ERIA Research Project Report 2012, No. 28

STUDY ON INTERNATIONAL COOPERATION CONCERNING NUCLEAR SAFETY MANAGEMENT IN EAST ASIAN COUNTRIES

Edited by
Tomoko Murakami

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June 2013

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LIST OF PROJECT MEMBERS

Working Group Members

MS. TOMOKO MURAKAMI (LEADER): Senior Economist, Manager, Nuclear Energy Group, Strategy Research Unit, The Institute of Energy Economics, Japan (IEEJ).

MR. MITSUO MATSUMOTO (COORDINATOR): Managing Director for Research Affairs, Economic Research Institute for ASEAN and East Asia (ERIA).

MR. BRETT JACOBS (COORDINATOR): Energy Director, Economic Research Institute for ASEAN and East Asia (ERIA).

MR. PHOUMIN HAN (COORDINATOR): Energy Economist, Economic Research Institute for ASEAN and East Asia (ERIA).

DR. SYAHRIR: Head, Safety and Environment Division, Radioactive Waste Technology Center, National Nuclear Energy Agency (BATAN), Indonesia.

MR. NAOKI NISHIDA: Researcher, Nuclear Energy Group, Strategy Research Unit, The Institute of Energy Economics, Japan (IEEJ).

MR. YUJI YAMAGUCHI: Researcher, Nuclear Energy Group, Strategy Research Unit, The Institute of Energy Economics, Japan (IEEJ).

MR. MOHD PAUZI MOHD SOBARI: Director, Installation Nuclear Division, Atomic Energy Licensing Board of Malaysia, Malaysia.

MS. CARMENCITA A. BARISO: Director III, Energy Policy and Planning Bureau, Department of Energy (DOE), Philippines.

DR. WON-JAE PARK: Director, Emergency Preparedness & Environment Division, Korea Institute of Nuclear Safety (KINS), Korea.

DR. NI EULALIA HAN: Research Fellow, Energy Security Division, Energy Studies Institute, National University of Singapore (NUS), Singapore.

MR. SAMERJAI SUKSUMEK: Deputy Director General, Management Division, Energy Policy and Planning Office (EPPO), Ministry of Energy (MOEN), Thailand.

MR. NGUYEN NGOC HUYNH: Specialist, Nuclear and Technical Power Department, General Directorate of Energy (GDE), Ministry of Industry and Trade (MOIT), Vietnam.

ABSTRACT

Responding to the Cebu Declaration of the leaders of the East Asia Summit (EAS) Some of the ASEAN countries plan to introduce commercial nuclear reactors in early 2020s due to their high growth of the energy demand. In the 1st Working Group meeting, the information on the current development plan with regard to safety regulation and nuclear security systems has been shared among the member countries in order to identify problems in establishing an emergency action plan for accidents and in considering desirable cross-border cooperation. In the 2nd Working Group meeting, proposals for regional cooperation such as emergency response, planning and management, technology and industrial development for nuclear safety and security are to be discussed.

The major findings are:

- Most member countries have some kind of a national nuclear regulatory body and have a common awareness that every country should play a role in regional cooperation on nuclear safety, irrespective of the development status of commercial nuclear power generation.
- The countries which already have nuclear energy technology, Korea, China and Japan, will be expected to provide information on the reactor and fuel technologies, safety regulatory schemes, security and safeguard issues and most of all, human resources development plans.
- Nuclear accident at the Fukushima Daiichi in 11 March 2011 has given a serious impact among ASEAN countries even though the location of the accident is very far from their residences. Prompt and accurate information sharing in the regional scale would be the top priority in case of a serious nuclear accident

EXPECTED POLICY IMPLICATIONS

The basic principle for international safety cooperation can be summarized to four major issues which would make great contribution for enhancement of domestic, regional nuclear safety:

1) **Participation in the initiatives of international organizations which include international convention, code of conducts and other collaborative programs in proactive manner**

The activities to establish the regional nuclear safety regime would include the implementation of the international treaties and conventions for nuclear safety, exchange of information on nuclear safety and regulation, cooperation of R&D on nuclear safety and various international cooperation and supports.

2) **Contribution to regional nuclear safety from experienced countries to newcomers**

The strategy for supporting newcomers would be implemented by installing safety networks to enhance effectiveness and efficiency for cooperation, such as ANSN, which would be one of good exemplary for the regional cooperation. Providing some training and education programs for regulatory staffs in ASEAN countries through the expert organization such as Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN) in Japan, or as International Nuclear Safety School of KINS (INSS) in Korea would be highly promising measures.

3) **Exchange information, experience and technologies by building cooperative relationship with regulatory organization worldwide**

Establishment of the ASEAN Regional Radiological and Nuclear Emergency Preparedness and Response Hub (tentative name) is proposed by the member countries, which would provide expertise and technical assistance on preparedness and response among the regional countries in case of radiological or nuclear emergencies, as well as contributing to establishment of the global nuclear safety regime by leading regional nuclear safety networks.

4) Preparation for dealing with cross-border radioactive releases in case of nuclear disasters

Gaseous radioactive materials such as noble gases might rapidly cross borders in case of an accident in nuclear facilities. Early detection and air (or water) monitoring systems, meteological and weather monitoring systems, radioactive plume dispersion modeling capabilities and most of all, decision making networks among all related countries would be highly desirable.

CHAPTER 1

Nuclear Energy Policy Trends in Member Countries

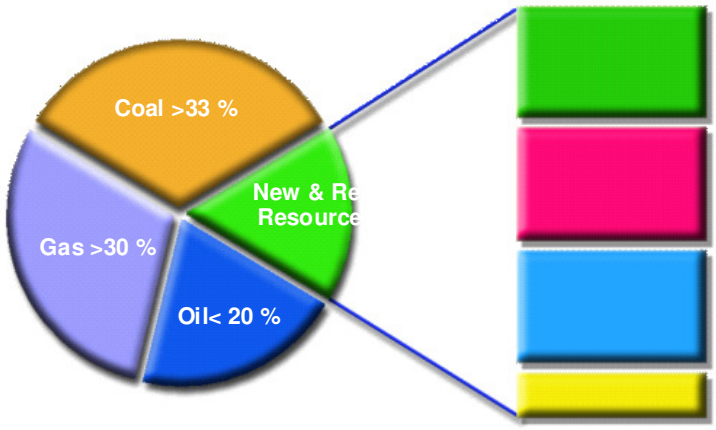
1. Indonesia

1.1 Energy demand/supply outlook

The energy needs of Indonesia have been rising due to population growth and economic progress in the last several decades. The government of Indonesia aims to apply an optimum energy mix comprising all viable and prospective energy sources.

The national energy policy, enacted as Government Regulation No. 5 of 2006, indicates the targeted energy mix until 2025. The share of nuclear energy is about 2% of primary energy, or 4% of electricity (4000 MWe). The primary energy portfolio in Indonesia as of 2005 and the projection for 2025 is shown in Figure 1.

Figure 1: Targeted National Energy Mix 2025 in Presidential Decree No. 5 / 2006



Indonesia intends to decrease the oil ratio in its energy mix to 20% or less, while depending more on gas, coal, and renewables. Indonesia has a large potential in geothermal energy and is making the most of it, while also developing biofuels, wind,

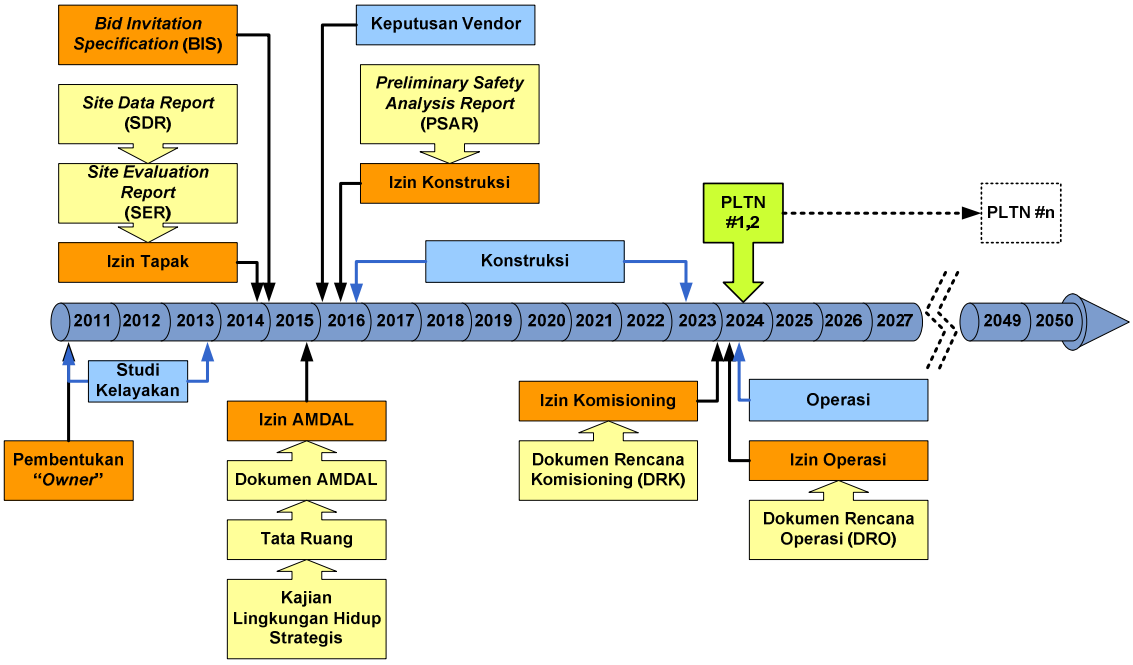
solar, and nuclear.

1.2. Nuclear Energy Policy and Development Plan

The government of Indonesia intends to introduce the first two units of nuclear power and commence commercial operation before 2020, as stated in Act No. 17 of 2007 (National Long-Term Development Planning 2005-2025). Act No. 17 also states that Indonesia will implement nuclear energy for electricity generation between 2015 and 2019, while strictly considering safety factors. Presidential Regulation No. 5 of 2010 (Mid-Term National Development Planning 2010-2014) assigned to the National Nuclear Development Authority in Indonesia (BATAN), among other things, the "preparation of the first nuclear power plant in Indonesia, which among others includes site and environmental study, as well as feasibility study." These are the legal bases for the national development plan for nuclear power in Indonesia.

The official roadmap for the introduction of commercial nuclear power plants in Indonesia is shown in Figure 2. The roadmap was initially established in 2007, based on Act No. 17 of 2007.

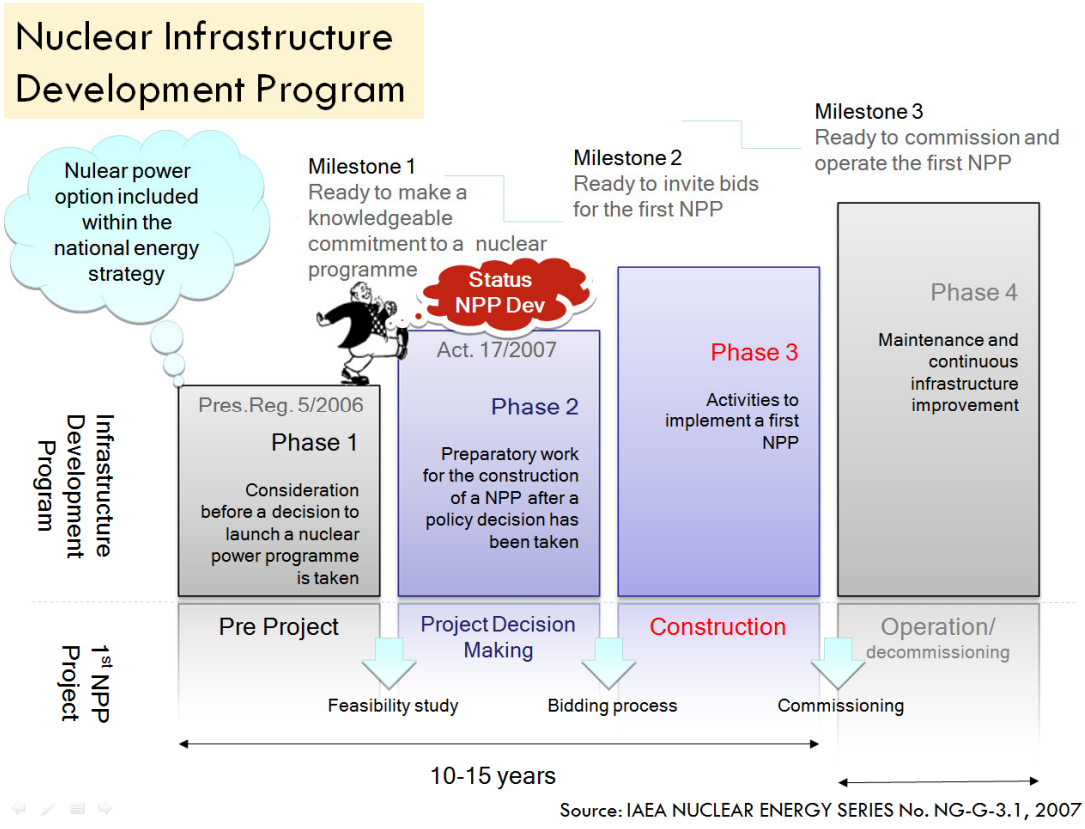
Figure 2: The Roadmap for the Introduction of Nuclear Power Plants in Indonesia



After the completion of the site study, the government of Indonesia will issue the Bid Invitation Specification (BIS) in 2014 and select the vendor in 2015. The operator will submit the safety assessment report (Preliminary Safety Analysis Report) to the national safety authority (BAPETEN). Once the license is issued, construction work will start, and in 2024 the first two units will commence operation.

However, there remain some issues to be resolved. BATAN requested that the International Atomic Energy Agency (IAEA) perform an Integrated Nuclear Infrastructure Review (INIR) mission under the framework of the Technical Cooperation (TC) program (INS/4/037), in a letter dated August 5, 2009. In response to the request, an INIR mission provided an external peer review conducted by the IAEA in November 2009. The Nuclear Infrastructure Development Plan of Indonesia, which has been reviewed by the INIR mission team, is shown in Figure 3.

Figure 3: The Nuclear Infrastructure Development Plan of Indonesia



The preparation of the nuclear infrastructure is implemented by issue-specific inter-agency teams. The institutional members of the teams are those directly related to the objectives to be achieved (for example, the institutional members of the team for human resources development are MEMR, BATAN, BAPETEN, and so on).

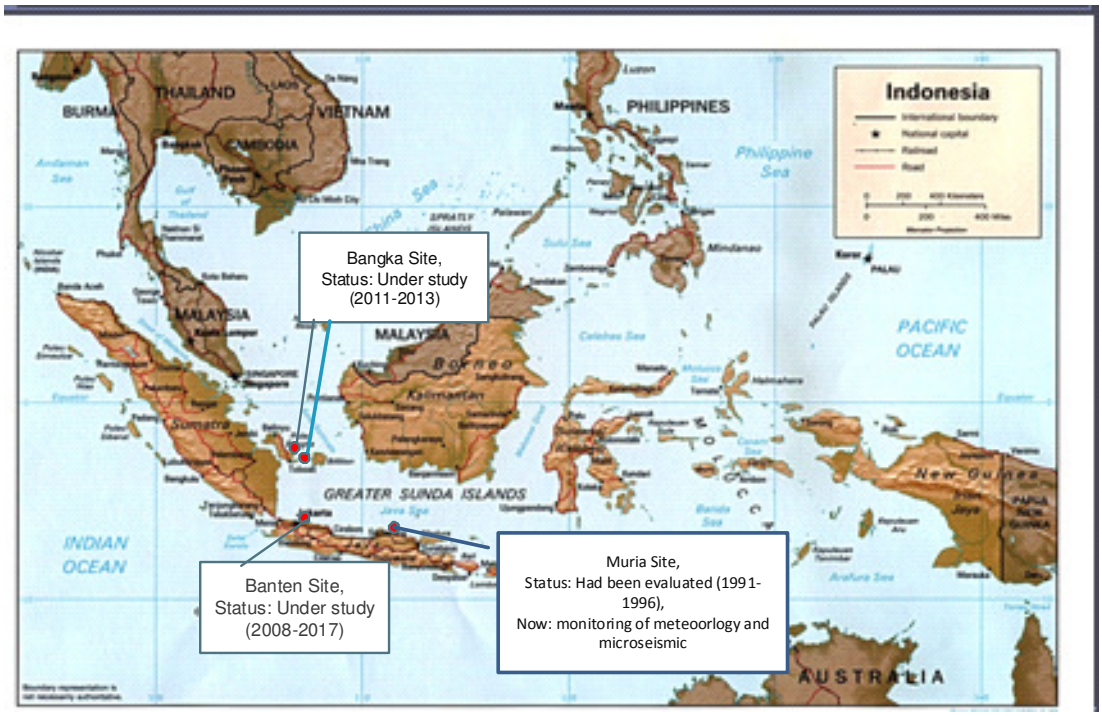
The INIR mission showed that Indonesia has done extensive preparatory work on most infrastructure issues, which would allow the country to make the decision to further consider the introduction of nuclear power (i.e., to go from Phase 1 to Phase 2 in the milestone methodology). However, since no decision has been taken by the government regarding which organization will be responsible for owning and operating the nuclear power plants, the mission suggested that some issues – mainly, those connected to the responsibilities of the owner/operator of the nuclear power plant – still require further work, most of which can be performed in parallel during Phase 2.

BATAN and related organizations in Indonesia have started preparing for the Action Plan for Phase 2 based on the review. The national development team worked on additional documents related to Infrastructure of LILW (Low and Intermediate Level Waste); conducted activities related to Public Information and Education in order to build a comprehensive understanding of nuclear power plants (NPPs) (according to Presidential Instruction No. 1 of 2010); and conducted the Pre-feasibility Study for Bangka Site from 2011 to 2013. Most important, they established the national team of human resources development (HRD) for the nuclear power plant, consisting of members from various institutes. The task and program of the team are:

- Development of an academic paper on “Preparation of Human Resource Development for the First Nuclear Power Plant in Indonesia”
- Development of a blueprint on “Human Resource Development for Nuclear Power Plant”
- Establishment of a Nuclear Training Center for NPP

There have been several site studies conducted by BATAN and related organizations in Indonesia since the late 1980s. Figure 4 shows the location and the status of the sites under investigation.

Figure 4: NPP Sites under Investigation in Indonesia



Java is the most populous island in Indonesia, holding 59% of the national population, as well as the site of major industrial activity. Two possible sites for NPP in Java are the Muria Peninsula (Ujung Lemahabang at Balong village) and Banten (Kramatwatu-Bojonegara).

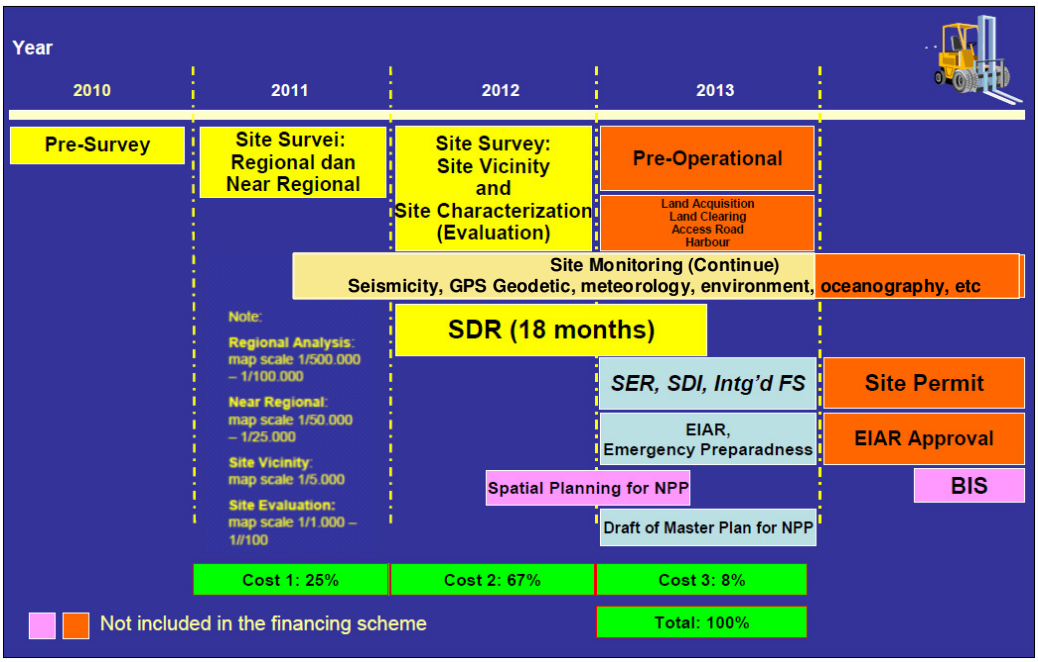
On the Muria Peninsula, the local residents in and around Balong are refusing the NPP program and all related activities, and the site investigation is not finished yet. Another 5 years will be necessary to complete the investigation but activities are now pending.

Kramatwatu-Bojonegara in Banten is another potential site. The site needs further intensive investigation, mainly in volcanology and seismic evaluation, as well as special social-economic and cultural studies due to the dense and heterogeneous population. To complete the study, at least another 7 years are needed.

The third potential site is Bangka, not too far from Jamali. Since Bangka Island is located on the Intra Plate, it is far from active volcanoes: the closest one is Mt. Lumut Balai in Lampung, ±303 km from Bangka. It therefore has a comparatively low seismic risk, and no potential tsunami hazard due to the shallow sea. The total population of Bangka-Belitung is 1,074,775, which is quite a low population density

for Indonesia. The investigation is still under way and at least 3 more years are needed. Figure 5 shows the roadmap for the site study in Bangka Island.

Figure 5: The Roadmap for the Site Study in Bangka Island



Recently, additional potential sites in East and West Kalimantan have been proposed by the government. The Kalimantan local government has submitted a proposal to the central government to build nuclear power plants in the region, and they are ready to invite local and foreign investors to join the project. In 2013, the government prepared a pre-feasibility study to initiate a review of the opportunities to build nuclear units in Borneo Island, and are now preparing to coordinate the joint work among related agencies.

1.3. Organizations

The national energy policy authority in Indonesia is the Ministry of Energy and Mineral Resources. The nuclear development policy authority is BATAN, the national nuclear energy authority. The regulatory authority is BAPETEN. These are independent of each other. Table 1shows the organizations involved in the Nuclear Infrastructure Preparation and the scope of work of each organization.

Table 1: Organizations involved in National Infrastructure Preparation and the Scope of Works

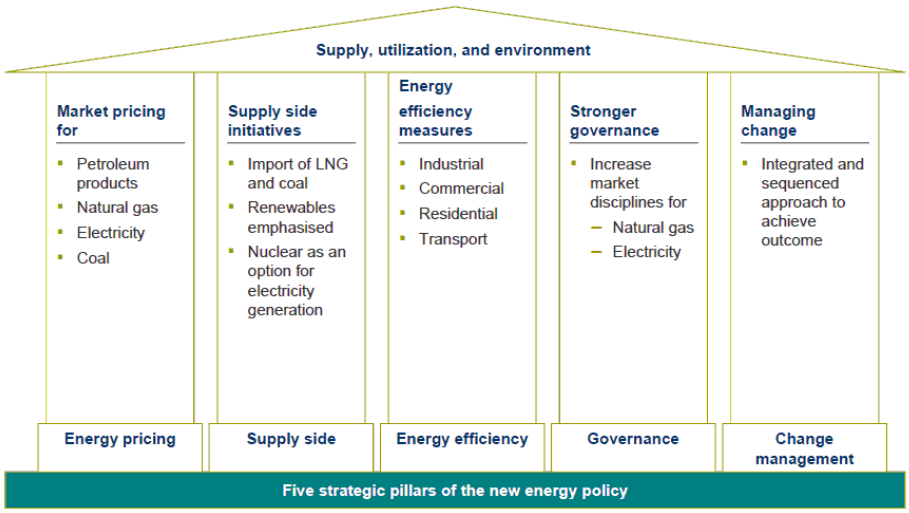
Responsible institutions	Scope of work
• BATAN (National Nuclear Energy Agency)	▪ Nuclear Safety ▪ Stakeholder Involvement (Socialization Program) ▪ Siting ▪ Fuel Cycle and Radioactive Waste ▪ Environmental Protection
▪ BAPETEN (Regulatory Body)	▪ Nuclear Safety ▪ Legislative Framework ▪ Regulation Framework ▪ Safeguard, ▪ Radiation Protection, Emergency Planning, and Security & Physical Protection
▪ Directorate General of New and Renewable Energy and Energy Conservation-Ministry of Energy and Mineral Resources ▪ Training and Education Agency-Ministry of Energy and Mineral Resources ▪ Electricity State Own Company (PLN) ▪ Ministry of Industry and Ministry of Environmental	▪ National Position ▪ Management ▪ Funding & Financing ▪ Electrical Grid ▪ Human Resources Development ▪ Stakeholder Involvement ▪ Environment Protection ▪ Industrial Involvement and Procurement.

