Japan's Energy Situation

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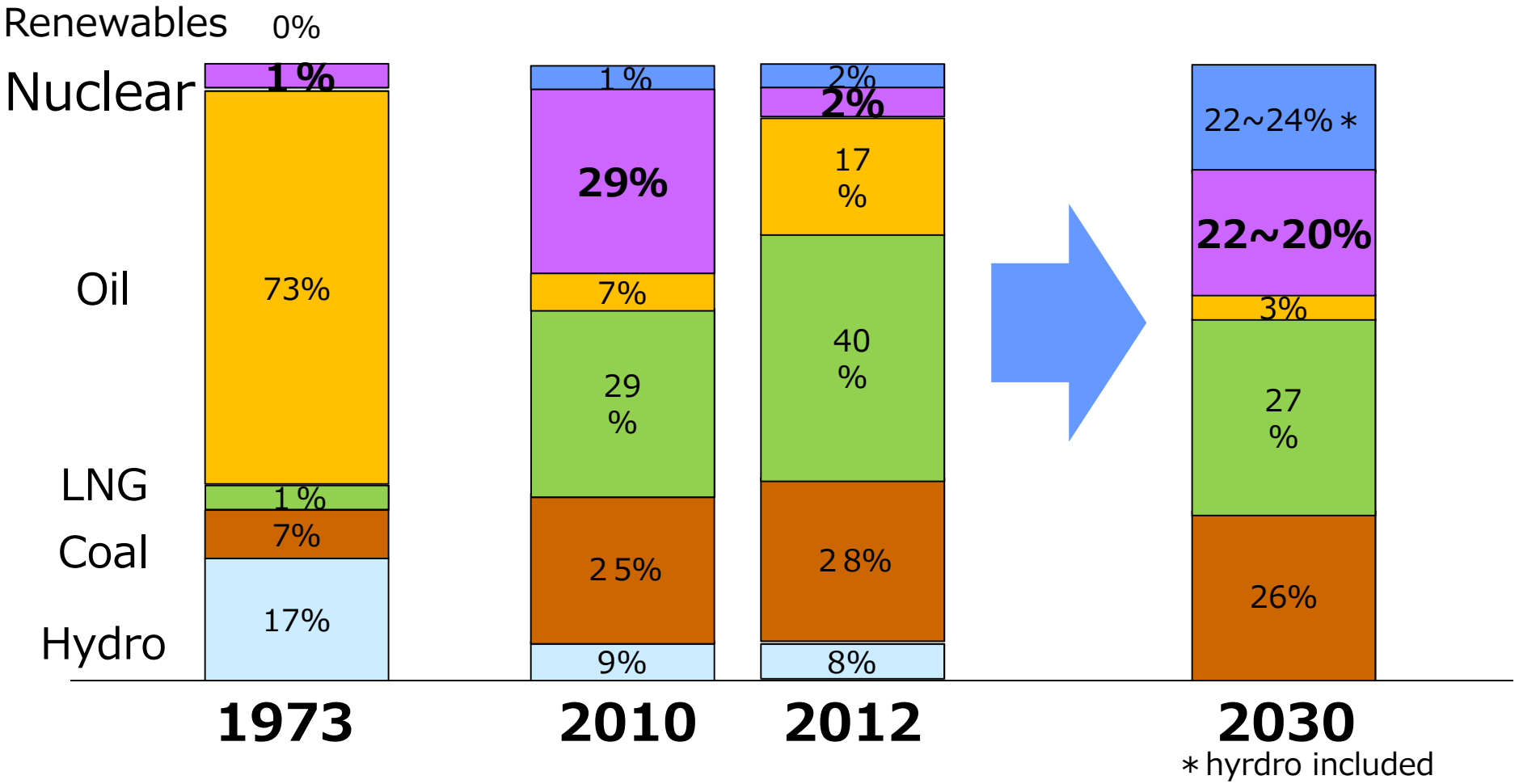
Japan's historical generation portfolio

