



UNIVERSITÉ DE GENÈVE

# Nuclear energy, an option for sustainability ?

Franco Romerio  
CUEPE

# Content

1. Problem: nuclear energy and sustainability
2. Perspectives: short and medium term
3. Perspectives: long term
4. Conclusion: renaissance of nuclear energy

“Doubt as to one’s own opinions and the respect of others’ are the pre-condition of any real progress in science”  
(Maurice Allais)

# 1. Problem

Does nuclear energy represent  
an option for “sustainability” ?

# Nuclear dilemma

- Nuclear energy brings about major risks
- Very controversial issues
  - Health and environment
  - Reactors safety
  - Radioactive waste disposal
  - Terrorism and proliferation
  - Financial viability
  - Social acceptability

# Nuclear dilemma

- Nuclear energy can contribute
  - To meeting the electricity consumption's growth in developed and developing countries
    - See development of China and India
    - See tensions on the European electricity market
  - To reducing CO<sub>2</sub> emissions
    - A global threat

# Nuclear dilemma

- What to do ?
  - To abandon nuclear energy because of the risks?
  - To accept it because its contribution to CO<sub>2</sub> reduction and energy supply?
- My point of view
  - One shouldn't abandon nuclear energy, at least in the short and medium term
  - Nuclear energy represents an “unfortunate necessity”

## 2. Perspectives

Short and medium term

# Transitional technology ?

- Nuclear energy should represent a transitional technology
  - Like combined cycles gas turbines (CCGTs)
  - A technology for the short and medium term
  - Waiting for the take-off of the renewables, which are not yet able to bridge the gap between demand and supply
- Meaning of “transitional”
  - 2050 ? 2100 ? ... ?



# Energy mix

- One should create an appropriate energy mix
- Diversification and flexibility should be promoted
  - To create well balanced portfolios (including nuclear energy and renewables)
  - To be able to adapt choices in accordance with evolutions in uncertainties
- There is no other way to manage the risks

# Energy mix

- The potential of nuclear energy should be stressed
- Ex. scenario conceived by MIT (2003) :
  - 1000 reactors (1000 MW each) worldwide by 2050
  - This represents **19%** of the **electricity generation**
  - This allows reducing the anthropogenic carbon emissions by **15%**

# Measures

- New investments in nuclear energy depends on different factors :
  - Market design (CO<sub>2</sub> tax or certificates ... )
  - Acceptability (a new deal, transparency ... )
  - Waste disposal (international, appropriate options ... )
  - Terrorism and proliferation (international collaborations ... )
- Measures must be taken

# Generation III/III+

- Evolutionary design offering improved economics and safety for near-term deployment
  - Ex. Finland, EPR, Olkiluoto 3
- To avoid any misunderstanding
  - “We have not found and... do not believe it is realistic to expect that there are new reactor and fuel cycle technologies that simultaneously overcome the problems of cost, safety, waste, and proliferation” (MIT, 2003)

# 3. Perspectives

Long term

# Abandon ?

- In the long term, we should
  - Envisage the abandon of nuclear energy
  - Aim for the development of renewable energy, rational use of energy, changes in lifestyles

# Generation IV

- Should we invest in R&D for Generation IV (~2040) ?
- Targets
  - Nuclear power plants highly economical, safer, proliferation resistant, minimal waste
- Experience
  - Very slow progresses since the 90s
  - Another failure, like breeder reactors in the 60/70s ?

# Generation IV

- The opportunity cost of R&D should be carefully evaluated
- One shouldn't kill options, but one should discriminate
- How does a decision concerning the “long term” impact on the “short/medium term” ?



“In Anbetracht der notwendigen Innovationstiefe und des Umfanges dieser Aufgabe ist klar geworden, dass die Ziele für eine erfolgreiche Zukunft der Kernenergie nur erreicht werden können, wenn grundsätzlich neue Konzepte umgesetzt werden, wenn heute mit den notwendigen Forschungs- und Entwicklungsarbeiten begonnen wird, wenn die Arbeiten international bzw. global koordiniert vorangetrieben werden, und wenn die Ressourcen fokussiert eingesetzt werden.”

(Paul Scherrer Institut, 2005)

## 4. Conclusion

Renaissance of nuclear energy ?

- Nuclear energy may contribute to the “sustainable development” in the short and medium term
- It represents a transitional technology
- In the long term, it is possible to envisage its abandon

Like “Renaissance” which represented the *transitional movement* in Europe between the 14<sup>th</sup> and the 17<sup>th</sup> century, “Nuclear renaissance” will likely consist in a *technological transition* between the 20<sup>th</sup> and the 22<sup>th</sup> century.

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  
[www.unige.ch/cuepe](http://www.unige.ch/cuepe)  
[franco.romerio@cuepe.unige.ch](mailto:franco.romerio@cuepe.unige.ch)

“Renaissance der Atomenergie in Europa ?”  
Technische Universität Wien  
10.10.2006