

Prospects on future nuclear energy initiative: a GIF initiative

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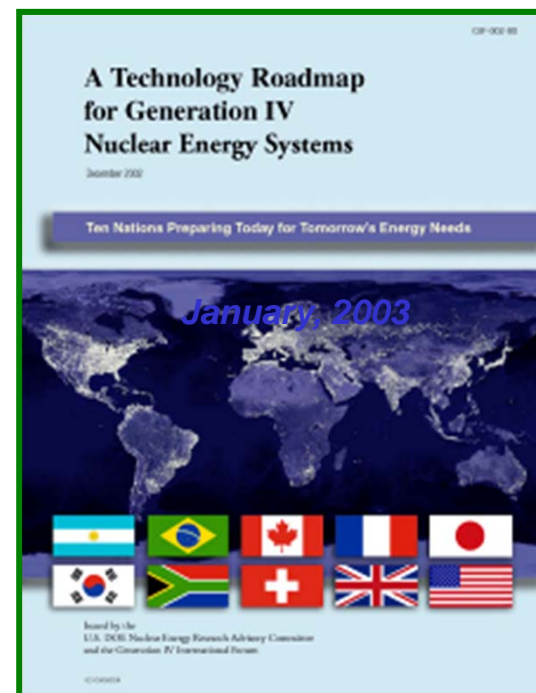
Function of the GIF

Charter signed in 2001 to:

- *Identify potential areas of multilateral collaborations on Generation IV nuclear energy systems*
- *Foster collaborative R&D projects*

Framework Agreement signed in 2005

- a) joint research and technology development;*
- b) exchange of technical information and data;*
- c) support for technological demonstrations;*
- d) conduct of joint trials/experiments;*
- e) participation of staff in experiments, analysis, design, ...;*
- f) exchange or loan of equipment for experiments;*
- g) organization of seminars; training;*
- h) monetary contributions to experimental facilities;*



http://www.gen-4.org/Technology_roadmap.htm

First level Goals for innovative systems

➤ **Sustainability–1**

Generation IV nuclear energy systems will provide sustainable energy generation that meets clean air objectives and promotes long-term availability of systems and effective fuel utilization for worldwide energy production.

➤ **Sustainability–2**

Generation IV nuclear energy systems will minimize and manage their nuclear waste and notably reduce the long term stewardship burden in the future, thereby improving protection for the public health and the environment.

➤ **Economics–1**

Generation IV nuclear energy systems will have a clear life-cycle cost advantage over other energy sources.

➤ **Economics–2**

Generation IV nuclear energy systems will have a level of financial risk comparable to other energy projects.

➤ **Safety and Reliability–1**

Generation IV nuclear energy systems operations will excel in safety and reliability.

➤ **Safety and Reliability–2**

Generation IV nuclear energy systems will have a very low likelihood and degree of reactor core damage.

➤ **Safety and Reliability–3**

Generation IV nuclear energy systems will eliminate the need for offsite emergency response.

➤ **Proliferation Resistance and Physical protection**

Generation IV nuclear energy systems will increase the assurance that they are a very unattractive and least desirable route for diversion or theft of weapons-usable materials and provide increased physical protection against acts of terrorism.

First level Goals for innovative systems

➤ **Safety and Reliability–1**

Generation IV nuclear energy systems operations will excel in safety and reliability.

