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IAEA Int'l Conf. on Human Resource Develoment for Introducing and Expanding Nuclear Power Programmes

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From knowledge creation to competence building

Euratom education and training activities in nuclear fission and radiation protection

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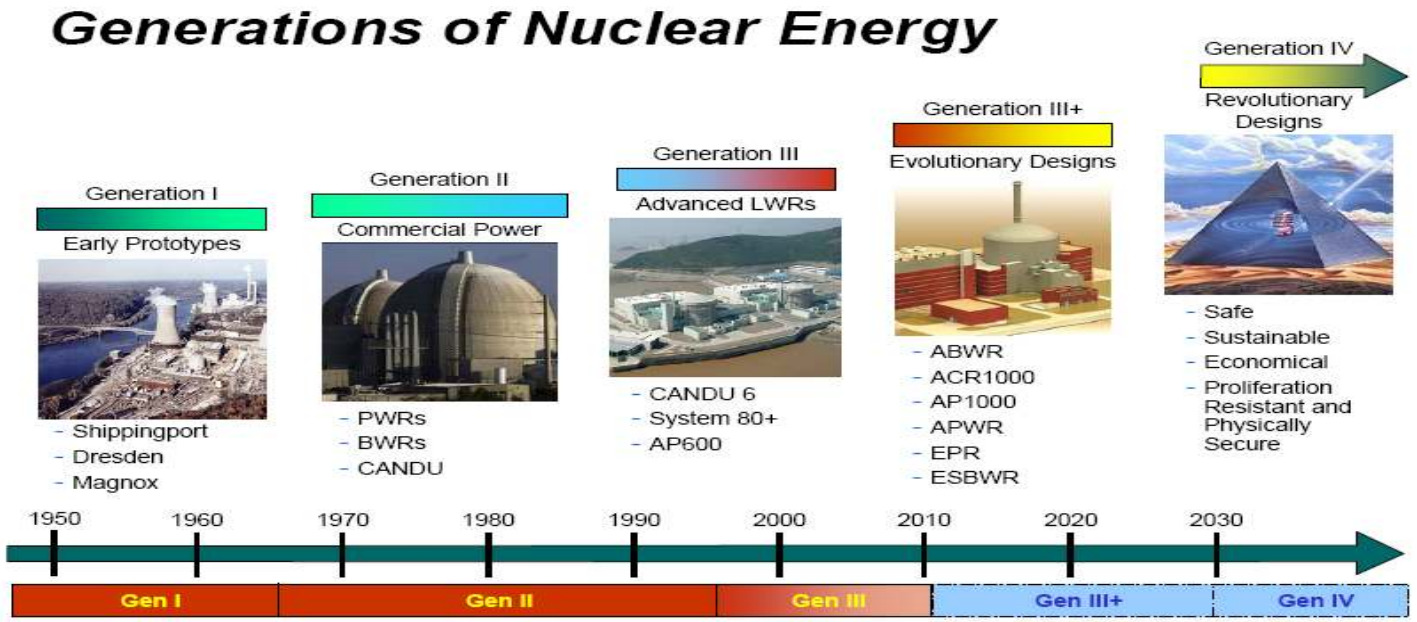
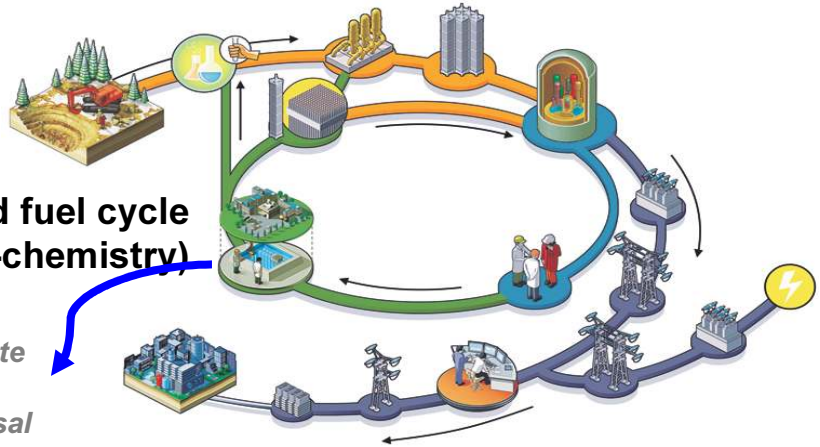




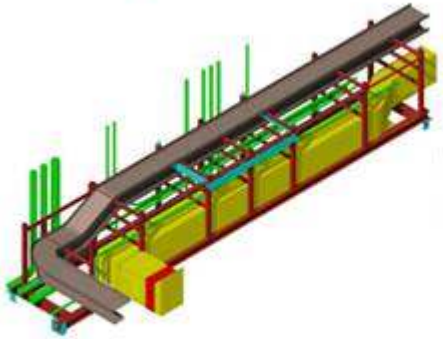
Medical applications of ionising radiations

The EPR 1600 MWe reactor (AREVA NP) under construction in Olkiluoto 3 (Finland)

