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INSTITUTUL DE ENERGII NUCLEARE

FISA 2019

9th European Commission Conference
on EURATOM Research and Training
in Safety of Reactor Systems

4-7 June 2019
Pitești, Romania



Euratom Research and Training Programme in safety of the reactor systems: Overview status, vision and future perspectives

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Content

1. EU Multi-Financial Framework Programme (MFF) 2021-27,
Horizon Europe and Euratom Research and Training (2021-25)

2. Overview Status and Vision

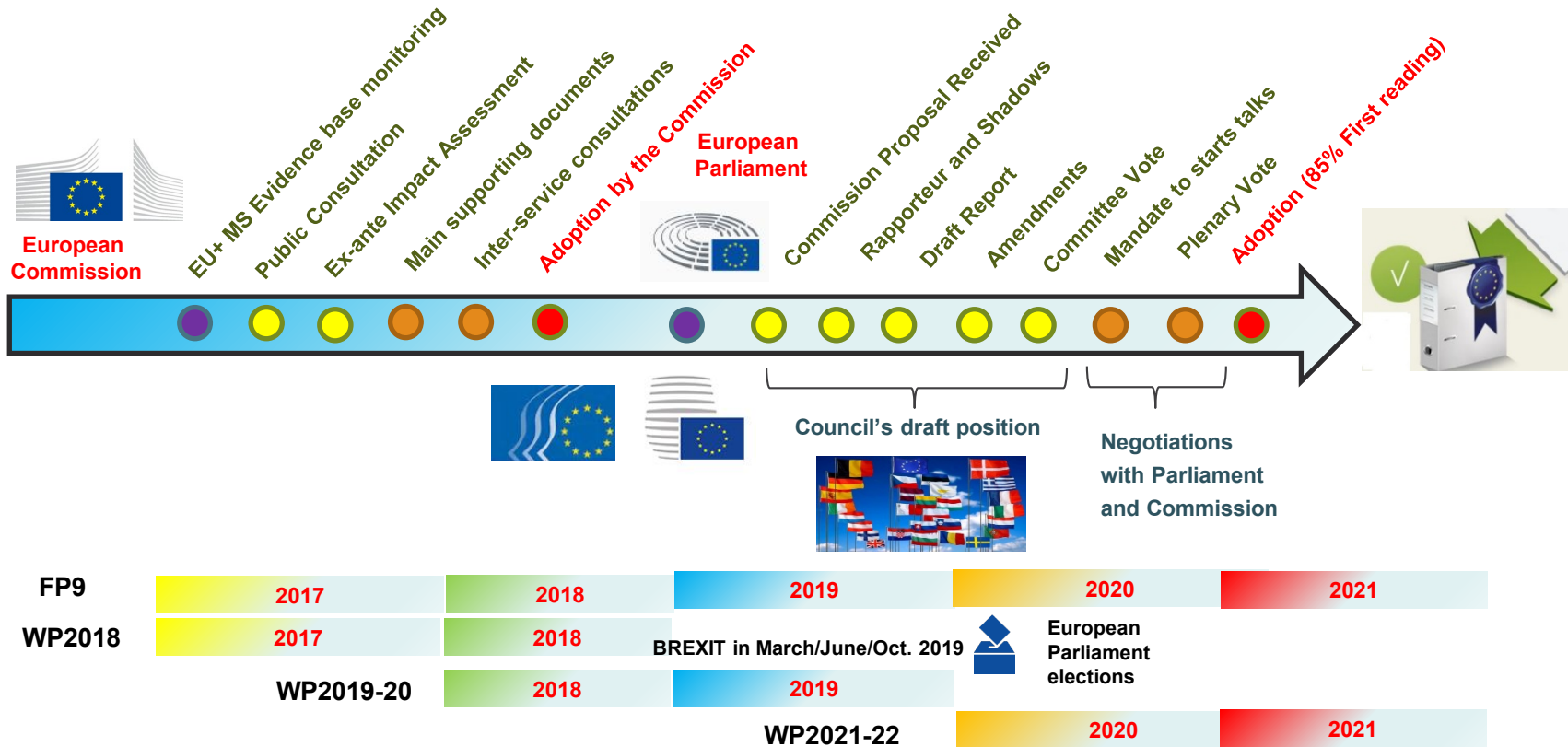
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SINCE 1957



3. Future Perspectives



EU Decision Making Process (timeline)



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

ALIGNED TO POLITICAL PRIORITIES

In billion euro, current prices



Simplification,
transparency
and
flexibility

https://ec.europa.eu/commission/publications/factsheets-long-term-budget-proposals_en



I. SINGLE MARKET, INNOVATION AND DIGITAL

€187.4

- 1 Research and Innovation
- 2 European Strategic Investments
- 3 Single Market
- 4 Space



II. COHESION AND VALUES

€442.4

- 5 Regional Development and Cohesion
- 6 Economic and Monetary Union
- 7 Investing in People, Social Cohesion and Values



