

## USE OF NUCLEAR ENERGY AND LAND WARMING

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### ABSTRACT

The world is facing an energy requirement that hardly will be covered by renewable sources actually researched. Though there is almost unanimity in the scientific community about the fact that nuclear energy is still a better option to replace oil and coal, environmental restrictions go on vigorous. And consequently, this non-consensus on nuclear energy benefits, greenhouse effect and weakening of ozone layer go on causing the land warming. In Brazil, nuclear plants are competitive and are capable to produce energy in a safe way, thus contributing to the stabilization of the national electric system and to the expansion of installed capacity and as alternative source of energy and applications for peaceful purposes, preserving the environment and planet inhabitants.

### 1. INTRODUCTION

Land warming, besides the destruction of *fauna* and *flora*, by the fast extinguishing, threatens with scenarios, at minimum, very concerning. An effect from this could be occurring in South Atlantic, affecting coast regions in Rio Grande do Sul and Santa Catarina, by means of devastating hurricanes.

Meteorological theory says that hurricanes in this area are discouraged by the low temperature of South Atlantic waters by Weddel Sea, at the east part in Antarctic Peninsula. However, according to indications, the warming in these waters is capable to be generating last destructive formations

Just the dissolution of ice floating cap in the Artic, incomparably more simple than the cap on stable soil in *Antartida* would compel the sea to grow seven meters. This would the end for a great number of island and coast cities: Londres, Nova York, Veneza, Toquio and Rio de Janeiro, among them.

Betting in alternative sources of clean energy would be a promising way if we had enough time for that.

If we could restrict, right now, all the production of gases that contribute for greenhouse effect, the retreat in terms of a global raise in the temperature would take thousand years to occur.

Greenhouse effect was predicted, among others, by John Tyndall, in England, in 1863 - that is, 144 years ago.

In 1896, the physical-chemist and Nobel Prize, the Swedish Svante Arrhenius attracted attention for their effects, but the technological civilization, voracious energy consumer did not consider these information. Market pragmatism, among others, showed itself more relevant than a future predicted fact[2].

## **2. GLOBAL WARMING AND NUCLEAR INDUSTRY**

Supported on a new argumentation, the nuclear industry recovers its hope in the occurrence of a new nuclear "boom", from the beginning of XXI century, still remembering that we should be initiating, some decades on, at the "Hydrogen Economy" age, that including is capable to dedicate more space to nuclear energy.

The bases of these expectations are supported into five major arguments:

- Worn-out of fossil fuels;
- Reduction in CO<sub>2</sub> emission;
- Difficulties, in a near future, in the use of great blocks of renewable energy;
- Increasing of safety in the new reactors generation;
- Generation cost more and more competitive when compared to other energetic alternatives.

In United States these costs have being informed as to reach values lower than 2 cents/k/kWh, where more efficient plants get 1.5 cents/k/kWh.

There is a comprehensive understanding and agreement about that oil and gas explorative reserves will be depleted within 50 years, while the coal ones are able to last more than 200 years. Considering that the energetic plan from the nations need to be considered at long-term, we can not allow ourselves to ignore the question on the depletion of fossil energetic reserves, once we have to predict how to fulfill our energy requirements in the future.

At the seventies and beginning of eighties the major concern was the releasing of sulphur dioxide and nitrogen oxides, which produce rain acids, in prejudice of forests and lakes. This concern still persist, however there are presently various modern techniques to eliminate or to reduce vigorously the emission of these harm gases, but at a considerable cost.

Nevertheless, there are non available techniques to remove or neutralize the CO<sub>2</sub> formed from the burning of all fossil fuels and that along other gases, such as the methane, released during the extraction and pumping of natural gas, are known as the cause of the raise in global atmosphere temperature – global warming. In fact, if all nuclear reactors presently in operation worldwide were replaced by coal plant, at an equivalent capacity, about 2,600 millions of CO<sub>2</sub> tons would be added to the worldwide atmosphere, 9% of all emissions from fossil fuels.

