HORIZON 2020

Euratom Research and Training Programme
Work Programme 2016-2017

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Outline of the presentation

1. Euratom Treaty and policy frameworks
2. Euratom Research and Training programme
3. European nuclear fission landscape
4. EU-Ukraine collaboration in nuclear domain
5. Work Programme 2016-2017 and fission call

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The Treaty establishing the European Coal and Steel Community (ECSC) was signed in Paris in 1951.

The Treaty establishing the European Economic Community (EEC) was signed in Rome in 1957.

The Treaty establishing the European Atomic Energy Community (Euratom) was signed in Paris in 1957.

The Treaty of Nice was signed in 2001, increasing the number of Member States from 15 to 27, which is now 28.


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Rome 1957: Signature of the Treaty establishing the European Atomic Energy Community (Euratom)

- **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)

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The strategy of the European Energy Union has five mutually-reinforcing and closely interrelated dimensions designed to bring greater energy security, sustainability and competitiveness:

• Energy security, solidarity and trust;
• A fully integrated European energy market;
• Energy efficiency contributing to moderation of demand;
• Decarbonising the economy; and
• Research, Innovation and Competitiveness

A new strategy for R&I ... putting the EU at the forefront of smart grid and smart home technology, clean transport, as well as clean fossil fuel and the world's safest nuclear generation, is central to the aim of turning the EU into a motor for growth, jobs and competitiveness

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- Introduction of a high-level "Nuclear safety objective for nuclear installations" (Article 8a – (1) new nuclear installations and (2) existing nuclear installations)


Council Directive 2013/59/Euratom laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation

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EU research - the story so far

- 1957: Euratom Treaty
  - Concept of Community Research programmes
  - Joint Research Centre established
- 1987: ‘Single European Act’
  - Science becomes a Community responsibility
- 1992: Treaty on European Union
  - Role of RTD in the enlarged EU
- 2000: European Research Area (ERA) launched
  - EC Framework Programme (2007-2013)
  - Euratom Framework Programme 'FP7' (2007-2011)
- 2011: Euratom Framework Programme 'FP7+2' (2012-2013)

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Research and Training Programme of Euratom (2014-2018) complementing the Horizon 2020 Framework Programme for Research and Innovation


- **General objective:** To pursue nuclear research and training activities with an emphasis on continuous improvement of nuclear safety, security and radiation protection, notably to potentially contribute to the long-term decarbonisation of the energy system in a safe, efficient and secure way.

- That general objective shall be **implemented** through:
  - Activities in the form of **indirect and direct actions**
  - Cross-cutting activities within the Euratom Programme (i.e. fusion/fission)
  - Cross-cutting activities & interfaces with H2020 Framework Programme
  - International cooperation with third States and international organisations

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Euratom Programme (2014-18) complementing H2020

Council Regulation of 16 December 2013

Indirect actions
DG-RTD
Fusion R&D Programme

Indirect actions
DG-RTD
Nuclear Fission, Safety and Radiation Protection

Direct actions
JRC
Nuclear Safety and Security

Total budget: € 1603 million

ITER (2014-2020) through JU-F4E: € 2915 million in current values

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Specific objectives (Indirect Actions)

- Supporting safety of nuclear systems
- Contributing to the development of safe, longer term solutions for the management of ultimate nuclear waste, including final geological disposal as well as partitioning and transmutation
- Supporting the development and sustainability of nuclear expertise and excellence in the Union
- Supporting radiation protection and development of medical applications of radiation, including, inter alia, the secure and safe supply and use of radioisotopes
- Moving towards demonstration of feasibility of fusion as a power source by exploiting existing and future fusion facilities
- Laying the foundations for future fusion power plants by developing materials, technologies and conceptual design
- Promoting innovation and industry competitiveness
- Ensuring availability and use of research infrastructures of pan-European relevance
Specific objectives (Direct Actions)

- Improving **nuclear safety** including: nuclear reactor and fuel safety, waste management, including final geological disposal as well as partitioning and transmutation; decommissioning, and emergency preparedness

- Improving **nuclear security** including: **nuclear safeguards**, non-proliferation, combating illicit trafficking, and nuclear forensics

- Increasing excellence in the **nuclear science base for standardisation**

- Fostering **knowledge management, education and training**

- Supporting the **policy of the Union** on nuclear safety and security
• The **indirect actions** of the Euratom Programme should mutually reinforce research efforts of the Member States and the private sector.

• Therefore, the priorities of the work programmes are to be established on the basis of appropriate inputs from **national public authorities** and nuclear research stakeholders grouped in bodies or frameworks such as **technology platforms, European joint programmes and technical forums** for nuclear systems and safety, management of ultimate waste and radiation protection/low-dose risk, fusion research, or any relevant organisation or forum of nuclear stakeholders.

