



STELLARIA

L'ENERGIE POUR DES SIECLES

www.stellaria-energy.com

CO-FONDERS

Based in Grenoble



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CEO & Product Owner

25+ ans d'expérience dans l'industrie



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Directeur Technique (CTO)

20+ ans d'expérience dans le nucléaire



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Architecte GEN4

5 ans d'expérience en conception réacteur



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DESBRIERE**

Expert en sûreté nucléaire

40+ ans d'expérience en sûreté et exploitation



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GERSCHENFELD**

Expert Thermohydraulique

10+ ans d'expérience en code de calcul & techno

CO-INVESTORS

PARTNERS

LABELS



TEAM

1. WHY a STELLARIUM ?

ANALYSIS

Less carbon → more nuclear for big industrial sites

Data centers **EQUINIX**

- +18 GW en 2035



Mines **ERAMET**

- +200 MW offgrid (N Calédonie)
- BHP Billinton Australie**
- +600 MW Offgrid sans eau



Métallurgie **ARCELOR**

- Moteurs elec +10 à 30 MW
- Stop & go Four à arc +200 MW



Ports **CMA CGM**

- 2030 Connexion bateaux obligatoire au port
- +100MW/terminal en ville



Energies et mobilités **SHELL**

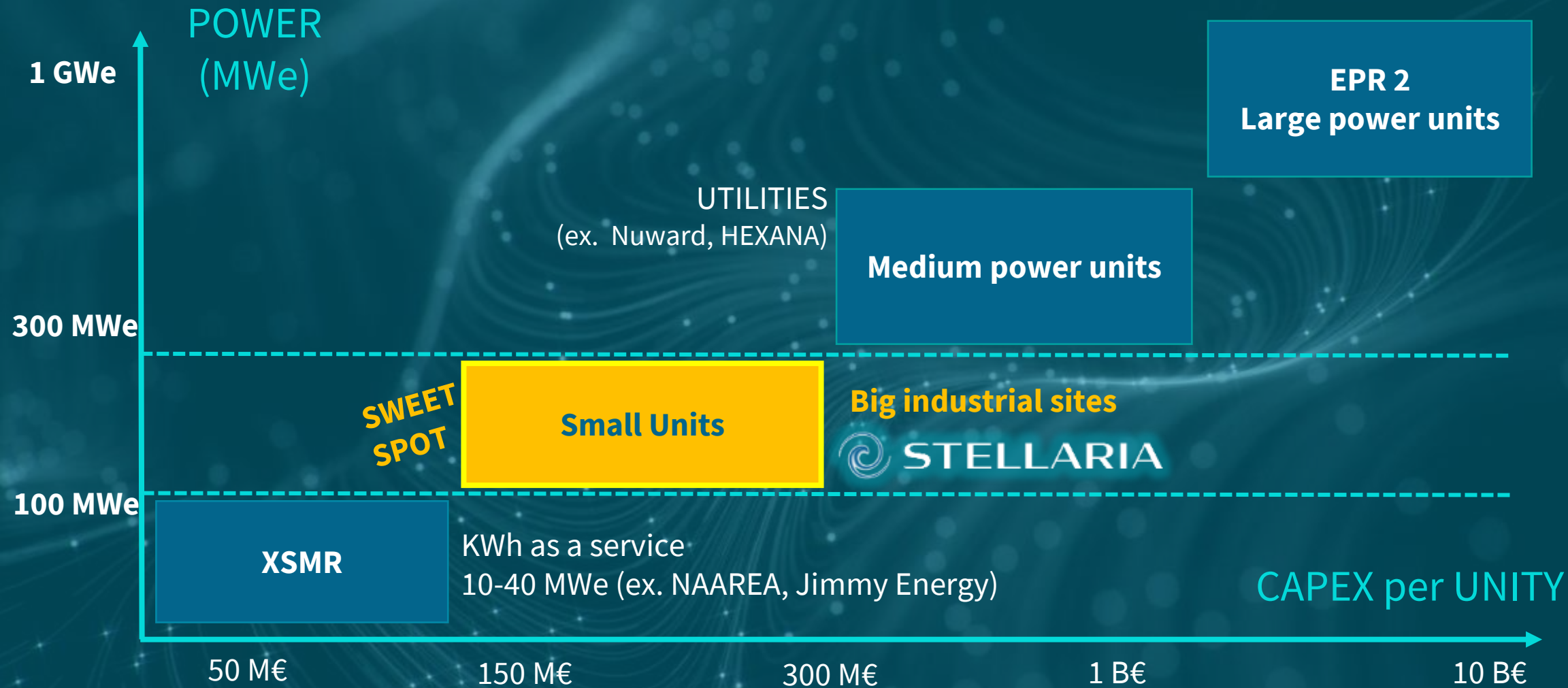
- Zone explosive ATEX,
- Stop & Go Vapo-craqueur +400MWth
- 10% de pétrole perdu dans le process
- 1,2 GW pour les VE (en UE)



