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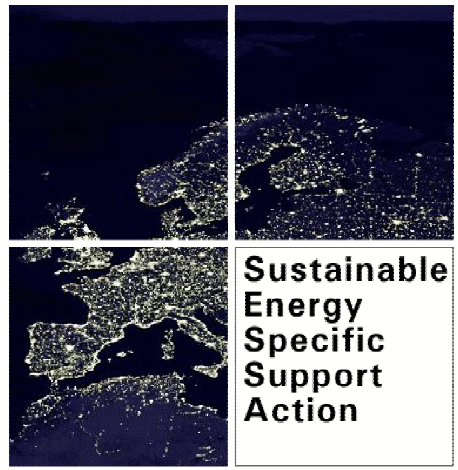

Pros and cons of nuclear industry : vision II

Franco Romerio

CUEPE

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1. Problem

Does nuclear energy represent an option for sustainable development ?

2. Approach

- Risk
  - Identification, attitude and management
  - Major risk (disaster)
  - Environment, health
  - Electricity supply
- An interdisciplinary analysis
- Nuclear industry between the past and the future

3. Paradigms of energy policy

- An energy policy paradigm
  - To reduce the energy dependence of Western countries
  - Through the development of nuclear energy
  - … and the increase of the electricity share in the national energy balance

- A paradigm
  - Defined in the 50s
  - Destabilized by the antinuclear opposition and the problems encountered by the nuclear sector itself
  - Resumed in the 90s by the discussions on climate change
- We can’t subscribe this paradigm without discussing
  - The risks brought about by nuclear energy
  - Past failures

4. Programmes *versus* realisations

Western Europe

Programme defined in	Already set up	Programmes for the years							
		1975	1980	1985	1990	1995	2000	2010	2020
1956	< 1	33							
1960	< 1	10-35							
1966	6	40	90						
1970	10	34-42	79-118	142-263					
1973	16		73-85	155-204	280-448				
1975	19		65-79	165-212	262-380		409-804		
1978	26			107-146	195-273	**260-418**	310-560		
1979	41			100-113	165-209	224-291	275-407		
1982	47				142-158	171-219	223-317	329-557	421-803
1986	77				121	140	172		
1992	118					124	130	131	
1996	121						128	120-122	
2001	126							101 f	92-99
Realisations	19	47	92	120	121	**123**	126		

5. Appearances *versus* realities

- Studies carried out by the nuclear sector
  - Wishful thinking
  - Reassuring attitude
  - Lack of transparency
- Gaps between the “reality” and the “objectives”
  - Nuclear safety, production costs, market penetration, etc.

Example

- In England, the CEGB recognised that the variables used to estimate the production costs had “the nature of targets”
- The Select Committee on Energy criticised the figures produced by the CEGB : “difficult to follow, inadequately presented and based on questionable and often unspecified assumptions”
- In France, Ailleret (EdF) pointed out that a “sub-conscious mechanism… leads us to choose the combination of parameters which fixes a competitive cost”

6. Critical problems

- Problems (risks)
  - That largely contributed in preventing nuclear development in the past
  - That may cause new short-circuits in years to come

a) Health effects of ionizing radiations

- Risk of cancer, leukaemia and genetic malformations
- Controversial problem
  - Radioprotection is based on both scientific studies and on appreciations of an ethical, socio-economic, military nature
  - Relatively high margins of uncertainty
- An important source of uncertainty for the future of nuclear industry

b) Reactors safety

- Probability of occurrence of a major accident (with core meltdown)
- Controversial issue
  - Possible impact of “common mode failures”, human behaviour and other critical factors on the security systems
  - Doubts on the robustness of very low probabilities of occurrence
- Major risk represents a Damocles sword hanging over nuclear energy’s future

c) Radioactive wastes disposal

- Risk represented by the fission products and actinides
- Controversial issue
  - Vulnerability of the repository systems (radionuclides migration, rock fractures filled by water, human intrusions)
  - Validation of the hypotheses on the repository behaviour over centuries
- How to be serene towards future generations?

d) Proliferation and terrorism

- Growing concern for many countries
- Risk of proliferation
  - Presence of plutonium stocks of civil and military origin, of which part could be (or already has been) lost from control
- Risk of terrorist attacks
  - Some nuclear installations equipped with ground-to-air missiles following September the 11th

e) Returns

- Economic risk (market prices, costs, returns)
- Nuclear energy *versus* CCGTs
  - Capital intensity, impact of the discount factor, pay-back time, flexibility
  - Fuel, prices, scarcity
- Cost of plant decommissioning ?
  - Nuclear history of unfulfilled expectations
- Difficult for nuclear to be profitable, in particular in competitive markets

f) Nuclear energy market share

- Risk to promote electricity consumption, against efficiency programmes, in order to facilitate nuclear power's penetration into the market
- This strategy was developed in several countries in the 70s
- It is inconsistent with sustainability

g) Nuclear energy's social acceptability

- Subjective attitude towards risk
  - A very important factor to understand the opposition against nuclear energy
  - We should study mental processes and intrinsic motivations, which influence the individual and social behavior – emotions, memories, perceptions *(cf. prospect theory)*
- Other sources of uncertainty, at least in democratic countries

7. Perspectives

- Nuclear energy provokes considerable risks, major risks are inevitable
  - Fossil fuels also provoke major risks

    (CO_2 sequestration and disposal is no less complex than that of nuclear wastes)
  - Energy efficiency is not free, its potential is insufficient
  - Similar problems with new renewable energy in the near future

Therefore

- The nuclear option is acceptable
- We would like to recommend its abandon, but it is not possible

However

- No more the very ambitious nuclear programs of the 70s !
- We need diversification and flexibility
  - Diversification = creation of well balanced portfolios (efficiency measures included)
  - Flexibility = possibility to adapt choices in accordance with evolutions in uncertainties
- This approach facilitates the search for a compromise between different energy policy conceptions

However

- No more wishful thinking, lack of transparency and evaluations carried out by experts of questionable independence !
- As stated by Marie Angèle Hermitte:

  “Expertise must be organised in such a manner that controversies and contradictions are manifest and that officials can make decisions with their consideration”

8. Conclusions

- Nuclear energy might represent an option for sustainable development as long as it is used with a great deal of precaution
- We should not underestimate the risks, which are spread over hundreds of years (also the subjective attitude towards risk)
- We should demand the greatest transparency and the implication of independent experts

A New « SESSA » on Nuclear Energy and its Alternatives ?

Franco Romerio
University Center for the Study of Energy Problems (CUEPE)
University of Geneva

Route de Drize 7
CH - 1227 Carouge – Geneva – Switzerland
Tel. 0041- 22 - 3790653
franco.romerio@cuepe.unige.ch

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