Overview of Generation-IV International Forum (GIF) Status

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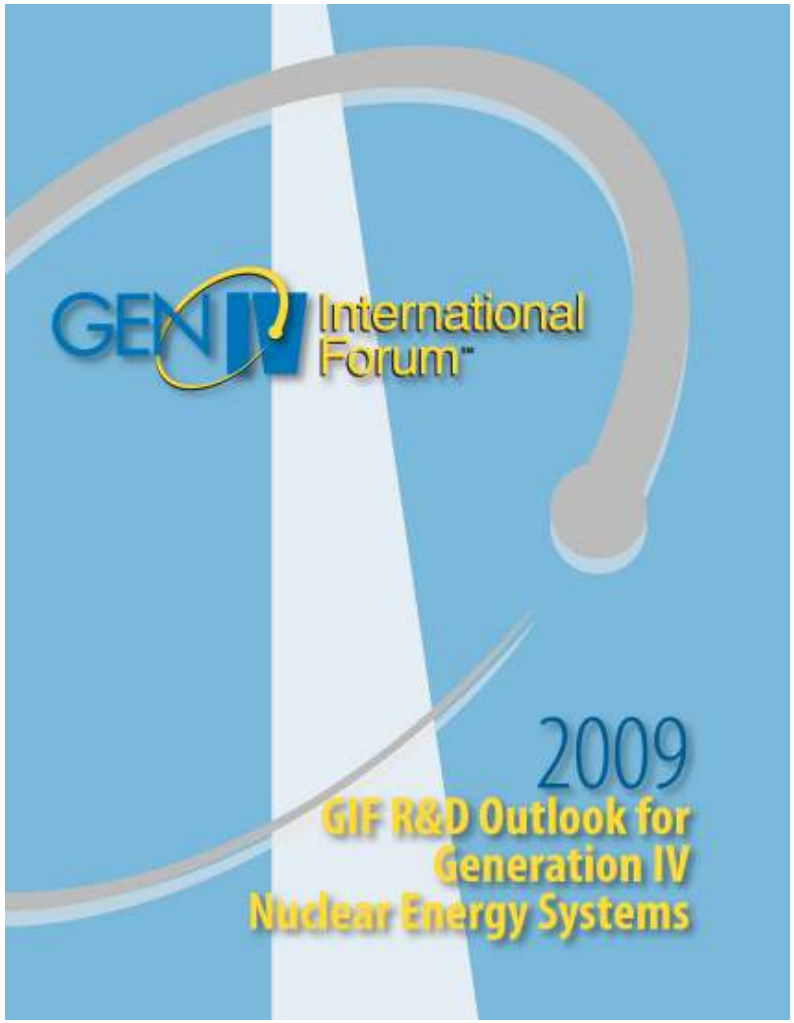


Preview

- Basis
- Background
- Technical scope
- Participants
- Status of Gen-IV systems
- Near term (5 year challenges)

