

# Role of Nuclear Power in National Energy Context in Japan

Joint Japan-IAEA Nuclear Energy Management School in  
Japan

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*Note: The views expressed here are of my own and do not necessarily reflect those of the JAEC nor the government.*

# Summary

- Japan's energy policy has been shifting its priority since 1960s. Energy security, Environment protection and Economic efficiency are three pillars of Japan's energy policy and **nuclear power had been one of the most important energy sources in Japan until the Fukushima accident on 3/11/2011.**
- Since 3/11, Japan's new energy policy (**reducing dependence on nuclear power**) will **require a paradigm shift (enhanced transparency, reform in policy making process, etc. ).** It also requires a long transition period. **Regaining public trust is essential** to realize such transition.
- Nuclear energy policy has also **many unresolved issues**, including final disposal of radioactive waste, spent fuel management and plutonium management etc., regardless of future direction of nuclear energy policy.



# Japan Atomic Energy Commission (JAEC)

## ○The Role of Japan Atomic Energy Commission

The Japan Atomic Energy Commission is set up in the Cabinet Office and has five commissioners. Its mission is *to conduct planning, deliberations, and decision-making* regarding basic policy for research, development, and utilization of nuclear energy, including the formulation of the Framework for Nuclear Energy Policy *except matters related to nuclear safety regulation*. When the JAEC deems it necessary as a part of its assigned mandate, *JAEC can recommend and demand reports of the head of relevant administrative organization through the Prime Minister*.

Members: 5 (appointed by the Prime Minister with the consent of the House of Representatives and House of Councilors)



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~~Commissioner~~  
Dr. Akira OMOTO

# Japan's Energy Policy Before 3/11



# Historical Shifts in Japan's Energy Policy(1)

- 1950s~1973: Shift from domestic Coal to imported Oil
  - Domestic coal and hydro were the main energy sources, but not enough to catch up rapidly growing energy demand.
  - Shift to imported cheap oil became major policy goal.
- 1973~1980s: Shift from Oil to Nuclear, LNG and imported Coal
  - Reduce dependence on oil became top priority
  - Rapid expansion of nuclear power, LNG, and coal power (imported coal)
  - Three Laws for Electricity Power Promotion (Siting, Technology Development, Special Tax) in 1974
  - Law for Development of “Alternative Energy Sources” such as renewables, advanced coal, advanced gas turbine in 1978
  - Law for Energy Conservation in 1979



## Historical Shifts in Japan's Energy Policy(2)

- 1990s:

- (1) Liberalization of Electricity Market (primarily to reduce electricity price)

- Utility Industry Law amendment in 1995, 1999, and 2003 which allows liberalization of about 60% of total retail market (but not for small scale commercial sector and households)

- (2) Climate Change (promotion of low-carbon energy sources)

- Law for Promotion of Measures against Global Warming in 1998
    - Commitment to Kyoto Protocol target (-6% from 1990 by 2012)

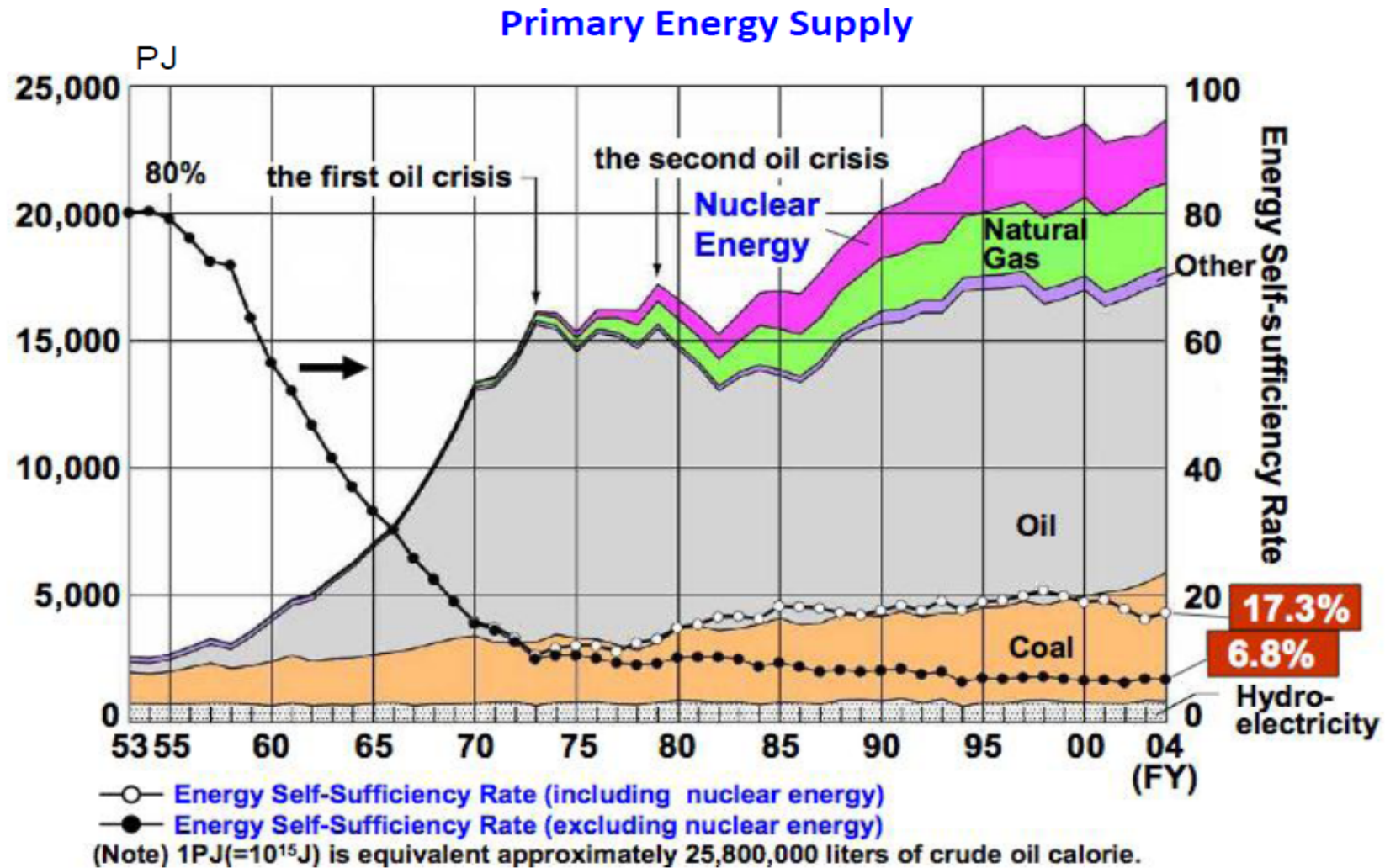


# Historical Shifts in Japan's Energy Policy(3)

- 2000s ~ until 2011/3/11: Balanced energy policy to promote 3E (Energy, Economy and Environment)
  - Energy Basic Law in 2003 gives authority to METI for overall energy policy, but requires METI to publish “Energy Basic Plan” every three years
  - Last Energy Basic Plan was published in 2010
  - New commitment to reduce CO2 by 25% from 1990 level by 2020
  - Emphasis on energy security and climate change and increasing share of nuclear and renewable energy sources (~50% nuclear ~20% renewable of total electricity production)



# Japan's Primary Energy Trends (1953-2004)

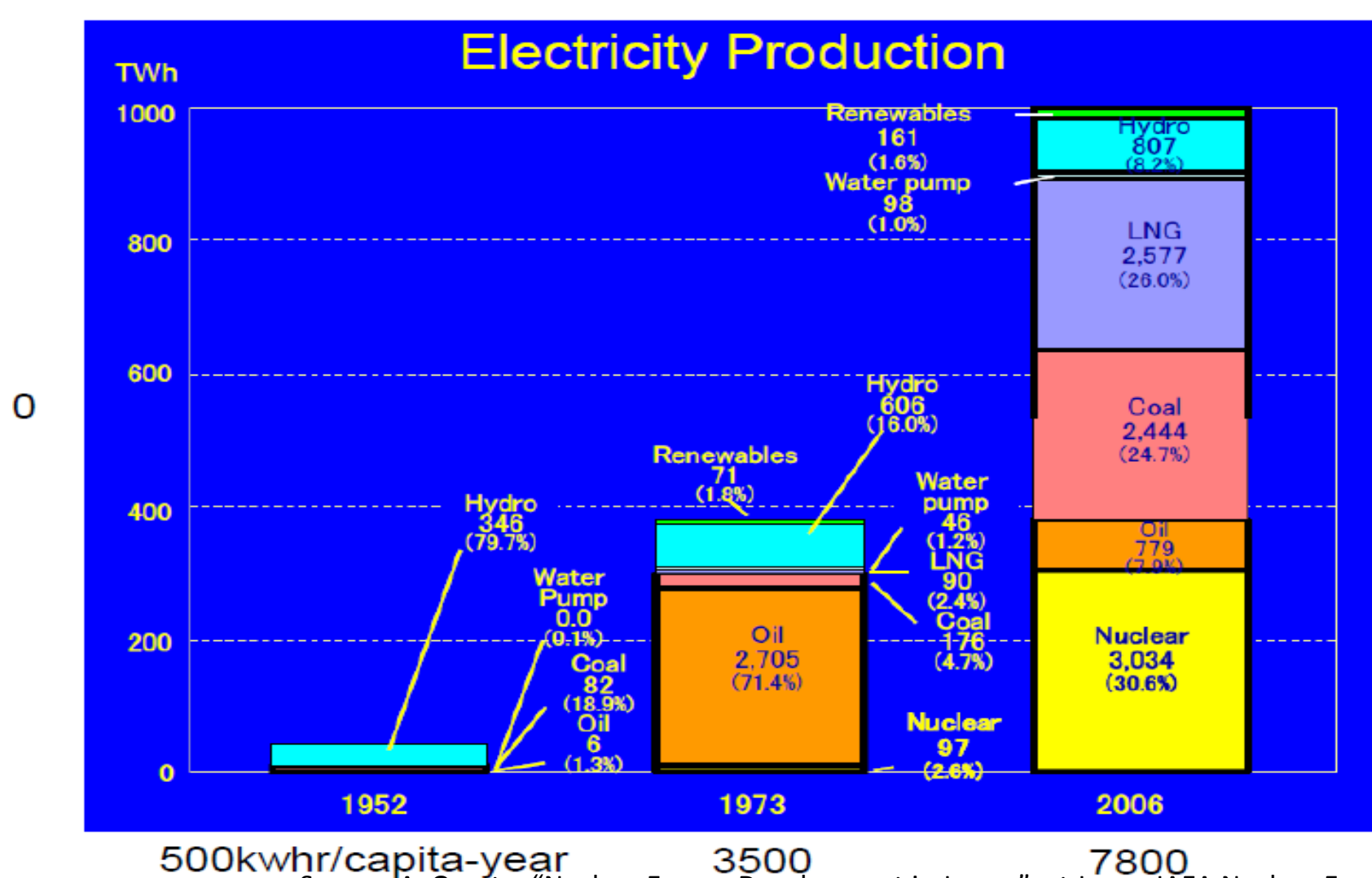


Source: A. Omoto, "Nuclear Energy Development in Japan," at Japan-IAEA Nuclear Energy Management School, June 11-29, 2012.

