



Energy Policy,* EURATOM FP Activities and Successful Strategy for P&T Research

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OUTLINE

- **EU Energy Concerns and Energy Policy**
- **Euratom Framework Programs (FPs)**
- **Research on P&T and Advanced systems**
- **Debate on Orientation of P&T Research**
- **Concluding Remarks**



EU Energy Concerns

- **Energy is the driver of economic growth and prosperity**
- **Energy concerns have been a permanent feature of the European reconstruction**
- **Two of the three European treaties deal with energy:**
 - **European Coal and Steel Community (ECSC) Paris 1951**
 - **European Atomic Energy Community (EURATOM) Rome 1957**



Energy

OBJECTIVE

Transforming the current fossil-fuel based energy system into a more **sustainable** one based on a **diverse portfolio** of energy sources and carriers combined with enhanced energy efficiency, to address the pressing challenges of **security of supply** and **climate change**, whilst increasing the **competitiveness** of Europe's energy industry.



Energy Policy

Energy policy remains political, nevertheless, it attempts to balance the following:

- Economics**
- Environmental Protection**
- Security of Energy Supply**

including sustainability which is inherently a worthy cause and represent goodness!

“Nuclear has high level of political sensitivity. While France and Finland plan new nuclear plants, nuclear is illegal in Austria and Ireland!”



Economics

- **Some countries in Europe push for 'market-based approaches'.**
- **Nevertheless, these approaches are influenced by overt or covert subsidies for policy or social reasons and distort the true market.**
- **Market economy structures and effective competition are the key building blocks of economically viable energy options.**
- **Nuclear power plants have high investment costs and nuclear waste must be taken care of!**



Environmental Protection

- **Environmental Protection concerns have moved from**
 - **Local issues (smog), to regional-international (acid rain) to truly global issues (climate change)**
 - **Reduction of GHG emissions are likely to come from electricity generation rather than in transport and heating**
 - **Decarbonising vehicle sector and home heating systems necessitate relying on low-carbon electricity. This goes in favour of nuclear energy!**
 - **But nuclear energy has to solve the waste management issue which can be viewed as a 'wicked problem' that can appear one instant 'close to solution' and the next that 'no solution can ever be found'.**



Security of Energy Supply

- **Energy Security:**
 - **Diversity of electrical generation options using diverse fuels from diverse sources.**
 - **Combined Cycle Power Plants**
 - **Energy efficiency is good (but, now power=>no light)**
 - **Lower wastage is essential**
 - **Coal has best credentials for security of supply but it is dogged by the high GHG emissions.**
 - **Nuclear as base load supply also provide energy security but it has negative public acceptance**
 - **Varied renewable energies would contribute**



Sustainability

- **Sustainability is popularly considered as a worthy cause.**
- **Economics of sustainability depends very much on the 'discount rate'. If it is large, economics may not be in favour of sustainability and unsustainable solutions may become more attractive.**
- **Sustainability approach aims to avoid crises. It may thus deny one the innovative and creative periods as is evidenced from 'war-like' situations.**
- **Achieving decarbonised society without the widespread use of nuclear energy may perhaps only be possible in an authoritarian regime?**
- **Fossil fuels face more rapid fuel depletion whereas nuclear fuel cycle can be stretched by nuclear technologies like reprocessing and fast reactors or novel fuels such as thorium.**



Nuclear Energy Research

- In the EU, the nuclear energy research is carried out under the framework of the European Atomic Energy Community (**EURATOM**) treaty.
- **Framework Programs** of the European Union have been a very fruitful tool to channel Member States' common research funds in areas of European-wide interest especially where European added value dominates.
- The technologies developed in Europe can be used or adapted to meet the needs of other countries.
- International collaboration is an important policy element of the EU Framework Programs.



