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Session : Nuclear Renaissance and the role of SMR for net zero power systems

The Strategy Approach for SMR/AMR in France

Presented By

ADVOCAT Thierry, Nuclear Counsellor (Embassy of France in New Delhi)

GAVOILLE Pierre (CEA), MAURIN Mathieu (EDF)

INTRODUCTION/CONTEXT: French Approach for SMRs

- GOAL : 1st concrete for LW-SMR and 1 prototype of "other technology" launched by 2030

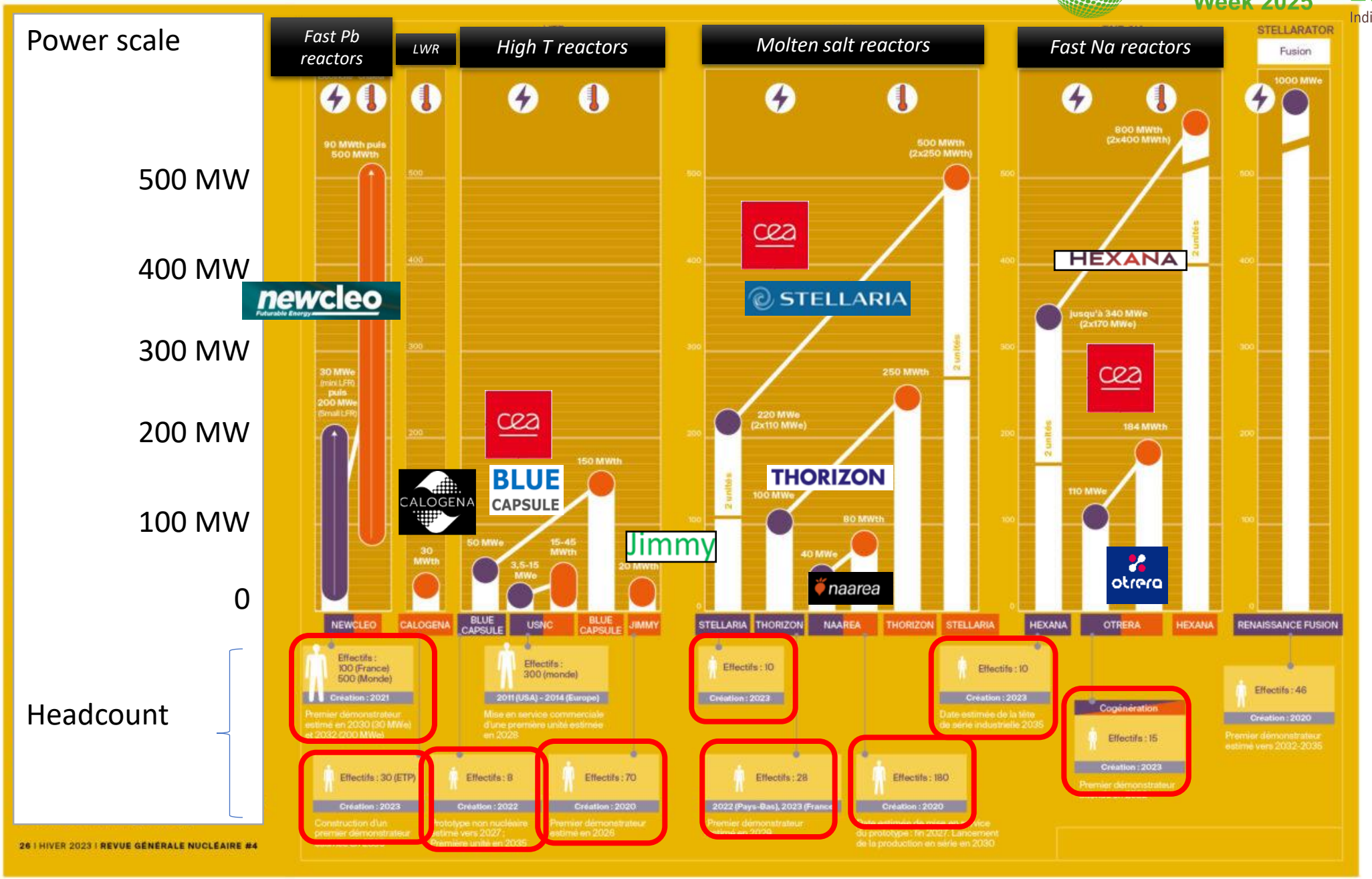
- Nuclear Industry is no longer dependent solely on R&D and public funding
  - Adopting an entrepreneurial mindset + increased dynamism→ **Startups**
  - Attracting substantial private investment