<http://www.nuclear.jp/nem/modules/d3downloads/index.php?page=visit&cid=2&lid=17>



# Japan's Electricity Production Mix (1952-2006)



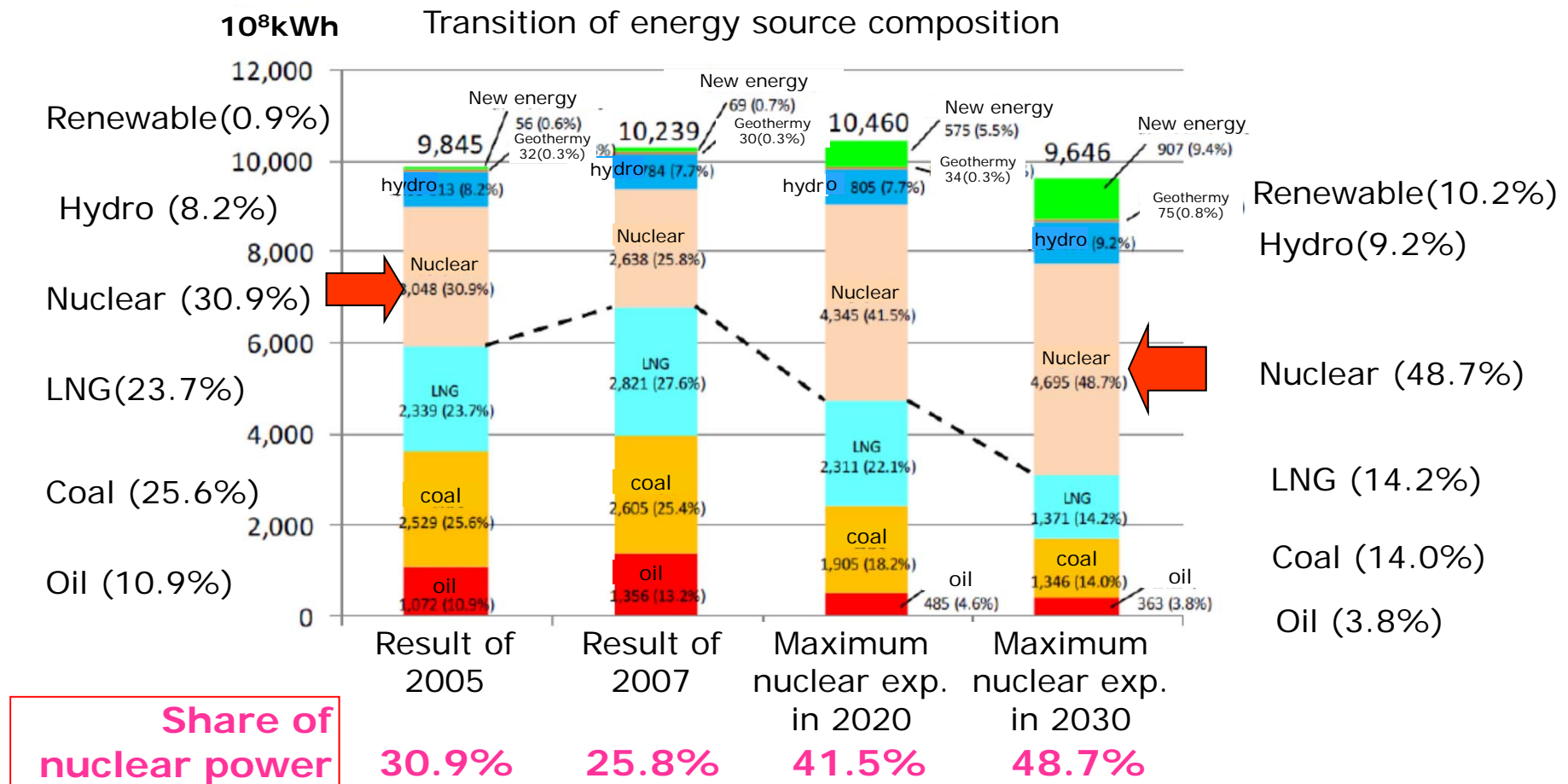
Source: A. Omoto, "Nuclear Energy Development in Japan," at Japan-IAEA Nuclear Energy Management School, June 11-29, 2012.

<http://www.nuclear.jp/nem/modules/d3downloads/index.php?page=visit&cid=2&lid=17>



# Goal of Power Production Mix in 2030

## Before 2011/3/11



Source: Institute of Energy Economics, March 2010

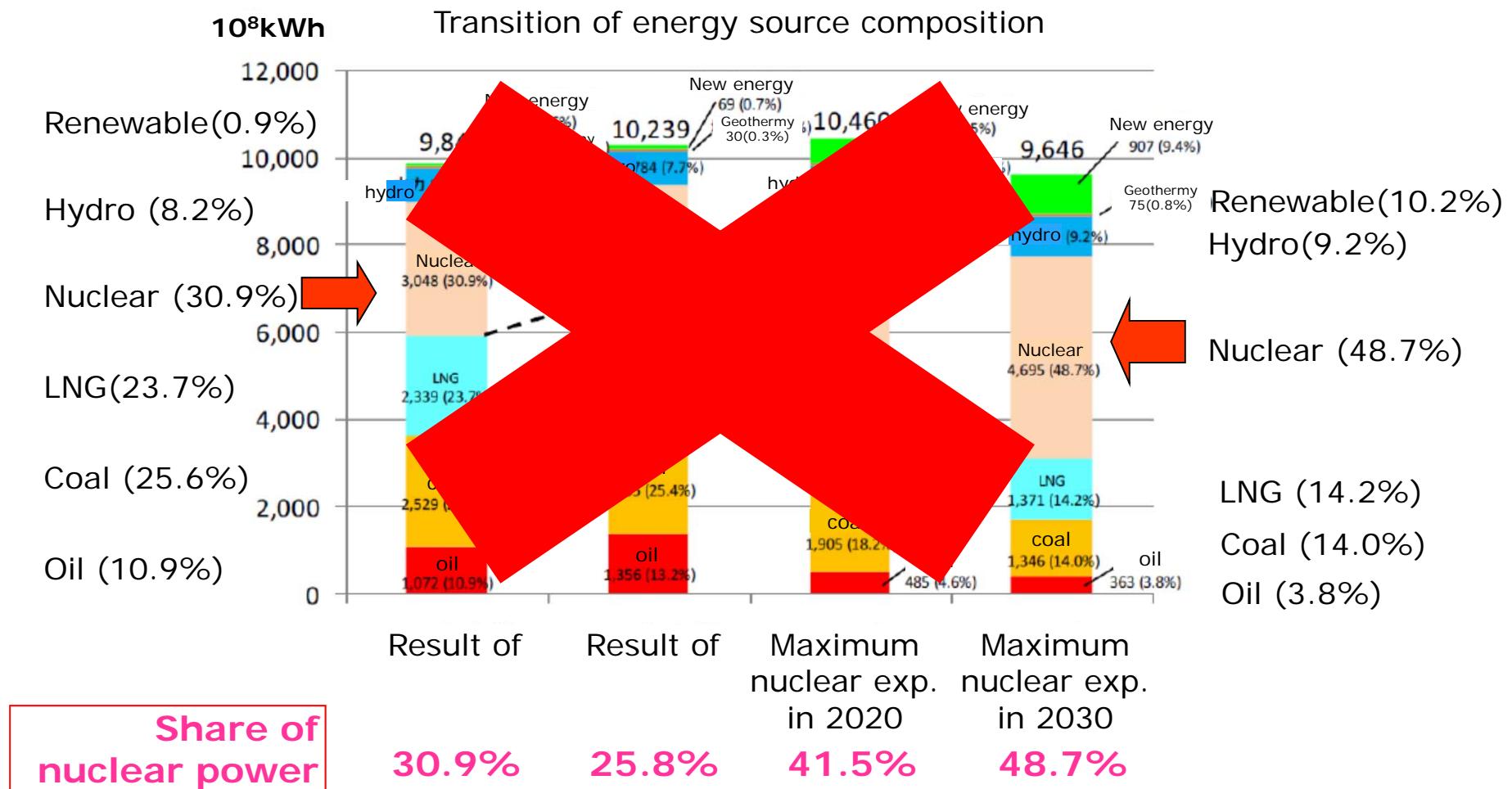


# Japan's energy policy after 3/11



# Goal of Power Production Mix in 2030

## Before 2011/3/11



Source: Institute of Energy Economics, March 2010

# Personal Reflections on the Fukushima accident

- *Feel deep responsibility and regret for what happened as a person/expert engaged in nuclear energy. Would like to express my sincere apology for all people affected by the accident.*
- Fundamental shift in thinking about risk of nuclear energy.
  - Risk is as large as risks of nuclear proliferation and nuclear security (I thought nuclear safety risk is smaller)
  - Social/political/economic risks are tremendously larger than I thought. It has become an issue of human security.
  - Protection of human lives is not good enough. Release of radioactive materials which would cause long term impacts on society and environment should not be allowed.
  - About 160,000 people are still not living in their own homes and are concerned about their health, future life and future of their homeland. It is heartbreaking to listen to their story, with anger, frustration and anxiety.
- Assuring and restoring life and welfare of people affected by the accident is the top priority.





