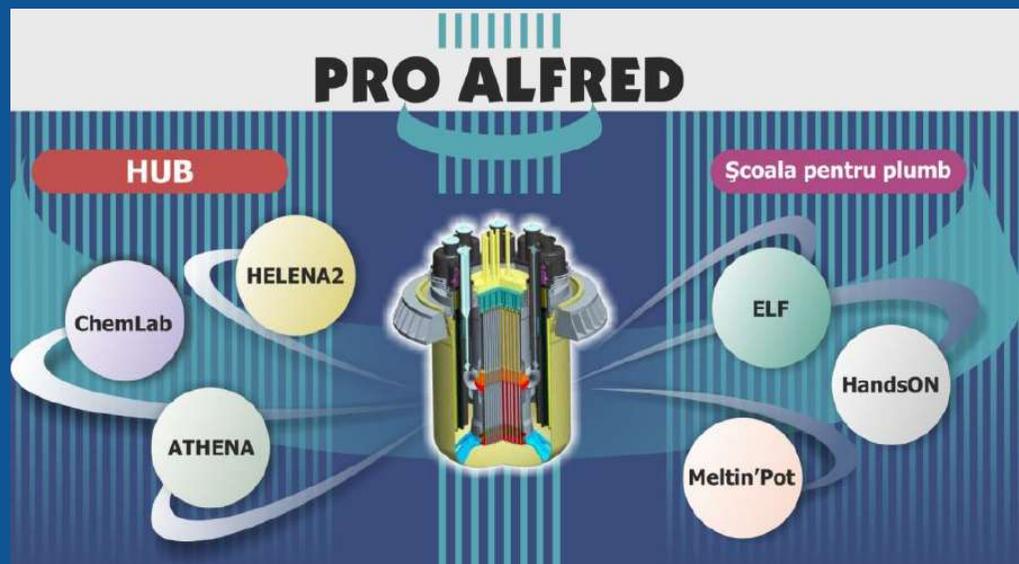




EU Nuclear policies and Euratom R&D perspectives



Roger GARBIL
European Commission
DG Research and Innovation
Euratom Research
Head of the Fission sector
Roger.Garbil@ec.europa.eu



PRO ALFRED Conference, virtual meeting, 22-23 October 2020

Content

1. EU/Euratom R&D: **FISA2019 EURADWASTE'19 Proceedings** available!
2. EU Multi-Financial Framework Programme (**MFF 2021-27**)
Horizon Europe and **Euratom Research and Training (2021-25-27)**
EU Enabling Framework for a **2050 Carbon-neutral economy**, PINC, SET-Plan
3. EU/Euratom **Achievements, Opportunities** and **future perspectives**



FISA 2019 / EURADWASTE '19 / ENEN PhD Event and Prize



Over 400 scientists from 200 organisations and 40 European countries and world-wide...

These conferences provided additional **opportunities to address and engage with all relevant stakeholders**, to further strengthen the EU's innovation potential, careers' attractiveness to the young generation, the research community, policy makers and civil society.

EPJ-N publications (PhD Awards, Session papers)
FISA 2019 EURADWASTE'19 conference proceedings
Publication Office of the European Union (Proceedings)

<https://www.epj-n.org/>
<http://fisa-euradwaste2019.nuclear.ro/>
<https://op.europa.eu/en/>

**Next...
FISA2022
...(Feb., tbc)**

Conferences' Proceedings FISA 2019 / EURADWASTE '19 ... available!



FISA 2019 Proceedings

<https://op.europa.eu/en/publication-detail/-/publication/9cfc43f8-cbc7-11ea-adf7-01aa75ed71a1/language-en/format-PDF/source-140481060>



EURADWASTE '19 Proceedings

<https://op.europa.eu/en/publication-detail/-/publication/fe1b968b-cbc8-11ea-adf7-01aa75ed71a1/language-en/format-PDF/source-140505052>

Keep in touch



ec.europa.eu/



europa.eu/



[@EU_Commission](https://twitter.com/EU_Commission)



[@EuropeanCommission](https://www.facebook.com/EuropeanCommission)



[European Commission](https://www.linkedin.com/company/European-Commission)



[europeancommission](https://www.instagram.com/europeancommission)



[@EuropeanCommission](https://medium.com/@EuropeanCommission)



[EUTube](https://www.youtube.com/EUTube)



[EU Spotify](https://www.spotify.com/EU_Spotify)

edp open

EPJ N Nuclear Sciences & Technologies

EPJ N Topical issues

- TOPICAL Edition
- AWARDS Selection

<https://www.epj-n.org/>

<https://www.epj-n.org/component/toc/?task=topic&id=1234>

<https://www.epj-n.org/component/toc/?task=topic&id=1169>



Romanian Presidency of the Council of the EU in 2019 Conferences <http://fisa-euradwaste2019.nuclear.ro/>

FISA 2019 Presentations

<http://fisa-euradwaste2019.nuclear.ro/fisa/>

EURADWASTE '19 Presentations

<http://fisa-euradwaste2019.nuclear.ro/euradwaste/>



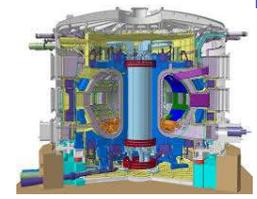
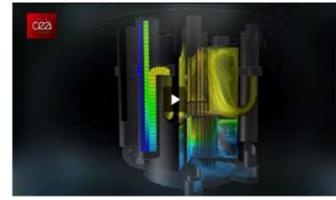
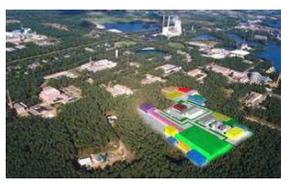
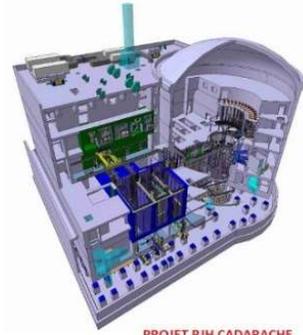
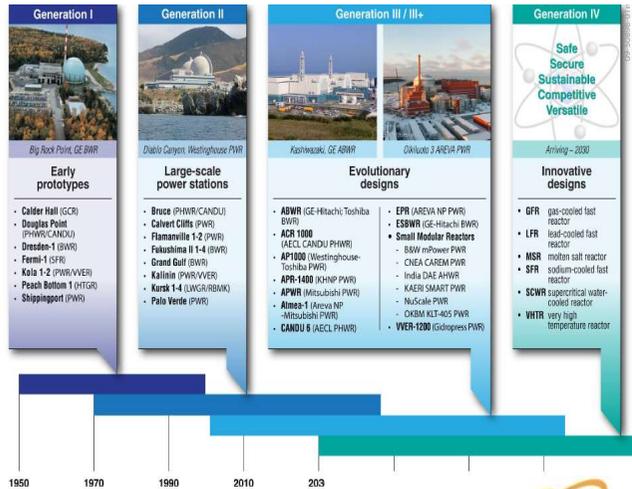
romania2019.eu

RAIEN
ICN
PITESTI
INSTITUTUL DE CERCETARI NUCLEARE

9th European Commission Conference on EURATOM Research and Training in Safety of Reactor Systems
Pitesti, Romania, 4-7 June 2019