➤ **Safety and Reliability–2**

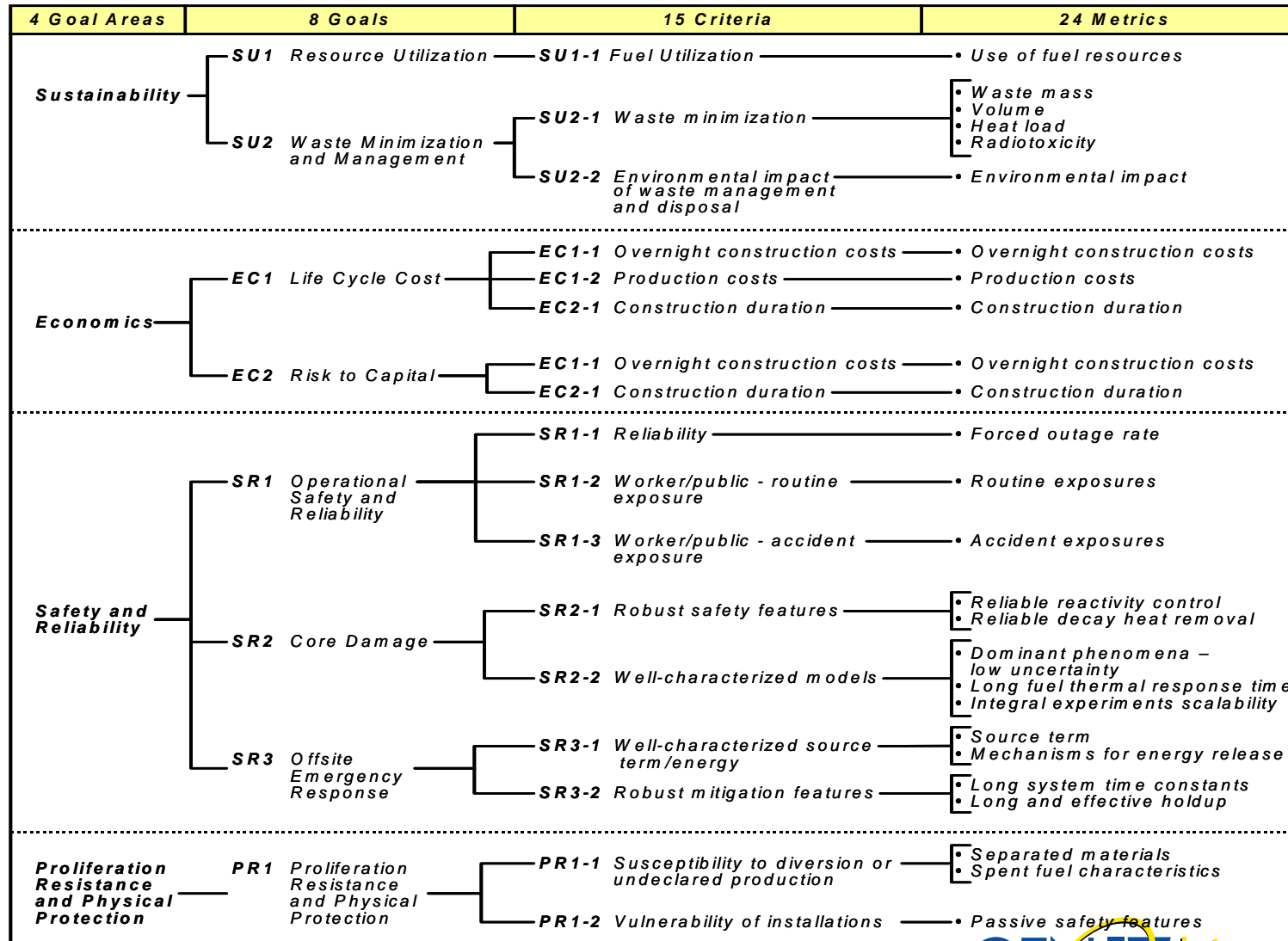
Generation IV nuclear energy systems will have a very low likelihood and degree of reactor core damage.

➤ **Safety and Reliability–3**

Generation IV nuclear energy systems will eliminate the need for offsite emergency response.

4 objectives, 15 criteria & 24 performance indicators

Rollup of Metrics, Criteria, Goals and Goal Areas



2001: 120 Generation IV concepts classified in 19 homogeneous families

GEN IV - Roadmap : Systems Identification

- Water-cooled reactors

- W1 - IPSR
- W2 - SBWR
- W3 - CANDU NG
- W4 - SCWR, thermal
- W5 - SCWR, fast
- W6 - HC-BWR