• The priorities for **direct actions** are to be established through consultation of the policy DGs of the Commission and of the JRC GB.

• The JRC must notably contribute to the nuclear safety research needed for safe, secure and peaceful use of nuclear energy and other non-fission applications. The JRC will provide a scientific basis for the relevant Union policies and, where necessary, react within the limits of its mission and competence to nuclear events, incidents and accidents.
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Sustainable Nuclear Energy Technology Platform (SNETP)

What R&D to support this vision?
SNE-TP SRA

First Reactors

1950 1970 1990

Generation I

What R&D to support this vision? SNE-TP SRA

Generation II

Dismantling & clean-up

Generates 31% of Europe's electricity

Generation III

New builds in Finland and France (EPR), others...

Generation IV

Start of industrial deployment in 2040-2050

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**SNETP**

- **Three pillars**
  - Nuclear Cogeneration Industrial Initiative (NC2I)
  - SUSTAINABLE NUCLEAR ENERGY TECHNOLOGY PLATFORM (SNETP)
  - European Sustainable Nuclear Industrial Initiative (ESNII)

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- 'TWG Gen II & III' to implement SRIA on current and future LWRs
- NULIFE NoE to implement SRIA on LTO/PLIM
- SARNET NoE to implement SRIA on Severe Accidents
- NUGENIA

- More than 100 members;
- a **shared** vision of the future of nuclear energy in Europe
- SRA issued in 2009 and updated in 2013
- Deployment Strategy issued in 2010

**LWR Current and Future**

- Innovative materials and fuels
- Simulation, Modelling, Experiments
- Education and Training
- R&D infrastructures
- Safety

**Other applications of nuclear**

- HTR, Prod. H₂, etc.

**Fast systems with closed fuel cycles**

- Sustainability

**Innovative materials and fuels**
Eight technical areas

1. Plant safety and risk assessment
2. Severe accidents
3. Core and Reactor operation
4. Integrity assessment of systems, structures and components
5. Fuel, waste management (all but geological disposal) and dismantling
6. Innovative Gen III design
7. Harmonisation
8. Inspection

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• **Demonstrators** are a required step for assessing the technology in order to bring it to the market.
• **No prioritization** between gas and lead cooled reactors, in complementarity to Sodium technology.
Multidisciplinary European Low-Dose Initiative (MELODI)

- Multidisciplinary approach to resolving outstanding issues relating to risk from low and protracted exposure to ionising radiation: RP, (radio)biology, health physics, genomics, epidemiology, ...
- Main European RP research funding organisations
- ‘Joint Programming Initiative’ linking national and Euratom programmes → Strategic R&I Agenda
- Project DoReMi (Network of Excellence)
- Euratom calls for proposal increasingly oriented towards MELODI requirements

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Implementing Geological Disposal of Radioactive Waste – Technology Platform

- **Implementation-oriented** R&D activities on all remaining key aspects of deep geological disposal of spent fuel and long-lived radioactive waste
- Demonstration on the **technologies** and **safety**
- Main European RW-GD research funding organisations
- Euratom calls for proposal largely oriented towards IGD-TP requirements

- **Bologna Declaration on the "European Higher Education Area"**
  (June 1999 – 47 signatory States)
  => “European Credit Transfer and accumulation System” /ECTS/
- **Copenhagen Declaration on “enhanced European cooperation in VET”**
  (November 2002 – signed by all 28 EU Member States)
  => “European Credit system for Vocational Education and Training” /ECVET/

European System: 1 year = 60 ECTS

1 ECTS ~ 10 Hours

**BOLOGNA 1999:**
MUTUAL RECOGNITION OF ACADEMIC GRADES

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**COPENHAGEN 2002:**
Lifelong learning and cross-border mobility
Strategic Energy Technology Plan (SET-Plan) & nuclear fission

Key EU technology challenges for the next years

... to meet 2020 targets:
- Maintain competitiveness in fission technologies, together with long-term waste management solutions

... to meet 2050 vision:
- Complete the preparations for the demonstration of a new generation (Gen-IV) of fission reactors for increased sustainability

Priority European Industrial Initiatives:
- Sustainable nuclear fission initiative: focus on the development of Generation-IV technologies

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EU-Ukraine collaboration

Legal basis

for nuclear fission:

• Agreement for Cooperation in the field of nuclear safety (2002)

• Agreement for Peaceful uses of nuclear energy (2006)

for nuclear fusion:

• Agreement for Cooperation in the field of controlled nuclear fusion (2002)

Information is not legally binding
Lines of collaboration

- **DG DEVCO (EuropeAid)/ European External Action Service / DG JRC**

- **Nuclear Safety Programme for Ukraine, Joint Support Office**
  - Concrete dedicated projects in frame of **TACIS** and **Instrument for Nuclear Safety Co-operation (INSC)**
  - **Dedicated** budget for 2007-2013 - **€524 mln** (in total for all countries!)
  - **340 (!) projects** for Ukraine (1991-2010) Examples of projects:
    - Training Centre for NNEGC Energoatom Staff
    - Upgrade of Reactor Protection System at KhNPP

