

Changing Energy Landscape –Challenges for Asia–

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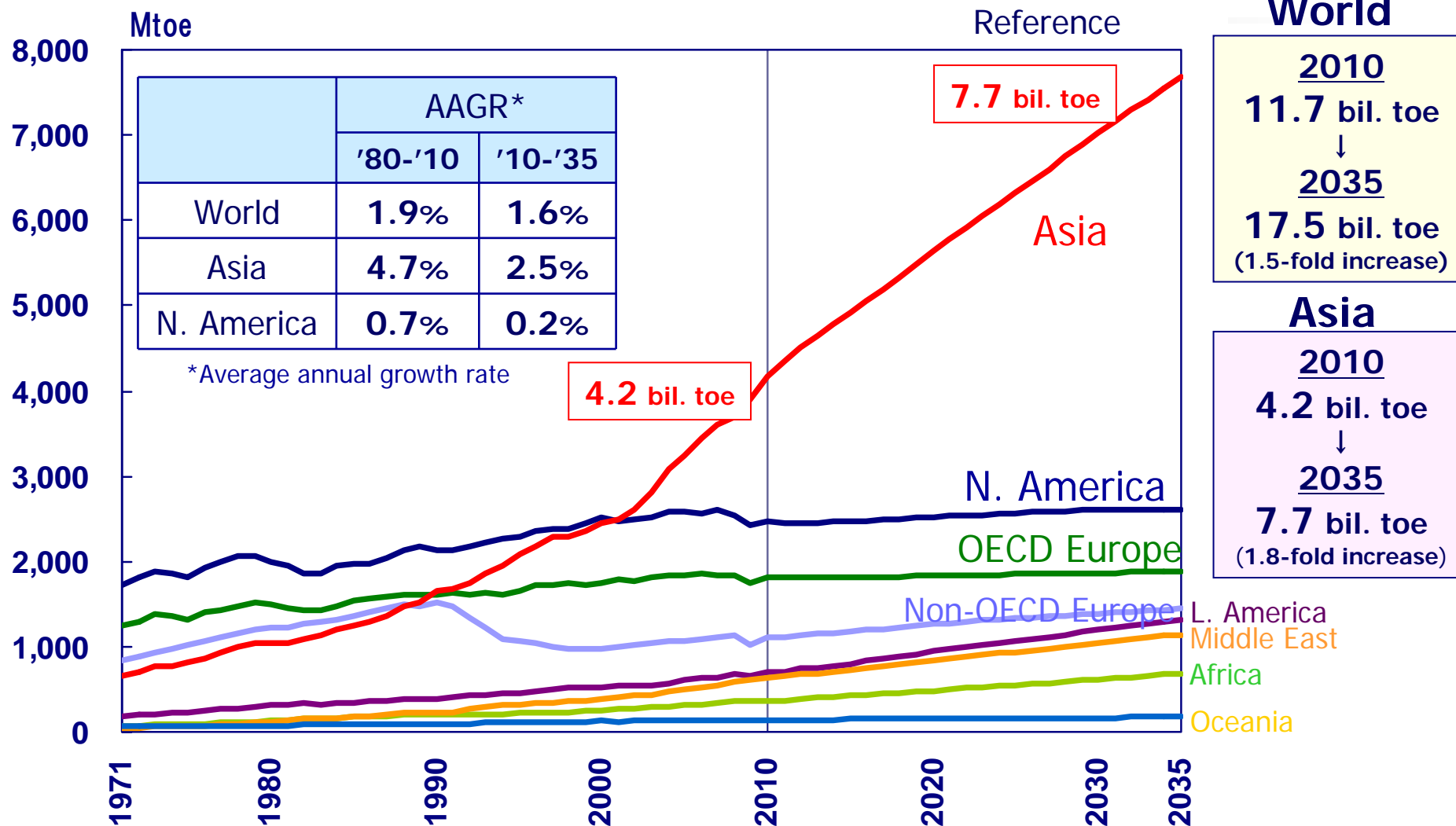
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1-1. Asia : Center of growth and energy consumption

Growth center means energy consumption center.

World Energy Supply and Demand Outlook (by Region)



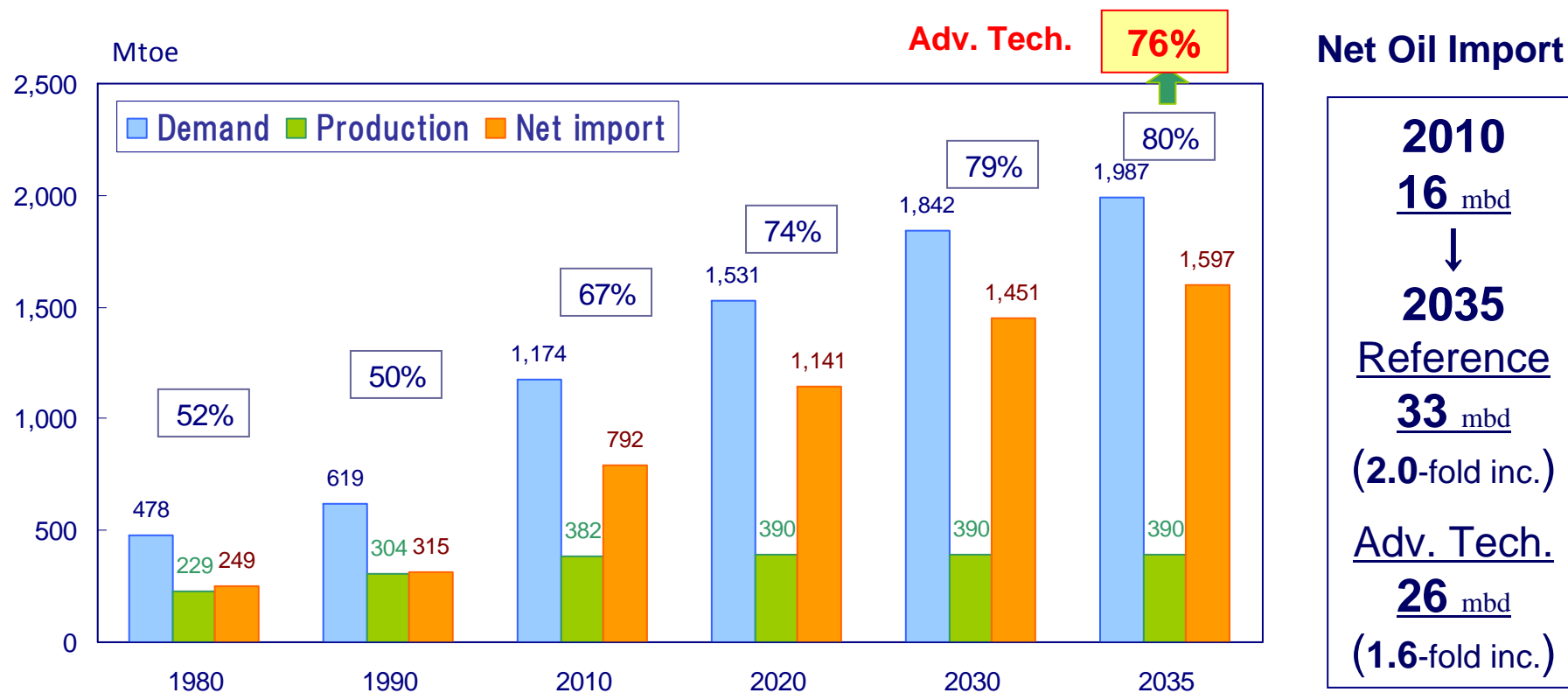
■ Reflecting high economic growth for Asian countries, primary energy demand in Asia will increase 1.8 times by 2035 from current levels; 4.2 billion toe(2010) → 7.7 billion toe(2035).

■ Non-OECD countries will represent 93% of incremental growth of global energy demand.

Source: IEEJ "Asia/World Energy Outlook 2012"

