SCJ and CRDS Symposium
Role and Responsibility of Scientists in the Response to TRPCO Fukushima Nuclear Power Plant Accident
- Contribution from Economics Points of View-

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- Features of Energy Supply & Demand in Japan

  / Low level of the self-sufficiency rate of primary energy source (4%) and high level of the dependency on the middle-east countries (90% in 2007).

  / Dependency of the petroleum in total primary energy source was declining from 80% just after the first oil crisis to 50% in 2007 and the share of the nuclear power in electricity was increasing from 3% in 1974 to 30% in 2007.

  / Final energy consumption was stable in industrial use, but rapidly increased in commercial & residential use and transportation use during 1973-2007.

- **3E（Energy-Economy-Environment) + Energy Security**

  / Targets of the 2010 energy basic plan in the year 2030：

  - Share of the self-developed primary energy source including over-sea will be increased to 70%.
  - The rate of the zero-emission energy source in electricity will be increased from 34% in 2010 to around 70% in 2030.
  - C02 emission in household will be decreased to the 50% level of the present.
  - The highest level of the energy efficiency in industry will be maintained stably.

  Consequently, CO2 emission in 2030 will be reached to 70% of the 1990 emission.

Basic Summary of the 2010 Energy Basic Plan in Japan

Basic Objectives

- Maintaining the energy security in the world-wide expansion of the enrgy demand.
- Reducing the house worming gas emission.
- Sustainable economic growth.

Targets in 2030

Share of the self-developed primary energy source including over-sea will be increased to 70%
The rate of the zero-emission energy source in electricity will be increased from 34% in 2010 to around 70% in 2030.
C02 emission in household will be decreased to the 50% level of the present.

Strategies

Strategies for expanding energy sources

○官民一体となった資源国との戦略的関係の深化
○戦略レアメタルの自給率50%以上（リサイクル、代替材料開発も加味）
等

Strategies for sustainable energy supply

Increasing the share of renewable energy source.
By introducing the feed-in-tariff system.
Construction of new nuclear energy power plants.
Increasing the efficiency of coal power plant.

革新的なエネルギー技術の開発・普及拡大

Low co2 emission and high energy efficiency

Increasing the energy efficiency in industry use.
Increasing zero emission house.
Increasing the energy efficiency of the housing use.
Expanding the use of LED. (100% in2030)
Increasing the energy efficiency in transportation.

等

Toward Smart Grid and Smart Community

○スマートグリッドやスマートコミュニティーの国内外での実証
等

エネルギー・環境分野における国際展開の推進

Consequently, CO2 emission in 2030 will be reached to 70% of the 1990 emission.

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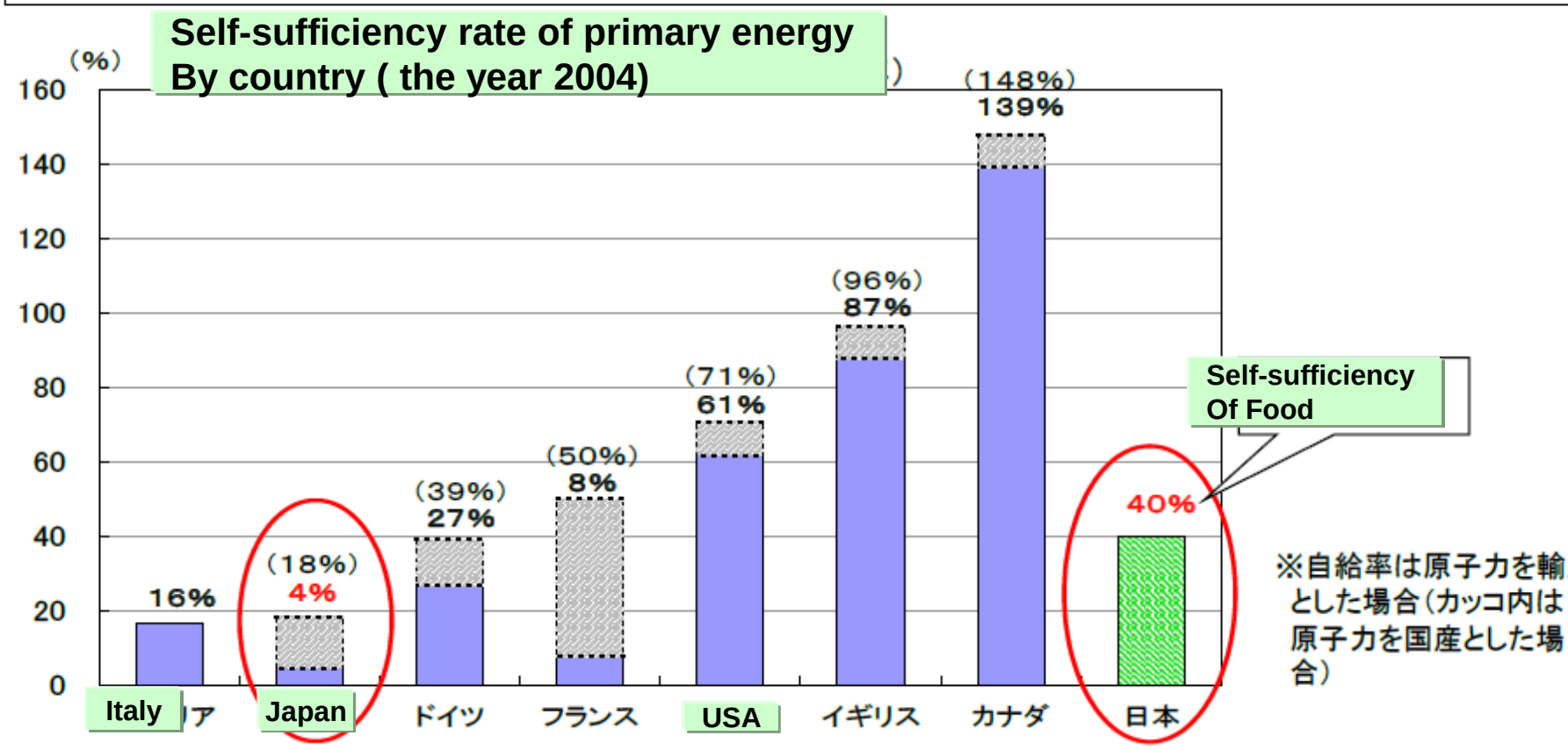
Self-sufficiency rate of primary energy source

