Energy Policy in Japan
---Challenges after Fukushima---

January 24, 2013

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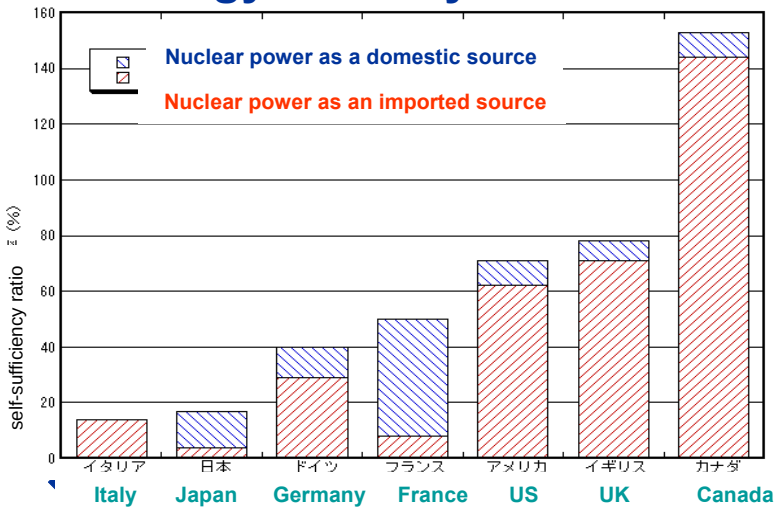
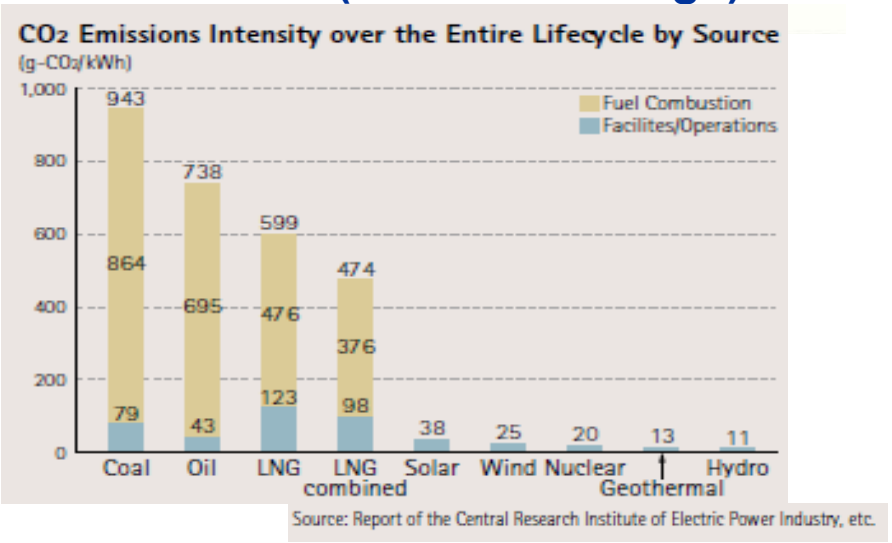
1. Energy Policy before Fukushima

1) 3E as key elements

◆ Energy Security



◆ Environment(Climate Change)



◆Efficiency(Cost)

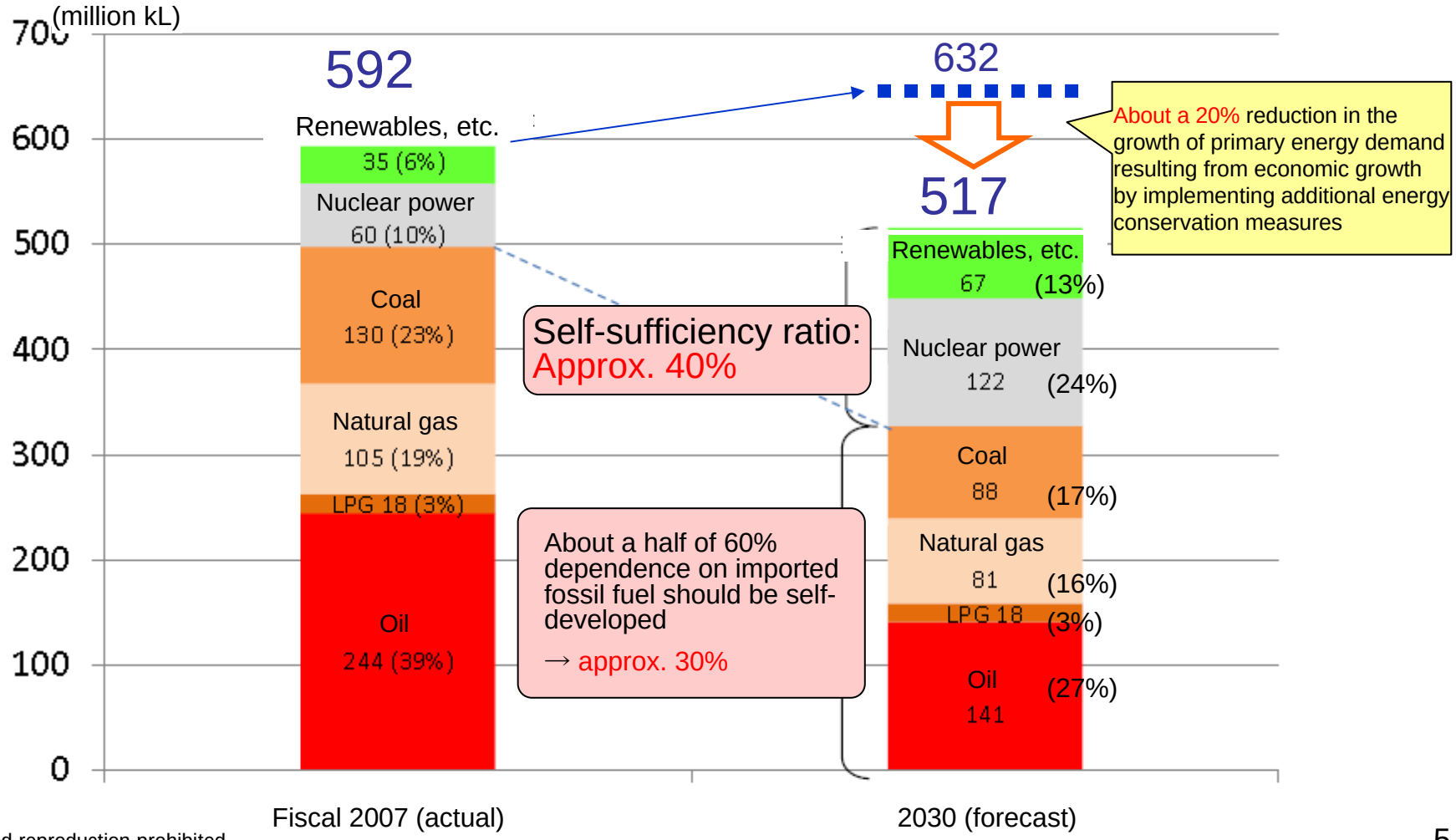
Energy White Paper

Power Source	Generation Cost（yen／kWh）	Capacity Factor (%)
Hydro	8.2~13.3	45
Oil	10.0~17.3	30~80
LNG	5.8~7.1	60~80
Coal	5.0~6.5	70~80
Nuclear	4.8~6.2	70~85
Solar	46	12
Wind	10~14	20

Source: White Paper on Energy, METI

2) A basic energy plan to address 3E was determined in 2010① :Primary Energy

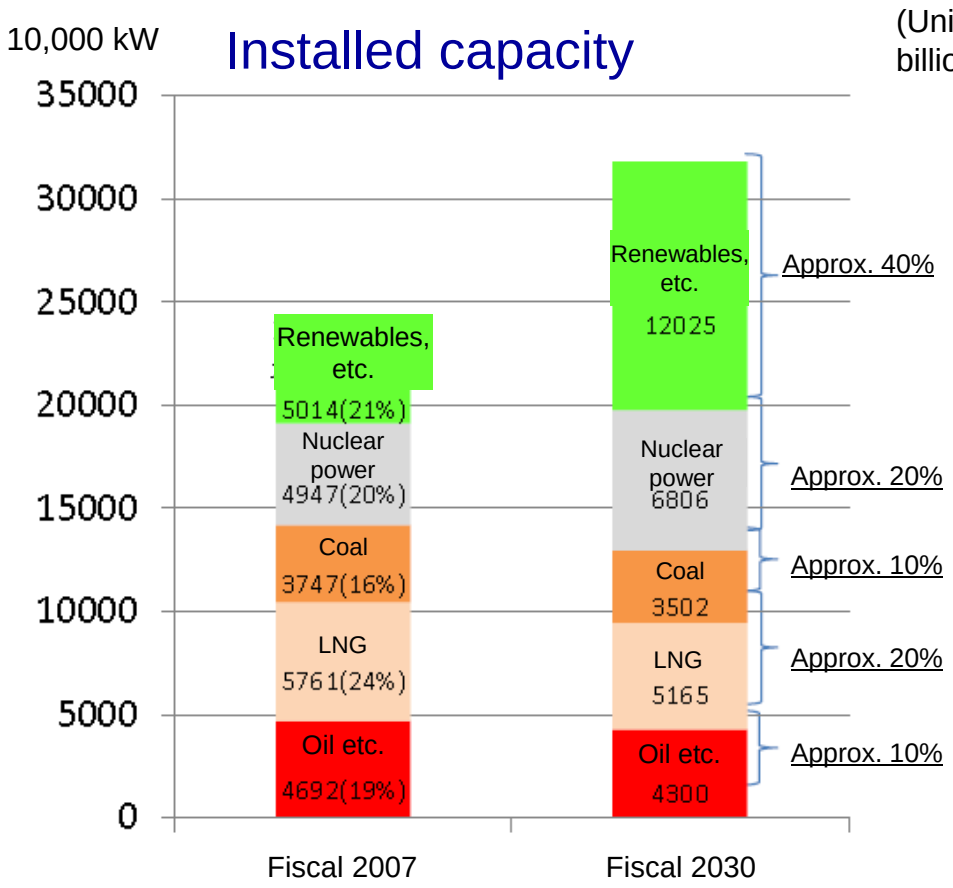
- Increasing the self-managed energy ratio (self-sufficiency ratio + self-development ratio) from 38% to ~70%
- Reducing CO2 emissions by 30% from the 1990 level

