

**Seminar on neutron research centre in the Øresund region  
(European Spallation Source)**

29 November 2002

**ESS, P&T and EU**

**What is the impact of ESS and P&T on EU 's energy policy?  
On EU-financed research?**

**Yves Marignac, Assistant Director, WISE-Paris**

## **The issue of ESS and P&T research inside the EU**

### **Current status of nuclear energy in the EU**

Nuclear energy in Member States – Euratom and the Commission  
Accessing countries – Euratom reform – The “Nuclear Package”

### **Current status of long-lived waste management in the EU**

Spent fuel management in Member States – R&D programmes  
Roadmap to ADS – Project directive on nuclear waste management

### **Current status of European-financed R&D**

EU Framework Programme – The ESS project

### **ESS and the P&T programme in this framework**

Justification – Alternatives – Cost and impact

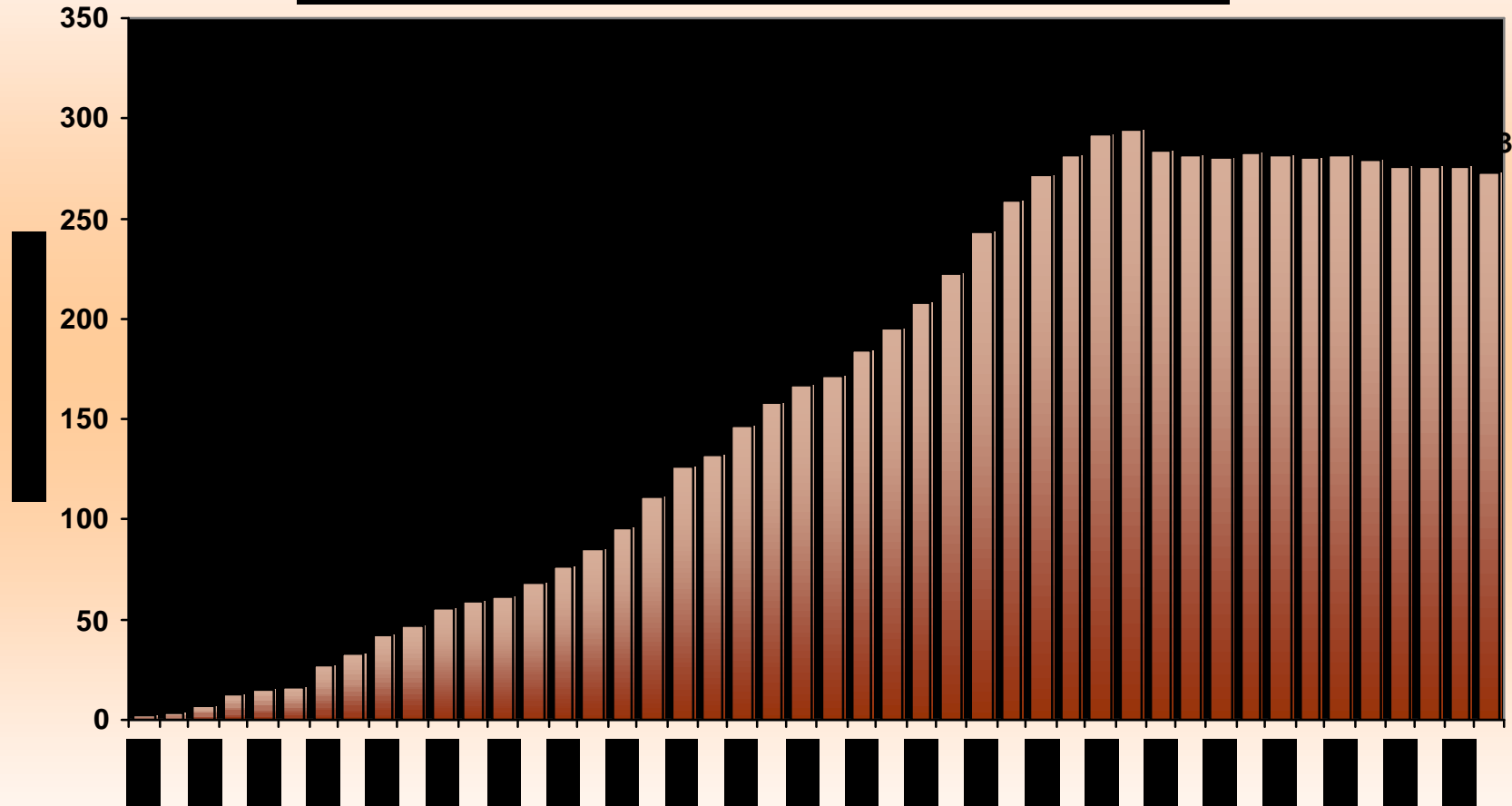
## Nuclear energy in the EU

- **A very contrasted situation in Member States but:**
  - 7 out of 15 countries don't operate nuclear power plants
  - 5 out of the 8 that operate nuclear power plants have decided either a moratorium or a phase-out
  - only 1 of the 3 that leave the option open has announced a new construction project
- **The role of nuclear energy today and in the future**
  - 124 operating reactors but clear tendency: decline
  - 35% of electricity consumption inside EU but tendency: decline
- **In line with international situation and tendency**

## Current status of nuclear energy in Member States

COUNTRY	NUCLEAR REACTORS (POWER PLANTS)			POLITICAL STATUS
	Operating	Shut down	Construction	
<b>Austria</b>	Started one construction then cancelled (1978)			No nuclear programme
<b>Belgium</b>	7 (6ZGW)	1	None	Phase-out decision 2001
<b>Denmark</b>	Never started a nuclear programme			No nuclear programme
<b>Finland</b>	4 (2,7 GW)		1 project	Project authorizedZ2002 butZnot started yet
<b>France</b>	59 (65 GW)	12	None	Decision open onZnew constructionZ(EPR)
<b>Germany</b>	19 (22,4ZGW)	18	None	Phase-out law 2000
<b>Greece</b>	Never started a nuclear programme			No nuclear programme
<b>Ireland</b>	Never started a nuclear programme			No nuclear programme
<b>Italy</b>	None	4	None	Phase-out decision (referendum in 1987)
<b>Luxemburg</b>	Never started a nuclear programme			No nuclear programme
<b>Netherlands</b>	1 (0,5 GW)	1	None	Moratorium in 1994 ButZclosureZpostponed
<b>Portugal</b>	Never started a nuclear programme			No nuclear programme
<b>Spain</b>	9 (7,8 GW)	1	None	Moratorium in 1984
