Nuclear Energy Policy in the Post-Fukushima Era: A Need for a Paradigm Shift

STS Forum on the 2011 Fukushima / East Japan Disaster
UC Berkeley, May 11-13, 2013

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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

- Fukushima Dai-ichi nuclear power accident has become one of the worst accidents in nuclear history and it is not completely over yet. The biggest impact is loss of public trust.
- This has serious implications for not only Japan but also global nuclear energy development.
- 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)

Chairman
Dr. Shunsuke KONDO

Vice Chairman
Dr. Tatsujiro SUZUKI

Commissioner
Ms. Etsuko AKIBA

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Commissioner
Dr. Mie OBA

RESIGNED
Commissioner
Dr. Akira OMOTO

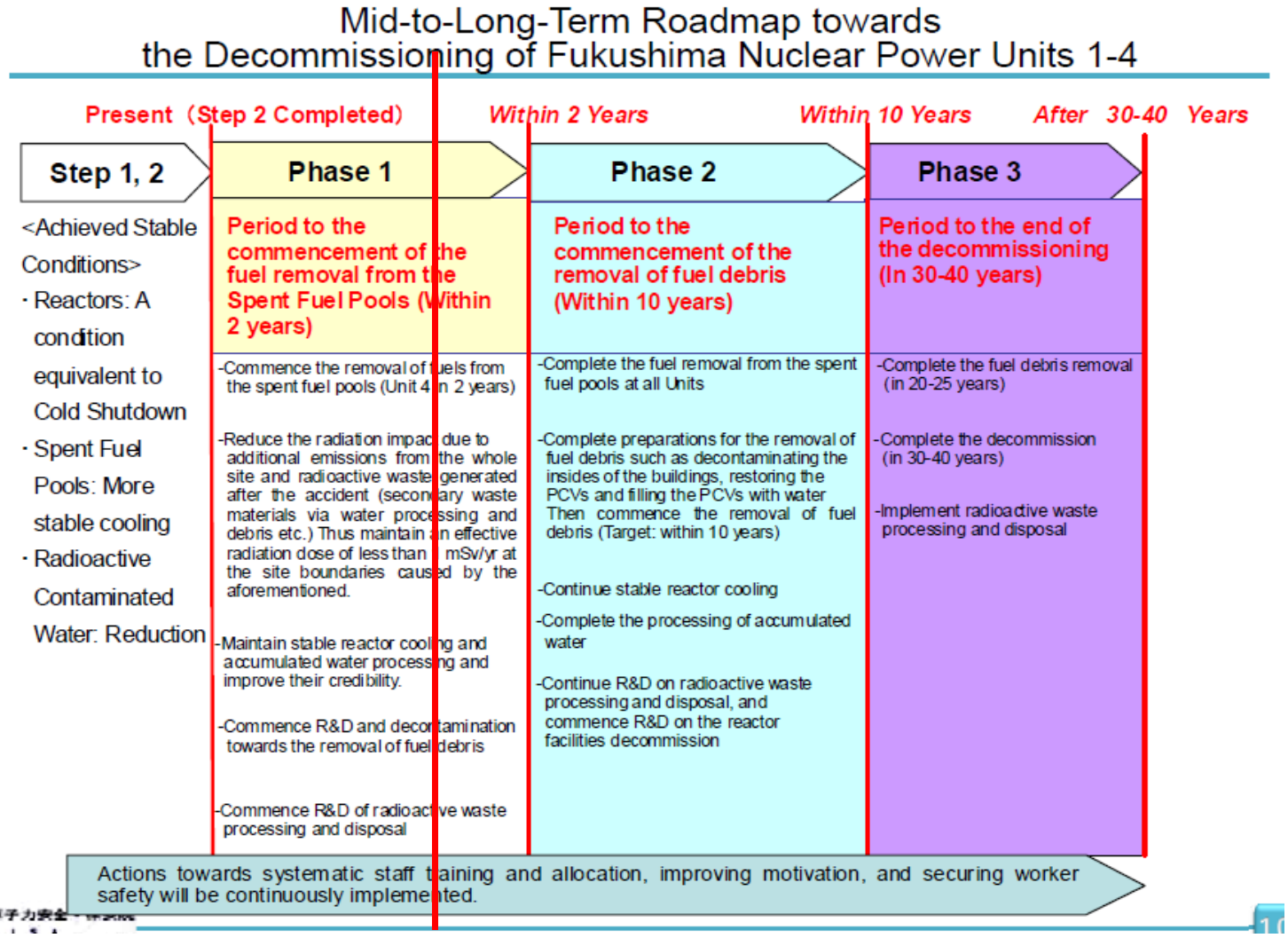
Personal Reflections on the Fukushima accident

- *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.

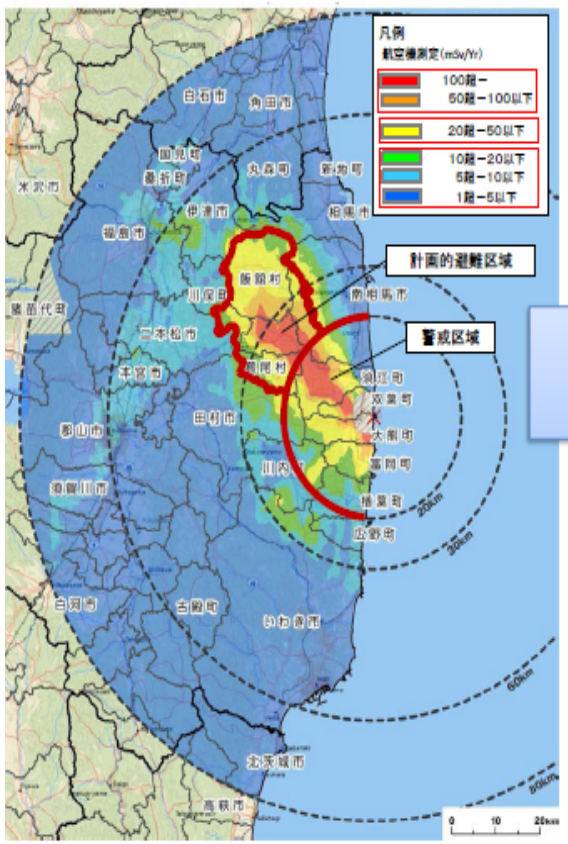
Mid-Long Term Roadmap for Fukushima Dai-ichi



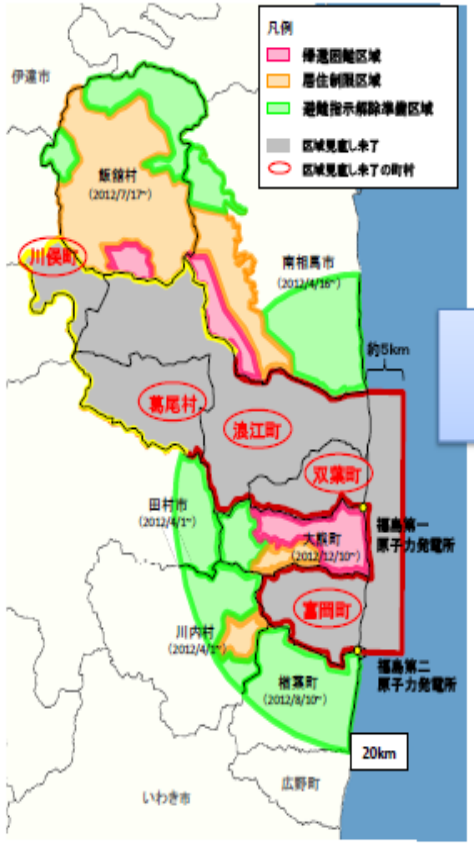
Source: M. Yasui, Nuclear and Industrial Safety Agency (NISA), March 2012, http://www.nsr.go.jp/archive/nisa/english/files/en20120321.pdf

Evacuation Area Amended (March 7, 2013)

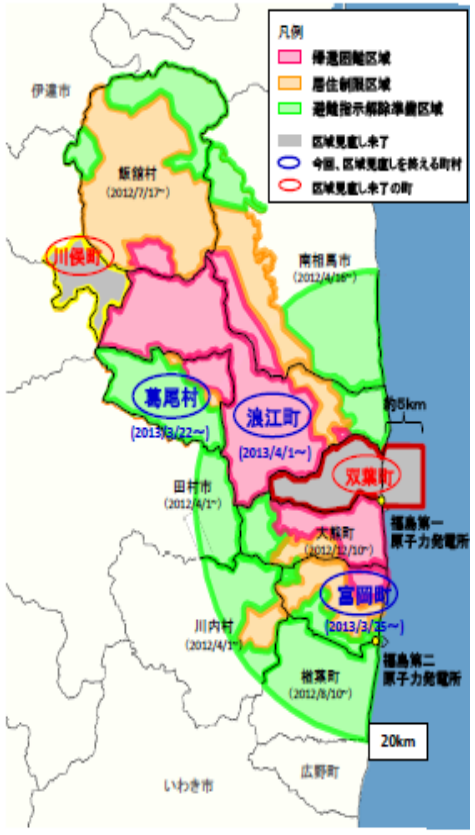
(As of April 29, 2012)



(Dec 10, 2012)



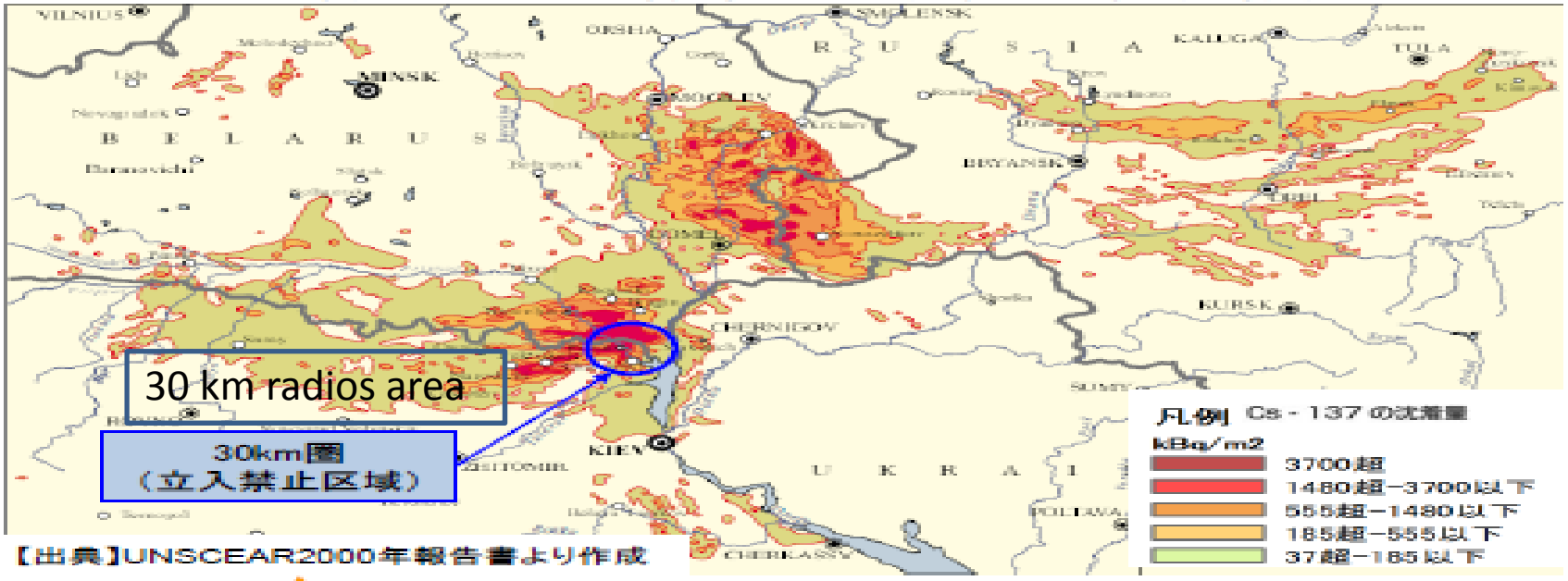
(After April 1, 2013)



http://www.kantei.go.jp/saigai/pdf/20130307gainenzu.pdf

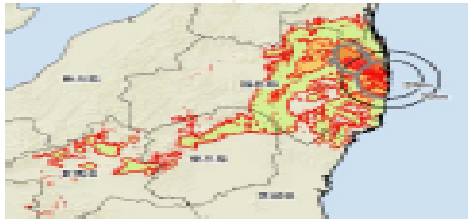
Compared with the Chernobyl accident

図表　チェルノブイリ原発事故による汚染（1989年12月時点）



【出典】UNSCEAR2000年報告書より作成

両図を同縮尺で記載



図表　東電福島第一原発事故による汚染（2011年11月時点）

【出典】文部科学省発表資料（2011年11月）より作成

図表　汚染地域の面積

汚染濃度（kBq/㎡）	汚染地域の面積（km²）		
	チェルノブイリ原発事故 Chernobyl	東電福島第一原発事故 Fukushima	チェルノブイリと比較した福島第一の規模 F/C
＞ 1,480	3,100	200	6 %
555 － 1,480	7,200	400	6 %
185 － 555	18,900	1,400	7 %
37 －185	116,900	6,900	6 %
合計面積	146,100	8,900	6 %