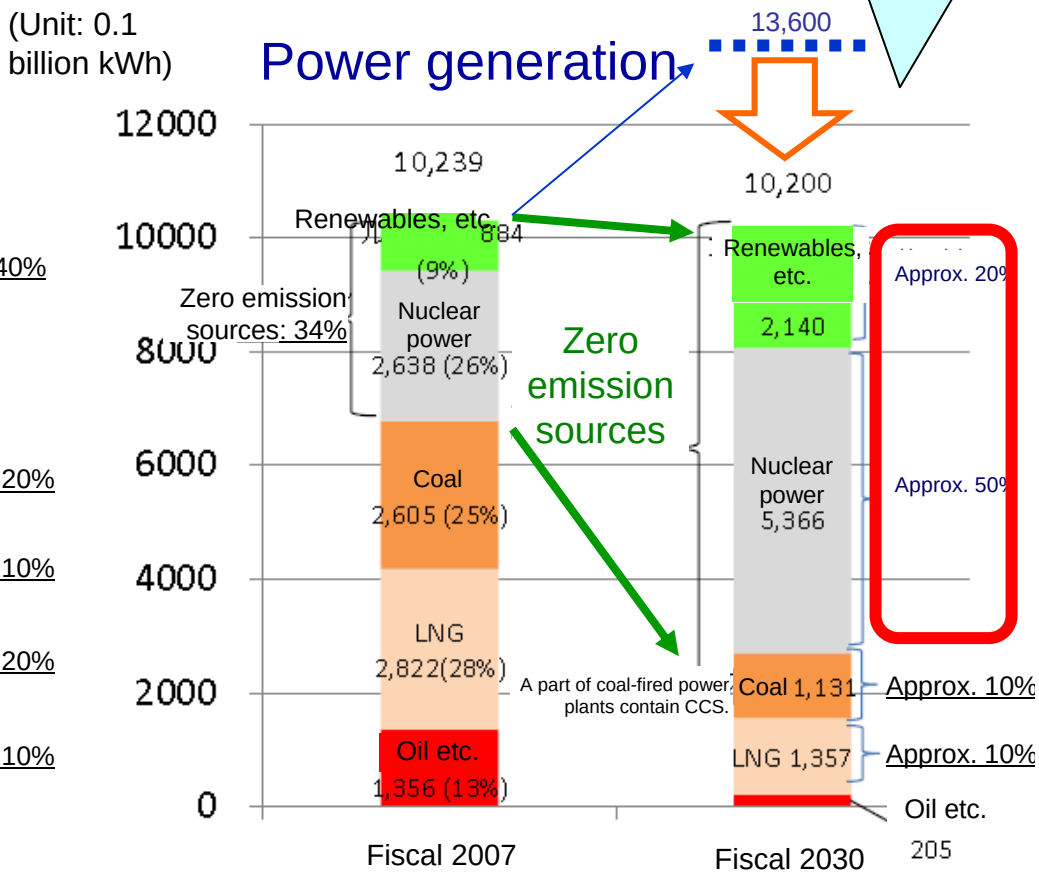


2) A basic energy plan to address 3E was determined in 2010② ：Generation Mix

- Building 14 reactors at new and existing sites and improving the operating ratio from 60% to 90%
- Increasing the introduction of renewable energy by 2.4 times
  (by 15 times, excluding hydropower)
- Increasing the proportion of zero-emission power sources from 34% to ~70%

About a 30% reduction in the growth of electricity demand resulting from economic growth by implementing additional energy conservation measures





2. Challenges after Fukushima

1) The trust on nuclear safety was seriously damaged

<Global shift in opinion on nuclear energy after Fukushima＞

Unit: %

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

Source: Galop International (April 19,2011)

2) From 3E to 3E + S +M

a. Energy Security
＊Geopolitical situation in Middle East continues to be uncertain.

b . Environment
＊The importance of Global warming remains unchanged.

c. Economic Efficiency
＊Nuclear energy seems to be less costly for Japan.

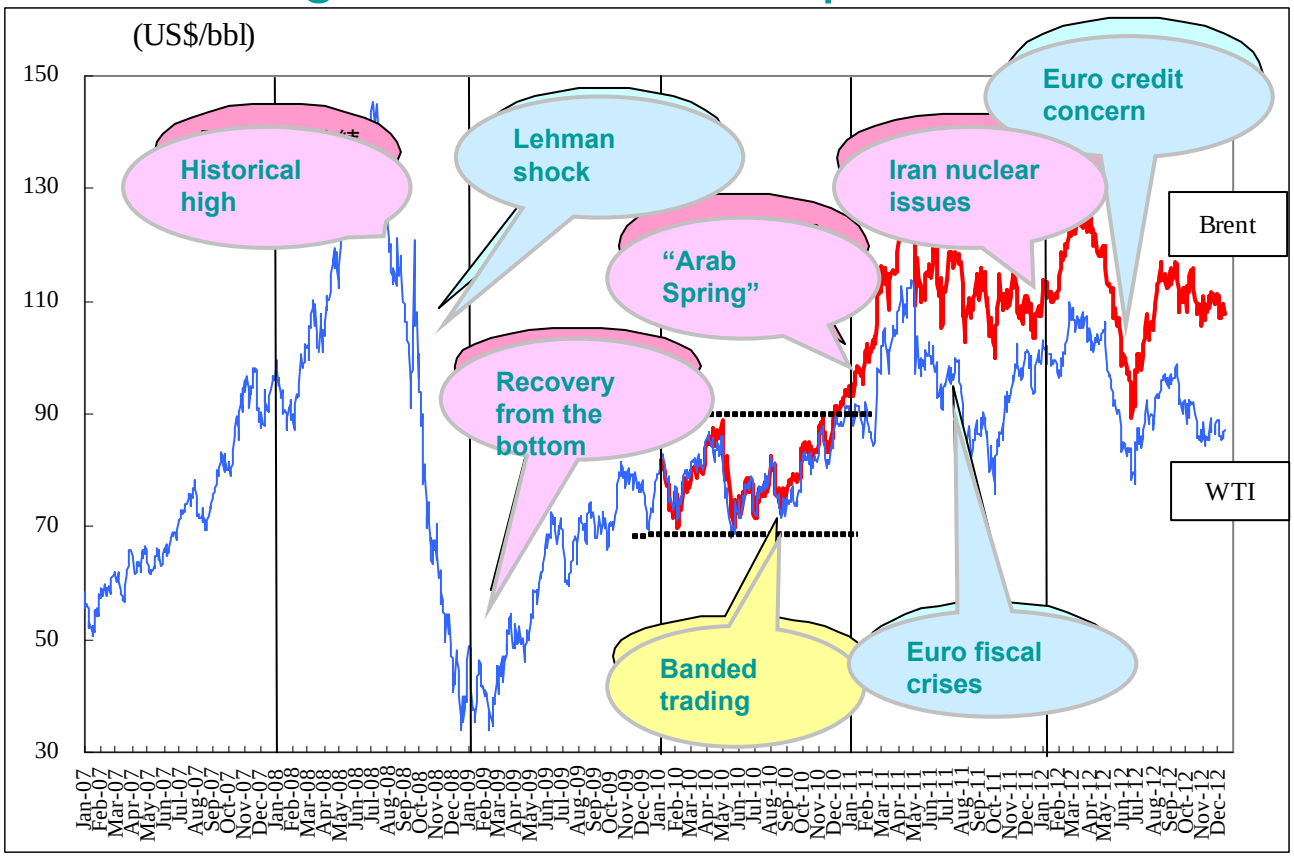
・・・・・・・・・But・・・・・・・

d. Safety
＊The challenge is whether nuclear safety is comfortablly assured.

e. Macro Economic Impact
＊Appropriate energy mix should be found to minimize the adverse effect on economic development

a. Energy Security① : 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



- 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.

a. Energy Security② : Uncertainty in Middle East (eg. Sanctions against Iran)

- Passage of oil through the Strait of Hormuz: more than 17 million B/D (approx. 20% of worldwide oil production; approx. 85% of oil imported by Japan)