<b>Sweden</b>	11 (9,8 GW)	2	None	Phase-outZdecisionZinZ1980 but only 1Zreactor closed
<b>United Kingdom</b>	33 (13,5 GW)	12	None	Plan to close oldest NoZplanZforZreplacement
<b>TOTAL</b>	<b>124</b>	<b>51</b>	<b>1 project</b>	

**Western Europe and North America  
Nuclear Reactors in Operation from 1956 to 2001**



Source: PRIS, CEA 1998, ATOMWIRTSCHAFT, IAEA 2001

## Nuclear energy at European Union level

- **Euratom Treaty:**

- clear goal of “promotion” of nuclear energy
- implemented a framework that strongly backed the large scale development of nuclear industry, including: economic distortion, regulatory adapted framework and large R&D support from EU

- **Green Paper on “Security of Energy Supply”:**

(issued by European Commission in Nov. 2000)

- underlines the role of nuclear energy in the EU security strategy
- identifies one key condition: solution to the waste management problem
- clearly defines other fields than nuclear energy as the top priorities: developing renewable energies and energy efficiency

## Main political issues regarding nuclear energy and the EU

- **Accessing countries:**

- 7 of the 12 candidate countries have a total of 22 nuclear reactors, of which 20 are of Soviet design
- it may “tilt” the balance of nuclear energy support inside EU
- but it raises strong concerns about nuclear safety

- **Euratom reform needed:**

- it created political and economical conditions favouring nuclear energy
- but it failed to develop a control over issues such as safety and waste
- and this will get worse as the european energy market gets more open

- **European Commission “Nuclear Package”:**

- harmonization of nuclear safety standards
- need to progress on the waste management policy with clear priority to geological disposal (including a time schedule)

## Waste (spent fuel) management policies in EU Member States

- **Only some countries concerned or a concern for all countries:**
  - Principle: each country is responsible for the management of the waste it produces
  - but because of the long-lived nature of the waste, a problem to all through future generations
  - and because the potential large-scale dispersion of some nuclides, a regional or even global threat
- **Various progress in spent fuel/HLW waste management but:**
  - no final solution implemented in any of the Member States yet
  - a move from reprocessing to direct disposal
  - geological disposal seen as unavoidable in most of the countries
  - most advanced decision process in countries with a clear direct disposal strategy
- **Various efforts in R&D for geological disposal and P&T**