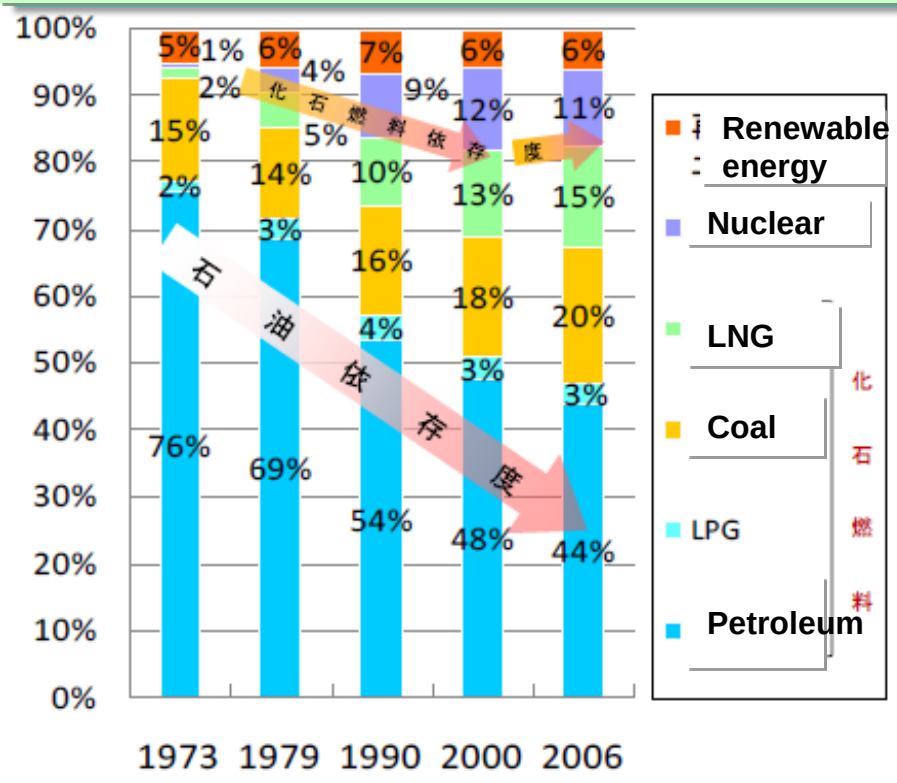
Low level of the self-sufficiency rate of primary energy source (4%)
and high level of the dependency on the middle-east countries (90% in 2007).