1-2. Asia: Center for growth and energy consumption

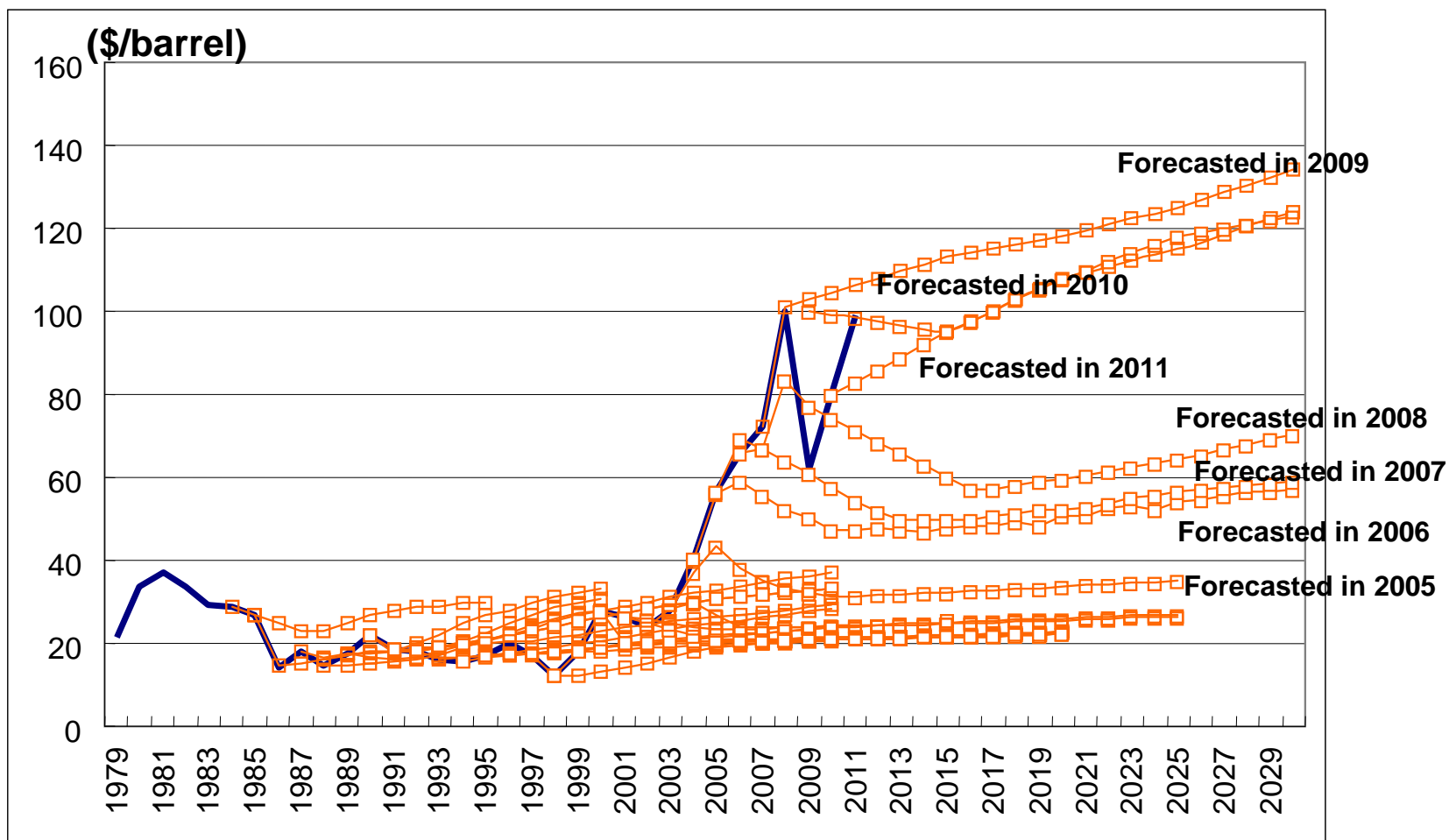
As energy consumption increases, energy independence is weakened



- Net oil import in Asia will expand from 16 mb/d (800 Mtoe) in 2010 to 33 mb/d (1,600 Mtoe) in 2035.
- Oil production in Asia (such as China, India, Indonesia and Malaysia) will marginally increase, not keeping pace with the steady increase in oil demand. Therefore, net oil import ratio will reach 80% in the Reference Scenario, and 76% in the Adv. Tech. Scenario by 2035 (compared with 67% in 2010).

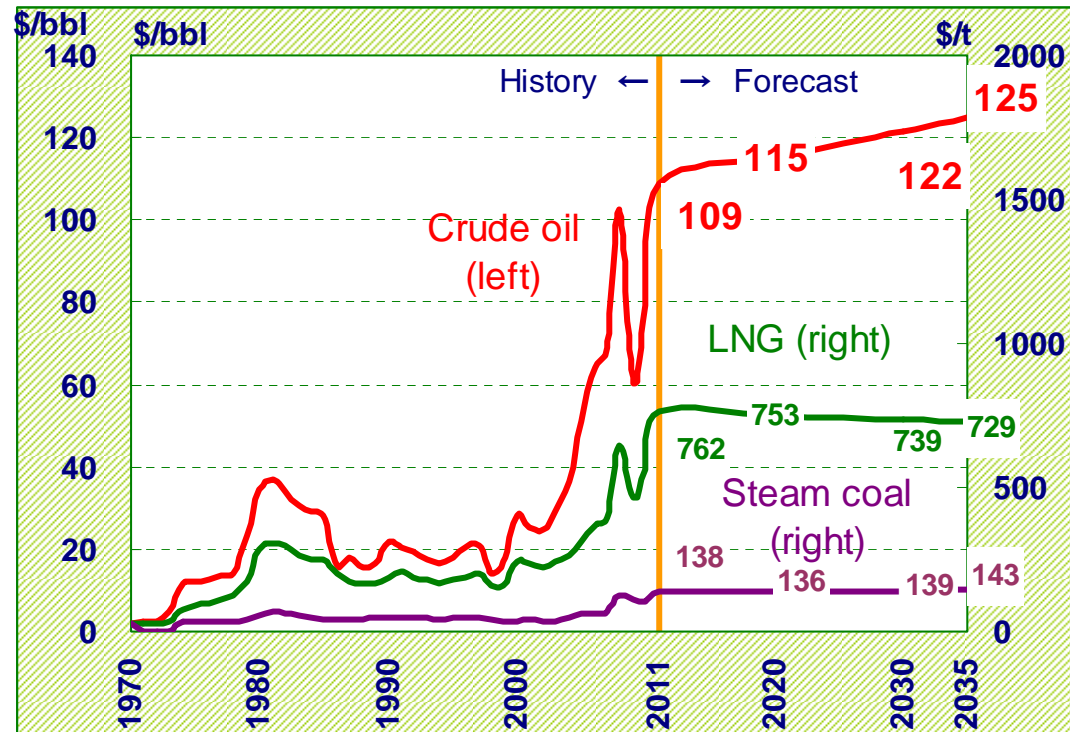
1-3. Asia : Center of growth and center of energy

Forecasts for oil prices have been revised significantly upward in the last five years.



Source: annual editions of "International Energy Outlook" from the US Energy Information Administration (EIA)

<Reference> Energy Prices and Relative Prices (2011 price USD)

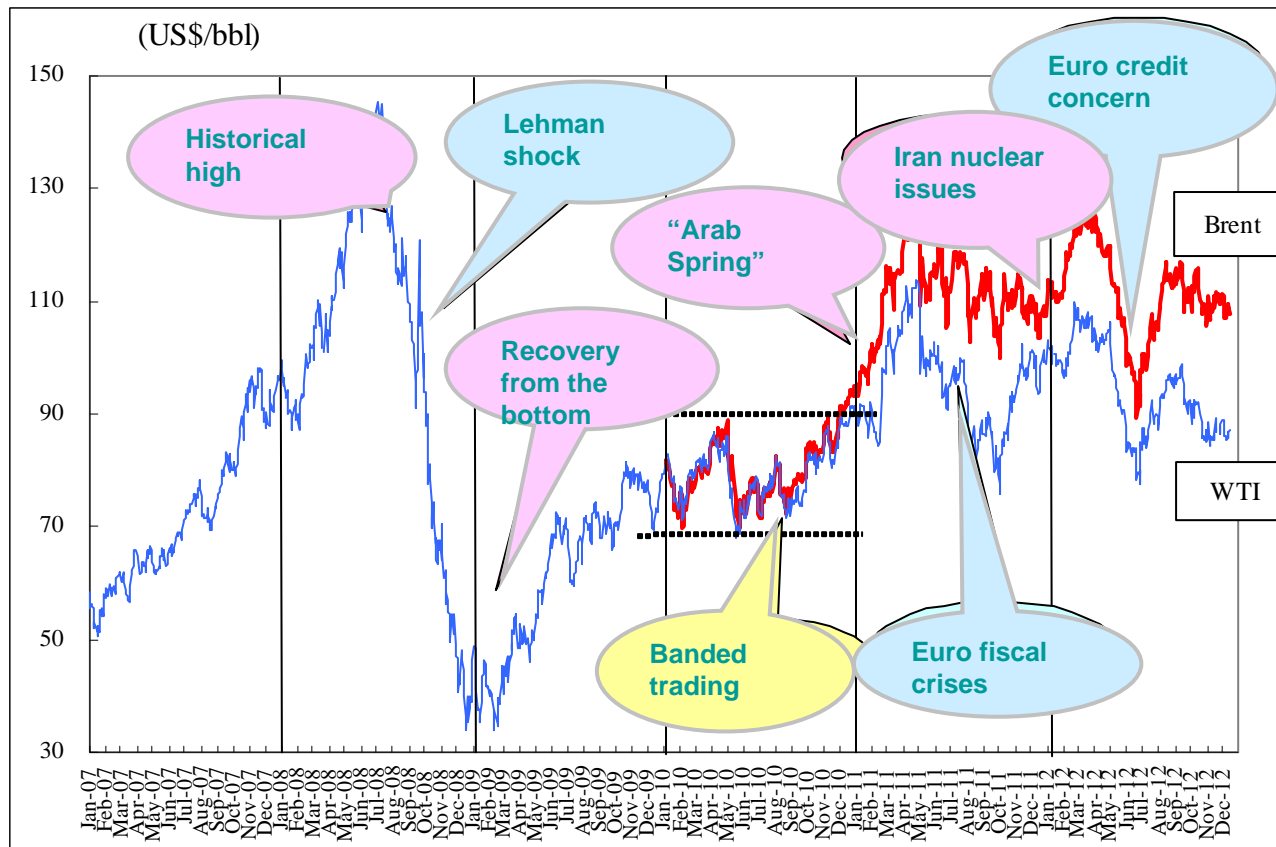


In the graph, energy prices are expressed as Japan's import energy prices (on a CIF basis).

- Crude oil prices will continue to rise in the future resulting from the tight supply-demand balance. Oil demand is projected to increase driven mainly by Asia, while upstream investment may not progress at a pace meeting the demand growth.
- Japan's LNG import price is projected to gradually decline.
- Coal price will show relatively moderate growth compared with the crude oil.

