



# Welcome to Global 2011

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# March 11 Event

- The Great East-Japan Earthquake and the resulting tsunamis struck the Fukushima Daiichi Nuclear Power Plant of TEPCO on March 11, 2011.
- This caused a nuclear accident that was unprecedented: the simultaneous progression of severe accidents at multiple units and the continuation of accident over an extended period of time.
- The fact that this accident has raised concerns around the world about the safety of nuclear power generation is a matter which Japan takes with the utmost seriousness and remorse.
- In the face of this hardship, Japan has received supports and expressions of solidarity from around the world. **I would like to express Japan's sincere gratitude to you.**



## Notice:

GLOBAL Organizing Committee decided to reschedule the meeting period as Dec.11-16,2011 at Makuhari, because of the nuclear power plant accident in Japan.



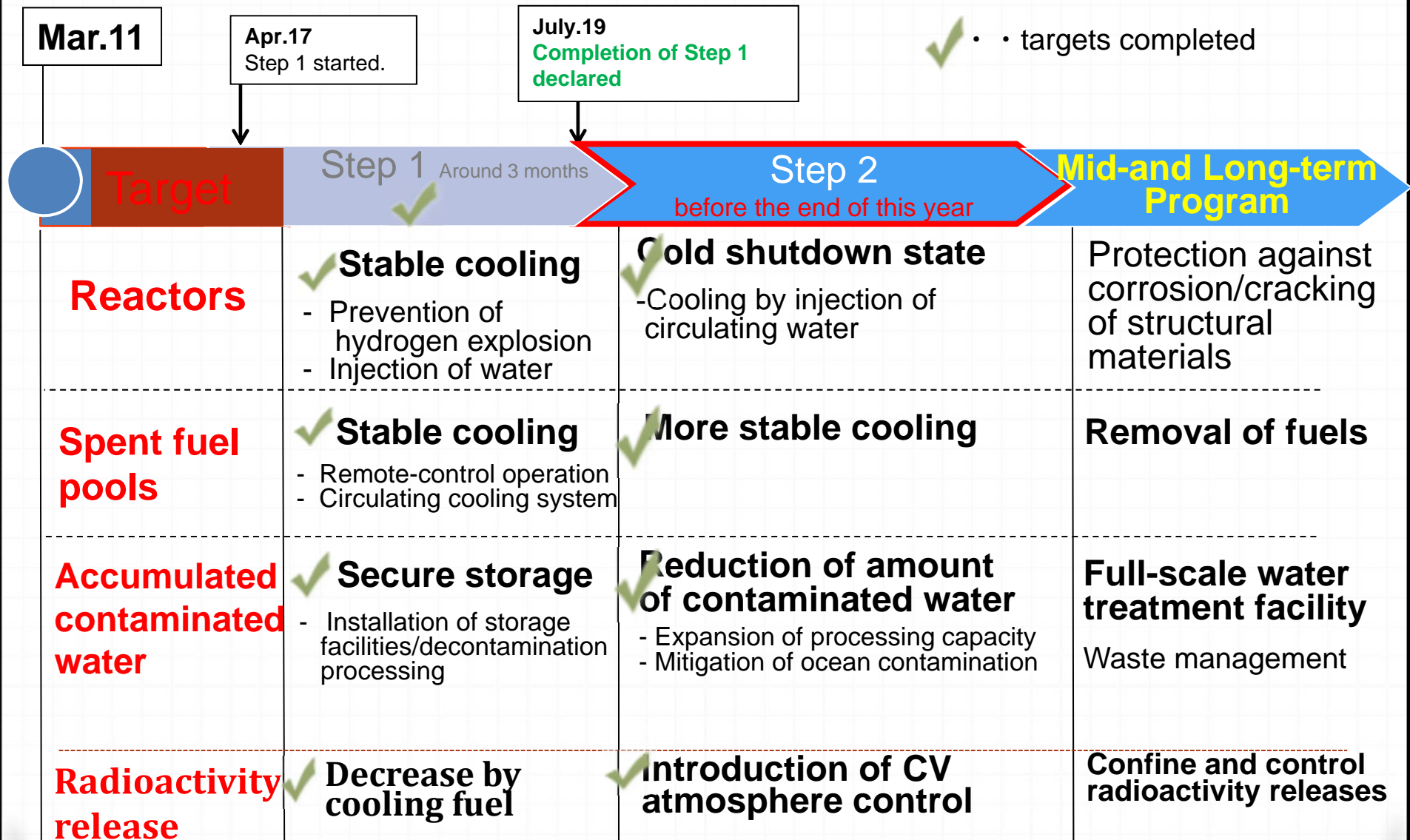


# Responsibility of Nuclear Community in Japan

Make every effort to

- Stabilize the situation at the Fukushima plants
- Recover the life of people in Fukushima, where many people have been traumatized by the relocation, the breakdown in social contacts, fear and anxiety about what health effects might result from the exposure to radiation due to the contamination of their environment caused by the accident
- Recover the public trust upon the nuclear safety management system in Japan, reorganizing it based on the lessons learned from the event.

