CENER | NATIONAL RENEWABLE ENERGY CENTRE

IGLOO

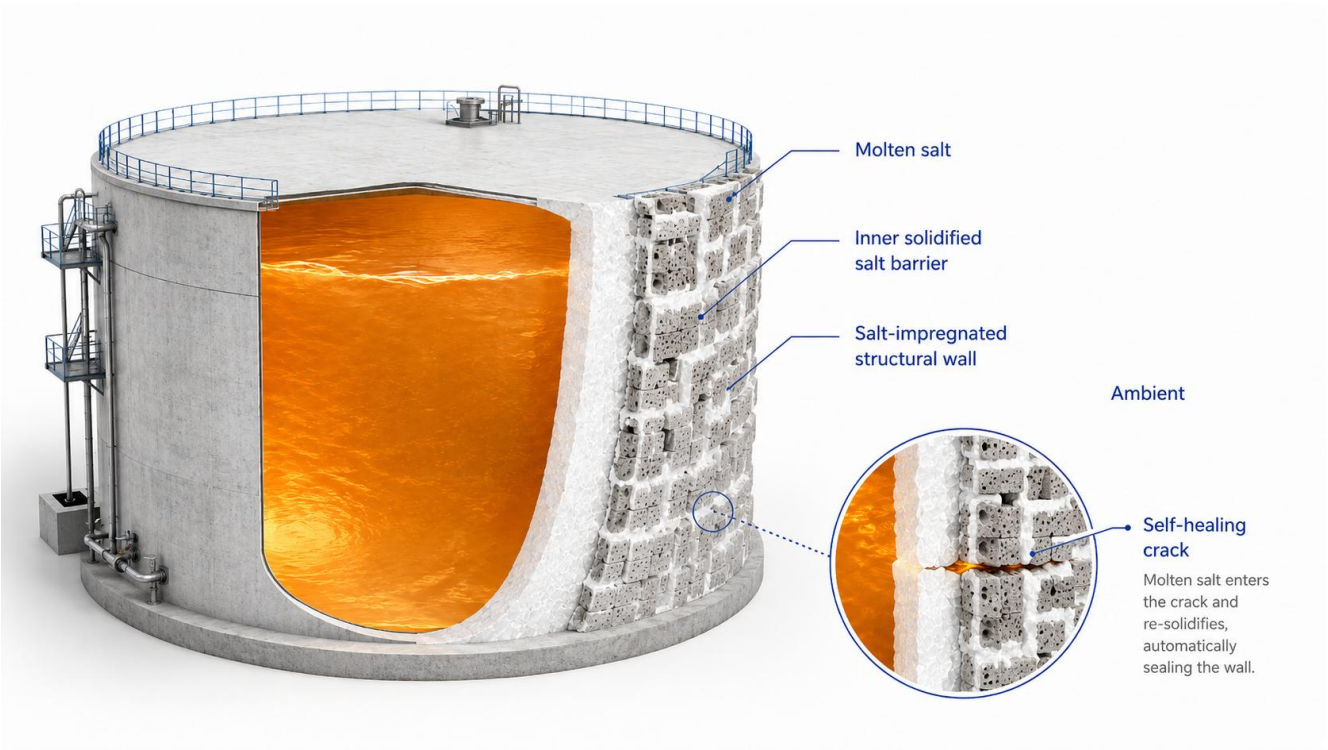
Self-Contained Molten Salt Tanks for Scalable Thermal Energy Storage

A breakthrough tank concept using solidified molten salt as part of the containment wall to reduce corrosion risk, overcome size limitations and enable next-generation CSP storage.

STRATEGIC CO-DEVELOPMENT / DEMONSTRATION OPPORTUNITY FOR CHINA

IGLOO is a new construction concept for molten-salt thermal energy storage tanks. Instead of relying on a conventional steel containment wall in direct contact with high-temperature molten salt, IGLOO uses solidified molten salt as part of the wall itself. The structural wall is built from porous cementitious or ceramic elements and then impregnated with molten salt during construction. After cooling, the salt solidifies and creates a chemically compatible barrier that separates the liquid molten salt inside the tank from the structural wall.

In molten salt storage, the tank wall becomes the weakest link. IGLOO turns the storage medium itself into part of the solution.



Conceptual section of the IGLOO self-contained molten salt tank showing the liquid salt, inner solidified salt barrier, salt-impregnated structural wall and self-healing crack behaviour.