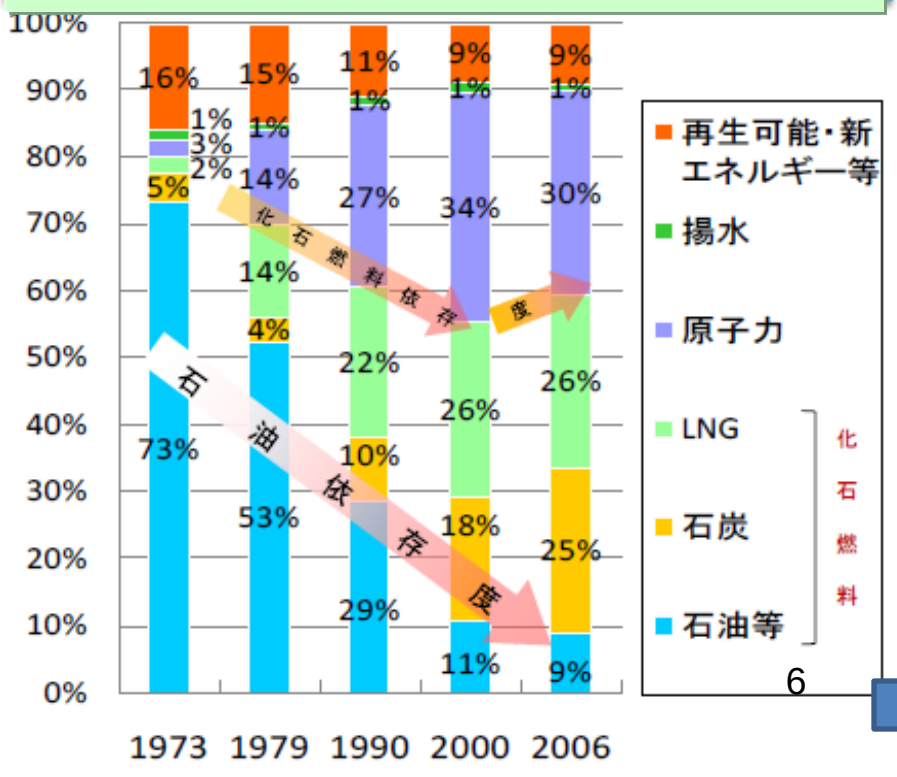
Trends of Primary Energy Source and Electricity

Dependency of the petroleum in total primary energy source was declining from 80% just after the first oil crisis to 50% in 2007 and the share of the nuclear power in electricity was increasing from 3% in 1974 to 30% in 2007.