- Gas-cooled reactors

- G1 - PBR
- G2 - PMR
- G3 - VHTR
- G4 - HTGR closed cycle
- G5 - GFR

- Liquid-metal cooled reactors

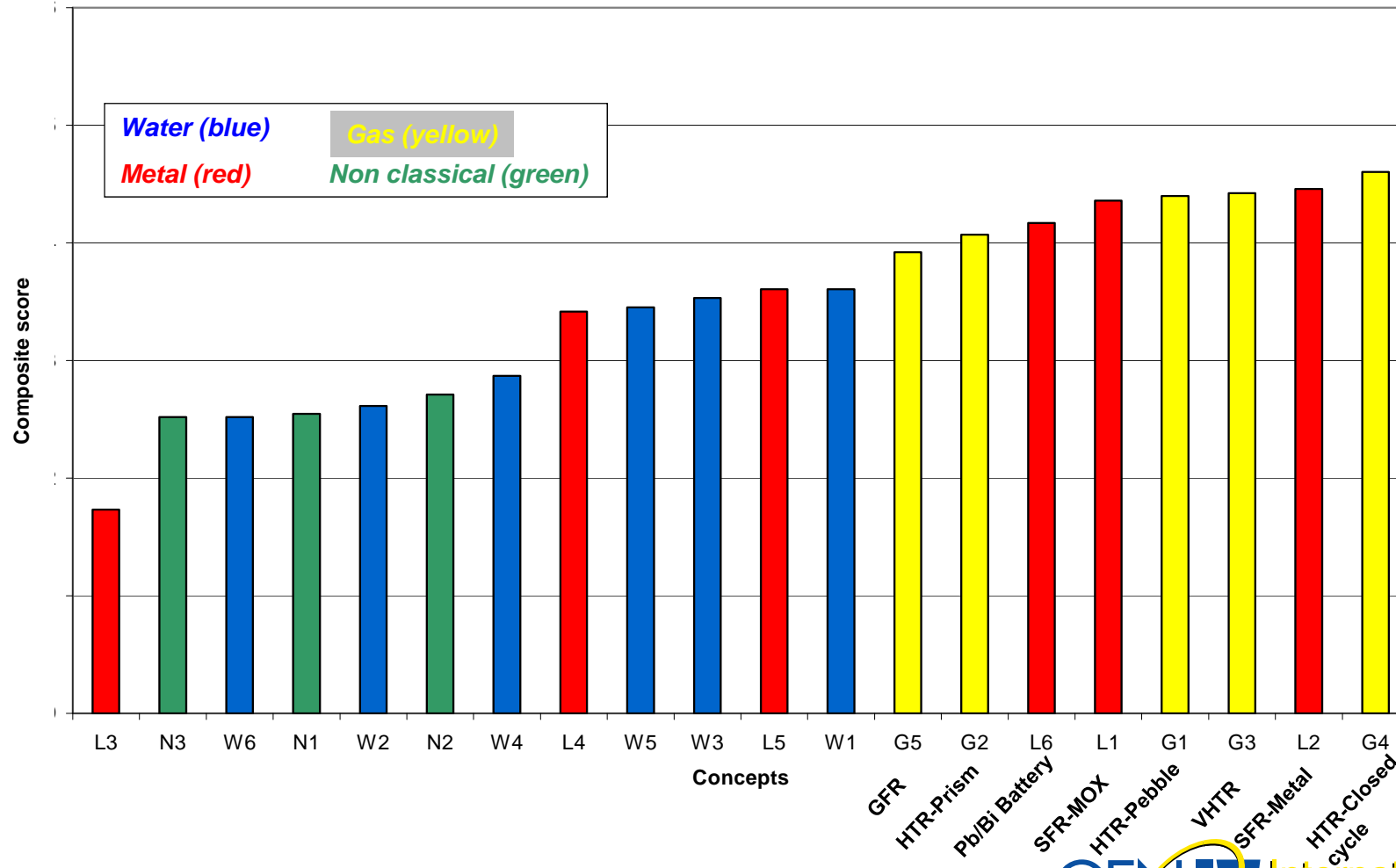
- L1 - Na cooled, MOX, aqueous
- L2 - Na cooled, metal fuel, pyrometallurgy
- L4 - Pb/Bi cooled, small
- L5 - Pb/Bi cooled, large
- L6 - Pb/Bi battery

- Non-classical reactors

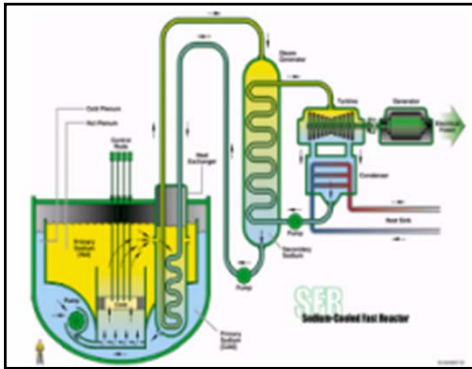
- N1 - MSR
- N2 - VCR
- N3 - AHTR (molten salt cooled)