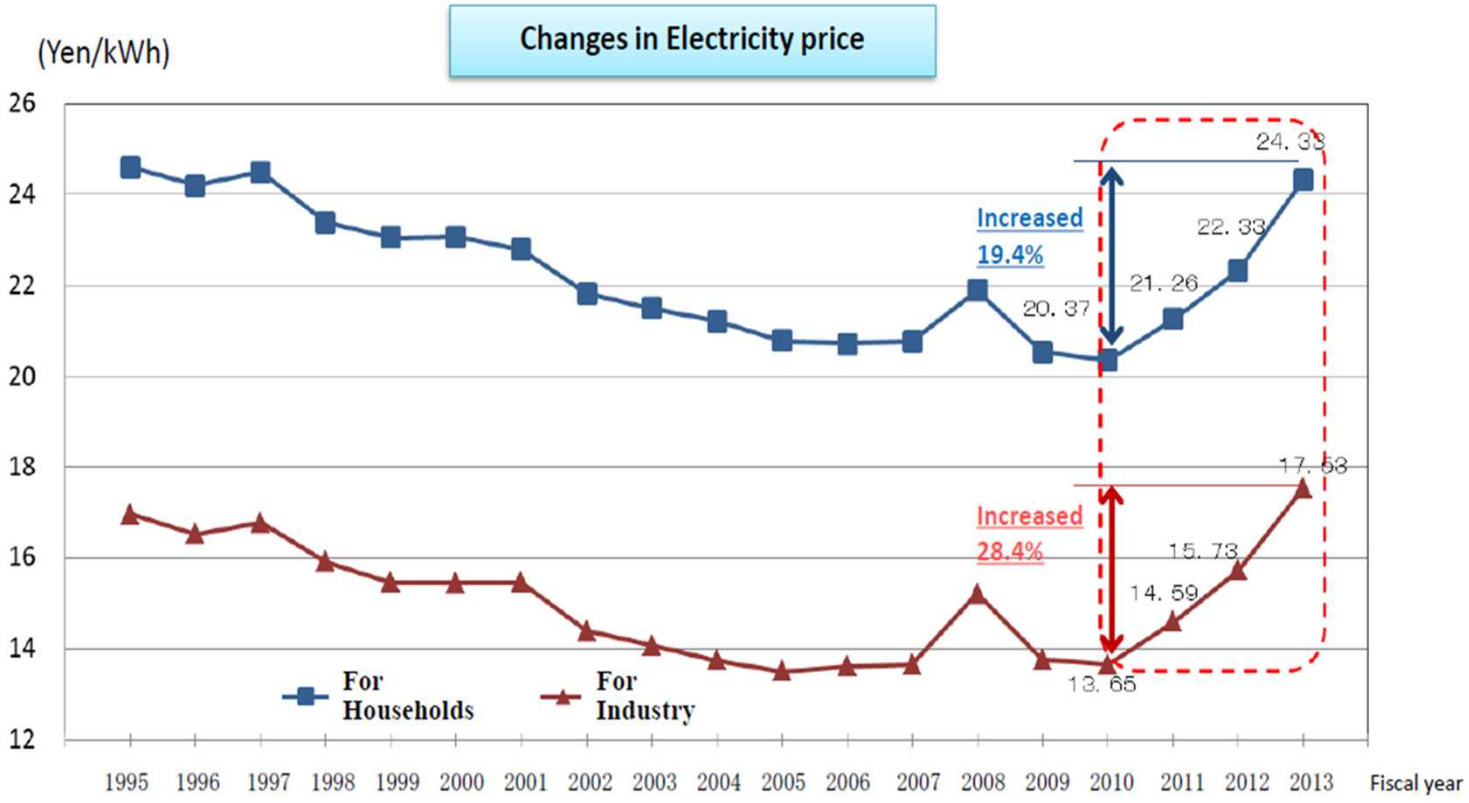


Japan's energy mix and associated fuel costs since the earthquake disaster

- Nuclear power plants are out of operation
  → Loss equivalent to 30% of total power supply
- Renewable energy accounts for only 2.2% (as of 2013, excluding hydraulic power) and 10% (including hydraulic power).
  Although the ratio of renewable energy is rapidly increasing since the introduction of FIT in July 2012, it is still far from enough to replace the loss of nuclear energy.
- Thermal power stations are being operated at full capacity to replace nuclear power.
  → 90% dependence on thermal power
- Increase in thermal power fuel costs to make up for the loss of nuclear power is estimated to reach a cumulative total of 14,700 billion yen by the end of fiscal 2015. Cost for fiscal 2015 is expected to be contained at around 2.3 trillion yen, thanks to the decline of crude oil/LNG costs and resumption of the operation of Sendai Nuclear Power Plant.
  (However, the figure still represents an increase in burden of approx. 20,000 yen per capita and 3 yen per 1 kWh.)

soaring electricity prices

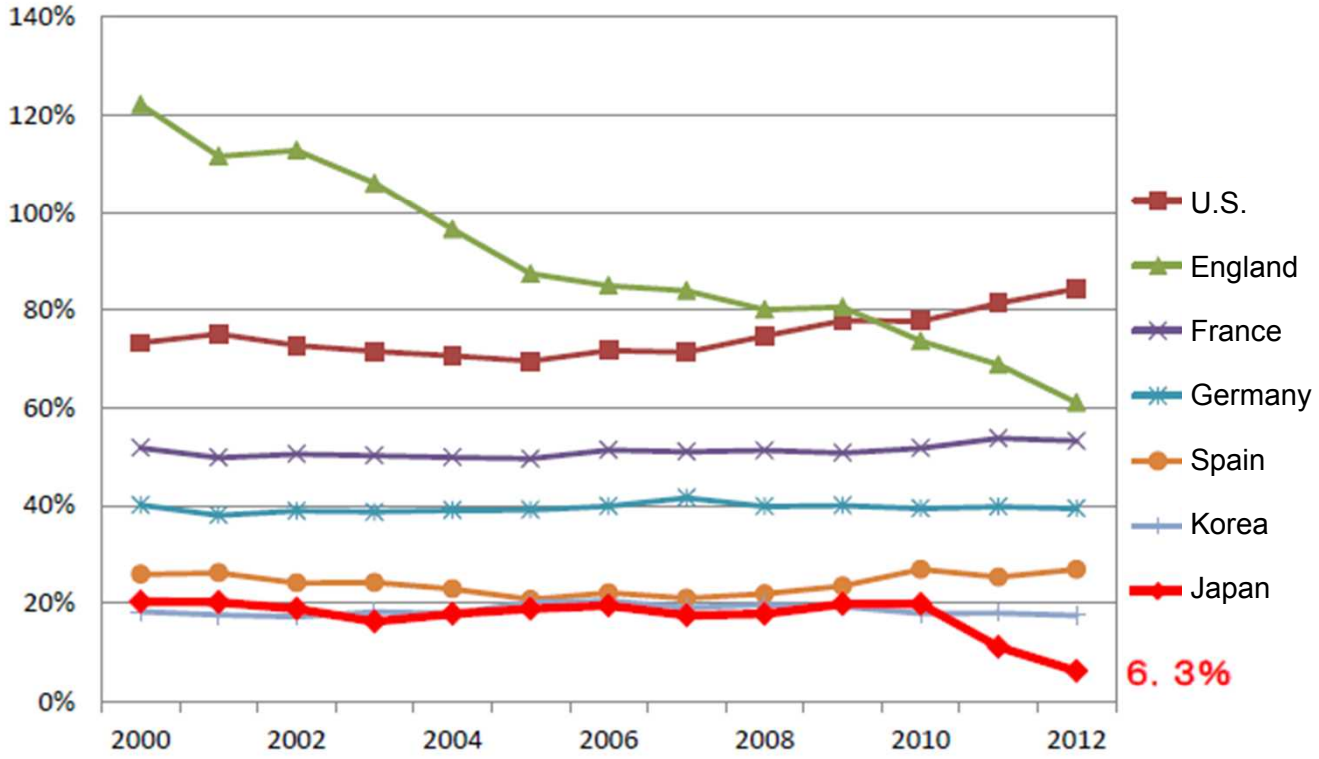
- Since 2011, electricity prices for industry and household have increased by 40% and 25% respectively. This is not only caused by increasing fossil fuel import, but also expanding indirect subsidy cost of FIT.