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http://www.meti.go.jp/earthquake/nuclear/pdf/130314_01a.pdf

Cherry blossom in Tomioka Town (10 km from Fukushima Daiichi)

http://img2.blogs.yahoo.co.jp/ybi/1/e6/47/pocoyuko2006/folder/581347/img_581347_54615521_0?1335789300

http://www.asahi.com/special/news/images/TKY201304070098.jpg

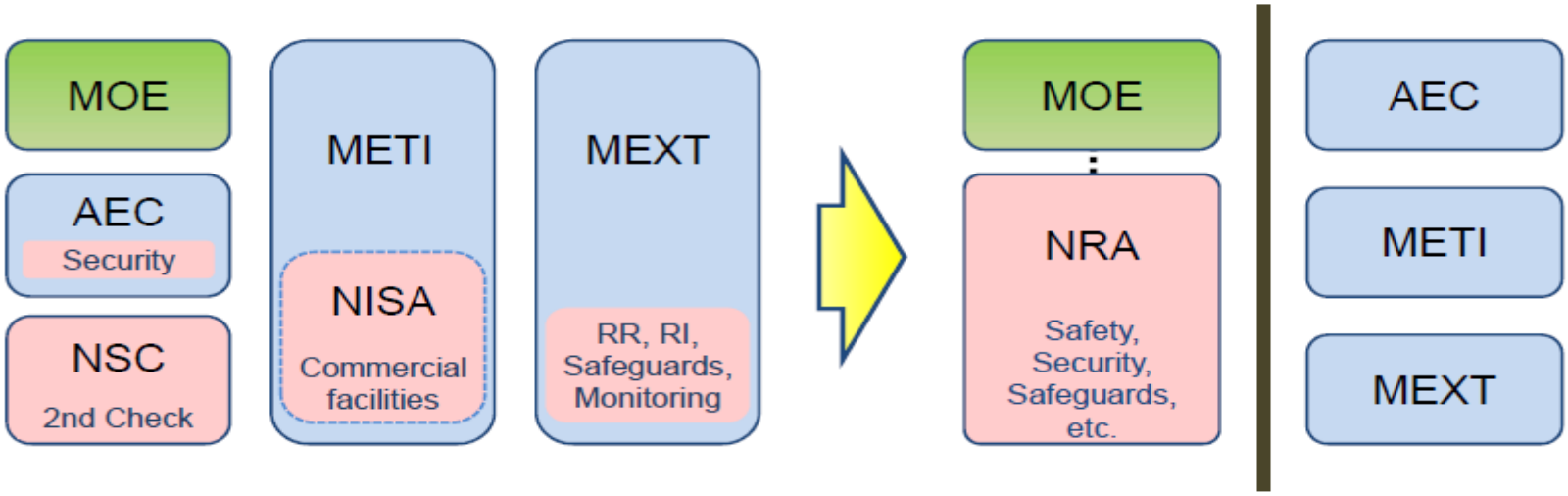
Most Important Lessons Learned from Fukushima: "Thinking Unthinkable" and "Resilience"

- "*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.
- "Resilience" beyond "defense in depth" is needed for preparing "unexpected crisis".
  - Resilience means a capability to respond to "unexpected crisis" as well as to restore safe and secure status of the social system.

Establishment of New Nuclear Regulatory Authority (NRA)

4

Integrated and Independent



AEC : Atomic Energy Commission
METI : Ministry of Economy, Trade and Industry
MEXT : Ministry of Education, Culture, Sports, Science and Technology
MOE : Ministry of the Environment
NISA : Nuclear and Industrial Safety Agency (abolished)
NSC : Nuclear Safety Commission (abolished)

Source: Toyoshi Fuketa, "Proposed Regulatory Requirements in Japan" March 13, 2013
http://www.nsr.go.jp/english/data/20130313presen.pdf

Structure of proposed requirements

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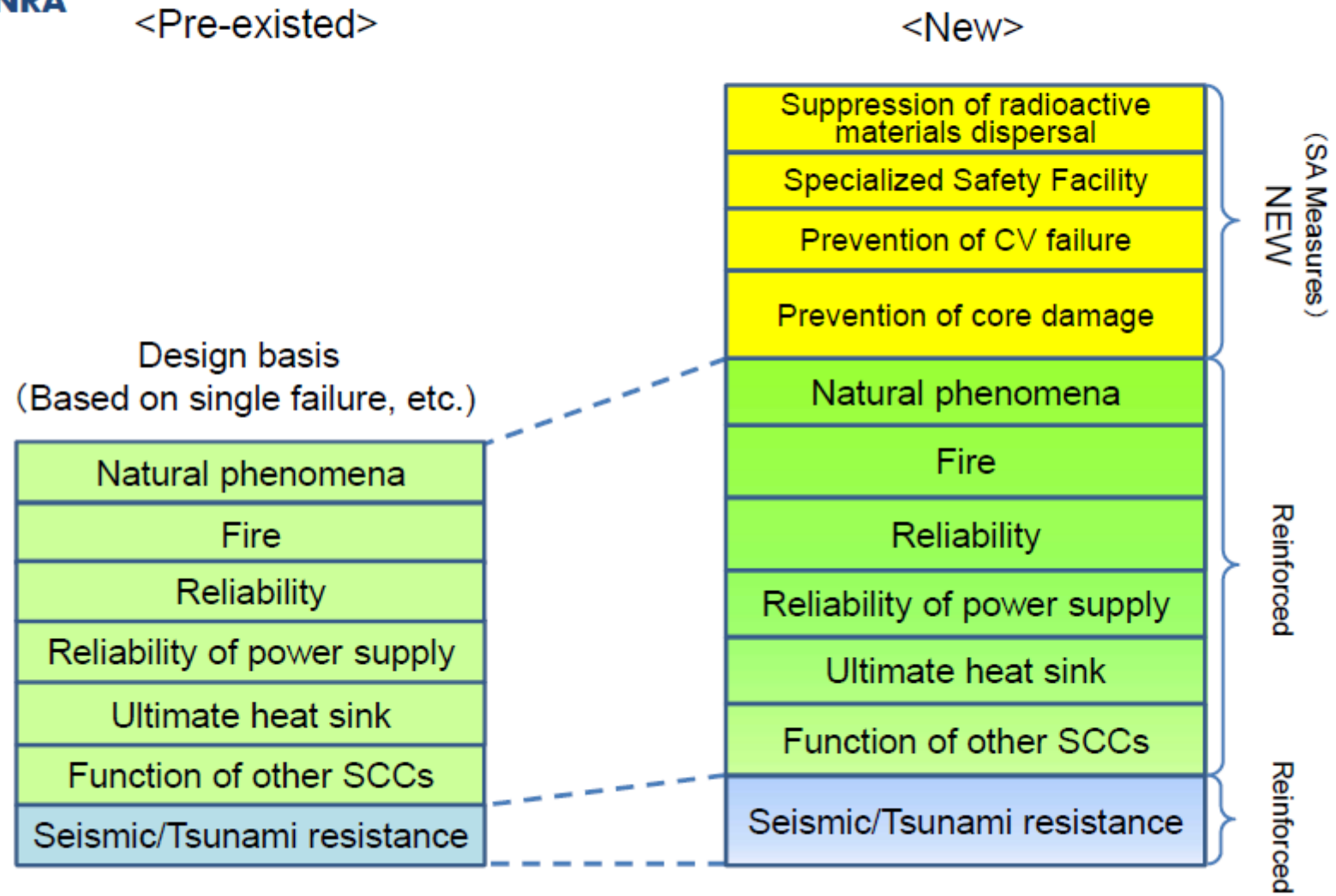
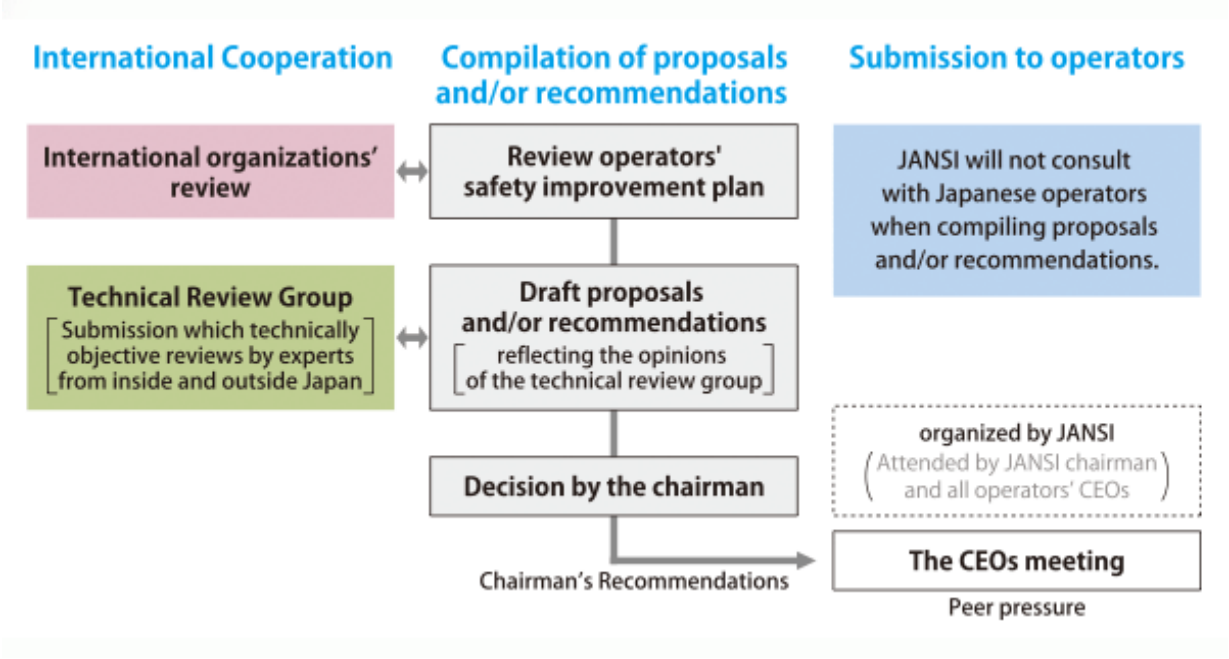


Source: Toyoshi Fuketa, "Proposed Regulatory Requirements in Japan" March 13, 2013
http://www.nsr.go.jp/english/data/20130313presen.pdf

Japan Nuclear Safety Institute (JANSI) established (2012)

- MISSION: "…It is necessary for operators themselves to engage in continuing measures to improve safety, and to engage in untiring pursuit of the world's highest level of safety."