Global Evaluation for all the concepts

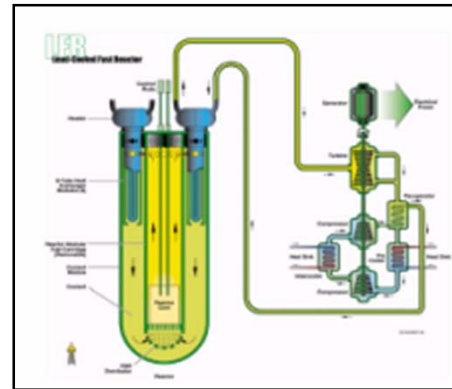
75th Percentile Composite Scores



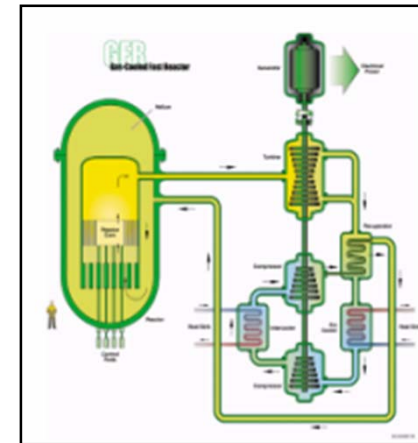
The six systems



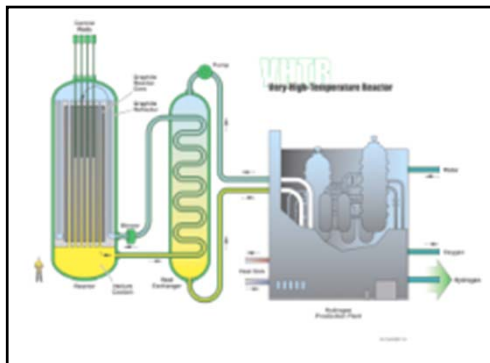
Sodium-cooled Fast Reactor



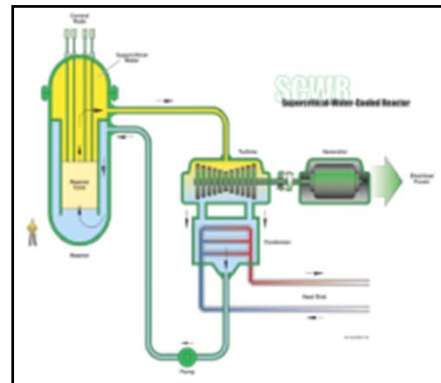
Lead-cooled Fast Reactor



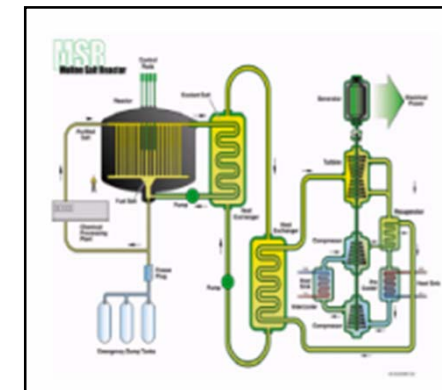
Gas-cooled Fast Reactor



Very High Temperature Reactor



Supercritical Water-cooled Reactor



Molten Salt Reactor