[Source] Created based on the "Electricity Demand Report" (Federation of Electric Power Companies in Japan) and the materials concerning the power companies' final settlement reports, etc.

Self sufficiency ratio of primary energy in major countries

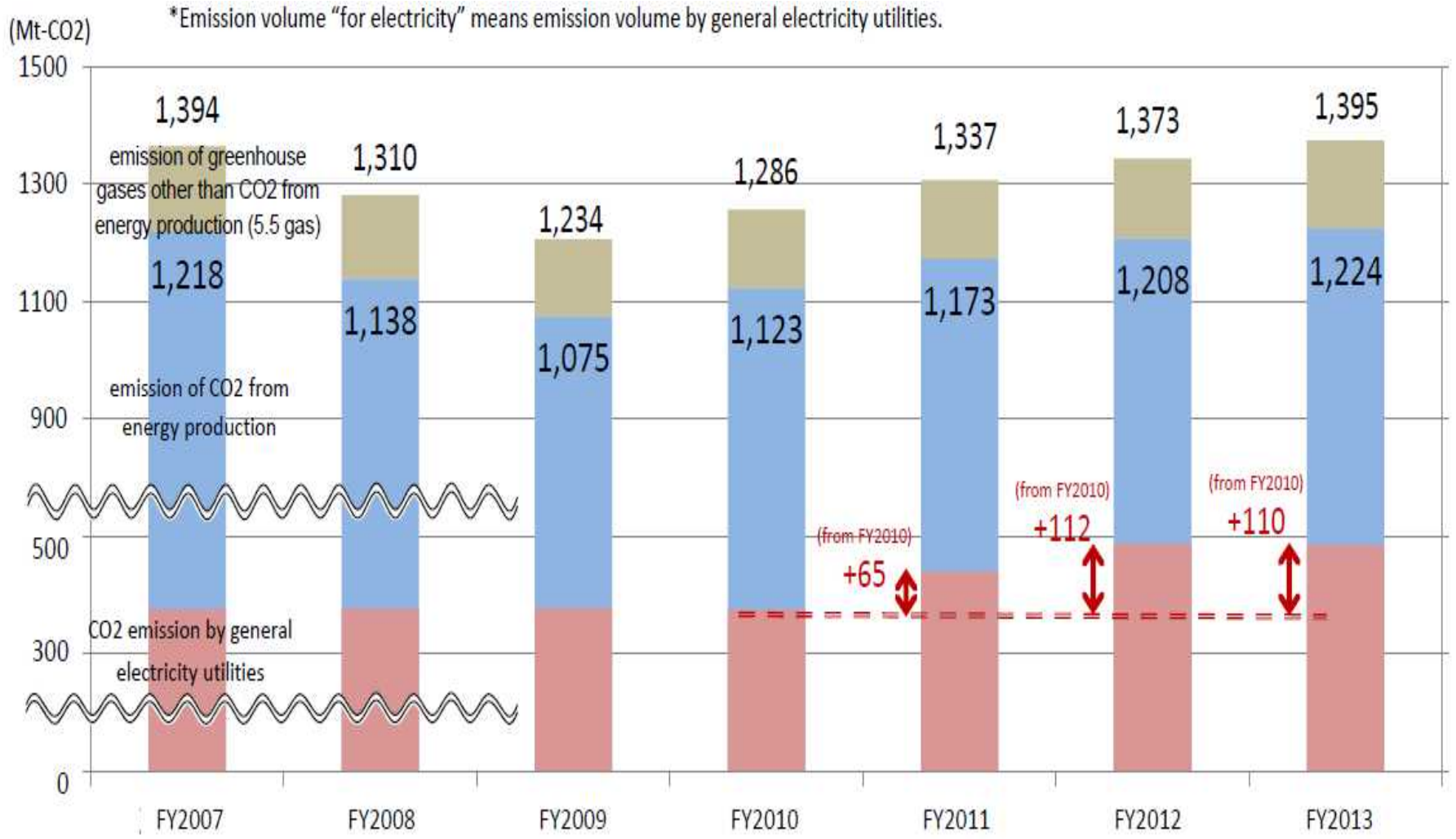
- Each country has worked to improve its self sufficiency ratio since the oil crisis experienced in the 1970's-80's.
- England became an oil exporter in the 1980's following the development of the North Sea Oil and Gas, but recently its self sufficiency ratio is declining due to reduction in production.
- Ever since the oil crisis, France has improved and maintained its energy self sufficiency ratio by promoting nuclear power generation.
- Although the U.S. experienced a decline in energy self sufficiency and increased dependency on imported oil since the 1980's, the figures are now improving due to shale gas production.