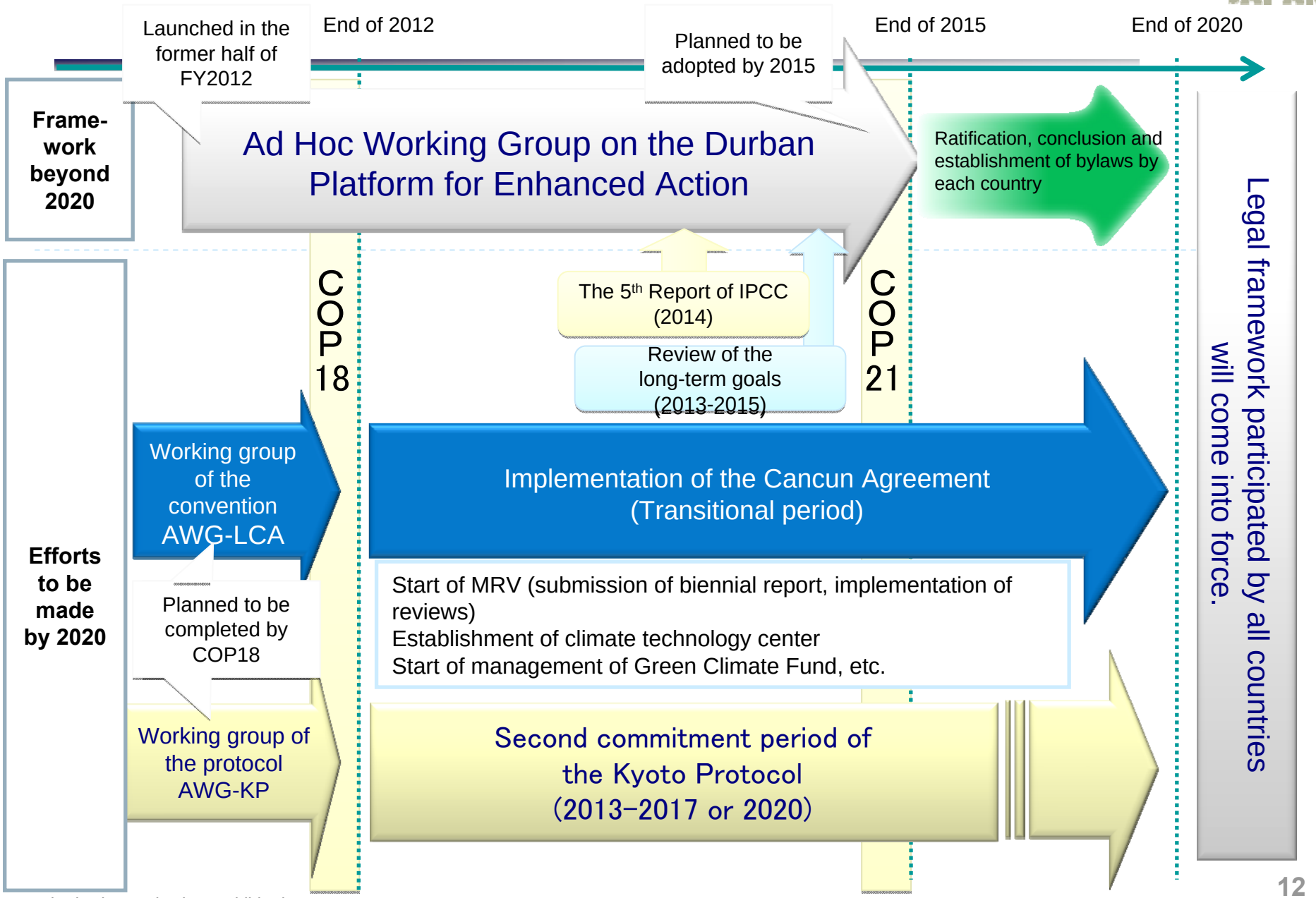
- Passage of LNG through the Strait of Hormuz: More than 82.60 million tons (approx. 30% of world LNG production; approx. 25% of LNG imported by Japan)

Notes:
- Based on Foreign Trade Statistics of 2010. Imports from Iran, Iraq, Bahrain, Saudi Arabia, Kuwait, Qatar and UAE are assumed to pass through the Strait of Hormuz.

- There are two sea lanes, each two miles wide, one to the Persian Gulf and the other to the Indian Ocean.

- The two lanes are separated by two miles.

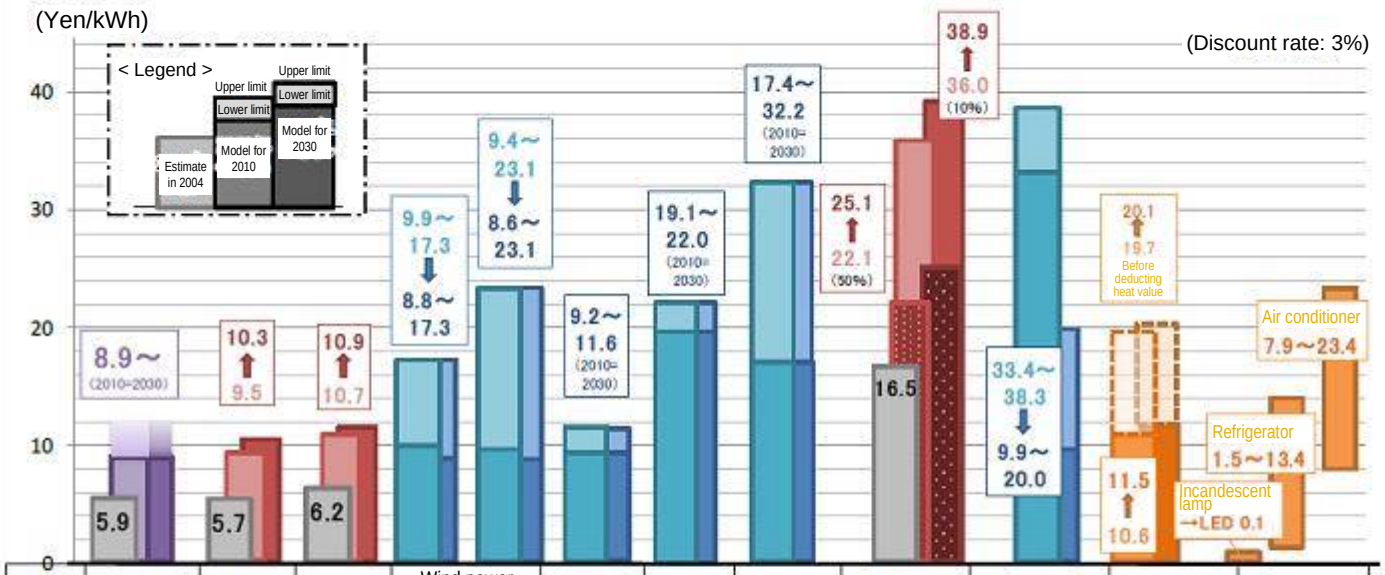
b. Environment (Climate Change) : Future Schedule for New Framework



c. Economic Efficiency (Cost): Nuclear power seems less costly in 2030

Points to estimate costs

- Model plant form (Based on plants which started to operate these 7 years, subsidies paid these 3 years, etc)
- Including social costs such as cost for countermeasures against nuclear accident risks and political policy costs
- As for models for 2020 and 2030, estimated the cost expecting increase of fuel cost and CO2 reduction cost, and decrease of the price caused by technology innovation



	Nuclear	Coal thermal	LNG thermal	Wind power: Onshore	Wind power: Offshore, Gravity base	Geothermal	Micro-hydro	Biomass (Woody biomass combustion)	Oil thermal	Photovoltaic (houses)	Gas cogeneration	Energy saving
Scenario, etc.	Nuclear fuel cycle current model	Scenario under new policy	Scenario under new policy	Unchanged - reduction	Unchanged - reduction	–	–	–	Scenario under new policy	Reference – paradigm shift	Scenario under new policy	–
Capacity factor	70%	80%	80%	20%	30%	80%	60%	80%	50%・10%	12%	70%	–
稼働年数 (2030年モデル)	40年	40年	40年	20年	20年	40年	40年	40年	40年	20年 (35年)	30年	–
留意点・ポイント	8.9円は下限。事故の損害額が5.8兆円から1兆円増えるごとに0.1円増。次世代軽水炉による合理化は、定量的には見込まず。	燃料費・CO2対策費用上昇、発電効率向上	燃料費のウェイト大。発電効率向上シェールガスのメリットは資源戦略が鍵。	量産効果でコスト低減の可能性あり。立地の拡大には、規制・制度改革、系統強化等が必要。		安定電源として有望。電源線のコストの問題がある。導入可能量拡大には、立地に係る課題の解決などが必要。	安定的な発電が可能、多くの場所で可能性あり。	未利用間伐材の収集・運搬距離等により燃料費が変動。	主に燃料費が上昇	量産効果でコスト半減の可能性あり。次世代太陽電池が実現すれば、コストはさらに下がる可能性あり。大量導入には、系統対策が必要。	熱の利用を勘案すると大規模集中電源並み。電気代（業務・産業：13.7円）の節約を考慮すると需要家のメリット大。	機器によって幅あり 電気代（家庭：20.4円）の節約を考慮するとメリット大。
今後の対応	○原子力の事故費用：最新の情報が得られ次第、数字を見直し。 ○技術革新や量産効果によるコスト低下：技術革新の進歩や普及の動向に応じて、試算結果の見直しや試算への組込み。 ○系統安定化対策：エネルギーミックスのシナリオが固まった段階でシナリオ毎に試算。 ○経済効果：エネルギーミックスのシナリオが決まった段階でマクロ的な効果として分析・試算。											

(Source) Cost Investigation Committee,Dec.2011

- The Cost Investigation Committee was established to reexamine the generation cost after the Fukushima accident.

