



# The Euratom Framework Programme FP7 *Nuclear Fission & Radiation Protection*

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## Contents

- FP7 Euratom programme in nuclear fission and RP
  - Implementation, calls 2007, 2008, 2009 & 2010
  - Strategic / operational priorities, contribution to R&D in the area of waste management, nuclear systems and safety
  - Overview of principal Euratom FP6 (2003-2006) & FP7 (2007-2011) projects supporting advanced and/or Gen-IV nuclear systems, nuclear data, P&T and ESNII (European Sustainable Nuclear Industrial Initiative)
  - Conclusions



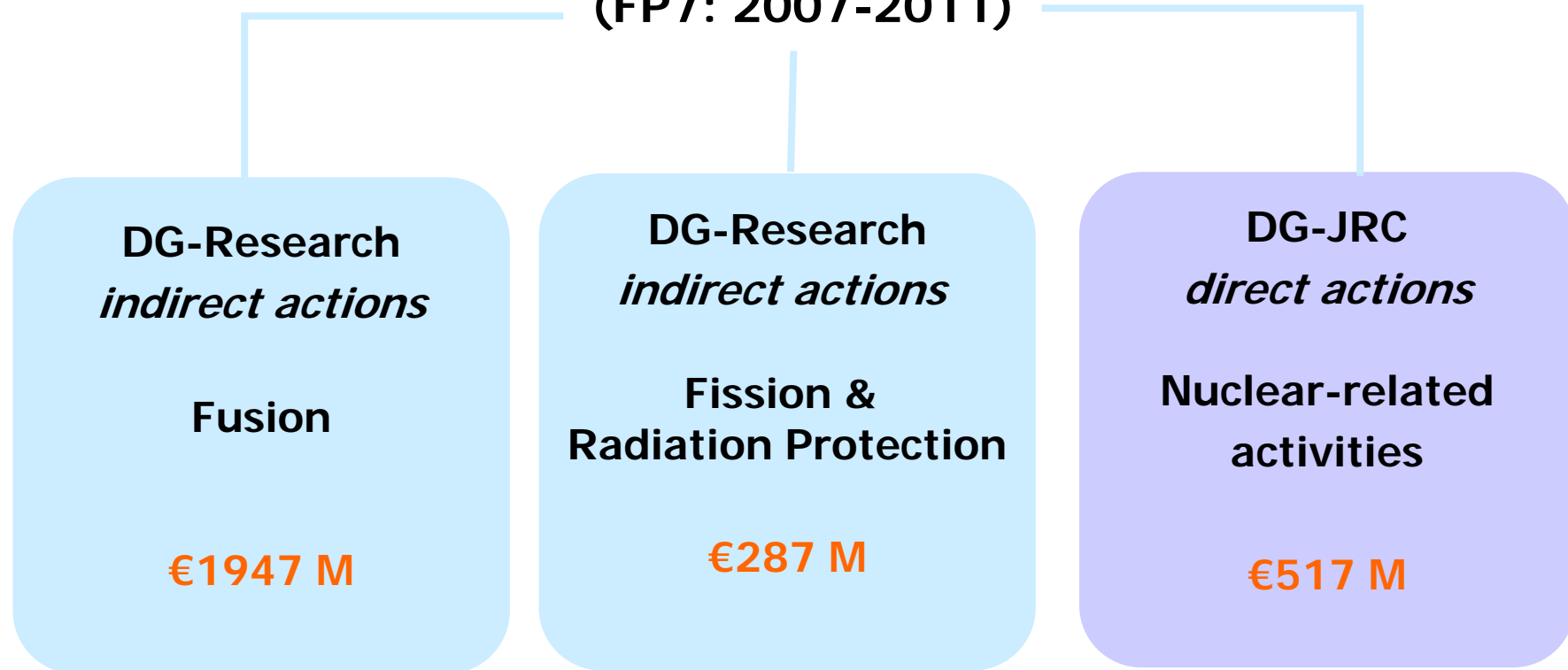


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## Euratom FP7 fission & RP – *implementation*

### Euratom 7<sup>th</sup> Framework Programme for “Nuclear Research and Training Activities” (FP7: 2007-2011)



**Total Euratom FP7 = €2751 M**





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## Euratom FP7 fission & RP – *programme objectives*

- Establish a sound scientific & technical basis for the safe long-term management of hazardous radioactive waste
- Promote safer, more resource-efficient and competitive exploitation of nuclear energy
- Ensure a robust and socially acceptable system of protection of man & the environment against the effects of ionising radiation.





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## Euratom FP7 fission & RP – *strategic priorities*

- Promote a true “European Research Area” in nuclear science and technology
- Support for EU policy initiatives, SET-Plan, Energy Policies and Nuclear is a very low carbon technology
- International cooperation – “mutual interest and benefit”





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## Implementation of Euratom FP7 “fission”

- Annual work programmes & calls for proposals
- Evaluation by independent experts
- Main criterion: scientific and technical excellence
- Range of funding schemes promoting integration
- Shared cost & leverage effect of EU funding
  - ➔ 3 calls completed to date with €180M in EC funding and > €300M total costs

*4<sup>th</sup> FP7 Euratom “fission” call for proposals published on 13 Nov.09 with deadline 8 April 2010 and spring 2010*

*Evaluation Call budget €48.9M*

*[http://cordis.europa.eu/fp7/wp-2010\\_en.html](http://cordis.europa.eu/fp7/wp-2010_en.html)*



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## Euratom FP7 fission & RP *Objectives – Waste Management*