<Reference> Trend of Oil Prices

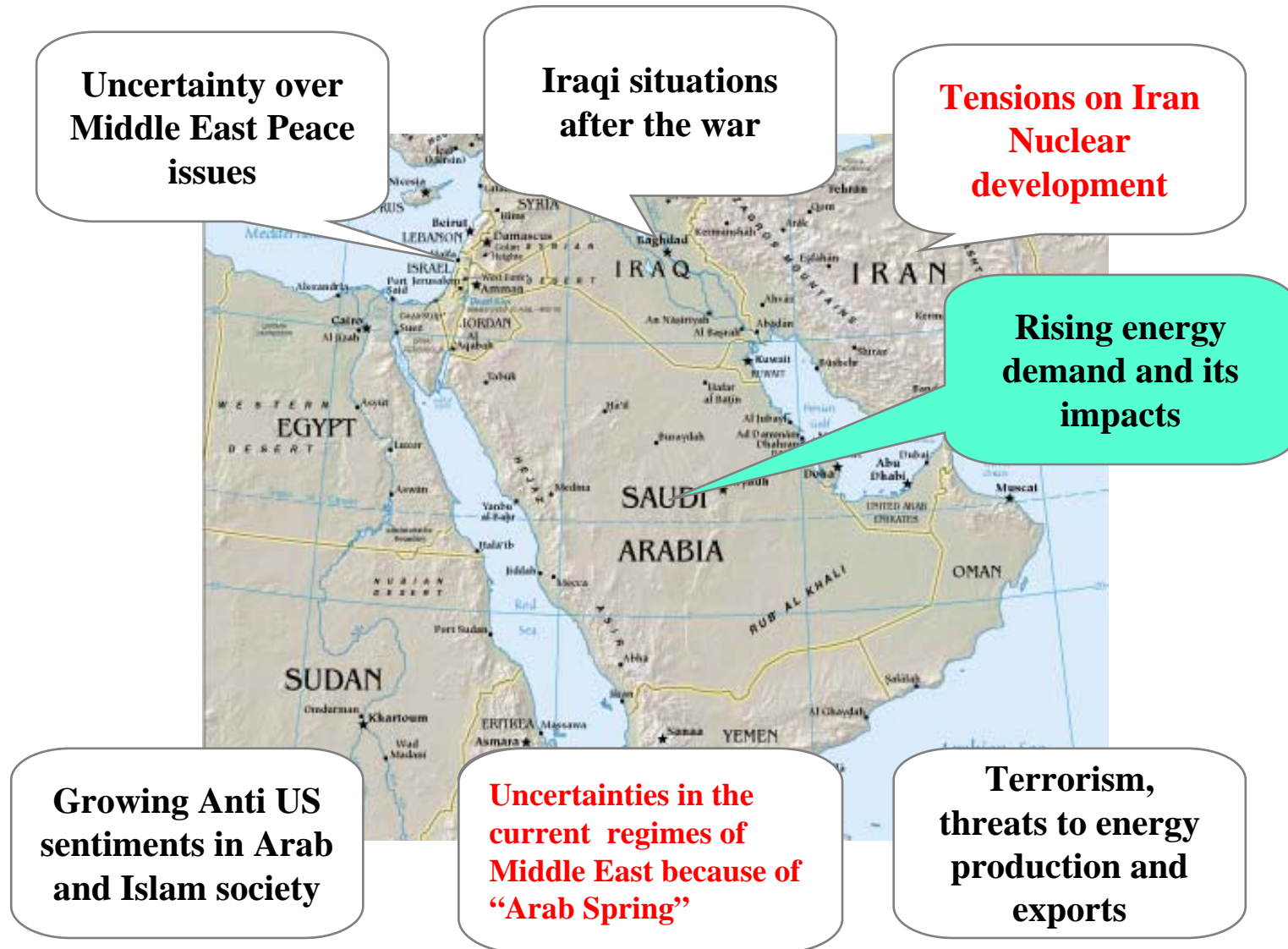
- Crude oil price have remained at a very high level in 2012.
- Average Brent crude oil price is forecasted at \$105/B (+/1\$10/B) for 2013



- Average Brent crude oil is \$111.7/B (WTI \$94.2/B)
- The price level remained at a historically very high level since 2011.
- Brent exceeded \$120/B in February to March 2012 due to geopolitical concerns.
- Although Brent fell since May 2012 due to European fiscal crises, it regained another momentum afterward.
- Since October 2012, Brent and WTI maintained above \$100/B and \$80/B, respectively.

2-1. Recent Uncertainties in the Global Energy Landscape

Uncertainty in M.E. has deepened as Arab Spring spread.



Source: Prepared by IEEJ

2-2. Recent Uncertainties in the Global Energy Landscape

Shale revolution : The surge in unconventional oil & gas has huge implication.

Remaining technically recoverable oil resources by type and region

	Conventional		Unconventional			total
	Crude oil	NGLs	Extra heavy oil and bitumen	Kerogen oil	Light tight oil	
OECD Americas	253	57	809	1000	70	2188
OECD Europe	59	31	3	4	18	116
E.Europe/Eurasia	352	81	552	20	14	1019
Asia	100	37	3	16	63	219
Middle East	982	142	14	30	4	1172
Africa	255	52	2	0	33	341
Latin America	245	32	498	3	37	815
World	2245	433	1880	1073	240	5871

Source: IEEJ “Asia/World Energy Outlook 2012”

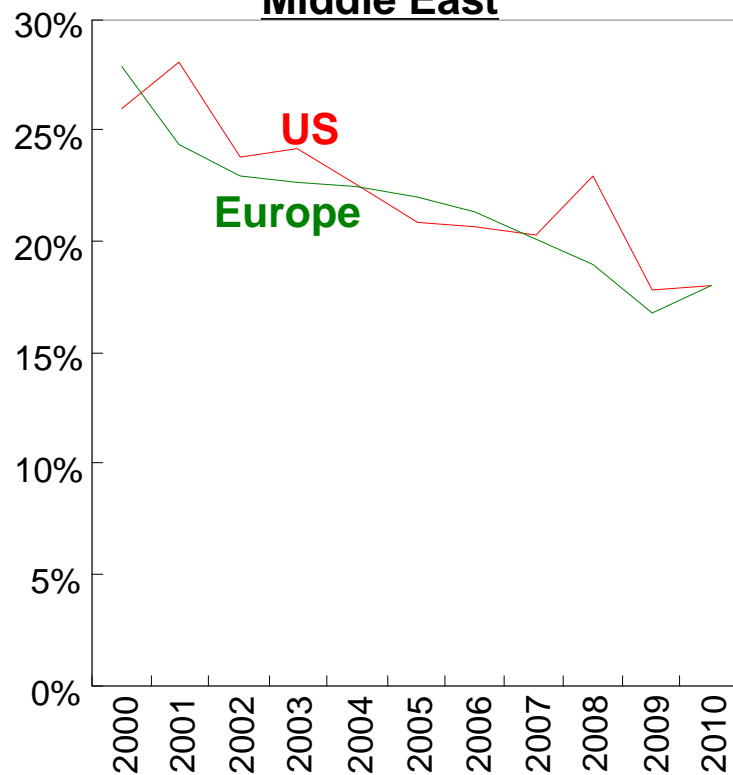
Remaining technically recoverable natural gas resources by type and region

	Conventional	Unconventional			total
		Tight gas	Shale gas	Coalbed methane	
E.Europe/Eurasia	144	11	12	20	187
Middle East	125	9	4		137
Asia-Pacific	43	21	57	16	137
OECD Americas	47	11	47	9	114
Africa	49	10	30	0	88
Latin America	32	15	33		80
OECD Europe	24	4	16	2	46
World	462	81	200	47	790

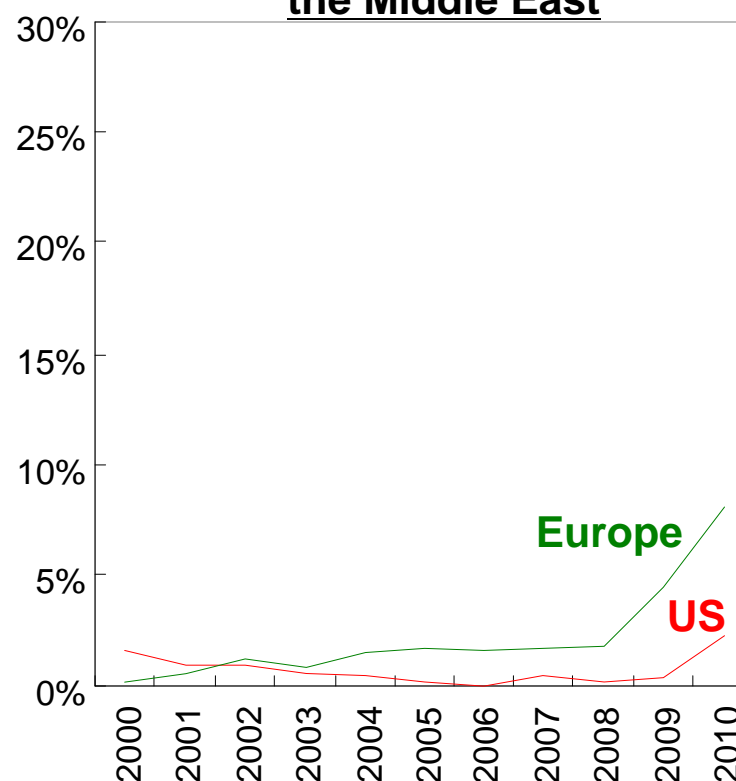
Source: IEEJ “Asia/World Energy Outlook 2012”

<Reference> Implications of decreasing dependence on Middle East in Europe / US

Dependence of oil import on the Middle East



Dependence of natural gas import on the Middle East



- Oil: US dependence on the Middle East continues to decline while the import from Canada and Central and South America increases and dependence of Europe on the Middle East continues to decline while the import from former USSR countries increases.
- Natural gas: Dependence on the Middle East slightly increases due to reinforced LNG export capacity in the Middle East.

