



The Generation IV International Forum Advancements and Objectives

Yutaka Sagayama

Chair of the Generation IV International Forum

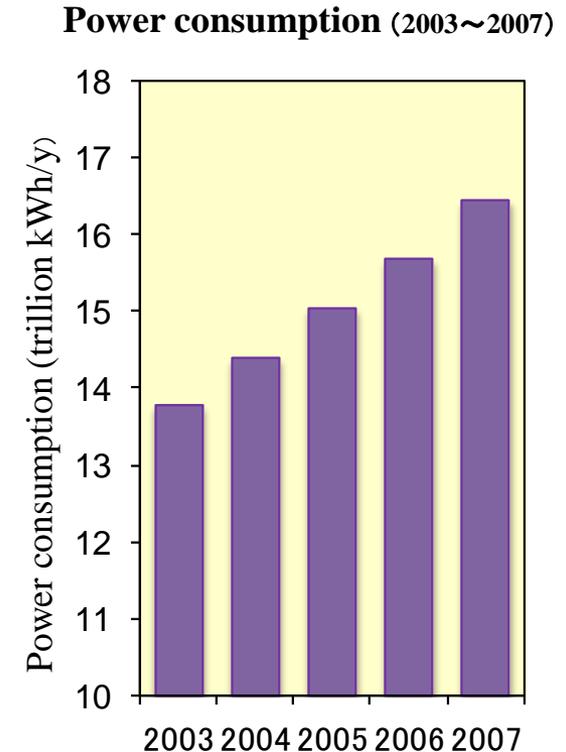
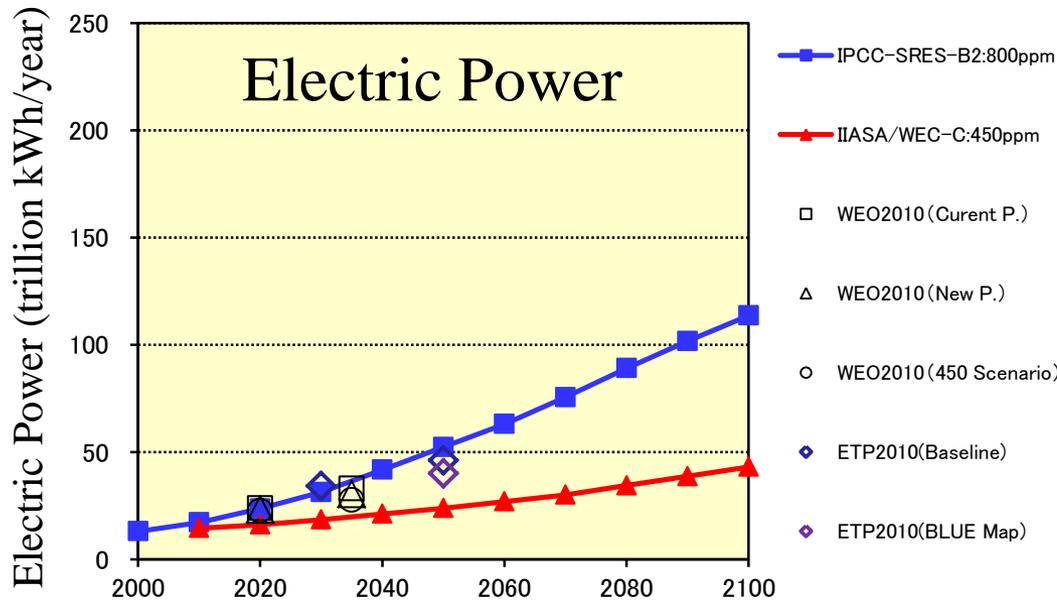
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Prospect on demand of Electric Power in the world

- Demand of electric power is prospected by international organizations to continue steady growth.
- Power demand actually is increasing.
- Capability for supply that is available for growth of power demand would be necessary.