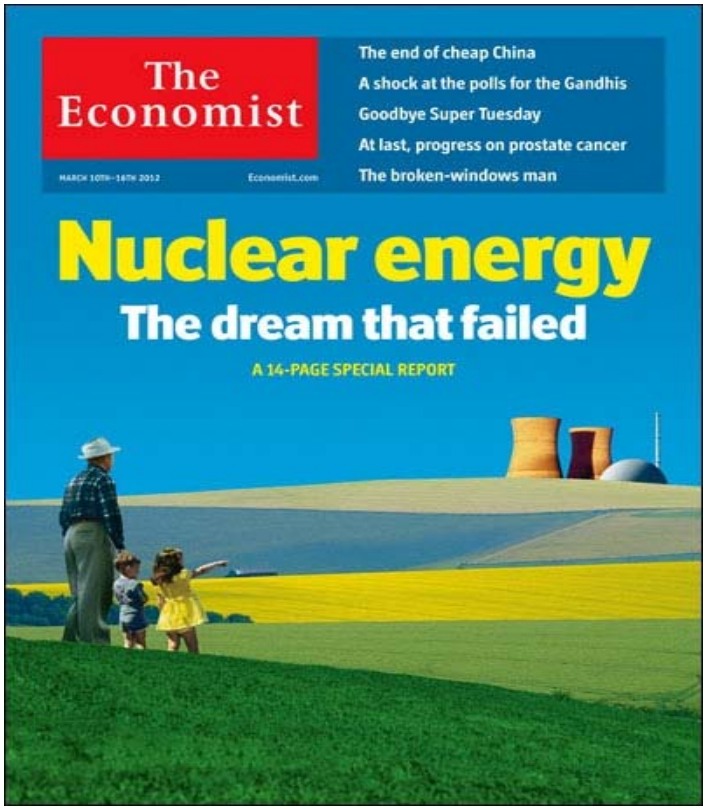


http://www.genanshin.jp/english/association/establishment.html

Impact on Global Nuclear Energy Development

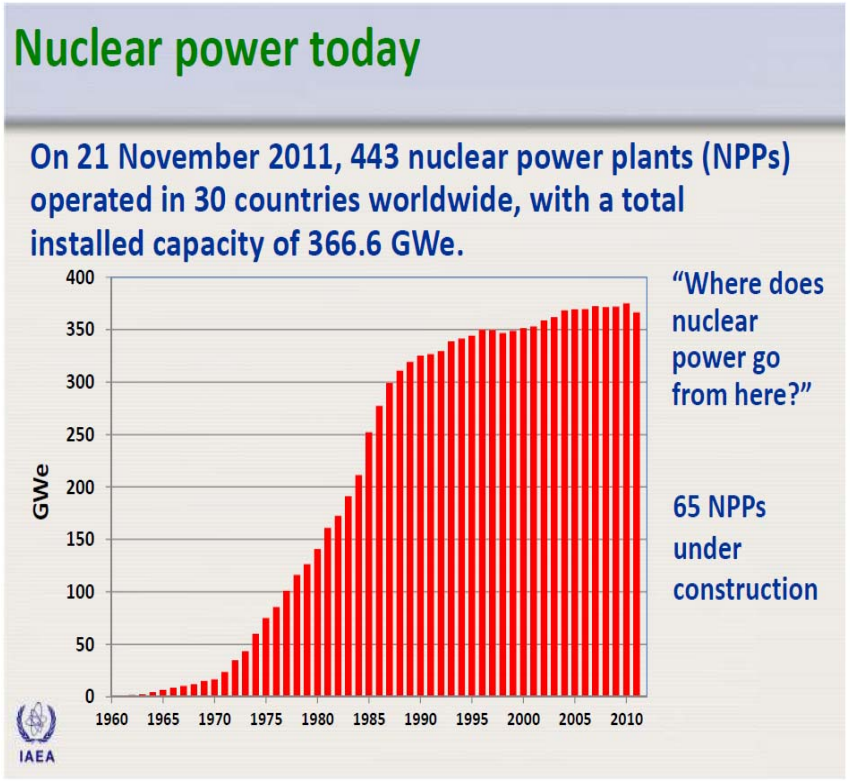
From “Nuclear Renaissance” to “Failed Dream”? by “The Economist”

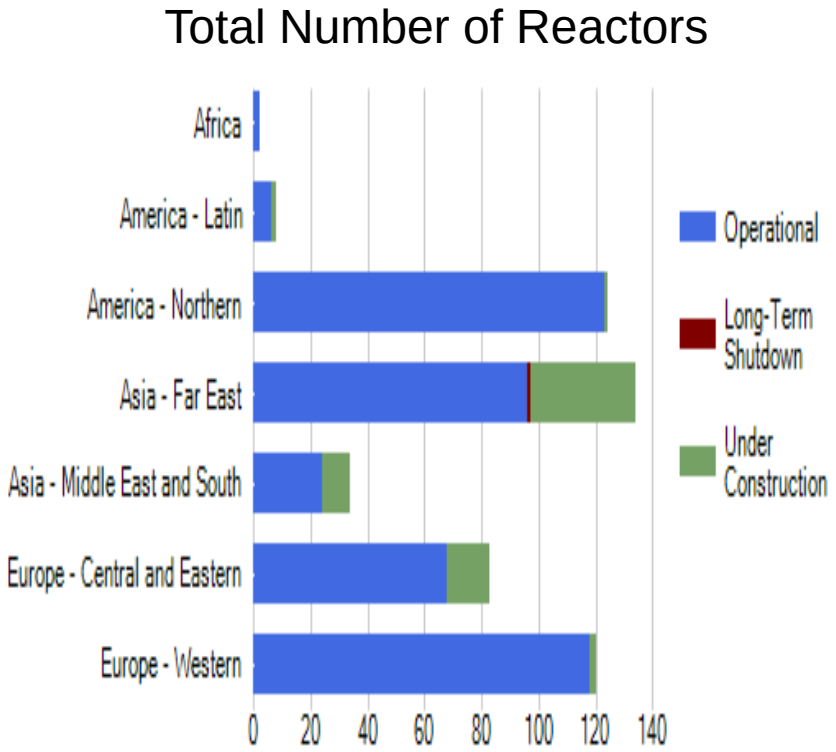
“A nuclear revival is welcome so long as the industry does not repeat its old mistakes”
--The Economist, September 8, 2007



“For nuclear to play a greater role, either it must get cheaper or other ways of generating electricity must get more expensive.”– The Economist, March 10, 2012

Global Nuclear Power Development Current Status (IAEA)

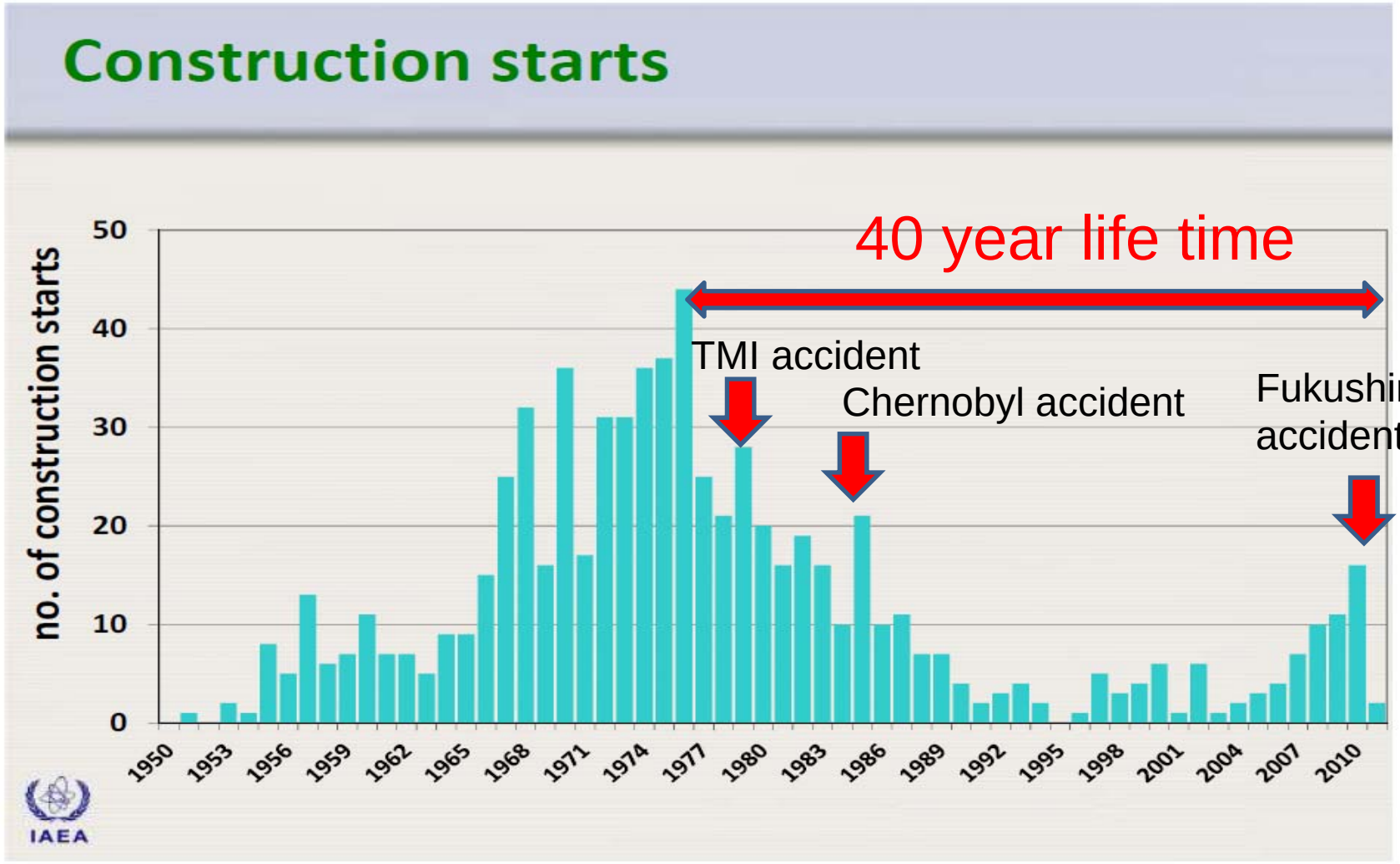




Source: H-HolgerRogner, Head, Planning & Economic Studies Section (PESS)Department of Nuclear Energy, International Atomic Energy Agency, "Energy, Electricity and Nuclear Power Estimates for the Period up to 2030," November 2011.

As of Feb. 4, 2013, 437 nuclear power plants (372.6 GWe) are operating and 67 units are under construction. http://www.iaea.org/pris/

Global Nuclear Power Plant Construction (IAEA)
: Replacement of old reactors are coming….



Source: H-HolgerRogner, Head, Planning & Economic Studies Section (PESS)Department of Nuclear Energy, International Atomic Energy Agency, "Energy, Electricity and Nuclear Power Estimates for the Period up to 2030," November 2011.

Impact on Asia: No major policy changes

Bangladesh: There is no change in plans to promote nuclear policy. Bangladesh signs with agreement between Russia about the construction of Rooppur NPP in November 2011.