- **Electrifier → besoins par site * 2 à 10**
- **Aucune solution actuelle de décarbonation 24h/24 déployable « à l'échelle »**
- **Nouveaux besoins en rupture**, en résumé:
Bas coût, net zéro, génération locale, déployabilité mondiale, modularité, zones explosives (zone ATEX), multi usages (électricité, chaleur, vapeur, molécules), multi-cyclage des combustibles et pérennité, grande pilotabilité, continuité et autonomie, robustesse et redondance, zones de sûreté minimale & acceptation sociale BtoC...

→ **Safety, pilotability, power continuity, social acceptance**

The GOOD SCALE for the GOOD REACTO → not only the power !



WORLD COMPETITION & CHALLENGES

UN MARCHÉ

Funds for MSR in China : 3 B \$; and in North America : 1 B \$

**Hight risk of disruption of the european MSR sector
→ Create MSR european leaders**

HUGE MARKET :

2 000

Industrial sites
EU/MO/APAC

€600 B/y*

Bill payed by energo-intensive
CAPEX+OPEX 2022

€60 B/y

10%** = Market share for SMR
(investimation in 2035)

€1 B/y

1,5% = STELLARIA en
2035

*source IEA

**source AIEA

STELLARIA, confidentiel, Tous droits réservés



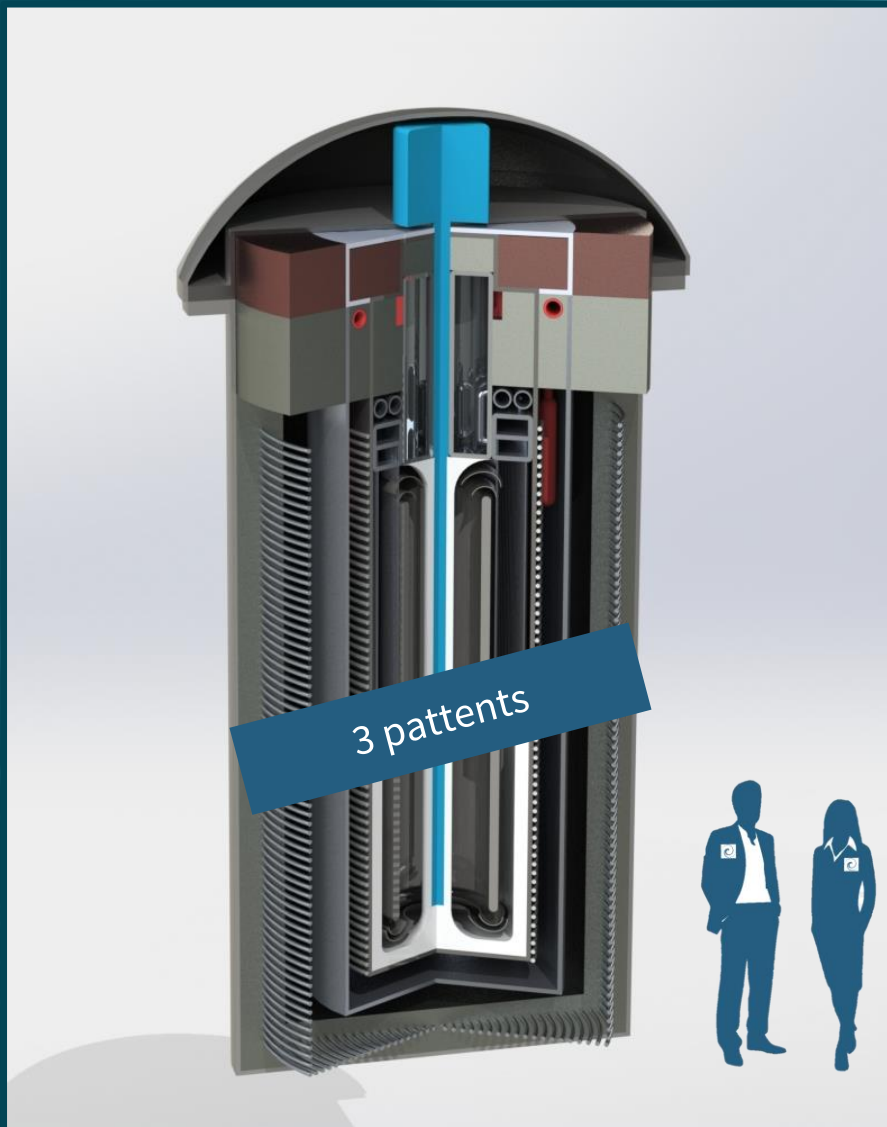
MARKET

2. Technical Challenges

- 1 **▪ Safety & fiability**
Example: No exclusion zone for populations in case of major accident
