# BLUE CAPSULE
TECHNOLOGY

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# UNIQUE NUCLEAR HEAT : BLUE CAPSULE'S SINGULAR APPROACH TO DESIGN SIMPLIFICATION AND INTEGRATION IN SMALL MODULAR REACTORS

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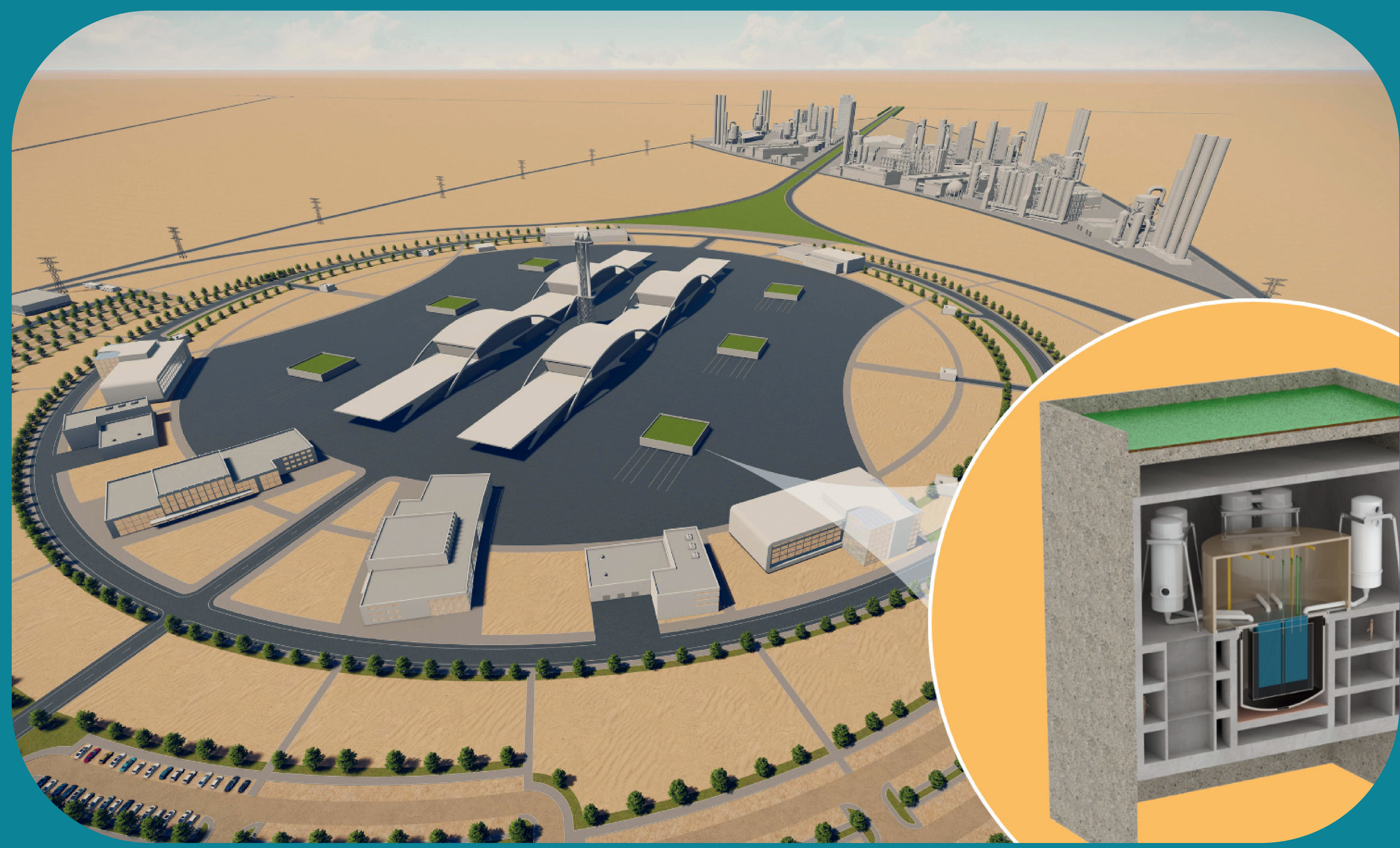


## WHY BLUE CAPSULE? WHY THIS SMR?

Decarbonisation. Competitiveness. Energy sovereignty.