Challenges of Nuclear Fission Research in Europe

- **Consolidate the management of technological solutions for the back-end of the fuel cycle and its societal acceptance**
- **Present generation of reactors (GEN II, III):
Ensure a safe and efficient operation**
- **Long-term sustainable solution: implement the GEN IV fast reactor systems + dedicated ADS**
- **Explore the non-electricity use of nuclear energy:
High temperature processes**
- **Ensure nuclear controls, radiation protection and security within Europe and outside**
- **Accelerate European research integration and setting up of priorities**
- **Enhance and coordinate Education & Training efforts**



Euratom Framework Programs

- **European Community research has been organised in Framework Programs (FP) of durations of 4-5 years since 1984.**
- **FP3: 1990-94, FP4: 1994-98, FP5: 1998-02**
- **FP6: 2002-06 FP7: 2007-11 (possibly to 2013)**
- **Organisation of Euratom Activities is as follows:**
 - ➔ **Fusion Energy Research (EC-RTD)**
 - ➔ **Nuclear Fission and Radiation Protection (EC-RTD)**
 - ➔ **Nuclear Activities of EC Joint Research Centre (JRC)*:**
 - (i) IE, Petten; (ii) **IRMM, Geel**, (iii) ITU, Karlsruhe;
 - (iv) IPSC+IHCP+IES, Ispra and (v) IPTS, Seville.

* **Activities implemented by JRC are known as 'direct actions'. EC-JRC also takes part in EC-RTD 'Indirect Actions'.**



EURATOM Framework Programs Budget

	FP6 (2002-06)	FP7 (2007-11)
	M€	M€
• Fusion Energy Res	824	1947
• Fission & Rad Prot	209	287
• JRC's Nuclear Activity	319	517
Total	1352	2751



Implementation of Euratom FP on Research & Training

- **Approval by the Council of Ministers of Member States**
 - **Framework Program (~5 years) with budget**
 - **Specific Programs: (i) Res & Training, (ii) JRC activities**
 - **Rules of Participation + Funding Schemes**
- **Detailed Technical Work Program (yearly) approved by EC**
- **Publication of Call for Proposals from European consortiums with participation from Third countries**
- **Evaluation of Proposals by Independent Experts**
- **Selection of proposals and negotiation of grant agreements by the EC**
- **Follow-up and monitoring of projects by the EC**



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Technology Platforms:

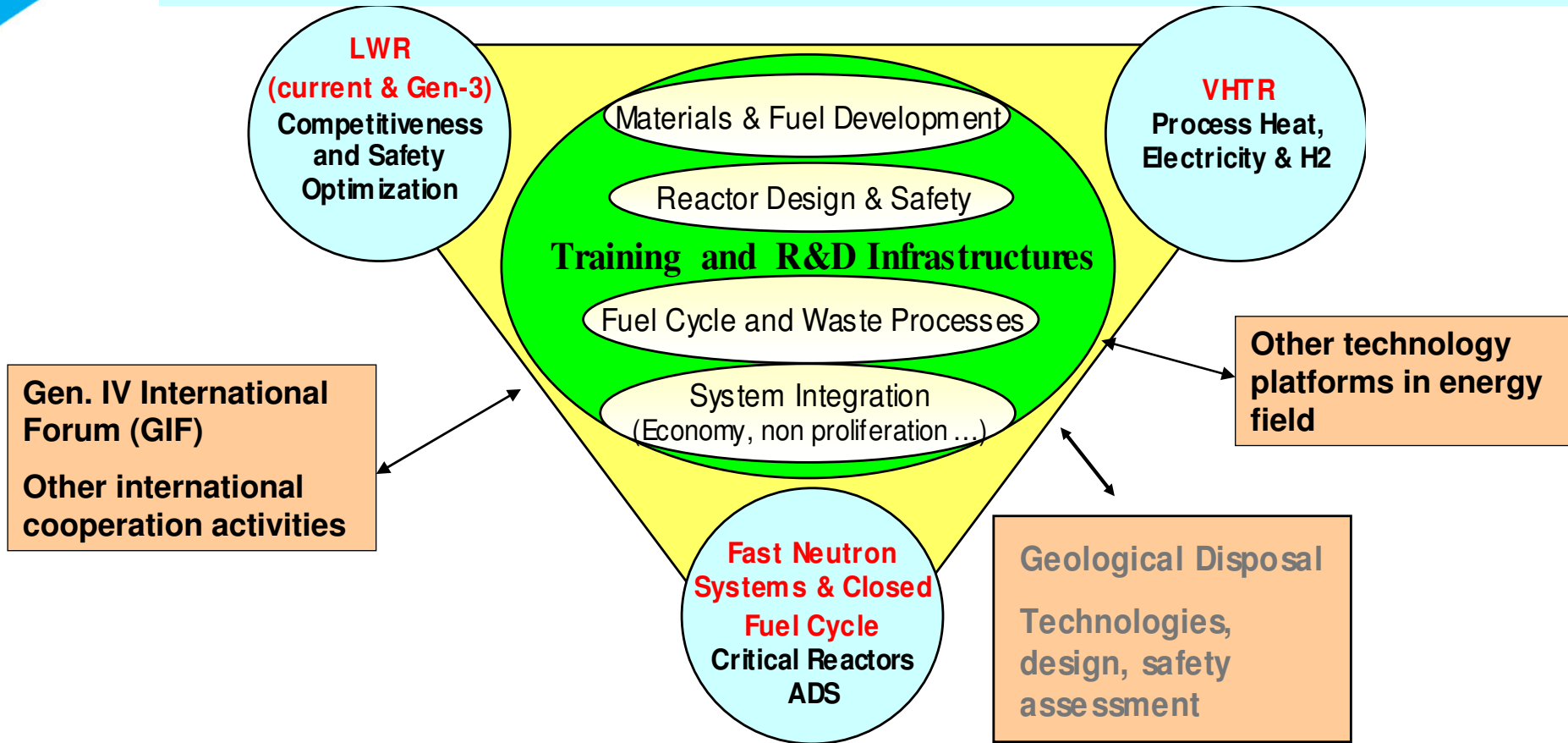
Framework to unite stakeholders around:

