European Nuclear Research
A contribution to solving the energy challenges

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Contents

• Setting the scene: the wider context
• Euratom Research Framework Programme
• Sustainable Nuclear Energy Technology Platform = SNE-TP
• Strategic Energy Technology Plan = SET-P
Setting the scene

- Nuclear Power in the EU today: 1/3 electricity, >150 NPPs in 15 MS, >130 GWe installed, full fuel cycle

- Challenges for the future:
  - Energy Challenges: supply, environment, economy, security: role of nuclear
  - Nuclear ageing
  - Liberalisation of the electricity market
  - Divergent policies of MS on nuclear – ENEF
  - Nuclear development in other parts of the world

- EU/EC role: Policy and Financing Tools:
  Energy Policy (Low Carbon Economy - 3x20 target; 2050 vision),
  Knowledge and Research Policy (Lisbon target, ERA, Research FP),
  link = SET Plan (ia nuclear fission),
  International Cooperation (eg INSC, Euratom in GIF, Research FP)

- Need for further R&D and innovation, coordinated at EU level - with the ultimate goal = sustainability of nuclear power = SNETP/Euratom FP
Coupling Energy and Knowledge/Research: the Strategic Energy Technology Plan

SET PLAN

Research - Development ………… Demonstration – Deployment
Euratom research budget

€ Million

FP4
FP5
FP6
FP7

794
788
824
1947

271
281
319
517

170
191
209
287

0
500
1000
1500
2000
2500
3000

Fusion
Fission
JRC

4 years
5 years!
Euratom “fission” Programme

Key cross-cutting activities:
• Research infrastructures
• Human resources, mobility & training

Radiation protection:
• Risk from low doses
• Medical uses of radiation
• Emergency management

Platform launched on 21 Sept. 07!
Projects implemented using a variety of “funding schemes”, depending on desired objective:

- **Collaborative Projects** to carry out multi-partner R&D actions on basis of shared cost
- **Networks of Excellence** to promote sustainable integration amongst key organisations
- **Coordination Actions** to fund networking activities
- **Support Actions** to fund studies and general programme support
- Also used for training actions, support for/access to infrastructures, or combinations
One example - PLIM lead project

**Strategy**
- End User Group RA-2 EDF (EKK)

**R&D projects**
- Proposal evaluation and planning RA-1 BE
- Pilot projects
  - SCC RA-3 SCK•CEN (EDF)
  - TF RA-4 CEA (EDF)
  - I&C (feasibility) RA-5 FKA
  - DMW (feasibility) RA-6 ANP-G

**Resources**
- Knowledge management and communication IA-3 NRI
- Competences and facilities IA-1 CEA
- Expert Groups
  - Materials IA-2-1 SCK•CEN (EDF)
  - Integrity IA-2-2 ANP-G (SERCO)
  - Lifetime IA-2-3 SERCO (EKK)
  - Safety & risk IA-2-4 FKA (VTT)

**Advanced PLIM methodologies**

**Harmonisation**
- IA-5 JRC

**Links to regulators**
- SA-5 CEA

**Coordinator**
- VTT
• FP6 projects on Website:  

• FP7 on the CORDIS Website www.cordis.europa.eu/fp7
  – Euratom FP7, SP, WP, Call Fiches
  – Guide for Applicants
  – Rules for Participation
Sustainable Nuclear Energy Technology Platform (SNE-TP)

www.snetp.eu

21 SEPTEMBER 07
key role in better aligning EU research priorities to industry’s needs, and address challenges through:

- Shared vision of stakeholders;
- Positive impact on a wide range of policies;
- Reduced fragmentation of research and development efforts;
- Mobilisation of public and private funding sources.
Structure of SNE-TP today

- Not yet in place
  - Member State Mirror Group

- Established Oct 07
  - Governing Board

- Established Oct 07
  - Executive Committee
    - 1st meeting: Jan 08
      - WG: Strategic Research Agenda
    - Kick-off 19th May
      - WG: Deployment Strategy
    - Kick-off 29th April
      - WG: Education, Training & Knowledge Management
    - Not yet in place
      - WG: Funding Mechanisms

Platform Operations:
- FP projects – National / Multi-lateral projects

Biennial General Assembly
- 26 Nov. 08, Brussels
## SNE-TP: SRA + DS and after

<table>
<thead>
<tr>
<th>2008</th>
<th>2009 -… 2020-2025</th>
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<tbody>
<tr>
<td><strong>Strategic Research Agenda</strong></td>
<td><strong>Deployment Strategy</strong></td>
</tr>
<tr>
<td>- Gen II, III LWR incl. innovations</td>
<td>- Market opportunities and technologies</td>
</tr>
<tr>
<td>- Advanced Fuel Cycles</td>
<td>- Prioritize in terms of cost, feasibility and deployment time-frames</td>
</tr>
<tr>
<td>- Gen IV FNS</td>
<td>- Human and financial resources</td>
</tr>
<tr>
<td>- Non-electrical applications of nuclear</td>
<td>- Economic, environmental and social impact → benefits</td>
</tr>
<tr>
<td>- Large Research Infrastructures</td>
<td>- International cooperations</td>
</tr>
<tr>
<td>- Cross-cutting R&amp;D</td>
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</table>
2010: Harmonized Life Time Extension Methodology

2010-12: Optimization of Severe Accident Management Procedure for LWR

Continuous optimisation of fuel performances and safety

2010: improved fuel cycle economy ; viability of high conversion ratio designs

2012: Viability of SCWR
Advanced Fuel Cycle for resource optimisation and waste minimisation (AREVA)

Optimising natural resources: (linked to innovations for LWR)