2. Malaysia

2.1. Energy demand/supply outlook

The latest national energy policy in Malaysia is "The Tenth Malaysia Plan 2011-2015," published by the Economic Planning Unit in the Prime Minister's Department. According to this plan, GDP growth of 10.1% in the first quarter of 2010 represented the fastest quarterly growth in 10 years, and Malaysia's goal of high-income status by 2020 requires, among other things, achieving an average GDP growth of 6.0% per annum. To ensure the effective sourcing and delivery of energy, the New Energy Policy (2011-2015) emphasizes energy security and economic efficiency, as well as the impact to the environment and to society. The Policy focuses on five strategic pillars: initiatives to secure and manage a reliable energy supply; measures to encourage energy efficiency (EE); adoption of market-based energy pricing; stronger governance; and managing change, as shown in Figure 6.

Figure 6: Five Strategic Pillars of the New Energy Policy



SOURCE: Economic Planning Unit

The Malaysian government intends to enhance energy security through the development of alternative resources, particularly hydro, as well as the import of coal and liquefied natural gas (LNG) by 2015. The development of new coal-based plants would also be necessary to ensure security of supply in Peninsular Malaysia. The

application of supercritical coal technology should be explored to reduce carbon emissions. In addition, the development of NPPs as an option for electricity generation is being considered as a way to ensure a reliable and cost-effective supply in Peninsular Malaysia.

2.2. Nuclear Energy Policy and Development Plan

Malaysia's first nuclear power planning study was conducted in 1979. It was followed by a series of studies covering various planning aspects from the mid-1980s to the early 1990s, all with technical assistance from the IAEA. Consequently, the government of Malaysia decided in June 2009 to consider nuclear energy as one of the fuel options for electricity supply post-2020, especially for the Peninsula, and to include it in the country's five-year development plan (i.e., The Tenth Malaysia Plan), which is the current national plan of Malaysia.

On July 16, 2010, the government officially adopted the National Nuclear Policy as a guideline for the development of a nuclear sector for electricity generation and non-electricity generation. On October 25, 2010, the Economic Transformation Program was launched under the National Key Economics Area (NKEA). In this program, 19 Entry Point Projects (EPP) were identified under the Oil, Gas & Energy NKEA sector, including Deploying Nuclear Energy for Power Generation. In December 2010, based on the recommendation of the IAEA, a Nuclear Energy Program Implementing Organization (NEPIO) was established. The government also decided to establish a Nuclear Power Development Steering Committee, led by the Ministry of Energy, Green Technology and Water, to plan and coordinate preparatory efforts towards deploying nuclear energy for electricity generation.

2.3. Organizations

Under the Nuclear Power Development Steering Committee, established in 2010, various studies have been conducted on formulating a Nuclear Power Infrastructure Development Plan (NPIDP), which is targeted to be ready by 2013. Three Working Committees, comprising relevant ministries, government agencies and government-linked companies (GLCs), were also established under the Steering Committee:

- Nuclear Power Program Development Working Committee, led by the Malaysian Nuclear Agency (Nuclear Malaysia)
- Nuclear Power Project Development Working Committee, led by Tenaga Nasional Berhad (TNB), the electric utility for Peninsular Malaysia
- Nuclear Power Legislative Development Coordination Working Committee, jointly led by the Atomic Energy Licensing Board (AELB) and the Energy Commission (ST)

This structure, comprising the Steering Committee and its three Working Committees, could then be considered a Nuclear Energy Program Implementing Organization (NEPIO), as recommended in the IAEA document on "Milestones in the Development of a National Infrastructure for Nuclear Power" (Nuclear Energy Series No. NG-G-3.1). The formulation of the NPIDP is meant to enable the government to make appropriate decisions on the implementation of nuclear power projects.

The government also decided in December 2010 to establish a new, fully dedicated NEPIO to supersede the Nuclear Power Development Steering Committee, established by the government in June 2009, and all three of its Working Committees on Nuclear Power Program Development, Project Development, and Legislative Development Coordination. Subsequently, the new NEPIO was established as the Malaysia Nuclear Power Corporation (MNPC) under the Companies Act of Malaysia, and placed under the jurisdiction of the Prime Minister's Department in January 2011. To facilitate its functions, the organizational structure of the MNPC consists of three main divisions, identical to the three Working Committees under the Nuclear Power Development Steering Committee, which the MNPC has superseded:

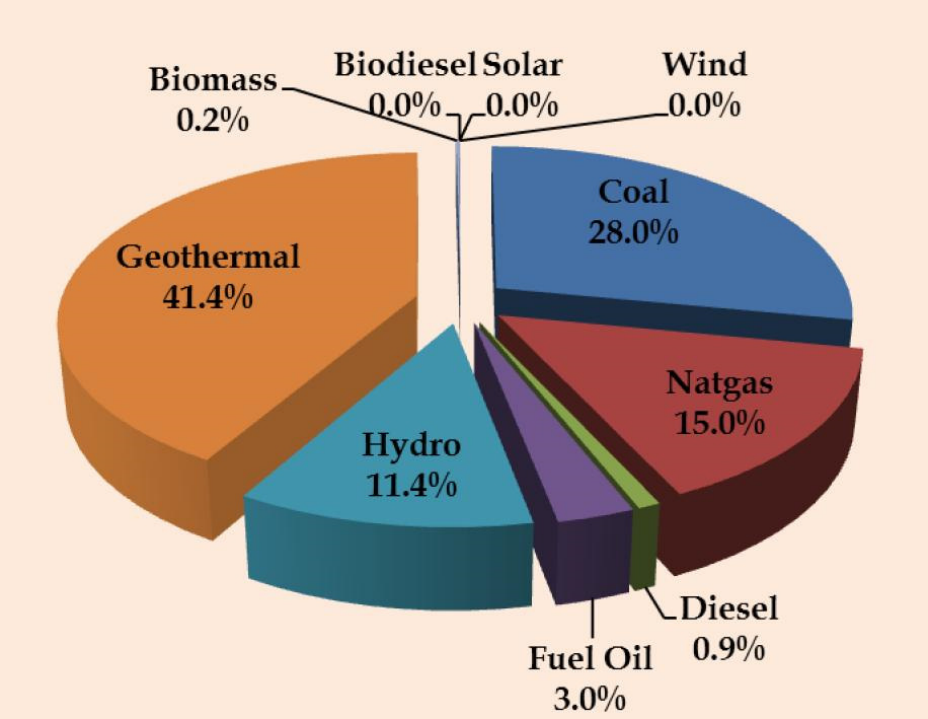
- Nuclear Power Program Development
- Legislative and Regulatory Development Coordination
- Nuclear Power Project Development

3. Philippines

3.1. Energy Demand/Supply Outlook

Energy policy in the Philippines is decided by the Department of Energy (DOE). The latest power plant development plan is the "Power Development Plan 2009-2030 (PDP2009-2030)." In 2011, the share of electric power provided by biomass was about 40%, and by hydro about 10%.

Figure 7: Fuel Input Mix for Power Generation in 2011



Electricity demand is projected to increase from 55,417 GWh in 2008 to 86,809 GWh by 2018, and up to 149,067 GWh by 2030. This translates to a rise in peak demand from 9,226 MW in 2008 to 14,311 MW by 2018, and to about 24,534 MW by 2030. According to a simulation by DOE, around 17 GW of new capacity is necessary during the period 2009-2030 in order to meet this demand. Committed power plant development projects only reach 1,338 MW (Figure 8) and the remaining capacity requirements are still open for private sector participation.

Figure 8: List of Committed Projects

Grid	Project Name	Capacity (MW)	Target Completion	Location	Proponent
Luzon	2x300MW Coal-Fired Power Plant	600	4th Qtr. Of 2012	Mariveles, Bataan	GN Power
	Sub-total Luzon	**600**			
Visayas	3x80MW CFB Power Plant Expansion Project	240	Unit I-March2010 Unit II-June 2010 Unit III-Jan 2011	Brgy. Daanlungsod, Toledo City, Cebu	Cebu Energy Development Corporation (Global Business Power Corp.)
	2x100MW Cebu Coal-Fired Power Plant	200	Unit 1-Feb 2011 Unit 2-May 2011	Naga, Cebu	KEPCO SPC Power Corporation (KSPC)
	17.5MW Panay Biomass Power project	17.5	2011	Brgy. Cabalabaguan, Mina, Iloilo	Green Power Panay Phils., Inc.
	Nasulo Geothermal Plant	20	2011	Nasuji, Valencia, Negros oriental	Energy development Corporation
	2x80MW CFB Power Plant	160	Unit I-Sep 2010 Unit II-Dec 2010	Brgy. Ingore, La Paz, Iloilo	Panay Energy Development Corporation (Global Business Power Corp.)
	Sub-total Visayas	**638**			
Mindanao	Sibulan Hydroelectric Power (Unit I-16.5MW) (Unit II-26MW)	43	Unit I-Feb2010 Unit II-Apr 2010	Sta. Cruz, Davao del Sur	Hedcor Sibulan, Inc.
	Cabulig Mini-Hydro Power Plant	8	June 2011	Plaridel, Jasaan, Misamis oriental	Mindanao Energy Systems,Inc. (MINRGY)
	Mindanao 3 Geothermal	50	July 2014	Kidapawan, North Cotabato	Energy Development Corporation
	Sub-total Mindanao	**101**			
Total Philippines		**1,338**			

Note: Mindanao 3 Geothermal Plant was moved to 2014 from its original target year of 2010

3.2. Nuclear Energy Policy and Development Plan

The use of nuclear energy for power generation remains a long-term option for the Philippines. Cognizant of the merits of nuclear energy in terms of supply security, stability and environmental considerations, the government is open to embarking on nuclear power generation plans in the future and looking at improvements in existing safety standards and technology advancement as necessary preconditions (notwithstanding opposition from various environmentalists and other interest groups).

In 2007, there was a resurgence of interest in nuclear energy in the Philippines as a result of the so-called "nuclear renaissance" that occurred in the international energy community. A Task Force on Nuclear Power Program was even established by the then DOE Secretary to serve as an interim unit within DOE to attend to nuclear-related matters. The new wave of interest also prompted a government-initiated request, in 2008, for an IAEA Mission review of the Development of Infrastructure to Support a Nuclear Power Program in the Philippines and the Feasibility of Rehabilitating the Bataan Nuclear Power Plant. Subsequently, the Mission Report led to the creation of an inter-agency core group to work on the

recommendations of the IAEA Mission, which included, among other things, conducting a Feasibility Study to verify the condition of the Bataan Nuclear Power Plant (BNPP) and establishing a strategic plan for its rehabilitation program. It also involved providing advice to the government on the general requirements for launching a nuclear power program. The scope of the 19 areas identified range from National Position, Nuclear Safety, and Regulatory Framework to Fuel Cycle and Waste Management.

Under a Memorandum of Understanding signed between the National Power Corporation (NPC) and the Korea Electric Power Corporation (KEPCO) in 2008, KEPCO conducted a feasibility study on the possible rehabilitation of the BNPP. In its official report submitted to the NPC in 2010, KEPCO concluded that BNPP rehabilitation is technically feasible at a cost of US$1 billion. The study team specifically stated that the primary system of the plant was in relatively good state while the secondary system had been corroded by saltwater and humidity. Some equipment would also have to be replaced, overhauled and updated.

In the same year, there were also initiatives to study the possible conversion of BNPP into either a coal-fired or natural gas-fed facility. Based on the initial findings, a conversion to coal appears more feasible.

The undertaking of further initiatives, however, momentarily suffered a setback following the Fukushima accident in March 2011. Just after the Fukushima accident, the Philippines Nuclear Research Institute, Department of Science and Technology (DOST-PNRI), as the competent authority on nuclear matters, undertook the following immediate measures to allay public fears on the impact of Fukushima:

- Convening of the PNRI Executive Coordinating Council with the Experts Support Team
- Deployment of radiation monitoring teams
- Activation of the National Radiological Emergency Preparedness and Response Plan (RADPLAN) by the National Disaster Risk Reduction Management Council (NDRMMC)

This enabled the government to provide timely, accurate and objective information to the public. The PNRI also produced daily information bulletins on its

website, and held press conferences and interviews with the media. The PNRI also pursued a more aggressive information campaign to promote nuclear applications.

There were varied reactions among Filipinos on nuclear energy after Fukushima. For those who perceived nuclear as an environmental hazard, Fukushima was an affirmation of their campaign against any plan to revive BNPP, let alone build a new plant. Academic discussions and public debates, using tri-media and social networking sites, deliberated the pros and cons of nuclear energy.

Be that as it may, the vast amount of information and literature available through the internet, through tri-media (both international and domestic), and partly through the efforts of the government (through its related international cooperation activities) enabled Filipinos to reach a good level of understanding and awareness on the merits of nuclear energy development. As a concrete example, in January 2012, barely two months prior to the first-year anniversary of Fukushima, an advocacy forum known as Arangkada Philippines, which is supported by top-level private sector groups such as the Joint Foreign Chambers of Commerce in the Philippines, recommended that the government "include nuclear power development in the national power development plan" and that the Philippine Congress pass a "resolution supporting the consideration of the development of nuclear energy."

Likewise, in April of the same year, one of the recommendations from the Mindanao Power Summit was the establishment of a nuclear power plant to provide long-term solutions to the region's perennial power problems, which have caused daily rotational brownouts lasting from 8 to 9 hours. Mindanao, located in the southern part of the country, sources a good portion of its power from hydropower facilities and thus is easily affected, especially during summer months and in extreme cases such as the El Niño phenomenon.

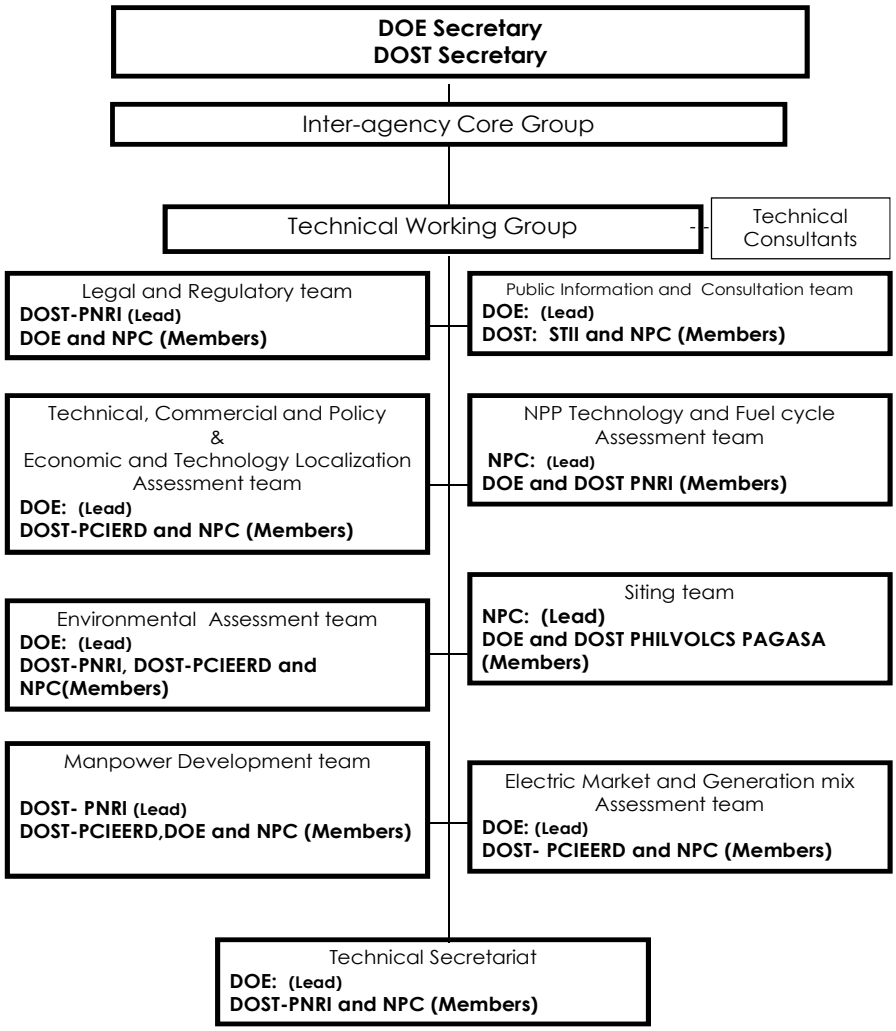
There are also sub-national government units who have manifested interest through the issuance of local resolutions enjoining the national government to study the feasibility of establishing a nuclear power facility in their respective areas.

3.3. Organizations

By virtue of an inter-departmental order between the Philippines' Department of Energy and Department of Science and Technology (DOST), the Inter-agency Core

Group on Nuclear Energy was established in 2009 with the prime objective of developing, managing and formulating policies and strategies on nuclear power generation. Part of its mandate is to undertake the feasibility study on the rehabilitation of BNPP. The Core Group was also envisioned to serve as an interim NEPIO. It is chaired by the DOE and co-chaired by the DOST. Its members include the National Power Corporation (NPC), the government agency in charge of preserving and maintaining the BNPP, and the Philippine Nuclear Research Institute. A corresponding Technical Working Group was also formed, composed of 8 study teams, to look into the 19 infrastructure requirements of a nuclear power program (Figure 9). Among the Core Group's accomplishments was the series of Information, Education and Communication (IEC) activities conducted in major cities of the country in 2010. The IEC focused on the benefits of nuclear technology applications in the Philippines, specifically in the areas of medicine, agriculture, and research, as well as the ways that nuclear safety, security, and safeguards are ensured through effective regulation. In a public perception survey conducted during the IEC sorties, more than 60% of the respondent participants expressed a willingness to support a nuclear power program. (The participants mostly comprised energy stakeholders.)

Figure 9: Inter-Agency Core Group Organizational Structure



4. Singapore

4.1. Energy Demand/Supply Outlook

Singapore is reliant on fuel imports for the country's energy needs and is alternative energy-disadvantaged due to its natural geography. Its energy dilemma lies in balancing three policy objectives: economic competitiveness, environmental sustainability, and energy security. The primary fuel for electricity generation has shifted from fuel oil to natural gas since electricity market liberalization in 2000. Currently, more than 90% of electricity generated in Singapore is from gas, as it is economically competitive and efficient compared to other fuels. It is also the cleanest

fossil fuel available today.

4.2. Nuclear Energy Policy and Development Plan

In 2010, the government embarked on a pre-feasibility study on nuclear energy in response to a recommendation by the Economic Strategies Committee. It was conducted by Singapore's Ministry of Trade and Industry with the assistance of international experts. The study was part of Singapore's efforts to continually explore all options that could help the country overcome its energy constraints and enhance its energy security. The pre-feasibility study covered a range of areas, including nuclear safety, security and risk assessment, human resource development, and nuclear energy systems and demand. The conclusions of the pre-feasibility study are:

- Nuclear energy technologies presently available are not yet suitable for deployment in Singapore. Although the latest designs of nuclear power plants are much safer now, the risks to Singapore, given that it is a small and dense city, still outweigh the benefits at this point.
- Singapore needs to continue to monitor the progress of nuclear energy technologies to keep the country's options open for the future.
- Singapore needs to strengthen capabilities to understand nuclear science and technology.
- Singapore will track related developments in areas such as emergency response and radioactive waste disposal, so as to assess the implications of evolving nuclear energy technologies and regional nuclear energy developments for the country, and strengthen the country's operational preparedness and existing capabilities in radiation and incident response.
- Singapore will support research in relevant areas of nuclear science and engineering, and train a pool of scientists and experts through education programs in local and overseas universities.
- Singapore will play an active role in global and regional cooperation on nuclear safety.

Singapore will support research in relevant areas of nuclear science and

engineering, and train a pool of scientists and experts through education programmes in local and overseas universities. We will also play an active role in global and regional cooperation on nuclear safety. Singapore is currently engaged in organizations/platforms such as the IAEA, the Asian Nuclear Safety Network, and ASEAN's Nuclear Energy Cooperation Sub-Sector Network (NEC-SSN).

4.3. Organizations

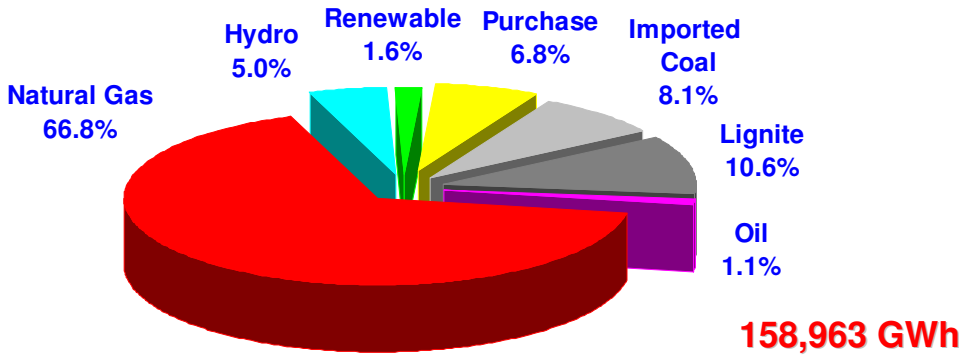
Singapore currently does not have plans to introduce nuclear energy into its fuel mix. There is no single organization responsible for nuclear-related issues.

5. Thailand

5.1. Energy Demand/Supply Outlook

In 2011, more than half of the electricity in Thailand was generated by natural gas, and one-third imported from Myanmar.

Figure 10: Electricity Generation by Fuel in 2011



In the "Thailand Power Development Plan 2012-2030" (PDP2010: Revision 3), the government has set new policies for economic stimulation, causing trajectory changes in GDP growth rate projections for the period 2012-2020. However, according to the power demand forecast for 2030, net peak demand is still 52,256 Megawatt (MW), some 3,494 MW (or 6.27%) lower than that of the previous version

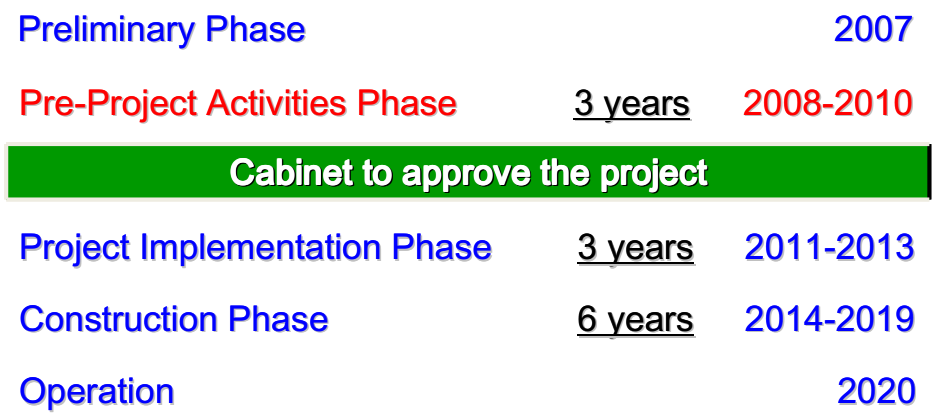
of the forecast. The total generating capacity during the period 2012 – 2030 can be summarized as follows:

- Total capacity (as of December 2011): 32,395 MW
- Total added capacity during 2012 – 2030: 55,130 MW
- Total retired capacity during 2012 – 2030: 16,839 MW
- Grand total capacity (at the end of 2030): 70,686 MW

5.2. Nuclear Energy Policy and Development Plan

The nuclear power development schedule in Thailand was approved in 2007 by the Thai Cabinet as part of a nuclear infrastructure plan, based on the IAEA document "Milestones in the Development of a National Infrastructure for Nuclear Power" (NG-G-3.1). NPP would commence operation in 2020.

