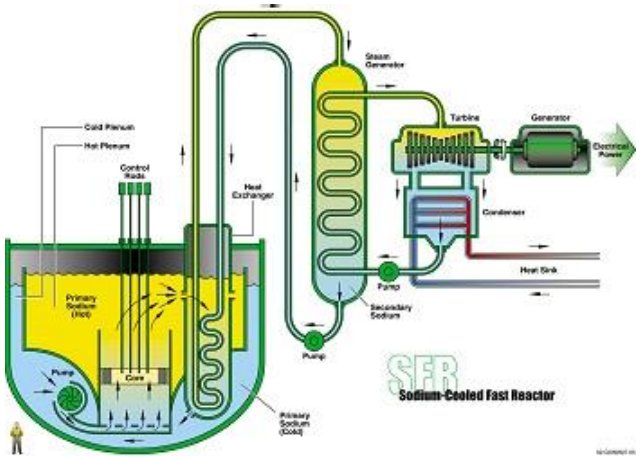
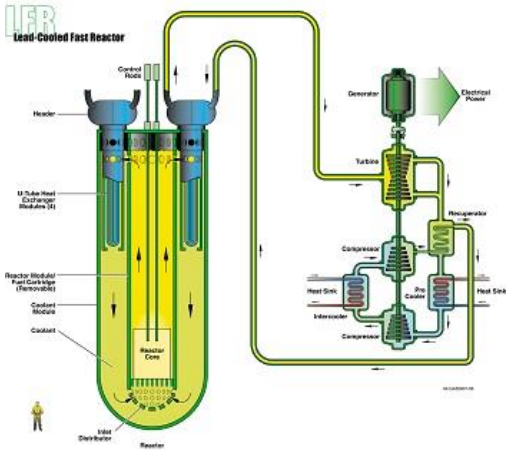
Overview of Gen-IV developments and Generation IV International Forum (GIF)

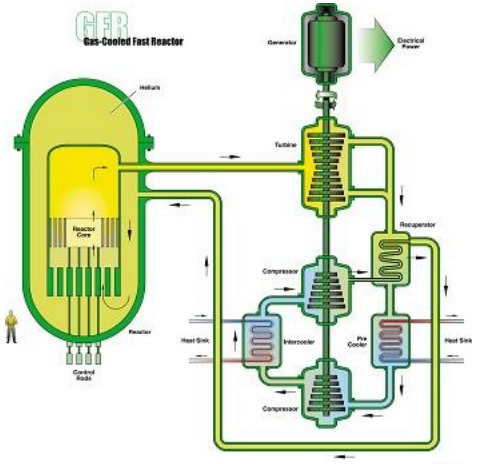
Kamil Tuček
On behalf of GIF colleagues
European Commission, Joint Research Centre (JRC)

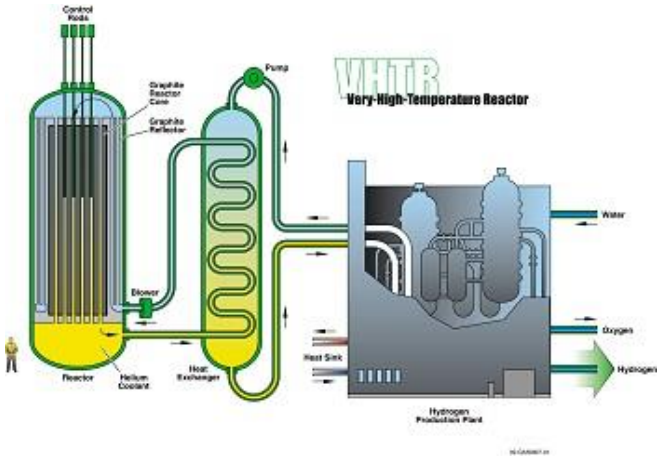
SNETP Forum 2021, 2-4 February 2021

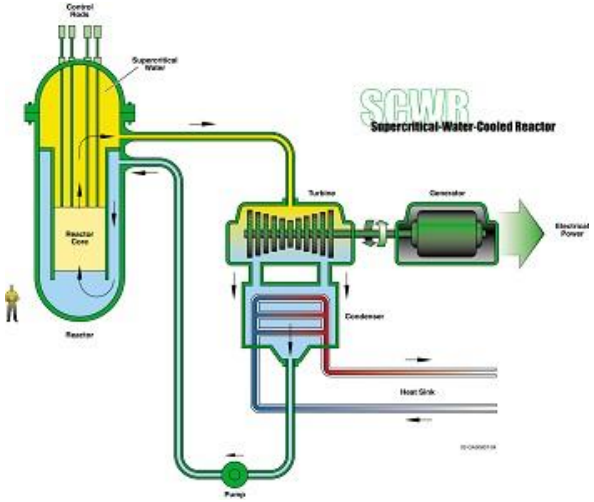
Generation IV Systems

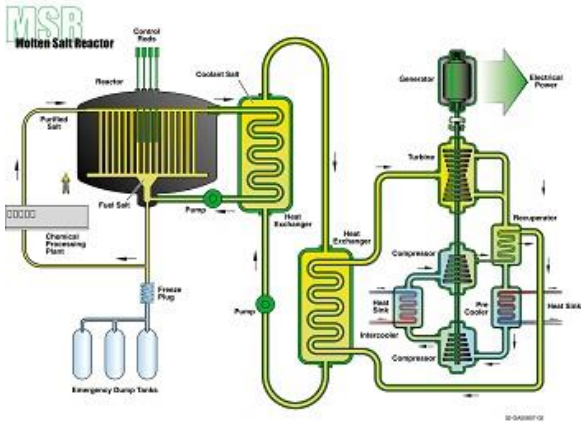












Aiming at improvements in:

- Sustainability
- Economics
- Safety and reliability
- Proliferation resistance and physical protection