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Lines of collaboration

- **DG RTD / DG JRC**
  - research and innovation
    - in frame of EURATOM research and training programme

- **Contact Expert Groups for STCU:**
  - e.g. CEG – Fusion, CEG – Severe Accident Management
  - research projects

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**Fusion**

- **Coordinating Committee** established in **2008**
- Initially co-chaired from Ukrainian side by Tereshin V.I., currently by Zagorodny A.G
- About **40** collaborative activities since then
- **2nd meeting** of the Coordinating Committee
  
  *Brussels, November 2013*

- Mapping of EU-Ukraine activities (**25 active**)

- **Ukraine** – member of Eurofusion **consortium**?

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Fission

- High-level technical bilateral meetings in 2010 and 2012
- Coordination Committee set up in November 2014
- Ukrainian entities participated in 11 Euratom fission FP7&FP7+2 projects, with total budget of participation of \( \sim 1.5 \text{ mln } \) € and EC contribution of \( \sim 1 \text{ mln } \) €
- Ukrainian entity is a partner in H2020 ESSANUF project, with budget & EC contribution \( \sim 130 \text{ k€} \)
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Total budget H2020: EUR 74,83 billion

Budget of the **Energy Challenge**: EUR 5,69 billion

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2016-2017 calls of the Energy Challenge

**Energy Efficiency (EE)**
- Heating and Cooling
- Engaging consumers
- Buildings
- Industry, services and Products
- Innovative financing

**Competitive low-carbon energy Technologies (LCE)**
- Energy system (grids, storage)
- Renewable energies
- Decarbonising fossil fuels
- Socio-economic research
- European Research Area in energy

**Smart Cities and Communities (SCC)**
- Light-house demo projects

**Nuclear fission and radiation protection (NFRP)**
- Nuclear Safety
- Radioactive Waste Management
- Radiation Protection
- Research Reactors
- Education and Training

Information is not legally binding
The 2016-2017 calls of the Energy Challenge

Call budgets (in Mio €)

<table>
<thead>
<tr>
<th>Call</th>
<th>2016</th>
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<tbody>
<tr>
<td>EE</td>
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<td>SME</td>
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<tr>
<td>NFRP</td>
<td>57,74</td>
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NFRP-2016-2017 call main features

- One EURATOM Work Programme for 2016-2017

- One EURATOM fission call for 2016-2017

- Single stage evaluation procedure: remote individual phase and consensus plus panel stage in Brussels

- Combined indicative budget for Euratom Fission NFRP-2016-2017 call - ~105 M€
Instruments

**Research and innovation actions**

- Basic and applied research, technology development, testing and validation, but **limited** demonstration or pilot activities

- **Funding rate: maximum 100%**

**Coordination and support actions**

- Networking, coordination or support services, policy dialogues, dissemination, awareness-raising, communication, studies, etc.

- **Funding rate: maximum 100%**
**European Joint Programming - Co-fund action**

- Implementation of commonly agreed 2050 Roadmap
- Grant to identified beneficiaries
- EFDA members form *Eurofusion* consortium
- €457.77 million committed in annual instalments over the 5 years, 2014-18 (€77.36 million from the 2014 budget)
- The Euratom contribution will be limited to a maximum of 55% of the total eligible costs of the action.
- *Yearly revision* of workplan

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Reactor systems

- Safety & competitiveness of nuclear installation
- Advanced nuclear systems for increased sustainability
- Advanced systems for non-electrical uses

Radiation protection

Geological disposal

Research infrastructures
Training and mobility
Cross-cutting and International Cooperation (INCO)

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A - Support Safe Operation of Nuclear Systems

- NFRP 1: Continually improving safety and reliability of Generation-II and -III reactors
- NFRP 2: Research on safety of fast neutron Generation-IV reactors
- NFRP 3: Investigating the safety of closed nuclear fuel cycle options and fuel developments
- NFRP 4: Research on the safety of Small Modular Reactors
- NFRP 5: Materials research for Generation-IV reactors

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B - Contribute to the Development of Solutions for the Management of Radioactive Waste

- **NFRP 6**: Addressing key priority R&I issues for the first-of-the-kind geological repositories
- **NFRP 7**: Research and innovation on the overall management of radioactive waste other than geological disposal
- **NFRP 8**: Pan-European knowledge-sharing and development of competence in radioactive waste management
The EJP on Radiation Protection (~10-15 M€/year) will promote a multidisciplinary approach as needed, and also accelerate scientific understanding in the area. This is indispensable for promoting:

- A well-informed debate on nuclear
- Scientifically-based safety regulations

C - Foster radiation protection

- NFRP 9: Impacts of low-dose radiation exposure
D - Management of research reactor availability in Europe

- NFRP 10: Support for the optimised use of European research reactors
- NFRP 11: Support for the EU security of supply of nuclear fuel for research reactors

E - Support development of nuclear competences at EU level

- NFRP 12: Support for careers in the nuclear field

*Information is not legally binding*
F - Fission/fusion cross-cutting actions

• NFRP 13: Fission/fusion cross-cutting research in the area of multi-scale materials modelling
• NFRP 14: Cross-cutting support to improved knowledge on tritium management in fission and fusion facilities

Cross-fertilisation between fission and fusion communities

Only proposals with substantial benefit for both fission and fusion will be retained

Information is not legally binding
• **Publication** of the Call: 14 October 2015

• **Submission**: from 11 May to 05 October 2016

• **Evaluation**: November - December 2016

• **Information** to the applicants: February - March 2017

• **Signature** of Grant Agreements: May 2017

*Information is not legally binding*
B.1: Support for fission research & innovation (R&I) investment projects of pan-European relevance through the InnovFin instrument
B.2: SOFT Innovation Prize
B.3: External expertise for proposals' evaluation and projects' monitoring
B.4: Expert group for interim evaluation of the Euratom Research and Training Programme 2014-2018
B.5: External expertise for international cooperation in nuclear research with targeted countries
B.6: Public procurement - Studies for the interim evaluation of fission and fusion indirect actions under the Euratom Research and Training Programme 2014-2018
B.7 Contribution to the Organisation for Economic Co-operation and Development (Nuclear Energy Agency) / Secretariat for the Generation-IV International Forum

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European Consortium for the Development of Fusion Energy
https://www.euro-fusion.org/

Sustainable Nuclear Energy Technology Platform
http://www.snetp.eu/

NUGENIA association (Gen II&III)
http://www.nugenia.org/

Implementing Geological Disposal of Radioactive Waste Technology Platform
http://www.igdtp.eu/

Multidisciplinary European Low-Dose Initiative - MELODI
http://www.melodi-online.eu/

Strategic Energy Technology Plan

European Energy Research Alliance
http://www.eera-set.eu/

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EERA: Joint Programme on Nuclear Materials:
http://www.eera-jpnm.eu/

European Nuclear Education Network
http://www.enen-assoc.org/

Strategic Energy Technologies Information System
https://setis.ec.europa.eu

Strategic Energy Technologies Information System - European R&I landscape database

Participant Portal – H2020 Funding Opportunities

Participant Portal – H2020 Experts

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Thank you for your attention!
Euratom participation in GIF

Aimed at:

- Representing all EU Member States (except France, a direct GIF member) in such a major R&D international collaboration
- Allowing all interested EU organizations to contribute to GIF R&D projects and to obtain all projects results, while respecting the GIF IPR rules
- Enhancing the international dimension of R&D of new reactor systems, and of their safety design criteria: it is the aim of all GIF members to achieve highest safety standards
- Increasing the visibility worldwide of European projects and organizations

Euratom contribution to GIF comes mainly from the FP Indirect Action projects and also from direct JRC contributions (direct contributions from MSs are also possible)
**Generation IV International Forum (GIF)**

*Inter-governmental Agreement - 10 members incl. Euratom*

- DG.JRC as Implementing Agent of Euratom
- Six systems: Very high-temperature gas reactors (VHTR), Sodium-cooled fast reactors (SFR), Gas-cooled fast reactors (GFR), Super-critical water-cooled reactors (SCWR), Lead-cooled fast reactors (LFR), and Molten Salt reactors (MSR)
- Technology goals: sustainable development (optimal utilization of natural resources also related to security of supply, waste minimisation and environmental protection), industrial competitiveness, safety and reliability, and proliferation resistance and physical protection
- Also focused to different applications: hydrogen, desalinated water, heat...

**Indirect actions related to GIF features**

- 34 related projects from *Calls 2007 to 2012* with EC contribution: € 122.5 m
  - Reactor systems 10 projects - € 30.2 million
  - Advanced fuel 8 projects - € 40.8 million
  - Advanced materials 8 projects - € 26.5 million
  - Codes and data 8 projects - € 25.0 million
Main INCO topics in Fission WP 2016-17

Euratom fission programme is opened to non-EU partners

Not exhaustive proposed topics in which INCO is specifically recognised as beneficial:

- NFRP 1 - Continually improving safety reliability of Generation II and III
- NFRP 4 - Research on the safety of small modular reactors
- NFRP 7 - Research and Innovation on the overall management of radioactive waste other than geological disposal
- NFRP 9 - Impacts of low dose radiation exposure
- NFRP 12 - Support for careers in the nuclear field
- NFRP 14 - Cross-cutting support to improved knowledge on tritium management in fission and fusion facilities