Figure 11: Nuclear Power Development Schedule Approved in 2007



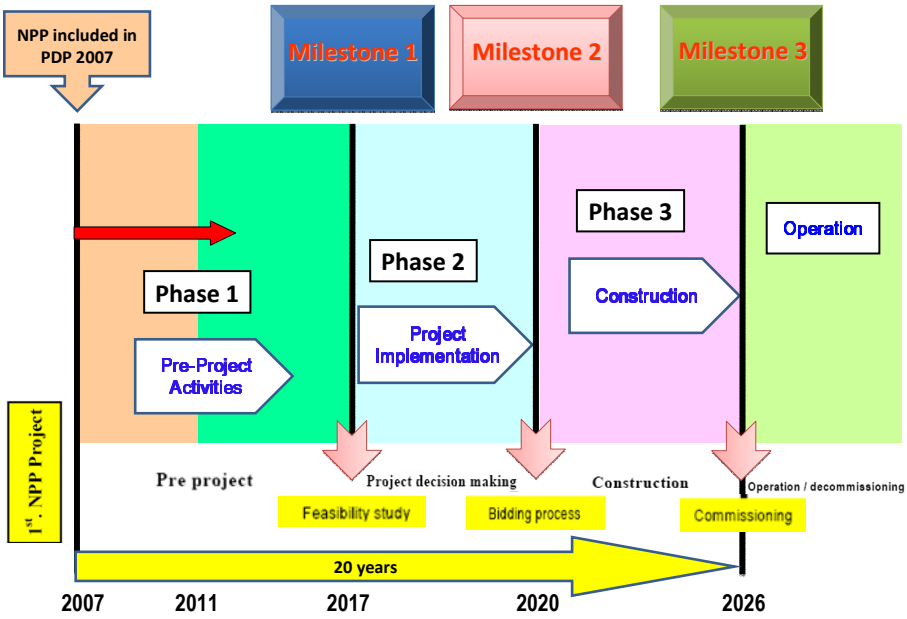
The IAEA's Integrated Nuclear Infrastructure Review (INIR) concluded that "Thailand can make a knowledgeable decision on the introduction of nuclear power." The Nuclear Power Infrastructure Establishment Coordination Committee (NPIECC) and its sub-committees prepared and submitted a readiness report to the Ministry of Energy at the end of 2010, and this report was submitted to the National Energy Policy Council (NEPC) for consideration to proceed to Phase 2 (Project Implementation).

In March 2011, the Fukushima accident occurred. In "PDP2010: Revision 3," approved by the Cabinet on June 19, 2012, the commencement of NPP operations

was postponed to 2026 and 2027. The main reasons for postponing the NPP project are:

- To review Nuclear Safety Measures and the Emergency Preparedness and Response Plan, to include lessons learned from the Fukushima accident
- To prepare infrastructure to support NPP (legislative framework, regulatory framework, stakeholder involvement, etc.)
- To promote public acceptance of nuclear power

Figure 12: Thailand NPP Project Schedule (IAEA Milestones)



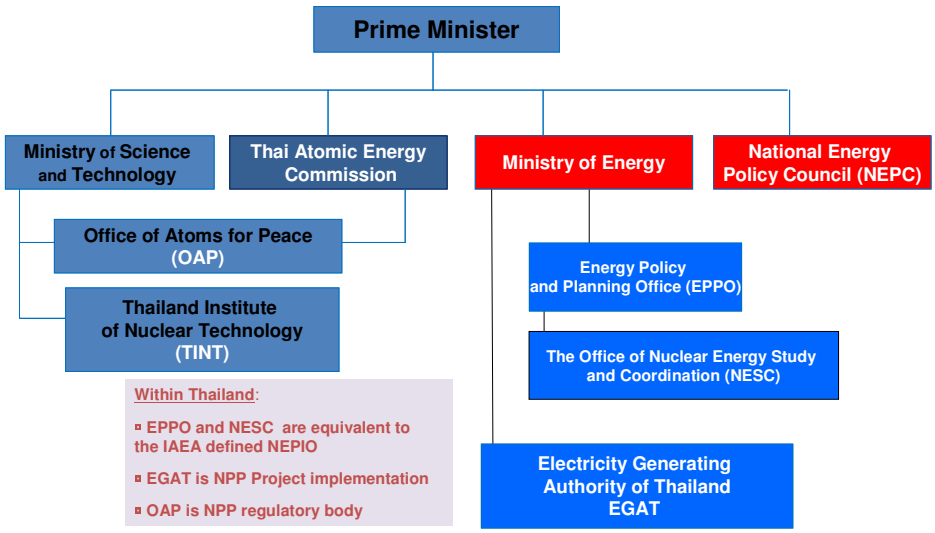
5.3. Organizations

The latest energy development policy in Thailand is "PDP2010: Revision 3," designed by the Ministry of Energy and approved by the Cabinet on June 19, 2012.

The Electricity Generating Authority of Thailand (EGAT) is responsible for the first nuclear power plant under the supervision of the Nuclear Power Utility Subcommittee, and is responsible for planning, feasibility study, site selection, project implementation, construction, operation, and decommissioning. EGAT has been working with Burns and Roe Asia to conduct a Nuclear Power Plant Feasibility Study (2008-2010).

The Thailand Institute of Nuclear Technology (TINT) is a research institute under the Ministry of Science and Technology. TINT is responsible for research and development (R&D), nuclear applications, training, and so on.

Figure 13: Organization for Planning Nuclear Power Plants



6. Vietnam

6.1. Energy Demand/Supply Outlook

According to the power sources development program, period 2011-2030 in Vietnam (Master Plan No.7), current grid capacity in Vietnam is about 22,000 MW. Demand is estimated to be 75,000 MW by 2020 and 146,800 MW by 2030. In 2030, nuclear power will account for 10.1% of total power (70 billion KWh), and the total capacity of NPPs will be about 10.700 MW/146.800 MW.

Figure 14: Electricity Portfolio of Vietnam in 2020 (Total Capacity: about 75,000 MW)

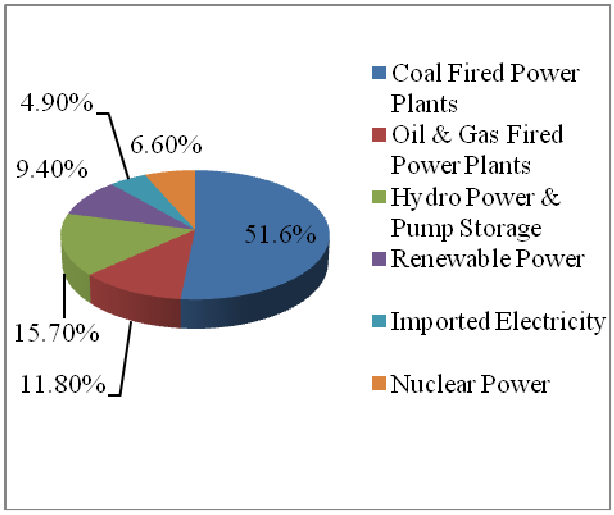
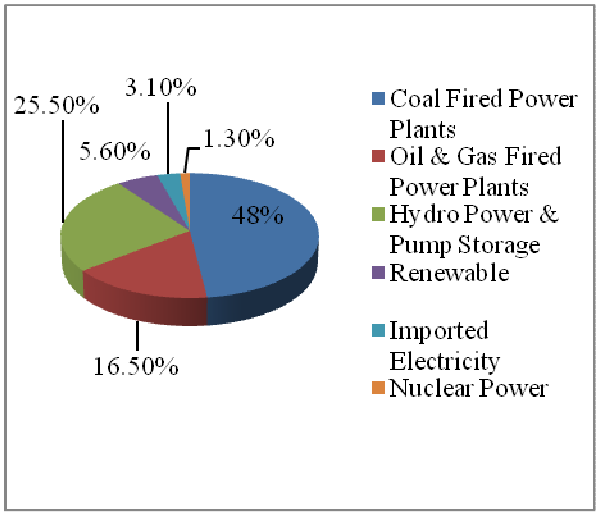


Figure 15: Electricity Portfolio of Vietnam in 2030 (total capacity: about 146,800 MW)



6.2. Nuclear Energy Policy and Development Plan

On January 3, 2006, the Prime Minister approved the Strategy on Peaceful Use of Atomic Energy up to 2020 (Decision No. 01/2006/QD-TTg). On July 23, 2007, the Prime Minister approved the Master Plan for Implementation of the Long-term Strategy on Peaceful Use of Atomic Energy up to 2020, covering all activities related to the development of nuclear infrastructures and capabilities for future self-reliance

in NP technology.

The Ninh Thuan Nuclear Power Project was approved by Resolution No. 41/2009/QH12 of the National Assembly on November 25, 2009. On March 18, 2010, the Prime Minister approved the Master Plan for Implementation of the Ninh Thuan Nuclear Power Project, Decision No. 460/TTg-KTN. On May 4, 2010, the State Steering Committee (SSC) of the Ninh Thuan Nuclear Power Project was established according to Decision No. 580/QD-TTG of the Prime Minister. The SSC is chaired by the Deputy Prime Minister of Vietnam.

On July 24, 2010, Decision No. 957/QD-TTg of the Prime Minister, on the strategy and the master plan, identified the priorities for development of atomic energy applications in the coming years, including focusing on the construction of the first and second units, for commissioning by 2020. According to the Atomic Energy Law (Article 9) and Prime Minister Decision No. 446/QD-TTg, issued in April 2010, the National Council for Nuclear Safety (NCNS) was established as a consultancy body for the Prime Minister.

On June 17, 2010, the Prime Minister approved the Orientation Planning for Vietnam NPP Development up to 2030, in Decision No. 906/QD-TTg.

Table 2: Orientation Planning to Build NPPs in Vietnam

Nuclear Power Project	Year of Commission
Ninh Thuan 1, # 1, 1000MW	2020
Ninh Thuan 2, # 1, 1000MW	2020
Ninh Thuan 1, # 2, 1000MW	2021
Ninh Thuan 2, # 2, 1000MW	2021
NPP 3, # 1, 1000MW	2022
NPP 3, # 2, 1000MW	2023
NPP 4, # 1, 1000MW	2026
NPP 4, # 2, 1000MW	2027
NPP central 1 ,# 1, 1350MW	2028
NPP central 1 ,# 2, 1350MW	2030

Current status of NPP development

According to Resolution No. 41/2009/QH12, the first nuclear power project in Vietnam will be built in Ninh Thuan province and Vietnam Electricity (EVN) is nominated as the project investment owner. This project includes 4 units with the total capacity of 4000 MW. The first two units of 1000 MW will be put into operation in early 2020.

Ninh Thuan 1 NPP Project

October 31, 2010: Russia-Vietnam Inter-Governmental Agreement on cooperation in constructing NPP in Vietnam was signed in Hanoi.

November 21, 2011: Agreements on (i) finance for Site Approval Dossier and FS of Ninh Thuan 1 NPP project, and (ii) State export credit of Russian Federation for construction of NPP in Vietnam, were signed in Hanoi.

November 21, 2011: Contract for consulting services for developing Site Approval Dossier and FS of Ninh Thuan 1 NPP project was signed in Hanoi.

Ninh Thuan 2 NPP Project

October 31, 2010: Vietnam – Japan Joint Statement with reference to cooperation in construction of NPP in Vietnam was signed in Hanoi.

September 28, 2011: Contract for consulting services for developing Site Approval Dossier and FS of Ninh Thuan 2 NPP was signed in Hanoi. Finance was provided by the Government of Japan.

September 29, 2011: MOU between EVN and JINED for cooperation in Ninh Thuan 2 NPP project was signed in Hanoi.

October 31, 2011: Arrangement for cooperation in construction of Ninh Thuan 2 NPP in Vietnam was signed in Tokyo.

The financial arrangement between Vietnam and Japan is still under negotiation.

Action plan for Nuclear Power Program after Fukushima

Consistent with the NPP development plan and selecting the most modern technology with passive safety and proven systems, the government forced the relevant organizations to prepare seriously for the NPP Project. Such actions were

taken:

- Selecting the best sites
- Strengthening safety requirements against natural hazards, and increasing the level of safety design for earthquake and for tsunami after the Fukushima accident
- Establishing regulatory policies and an effectively independent regulatory body
- Concentrating on HRD for the nuclear program, as well as motivating R&D

Relevant legislation, in particular the 2008 Law on Atomic Energy, will be revised and promulgated as soon as possible in order to ensure an effectively independent regulatory body; a clear delineation of responsibilities of authorities involved in the nuclear power program; and adequate provisions on emergency preparedness and response, radioactive waste and spent fuel management, decommissioning, nuclear security, safeguards, and civil liability for nuclear damage.

6.3. Organizations

The responsibility of the SSC is not limited to the Ninh Thuan Nuclear Project. The outcomes of the SSC are distributed to all participating organizations as government orders to take necessary actions.

The formation of the 5 Technical Sub-Committees under the SSC is on-going: the formulation of 2 sub-committees will be done by the end of the 1st quarter of 2013, and the remaining 3 sub-committees by the end of 2013. The sub-committees are for Nuclear Safety and Security, chaired by Ministry of Science and Technology (MOST); NPP Technology, Nuclear Fuel and Radioactive Waste, chaired by Ministry of Industry and Trade (MOIT); Construction, chaired by Ministry of Construction (MOC); Nuclear Power Industry Development, chaired by MOIT; and Training, Public Information and Communication, chaired by MOST.

The Permanent Office of the State Steering Committee was established and staffed (6 employees) under MOIT in 2011. Its main responsibilities are to provide advice and assistance for the SSC; to coordinate work between SSC members and the relevant ministries, agencies and local authorities; and to assist the SSC in

supervising and monitoring the implementation of the project.

The National Council for Nuclear Safety (NCNS) was established as a consultancy body for the Prime Minister on nuclear safety. VARANS, the official nuclear safety authority of Vietnam, is a standing organization of NCNS that has responsibility for the working program preparation of NCNS, including all conditions for operation of NCNS. The President of NCNS is the Minister of MOST; the Vice-presidents of NCNS are the Deputy Ministers of MOST and MOIT; the Committees include the Deputy Ministers of Security, Defense, the General Director of VARANS, and experts in the field of nuclear safety.

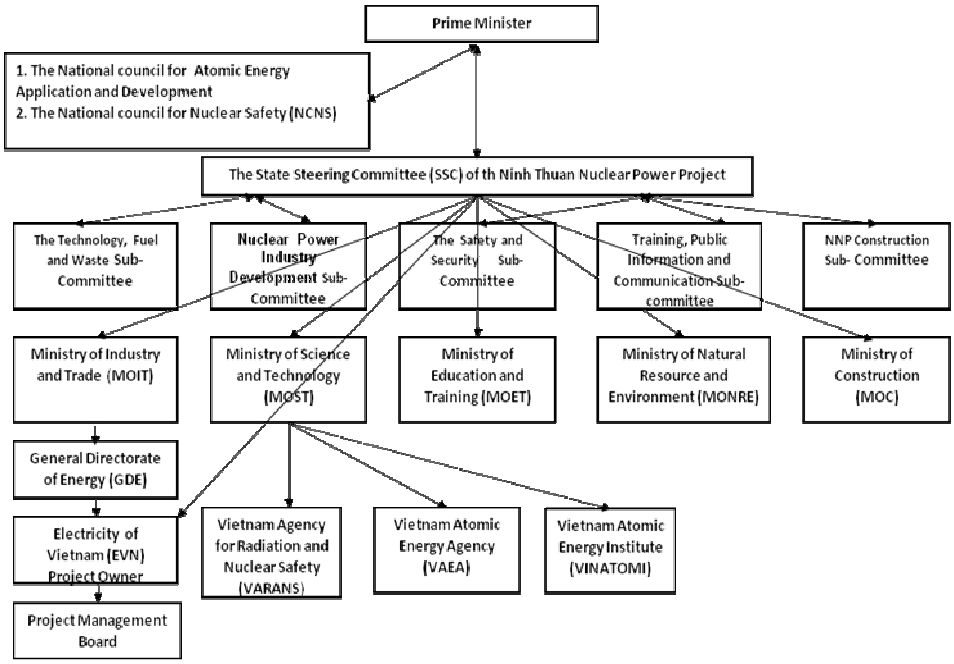
The National Council for Atomic Energy Application and Development was established as a consultancy body for the Prime Minister on atomic energy application and development for peaceful purpose.

The Ministry of Industry and Trade licenses commissioning and electricity operation based on comments from the National Council for Nuclear Safety. The Ministry of Science and Technology licenses the permission for construction of nuclear power plants based on comments from the National Council for Nuclear Safety.

The Ministry of Natural Resources and Environment cooperates with the MOST in guidance of the Energy Information Agency (EIA) for nuclear power plants, and evaluates and approves the EIA of nuclear power plant.

EVN was designated as the owner of the Ninh Thuan NPP Projects and the EVN Nuclear Power Project Management Board (EVNNPB) was established.

Figure 16: Organizational Structure for Nuclear Energy in Vietnam



7. Korea

7.1. Energy Demand/Supply Outlook

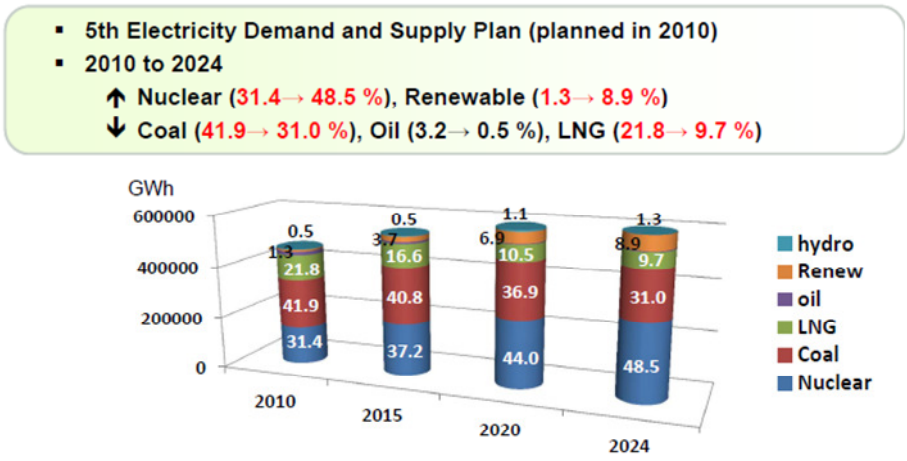
Korea adopted Long-term Vision for "Green Growth" as Basic plan for National Energy System in 2008. In this vision, the three main pillars are the expansion of nuclear and renewable, and energy efficiency. The energy mix in 2030 is shown in Table 3.

Table 3: Energy mix in 2008 and 2030

	2008	2030
Fossil energy	83%	61%
Renewables	2.4%	11%
Nuclear	14%	27.8%

In 2010, Korea announced the "National Energy Supply Plan by 2024." This plan shows the share of nuclear and renewable will be increased, while coal, oil, and LNG will be reduced. The details of the energy mix are shown in Figure 1-7-2.

Figure 17: 5th Electricity Demand and Supply Plan



GWh

Year	Nuclear	Coal	LNG	oil	Renew	hydro	Total
2010	144,856	193,476	100,690	14,693	5,949	2,084	461,747
2015	201,089	220,886	89,891	6,795	20,009	2,551	541,221
2020	259,378	217,454	62,081	3,039	40,648	6,256	588,856
2024	295,399	188,411	59,201	2,912	54,467	8,202	608,591

7.2. Nuclear Energy Policy and Development Plan

Since the introduction of the first NPP in 1978, the Korean government has maintained a consistent national policy of fostering nuclear power industries for stable energy supply, to overcome the insufficient energy resources in the country. In addition, the last Lee administration pushed the nuclear sector as a growth driver and a viable source of clean, green, and affordable energy.

With respect to Korea's energy policy, the need for national energy security to minimize dependence on oil and gas imports is a key consideration. Korea's energy policy will continue to have nuclear power as a major element of electricity production. Another important reason for the expanding role of nuclear energy is the cost advantage of nuclear energy compared to other fuels. The low cost of nuclear power comes from the economies of scale and learning effect resulting from continuous construction of nuclear power plants in Korea. The huge R&D investment in operations and maintenance process improvement also contributed to reducing cost and enhancing performance, including the utilization factor (the maximum demand of a system divided by its rated capacity) of nuclear plants, which then makes nuclear power more economical in the Korean market. As an example, nuclear power costs are the lowest in Korea: in 2008, the generation cost of nuclear was 39 won per kWh, compared with coal at 53.7 won, LNG at 143.6 won, and hydro at 162 won. As of now, nuclear power accounts for approximately 32% of the total electricity generation in Korea.

In 2008, the government finalized the first Korean National Energy Master Plan, which covers the period 2008-2030. According to the Master Plan, nuclear power would be expected to account for 59% of electricity production by 2030. To make this possible, the government will build 17 additional plants, totaling 38 NPPs by that year.

Consistent with the Master Plan, the Minister of Knowledge Economy (MKE) has to prepare and announce a Basic Plan of Long-Term Electricity Supply and Demand (BPE) on a biennial basis. The BPE provides long-term energy policy directions and information on electricity supply and demand, such as the electricity facility plan to secure stable electricity supply. Generation companies can apply for government approval of their generation business and power plant construction plans

based on the BPE.

The most recent BPE (the 5th) including nuclear power development was established in December 2010 and covers a planning period from 2010 to 2024. According to the 5th BPE, the government plans to increase the proportion of nuclear energy facilities within total energy facilities from 24.5% to 32%, and the proportion of nuclear power generation capacity within total power generation capacity from 31.4% up to 48.5%, by constructing a total of 11 NPPs by 2024 (including the 5 units (OPR1000 3 units, APR1400 2 units) that are currently under construction and an additional 6 units (APR1400) that are planned). The 6th BPE, stipulated on February 22, 2013, and covering a planning period from 2013 to 2027, has not made any decision on whether additional nuclear power plants will be constructed after 2024.

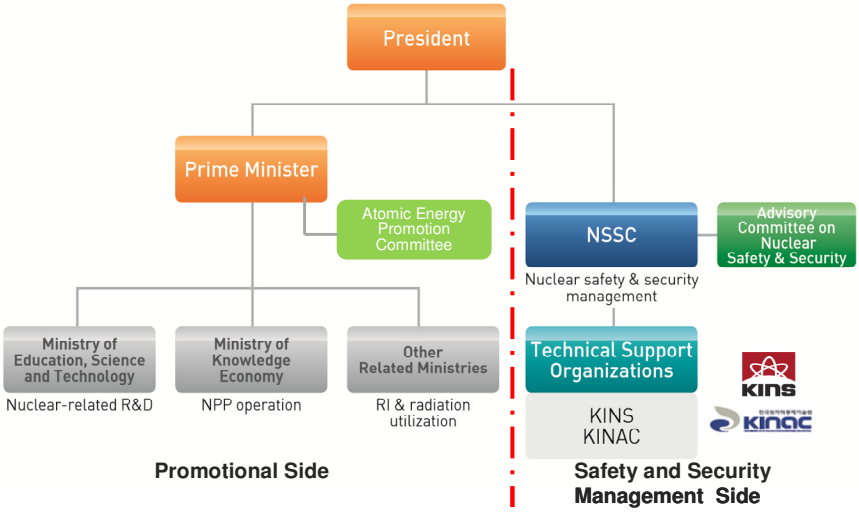
Positive anticipation is prevailing in the nuclear community that Korea will continue using and developing nuclear energy, together with strengthening the safety of nuclear power plants. There has been a general expectation that the policy on nuclear energy in the upcoming Park administration, after this February, will continue to keep the same position as in the Lee administration. It will be certainly based upon a common understanding widely distributed among the general public, even after the Fukushima accident: that is, as energy security is essential in Korea, the gradually expanding nuclear power plant policy is required. Fossil fuel has weaknesses in terms of reserves and environmental pollution, while renewable energy, such as solar, wind, and tidal power, is weak economically and in terms of energy security. Therefore, while enhancing nuclear safety step-by-step, the current nuclear policy must continue. Nuclear energy is expected to continue to have a role until nuclear fusion energy and innovative renewables become the main contributing power sources in the future.

In this regard, the second Korean National Energy Master Plan, to be announced by the end of 2013, will fully reflect the future direction of the new administration on nuclear energy policy. It will be finally determined through open and in-depth public discussion on the sustainability of nuclear energy.

7.3. Organizations

Korea's government bodies for nuclear energy are separated into a promotional side and a safety and security management side. Before Oct 26 of 2011, the Ministry of Knowledge and Economy (MKE) has responsibility for NPP operations and other energy policy. The Ministry of Education, Science and Technology has responsibility for nuclear-related R&D. As for the safety and security management side, the details are to be mentioned in Chapter 2.

Figure 18: Government Bodies for Nuclear Energy in Korea (as of 2012)



8. Japan

8.1. Energy Demand/Supply Outlook

Since the Fukushima accident on March 11, 2011, Japan's power supply portfolio has been significantly changed. Thirty-six nuclear power plants were in operation just before the accident. Ten plants were shut down directly by the earthquake; after the accident, only Ohi 3 and 4 received permission to restart. Consequently, Japan has depended heavily on thermal generation in these two years, and especially on oil and LNG. The share of thermal generation has risen from 60.25% in FY2010 to 89.62% in FY2012.