III. NATURAL RESOURCES AND ENVIRONMENT

€378.9

- 8 Agriculture and Maritime Policy
- 9 Environment and Climate Action



IV. MIGRATION AND BORDER MANAGEMENT

€34.9

- 10 Migration
- 11 Border Management



V. SECURITY AND DEFENCE

€27.5

- 12 Security
- 13 Defence
- 14 Crisis Response



VI. NEIGHBOURHOOD AND THE WORLD

€123

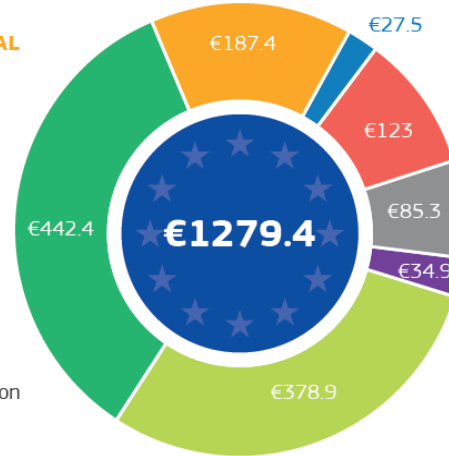
- 15 External Action
- 16 Pre-Accession Assistance



VII. EUROPEAN PUBLIC ADMINISTRATION

€85.3

- 17 European Public Administration



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

Euratom Research and Training (5 years)

Indirect RTD

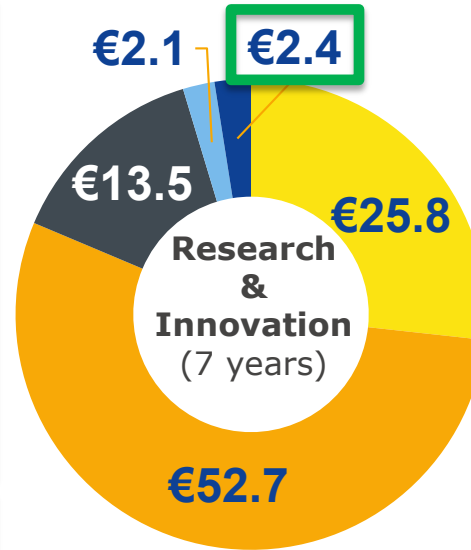
• Fusion R&D	EUR 724 million
• Fission R&D Safety and radiation protection	EUR 330 million

Direct JRC

• Fission Safety and safeguards	EUR 620 million
---------------------------------	------------------------

ITER 7 (years, a dedicated EC Decision)

EUR 6.1 billion



€ billion
In current prices

- Open Science
- Global Challenges & Ind. Competitiveness
- Open Innovation
- Strengthening ERA
- Euratom

* This envelope includes EUR 3.5 billion allocated under the InvestEU Fund.

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

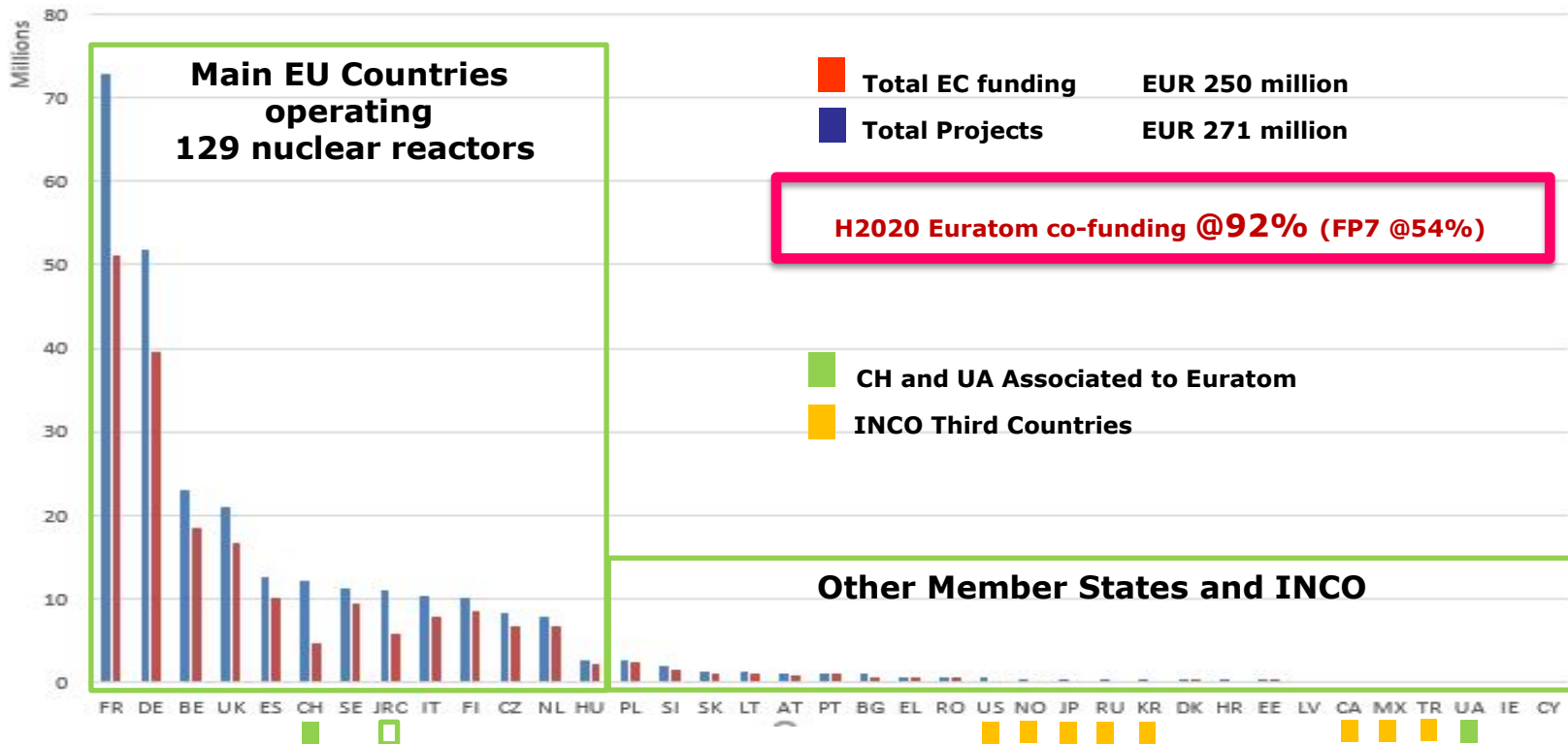
https://ec.europa.eu/commission/publications/research-and-innovation-including-horizon-europe-iter-and-euratom-legal-texts-and-factsheets_en