# Current Status

- It will take at least 30 years to clean up and decommission the Fukushima Dai-ichi site.
- Total liability (compensation) amount is estimated to be at least 6 trillion yen (\$60 billion) which is likely to grow further.
- Only two (out of 50) nuclear plants are operating, but due to energy conservation/efficiency improvement efforts no power shortage occurred during this summer peak. Still about 3.5 trillion yen (\$35 billion) was paid more for fossil fuel than last year. All utilities except Hokuriku and Okinawa suffered largest loss (total of 1.3 trillion yen in FY 2012).
- Newly established Nuclear Regulatory Authority (NRA) has been working on new regulatory standards and published its draft. NRA plans to publish the standards by July for reactors and for nuclear fuel cycle facilities by December. Until then, no reactors/facilities are not allowed to start up.



# The most important lesson learned from Fukushima:

## Thinking Unthinkable

- *“The Investigation Committee is convinced of the **need of a paradigm shift** in the basic principles of disaster prevention programs for such a huge system, whose failure may cause enormous damage.”* - from the Interim Report by the Gov’t investigation committee (Dec. 2011)
- **“Thinking unthinkable”** is essential in preparing for the emergency and for energy security.
- Conventional energy security policy (ex. energy independence) needs to change to new “comprehensive energy security policy,” with emphasis on **“resilience.”**



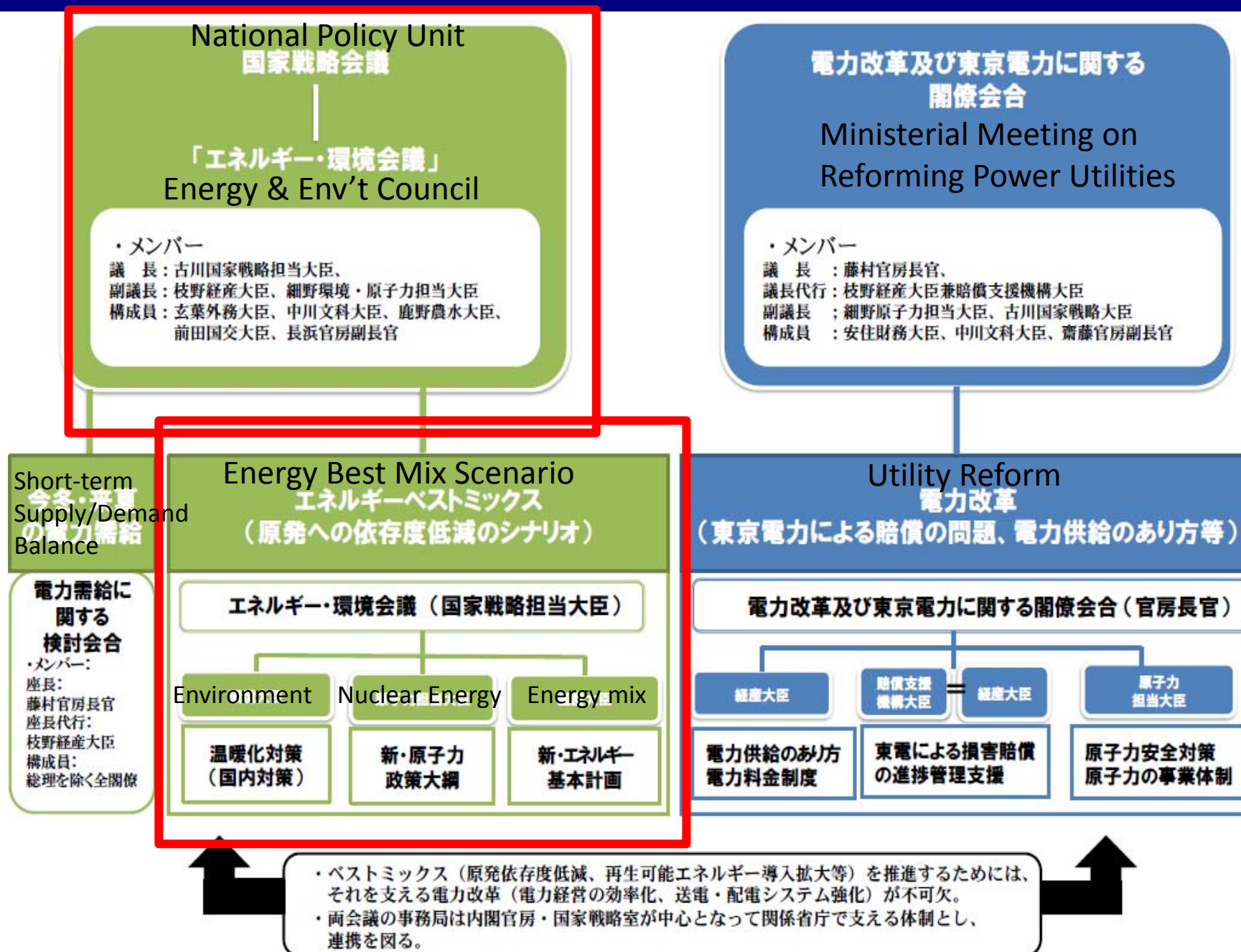
# Implications for Energy Security

- Keeping the diversity of energy option is critically important
  - Important to keep all available energy options (R&D on nuclear energy needs to be maintained)
  - Increased consumption of fossil fuel, in particular natural gas is inevitable: diversity of supply sources is essential
- The Fukushima also reminded us of :
  - Risk of multi-units on the same site
  - Importance of trans-regional power grid network
  - Rapid energy demand response (need for smart-grid)





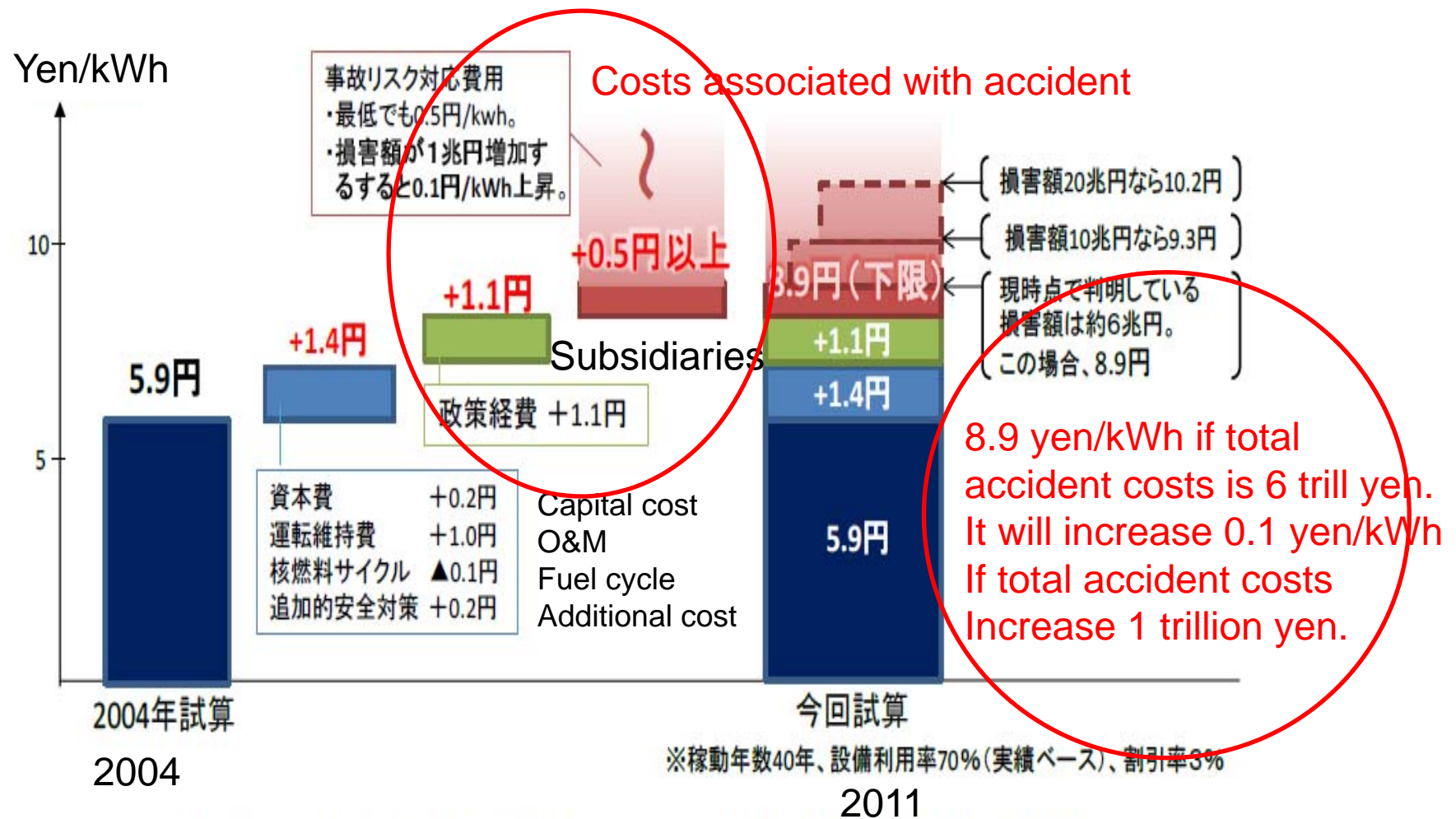
# New Framework for Energy and Environmental Policy



# New Energy Policy: Three Philosophies (July 29, 2011) by Energy and Environment Min. Council

- (1) Three principles toward new best energy mix  
(*reducing dependency on nuclear power*, strategic approach for energy security, *complete reevaluation of nuclear energy policy*)
- (2) Three principles toward new energy system  
(realization of distributed energy system, international contribution, multi-eyed approach)
- (3) Three principles toward national consensus  
(*national debate in order to overcome “pro-anti-conflict”*, *strategy based on objective data*, dialogue with various sectors of the public).