China: Important role of nuclear power in China is not changed. China has temporarily stopped the authorization of new projects after the accident, but the construction of NPP has restarted now.

India: Domestic energy demand is increasing, and nuclear power is considered to be an important option as a clean energy source (no change). Construction of new NPPs are progressing according to the existing plan.

Indonesia: 49.5% of the population is in favor (35.5% opposition) for against nation's nuclear policy. Nuclear power is considered as one of the main power source to support energy security.

Kazakhstan: There is no change in plans to promote nuclear power. many people are aware that there is no other option to incorporate nuclear power for the realization of nation's policy.

South Korea: There is no change in nuclear policy. Based on the "4th Comprehensive Nuclear Energy Promotion Plan", South Korea continues to build NPPs in six locations from 2012 to 2017.

Malaysia: There is no change in plans to begin the operation of Malaysia's first nuclear reactor in 2021.

Vietnam: There is no change in plans to promote nuclear power. Vietnam plans to build high safety NPPs learned from Fukushima accident with Japan and Russia in cooperation.

Taiwan: Announced an energy policy to reduce the dependence on nuclear power.

Thailand: Decided the postponement of the plan to build five NPPs for 3 years.

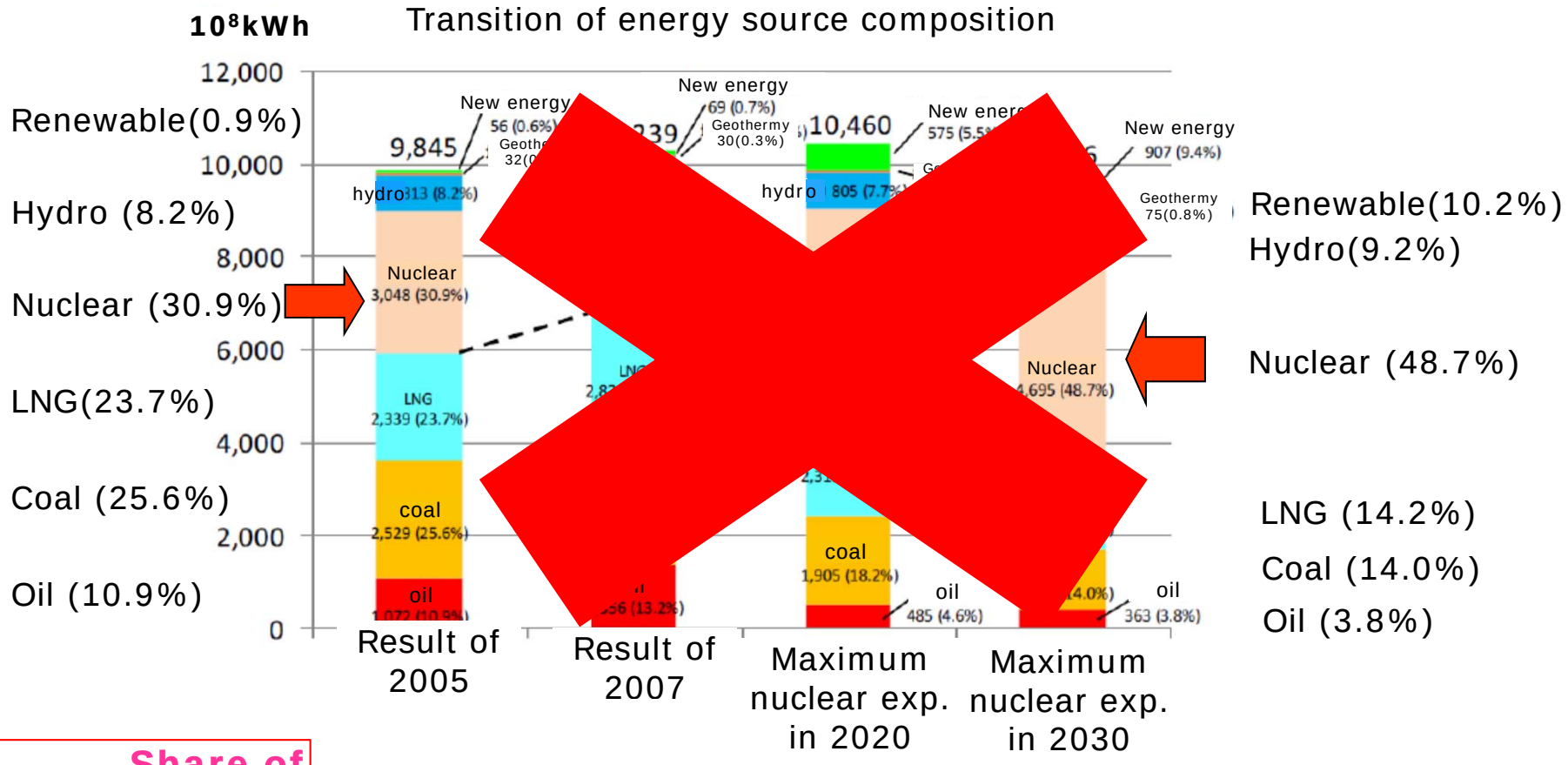
Estimates of Nuclear Electrical Generating Capacity : Comparison of estimates in 2012 and 2011

	Actual in 2011	Estimates for 2030 Estimated		Estimates for 2050 Estimated	
		in 2011	in 2012	in 2011	in 2012
World Total					
Nucl. Capacity (GWe)			-9%		-16%
Low Estimate	368.8	501	456	560	469
High Estimate		746	740	1228	1137
			-1%		-7%
Share (%)					
Low Estimate	7.1	5.2	4.7	2.7	2.3
High Estimate		6.2	6.2	6.0	5.7
Far East					
Nucl. Capacity (GWe)			-15%		-13%
Low Estimate	79.8	180	153	220	191
High Estimate		255	274	450	417
			+7%		-7%
Share (%)					
Low Estimate	5.0	6.4	5.5	4.2	3.7
High Estimate		7.5	8.2	8.6	8.1

Source: International Atomic Energy Agency, "Energy, Electricity and Nuclear Power Estimates for the Period up to 2050,"
2011 Edition http://www-pub.iaea.org/MTCD/Publications/PDF/RDS1_31.pdf
2012 Edition http://www-pub.iaea.org/MTCD/Publications/PDF/IAEA-RDS-1-32_web.pdf

Japan’s energy policy after 3/11

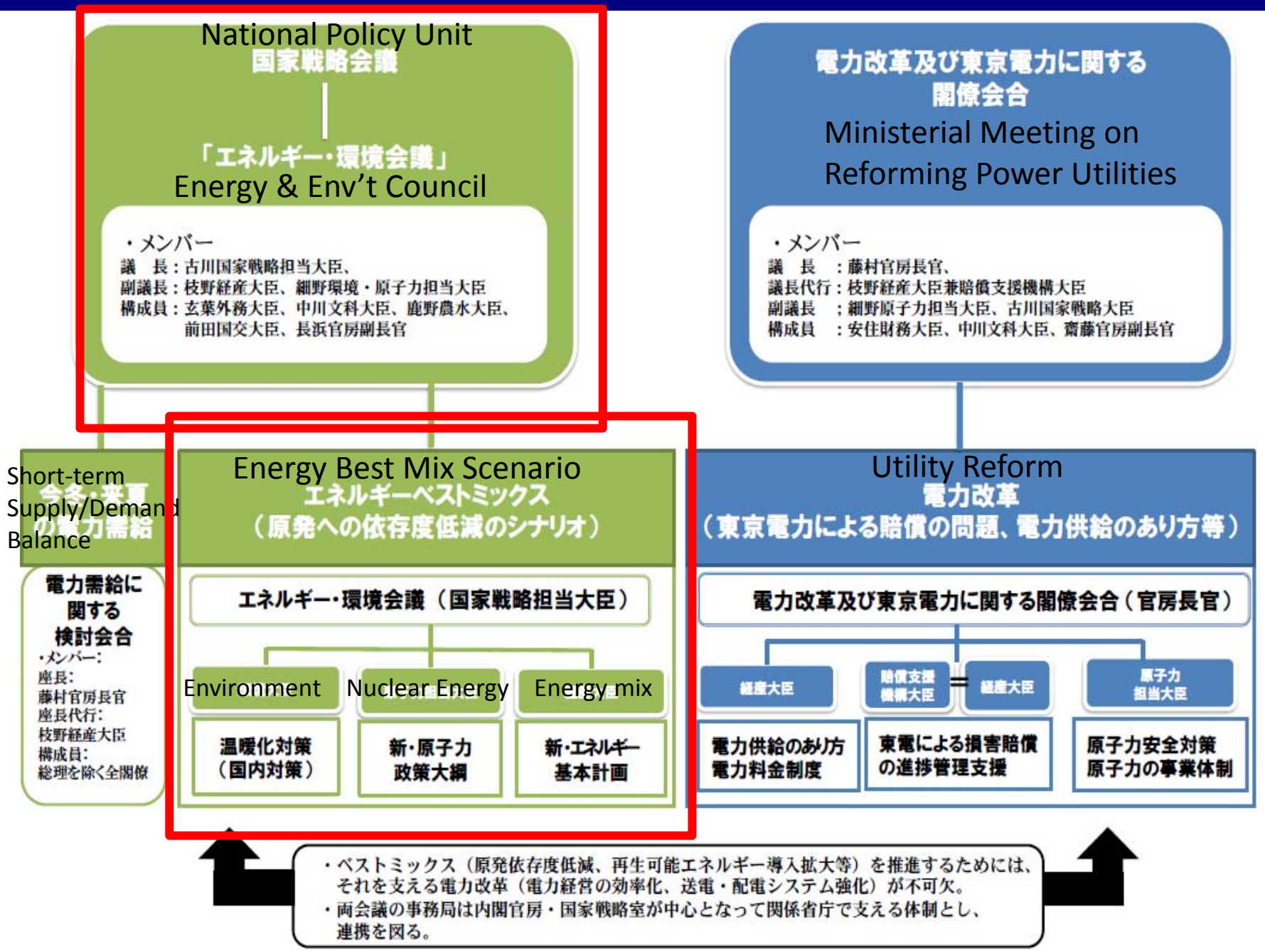
Goal of Power Production Mix in 2030 Before 2011/3/11



Share of nuclear power	**30.9%**	**25.8%**	**41.5%**	**48.7%**

Source: Institute of Energy Economics, March 2010

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)

