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 Technololy Plan = SET-P

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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

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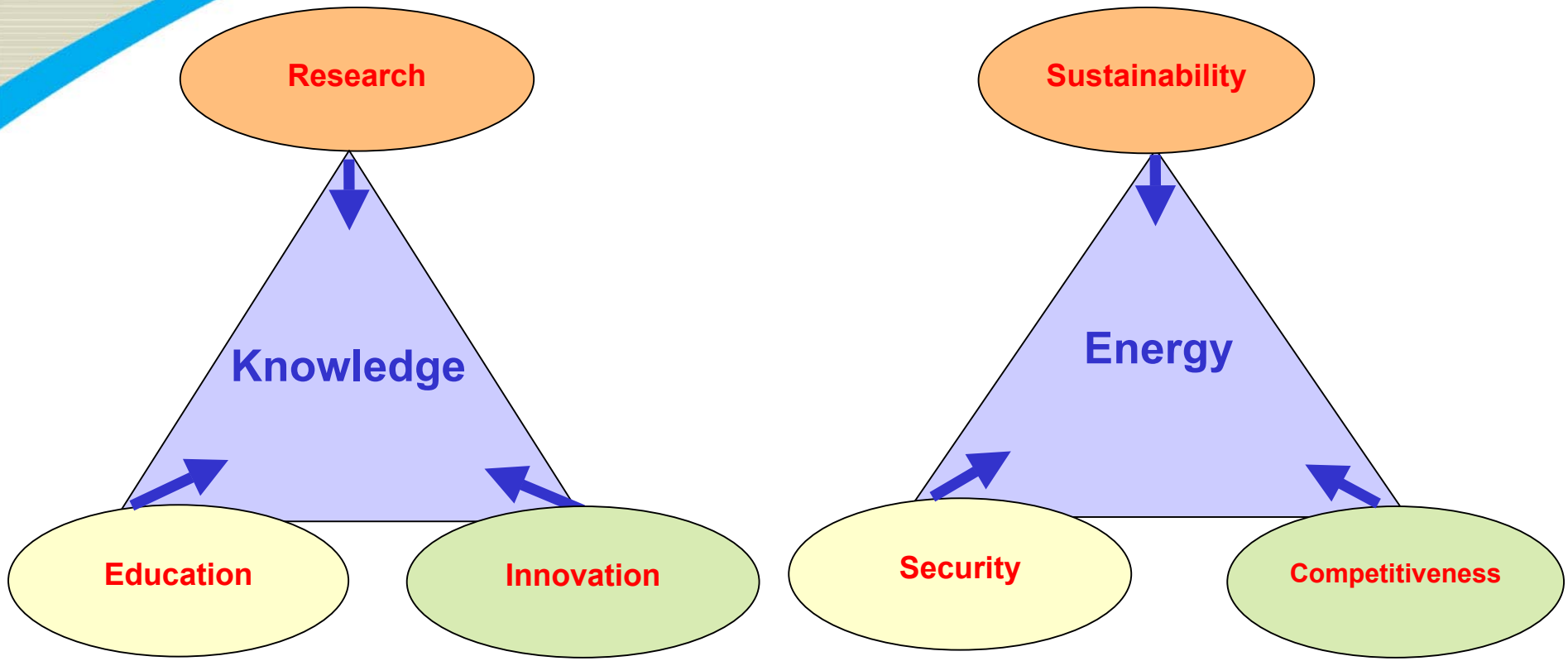
Coupling Energy and Knowledge/Research : the Strategic Energy Technology Plan