2-3. Recent Uncertainties in the Global Energy Landscape

The trust on nuclear safety was seriously damaged because of Fukushima nuclear accident.

<Global shift in opinion on nuclear energy after Fukushima >

Unit: %

	Before (Pro: Con)	=>	After (Pro: Con)
① Japan	52:28	=>	39:47
② USA	53:37		47:44
③ France	66:33		58:41
④ Germany	34:64	=>	26:72
⑤ Russia	63:32		52:27
⑥ Korea	65:10		64:24
⑦ China	83:16		70:30

Source: Gallup International (April 19,2011)

3-1. How have energy policies changed in major countries ?

1) General direction of energy policy, given three recent developments in the energy arena:

- **Nuclear energy promotion policy** seem to remain unchanged, particularly in Asia, with some slowdown in major countries. Concerns with energy security and Climate Change are driving forces .A few European countries such as Germany are exceptions.
- **Renewable energy** appears to be steadily expanding, but are faced with challenges such as higher cost and intermittence.
- **Natural gas** which is a cleaner energy is becoming popular, but in Europe, there also seem to be shifts to cheaper **coals** exported from the US.

3-2. How have energy policies changed in major countries ?

2) Energy policy in Asia

A. China

- Dependence on **petroleum import has been increasing**
(▲18% in 1990-> 63% in 2010->76% in 2035 ieej est.)
- Aggressive to acquire** oil and gas overseas
- Expands nuclear power** (15+26 plants under construction) and **renewable energy**

B. Korea

- energy **self sufficiency ratio** is very low (approximately 4%)
- **nuclear energy** is necessary for 3E
- eager for **renewable** energy

C. ASEAN.

- shift from petroleum and coal to **gas**
- **a few countries** are promoting nuclear energy
- enthusiastic about **renewable energy**

3-2. How have energy policies changed in major countries ?

2) Energy policy in Asia

D. Japan

- The Abe administration **started the review of energy policy in March 2013,** at the advisory organ for METI Minister

- LDP's commitment before the election last December,

a. Short tem

- * **Existing nuclear reactors should be restarted as** the **Nuclear Regulatory Commission,** which was established in mid- September in 2012, **confirms their safety** within three years.

b. Long term

- * **The best energy mix should be determined within ten years,** by evaluating the performance of renewable energy , which is being increasingly introduced after “ Feed in tariff system ” set in last July .

4. How to cope with recent uncertainties : Four cooperative agenda for Asia

1. Energy Conservation

2. Elimination of Asian Premium for LNG Trade

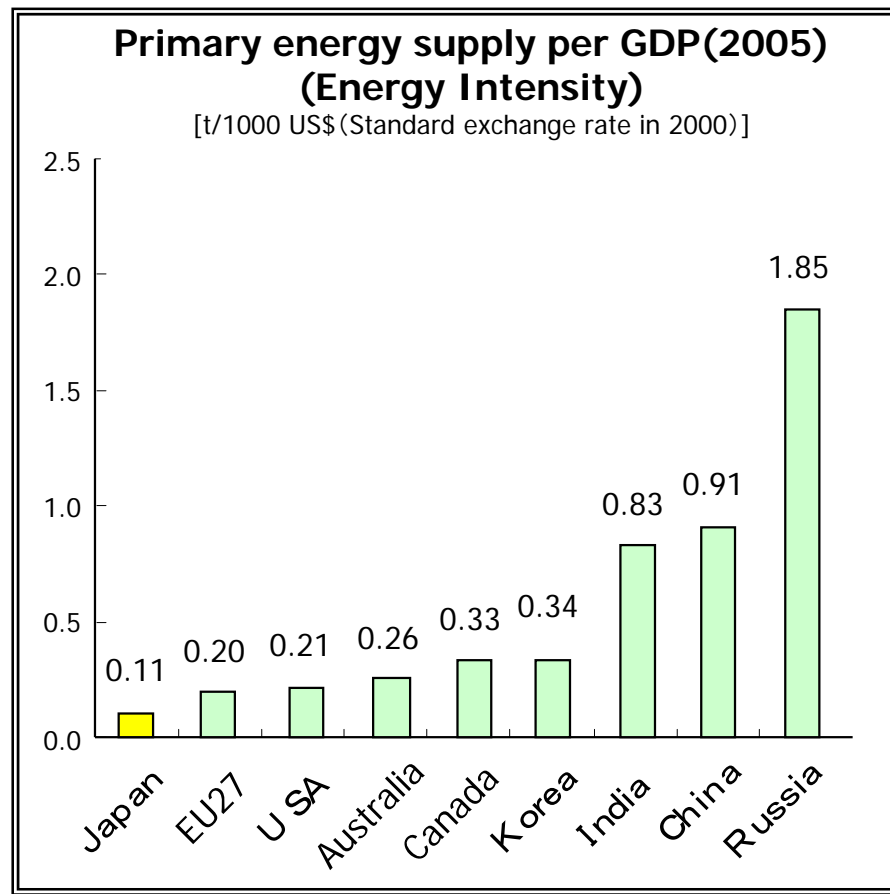
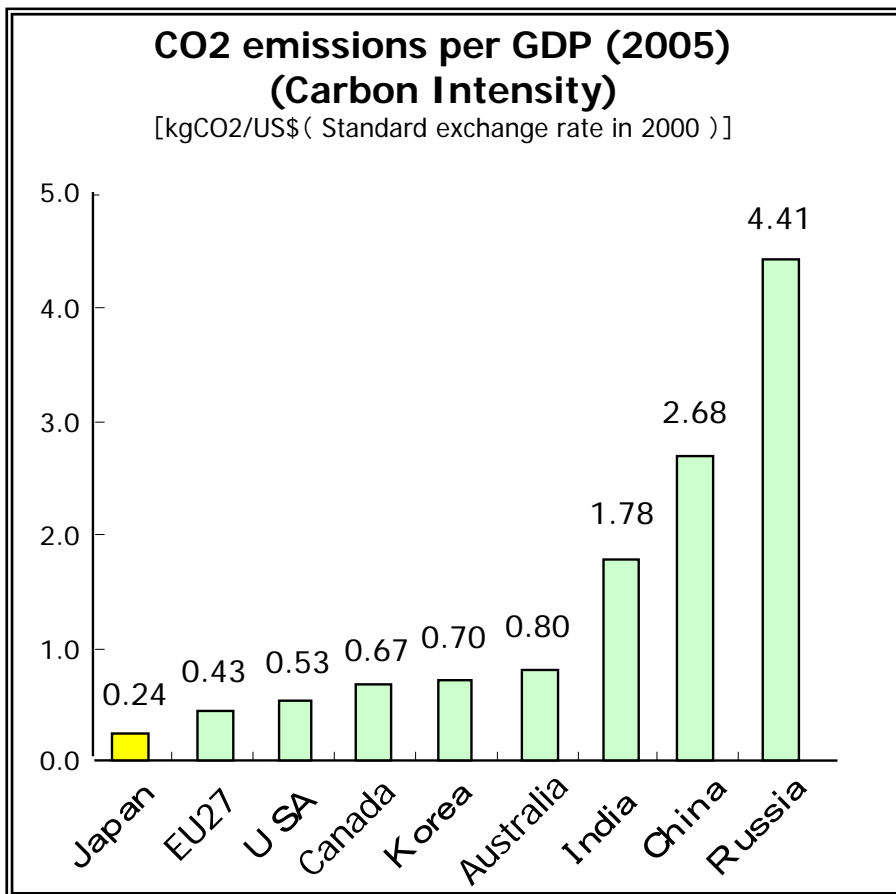
3. Ensuring safety of Nuclear Energy