Table 4: Transition of the Power Portfolio in Japan

	Hydro	Thermal	Nuclear	Renewables
FY2010	8.08%	60.25%	31.39%	0.28%
FY2012(※)	8.18%	89.62%	1.87%	0.33%

As mentioned above, almost all NPP, which had supplied about 30% of domestic electricity, have been stopped. Japan twice experienced severe power shortages after the Fukushima accident. T o prevent blackouts, the government set strict power-saving targets for industry and households. Electric power utilities managed to secure the supply capacity by operating almost all thermal power plants and installing emergency power plants, such as gas turbines, which utilities can install in a short period. Even now, the situation where almost all NPPs are not permitted to restart has not changed, although some power plants damaged by the earthquake and tsunami have completed repair work and are now ready to come back to the grid.

Although the restart of nuclear power plants in Japan is regarded as critical in view of Japan's "3Es" (energy security, environmental protection, and economic efficiency), the necessary conditions for permission to restart the plants have continued to be uncertain since the Fukushima accident and still are not fixed as of May 2013. The new Nuclear Regulatory Authority of Japan (NRA), which was established in September 2012, states that the NRA will make technical assessments of safety for individual nuclear power plants, based on the new regulatory safety

standards. Consequently, the expected timing for restarting the nuclear power plants is still uncertain. Many experts in Japan seem to take a view that the restart may be possible in the late second half of 2013 at the earliest, as the formal process of the NRA assessment may begin after the new safety standards are established in July 2013. In these circumstances, it is quite likely that the short-term power balance in Japan will continue to be very severe for this fiscal year at least.

It is not only the short-term perspective that is uncertain: the long-term outlook is also uncertain and still subject to confused discussion. In the next section, the trends and the major issues for long-term energy and nuclear policy are discussed.

8.2. Nuclear Energy Policy and Development Plan

In 2010, the cabinet approved the Strategic Energy Plan of Japan, which described Japan's energy policy to 2030 (details shown in Figure 19). In this plan, the intention to raise the zero-emission power source ratio from 34% to about 70% and reduce energy-related CO2 emissions by 30% or more in 2030 (compared to the 1990 level) was declared. To achieve these targets, the share of nuclear power generation would be raised from 26% in 2007 to 53% in 2030.

After the Fukushima accident, the government decided to restructure the Strategic Energy Plan due to increasing public distrust of nuclear. To reconsider the energy plan, the government established three major meetings:

- Energy and Environmental Council (under the National Policy Unit)
- Planning "Innovative Strategy for Energy & Environment"
- Chaired by the Minister of State for National Policy
- Committee to Study Costs and Other Issues (under the National Policy Unit):
- Verifying the cost of generation
- Members include economists, engineers and consultants
- Fundamental Issues Committee (under METI):
- Discussing the details of the energy mix in order to make a revised Strategic Energy Plan
- Members include economists, engineers, consumer groups, environmentalists, private sector and anti-nuclear organizations

The Energy & Environmental Council adopted the "Innovative Strategy of Energy & Environment" on September 14, 2012. This strategy includes the following targets:

- Realization of a society not dependent on nuclear power:
- Strictly applying the stipulated rules regarding safety assurance and the forty-year limitation on operation
- Restarting the operation of nuclear power plants will be approved by the Nuclear Regulation Authority
- No new construction of nuclear power plants
- The government will mobilize all possible policy resources to such a level as to even enable zero operation of nuclear power plants by the 2030s
- Realization of green energy revolution
- Ensuring a stable supply of energy
- Bold implementation of reform of electricity power systems
- Steady implementation of global warming countermeasures

After announcing the zero-nuclear policy, industry and the government expressed their opinions against zero-nuclear, while the US, UK and France also expressed their concerns about zero-nuclear.

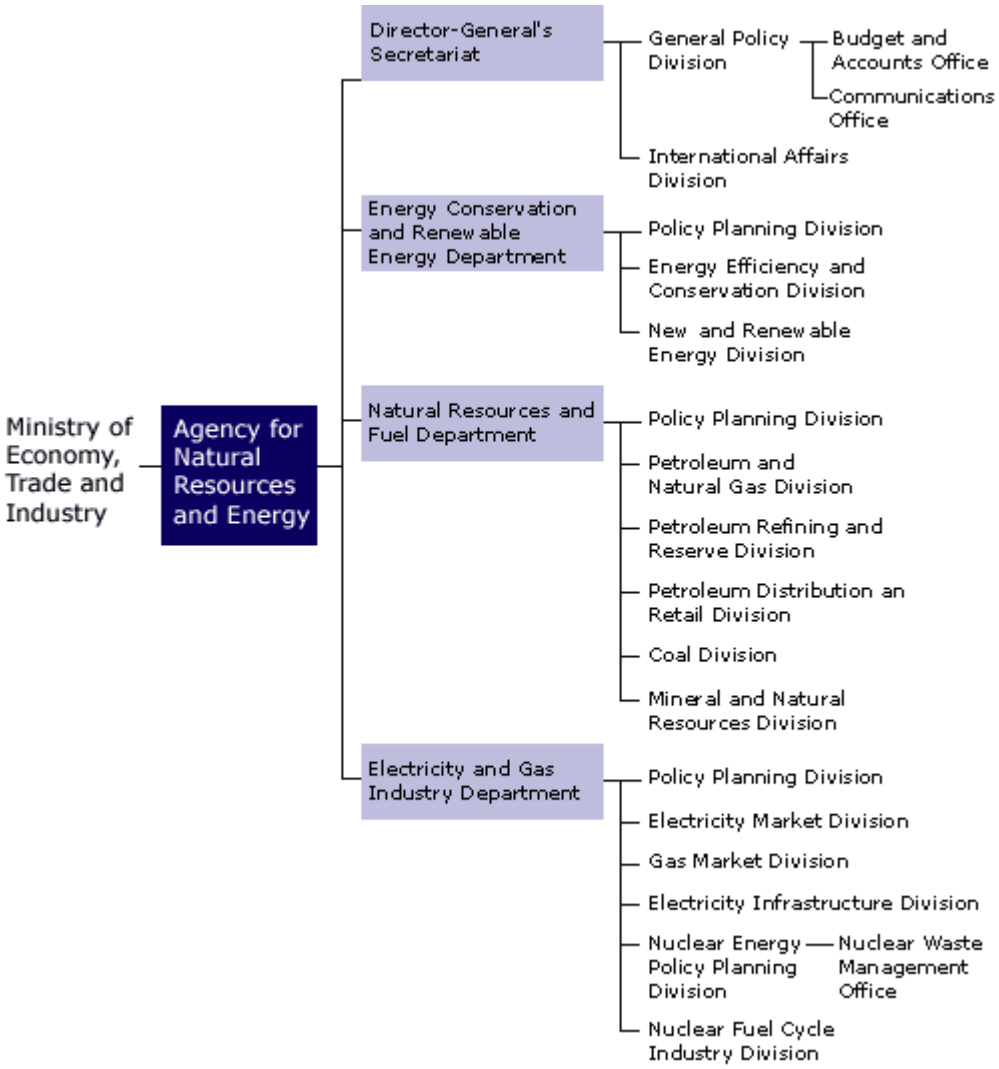
On September 19, 2012, the cabinet released a statement that "the Government of Japan will implement future policies on energy and the environment, taking into account the Innovative Strategy on Energy and the Environment," while not directly adopting the Strategy.

On December 16, 2012, the Liberal Democratic Party of Japan (LDP) won the Lower House election and the Abe Cabinet began. Prime Minister Abe said that the former DPJ cabinet's energy policy was "only a wish," and therefore he would make a firm energy policy. Soon after the election, the Abe cabinet started to reconstruct the energy policy discussion, especially on nuclear policy. In March 2013, the discussion on the long-term energy policy restarted in the General Subcommittee, an advisory committee for Natural Resources and Environment. Nothing certain has been determined as of May 2013.

8.3. Organizations

The Ministry of Economy, Trade and Industry (METI) is responsible for energy policy, including nuclear. The Agency for Natural Resources and Energy is one of the agencies within METI. The Nuclear Energy Policy Planning Division is in charge of nuclear energy policy development. Figure 19 shows the organization chart of the Agency for Natural Resources and Energy.

Figure 19: Organization Chart of Agency for Natural Resources and Energy



9. Summary and Policy Implications

Several ERIA member countries have been planning to introduce nuclear power, generally eyeing completion in the 2020s, under government initiatives derived in the light of growing electricity demand and the need for securing energy resources. In reality, however, these plans have been likely to experience delays by several years or more due to wavering discussions or concerns.

The severe accident that occurred in 2011 had a significant impact on nuclear development plans in Asian countries. In most countries the planning for introducing nuclear power is likely to be delayed or suspended. However, the delays and the ongoing discussions on introducing nuclear power have not arisen solely from the Fukushima accident. Every country has its specific situation and circumstances. Since nuclear is not the only option for securing energy and for protecting the environment, discussions toward a consensus should be continuously enhanced both domestically and cross-regionally.

CHAPTER 2

Nuclear Safety and Emergency Planning Schemes in Member Countries

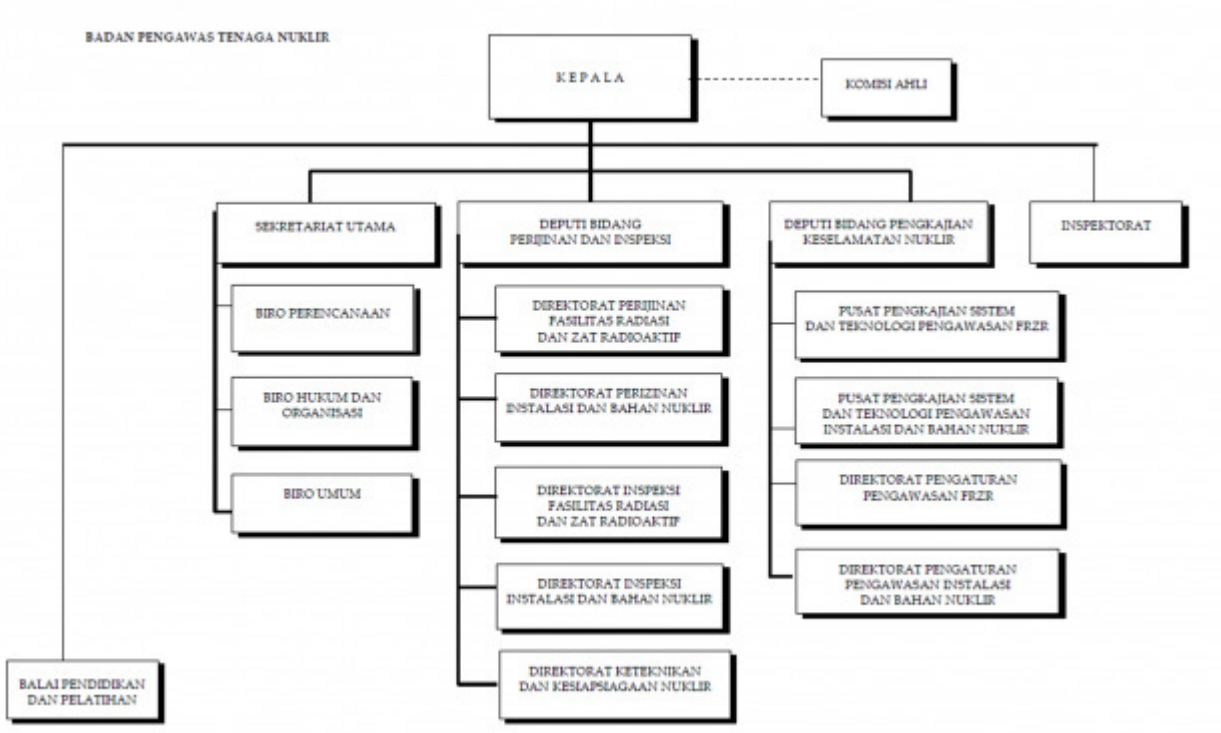
1. Indonesia

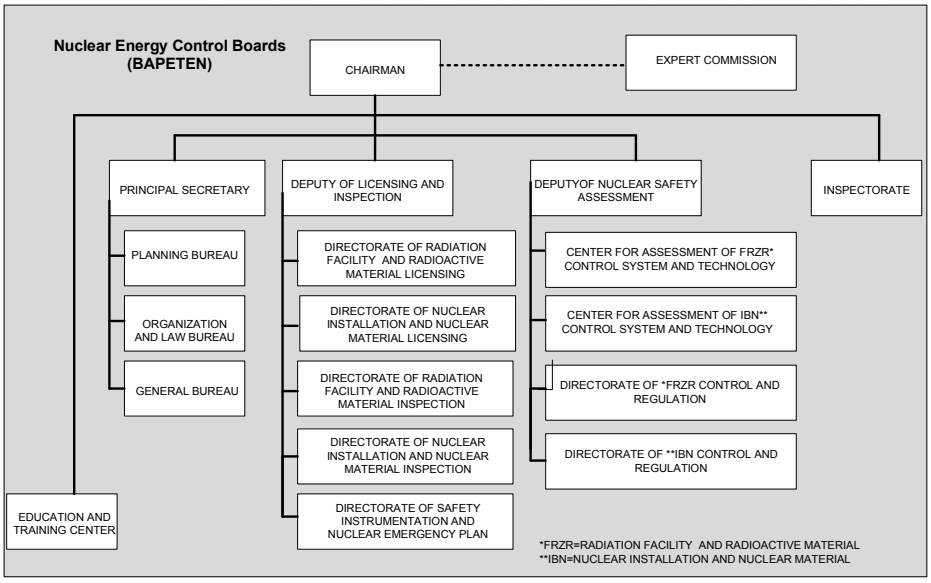
1.1. Safety Regulatory Authority

BAPETEN is the national nuclear regulatory authority of Indonesia. It was established in 1997 and has been in charge of safety assessment, licensing of nuclear facilities, safeguards, radiation protection, emergency planning, nuclear security, and physical protection. Act No. 10/1997 on Nuclear Energy, Article 14, designates BAPETEN as the sole and independent authority to control any nuclear energy utilization through regulation, licensing, and inspection. BAPETEN performs its functions through the implementation of licensing and inspection of the construction and operation of nuclear reactors, nuclear installations, nuclear material facilities, radiation sources, and the development of nuclear emergency preparedness. BAPETEN also takes the lead as the National Coordinating Authority (NCA) in establishing the National Emergency Preparedness and Response System in Indonesia.

As of 2013, there are some 41 experts working for safety assessment and the reviewing of nuclear facilities; 25 working for radiation protection; 20 for security and physical protection; and 15 for emergency planning. Figure 1 shows the organizational structure of BAPETEN.

Figure 1: Organization Structure of BAPETEN





1.2. Legislation

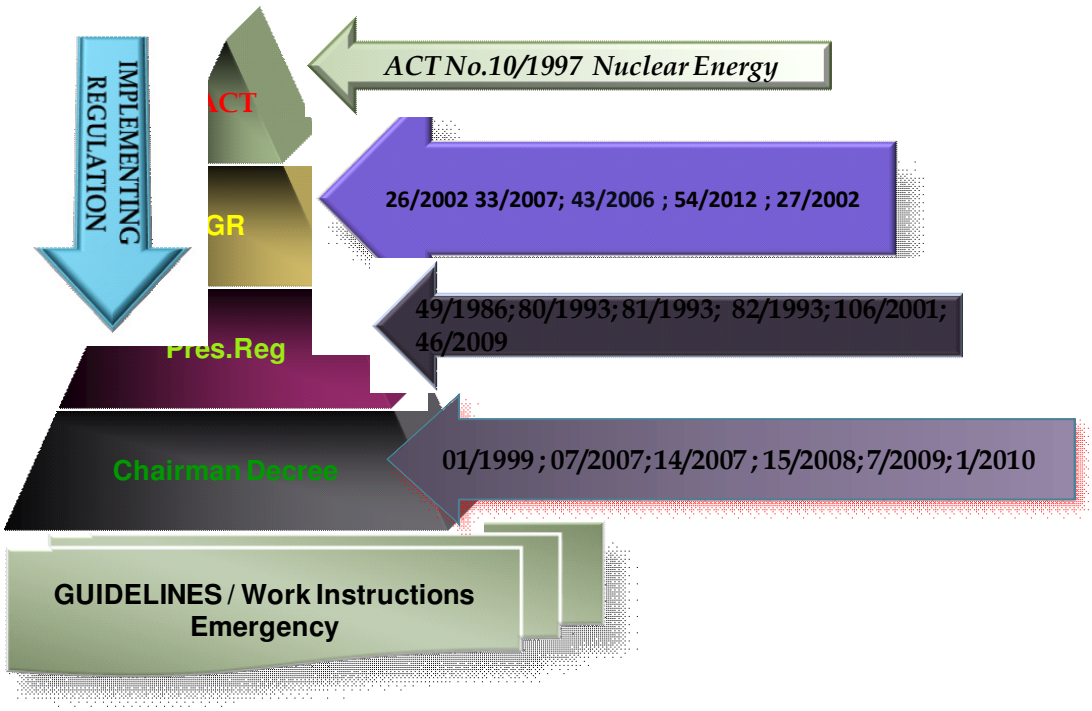
There are several layers of legislation concerning nuclear safety, security, and emergency planning. Act No. 24/2007 on National Disaster Countermeasures designates the National Disaster Management Agency (BNPB) as the responsible body in case of emergency, including radioactive releasing accidents. GR No.

54/2012 on Safety and Security of Nuclear Installation (Article 66-93, Paragraph on Emergency Preparedness System) establishes the National Nuclear Emergency Preparedness Organization (OTDNN) as a responsible body.

A licensee obliged to establish an Emergency Response Plan is subject to the following guidelines:

- GR No.54/2012 on Safety and Security of Nuclear Installation
- GR No.33/2007 on Safety of Ionizing Radiation Utilization and Security of Radioactive Sources
- GR No.43/2006 on Licensing of Nuclear Reactor
- GR No.26/2002 on The Safe Transportation of Radioactive Materials
- GR No.27/2002 on Radioactive Waste Management
- CD No. 01/2010 on Nuclear Emergency Preparedness and Response
- CD No. 8/2012 on Preparation of Safety Assessment Report of Non-Power Reactor

Figure 2: Legislation Structure for Nuclear Emergency Preparedness



2. Malaysia

2.1. Safety Regulatory Authority

The Atomic Energy Licensing Board (AELB) is the regulatory body responsible for all aspects of radiation protection and nuclear safety in Malaysia. The AELB was established under Section 3 of Act 304 and placed under the jurisdiction of the Prime Minister's Department on February 1, 1985, before jurisdiction was transferred to the Ministry of Science, Technology and Innovation (MOSTI) on October 27, 1990. The Board of the AELB consists of five members (a chairman and four others), all appointed by MOSTI; the Director General of the AELB serves as Executive Secretary.

The AELB's main objective is to regulate and control all nuclear activities, such as the use, transport, and import/export of radioactive and nuclear material, and the siting, construction, operation, and decommissioning of nuclear facilities. This is to ensure that such activities are carried out safely and do not endanger workers, members of the public, properties, and the environment with radiation hazards. To achieve these objectives, the AELB is responsible for the following issues:

- Authorizing the activities related to radioactive materials, nuclear materials, and radiation-producing devices after appropriate review and evaluation of proposed activity
- Conducting inspection (surveillance) and taking enforcement actions to ensure radiation safety requirements are being implemented
- Establishing standards and regulations for radiation protection and safe operation pertaining to atomic energy

The functions of AELB as stated in Act 304 are as follows:

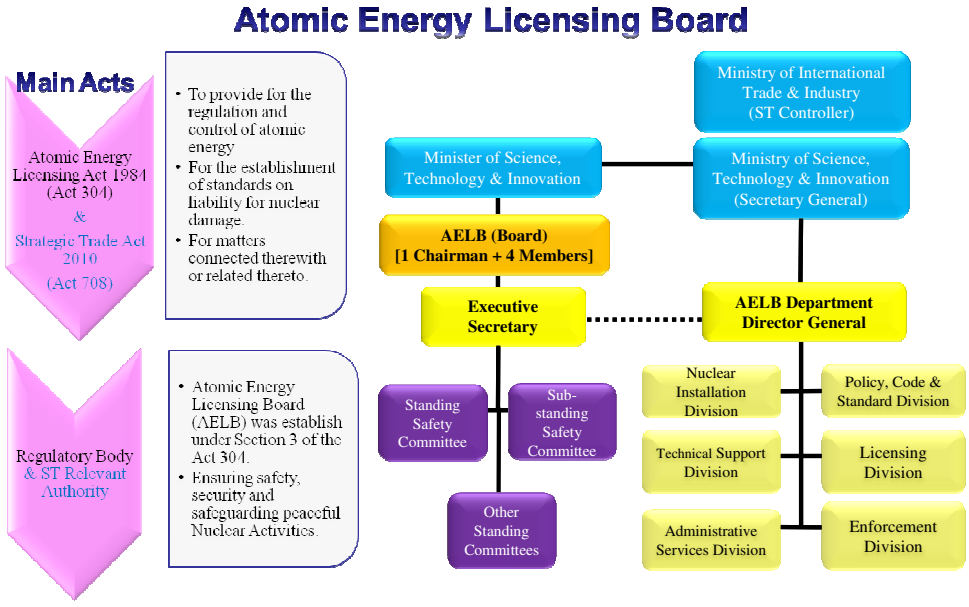
- To advise the Minister of Science, Technology and Innovation and the government of Malaysia on matters relating to the Atomic Energy Licensing Act 1984 and developments pertaining thereto, with particular reference to the implications of such developments for Malaysia
- To exercise supervision over the production, application, and use of atomic energy and matters incidental thereto
- To establish, maintain, and develop scientific and technical co-operation with

such other bodies, institutions, or organizations in relation to nuclear matters or atomic energy as the Board thinks fit for the purposes of the Atomic Energy Licensing Act 1984

- Where so directed by the government of Malaysia, to perform or provide for the performance of the obligations arising from agreements, conventions, or treaties relating to nuclear matters or atomic energy to which Malaysia is a party, where such agreements, conventions, or treaties relate to the purposes of the Atomic Energy Licensing Act 1984
- To do such other things arising out of or consequential to the functions of the Board under the Atomic Energy Licensing Act 1984 which are not inconsistent with the purposes of this Act, whether or not directed by the Minister

Besides regulating Act 304, the AELB is also responsible for regulating the Strategic Trade Act 2010 (Act 708), which was gazetted on October 1, 2010. This Act provides for control over the export, transshipment, transit, and brokering of strategic items, including arms and related material, and other activities that will or may facilitate the design, development, and production of weapons of mass destruction and their delivery systems, as well as other matters connected therewith. This Act is administered by the Ministry of International Trade and Industry (MITI) and the Controller is responsible for regulating the Act. Under this Act, AELB has been designated as a relevant authority and responsible for issuing permits for nuclear material and nuclear-related items. The organizational structure of AELB is shown in Figure 3.

Figure 3:Atomic Energy Licensing Board



2.2. Legislation

The safe use of atomic energy in Malaysia is governed by the Atomic Energy Licensing Act 1984 (Act 304). This Act provides for the regulation and control of atomic energy, for the establishment of standards on liability for nuclear damage, and for matters connected therewith or related thereto. Under this Act, any person who wants to carry out any activity – including the use, transport, or import/export of radioactive material, nuclear material, and irradiating apparatus; and the siting, construction, operation, and decommissioning of nuclear installations – requires a license from the Board of the AELB. The Board has the power to cancel or suspend any license issued under this Act if the licensee has committed an offence under this Act or committed a breach of any of the conditions of the license. To dispose, accumulate, and transport any radioactive waste is prohibited under this Act without prior authorization in writing from the Board. This Act also provides power to any senior public officer to enter, inspect, and take samples at all times at any premises, site, nuclear installation, or conveyance if he has reasonable ground to believe that there is activity being conducted which requires a license under this Act, and if any person contravenes any provisions of this Act there is a provision of penalty to those who commit an offense under this Act.