- Due to reasons such as the cost of accident prevention measures, the increase of construction cost and the rising crude oil price, the costs of thermal power and nuclear power generation have risen from the previously estimated levels. Even according to the lowest estimations, the generation cost was given as follows:
8.9 yen/kWh by nuclear power, 9.5 yen/kWh by coal-fired generation and 10.7 yen/kWh by LNG-fired generation.

- As the presently confirmed loss caused by the Fukushima accident, 5.8 trillion yen was added to the cost of nuclear power generation.
The additional cost of each trillion yen will raise the generation cost by 0.09 yen/kWh.

d. Safety① : Nuclear Policies of Major Countries

1) —①　Consistently promoting

- US：The government has been consistently promoting nuclear power in terms of security and more recently, in terms of anti-global warming.
- France：It has been promoting nuclear power in terms of security. Even after the recent change in administrations, its energy policy based on nuclear power has remained unchanged.
- Ukraine：It keeps nuclear option in order to prevent too much dependence on Russia, taking due consideration for the Chernobyl accident. (The Prime Minister of Ukraine once said “only the wealthy nations can discuss elimination of nuclear power.”)
- Korea：It has been consistently promoting nuclear power in terms of security and is very eager to export nuclear infrastructure.
- China：It is promoting nuclear power to cope with the increasing electricity demand and to ensure security, and more recently, in terms of anti-global warming.

1) —②　Shifted to be pro-nuclear after declining nuclear popularity or moving back and forth between pro- and anti-nuclear

- UK：It used to put priority on market fundamentalism; however, it shifted to be pro-nuclear in terms of security and anti-global warming measures.
- Sweden：Although it once expressed to become a nuclear-free nation in response to the public referendum results in 1980, it continues to use nuclear power because of being unable to get future perspective of securing alternate power sources. The plant operator published a replacement plan in 2012.

2) Shifted to be nuclear-free after moving back and forth between pro- and anti-nuclear

- Germany：After announcing to become a nuclear-free nation and then withdrawing such decision, it announced again to phase out its nuclear power by the end of 2022.
- Italy： Although it announced to become a nuclear-free nation by the end of 1990, a bill to re-introduce nuclear power was passed in 2009. Then, it shifted again to abandon nuclear power in response to the Fukushima accident.

d. Safety②: The cause of the Fukushima accident

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

①Safety measures/emergency response measures
: Introducing new techniques and findings covering complex disaster.

②Safety measures taken in the nuclear power generation system
: Severe accident measures

③Preparation for nuclear disasters
: Risk management system in time of a nuclear disaster

④Measures to prevent/mitigate damages
: Activities to disseminate risk information, monitoring, evacuation of residents, etc.

⑤International consistency
: Consistency with the international criteria including IAEA standards, etc.

⑥How the related organizations should be
: Independence of nuclear safety organizations

⑦Continuous investigation
: Continuation of investigation activities, etc.

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

①Supervision of a regulatory authority by the national diet
: Establishment of a permanent committee

②Review of the government's risk management regime
: Operators shall have the primary responsibility on the site.

③The response of the government to the disaster victims
: Information disclosure, prevention of escalation of contamination

④Supervision of the electric utilities
: Preventing the operators to put undue pressure to the regulatory authority.

⑤Requirements of the new regulatory organization
: Independence, high transparency, and expertise etc.

⑥Review of nuclear regulation laws
: Review and backfit based on the world latest technologies.

⑦Utilization of independent investigation committee
: Establishment of a third party committee in the diet.

d. Safety ③: 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.

d. Safety④: Way to Regain the Public Trust on Nuclear Safety

Abandoning safety myths and ensuring defense in depth

:The risk of recurrence of the accident shall be reduced from 3 viewpoints under the public-private partnership and radiation damage shall be prevented in case of accident.

a. Enhancement of Measures for severe accident and for station blackout etc.; Restarting only the plants for which safety measures have been applied under the previous safety regime

- Emergency safety measures ＋ stress test
- Additional safety measures consisting of 30 subjects
- Continuous progress of the safety regulation framework
- Enhancement of countermeasures against emergency based on the idea that absolute safety never exists.

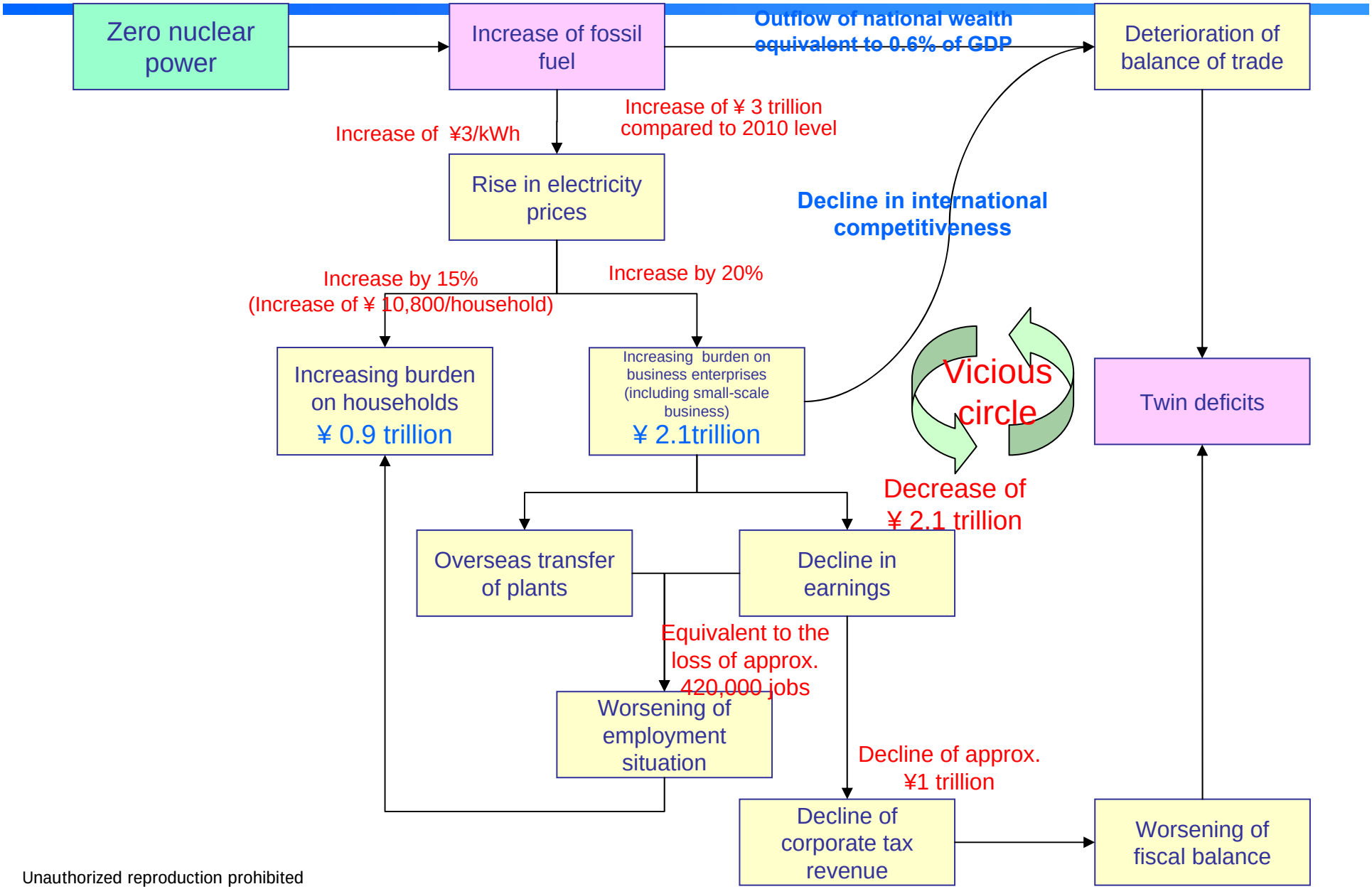
b. Securing independence of the Nuclear Regulation Authority and restarting under the new safety regime

- Enhancement of the measures to secure safety and reinforcement of both hardware and software in response to the implementation of strict regulations and inspections
- On September 19, the Nuclear Regulatory Authority was established, and Mr. Shunichi Tanaka the chairman of the Authority announced to review the above item a.

c. In addition implementing mutual verification of safety under the international cooperation … Ensuring compliance with the international standards

- Further contribution to the enhancement of the IAEA safety standards and taking initiative in performing peer reviews
- Performing mutual surveillance and sharing information on the best practice with the US and France