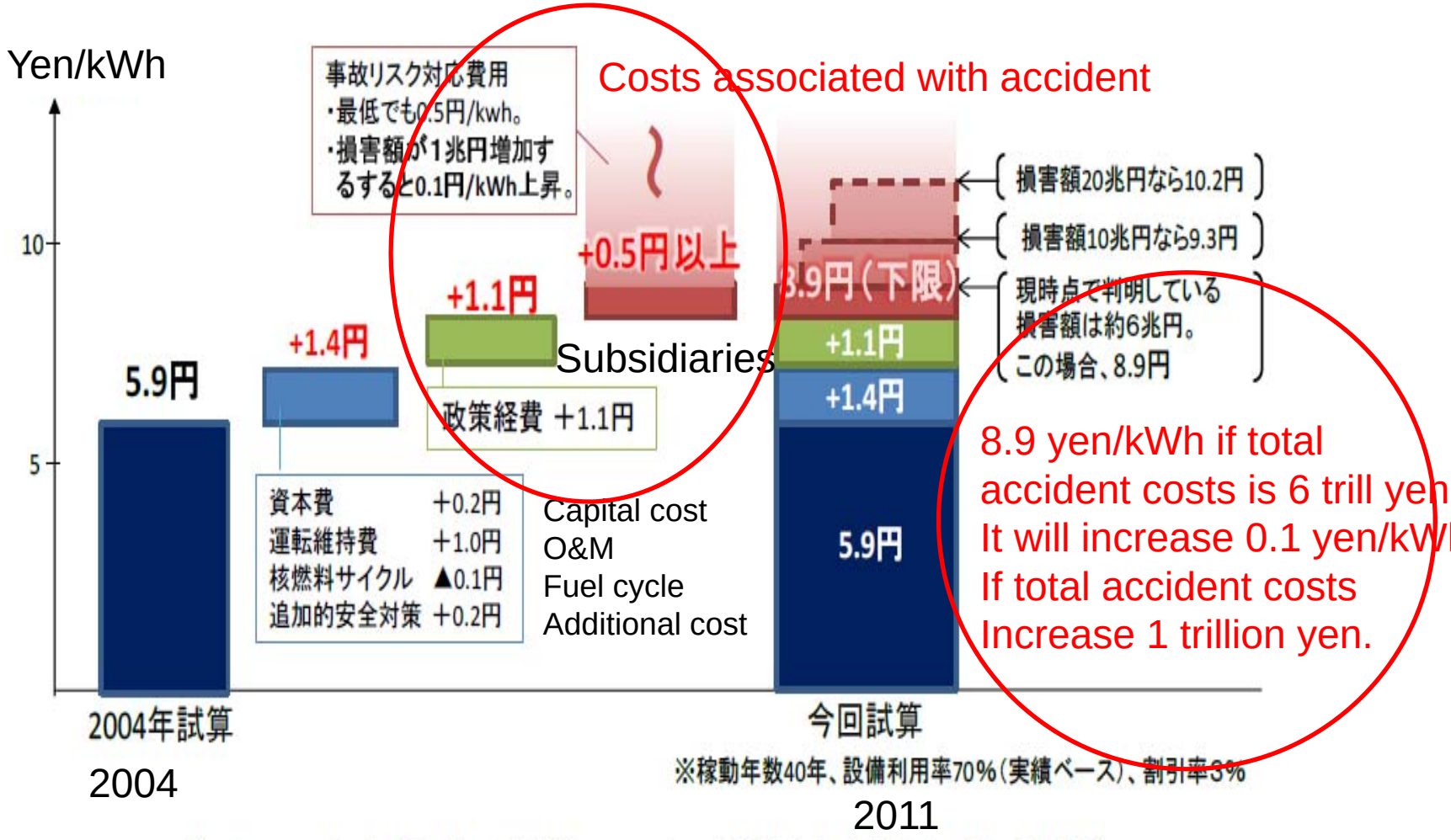
(3) Three principles toward national consensus (*national debate in order to overcome "pro-anti-conflict"*, *strategy based on objective data*, dialogue with various sectors of the public).

http://www.cas.go.jp/jp/seisaku/npu/policy09/pdf/20110729/siryo2_2.pdf

Japanese gov't report to the IAEA says "need national discussion"

- At the same time*, it is necessary for Japan to conduct national discussions* on the proper course for nuclear power generation while *disclosing the actual costs of nuclear power generation, including the costs involved in ensuring safety*.

Source: Nuclear Emergency Response Headquarters, Government of Japan,
"Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety -The Accident at TEPCO's Fukushima Nuclear Power Stations -", June 2011.
http://www.kantei.go.jp/foreign/kan/topics/201106/iaea_houkokusho_e.html



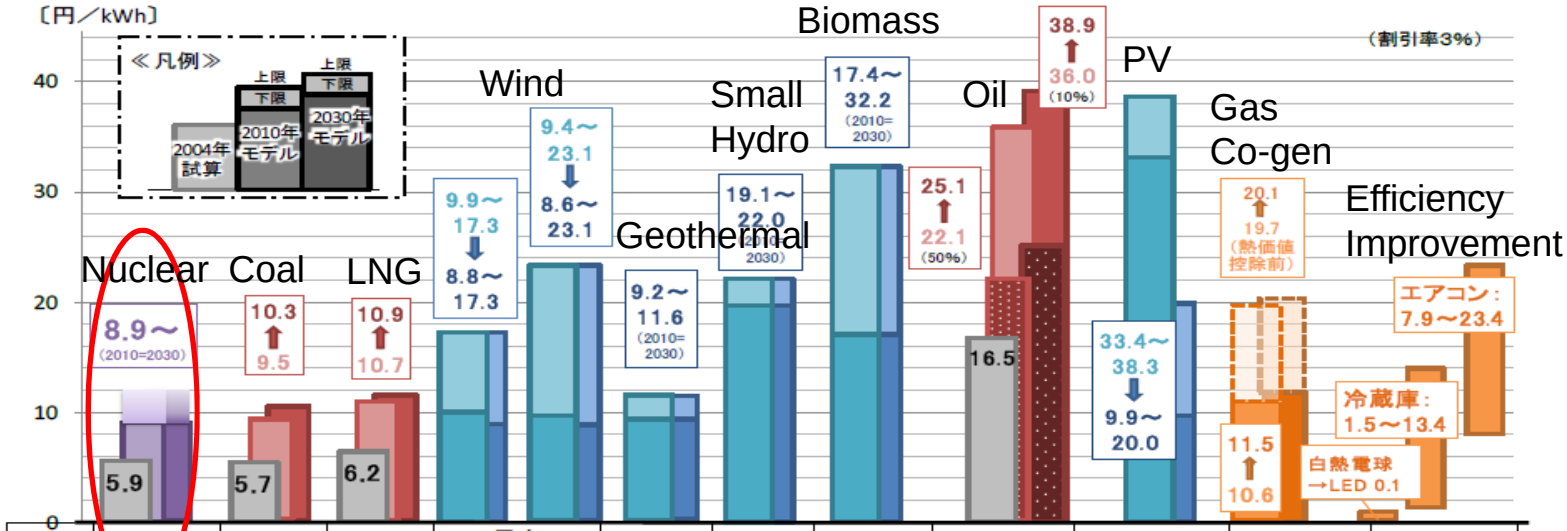
（図 ２０）原子力の発電コスト（2004 年試算と今回試算）

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。

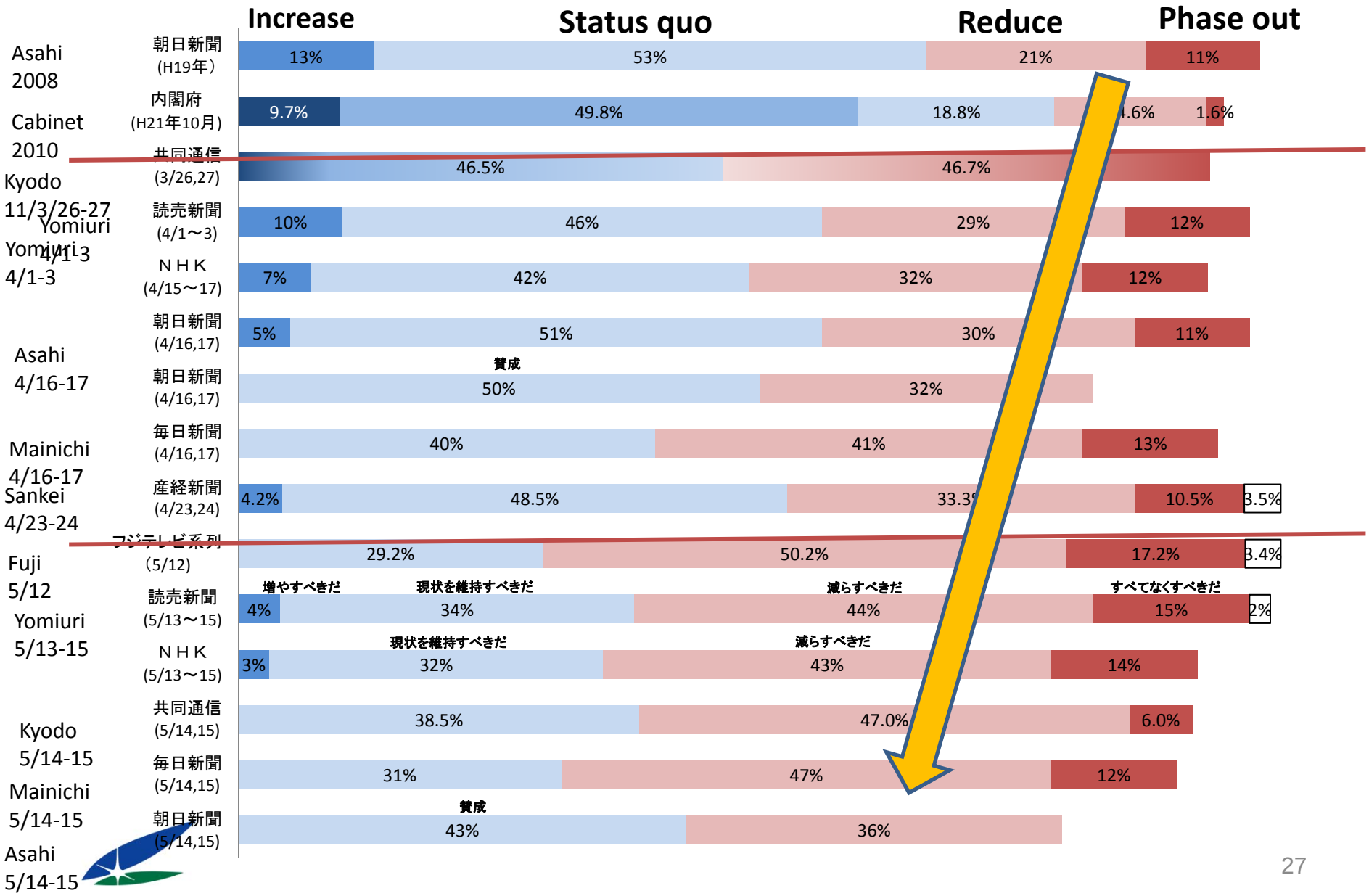


	原子力	石炭火力	LNG火力	風力 陸上	風力 洋上着床式	地熱	小水力	バイオマス（木質専焼）	石油火力	太陽光（住宅用）	ガスコジェネ	省エネ
シナリオ等	核燃料サイクル現状モデル	新政策シナリオ	新政策シナリオ	横ばい～低減	横ばい～低減	—	—	—	新政策シナリオ	参照～パラダイムシフト	新政策シナリオ	—
設備利用率	70%	80%	80%	20%	30%	80%	60%	80%	50%・10%	12%	70%	—
稼働年数（2030年モデル）	40年	40年	40年	20年	20年	40年	40年	40年	40年	20年（35年）	30年	—
留意点・ポイント 赤：増加要因 青：低減要因 黒：その他（導入ポテンシャルに関する記述を含む。）	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。											