Research Framework Programmes Budgets

Research Framework Programme	Total EU funding (EUR billion)	Total EURATOM funding (EUR billion)	EURATOM funding (EUR million) for fission (indirect actions) fusion (indirect actions) JRC (direct actions)	ITER funding for its construction (EUR billion)
FP4 (1994-1998)	11.88	1.23	170 – 794 - 271	-
FP5 (1998–2002)	13.70	1.26	191 – 788 - 281	-
FP6 (2002–2006)	17.88	1.35	209 – 824 - 319	-
FP7 (2007–2013)	50.52	2007-11 = 1.45	287 - 654* - 514	(2007-2020 = 6.6 cap) 2007-11 = 1.3
		2012-13 = 0.55	118 - 197* - 233	2007-11 = 1.3 2012-13 = 1.3 (+)
FP8 Horizon 2020 (2014-2020)	86	2014-18 = 1.79	355 - 710* - 724	2014-20 = 2.7
		2019-20 = 0.771	152 – 350* - 269	
FP9 Horizon Europe (2021-2027) (Commission proposal)	100	2021-25 = 1.674 (2021-27 = 2.4)	330 - 724* - 620	2021-27 = 6.1

* Excludes ITER construction

H2020 EURATOM Fission RTD Calls 2014-2017



A total of 47 projects co-funded within two 2-years' calls in addition to JHR (EUR 15 million) and InnovFin (EUR 20 million)

EU/EURATOM Fission RTD Work Programmes

25%

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)

25

3

5

5

2

20%

Radiation protection

- Non-power applications

7

15%

Research infrastructures

Training and mobility

Cross-cutting INCO

6

5

4

Grand Total:

Euratom Fission RTD ~ 50 Mi€ / Year

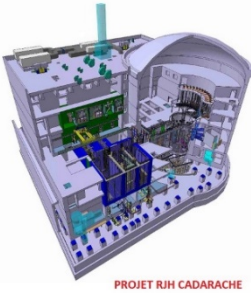
Euratom Fission JRC ~ 50 Mi€ / Year

Total ~ 10 % EU Public&Private Fission R&D

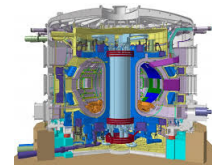
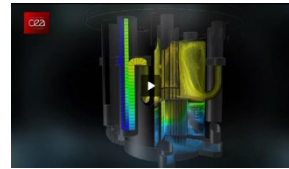
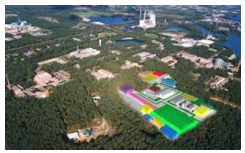
EU/EURATOM Research and Training