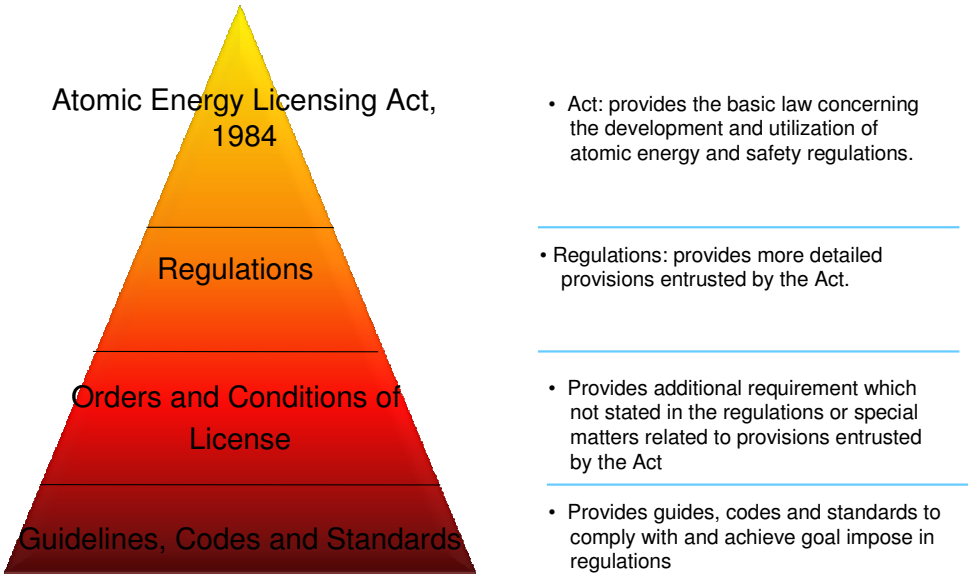
The Minister may, for the purpose of carrying out the provisions of this Act,

make any regulations and orders. Since the Act came into force, the government of Malaysia, with the recommendation of the Board, has gazetted several regulations, such as:

- Radiation Protection (Licensing) Regulations 1986
- Radiation Protection (Transport) Regulations 1989
- Atomic Energy Licensing (Appeal) Regulations, 1990
- Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011
- Atomic Energy Licensing (Basic Safety Radiation Protection) Regulations 2010

The regulations are then supported by a code of practices, standards, and advisory materials. The legal framework is shown in Figure 4.

Figure 4: Malaysian Legal Framework



3. Philippines

3.1. Safety Regulatory Authority

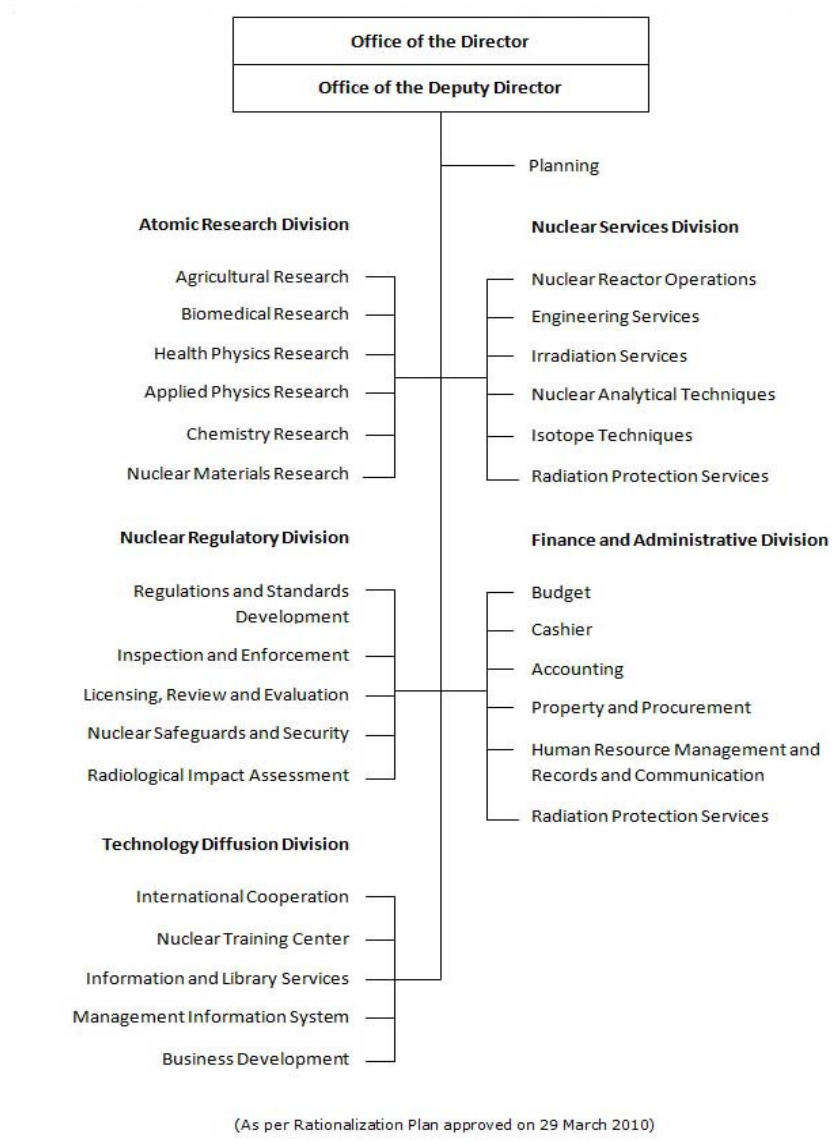
Regulations for nuclear facilities and radiation safety programs in the Philippines are inherent in the mandate of two executive offices in the Philippines: the Philippine Nuclear Energy Institute, under the DOST; and the Bureau of Health Devices and Technology, under the Department of Health. Currently, however, PNRI also serves as both the nuclear regulatory and promotional arm of the government.

The PNRI, formerly the Philippine Atomic Energy Commission (PAEC), is the sole agency of the government mandated to advance and regulate the safe and peaceful applications of nuclear science and technology in the Philippines. It is one of the research institutes under the DOST. Under Executive Order 128, the PNRI is mandated to perform the following functions:

- Conduct research and development on the application of radiation and nuclear techniques, materials and processes
- Undertake the transfer of research results to end-users, including technical extension and training services
- Operate and maintain nuclear research reactors and other radiation facilities
- License and regulate activities relevant to production, transfer and utilization of nuclear radioactive substances
-

The PNRI is headed by a Director, assisted by a Deputy Director. It is presently composed of 4 Technical Divisions and the Administrative/Finance Division. The organizational chart of PNRI appears in Figure 5.

Figure 5: Organizational Structure of the PNRI



Office of the Director (OD)

The Office of the Director (OD) formulates policies, overall thrusts, and strategic plans and provides executive direction in the implementation of nuclear research and development, technical services, technology diffusion, operations, and regulations for the peaceful uses of atomic energy in the country. It represents the Institute in international, regional, and national activities, and establishes collaborative programs and projects with local and international bodies.

Office of the Deputy Director (ODD)

The Office of the Deputy Director (ODD) assists the Director in the formulation of policies, overall thrusts, and strategic plans, and in providing executive direction in the implementation of nuclear research and development, technical services, technology diffusion, operations, and regulation of the peaceful uses of atomic energy in the country. It also represents the Institute in international, regional, and national activities, and assists in establishing collaborative programs and projects with local and international bodies.

Atomic Research Division (ARD)

The Atomic Research Division (ARD) focuses on research and development programs on the safe and peaceful uses of radioactive and nuclear materials, and atomic and nuclear techniques and processes, in order to contribute to government efforts to increase agricultural and industrial productivity, ensure health security, and safeguard the environment.

Nuclear Regulatory Division (NRD)

The Nuclear Regulatory Division (NRD) performs the regulatory functions of PNRI in licensing and regulating the possession and use of nuclear and radioactive materials and facilities, as mandated by Republic Acts 2067 and 5207 (both as amended) and Executive Order 128. The NRD also implements the PNRI Policy on Internal Nuclear Regulatory Control Program, and the coordination of nuclear and radiological emergency preparedness and response activities. in addition, the NRD undertakes activities in support of international commitments on nuclear safety, safeguards, and security of nuclear and radioactive materials and facilities.

Nuclear Services Division (NSD)

The Nuclear Services Division (NSD) is the service-oriented arm of the Institute, engaging clients from industry, business, government, the medical and academic sectors, and the research staff of the Institute, in order to provide specialized nuclear services that enhance product quality, improve processes, and generate information derived from the use of nuclear techniques. The Division offers, among others,

services such as irradiation of materials and commodities, dispensing of radiopharmaceuticals for the diagnosis and treatment of diseases, radiotracer technologies, calibration of radiation detection equipment, dosimetry, and engineering works and analytical testing that harness the unique, value-added role of nuclear techniques.

Technology Diffusion Division (TDD)

The Technology Diffusion Division (TDD) increases the awareness and understanding of stakeholders and the public on the various aspects of nuclear science and technology, and takes charge in the transfer and commercialization of technology and business development.

Finance and Administrative Division (FAD)

The Finance and Administrative Division (FAD) provides advice and assistance in policy formulation relevant to fiscal and administrative matters. FAD also provides administrative (Human Resource Management and Records/Communications, Medical Services), financial (Budget, Accounting, Property and Procurement, Cashiering), and auxiliary services (Plant Services, Motor Pool) for the successful implementation of the Institute's programs.

3.2. Legislation

The DOE and DOST should advocate for the refiling and passage of the Comprehensive Nuclear Energy Law (House Bill Nos. 3155 and 3254), which aims to create a Nuclear Energy Regulatory Commission. The proposed Commission would consolidate the regulation of the nuclear industry into one independent and strong regulatory body that directly reports to the President. Nuclear safety should necessarily be integrated into this enabling law.

Major national laws and regulations in nuclear power are as follows:

- Republic Act 2067 (Science Act of 1958) created the Philippine Atomic Energy Commission (PAEC).
- Republic Act 3859 (Amending RA2067) vested PAEC with a dual mandate to promote peaceful applications of atomic energy and to license and regulate the

use of radioactive materials.

- Republic Act 5207 (Atomic Energy Regulatory and Liability Act of 1968) authorized PAEC to issue licenses for the construction, possession and operation of any atomic energy facility, including nuclear power plants (NPPs).
- Republic Act 6395 (1971) authorized the National Power Corporation (NPC) to establish and operate NPPs.
- Presidential Decree No. 606 constituted PAEC as an independent and autonomous body and effected its transfer from the National Science Development Board (NSDB) to the Office of the President (OP).
- Presidential Decree No. 1206 (1977) created the Ministry of Energy (MOE), subsuming PAEC from OP.
- Executive Order 613 (1980) transferred PAEC from MOE back to OP.
- Promulgation of the Code of PAEC Regulations in 1981 included national standards and regulatory requirements, to wit:
- CPR Part 3: Standards for Protection Against Radiation
- CPR Part 4: Rules and Regulations on the Safe Transport of Radioactive Material
- CPR Part 7: Licensing of Atomic Energy Facilities (based mainly on US NRC documents and IAEA standards, codes and guidelines)
- Executive Order 708 (1981) attached PAEC to the Office of the Prime Minister.
- Executive Order 784 (1984) reorganized NSDB to National Science and Technology and placed PAEC under its supervision.
- Executive Order 980 (1984) converted PAEC into a multi-headed agency known as the Board of Commissioners and reaffirmed its role as the nuclear regulatory board.
- Executive Order 128 (1987) reorganized NSTA into the Department of Science and Technology (DOST) and PAEC became the Philippine Nuclear Research Institute.

Legislation proposed but pending in congress includes:

- House Bill No. 6300: An Act Mandating the Immediate Rehabilitation, Commissioning and Commercial Operation of the Bataan Nuclear Power Plant, Appropriating Funds therefore, and for Other Purposes (2009)

- House Bill Nos. 3155 and 3254: An Act to Regulate the Nuclear Security and Safety Aspects in the Peaceful Utilization of Radiation Sources through the Creation of the Philippine Nuclear Regulatory Commission, Appropriating Funds therefore, and for Other Purposes (2009)
- House Bill No. 1291: An Act Mandating an Immediate Validation Process which Satisfies Internationally Accepted Nuclear Power Industry Norms to Determine the Bataan Nuclear Power Plant's Operability, Culminating in either the Immediate Rehabilitation, Certification and Commercial Operation Or, the Immediate Permanent Closure and Salvage Value Recovery of the Bataan Nuclear Power Plant, Appropriating Funds therefore, and for Other Purposes (2010)

4. Singapore

4.1. Safety Regulatory Authority

There are currently no nuclear regulatory bodies or legislation related specifically to the use of nuclear energy, as Singapore does not have a nuclear power program. The Centre for Radiation Protection and Nuclear Science of the National Environment Agency regulates nuclear materials in the industrial and medical fields.

5. Thailand

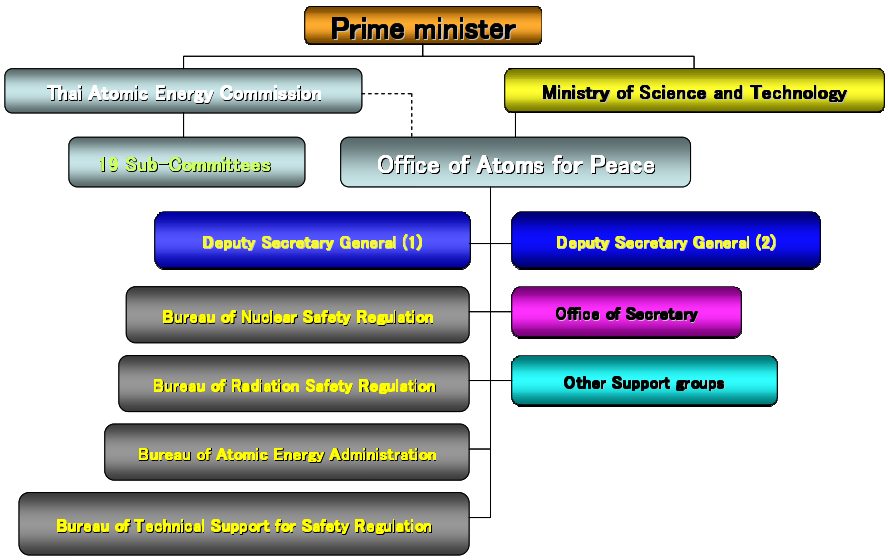
5.1. Safety Regulatory Authority

There is no nuclear regulator in Thailand, but the Office of Atoms for Peace (OAP), which is under the supervision of the Atomic Energy Commission and the Ministry of Science and Technology, will likely be a nuclear regulatory body in the future. OAP is currently responsible for drafting Atomic Energy for Peace Act, strengthening staff capabilities, and promoting public awareness of nuclear energy.

OAP has four missions:

- To formulate policies and strategic plans on the development and utilization of atomic energy, as well as to coordinate the plans and hence move towards realistic practice
- To perform R&D to promote the safe and extensive utilization of nuclear energy; to transfer nuclear technology and provide capacity for the useful utilization of nuclear technology for national development in medicine, agriculture and industry
- To regulate and ensure safe utilization of nuclear energy
- To be a center for technical cooperation and other activities associated with the peaceful application of nuclear energy, in collaboration with local and international organizations.

Figure 6: Office of Atoms for Peace Organization[1]



5.2. Legislation

The use of atomic energy in Thailand is legislated by the Atomic Energy for Peace Act, which was enforced in 1961. This act aims to protect life, health, and property from the hazards of nuclear energy and from the harmful effects of ionizing radiation. The act provides compensation for damage caused by nuclear energy or ionizing radiation, and aims to prevent danger to internal or external security from the use or release of nuclear energy and to meet obligations in the field of nuclear energy and protection against radiation.

[1] Office of Atoms for Peace (OAP), Chalathip Kueakob

6. Vietnam

The Law on Atomic Energy (Law No. 18/2008/QH12) defines radiation and nuclear safety. These definitions reflect the fundamental safety objective of the IAEA Fundamental Safety Principles, which is to "protect people and the environment from the harmful effects of ionizing radiation." Many staff members from multiple organizations in Vietnam, including EVN and VARANS, have been trained in basic nuclear power principles, nuclear safety principles and IAEA Safety Requirements and Guides. Much of this training has been conducted/coordinated via IAEA programs, or via bilateral agreements with other states (most notably, the Russian Federation, Japan, and the United States). Various government officials have met with representatives of the Regulatory Cooperation Forum regarding the importance of a competent and independent regulatory body.

VARANS has also been assisted by the US NRC in developing informal guidance related to the resources needed to review a safety analysis report. Although all organizations recognize the importance of a strong safety culture, programs are not yet planned for the development of safety culture in the relevant organizations (EVN, VINATOM, VARANS). VARANS is preparing new regulations regarding natural hazards analysis and severe accident management.

6.1. Safety Regulatory Authority

Governmental Decree 28/2008/ND-CP established the Vietnam Agency for Radiation and Nuclear Safety (VARANS) as a regulatory body. VARANS is an agency under the MOST with the duty of assisting the Minister in the state's management of radiation and nuclear safety. MOST Minister Decision 2248/QD-BKHCN details its roles, responsibilities, and organizational structure. The organizational structure of VARANS includes: Department of Administration and Planning; Department of Licensing; Department of Nuclear Control; Department of Nuclear Safety; Department of Inspection; Department of International Cooperation; Department of Legislation and Information; Department of Training; Department of Technical Assistance for Radiation and Nuclear Safety.

VARANS reviewed and approved the Safety Analysis Report for Nuclear Power

Plants, in which it aims to organize and develop international cooperation activities in radiation and nuclear safety as assigned by the Ministry, and to participate in the execution of international treaties and other international agreements on radiation and nuclear safety.

The General Directorate of Energy (GDE) was also established under MOIT. The main role of the GDE is assisting MOIT in the development of energy programs, including nuclear, and in licensing NPP operation based on comments of the National Council for Nuclear Safety, implementing the Nuclear Power Plants Development Plan, cooperating with international partners, negotiating and signing agreements and treaties on NPP cooperation, organizing trainings on nuclear power plant management, and approving NPP design.

6.2. Legislation

Current legislation related to nuclear safety/security is as follows:

- Law on Atomic Energy 2008 (No. 18/2008-QH12): required to develop and promulgate secondary legal documents, including NPP standards
- Decree No. 70/2010/ND-CP: detailed implementation direction for several articles of the Nuclear Power Law on NPP
- Circular No. 19/2010/TT-BKHCN: guidance on inspection of radiation and nuclear safety
- Circular No. 02/2011/TT-BKHCN: guidance on control of nuclear materials and source materials
- Circular No. 28/2011/TT-BKHCN: guidance on safety assessment, NPP site selection
- Circular No. 30/2012/TT-BKHCN on the requirements for nuclear safety in NPP designs (based on IAEA document No. SSR-2)
- Circular No. 29/2012/TT-BKHCN on the requirements for contents of Preliminary Safety Analysis Report (PSAR)
- Requirements for the establishment and approval of an emergency preparedness plan for nuclear and radiation
- Circular No. 23/2012/TT-BKHCN on the safe transport of radioactive materials, including requirements regarding criticality safety

- Circular No. 19/2012/TT-BKHCN on ensuring radiation protection for occupational exposure and public exposure

Detailed requirements (circulars) regarding the safety categorization of systems, structures, and components are planned for completion and approval in 2013 and the following years.

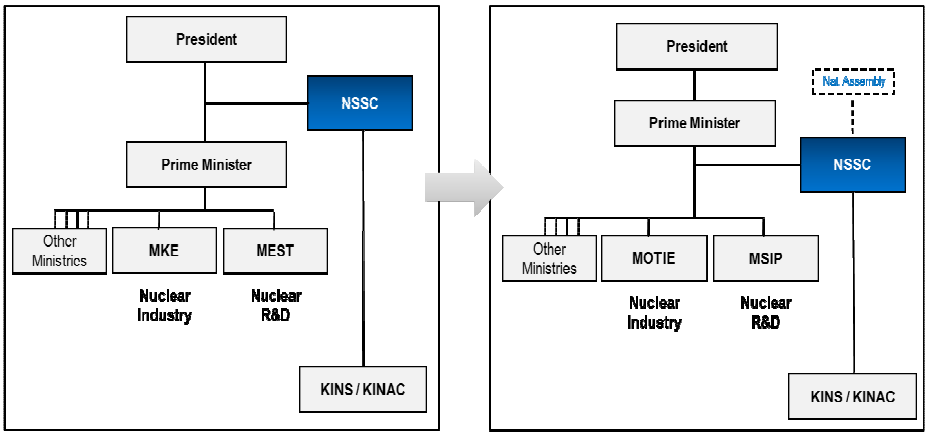
7. Korea

7.1. Safety Regulatory Authority

Fukushima accident played a role as trigger in creating an independent Nuclear Safety Commission under the control of the President, which would take over the mission, duties and responsibilities of the Ministry of Education, Science and Technology (MEST). The Nuclear Safety and Security Commission (NSSC) was launched on Oct. 26 of 2011, to ensure its independence and upgrade nuclear safety amid widespread public fears in the wake of the Fukushima accident. Previously, the nuclear safety authority in Korea was a department under the Minister of Education, Science and Technology (MEST), before October of 2011.

However, once again, new government decided to move the governmental position of NSSC under the control of Prime Minister, and an amendment of Government Organization Act including the act on establishing and operating NSSC was passed in March of 2013, which still guarantees sufficient independence from other government organizations. The amendment of the act on establishing and operating NSSC includes that the NSSC consists of 9 commissioners including a chairperson of the vice-minister level. Only chairperson and one commissioner are standing, and chairperson shall be appointed by the president at the recommendation of the Prime Minister. Half of eight commissioners shall be appointed by the President at the recommendation of the Chairperson and the other four commissioners shall be appointed by the president at the recommendation of the National Assembly.

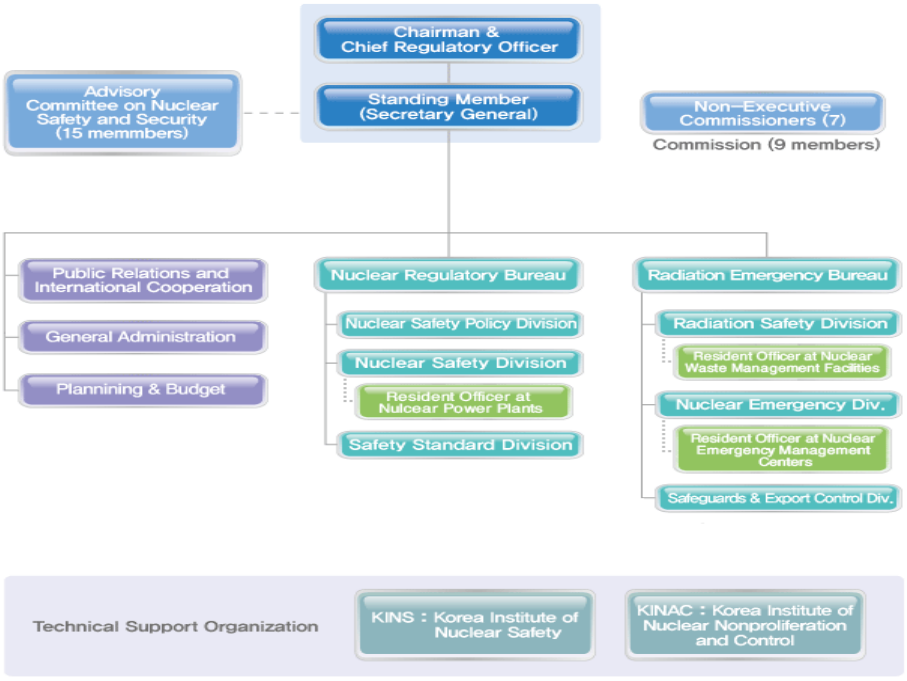
Figure 7: Reform of Regulatory System in South Korea



Function	Before	After
Nuclear Industry	MKE	MOTIE
Nuclear R&D	MEST	MSIP
Safety Regulation	Under the President (Minster Level)	Under the Prime Minister (Vice-Minister Level)

MKE : Ministry of Knowledge and Economy
MEST : Ministry of Education, Science and Technology
MSIP : Ministry of Science, ICT & Future Planning
MOTIE : Ministry of Trade, Industry and Energy

Figure 8: Organizational Chart of the NSSC

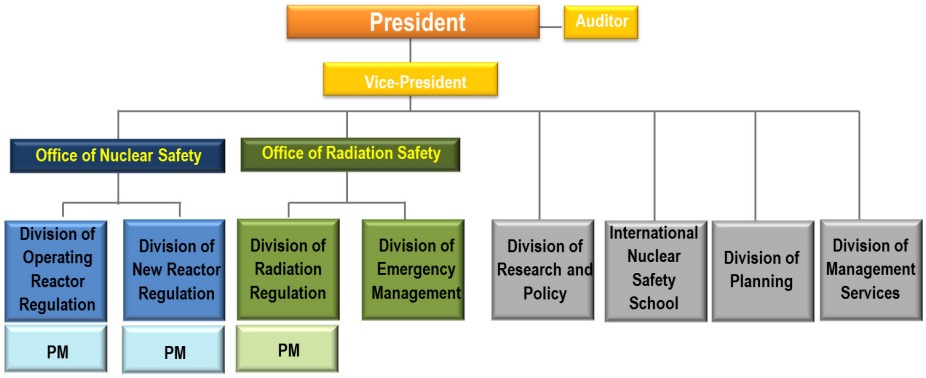


From a legislative point of view, the authority to regulate nuclear safety and establish nuclear safety policies is clearly entrusted to the NSSC through relevant laws, including the NSA. The Commission also maintains a close cooperative

system with other government agencies that are in charge of some activities relating to nuclear safety management in pursuance of their own functions, per the Government Organization Act. For example, under close cooperation with the Commission, the Ministry of Public Administration and Security (i.e., the National Emergency Management Administration under this Ministry) is responsible for national emergency preparedness at nuclear power facilities, and rescue efforts in case of an emergency like a fire.