- **a common “vision” for the technology concerned**
- **mobilisation of a critical mass of research and innovation effort**
- **definition of a Strategic Research Agenda**



SNE-TP Launched on 21/09/2007

Sustainable Nuclear Energy Technology Platform (SNE-TP)





EURATOM FP7 (2007-11) Nuclear Fission & Radiation Protection

Geological disposal of long-lived radioactive waste and the reduction of toxicity of radioactive waste through **partitioning & transmutation**

Operational safety of existing reactor systems and the **potential of future reactor systems** for safer, more efficient power plants and **competitive nuclear industry**

Radiation protection – especially risks from low doses, medical uses, emergency management and mitigation of the impact of **radiological terrorism**

Key cross-cutting activities:

- Support for research infrastructures
- retaining competences and know-how in all areas of nuclear science



Management of Radioactive Waste in FP7

OBJECTIVES

- **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



Reactor Systems in FP7

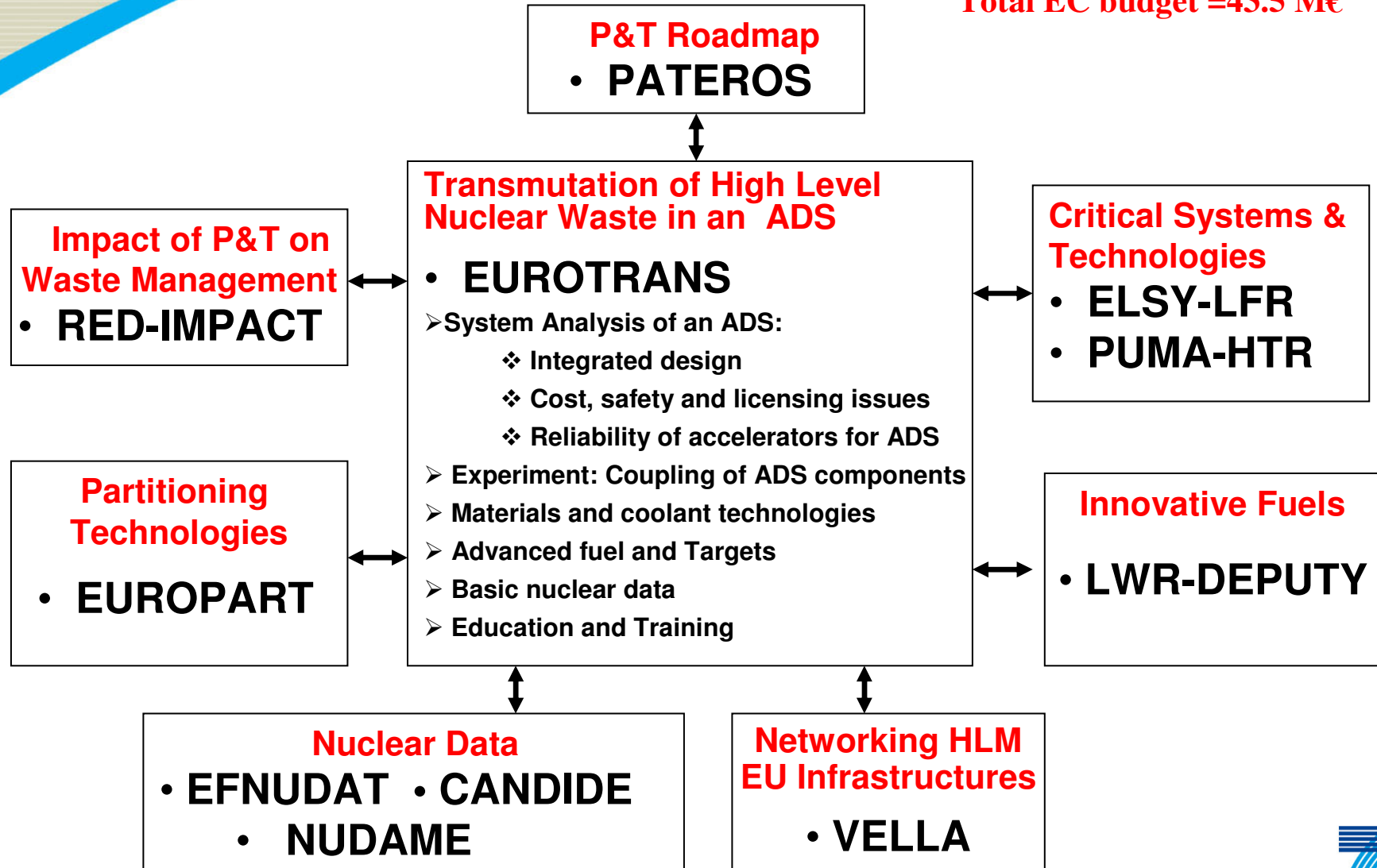
OBJECTIVES

- **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**



FP6 (2002-06) Projects on P&T

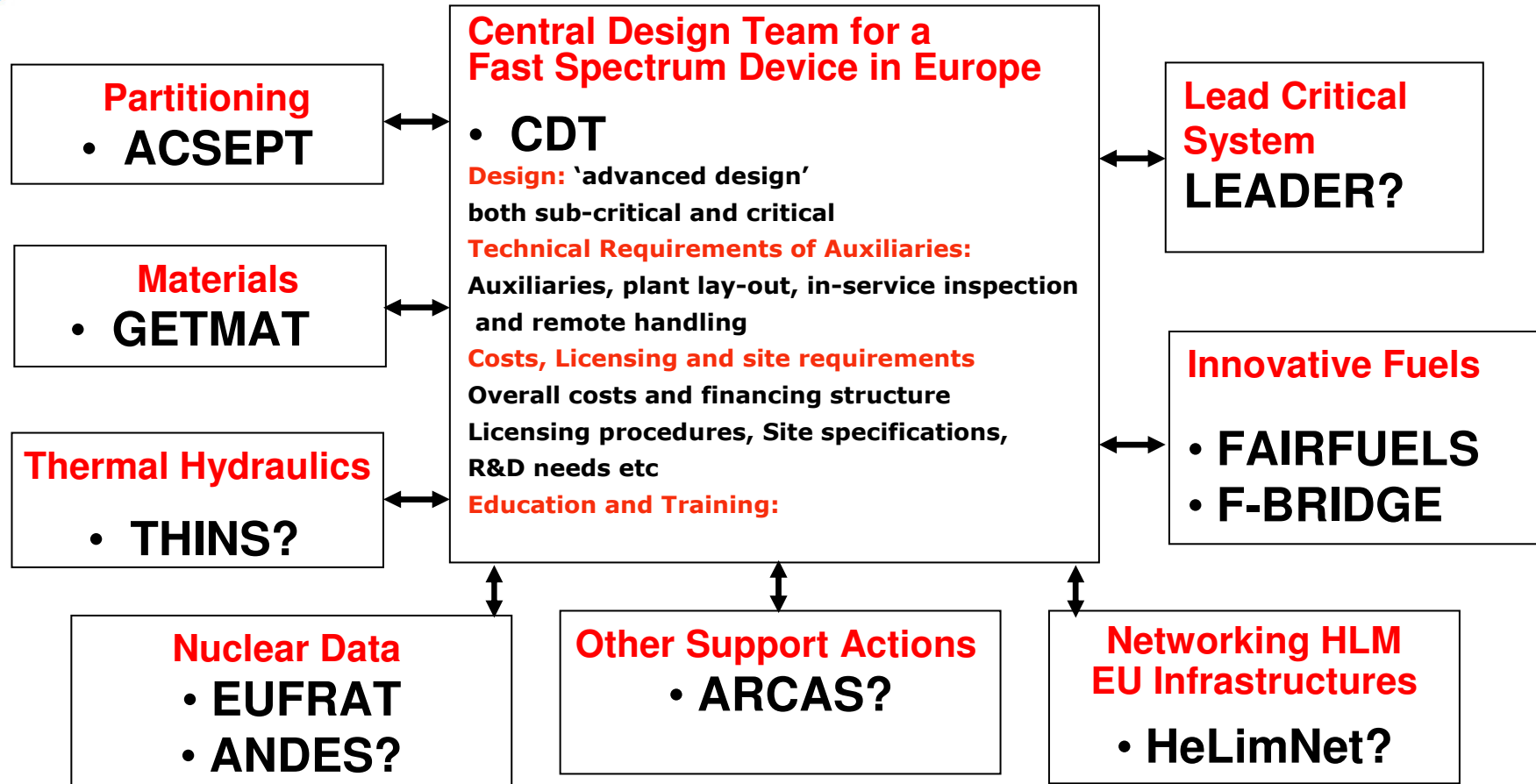
Total EC budget =43.5 M€





FP7-2007 and 2008 Projects on P&T and potential 2009 Projects

Total EC budget =35-40 M€?