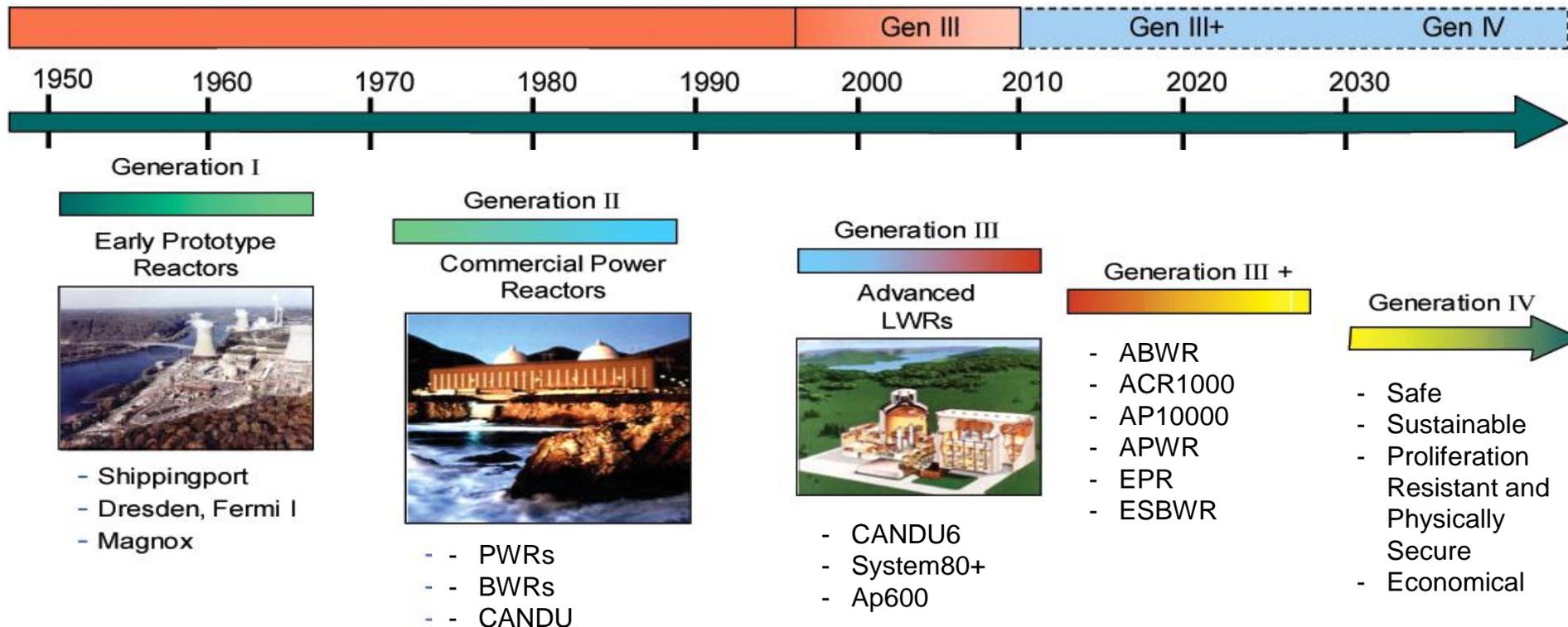
- IIASA/WEC: “GLOBAL ENERGY PERSPECTIVES”, IIASA/WEC (1998),
- IPCC/SRES: “Special Report on Emissions Scenarios”, IPCC(2000),
- WEO2010: World Energy Outlook 2010, IEA,
- ETP2010: Energy Technology Perspective 2010, IEA
- IEA, “Energy Balances of OECD Countries”, “Energy Balances of Non-OECD Countries”

Generation IV International Forum (GIF)

- International cooperation framework for the development of next generation (Generation-IV) nuclear energy systems (Gen-IV systems)
- Conducting various international cooperative R&D for 6 reactor systems
- Crosscut evaluation and methodology development in working groups for safety, cost evaluation, and proliferation resistance and physical protection

Generation of Nuclear Energy Systems

- Current nuclear plants under operation mainly belong to Gen-II and Gen-III reactors.
- Gen-III+ and Gen-IV reactors are expected as next nuclear power plants.
 - Gen-III reactors are featured by more safety measures.
 - Gen-IV reactors are promoted toward commercialization in around 2030s.



Objectives of Gen-IV systems development

Goals : Four challenging technology goals have been defined to be applied to innovative nuclear reactor concepts in the 21st century:

- ① **Safety and Reliability** (safe and reliable operation, no offsite emergency response)
- ② **Sustainability** (effective fuel utilization, minimization of nuclear waste)
- ③ **Proliferation Resistance & Physical Protection** (to assure unattractive and the least desirable route for diversion or theft of weapons-usable materials, and provide increased physical protection against acts of terrorism)
- ④ **Economic Competitiveness** (life-cycle cost advantage over other energy resources)

Phase: Each Generation-IV reactor system has been promoted on three stages.

- ① **Viability Phase**
- ② **Performance Phase**
- ③ **Demonstration Phase**

Target : Commercial Deployment is expected around 2030s or beyond.

GIF's History

Jan. 2000 **Joint Statement was announced in D.C. .**

Jul. 2001 **GIF Charter was signed.**

*Nine countries signed the GIF Charter in July 2001. Subsequently, it was signed by Switzerland, EU, China and Russia.