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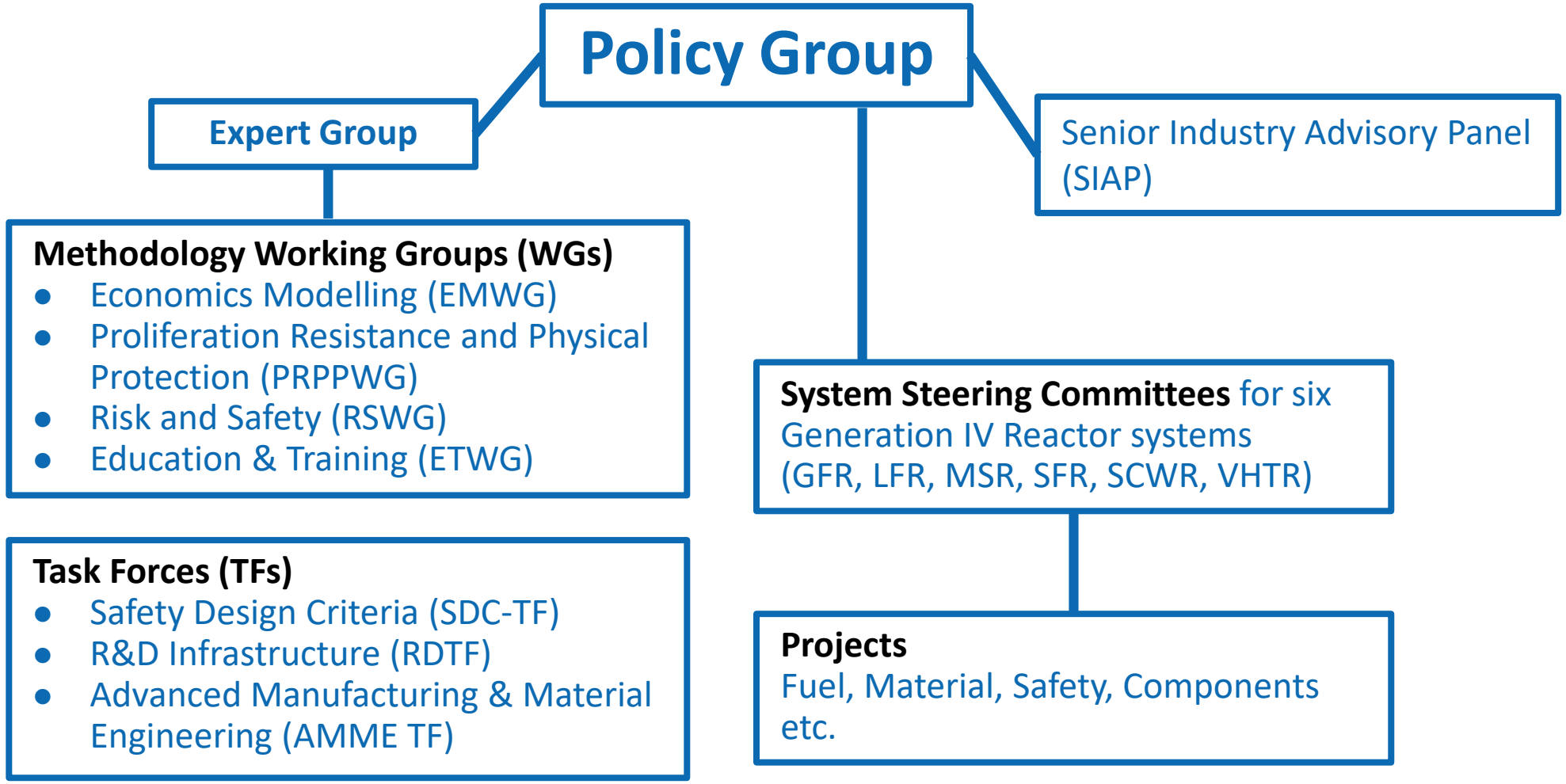
https://www.gen-4.org

GIF Governance



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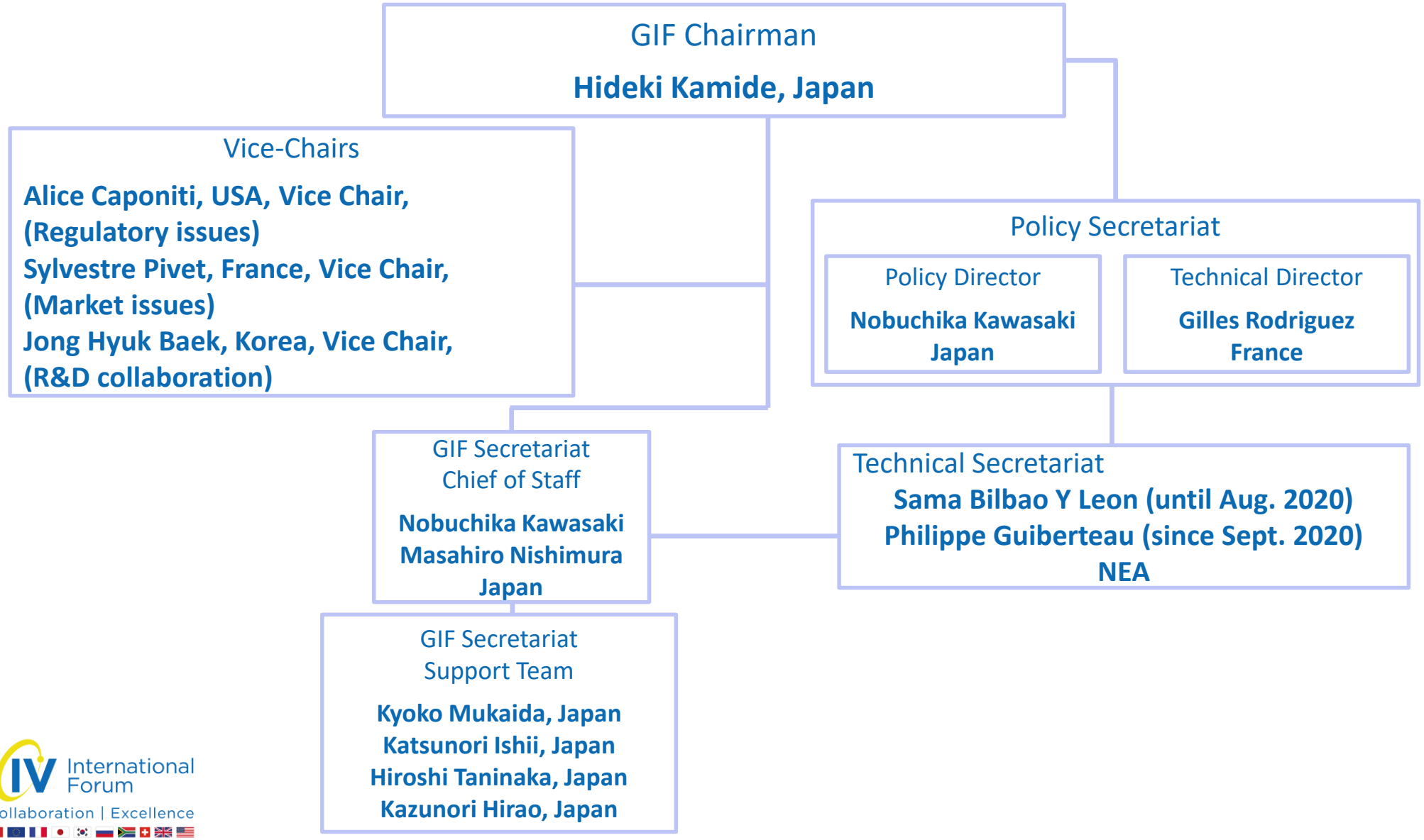
GIF Board 2020-2021