SET PLAN

Research - Development ..... Demonstration – Deployment

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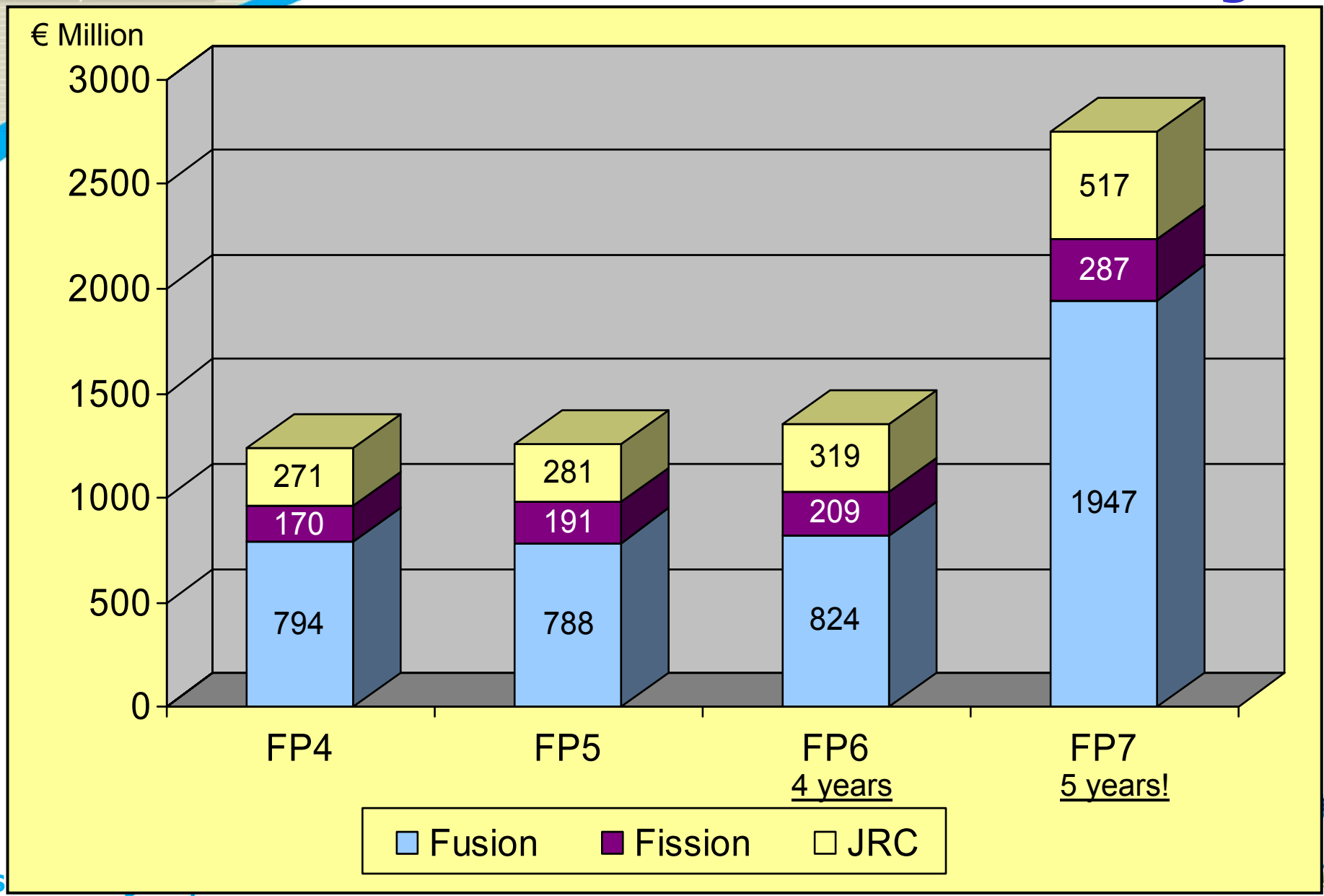
Euratom research budget



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Euratom "fission" Programme

C
A
R
D

Platform launched on 21 Sept. 07!

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

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Euratom Programme instruments - funding schemes

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

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One example - PLIM lead project

Strategy

End User Group
RA-2 EDF (EKK)

Business and integration plan
IA-7 VTT

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

R&D projects

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

Euratom Programme
More information

- FP6 projects on Website:
  http://ec.europa.eu/research/energy/fi/fi_pubs/article_1186_en.htm
- FP7 on the CORDIS Website www.cordis.europa.eu/fp7
  - Euratom FP7, SP, WP, Call Fiches
  - Guide for Applicants
  - Rules for Participation

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Sustainable Nuclear Energy Technology Platform (SNE-TP)

www.snetp.eu

21 SEPTEMBER 07

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Technology Platforms: Vision Report, Strategic Research Agenda & Deployment Strategy

- 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.