→ “Everything” stays in the reactor
- 2 **▪ Economic Competition**
STOP gas and coal ! Pilotability, multi-usages (and new usages ?!)
- 3 **▪ Sustainability and adaptation to existing and future cycles**
Breeder, use of existing resources (U238 !), fuel versatility
- 4 **▪ Simplified construction... and operation !**
Multiplication of sites, gain in standardization,
Exports, longevity
- 5 **▪ No prolifération**
Industrial sites with safety culture, wasted materials

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CONCEPTION (1/2)

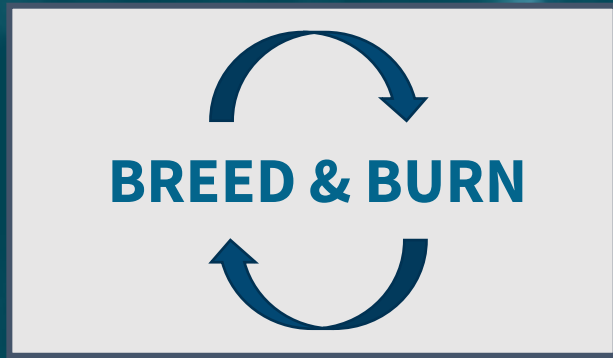


- **Power** → 250 MWth - 110 Mwe by STELLARIUM
- **Liquid fuel (chloride salt)**
+/- 30% Puissance Nominale /minute
High température (T_{max} ~650°)
- **No Pressure**
- **Natural convection**
Passive, no mechanical pieces in movement
→ simplified design and... operation
- **Double vessel changed every 5 – 10 years**
Corrosion solution (waiting more material experiments),
The « 10 years inspection » simplified

CONCEPTION (2/2)

▪ Fast Neutron Reactor (spectrum faster than a Sodium Fast Reactor)

1. Can use very bad/old plutonium
2. Burner for minor actinides
3. B'n B concept = « *It regenerates and burns the fissile in the same salt* » for 15 years... and more.