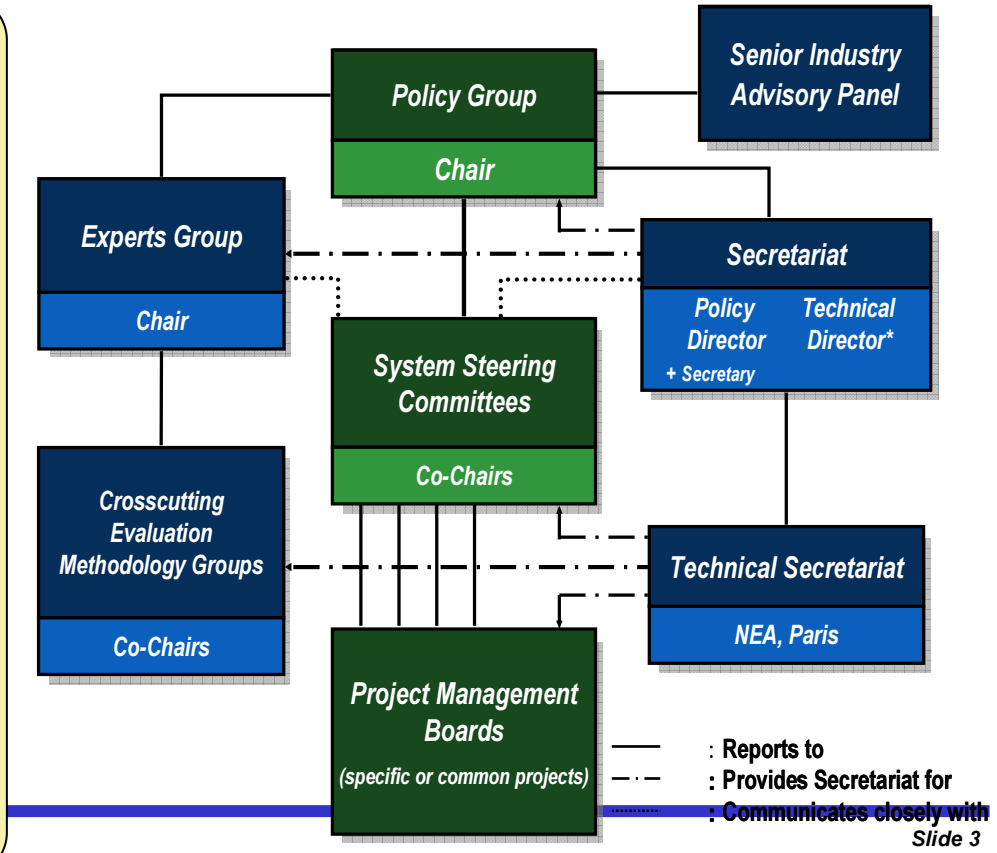
GIF(Generation IV International Forum)

○ Participating nations:

(Argentina), (Brazil), Canada, China, France, Japan, Korea, Russia, South Africa, Switzerland, (The U.K.), U.S.A., EU

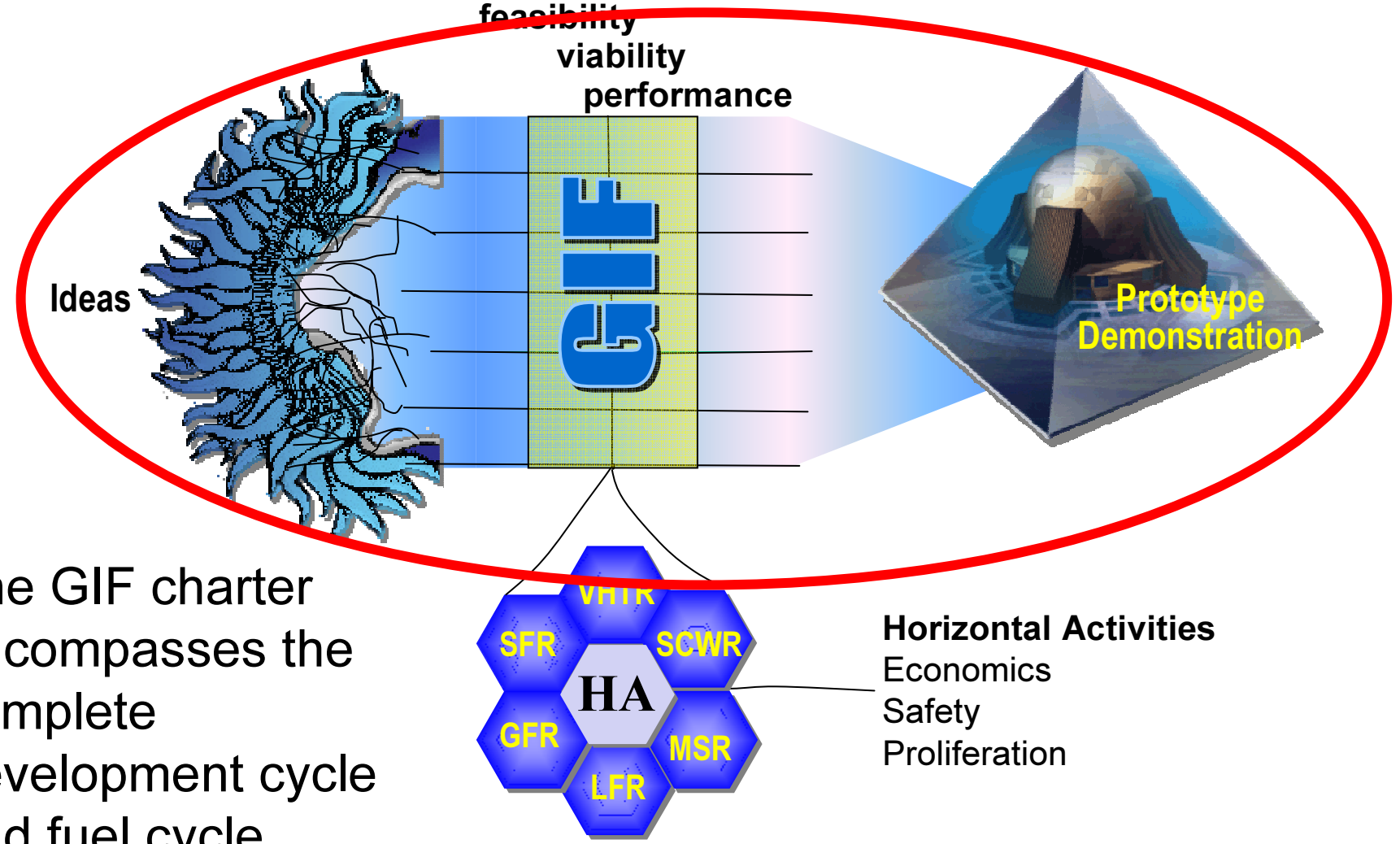
○ Goals and organization:

- ***Sustainability***
  - resources and waste management
- ***Proliferation Resistance ands Physical Protection***
  - Not a weapons path; secure against terrorism
- ***Economics***
  - Competitive cost and financial risk
- ***Safety and Reliability***
  - low risk of core damage, no EP




Helium
Pb-Bi
Actinides
CO2
550 C
Thermal
Heavy H2O
Uranium
SC Water
Thorium
Electricity
Plutonium
In the beginning, there was the GIF roadmap
Heat
Lead
800 C
Li salt
Hydrogen
Epithermal
Water
1000 C
Large
Sodium
Direct
Breeder
Small
Medium
Hydrogen
Brayton
Fast
Long Life
Burner

From concept to demonstration



The GIF charter encompasses the complete development cycle and fuel cycle

Horizontal Activities
Economics
Safety
Proliferation

Strategy

1. Identify challenging goals
2. Create a multilateral framework for cooperation among leading nuclear development nations
3. Organize, grow, expand membership:

   Canada, China, EU, France, Japan, Republic of Korea, Russia, Switzerland, USA, South Africa

Goals

Sustainability: resources and waste management

Economics: Competitive cost and financial risk

Safety: Reliable, low risk of core damage, no EPZ

Proliferation: Not a weapons path; secure against terrorism

Generation-IV Nuclear Energy Systems • International Partnerships

System	CA	CN	EU	FR	JP	KR	RU	CH	US	ZA
VHTR	✔	✔	✔	✔	✔	✔		✔	✔	P
SFR		✔	✔	✔	✔	✔	O		✔	
GFR			✔	✔	✔			✔		
SCWR	✔		✔	P	✔					
LFR			P		P	P			P	
MSR			P				O		P	