P&T Strategy: Orientation towards RWM or Advanced Systems

- **P&T is expected to strongly minimise the waste legacy for GD in terms of volume, thermal load and radiotoxic inventory.**
- **Recognising this fact, the Council decided in FP4-FP7, to put P&T research under RWM alongside GD.**
- **Sustainability of nuclear energy requires a closed fuel cycle.**
- **P&T finds a very useful niche in the waste transmutation research in Gen IV P&T links GD (RWM) and Gen IV Advanced Systems (AS)**

The debate is whether P&T should lean more on RWM than on AS or vice-versa so that its research resources are safeguarded?



Concluding Remarks

- **Reliable, environmentally friendly, affordable, sustainable energy source that can meet our growing needs is a big challenge.**
- **Energy issue has no simple solutions.**
- **Energy conservation and a mix of energy sources where nuclear provides the base-load electricity needs may be required.**
- **The future is very uncertain and meeting the challenges depends on bold political leadership.**
- **Perhaps the best course of action for nuclear proponents is to engage the public in the nuclear debate in a transparent manner.**



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FISA-2009 Conference, "EU Research and Training in Reactor Systems" Prague, 22-25 June 2009

22 June 2009

- **AM: Introductory keynote lectures**
- **PM: Safety and competitiveness of nuclear installations**