Trends of Primary Energy Source

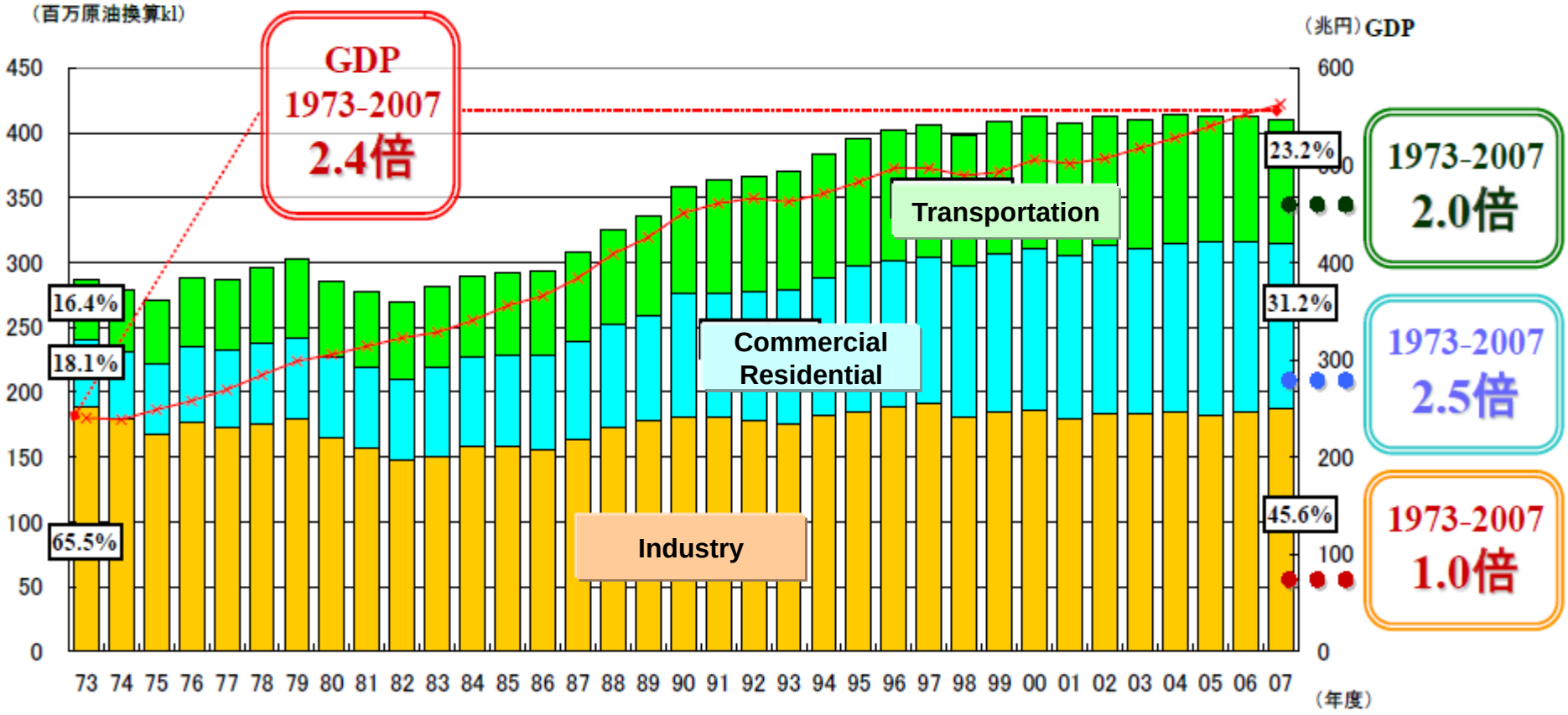


Trends of Electricity Source



Trends of Final Energy Consumption (1973-2007)

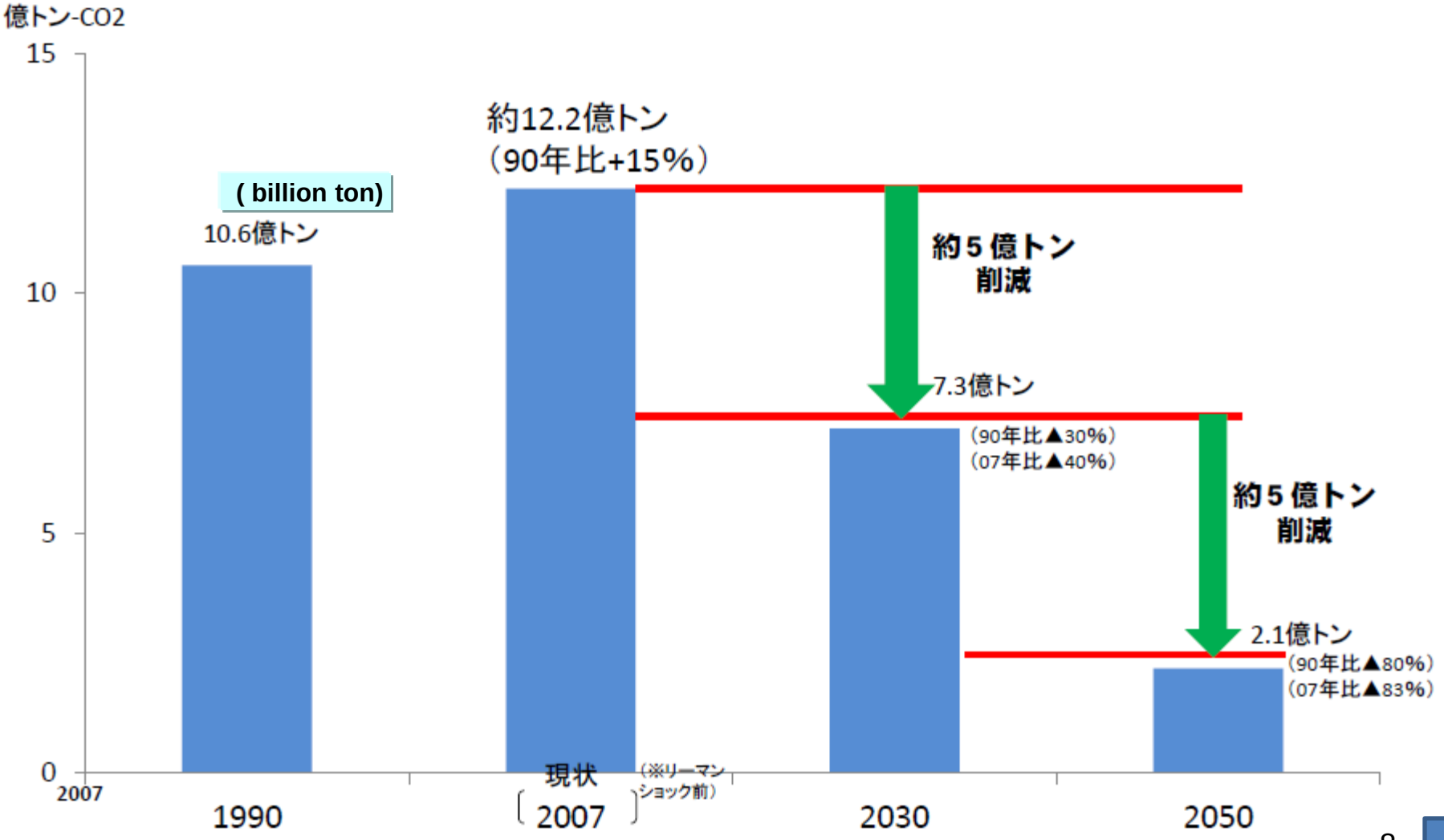
Final energy consumption was stable in industrial use, but rapidly increased in commercial & residential use and transportation use during 1973-2007.