(図 20) 原子力の発電コスト (2004 年試算と今回試算)

Nuclear Power Generation Costs (2004, 2011)

出所: コスト等検証委員会報告書、2011年12月19日

<http://www.npu.go.jp/policy/policy09/pdf/20111221/siryo3.pdf>



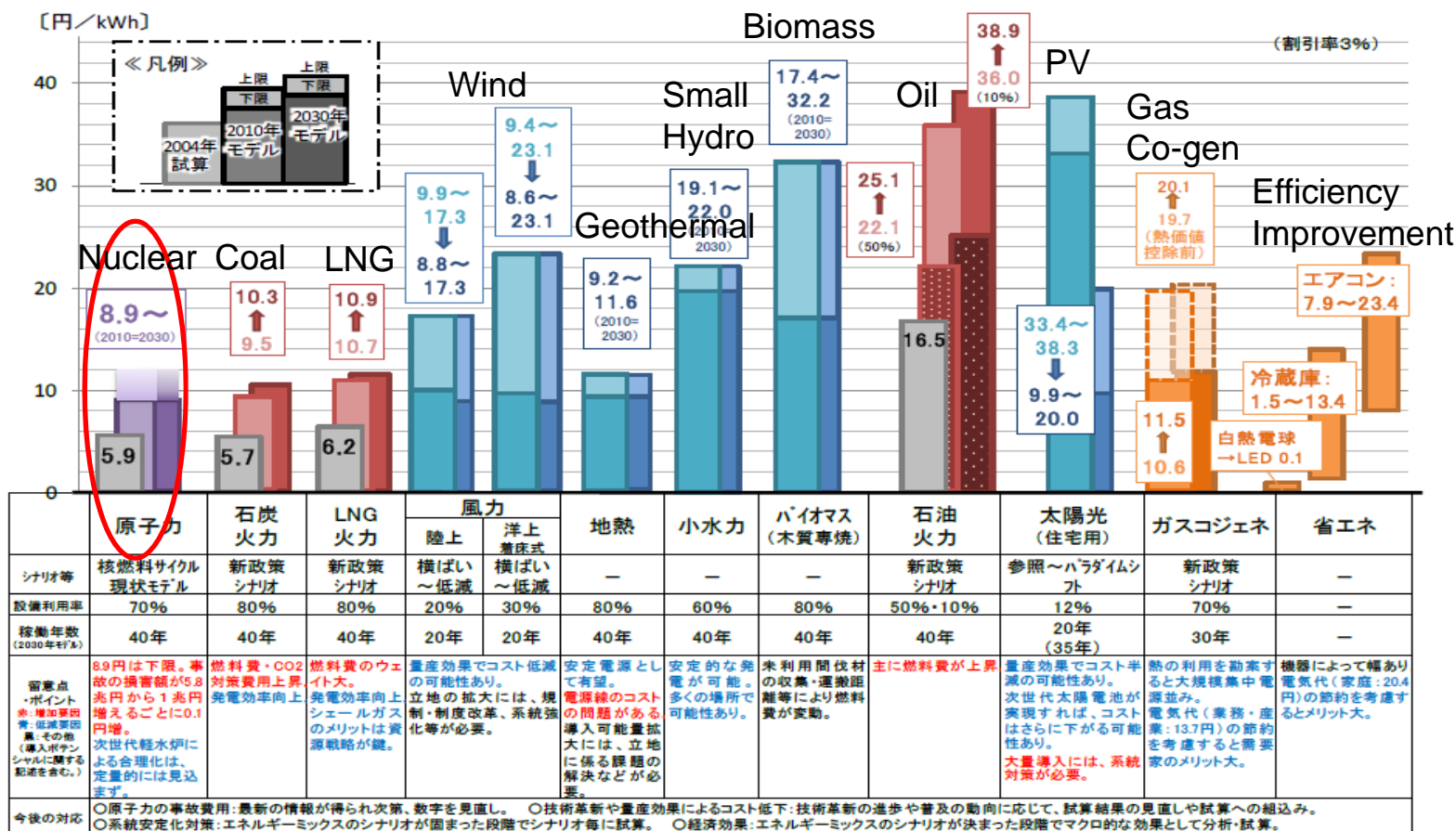
# Nuclear power can be competitive, but social costs can be high...

## 【コスト試算のポイント】

○モデルプラント形式(最近7年間の稼働開始プラント、最近3年間の補助実績等を基に設定)

○CO2対策費用、原子力の事故リスク対応費用、政策経費等の社会的費用も加算。

○2020年、2030年モデルは燃料費・CO2対策費の上昇、技術革新等による価格低減を見込んで試算。



(図 36) 主な電源の発電コスト (2004年試算/2010年・2030年モデルプラント)



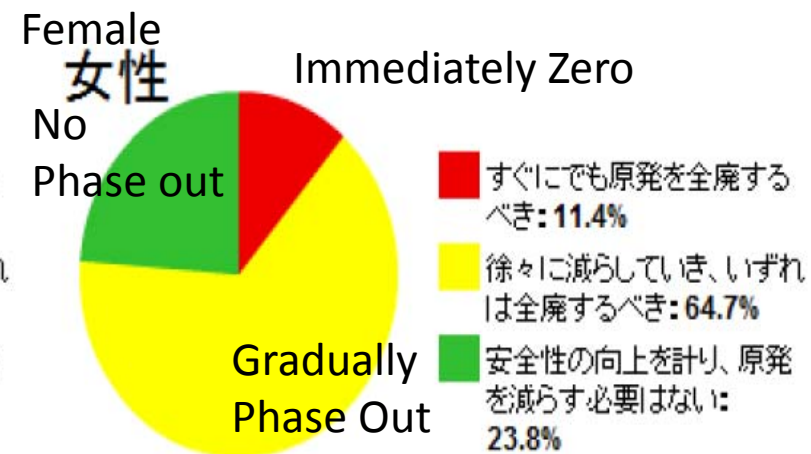
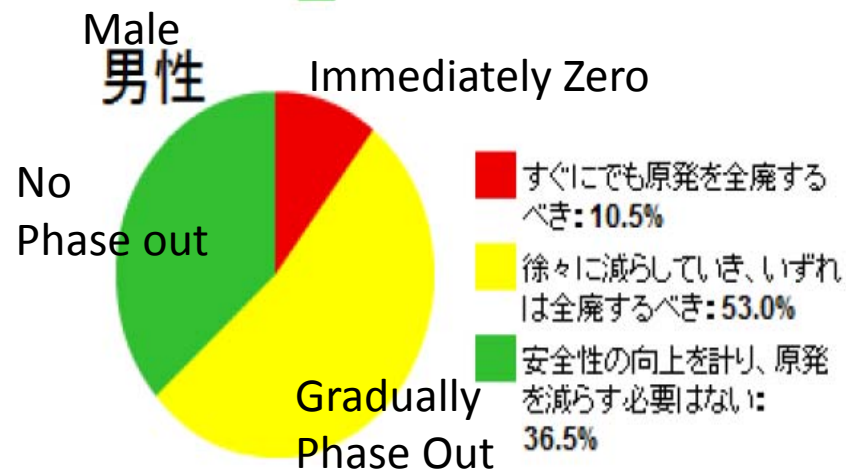
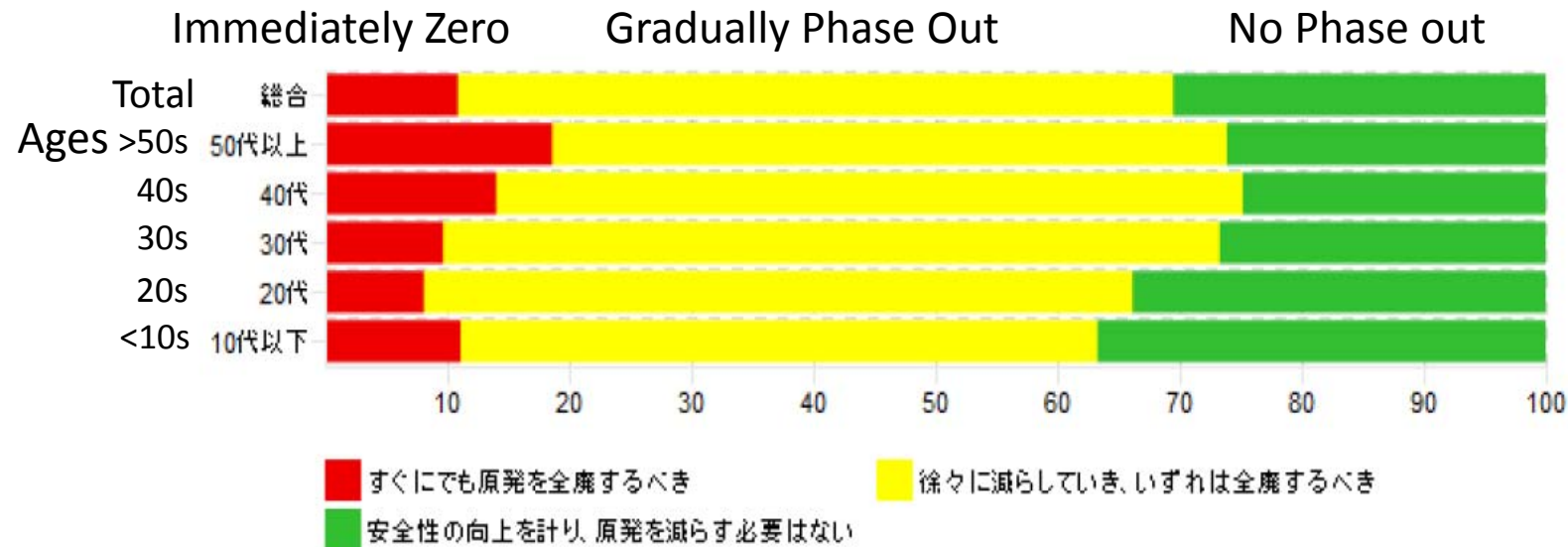
出所: コスト等検証委員会報告書、2011年12月19日

<http://www.npi.go.jp/policy/policy09/pdf/20111221/siryo3.pdf>



# Internet Polling Results (2012/08)

- Sample of more than 1 million people -



<http://info.nicovideo.jp/enquete/special/genpatsu/201208/index.html>



# Findings by the Verification Committee on National Public Debate (Aug. 28, 2012)

- For future directions of dependence on nuclear power
  - According to the national debate taken place this time, at least **majority of the public share desire to establish a society without dependent on nuclear power**
- For the time table and feasibility to achieve a society without dependent on nuclear power
  - It seems **there is not yet clear consensus on the time table and its feasibility** of achieving the society without dependent on nuclear power.
- For background on the fact that many citizens are taking actions against nuclear power
  - **It seems clear that there is a strong mistrust and anxiety against the government** and thus the top priority is to resolve such mistrust and anxiety against the government and nuclear power.