Contributions to the GIF

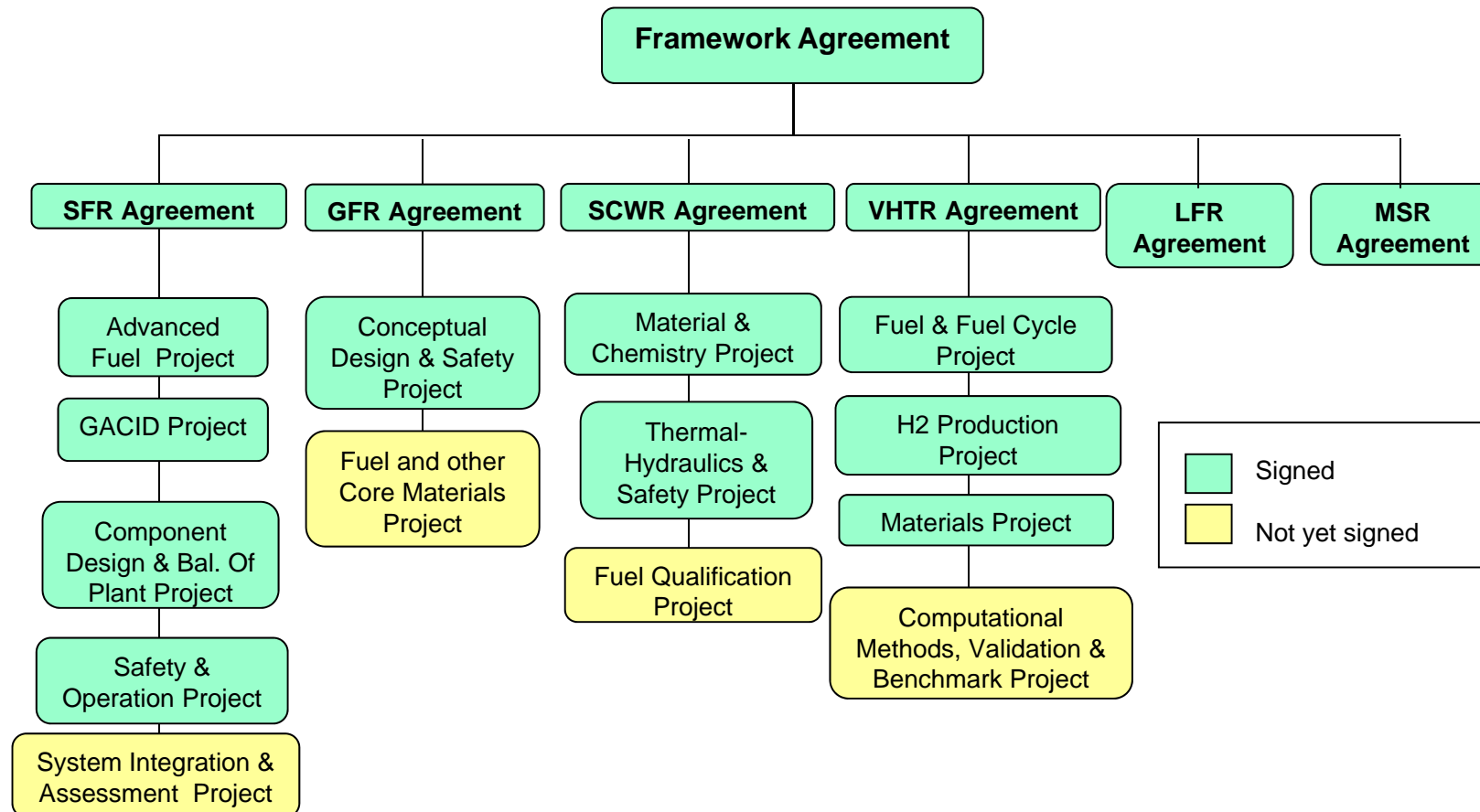


**Japanese Chairmanship since end of 2009 (3 year term):
Mr Yutaka Sagayama, from JAEA**

| VHTR | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | |
|-------------|---|---|---|---|---|---|---|---|---|---|
| GFR | | ◆ | ◆ | ◆ | | ◆ | | | | |
| SFR | | ◆ | ◆ | ◆ | ◆ | | ◆ | ◆ | | ◆ |
| SCWR | ◆ | ◆ | | ◆ | | | | | | ◆ |
| LFR | | ◆ | | ◆ | | | | | | ◆ |
| MSR | | ◆ | ◆ | | | | | | | |

Status of GIF agreements (Oct. 2011)