- **Implementation-oriented R&D** on all remaining key aspects of deep **geological disposal** of spent fuel and long-lived radioactive waste, demonstration of technologies and safety and the development of a **common European view** on the main issues related to management and disposal of waste
- RTD in all areas of **Partitioning and Transmutation** to develop **pilot facilities** for the most advanced partitioning processes and transmutation technologies involving **sub-critical** and **critical systems**
- Research on **other concepts** aimed at reducing the amount and or hazard of the waste disposal





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## Euratom FP7 fission & RP *Objectives – Reactor systems*

- **Safety of Nuclear Installations**
  - Continued safe operation of all relevant types of **existing reactor systems** (including fuel-cycle facilities)
  - **Lifetime extension**
  - Development of new **advanced safety assessment methodologies** (both technical and human element)
  - Prevention and **mitigation of severe accidents**
- **Advanced nuclear systems:**
  - Improve efficiency of advanced systems and fuels and collaborate with the **Generation IV International Forum**
  - Assess potential, proliferation resistance and long-term sustainability including upstream research activities (especially material science), the fuel cycle and innovative fuels and waste management aspects of **selected advanced reactor systems**





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# Euratom FP7 fission & RP – *strategic priorities*



## Safety Authorities



SET-Plan



## Stakeholders



European & International Organisations



European Research Policy

EU Framework programmes

National programmes

International Cooperation

## Research & Innovation



MELODI



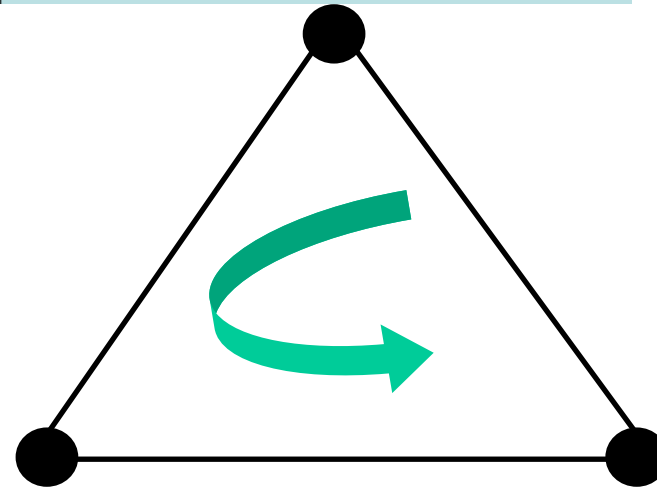


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# Euratom FP7 fission & RP – *strategic priorities*

EU Forum on transparencies issues, opportunities and risks of Nuclear energy gathering all relevant Stakeholders in Nuclear field (EU MS, EU institutions, European Parliaments, Nuclear industry, electricity consumers and civil society)



EU High Level Group on Nuclear Safety and Waste Management





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## Euratom FP7 fission & RP – *Technology Platform main objectives*

- Framework to unite stakeholders around:
  - a common “vision” for the technology concerned
  - definition of a Strategic Research Agenda, deployment and Implementation strategies
  - mobilisation of a critical mass of research and innovation effort (facilities, competences in the nuclear field)
  - Support for EU policy initiatives, SET-Plan and Energy Policies
  - A true European ERA and International cooperation – “mutual interest and benefit”





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# Euratom FP7 *fission & RP programme and scope of ERA initiatives*

**IGD-TP**

Launch event 12 Nov.09

[www.igdtp.eu](http://www.igdtp.eu)

Management

- Geological disposal
- Partitioning & Transmutation

**S  
N  
E  
P**

Research

SRA published June 09

[www.snetp.eu](http://www.snetp.eu)

- Nuclear safety
- Advanced reactors

**MELODI**

Radiation protection

Intl. workshop Sept.09

[www.hleg.de](http://www.hleg.de)