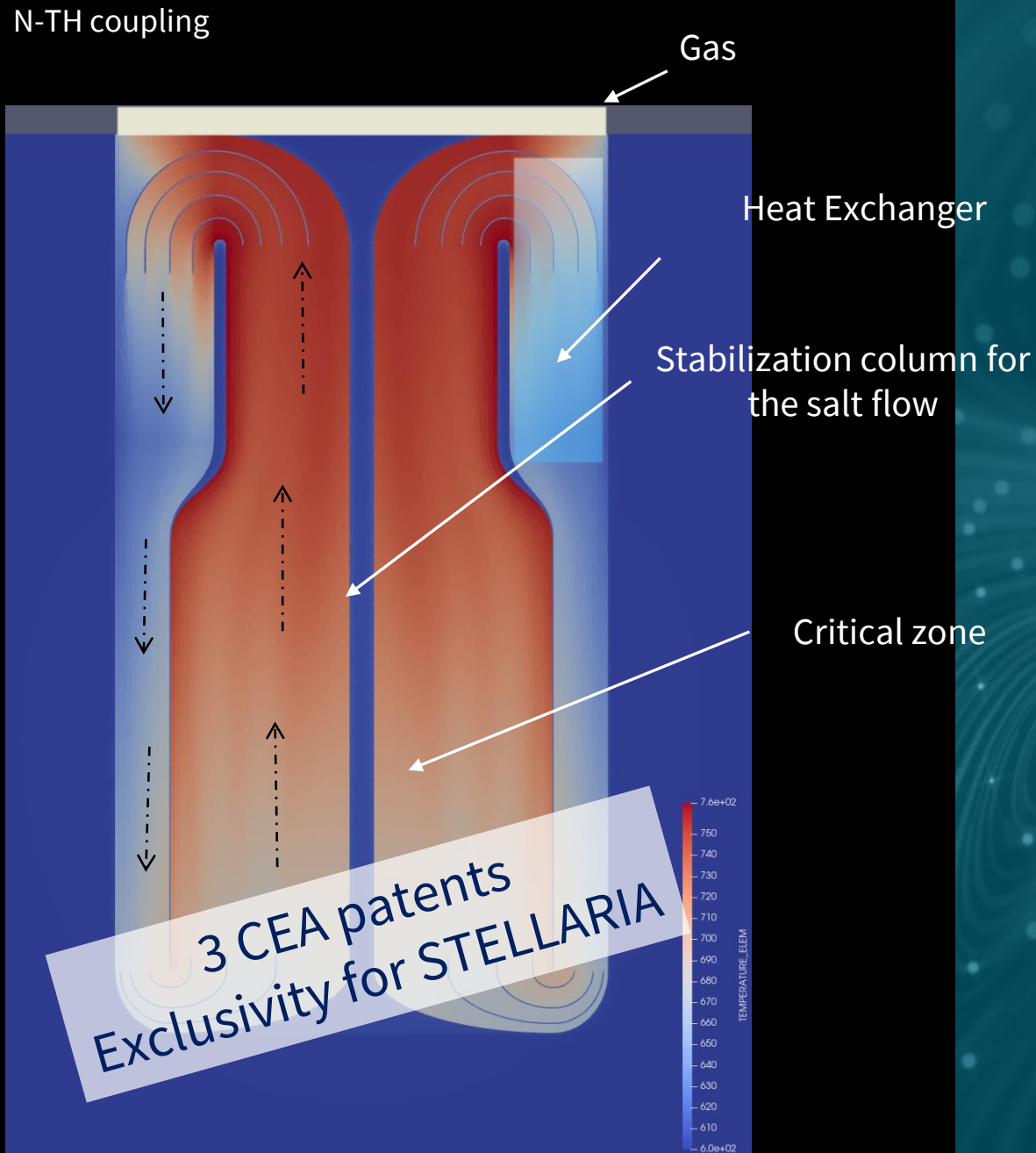


▪ One vessel for different fuels !

- Burner using Pu or Uranium (HALEU at ~15%)
- Breeder for a large scale of salts mixing U, Pu,Th, etc.

The STELLARIUM → a flexible tool !

a REACTOR using NATURAL CONVECTION



- ✓ **Low circulation speed of the salt**
→ No mechanical vibrations
- ✓ **No pump / Low pressure (~1 bar)**
We hope → Easier to operate
- ✓ **Known temperature range** for materials
 $T_{\max} < 700^{\circ}\text{C}$