Source: IEA Energy Balance 2014

Source: Material by Ministry of Economy, Trade and Industry

Increasing CO2 Emissions from Power Sector



Source: Energy Statistics, Environment Actin Plan (FEPC), Ministry of Environment

History of “decarbonation rate” in developed countries

- Comparison of decarbonation rate of each period of each country
- In the 1980s, France stood out at 4.2%: Amount of power generated by nuclear power increased by 5 times in 10 years
- Ratio of renewable energy to primary energy in Germany drastically increased from 3% to 9% in 2000s, but decarbonation rate is not so large at negative 0.8%

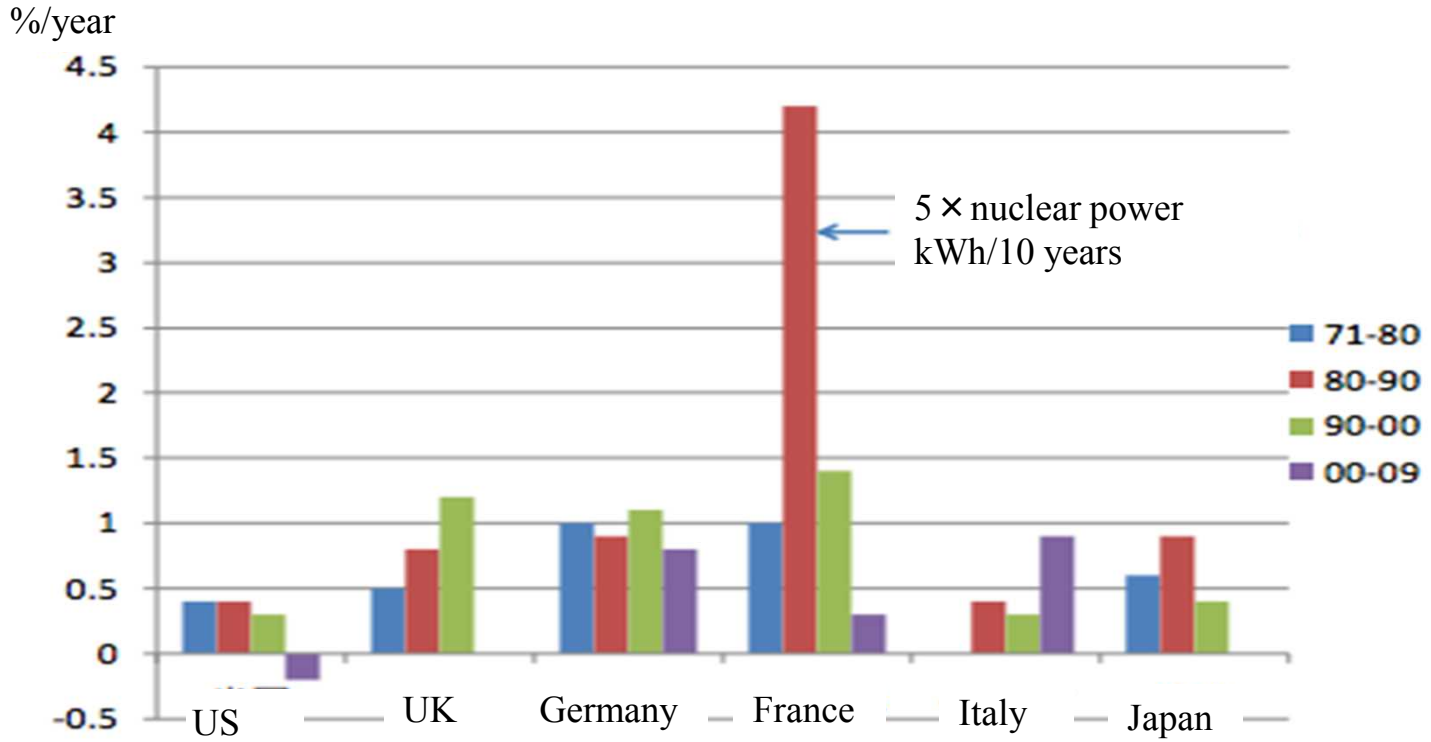
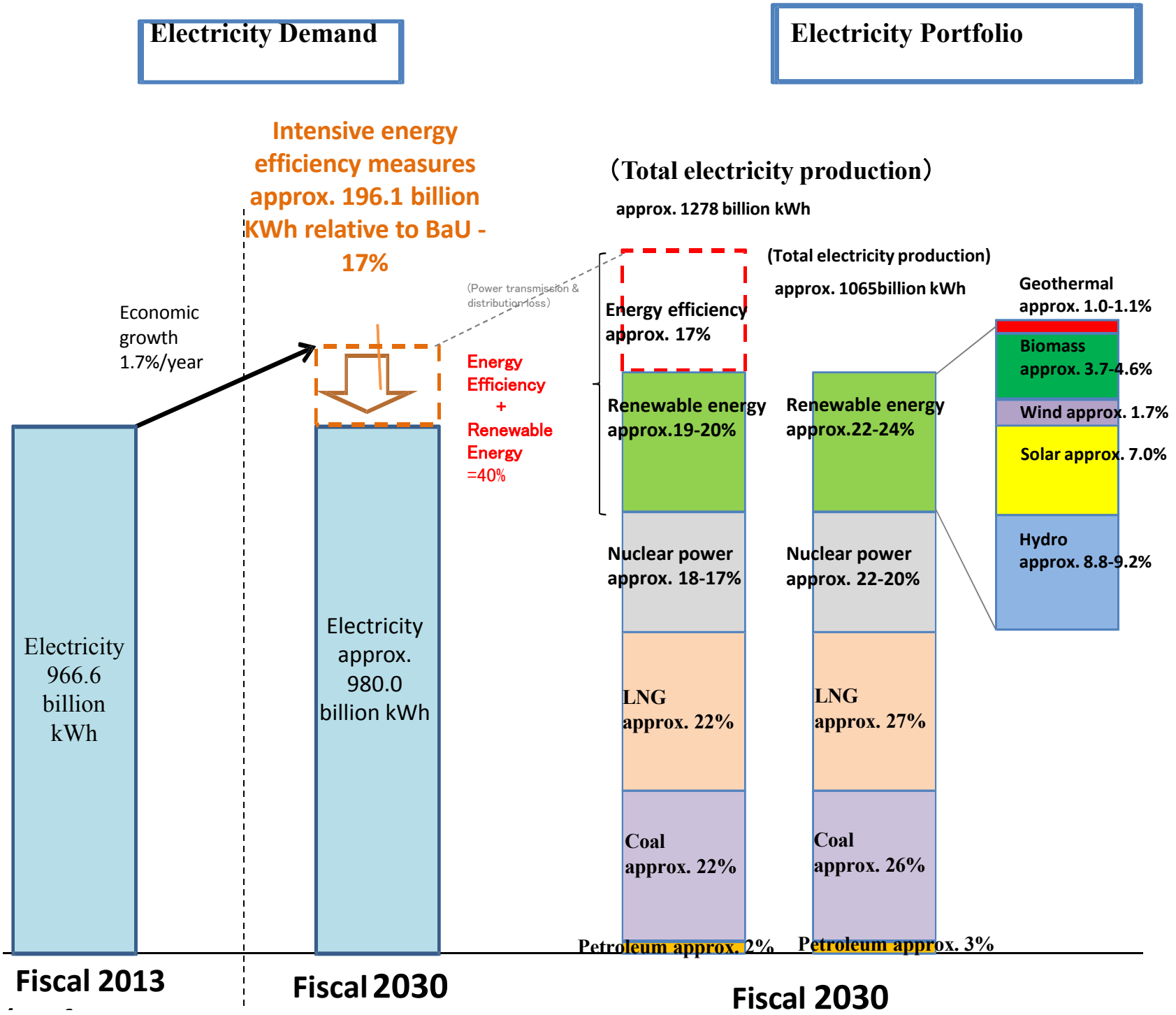


Figure 4. Decarbonation rate of developed countries in the past 30 years (-C/E change rate)

