

Regulatory challenges for the French Regulator with the future of the Nuclear Fuel Cycle



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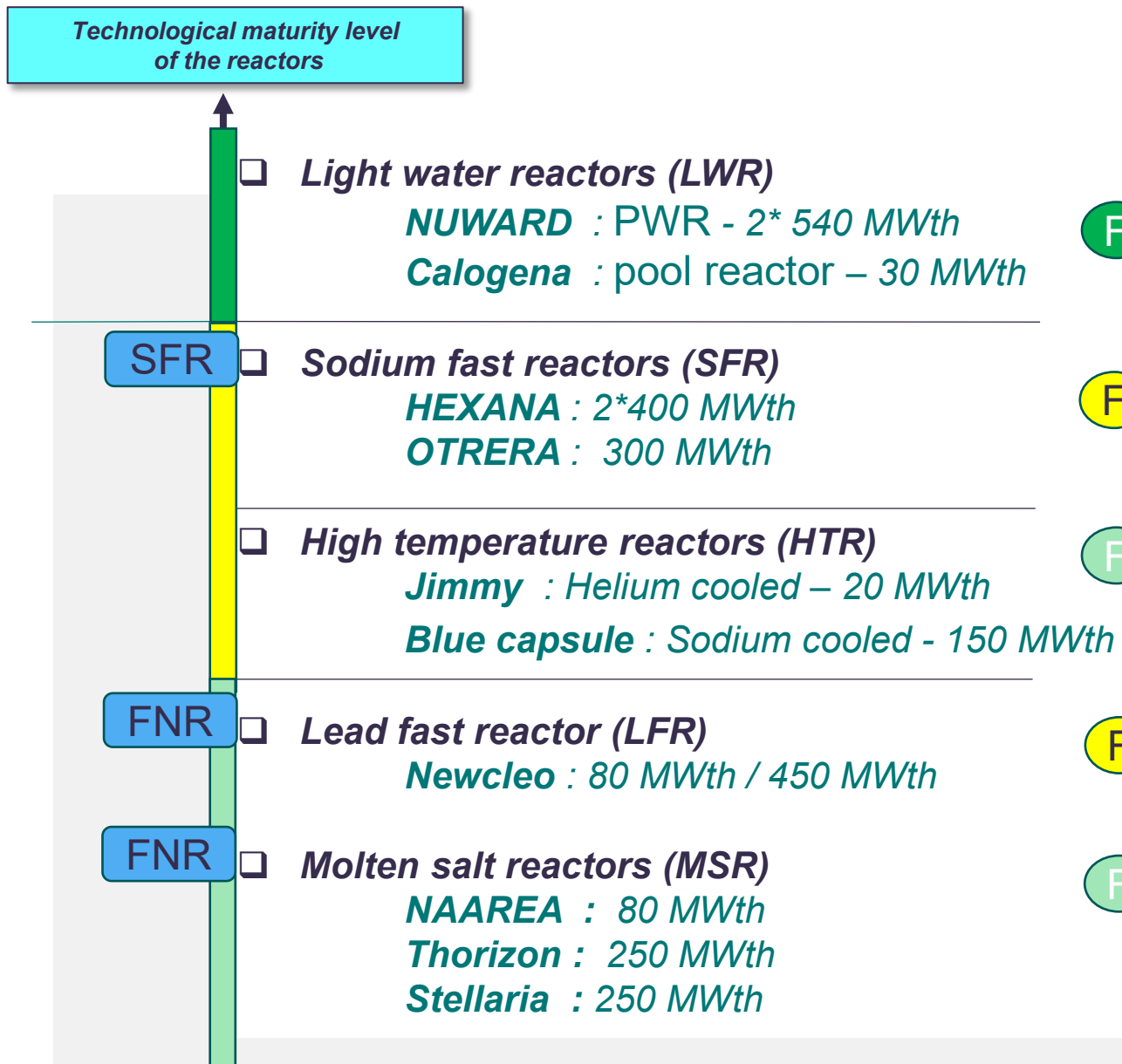
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1. THE CURRENT FRENCH NUCLEAR POWER INDUSTRY

The French Specificity

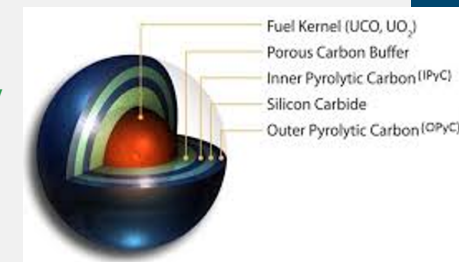
- A limited number of operators: EDF, ORANO, ANDRA, CEA
- Except the mines, Fuel Cycle Facilities in France
 - Conversion facility (Malvesi)
 - Enrichment facility (GB II)
 - Fuel fabrication (UO₂ Romans (Framatome/EDF), MOX (Melox))
 - Reprocessing Plant (La Hague)
- One type of Fuel: Light Water Reactor
 - 2 main providers: Framatome and Westinghouse

2. SMR : the main projects in France



Availability of the fuels

- ⓕ Standard fuel U <5%
- ⓕ Fuel MOX-SFR
- ⓕ TRISO Fuel
 → No industrial production capacity
 → No HALEU supply in Europe
- ⓕ Fuel MOX-LFR
- ⓕ Chloride salts U/PU
 → No industrial production capacity
 → Step of prior enrichment in Cl₃₇ needed



2. SMR: FUEL CHALLENGES

For ASN the whole Fuel Cycle, the dismantling activities and the Radioactive Waste Management have to be taken into account since the beginning

Specific issues:

- ASN should receive (2024) a licence application for a modular construction facility by Jimmy (construction of the reactor vessels loaded with TRISO fuel).
- ASN should receive (2024) a licence pre-application license for a MOX fuel fabrication facility by Newcleo

Safety objectives:

- SMR : how safe is safe enough?

The assessment of several unusual applications is also a real challenge for ASN



2. ACCIDENT TOLERANT FUELS CHALLENGES

Fuel modifications result from several industrial needs:

- to take into account operating experience or new operating constraints
- to improve the behavior of fuel assemblies under accidental conditions

Regarding ATF, EDF strategy is based on evolutionary designs of the fuel rods:

- development in cooperation with suppliers
- with preliminary qualification, including test in nuclear reactors

Implementation takes 5 to 10 years when a modification requires the use of precursor test fuels (more than 10 years with breakthrough technologies)

2. ACCIDENT TOLERANT FUELS CHALLENGES

EDF mid term strategy:

- Consideration of chromium-coated cladding (already tested on operating reactors)
- Pellets doped with Cr₂O₃ and Al₂O₃-Cr₂O₃
- Need to take into account the possibility to reprocess the fuel in La Hague (solubility)

EDF long term strategy:

Issues under evaluation:

- Ceramic cladding
- High density pellets

=> For ASN it's a « usual » assessment process

3. CONCLUSION

For ASN, the current main regulatory challenge is with SMRs

- Many newcomers with a limited nuclear experience
- Innovative designs
- Innovative fuel concepts mainly not anticipated
- A limited capacity of assessment at ASN

International cooperation is thus welcome



THANK YOU FOR YOUR ATTENTION!