（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）

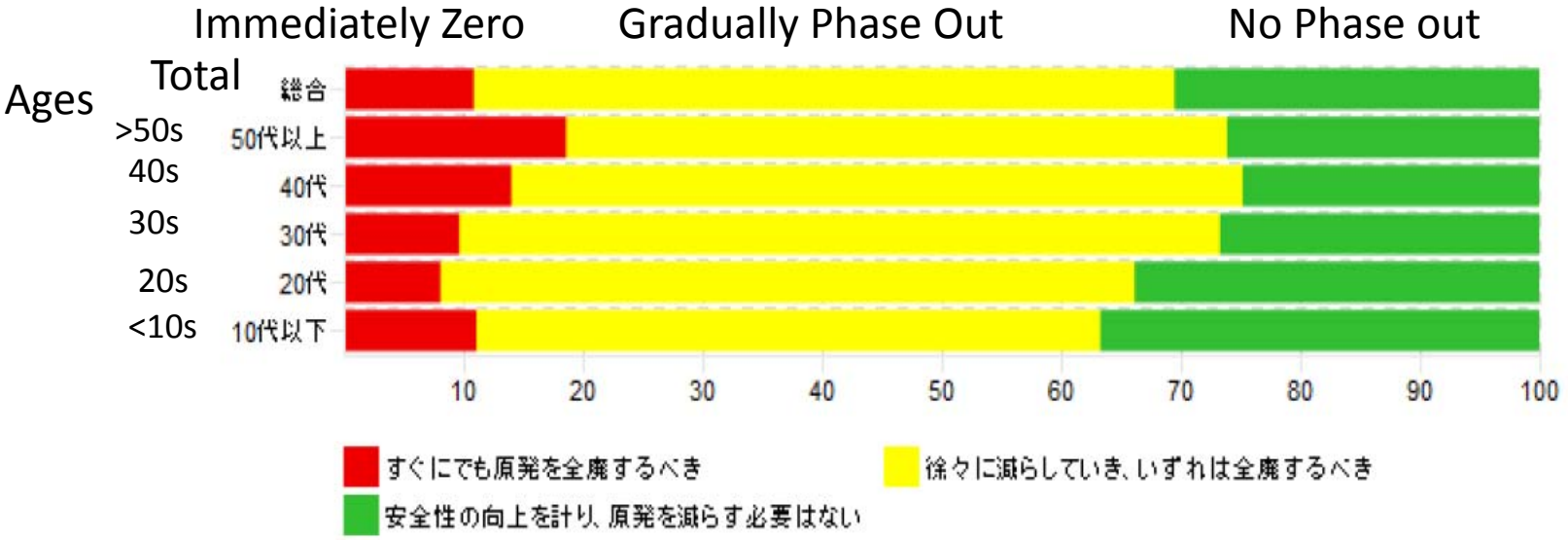
出所：コスト等検証委員会報告書、2011年12月19日
http://www.npu.go.jp/policy/policy09/pdf/20111221/siryo3.pdf

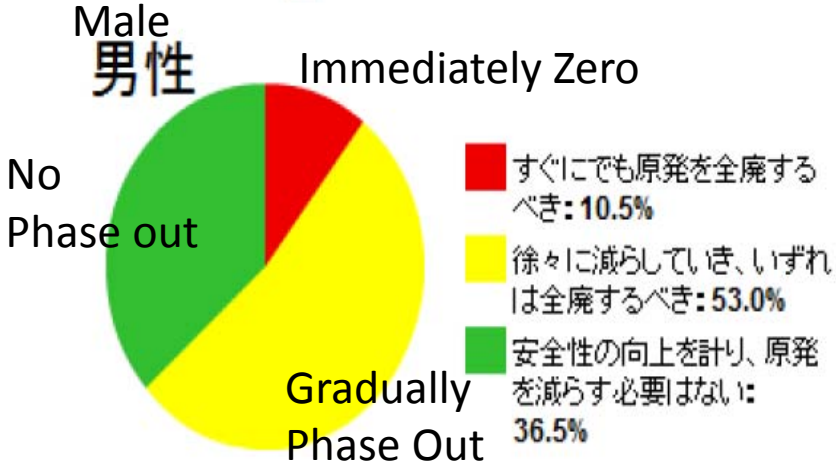
Public Opinion Shifting to “reduce” and “phase out”

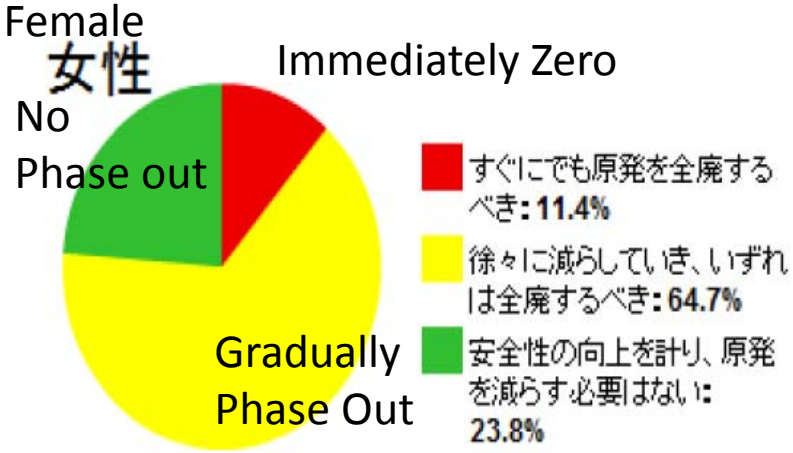


Internet Polling Results (2012/08)

- 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.

http://www.cas.go.jp/jp/seisaku/npu/policy09/pdf/20120904/shiryo1-2.pdf

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

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 Principe 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 (later)

（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

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

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

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

Major Nuclear Energy Policy Issues: Loss of Public Trust and Importance of Transparency

Transparency: Assuring public trust

- Lack of transparency has resulted in loss of public trust not only in nuclear safety but, more importantly, in overall nuclear governance in Japan.
  - Ex. “Closed meetings” at the JAEC Technical Subcommittee on Nuclear Power and Nuclear Fuel Cycle triggered the issue of “transparency and fair policy making process”

- Public trust is also important for nuclear security.
  - “*Moreover, public understanding and cooperation are vital to improve the effectiveness of nuclear security. It should be emphasized that related organizations strive to inform the public of the objectives of nuclear security at every opportunity*.” – Report by the JAEC Advisory Committee on Nuclear Security (2012/03/09)

Reform of JAEC Operations for better transparency (Aug. 30, 2012)

- For “Preparatory Sessions”

1. “3-people Rule”: If more than 3 commissioners (out of 5) have “preparatory sessions”, a staff must attend and keep the summary of the session for the record
2. “Meeting with outside parties”: Any unofficial meeting with parties outside the government agencies (stakeholders, experts, NGOs, media, etc.) , summary of the meetings should be kept as record

- For “Preparing the policy documents” (for traceability)

1. Procedures for preparing the policy documents are now clarified
2. Responsible person(designated by the Commissioners or Chairperson) must keep all the tracking records for changes made for drafts prepared for the final document

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)
- 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

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.

http://www.aec.go.jp/jicst/NC/about/kettei/121127-2_e.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.

http://www.aec.go.jp/jicst/NC/about/kettei/121225-1_e.pdf

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

HLW Disposal Issues in Japan

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?

- 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

Nuclear Fuel Cycle Policy Issues

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

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…

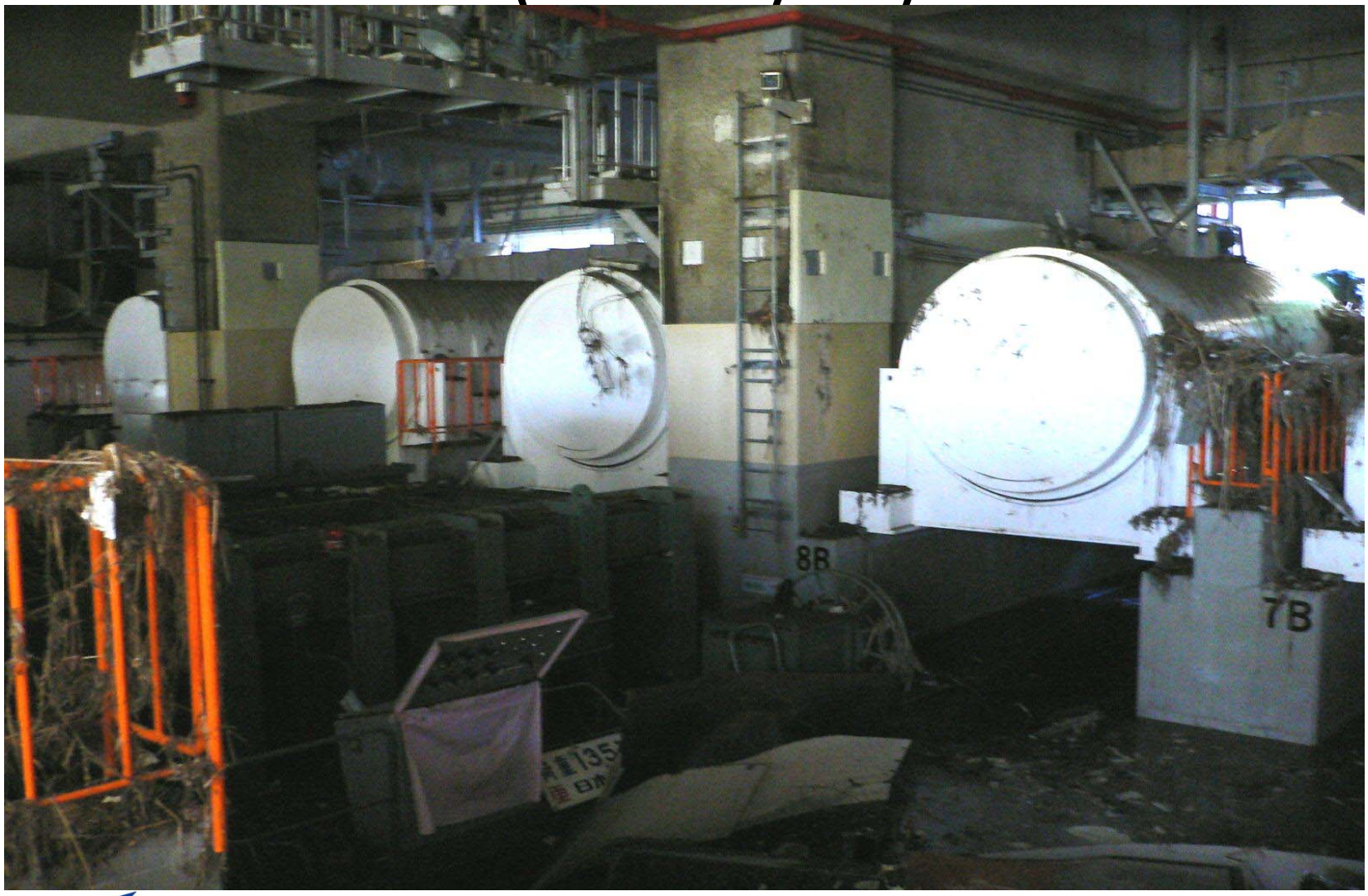
Rokkasho reprocessing plant

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
1st 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)



http://photo.tepco.co.jp/library/110909_2/110909_69.jpg

Increasing Concern over Plutonium Stockpile

"Japan's Nuclear Mistake," by Frank N. von Hippel and Masafumi Takubo (*The New York Times*, Op-Ed, Nov. 29, 2012):

- "…but just one successful theft by would-be nuclear terrorists would create a global crisis. Of even more concern is how reprocessing provides cover for other countries to acquire a nuclear option.... The two countries should instead jointly lead a global effort to reduce existing stocks of separated plutonium by discouraging reprocessing and encouraging safe disposal of already separated stocks"

Response by JAEC Chairman, Published: December 9, 2012

- "Of course, we share the writers' concern about current stockpile of plutonium in Japan …we hope the new Japanese government, after the general election on Dec. 16, will keep this 'no plutonium surplus policy' or even make it stronger, given the increased concern over nuclear terrorism and tension in northeast Asia. "

SHUNSUKE KONDO Chairman, Japan Atomic Energy Commission
Tokyo, Dec. 3, 2012
http://www.nytimes.com/2012/12/10/opinion/japans-plutonium-policy.html?ref=glo&_r=0

US Concern over Japanese Plutonium Stockpile (Kyodo, 13/04/22)

- Some U.S. government officials and experts have strong concerns about Japan's plan to operate a nuclear fuel reprocessing plant in Aomori to retract plutonium while most of the nation's reactors remain shut down
- U.S. Assistant Secretary of State Thomas Countryman as saying that if Japan conducts nuclear spent fuel reprocessing while its profitability remains unclear, there is a chance that Japan's international reputation may be significantly damaged.
- U.S. Deputy Secretary of Energy Daniel Poneman was quoted by Suzuki as saying that he has great concern that Japan may possess a large inventory of plutonium without plan to consume it.