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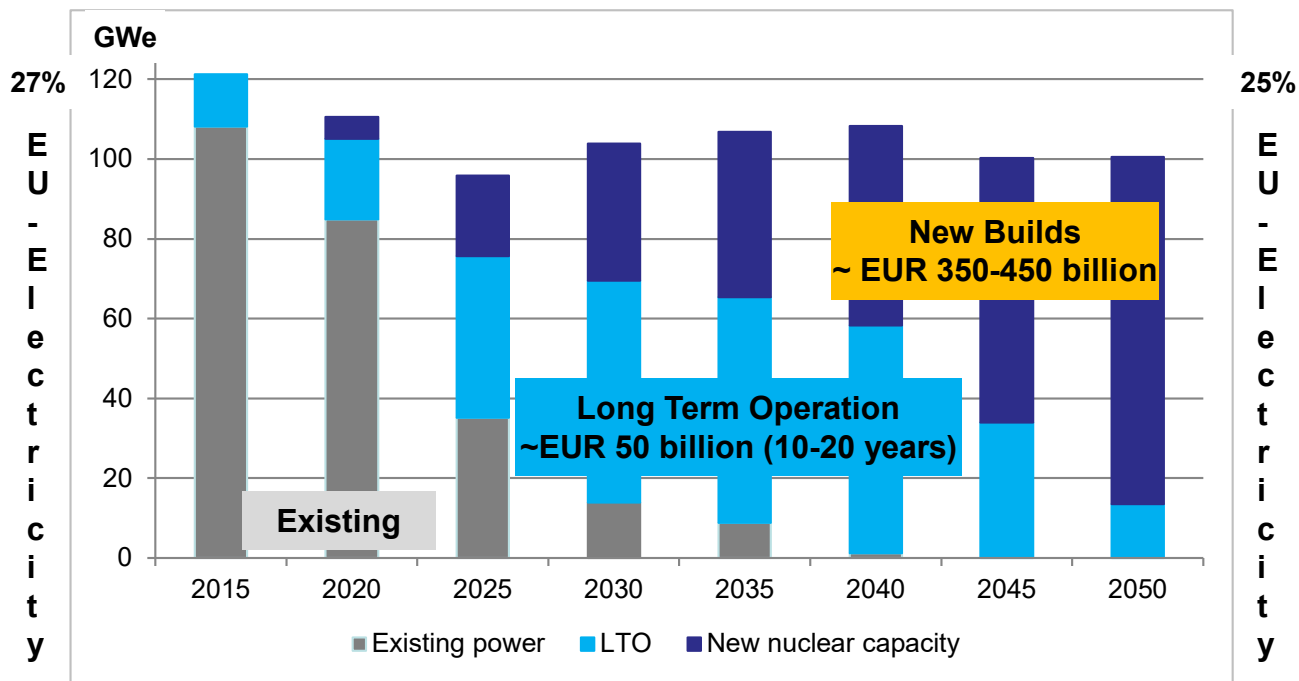
Generation I	Generation II	Generation III / III+	Generation IV
<p>Big Rock Point, GE BWR</p> <p>Early prototypes</p> <ul style="list-style-type: none"> Calder Hall (GCR) Shippingport (GCR) Dresden-1 (GCR) Fermi-1 (SFR) Kala 1-2 (PWR/VVER) Pressurized Water Reactor (PWR) 	<p>Dabob Canyon, Westinghouse PWR</p> <p>Large-scale power stations</p> <ul style="list-style-type: none"> Bruce (PWR/CANDU) Calvert Cliffs (PWR) Flamanville 1-2 (PWR) Edwards (SFR) Grand Gulf (BWR) Kalina (PWR/VVER) Kozlodub (GCR) Palisade (PWR) 	<p>Akwashuk, GE ABWR</p> <p>Evolutionary designs</p> <ul style="list-style-type: none"> ABWR (GE-Hitachi, Toshiba BWR) ESBWR (GE-Hitachi BWR) Small Modular Reactors (SMR) SWR (Westinghouse-Toshiba PWR) AP1000 (Westinghouse-Toshiba PWR) APR-1400 (KCHNP PWR) APWR (Mitsubishi PWR) ATRAC-1 (Hitachi PWR) Mitsubishi PWR CANDU 6 (AECL PWR) 	<p>Safe Secure Sustainable Competitive Versatile</p> <p>Aiming - 2030</p> <p>Innovative designs</p> <ul style="list-style-type: none"> EFBR (gas-cooled fast reactor) LFR (lead-cooled fast reactor) MSR (molten salt reactor) SFR (sodium-cooled fast reactor) SCWR (supercritical water-cooled reactor) VHTR (very high temperature reactor)



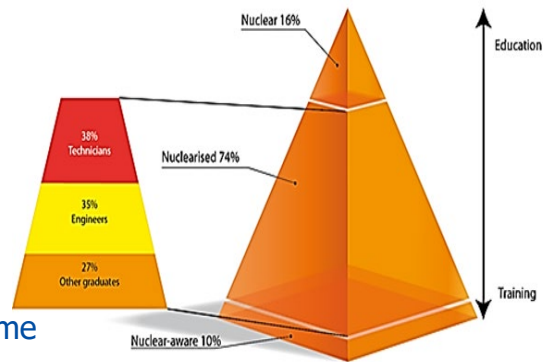
SUSEN
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ALFRED