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Main missions of GIF (2019-2021)

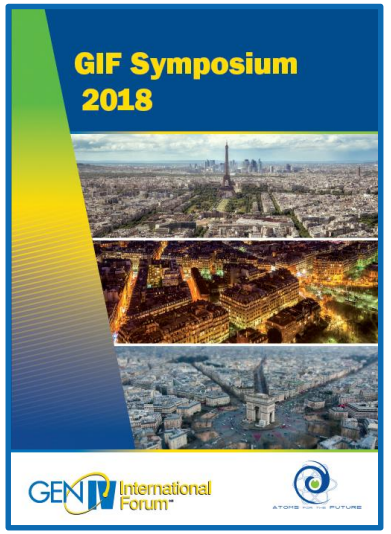
- **Market Opportunities and Challenges for Deployment**
  - Enhanced interaction with industry, incl. with SMR vendors
  - Investigation of increased **flexibility and coupling with non-electrical applications of nuclear heat**
- **Safety and Regulation**
  - **Increased interaction with the regulators**, e.g. in the frame of the NEA Working Group on Safety of Advanced Reactors (WGSAR)
  - Development of system-specific Safety Design Criteria (SDC) and Guidelines
- **Enhancement of R&D cooperation**
  - Use of R&D infrastructures to improve international collaboration - R&D Infrastructure TF
  - Advanced manufacturing - Advanced Manufacturing & Materials Engineering TF
- **Improved communication of GIF Results to Citizens, Policy makers, Regulators, Industry**
  - New GIF newsletters and GIF visual branding
- **Enhanced Education & Training as well as Knowledge Management**

Position better the Gen-IV systems in the global decarbonised energy mix to facilitate deployment

https://www.gen-4.org/gif/jcms/c_122378/newsletters-archive

2020 Highlights from the GIF activities

- The GIF 2019 Annual Report published
- The GIF 2018 Symposium proceeding published
- The COVID-19 pandemic has changed significantly the way the GIF community works
  - Most of the GIF meetings were completed virtually, providing also additional agility and flexibility
  - Agendas of meetings were optimized and shortened
  - Multiple sessions were organized to replace one in-person meeting
  - Sharing of the GIF documents via the GIF Website was also improved
- First brainstorming meeting on the use of **Generation IV Reactors for Non-Electrical Applications was held in Nov. 2020 → second brainstorming planned on 11 Feb 2021**
- Many ongoing activities carried out by the System Steering Committees, Project Management Boards, WG and TF members



https://www.gen-4.org/gif/jcms/c_117864/2018-gif-symposium-proceedings
https://www.gen-4.org/gif/jcms/c_119034/gif-2019-annual-report

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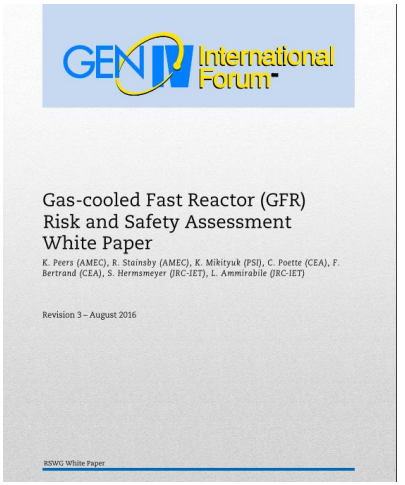
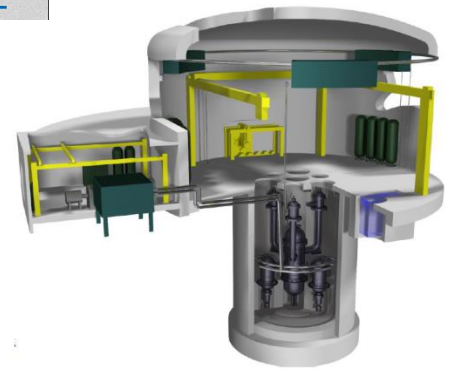
Highlights related to GFR

- GFR System Arrangement signed by Euratom, France, and Japan
  - Existing **Project Arrangement** on Conceptual Design and Safety
  - Provisional project on Fuel and core materials
  - Proposed project on GFR Technology
- Development of **GFR reference documents**
  - GFR Risk and Safety Assessment White Paper (completed in 2016)
  - GFR System Safety Assessment (draft)
  - GFR Safety Design Criteria (draft)
- **Europe**: The main project **ALLEGRO** - preparatory phase is carried out by the V4G4 Centre of Excellence. The work is being supported by the Euratom collaborative project **SafeG**, among others aiming at:
  - strengthening of inherent safety
  - resolving remaining open questions in residual heat removal in accident conditions
- For details on the ALLEGRO project and GFR activities, cf. the subsequent presentation of Branislav Hatala (VÚJE) and Petr Vácha (ÚJV Řež)