（出所）総合エネルギー統計、国民経済計算年報

Future Trend of CO2 Emission in Planning

○長期的なCO2排出量パスとの関係では、2030年までの約20年間で、現状から約5億トンが削減され、2050年（90年比▲80%）までの削減量のうち、ほぼ半分が実現されるイメージとなる。



Planned Primary Energy Source

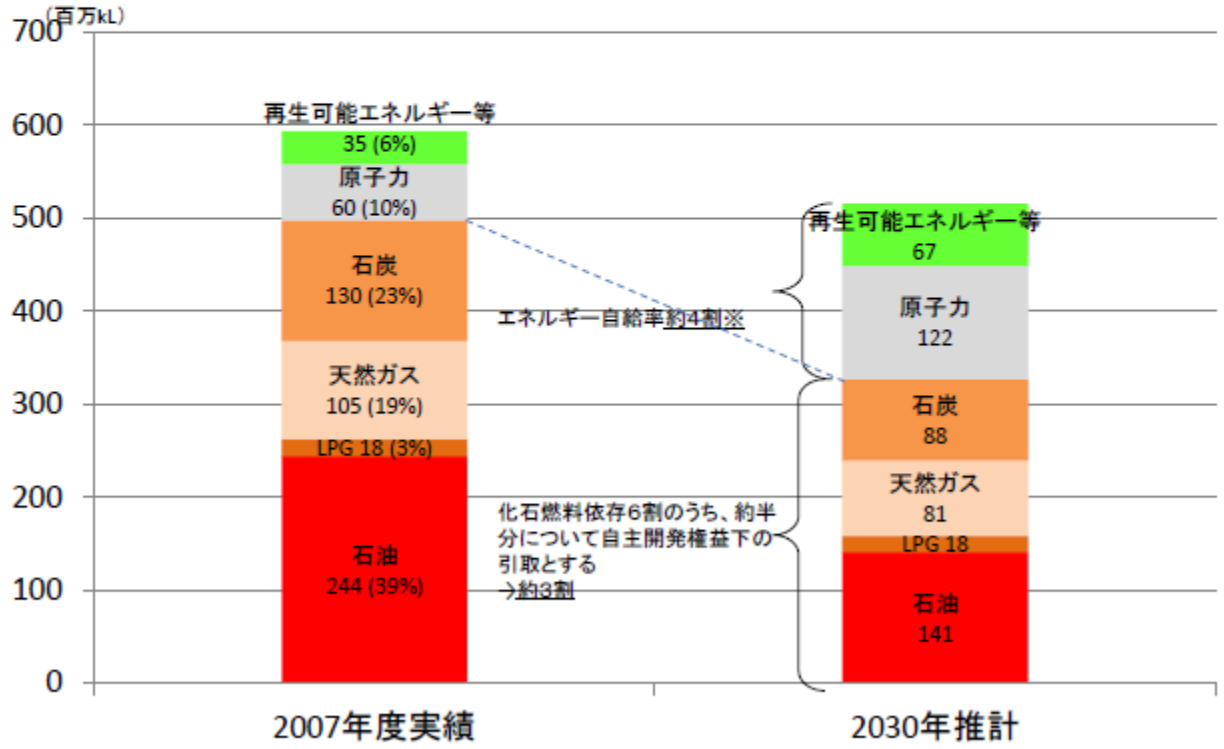
転換部門

○再生可能エネルギー　Renewable energy source under the system of FIT

○原子力　Nuclear power (New Construction: 14 plants until 2030)

（試算結果）

○従来のエネルギー自給率（現状18%）が倍増する。加えて、自主開発権益下の化石燃料の引取量（現状26%）を倍増させることにより、自主エネルギー比率は約70%（現状38%）となる。



