

# Next-Gen Molten Salt TES Technology for Advanced Carnot Batteries

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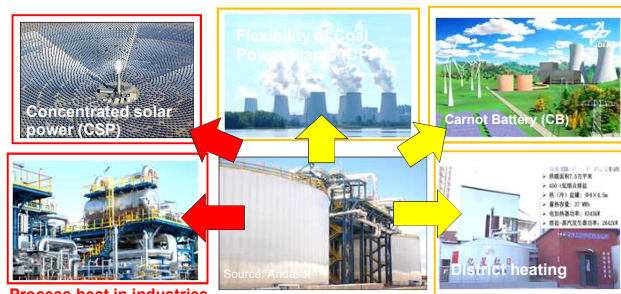
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## Molten Salt Thermal Energy Storage (MSTES)

- **Main advantages of MSTES technology:**
  - ✓ **Inexpensive:** CAPEX of commercial Nitrate MSTES ~30 Euro/kWh [1],
  - ✓ **Safe:** Non-pressurized, non-toxic and non-flammable,
  - ✓ **Long lifetime:** >30 years, > 10 000 cycles,
  - ✓ **Mature:** Commercially demonstrated in GWh-scale for >15 years.
- **Commercial and emerging applications of MSTES:**
  - ✓ **Process heat in industries** (thousands of commercial installations, e.g., heat carrier or thermal bath),
  - ✓ **CSP plants** (>2GW<sub>el</sub> / >50GWh<sub>th</sub>),
  - ✓ **Carnot Battery** (under demonstration),
  - ✓ Increasing **flexibility of coal power plants** (under demonstration),
  - ✓ **District heating** using excess green electricity (under demonstration).
- **DLR has >30 years experience in R&D of MSTES.**



= Commercial applications  
 = Under demonstration

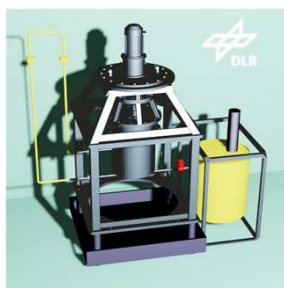
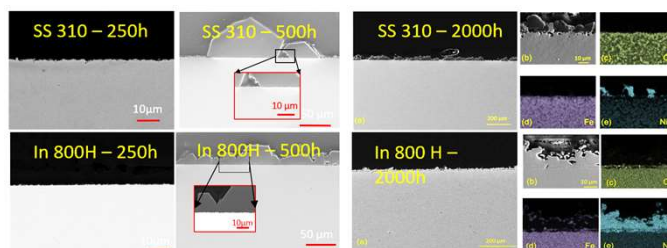
[1] M. Mehos, et al. Concentrating solar power Gen3 demonstration roadmap. US: NREL, 2017.

## Next-Gen MSTES for Advanced Carnot Batteries

### Next-Gen MSTES based on chlorides (Gen-3) [2]

- **Higher operating temperature:** 420-750°C
- **Inexpensive and abundant material:** MgCl<sub>2</sub>-NaCl-KCl, <5 Euro/kWh<sub>th</sub>
- **Low CAPEX:** Similar to that of commercial Nitrate MSTES
- Patented **corrosion control system (CCS) technologies**
- **100 kg-scale Test loop** with CCS (up-scaling) in progress.

[2] Q Gong, T Bauer, W. Ding, et al., Applied Energy 324, 2022, 119708

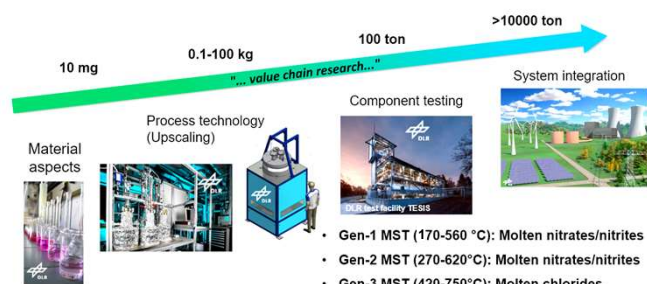


### Advanced Carnot Battery with Next-Gen MSTES

- **Advanced power cycles** (e.g., sCO<sub>2</sub> Brayton) and **E-heater/high-temperature heat pump** integrated
- **High operating temperature:** >700°C
- **High round-trip electricity storage efficiency:** >50%
- **Potential lower levelized cost of storage (LCOS)** than Carnot Battery with Nitrate MSTES and steam Rankine power cycle



## MSTES R&D Group and Materials Labs in DLR



### Group for value chain research of MSTES in DLR

- From material via component to system level
- Three generations MSTES



Three well-equipped MSTES materials labs in DLR (Technical, Chemical and Thermophysical)

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