EU/EURATOM Research and Training

ToGether®
SINCE 1957



EU Multi-Financial Framework Programme (MFF) 2021-27

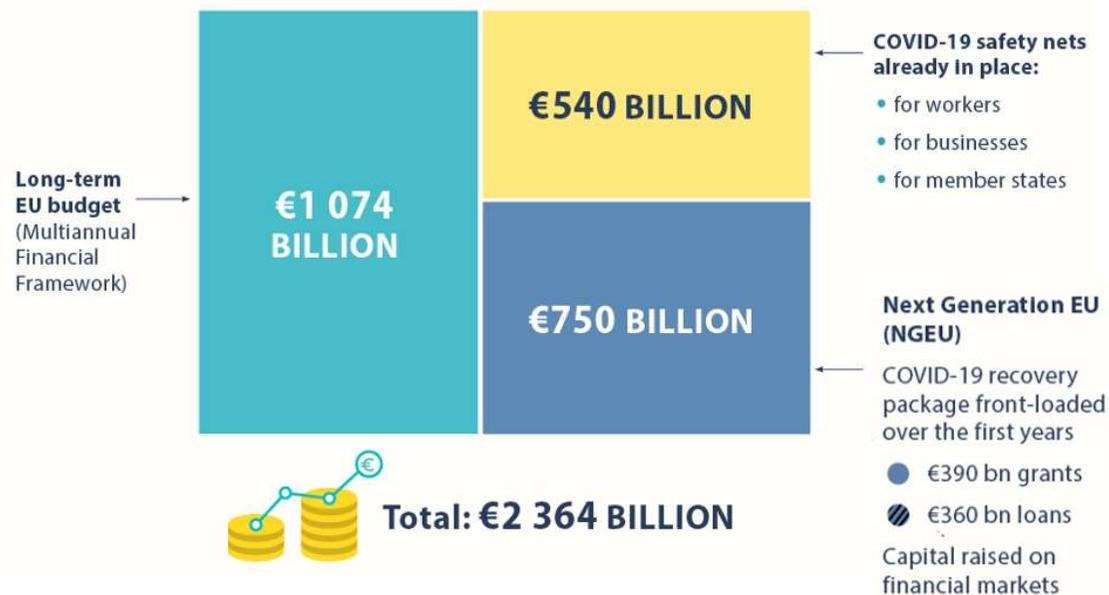
Horizon Europe and Euratom Research and Training (2021-25-27)

EU Enabling Framework for a 2050 Carbon-neutral economy, SET-Plan

European Community Nuclear Illustrative Programme PINC

Multi-Financial Framework Budget Proposal (MFF 2021-27)

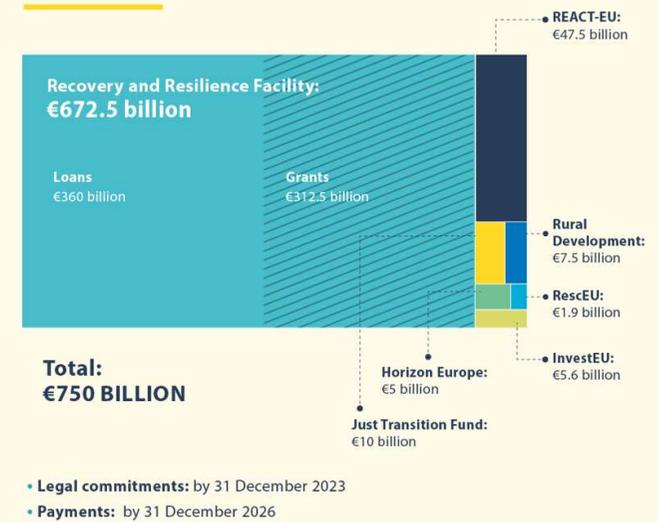
Overall architecture



... Brexit



Investing in a green, digital and resilient EU



Increasing investment in the climate and digital transitions



Infographic - Proposal for an EU recovery plan – key features 17-21.07.2020
<https://www.consilium.europa.eu/en/infographics/mff-recovery-negobox/>

EU Enabling Framework for a 2050 Carbon-neutral economy



Source: European Political and Strategy Centre (EPSC)

SET PLAN DELIVERING RESULTS

ACCELERATING EUROPE'S TRANSITION
TO A NET-ZERO ENERGY SYSTEM

Let's work together for making
Europe the first climate-neutral
continent!

Contact SET-PLAN-SECRETARIAT@ec.europa.eu

INVESTMENTS TO BE MOBILISED

Technological
leadership in
renewables

€3.6
BILLION

Smart consumer-centric
energy system

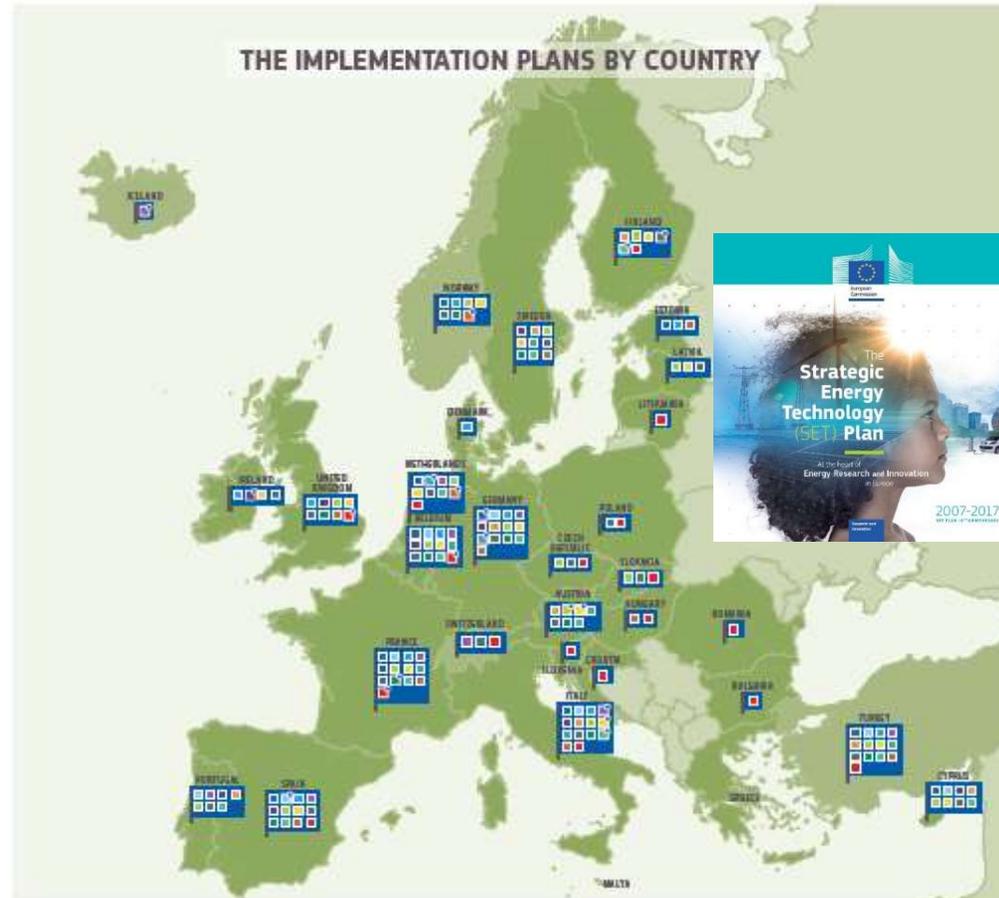
€105
BILLION

Strengthening
energy-efficient
systems

€4.5
BILLION

Decarbonising
transport
systems*

€2.9
BILLION



SUSTAIN TECHNOLOGICAL LEADERSHIP IN RENEWABLES (1 AND 2)

- Solar Photovoltaics (PV) IP
- Concentrated Solar Power / Solar Thermal Electricity (CSP/STE) IP
- Offshore Wind Energy IP
- Deep Geothermal Energy IP
- Ocean Energy IP