# Roadmap towards Restoration from the Accident at the Site Developed on May 17



# Deliberation of Arrangement to Remove SFs and Core Debris and Technology R&D Programs necessary

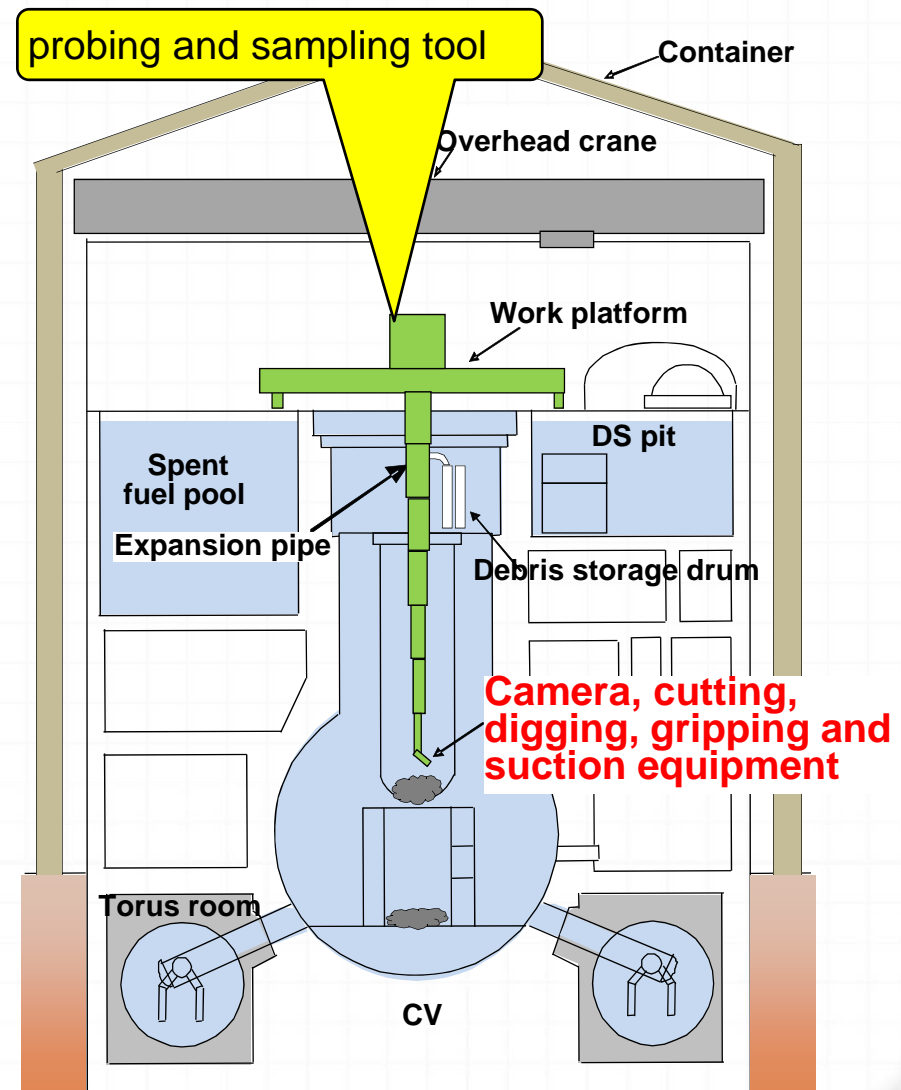
## Example

### Activity

- Probing the inside of RPV and taking samples

### Necessary Technology R&D

- Decontaminate the building
- Reestablish leak tightness
- Remotely probe and take samples in high radiation area
- Clarify properties of debris/material
- Treat contaminated water and waste



# Measures for Off-site Remediation

To decrease existing and potential annual exposures, we should pursue;

- Reducing the number of exposed people
- Modifying pathways of contaminant to a people
- Removing existing sources by decontamination.

The priority choices the Government is pursuing are

- a. Restriction of inhabiting in the area where expected annual additional dose is larger than 20 mSv;
- b. Strict shipping control for agricultural products, animal products and marine products through radiological surveys
- c. Step-by-step decontamination of the peoples' environment.