Jul. 2002 **6 Innovative nuclear systems were selected.**

Dec. 2002 **Technology Roadmap was created.**

Feb. 2005 **Framework Agreement was concluded.**

Jul. 2011 **Extension of GIF charter was signed.**

GIF Governance Structure

• Policy Group (PG)

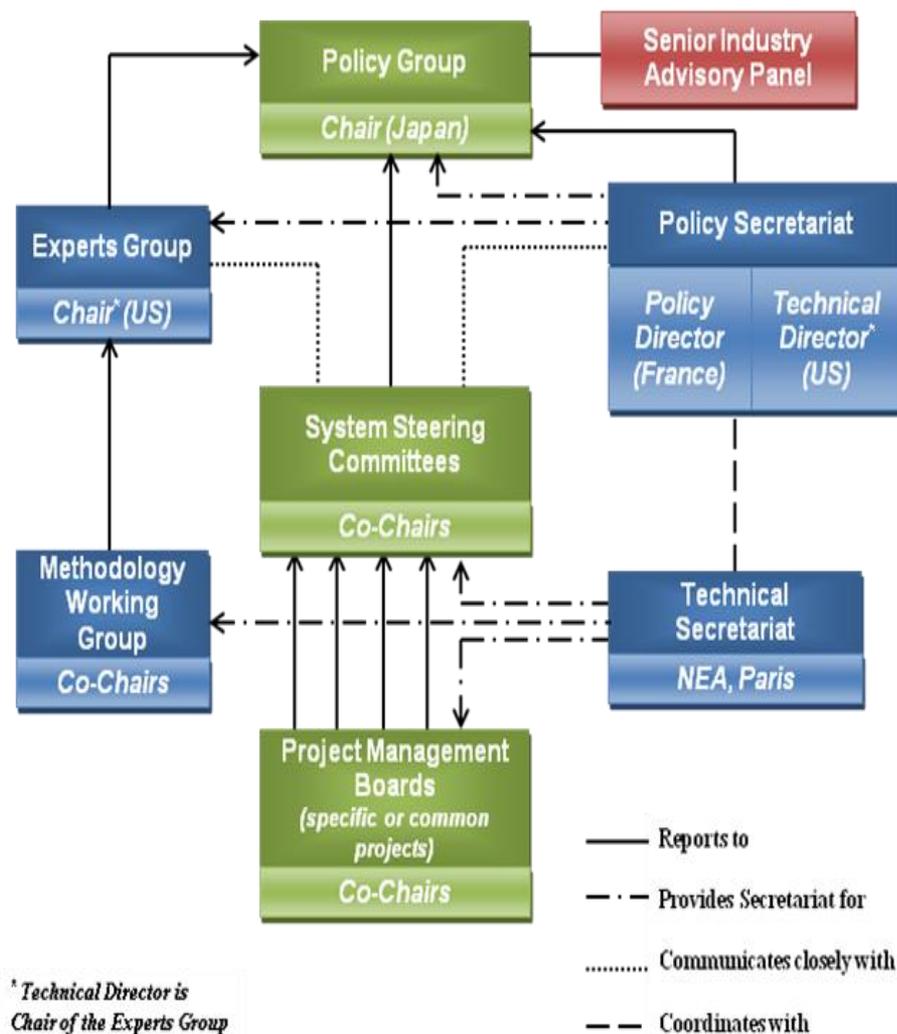
The Policy Group acts as a decision-making body for the overall framework, policy and interaction with other organizations

• System Steering Committees (SSCs)

SSCs are organized for each Gen-IV systems to plan and management of the R&D.

• Project Management Boards (PMBs)

Within each system, PMBs are established for planning and implementation of the corresponding project activities.



Interactions with industries and support of GIF

The Senior Industrial Advisor Panel (SIAP), consisted of executives from the industries of GIF member countries, advises PG from industrial point of view. PG has discussed with SIAP members once a year in the PG meeting.

Areas of Advice are:

- Project management
- Process of R&D, deployment and commercialization
- Priorities of key stake holders
- Licensing
- Validity of business models
- Safety criteria
- Quality management, etc.

• Experts Group (EG)

The Experts Group assists PG by evaluating R&D strategy and methodologies.

• Methodology Working Groups (MWGs)

MWGs are responsible for developing methodologies for the assessment of Gen-IV systems in the fields of economics, PRPP and risk & safety.

• Senior Industry Advisor Panel (SIAP)

SIAP, consisted of executives from the industries of GIF member countries, advises GIF from industrial point of view.