RITE Director Yoichi Kaya material 2.27.2013

Comparison of GHG emission reduction target

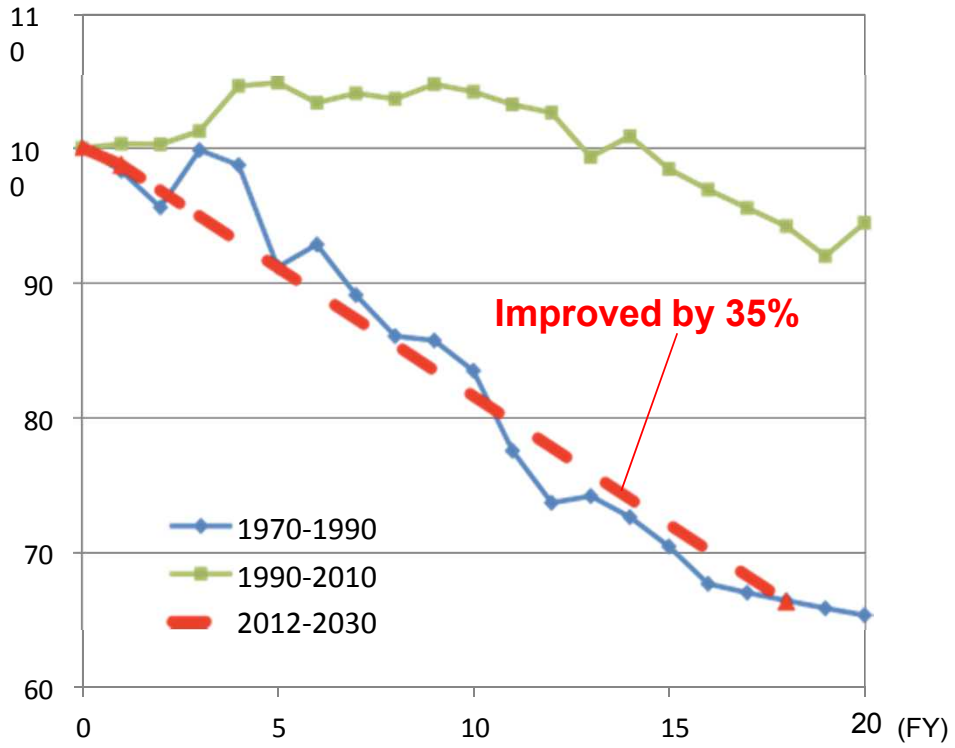
	Basic year 1990	Basic year 2005	Basic year 2013
Japan	▲18.0% （2030年）	▲25.4% （2030年）	▲26.0% （2030年）
US	▲14～16% （2025年）	▲26～28% （2025年）	▲18～21% （2025年）
EU	▲40% （2030年）	▲35% （2030年）	▲24% （2030年）


Electricity Demand
Electricity Portfolio
Intensive energy efficiency measures approx. 196.1 billion KWh relative to BaU -17%
(Total electricity production)
approx. 1278 billion kWh
(Power transmission & distribution loss)
Economic growth 1.7%/year
Energy Efficiency + Renewable Energy =40%
(Total electricity production)
approx. 1065billion kWh
Energy efficiency approx. 17%
Renewable energy approx.19-20%
Renewable energy approx.22-24%
Geothermal approx. 1.0-1.1%
Biomass approx. 3.7-4.6%
Wind approx. 1.7%
Solar approx. 7.0%
Hydro approx. 8.8-9.2%
Nuclear power approx. 18-17%
Nuclear power approx. 22-20%
LNG approx. 22%
LNG approx. 27%
Coal approx. 22%
Coal approx. 26%
Petroleum approx. 2%
Petroleum approx. 3%
Electricity 966.6 billion kWh
Electricity approx. 980.0 billion kWh
Fiscal 2013
Fiscal 2030
Fiscal 2030

Energy consumption efficiency