23 June 2009

- **AM:**
 - **Innovative nuclear systems**
 - **Advanced fuel cycles and materials and partitioning and transmutation**
- **PM: Advanced nuclear systems of generation IV**

24 June 2009

- **AM: Education & training and large infrastructures**
- **PM: Concluding keynote lectures**



Post-FISA workshops Prague (CZ)

25 June 2009

- 1. HTR / V-HTRs for nuclear co-generation:
Towards International Demonstration?**
- 2. Commonalities between nuclear fission and fusion
Research: Achievements and Prospects.**
- 3. Integration of Nuclear Education and Training:
Common Needs, EU Vision & Implementation**
- 4. Advanced Numerical simulation tools.**
- 5. International collaboration with non-EU countries:
Achievements and Prospects.**
- 6. Clustering of partitioning and transmutation activities.**
- 7. Research towards harmonization of technical nuclear
safety practices in Europe.**



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Post FISA Workshop # 6

Clustering of Partitioning and Transmutation Activities
Corinthia Towers Hotel
Praha (CZ)

Thursday 25 June 2009

Draft Final Agenda

09:00 Welcome and Introduction.....Ved Bhatnagar (EC)

Session I: Chair / Co-chair: Concetta Fazio (FZK) / Enrique Gonzalez (CIEMAT)

09:10 Fuel Cycle Options for Europe.....Bernard Boullis (CEA)

09:40 State-of-the-art and Future Research Needs in Partitioning
TechnologyStéphane Bourg (CEA)

