Postscript

Far from stemming from a mere optimization approach to the generation of reactors currently being deployed – the much-acclaimed third generation, which has achieved high levels of safety, ease of operation, and economic competitiveness, but which only utilizes, once enriched with isotope 235, 0.6% of the natural uranium required for its operation – fourth-generation reactors embody a range of major technological breakthroughs, related to decisive advantages, in terms of uranium utilization, regardless of isotopy, of plutonium consumption, and reduction of ultimate waste. The advantage afforded by these fourth-generation systems relates, indeed, to their ability to use equally natural uranium, depleted uranium, or recycled uranium obtained from spent fuel, yielded by a previous fuel load, thus multiplying, potentially, by over a hundredfold the amount of energy generated by the same amount of raw material. This strategy meets the concern for savings in terms of energy resources, this being a major challenge for the present century, and those to come, even as it affords the capability to transmute minor actinides, primarily americium, as stipulated by the French Act of 28 June 2006, with the aim of optimizing the high-level waste storage situation.
France has opted to go for the in-depth investigation of two distinct systems, as regards the industrial reactors liable to be built from the 2040s: a sodium-cooled fast reactor, and another model, likewise a fast reactor, but gas-cooled.
The first concept – the viability of which is assured in principle, as a result of the operation of the French Rhapsodie, Phénix, and Superphénix reactors, as indeed of a number of other reactors in other countries, all of which, aside from the difficulties inherent in any prototype, are proven in operation – is to be subjected to a thoroughgoing reassessment, to meet requirements matching, or higher than, those for current industrial reactors.
This strategy entails that we bring together an ensemble of very high-level scientific, and technological expertise bearers, bringing in the most creative, ingenious minds, able to draw on the experience that has been gained, while showing a strong capacity for innovation.
The viability of the second concept as a whole has yet to be demonstrated, involving as it does particularly bold technological breakthroughs, such as production of fuel materials withstanding temperatures higher than 1,600 °C, or the design of an enclosure to contain pressurized, high-temperature helium, with very low leakage rates.
This highlights the importance, for that research effort, of modeling and simulation tools, and the associated experimental validation instruments, if advances are to be made in a deliberate fashion, to arrive at the best technological options to be selected for the prototype, planned for the next decade.
Such is the full extent of the challenge set for current investigations.
This issue of *Clefs CEA* brings in-depth coverage of some of the crucial issues, as regards achieving this goal.
These major technological challenges, vital as they truly are for the future of this country, as indeed, more widely, for the future of the world, must be met within a very tight schedule. They are an incitement for all to rally, and ensure that French research, and industry remain at the forefront, on the international scene

“Major technological challenges, vital as they are for the future of this country, as indeed of the world, must be met.”

Laurence Godart/CEA

Bernard Bigot

> Bernard Bigot
High Commissioner for Atomic Energy