A SMART CONSUMER-CENTRIC ENERGY SYSTEM

- Smart Solutions for Energy Consumers IP (3.1)
- Towards Positive Energy Districts for Sustainable Urbanisation IP (3.2)
- Energy Systems IP (4)

DEVELOP AND STRENGTHEN ENERGY EFFICIENT SYSTEMS

- Energy Efficiency in Buildings IP (5)
- Energy Efficiency in Industry IP (6)

ENERGY OPTIONS FOR SUSTAINABLE TRANSPORT SYSTEMS

- Batteries for E-Mobility and Stationary Storage IP (7)
- Renewable Fuels and Bioenergy IP (8)

CCUS

- Carbon Capture Utilisation and Storage IP (9)

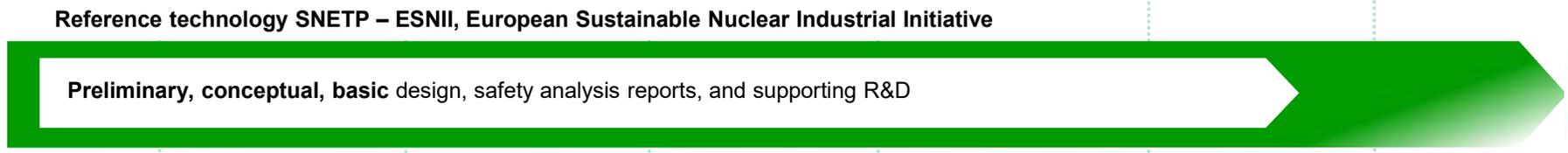
- Nuclear Safety **Key Action n.10**
- ★ Chair **18 EU MS signed up!**

Non-exhaustive list of stakeholders, including:

BEUC (European Consumer Organisation), Bouyges, European Chemical Industry Council (CEFIC), European Association for the Promotion of Cogeneration (COGEN Europe), European Energy Research Alliance (EERA), ESMIG (European Smart Energy Solution Providers), ETIP Photovoltaic Solar Energy (PV), ETIP District Heating and Cooling (DHC), European Turbine Networks (ETN), European Platform of Universities in Energy Research and Education (EUA-EPUE), European Technology and Innovation Platform on Wind (EUREC / ETIP PV), European Confederation of Iron and Steel Industries (EUROFER), Fuel Cells and Hydrogen Joint Undertaking (FCH JU), KIC Innoenergy, ETIP Smart Networks for Energy Transition (SNET), Northvolt and ETIP Sustainable Nuclear Energy Technology Platform (SNETP).



**ASTRID-
-Like
SFR
Prototype**



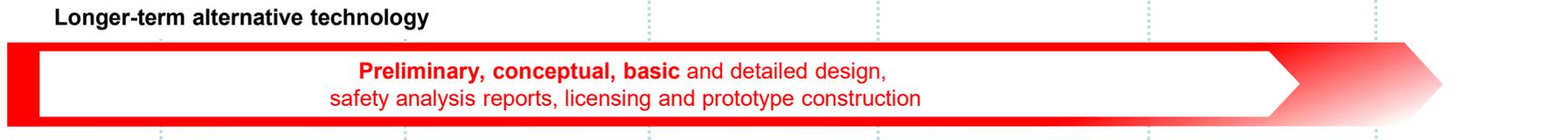
**MYRRHA
Flexible
Irradiation
Facility**



**ALFRED
LFR
Demonstrator**



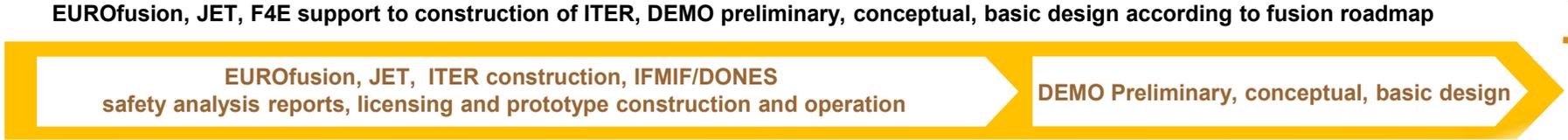
**ALLEGRO
GFR
Demonstrator**



**HTR
Heat
Cogeneration**

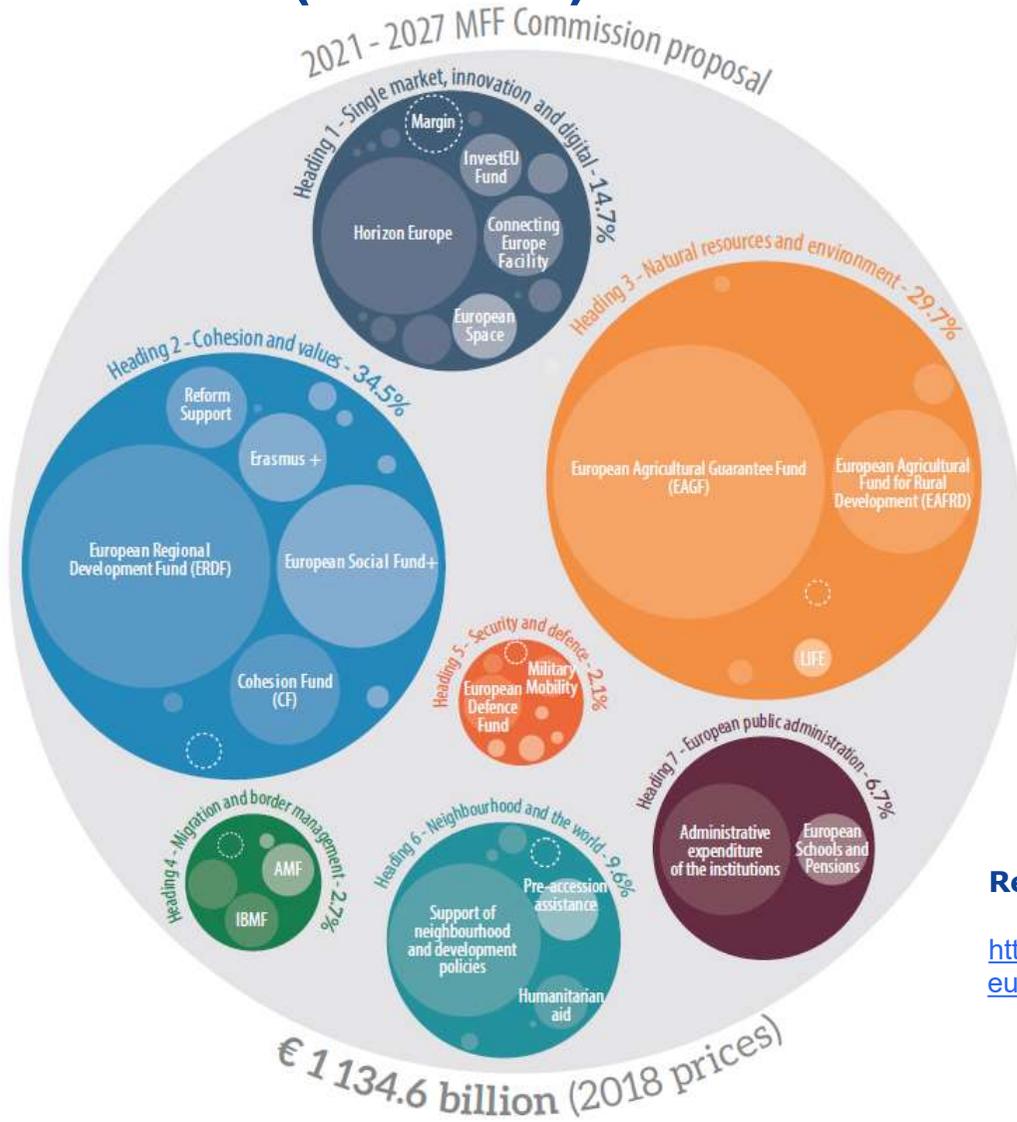


**Fusion
EUROfusion
F4E
ITER DEMO**



FP9 (2021-27) Horizon Europe Budget: €100 → 94 billion*

2018 proposal... July 2020 update



Euratom R&D Budget (7 years) EUR billion 2.4 → 1.98

Euratom Research and Training (7 years)