- Estimates for energy demand suggest final energy consumption of around 326 million kL, if all possible energy saving measures were thoroughly implemented (representing a 13% reduction compared to when the measures were not implemented).
- **Significant improvement of energy efficiency, comparable to that seen after the oil crisis, can be realized by accumulating these energy saving measures.**

[Improvement in energy efficiency]



Energy efficiency = Final energy consumption / Real GDP

Key elements for a comprehensive solution to problems surrounding nuclear power

1) **Replacement/new construction (maintaining necessary technologies and human resources)**
   - Development of a business environment that will enable procurement of funding from the private capital market

     Risk sharing between public and private sectors and improvement of business environment including amendment of compensation legislations (Japan's Act on Compensation for Nuclear Damages imposes "no-fault" and unlimited liability on the operator)

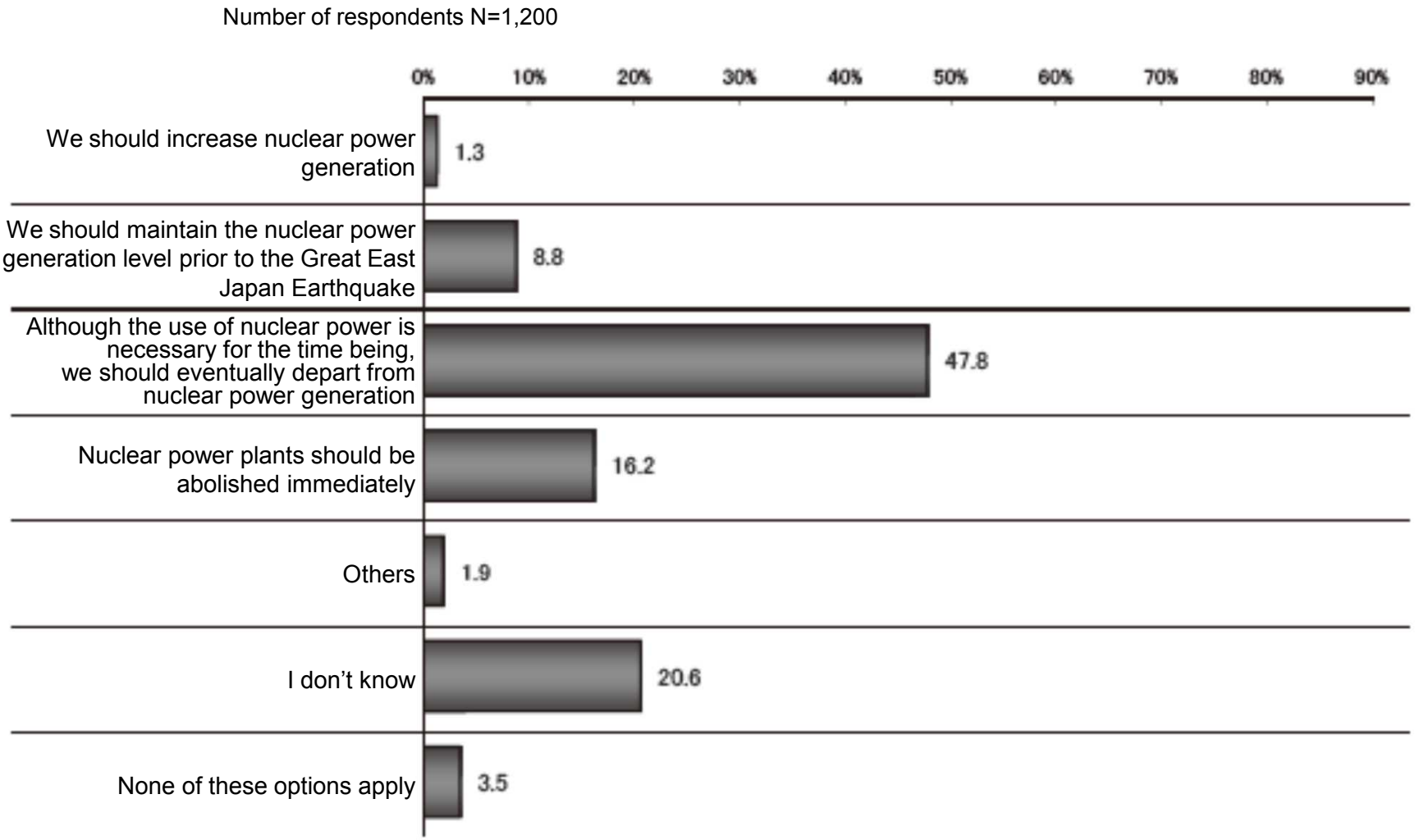
2) **Development of a consistent solution through to the back end**
   - Integrated approach to decommissioning, interim storage, reprocessing, and final disposal