A higher use of energy renewable sources - wind, solar energy and biomass - is invariably required by environmentalist barracks. A considerable amount of research and development have been spent in these energy sources and it is expected that one day they will provide substantial amounts of energy in the future. Nevertheless, actually their contribution is only 0.1% from worldwide energy. Unfortunately, these sources carry various disadvantages that affect their economy and use. Solar rays and winds are intermittent and unless it is not discovered effective means of energy storage, these sources will not be able to supply the energy we need, in a continuous way. Another disadvantage inherent to renewable sources is related to their showing up in a disperse manner. If we are in need of a significant amount of energy (electricity) from solar, eolian or biomass origin, we will have to cultivate great areas and this will not be cheap. It is calculated that to produce electrical generating capacity, actually, considering a 1,000 MWe plant, it will be required: a 50 to 60 km<sup>2</sup> area of solar cellules or wind propeller; or a 3,000 to 5,000 km<sup>2</sup> of biomass cultivation.

It is not hard to understand that will be not viable make these energy sources, economically competitive for great demand blocks. However these sources must be continually researched we should not keep illusions that a short or medium term they will offer enormous amounts of energy that will be required.

The Humanity walked from the use of firewood to coil, oil, gas and uranium because the high energy concentration offers economy and convenience.

A few data are capable to help in the illustration of the meaning of energy density:

- 1 kg of firewood produces around 1 Kwh of electricity;
- 1 kg of coil produces around 3 Kwh of electricity;
- 1 kg of oil produces around 4 Kwh of electricity;
- 1 kg of natural uranium produces around 50.000 Kwh of electricity;
- 1 kg of plutonium produces around 6.000.000 Kwh of electricity.

Understandingly, differences in energy density show a great impact in required activities to extract, to store and to transport the fuel. In a popular referendum, Austria decided quitting to operate a nuclear unity that consumed 30 tons a year of uranium. Both coil plants that were constructed in replacement, burn now from 1.5 to 2 millions tons a year of coil. Another example, that illustrates how the high energy density can be used in small nuclear centrals are the four 12 MWe plants that Russians constructed to provide electricity to a mining community in an inaccessible area in Artic. The fuel uranium can be air transported and the final used fuel can be removed, equally, by air.

If the almost total absence of CO<sub>2</sub> emission makes nuclear energy an attractive option by answering to the risk of global warming, other nuclear energy aspects should as well considered.

From the economical viewpoint, nuclear energy used to have an excellent advantage on fossil fuels. This advantage practically disappeared, due to increasing costs resulting from a lot of requirements related to safety aspects. Nevertheless, while electricity based on fossil has being forced to trail the costs of antipollution providences, nuclear energy can still foresee constructive improvements which will make cheaper future plants.

A relevant factor a lot of times non-considered is that a great part of nuclear energy cost is spent at the beginning – at plant construction – Fuel uranium is relatively cheap. For oil plants and especially coal ones, the situation is opposed: construction cost is not that high, but fuel cost during unity life is considerable. For countries in development, in need of capital for investing, this is clearly a negative factor along the requirement for an industrial infrastructure, technological and specialized manpower. These factors will be able to advise against the nuclear option for these countries[2].

Nevertheless, the major factor and that is in the heart of skeptic people in relation to nuclear energy is the fear of nuclear accidents that result in radioactivity releasing to the environment. Chernobyl accident remains still today as a scaring image. Without trying to reduce that tragic accident, it needs to be faced under a higher perspective and the existing safety in nuclear energy should be compared to the safety for alternative means of energy generation. It should be kept in mind that new technologies always faced some accidents from which the lessons should be learned.

Either Three Mile Island accident – in which none radioactivity was released to the environment – or Chernobyl disaster, both brought the introduction of new safety characteristics in nuclear reactors and developed safety international culture by IAEA (International Atomic Energy Agency).

In spite of this, we know that in any technology will occur some accidents and we expect that these ones do not become accidents. The risk is not zero. IAEA established an International Scale of Nuclear Event (IENE) which classifies the accidents as such we classify the hurricanes: from 1 to 7. This scale will help the public to be conscious that the most of accidents are of a secondary relevance and do not present risks to public health.

When we consider the risks of electricity nuclear generation, we need to be alert that alternative means of electricity generation show risks too. Actually, higher accidents – in terms of fatalities – in energetic sector are related to the rupture of hydroelectric plants dams. An example was the fail in 1979 of a dam in Macchu, in India, where 2,500 people died. There has been occurring too serious accidents with gas piping and storage and oil transportation. A piping gas explosion, in Guadalajara, in Mexico, killed 200 people in 1992[4].