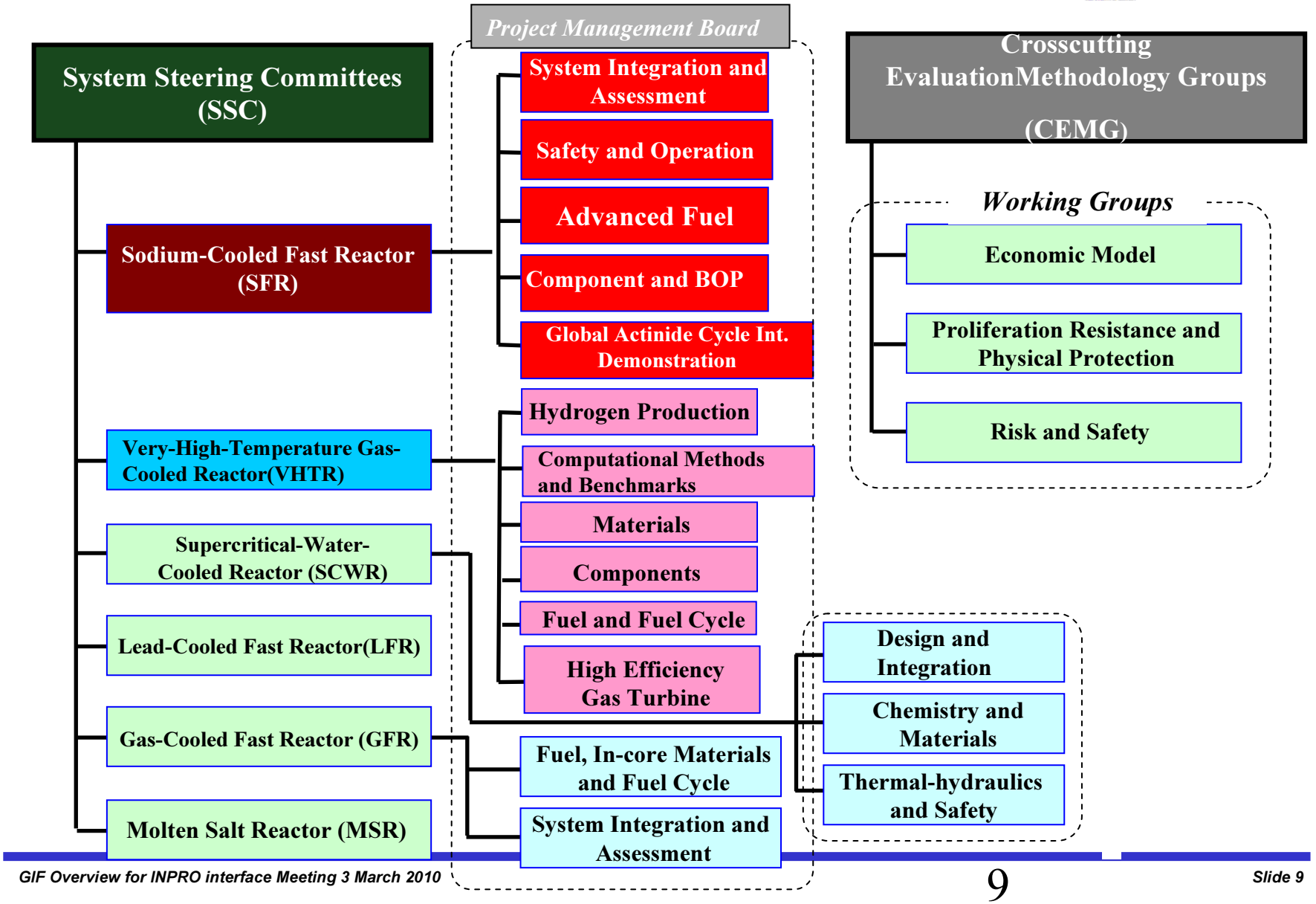
P= provisional participant; **O** = observer; Argentina, Brazil, and the United Kingdom are inactive. The Republic of South Africa acceded in 2008. The Russian Federation plans to accede in 2009.

Participating Nations for Generation IV System Developments

Generation IV Systems	Argentina	Brazil	Canada	France	Japan	Korea	South Africa	Switzerland	U.K.	U.S.A.	EU	China	Russia
Sodium-cooled Fast Reactor (SFR)				○	◎	○				○	○	○	(○)
Very-high Temperature Gas-cooled Reactor (VHTR)			○	○	○	○	(○)	○		○	◎	○	
Gas-cooled Fast Reactor (GFR)				◎	○			○			○		
Supercritical-water cooled Reactor (SCWR)			○		○						◎		
Lead-cooled Fast Reactor (LFR)					○					○	○		
Molten Salt Reactor (MSR)				○						○	○		

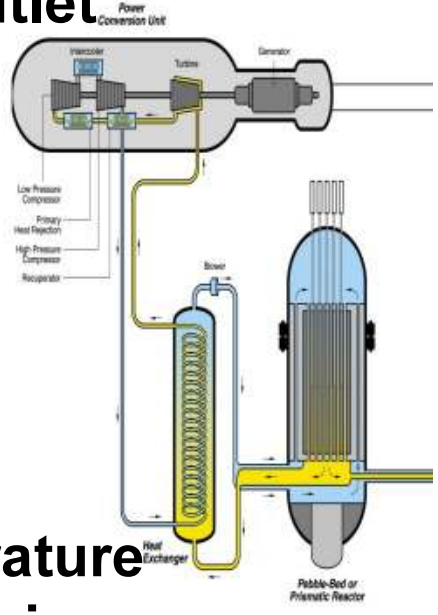
Note ○: Participating Nations, ◎: Co-chair country, ( ): Observer