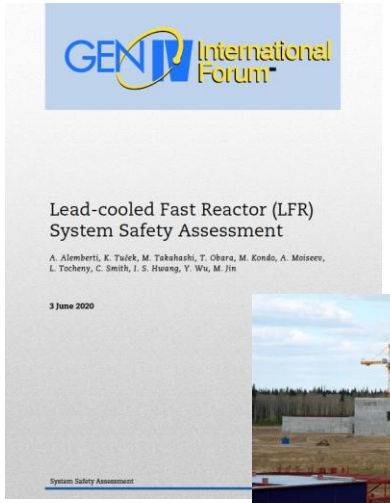
ALLEGRO concept



https://www.gen-4.org/gif/upload/docs/application/pdf/2016-10/rswg_gfr_white_paper_final_2016.pdf
https://cordis.europa.eu/project/id/945041

Highlights related to LFR and HLM technology

- Withing GIF, LFR members work under the framework of MoU
- Activities concentrate on the development of top-level reports
  - **LFR System Safety Assessment (SSA)** was published in June 2020
  - **White Paper on the LFR PRPP aspects** has been finalised in cooperation with GIF PRPPWG and transmitted to EG
  - **LFR Safety Design Criteria (SDC)** document is being prepared in collaboration with GIF RSWG, and is expected to be finalised and transmitted to GIF Expert Group in early 2021
- **World**: The licensing of the BREST LFR research demonstrator is currently being completed with site preparations ongoing in Tomsk, Russian Federation
- **Europe**: Two main projects: (i) **MYRRHA** R&D infrastructure (ADS demonstrator) under construction in Belgium; and (ii) LFR demonstrator **ALFRED** in Romania. Euratom collaborative projects supporting LFR- and heavy liquid metal (HLM)- R&D activities: **GEMMA, PATRICIA** and **PASCAL**
- For details cf. subsequent presentations of Didier De Bruyn (SCK•CEN), Michele Frignani (Ansaldo), and Paul Schuurmans (SCK•CEN) in this session



Site preparations for the BREST-OD-300 construction

GEMMA

PATRICIA

PASCAL

https://www.gen-4.org/gif/upload/docs/application/pdf/2020-06/gif_lfr_ssa_june_2020_2020-06-09_17-26-41_202.pdf
https://www.riatomsk.ru/article/20201109/severs k-brest-300-sroki/
http://www.eera-jpnm.eu/gemma/
https://patricia-h2020.eu/
https://cordis.europa.eu/project/id/847715
https://cordis.europa.eu/project/id/945341

Highlights related to MSR

- A large interest around the MSR technology, with more than 40 concepts of a large variety being developed worldwide
- Within GIF, the MSR system is currently ongoing transition from Memorandum of Understanding (MoU) to **System Arrangement** (SA)
- Three (3) **Project Arrangements** are under development:
  - Fuel and coolant salt properties
  - Materials and components
  - System integration and cross-cutting issues
- Safety aspects have been identified as a key driver for the R&D Roadmap → ongoing interactions with GIF RSWG to create Task Force on the **MSR safety approach**
- **World**: Prototype MSR - TMSR-LF1 - is under construction in China
- **Europe**: Euratom collaborative project **SAMOSAFER** focuses on development of DiD approaches, development of theoretical models for safety-relevant phenomena, as well as related experimental setups
- For details on the MSR R&D activities cf. subsequent presentations of Ralph Hania (NRG) and Paul Gauthé (CEA) in this session

TMSR-LF1

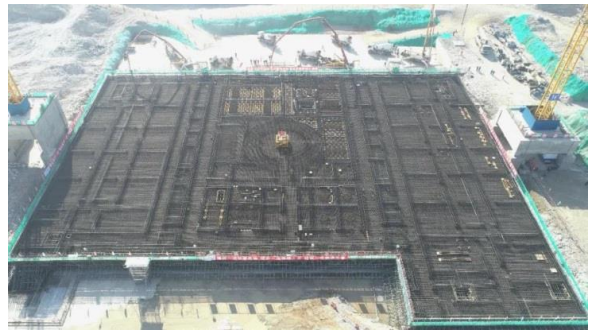
SAMOSAFER

Successful synthesis of UCl_4 at JRC Karlsruhe

https://samosafer.eu/

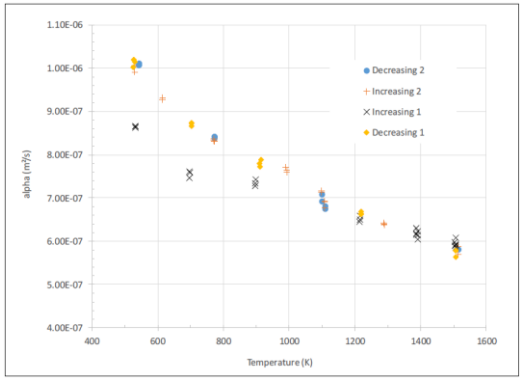
Highlights related to SFR

- **Most active GIF system (together with VHTR) with four R&D Projects running:**
  - System Integration and Assessment (SIA)
  - Safety and Operations (S&O)
  - Advanced Fuel (AF)
  - Component Design and Balance of Plant (CD&BOP)
- **Five SFR Design Concepts:**
  - Loop Option (JSFR Design Track)
  - Pool Option (KALIMER-600, ESFR, and BN1200 Design Tracks)
  - Small Modular Option (SMFR Design Track)
- Revision of **SFR System Research Plan** was completed and approved by System Steering Committee in October 2019
- **White Paper on the SFR PRPP aspects** has been finalised and transmitted to EG
- **World**: Construction of two pilot SFR units (CFR-600) is ongoing in China
- **Europe**: Euratom collaborative project **ESFR-SMART** focuses on enhancing the safety of Generation-IV SFRs – for details cf. subsequent presentation of Konstantin Mikityuk (PSI)



Construction site of CFR-600

ESFR-SMART
sodium fast reactor safety

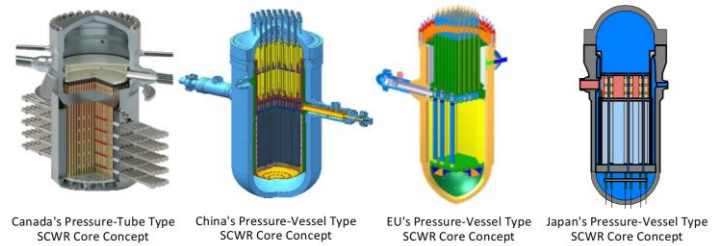


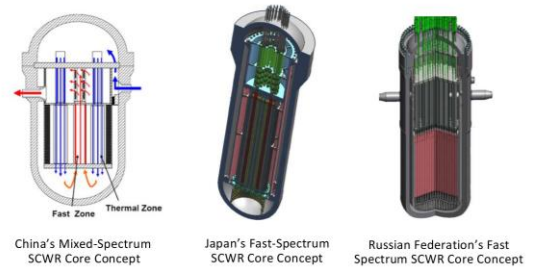
Thermal diffusivity measurements of $(U,Am)O_{2-x}$ at JRC Karlsruhe