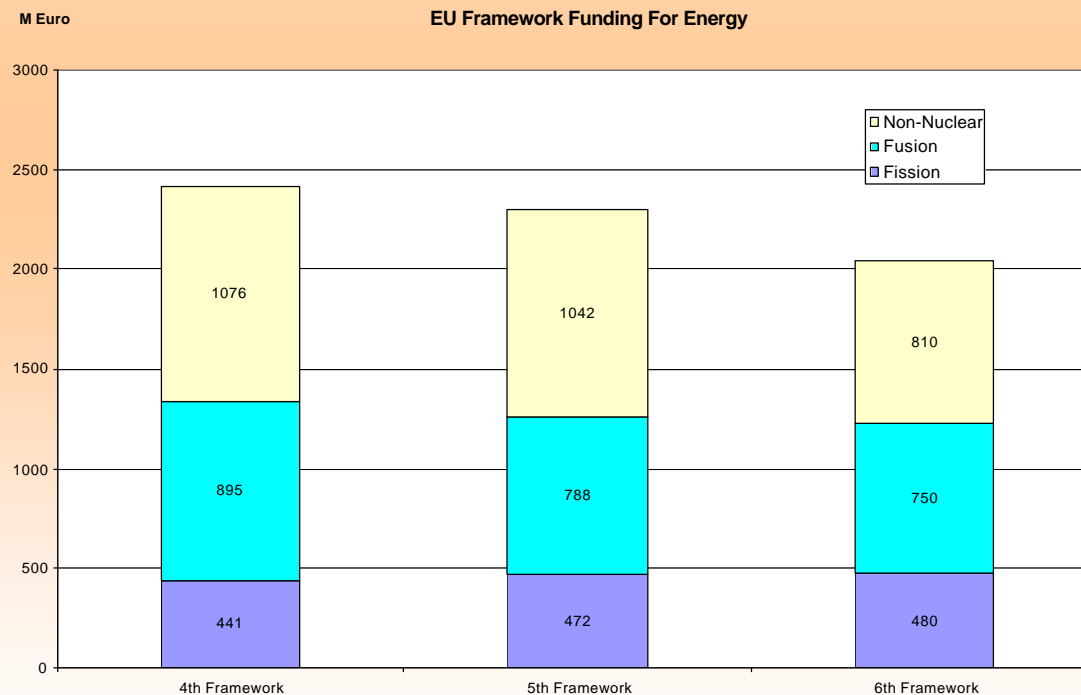
## European Union R&D

- **Framework Programmes (since 1984):**
  - 5 years programmes with 1 year overlapping
  - implemented by the Commission after adoption by Council and Parliament, no “national quotas” by Member States
  - next programme FP-6 starting in 2003
  - main focus of FP-6: “creation of a true European Research Area” including the specific goal of developing “research infrastructures”
- **A very important budget:**
  - Euros 17.5 billions for FP-6
  - ie 4% of the overall EU budget
  - 5.4% of all public (non-military) research spending in Europe

## European Union R&D on energy

- **High budget for nuclear energy through Euratom**

- 7% of the FP-6 budget, ie Euros 1,230 million, spent on nuclear research
- fission and fusion get 50% more funding than all other energy sources
- support to JRC (Joint Research Centre), about 50% on nuclear research



## European Union R&D on nuclear waste

- **R&D budgets on partition & transmutation**

- approx. 30 million Euros to R&D on transmutation in 2000-2001 (FP-5)  
ie about 15 million Euros by year
- A total of 90 million Euros devoted to all waste management in FP-6

- **The “road to transmutation”:** ADS

- 13 R&D projects funded under FP-5
- project of one infrastructure - Accelerator Driven System
- 3 strategies: double stratum, single stratum, phase-out
- “the most effective” is double stratum
- Alternatives: upgrading of existing facilities (ILL, ISIS)  
or increased participation in external projects (US - SNS, Japan - JNS)