4. Regional network : Natural Gas and Power Grid

4-1. How to cope with those uncertainties: Cooperation

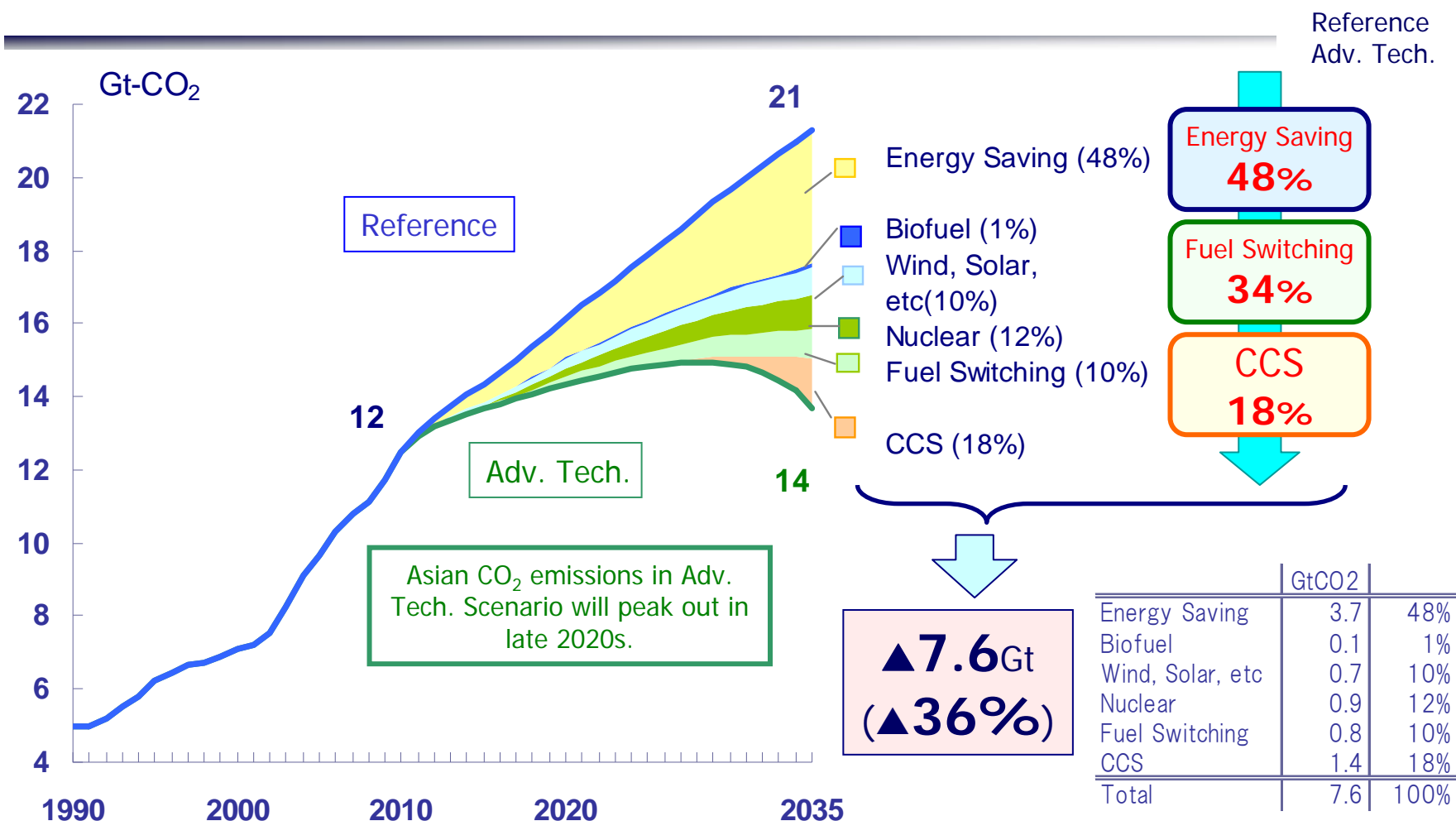
Energy conservation is beneficial for all importing countries.

Energy conservation would increase energy independence and contribute to combat Climate Change



Source: IEA (2007), "CO2 emissions from fuel combustion 1971-2005"

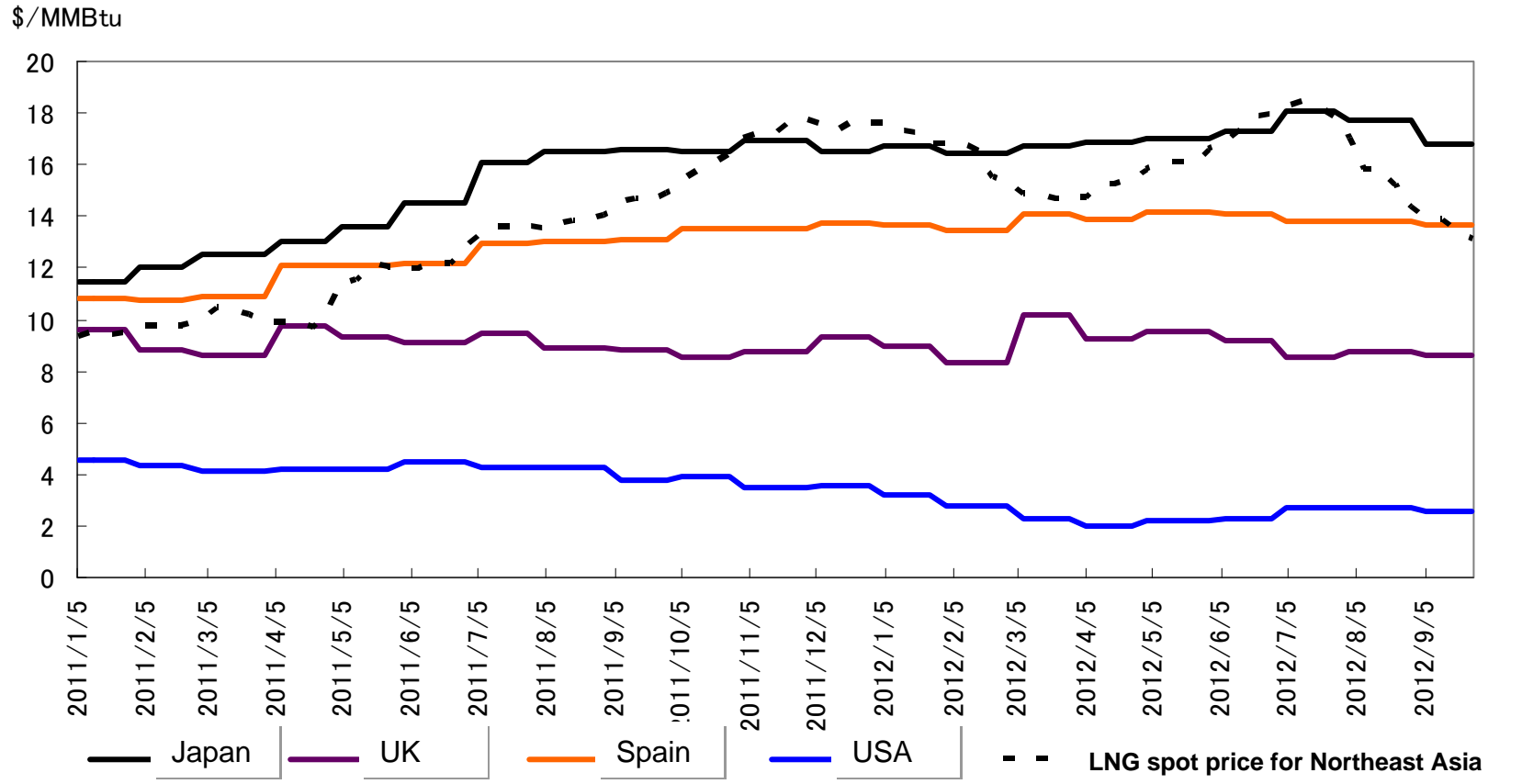
<Reference> CO₂ Emissions Reduction by Technology (Asia)



- Aggressive development and deployment of advanced technologies in Asia enables to considerably reduce CO₂ emissions and realize its peak by late 2020s.

4-2. How to cope with those uncertainties: Cooperation

Asian spot market and Asian hub are necessary to eliminate Asian Premium of LNG trade in Asia



Source: Energy Intelligence, EIA



4-3. How to cope with those uncertainties: Cooperation

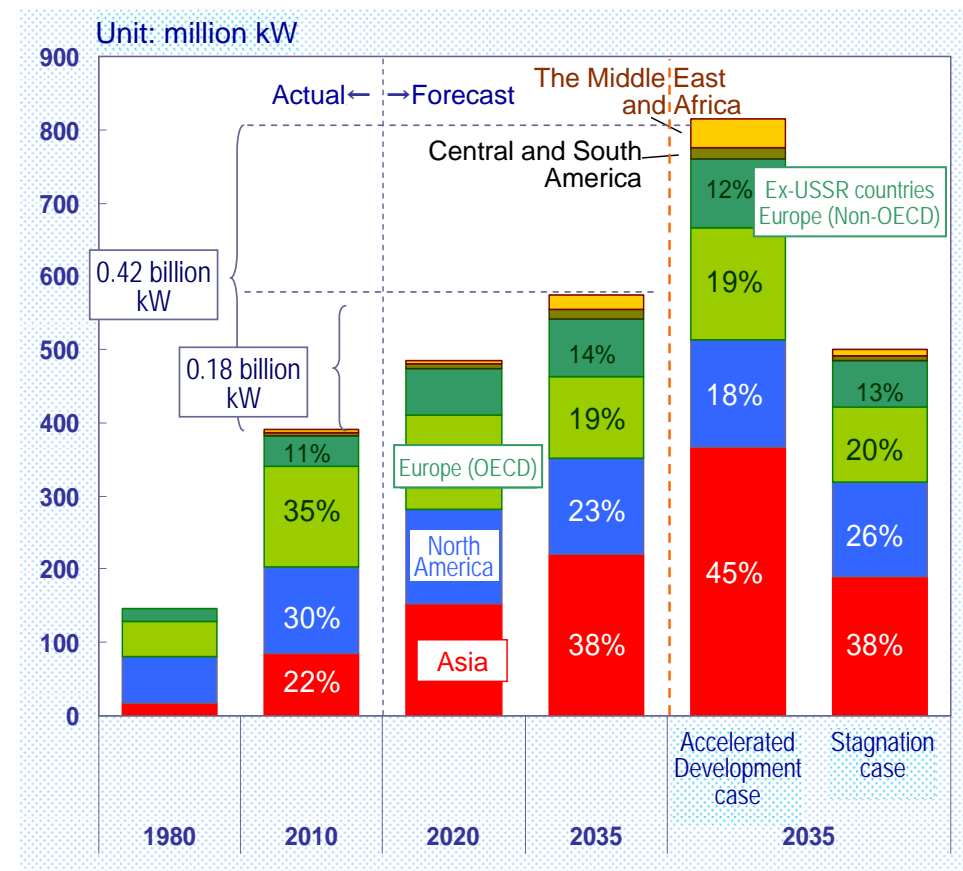
Nuclear Power could expand safely based on lessons from Fukushima

- The rapid expansion of nuclear power generation in Asia is based on its advantages of *energy security* and *global warming prevention*, and the vital need for nuclear power as an *economically efficient generation option*, for economic growth.
- The total installed capacity of nuclear power generation in Asia is expected to increase by at least a factor of two to four from the present level by 2035.