10 Projects signed, 4 planned

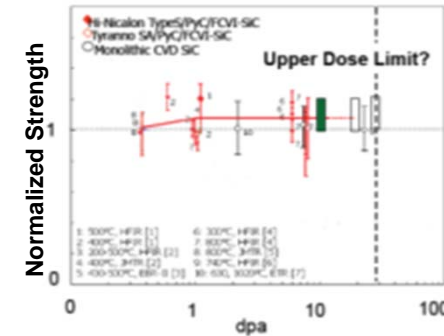
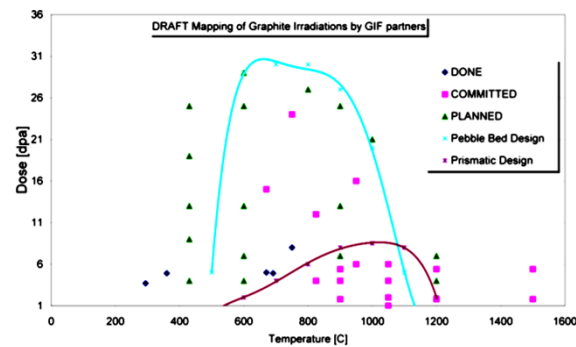
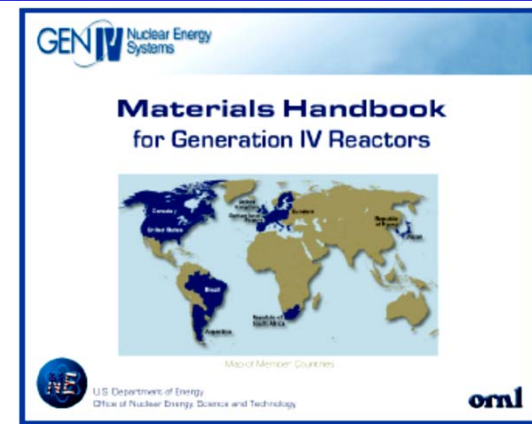


Examples of GIF results

VHTR Materials Project

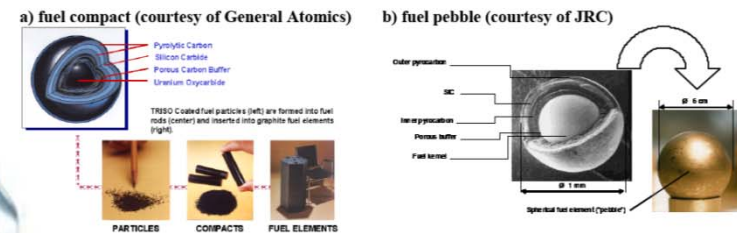
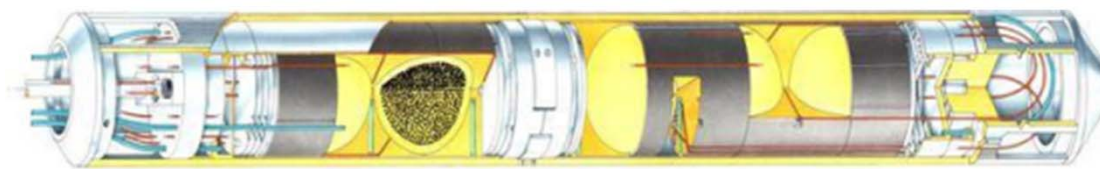
117 documents uploaded in the “Materials Handbook” database.

- Graphite + Metals and Design Methods + Ceramics and Composites



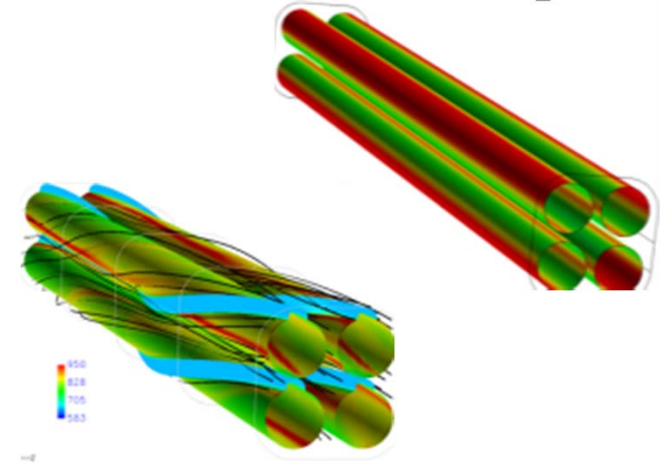
VHTR Fuel & Fuel Cycle Project

Several TRISO fuel irradiations in different GIF countries.



