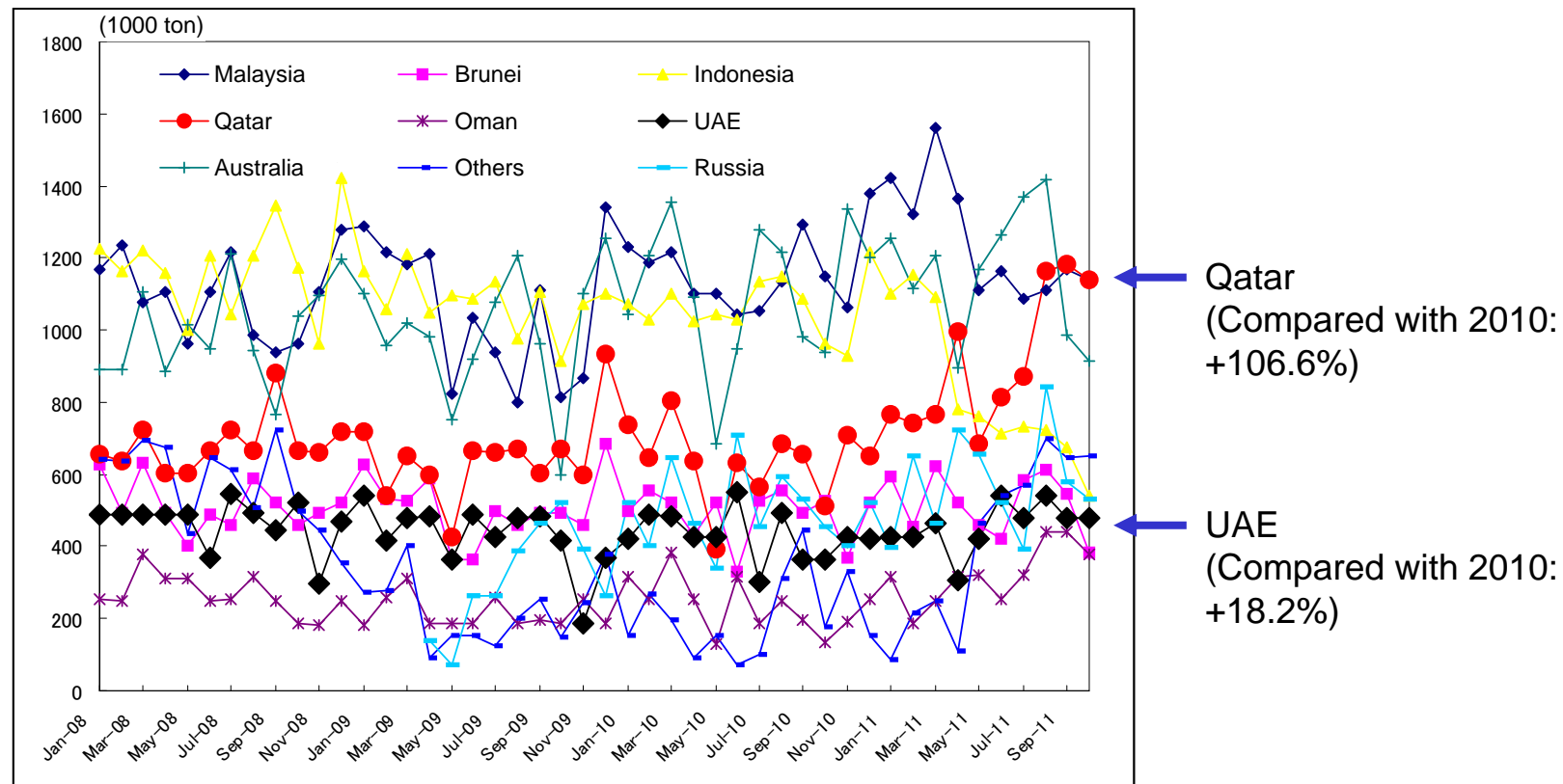
- Major Exporters of LNG: **Qatar and UAE would be significantly affected by closure of the Strait of Hormuz.**

	LNG Production Capacity (World trade volume: 221 MT in 2010)	LNG Import by Japan (7.17 MT in total in Dec. 2011)
Qatar	77 MT (25.7%)	19.4%
UAE	5.6 MT (2.8%)	5.9%

- **Different from oil, LNG is vulnerable to a crisis.**
 - No international cooperation mechanism (unlike IEA for oil) during an emergency
 - No surplus production capacity (surplus production capacity of OPEC for oil) in the international market
 - Limited inventory (equivalent to approx. 20 days for Japan) in consuming countries
- **Disruption of supply leads to skyrocketing price as well as physical problems.**
 - The price of LNG in Japan is linked with the crude oil price. Therefore, if the crude oil price rises, so will the LNG price.
 - The spot LNG price has significantly increased due to tight supply and demand, rising by 6-70% in the past 10 months.

Reference 11: LNG Imports from the Middle East

■ In 2011, imports from Qatar doubled.



Source: Monthly Report of Mineral Resources and Petroleum Products Statistics, etc.

Note: The recent LNG ratio accounts for 40% of power and is heavily reliant on Qatar.

(3) If Energy Security Is Not Ensured

What happens if energy security is threatened?

- Disruption of energy supply
- Soaring energy prices and volatility
- Competition for energy resources, resulting in useless disputes
- Resource nationalism, market power issues brought by oligopoly → Compulsory acquisition and imposed higher prices
- Global warming issues inhibit sustainable development
 - Climate changes and abnormal weather attracting attention worldwide

- Impacts of the Great East Japan Earthquake and Nuclear Power Plant Accident
 - If nuclear power plants fail to be restarted in FY 2012:
 - Switching to LNG/oil - imports will exceed 3 trillion yen
 - Shortage of electricity supply - there will be almost a 12% shortage in Japan this summer
 - Increase in global warming gases - 14% increase compared with 1990
 - Adverse effect on macro economy (GDP, employment, etc.)

(4) Actions for Energy Security and Status of Nuclear Power Generation



⇒ **Market mechanism alone is insufficient** (R&D, subsidies for introduction, resource diplomacy, safety regulations, etc.)

What is the contribution of nuclear power?

Demand side:

- Control of demand (R&D/subsidies for introduction) - Energy conservation

Supply side:

- Improvement in energy self sufficiency - **renewable energy** + **nuclear power**
- Inexpensive energy - **nuclear power**/coal and LNG
- Securing of a large volume of high density energy efficiently (support for introduction and compensation) - **nuclear power**
- Secured power stability of **renewable energy** - linked with coal and LNG + batteries
- Diversification of energy sources (R&D/subsidies for introduction) - **renewable energy** + **nuclear power**
- Measures for distribution and diversification of import sources (resource diplomacy) - LNG + **nuclear power**
- Measures to strengthen relations with major suppliers + enhance negotiating capability (resource diplomacy) - oil, coal, LNG, and **nuclear power**
- Actions to prevent global warming (R&D/subsidies for introduction) - **renewable energy** + **nuclear power**
- Measures to strengthen emergency response (reserve effect) (national reserves/support for introduction) - oil (200 days) and **nuclear power (5 years)**
- Export of infrastructure, assurance of safety and cooperation to cope with global warming (resource diplomacy) - coal fired, **renewable energy**, **nuclear power**, etc.

Safety aspect:

- **Secured nuclear safety**: stricter regulations, independent regulatory organizations, international cooperation through IAEA, etc.