Outlook for Installed Capacities in Asia for Nuclear Power Generation
(Unit: million kW)

	2010	2020			2035		
		Reference case	Accelerated development case	Stagnation case	Reference case	Accelerated development case	Stagnation case
China	9	60	70	60	104	158	104
Taiwan	5	8	8	5	6	8	4
South Korea	18	24	32	24	34	48	34
ASEAN	0	0	0	0	9	26	3
India	4	18	26	18	35	72	35
All Asia	85	153	179	139	220	366	190

Outlook for Installed Capacities in the World for Nuclear Power Generation



Source: Asia and World Energy Outlook 2011



<Reference> The cause of the Fukushima accident tells us lessons

I) The Japanese Government's Nuclear Incident Investigation and Verification Committee

- ① Safety measures/emergency response measures
: Introducing new techniques and findings covering complex disaster.
- ② Safety measures taken in the nuclear power generation system
: Severe accident measures
- ③ Preparation for nuclear disasters
: Risk management system in time of a nuclear disaster
- ④ Measures to prevent/mitigate damages
: Activities to disseminate risk information, monitoring, evacuation of residents, etc.
- ⑤ International consistency
: Consistency with the international criteria including IAEA standards, etc.
- ⑥ How the related organizations should be
: **Independence of nuclear safety organizations**
- ⑦ Continuous investigation
: Continuation of investigation activities, etc.

II) The National Diet of Japan, Fukushima Nuclear Accident Independent Investigation Commission

- ① Supervision of a regulatory authority by the national diet
: Establishment of a permanent committee
- ② Review of the government's risk management regime
: Operators shall have the primary responsibility on the site.
- ③ The response of the government to the disaster victims
: Information disclosure, prevention of escalation of contamination
- ④ Supervision of the electric utilities
: Preventing the operators to put undue pressure to the regulatory authority.
- ⑤ Requirements of the new regulatory organization
: **Independence**, high transparency, and expertise etc.
- ⑥ Review of nuclear regulation laws
: Review and backfit based on the world latest technologies.
- ⑦ Utilization of independent investigation committee
: Establishment of a third party committee in the diet.

< Reference > Significance of International Standards

<10 fundamental safety principles set out by IAEA>

Principle 1: The prime **responsibility** for safety **rests with the licensees**.

Principle 2: An effective framework for safety, **including an independent regulatory body**, must be established and sustained by the governments.

Principle 3: Leadership in safety matters has to be demonstrated at the highest levels in an organization.

Principle 4: Only those facilities and activities whose benefits exceed radiation risks should be justified.

Principle 5: Protection shall be optimized to provide the highest level of safety and it shall be reviewed regularly.

Principle 6: Individual risk shall be controlled within the prescribed limits.

Principle 7: **People and environment**, present and future, must be protected against **radiation risks**.

Principle 8: Primary means of the **prevention and mitigation** of the accident consequence are the “**defense in depth**”. Good design and engineering features providing safety margins, and diversity and redundancy must be introduced.

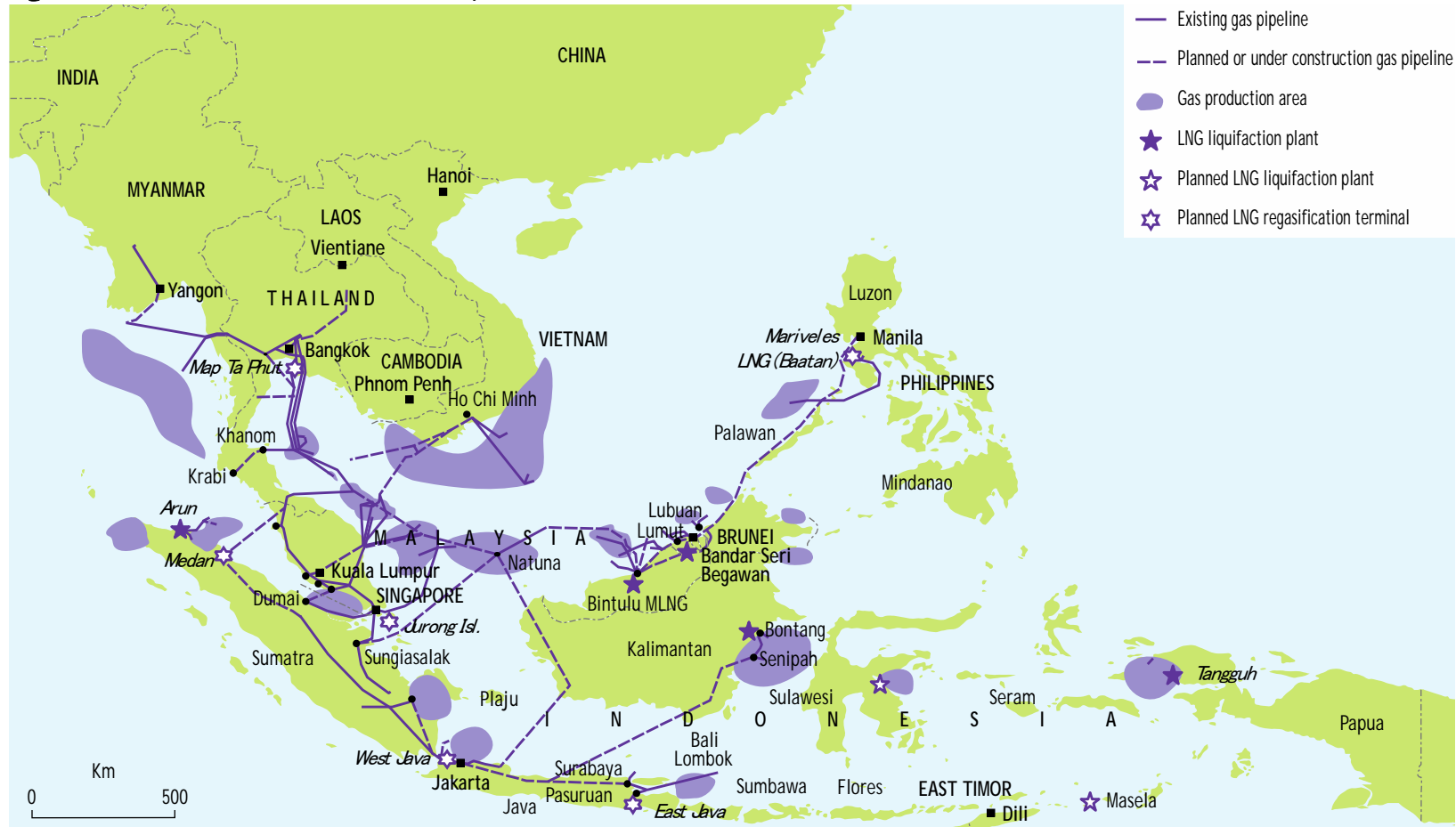
Principle 9: **Emergency preparedness** and response should be established.

Principle 10: Protective actions to reduce radiation risk must be **justified and optimized**.

4-4. How to cope with those uncertainties: Cooperation

① ASEAN is working on Gas Pipeline System, which would help spot market expand and establish an Asian hub.

Figure 15.16 • The Trans-ASEAN Gas Pipeline (TAGP)