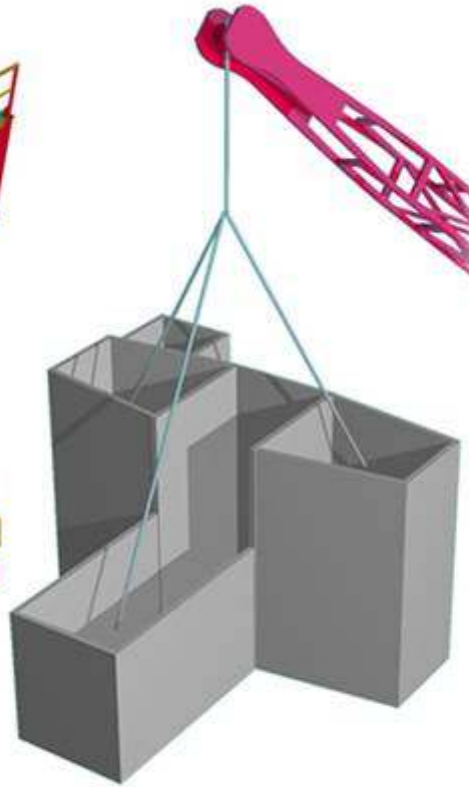
Reactor vessel arrives at the site – January 2009

The AP1000 reactor (Westinghouse – Toshiba): modules designed into from the beginning

Pump/Valve Module



Raceway Module



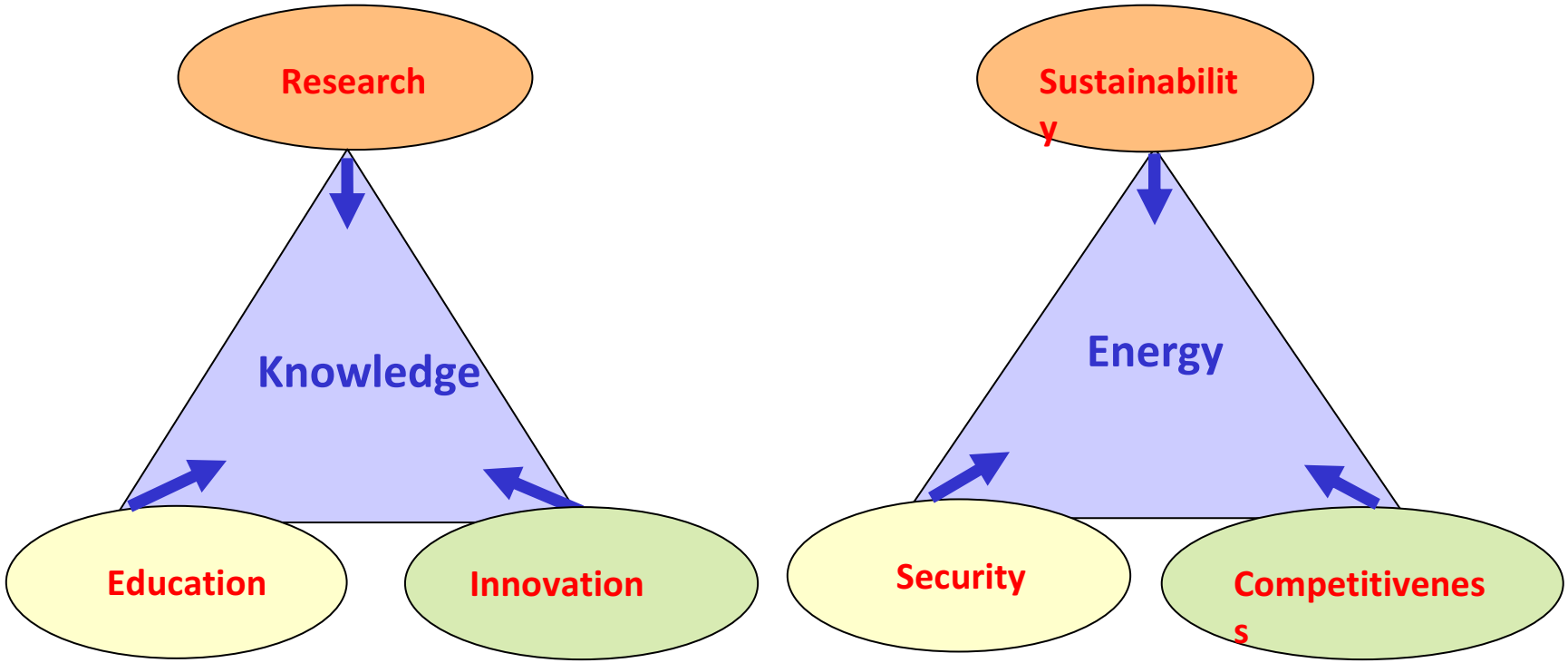
Structural Module

Depressurization Module

Module Type	Number
Structural	122
Piping	154
Mechanical Equipment	55
Electrical Equipment	11
TOTAL	342

