Nuclear Energy and Sustainable Development : *criterions and indicators*

Benjamin Dessus – Global Chance
Yves Marignac – WISE-Paris

Two main principles for this rapid overview

- I - For the time being Nuclear Energy is far from being compatible with the objectives of SD (sustainable development)
- II - At the same time , nuclear energy is not « congenitally »and definitely condemned to remain incompatible with sustainable development.
- Why these two *petitio principii*?
- If the first one is not accepted there is no reason to dictate any limitation to the development of nuclear (but the depletion of fissile fuels), and if the second is not accepted there is no future at all for nuclear.

If accepted, these two assumptions give us the opportunity to formulate three questions :

- I - What kind of criterions for achieving compatibility with SD?
- II - How and with whom discuss democratically of theses criterions?
- III - What way and what steps define to progress in the right direction towards the final goal?What kind of indicators to estimate that progression?

Main topics about Nuclear and SD

- I - The **contribution to development** (human and technical investment step, unit size, etc.)
- II - The **global and local environment** concerns (major accident risks, long life high activity nuclear waste, decommissioning, etc.)
- III - The **security** concerns (proliferation and terrorist threats, etc.)

I - The contribution to development

- Main impediments for developing countries
- I - **Technical capacity building** . The appropriation of the whole technology implies a very heavy human, technical and scientific investment (several thousands of technicians people and engineers for decades).
- So it is probably useful to define an indicator of human capacity building investment to assess the viability of the technology for a country or a region at different times.

I - The contribution to development

- II - **Size adequation of the Plants with the electricity needs of the country and the size of the grid or/and size of the step of investment compared to the economy of the country.** This is due to the important size of present nuclear units (1,000 to 1,500 MW).
- It is probably useful to discuss an indicator to take into count the appropriate size of the plants and investment versus energy consumption and state of development of the local economy (a threshold in terms of MW and share of production)
- For industrial countries it is probably useful to define the criteria (may be in the form of a max share) for nuclear energy not to monopolise human and/or financial resources

II - The global and local environment concerns

- A - Major accident risks

- Specificity: a very weak probability (but not zero) and drastic consequences for humanity.
- The present strategies are based on an estimation of the value of the product of the accident probability multiplied by it's consequences.
- But this cannot be a satisfying strategy, since it is based on the product of an infinitely small quantity , by an infinitely big one .

A - Major accident risks

- Indeed the criterion for long term should be intrinsic safety (id est no physical possibility of a given type of accident).
- In the meanwhile it would be possible to define criterions and indicators based on the estimation of the product "vulnerability by sensitivity"
- Where :
- Vulnerability deals with the + or - potential of a given technology to be victim of a type of technical hitch (for example the core fusion)
- Sensitivity deals with the consequences attached to that technical hitch for each technology

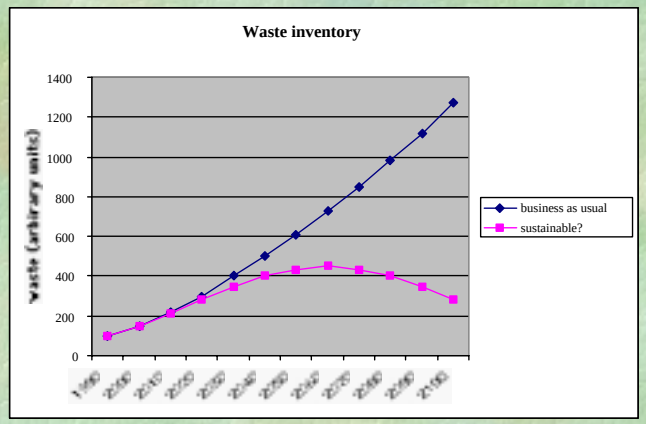
II - The global and local environment concerns

B- Long-Lived and High Level Waste (HLW) inventory

- Indeed the criterion for a long term perspective should be a zero global HLW inventory. This implies to develop *highly hypothetical* solutions which at the same time:
- Do not produce any new HLW waste,
- Are able to reduce to (almost) zero the historic HLW inventory (transmutation, etc.)

B - HLW inventory.

- Proposed strategy: as for GES, limit the world nuclear waste inventory by steps (as for GES and Kyoto).



B - HLW inventory.

- Difficulties linked to this strategy:
- The definition of an appropriate « unit » to measure the inventory is not easy - and may even prove impossible
- The reduction of the HLW inventory must not be obtained through the transfer of the risk in space or time, as HLW are only one of the multiple nuclear pollutions (discharges and waste), ranging from short term to very long term and local to worldwide populations exposures.

B - HLW inventory.

- That global limitation of the world inventory could be performed either by:
- More and more sustainable technologies (less waste by MWh)
- Less installed power
- And why not, with the possibility as for Kyoto to exchange « waste permits » between countries
- And give time for new technologies able to reduce the global inventory to emerge.

III - The security concerns

- A -Proliferation risks:
- The use, by any State or (even less likely) group of individuals, of materials, facilities, etc. of the civilian nuclear programmes to develop nuclear weapons of mass destruction.
- B - Terrorist threats:
- Risks range from a plane crash on a nuclear facility to the « dirty bomb » using radioactive material in a conventional explosive device.

A -Proliferation risks :

- Indeed the criterion of no proliferation should be the **physical** impossibility to derive weapons from the civil nuclear technology used. But this goal is perhaps impossible to achieve.
- So it is important to discuss an indicator of the specific proliferation risk degree for each technology as for the present « spent fuel standard » but extended to the whole chain from the mine to the eventual disposal of waste.

B - Terrorist threats:

- The same principles and indicators as for major accidents should be set up, based on an estimation of vulnerability and sensitivity of different technologies to these terrorist attempts.
  (unless accidents, terrorist threats can not be evaluated through probabilistic risk assessment (PRA))

Provisional conclusions and questions to answer

- **The final goal and criterions should include :**
- **1 - No major accident “physical possibility”**
- **2 - No proliferation “physical possibility”**
- **3 - A zero long-lived high level waste inventory**
- **4 - A real contribution to development**
- **They differ from the present strategies which deal mainly with the reduction of the consequences of the drawbacks induced by non fulfilling these criterions (for example the non proliferation treaty, the waste burying, the confinement walls etc.)**

Provisional conclusions and questions to answer

- These global criterions are much more difficult to fulfil :
- So it would be useful to discuss indicators which would give a dynamic information on the progress towards SD , not only on individual technologies , but at the same time on the whole world situation (taking into account the consequences of the stock of past and present technologies to the balance sheet).

Provisional conclusions and questions to answer

- The nature and the number of these indicators is a first question to discuss and propose to the democratic debate.
- If adopted , the quantitative evolution of these indicators could be discussed at different levels, from nations to UN organisations, in a process similar to the climate or biodiversity negociations, to fix the steps and the commitments necessary
- To fulfil in a long term perspective the goals of SD