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How to take into account the fleet composition in order to evaluate Fast Breeder Competitiveness

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Fast reactor competitiveness is usually examined by comparing fast reactors and light water reactors (LWRs) LCOE (levelized cost of electricity).
As fast reactors have an investment cost higher than LWRs, their kWh production cost is higher than that of LWRs (with the natural uranium current price) and their competitiveness will thus take place when the increase of the natural uranium cost will be enough to counterbalance their additional investment cost.

In fact, the interest of the fast reactors is to allow the implementation of sustainable nuclear power fleet not consuming natural uranium, but only depleted uranium which we have, unlike the natural uranium, considerable resources.
The real objective is not to build a reactor not consuming natural uranium, but to have a sustainable nuclear fleet consuming depleted uranium only.

For this purpose, fast reactors are necessary, but it doesn't imply that the whole fleet will be made of fast reactors only. It is a possibility, but not the only one.

Indeed, these break-even(isogenerator) reactors can become fast-breeder reactors (FBRs) by using blankets and available plutonium surplus can be used in other reactors consuming plutonium, but not consuming natural uranium. For example, we can build a fleet including fast-breeder reactors but also LWRs like EPR with a 100 % MOX load. The different shares of the two reactor types will be defined by the balance between plutonium produced in FBRs and plutonium consumed in LWRs.

By doing this, the additional investment cost of FBR is diluted because it does not concern more than a part of the sustainable fleet (as a matter of fact the cost of the kWh produced by a100 % MOX EPR is not very different from that of the UOX EPR with a current natural uranium cost).

Considering the effect of such a fleet including both FBR and 100% MOX LWR this study suggests that increasing the breeding ratio for FBR and increasing the conversion ratio of LWR by considering high conversion ratio LWR could be economically efficient.

This study shows that a corrective factor depending on the fleet composition should be taken into account in the FBR overcosts in order to examine its competitiveness.

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