Blue Capsule is designing a 150 MWth high-temperature reactor so that industry can access low-carbon heat (750°C), steam (650°C) and electricity (50 MWe) to transition away from imported fossil fuels.

A cross-over of sodium-cooled and HTR technology, this reactor features TRISO fuel for a safe, compact design.

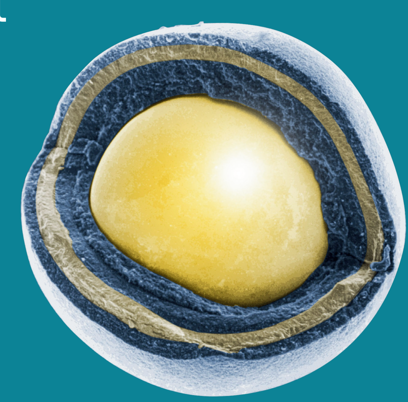
The global market for industrial heat is roughly 57,000 TWh. That's 1.5 times China's primary energy demand.

And in Europe? The market for industrial heat is roughly 1200 TWh, equating to 1000+ Blue Capsule modules.

## DESIGN AND OPERATION SIMPLIFICATION


- High thermal exchange capacity => cooling of core power by **natural circulation**.
- Boiling point of ~883°C => high temperatures for customer, but with **no pressuriser**.
- Transients are slow => time for operators to deal with events.

- Core derived from HTTR design, with fuel compacts made of **TRISO in graphite matrix**.
- Blue Capsule fuel (unlike in HTTRs) is encapsulated in ceramic cylinders.
  - Assembly not in contact with sodium => **simple fuel handling**.
  - Small neutronic weight of fuel assembly => **simple online refueling** at full power.



## INTEGRATION WITH EXISTING INDUSTRIAL SITES

Historically, nuclear power was not designed to connect to customers other than electrical grids. Equally, nuclear power plants were never installed close to industrial sites.

**The challenge for Blue Capsule? To provide high temperature-grade power very close to the final user.**

Consequently, a safe connection must be made available very close to the reactor itself.

- No radioactive content should be present in the "coupling fluid".
- No event on the conventional site should have an impact on reactor safety functions.

**Potential markets?** → **3 end user types:**

| "Plug-in" | "Multi-vector" | "Pre-heating" |
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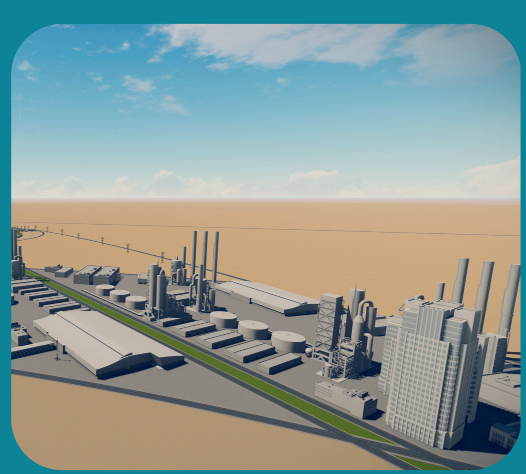
|  |  |  |

## LICENSING SIMPLIFICATION

**Maximum safety = major design options that lead to a controlled operation of the installation.**

- **Prevention.** Core cooling based on primary circuit with natural circulation + complete absence of pipelines, valves & tee-branch
  - Risk of accidents related to primary circuit greatly limited.
- **Accidental transients.** Fuel temperature margins ~400°C as concerns TRISO robustness + inertia of various core components
  - A design with favourable physics & time to manage events.
- **Fallback state.** Sub-critical (control rods drop); power transfer from core => Na/boiler structures; forced convection evacuation
  - A simple approach that helps with compliance with post-accident procedures.
- **Safety demonstration.** Based on methods and data developed in Phenix, Superphenix & Astrid projects
  - Validation at proof-of-concept in 2025-26 (laboratory scale), & at non-nuclear prototype in 2030 (reactor scale).

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**FRANCE 2030 LAUREATE IN THE CALL FOR "INNOVATIVE NUCLEAR REACTORS"**