Source: Kyodo News, “U.S. officials concerned about Japan's plan to reprocess nuclear fuel.” Mon, 04/22/2013

Global Civilian Plutonium Stockpile (2010)
- Reprocessing has international security implications -

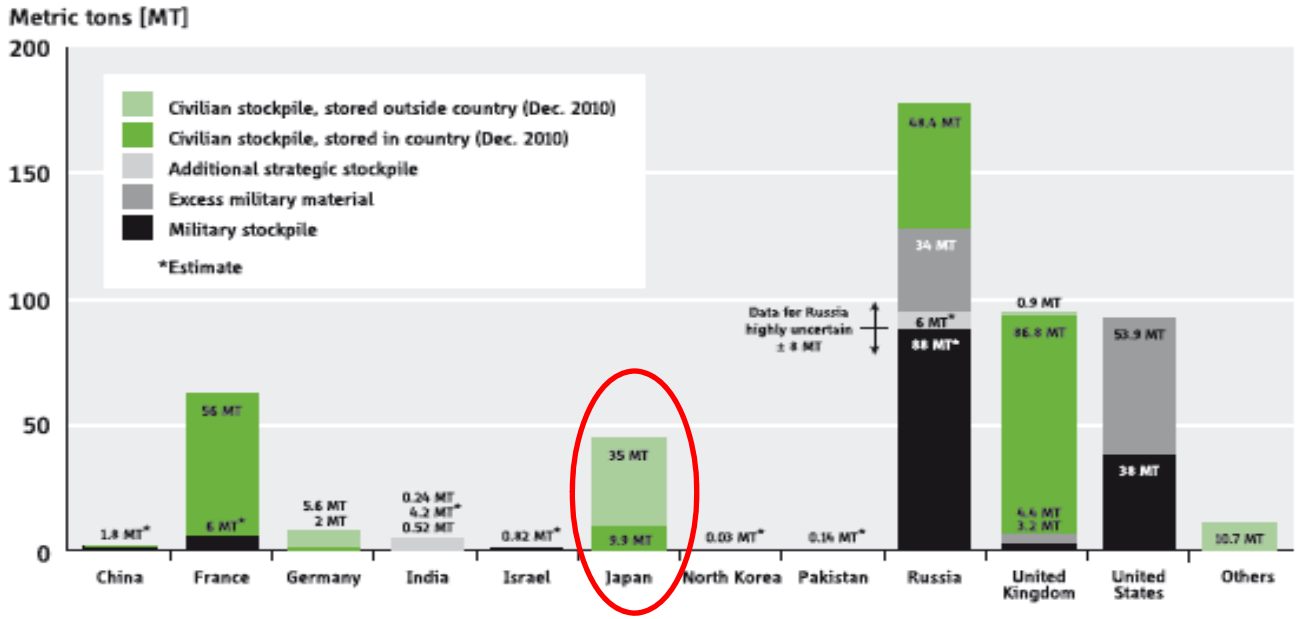


Figure 4. National stocks of separated plutonium. Civilian stocks are based on the most recent INFCIRC/549 declarations for December 2010 and are listed by ownership, not by current location. Weapon stocks are based on non-governmental estimates except for the United States and United Kingdom whose governments 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.

Source: International Panel on Fissile Material (IPFM), Global Fissile Material Report 2012, http://fissilematerials.org/library/gfmr11.pdf

Plutonium Stockpile in Japan (as of the end of 2011)

	2010 (kg)	2011 (kg)
Stock in Japan (Pu total)		
Reprocessing Plants	4,362	4,364
MOX Fuel Plant	3,365	3,363
Stored at Reactors	2,208	1,568
Sub-total (Pu fissile)	9,936(6,730)	9,295 (6,316)
Stocks in Europe (Pu total)		
UK	17,055	17,028
France	17,970	17,931
Sub-total :Pu total(Pu fissile)	35,025(23,373)	34,959(23,308)
Total (Pu fissile)	44,961(31,237)	44,254(31,837)

Source: Japan Atomic Energy Commission (2011, 2012) http://www.aec.go.jp/jicst/NC/iinkai/teirei/siryo2012/siryo39/siryo2.pdf

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).

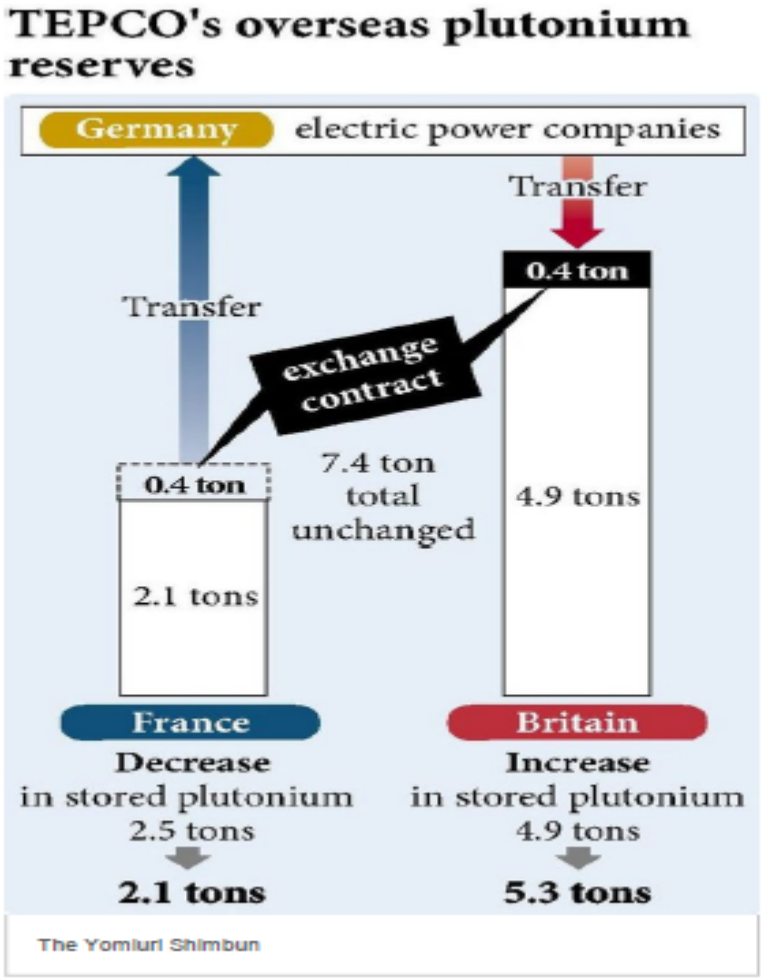
  – ***"Plutonium stockpile should be reduced regardless of fuel cycle options chosen in the future"*** (Statement in JAEC Subcommittee on Nuclear Power/Nuclear Fuel cycle technologies)

A Proposal for Plutonium Use Policy - personal opinion -(2013/03/26)

3 new principles should be introduced.

1. Demand comes first: Reprocessing should take place only when plutonium demand(use) is specified.
2. Stockpile reduction: Matching demand/supply is not good enough. Existing stockpile should be reduced before further reprocessing.
3. Flexible plan: Current Pu use plan (MOX recycling in 16~18 units) is no longer certain. Other options (Pu ownership transfer, disposition as waste etc.) need to be pursued. With minimizing cost, transportation and time required to dispose.

Plutonium swapping for Win-Win Deal among interested parties



Tokyo Electric Power Co. has struck a deal with a French fuel maker and a British public entity that allowed the Japanese utility to swap plutonium with German electric power firms.

Under the deal, TEPCO exchanged 0.4 ton of plutonium stored for TEPCO in France by Areva SA for the same amount in Britain owned by Germany.

The transaction was made on paper and did not involve an actual transfer of plutonium.

Source: "TEPCO, German firms swap Plutonium, " The Yomiuri Shimbun, 2013/04/25
http://the-japan-news.com/news/article/0000160460

Final Message

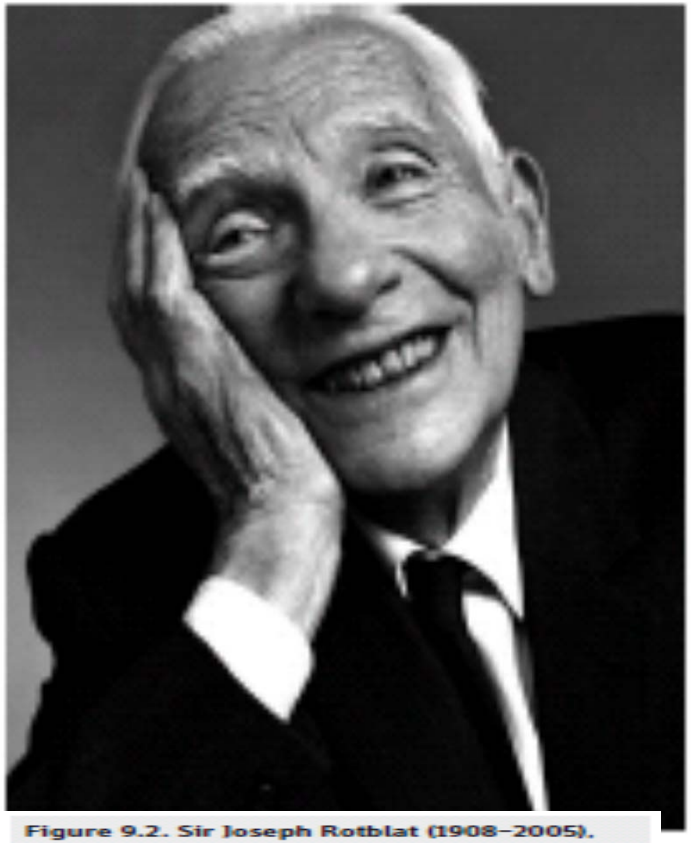


Figure 9.2. Sir Joseph Rotblat (1908–2005), a Manhattan Project scientist, one of the founders of the scientists' Pugwash movement, and a strong advocate of societal verification. Rotblat, a Nobel Laureate, was a leading supporter of Israeli whistle-blower Mordechai Vanunu, arguing that Vanunu's exposure 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!