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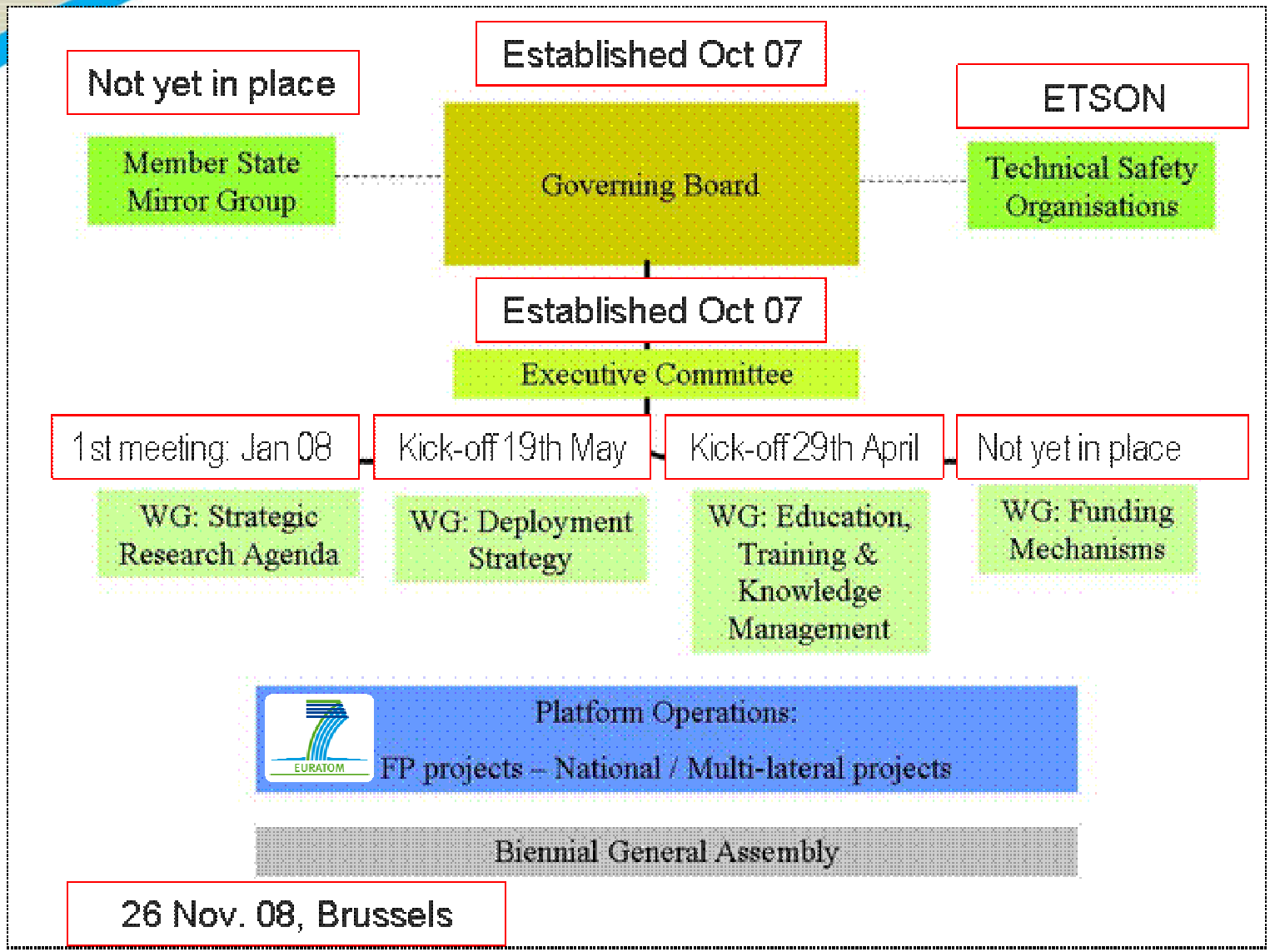
Structure of SNE-TP today