- SMR is not a technology, it is an industrial and economical strategy**, to compensate the scale effect** with serial production, prefab., simplified design, new markets beyond power to the grid.

- However, **Startups** still rely on a solid scientific foundation and the knowledge and expertise of highly qualified engineers and researchers from the "Majors "

- Closing fuel cycle : Gen3 and Gen4 at the same time for SMR projects

CONTEXT : (Discussion Point 5) -Advancement in AMR Techn.



USE CASE / CASE STUDY (1/2) : LWR-SMR

nuward EDF GROUP

- A Generation 3+ **Pressurised Water Reactor (**3-5% U-235 **UOX fuel)**
- Capable of producing **electricity (300 to 500 MWe) & Heat (**in up to **100 MWth in cogeneration mode**
- Design based on proven technology bricks only
- **Modular approach** and off-the-shelf components
- Construction in **48 months**

Co-development opportunities

Pre-conceptual design	Conceptual design	Basic design, detailed design and client's firm engagements	Construction
2024	2026	early 2030s	

CALOGENA

- Gen 3+ Pool Type Research reactor at Low P (5bars), 3-5% U-235 **UOX fuel**
- Producing Heat (30MWth) to decarbonize district heating

USE CASE / CASE STUDY (2/2) : Fast Breeder AMR

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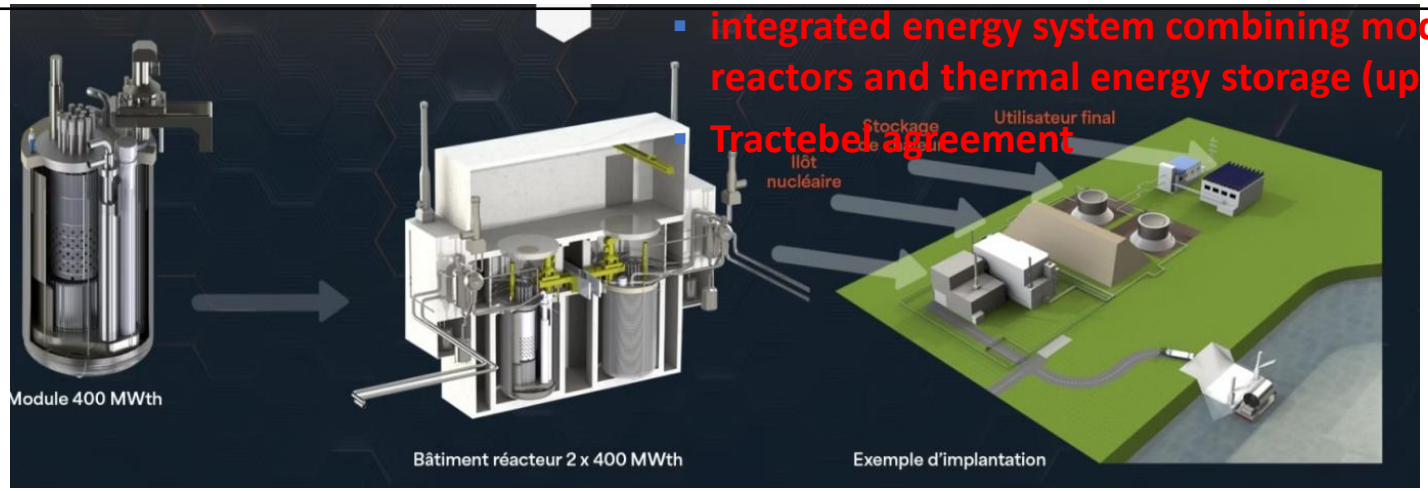
Na-FBR

otrera

- Reactor In ground (less than 1ha)
- Co-generation : 110MWe +180MWth (100-150°C)
- MOX-fuel (10y duration)
- No water/Na interaction : 4 containement barriers
- No-test reactor needed