10:10 State-of-the-art and Prospects of Implementation of Lead-Cooled Fast
ReactorsLuciano Cinotti (DEL - FUNGO)

10:40 Accelerator Driven Sub-critical Systems as Dedicated
and Efficient Minor Actinide Burners and Challenges on the
Road to Demonstration.....Peter Baeten (SCK/CEN)

11:10 Coffee Break

11:30 Impact of P&T on Waste Management and
Geological Disposal.....Jan Marivoet (SCK/CEN)

12:00 Basic Studies in Support of Licensing Applications and Reducing Design
Safety Margins in Sub-critical and Critical Fast Reactor
Systems.....Enrique Gonzalez (CIEMAT)

12:30 Successful Approaches to Education and Training in Nuclear
Fission.....Michel Giot (UCL)

13:00 Lunch Break



- 14:00 The Way Forward to Meeting the Challenges of Structural Materials for ADS and Fast Reactor Systems in Europe...Lola Gomez-Briceno (CIEMAT)
- 14:30 Challenges to Meet the Near-term Needs of Fuel Development for ADS and Fast Reactor Systems in Europe..... Sander De Groot (NRG)
- 15:00 Prospects of Partitioning and Transmutation.....Bernard Carluec (AREVA)

15:30 Coffee Break

Session II: Panel Moderator: Ved Bhatnagar (EC)

16:00 **Panel Discussion:**

"Successful Strategy for Partitioning and Transmutation Research: Orientation towards Radio-active Waste Management or Advanced Systems?"

Panellists:

**Hamid Aït Abderrahim (SCK/CEN), Frank Carré (CEA), Stefano Monti (ENEA),
Didier Haas (JRC), Andres Felipe (Iberdrola, ES)**

17:45 Concluding Remarks of the Workshop.....Concetta Fazio/Enrique Gonzalez

18:00 End of Workshop



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Post-FISA 2006 Workshop # 2
Synergy between Fission and Fusion Research
Corinthia Towers Hotel
Praha (CZ)

Thursday 25 June 2009

Draft Agenda

09:00 Welcome and Introduction (David Maisonnier, EC)

SESSION I: Chair/Co-chair: Christian Latgé, CEA and Arjan Koning, NRG

09.10 Common R&D Issues in Fission and Fusion
and Synergies in Cooperative Research.....C. Latgé, CEA

09.40 Fission and Fusion Issues in Alkali and
Heavy Liquid Metal Technologies..... Pietro Agostini, ENEA

10.10 Commonalities in Corrosion and Protection of
Structural Materials for Fission and Fusion.....Georg Müller, FZK

10.40 Application of Common Thermal Hydraulics and Computational
Fluid Dynamics codes to Fission and Fusion.....Ferry Roelofs, NRG

11:10 Coffee Break

11.30 Techniques for Reliability of Microwave and Accelerator Components
for CW Operations for Fission-Fusion Research.....S. Bousson, CNRS

12.00 Tritium Issues in Fission and Fusion Devices.....Olivier Gastaldi, CEA

12.30 Common issues in Fission and Fusion Devices
In-Service Inspection.....Mark Dierckx, SCK/CEN (TBC)

13.00 Lunch Break



- 14.00 Fission and Fusion Common Fundamental Issues
on Materials and Irradiation Damage.....JG Van der Laan, NRG (TBC)
- 14.30 High Energy Nuclear Data Common
to Fission and Fusion.....A. Koning (NRG)
- 15.00 Fission and Fusion Common Remote
Handling Issues.....Carlo Damiani (F4E)
- 15.30 Site Specification and Licensing Issues
Common to Fission and Fusion.....Sergio Ciattaglia (ITER)
- 16.00 Coffee Break

Session II: Panel Moderator: Arjan Koning (NRG)

16:20 Panel Discussion:

"Is there any Synergy in Bridging Fission and Fusion Research on Materials?"

Panellists:

**Italo Ricapito (F4E), Jean-Louis Boutard (EFDA), M. Abdou (CESTAR, California),
Christiane Latgé (CEA)**

17:30 Concluding Remarks on the Workshop.....Christian Latgé/Arjan Koning

17:45 End of Workshop



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FISA-2009 Prague (CZ)

Venue

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Website

http://cordis.europa.eu/fp7/euratom-fission/fisa2009_en.html