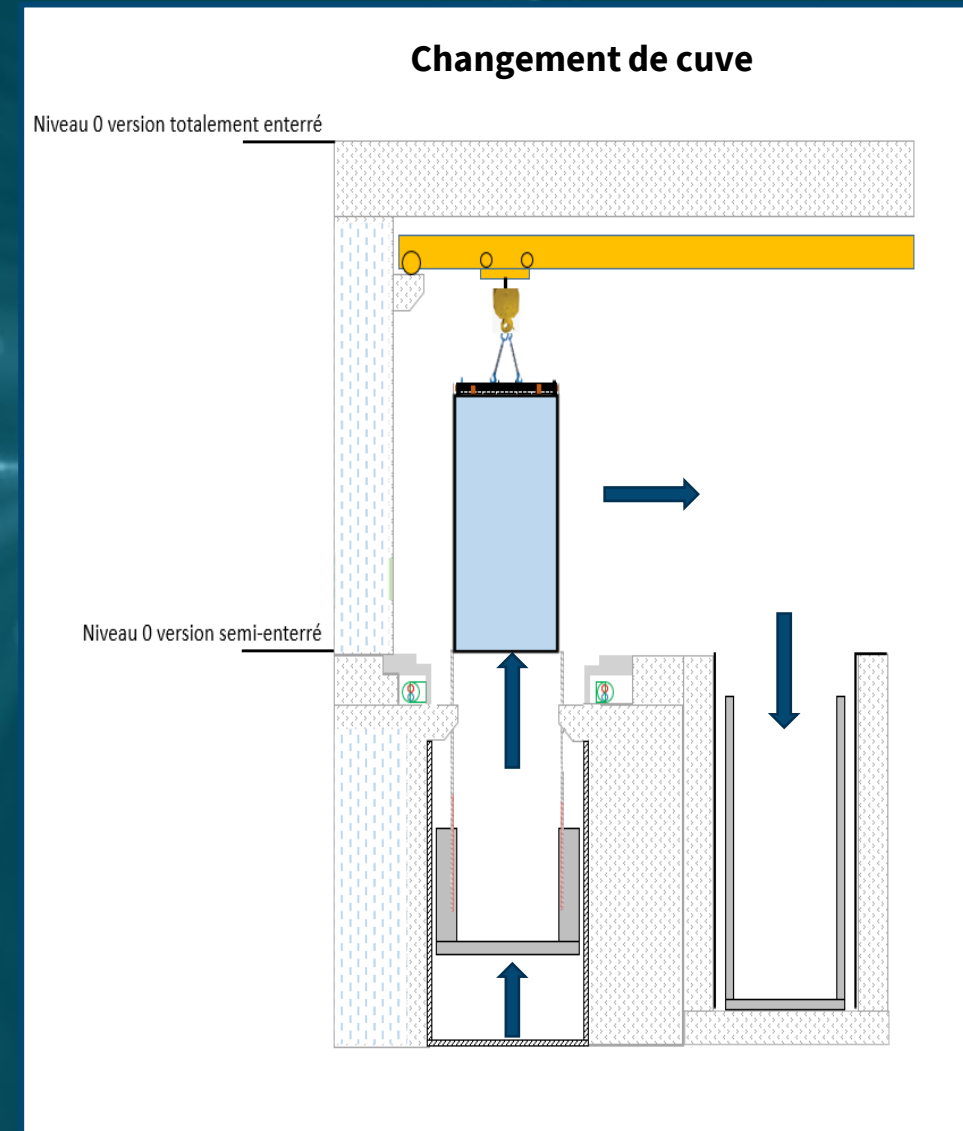
OPERATION & SAFETY from the PRE-DESIGN phase