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

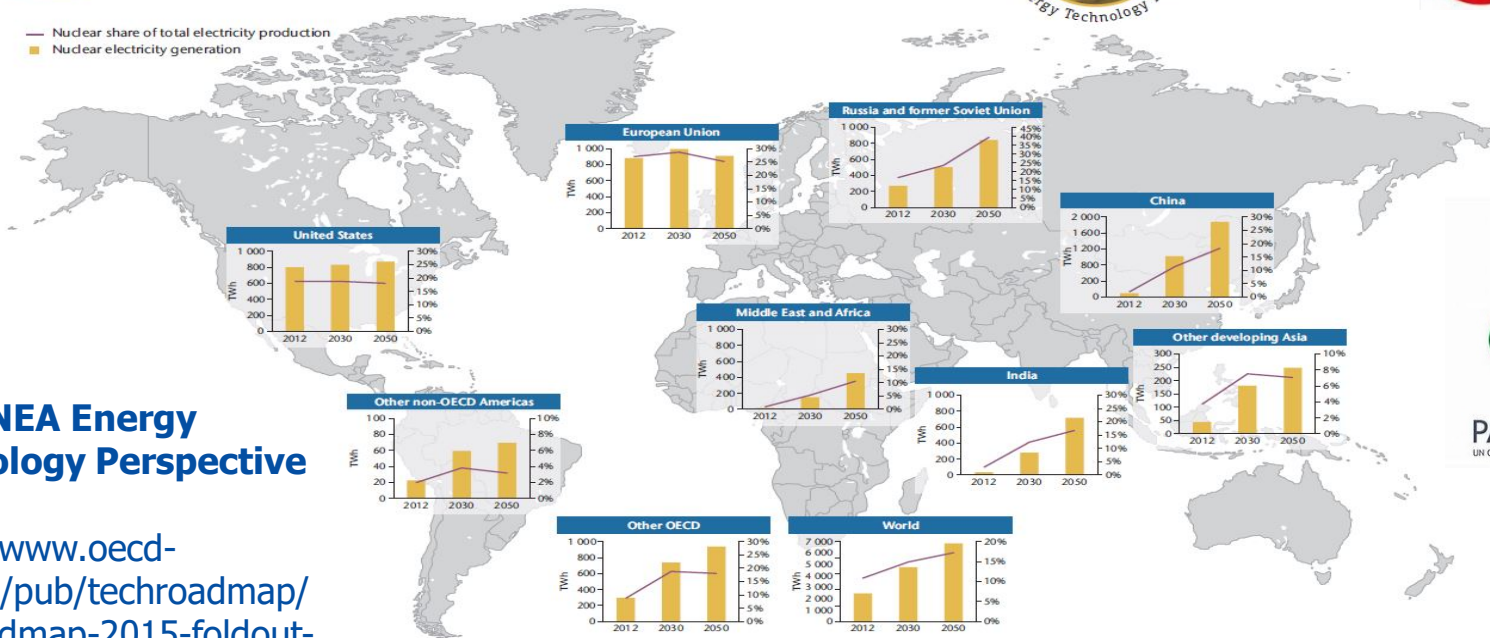
<https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/2050-long-term-strategy>

Global Perspectives

Electricity generation (TWh) and share of electricity generation (%) in 2012, 2030 and 2050 in 2DS



— Nuclear share of total electricity production
 ■ Nuclear electricity generation



COP21 - CMP11
PARIS 2015
 UN CLIMATE CHANGE CONFERENCE

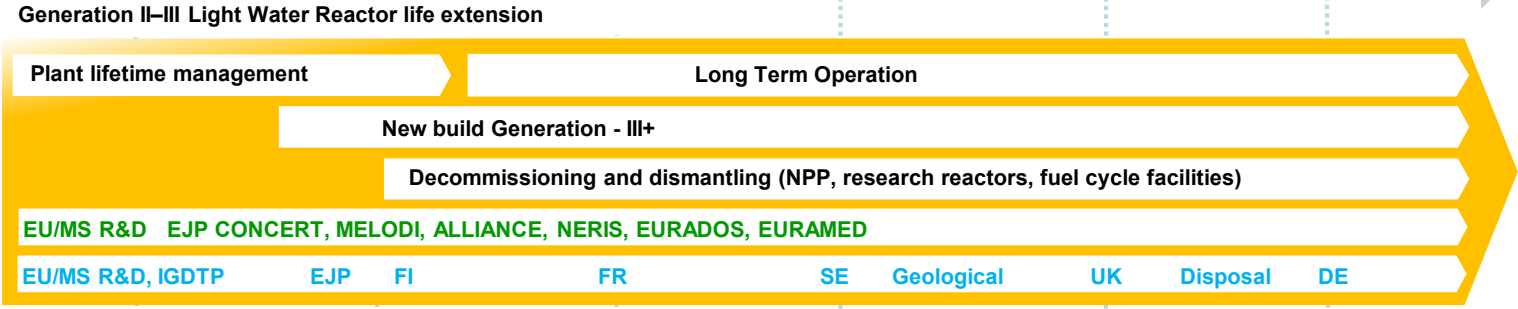
IEA – NEA Energy Technology Perspective 2015