# Summary of Innovative Energy and Environmental Strategy (2012/09/14)

1. Realization of a society not dependent on nuclear power in earliest possible future (see the next pages)
2. Realization of a green energy revolution
  - Compose the “Framework for Green Development Policy” by the end of this year
  - (1) Power saving: more than 110 billion kWh (~10%) by 2030
  - (2) Energy saving: more than 77 million kl (~19%) by 2030
  - (3) Renewable energy: more than 300 billion kWh (three times) by 2030
3. Stable supply of energy
  - (1) Intensive use of thermal generation
  - (2) Intensive use of heat, including cogeneration
  - (3) Technologies related to the next generation energy
  - (4) Stable and inexpensive securement and supply of fossil fuels
4. Reform of the electric power system
5. Steady implementation of measures against global warming

Source: The Energy and Environment Council, “Innovative Strategy for Energy and Environment,” September 14, 2012.  
[http://www.cas.go.jp/jp/seisaku/npu/policy09/pdf/20120914/20120914\\_1.pdf](http://www.cas.go.jp/jp/seisaku/npu/policy09/pdf/20120914/20120914_1.pdf)



# Summary of New Energy and Environmental Strategy (2012/09/14) (on nuclear energy policy)

Realization of “Society not dependent on nuclear power” in earliest possible future

: Mobilize all possible policy resources to such a level as to even enable zero operation of nuclear power plants in the 2030s.

(1) 3 Principle guidelines

- Strictly apply 40-year limitation of reactor operation
- Restart the operation of nuclear power plants once the Nuclear Regulation Authority gives safety assurance
- Not to plan the new and additional construction of a nuclear power plant

(2) 5 policies to achieve society without dependent on nuclear power

(3) Review and constantly re-examine the path towards realization of a society not dependent on nuclear power

Source: The Energy and Environment Council, “Innovative Strategy for Energy and Environment,” September 14, 2012. [http://www.cas.go.jp/jp/seisaku/npu/policy09/pdf/20120914/20120914\\_1.pdf](http://www.cas.go.jp/jp/seisaku/npu/policy09/pdf/20120914/20120914_1.pdf)





# 5 policies towards realization of a society not dependent on nuclear power

## 1. The Nuclear Fuel Cycle policy

- Engage in reprocessing projects with assuming responsibility for the international community
- Have discussions with related local governments and with the int'l community responsibly

## 2. Maintaining and strengthening human resources and technology

- Develop policies by the end of this year

## 3. Cooperation with the international community

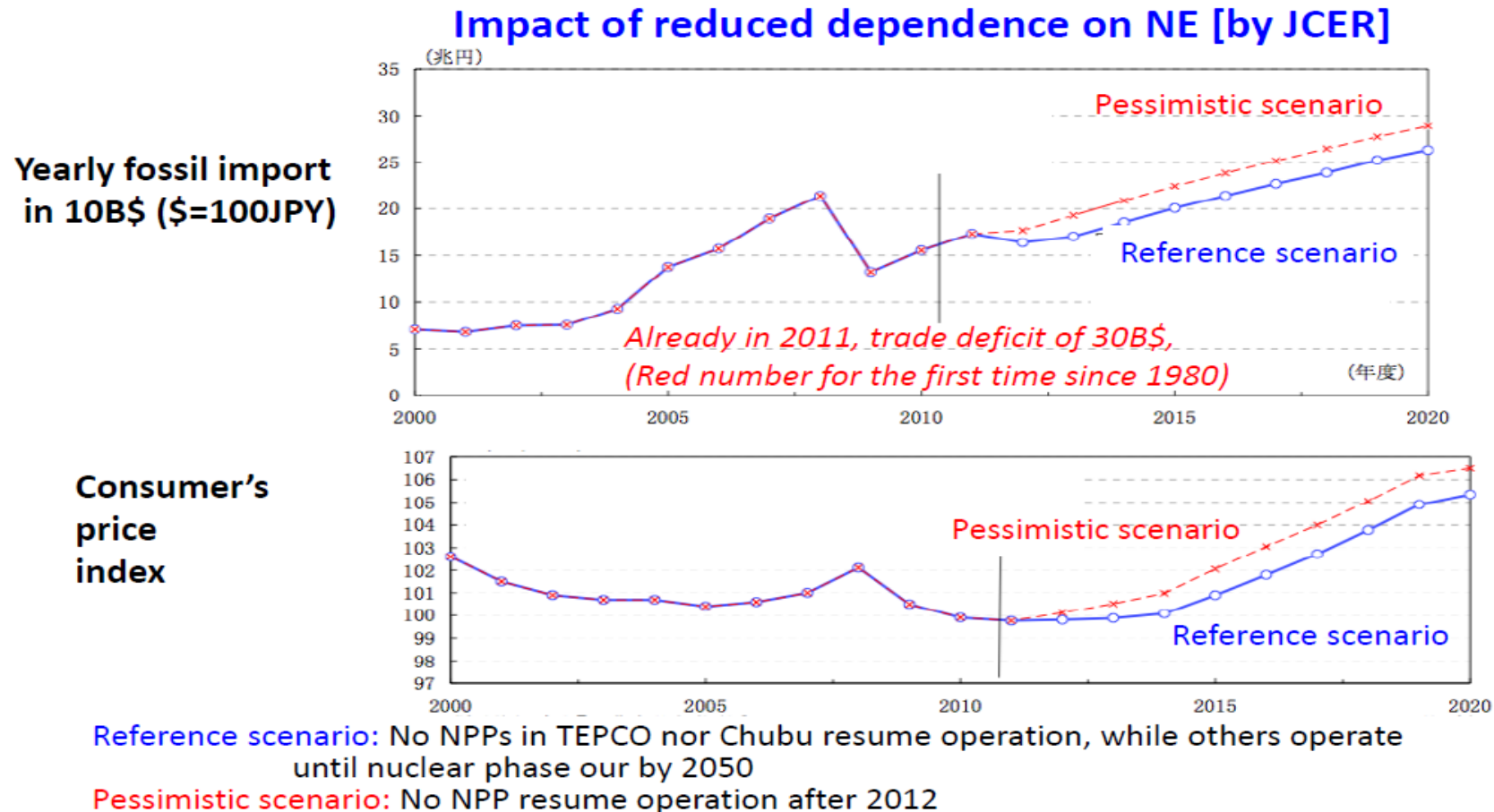
## 4. Strengthening measures for local areas with nuclear power facilities

## 5. Systems of nuclear power projects and the liability system for nuclear-related damages

Source: The Energy and Environment Council, "Innovative Strategy for Energy and Environment," September 14, 2012.  
[http://www.cas.go.jp/jp/seisaku/npu/policy09/pdf/20120914/20120914\\_1.pdf](http://www.cas.go.jp/jp/seisaku/npu/policy09/pdf/20120914/20120914_1.pdf)



# Impact of Nuclear Phase Out (by JCER)



[SOURCE] JCER (Japan Center for economic Research, 2011Dec)  
<http://www.jcer.or.jp/research/middle/detail4300.html>

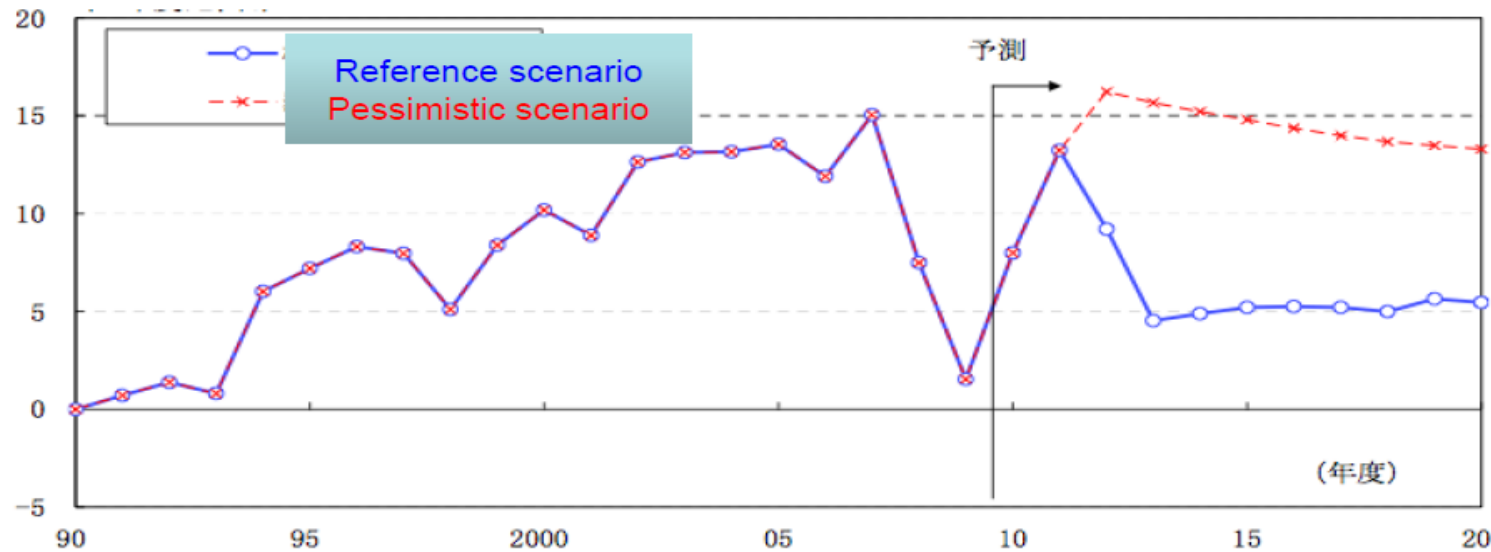


Source: A. Omoto, "Nuclear Energy Development in Japan," at Japan-IAEA Nuclear Energy Management School, June 11-29, 2012.