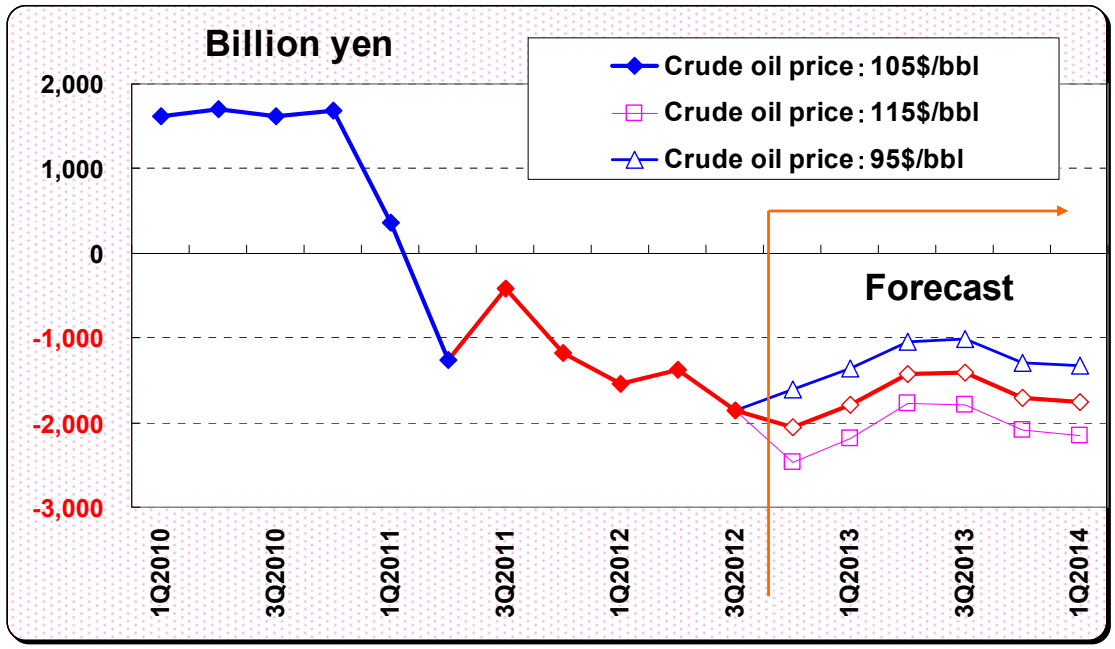
e. Macro Economic Impact①:　Vicious Circle due to Hollowing-out (The case for 2012)



e. Macro Economic Impact②： Increasing Import of Fossil Fuel and Worsening of Trade Deficit

- Both export and import will increase because the world economy (Japanese and overseas) is recovering gradually in **FY2012**. Japan's trade deficit will remain unchanged from FY2011 due to the large amount of fuel imports and high fuel prices.
- In **FY2013**, recovery of overseas demand will increase Japanese exports. On the other hand, fossil fuel import value will remain high and the trade deficit will also remain high at 6.3 trillion yen.

◆Balance of trade



◆Export and Import

(Trillion yen)	Actual		Forecast	
	FY2010	FY2011	FY2012	FY2013
Export	67.8	65.3	63.4	63.6
Import	62.4	69.7	70.5	69.9
Fossil Fuels	18.1	23.1	24.2	23.4
Balace of Trade	5.4	▲ 4.4	▲ 7.1	▲ 6.3

FY2013

Oil price
-10 $
-4.6 trillion yen

Oil price
+10 $
-7.8 trillion yen

trade deficit (3 years in a row)

Source : Historical data from Ministry of Finance, forecasts from IEEJ.

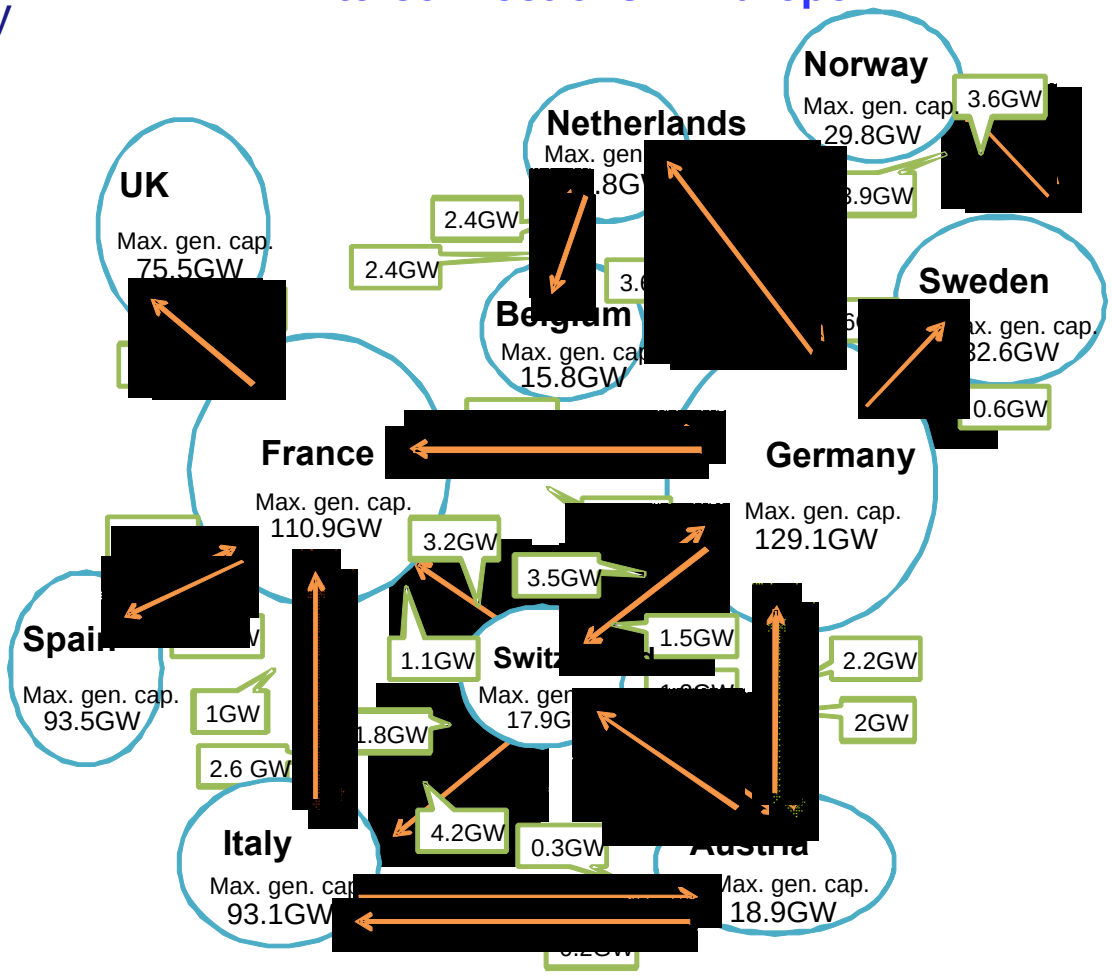
3) Differences between Germany and Japan ① : Significance of Networking with Other Countries

★ 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.

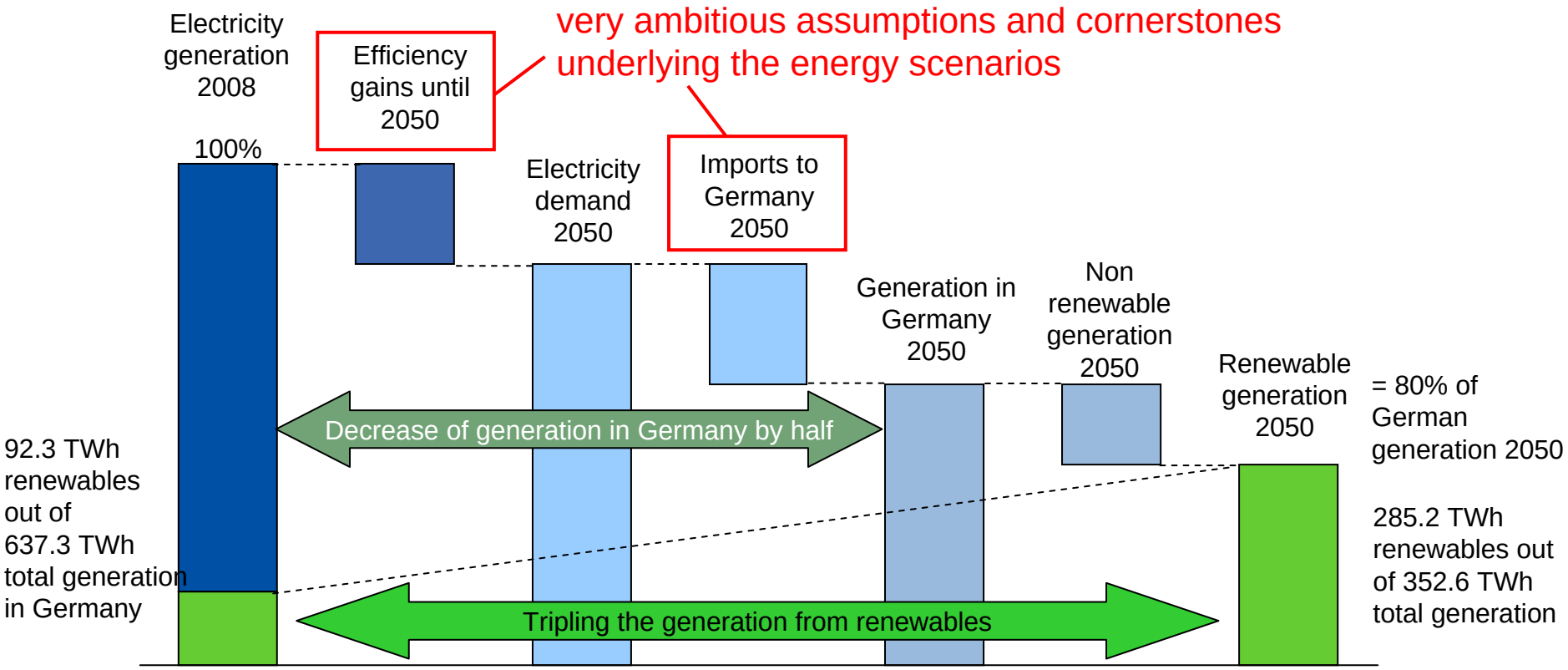
Energy security
Cost
Best mix
. . .