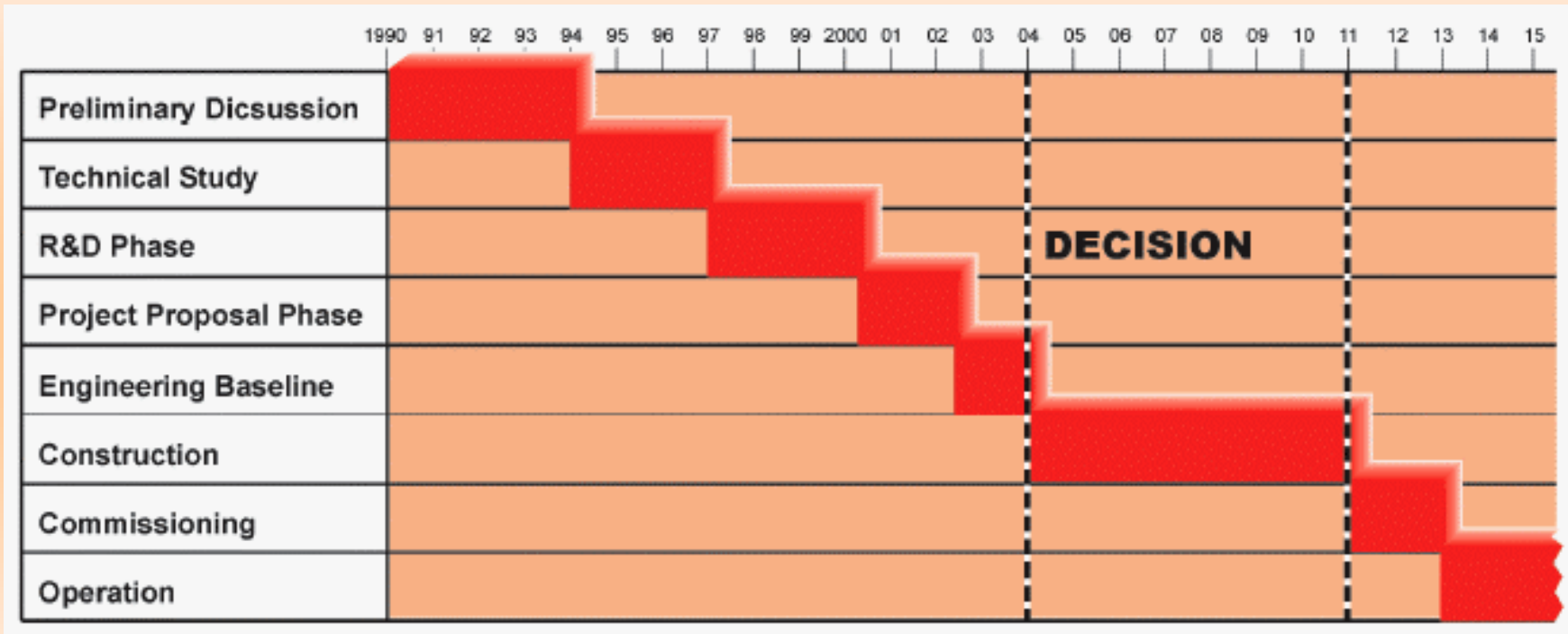
- **But new priority given to geological disposal by the EC**

- with time schedule that does not allow for P&T implementation

## ESS and/or ADS project(s)

- **The ESS project:**
  - officially not for P&T
  - current design not suitable for P&T
  - however, the basic design is flexible and fulfills the requirements for P&T implementation
- **The ESS and ADS projects:**
  - same timetable
  - same order of budgets
- **ESS not (only) devoted to P&T:**
  - may benefit from more budget lines in FP-6 (and following programmes) than ADS, while P&T line is not enough for financing ADS
  - but unlikely that EU financing goes in both projects