- Risk from radionuclides
- Medical applications
- Emergency management
- other

• Research infrastructures

• Human resources, mobility & training

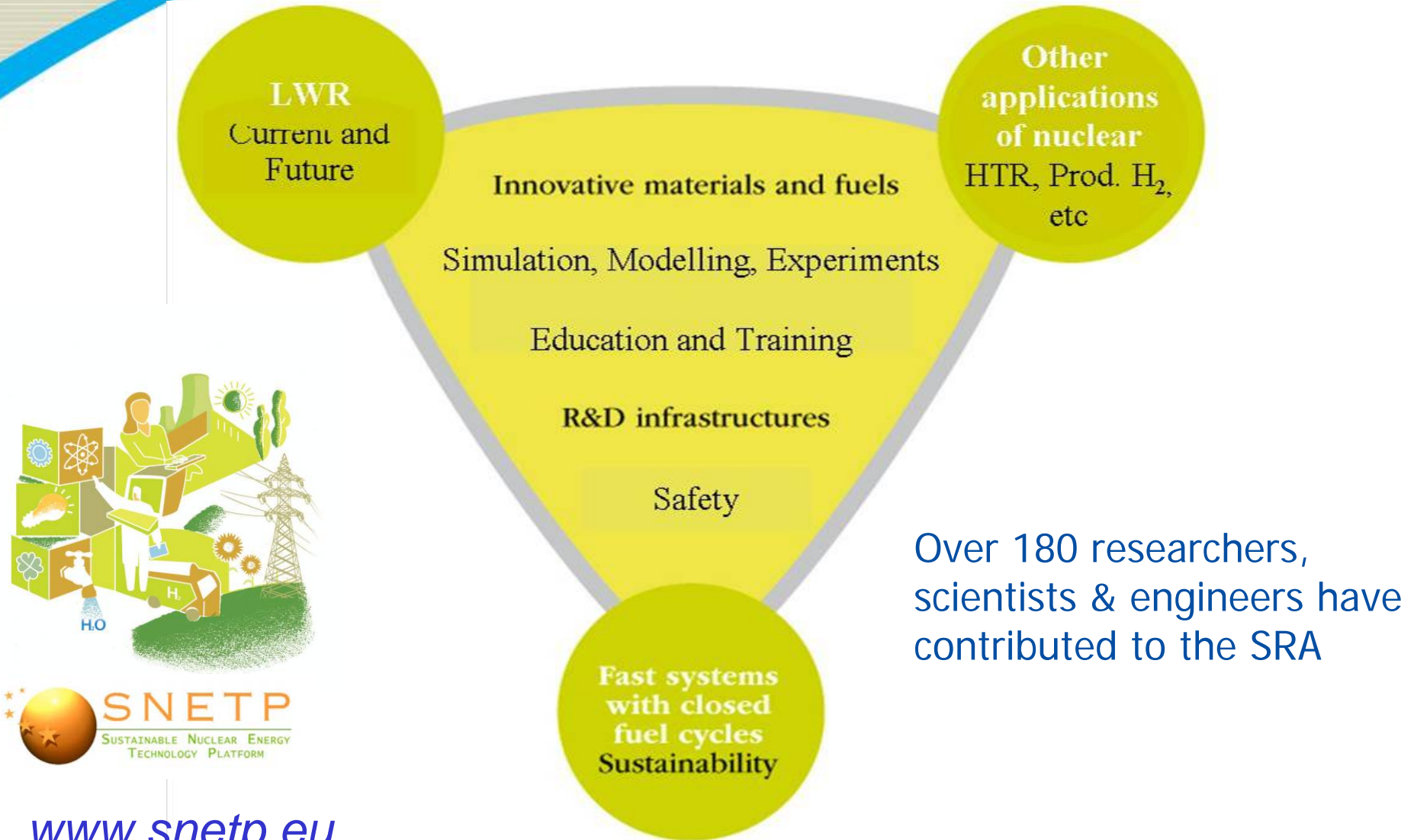


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# Sustainable Nuclear Energy TP

## 3 main pillars + key cross-cutting issues





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## Examples of major FP7 projects *safety / simulation / cross-cutting 1/2*

Project acronym and title	Key areas of R&D	<u>Coordinating organisation &amp; no of partners*</u>	Start date & duration	Total budget / EU contribution Scheme
<b>ASAMPSA2</b> - Advanced Safety Assessment Methodologies: level 2 PSA (European Best Practices L2 PSA guidelines)	Developing best practice guidelines for severe accident probabilistic safety assessment (PSA)	IRSN (FR) <b>21 from 12</b>	1/1/08 36 months	<b>€2.1M / €1.5M</b> CSA-SA
<b>MMOTION</b> - Man-Machine-Organisation through Innovative Orientations for Nuclear	Analyse current and future situations concerning man-machine organisation (MMO) in nuclear power plants, as well as safety related aspects.	EDF (FR) <b>10 from 8</b>	1/01/09 24 months	<b>€2.4M / €1.4M</b> CSA
<b>GETMAT</b> - Gen-IV and Transmutation Materials	Development, selection, qualification, modelling, performance of Gen.IV structural materials	KIT (DE) <b>24 from 11</b>	1/2/08 60 months	<b>€14M / €7.5M</b> Large CP
<b>NURISP</b> - Nuclear Reactor Integrated Simulation Project	New generation of simulation tools Core Physics, Thermal-Hydraulics, Multi-Physics and more integration of the codes	CEA (FR) <b>22 from 14</b>	1/1/09 36 months	<b>€10.3M / €6M</b> Large CP

*\*only partners from EU MS and Euratom Associated Countries can normally receive EU funding*



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## Examples of major FP7 projects *safety / simulation / cross-cutting 2/2*

Project acronym and title	Key areas of R&D	<u>Coordinating organisation &amp; no of partners*</u>	Start date & duration	Total budget / EU contribution Scheme
<b>SARNET 2</b> – Severe Accident Research NoE 2	Common research programmes and developing common computer tools and methodologies for NPP safety assessment	<u>IRSN (FR)</u> <b>41 from 20</b>	1/04/09 36 months	<b>€38M / €5.75M</b> NoE
<b>PERFORM60</b> - Prediction of the Effects of Radiation FO reactor pressure vessel and in-core Materials using multi-scale modelling - 60 yrs foreseen plant lifetime	Multi-scale modelling tools to simulate the combined effects of irradiation and corrosion on the RPV	<u>EDF (FR)</u> <b>20 from 8</b>	01/03/09 48 months	<b>€13.6M / €6M</b> Large CP
<b>THINS</b> - Thermal-hydraulics of Innovative Nuclear	Cross-cutting thermal-hydraulic issues encountered in various innovative nuclear systems	<u>KIT (DE)</u> <b>24 from 13</b>	01/02/10 48 months	<b>€10M / €5.9M</b> Large CP