Power System Interconnections in Europe



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

3) Differences between Germany and Japan②: Germany is planning to import electricity from neighbouring countries



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

3. Desirable Energy mix

1) Options under Discussion① : 3 options

Four options under discussion (Advisory Committee for Natural Resources and Energy, as of June 7):

	Nuclear power	Renewable energy	Fossil-fired generation	Cogeneration	Energy conservation (power conservation)	CO_2 emissions (change from the 1990 level)
Option (1)	0%	35%	50%	15%	-20% (-10%)	−16%
Option (2)	15%	30%	40%	15%	-20% (-10%)	−20%
Option (3)	20-25%	25-30%	35%	15%	-20% (-10%)	−23%
(Addition)	35%	25%	25%	15%	-20% (-10%)	−28%

Option (4) Achieving the most desirable generation mix for society by the choice of power consumers in the market after setting up a framework for sharing the social cost (of generation) by utilities (and power consumers)

1) Options under discussion②: Economic Impact Analysis

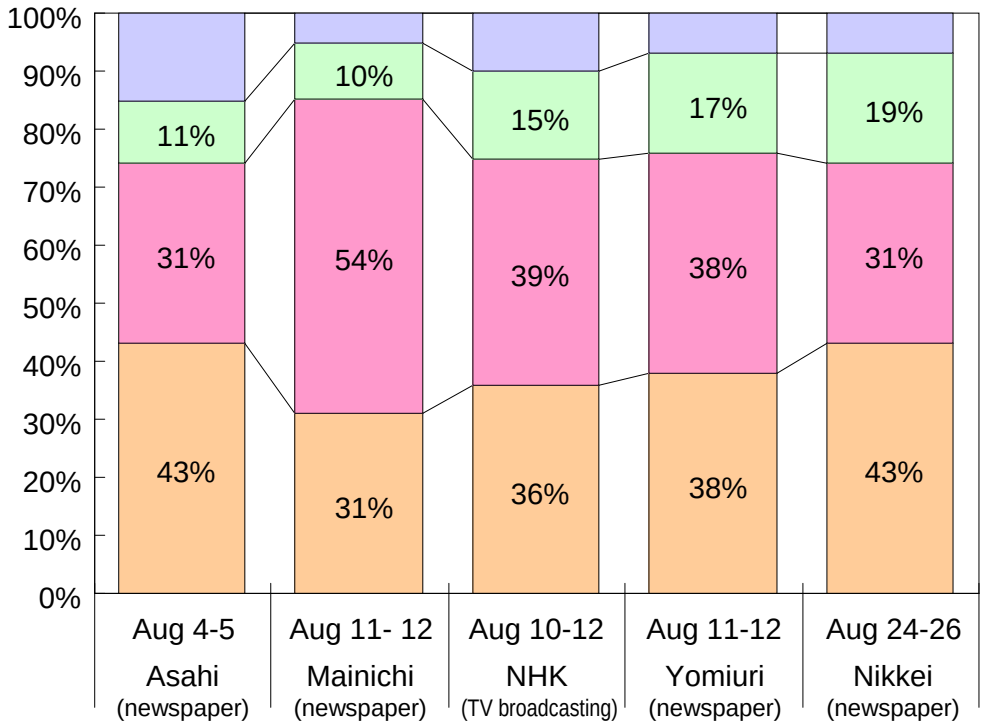
(Interim outputs from the Advisory Committee for Natural Resources and Energy as of June 7)

	Real GDP	Impact on household budget (substantial)	Electricity charge (nominal) (In FY2010: about 9,900 yen/month, or 118,800 yen per year)
Option (1)	-5.0 to -2.0% [-31 to -12 trillion yen]	-6.0% to -5.6% [-19 to -18 trillion yen]	99% to 102% [19,700 to 20,000 yen/month] (236,400 to 240,000 yen/year)]
Option (2)	-4.1 to -1.5% [-25 to -9 trillion yen]	-4.6% to -4.4% [-15 to -14 trillion yen]	71% [16,900 yen/month] (202,800 yen/year)]
Option (3)	-3.6 to -1.2% [-22 to -7 trillion yen]	-4.2% to -3.8% [-14 to -12 trillion yen]	54% to 64% [15,200 to 16,200 yen/month] (182,400 to 194,400 yen/year)]
(Additional scenario)	-2.5 to -0.9% [-15 to -6 trillion yen]	-3.4% to -2.9% [-11 to -9 trillion yen]	38% to 39% [13,700 to 13,800 yen/month] (164,400 to 165,600 yen/year)]

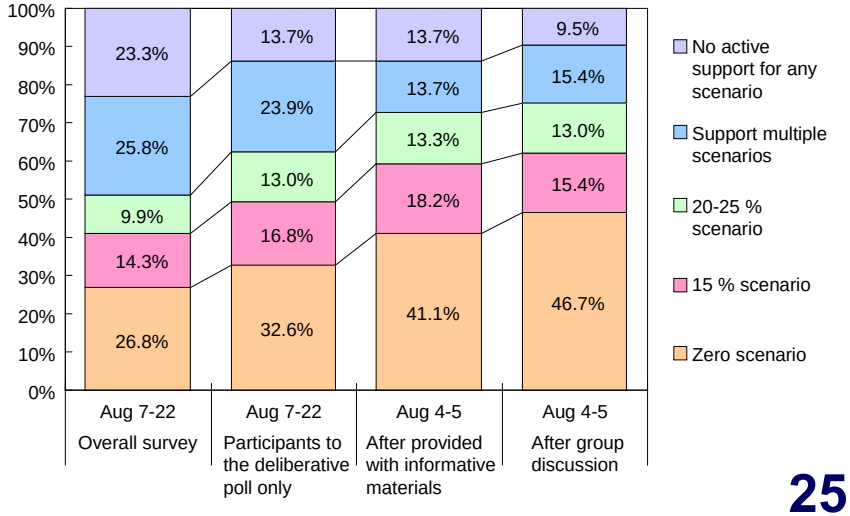
These are the results of estimations made at research institutions (the Research Institute of Innovative Technology for the Earth and Associate Professor Nomura of Keio University) using generation cost data provided by the Cost Investigation Committee.

1) Options under discussion③ : The public view is divided

Results of the opinion poll

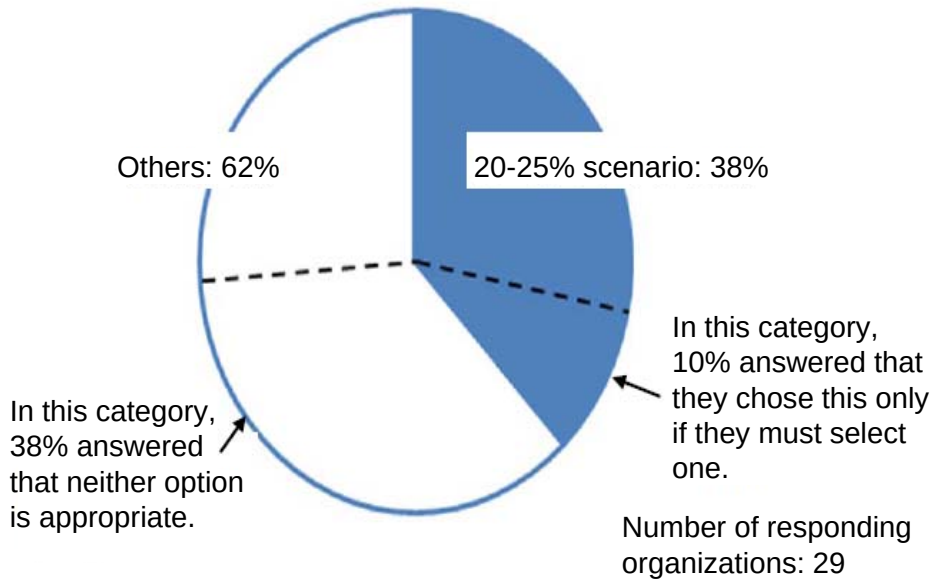


Results of the deliberative poll



1) Options under discussion ④：Business associations said " zero scenario is not the right option

Questionnaire by Japan Federation of Economic Organizations



Opinions of Japan Association of Corporate Executives

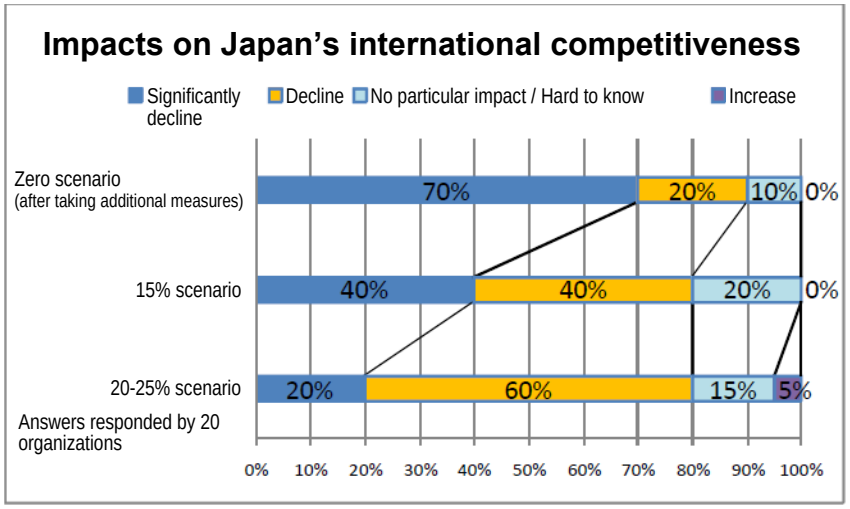
(1) "Zero scenario" is not the right option to adopt