<http://www.nuclear.jp/nem/modules/d3downloads/index.php?page=visit&cid=2&lid=17>

# Impact of Nuclear Phase Out (by JCER)

## CO2 discharge [% increase from 1990]



[SOURCE] JCER (Japan Center for economic Research, 2011Dec)

<http://www.jcer.or.jp/research/middle/detail4300.html>

NIES (National Institute of Environmental Studies) report (2012.4.12): 25% reduction of GHG release(from 1990 level) will be possible w/o NE, if renewables share increase from 9% (2010) to 34% and primary energy saving of 24% from 2010 level

Further, estimation by the IEEJ (Institute of Energy Economics Japan) of the economic impact of nuclear phase-out → GDP loss : -3.6%, job loss : 200,000, accelerate manufacturing industry's shift to overseas



Source: A. Omoto, "Nuclear Energy Development in Japan," at Japan-IAEA Nuclear Energy Management School, June 11-29, 2012.

<http://www.nuclear.jp/nem/modules/d3downloads/index.php?page=visit&cid=2&lid=17>

# PM Abe's statement on Nuclear Power Policy (2013/01/04)

- We will first of all determine whether or not to restart nuclear power plants on the basis of scientific safety standards.
- Then over the course of roughly three years we will assess the futures of existing nuclear power plants and transition to a new stable energy mix over ten years. The new construction or replacement of nuclear power plants is not a matter that is able to be determined immediately.
- We should make our determination in accordance with the principle of gradually decreasing our degree of reliance on nuclear power to the greatest extent possible.
- In addition, it is necessary for the national government to take responsibility for accelerating examination of the issue of spent nuclear fuel disposal.



- Press Conference, Jan. 4, 2013.

[http://www.kantei.go.jp/foreign/96\\_abe/statement/201301/04kaiken\\_e.html](http://www.kantei.go.jp/foreign/96_abe/statement/201301/04kaiken_e.html)

# PM Abe's Statement at Diet on Energy Policy (2013/02/28)

- Reflecting on the accident at Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Station, under the Nuclear Regulation Authority, **we will foster a new culture of safety that will uncompromisingly enhance the degree of safety.** After doing so **we will restart nuclear power plants where safety has been confirmed.**
- **We will promote the introduction of energy conservation and renewable energies to the greatest possible extent to reduce our degree of dependency on nuclear power as much as possible.** At the same time, we will begin a **fundamental reform of the electric system.**

[http://www.kantei.go.jp/foreign/96\\_abe/statement/201302/28siseuhousin\\_e.html](http://www.kantei.go.jp/foreign/96_abe/statement/201302/28siseuhousin_e.html)



# New policy debate has begun

- METI's Advisory Council on Energy, Committee on Comprehensive Energy Policy has started its deliberation since March 15, 2013.
- New Energy Basic Plan needs to be published by the end of 2013.
- Three major energy stages are identified:
  1. **Production** (nuclear power and fuel cycle, renewable energy, fossil fuel, advanced fossil power, etc.)
  2. **Distribution** (Power System reform, energy infrastructure and network, supply chain of oil/LPG, etc.)
  3. **Consumption** (Demand response, smart community, energy efficiency, co-generation, fuel cell and hydrogen-energy, etc.)



Need a “paradigm shift” and “transition period”

- Japan’s new energy policy (reducing dependence on nuclear power) will require a paradigm shift (enhanced transparency, reform in policy making process, etc. ). Regaining public trust is essential.
- Energy system is a large complex system, consisting of hard infrastructure (power plants and transmission systems. Etc.) as well as social/economical/legal infrastructure (law and regulations, industrial structure, local and public trust, etc.) . Thus it will require a long transition period.



# Major Nuclear Energy Policy Issues (regardless of future directions of nuclear energy policy)





# Turning Point of Nuclear Energy Policy: Need a “transition period”

- Require a “transition period” from “expansion of nuclear power” policy to “reducing dependence on nuclear power” policy
  - In particular, **fuel cycle policy needs to be more flexible** given the uncertain future of nuclear energy
  - Large negative impacts can be minimized by introducing such “transition” period
- Major nuclear energy issues while reducing nuclear power dependence: **Restoring public trust and keeping the flexibility are the key factors**
  - Spent fuel storage capacity needs to be expanded and measures to make direct disposal possible should be initiated
  - Assuring safety of existing plants
  - International cooperation on nuclear safety, nuclear non-proliferation, nuclear security
    - **Management of plutonium stockpile**



# Important issues on nuclear fuel cycle policy (by JAEC, June 21, 2012)

1. Expansion of the storage capacity of spent fuel on-site and off-site of nuclear power plants, including dry storage, finding final disposal site for high-level radioactive waste, the discussing the development of technology enabling direct disposal and the required measures and regulations.
2. A comprehensive assessment of nuclear fuel cycle business operations focused on the performance of plant operation at the Rokkasho Reprocessing Plant, progress of plutonium utilization and international perspective (in several years).
3. Construction of an effective check-and-review system for R&D of FBRs, an R&D system to produce innovative and competitive advanced reactors, and effective and efficient R&D utilizing international cooperation without insisting on finalizing the domestic R&D.
4. Establishment of nuclear fuel cycle policy which takes sufficient account of the increased safety of nuclear power generation worldwide, reducing nuclear nonproliferation and the nuclear security risk.
5. The government is responsible for deciding nuclear policies, with the more explicit assignment of responsibilities to government and private utilities, and enhanced trust via sincere communications with people, and ensuring transparency.



# Major Nuclear Energy Policy Issues (@JAEC)

Important issues regardless of future nuclear energy policy

- Fukushima Daiichi Decommissioning Measures (11/27)
- Human Resource Development (11/27)
- Disposal of High-level Radioactive Waste (12/18)
- Research and Development (12/25)
- Public Confidence (12/25)
- Spent Fuel/Pu management and International Issues(?)



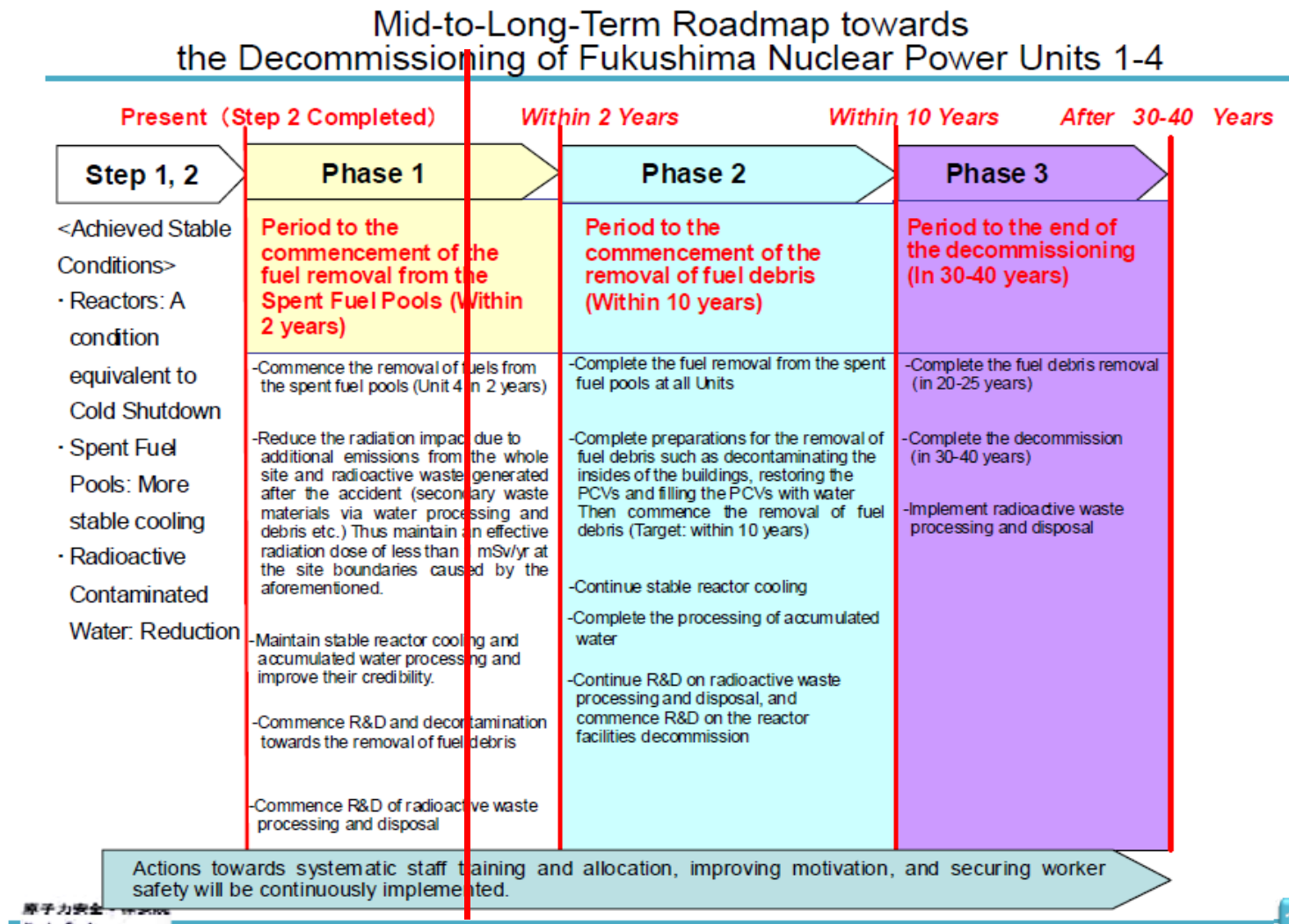
# Mid to Long term Measures for Fukushima Daiichi Site(2012/11/27)

- The government is also obliged to strive to **maintain transparency of operations** throughout the work so that the domestic and international communities correctly understand that the medium- and long-term measures are carried out in this manner.
- **The government should establish an independent (third party) organization** with overseas experts as members to assess and audit the medium- and long-term measures based on the above criteria, with the authority to make recommendations to the government on improvements as required.