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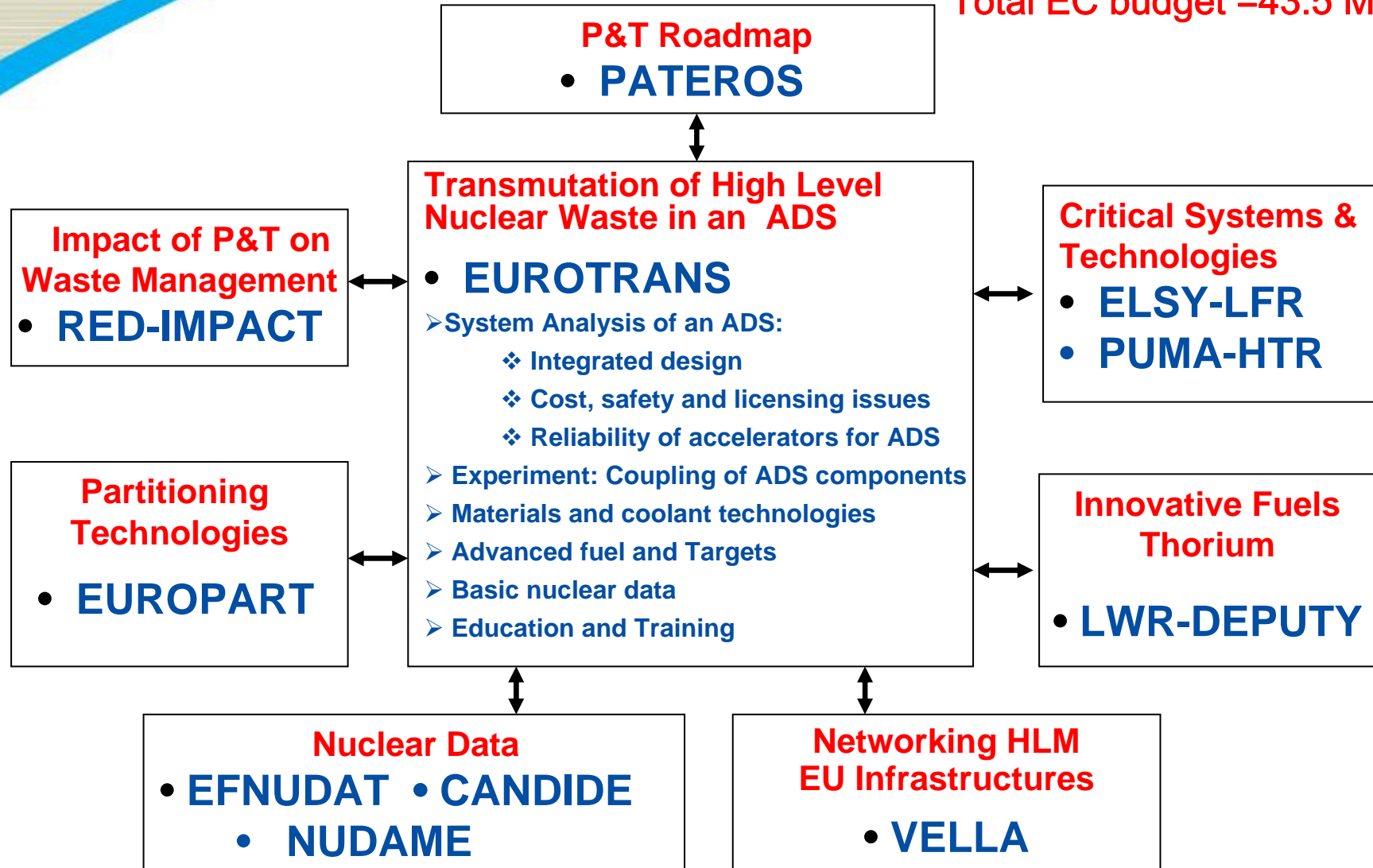


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## FP6 (2002-06) Projects on P&T