Utilities

Technology Providers

Consultancy/Other industry

TSO

Research Organisations

Universities

NGO

EU Organisations

SNE-TP: SRA + DS and after

2008		2009 -…. 2020-2025
Strategic Research Agenda	**Deployment Strategy**	**Implementation of R,D & D programmes**
➢ Gen II, III LWR incl. innovations ➢ Advanced Fuel Cycles ➢ Gen IV FNS ➢ Non-electrical applications of nuclear ➢ Large Research Infrastructures ➢ Cross-cutting R&D	➢ Market opportunities and technologies ➢ Prioritize in terms of cost, feasibility and deployment time-frames ➢ Human and financial resources ➢ Economic, environmental and social impact → benefits ➢ International cooperations	**Projects, then FP8…** **SET Plan EII for Sustainable Fission** **Other PPP, national programmes, etc**  **JHR Public/Private Partnership, construction 2007-2014** **MYRRHA, etc**

Gen. II and Gen. III Light Water Reactors & innovations (EDF, E.ON)

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

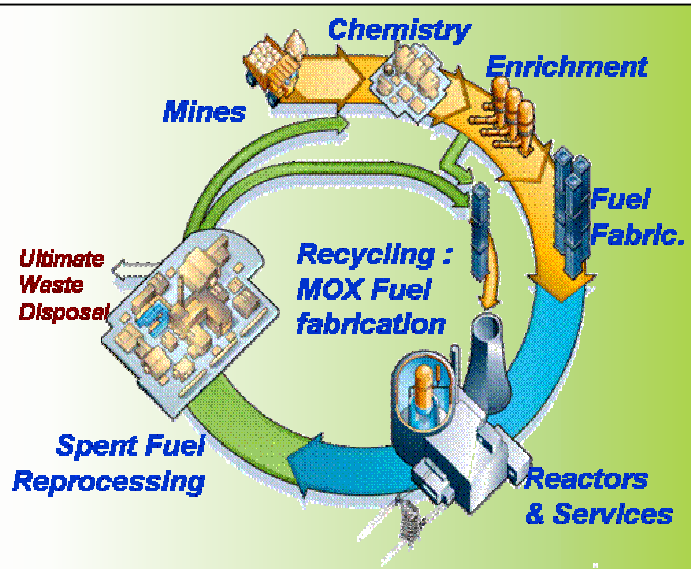
Advanced Fuel Cycle for resource optimisation and waste minimisation (AREVA)

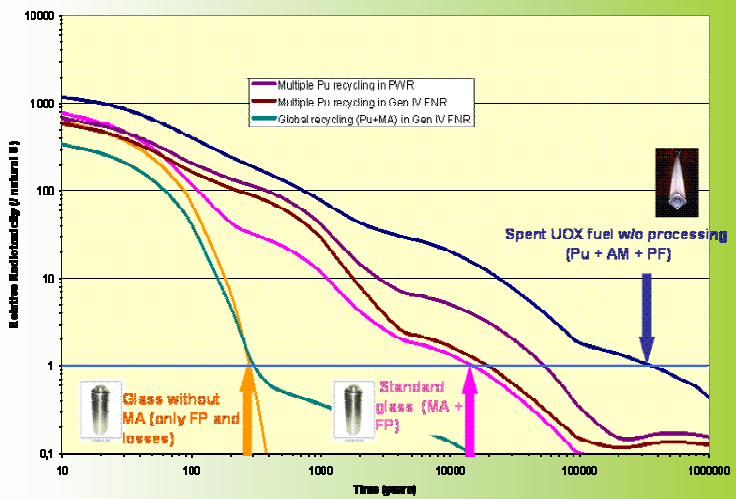
Optimising natural resources: (linked to innovations for LWR)

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

Nuclear waste minimisation:

- Partitioning and Transmutation





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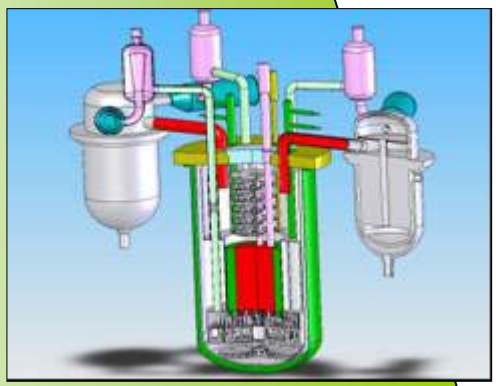
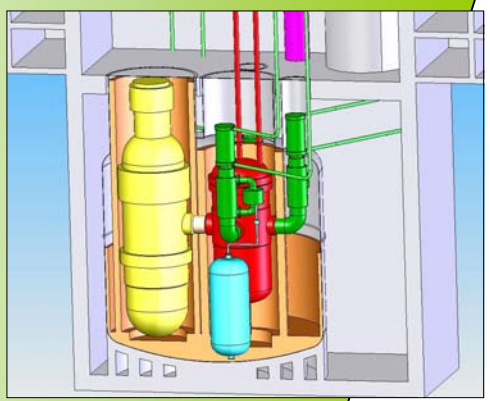
Gen.IV Fast Systems (CEA, NNC, Del Fungo Giera, SCK)

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



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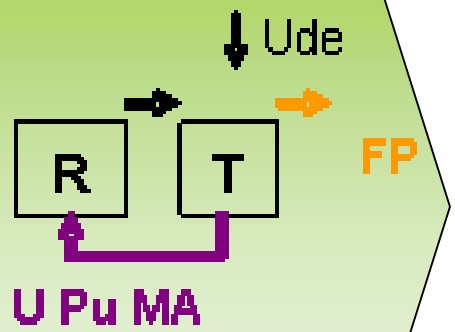
Associated Fuel Cycle Research (CEA)

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)



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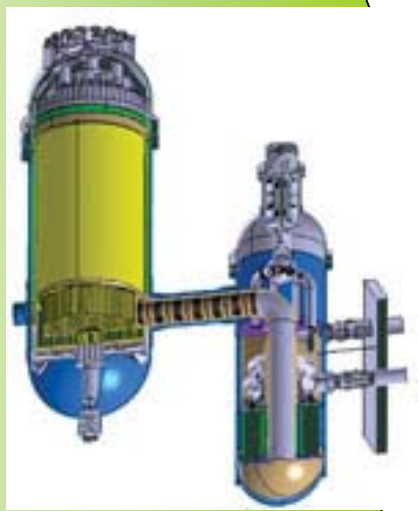
Research Road Map for New Applications of Nuclear Energy (AREVA)

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



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Large nuclear research infrastructures of European interest (NRG)

- the **Jules Horowitz** high-performance **Material Test Reactor**, identified in the *European Strategy Forum on Research Infrastructures* (ESFRI) roadmap.