The government established the Korea Institute of Nuclear Safety (KINS) in 1990 and the Korea Institute of Nonproliferation and Control (KINAC) in 2006, as regulatory expert organizations for supporting the Commission in strengthening technical capabilities related to nuclear safety regulation, as such regulation requires considerable knowledge of specialized technology. Under entrustment from the Commission, KINS is in charge particularly of technical aspects of nuclear safety regulation, including safety reviews, inspections, education, and safety research, based on technical knowledge and accumulated regulatory experience. KINAC carries out tasks entrusted by the Commission with respect to physical protection of nuclear power-related facilities and nuclear materials, related safety measures, and import and export control.

Figure 9: Organizational Structure of KINS

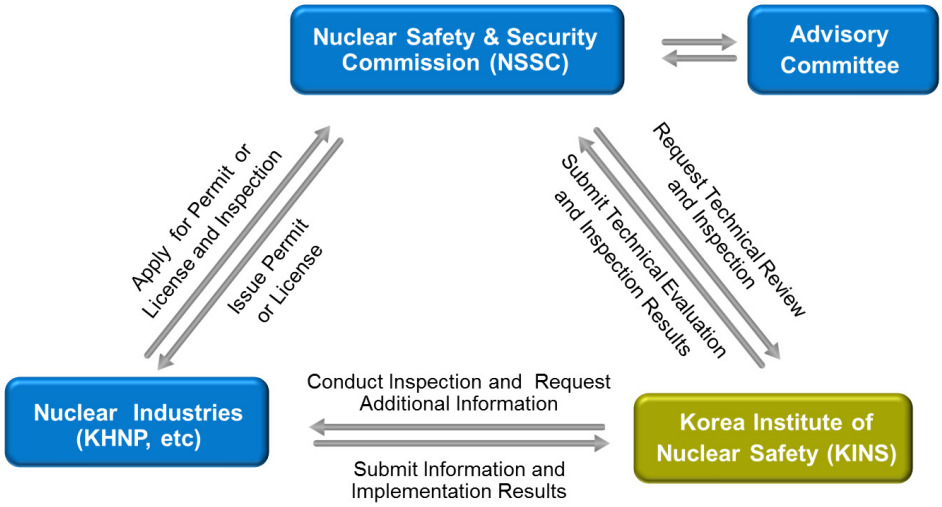


-Total Staff : 415 (Technical Staff of 88.4%)
(As of April 2012)

For closer regulatory support between the NSSC and its regulatory expert organizations, a few employees from KINS and KINAC are dispatched as liaison officers to NSSC headquarters. Furthermore, regulatory operations, such as the on-site inspection and supervision of the resident offices established in the nuclear facility sites, are jointly conducted by the NSSC and the resident inspectors dispatched by KINS and KINAC.

To fulfill its responsibilities in a better and more effective way, the Commission organizes and makes use of several consultant committees, including the Advisory Committee on Nuclear Safety and Security (ACNSS), to obtain valuable consultation and in-depth review on important technical issues under its jurisdiction. The Committee consists of up to 15 senior experts and is divided into 12 areas focusing on nuclear technological areas, including nuclear reactor physics, security and non-proliferation, and radioactive waste. The NSSC may also organize and operate the Special Ad-hoc Investigation Committee if nuclear and/or radiation accidents occur. Both Committees have been carrying out their responsibilities with technical support from KINS or KINAC.

Figure 10: Mechanism for nuclear safety in Korea



Last January, as part of a sweeping government reorganization plan, the presidential transition committee proposed a plan that would change the status of the NSSC. If the plan goes ahead, the current presidential body will be downgraded to a

body affiliated to a newly created super-ministry in charge of policies on science research, information and communications technology, and atomic energy development. In addition, the NSSC would be led at the vice-minister level. The government reorganization plan is currently under review at the National Assembly. Until now, most of the lawmakers involved in the issue have been opposed to the plan and have tentatively agreed to draw up an alternative option to move the Commission to the Prime Minister's Office.

The decision to separate the Commission from the newly created ministry is intended to guarantee and strengthen the independence of safety from the promotion of nuclear energy. This institutional arrangement might be of great help, but what is more important is how the Commission is actually operated by its members. The final decision on the fate of the Commission will be made soon.

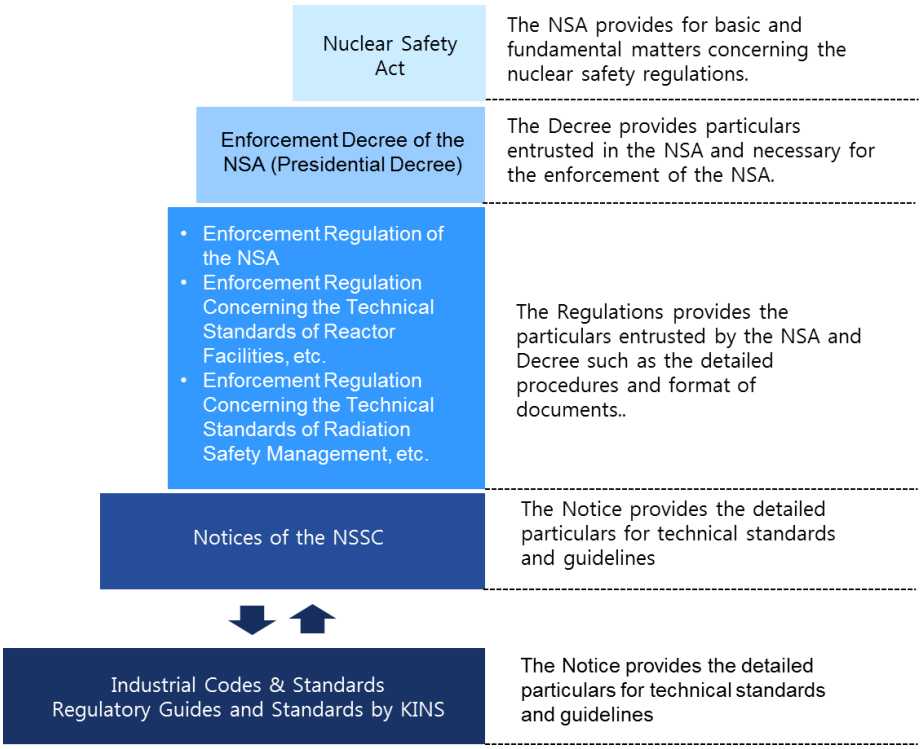
7.1. Legislation

There are several laws concerning nuclear safety and security:

- Nuclear Safety Act: To provide basic and fundamental matters regarding safety regulations
- Physical Protection and Radiological Emergency Act:
- To establish a system for physical protection of nuclear materials and nuclear facilities
- To provide legal and institutional bases for preventing radiological disaster and constructing countermeasures against radiological emergencies
- Act on Establishing and Operating the Nuclear Safety Commission
- Act on the Korea Institute of Nuclear Safety
-

The Nuclear Safety Act (NSA) is the most significant law for nuclear safety. The NSA provides for basic and fundamental matters concerning nuclear safety regulations. The legislative framework for nuclear safety is shown in Figure 11.

Figure 11: Legislative Framework for Nuclear Safety



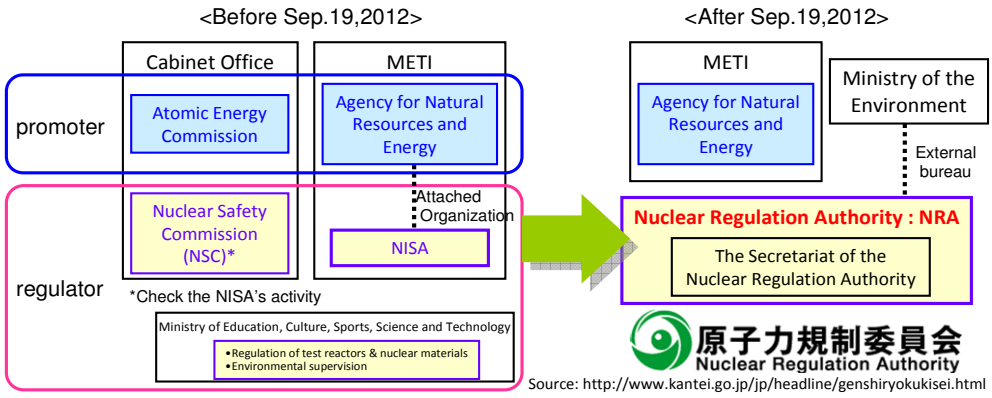
8. Japan

8.1. Safety Regulatory Authority

Before the Fukushima accident, nuclear facilities were regulated by the Nuclear and Industrial Safety Agency (NISA), which was under the Ministry of Economy, Trade and Industry (METI). The Agency for Natural Resources and Energy, which is a promoter of nuclear energy, was under the METI as well. The regulatory authority was not independent in Japan.

After the Fukushima accident, a new regulation authority, the Nuclear Regulation Authority (NRA), was established as an independent organization, on September 19, 2012. The NRA is under the umbrella of the Ministry of the Environment; however, the authority is independent both from the government and from the political parties.

Figure 12: Nuclear Regulatory Organization Structure in Japan

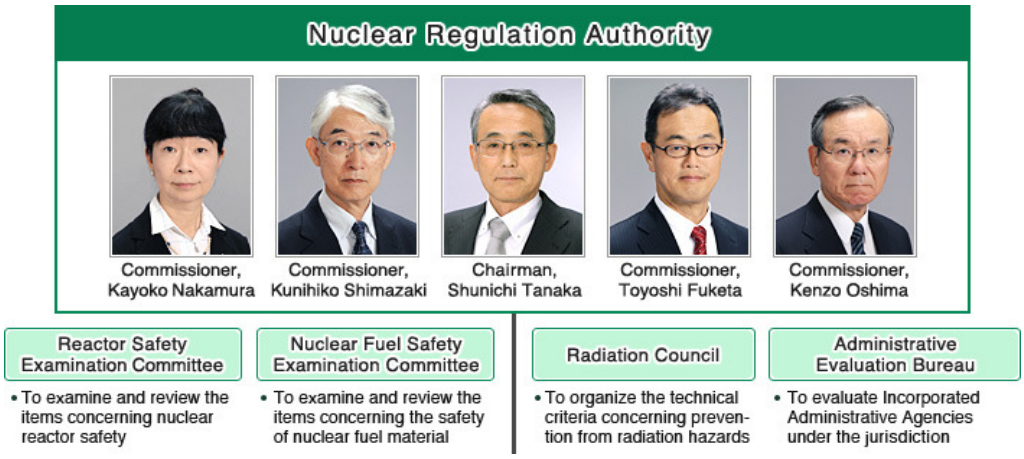


According to the core values of the NRA, it was established to absorb and learn the lessons of the Fukushima accident, and the nuclear safety system and management must be rebuilt on a solid basis, placing the highest priority on public safety and a genuine safety culture. Its guiding principles for activities are as follows:

- Independent Decision-Making
- Effective Actions
- Open and Transparent Organization
- Improvement and Commitment
- Emergency Response (preparedness)

One chairman and four commissioners were appointed by the government, and there are some committees and other divisions, as shown in Figure 13. The number of NRA staff is about 450, many of whom came from the old regulatory authority under METI, as well as some staff from the departments of police and defense.

Figure 13: NRA Commissioners and Committees (Source: NRA homepage)



A number of study teams, advisory committees and expert committees were established under the NRA. Eighteen committees are active as of May 2013, and they are discussing the new regulatory standards, specific site fracture zones (active faults), nuclear security, investigation of Fukushima accident, and so on.

8.2. Legislation

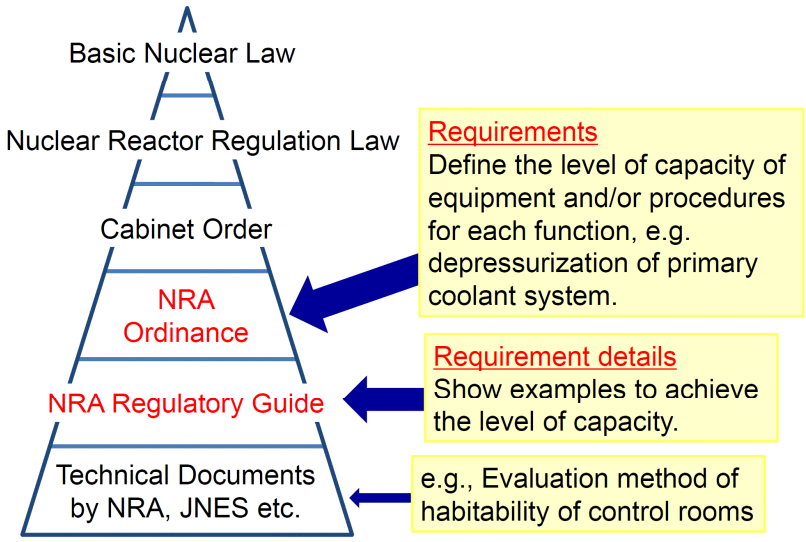
Amendments to the nuclear regulation act were promulgated in June 2012. Under this act, regulations have been enhanced in several areas:

- New regulation on severe accidents: Legally requested measures to prevent and to mitigate severe accidents
- Regulation based on state-of-the-art information: Develop new regulatory standards and apply to existing nuclear facilities (backfitting); introduce new systems (e.g., design certification)
- Forty-year operational limit for NPPs: Legally define the limit to 40 years; NRA can permit an extension of less-than-20-years
- Special regulation for disaster-experienced NPPs
-

The structure of NPP regulation legislation is shown in Figure 14. The draft New Safety Standards (NRA Ordinance and NRA Regulatory Guide in this figure) were released at the end of 2012; public comments were solicited from February 7 to February 28, 2013. The NRA and its study teams are discussing the new safety

standards in light of the public comments. The new safety standards are expected to be enforced in July 2013.

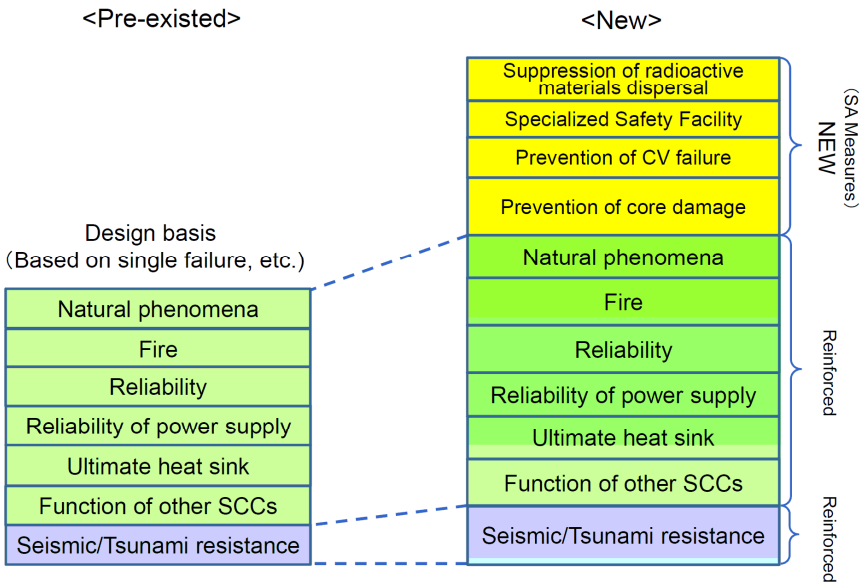
Figure 14: Structure of NPP Regulation Legislation



Source: NRA homepage.

The NRA has released some draft safety standards, whose requirements are reinforced and added as shown in Figure 15:

Figure 15: Structure of Proposed Requirements



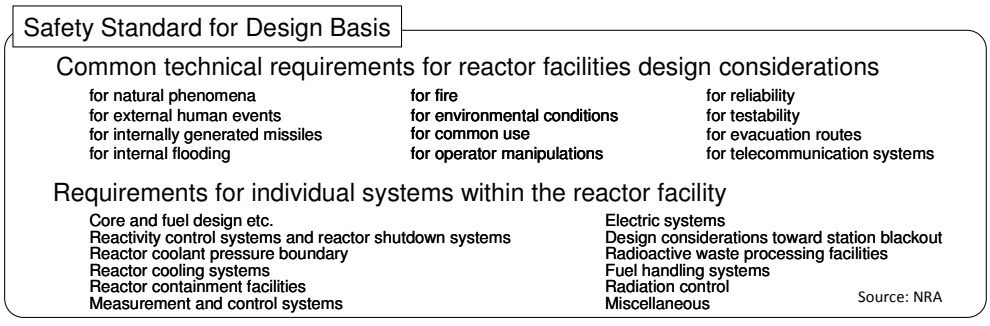
Source: NRA homepage.

Safety Standard for Design Basis

Before the Fukushima accident, there was a safety standard for design basis. The new safety standard for design basis is based on the old one but a few regulations have changed:

- Consideration of internal flood, airplane crash, terrorism (including cyber terrorism), etc.
- Consideration of fire protection (in a new guide which will be decided later)
- Preparation of fuel for emergency diesel generators for 7 days

Figure 16: Example of the Safety Standard for Design Basis

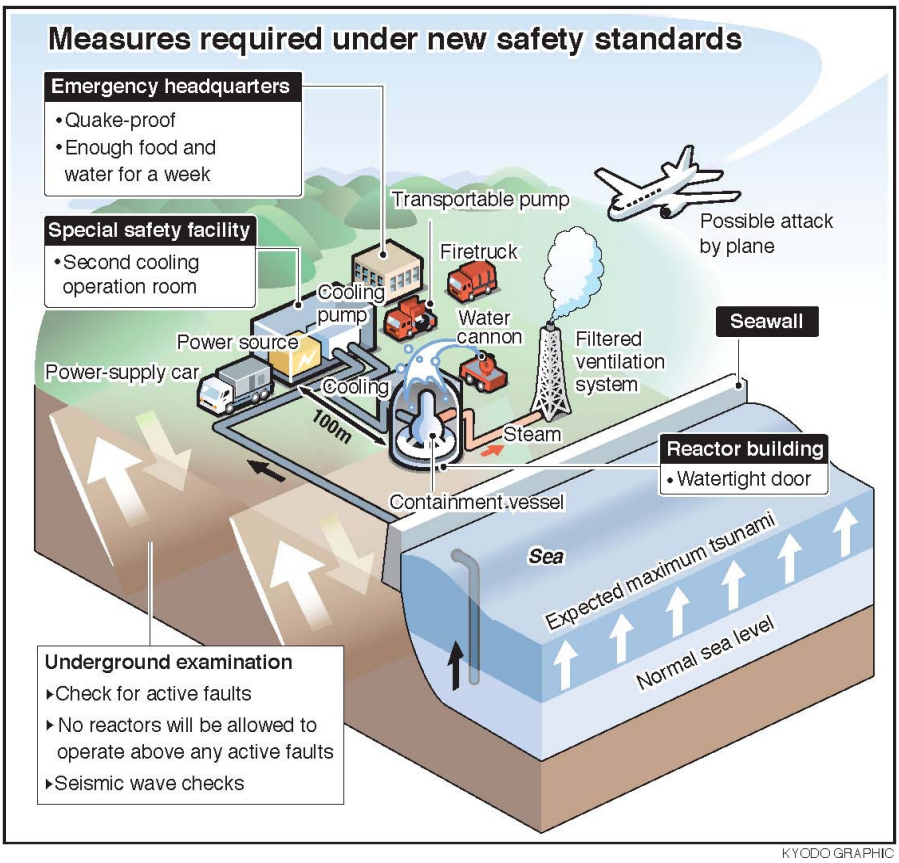


Safety Standard for Severe Accident

Under this standard, many measures are required to be put in place:

- Equipment to manage a severe accident (portable electricity power supply and water supply pumps, etc.)
- Emergency headquarters and specific safety facilities (to mitigate the release of radioactive material after core damage by natural hazard, airplane crash, etc.)
- Preparation of procedures, implementation of drills, and development of emergency response organization

Figure 17: Measures Required under New Safety Standards



Source: The Japan Times.

Safety Standard for Earthquakes and Tsunamis

Before the Fukushima accident, the "Regulatory Guide for Seismic Design" was the safety standard for earthquakes and tsunamis, but little was written about tsunamis in the old guide. In the new safety standards, requirements for the assessment of tsunamis (and earthquakes) are strengthened:

- Requirement to decide design based tsunami (the operator has to consider not only tsunamis caused by earthquake, but also by volcano, etc.)
- Important equipment has to be waterproof or installed higher than the design-based tsunami height
- Important equipment should not have to be installed on active faults (this was indirectly required before Fukushima)
- Active faults are defined as those that have moved in the last 400,000 years (before Fukushima, this was 120,000 – 130,000 years)

Opinions from the operators/experts

Operators and experts have some opinions against the draft safety standards, as follows:

- The new safety standards should be based on defense-in-depth; management should be evaluated under beyond-design conditions, discussed and determined based on scientific and technically reasonable evidence (plant life limit within 40 years, definition and assessment of active faults, etc).
- The current draft safety standards fail in that they are not performance-based regulation but only hardware regulation, and leave little room for alternative measures (diversified emergency power sources, containment venting systems, alternative control center, etc).
- They are also not best prepared for unexpected events.
- There is little consideration of the relative risk which is excessively severe among other countries in the world (beyond the international standards).
-

Despite these severe criticisms, the draft safety standards will likely be fixed and endorsed in July 2013.

CHAPTER 3

International Cooperation on Emergency Preparedness and Human Resources Development

1. Indonesia

1.1. National Plan for Emergency Preparedness

The basic concept of the national nuclear emergency plan in Indonesia is to ensure that the arrangements for a nuclear emergency response are available on the facility, local government, and national levels. The functions of the response are defined, including identification, notification and activation, mitigatory action, urgent protective action, protection of emergency workers and the public, and information and instruction to the public.

Figures 1, 2, and 3 show the organization of emergency response at the national, province and facility levels. The role of the technical support section in each organization is to collect information, analyze the facts, and advise the operating team and any other relevant parties. The role of the operating section is to share information and conduct necessary actions.