The research and development organization in GIF

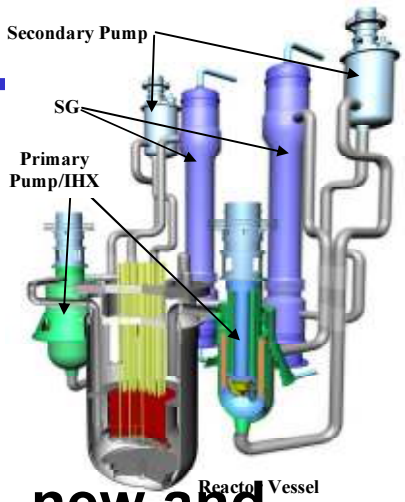


Very High Temperature Reactor outlook

- **Strong national programs and GIF arrangements**
- **Benefits from large national programs with plans for near-term prototype construction of GCRs with outlet temperatures of 750-850 C.**
- **Goal: Complete viability phase in 2010**
- **Technical focus**
  - TRISO fuel (oxide and oxicarbide)
  - Hydrogen production processes
  - Core and cooling system materials
- **Requirements for R&D, set power and temperature requirements, move into performance and design optimization phase.**



550 C

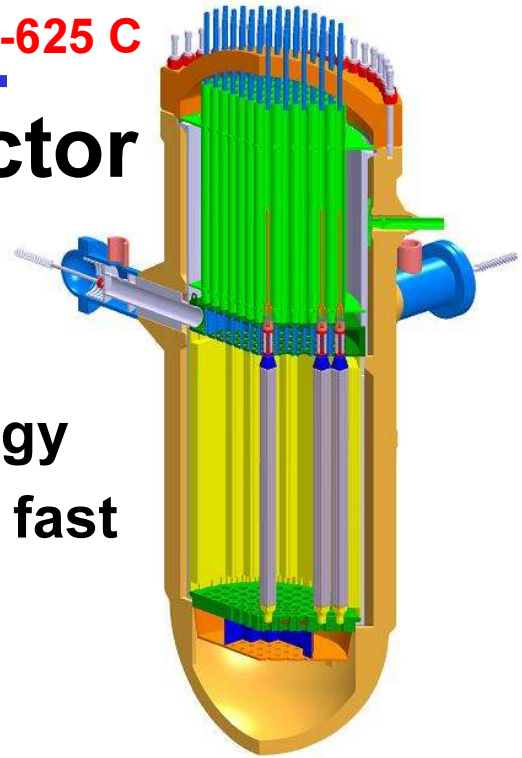


Sodium Fast Rector outlook

- **Strong national programs and experience**
- **Goal: Complete performance phase by 2015**
- **Gather fresh operating experience from existing, new and restarting reactors**
- **Key technical focus**
  - Advanced fuels including actinide recycling
  - Converge safety approach
  - Resolve feasibility issues regarding in-service inspection and repair
  - Energy conversion systems
  - Codes and standards for high temperature application

510-625 C

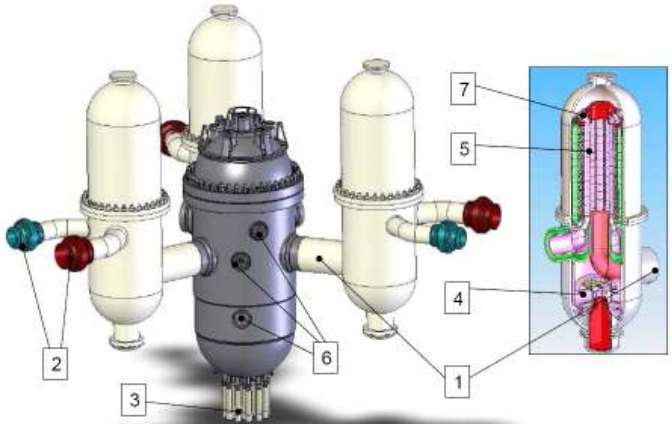
Supercritical Water-Cooled Reactor outlook