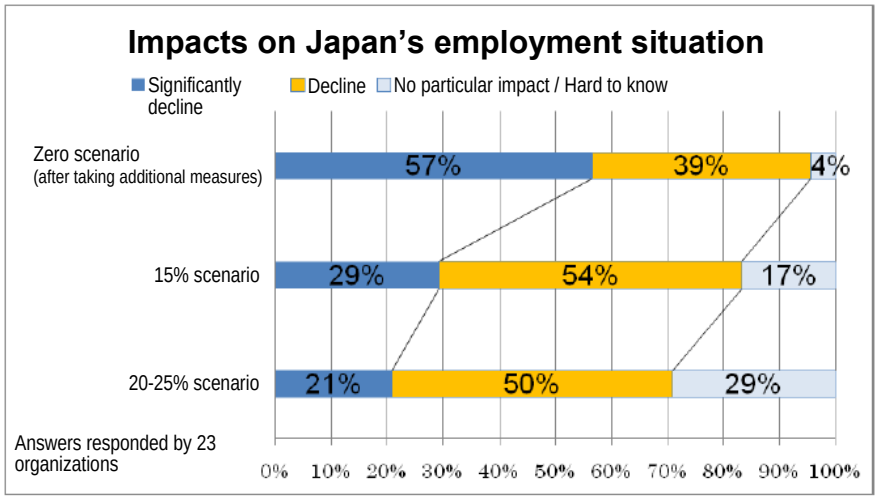
'2) The rate of nuclear power should be flexibly examined after establishing the new safety standards and taking technical innovations into consideration.

- **Responsible political decision and explanation to the public are essential for the problems related to the future of the nation.**
- **At present, it is more appropriate to decide only the outline of the future policy while continuously verifying the details, rather than making a threefold choice.**

1) Options under discussion⑤：Business association expressed serious concerns on their competitiveness

Questionnaires carried out by the Japan Federation of Economic Organizations





Source：Results of the questionnaires regarding the options of the energy/environmental policies, carried out by the Japan Federation of Economic Organizations, on August 13, 2012

2) Status of "Innovative Energy and Environmental Strategies" ①： Major points of the strategies published in Mid Sept.

(Three pillars)

1) Earliest possible realization of a nuclear independent society
   * Devote all types of political resources to realize zero nuclear power in the 2030's
   * NPSs of which safety is confirmed in the above process will be used as important power source
2) Implementation of green energy revolution
   * Emergence of a newly growing economic sector
3) Stable energy supply
   * Ensuring fossil fuel supplies, thermal use, research and development of next generation energy technology

As a result,

○GHG emissions in 2020 are expected to be cut by 5-9% (compared to 1990 level).
In 2030, emissions are expected to be cut by almost 20% (compared to 1990 level).

(Note) According to the current plan, the emissions in 2020 and 2030 are expected to be cut by 25% and 30%, respectively.

However, this strategy itself was not approved by Cabinet meeting

2) Status of "Innovative Energy and Environmental Strategies" ②: Serious concerns expressed by industries etc.

(Concerns for the goal to achieve zero NPP in the 2030's)

1) Decline of economic power of Japan, hollowing-out, outflow of national wealth
2) Weakening of the energy security system
3) Escape from international responsibility to combat global warming
4) Absence of specific supporting evidence for the expansion of renewable energy
5) Increasing difficulty in maintaining nuclear technology and human resources; Difficulty in contributing to ensuring nuclear safety in Asia
6) Adverse effects are expected in the relationship between the US and Japan which have been interpolated by each other in the field of nuclear technology. Japan's cooperative relationship with the UK and France may also be affected
7) Making it difficult for the national government to fulfill the state responsibility for the local communities hosting nuclear facilities
8) Others
   - Decline of negotiating power for securing fossil fuel
   - Confusion in the world crude oil/natural gas market

4. Developments after the General Election last December

1) The outcome of the general election on Dec.16,2012

< The outcome of the Election in the Lower House>

LDP won in a overwhelming manner while the voting rate was relatively low.

	Before	After
-LDP +Komei Party	139	325
(LDP)	(118)	(294)
-DPJ +Peoples' New Party	233	58
-Japan Restoration Party	11	54
-Others	96	43
-Total	479	480

2) The messages from the new administration

< The policy of LDP>

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 .

3) Preferable Energy Mix･･･My personal recommendation

My personal view on the theme (energy mix <power generation mix>: option ③

1) Comprehensive viewpoints

●S+3E　Safety　＋Energy Security
＋Efficiency (energy efficiency and costs)
＋Environment (environmental conservation and measures against global warming measures)

●”There is no perfect energy” for a resource-poor country like Japan.

●In addition to “energy conservation”, four types of energy, that is, “nuclear energy,” “renewable energy,” “fossil energy” and “cogeneration” should be combined in a well-balanced and diverse way to assure energy security.

ーーーー**Prferable Energy Mix**

●”Nuclear”:”Renewable”:”Thermal”:”Cogeneration”　＝　25:25:35:15%

2) International viewpoint

●Germany can import electricity from the EU-wide network (which has the supply capacity equivalent to 10 times as much as the electricity demand in Germany)

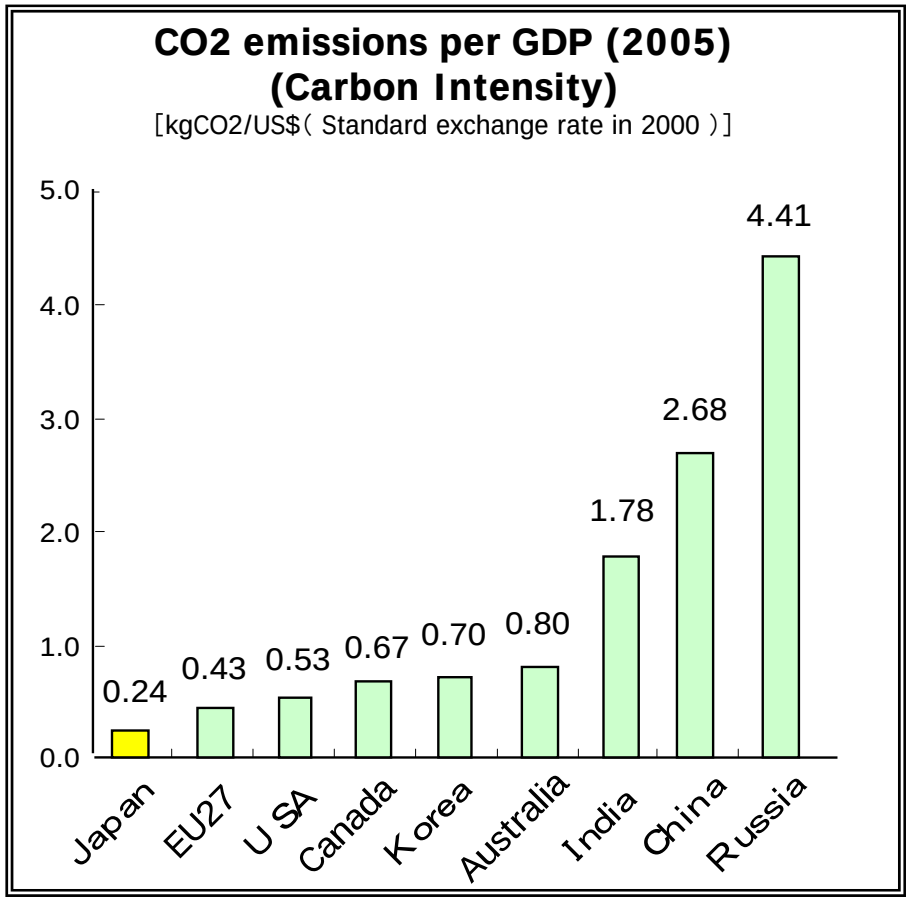
●Nuclear power generation output is expected to sharply rise in the countries such as China and India: 4 – 7 times as much as the present status within the next 2 decades (160-260 units).

