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The French Nuclear Fuel cycle: current status and possible future options

France has deployed from the late 1970's a fleet of large water reactors (63 GWe within about 20 years, due to French government decisions in the early seventies); and, in the same time, fuel cycle industrial facilities have been launched to deserve a closed fuel cycle policy. The main drivers for reprocessing and recycling strategy were to take advantage of valuable content of used fuels, while optimizing final waste management.

This strategy provides uranium and SWU savings (about 10% of French electricity comes from burning MOX fuels), and final waste without plutonium, which simplifies long-term management. Plutonium is a sensitive element to several respects (fissile, radiotoxic, heat emitter) and, if not recycled and burnt, management policies would have to take into account such heavy drawbacks. Recovered plutonium is systematically recycled (no increase of separated Pu stockpile, reprocessing is strictly adjusted to refueling capacities); and used MOX fuels are currently safely stored in pools, as a resource for future nuclear systems.

Reprocessing and recycling has been operated at commercial scale in France for more than two decades: more than thirty thousand tons of used fuels have been reprocessed, more than two thousand tons MOX fuels manufactured, and fuel cycle technologies have testified industrial maturity.

This can be seen as the first step toward fully sustainable nuclear systems: used MOX fuels are not currently reprocessed (the recovered Plutonium from reprocessing would not be suitable for efficient recycle into current LWRs), so recycle is only once. The deployment in the French fleet of generation IV fast neutron reactors could allow, in the future, a complete and recurrent recycle of both uranium and plutonium, drastically extending natural uranium use (about two orders of magnitude), and possibly eradicating any minor actinide content in the final waste.

Such options are currently investigated in the frame of a specific Act, voted by the French Parliament "for sustainable management of radioactive materials and waste". Different scenarios have been drafted and will be assessed (taking into account the diverse criteria and appropriate attributes), as a joint work embedding research and industrial bodies. And a dedicated research program, the ASTRID program, has been launched by CEA: it aims at designing of a generation IV sodium cooled demonstrator (both reactor and related fuel cycle facilities), which could be operated from around 2025, as the foundation stone of this new step towards increased sustainability.

Country/ int. organization

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