# Strategy for Decontamination of Peoples' Environment

- ◆ Reduce the size of the areas where estimated additional annual exposure is larger than 20 mSv and residents have been already evacuated through step by step decontamination activities based on the results of demonstration activities.
- ◆ Reduce the additional annual exposure below 1 mSv on a long term basis in non-restricted areas where it is below 20 mSv.
  - Pursuing wide area decontamination in highly contaminated areas and localized decontamination in relatively low contamination areas, identifying hot spots such as those locations where sludge in the drains or gutters has collected.
  - Pursuing exhaustive decontamination of **children's' environment** (schools, play grounds, etc.), aiming at reducing their annual additional exposure to 1 mSv as soon as possible.



# International Supports and Advices

## **MISSION REPORT**

### **THE GREAT EAST JAPAN EARTHQUAKE EXPERT MISSION**

### **IAEA INTERNATIONAL FACT FINDING EXPERT MISSION OF THE FUKUSHIMA DAI-ICHI NPP ACCIDENT FOLLOWING THE GREAT EAST JAPAN EARTHQUAKE AND TSUNAMI**

**Tokyo, Fukushima Dai-ichi NPP, Fukushima Dai-ni NPP and  
Tokai Dai-ni NPP, Japan**

*24 May – 2 June 2011*

IAEA MISSION REPORT

DIVISION OF NUCLEAR INSTALLATION SAFETY

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY

## **Airborne Monitoring By USDOE**

## **IAEA's International Expert Mission on Remediation**

## **International Symposium on Decontamination cosponsored by IAEA and NEA held in Fukushima on 16 October 2011**

## **Participation in Risk Communication Activities at Fukushima by Radiation Safety Experts including ICRP Members**

# Root Causes of the Accident

- ◆ Nuclear regulator and operators, who were shy with probabilistic analysis, failed to let the experts of tsunami know the necessity of having information about a tsunami that has a frequency of exceedance of less than 1 in 10,000 years.
- ◆ Before 2000 the experts of tsunami had been interested in finding the historical maximum tsunami height at a given site with limited resources available. However, nuclear people had utilized it as a design basis without paying due attention to the limitation.
- ◆ Nuclear regulator and operators also failed to recognize the emerging need for defense-in-depth features that would prevent a disproportionate increase in radiological consequences from an appropriate range of events that are more severe than the design basis event including terrorist attacks, i.e. the need for severe accident mitigation features that should prevent severe external events causing prolonged station blackout.

# Nuclear Safety and Security Agency

- The Cabinet decided to create “Nuclear Safety and Security Agency (NSSA) (tentative)” next April as an affiliated organization of the Ministry of Environment, separating the nuclear safety regulation section of the Nuclear and Industry Safety Agency (NISA) from the Ministry of Economy, Trade and Industry (METI) and integrating the function of the Nuclear Safety Commission (NSC).
- The NSSA will be in charge of safety regulation on the use of reactors and nuclear fuel materials, nuclear security, leading function in environmental monitoring and crisis management including emergency responses.

## Compensation of Damage Caused by the Accident

- ◆ The Law says that plant operator liability is exclusive, absolute and unlimited. The government may relieve the operator of liability if it determines that damage results from “a grave natural disaster of an exceptional character”.
- ◆ The government, judging that the accident was a man-made disaster (to be precise, TEPCO asked the Government to postpone the legal decision of the applicability of the relief clause related with a grave natural disaster to expedite the damage compensation), set up a new state-backed institution called **Nuclear Damage Liability Facilitation Fund** to expedite payments to those affected. The Fund receives financial contributions from nuclear power plant operators in Japan, and from the government through special bonds that total JPY 5 trillion (\$62 billion). The provision for contributions from nuclear operators is similar to that in the USA.
- ◆ The TEPCO have to pay a special annual fee for the government support, maintaining adequate power supplies and decreasing fixed assets into cash as the need arises.



# International Responses

- **Stress tests or equivalent reviews** to determine capability to handle beyond design basis events including severe accident
- The IAEA adopted **the 12-Point Action Plan on Nuclear Safety**. In the action plan, we all agreed to work hard for stronger international safety standards.
- A key issue should be how to and how quickly to achieve a harmonization of technical safety standards among member states so that everybody will adopt a key lesson learned at Fukushima, that is, the need for enough thickness of defense-in-depth in design and operation of nuclear facilities to prepare for the worst and enjoy the benefit of nuclear power under enhanced safety framework.