Total EC budget = 43.5 M€



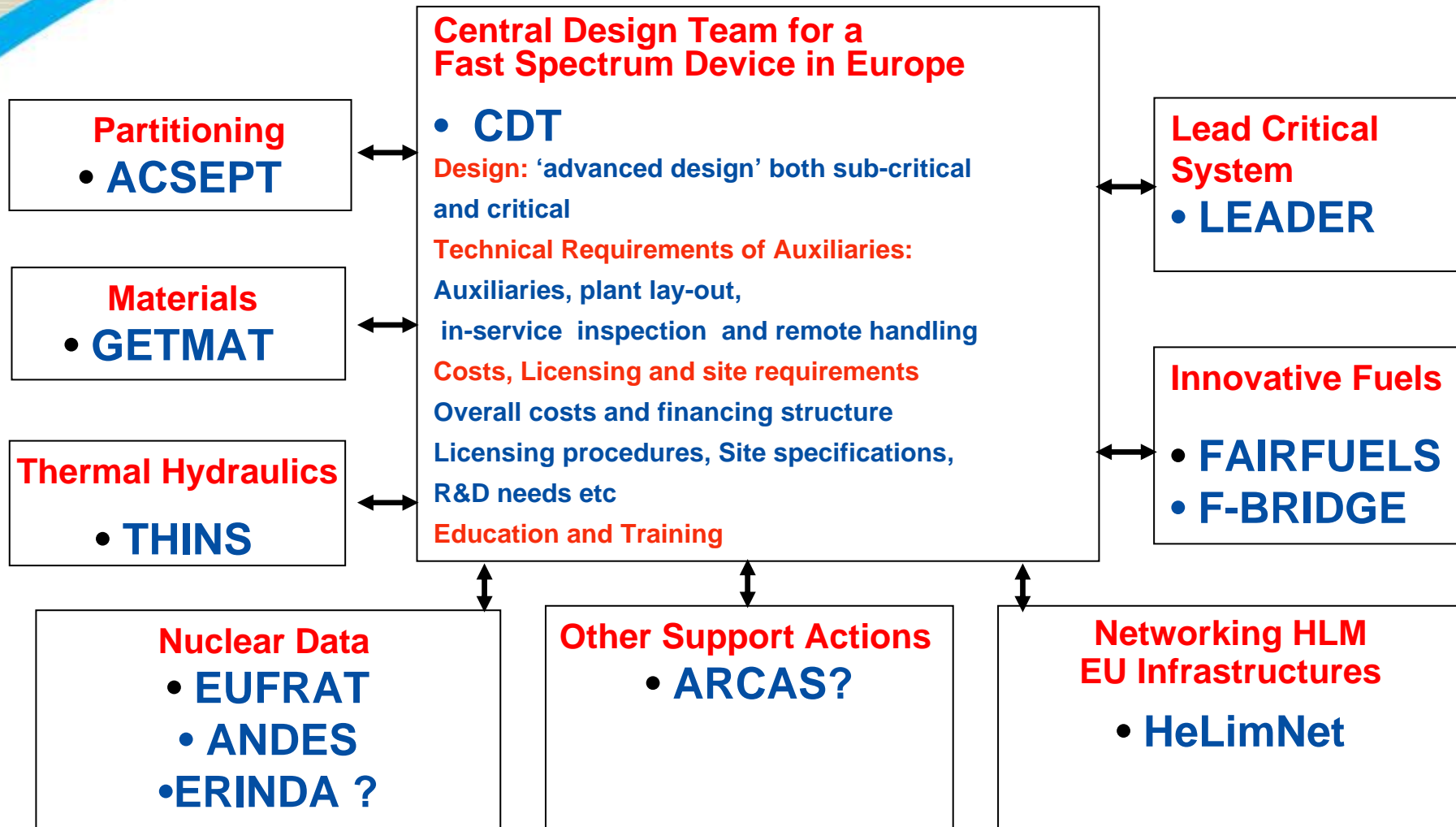


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# FP7 (2007-2011) Projects on P&T

Total EC budget = 40 M€






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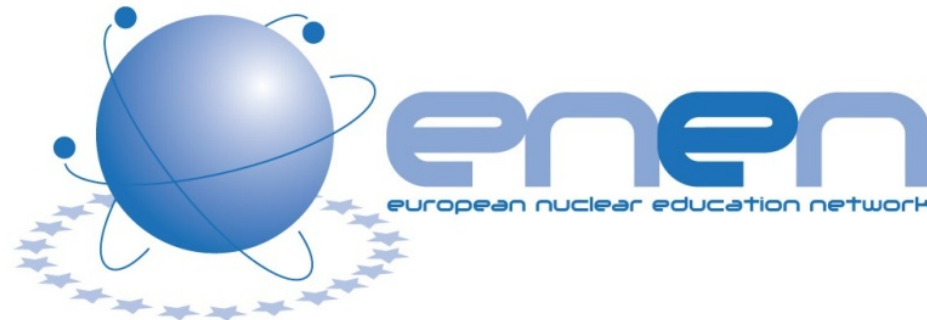
# Maintaining competences

## *Education, Knowledge and Training*

- Core aspect of the fission programme: training work packages in all major projects, EFTS – Euratom Fission Training Schemes, support for ENEN strategy

	
COUNCIL OF THE EUROPEAN UNION	Brussels, 13 November 2008 (18.11) (OR. fr)
15406/08	
RECH 341 ATO 99	
<b>"IA" ITEM NOTE</b>	
from :	General Secretariat of the Council
to :	Permanent Representatives Committee/Council
No. prev. doc. :	14916/08 RECH 325 ATO 90
Subject :	Draft Council conclusions on the need for skills in the nuclear field - Adoption
1. At the initiative of the Presidency, the <u>Joint Working Party on Research/Atomic Questions</u> examined draft Council conclusions on the need for skills in the nuclear field.	
2. At its meeting on 3 November 2008, the <u>Working Party</u> reached agreement on the attached draft conclusions.	
3. The <u>Permanent Representatives Committee</u> is therefore invited to recommend that the <u>Council</u> adopt the conclusions as an "A" item at one of its forthcoming meetings.	

## EU Council conclusions on the "need for skills in the nuclear field" (Brussels, 5 December 2008)



<http://www.enen-assoc.org/>



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## Pillar on present & future LWRs *Plant lifetime management / extension*

- FP6: NULIFE Network of Excellence
  - 5 year project starting end 2006
  - Sustainable integration in PLIM and the evolution towards a NULIFE Institute with customer-driven programme
  - Utilities playing a leading role
- FP7: 2 collaborative projects
  - STYLE: non-RPV components
  - LONGLIFE: long-term embrittlement / RPV
  - ... links with NULIFE & PERFORM60





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## Pillar on other applications of nuclear

- FP6: RAPHAEL Integrated Project



→ *Reactor for Process Heat, Hydrogen and Electricity*

- FP7: EUROPAIRS coordination action



→ *End User Requirements for Process Heat Applications with Innovative Reactors for Sustainable Energy Supply*





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# Sustainability Pillar: "European Sustainable Nuclear Industrial Initiative" – ESNII (SET-Plan)

2008

2012

2020

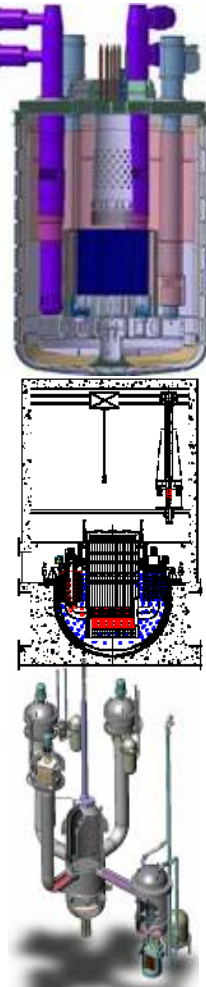
**SFR** Reference (proven) technology

**LFR**

Alternative technology

**GFR**

Supporting infrastructures, research facilities  
loops, testing and qualification benches,  
Irradiation facilities  
incl. fast spectrum facility (MYRRHA)  
AND fuel manufacturing facilities