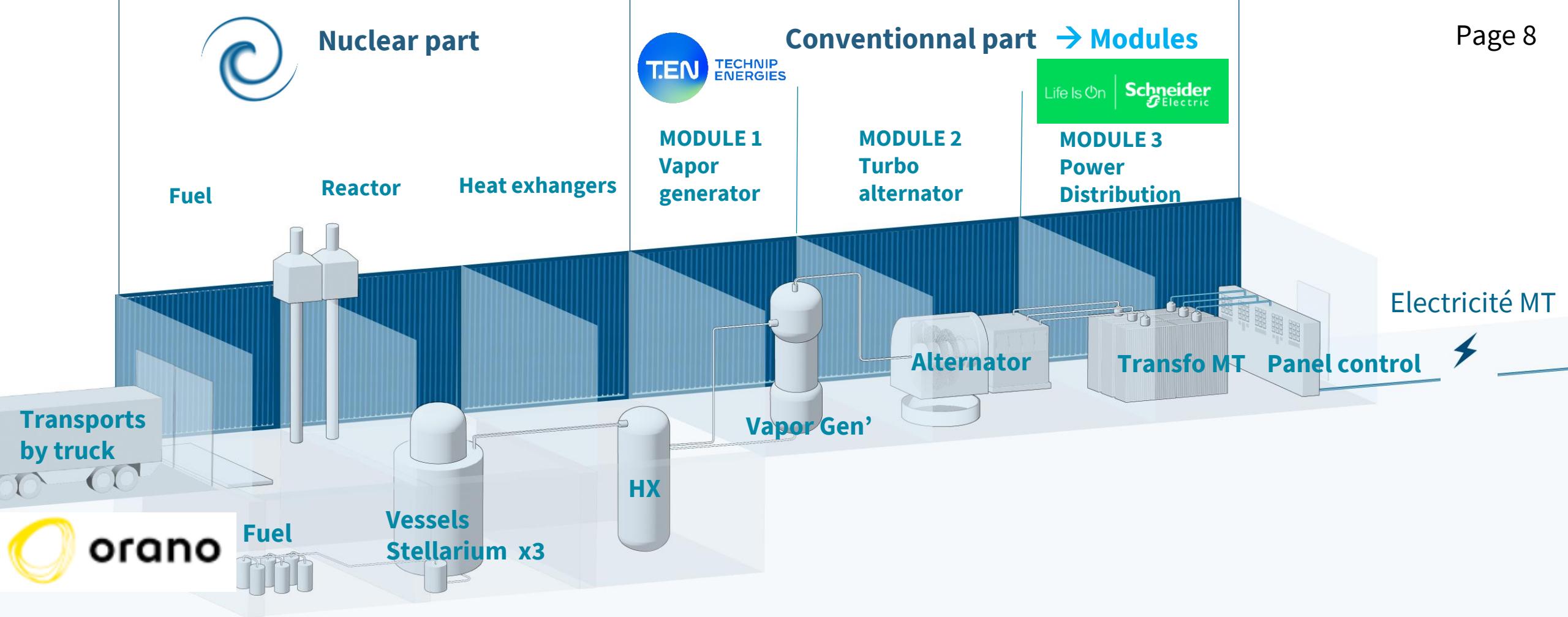
- **The definition of operating operations, phase by phase, is very important for us !**

- Fission gas management,
- Vessel changes,
- Manage the fuel,
- Neutronics controls,
- The “Ten-year inspection”,
- etc.