     Review of responsibility allocation of the nuclear fuel cycle (Policy decision and disposal responsibilities assumed by the "Nuclear Waste Management Organization of Japan" and responsibility for the execution assumed by private operators)

3) **Rationalization of regulatory activities by amending the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors**
   - Shared understanding of the philosophy and methodology

     While Japan aims to establish "the strictest control standards in the world", it still has not completed the introduction of Probabilistic Risk Assessment (PRA) standards.

The majority of the people think that the use of nuclear power is unavoidable for the time being

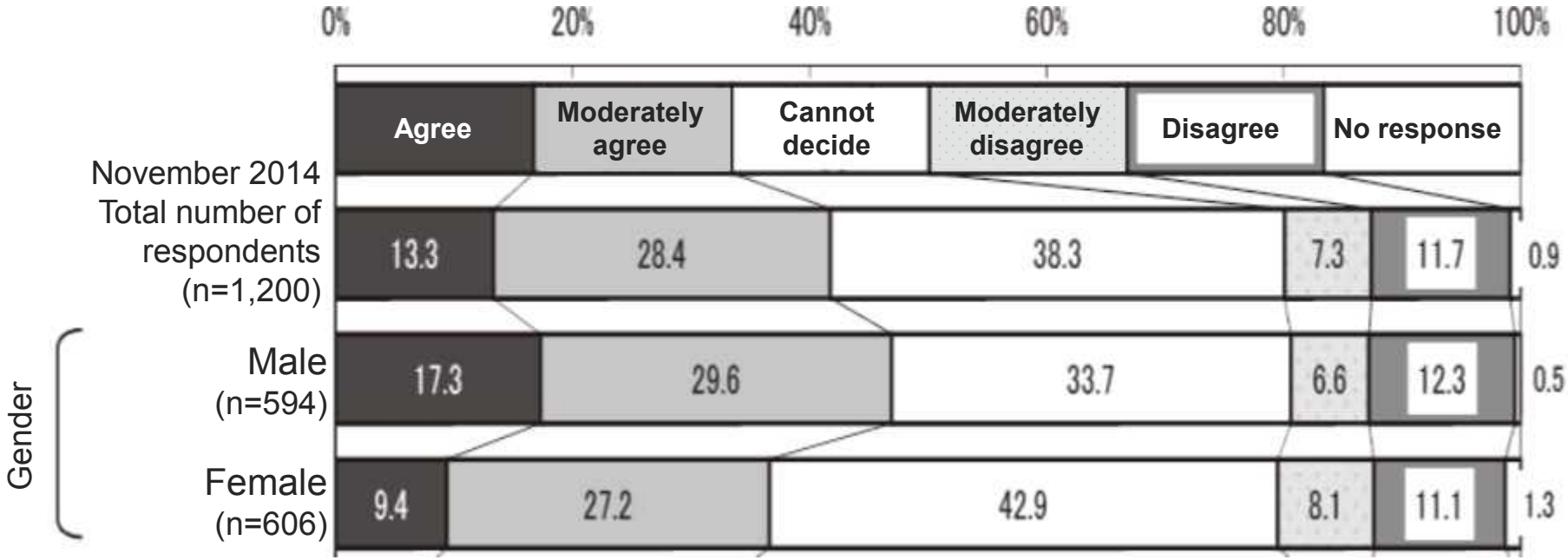


Latest trends in public opinion concerning the necessity (benefits) of nuclear power

Positive responses on the necessity of nuclear power generation (“Agree” + “Moderately agree”) accounted for 41.7%. On the other hand, negative responses (“Disagree” + “Moderately disagree”) accounted for 19.0%. This shows that public opinion may have shifted significantly toward the positive side compared to last year.