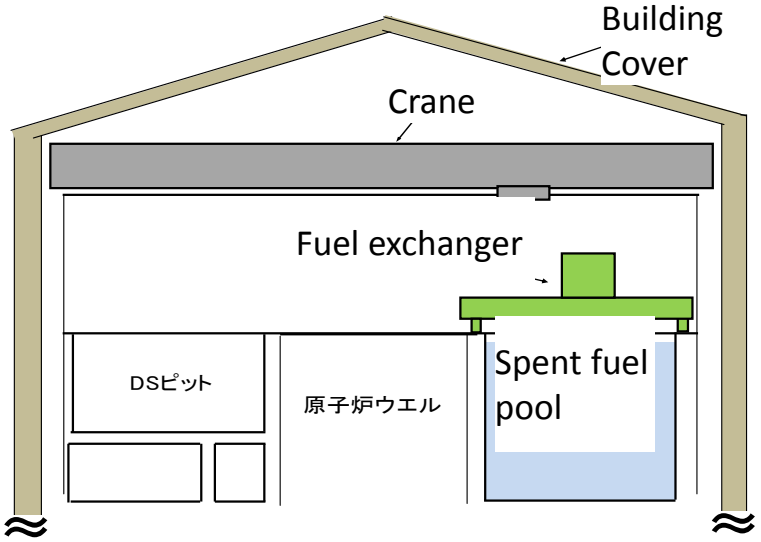
REFERENCE MATERIALS

Removal of Spent Fuel (SF) from SF pool

SF remain covered by water during and after the accident: sipping analysis suggests that SF is mostly intact, though some might be damaged by falling objects due to hydrogen explosion

1. Remove rubbles by crane

2. Install refueling machine & overhead crane



3. SF transfer by cask

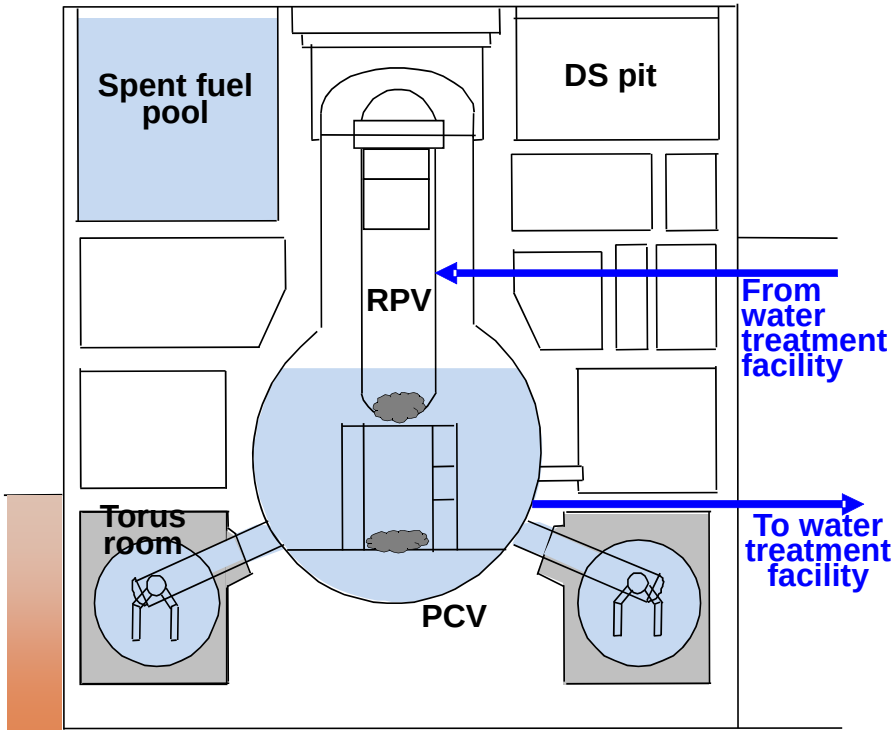
Removal of core debris

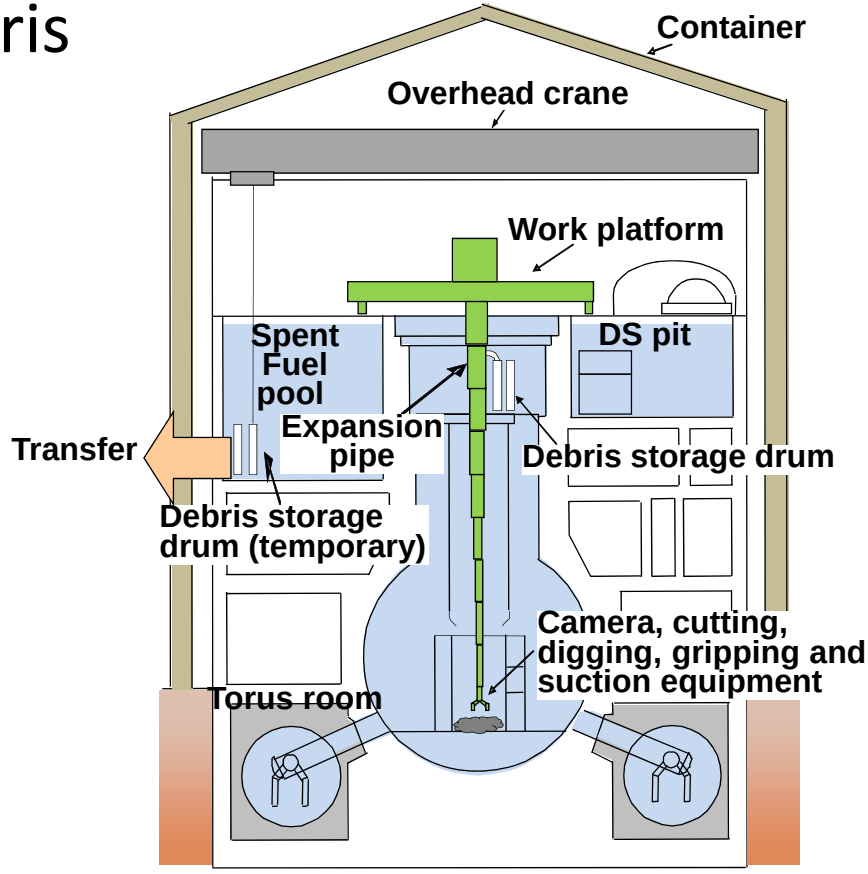
Decontamination (to reduce exposure)

→ Plugging the leaky holes

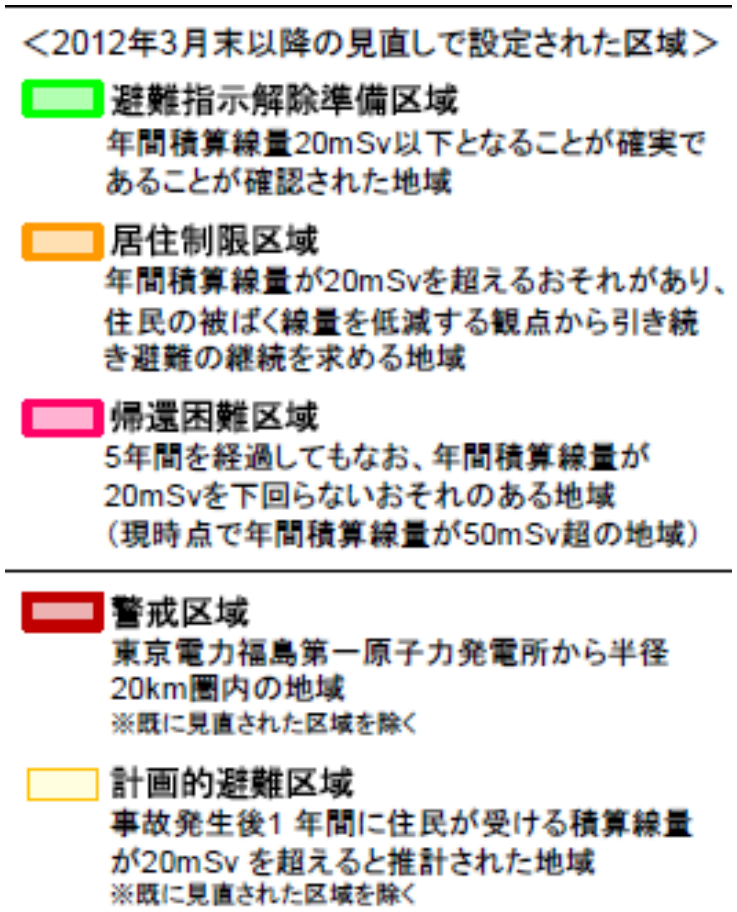
→ Flooding the containment

→ Removal of core debris



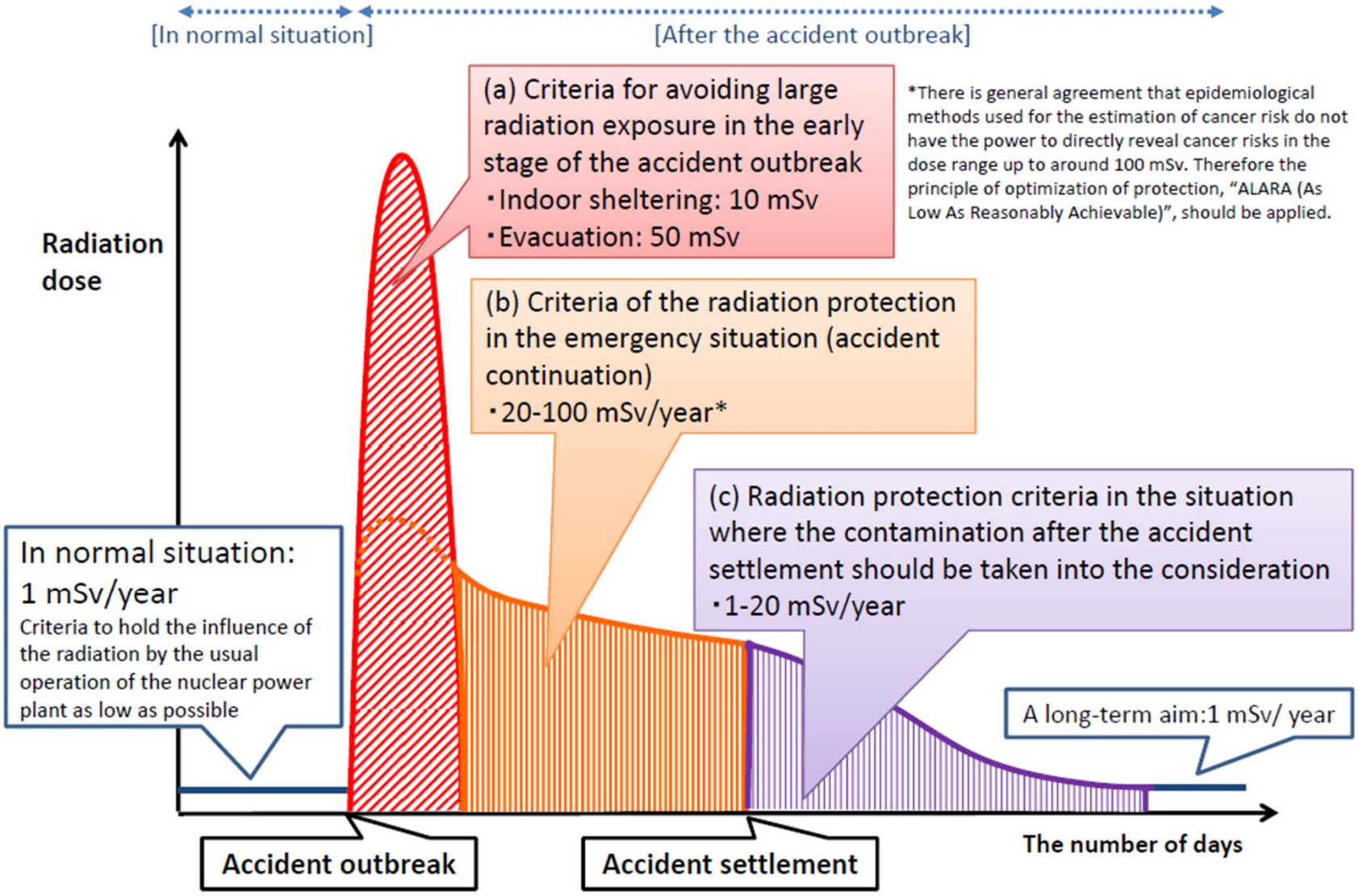


Re-defined Evacuation Zones (March 7, 2013)



- It is assured that expected dose will be less than <20 mSv/y (can return home soon)
- Expected dose can be higher than 20 mSv/y but <50 mSv/y
- Currently >50 mSv/y and will not be <20mSv/y after 5 years
- Exclusion Zone (20 km from the Fukushima Dai-ichi)
- Total cumulative dose is expected to be >20 mSv within a year after the accident

The idea of the criteria of the radiation dose for the radiation protection



Evacuation Criteria for Fukushima compared with the Chernobyl