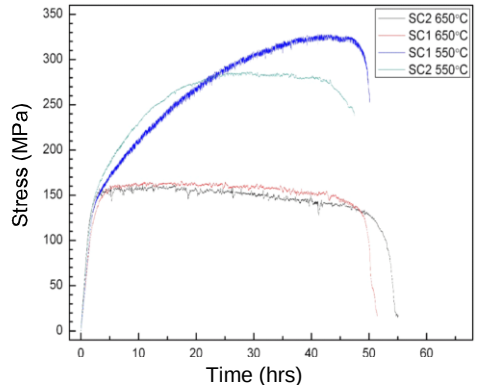
https://www.gen-4.org/gif/jcms/c_95916/gif-sfr-safetyassessment-20170427-final
https://world-nuclear-news.org/Articles/China-starts-building-second-CFR-600-fast-reactor
http://esfr-smart.eu/

Highlights related to SCWR

- **Two R&D Project arrangements established (currently being extended):**
  - Materials and Chemistry (2010)
  - Thermal-Hydraulics and Safety (2009)
- Provisional project on System Integration and Assessment
- Within GIF, four SCWR core concepts with **thermal spectrum** and three other core concepts with **mixed or fast spectrum** have been proposed
- **Europe**: Joint Euratom-China-Canada project **ECC-SMART** has just started. It aims at the assessment of the feasibility and identification of safety features of an intrinsically and passively safe SMR cooled by supercritical water – cf. subsequent presentation of Markéta Krýková (CV Řež) in this session
- **10th International Symposium on SCWRs**
  - Scheduled in March 2021
  - Will be organized as videoconference or webinar







Measurement of stress corrosion cracking in the SCW conditions at JRC Petten

https://www.gen-4.org/gif/jcms/c_103619/gif-scwr-safetyassessment-finaldec2018
https://cordis.europa.eu/project/id/945234

Highlights related to VHTR

- **Four active VHTR "pre-competitive" Projects**
  - **Materials:** Graphite, metals, ceramics - corrosion, joining, irradiations
  - **Fuel:** Fabrication, characterisation, qualification, waste management
  - **Hydrogen Production:** Iodine-Sulphur (850°C), Copper-Chlorine (530°C), High temperature electrolysis (650°C)
  - **Computer Tools for Design and Licensing:** Thermal-hydraulic analysis (CFD), Neutronics and nuclear cross-section data, Radioisotope chemistry and transport, Reactor and plant dynamics
- Development of **VHTR Safety Design Criteria** on the basis of IAEA TECDOC and in cooperation with RSWG
- **World:** Construction of HTR-PM HTR demonstration plant is ongoing in China
- **Europe**: Euratom collaboration project **GEMINI+** project is ongoing, in which partners are working together towards the demonstration of high temperature nuclear cogeneration with an HTR in Poland – cf. presentation of D. Hittner (NC2I) and M. Fütterer (JRC) in Session 5

Construction site of HTR-PM

GEMINI+

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https://www.gen-4.org/gif/jcms/c_103659/gifvhtr-safety-assessment-finaldec2018
https://www.world-nuclear-news.org/Articles/Cold-testing-of-HTR-PM-reactors-completed
https://htr2020.org
http://www.gemini-initiative.com/geminiplus/

Highlights of Risk & Safety WG Activities

- **The RSWG work is to a large extent licensing-relevant**
  - RSWG promotes a consistent approach related to safety, risk, and regulatory aspects between Gen-IV systems
- **RSWG collaborates with and supports SSCs**
  - Finalization of **LFR** safety design criteria
  - Coordination with **VHTR** and **MSR** SSCs to develop system-specific design criteria for these systems
- **RSWG interacts with regulators in the frame of OECD/NEA WGSAR**
  - Coordinated GIF SSC input to **WGSAR Fuel Qualification report** (description of fuel types/forms, their role in safety case, and challenges to fuel qualification)
- **Interfaces with IAEA**
  - GIF participation in **revision of IAEA safety standards** for advanced reactors
  - IAEA-GIF meeting: possible collaboration in the area of Design Safety and Safety Assessment (July 9, 2020)
- **Update of GIF Basic Safety Approach Report submitted for Expert Group review**
  - Clarifies severe accident and practical elimination definitions
  - Integrates post-Fukushima requirements for Gen-IV systems to ensure compliance with new regulations

Highlights of Economics Modelling WG Activities

Proposed Studies for the EMWG

- ❑ Advanced Nuclear Technology Cost Reduction Strategies
- ❑ Financing of Gen-IV reactors
- ❑ Market functionalities of Gen-IV reactors
- ❑ Model Benchmarking of Gen-IV reactors based on Integrated Energy Systems
- ❑ Support to other GIF activities
  - ✓ Market issues
  - ✓ Advanced manufacturing
  - ✓ Regulatory issues

- EMWG develops methodologies to assess Gen-IV systems, and studies the challenges and opportunities for deployment of Gen-IV systems in future low-carbon energy markets including:
  - **flexibility requirements** for integration in grids with significant renewable sources
  - improvement of **cost competitiveness** of Gen-IV systems through cogeneration
- Main EMWG activity on the flexibility of Gen-IV systems was recently completed with the publication of the **revised Position paper on Flexibility**
- **EMWG will further focus on**:
  - **Cost reduction of advanced nuclear technology**
    - Aiming at defining cost reduction strategies and developing a systematic economic review process
  - **Private financing of advanced nuclear technology**
    - Aiming at identifying the **barriers and changes** required to enable the private sector financing of nuclear power

