第28回原子力委員会 資料第1号







The NEA: 34 Countries Seeking Excellence in Nuclear Safety, Technology, and Policy

- A premier international platform for cooperation in nuclear technology, policy, regulation, research, and education.
- 34 member countries + strategic partners (e.g., China and India).
- 8 standing committees and more than 80 working parties and expert groups.
- Global relationships with industry, universities, and civil society.



of the world's installed nuclear capacity





Major International Cooperative Frameworks

NEA Serviced Bodies

- Generation IV International Forum (GIF) with the goal to develop new fission technologies with greater sustainability (including effective fuel utilisation and minimisation of waste), economic performance, safety and reliability, proliferation resistance and physical protection.
- Multinational Design Evaluation Programme (MDEP) - initiative by national safety authorities to leverage their resources and knowledge for new reactor design reviews (ABWR, AES2006, AP1000, EPR, HPR1000).
- International Framework for Nuclear Energy Cooperation (IFNEC) – 65-country forum for multilateral discussion and analyses of a wide array of nuclear topics involving both developed and emerging economies.

28 Major Joint Projects

- Nuclear safety research and experimental data (e.g., thermal-hydraulics, fuel behaviour, severe accidents).
- Nuclear safety databases (e.g., fire, common-cause failures).
- **Nuclear science** (e.g., thermodynamics of advanced fuels).
- Radioactive waste management (e.g., thermochemical database).
- **Radiological protection** (e.g., occupational exposure).
- Nuclear Education, Skills and Technology Framework (NEST) (promoting the development of a new generation of subject matter experts.)





Global Forum on Nuclear Education



First Exploratory Meeting - Paris, 24-25 July 2019

The **NEA Global Forum on Nuclear Education**, **Science, Technology and Policy** is a platform for international cooperation in nuclear technology education. The Forum:

- Provides NEA engagement with academic institutions developing the next generation of nuclear science and technology experts
- Brings creative thinking to policy challenges
- Provides academic institutions around the world with a framework for interaction, co-operation, and collective action
- Held a special workshop in Tokyo this week to discuss the revitalisation of nuclear technology education in Japan

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Fukushima Daiichi: Long-term Impacts on the Nuclear Sector

- Last year, NEA issued an authoritative study to assist policymakers and the general public to understand the multi-dimensional issues stemming from the accident;
- Presents the current situation and reviews the responses by Japanese authorities and the international community since the accident;
- Examines the future of the site and that of the affected region and population, outlining areas for further improvement;
- Makes 9 strategic recommendations to enhance the remediation effort and the lives of those impacted by the accident.









Japan after Fukushima Daiichi: Impacts and Changes

- Added to the tragedy caused by the Great East Japan Earthquake and tsunami by leading to dislocations and creating widespread public anxiety and mistrust
- Led to the long-term shut-down of Japan's nuclear power plants; after 11 years only 10 are able to operate.
- Set the stage for the establishment of the Nuclear Regulatory Authority (NRA), a strong, independent safety regulator.
- Caused severe negative impacts to Japan's nuclear energy technology development and educational programs







Japan after Fukushima Daiichi: *The Site and Surrounding Communities*

- Significant progress has been made toward site stabilization and remediation, but decades of work lay ahead
- Long-term impacts on the surrounding communities persist; further efforts are needed to assure recovery
- Issues such as disposition of contaminated water and eventual disposal of wastes remain complex and often contentious
- New technologies and new clean-up approaches will be needed to address all clean-up challenges; international engagement can accelerate these efforts







Japan after Fukushima Daiichi: *The Contribution of Nuclear Energy*

- Before 3/11, Japan expected to obtain about 40 percent of its electricity from nuclear energy before 2030; today, the share is only about 7 percent
- None of Japan's BWR reactors have returned to operation since they ceased operations after 3/11
- Japan's national plan calls for 20-22 percent nuclear by 2030, which would require all restartable plants to be brought online
- Japan's decarbonization will be very difficult—if not impossible—without a major nuclear energy component







Japan after Fukushima Daiichi: Japan's Nuclear Technology Infrastructure

- Funding for many ambitious technology R&D programs was reallocated to other needs; goals and targets are not as clear as before 3/11
- University programs have eroded substantially and few young Japanese are interested in nuclear energy careers
- Key nuclear research facilities were shut down after 3/11 and others await restart
- Government ministries and agencies have lost important technical and policy expertise over the last decade; unless these capabilities are rebuilt, progress will be very difficult





Japan after Fukushima Daiichi: Japan's Nuclear Safety Approach



- The first two NRA Chairman are to be lauded for leading the NRA through an unprecedented situation and rapid establishment of regulations and nuclear safety practices
- Nuclear regulation in Japan is far more conservative than in other OECD countries; however, the fact that Japan endured the 1F accident makes this understandable
- Criticisms that NRA is too isolated and moving too slowly to enable plant restarts do not always reflect the societal context in which NRA conducts its work





The World is Changing Rapidly



- In the wake of COP26, many OECD and emerging economies reassessed their decarbonization strategies.
- The focus on 2030 targets for CO₂ reductions have forced both increased investment in energy and a much larger degree of reality.
- Rising prices and energy supply concerns in the context of the ongoing war in Ukraine have completely changed the focus of policymakers—energy security is now the driving issue in many capitals.
- Increasing numbers of governments are looking to nuclear energy as part of their overall energy strategies.