**SFR Prototype**  
ASTRID  
250-600 MWe

**ETPP**  
EU Technology  
Pilot Plant  
MYRRHA  
LFR Demo

**ALLEGRO**  
GFR Demo

- Test bed of GFR technologies
- Innovative fuel
- MA transmutation
- Coupling to heat applications

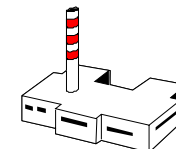
2040: Target for deployment of Gen-IV Fast Neutron Reactors  
*or earlier if new energy needs (electric vehicles, process heat applications)*

**Cost:**  
**€6-10billion**

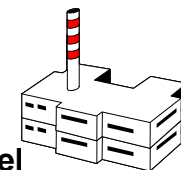
XT-ADS  
MYRRHA



MA fuel  
micropilot



MOX fuel  
fab unit





Project acronym and title	Key areas of R&D	<u>Coordinating organisation &amp; no of partners*</u>	Start date & duration	Total budget / EU contribution Scheme
<b>ACSEPT</b> – Actinide reCycling by SEPARation and Transmutation	Advanced partitioning - chemical processes; aqueous & pyro	<u>CEA (FR)</u> <b>34 from 14</b>	1/3/08 48 months	<b>€23.79M / €9.0M</b> CP-IP
<b>F-BRIDGE</b> – <u>B</u> asic <u>R</u> esearch for <u>I</u> nnovative <u>F</u> uel <u>D</u> esign for <u>GEN IV</u> systems	Basic research on Gen-IV fuel-cladding systems	<u>CEA (FR)</u> <b>20 from 8</b>	1/03/08 48 months	<b>€10.2M / €5.5M</b> CP
<b>FAIRFUELS</b> – FAbrication, Irradiation, Reprocessing of FUELS and targets for transmutation	Fuels an targets for partitioning, with close links to Gen-IV	<u>NRG (NL)</u> <b>11 from 6</b>	1/2/09 48 months	<b>€7.7M / €3.0M</b> CP-IP
<b>CDT</b> – Central Design Team	Design of a sub-critical or critical fast-spectrum Transmutation Experimental Facility	<u>SCK.CEN (BE)</u> <b>20 from 8</b>	1/4/09 36 months	<b>€3.85M / €2M</b> CP-FP
<b>CP-ESFR</b> – Collaborative Project on European Sodium Fast Reactor	Key viability and performance issues supporting development of a Gen-IV European SFR	<u>CEA (FR)</u> <b>24 from 9</b>	01/01/09 48 months	<b>€11M / €5.8M</b> CP-IP

*\*only partners from EU MS and Euratom Associated Countries can normally receive EU funding*





# FP7 projects benefitting ESNII

2/2

Project acronym and title	Key areas of R&D	<u>Coordinating organisation &amp; no of partners*</u>	Start date & duration	Total budget / EU contribution
<b>GOFATR</b> – European Gas Cooled Fast Reactor	Key viability and performance issues supporting development of a Gen-IV European GFR	<u>AMEC (UK)</u> <b>24 from 11</b>	1 <sup>st</sup> Q 10 36 months	<b>€5.3M / €3.0M</b>
<b>LEADER</b> – Lead Cooled European Advanced Demonstration Reactor	Key viability and performance issues supporting development of a Gen-IV European LFR	<u>ANSALDO (IT)</u> <b>17 from 11</b>	2/4/10 36 months	<b>€5.6M / €3.0M</b>
<b>ADRIANA</b> – Advanced Reactor Initiative And Network Arrangement	Network dedicated to nuclear Industrial Initiative ESNII Gen.IV needed research infrastructures	<u>UJV-Rez (CZ)</u> <b>15 from 6</b>	1/2/10 18 months	<b>€1.4M / €1.0M</b>
<b>Deloitte Study</b> – Financing and legal means for ESNII	Funding opportunities and legal status options for ESNII	<u>Deloitte (SP)</u> <b>1 from 1</b>	1/8/09 6 months	<b>€0.055M / €0.055M</b>

*\*only partners from EU MS and Euratom Associated Countries can normally receive EU funding*

CORDIS publication

[http://cordis.europa.eu/fp7/euratom-fission/library\\_en.html](http://cordis.europa.eu/fp7/euratom-fission/library_en.html)

[ftp://ftp.cordis.europa.eu/pub/fp7/docs/fin-266-euratom-web-jun09v02\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/fp7/docs/fin-266-euratom-web-jun09v02_en.pdf)



