

# **International Conference on Fast Reactors and Related Fuel Cycles: Safe Technologies and Sustainable Scenarios (FR13)**

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## **Opening Session**

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Mister Chairman, Ladies and Gentlemen,

It's a great pleasure and an honor for me to attend the opening ceremony of the international conference on "fast reactors and related fuel cycles" under the auspices of the International Atomic Energy Agency here in Paris. I thank the Organizing Committee to have invited me to present an overview of the challenges we have to face in order to elaborate a long-term sustainable energy policy while coping with the short term constraints, not only for France or Europe, but more broadly worldwide. Indeed, I am very pleased to share with you my deep belief that the fast neutrons reactors and the good complementarity between nuclear and renewable energies represent key assets for such a policy.

### **Tr2**

The world has to deal with an unavoidable increase of the energy needs to let the legitimate expected social and economic development of many countries in the next two decades despite all the efforts we have to do for better energy efficiency and for large energy savings in the most advanced economies.

### **Tr3**

In Europe today, the energy supply relies on fossil fuels at over 75 % of its primary energy consumption. Worldwide, it is over 82%.

Such a massive use of fossil fuels is thus both a threat for the environment, climate and health, and also for our economies. In 2012, for France, fossil fuel imports represent an expense 3 times larger than in 2005, and over 90% of France's trade deficit.

### **Tr4**

If keeping this current energy mix, we will strongly contribute to a large increase of the risk of climate change, environmental and human health impacts, and their damaging effects.

Tackling climate change, environmental and health issues will require the priority use of CO<sub>2</sub> emission free energy sources.

Despite Kyoto protocol and many political international statements, the amount of CO<sub>2</sub> emission per year has known a +40% growth from 1990 to 2009, with the correlated increase of temperatures.

To ensure a sustainable development, the world needs a sustainable energy supply, which makes a sufficient amount available for everybody at an acceptable price.

For all these reasons, the substitution of fossil fuel consumption as soon as possible and as large as possible with CO<sub>2</sub> free energy sources must be our top priority. The corner stone of any sustainable European energy is the reduction of our consumption of fossil fuels with three axes of action relative to the technologies using these fuels: energy savings, improved efficiency, substitution by other technologies which do not use such fuels, as renewable and nuclear energies.

#### **Tr5**

In November 2011, the European Commission distributed a project entitled “Energy Roadmap 2050”, with more ambitious targets than those of the 3x20 objectives for 2020. All studied scenarios in the frame of the roadmap include an increase of the share of the Renewable Energy Sources, a decrease of the use of fossil fuels, a contribution of the nuclear technology in the range up to 20% depending on the hypothesis for public acceptability, and a large improvement of energy efficiency.

The renewable energy sources will require specific developments in terms of grids, storage capacities, and production and connection infrastructures.

According to this scenario and to cope with the intermittency issues, gas will very likely remain a significant energy source in the European mix provide we develop carbon capture and sequestration or recycling.

For France, we believe we may be even more ambitious and rely only on nuclear and renewable energies by 2050.

In CEA, we are working in all carbon-free energy sectors with one major goal: to decarbonize the energy production in France completely.

High uncertainties are attached to the proposed scenarios, particularly regarding energy sources and energy storage. The competitiveness of European industrial companies as well as the buying power of the consumer needs to be preserved and the environmental constraints must be accounted for.

In these conditions, it is of first importance to keep open a reasonable spectrum of options, to have a pragmatic strategy not to substitute a technology by another at large scale before having demonstrated the real capacity of this new one in term of reliability, integration and economy, and to develop synergies between the various carbon free energy sources.

Indeed, nuclear energy and renewable energies have a large potential of complementarity.

Nuclear is a massive, concentrated, continuous and as steady as possible way of producing electricity. Furthermore, it produces a large quantity of fatal heat, a part of which could be used.

Renewable energies are diffuse, low intensity, intermittent ways to produce electricity, heat or mechanical forces, and mostly non-programmable ways with an acceptable reliability more than a few hours. Most of them (waterpower, photovoltaic, windmills, the various marine energies, and geothermal energies) however produce electricity.