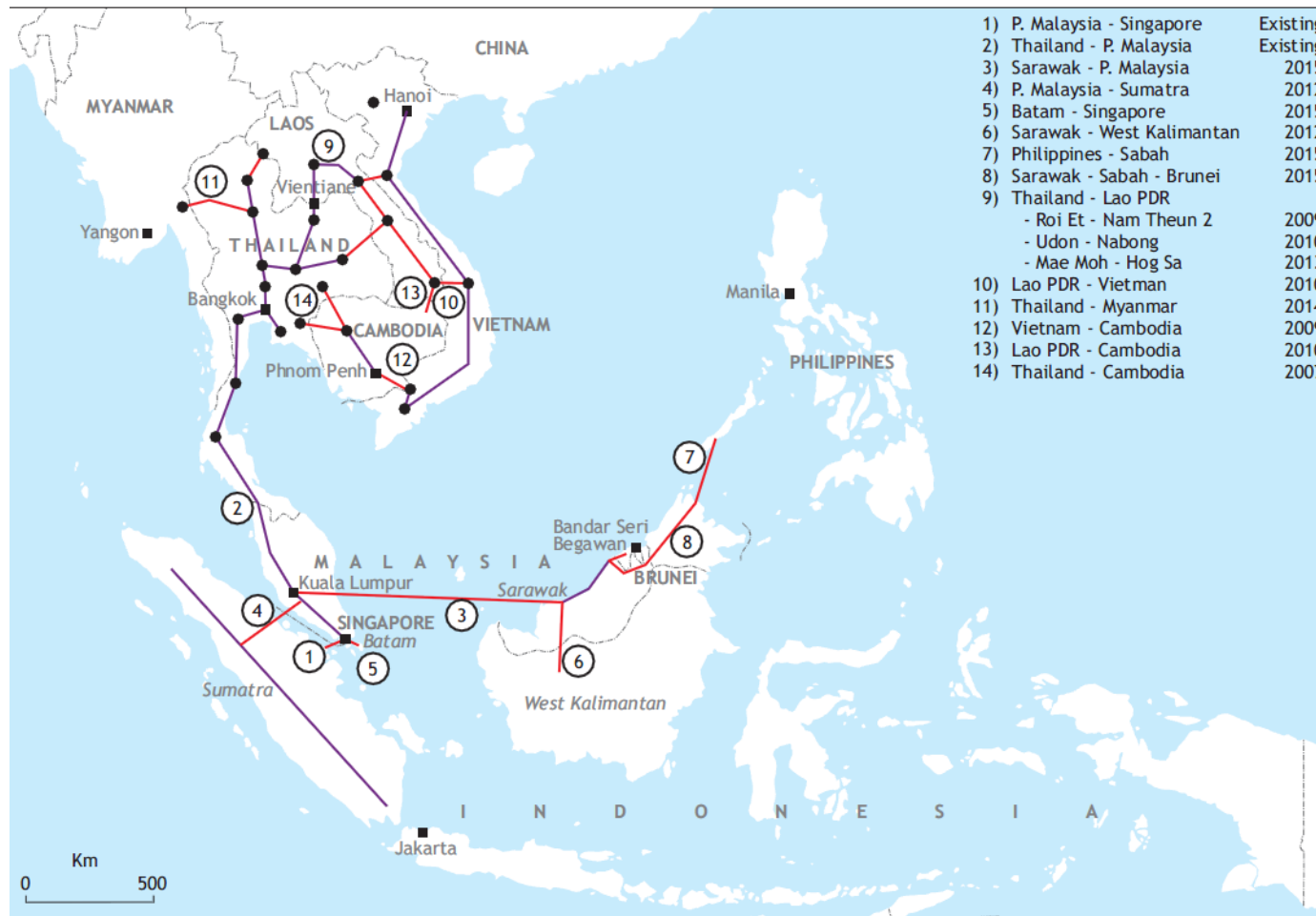


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Source: ASCOPE Secretariat

4-4. How to cope with those uncertainties: Cooperation

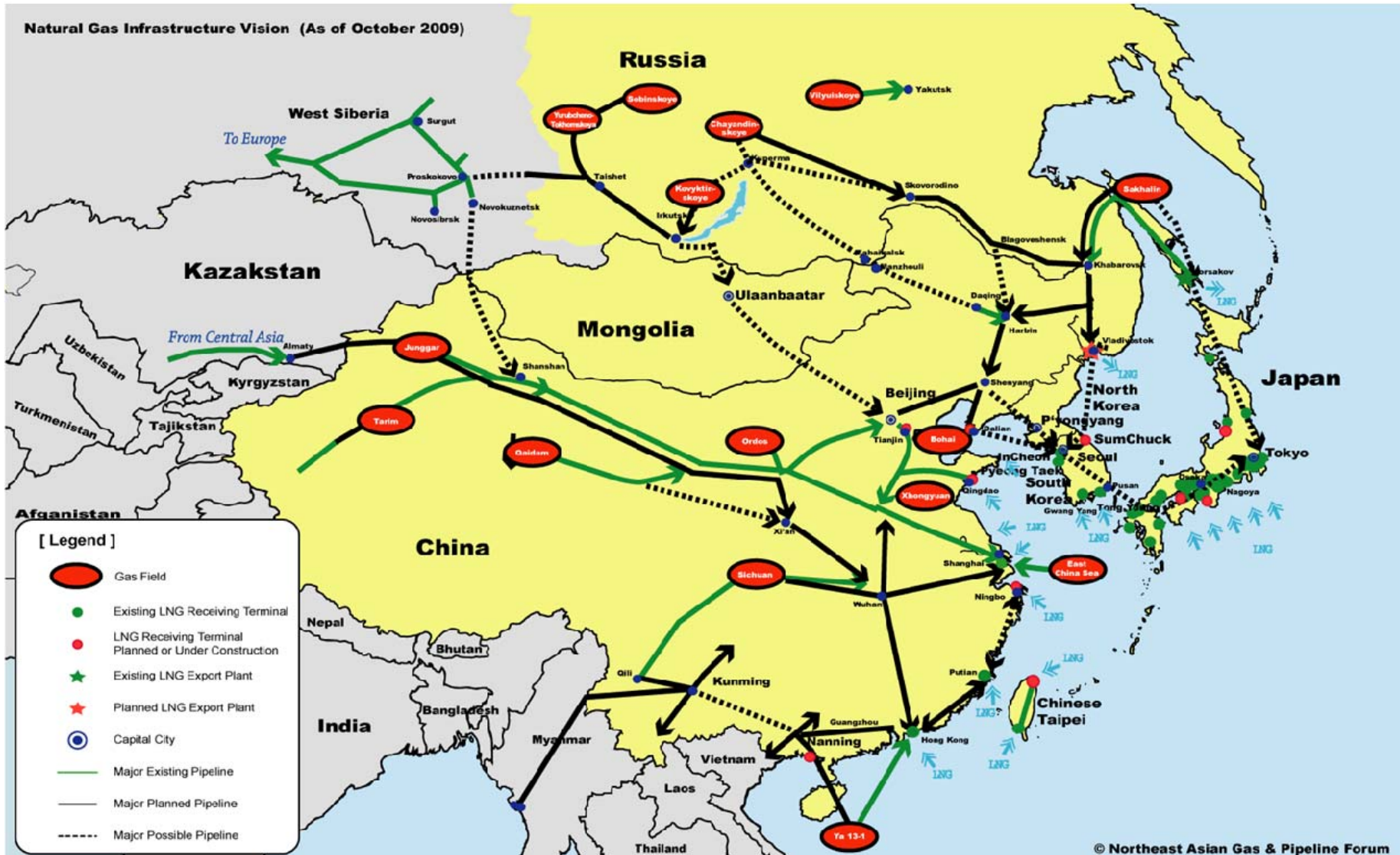
② ASEAN is working on Power Grid Interconnections, which would facilitate to minimize the excess capacity and enlarge the capacity to absorb unstable generation by renewable energy



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4-4. How to cope with those uncertainties: Cooperation

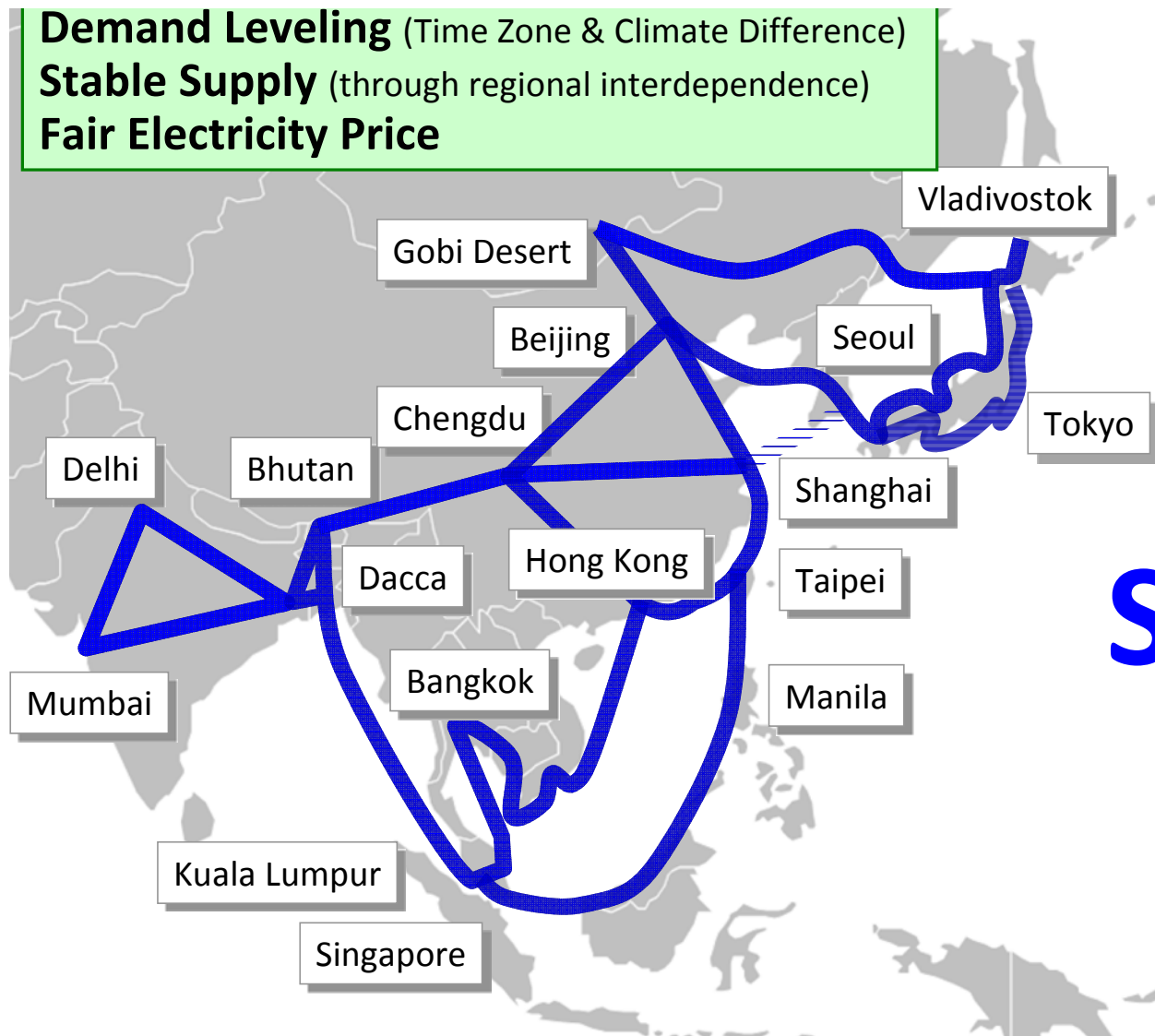
③ North East Asian Gas pipeline network has started being discussed.