Figure 1: Emergency Response Organization on the National Level

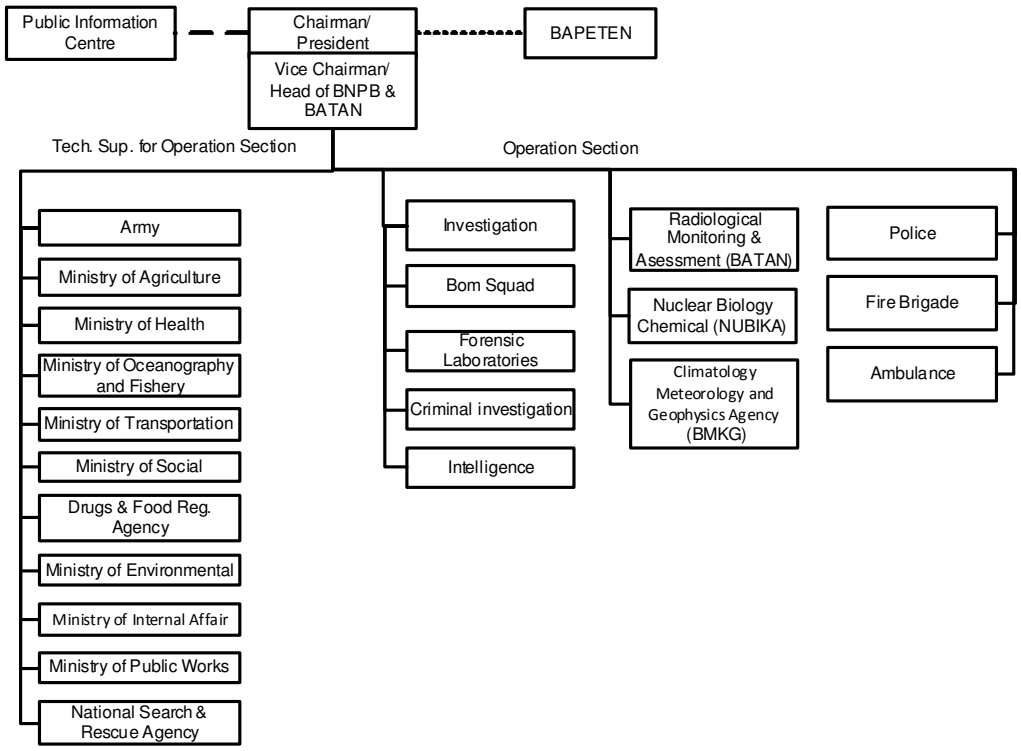


Figure 2: Emergency Response Organization on the Local Government Level

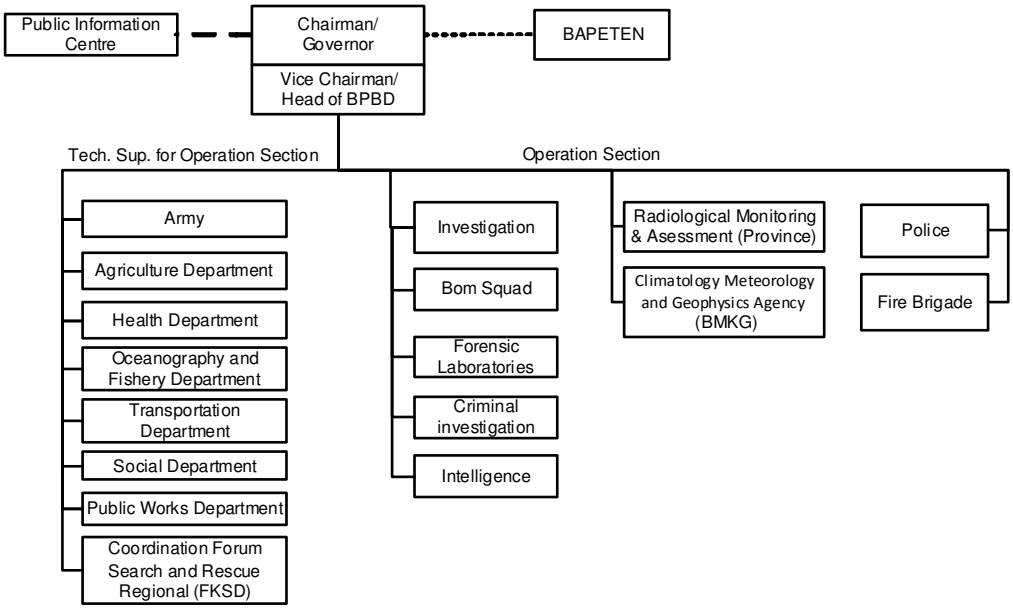
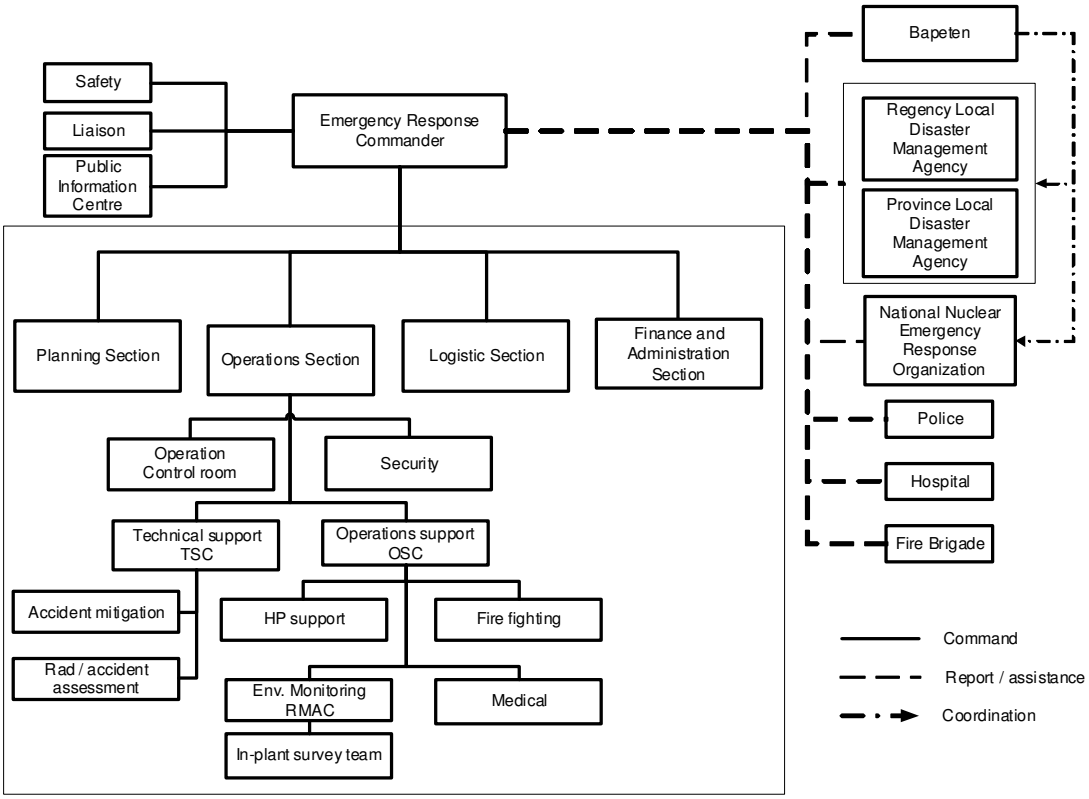


Figure 3: Emergency Response Organization on the Plant Level



The Indonesian Nuclear Agency (BATAN) is responsible for the technical operation, in cooperation with the national emergency agency. It also conducts emergency environmental monitoring based on ERMEWS information, survey and critical group dose analysis, radiological impact assessment for the short, intermediate and long terms, waste management, and medical emergencies with the health ministry. The role of BAPETEN is to control the safety and security of the emergency response, to advise the Incident Commander on decision-making in emergency responses, and to coordinate with the IAEA. There is a dispatch team (FAT) for radiological emergencies within BAPETEN and it has some experience with radiation emergency activities.

1.2. International Cooperation on Emergency Preparedness

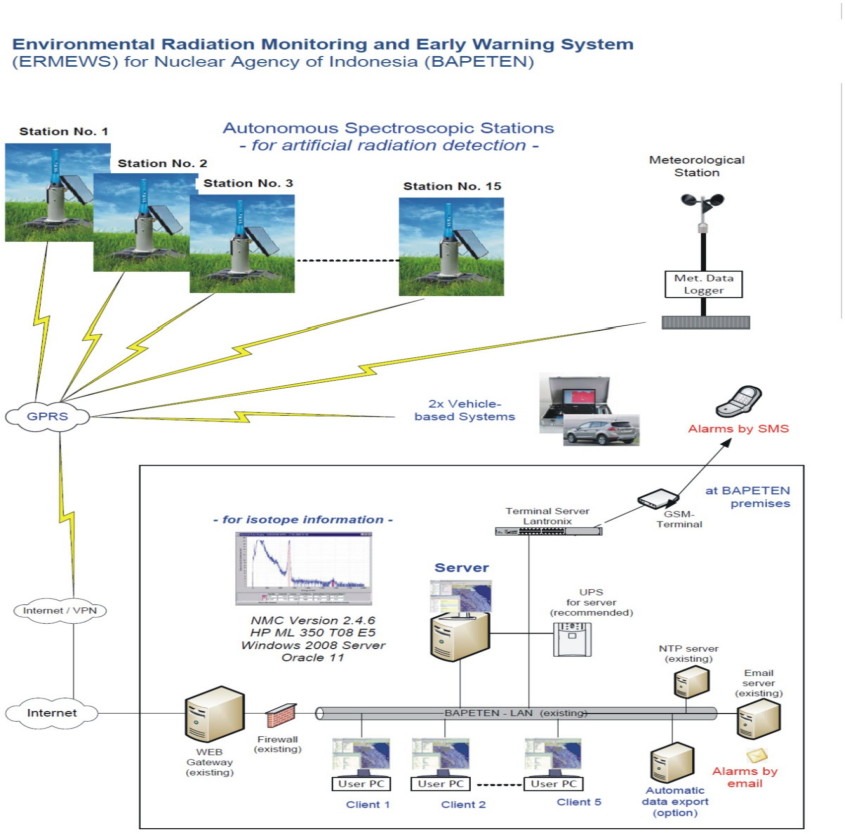
The purposes of regional cooperation in radioactive emergency are to enhance the capabilities of Indonesia in responding to and managing a radiological or nuclear emergency, and to promote a regional approach within ASEAN. Based on these objectives, Indonesia proposes two issues:

- Task 1: Installation of “state of the art” decision support capability in the national emergency centre, such as WSPEEDY, ARGOS CBRN, or RODOS, which links to regional nuclear emergency responses
- Task 2: Networking on international levels in the areas of early warning and air monitoring networks, radiological monitoring, meteorological and weather monitoring, radioactive plume dispersion modeling capabilities, and coordination in making decisions related to cross-border issues.
-

1.3. Domestic Program for Human Resources Development for Radiation Monitoring

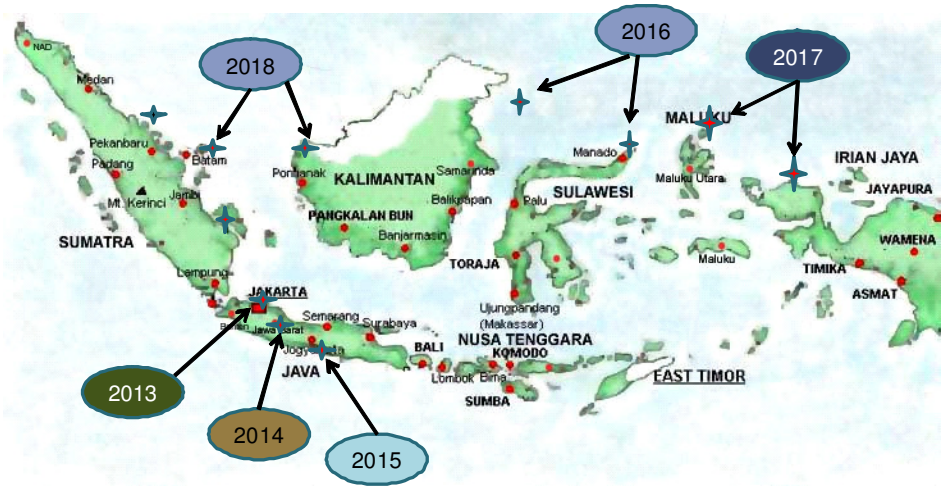
Radiation monitoring is one of the most important issues in the case of radioactive releases from nuclear facilities. The Indonesian government has established an Environmental Radiation Monitoring and Early Warning System (ERMEWS) to share hazardous information in the case of radioactive emergency. Figure 4 shows an image of ERMEWS. The main operating system and the server are in BAPETEN, the safety authority; the facilities, the sites and BAPETEN are connected by the internet.

Figure 4: How ERMEWS works in Case of Radioactive Emergency



The Indonesian government also has a program to expand the system to a nationwide level. As of 2013, the system works in a limited area near Jakarta; it will be implemented in a wider area in Java Island by 2015, and around areas in Sulawesi and Kalimantan Island by 2018. Figure 5 shows the implementation schedule for the ERMEWS system by the Indonesian government.

Figure 5: Implementation Schedule of ERMEWS system



2. Malaysia

2.1. National Plan for Emergency Preparedness

The National Security Council of the Prime Minister's Department has published Directive No. 20 – The Policy and Mechanism on National Disaster and Relief. The purpose of this Directive is to outline a policy on disaster management and relief on land, according to the level of disaster. This Directive also identifies and determines the roles and responsibilities of the various agencies involved in handling disasters, and AELB has been identified and designated as the Lead Technical Agency for Radiological and Nuclear Emergency in Malaysia. In order to handle disasters more effectively, the Disaster Management and Relief Committee (DMRC) has been established at the federal, state, and district levels, with the Deputy Prime Minister as chairman of this committee at the federal level. As the lead technical agency, AELB has prepared and documented a Radplan that outlines the procedures for radiological emergencies in Malaysia. AELB has also established a Radiological Emergency Response Center and Nuclear Emergency Team on 24-hour standby, with trained officers equipped with all necessary equipment and communication systems to respond if any emergency situations arise.

2.2. International Cooperation on Emergency Preparedness

The Fukushima Daiichi accident created a fear among the Malaysian population, even though the location of the accident is very far from Malaysia. AELB, as a nuclear regulatory body in Malaysia, took the initiative to inform the public about the situation in Fukushima Daiichi every day through mass media. AELB also alerted and activated their Nuclear Emergency Team on standby for 24 hours and monitored the level of environmental radiation exposure thorough the Environmental Radiation Monitoring System (ERMS), which has been installed at 7 locations throughout the country. Besides monitoring the environment, AELB also monitored all airplanes, vessels and passengers and randomly monitored all goods and foods coming from Japan.

Based on the experience in Malaysia during the Fukushima Daiichi accident, there is a need for the countries in this region to cooperate in radiological and nuclear emergency preparedness and response. Malaysia would like to propose cooperation in the following areas:

- Information sharing on accidents/incidents
- Exchange of emergency experts
- Providing expertise and technical assistance on preparedness and response among countries in the region
- Conducting joint training and exercises (table-top)
- Establishing the ASEAN Regional Radiological and Nuclear Emergency Preparedness and Response Hub

2.3. Domestic Program for Human Resources Development

To enhance the knowledge and skill of AELB's Nuclear Emergency Team in handling emergency situations, they always participate in any training program and exercise conducted by the National Security Council at a national level, especially those involving CBRN (chemical, biological, radiological, nuclear and explosive). This exercise normally involves all relevant agencies responsible in an emergency and first responders. AELB also periodically carries out an emergency exercise or drill with licensees to ensure their preparedness and readiness to respond in the event of a radiological emergency.

3. Philippines

3.1. National Plan for Emergency Preparedness

PNRI, the safety authority of the Philippines, serves as a lead agency in developing and updating an emergency plan—the National Radiological Emergency Preparedness and Response Plan (RADPLAN)—for all radiation-related accidents that may affect the Philippines. The RADPLAN has been set into action by the National Disaster Risk Reduction and Management Council (NRDMMC).

The purpose of the RADPLAN is to establish an organized emergency response capability for timely, coordinated action of the Philippine authorities in a peacetime radiological incident or emergency, in order to protect public health and safety. The scope of the RADPLAN includes all kinds of radiological emergencies, such as operating nuclear and radiation facilities, using and transporting radioactive materials, and accidents occurring outside of the Philippines with a significant impact on the country.

There are five types of emergencies:

- Emergencies from fixed nuclear or radiation facilities
- Emergencies occurring in the transport or loss of radioactive materials
- Emergencies from foreign sources having an environmental or health impact on Philippine territories, including the possible entry of contaminated food, scrap metals, and other materials
- Emergencies from re-entries of satellites with nuclear materials as components
- Emergencies from nuclear ships

There are also three classifications of emergencies:

- Emergency Level 1 – Alert
- Emergency Level 2 – Site Area Emergency
- Emergency Level 3 – General Emergency

The RADPLAN will be adopted under the following conditions:

- When a regional or local authority, other national organizations with jurisdiction, or the private sector requests government support in the event of a radiological emergency; or
- When government agencies must respond to meet their statutory obligations in

response to a radiological emergency.

A formal declaration will be made jointly by the Office of Civil Defense (OCD) and the PNRI in the activation of the RADPLAN, notifying concerned participating agencies and the affected local disaster coordinating councils.

There are six stages in the national response under the RADPLAN:

- Notification
- Mobilization
- Deployment
- Interventions and Recovery
- Deactivation
- Post-Accident Analysis and Evaluation

3.2. International Cooperation on Emergency Preparedness

Possible regional cooperation on emergency preparedness is as follows:

- Development and update of regulations, regulatory guides, rules of procedures, standards and criteria relative to the safety and security of radioactive materials
- Technology transfer to improve monitoring and analysis of radiation levels and other necessary equipment relevant to radiological emergency response
- The conducting of training on emergency preparedness and response
- Establishment of a Center of Excellence for Emergency Preparedness

3.3. Domestic Program for Human Resources Development

The decision to mothball the Bataan NPP in 1986 resulted in a vacuum for local expertise in the various areas of nuclear science and engineering. The government has lost the local expertise needed for the BNPP operation, either through reassignment or retirement of said personnel. (Some also became overseas workers.) Local universities have discontinued their nuclear energy engineering degree programs. Thus, current training of nuclear experts is heavily dependent on regional and international programs.

3.4. International Cooperation on Human Resources Development

The Philippines continues to avail itself of training courses and scholarships offered by the IAEA through the PNRI; the Forum for Nuclear Cooperation in Asia

through its Asian Nuclear Energy Training Program; and bilateral partners like the United States, Japan and Korea. The Philippines sits as a member of the ASEAN Sub-sector Network on Civilian Nuclear Energy, and within the ASEAN+3 (Japan, Korea and China) energy cooperation framework, the Philippines actively participates in the conduct of Nuclear Energy Human Resource Development and other technical trainings both at the senior policymaker and technical levels.

During the last quarter of 2012, the DOE and PNRI jointly collaborated with the IAEA in organizing Workshops on the Development of National Infrastructure for Nuclear Power Program and the Conduct of Self-Assessment using IAEA Specific Safety Guide No. 16: Establishing the Safety Infrastructure for Nuclear Power Program.

4. Singapore

4.1. International Cooperation on Emergency Preparedness

With the future growth of nuclear energy in the region, Singapore recognizes that it could play a role in global and regional cooperation on nuclear safety. This will facilitate the sharing of best practices in nuclear safety, emergency planning and response, human resources development, and the collective ability to respond to emergencies.

Areas of regional nuclear cooperation to which Singapore can potentially contribute

The Energy Studies Institute (ESI) is of the view that Singapore's foreseeable contribution in terms of regional and global nuclear safety cooperation will come from its emergency readiness planning, and cutting-edge research. Therefore, Singapore can potentially play an effective role in areas of regional nuclear cooperation such as emergency response, planning, and management, as well as technology development.

Current themes of nuclear-related research in Singapore

The ESI, situated at the National University of Singapore, is a think tank focusing on strategic energy research. It is currently in the process of carrying out research in three specific areas related to nuclear energy.

First, in terms of existing opportunities and challenges for regional nuclear cooperation in Europe, North America, the Middle East, Asia-Pacific, and Southeast Asia, it has looked at the various models and existing mechanisms of regional nuclear cooperation in the respective regions. It has identified the challenges that each region faces and looked at the prospects for regional nuclear cooperation in the context of the Asia-Pacific.

Second, to understand the impact of nuclear disasters/accidents (such as Three Mile Island, Chernobyl, and Fukushima), it examined the legal implications, cost, and environmental remediation of such accidents, comparing the effectiveness of the American, Soviet and Japanese governments' responses to their respective nuclear accidents, and highlighting issues that countries interested in acquiring nuclear technology should consider. It did a comparison of the American, Russian and Japanese responses to the nuclear accidents to date, identifying the costs and legal implications of nuclear accidents and the issues that any newcomer to the nuclear energy field must consider to predict nuclear accidents and how they can be prepared to deal with them.

Third, to understand the factors, conditions and actors that are able to shape public perception about nuclear energy, and the potential influence of pro- and anti-nuclear movements in Southeast Asia, ESI looked at the role of pro- and anti-nuclear energy movements and the potential role of international/regional NGOs in influencing the nuclear debate. It also identified the factors prompting such movements.

These nuclear energy-related research areas have been identified by ESI as important first steps to understand Singapore's potential role in regional nuclear cooperation.

Regional cooperation

The International Atomic Energy Agency (IAEA), Asian Nuclear Safety Network (ANSN), and ASEAN Nuclear Energy Cooperation Sub-Sector Network (NEC-SSN) play an important role in fostering regional cooperation on nuclear energy development and safety through the sharing of best practices and information exchange.

Moving forward, the IAEA could continue to implement more efficient communication systems to provide real-time information on nuclear accidents and frequent updates on the responses by affected countries to Member States.

As Southeast Asia is considering the development of nuclear energy – Vietnam, for example, is scheduled to begin nuclear plant operations in 2020 – the ANSN could focus on effective public communication of nuclear issues for a more integrated approach toward regional nuclear cooperation.

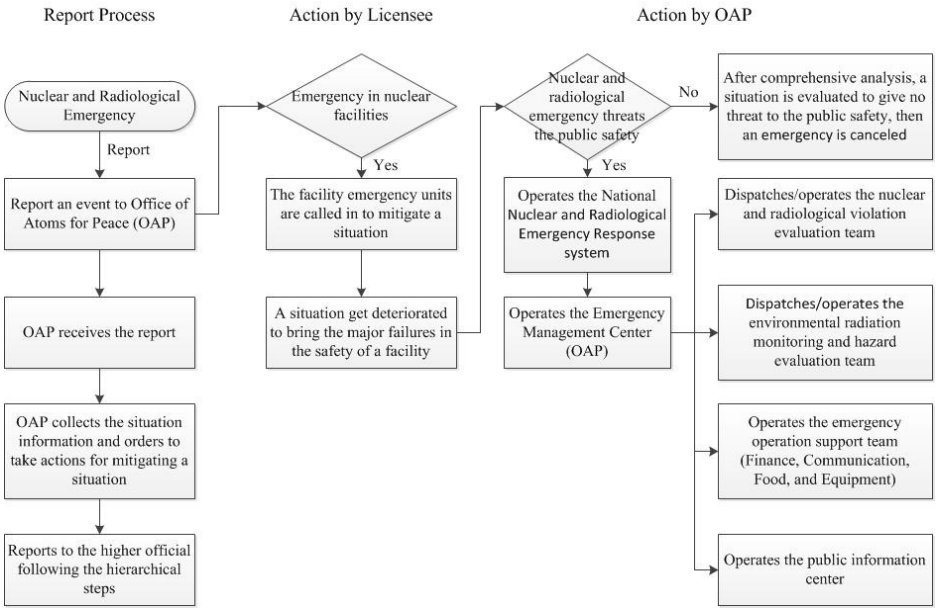
Finally, it will be useful for ASEAN NEC-SSN to cooperate on capacity building (including human resources development, education, and training) and, emergency preparedness and response plans, in order to facilitate the adoption of internationally recognised best practices and safety standards in the region.

5. Thailand

5.1. National Plan and International Cooperation for Emergency Preparedness

The National Nuclear and Radiation Emergency Plan was endorsed on June 4, 2010, and officially enforced by the end of 2010. The purpose of the national radiological emergency response system is to prevent public disasters, mitigate disasters, provide relief after disasters, and rebuild societies after disasters. The emergency response system is led by OAP.

Figure 6: National Radiological Emergency Response System of Thailand



Policy statements for emergency preparedness are as follows:

- All organizations shall be ready for nuclear and radiological emergency situations.
- All government ministries and agencies, response organizations, and the general public shall be involved and support the National Disaster Prevention and Mitigation Plan and National Protection Plan.
- All ministries, agencies, and response organizations shall use the National Nuclear and Radiological Emergency Plan as the primary plan for a radiological emergency.
- The implementation of emergency preparedness and response shall be done by unifying and effective methods, with prompt readiness for every situation.

5.2. Domestic Program and International Cooperation for Human Resources Development

After the Fukushima accident, the government decided to extend the "Pre-Project Activities" phase for 2011-2016. Programs for human resources development will be focused in this period, and research and development programs (including education

and training) will be mainly focused on the area of non-power applications.

Under the Country Program Framework for 2006-2011, signed by the Government of Thailand and the IAEA, technical cooperation assistance shall be provided to the following sectors:

- Agriculture
- Health
- Environment
- Energy
- Science & Technology
- National Development on Nuclear Science & Technology
- Utilization of Research Reactor
- Radiation Safety and Radioactive Sources Security
- Nuclear Safety

Under the Host Government Agreement (HGA), the following efforts were made in 2009-2010:

- Regional Training Course on Basic Applications of Radiation Modification of Polymers for Agriculture (October 19-23, 2009, Bangkok)
- Workshop on Safety Assessment for Predisposal Radioactive Waste Management Facilities (ANSN) (November 23-27, 2009, Bangkok)
- Workshop on Periodic Safety Review of Research Reactors (ANSN) (November 30-December 4, 2009, Bangkok)
- FAO/IAEA Regional Training Course on Surveillance of Tephritid Fruit Flies in Support of Planning and Implementing Area-Wide Integrated Pest Management Program (January 18-22, 2010, Bangkok)
- Regional Meeting on Analysis of Non-conformities in Fulfillment of the Requirement of ISO15189 and Biosafety Training, especially for BSL3 Laboratories (November 9-13, 2009)
- Regional Workshop to Facilitate the Development and Dissemination of e-Learning Course on the Cyber Platform (May 17-20, 2010, Bangkok)
- Regional Training Course on Ventricular Function Evaluation with Fated Photon Emission Computed Tomography (SPECT) and Radionuclide Vertriculography (MUGA) (July 19-23, 2010)

- Regional Training Course on Safety Case for Predisposal Management and Centralized Storage of Radioactive Waste (November 8-12, 2010, Bangkok)
- Regional Meeting to Create a Network of Medical Professionals on Radiation Protection of Children (December 15-17, 2010, Bangkok)

6. Vietnam

6.1. National Plan for Emergency Preparedness

With the National Nuclear and Radiological Emergency Plan (NNREP), Vietnam has established a framework for radiological and nuclear emergency planning (preparedness and response), which allows for the implementation of Emergency Preparedness and Response (EPR) arrangements that are commensurate with the currently recognized threat. However, to implement a nuclear power program, Vietnam's EPR arrangements need to be upgraded to cope with the consequences of emergencies at NPPs. For the further development of the EPR arrangements, the NNREP needs to be completed, taking into account IAEA Safety Standards.