SCWR Thermal-Hydraulics and Safety Project

- *Heat transfer of supercritical fluids*
 - *From tubes and annuli to rod bundles*



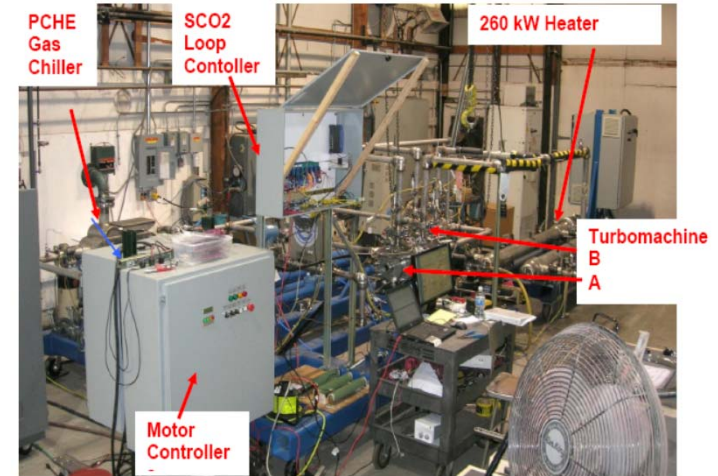
SCWR Materials & Chemistry Project

- *Round Robin tests on corrosion and radiolysis on structure materials*
- *Supercritical water loop under development*

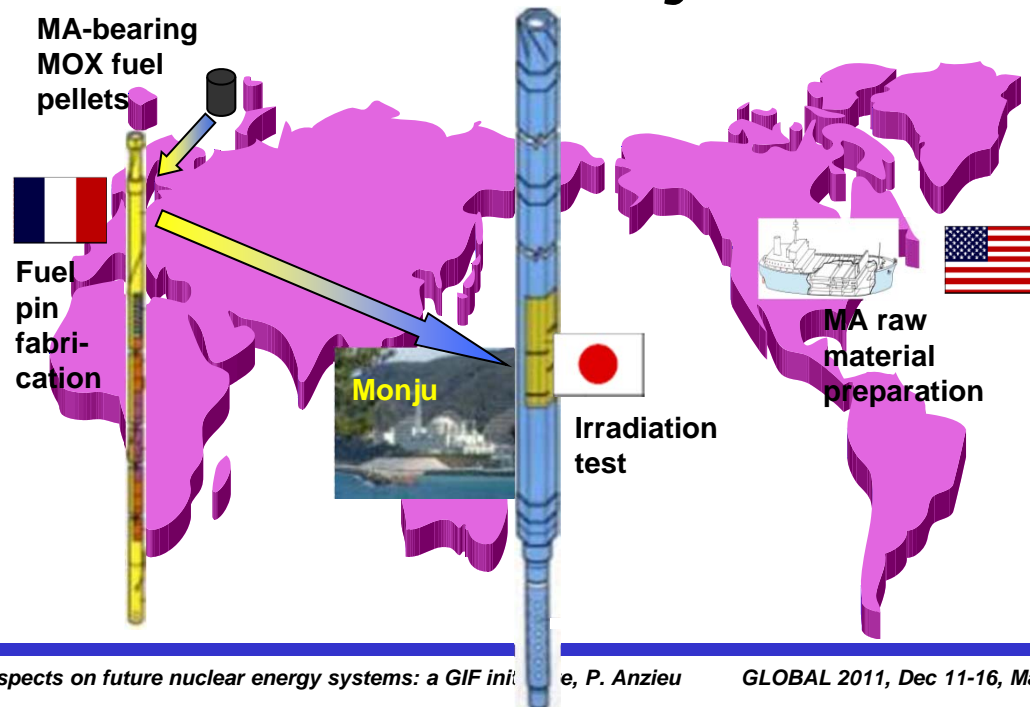


SFR Component Design & Balance of Plant Project

- **Supercritical CO₂ Brayton cycle**
 - Common development program
 - Small-scale demo loop under completion



