The Euratom Framework Programme FP7
Nuclear Fission & Radiation Protection

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Contents

• FP7 Euratom programme in nuclear fission and RP
  ➔ 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
Euratom 7th Framework Programme for “Nuclear Research and Training Activities” (FP7: 2007-2011)

- DG-Research indirect actions
  - Fusion
    - €1947 M

- DG-Research indirect actions
  - Fission & Radiation Protection
    - €287 M

- DG-JRC direct actions
  - Nuclear-related activities
    - €517 M

Total Euratom FP7 = €2751 M
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.
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”
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

4th FP7 Euratom “fission” call for proposals published on 13 Nov.09 with deadline 8 April 2010 and spring 2010
Evaluation Call budget €48.9M
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.
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
Euratom FP7 fission & RP - strategic priorities

Safety Authorities

Stakeholders

European & International Organisations

European Research Policy

EU Framework programmes

National programmes

International Cooperation

Research & Innovation

SET-Plan

MELODI
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)

EN S REG
European Nuclear Safety Regulators Group

EU High Level Group on Nuclear Safety and Waste Management

MELODI

Euratom FP7 fission & RP - strategic priorities

European Nuclear Energy Forum
Bratislava – Prague
Inaugural Meeting
Bratislava, 20-27 November 2007

SNETP
Sustainable Nuclear Energy Technology Platform

IGD-TP
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”
Euratom FP7
fission & RP programme and scope of ERA initiatives

Launch event 12 Nov.09
www.igdtp.eu

SRA published June 09
www.snetp.eu

Intl. workshop Sept.09
www.hleg.de
Sustainable Nuclear Energy TP
3 main pillars + key cross-cutting issues

Over 180 researchers, scientists & engineers have contributed to the SRA

www.snetp.eu
## Examples of major FP7 projects

### safety / simulation / cross-cutting 1/2

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

*only partners from EU MS and Euratom Associated Countries can normally receive EU funding
# Examples of major FP7 projects

## safety / simulation / cross-cutting 2/2

<table>
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<tr>
<th>Project acronym and title</th>
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<tbody>
<tr>
<td><strong>SARNET 2 – Severe Accident Research NoE 2</strong></td>
<td>Common research programmes and developing common computer tools and methodologies for NPP safety assessment</td>
<td>IRSN (FR) 41 from 20</td>
<td>1/04/09 36 months</td>
<td>€38M / €5.75M NoE</td>
</tr>
<tr>
<td><strong>PERFORM60 - Prediction of the Effects of Radiation FOR reactor pressure vessel and in-core Materials using multi-scale modelling - 60 yrs foreseen plant lifetime</strong></td>
<td>Multi-scale modelling tools to simulate the combined effects of irradiation and corrosion on the RPV</td>
<td>EDF (FR) 20 from 8</td>
<td>01/03/09 48 months</td>
<td>€13.6M / €6M Large CP</td>
</tr>
<tr>
<td><strong>THINS - Thermal-hydraulics of Innovative Nuclear</strong></td>
<td>Cross-cutting thermal-hydraulic issues encountered in various innovative nuclear systems</td>
<td>KIT (DE) 24 from 13</td>
<td>01/02/10 48 months</td>
<td>€10M / €5.9M Large CP</td>
</tr>
</tbody>
</table>

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FP6 (2002-06) Projects on P&T

Total EC budget = 43.5 M€

Impact of P&T on Waste Management
• RED-IMPACT

Partitioning Technologies
• EUROPART

Transmutation of High Level Nuclear Waste in an ADS
• EUROTRANS
  ➢ System Analysis of an ADS:
    ❖ Integrated design
    ❖ Cost, safety and licensing issues
    ❖ Reliability of accelerators for ADS
  ➢ Experiment: Coupling of ADS components
  ➢ Materials and coolant technologies
  ➢ Advanced fuel and Targets
  ➢ Basic nuclear data
  ➢ Education and Training

Critical Systems & Technologies
• ELSY-LFR
• PUMA-HTR

Innovative Fuels Thorium
• LWR-DEPUTY

Networking HLM EU Infrastructures
• VELLA

Partitioning Technologies
• EUROPART

Nuclear Data
• EFNUDAT • CANDIDE
• NUDAME

P&T Roadmap
• PATEROS

Total EC budget = 43.5 M€
Central Design Team for a Fast Spectrum Device in Europe