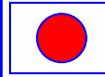
• Technical Secretariat (OECD/NEA)

OECD NEA acts as the Technical Secretariat to support GIF.

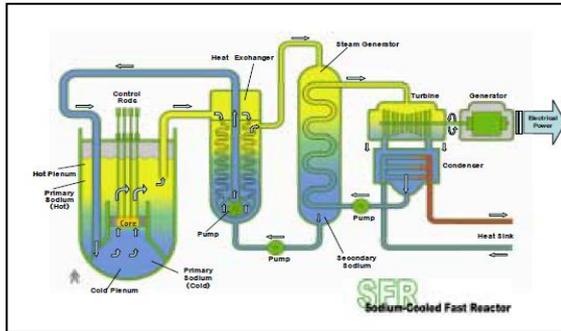
Membership to GIF System Arrangements

X: Signatory , MOU: Memorandum of Understanding

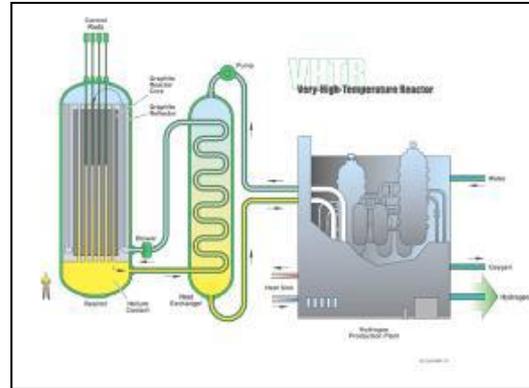
(GIF members: 12 countries and 1 agency)

	 CAN	 FRA	 JPN	 ROK	 ZAF	 CHE	 USA	 EUR	 PRC	 RUS	 UK	 RFB	 ARG
Sodium-cooled Fast Reactor (SFR)		X	X	X			X	X	X	X			
Very High Temperature Reactor (VHTR)	X	X	X	X		X	X	X	X				
Gas-cooled Fast Reactor (GFR)		X	X			X		X					
Supercritical Water-cooled Reactor (SCWR)	X		X					X		X			
Lead-cooled Fast Reactor (LFR)			MOU					MOU		MOU			
Molten Salt Reactor (MSR)		MOU						MOU					

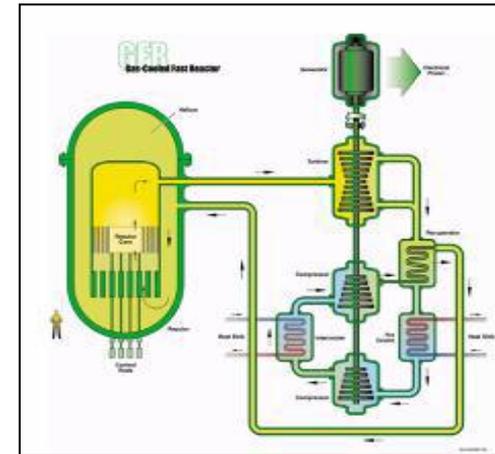
Six Gen-IV systems



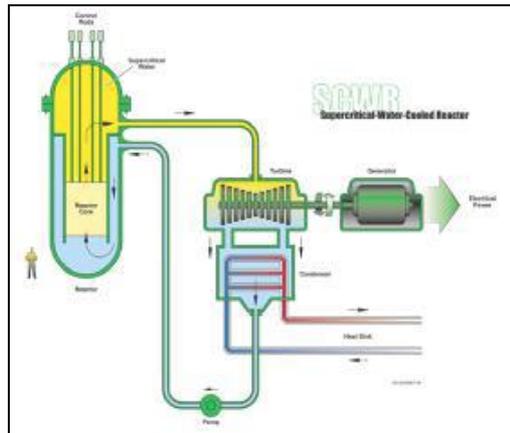
Sodium-cooled Fast Reactor (SFR)



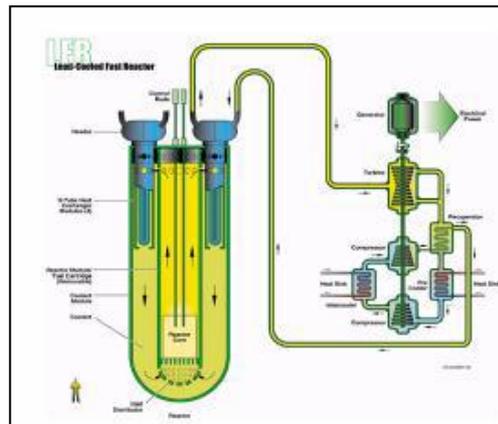
Very High Temperature Reactor (VHTR)