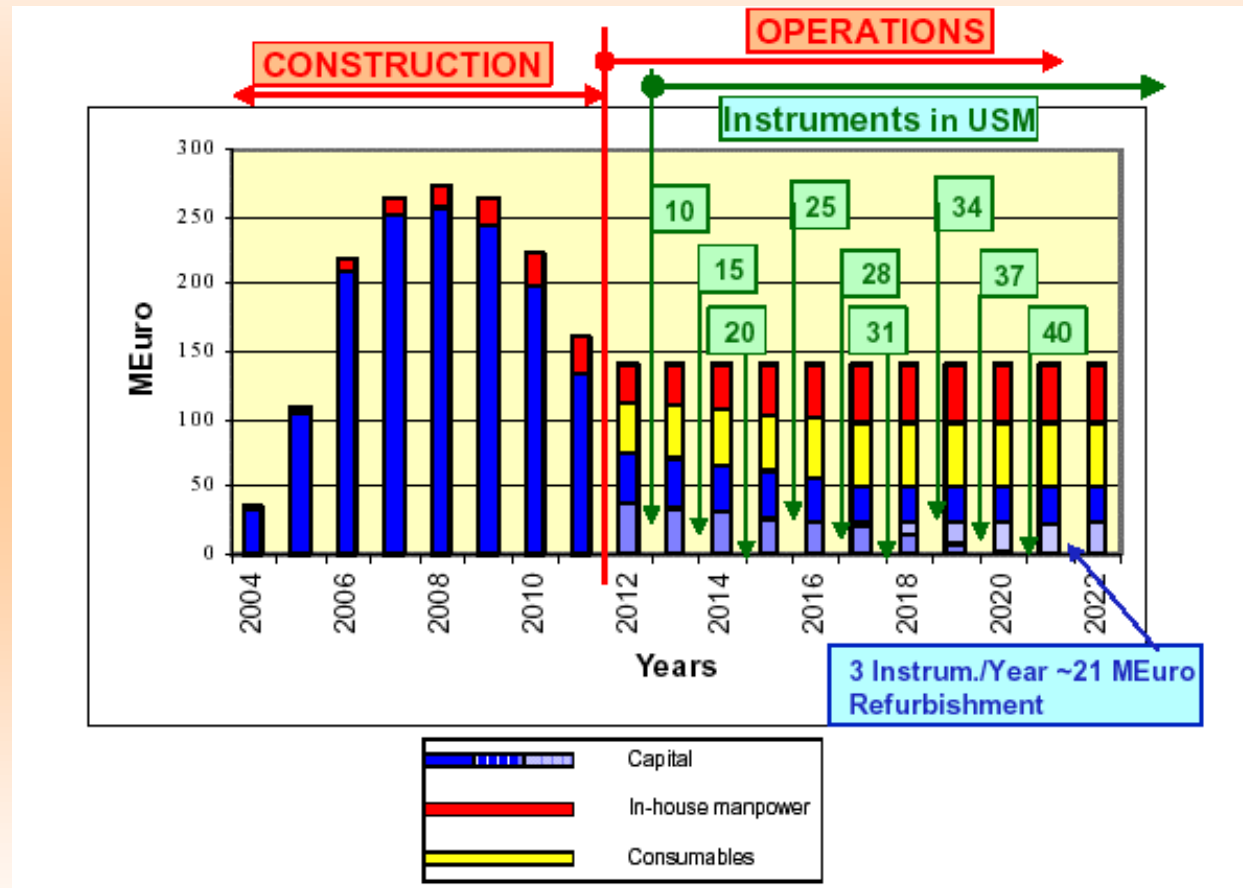
## ESS and/or ADS project(s)



## ESS and/or ADS project(s)

Year 2000+	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	20	30	45
	5 <sup>th</sup> FWP		6 <sup>th</sup> FWP				7 <sup>th</sup> FWP											
<b>ADS (Phase 1)</b>																		
Basic & Supporting R&D																		
Choices of Options																		
Design & Licensing																		
Construction																		
Low power testing																		
Full power testing																		
Operation																		
<b>ADT (Phase 2)</b>																		
Conversion																		
Operation																		
<b>Prototype</b>																		
<b>Industrial Deployment</b>																		

## ESS and/or ADS project(s)



## ESS and/or ADS project(s)

Year 2000+	1	2	3	4	5	6	7	8	9	10	11	12	Total
	5 <sup>th</sup> FWP		6 <sup>th</sup> FWP				7 <sup>th</sup> FWP						
Basic & Support R&D	30		90				70			10		200	
Engineering Design	5		75				60			10		150	
Construction	0		80				300			70		450	
Fuel	0		10				120			50		180	
<b>Total</b>	<b>35</b>		<b>255</b>				<b>550</b>			<b>140</b>		<b>980</b>	
<i>R&amp;D for Dedicated Fuel</i>	<i>5</i>		<i>70</i>				<i>70</i>			<i>35</i>		<i>180*</i>	

\* Estimated cost to 2012 for development of dedicated fuel & fuel processing



## **ESS and/or ADS project(s) : the justification case**

- **Basic principle: scientific community interest is not enough**
- **Need to look at:**
  - **Direct costs, direct benefits and alternatives**
  - **Indirect costs**
  - **Direct and indirect impacts**
  - **Systemic effects in other fields**
- **These issues have to be discussed before any new step in ESS and/or ADS implementation**