<https://www.oecd-nea.org/pub/techroadmap/techroadmap-2015-foldout-a3.pdf>

This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

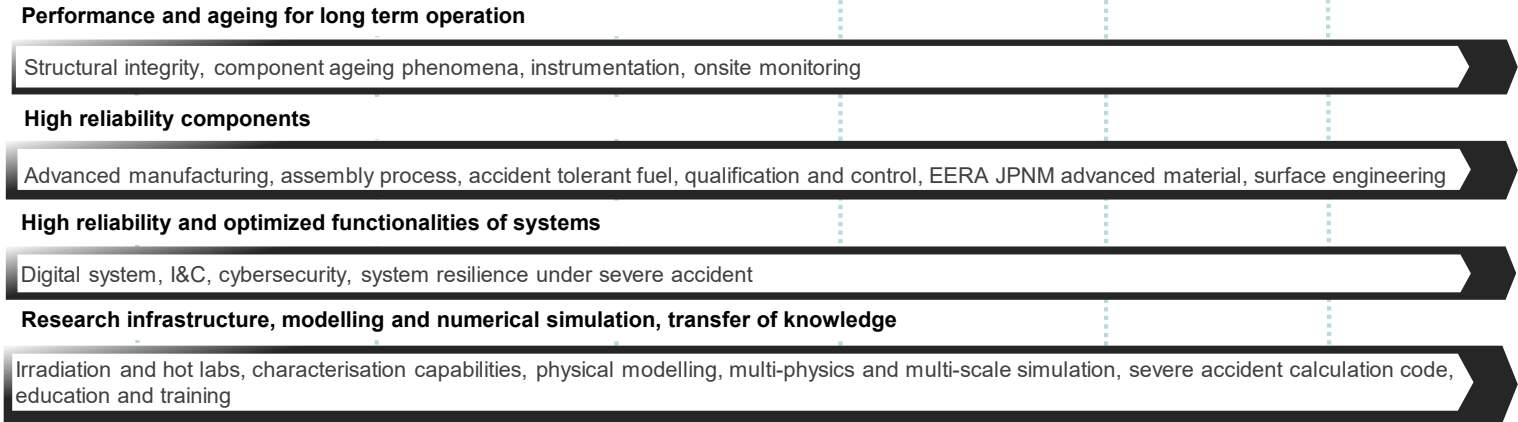


**Gen-II-III
-
LWR
-
NUGENIA
IGDTP
MELODI**

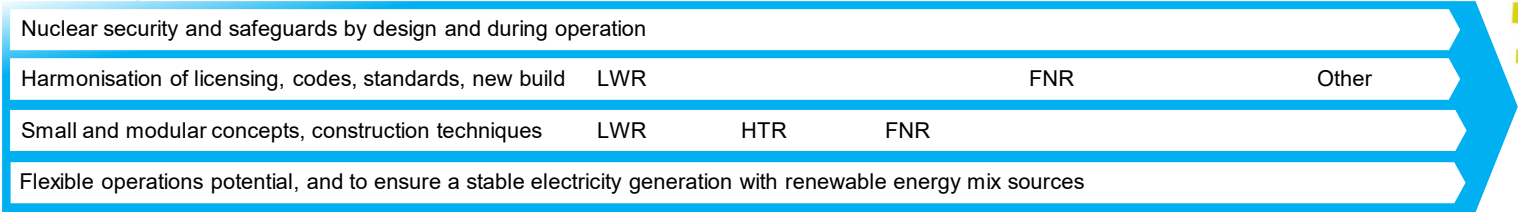


**Cross-cutting
Technology

R&D
-
Sharing
capabilities,
methods, tools,
innovation,
transfer of
knowledge**



**Methodologies
Gen-II-III-IV
and
Cogeneration**



1 **NUGENIA**
Nuclear Generation II & III Association

2 **CONCERT**
CONCERT
EUROPEAN COMMISSION
EUROPEAN UNION
EUROPEAN NUCLEAR RESEARCH INFRASTRUCTURE

3 **EJP WASTE**

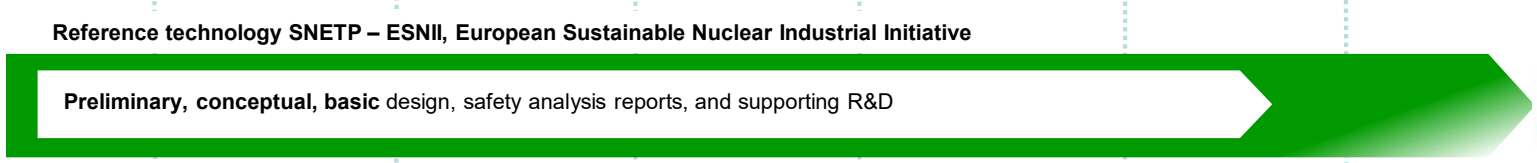
4 **EJP WASTE**

5 **DECOM**

7 **EERA JPNM**
JOINT PROGRAMME ON NUCLEAR MATERIALS



ASTRID-
-Like
SFR
Prototype



MYRRHA

Flexible
Irradiation
Facility



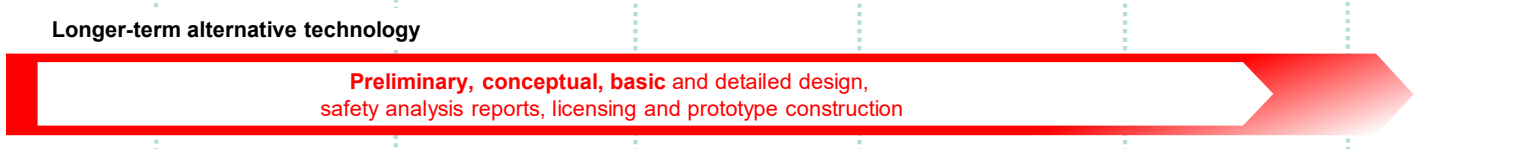
ALFRED

LFR
Demonstrator



ALLEGRO

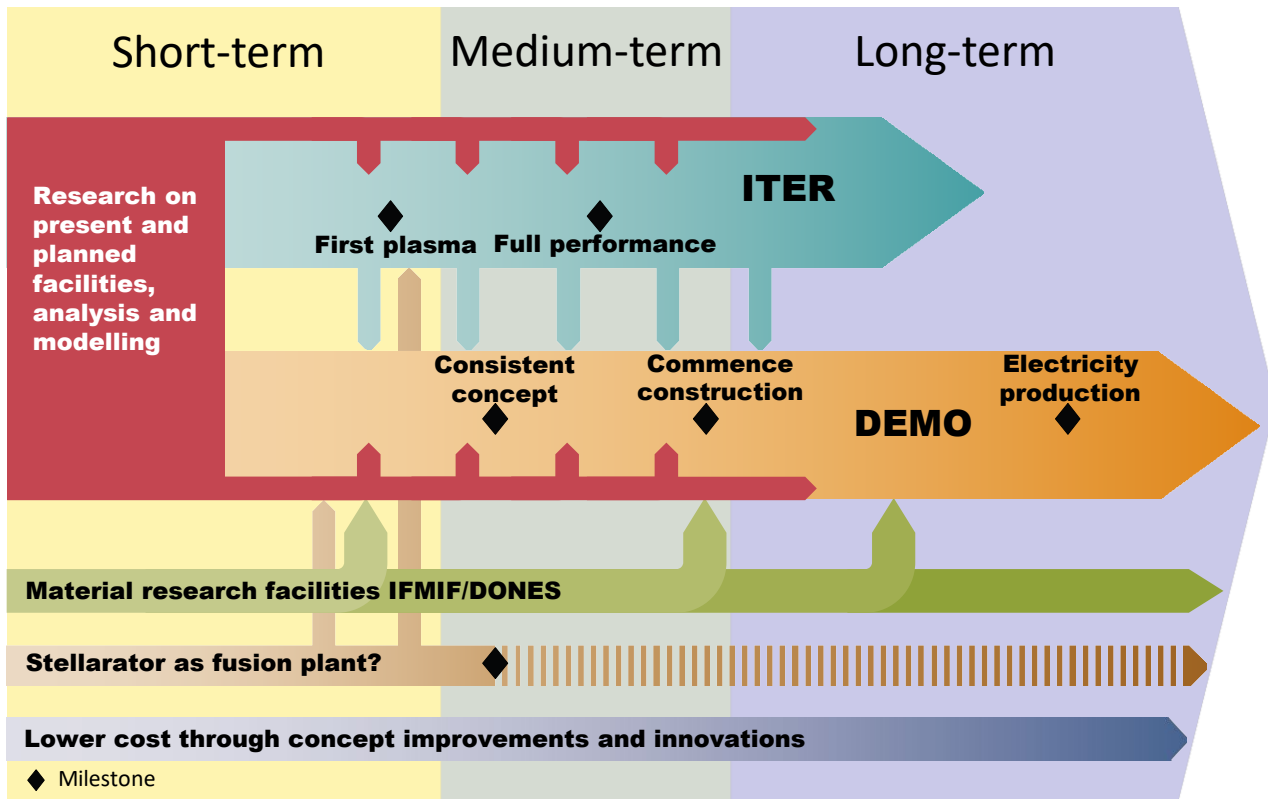
GFR