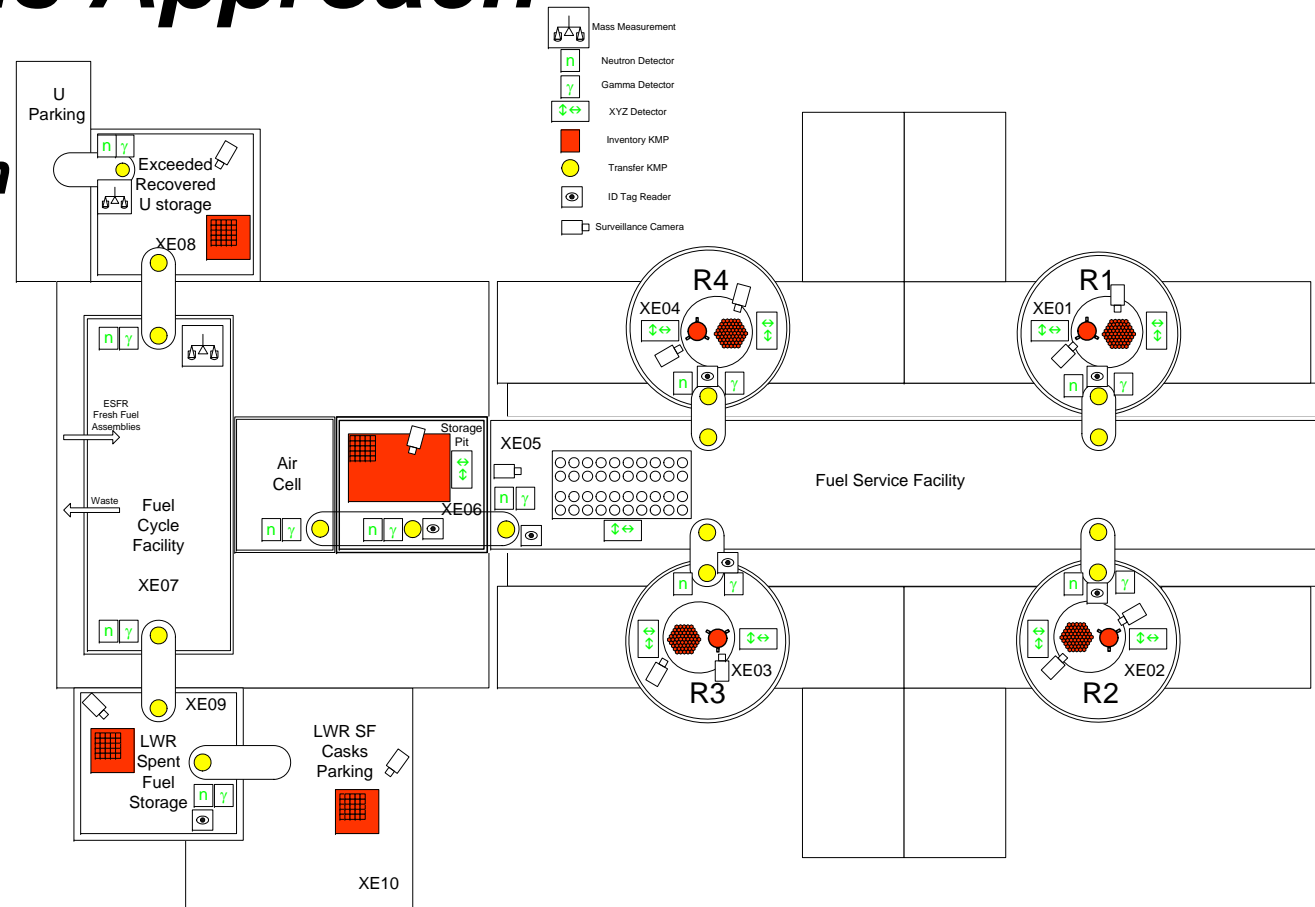
SFR GACID Project



- **A Global Actinide Cycle International Demonstration**

Proliferation Resistance & Physical Protection Working Group: A Safeguards Approach

- Implementation of cameras, gamma and neutron detectors, mass measurements



Conclusion

- ***The Generation IV International Forum has already defined a R&D strategy in support to future nuclear technologies***
- ***It has also developed a legal framework that combines R&D exchange, intellectual property and rights of use***
- ***Beyond Strategy and Information Exchange, GIF combines the sharing of research and information protection***
 - ***Several results already obtained***

THANK YOU