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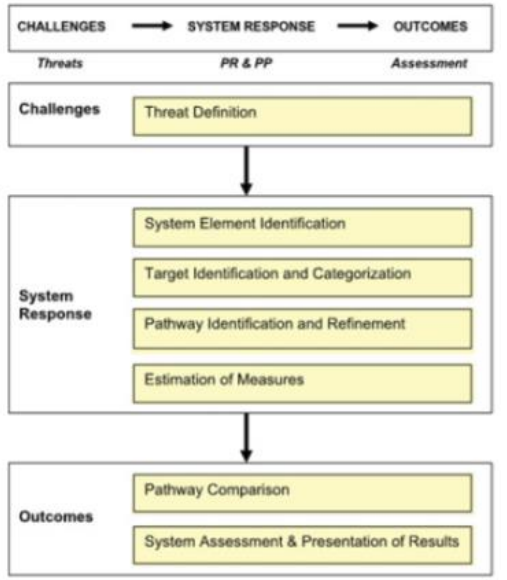
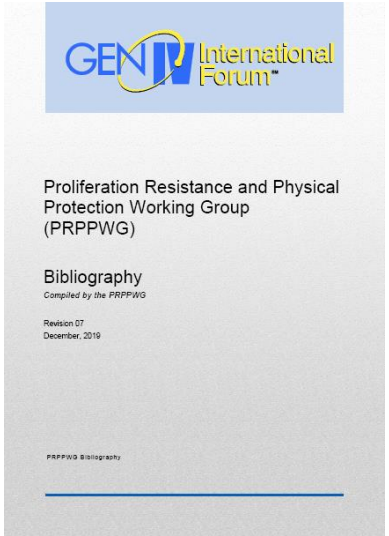
Highlights of Proliferation Resistance & Physical Protection (PRPP) WG Activities

- **PRPPWG developed technology-neutral methodology for assessments of Proliferation Resistance & Physical Protection aspects of Gen-IV systems** – currently in Revision 6 (Japanese and Korean translations available)
- "**Case Study**" issued: an example (sodium-cooled) fast reactor system was chosen to develop and **demonstrate the use of the methodology** – resulted in major report
- **In joint effort with all six GIF System Steering Committees, assessments of PRPP aspects of all six GIF systems were conducted** and resulted in a major report. The six White Papers are currently being updated.
- All three reports can be obtained on the GIF website: https://www.gen-4.org/gif/jcms/c_9365/prpp
- Updated GIF PRPP Bibliography in January 2020





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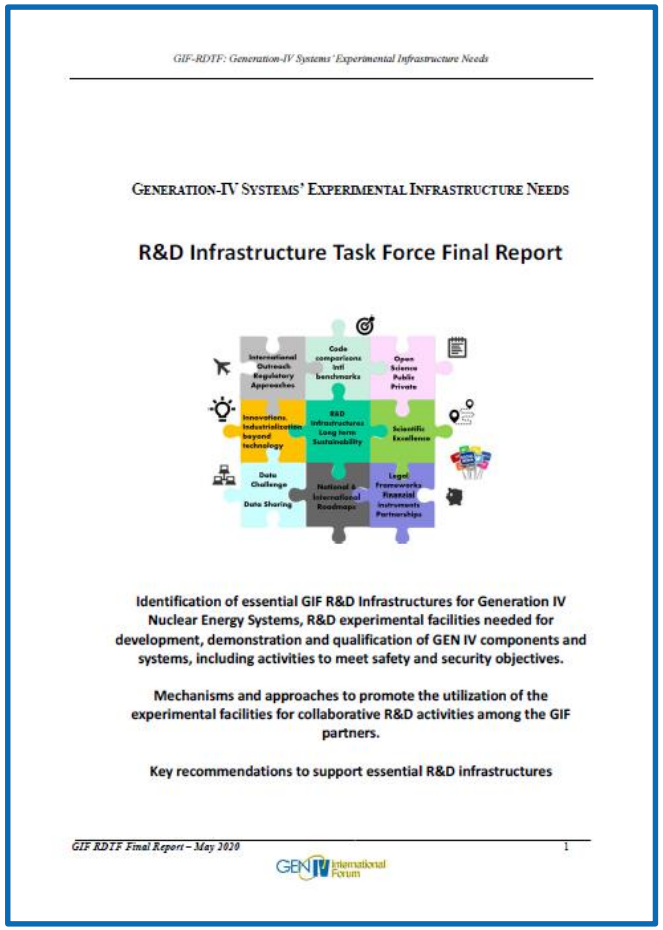
Task Force on R&D Infrastructure

- **Final report issued in May 2020**
  - **Identifies essential large (and key) experimental infrastructures needed in support of Gen-IV systems** R&D activities in terms of feasibility / performance as well as demonstration / deployment
  - Facilitates R&D collaboration across Gen-IV systems
  - **Promotes utilization of experimental facilities for collaborative R&D activities among GIF partners**
  - Facilitates GIF partners' access to the various R&D facilities in the GIF member countries
- The document will be freely downloadable on the GIF website in Feb. 2021 & a dedicated GIF Webpage is under construction


GIF-RDTF: Generation-IV Systems' Experimental Infrastructure Needs

GENERATION-IV SYSTEMS' EXPERIMENTAL INFRASTRUCTURE NEEDS

R&D Infrastructure Task Force Final Report

Identification of essential GIF R&D Infrastructures for Generation IV Nuclear Energy Systems, R&D experimental facilities needed for development, demonstration and qualification of GEN IV components and systems, including activities to meet safety and security objectives.

Mechanisms and approaches to promote the utilization of the experimental facilities for collaborative R&D activities among the GIF partners.