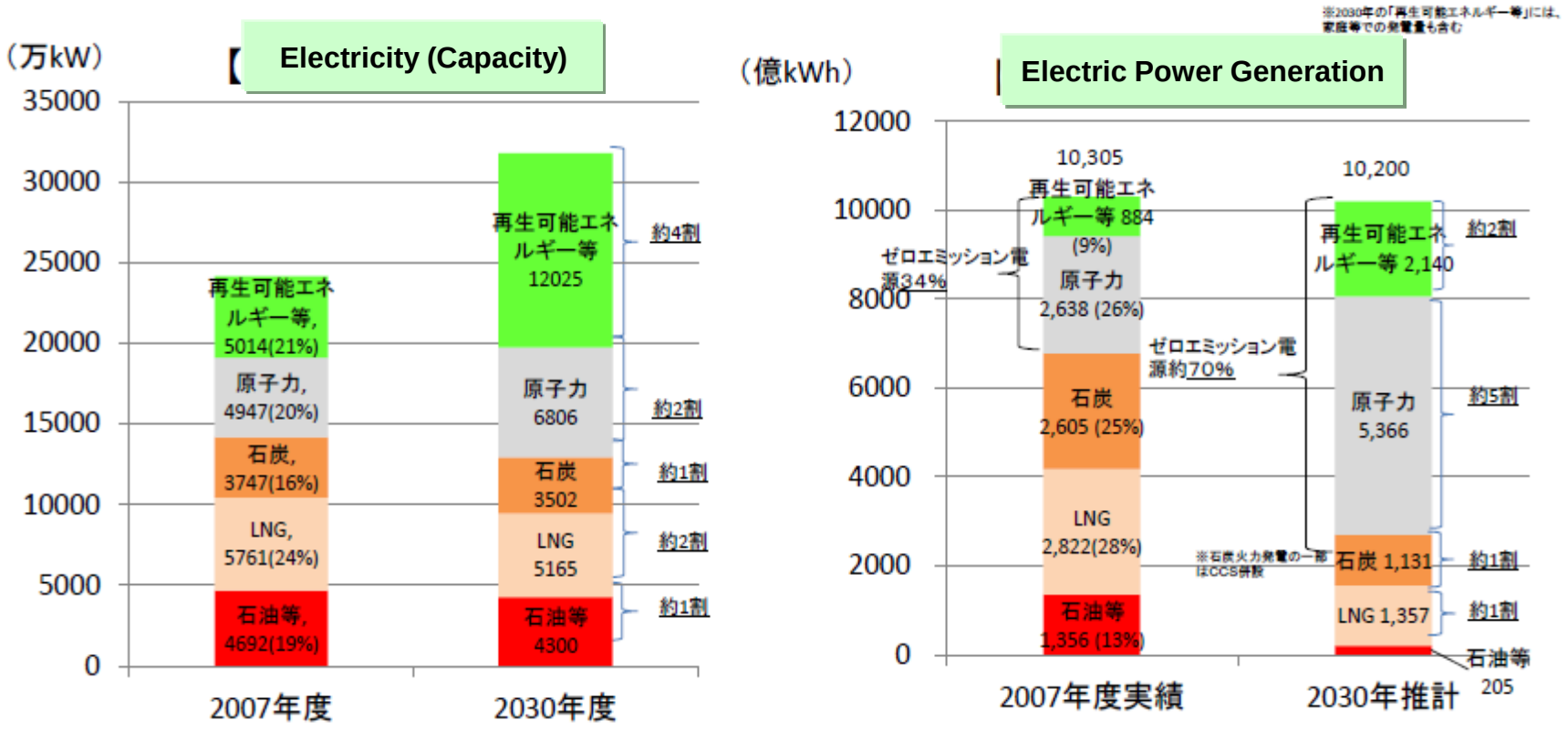
エネルギー自給率 約4割 ＋ 化石燃料の自主開発権益下の引取 約3割 ＝自主エネルギー比率 約70%

※エネルギー自給率には、再生可能エネルギー等、原子力の他、国内で産出される化石燃料も含む

※「再生エネ等」には、給湯・空調等による空気熱は含んでいない。

Planned Share of Electricity

Share of zero emission electric power generation :34%(2007) to 70%(2030)