It is necessary, equally, to remember that in the presentation of statistics like that, nuclear industry is not used to mention that the unique from these technologies, all of them with their inherent risks, whose accidents can affect future generations, is the nuclear option.

We can not lose the focus, nevertheless, that the environment question is a global question. Effects on environmental degradation do not respect borderlines. The imminence of atomic catastrophes, greenhouse effect, weakening of ozone layer, oceans poisoning, demographic explosion, natural resources running out, desertification of fertile areas, the lost of biodiversity, are problems which attain the whole planet. It is too a global question because it can not be understood and faced in separate. Environmental question is primarily, a socio-political question. A question connected to the developing model, life style and way of organizing power and property of a given society type.

*Clube de Roma* study, in its basic conclusions, set in a clear way the socio-political profile of the ecological question. This study, dated 1972, when denounced the risks of an endless growth for worldwide population, fought in favor of an effective population actions towards the reversion in the trend of accelerated and destructive growth and to attain a state of ecological and economical stability, of global balance, capable to satisfy, in a far future, basic materials requirements of each person in Earth and to guarantee to each one of them equal opportunities for accomplishing their human potential. From these conclusions we can verify that the ecological question proposes a change on progress paradigm (endless growth) via population political action, to make viable the life on the planet at social equity conditions.

*A posteriori*, eco-development theory, founded on social equity tripod – ecological prudence – economical efficiency, reinforced socio-political aspects on the environmental question. Principles and directives for this theory harnessed information on the production of international documents on environmental and development – from *Declaração de Cocoyok (Conferência das Nações Unidas sobre Comércio e Desenvolvimento)*, de 1974, to *Declaração do Rio de Janeiro (Conferencia das Nações Unidas on Environment and Development)*, 1992.

Due to the comprehensiveness of ecological question, the understanding about the meaning of environment can not be reduced to nature spaces and resources. It should be enlarged to contain, too, relations “between socio-cultural systems and its biophysics support, in a hierarchy of organization levels which initiates from local or communitarian up to global or eco-spherical”[3,5].

### 3. ARTICULATED CONCLUSIONS

1. The use of nuclear energy as energy alternative source is required for fight the global warming and to salve the planet. In a near future, nuclear energy will be able to foresee constructive improvements that will make their plants cheaper and comprehensively accomplishable, in a compact way and with an optimum cost/benefit for the generation of electric energy.
2. An implantation politics for the use of nuclear energy, with a safe development, should be discussed and formulated at national legislative sphere, due to the production and dissemination of knowledge that are extremely fast, in our global world.
3. Nuclear energy use, as alternative energy source and in applications for pacific purposes, aiming to preserve environment and planet inhabitants, is an immediate concerning, and so we should keep updated the Law and Regulation in this area, not just at national level, but in parallel, to International Law.
4. Environmental question, in their actions, normally do not respect borderlines, attaining indistinctly the whole planet. It is a socio-political question. A question related to development model, to the life style and to the power and property organization way of a given society type.
5. Environmental protection politics are related to a set of programs, services and actions that aim to preserve the ecological balance from the environment and the integrity of cultural

assets. But commonly are distorted and previligiare particular interests in prejudice of diffuse interests.

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#### REFERENCES

1. E. VIOLA, *Meio ambiente, desenvolvimento e cidadania: desafios para as ciências sociais*, Cortez, São Paulo & Brasil (1995).
2. J.M. NOGUEIRA, “Estratégias de desenvolvimento e meio ambiente”, *SIMPÓSIO ESTADUAL SOBRE MEIO AMBIENTE E EDUCAÇÃO UNIVERSITÁRIA*, São Paulo, 1989, Anais, pp.70 (1990).
3. O. MEDAUAR, *Constituição Federal, Coletânea de legislação de direito ambiental*, Revista dos Tribunais, São Paulo & Brasil (2004).
4. V. M. RIBEIRO, *Tutela penal nas atividades nucleares*, Revista dos Tribunais, São Paulo & Brasil (2006).
5. V. P. FREITAS, *A Constituição Federal e a efetividade das normas ambientais*, RT, São Paulo & Brasil (2000).