2. Euratom research and Training (SNE-TP)

Knowledge and Energy: complementary policies in the EU



<= RD & DD =>

Research, Development ..... Demonstration, Deployment

<= Education (knowledge creation) ⇔ Training (competence building) =>

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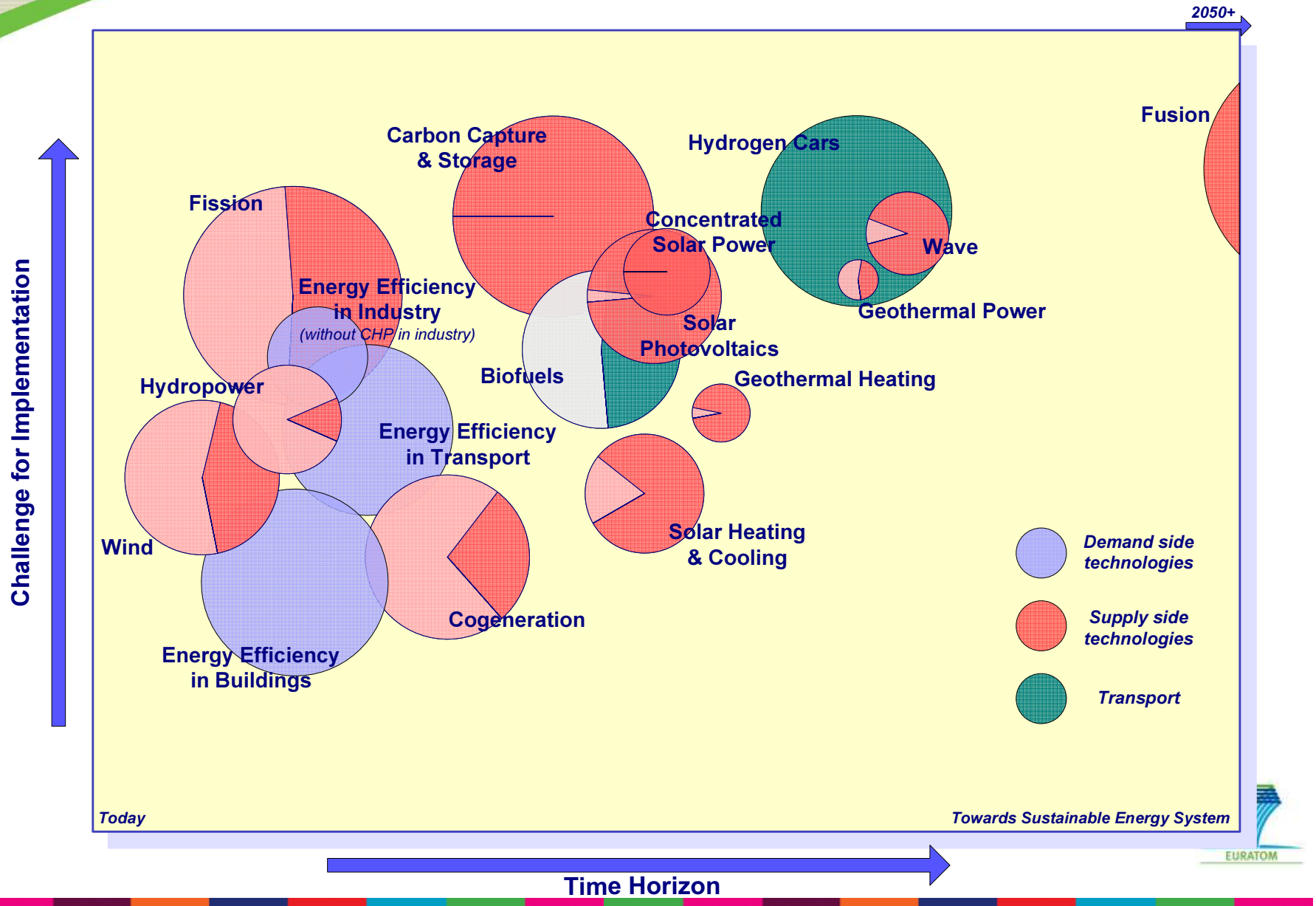
SET Plan (COM(2007)723) Potential of technologies



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Innovation cycle for nuclear fission (RD&DD) from preconceptual to final design

RD&DD	*Stages*	*Definition*	*Contact with Regulators*	*Design Authority*
Research	*1.Preconceptual*	*Options and ideas*	*Global Principle.*	*Originator (RTD)*
	2. Conceptual	***Viability report*** *Design & Fuels Requirements*	*Is the concept licensable?*	*Systems Integration & Assessment*
Development	*3. Preliminary*	***Performance report***		*Systems Integration & Assessment*
Demon-stration	*4. Basic Design*	***Demonstration report*** *First quote. Formal guidance.*	*Formal license* *Discussions.*	*Vendor*
	5. Detailed Design	*Procurement.*		*Vendor*
Deployment	*6. Final Design*			*User*

… manufacturing, construction, commissioning, operation, decommissioning, …
(= 100 years for a NPP)

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Education and Training: from knowledge creation to competence building

Education and Training (E&T) are usually defined as follows:

- **Education** is a basic or life-long learning process: education is broader than training and encompasses the need to maintain completeness and continuity of competences across generations