6.2. Domestic Program for Human Resources Development

In Decision No. 1558/QD-TTg on August 18, 2010, the Prime Minister approved the project "Training and Human Resource Development (HRD) for Nuclear Energy," which indicated the national direction, objectives, funds and implementation responsibilities in training and HRD for nuclear energy at the national level. This decision assigns the following responsibilities:

- MOET: overall responsibility for implementing the scheme, including the upgrading of the nuclear capability of selected universities and the VINATOM training centre
- MOIT and EVN: implementation of "Human resource training for NPP projects in Ninh Thuan" (Document No. 460/TTg-KTN)
- MOST: preparing the training needs of all other organizations (apart from EVN), as needed to support the nuclear power program.

The National Steering Committee (NSC) on human resource development

(HRD) in the field of atomic energy was established according to Decision No. 940/QD-TTG of the Prime Minister, dated June 17, 2011. The NSC is chaired by the Deputy Prime Minister of Vietnam in charge of education and training, science and technology, and social affairs. The Management Board, which is headed by the Minister of Education and Training, was also established to assist the NSC.

6.3. International Cooperation on Human Resources Development

Vietnam participates in some programs of the IAEA, RCA, and FNCA, and is involved in the Nuclear Energy Cooperation Sub-Sector Network (NEC-SSN) in the areas of legislative framework, public acceptance, and human resources development (among others). It also cooperates bilaterally with the Russian Federation, Japan, and the United States on training programs in nuclear fields. Further enhancement in the areas of Probability Safety Analysis (PSA) for nuclear safety and of Nuclear and Radiological Emergency Plans would be desirable within regional cooperation.

7. Korea

7.1. National Plan for Emergency Preparedness and Human Resources Development

The radiological emergency response scheme involves the Central Response Committee chaired by the Prime Minister, National Emergency Management Committee (NEMC), Off-site Emergency Management Center (OEMC), the Local Emergency Management Center (LEMC), the KINS-Radiological Emergency Technical Advisory Center, Korea Institute of Radiological and Medical Science (KIRAMS)-Radiological Emergency Medical Center, and KHNP-Emergency Operation Center (Table 1).

The central government has the responsibility of controlling and coordinating the countermeasures against a radiological disaster. In particular the OEMC, which consists of experts dispatched from the central government, local governments and designated administrative organizations, has responsibility of performing coordination of the management of radiological disaster and decision-making on

public protective actions (sheltering, evacuation and food restriction, Etc.). The OEMC consists of 7 actual groups including the Joint Public Information Center, which is in charge of providing accurate and unified information about radiological disasters and the OEMC Advisory Committee for the director of the OEMC.

Established by the local governments concerned, the LEMC implements the OEMC's decisions concerning public protective actions.

When an accident occurs, the KHNP as an operator of nuclear installation is responsible for organizing an Emergency Operation Center and taking measures to mitigate the consequences of the accident, restore the affected installations, and protect on-site personnel.

In addition, the central government establishes the national radiological emergency medical system for the coordination and control of radiological medical services. It consists of the National Radiological Emergency Medical Service Center and the primary and secondary radiological emergency medical hospitals designated by the region. The KIRAMS established the Radiological Emergency Medical Center, operating the national radiological emergency medical system during radiological disasters.

If any accident occurs in the nuclear facilities, the operator shall immediately report the emergency situation to the NSSC and local government, in accordance with the NSSC Notice (Radiation.003, Notice on Radiological Emergency Preparedness for Nuclear Licensee).

Korea's nuclear emergency plan is based on the Act for Physical Protection and Radiological Emergency (APPRE) and the Civil Defense Act. There are 4 different plans:

- National Emergency Plan (by central government)
- Local Emergency Plan (by local government)
- Emergency Technical Advisory Center Plan (by KINS)
- Licensee's Emergency Plan (by KHNP: approved by regulatory body)

Core elements of emergency preparedness are the following:

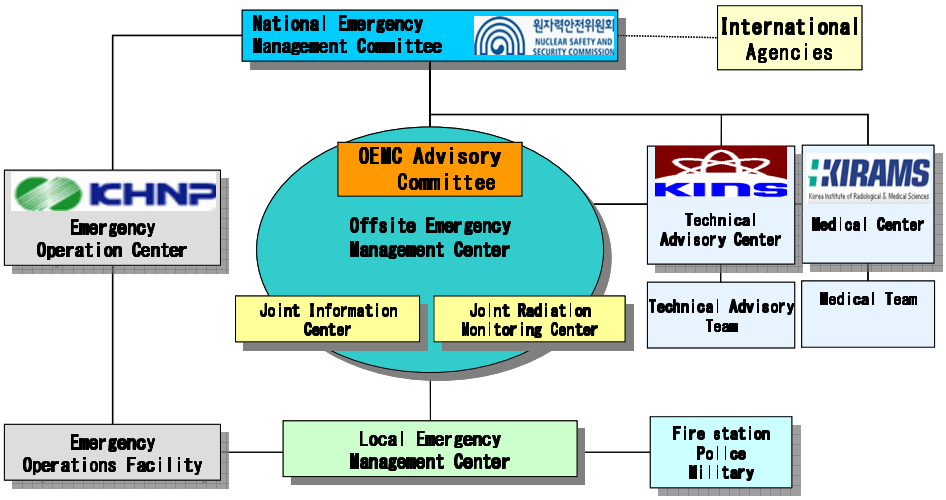
- Emergency Planning
- NSSC and local governments formulate Radiological Emergency Plans at the national and local levels, respectively.

- KINS reviews the Radiological Emergency Plan submitted by the NPP licensee as a licensing condition.
- Emergency Exercises
- NSSC, relevant central administrations, local government authorities, and NPP licensees conduct a set of emergency exercises and/or drills to demonstrate the effectiveness of EP&R.
- Emergency Training
- NSSC manages emergency training as per the APPRE.
- KINS conducts regulatory inspection of the training program in radiological emergency educational institutes.

Table 1: Types of Radiological Emergency

Class	Criteria	Response	
Alert	• Failure of sealing of radioactive container • Actual or potential degradation of plant safety • Expected release limited to a small fraction of PAG exposure levels	Others	• Activate TSC, OSC • Alert off-site emergency organizations
		KINS	• Activate Preliminary TAT
Site-area emergency	• High probability of major failures of plant functions • Need to protect the public • No expected release exceed PAG exposure levels except near site boundary	Others	• Activate EOF, LEMC • Alert NEMC
		KINS	• Activate TAT - Dispatch site TAT (plant, province/country) - Technical Advice
General emergency	• Actual or imminent substantial core degradation • Loss of containment integrity • Release can be reasonably expected to exceed PAG exposure levels	Others	• Activate NEMC
		KINS	• Maintain site area emergency status • Technical support • Recommend protective action

Figure 7: National Emergency Response Scheme



7.2. International Cooperation on Emergency Preparedness and Human Resources Development

Korea would be in a solid position as a responsible global partner by contributing to a regional/global nuclear system advancing the safe, secure, and peaceful applications of nuclear energy worldwide. The basic principle for international safety cooperation can be summarized in 3 key elements: 1) Participating in the initiatives of international organizations, which include international conventions, codes of conduct, and other proactive collaborative programs; 2) Contributing to global nuclear safety through creative partnerships with newcomers and supporting the establishment of a robust regulatory infrastructure; and 3) Exchanging information, experience, and technologies by building solid cooperative relationships with regulatory organizations worldwide. These elements will make a great contribution to the enhancement of domestic, regional, and global nuclear safety.

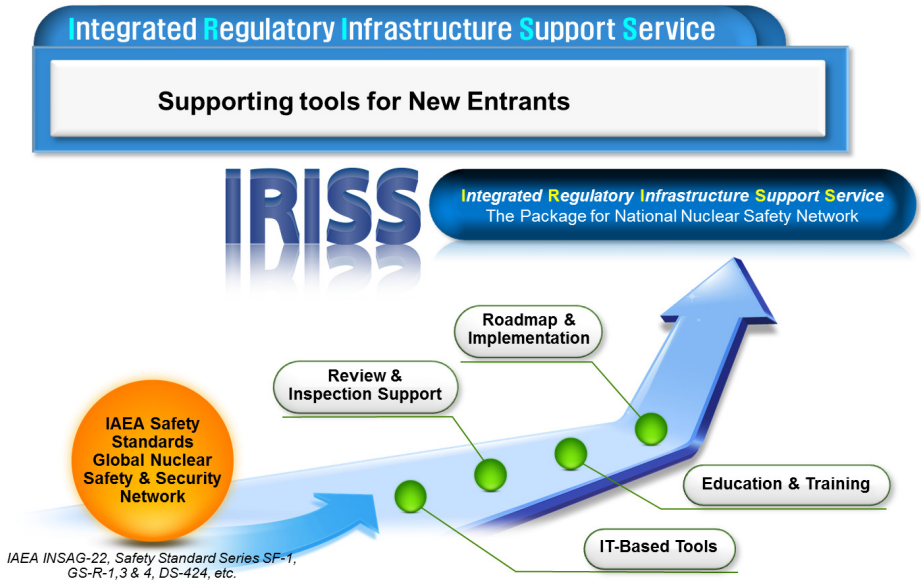
The first element, international cooperation, is shown in the active participation of Korea in a wide range of international activities that contribute to the establishment of a global nuclear safety regime. These activities include the implementation of international treaties and conventions for nuclear safety, the exchange of information on nuclear safety and regulation, cooperation in R&D on nuclear safety, and various international cooperation and supports. To achieve this

objective, Korea has been making efforts to promote the effectiveness and efficiency of nuclear safety regulation, by sharing operating and regulatory experiences and good practices through various bilateral and multilateral cooperation programs (such as the IAEA and OECD).

With respect to the second element, regional cooperation with newcomers who have a keen interest in the development of nuclear energy, Korea has been willing to develop concrete plans to assist them. The strategy for supporting newcomers can be implemented in a variety of ways. The first is to install regional safety networks in order to enhance effectiveness and efficiency through cooperation. The ANSN is a good example of regional cooperation. Second, the Integrated Regulatory Infrastructure Support Service (IRISS), consisting of IT-based tools, has been introduced for package-type support complying with customized programs of differentiated content for each state's need (as shown in Figure 8). The IRISS, developed by KINS, is an advisory package providing guidance and consultation on the establishment of a firm regulatory infrastructure and the enhancement of a regulatory body's competency. Finally, the training and education of regulatory staffs in the region through the International Nuclear Safety School (INSS) of KINS can provide, in an effective and efficient manner, the sharing of Korean experience and expertise accumulated during their development of nuclear energy with newcomers from the Asian and African regions.

With plenty of regulatory experience, KINS is actively developing programs to support the establishment of regulatory infrastructures in new entrant countries interested in the construction of new nuclear power plants, and is particularly contributing to the establishment of the global nuclear safety regime by leading regional nuclear safety networks.

Figure 8: Structure of the IRISS



Since 2008, Korea has participated in the Northeast Asian Top Regulators' Meeting on Nuclear Safety (TRM), which was established by Japan, China, and Korea to enhance regional cooperation on nuclear safety in Northeast Asia.

8. Japan

8.1. National Plan for Emergency Preparedness

In Japan, in light of the Three Mile Island (TMI) accident in 1979, the now-defunct Nuclear Safety Commission developed nuclear emergency preparedness guidelines, which was revised 14 times by 2010. Today, new safety regulator Nuclear Regulation Authority has implemented new emergency preparedness guidelines called the Nuclear Emergency Response Guidelines, based on the lessons learned from the Fukushima accident. This section provides an overview of Japan's structure for nuclear emergency preparedness and the Nuclear Emergency Response Guidelines currently in effect.

The nuclear emergency response measures in ordinary times are executed in accordance with the Nuclear Emergency Response Guidelines, which have been

established by the Nuclear Regulation Authority under the Act on Special Measures Concerning Nuclear Emergency Preparedness. Since wide-ranging government agencies and ministries are involved in this process, the Nuclear Emergency Preparedness Council, formed within the Cabinet, serves as the overall coordinating body. The Nuclear Regulation Authority plays the key role in emergency preparedness in framework by providing specialized and technical knowledge of nuclear safety.

In the event of a nuclear emergency, the Nuclear Emergency Response Headquarters is set up within the Cabinet to comprehensively coordinate central government agencies and local governments.

Figure 9: Organization of Nuclear Emergency Preparedness

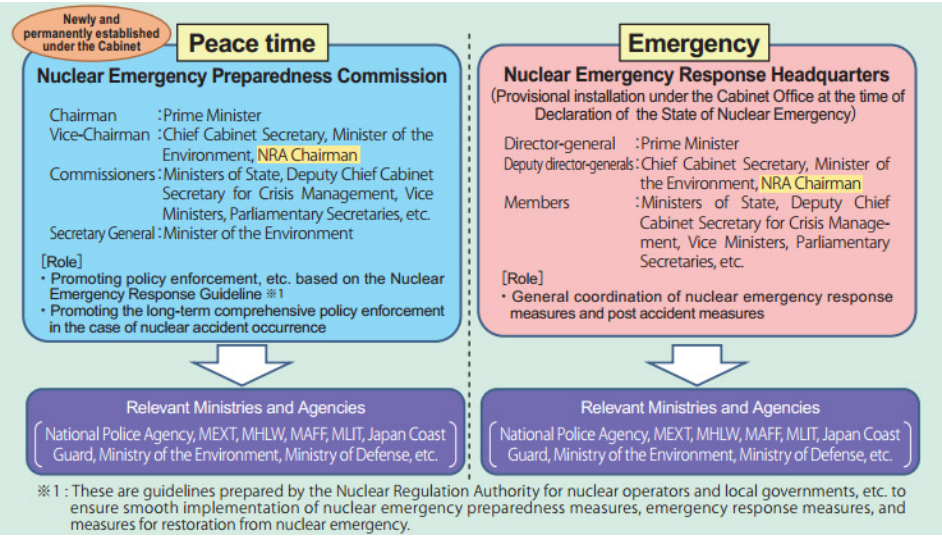
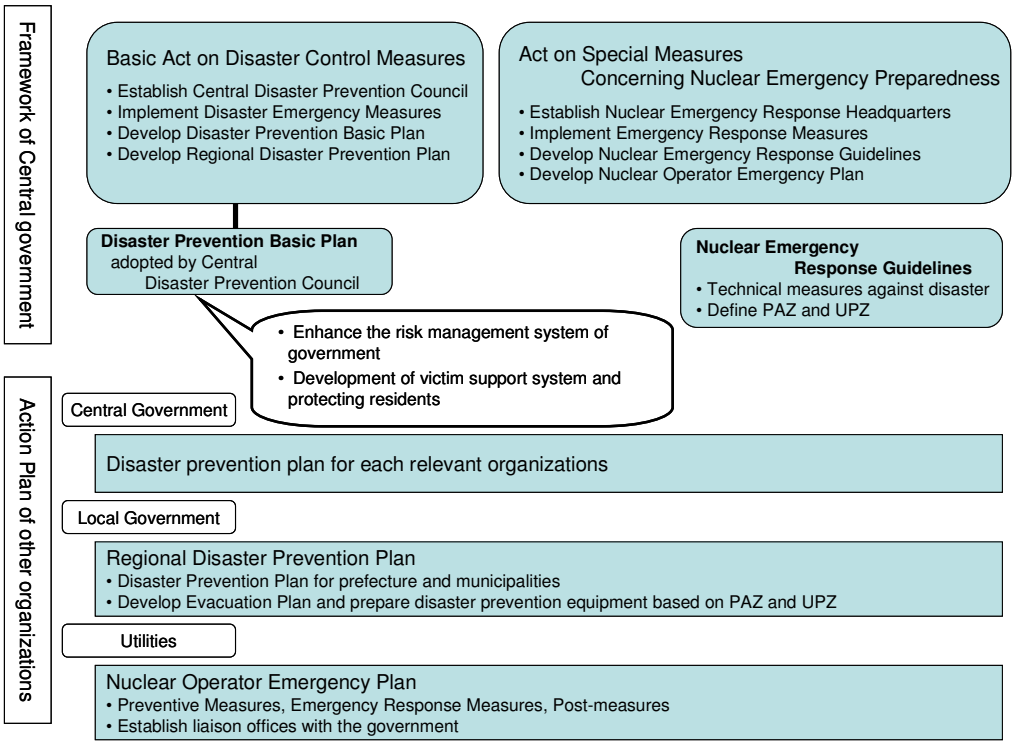


Figure 10 shows Japan's institutional framework for nuclear emergency response. The Act on Special Measures Concerning Nuclear Emergency Preparedness, a law specifically designed for nuclear emergency management, defines the basic framework for emergency preparedness and identifies what kind of guidelines and plans should be formulated. The national and local governments and operators are required to set up their own emergency response plans in accordance with the Nuclear Emergency Response Guidelines in place under this law.

Figure 10: Japan's Framework of Nuclear Emergency Preparedness Plan



The Nuclear Emergency Response Guidelines were established on October 31, 2012. After a revision on January 30, 2013, another revision was drafted and is under debate now.

The key elements of the Guidelines are as follows:

- Principles of nuclear emergency response
  - Basic concepts of radiation protection measures
- Issues concerning precautions against nuclear emergency
  - Predefining the Emergency Action Level (EAL), which is the basis for decision making in emergency situations, and the Operational Intervention Level (OIL) regarding air dose rates
  - Predefining the Precautionary Action Zone (PAZ, an approximately 5-km radius zone around the facility) and the Urgent Protective Action Planning Zone (UPZ, an approximately 30-km radius zone around the facility), where preparations, such as being ready for evacuation, have been made
  - Making preparations, such as providing information, performing monitoring, establishing a structure for radiation emergency medicine, and conducting

education and drills

- Issues concerning quick emergency response
  - Performing emergency monitoring to quickly ascertain the situation
  - Immediately providing accurate information to local residents
  - Implementing appropriate protective measures according to EAL/OIL
- Issues concerning nuclear emergency measures over the medium to long term
  - Evaluating the long-term health and environmental effects of radiation
  - Implementing decontamination measures to minimize the impact

The Guidelines have been developed by fully reviewing traditional emergency preparedness guidelines. There is a notable difference from the traditional one, which defined only the Emergency Planning Zone (EPZ), a 5-km radius zone around the nuclear power plant, as the area where preparations for evacuation and other actions should be made in case of a nuclear emergency. The new version has expanded the area where preparedness is required, defining two additional zones: PAZ within a 5-km radius and UPZ within a 30-km radius.

The Precautionary Action Zone (PAZ) is an area where precautionary protective actions, such as immediate evacuation based on the EAL, should be taken even before the stage of releasing radioactive material to the environment, in order to avoid effects of radiation exposure from a rapidly developing nuclear accident. Since IAEA standards specify that the maximum radius of the PAZ should be 3-5 km from the nuclear facility, the Guidelines stipulate that the general size of the PAZ should be "an approximately 5-km radius of the nuclear facility."

The Urgent Protective Action Planning Zone (UPZ) is an area where emergency protective actions are in place based on the EAL and OIL in order to minimize the risk of stochastic effects. Since IAEA standards specify that the maximum radius of the UPZ should be 5-30 km from the nuclear facility, the Guidelines stipulate that the general size of the UPZ should be "an approximately 30-km radius of the nuclear facility."

As a safeguard against radiation exposure, the Guidelines require prior distribution of stable iodine to people in the PAZ and the stockpiling of the pills by local governments outside the PAZ. As of May 2013, the draft revision of the Guidelines is in the public comment process. With respect to the prior distribution of

stable iodine to people in the PAZ, the revision states that briefing by doctors in advance and appropriate preliminary studies on side effects and allergies should precede the distribution. It further requires that the decision on stable iodine prophylaxis should be made by the Nuclear Regulation Authority and that the Nuclear Emergency Response Headquarters or the local government should issue orders in accordance with the decision.

8.2. Situation of Human Resources Development

Many nuclear-related departments have been established at universities across Japan to nurture excellent nuclear engineers to meet the advancement of nuclear development. In the 1980s, when many nuclear power stations were built, a substantial number of such departments existed, with 10 university departments and 11 graduate courses dedicated to nuclear studies. The number then began falling and the downward trend in academia continued until around 2004, pushing the number down to 1 university department and 4 graduate courses by 2004. However, with the recent renewed awareness of the importance of nuclear energy, the number has increased to 3 university departments and 8 graduate courses as of 2012. Nevertheless, much fewer students are interested in studying in nuclear-related departments today because of the increased public distrust in nuclear energy induced by the Fukushima accident and the announcement of the policy of moving away from nuclear power by the administration led by the Democratic Party of Japan. This is a crisis situation if Japan intends to continue developing outstanding nuclear engineers who could contribute to the nuclear industry at home and even abroad.

The Nuclear Science and Technology Committee of the Council for Science and Technology, the Ministry of Education, Culture, Sports, Science and Technology, addressed the situation by compiling a report titled “Current State and Challenges for Basic/Fundamental R&D on Nuclear Power” on May 29, 2012. It draws up the policy of continuing the enhancement of efforts toward basic and fundamental R&D and human resources development needed for decontamination, reactor decommissioning, improved safety at nuclear facilities, and radioactive waste management, regardless of Japan’s direction of nuclear use.

CHAPTER 4

Proposals and Discussions on International Cooperation in Case of Emergency

Most member countries have some kind of a national nuclear regulatory body and have a common awareness that every country should play a role in regional cooperation on nuclear safety, irrespective of the development status of commercial nuclear power generation.

The countries which already have nuclear energy technology – Korea, China, and Japan – will be expected to provide information on reactor and fuel technologies, safety regulatory schemes, security and safeguard issues, and most of all, human resources development plans.

The nuclear accident at Fukushima Daiichi on March 11, 2011, has had a serious impact on ASEAN countries, even though the location of the accident is very far from their homes. Prompt and accurate information sharing on a regional scale would be the top priority in the case of a serious nuclear accident.

Therefore, we would like to propose some ideas for constructing frameworks for regional cooperation concerning nuclear safety and emergency preparedness. The basic principle for international safety cooperation can be summarized as 3 major issues that would make a great contribution to the enhancement of domestic and regional nuclear safety.

1) Participation in the initiatives of international organizations, including international conventions, codes of conduct, and other proactive collaborative programs.

   Activities to establish the regional nuclear safety regime would include the implementation of international treaties and conventions on nuclear safety, the exchange of information on nuclear safety and regulation, cooperation in R&D on nuclear safety, and various forms of international cooperation and support.

2) Contributions to regional nuclear safety, from experienced countries to newcomers

The strategy for supporting newcomers would be implemented by installing safety networks to enhance the effectiveness and efficiency of cooperation (such as ANSN, which serves as a good example of regional cooperation). Providing training and education programs for regulatory staffs in ASEAN countries through expert organizations such as the Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN) in Japan, or the INSS in Korea, would be highly promising measures.

3) Exchange of information, experience, and technologies through the building of cooperative relationships with regulatory organizations worldwide

The establishment of the ASEAN Regional Radiological and Nuclear Emergency Preparedness and Response Hub (tentative name) is proposed by the member countries. It would provide expertise and technical assistance on preparedness and response to regional countries in case of radiological or nuclear emergencies, as well as contributing to the establishment of the global nuclear safety regime by leading regional nuclear safety networks.

4) Preparation for dealing with cross-border radioactive releases in case of nuclear disasters

Gaseous radioactive materials such as noble gases might rapidly cross borders in case of an accident in nuclear facilities. Early detection and air (or water) monitoring systems, metrological and weather monitoring systems, radioactive plume dispersion modeling capabilities and most of all, decision making networks among all related countries would be highly desirable.

Compensation matters in case of radioactive releases were not discussed in the working group, however, it is one of the most significant issues in the nuclear business. “How should we deal with the Convention on Supplementary Compensation for Nuclear Damage (CSC), one of the international treaties on compensation for nuclear disasters?” would be another theme to be discussed in the area of cooperation on nuclear safety management.