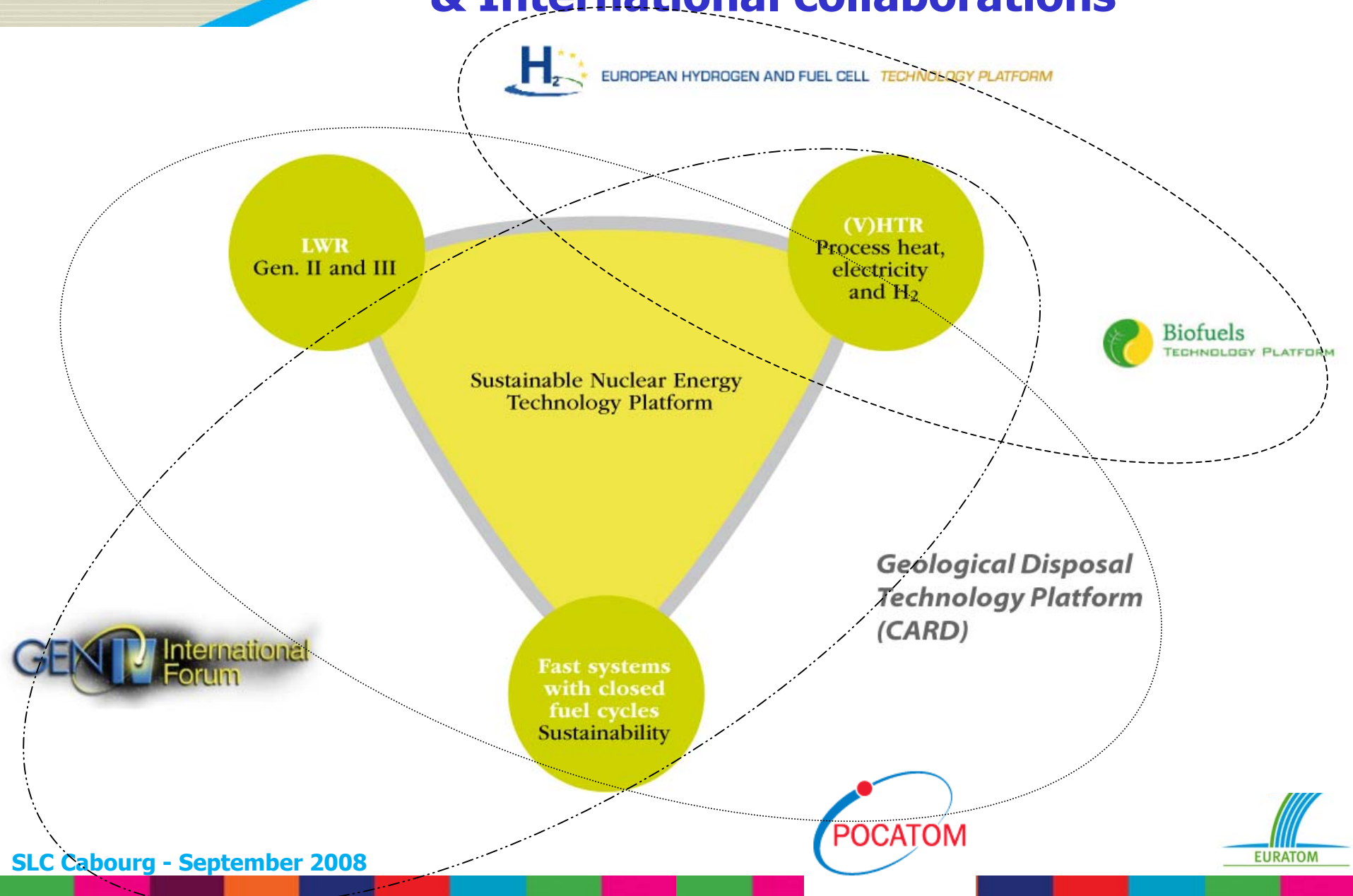
Countries	Reactor	Operation	Power (MWth)
Czech Rep.	LWR 15	1957	10
Norway	Halden	1960	19
Sweden	*R2*	*1960-2005*	*50*
Netherlands	HFR	1961	45
Belgium	BR2	1961	60-120
France	OSIRIS	1966	70
Poland	MARIA	1974	30

- 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**

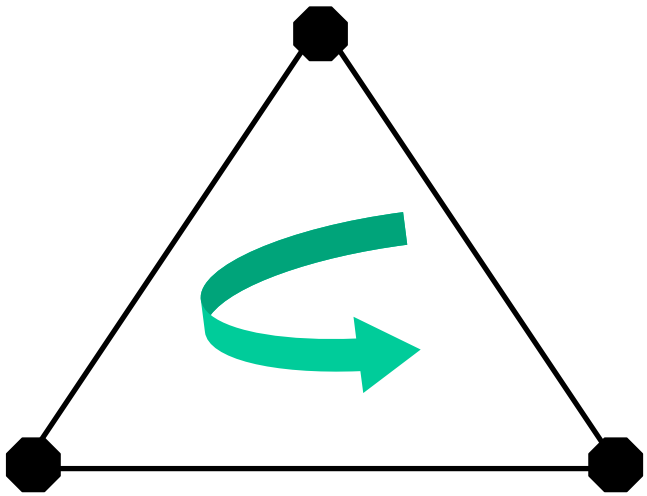
Interactions with other TPs & International collaborations



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.