(it is essentially a knowledge creation process,

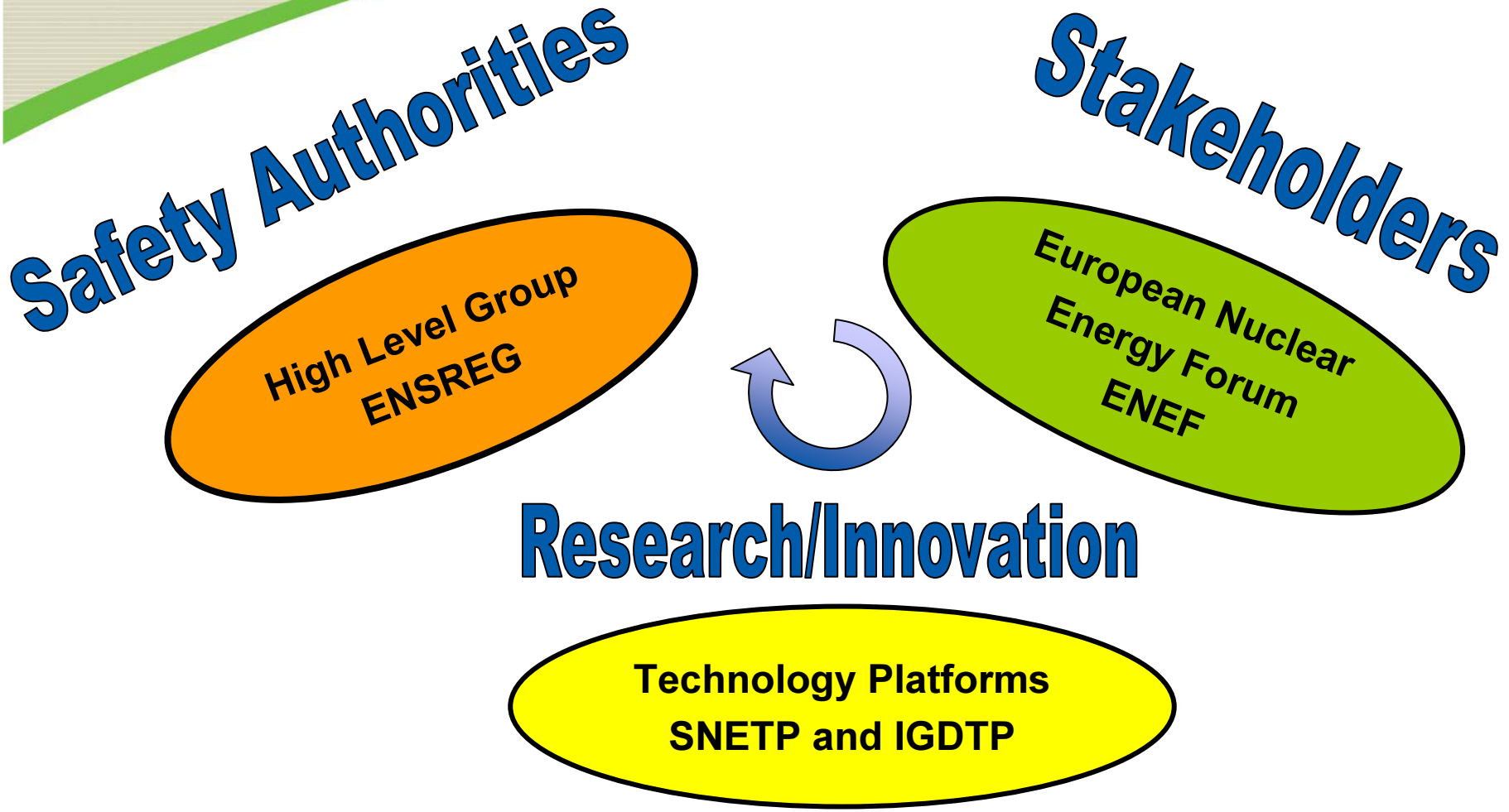
involving academic institutions as suppliers, and students as customers).

- **Training** is learning a particular skill (or know-how) required to deliver a particular outcome: training is about schooling activities other than regular academic education schemes

(it is essentially a competence building process,

involving employers as suppliers, and on-the-job professionals as customers).

EU Stakeholders in nuclear fission



ENSREG = European Nuclear Safety Regulators Group
http://ec.europa.eu/energy/nuclear/ensreg/ensreg_en.htm

ENEF = European Nuclear Energy Forum
http://ec.europa.eu/energy/nuclear/forum/forum_en.htm

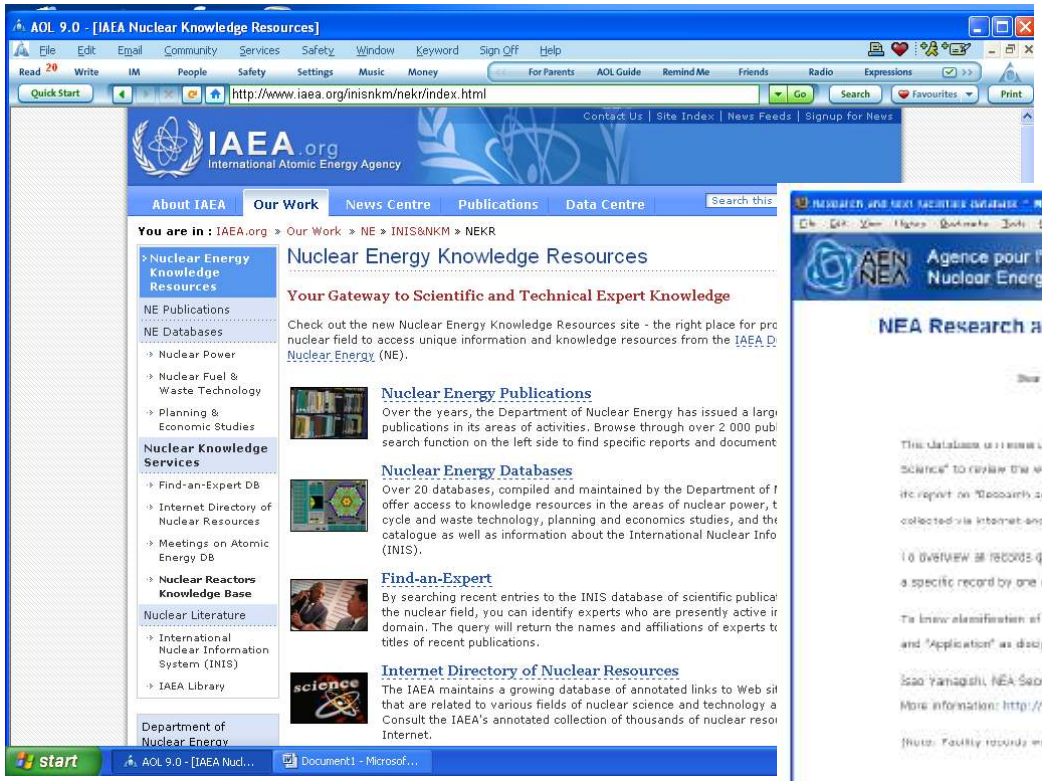
SNE-TP = Sustainable Nuclear Energy Technology Platform – http://www.snetp.eu/

IGD-TP = Implementing Geological Disposal of Radioactive waste - http://www.igdtp.eu/

Need for new skills in the nuclear field

Warnings since 2000 from IAEA, OECD/NEA and European Commission

http://www.iaea.org/inisnkm/nkm/



http://www.nea.fr/rtfdb/public

Nuclear Safety Directive
(Brussels, 25 June 2009)
(= binding !)