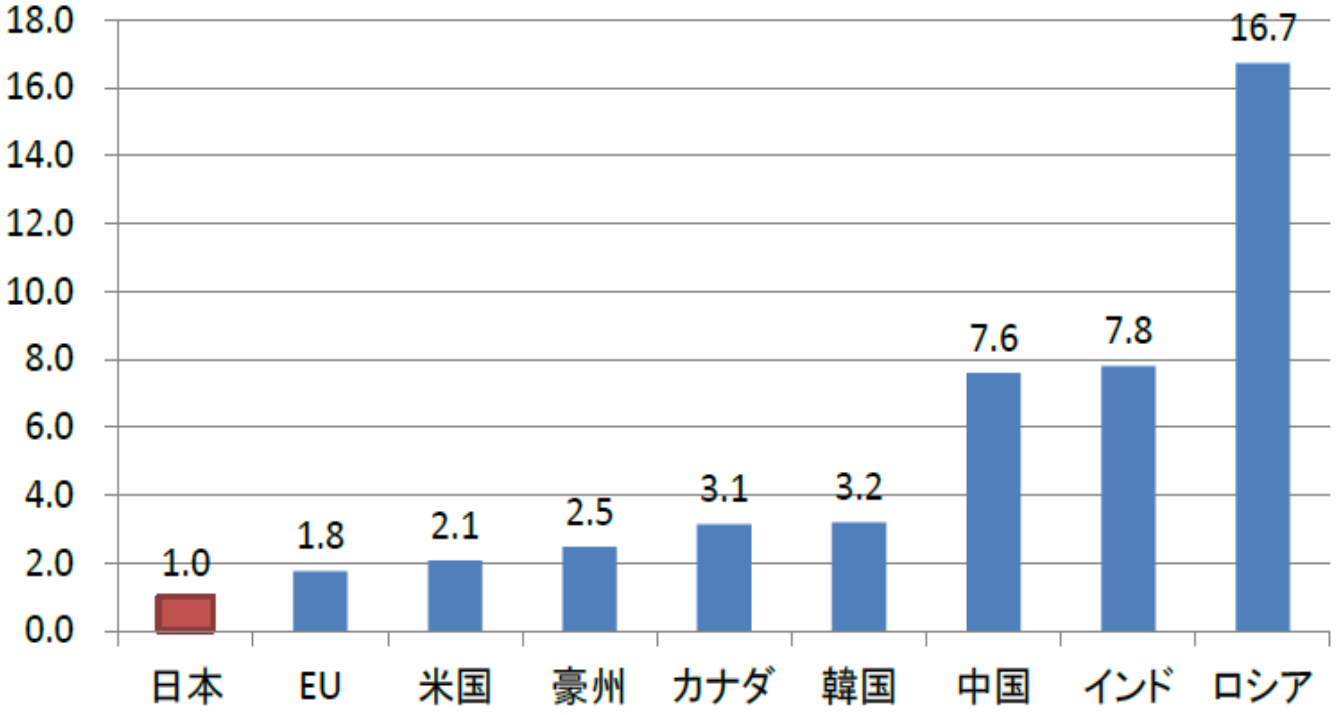
※大幅な省エネルギーや、立地地域を始めとした国民の理解及び信頼を得つつ、安全の確保を大前提とした原子力の新増設（少なくとも14基以上）及び設備利用率の引き上げ（約90%）、並びに再生可能エネルギーの最大限の導入が前提であり、電力系統の安定度については別途の検討が必要である。
※石炭火力については、商用化を受けて、リプレース時には全てCCSを併設すると想定。今後の技術開発やCO2の貯留地点の確保等によって変動しうる点に留意が必要。
※ゼロエミッション電源約70%には、再生可能エネルギー等のうち、廃棄物発電及び揚水発電を除く。
※2007年度実績の発電電力量は、卸売電力取引所における取引等の電源」種別が不明な▲66億kwhを差し引いていない値

Highest Energy Efficiency in the World

○日本は、世界トップレベルの低炭素経済を実現。

○更なる削減には他国に比べてより多くの費用が必要となる。

Primary Energy Supply per GDP in 2007
(toe/1000US$ in 2007 exchange rate)

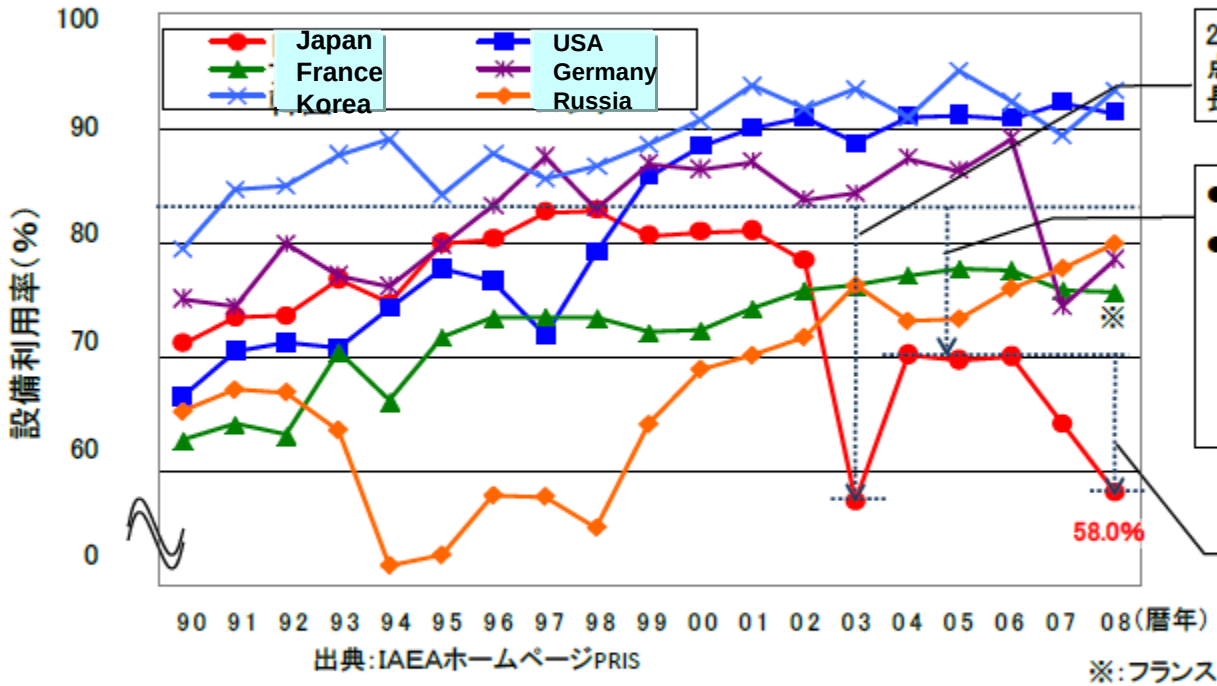


出典：IEA Energy Balance OECD 2009, Energy Balance Non OECD 2009

Utilization Rate of Nuclear Power Plants

/ Utilization rate of nuclear power plant in Japan was declining recently.