Self-contained	No steel contact	Self-healing	TRL 3 to 6/7
salt-based containment	with liquid molten salt	crack sealing behaviour	demonstration pathway

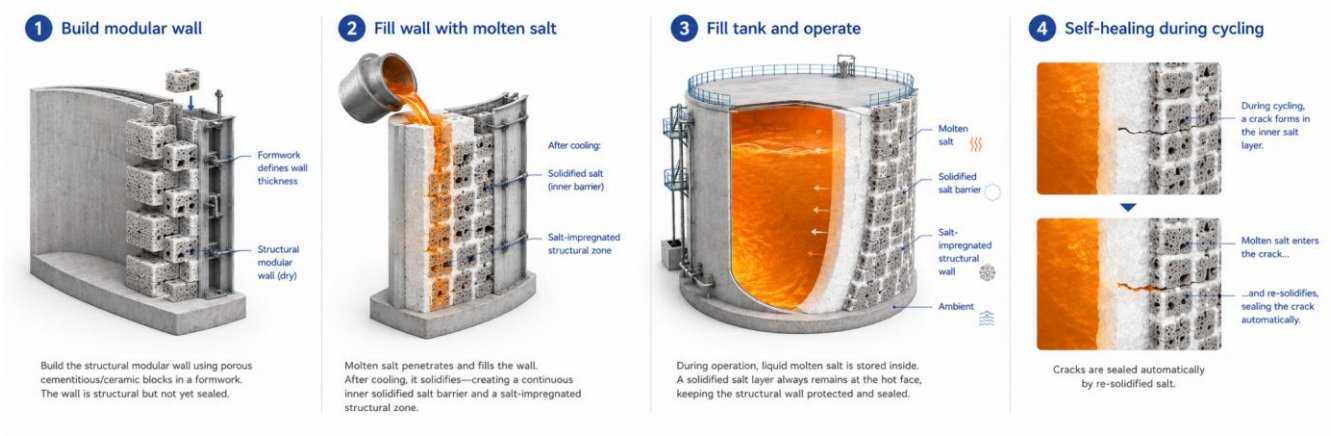
Why molten salt tanks need a new approach

Molten salt storage is the only thermal storage technology widely demonstrated at commercial scale for CSP, but conventional steel tanks face two persistent limitations: corrosion and thermal-cycling stress. High-temperature molten salts are corrosive in direct contact with steel, while repeated charge and discharge cycles generate expansion and contraction stresses that limit tank size and increase maintenance risk. These constraints make large-scale, long-duration storage more expensive and less robust than it could be.

The IGLOO solution

IGLOO proposes a self-contained tank wall where the same material used for heat storage - molten salt - also becomes part of the containment system. The wall is not a conventional sealed steel shell. It is a modular civil-engineering structure impregnated with salt. During operation, the inner salt layer may partially melt and solidify as the tank charges and discharges, but liquid molten salt never reaches the structural wall because a solid or phase-change salt barrier remains in between.

How it works



IGLOO construction and operation sequence: the porous structural wall is built, filled with molten salt, solidified, operated as a storage tank and self-sealed during thermal cycling.

- Build the modular wall: porous cementitious or ceramic blocks, large-format bricks or equivalent structural elements are assembled. This wall provides mechanical support but does not need to be the primary sealed barrier.
- Fill the wall with molten salt: the wall is confined with a formwork or equivalent system and molten salt is poured into pores, joints and gaps.
- Solidify the salt wall: after cooling, the salt solidifies inside the wall and becomes a functional construction material, sealing and chemically protecting the structure.
- Operate the tank normally: the tank is filled with molten salt. During charging and discharging, only an inner phase-change zone cycles between liquid and solid; a solid salt barrier protects the structural elements.
- Self-healing behaviour: if cracks appear, liquid molten salt can enter locally and re-solidify in the next cycle, automatically sealing the defect.

Technical advantages

- Corrosion risk addressed at the root, because the containment barrier is chemically identical to the storage medium.
- Potential to overcome conventional tank size limitations through modular civil-engineering construction.
- Reduced use of expensive corrosion-resistant steel and potential CAPEX/OPEX reduction.
- Potential pathway to next-generation higher-temperature salts such as chlorides and carbonates, beyond current nitrate systems.
- Simple, robust and potentially circular material concept based on inorganic, widely available materials.

Target applications

- Thermal energy storage for solar tower CSP plants.
- Power-to-heat-to-power and grid-scale long-duration storage.
- Hybrid CSP plants with electric heaters and flexible grid operation.
- Repowering of thermal assets using molten-salt storage.
- High-temperature storage for next-generation CSP and industrial heat.

Current maturity and development need

IGLOO is an early-stage protected concept supported by small-scale tests and thermal modelling. Existing work has demonstrated the feasibility of maintaining salt solidification inside the wall and preventing leakage at small scale. The next step is relevant-scale demonstration under representative molten-salt filling, draining and thermal-cycling conditions, with a construction methodology suitable for industrial replication.

Intellectual property

- Protected technology. European priority application EP22383208.0.
- International and national-phase patent filings are in progress, including China.
- Publication details should be disclosed only once officially available.

Opportunity for China

China is one of the most active markets for solar tower CSP deployment and has strong industrial capacity in construction, EPC, storage systems and high-temperature energy infrastructure. IGLOO should be positioned as a strategic co-development and demonstration opportunity: a Chinese partner could help validate, adapt, industrialize and deploy the concept in future CSP and power-to-heat storage projects.

Partnership model

CENER is seeking partners for joint development, demonstration, scale-up and future industrial exploitation. Ideal partners include CSP developers, EPC contractors, tank and civil-infrastructure companies, molten-salt technology suppliers, utilities and industrial groups seeking long-duration thermal storage solutions.

Partner with CENER to validate and scale a breakthrough molten-salt tank concept for China's next generation of dispatchable solar tower plants.