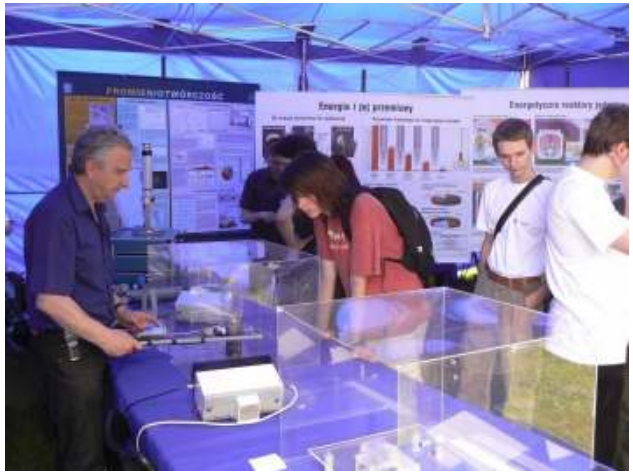
"Skills in the nuclear field"

"*Expertise and skills in nuclear safety"* in "Article 7":

"Member States shall ensure that the national framework in place requires arrangements for education and training to be made by all parties for their staff having responsibilities relating to the nuclear safety of nuclear installations in order to maintain and to further develop expertise and skills in nuclear safety."

http://register.consilium.europa.eu/pdf/en/09/st10/st10667.en09.pdf

3. Euratom policy for Education
(knowledge creation – higher level education)



Education: general principles (how to match supply and demand of knowledge ?)

- **MODULAR COURSES AND COMMON QUALIFICATION APPROACH**
  (offer a coherent evaluation framework for the proposed modules and select only top-quality for qualification)
- **ONE MUTUAL RECOGNITION SYSTEM FOR MASTER GRADES**
  (e.g. European Credit Transfer and accumulation System /ECTS/of ERASMUS across the Member States and beyond)
- **MOBILITY FOR TEACHERS AND STUDENTS ACROSS THE WORLD**
  (prepare the "internal market" for free circulation of experts and share the common nuclear safety culture)
- **FEEDBACK FROM "STAKEHOLDERS" (SCIENTIFIC AND FINANCIAL)**
  (involve the "future employers", in particular, in innovative academic programmes at master and Ph.D. level)

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The ENEN Association

A non profit international organization established on September 22, 2003 under the French law of 1901.

Mission

The preservation and further development of higher nuclear education and expertise in all areas of nuclear fission and radiation protection (education and training)

(As of March 2009, ENEN counted 50 university members, 7 research centres and 1 industrial company + many MoU's

Website = http://www.enen-assoc.org/)

"National European Nuclear Networks" and Internat'l Networks + Euratom NCPs

Some examples of national networks (non exhaustive):

- **NTEC** / Nuclear Technology Education Consortium (11 establishments) – lead by the Dalton Nuclear Institute in the UK
- **INSTN** / Institut National des Sciences et Techniques Nucléaires (CEA) - lead by Ministries in charge of Education and Industry in France
- **BNEN** / Belgian Nuclear Education Network (all "nuclear" universities) - hosted at SCK-CEN Mol in Belgium

+ collaboration with international networks world-wide (e.g. IAEA):

- **WNU** / World Nuclear University / an initiative of the World Nuclear Association under the umbrella of IAEA, launched in September 2003 (secretariat London)
- **ANENT** / Asian Network for Education in Nuclear Technology / IAEA, 2004

+ collaboration with network of National Contact Points (Euratom NCPs)