Indirect RTD

EUR million

- Fusion R&D: 1,040 → 809
- Fission R&D Safety and radiation protection: 475 → 370

Direct JRC

- Fission Safety and safeguards: 885 → 802

ITER (7 years, a dedicated EC Decision)

EUR billion 6.1 → 5.6

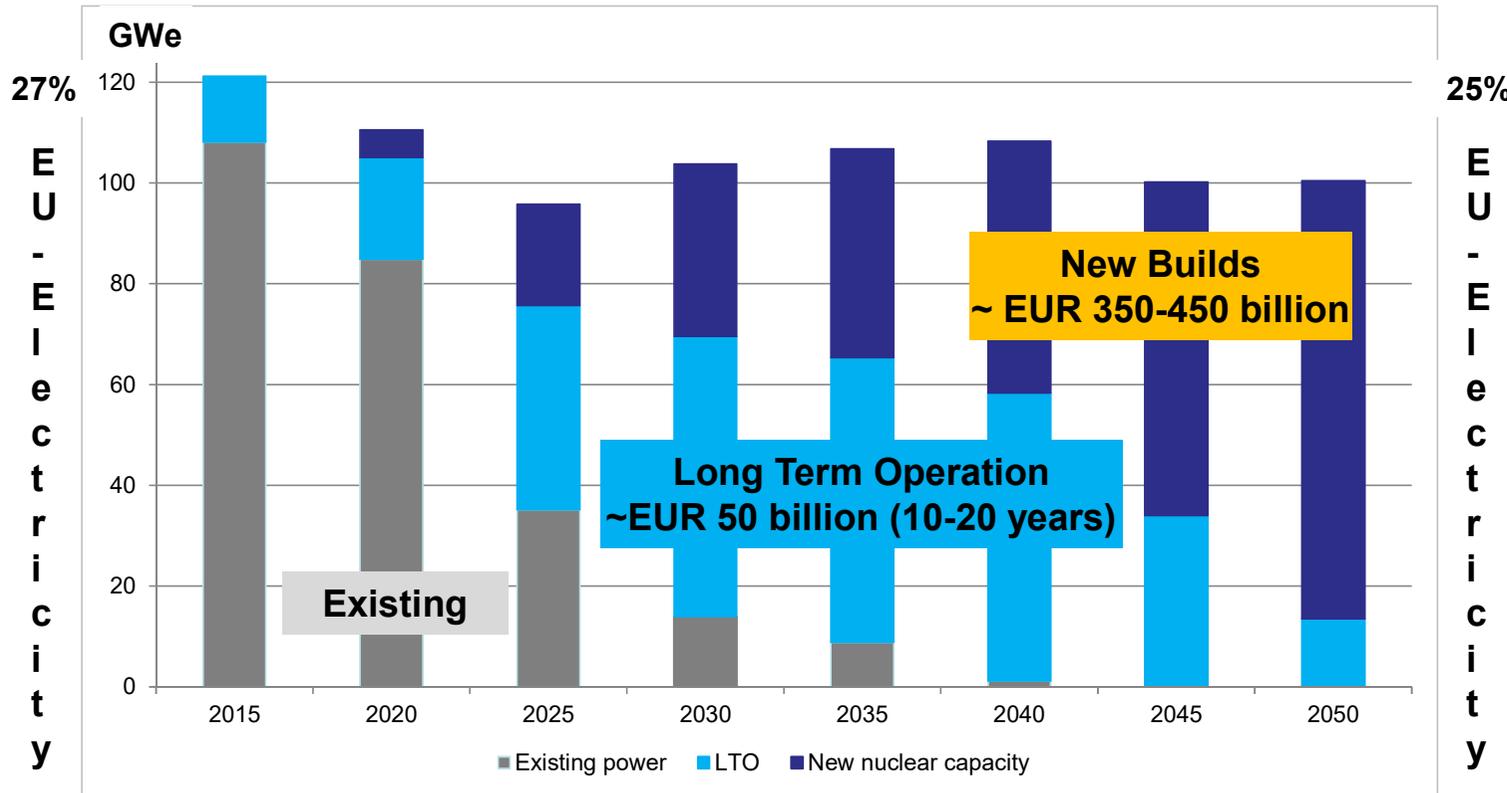
Research and Innovation (including Horizon Europe, ITER and Euratom) legal texts and factsheets (2018 Proposal)

https://ec.europa.eu/commission/publications/research-and-innovation-including-horizon-europe-iter-and-euratom-legal-texts-and-factsheets_en

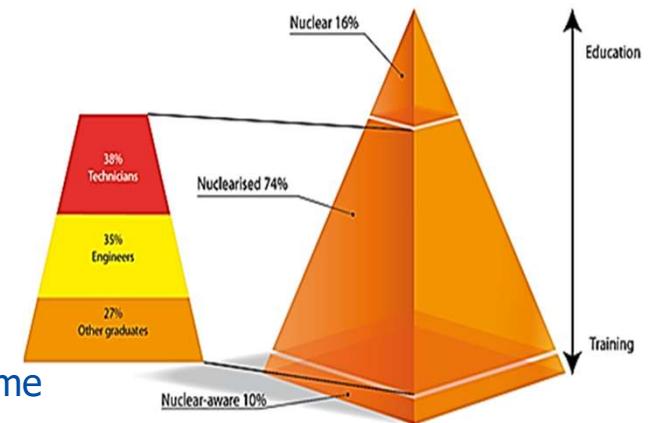


European Commission

EU Nuclear Electricity Generation (PINC 2017) and 2050 strategy



Other important aspects with respect to HR requirements for nuclear experts at a European scale are the experts employed by the regulatory bodies, their technical support organizations, and in nuclear research, education, and training.