Countries are Reviewing their Energy Strategies Many are looking to Nuclear Energy

U.K.'s Johnson Pushes to Make Nuclear 25% 2050 Power Mix

Government is drawing up an energy plan to boost clean supply
Prime Minister met with nuclear industry executives Monday

Energy crisis: Belgians get behind nuclear power

Tuesday, 29 March 2022

By Ugo Realfonzo NUCLEAR POLITICS

Italy / Nuclear Back On Agenda As Support For Advanced Reactor Technologies Grows

Nuclear makes a comeback in the Netherlands





The Netherlands' new coalition government has placed nuclear power at the heart of its climate and energy policy. Some EUR500 million (USD564 million) has been earmarked to support new nuclear build in the period to 2025.

Nuclear energy + Add to myFT

Macron restarts France's 'nuclear adventure' with plans for 6 reactors

Atomic energy is central to plan to meet net zero carbon emissions, French president says

News

South Korea's new president wants nuclear Uturn

By Mattia Baldoni





Nuclear in Emissions Reduction Pathways

Organisation	Scenario	Climate target	Nuclear innovation	Description	Role of nuclear energy by 2050	
					Capacity (GW)	Nuclear growth (2020-50)
IAEA (2021b)	High Scenario	2°C	Not included	Conservative projections based on current plans and industry announcements.	792	98%
IEA (2021c)	Net Zero Scenario (NZE)	1.5°C	Not included but HTGR and nuclear heat potential are acknowledged.	Conservative nuclear capacity estimates. NZE projects 100 gigawatts more nuclear energy than the IEA sustainable development scenario.	812	103%
Shell (2021)	Sky 1.5 Scenario	1.5°C	Not specified	Ambitious estimates based on massive investments to boost economic recovery and build resilient energy systems.	1 043	160%
IIASA (2021)	Divergent Net Zero Scenario	1.5°C	Not specified	Ambitious projections required to compensate for delayed actions and divergent climate policies.	1 232	208%
Bloomberg NEF (2021)	New Energy Outlook Red Scenario	1.5°C	Explicit focus on SMRs and nuclear hydrogen	Highly ambitious nuclear pathway with large scale deployment of nuclear innovation.	7 080	1670%

Many pathways require global installed nuclear capacity to grow significantly, often more than doubling by 2050.

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Nuclear Energy Can—and Must—Play a Larger Role In Support of Global Net-Zero Goals

In its 2018 special report, the IPCC reviewed **90 pathways consistent with a 1.5°C scenario** – i.e., pathways with emissions reductions sufficient to limit average global warming to less than 1.5°C.

On average, the scenarios reflect the need for global nuclear capacity to **triple by 2050 to 1160 gigawatts**, up from 394 gigawatts in 2020. EXERCICIC DESCRIPTION OF THE STATE OF CHARGE AND STATE OF CHARGE







The "Energy Trilemma"



There are <u>no</u> magic solutions to the Energy Trilemma.

National conditions, available natural resources and policy preferences will continue to shape energy policy decisions.





Japan's Nuclear Energy Future: Areas for Consideration

- 1. Fukushima Prefecture and the 1F Site
- 2. Future Approaches to Nuclear Energy
- 3. Nuclear Safety and Regulation
- 4. Human and Research Infrastructure

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- 1. Fukushima Prefecture and the 1F Site
 - Forensic Investigations
 — Technical analyses related to understanding the 1F accident progression and formation of core debris can provide both unique knowledge and enable a center of international scientific collaboration—IF Japan plans accordingly.
 - <u>Holistic Approach</u>—A holistic approach to 1F remediation, waste management, and community development would have tremendous benefits





- 1. Fukushima Prefecture and the 1F Site (continued)
 - <u>Consider</u>—Clarifying the government's interest in giving priority to technical studiers related to the 1F accident and core debris.
 - <u>Consider</u>—Developing a holistic plan for 1F remediation, related activities, and community development that involves all players in Japan. NEA can assist if desired.







- 2. Future Approaches to Nuclear Energy
 - <u>Nuclear Energy can be the Key to Success for Japan's Energy and</u>
 <u>Environmental Goals</u>—But much needs to be done to enable nuclear to play a expanding role. Public, political, and legal support is essential.
 - <u>Operation of Existing Plants is Vital</u>—Japan's commercial reactors are well-operated and well regulated. Policymakers can do more to enable their long-term operation.





- 2. Future Approaches to Nuclear Energy (continued)
 - Japan could be a strong market for Generation IV and SMR technologies — Advanced technologies can provide the answer to public concerns about safety; more could be done to highlight their potential in Japan and create opportunities to deploy them
 - <u>Consider</u>—Conducting an NEA Systems Cost study to examine Japan's energy options as it seeks to decarbonise AND consider strategies for near-term demonstration of advanced nuclear in Japan





- 3. Nuclear Safety and Regulation
 - <u>Public Confidence</u>—NRA's practices have helped rebuild public confidence in nuclear regulation, which is essential for any future nuclear operations
 - <u>Normalisation</u>—*NRA* was created in the aftermath of a crisis; it is reasonable for the government to review the NRA's structure and operation more than a decade after the crisis





- 3. Nuclear Safety and Regulation (continued)
 - <u>Consider</u>—Launching a comparative analysis of nuclear regulation legislation, practices, structures, and policies of Japan's approach in comparison to highly successful approaches overseas to inform a strategic review by the government. NEA can support such an effort.
 - <u>Consider</u>—Enabling a different salary and benefits structure for nuclear regulation professionals to retain valuable talent at NRA and encourage high-quality candidates to join the NRA.





- 4. Human and Research Infrastructure
 - <u>**Research Facilities**</u>—Japan's facilities are not only national assets they are essential international assets to OECD member countries
 - <u>Educational Infrastructure</u>—Without clear action to encourage young people, Japan will suffer a dehabilating expertise gap in the coming years
 - <u>**Consider</u>**—Instituting attractive scholarship programs to revitalize Japan's nuclear education system AND accelerating plans to restart key research facilities (e.g., JOYO, STACY)</u>





Thank you for your attention



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