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

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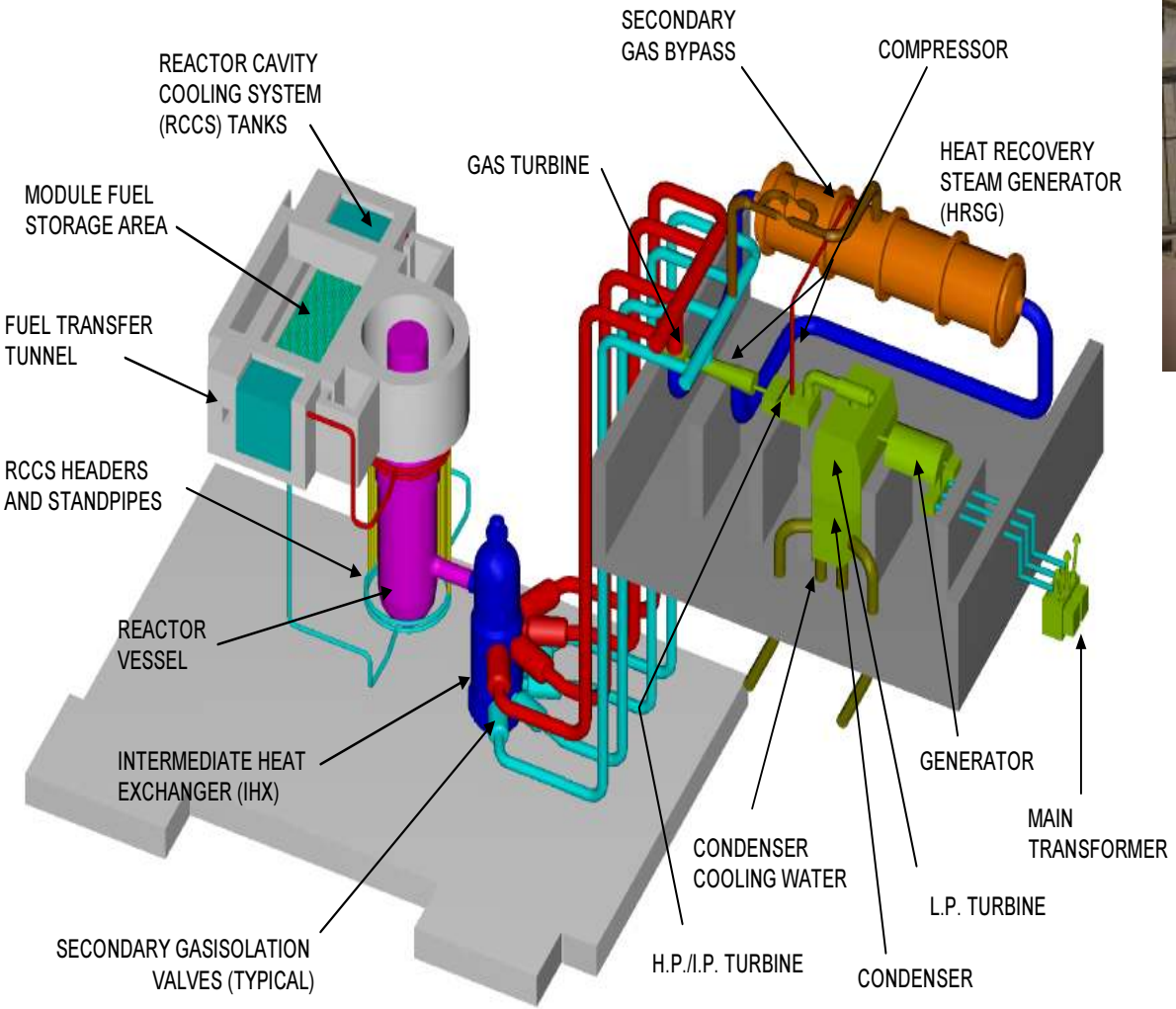
4. Euratom policy for Training
(competence building – higher level job requirements)



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Training: general principles
(how to match "supply" and "demand" of competences ?)

UK: - K = knowledge and understanding
- S = skills and behaviour

FR: - knowledge ("savoir")
- know-how ("savoir faire")
- behaviour ("savoir être")

1 – identify the competences required by the stakeholders and propose a competence building process at EU level

2 – mutual recognition framework for "competences" (e.g. ECVET in synergy with SNE-TP, MELODI, IGD-TP)

3 – mobility of trainers and trainees across the EU

4 – involvement of "end-users" and/or above EU platforms (e.g. future employers should have their say in the process)

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Towards a nuclear "Competence Passport": Euratom Fission Training Scheme (EFTS)

- The objective is to establish a Training Scheme which covers the structuring, organisation, coordination, mutual recognition and implementation of training in cooperation with local, national and international training organisations, to provide training courses and sessions at the required level to professionals in nuclear organisations or their contractors.
- Accreditation at EU level: ECVET ?

  (= EU Credit system for Vocational Education and Training)

To establish a common certificate ("competence passport") for professionals at EU level

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Example of AREVA: competences required by an integral system supplier

AREVA UNIVERSITY
Powering Your Talents

7 métiers techniques

couvrant 21 domaines

ordre 2007	METIERS AREVA	Code 2007	DOMAINES AREVA
25	MINES	M1	Géologie
26		M2	Mines
27	R & D	R1	Recherche
28		R2	Développement
29	GESTION de PROJET & AFFAIRES	G1	Pilotage PROJET & AFFAIRES
30		G2	Support Projet
31		G3	Gestion de Projet
32		G4	Gestion d'Affaires
33	INGENIERIE	T1	Pilotage Ingénierie
34		T2	Ingénierie de Conception
35		T3	Ingenierie de Réalisation
36	INTERVENTION & CHANTIERS	V1	Intervention & Chantiers
37	PRODUCTION	P1	Pilotage Production
38		P2	Méthodes de Production
39		P3	Soutien de Production
40		P4	Exploitation d'installations
41		P5	Fabrication
42		P6	Contrôle Qualité Produits
43	MAINTENANCE DE PRODUCTION	E1	Pilotage Maintenance de Production
44		E2	Methodes et Développement Maintenance
45		E3	Maintenance

Observatoire des métiers 2007

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Example of GEN III and IV engineering: competences required by system suppliers

ENEN III Project *(*EFTS 2008 *for Reactor Engineering*)

- **Four training schemes**
  - **Basic Nuclear Topics for Non-Nuclear Engineers**
  - **Design Challenges for Generation III NPP**
    - **2 professional profiles**
  - **Construction Challenges for Generation III NPP**
    - **2 professional profiles**
  - **Design Challenges for Generation IV Reactors**

    (e.g. System and Process Engineering, Safety Analysis Evaluation, HVAC Project Implementation, I&C Engineering).