- **CDT**
  - Design: ‘advanced design’ both sub-critical and critical
  - Technical Requirements of Auxiliaries:
    - Auxiliaries, plant lay-out, in-service inspection and remote handling
    - Costs, Licensing and site requirements
    - Overall costs and financing structure
    - Licensing procedures, Site specifications, R&D needs etc
    - Education and Training

Lead Critical System

- **LEADER**

Innovative Fuels

- **FAIRFUELS**
- **F-BRIDGE**

Other Support Actions

- **ARCAS?**

Networking HLM EU Infrastructures

- **HeLimNet**

**Materials**

- **GETMAT**

**Partitioning**

- **ACSEPT**

**Thermal Hydraulics**

- **THINS**

**Nuclear Data**

- **EUFRAT**
- **ANDES**
- **ERINDA ?**

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

Total EC budget = 40 M€

**Total EC budget = 40 M€**

**Materials**

- **GETMAT**

**Partitioning**

- **ACSEPT**

**Thermal Hydraulics**

- **THINS**

**Nuclear Data**

- **EUFRAT**
- **ANDES**
- **ERINDA ?**

**Central Design Team for a Fast Spectrum Device in Europe**

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    - Costs, Licensing and site requirements
    - Overall costs and financing structure
    - Licensing procedures, Site specifications, R&D needs etc
    - Education and Training
Core aspect of the fission programme: training work packages in all major projects, EFTS – Euratom Fission Training Schemes, support for ENEN strategy

EU Council conclusions on the "need for skills in the nuclear field" (Brussels, 5 December 2008)
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
Pillar on other applications of nuclear

- FP6: RAPHAEL Integrated Project
  - Reactor for Process Heat, Hydrogen and Electricity
- FP7: EUROPAPRS coordination action
  - End User Requirements for Process Heat Applications with Innovative Reactors for Sustainable Energy Supply
Sustainability Pillar: “European Sustainable Nuclear Industrial Initiative” - ESNII (SET-Plan)

- **SFR Prototype ASTRID**
  - 250-600 MWe

- **ETTP**
  - EU Technology Pilot Plant MYRRHA
  - LFR Demo

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

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

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

- **Cost:** €6-10billion
<table>
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<th>Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACSEPT</strong> – Actinide reCycling by SEParation and Transmutation</td>
<td>Advanced partitioning - chemical processes; aqueous &amp; pyro</td>
<td>CEA (FR) 34 from 14</td>
<td>1/3/08</td>
<td>€23.79M / €9.0M</td>
<td>CP-IP</td>
</tr>
<tr>
<td><strong>F-BRIDGE</strong> – Basic Research for Innovative Fuel Design for GEN IV systems</td>
<td>Basic research on Gen-IV fuel-cladding systems</td>
<td>CEA (FR) 20 from 8</td>
<td>1/03/08</td>
<td>€10.2M / €5.5M</td>
<td>CP</td>
</tr>
<tr>
<td><strong>FAIRFUELS</strong> – FAbrication, Irradiation, Reprocessing of FUELS and targets for transmutation</td>
<td>Fuels an targets for partitioning, with close links to Gen-IV</td>
<td>NRG (NL) 11 from 6</td>
<td>1/2/09</td>
<td>€7.7M / €3.0M</td>
<td>CP-IP</td>
</tr>
<tr>
<td><strong>CDT</strong> – Central Design Team</td>
<td>Design of a sub-critical or critical fast-spectrum Transmutation Experimental Facility</td>
<td>SCK.CEN (BE) 20 from 8</td>
<td>1/4/09</td>
<td>€3.85M / €2M</td>
<td>CP-FP</td>
</tr>
<tr>
<td><strong>CP-ESFR</strong> – Collaborative Project on European Sodium Fast Reactor</td>
<td>Key viability and performance issues supporting development of a Gen-IV European SFR</td>
<td>CEA (FR) 24 from 9</td>
<td>01/01/09</td>
<td>€11M / €5.8M</td>
<td>CP-IP</td>
</tr>
</tbody>
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## FP7 projects benefitting ESNII