International Comparison of Utilization by country



出典:IAEAホームページPRIS

2002年8月の電気事業者の不正に起因する点検等のため、定検前倒し及び定検期間延長。

●予防保全による定期検査期間長期化、

●トラブル・自然災害等。
04年: 美浜3号機二次系配管破断
05年: 宮城沖地震(女川1～3号機)
06年: 志賀1号機臨界事故隠蔽問題、浜岡5号機、志賀2号機蒸気タービン損傷 等

2007年7月の中越沖地震による柏崎刈羽原発の運転停止等。

※:フランスでは、電力需要に応じて出力を低下させる負荷追従運転が取り入れられているため、設備利用率が相対的に低い。

(参考)設備利用率向上のCO2排出削減効果

2007年度CO2排出量(実績) : 13億7,400万トン(90年比＋9.0%)

設備利用率が98年水準(84.2%)と仮定 : 13億1,100万トン (90年比＋4.0%)

90年比5%分改善
(6,300万トン)

2 Lessons from TEPCO Fukushima Nuclear Power Plant Accident

- **Importance of Evidence-based Risk Communication**

/ Environmental target among 3Es objectives was the highest priority due to the important policy concerns. Unfortunately we did not have any scientific evidences to confirm and discuss the implementation of the target positively.

/ As results, we did not take account of the risk to depend upon nuclear power plants sufficiently, and could not prepare for the overall supporting systems for the accidents.

/ Due to the lack of the fields of the communication among natural scientists, engineers and social scientists, we could not use the scientific knowledge concerning the safe operation of the nuclear power plants commonly and precisely.

/ limitation of the governmental committee like “Shingikai” . We have to create a new system to create the consensus in the public and feedback the public opinions in the decision making process.

- **Code of conduct required for scientists**
- **Interdisciplinary collaboration between Social Science and Natural Science and Inter-agency works in decision making process.**

・Construction of Science of Science, Technology and Innovation Policy

○ Growing expectations for Science, Technology and Innovation (STI) to cope with societal challenges, in responding appropriately to economic and social structural changes.

Multifaceted understanding and analyzing the economic and social conditions, societal challenges, and the present states and potential of science and technology which is necessary to cope with the challenges.

Evidence-based policy-formation through more rational process is required.

○ Deepening the understanding the processes among Science, Technology and Innovation, and visualizing the social and economic impact of STI policy.

The results must be utilized in the actual policy-formation, ensuring transparency in decision-making in order to meet accountability to the public.

○ Making use of evidence as shared social resources, which servers as a foundation for public participation in policy-formation.

Developing “Science of STI Policy” to realize evidence-based policy-formation.

After the Great East Japan Earthquake

○ Demand for policy reappraisal for the realization of a safe and secure society, stable energy supplies and dissemination of renewable energy.

○ Renewed awareness of the limits of Science and Technology, which require for reappraisal of previous policies.

○ High expectations for the role of Science and Technology to contribute to address social issues facing Japan for the recovery from the disaster and promote the sustainable growth and development of social economy.

○ Need to serious and objective reviews of previous policies to rethink the proper role of Science and Technology, and to find a vision and strategies of how science and technology can contribute to the society.

Now is the time to promote ”Science of STI Policy” to advance evidence-based policy-formation, when we need to plan national strategies and implement them for the recovery from the disaster and our future.

3. Toward a new energy infrastructure in Japan - What should and could we do as economics point of view now? -

- We should show several alternative scenarios concerning the energy infrastructure to the public.
- Scenario should describe alternative possibilities for energy sources and technologies. Economist needs to collaborate with natural scientist to evaluate feasibilities for alternative technologies.
- Scenario should also describe alternative policy menus to realize institutional structure corresponding to choices for energy sources and technologies.
- Policy menu should describe the impacts of the alternative scenarios on the economic and social structures including growth, employment, cost & price, competitiveness, environment etc.

  - Examples for alternative scenarios –

    - Scenario I : complete substitution to the renewable energy sources instead of nuclear energy.
    - Scenario II: gradual substitution to the renewable energy sources.
    - Scenario III: to continue the 2010 basic energy plan.