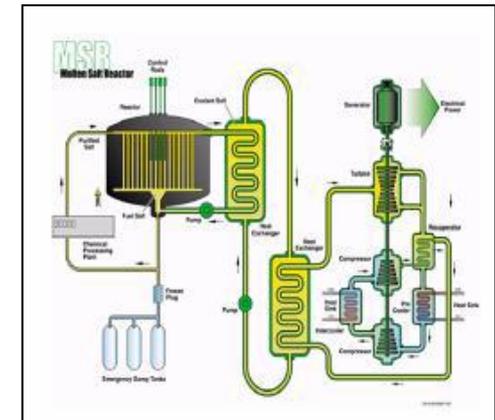
Gas-cooled Fast Reactor (GFR)



Supercritical Water-cooled Reactor (SCWR)



Lead-cooled Fast Reactor (LFR)



Molten Salt Reactor (MSR)

Projects & Progress of each system

(1) Sodium-cooled Fast Reactor(SFR)

Four projects (Advanced Fuel, Global Actinide Cycle International Demonstration, Component Design and BOP, Safety and Operation) have been promoted. A project arrangement of SI&A(System Integration and Assessment) is ready for signing.

(2) Very High Temperature Reactor (VHTR)

Three projects (Hydrogen production, Fuel and Fuel Cycle, Materials) are progressing steadily. CMVB(Computational Methods Validation and Benchmarking) is in a preparatory stage.

(3) Gas-cooled Fast Reactor (GFR)

Fuel and Core Materials project is being prepared for official agreements, and Conceptual Design and Safety project is in progress.

(4) Supercritical Water-cooled Reactor(SCWR)

Two projects (Materials and Chemistry, Thermal-hydraulics and safety) are on going. Fuel qualification test project is currently negotiated.

(5) Lead-cooled Fast Reactor (LFR), Molten Salt Reactor(MSR)

Memoranda of Understandings (MOUs) have been concluded for the LFR and MSR systems. System research plans are being prepared for both systems.

Recent GIF Activities (1): GIF/INPRO Collaborations

- Both GIF and INPRO are international cooperation frameworks for R&D of the next generation nuclear energy systems.
- Discussions and information exchanges are made for development of nuclear energy systems to meet the increasing future energy demand.
- Interface meeting has been held regularly, and SFR safety workshop has been conducted intensively.
- AS Fields of cooperation, there are methodology development (Safety, Economics, PRPP), etc.

Recent GIF Activities (2):

GIF Response to Fukushima Daiichi NPPs accident on Mar. 11, 2011

The GIF announced at PG meeting last October that it was confirmed to continue cooperation among GIF members and promote the development of the Gen-IV systems in future, while taking in the lesson learned from the accident of the Fukushima Daiichi nuclear power plants struck by the tsunami occurred on March 11, 2011.

Recent GIF Activities (3): SDC

- ◆ After the chair proposed to create SDC on SFR as international common criteria at PG meeting in the South Africa, October, 2010, GIF made a taskforce under the PG and has started examination.
- ◆ The SDC is the SFR design requirements meeting to safety goal and safety approach on Gen-IV systems.
- ◆ In order to achieve the enhanced safety for Gen-IV systems, the reinforced defense-in-depth is incorporated considering measures on prevention and mitigation of severe accidents. The lessons learned from Fukushima NPPs accident are also taken into account in the SDC.
- ◆ The draft SDC has been completed, and will be reviewed in tomorrow's GIF PG meeting.

Recent GIF Activities (4): Decadal Strategic Planning

Next decadal planning is under intensive review aiming at the further progress of GIF.

○ Strategic planning for next decade

- Ten years have passed from establishment of GIF
- Development of Gen-IV systems has shifted to next phase
- Technology has advanced

○ Taskforce for next decadal planning

- Technology roadmap update
- Strengthening R&D collaboration
- Strengthening ties with other international organizations

Summary

- The GIF has played a major role as an international framework for development of next generation nuclear energy systems since 2001.
- With increasing energy demands and global environmental challenges, demands for nuclear energy will further expand in the future.
- Actually, rapidly energy demand expanding countries including China and India plan to enlarge the capacity of nuclear power. The Gen-IV systems also need to be deployed.
- Even after Fukushima Daiichi NPPs accident, Gen-IV systems' importance has not changed. More enhancement of safety is crucial.
- The further development of Gen-IV systems needs close cooperation with INPRO and helpful advice from industries.

Thank you for your attention!

<http://www.gen-4.org/>