

Nuclear energy for a sustainable French energy mix

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Affordable, abundant, safe, environmentally benign energy supply is a critical input for a world economic and social balanced development. Fossils, renewables and nuclear are the three choices that public authorities are facing with when they have to define an energy policy for their country and fellow citizens. We all know that fossils based large energy production leads to an unacceptable increase of greenhouse gases with the unacceptable announced consequence on climate change. Renewables energies are very promising relatively to the aim. However, they have inherent limitation due to their variability, diffuse characteristic and their lack of predictability. Nuclear energy which does not suffer similar limits has very valuable assets and is then highly required for facing several of the unavoidable energy needs, since they are also massive and permanent. Furthermore, nuclear and renewables energies can be developed with efficient synergies.

The present French bill on energy transition has defined a pathway for energy production facilities, distribution networks and final users in order to reach the goal of 75% reduction in GHG emission in France in 2050 compared to 1990. Renewable energies (solar, wind, marines, biomass, hydraulics,...) which contribute mainly to the electricity production will take globally a larger place than presently (10%), reaching 32% of the final national consumption energy mix. While keeping the same nuclear capacity (63.2 GW) as now, a share of nuclear of not below 50% of the total electricity production before the mid-century, will allow to pursuit the development of a safe, economic and sustainable nuclear energy. Sustainability of nuclear energy has been considered by public authorities as key in France, and in 2013, a debate on radioactive waste deep disposal project has concluded that the decision to build the underground repository of radioactive high-level long-lived waste, named, CIGEO will be taken in 2015, for an operational service in 2025.

In the field of nuclear energy, economic competitiveness, continuous safety improvement, and a responsible waste management are our challenges for now and for the future. The need to maintain an industrial sector at the highest level of performance, and to prepare the future, commits countries to develop a high level scientific and technological research. R&D is an essential tool to support industrial activity and to prepare the challenges of the middle and long term future.

The nuclear energy division of CEA aims to maintain a high level of expertise in support to industry for the current nuclear fleet and to public decisions for the fourth generation of reactors, and to maintain high level nuclear experimental tools, as the JHR experimental reactor or the project of a new critical mock up ZEPHYR. In the field of nuclear safety, main efforts are on beyond design basis accidents and severe accidents, as the Fukushima event has showed that additional R&D was needed in this field: studies on loss of primary coolant accident, studies on reactivity accidents, hydrogen risk mitigation, corium-water and corium-concrete interactions, in parallel with the development of innovative solutions for In Vessel Retention. CEA prepares the future of nuclear energy by its design activities of the first GEN 4 prototype ASTRID, to be built by 2025, and its significant participation to the ITER fusion technology project. Cleaning up and dismantling old nuclear facilities need also R&D efforts to optimize industrial operations.