- Core with high conversion ratios
- Very high burnup fuels
- Recycling of plutonium and reprocessed uranium

Nuclear waste minimisation:

- Partitioning and Transmutation
Sodium cooled Fast Reactor (SFR) R&D programmes to bring innovations (safety, competitiveness)

2009: Pre-selection of design options
2012: Confirmation of design options – Preliminary and detailed design, safety analysis reports, validation R&D,
Construction of a prototype SFR in the range 250-600 MWe. 2020: Start up of operations

R&D to assess viability and performance of gas and lead cooled fast reactors, as well as Accelerator Driven Systems.
Selection in 2010-12 of a second type of fast neutron system of importance for Europe. Construction of a 50-100 MWth first experimental facility in Europe, 2020: start-up of operations
2012: selection of technologies for the closed fuel cycle with the development of minor actinide bearing fuels; selection made on a technological and economical basis, with an optimization of the waste form in terms of long term radio-toxicity and thermal load impact on the required volume for the geological repository.

Support the operation of a fast reactor prototype from 2020 onwards:

Construction in the period 2012-2017 of:

- a fuel manufacturing workshop
- a micropilot for minor actinide recycling (separation and minor actinide bearing fuel manufacturing)
Development of alternative fuels to oil for transport, including hydrogen and synthetic hydrocarbon fuel production, as well as processes that require heat and/or electricity such as desalination.

Tentative R&D agenda to support the realisation of First Of A Kind V/HTR Gen. IV reactor around 2020:

- **2010-12**: confirmation of key technologies (fuel, materials, components, power conversion, hydrogen production)
- **2015-20**: construction of a V/HTR and demonstration of cogeneration applications
Large nuclear research infrastructures of European interest (NRG)


- A fast-spectrum experimental system with a power range 50-100 MWth to support development and demonstration of innovative reactor-cooling technology (Gas/lead).

- A reactor to replace the High Flux Reactor as Europe’s main provider of medical isotopes.

- Fuel cycle facilities

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<table>
<thead>
<tr>
<th>Countries</th>
<th>Reactor</th>
<th>Operation</th>
<th>Power (MWth)</th>
</tr>
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<tbody>
<tr>
<td>Czech Rep.</td>
<td>LWR 15</td>
<td>1957</td>
<td>10</td>
</tr>
<tr>
<td>Norway</td>
<td>Halden</td>
<td>1960</td>
<td>19</td>
</tr>
<tr>
<td>Sweden</td>
<td>R2</td>
<td>1960-2005</td>
<td>50</td>
</tr>
<tr>
<td>Netherlands</td>
<td>HFR</td>
<td>1961</td>
<td>45</td>
</tr>
<tr>
<td>Belgium</td>
<td>BR2</td>
<td>1961</td>
<td>60-120</td>
</tr>
<tr>
<td>France</td>
<td>OSIRIS</td>
<td>1966</td>
<td>70</td>
</tr>
<tr>
<td>Poland</td>
<td>MARIA</td>
<td>1974</td>
<td>30</td>
</tr>
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Interactions with other TPs & International collaborations

Sustainable Nuclear Energy Technology Platform

LWR Gen. II and III

(V)HTR Process heat, electricity and H₂

Geological Disposal Technology Platform (CARD)

Fast systems with closed fuel cycles Sustainability

POCATOM

SLC Cabourg - September 2008
SNE-TP in the triangle of European « nuclear forums »

High Level Group Safety and Waste Management (Regulation)

European Nuclear Energy Forum (Policy, economics)

Sustainable Nuclear Energy Technology Platform (R&D)
Strategic Energy Technology Plan

• SET-Plan was issued by EC in Nov. 2007 (COM(2007)723, and endorsed by MS at Feb Council 2008: It provides a driver at EU scale (incl national and international levels) for development of different key low-carbon technologies to deliver secure, competitive and sustainable energy between now & 2020/50 (research, innovation, market penetration)

• Nuclear Fission and Fusion are included: what needs to be done in the next 10 years to meet the 2020 target and the 2050 vision:
  – Maintain the competitiveness of existing plants and tackle waste mgmt
  – Developing towards sustainability: GEN IV systems

• Calls for European Industrial Initiatives – incl one on GENIV: Inputs from SNE-TP: SRA end 2008 and elements of the GenIV European Industrial Initiative: preliminary cost evaluated at around 5 Billion Euros for 15 years

• SET Plan implementation starting in 2008: Steering Committee, Research Alliance, SETIS information system (web-portal at JRC), Communication on financing, European Energy Technology Summit (July 2009)
EII Sustainable Nuclear Energy (GEN IV)

- **Objectives – from SNE-TP (Technology Platform) vision**
  - To demonstrate the sustainability of nuclear energy by proving the technological, industrial and economic viability of new fast neutron reactors (Generation-IV)

- **Scope/main activities of TP**
  - Research enabling a final decision in 2012 on building an industrial SFR (sodium fast reactor: 250-600MWe) prototype – for operation in 2020
  - Research to enable selection by 2012 of alternative (gas or lead-cooled) fast reactor technology & decision for building a demonstration plant
  - Development of the associated closed fuel cycle technologies, with decision in 2012 on construction of pilot fuel manufacturing facilities
  - Construction and operation of research infrastructures:
    - Jules Horowitz Reactor (JHR – construction on-going)
    - Fast neutron multipurpose irradiation facility (for operation around 2018)
    - Specific testing and qualification facilities for component design, systems development and code validation.

- **Resources**
  - Global cost over the next 15 years estimated at €4700M (excluding JHR).
  - Major investments after 2012.