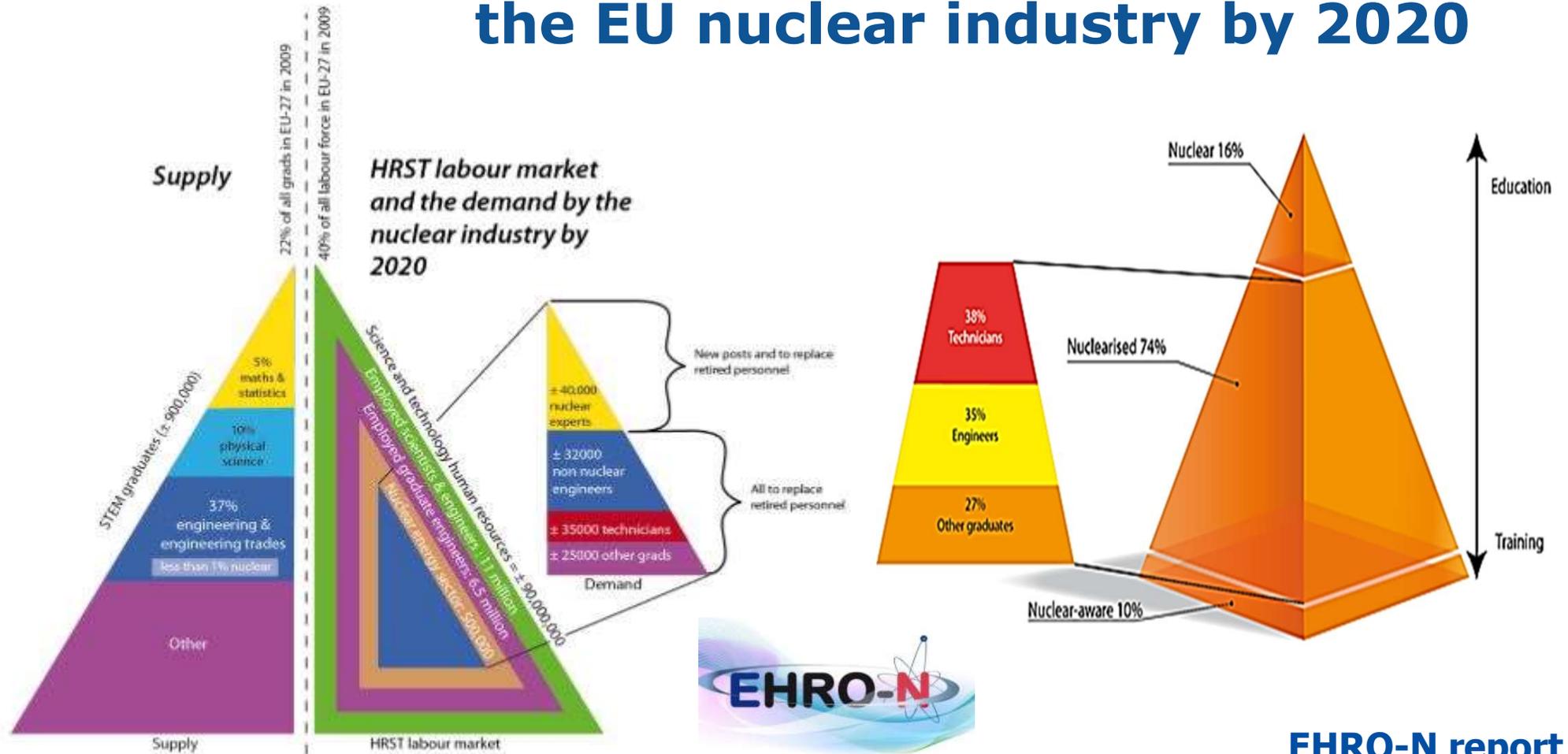
PINC - EU Nuclear Illustrative Programme

<https://ec.europa.eu/energy/en/news/commission-presents-nuclear-illustrative-programme>

2050 Long-term strategy

<https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/2050-long-term-strategy>

HR STEM labour market and the demand by the EU nuclear industry by 2020



Source: EHRO-N



EHRO-N report

http://ehron.jrc.ec.europa.eu/sites/ehron/files/documents/public/ehron_putting_into_perspective_report_2012_05_25_0.pdf

EU/Euratom Research and Training

Achievements

Challenges

Opportunities

Future Perspectives

EU/Euratom Fission achievements and challenges

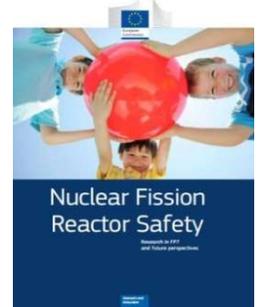
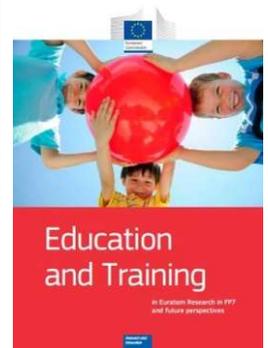
Nuclear Energy Development, including Research Activities (art.4-11)

Health and Safety (art.30-39)

Safeguards (Guarantees for Peaceful Uses) (art.77-85)

External Relations (art.101-106)

- **Safe and harmonised** management of radioactive waste
- **Enhanced safety** of design and operation of existing and future reactors
- **Lift uncertainty about health risks after low radiation dose** due to industrial and medical applications
- **Ensure transfer of knowledge** to future generation in the field
- **Integration of European research** programming and implementation
- **Challenges need to be addressed worldwide**



Euratom Treaty, EU Directives, E&T safety requirement

Euratom Treaty establishing the European Atomic Energy Community 25/03/1957

Euratom Community research and training programme

Each Member State **shall take the necessary measures with regard to teaching, education and vocational training**

- **EU Nuclear Installations Safety Directive 2009/71/Euratom, amendment 2014/87/Euratom** Expertise and skills in nuclear safety
- **EU Nuclear Waste Directive 2011/70/Euratom** for the responsible and safe management of spent fuel and radioactive waste Expertise and skills
- **EU Basic Safety Standards Directive 2013/59/Euratom** laying down for protection against the dangers arising from exposure to ionising radiation Requirements for radiation protection education, training and information

MS Transposition
----- Aug.2017
----- Aug.2013
----- Feb.2018



IAEA Convention on Nuclear Safety - Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life