# **The GLOBAL 2011 is the 10th Anniversary of the GLOBAL Conference Series That Started at Seattle in 1993.**

A keynote speaker of Seattle GLOBAL, Dr. Wolf Haefele, who was the father of German fast breeder program argued;

- The first wave of nuclear power deployments with an open fuel cycle is destined to saturate at the share under 20% of global electricity production, because nuclear power was put into an existing technical and institutional infrastructure characterized by the use of oil, coal and gas.
- To prepare ourselves for evolution or even revolution in the future, spent fuel should be tentatively stored internationally, as one cannot treat nuclear power like chemical power, uranium like yellow coal.

# Establishment of Generation IV International Forum (GIF)

The rationales :

- a. Prospects for energy needs show the possibility of a strongly increasing demand for nuclear power. In such a hypothesis, sustainability becomes a predominant concern, which means that preservation of natural resources, waste minimization and proliferation resistance are criteria as important as economy and safety:
- b. Other applications of nuclear energy than electricity production are to be considered, in particular, hydrogen production, industrial use of heat or desalination: and
- c. The development of new systems will take time and require validation and demonstration. Therefore, the target for industrial scale applications was 2030 or later.

# Establishment of the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)

- It intends to bring together nuclear technology holders and users to consider jointly international and national actions that would result in required innovations in nuclear reactors, fuel cycles or institutional approaches.
- It has attained a remarkable success in bringing about the understanding of the future development of nuclear energy systems from a national, regional and global perspective.



# Way to Combat Global Warming

- o IPCC: reductions of at least 50% in global CO<sub>2</sub> emissions compared to 2000 levels will need to be achieved by 2050 to limit the long-term global average temperature rise to between 2.0 C and 2.4 C.
- o The IEA studied the least-cost means of achieving the goal of halving global energy-related CO<sub>2</sub> emissions by 2050 (compared to 2005 levels) through the deployment of existing and new low-carbon technologies.

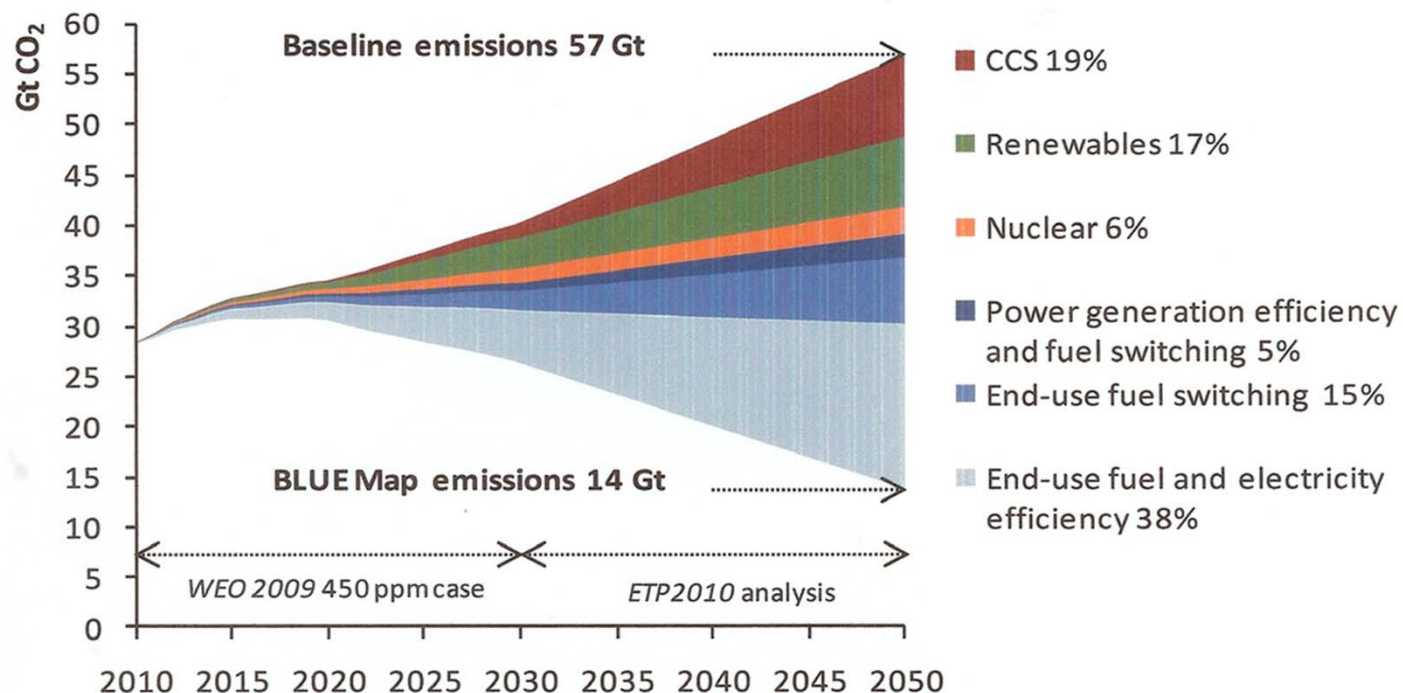
**ENERGY  
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PERSPECTIVES  
2010**

Scenarios &  
Strategies  
to 2050



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## Key technologies for reducing global CO<sub>2</sub> emissions under the BLUE Map scenario



A wide range of technologies will be necessary to reduce energy-related CO<sub>2</sub> emissions substantially.