[http://www.aec.go.jp/jicst/NC/about/kettei/121127-1\\_e.pdf](http://www.aec.go.jp/jicst/NC/about/kettei/121127-1_e.pdf)

# Mid-Long Term Roadmap for Fukushima Dai-ichi



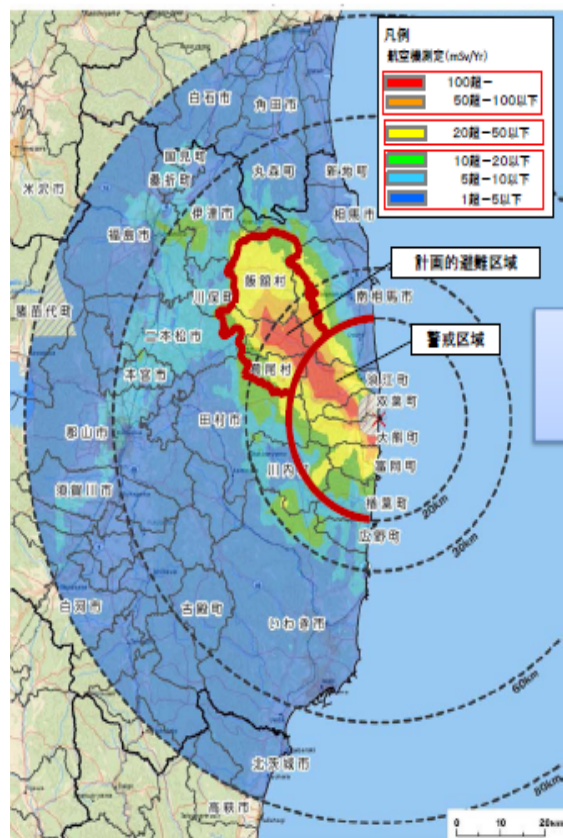
2011/12 2013/05

Source: M. Yasui, Nuclear and Industrial Safety Agency (NISA), March 2012,  
<http://www.nsr.go.jp/archive/nisa/english/files/en20120321.pdf>

# Evacuation Area Amended (March 7, 2013)

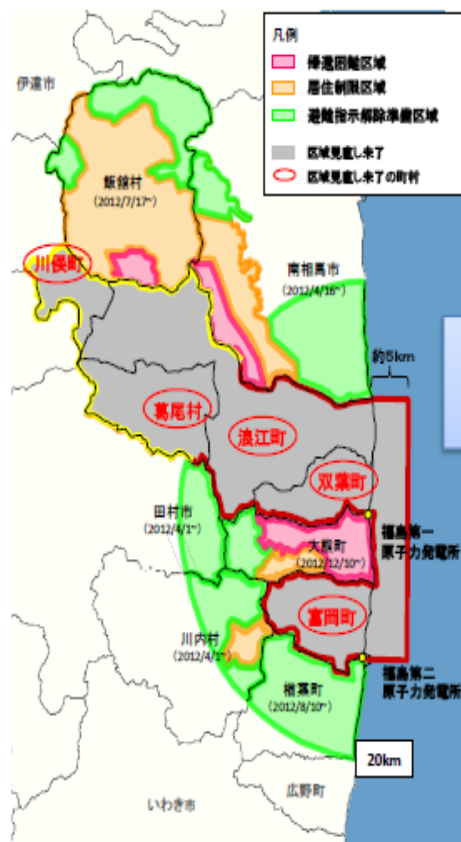
(As of April 29, 2012)

〔平成23年4月29日時点の  
線量分布〕



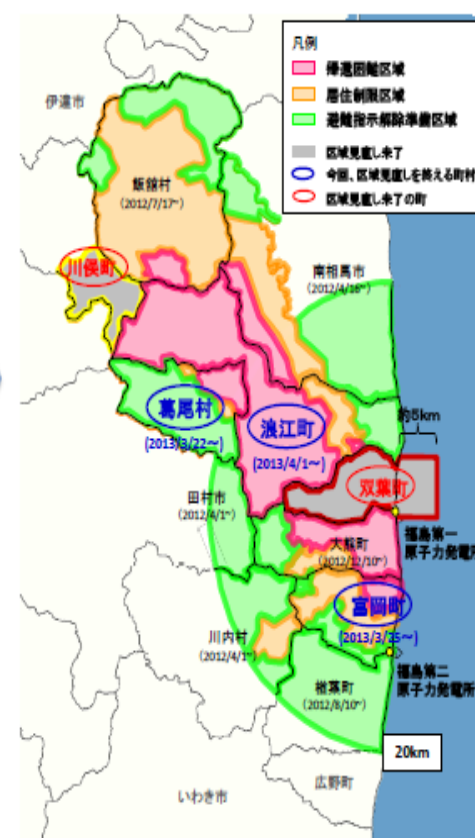
(Dec 10, 2012)

〔平成24年12月10日時点  
(今回の区域見直し前)〕



(After April 1, 2013)

〔平成25年4月1日以降  
(今回の区域見直し後)〕



# Human Resource Development(2012/11/27)

- Also highlighted were the **insufficient efforts of educators and researchers to provide the public with objective information**. Some also underlined **the lack of responsibility for ensuring safety and the defects in ethical education** as factors behind the accident.
- Accordingly, those engaged in the research and development of nuclear energy **must be capable of integrating a system to meet social needs in cooperation with experts in various fields, responsibly taking control of unexpected events with a strong sense of ethics** to prevent an event from developing into a disaster, and providing timely information which may affect society in various ways.





# HLW Disposal Issues in Japan

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- 1998: Report by the Special Committee on HLW Disposal of JAEC
- 2000: Law on “Final Disposal of Specified Radioactive Waste(HLW)” passed, establishing Nuclear Waste Management Organization (NUMO)  
Started the public process for initial literature survey for potential sites through voluntary process
- 2005: New Framework for Nuclear Energy Policy by JAEC endorsed the HLW disposal plan
- 2007: Toyo-town of Kochi Prefecture applied but due to opposition from both local public and prefectural governor, the Mayor resigned and new Mayor withdrew the application.
- 2008: Policy Evaluation Committee of JAEC recommended that JAEC should seek the opinion of “authoritative third party”
- 2010: JAEC decided to seek independent advice from Science Council of Japan (SCJ)





# Typical NIMBY Issue?

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- Public Polling on HLW Disposal Issue (2009) :
  - Are you in favor of making a decision now to build a final HLW disposal facility as a responsibility of current generation?  
**YES : ~82%**  
Absolutely Yes (51.9%)  
May be Yes (30.3%).
  - Are you in favor of hosting a final HLW disposal facility in your neighborhood?  
**NO: ~80%**  
May be No (34.3%)  
Absolutely No (45.3%)

# Reply from SCJ to JAEC (2011/9/11)

The government should rethink the HLW disposal policy fundamentally. The recommendations are:

1. Fundamental reform of HLW Disposal Policy
2. Enhanced awareness of the limit of science/technological capability and **assuring the autonomy of scientific community**
3. Restructure of the policy based on **(long term) “Temporal Storage”** to buy time to establish a responsible final disposal plan and **“Quantity Control” over HLW**
4. Need for a convincing decision making process to assure **fair distribution of burden**
5. Need for a **multi-stage consensus building process** through deliberation
6. Enhanced awareness of the need for long term and persistent efforts to solve the problem



<http://www.scj.go.jp/ja/info/kohyo/pdf/kohyo-22-k159-1.pdf>

## Renewing Approaches to Geological Disposal of HLW (JAEC, 2012/12/18)

The government should ...review basic government policy and governance of the operator with humility, and reflecting the lessons learned from the Reply: The recommendations are:

1. Clarify the amount and nature of HLW for disposal in association with nuclear energy and fuel cycle policies.
2. Apply the latest earth science knowledge to a viability study of geological disposal, and share the result with the public.
3. Improve the operation according to the discussions on the need and significance of interim storage (including long term “temporal storage”
4. Provide a system of sharing disposal techniques and the site selection process with the public
  - The responsible ministers should ...convincingly **establish an independent and functionally effective third party organization** to provide suitable advice to the government and related parties in time.
5. The government leads policy restructuring.

<http://www.aec.go.jp/jicst/NC/about/kettei/121218.pdf>



# Research and Development (2012/12/25)

- We should promote the study of psychology, organizational theory, business administration and sociology, etc. ...enabling better safety culture.
- ...**the potential for unexpected social influence** (safety, environmental impact (EI) and ethical issues, etc.) **must be assessed in advance.**
- ..it is important ..to **gain independent opinions**; not only from wide areas of physics and engineering but also from the social science academic community and civic groups, constituting an **autonomous comprehensive assessment organization from a wide perspective of ELSI** (ethical, legal, and social issues) and remit works.



# Toward Public Confidence Building Measures (2012/12/25)

- 4 important principles for improving public trust:
  - (1) Accountability of policy decision
  - (2) Disclosure of accurate information
  - (3) Transparency and Fairness and public participation in policy making process..
    - administrative bodies **should establish a verifiable decision-making process**, namely, from the creation of administrative documents, hearing from experts, interested parties and the public, to final making decisions
  - (4) Clear and understandable communication (for the general public)
- The government, with collaboration with local governments and utilities, need to establish a forum where **local public and stakeholders can share the information to improve transparency of policy making process and public confidence.**
  - Good examples can be seen in Kashiwazaki-Kariwa Citizen Forum and CLI in France



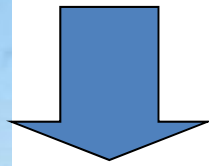
[http://www.aec.go.jp/jicst/NC/about/kettei/121225\\_1.pdf](http://www.aec.go.jp/jicst/NC/about/kettei/121225_1.pdf)

# Three types of spent fuel storage capacity

## At-reactor storage

Storage capacity: 20,630 tU/17 sites (as of Nov. 2011, 69% full)

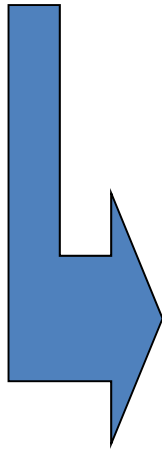
On-site dry cask storage is not allowed by local governments (Fukushima-1 & Tokai-2 was allowed).



If Rokkasho was cancelled...