→ All these decisive operations are the base to build a good design

- Upstream consideration of safety rules





MODULARITY IS THE KEY



INDUSTRIAL ALLIANCE

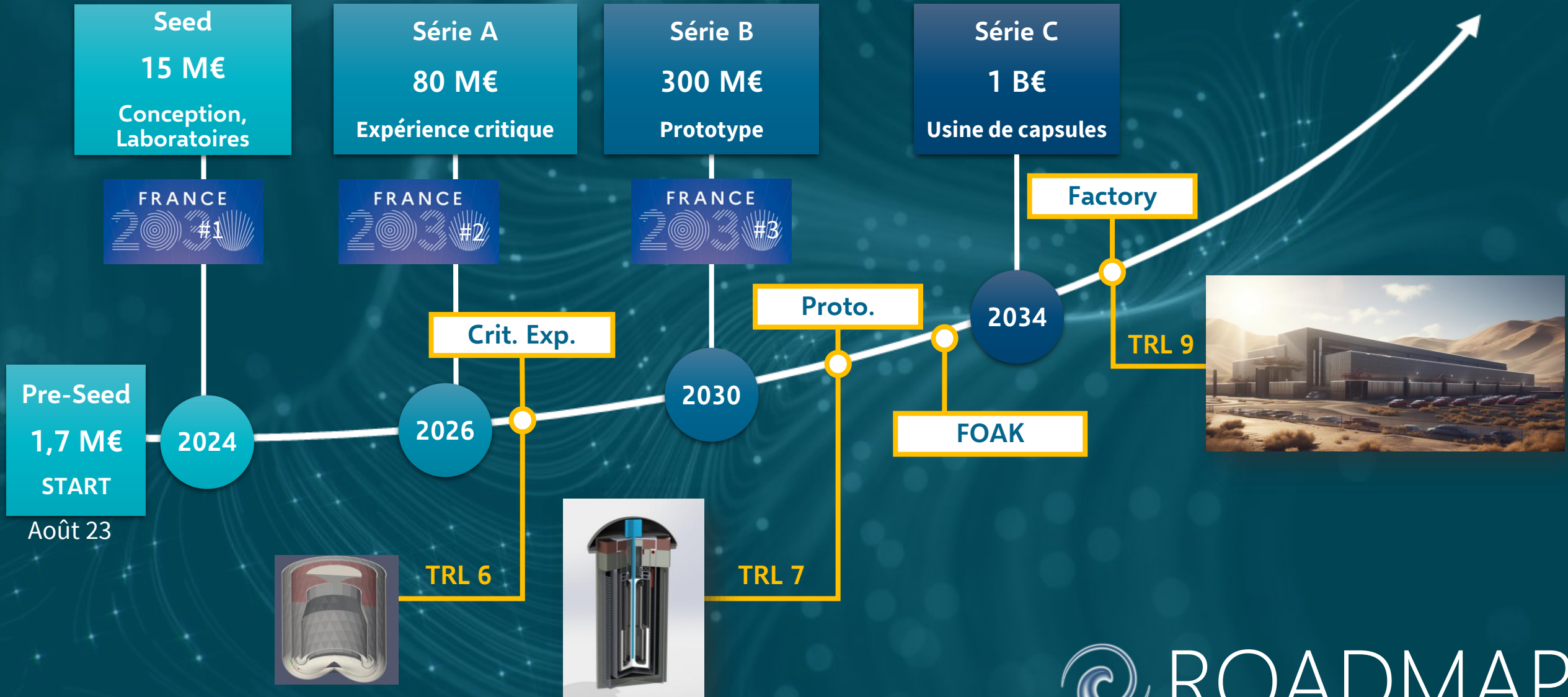
THE ONE VISION FOR OUR DESIGN

Simple, Robuste
& Polyvalent

Simple, Robust (*Healthy ?!*) & Versatile

4. The Road

ONE DECADE TO BUILD AN EUROPEAN MSR INDUSTRY



A CRITICAL EXPERIMENT in 2027

*The pathway coming from the ARE
(ORNL, 1954)*

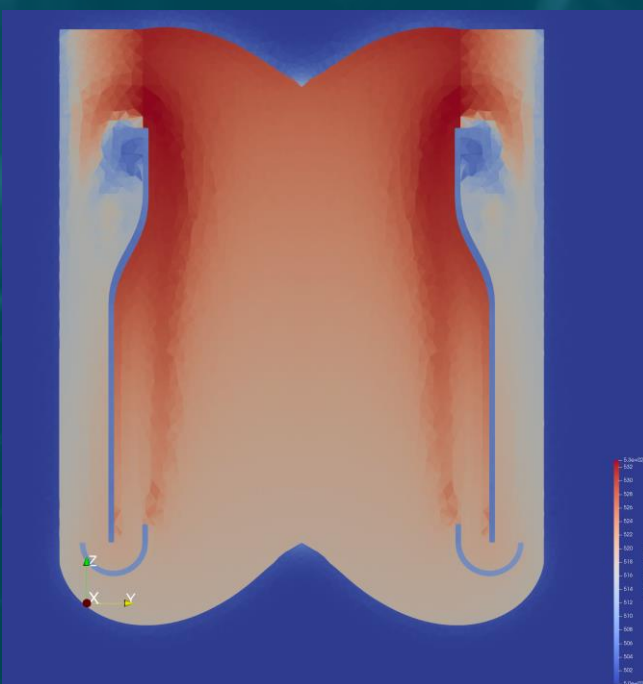
Objectives → Validations for :

- N/TH coupling codes and natural convection
- Monitoring the power by heat exchanger in NC
- Manage the reactivity insertions (safety studies)

Design → a very small object

- Salt with Pu
- $T_{\max} = 575 \text{ }^{\circ}\text{C}$
- Power : 100-200 KW_{th}
- Duration : Few weeks/monthes only

→ **We NEED to prove that a MSR is possible !**



5. Our Needs

OUR NEEDS ...

- (Less computers) more salt experiments we can build together
- We need more MSR formations (technical ones → manage salts)

... and ...

- More open minded people for free collaborations
- More money, people and autonomy for scientists in public organisms
Cause they are a foundation and a network for MSR

Thanks to the CNRS french team
who kept the MSR alive
in France from 2005 to 2017