- **Partners**
  - **ENEN, SCKCEN, UCL, TKK, LUT, INSTN, AREVA, ISAR, BME, CIRTEN, DUT, UPB, UL, JSI, TECNATOM, UNED, UPM, UPC, SULTAN**

- **Specifics**
  - **2 years duration, 50 persons trained, budget 2 Mio €**
    EC funding requested 1 Mio €

Example of "Radiation Protection Expert" : competences required by safety authorities

ENETRAP II Project *(*EFTS 2008 *for radiation protection*)

Primary focus: framework (demand ⇔ supply) enabling the development of the competences required for *Qualified Experts in Radiation Protection*

- legal basis ("demand"): Euratom legislation on *Basic Safety Standards* (96/29/EURATOM)

- develop *EU Reference Standards* for education and training in radiation protection + subsidiary objectives relating to mutual recognition

- definition for a "Radiation Protection Expert" (RPE), effectively replacing the current concept of a "Qualified Expert" (QE).

-"RPE Recognition" : forthcoming revision to the *Basic Safety Standards*

-specific task within the ENETRAP II project : establish the *requirements* for the recognition of the RPE (first by National Authority and then at EU level)

(ENETRAP II website at http://enetrap2.sckcen.be/)

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Example of Geological Disposal: competences required by radwaste agencies (1/2)

PETRUS II Project (EFTS 2008 *for Geological Disposal*)

- Site Investigation Design and Management
- Underground Construction
- Repository and Engineered Systems Design
- Above Ground Waste Handling Facility Design/Operation
- Underground Systems Engineering (Waste Handling)
- Operational and Post-Closure Safety

Science & Technology Passport

- Stakeholder Management/PR and Communication
- Project Management
- Legal and Economic

Management Passport

- Radiation Protection
- Repository Operation Technician

Operator Passport

PETRUS

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Example of Geological Disposal: courses supplied to meet the above requirements (2/2)

PETRUS II Project *(*EFTS 2008 *for Geological Disposal*)

Training Courses that are available – Science and Technology Passport

- Natural Analogues (Ecole des Mines de Nancy)
- From Surface Based to Underground Site Characterisation (ITC School)
- Petrology and Geochemistry of rocks relevant for final disposal (TU Clausthal)
- Numerical Modelling (Cardiff University)
- Microbial and Disposal of Radioactive Waste (Microbial Analytics Sweden AB)
- Introduction to the fundamentals of safety assessment in GD Safety (Posiva Oy)
- Assessment of DGR (RAWRA)

Training Courses that are available – Management Passport

- Staged Decision Making and Stakeholder Involvement (ITC School)
- Feasibility Studies and Cost Estimation of DGR (RAWRA)

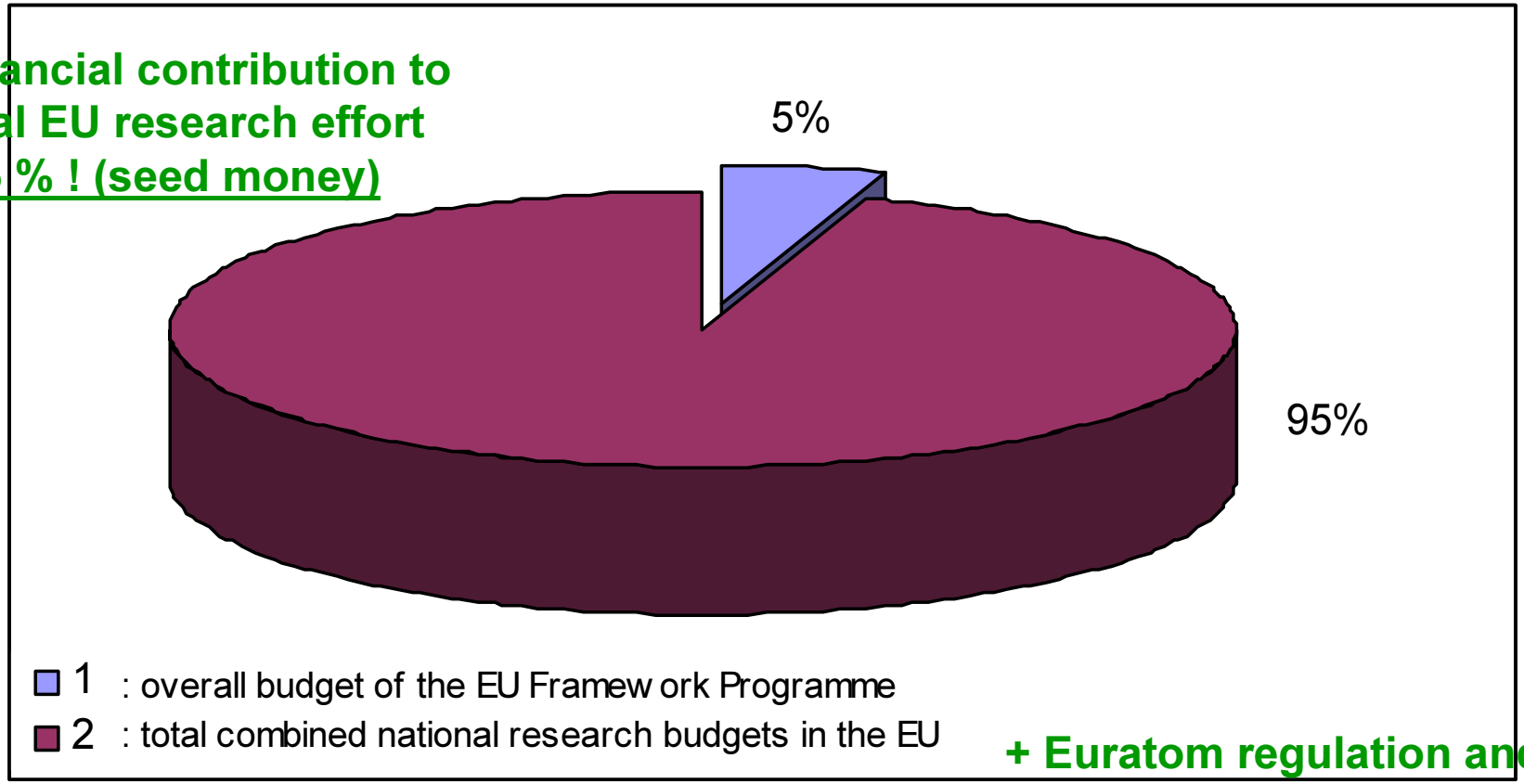
Training Courses that are available – Operator Passport

- Safety and Radiological Protection (NTI)
- Repository Operation, Construction and Operation (ITC School)

PETRUS

5. Conclusion: EC contribution to the global effort

EC financial contribution to global EU research effort
= 5 % ! (seed money)



+ Euratom regulation and financial incentives (e.g. EIB)

How to better coordinate the national research and training budgets in nuclear fission and radiation protection ?