Na-FBR

HEXANA



- integrated energy system combining modular Na-cooled fast reactors and thermal energy storage (up to 500°C)
- Tractebel agreement

Pb-FBR

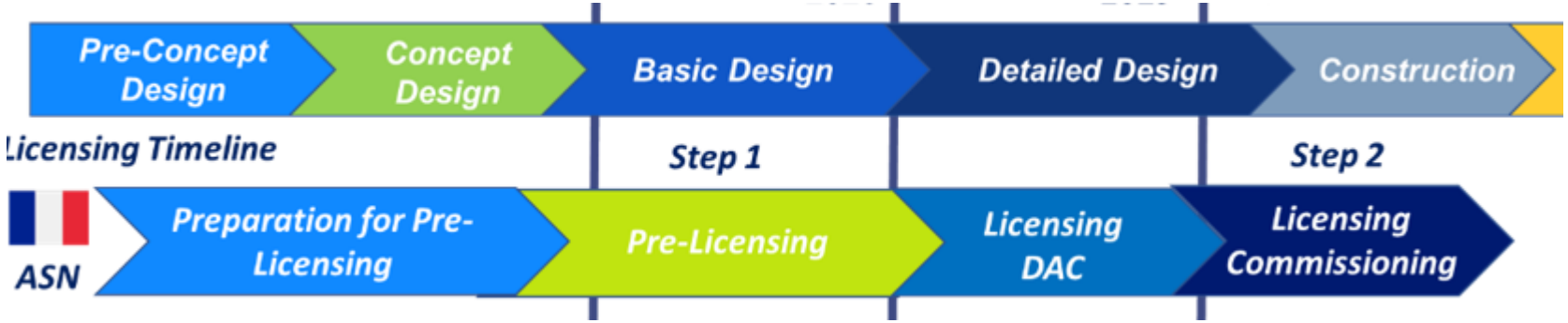
newcleo

- Test reactor LFS-30 MWe in 2030 →Land acquisition at NPP site in France
- Cooperation with UEA (ENEC), Sweden (Blykalla), SAIPEM (ENI-petroleum)
- Generic Design Assessment requested in UK

KEY TAKEAWAYS / RECOMMENDATIONS

1. SMR need to be licensed in several countries to establish a series: <u>joint efforts required</u> from regulators

2. Starting the Licensing processes as soon as possible



3. Fuel type depend on the reactor technology, and have various readiness levels (/technology and prod. capacities) : Industrial fuel fabrication facilities exist only for LW-type reactors

KEY TAKEAWAYS / RECOMMENDATIONS

4. **Current technology (Light Water Reactor) « LW SMR »**

(+) Industrial Fuel supply chain available
(+) Extensive feedback on safety / component fabrication
(-)Limited range of Heat supply in terms of T° (~250°C max.)

→ Expected Time to market for the 1st units : ~2030-2035

5. **Innovative designs (« Gen IV » reactors) « AMR »**

(+) Higher temperature heat available up to 800°C
(+): Better use of Pu-U nuclear materials (in most cases)
(-) : Technological Readiness level needs to be improved for some designs (MSR)
(-) : more or less feedback from existing units (licensing)
(-) Industrial Fuel supply chain availability
→ Expected Time to market for the 1st units: ~2035-2040+

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THANK YOU

For discussions/suggestions/queries email: isuw@isuw.in

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Links/References (If any)