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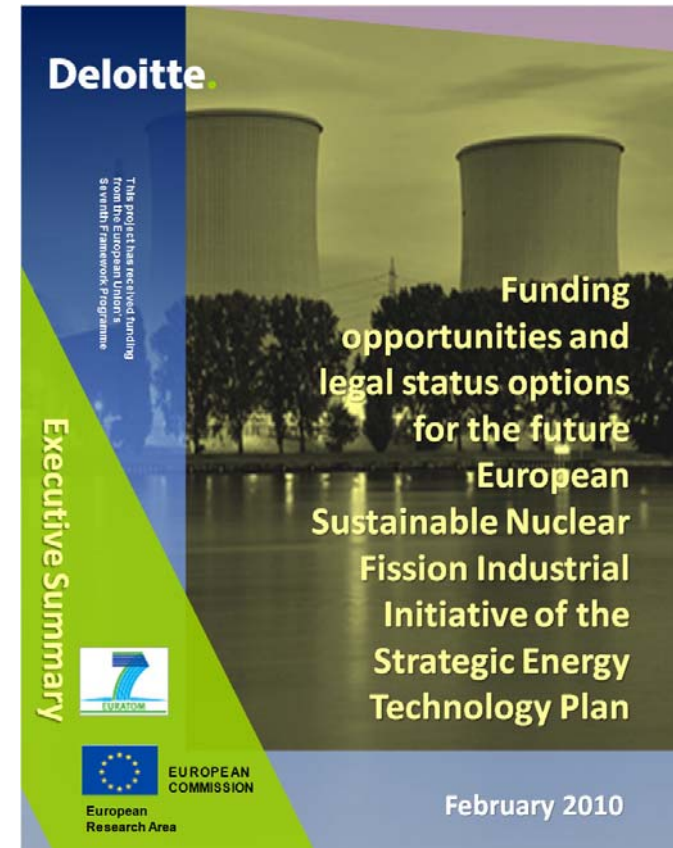
## ESNII Deloitte Study 1/4

**Deloitte.**

- **Deloitte Study: Funding opportunities and legal status options for ESNII the future European Sustainable Nuclear Fission Industrial Initiative of the Strategic Energy Technology Plan**

[http://cordis.europa.eu/fp7/euratom-fission/library\\_en.html](http://cordis.europa.eu/fp7/euratom-fission/library_en.html)

<ftp://ftp.cordis.europa.eu/pub/fp7/euratom-fission/docs/deloitte-gen4-022010-executive-summary.pdf>





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# ESNII Deloitte Study 2/4

## Financial sources

Source	Colour	Description	Criteria to include in the financial framework
EIB Loan (or Euratom)	Green	Financial support provided by these institutions.	Gen-IV initiative projects results are subject to uncertainty, so this source is limited according to promoter risk profile. In any case this percentage will never exceed 25.8% of forecast project value
Tax exemptions	Red	Exemptions of direct and/or indirect taxes due to Joint Undertaking or ERIC schemes.	Assumed that Joint Undertaking or ERIC schemes are used - represents between 14-15% of the total costs.
EU incentives & grants	Yellow	Financial support provided by Cohesion Policy Funds, Framework Programme, subsidies, etc.	Cohesion funds: limited up to 35% Other subsidies: according to the project characteristics and project promoters expectations.
Private investors	Cyan	Amount of money supported by providers of nuclear utilities, facilities and equipments, and other private energy players.	Information provided by private investors, promoters, etc.
National public research investors	Orange	Financial support provided by national nuclear organisations and other public R&D institutions.	Information provided by national nuclear research organisations.
Hosting country public investment	Dark Orange	Financial support dedicated to basic infrastructures co-related to the installation of a new research facility (land, civil buildings, access infrastructures, etc.)	Financial support that would be provided by national or local / regional authorities to host the projects: 5% of the budget.

This section was carried out with the collaboration of different agents, therefore being the best possible estimation in January 2010; it does not represent any financial commitment by the different project participants.



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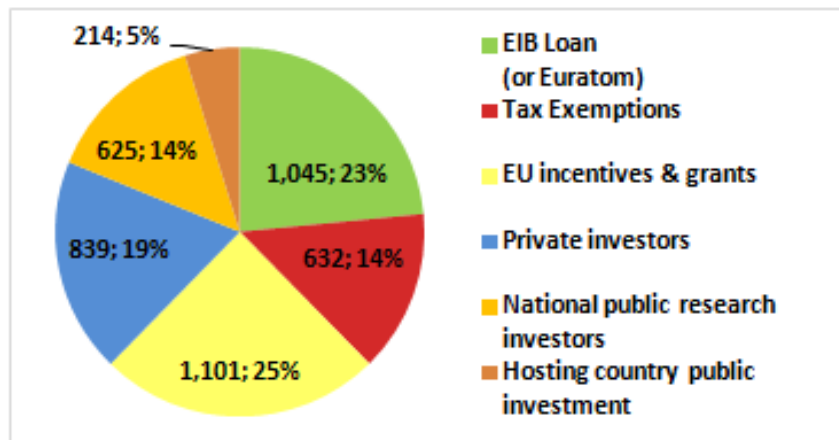
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# ESNII Deloitte Study 3/4

## Financial scheme SFR (600MWe)

**Deloitte.**

Million €	EIB Loan (or Euratom)	Tax Exemptions	EU incentives & grants	Private investors	National public research investors	Hosting country public investment
SFR 600 MWe	1,045	632	1,101	839	625	214



- Private bodies and national public research institutions each provide 20% of the funds; EIB finance 22.85% of the project
- If, during the design and construction, a joint undertaking scheme (or an ERIC) could be established according to project characteristics, then investment could be reduced (representing 14.2% of the financial support)
- A PPP agreement would be established (rights, liabilities, scope, contributions, etc.)