Key recommendations to support essential R&D infrastructures

GIF RDTF Final Report – May 2020 1

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Task Force on Advanced Manufacturing and Materials Engineering

- The R&D infrastructure report presented at the **GIF International Workshops with Nuclear Industry including SMR vendors and supply chain SMEs** (held at OECD/NEA on 18-20 February 2020)
- Gathered over 120 experts in the field of Advanced Manufacturing connected with GIF experts and industry
- Advanced manufacturing is a pathway to cost reductions (better competitiveness)
- Larger workshop (AMME & all the other Working Groups, Task Forces and Systems) is being prepared for 2022

Co-working
Joint synthesis

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Highlights of Senior Industrial Advisory Panel (SIAP)

- SIAP helps GIF to orient the research to **industrially relevant aspects**
  - This is the reason why for example flexibility capabilities of the six systems were analysed
- In the follow-up of the GIF Workshops held in February 2020, SIAP has issued a **set of recommendations** on four topics corresponding to **needs and expectations expressed by industry:**
  - **Public and governmental recognition and acceptance**
  - Research data structuring
  - **Technology acceptance and multi-national pre-licensing**
  - Global Gen-IV research infrastructures
- SIAP recommendations to be discussed by the Expert Group

Highlights of Education & Training WG Activities

Series of Gen-IV webinars

A series of Generation-IV webinars has been launched in September 2016 and is currently offered once a month:

- 1 h online lecture on one GIF system or cross-cutting topic from top-level experts with Q&A at the end of the presentation
- **49 webinars have been presented as of today**
- **Webinars are archived** and can be viewed at: https://www.gen-4.org/gif/jcms/c_82831/webinars
- Webinars have been converted to **YouTube** Video: https://www.youtube.com/channel/UCEHOQ63gD01fSKbCIY9XvSQ

Pitch Your Gen IV Research Competition

https://www.gen-4.org/gif/jcms/c_173183/pitch-your-generation-iv-research-competition

H2020 co-funded Indirect Action Projects related to Gen-IV

H2020 RTD Project	Topic	R&D area	Euratom € M	Total € M
ESFR-SMART	SFR	Adv. SFR	10.1	5.0
PASCAL	LFR	Adv. HLM ALFRED MYRRHA	3.8	4.6
SESAME	HLM	Adv. HLM Safety	5.2	6.6
SafeG	GFR	Adv. GFR Safety Allegro	3.8	4.5
VINCO	GFR	Adv. GFR Safety Allegro	1.1	1.1
GEMINI+	HTR	Adv. HTR Cogeneration	4.2	5.5
ECC-SMART	SCWR	Adv. SCWR SMR safety features	4.0	9.0
SAMOFAR	MSR	Adv. MSR Molten Salt	3.5	5.2
SAMOSAFER	MSR	Adv. MSR Molten Salt	3.5	4.5
PUMMA	FC	FC Fuel Pu management	3.8	7.0
INSPYRE	FC	FC MOX fuel licensing	4.1	9.5
PATRICIA	FC	FC P&T Myrrha	6.5	9.0
GENIORS	FC	FC Partitioning (P&T)	5.0	7.5
MEET-(&A)-CINCH	FC	E&T RadioChemistry	4.6	5.1
GEMMA	MAT.	Adv. Materials	4.0	6.7
M4F	MAT.	Fu/Fi materials	4.0	6.5
McSAFER	MODEL.	Adv. Modeling SMR	4.0	4.1

R&D Areas

- Computer codes
- Components
- Tribology and corrosion
- Fuel
- Material R&D
- Safety analysis and demonstration
- Multi-purpose plant
- Design and System Integration
- Development of a licensing framework
- P&T waste minimization and recycling
- Modelling
- SMR

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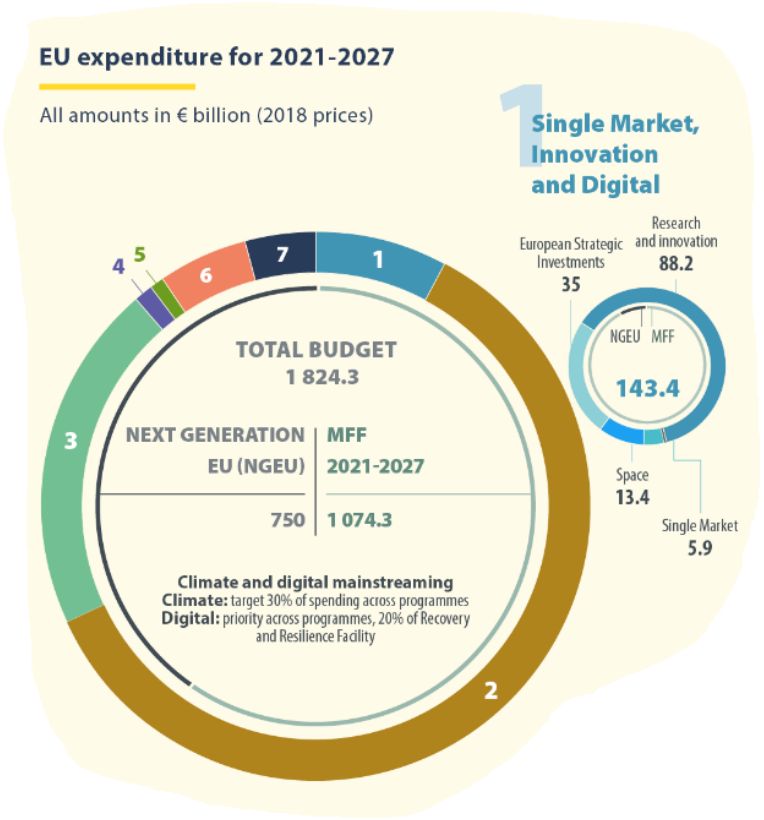
EURADWASTE '19 Presentations http://fisa-euradwaste2019.nuclear.ro/euradwaste/

FP9 (2021-27) Horizon Europe Budget: EUR 88,200 million



Euratom Research and Training	*(7 years) EUR 1,980 million*	**(5 years) EUR 1,380 million**
Indirect RTD		
• Fusion R&D	*809*	**583**
• Fission R&D Safety and radiation protection	*370*	**266**
Direct JRC		
• Fission Safety and Safeguards	*802*	**532**

ITER (a dedicated EC Regulation, 7 years)	**EUR million**
	5,600

On the basis of this political agreement reached on 18 Dec 2020, both Horizon Europe and Euratom regulations will be **hopefully formally adopted by Council by end February or beginning of March 2021**

EU Council PRESS RELEASE
EURATOM https://www.consilium.europa.eu/en/press/press-releases/2020/12/18/euratom-research-and-training-programme-council-reaches-political-agreement/pdf
ITER https://www.consilium.europa.eu/en/press/press-releases/2020/12/18/fusion-energy-political-agreement-in-the-council-on-iter-financing/pdf
EU Council COREPER AGREED TEXT
EURATOM https://www.consilium.europa.eu/media/47674/st14206-en20.pdf
ITER https://www.consilium.europa.eu/media/47673/st14217-en20.pdf

