

"Nuclear energy : what part of the solution for climate change?" Analysis according to an international security approach

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I am pleased to speak today at this forum as President of a consulting firm in the field of international trade and energy sector. Eurotradia leads a working group on "good practices in international trade and firms ethic" with industries and services firms. This group has been pleased to invite twice the general Secretary of the OEDC. I am also speaking as President of the economic Council of defence, a think tank which sets a dialogue between professionals of defence and other high personalities (firms, international, economic, universities, media, administrations). Within the Council, I lead since 2003 with the Professor Christian de Boissieu a working group which deals with "energy, environment and security".

After a strong development in United States, in western Europ and in "soviet Europe", electronuclear has suffered of several incidents (Three Mile Island, Tchernobyl) and has been curbed or stopped since the end of 80s because of the ecologist action. There is a confusion between electronuclear as energy source and poliferation.

Out of geopolitic tensions, the climat change effects conduct to think about a moderate contribution of electronuclear in the energy mix within the most important consumers in the world (North America, European Union, Russia, China, Japan, India, Brazil, South Africa ...)

I suggest you to analyse the subject in a particular approach : in which conditions electronuclear could contribute significantly to reduce economic, climatic and politic tensions in a future world ?

1. Geostrategy of energy (and environment) induces tensions for today and tomorrow

Some elements let us think that the evolution of the international context will bring tensions.

- **Demographic and economic growth**, in particular in China and India, induces increasing needs in energy.

- **Access to fossils resources is limited and local investments in energy project are not enough.** This situation conducts to regional tensions between regions with reserves and regions without reserves, countries which control new technologies and the others, and finally tensions in production and transit areas.
- All experts agree about **climate change as a reality**. If nothing is done, **impacts will be dramatic and irreversible** for our environment, our security and our economic growth (IECG report, Factor 4 from Christian de Boissieu, Stern's report).

If energy supply conducts to individualist behaviours, climate change is a global challenge and needs international cooperation or at least good understanding between countries.

To limit tensions, energy and technology solutions exist and should all contribute. Among technologies, electronuclear, through actual and future technology (IV generation), could bring a part of solution. Nuclear energy can respond to the increase of electricity needs, contributes to energy mix diversification and limits dependence to fossil resources. The part of nuclear energy in electricity production should be reasonable and increasing.

According to environmental challenge, electronuclear could be a good solution. Today, 25% of gas emissions and 80% of CO₂ come from energy sector. Electricity production is responsible of 40% of CO₂ emissions, as a result of coal uses.

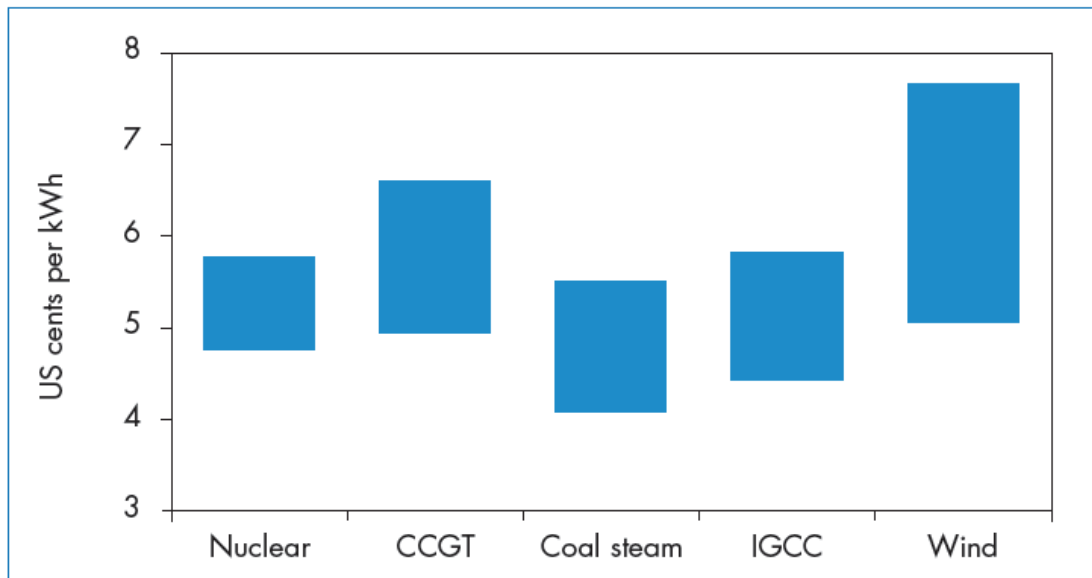
The comparison between fuels in electricity production shows that nuclear electricity gives less CO₂ emissions (6g/kWh) than coal (978g/kWh) or gas (427 g/kWh)¹. Furthermore, with implementation of a CO₂ market, the price of high carbon energy like fossil fuels will increase and low carbon energy like renewables and electronuclear will be more competitive.

Actually, the part of nuclear in global electricity production is yet moderate : 16% against 40% for coal and respectively 20% and 7% for gas and oil².