EU/EURATOM Fission RTD Work Programmes

~ 20%

Waste Management and 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

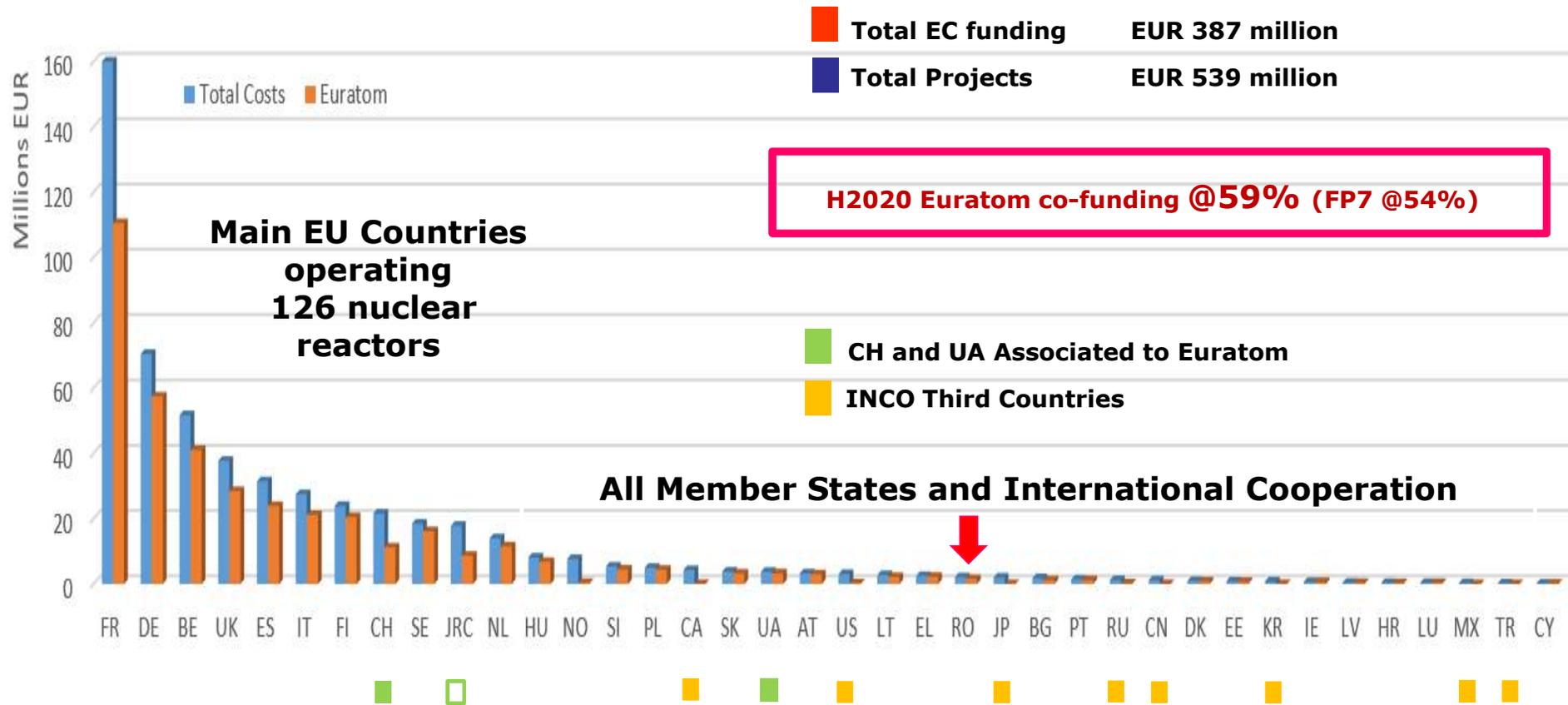
- Non-power applications

~ 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

EURATOM Fission H2020 (2014-20)



A total of 97 projects co-funded within two 2-years' calls in addition to JHR (EUR 21 million *) and InnovFin (EUR 20 million)
 * Access rights to JHR totalising EUR 32.5 million, 5.15% of irradiation time



R&D

Strategic studies

Knowledge management

Interacting with Civil Society



EURAD General Assembly

EURAD General Assembly

March 2021

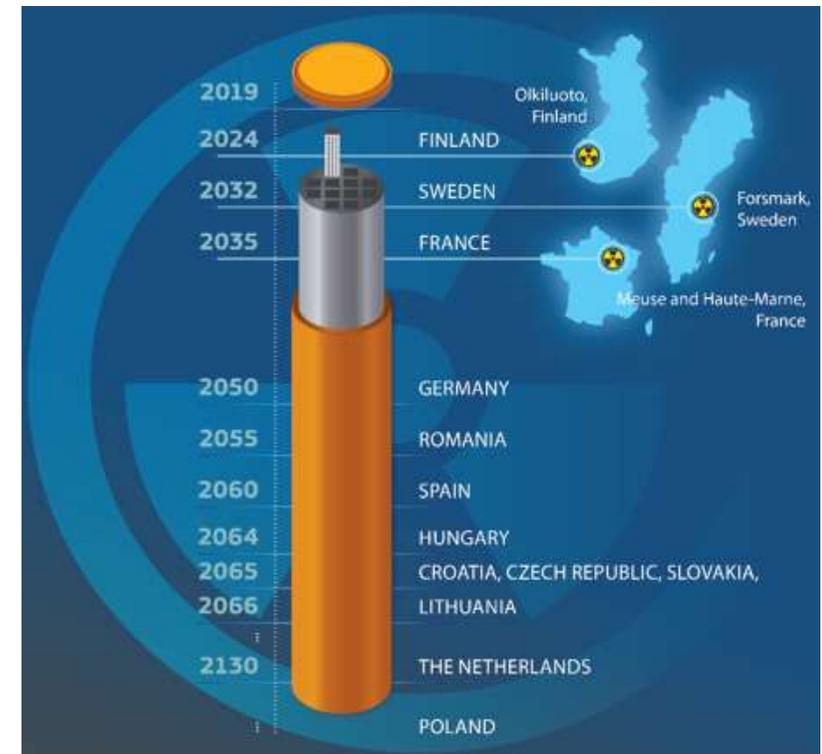


EURAD <https://www.ejp-eurad.eu/>

IGDTP <https://igdtp.eu/>

Radioactive Waste Management and Geological Disposal

A group of forerunners, also on a global scale, precedes by several decades the others



2nd Radioactive Waste Directive Implementation Progress Report EC / MS

COM(2019) 632 <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2019:0632:FIN>

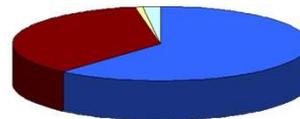
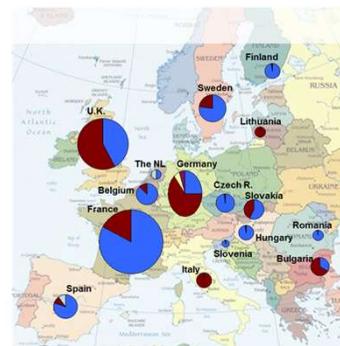
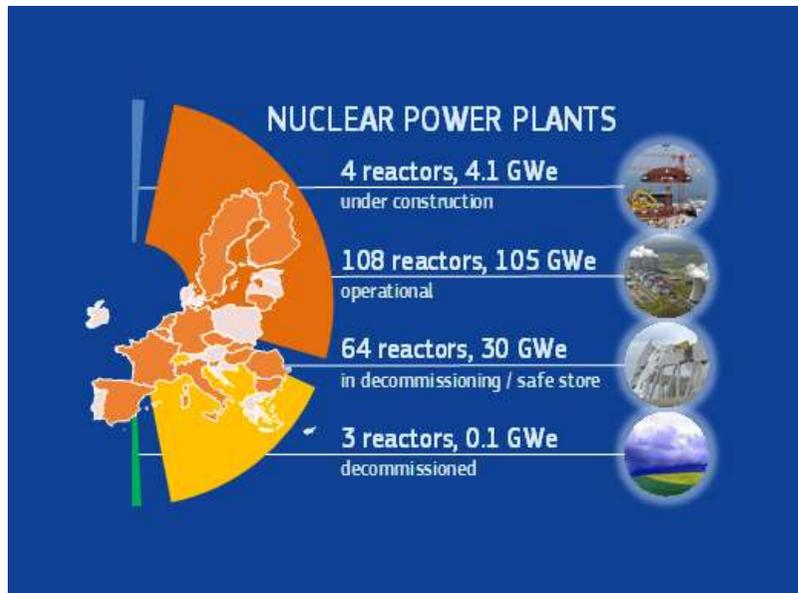
SWD(2019) 435 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019SC0435>

SWD(2019) 436 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019SC0436>

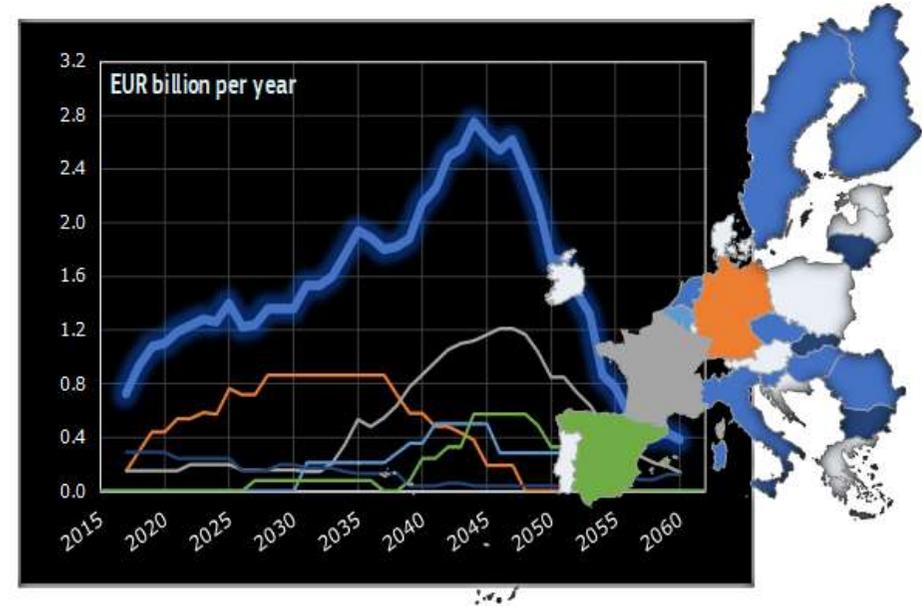
Nuclear Decommissioning Market and complementing R&D