# Our Obligation

- Train young generation of nuclear scientists and engineers who are to sustain the development and utilization of nuclear energy toward the future
- Promote carefully planned yet highly aggressive long-term research and development programs that exploit a nuclear energy's innate feature, namely, its economically harvestable resource base good for a millennium of world energy supply by closing the fuel cycle.
  - Produce a conceptual design of a fast reactor and its fuel cycle system that can satisfy the performance goals of safety, economy, sustainability, and proliferation resistance and operate its prototype system before 2030.
  - Explore advanced reprocessing technology that can efficiently recover minor actinides (MAs) as well as plutonium from spent fuel and advanced technology to fabricate fuel to burn such materials in fast neutron systems.
- GIF and INPRO should cooperate for pursuing sustainability of nuclear technology realizing sustainable nuclear energy technology with such characteristics.



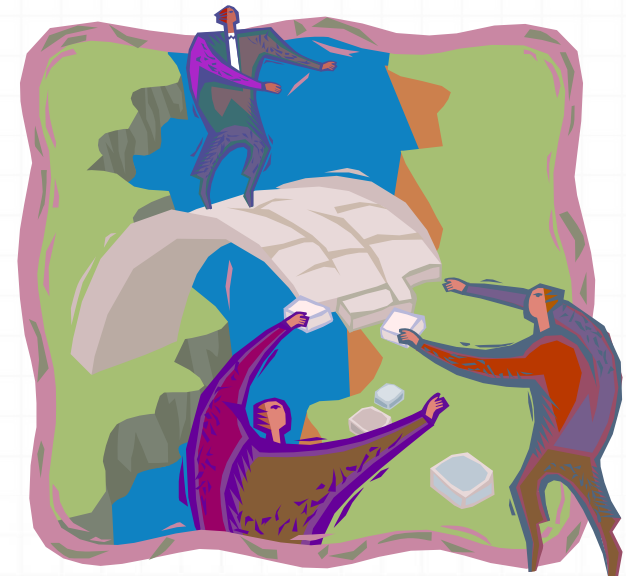
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# Plans for Evacuation Area

- The Government has started one demonstration decontamination project in every municipal area to try various approaches and establish the guideline for their widespread implementation.
- As for agricultural land, the Ministry of Agriculture, Forestry and Fisheries has promoted activities to verify the effectiveness of various decontamination technologies to be applied to contaminate agricultural fields.
- Based on the results of such projects, the Government will start a full-scale decontamination activity before the end of the year in cooperation with the municipal governments so that displaced people can return home as soon as possible, though it will be necessary to restore the operation of public services essential for living before removing the restriction of entrance.

# Overview of the Generation IV Systems

<i>System</i>	<i>Neutron Spectrum</i>	<i>Fuel Cycle</i>	<i>Size (MWe)</i>	<i>Applications</i>	<i>R&amp;D Needed</i>
<i>Very-High-Temperature Reactor (VHTR)</i>	Thermal	Open	250	Electricity, Hydrogen, Process Heat	Fuels, Materials, H <sub>2</sub> production
<i>Supercritical-Water Reactor (SCWR)</i>	Thermal, Fast	Open, Closed	1500	Electricity	Materials, Thermal-hydraulics
<i>Gas-Cooled Fast Reactor (GFR)</i>	Fast	Closed	200-1200	Electricity, Hydrogen, Actinide Management	Fuels, Materials, Thermal-hydraulics
<i>Lead-Cooled Fast Reactor (LFR)</i>	Fast	Closed	50-150 300-600 1200	Electricity, Hydrogen Production	Fuels, Materials
<i>Sodium Cooled Fast Reactor (SFR)</i>	Fast	Closed	300-1500	Electricity, Actinide Management	Advanced recycle options, Fuels
<i>Molten Salt Reactor (MSR)</i>	Epithermal	Closed	1000	Electricity, Hydrogen Production, Actinide Management	Fuel treatment, Materials, Reliability

## Projected nuclear capacity in the NEA high and low scenarios