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<th>Start date &amp; duration</th>
<th>Total budget / EU contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOFASTR – European Gas Cooled Fast Reactor</td>
<td>Key viability and performance issues supporting development of a Gen-IV European GFR</td>
<td>AVEC (UK) 24 from 11</td>
<td>1st Q 10 36 months</td>
<td>€5.3M / €3.0M</td>
</tr>
<tr>
<td>LEADER – Lead Cooled European Advanced Demonstration Reactor</td>
<td>Key viability and performance issues supporting development of a Gen-IV European LFR</td>
<td>ANSALDO (IT) 17 from 11</td>
<td>2/4/10 36 months</td>
<td>€5.6M / €3.0M</td>
</tr>
<tr>
<td>ADRIANA – Advanced Reactor Initiative And Network Arrangement</td>
<td>Network dedicated to nuclear Industrial Initiative ESNII Gen.IV needed research infrastructures</td>
<td>UJV-Rez (CZ) 15 from 6</td>
<td>1/2/10 18 months</td>
<td>€1.4M / €1.0M</td>
</tr>
<tr>
<td>Deloitte Study – Financing and legal means for ESNII</td>
<td>Funding opportunities and legal status options for ESNII</td>
<td>Deloitte (SP) 1 from 1</td>
<td>1/8/09 6 months</td>
<td>€0.055M / €0.055M</td>
</tr>
</tbody>
</table>

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CORDIS publication

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

Financial sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Colour</th>
<th>Description</th>
<th>Criteria to include in the financial framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIB Loan (or Euratom)</td>
<td></td>
<td>Financial support provided by these institutions.</td>
<td>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</td>
</tr>
<tr>
<td>Tax exemptions</td>
<td></td>
<td>Exemptions of direct and/or indirect taxes due to Joint Undertaking or ERIC schemes.</td>
<td>Assumed that Joint Undertaking or ERIC schemes are used - represents between 14-15% of the total costs.</td>
</tr>
<tr>
<td>EU incentives &amp; grants</td>
<td></td>
<td>Financial support provided by Cohesion Policy Funds, Framework Programme, subsidies, etc.</td>
<td>Cohesion funds: limited up to 35% Other subsides: according to the project characteristics and project promoters expectations.</td>
</tr>
<tr>
<td>Private investors</td>
<td></td>
<td>Amount of money supported by providers of nuclear utilities, facilities and equipments, and other private energy players.</td>
<td>Information provided by private investors, promoters, etc.</td>
</tr>
<tr>
<td>National public research investors</td>
<td></td>
<td>Financial support provided by national nuclear organisations and other public R&amp;D institutions.</td>
<td>Information provided by national nuclear research organisations.</td>
</tr>
<tr>
<td>Hosting country public investment</td>
<td></td>
<td>Financial support dedicated to basic infrastructures co-related to the installation of a new research facility (land, civil buildings, access infrastructures, etc.)</td>
<td>Financial support that would be provided by national or local / regional authorities to host the projects: 5% of the budget.</td>
</tr>
</tbody>
</table>
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.)
ESNI Deloitte Study 4/4
Financial scheme GFR (100MWth) in a New Member State

- 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
ESNI I

Mapping of Research Infrastructures

• NEA Research and Test facilities Database (RTFDB)
  ➔ http://www.nea.fr/rtfdb/public

• 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
• 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
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 pursue »…

• Hearing of January 2010, direct link, please choose ENGLISH (Original version Recommended, translation might be approximate)
  – listen at minutes 45 to 48

• and her CV,
Available Links

- EU Energy research: http://ec.europa.eu/research/energy/index_en.htm
- Information on FP7 and access to programmes and calls: http://cordis.europa.eu/fp7/home_en.html

- CORDIS publications
  - Euratom FP6 Research Projects and Training Activities, Volume I-II and III (PDF)
  - Euratom FP7 Research Projects and Training Activities, Volume I (PDF)
  - Volume II To be published

- Research*eu magazine http://ec.europa.eu/research/research-eu/index_en.html
Thank you for your attention!