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More info…

- **Cordis Euratom fission home page ("find a call"): http://cordis.europa.eu/fp7/euratom-fission/home_en.html**
- **EU research: http://ec.europa.eu/research/**
- **Seventh Framework Programme: http://ec.europa.eu/research/future/index_en.cfm**
- **Information on FP7 and access to programmes and calls: http://cordis.europa.eu/fp7/home_en.html**
- **EU nuclear policy (including text of Safety Directive): http://ec.europa.eu/energy/nuclear/index_en.htm**
- **SET-Plan: http://ec.europa.eu/energy/strategies/2007/2007_11_low_carbon_future_en.htm**

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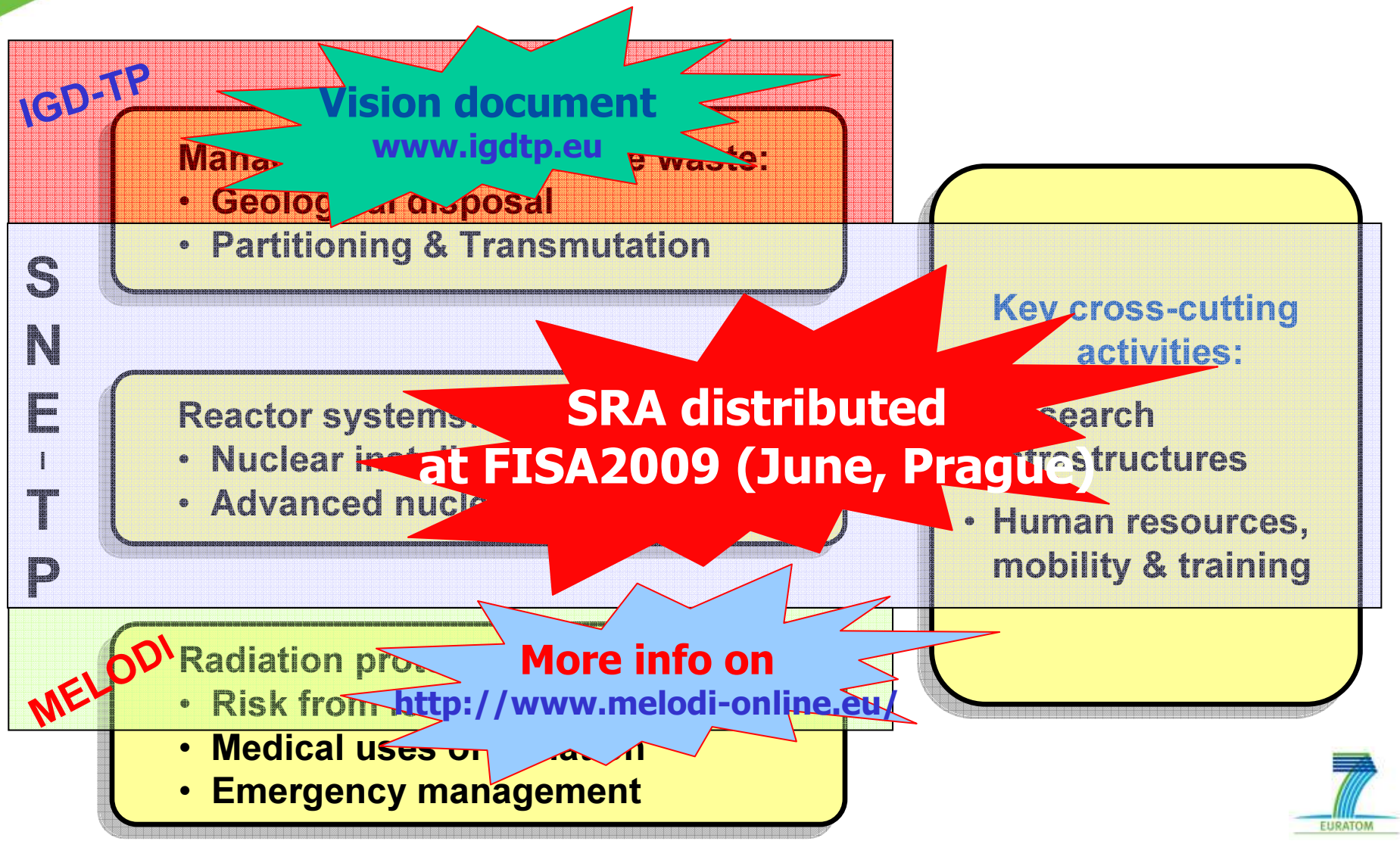
Euratom FP7
fission & radiation protection



FISA conference – 22-24 June 2009, Prague

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

FISA2009

Prague,
Czech Republic
22 > 24 June 2009

Seventh European Commission conference on
Euratom research and training in reactor systems

EU2009.CZ

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