Demonstrator



HTR

Heat
Cogeneration





Fusion Power Plants

10





Supporting Infrastructures - Safety Upgrade R&D



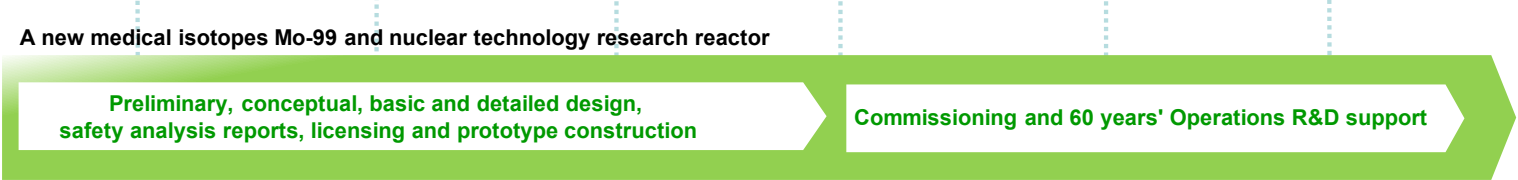
Cross-cutting Safety R&D



JHR Jules Horowitz Reactor

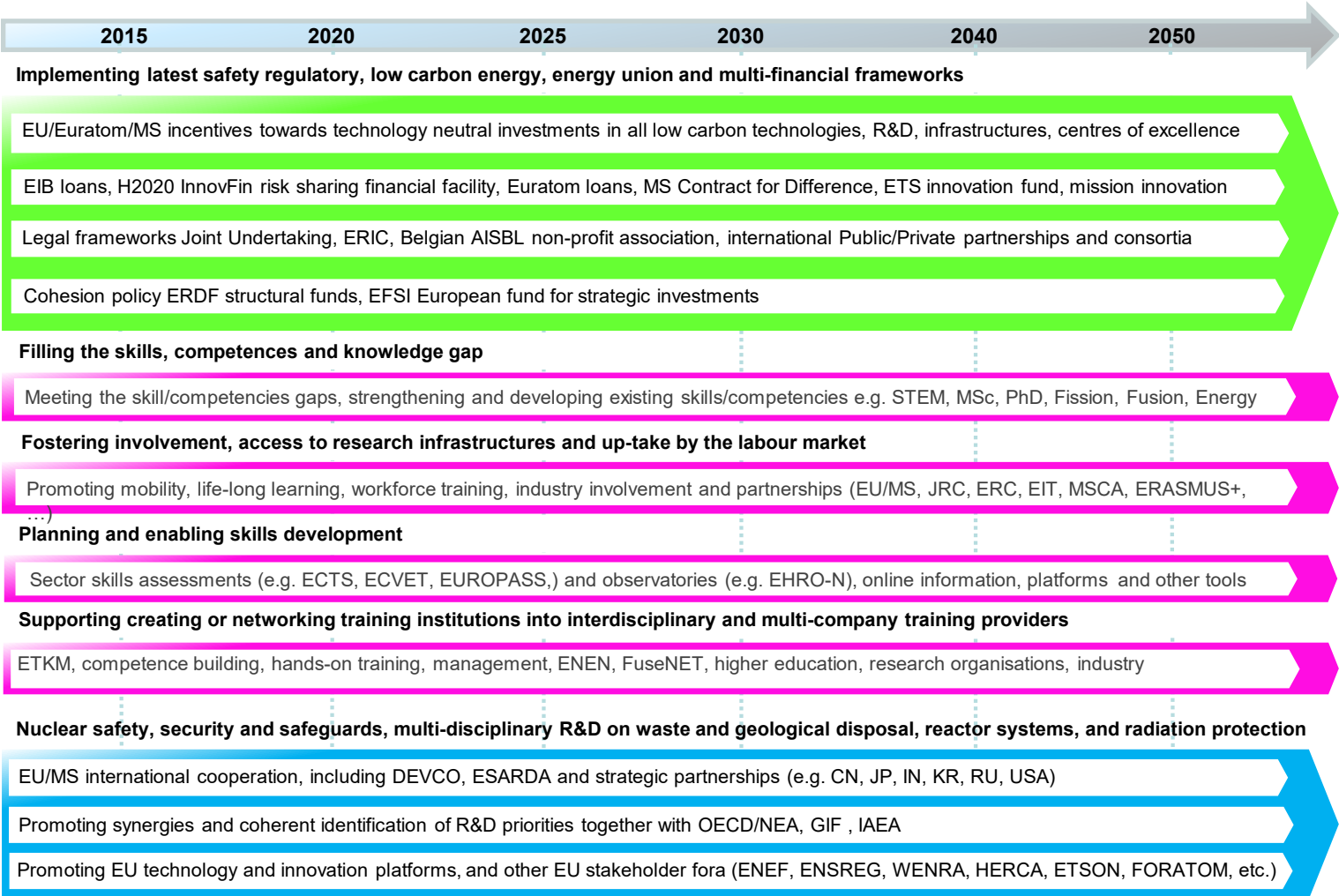


PALLAS



6

Key Enabling Conditions



Key Enabling Conditions

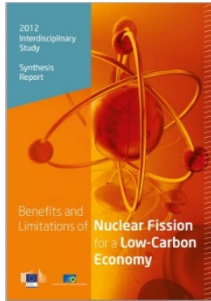


Let's Capitalise ... All initiatives FP7, ETPs, ERA, INCO, H2020

- Under Euratom, **EC** should promote and facilitate **EU Nuclear safety R&D** in MS, collab. IAEA, OECD/NEA, GIF
- **ETPs** are industry led to promote R&D and demonstration of EU fission technologies
- **EU fora** supporting nuclear policy, promoting stakeholders dialogue and safety improvements
- **ENEF** from 2007 and WG Transparency, risks and opportunities
- **ENSREG** from 2007, stress tests peer reviews
- **SNETP** composed of **NUGENIA**, **ESNII** and **NC2I** pillars
- **SET-Plan** Key action n.10 on nuclear fission and fusion
- **IGDTP** on geological disposal, EURAD
- **MELODI** with **NERIS-TP**, **EURADOS** and Alliance, **CONCERT**
- **ENEN** European Nuclear Education Network
- **INCO** structured dialogue on R&D policy and priorities



European Group of Ethics EGE Opinion 27 dated 16/01/2013



On January 16, 2013, the EGE adopted Opinion 27 an "**Ethical framework for assessing research, production, and use of Energy**".

The EGE recommends to achieve equilibrium between four criteria - access rights, security of supply, safety, and sustainability - in light of social, environmental and economic concerns.



2013 Symposium Proceedings
<https://publications.europa.eu/en/publication-detail/-/publication/e92b20be-9163-4aee-b469-87828b10c0f1/language-en>



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Thank You!

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