¹ Source : International energy agency, world energy outlook 2006

² Source : International energy agency, world energy outlook 2006

Electricity generation costs ranges of baseload technologies (with a 60\$ barrel price)



Source : International energy agency, world energy outlook 2006

If OECD countries and emerging countries improve the part of electronuclear in their energy mix, they will contribute to limit tensions. Nuclear development could not be engaged without reglementation strictly defined and implemented at national, regional and international scale.

2. Which main conditions are necessary to develop nuclear energy program ?

First, **industrial competitiveness in nuclear** should be ensured with a large market size, an industrial organization, and a industrial operator which controls technologies.

- Secondly, **safety** is a priority : implementation of an independent safety authority and selection of a industrial actor with a real "safety culture".
- Thirdly, countries developing electronuclear and international community should **respect non proliferation**. This includes to sign on the non proliferation Treaty, to accept IAEA control and to give free access for experts to relevant infrastructures. Solutions about used fuel storage should be engaged.
- Finally, **cooperation between industries and actors in nuclear sector** should be improved to make know-how exchanges easier. These cooperations, which already exist, could limit politic questions about nuclear development.

These conditions are not always together. If they are, the development of nuclear programs could bring successful results for energy and environment. New challenges in

energy and environment conduct some countries to wonder about electronuclear place in their future energy mix.

3. Overview of the world nuclear powers today and tomorrow ³

Top 10 Nuclear Generating Countries (2007, Billion kWh) and share of nuclear fuel in power generation (%)



Source: International Atomic Energy Agency

³ All data come from the world energy outlook report 2006

United States

Power settled : 100 GW in 2004 – 500 GW in 2030

Electricity mix today : 53% for coal, 26% for oil and gas, 22% for nuclear

First nuclear power in the world with 103 active reactors, industrial leader. United States shows a strong and active policy to improve local nuclear energy program (Energy policy act, 2005), based on a unsuccessful past experience. Major actor of non proliferation.

Europe

Power settled in EU-25: 131 GW in 2004 – 70 GW in 2030

Electricity mix today : 33% for coal, 21% for oil and gas, 35% for nuclear

For historic reasons or political choices, nuclear energy situation is very different within Europe. Electronuclear represents 35% of electricity mix thanks to France the 12 new European member states. Despite a favourable economic context (large market, industrial skills like Areva), acceptability of nuclear remains the major problem. Regarding the new context, some countries like Italy, Spain and Germany, who have decided to stop their nuclear programs, wonder again about a possible nuclear relaunch.

China

Power settled: 6GW in 2004 – 60 GW in 2030

Electricity mix today : 78% for coal, 4% for oil and gas, 2% for nuclear

Today, the level of nuclear electricity is low but should be two times more in 2020 thanks to a fast program of nuclear power plants construction. Chinese government has announced ambitious goals in terms of capacity : 60 GW in 2020. Soon, Chinese industries will be enough efficient to develop their own technologies and to take in charge used fuels re-treatment.

India

Power settled: 3GW in 2004 – 19 GW in 2030

Electricity mix today : 81% for coal, 12% for oil and gas, 2% for nuclear

Democracy in India ensures the respect of safety rules. But, efforts should be led in terms of nuclear acceptability (NPT). Its industry policy needs more coherence (many technologies developed including thorium solution).

Japan

Power settled: 45GW in 2004 – 66 GW in 2030

Electricity mix today : 27% for coal, 33% for oil and gas, 34% for nuclear

Japan has developed electronuclear since oil crises, so technology is well controlled. Japan is the third production in the top 10 after United States and France. Nuclear electricity covers 34% of electricity needs.

Russia

Power settled: 22GW in 2004 – 35 GW in 2030

Electricity mix today : 22% for coal, 62% for oil and gas, 11% for nuclear

Russia is a major actor (5th in the world) with a worldwide experience. Efforts should be led yet in terms of safety and nuclear acceptability. The government has defined ambitious goals for 2020 : to reach 25% of nuclear electricity instead of 11% today. On the industrial side, Atomenergoprom is a leader and responsible of all nuclear activities.

Beyond these main nuclear powers, we can notice lots of nuclear projet launched worldwide (Southe Africa, Brazil ...). We can wonder about it. Without excluding some countries, we need to analyse each country situation and to reinforce security and safety measures.

4. To conclude

In this energy geostrategy context, it is necessary to launch speficic analyses, to turn attention to international possible tensions and to improve reinforced cooperation. Global population is assumed to grow. Some countries, in particular India and China, are developing fastly their economy and they will need more energy rressources to support it. High carbon fuels, like coal, oil ans gas, represent yet the major part of electricity mix, higher than electronuclear and renewables, in spite of favourable policies. The productor countries invest in fossils projects even if national interests exist. As a result, production area, energy transports, production and distribution electricity systems are now experiencing international tension risks.

After a stable period then a decreasing time, electronclear could be relanched under control and achieved around 20% or 25% the the global production.

We should ensure that civil nuclear development will be launched with :

- Competitivity interest compared to other energy rressources
- Respect of security measures for reactors and storage systems/retreatment solutions
- Strict application of the non proliferation treaty
- Larger disponibility and capacity of human rressources
- Dialogue and cooperation between partners (industries, actors) in nuclear field.