Horizon Europe Euratom Call 2021-22: Overview Schedule

Event	Date
Drafting and Programme Committee WP2021-22	**02/2020 – 02/2021**
Adoption Euratom 2021-25.....	**03/2021**
Euratom WP2021-22 publication	**04/2021**
Submission Call open.....	**15/05/2021**
Deadline	**09/2021**
Evaluations	**10 – 11/2021**
Negotiations/Finalisation of Grants	**01 – 05/2022**
Grant Agreement signature.....	**06/2022**
First projects launched	**06/2022**

EC Funding and Tenders portal
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/home

European Commission

Pathways to commercialize Gen-IV

Six reactor systems to achieve GIF goals

Sustainability, Safety & Reliability, Economics, PR&PP + FLEXIBILITY

- ✓ Driven by increasing interest in SMRs and the ongoing evolution towards decarbonised energy-mix with increasing proportions of variable renewables, GIF works towards:
  - ➢ a reliable, sustainable, flexible power supply systems, with safety enhancements, and being cost competitive with these attributes
- ✓ With collaboration and sharing of the R&D results, better interaction with industrial / SMR vendors, public acceptance, and with the various demonstrators under construction, advanced nuclear power may make tangible contribution to the achievement of long-term **European climate and energy strategy targets**

A Clean Planet for all, A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy, Communication from the European Commission, COM(2018) 773 final of 28 November 2018
The European Green Deal, Communication from the European Commission, COM(2019) 640 final of 11 December 2019
Report on progress of clean energy competitiveness, Report from the European Commission, COM(2020) 953 final and accompanying SWD of 14 October 2020

GEN IV International Forum
Expertise | Collaboration | Excellence

Many thanks to

Gilles Rodriguez, GIF Technical Director

Roger Garbil, Head of the Fission Sector, DG RTD

All JRC colleagues as well as the Euratom representatives in the various GIF bodies

Thank you very much for your kind attention!

Back-up slides

Involvement of GIF Members in R&D on Gen IV systems (as of Jan 2021)

SFR			●	●	●	●	●			●	●	●
VHTR	●	●	●	●	●	●			●	●	●	●
LFR			●		●	●	●			●		●
SCWR		●	●		●		●					●
GFR				●	●							●
MSR	●	●		●			●		●	●		●

● : signatory of System Arrangement
● : signatory of Project Arrangement
● : signatory of MoU

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Euratom Research complementing **Horizon Europe**

- **EURATOM research and training programme: Council reached political agreement on 18/12/2020** on the proposed regulation establishing the research and training programme of the European Atomic Energy Community **for the period 1 January 2021 to 31 December 2025.**
- The aim of the regulation is **to pursue nuclear research and training activities** with an emphasis on the continuous improvement of nuclear safety, security and radiation protection, **as well as to complement the achievement of Horizon Europe's objectives**

- On the basis of this political agreement, both Horizon Europe and Euratom agreed text regulation will be **hopefully formally adopted by Council by end February or beginning of March**

EU Council agreement on Euratom Research and Training
PRESS RELEASE https://www.consilium.europa.eu/en/press/press-releases/2020/12/18/euratom-research-and-training-programme-council-reaches-political-agreement/pdf
COREPER AGREED TEXT https://www.consilium.europa.eu/media/47674/st14206-en20.pdf

Research and Innovation (Horizon Europe, ITER and Euratom) legal texts and factsheets (2018 Proposal)
https://ec.europa.eu/commission/publications/research-and-innovation-including-horizon-europe-iter-and-euratom-legal-texts-and-factsheets_en

Euratom/UK agreement COM(2020)857 final/2 dated 26/12/2020

On 24 December 2020, the European Commission and the UK Government reached an agreement on the terms of future trade and cooperation between the European Union (EU) and United Kingdom (UK), **which also includes the Euratom/UK agreement for cooperation on the safe and peaceful uses of nuclear energy**. This paves the way to the association of the UK to both Horizon Europe and the Euratom Programme.

UK will join the forthcoming Horizon Europe research program. UK will also pay to continue its involvement with a handful of other research programmes. **UK will participate in nuclear research under the Euratom treaty**, despite having withdrawn from the treaty itself. Its involvement with the international fusion energy project ITER will continue via an EU-run partnership (F4E Euratom Joint Undertaking) that also includes Switzerland.

EU Council Euratom/UK Recommendation for a COUNCIL DECISION COM(2020) 857 final/2 dated 26.12.2020
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020PC0857
EU Council agreement on Euratom Research and Training
PRESS RELEASE https://www.consilium.europa.eu/en/press/press-releases/2020/12/18/euratom-research-and-training-programme-council-reaches-political-agreement/pdf

EU/EURATOM Fission RTD Work Programmes

~ 20%

Geological disposal

- Decommissioning

~ 40%

Reactor systems

- Safety of existing nuclear installation (Gen II-III)
- Advanced nuclear systems for increased safety (Gen-IV)
- Partitioning, Transmutation and closed fuel cycle
- Cross-cutting aspects (e.g. fuels, materials, simulation, nuclear data)
- Other applications (e.g. cogeneration, support to Research Reactors)

~ 20%

Radiation protection

- Non-power applications

~ 20%

Research infrastructures
Training and mobility
Cross-cutting INCO

Grand Total:
Euratom Fission RTD ~ 50 Mi€ / Year
Euratom Fission JRC ~ 50 Mi€ / Year
Total ~ 10 % EU Public & Private Fission R&D

Perspectives

ToGEthe® SINCE 1957

- Euratom experience with FP is **a consistent success in pursuing excellence** in nuclear science research and technology
- **Close collaboration between** EC, MSs, OECD/NEA and IAEA, GIF, WNA, International Frameworks agreements
- **Stakeholders structured dialogue** on R&D policy, safety improvements, holistic approach and early involvement in decision making
- **Industry driven ETPs, Fora** are being capitalised

NEA Nuclear Energy Agency

IAEA.org International Atomic Energy Agency

SNETP Sustainable Nuclear Energy Technology Platform

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igd·tp safe solutions for radioactive waste

eurad European Joint Programme on Radioactive Waste Management

enen european nuclear education network

eTP European Technology Platforms

European Commission