Nuclear is well suited for the electricity base load needs while renewable energies are acceptable for more flexible uses if we may develop suited means of short lasting (a few hours or a few days) energy storage. Indeed, when we speak about renewable energy, since we have local production, we must favor local storage and consumption to avoid the grid bottlenecks and unreasonable over investment costs.

Worldwide, it is foreseeable that nuclear, which is a carbon free energy and has key advantages for security of supply and economic competitiveness, will keep a significant place while the share of renewable will increase.

## **Tr6**

In spite of the Fukushima accident, nuclear energy remains a widely shared option worldwide, even if some countries decide or consider a nuclear renouncement or a phase out.

Actually, nuclear energy is an energy that will grow in the world: many countries confirmed their nuclear option, because they need it: Saudi Arabia, China, India, South Africa, the United Arab Emirates, Korea, Brazil, Finland, Poland, Russia, Turkey and many others, need to utilize this option to meet their rapidly growing electric and drinking water demand. For them, nuclear is not an option, it is a necessity. It was a necessity before Fukushima; it is still a necessity after Fukushima. What is no longer an option is the strict respect of the highest safety international rules and standards for design of the new reactors and for operation, even in the most unlikely events.

Some 60 new reactors are currently under construction in the world.

Nuclear is and will still be a pillar of France's energy policy. It allows France to exhibit 4 times less CO<sub>2</sub> emissions for electricity production than all other large European countries and to benefit of electricity twice less expensive than in some other European countries. The goal

fixed by President Holland to pass from over 75% of our electricity supply coming from nuclear as it is since 20 year to 50% in the next 20 or 30 years is consistent with the substitution of fossil fuels consumption with renewable energies. Now, the fossil fuels are used for 43% in the housing and service industries and for 31% in the ground transportation. The renewables produced mainly electricity and in a less proportion heat. Both of them could be advantageously used in the housing and service industries and in the ground transportation. So the share of the electricity in our energy final consumption will mechanically increase and so, even if we keep steady our nuclear capacity, the nuclear share will decrease. The priority point of the France energy policy is a reduction of our fossil fuels consumption, not a reduction of our nuclear capacity by substituting it with fossil fuels extra capacities as some countries are doing it when they phase out nuclear.

### **Tr7**

After Fukushima, it is really essential for nuclear energy to regain confidence, locally in the vicinity of the nuclear power plants, at the level of each country, and on the international scene. Confidence of the public opinion in our long term energy policy is absolutely needed. This is not a partisan issue; in any country, a large majority should adopt it. If there is no stable consensual policy and regulations, nobody will invest on nuclear, a technology requiring a highly intensive capital but at a low operational cost.

It is necessary to raise the safety standards and to guarantee their widest application through the international community. The priority must be given to the no-release of damaging radioactive materials outside the nuclear site, whatever the normal, extreme natural conditions or accidental situations. The generalization of the “stress tests”, the peer reviews, the promotion of the best technical standards, are as many initiatives aimed at fulfilling that need. The question of crisis management at the international level must be also addressed.

But beyond each specific provision implemented in each specific country, it is also very important for confidence to build common rationales and shared practices on nuclear safety at the international level. Fukushima has shown once again that a nuclear accident somewhere has an impact everywhere. The international cooperation and the multilateral bodies play a critical role in this respect.

### **Tr8**

The fuel cycle and back-end management will stay another pillar of the confidence necessary for the use of nuclear energy in the long term. Each country using nuclear energy should have a sound and comprehensive fuel cycle policy.

Of course, various policy options as open or closed fuel cycles may be considered in different countries.

France chose the closed fuel cycle, recycling the uranium and plutonium present in the nuclear spent fuel and allowing dividing waste volume and toxicity respectively by a factor of five and ten.

### **Tr9**

Expected nuclear growth in the world will not be possible without sustainability. For a sustainable nuclear energy, research on future nuclear reactors is essential, in order to design reactors known as of IV<sup>th</sup> generation, that could ensure power production for hundreds of years, with a much better use of natural resources (a hundred times increase of the energy extraction from the uranium ores compared to the present technology), more environmental friendly techniques for extraction of uranium and a high level waste reduction.