Activities have increased and will further grow in the European Union

The total projected expenditures in decommissioning in the EU until 2060 are estimated at ~EUR 65 billion



TOTAL
Power reactors in EU: 222
Operating reactors: 128



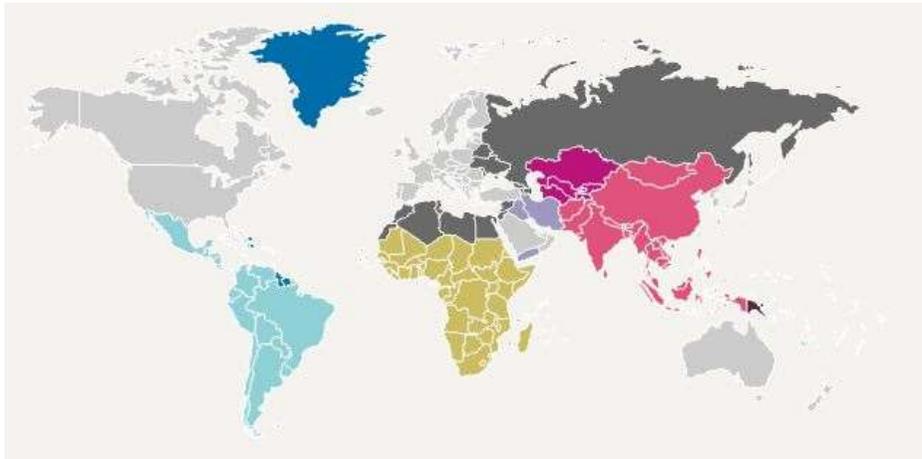
DG ENER STUDY Market for decommissioning nuclear facilities - 09/10/2019

<https://op.europa.eu/en/publication-detail/-/publication/2bf03904-ebf1-11e9-9c4e-01aa75ed71a1/language-en/format-PDF/source-110955267>

Complementing Euratom R&D...

EU Nuclear Safety and Decommissioning (LT, BG, SK and JRC)

	SECURITY
	Nuclear Safety and Decommissioning



Nuclear Safety & Decom
(MFF EU Security Prog. (not Euratom))
Update EU Council 21.07.2020 (tbc)
<https://www.consilium.europa.eu/en/meetings/european-council/2020/07/17-21/>

LT	490 million
BG	57 million
SK	50 million
JRC Decom	448 million
INSC (DEVCO)	160 million

Nuclear Safeguards and Security at JRC

Effective and Efficient Safeguards



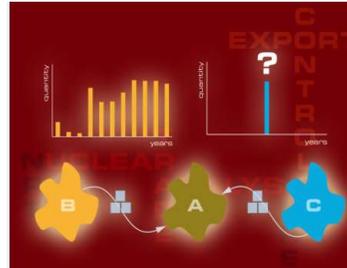
- Nuclear material measurements
- Reference materials
- Containment & Surveillance
- Process monitoring
- On-site laboratories

Verification Absence of Undeclared Activities



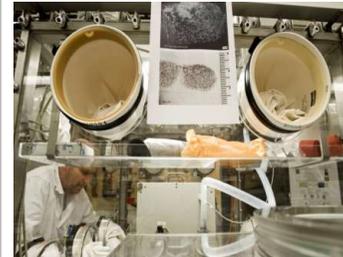
- Trace & particle analysis
- In-field tools for investigative inspector
- Reference materials

Nuclear Non Proliferation



- Export control
- Trade analysis
- Non-proliferation studies
- Outreach under INSC

Combating Illicit Trafficking



- Equipment development
- Testing & validation
- Nuclear forensics
- Nuclear preparedness
- National response plan
- CBRN, IcSP, ...



UN agency, 1957
Safeguards and Verification
Non proliferation, Additional
protocol
Nuclear Security / IEC



EURATOM
Rome treaty 1957
Chapter VII on nuclear
safeguards

JRC
(Joint Research Centre)
Nuclear Security
R&D, T&S support

TRAINING & EDUCATION European Nuclear Security Training Centre



EJP CONCERT – European Joint Programme for the integration of the radiation protection research

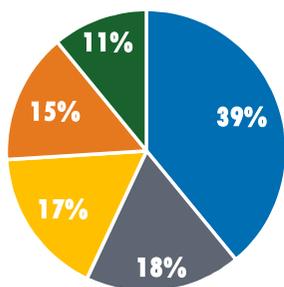


EJP CONCERT – European Joint Programme for the integration of the radiation protection research **01/06/2015 – 31/05/2020**, gathering 32 Beneficiaries and 52 European partners, **a Euratom grant of EUR 19.8 million, total costs EUR 32 million**

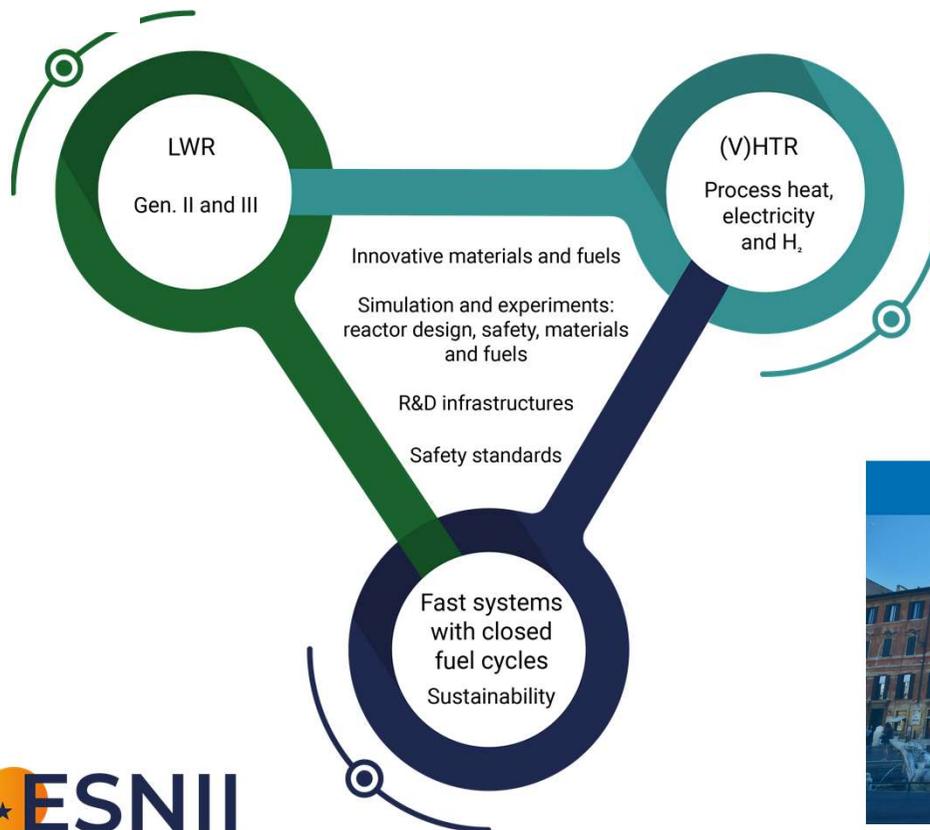
June 2019: SNETP Evolution towards a legal entity