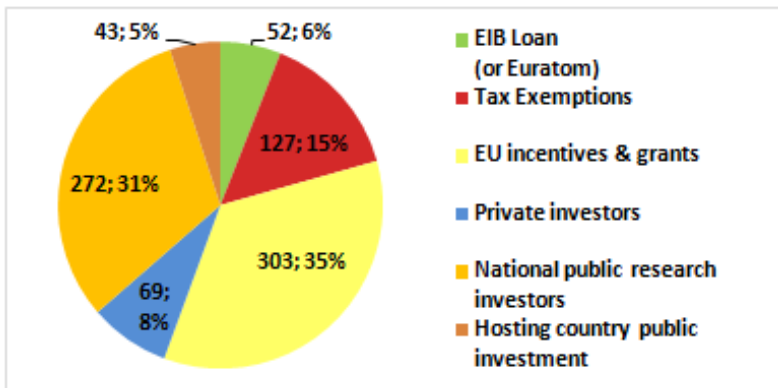
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# ESNII Deloitte Study 4/4 Financial scheme GFR (100MWth) in a New Member State



Million €	EIB Loan (or Euratom)	Tax Exemptions	EU incentives & grants	Private investors	National public research investors	Hosting country public investment
GFR 100 MWth	52	127	303	69	272	43



- Project hosted in a New Member State
- Project developed in convergence region receiving Cohesion Funds providing 35% of total funds
- A Joint Undertaking scheme (or ERIC) would enable tax exemptions totalling 14-15% of the financial support
- Private investors would support 8% of the total costs & National public research institutions would provide c. 30%
- Total amount provided by EIB and private investors combined should not exceed 14% of the project costs





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# ESNII

## *Mapping of Research Infrastructures*

- NEA Research and Test facilities Database (RTFDB)
  - <http://www.nea.fr/rtfdb/public>
  - Report <http://www.nea.fr/html/science/reports/2009/6293-Research-Test-Facilities.pdf>
- ADRIANA (ADvanced Reactor Initiative And Network Arrangement) is a coordination action supported by the Euratom 7th Framework Programme, dedicated to the **mapping and gap analysis of research infrastructures** in support of the European Sustainable Nuclear Industrial Initiative: "ESNII" established under the umbrella of the Sustainable Nuclear Energy Technology Platform (SNETP).
  - <http://adriana.ujv.cz/>





- FP7: more strategic approach to maximise effectiveness & EU added value (->**ERA**), particularly in response to EU policy objectives, **especially energy / SET-Plan**
  - ➔ better coordination between FP, MS & industrial programmes -> TPs / JPIs established in key areas:
    - SNETP, IGDTP, MELODI
    - SRAs / Deployment Strategy / Implementation Plan
    - key R&D stakeholders, especially industry and/or end users need to be involved and commit their own resources
    - effective interaction needed with ENEF and ENSREG
  - ➔ bi & multilateral international R&D cooperation remains a priority





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## Conclusions 2/4

- Tools at EU level: legislation, Forums (ENEF, ENSREG and SNETP/IGDTP/MELODI), SET Plan (implementation mechanism and financing means)
- Need to work all together EU/International and Public/Private partnerships, Nuclear renaissance
- Financing Communication from October 2009 should be approved during 2010 Council meeting
- ESNII Industrial Initiative due to be launched 13-14 November 2010 under the Belgian presidency





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## Conclusions 3/4

### New EU Research Commissioner

- Research, Innovation and Science Commissioner designate Mrs Máire Geoghegan-Quinn (former Irish Minister for Justice)
  - **...« Nuclear Energy research should be maintained and developed as an option for the MS who want to pursuit »...**
- Hearing of January 2010, direct link, please choose ENGLISH (Original version Recommended, translation might be approximate)
  - listen at minutes 45 to 48
  - <http://www.europarl.europa.eu/ParliamentLive.aspx?action=viewVideo&packageId=6c91e59f-0b3f-4c43-8419-8968fb6e8d67>
- and her CV,
  - [http://www.europarl.europa.eu/hearings/static/commissioners/cv/GEOGHEGAN-QUINN\\_CV\\_EN.pdf](http://www.europarl.europa.eu/hearings/static/commissioners/cv/GEOGHEGAN-QUINN_CV_EN.pdf)





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## Conclusions 4/4 Available Links

- EU Energy research: [http://ec.europa.eu/research/energy/index\\_en.htm](http://ec.europa.eu/research/energy/index_en.htm)
- Euratom Seventh Framework Programme: [http://cordis.europa.eu/fp7/euratom/home\\_en.html](http://cordis.europa.eu/fp7/euratom/home_en.html)
- Information on FP7 and access to programmes and calls: [http://cordis.europa.eu/fp7/home\\_en.html](http://cordis.europa.eu/fp7/home_en.html)
- Euratom Seventh Framework Programme funded projects [http://cordis.europa.eu/fp7/euratom-fission/library\\_en.html](http://cordis.europa.eu/fp7/euratom-fission/library_en.html)
- **CORDIS publications**
  - [http://cordis.europa.eu/fp6-euratom/library\\_en.html](http://cordis.europa.eu/fp6-euratom/library_en.html)
  - [http://cordis.europa.eu/fp7/euratom-fission/library\\_en.html](http://cordis.europa.eu/fp7/euratom-fission/library_en.html)
  - **Euratom FP6 Research Projects and Training Activities, Volume I-II and III (PDF)**
  - **Volume I** [ftp://ftp.cordis.europa.eu/pub/fp6-  
euratom/docs/nuclear\\_fission\\_eur21228\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/fp6-euratom/docs/nuclear_fission_eur21228_en.pdf)
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  - **Euratom FP7 Research Projects and Training Activities, Volume I (PDF)**
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euratom-web-jun09v02\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/fp7/docs/fin-266-<br/>euratom-web-jun09v02_en.pdf)
  - **Volume II** To be published
- Research\*eu magazine [http://ec.europa.eu/research/research-eu/index\\_en.html](http://ec.europa.eu/research/research-eu/index_en.html)
- Strategic Energy Technology Plan SET-Plan  
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