CEA is working in order to define an innovative sodium-cooled fast neutrons prototype, called ASTRID, in the framework of the 2006 French Act on sustainable management of radioactive materials and wastes.

CEA developed international R and D partnerships with many countries or organizations: for example, with Japan on core degradation, or on optimization of reprocessing plant for fast reactor fuels; with India, on safety and severe accidents; with Russia on core physics; in the framework of GIF, on safety, ...

Any energy policy should consider the long term perspective. For example, designing and constructing a new type of nuclear reactor will require at least 20 years with a follow-up operational time lasting a minimum of 60 years. This means that what we are doing today will have an impact on our energy mix till the end of this century.

### **Tr10**

The research at CEA is performed along 3 timelines:

1. Short term: Support the nuclear industry through the improvement of our present nuclear fleet (Generation II)
2. Medium term: Enhancing nuclear safety slashing the risks of new nuclear build (Generation III)
3. Long term: Pave the road to establish a sustainable nuclear future through the ASTRID project (Generation IV)

We also prepare the long-term future by a partnership gathering European partners and six other countries, implementing a considerable research program on controlled magnetic fusion: the ITER project which aims to demonstrate the extraordinary potential of nuclear fusion energy.

### **Tr11**

In 2013, we will see in France the organization of two major debates:

- one on radioactive waste deep disposal project, with the objective that the repository will be in operation by 2025,
- the other on energy transition : the French government is currently managing this energy debate for the next six months, with the objective to have a planning Act for energy transition for the end of the first semester 2013, including diversification of energy sources and promotion of energy efficiency.

The energy transition is necessary and CEA, with their skills, wishes to be instrumental to this energy debate and is participating through the French National Alliance for Energy Research Coordination (ANCRE).

The French Minister of Ecology, Sustainable Development and Energy, asked ANCRE to give perspective on the possible "future" for France, in a European and world context, by focusing her approach on scientific and technological aspects, including the potential associated to the breakthroughs and the technological innovations.

ANCRE decided to propose 3 scenarios of French energy mix evolution at the horizon 2025 and 2050: there are called "Maximum Sobriety", " Drastic reduction of fossil fuel dependence by a priority use of electricity «and " Diversified supplies to reduce fossil fuel dependency ".

### **Tr12**

To decrease the dependence on fossil fuels, France, like some other countries has decided to build its mix on nuclear and renewable, with the use of fossil fuels reduced as soon as possible, and prepare energy transition towards a carbon-free energy mix.

The optimum combinatorial uses of nuclear electricity (as steady as possible with a time scale for significant production change of the order of the day) and renewable (time scale for significant production change of the order or a fraction of hour) requests a large capacity of energy storage, which must be drastically developed – these energies are intermittent (no solar energy during the night, no wind energy without wind).

Research on storage remains essential. Renewable energies also require development of communication and information technologies to the service of the electrical grids: these smart grids will be able to match supply and demand. The modeling of electricity production from renewable sources is also important and will enable to anticipate the intermittent production.

It is only in a diversified mix that we will find the guarantee of our energy independence. It is by abolishing the barriers between energy production and uses that we will be able to think about original solutions for greater energy efficiency. We have to get a global approach of energetic systems and CEA is exactly working according to this model, from basic research to technological research up to the demonstrator.

### **Tr13**

#### **Conclusion**

In conclusion, I would like to share with you my deep conviction that the fission nuclear energy, with a mastered and always improved safety, with a high safety culture of all the stakeholders and in a first row the operators and nuclear control authorities will go on playing a major role in the 21th century and beyond since it answers the criteria of sustainable development. It will contribute in an important way to the world energy needs in complying with the expectation of our fellow citizens for low impacts of energy uses on climate, environment and health.

With the help of large international collaborations, CEA is committed to demonstrate pathways for making significant progress for future fast reactors and their corresponding fuel cycle.

In synergy with nuclear energy, the renewable energies must be widely developed.

Thank you for your attention.