Categories of membership (120 members)



- Research organisations
- Industry
- SMEs
- Academia
- Other



Networking

SNETP Forum 2021

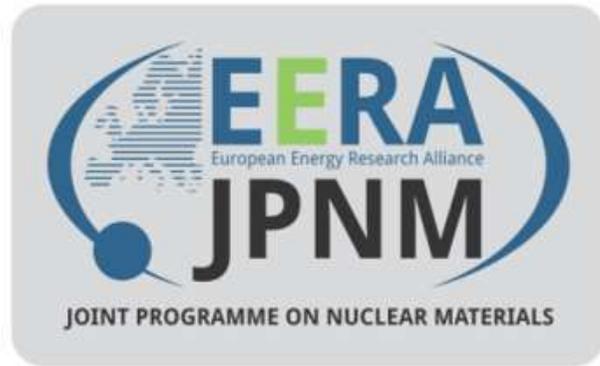


Towards innovative R&D in civil nuclear fission

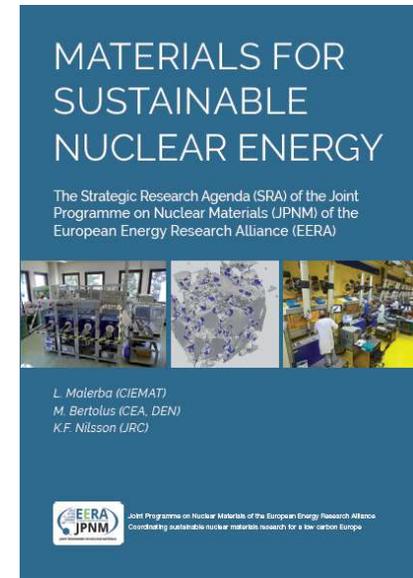
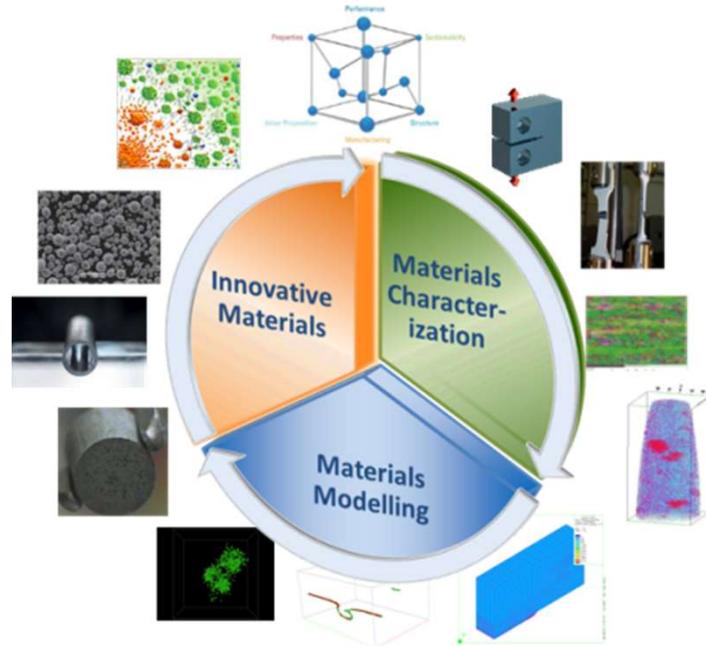
2-4 February 2021
Rome, Italy



EERA Joint Programme on Nuclear Materials



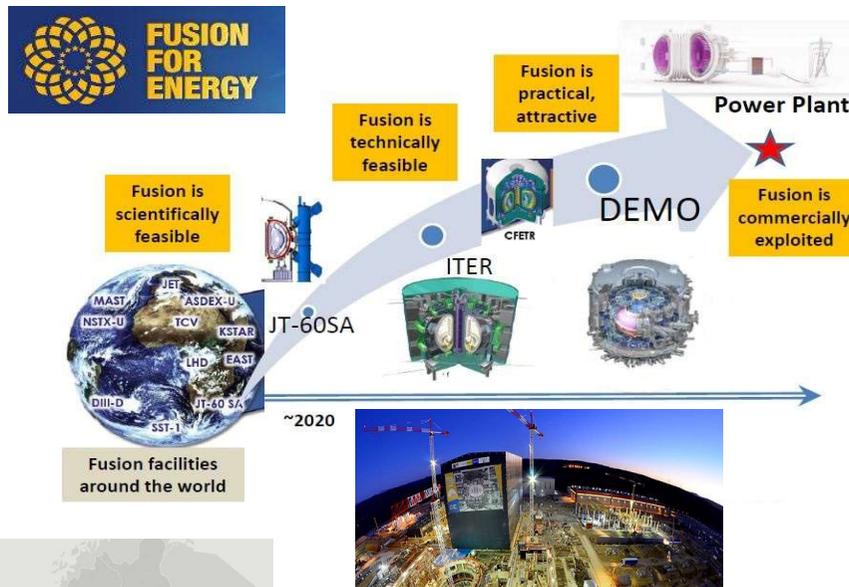
Overarching objective:
improve **safety & sustainability**
of nuclear energy, focusing on
materials issues



More than 50 organisations from 17 countries contribute to at least one of the 6 subprogrammes of the EERA JPNM devoted to qualification, modeling and development of structural and fuel materials - <http://www.eera-jpnm.eu>



Euratom F4E, EUROfusion roadmap and ITER



Euratom Joint Undertaking F4E for ITER and the Development of Fusion

Euratom contribution to the **Joint Undertaking 'Fusion for Energy' F4E** for the **2014-2020** period set at **EUR 2.9 billion**. ITER is an international collaborative project (EU, US, China, Japan, India Russia, South Korea)

This work has been carried out within the framework of the Euratom Research and Training programme (2014-2020) under grant agreement No 632002.

EUROfusion

EUROfusion consortium members*

- Tokamak
- Spherical Tokamak
- Stellarator
- Linear Device
- ITER (under construction)

*The entire list includes the headquarters of the EUROfusion consortium members and their main beneficiaries.

Map shows facilities are marked in the Euratom Fusion research programme 2014-2020 under grant agreement No 632002.

EUROfusion Joint Programme signed in **September 2014** (starting on 1st January 2014), extended till 31/12/2022 replaced all Euratom/Associations agreements, **2014-2022**, a contract of around **EUR 679 million** implementing Fusion roadmap, total costs **EUR 1.33 billion**, **30 main beneficiaries** and **200 European partners**

<https://www.euro-fusion.org/>

Conclusion and perspectives

- 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, 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



Thank You!



Publications – CORDIS (EC R&D Information Service)

**View all H2020 Euratom projects summaries
and public deliverables on CORDIS**

<https://cordis.europa.eu/>

H2020 Euratom projects (All)

[https://cordis.europa.eu/search?q=contenttype=%27project%27%20AND%20\(programme/code=%27H2020%27%20OR%20programme/code=%27H2020-Euratom%27\)%20AND%20\(%27euratom%27\)&p=1&num=100&srt=Relevance:decreasing](https://cordis.europa.eu/search?q=contenttype=%27project%27%20AND%20(programme/code=%27H2020%27%20OR%20programme/code=%27H2020-Euratom%27)%20AND%20(%27euratom%27)&p=1&num=100&srt=Relevance:decreasing)

... Latest relevant projects summaries !