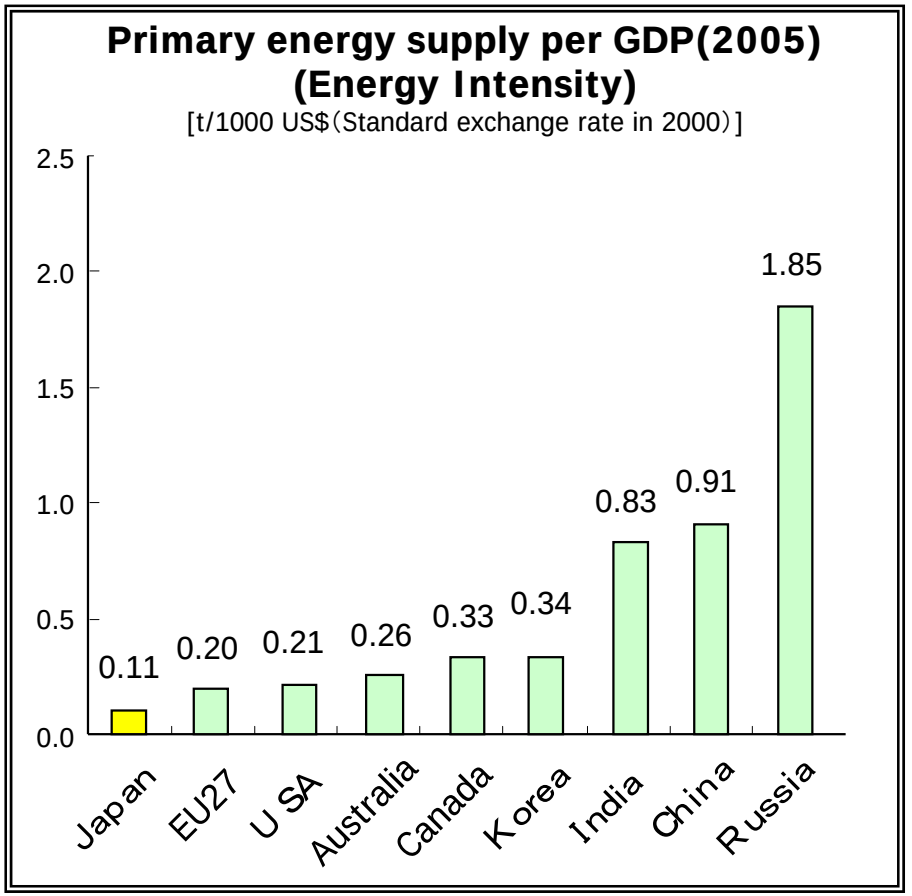
5. Possible energy cooperation in Asia

1) Energy conservation vs Climate Change

○ Energy conservation can address the issue of CC

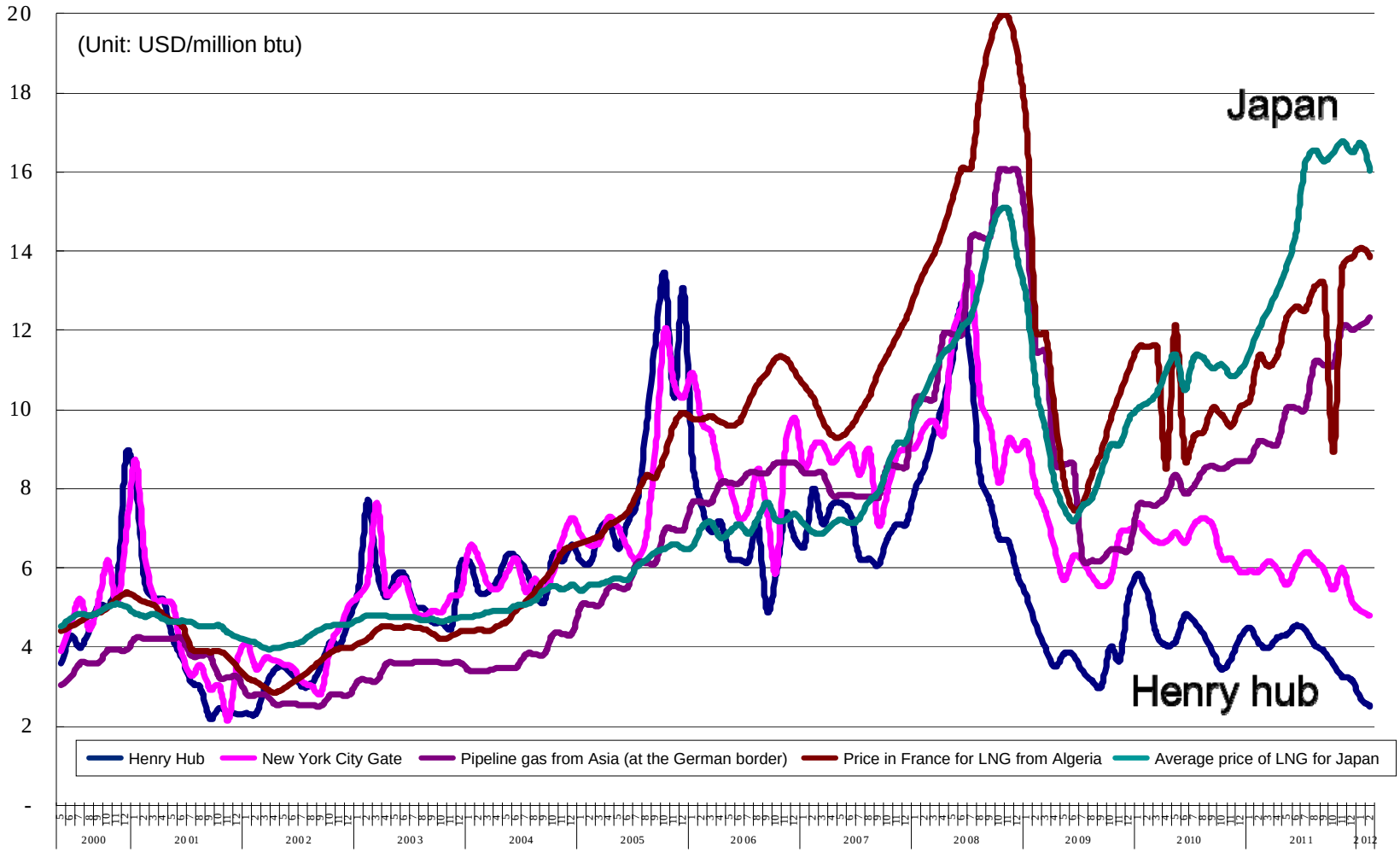
* Domestic mitigation efforts could be based on intensity improvement efforts.
* Japan's mid-term target aims at improving its carbon intensity, which is already the lowest among major countries.





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

2)Asian Premium in LNG trade needs to be resolved



Sources: Japan's customs clearance statistics and Energy Intelligence Data from the US Department of Energy

3) Nuclear Power Development in Asia v.s. Safety

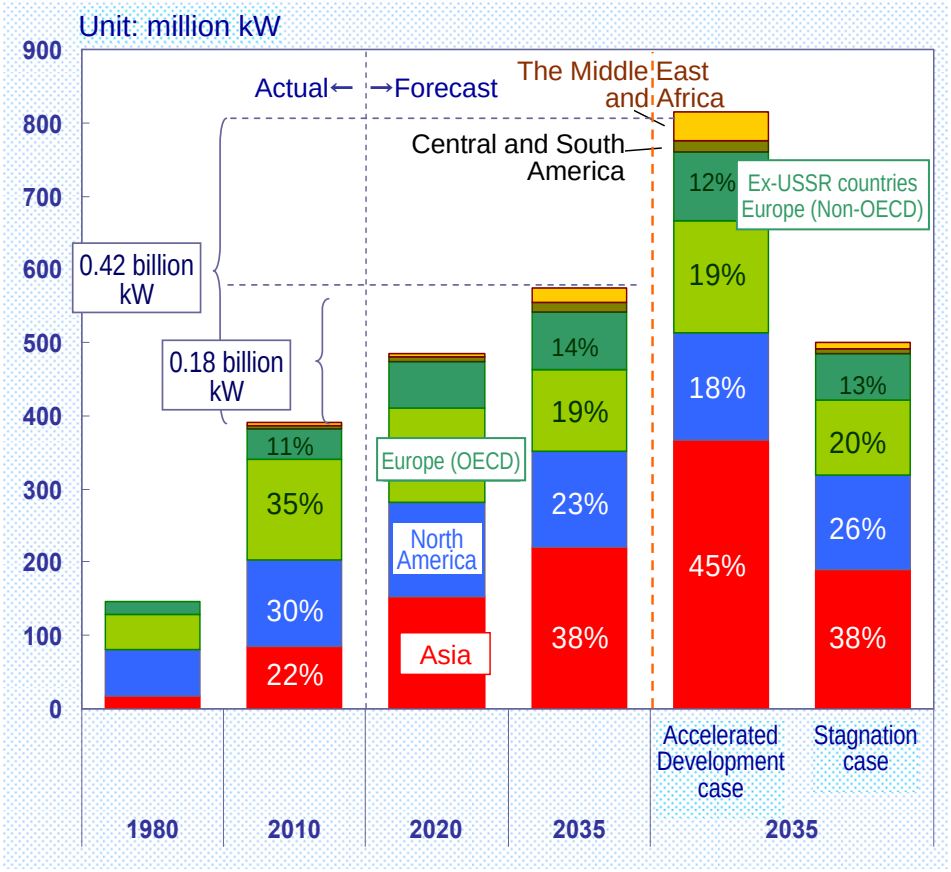
- The rapid expansion of nuclear power generation in Asia is based on its advantages of *energy security* and *global warming prevention*, and the vital need for nuclear power as *an economically efficient generation option*, for economic growth.
- The total installed capacity of nuclear power generation 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

The importance of US/Japan Cooperation

US/Japan Cooperation is indispensable for sustainable development in Asia, a growth center of the world by :

- ensuring stable supply of energy (Energy Security)
- addressing Climate Change (Environment)
- keeping energy price affordable(Efficiency)
- making nuclear energy safe while ensuring non-proliferation(Safety)
- keeping economies in good shape (Macro-economic impact)

7. Conclusion

1. 3E was key elements for energy policy in Japan before the Fukushima accident

2. After Fukushima, 3E + S + M has become important.

3. Although a new and desirable energy mix had been discussed at the Advisory Council to METI (Ministry of Economy, Trade and Industry) Minister for more than one year , no conclusion was made yet.

4. The new coalition government led by LDP seemed to intend to take a cautious approach to determine a new energy mix.

5. In the meantime, it is important for Japan to contribute to resolve the following problems in Asia.
   - to promote energy conservation
   - to resolve Asian premium in LNG trade
   - to make nuclear reactors safer

6. US /Japan Cooperation is indispensable for sustainable development in Asia

Thank you very much for your attention

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