4-4. How to cope with those uncertainties: Cooperation

④ A New Asian Vision for Asian super grid ?

Demand Leveling (Time Zone & Climate Difference)
Stable Supply (through regional interdependence)
Fair Electricity Price



Phase 3

Asia Super Grid

Total 36,000km

Presentation by Mr. Masayoshi SON

<Reference> Significance of regional grid in EU

Germany is surrounded by EU grid which would complement its supply shortage

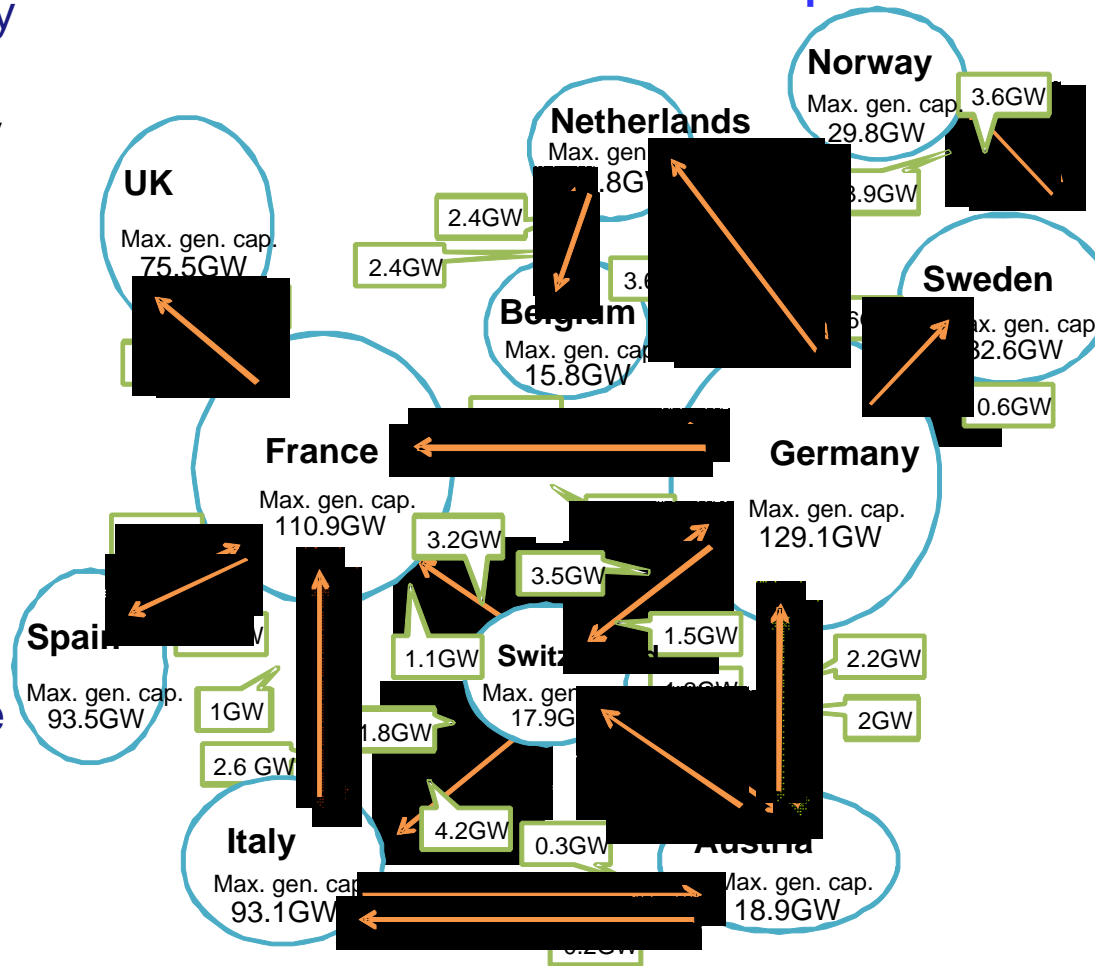
★ EU countries are connected by international networks for energy supply (power grids and pipelines). Note: The power supply capacity of the entire network is 10 times larger than the capacity of the German grid alone.

★ To optimize energy utilization in the entire Northeast Asian economic zone, Japan may consider power line interconnections with South Korea (and possibly also with China and Russia) as one of the options.

- Energy security
- Cost
- Best mix

...

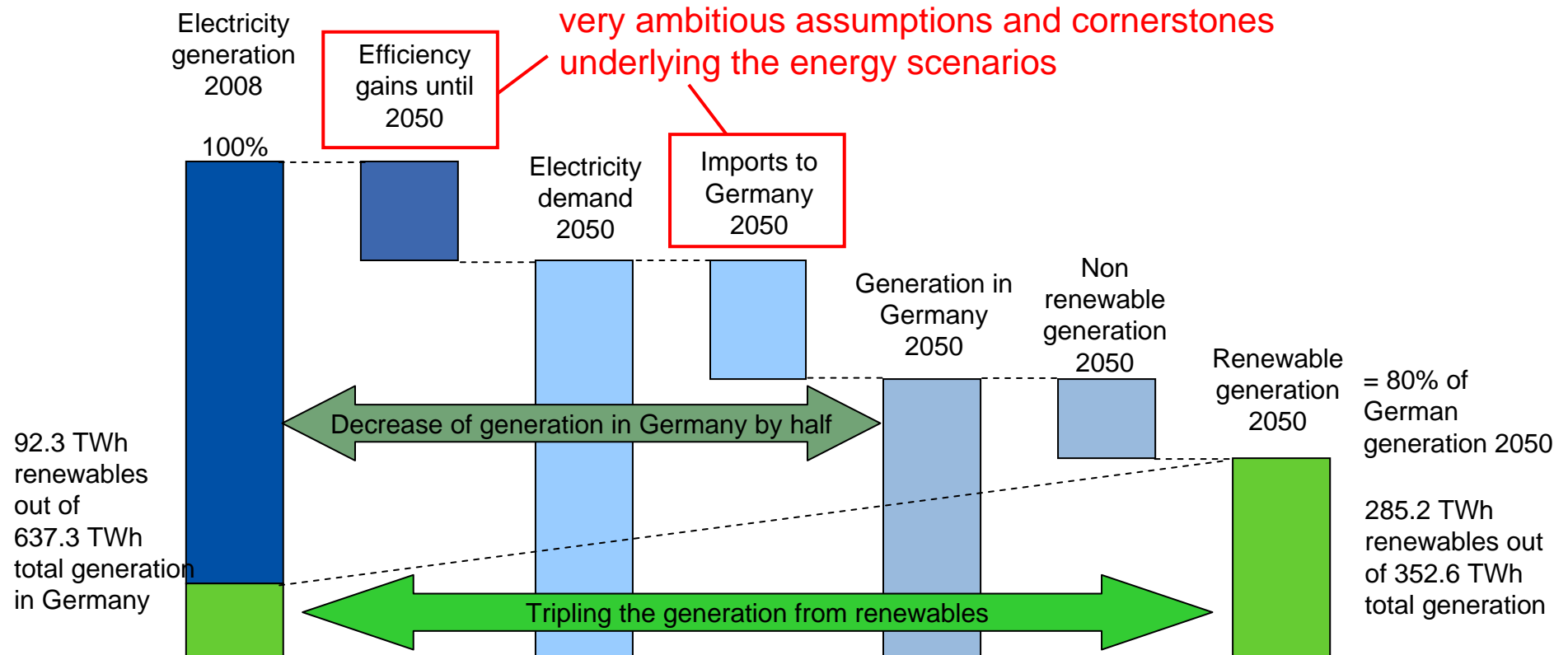
Power System Interconnections in Europe



Source: Material prepared by Secretary General Tanaka of IEA for an IEEJ meeting

< Reference > Significance of regional grid in EU

Germany is planning to import electricity from the neighbouring countries



Bruttostromerzeugung gemäß Tabelle A I-7, Szenario II A, Energieszenarien EWI, GWS, Prognos

5. Conclusion

1. Asia is a center of growth, but this means that Asia is a center of energy consumption
2. Energy landscape surrounding Asia is full of uncertainty
3. Asia is vulnerable unless appropriate energy policy is adopted and regional cooperation is made to cope with recent uncertainty
4. Four cooperation can be listed to be promoted;
 - 1) Energy conservation=>more energy independence
 - 2) Elimination of Asian premium for LNG trade
=> cheaper and cleaner
 - 3) Ensuring nuclear safety=> safer Asia
 - 4) Regional network for gas pipeline and power grid
=>more demand leveling and more renewable



Thank you for your attention!