- **Merges GEN-III+ reactor technology with advanced supercritical fossil plant technology**
- **Pressure vessel and pressure tube options; fast and thermal spectrum options**
- **Goal: Improve knowledge base to optimize designs**
- **Key technology focus:**
  - Materials, water chemistry, radiolysis
  - Thermal hydraulics and property changes around the critical point

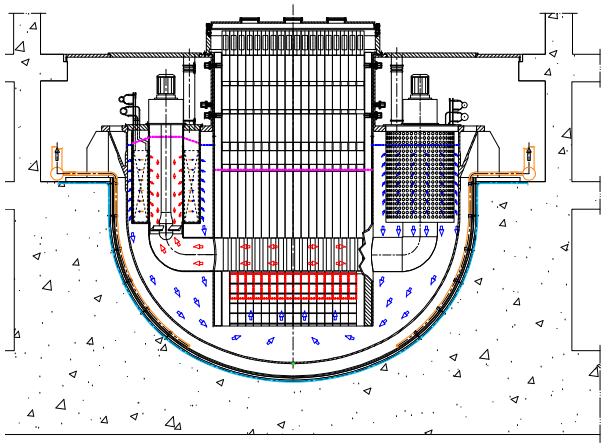
Gas-cooled Fast Reactor outlook

- **Limited experience; some benefit from VHTR**
- **Goal: Complete viability experiments by 2012**
- **Key technical focus:**
  - SiC clad carbide fuel
  - Safety—transient accident analysis
  - Components and materials



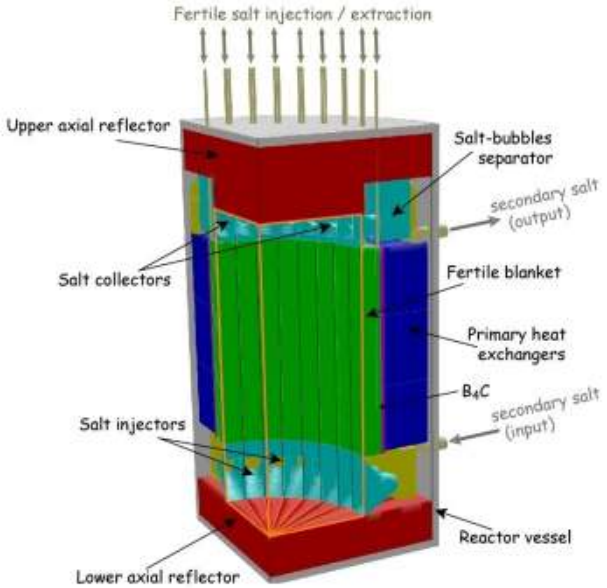
Lead Fast Reactor outlook

- **No formal GIF arrangement; provisional participation**
- **Goal: Resolve feasibility with respect to components and corrosion control**
- **Key technical focus:**
  - Materials
  - Design features
  - Operating parameters



Molten Salt Reactor outlook

- **No formal GIF arrangement; provisional participation**
- **Goal: Develop design features, processing systems and operating parameters within 5 years**
- **Divergent paths: solid fuel with molten salt coolant; dissolved fuel in molten salt coolant**
- **Key technical focus**
  - Resolve feasibility issues
  - Assess performance of candidate designs
  - Materials
  - In-service inspection
  - On-line salt treatment



Outlook for horizontal activities

- **Economics Methodology Working Group**
  - Tool set tested on several systems
  - Available through the NEA
  - Effort is “mature”
- **Risk and Safety Working Group**
  - Goal is to produce an integrated framework based on PRA
  - Effort is well established; perhaps ripe for re-assessment
- **Proliferation Resistance and Physical Protection WG**
  - Developing methodology that has been tested on example systems
  - Next steps would benefit from more feedback from GIF community

The 10th anniversary of GIF is perhaps a good time for the MWGs to examine their activities relative to other similar international efforts.

Summary

- **The GIF provides a unique framework for sharing the R&D burden of developing promising nuclear systems through the feasibility, viability and performance phases.**
- **The systems have some common challenges**
  - Higher temperatures for greater efficiency and in some cases additional applications beyond electricity
  - Materials required for the higher temperature and in some cases corrosive environment
  - Advanced components including power conversion
  - Robust, reliable fuel
- **A constant pressure to include old/new ideas (thorium, small reactors, etc.) in the light of new developments**
- **This interface meeting with IAEA/INPRO provides an excellent opportunity to assess allocation of effort.**