## Rokkasho reprocessing plant

Storage capacity: **3,000tU**  
(storage **2,929 tU** as of Sept. 2012)  
Construction cost: ¥2.14Trillion



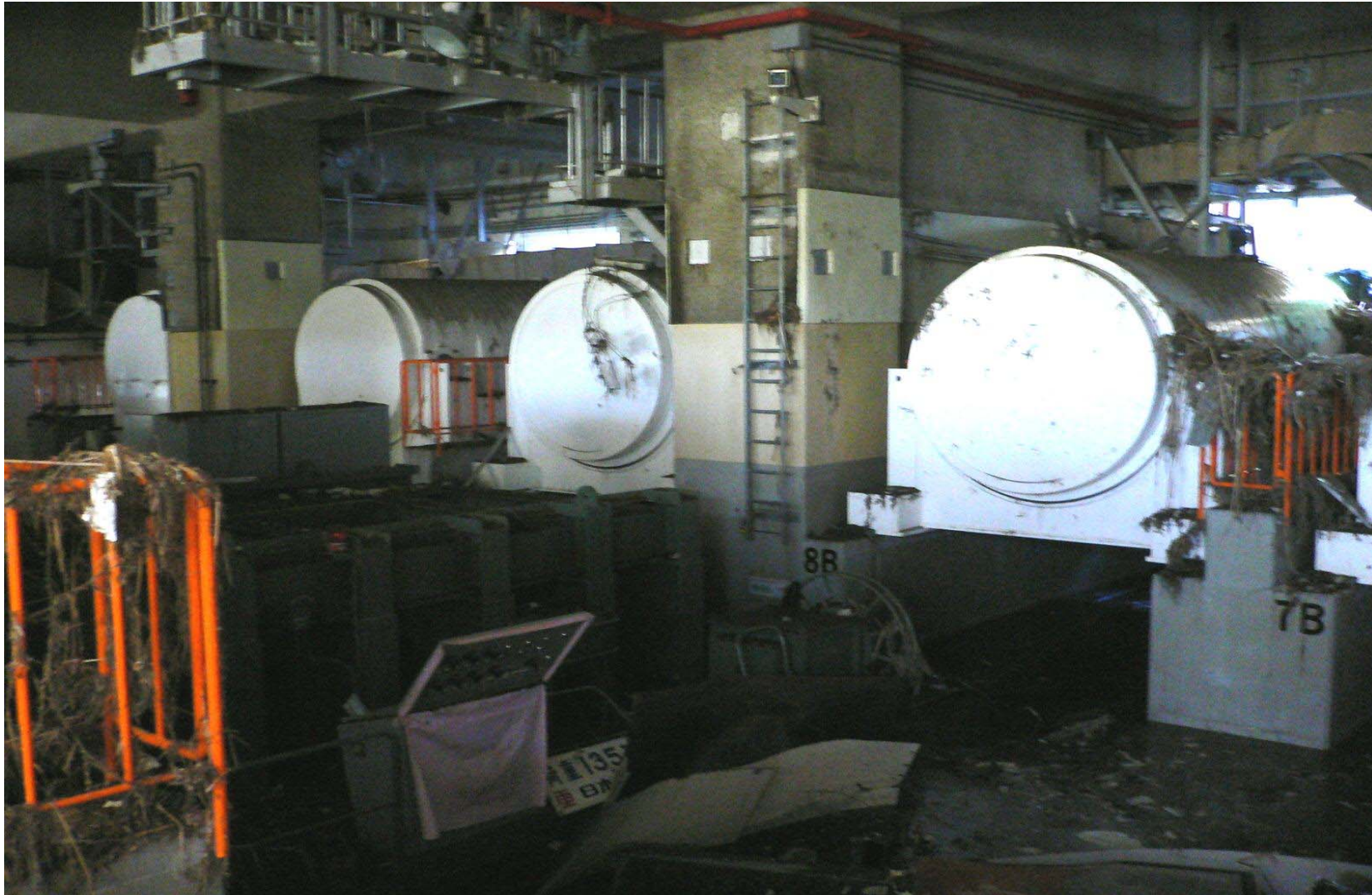
## Mutsu Interim storage site

Dry Cask storage type  
Capacity : totally 5,000 tU  
1<sup>st</sup> 3,000 tU, add 2,000tU in future  
Operation: October 2013 (or later)  
(Status : under construction)  
Construction cost: ¥0.1Trillion  
(including dry casks)



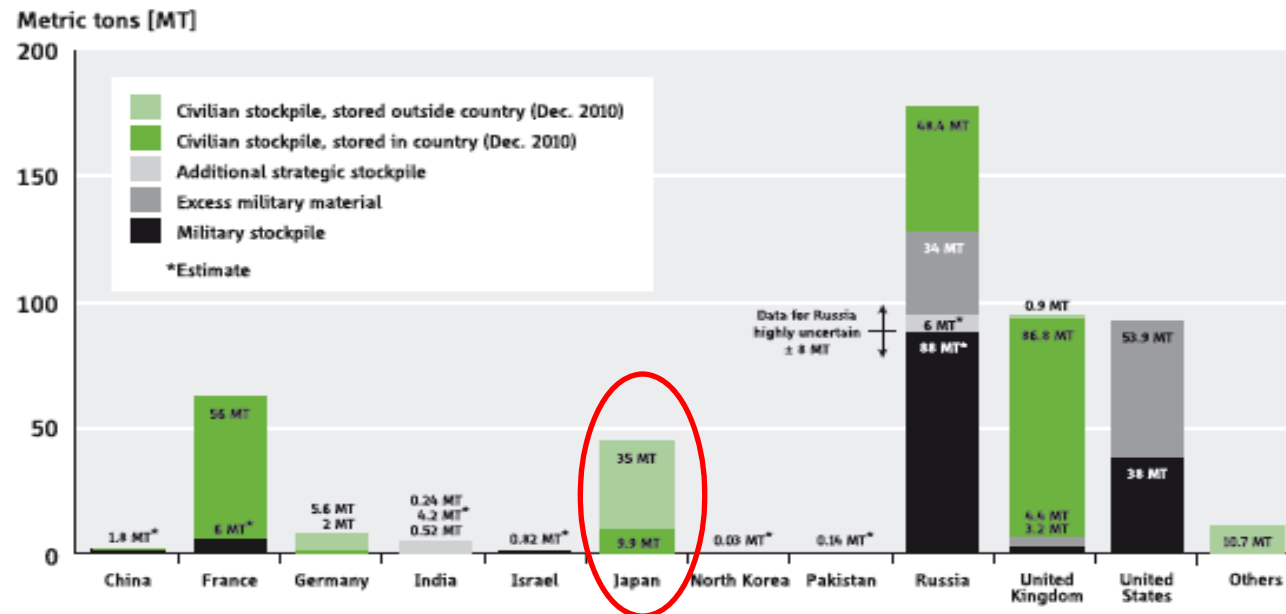


# Dry Cask Storage at Fukushima Dai-ichi (after 3/11)



# Global Civilian Plutonium Stockpile (2010)

- Reprocessing has international security implications -



**Figure 4. National stocks of separated plutonium.** Civilian stocks are based on the most recent INF-CIRC/549 declarations for December 2010 and are listed by ownership, not by current location. Weapon stocks are based on non-governmental estimates except for the United States and United Kingdom whose governments have made declarations. Uncertainties of the military stockpiles for China, France,

India, Israel, Pakistan, and Russia are on the order of 10–30%. The plutonium India separated from spent heavy-water power-reactor fuel has been categorized by India as “strategic,” and not to be placed under IAEA safeguards. Russia has 6 tons of weapon-grade plutonium that it has agreed to not use for weapons but not declared excess.



# JAEC's "No Pu surplus policy"

- In August 2003, JAEC announced its new guideline for plutonium management
  - Utilities are expected to submit **its plutonium usage plan annually before separation of plutonium.**
  - Its plan should include the information on:
    - (1) current plutonium stock
    - (2) planned usage of plutonium (name of power plant, or site, insertion period)
    - (3) amount of reprocessing (during that year)
    - (4) usage of plutonium (during that year)
    - (5) MOX contract plan and fabrication amount (during that year).
- ***"Plutonium stockpile should be reduced regardless of fuel cycle options chosen in the future"*** (Statement in JAEC Subcommittee on Nuclear Power/Nuclear Fuel cycle technologies)



# Final Message

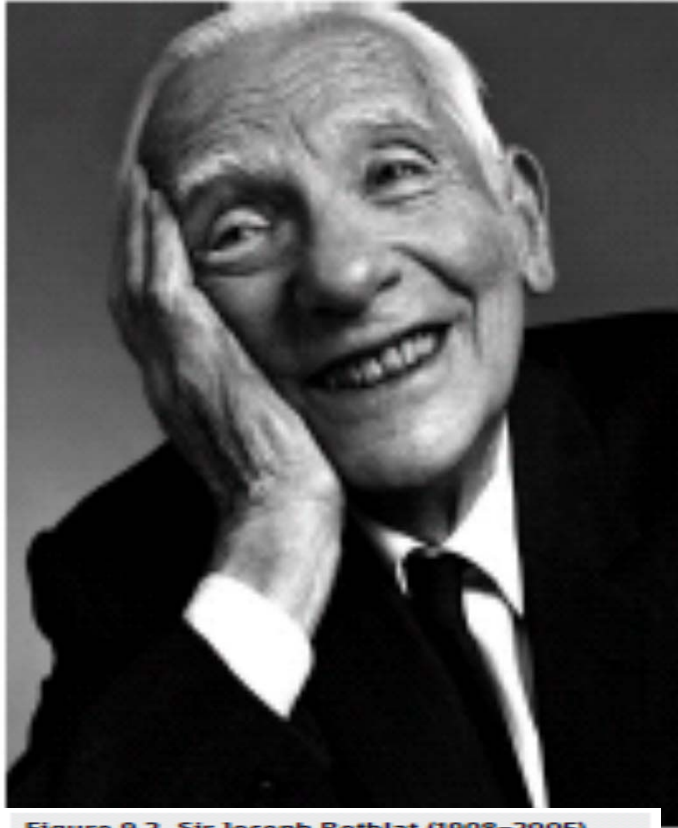


Figure 9.2. Sir Joseph Rotblat (1908–2005), a Manhattan Project scientist, one of the founders of the scientists' Pugwash movement, and a strong advocate of societal verification. Rotblat, a Nobel Laureate, was a leading supporter of Israeli whistle-blower Mordechai Vanunu, arguing that Vanunu's exposure of Israel's nuclear weapon program was an act of conscience. Credit: Peter Hönnemann.

Joseph Rotblat (1908-2005)

*Policy based on emotion can be irrational, but  
Policy without humanity can be unethical*

► *“Remember Your Humanity,  
Forget the Rest”*  
- Russell-Einstein Manifesto  
(1955)

Thank you very much for your attention!