Looking at difference by gender, positive responses were higher in males (46.9%) than in females (36.6%).

By age group, positive responses were high in respondents in their 20’s, accounting for nearly 50%. When broken down by whether the respondent has any children or not, those who have children showed higher positive responses and those without showed higher negative responses.



What issues Japan should think now

- How to realize the policy targets for long-term prospect of supply and demand in energy?
- How to overcome the disadvantages of liberalization of the electricity market?

  Who is going to realize the optimal energy mix?

  How can we eliminate the uncertainties surrounding nuclear power?
- Climate change can be fought through innovative technology development and by contributing to reduction of GHG emission in developing countries.

  We don’t have to be insistent on achieving reduction domestically.


IAEA
Why the Climate Needs Nuclear Energy
IAEA
International Atomic Energy Agency
NUCLEAR POWE
Low carbon ener
IAEA
One UN for
Sustainable
Industries and Energy
IAEA BULLETIN
CLIMATE CHANGE AND NUCLEAR POWER 2013
CHANGEMENTS CLIMATIQUES ET ENERGIE NUCLEAIRE
NUCLEAR TECHNOLOGY REVIEW

Thank you for your kind attention!

What caused the confusion on nuclear safety regulation

原子力安全問題の混乱の原因

1. **Luck of basic understanding on safety ,risk, regulatory base , defense in depth・・**

   基本的概念に関する共通理解の不足　　安全、リスク、規制基準、深層防護・・・

2. **Ambiguity of segregation of duties and locus of responsibility (government, NRC , licensee)**

   役割分担と責任所在の不明確性　　政府（規制委以外）、規制委、事業者・・

3. **Differnce between Japanese and US administrative organization(Japanese admisistrative organization prefer to collegial system)**

   日本型行政組織と米国型行政組織の差

U.S.NRC principles of action

自立性:	最高レベルの倫理観と専門性以外の何ものも規制に影響をおよぼすべきではない。ただし、独立性は孤立を意味するものではない。許可取得者および利害関係のある市民から広く事実や意見を求める必要がある。公共の利益は多岐にわたり、互いに矛盾することもあるが、これを考慮しなければならない。全ての情報を客観的かつ公平に評価した上で最終決定を下し、理由を明記した上で文書化しなければならない。
開放性:	原子力規制は市民の課題であり、公的かつ率直に取り扱われなければならない。法に定められているように、規制プロセスを市民に伝え、市民が規制プロセスに参加できる機会を設けなければならない。議会、他の政府機関、許可取得者、市民、さらには海外の原子力界と開かれたコミュニケーション・チャネルを維持しなければならない。
効率性:	米国の納税者、電気料金を支払っている消費者、許可取得者は皆、規制活動の管理・運営が可能な限り最良の状態であることを求める権利がある。最高の技術力・管理能力が求められ、NRCは常にこれを目指すものとする。規制能力を評価する手法を確立し、継続的に改善していかなければならない。規制活動は、それにより達成されるリスク低減の度合い位に見合ったものであるべきである。有効な選択肢が複数ある場合は、リソースの消費が最小となる選択肢を採るべきである。規制の判断は不必要な遅れが生じないようにすべきである。
明瞭性:	規制は、一貫性があり、論理的で、実用的であるべきである。規制とNRCの目標・目的との間には、明示的か黙示的かを問わず明瞭な関係性があるべきである。NRCの見解は、理解しやすく適用しやすいものであるべきである。
首尾一貫性:	規制は、研究および運転経験から得られるあらゆる知識に基づいて制定されるべきである。リスクを許容可能な低いレベルに抑えるため、系統間相互作用、技術的な不確かさならびに許可取得者および規制活動の多様性を考慮しなければならない。制定後は信頼性の高い規則として受け止められるべきであり、不当に移行状態にすべきはない。規制活動は常に、文書化されている規制と完全に一致すべきであり、迅速、公正、かつ決然と実施され、原子力の運営及び計画立案プロセスの安定化を促すべきものである。

出典:一般財団法人　日本エネルギー経済研究所原子力グループ　西田直樹「世界主要国の原子力規制組織の現状　－規制スタッフの重要性と要件－」IEEJ　2013年8月号　筆者一部改訳

Japan NRC principles of action

原子力規制委員会は、事務局である原子力規制庁とともに、その使命を果たすため、以下の原則に沿って、職務を遂行する。

（１）独立した意思決定

何ものにもとらわれず、科学的・技術的な見地から、独立して意思決定を行う。

（２）実効ある行動

形式主義を排し、現場を重視する姿勢を貫き、真に実効ある規制を追求する。

（３）透明で開かれた組織

意思決定のプロセスを含め、規制にかかわる情報の開示を徹底する。また、国内外の多様な意見に耳を傾け、孤立と独善を戒める。

（４）向上心と責任感

常に最新の知見に学び、自らを磨くことに努め、倫理観、使命感、誇りを持って職務を遂行する。

（５）緊急時即応

いかなる事態にも、組織的かつ即座に対応する。また、そのための体制を平時から整える。