TECHNISCHE UNIVERSITÄT WIEN
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Particle based Heat Exchange and Storage System suitable for CSP and for other TES-Applications

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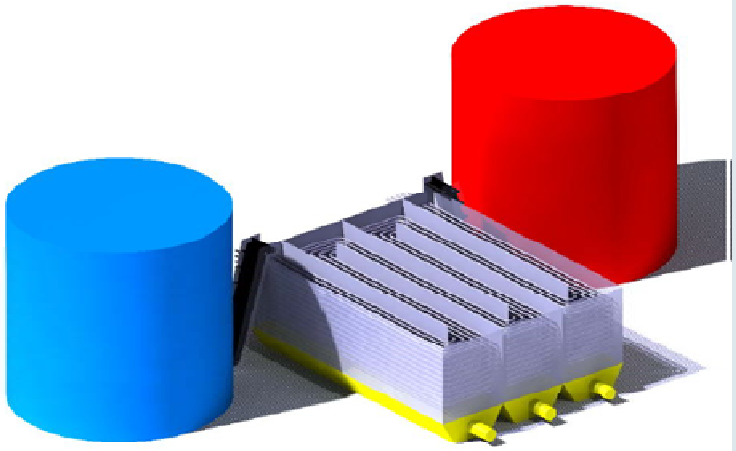
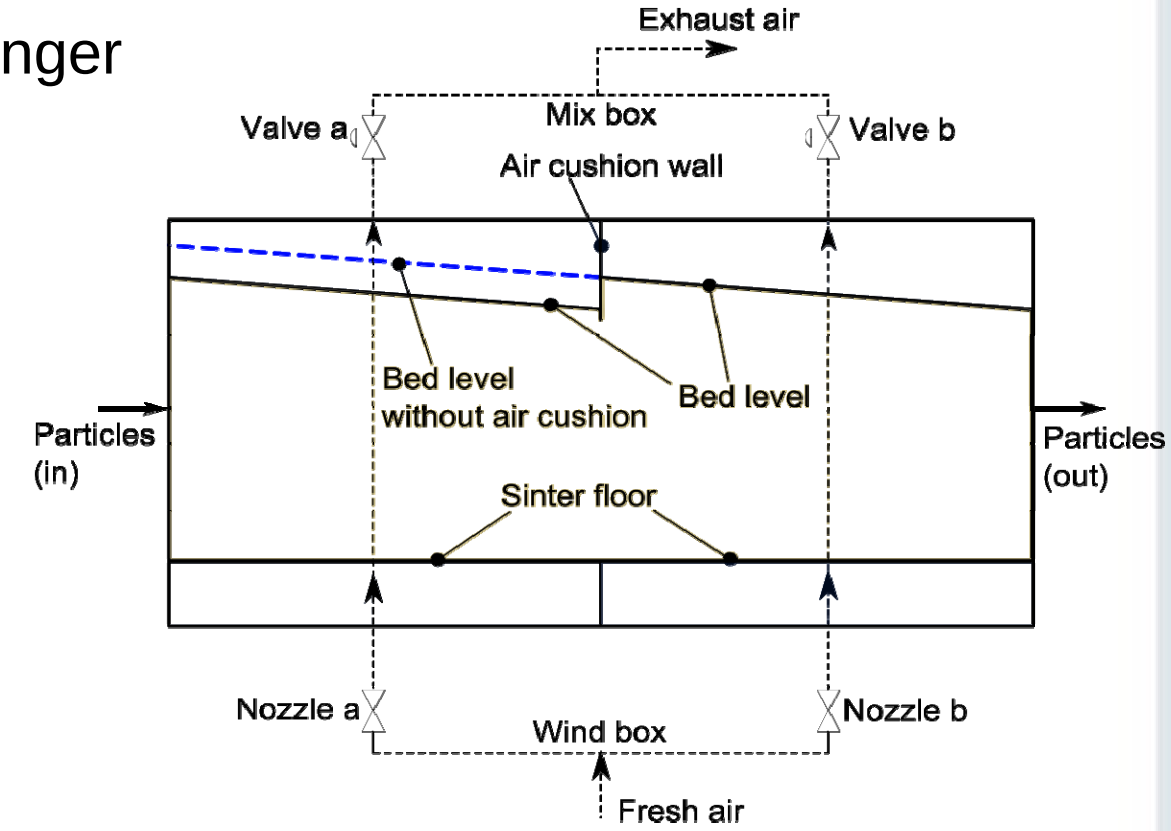
TUW - SandTES – Technology - Approach

- Two tank particle system approach (development started in 2011)
- Solids (Particle diameter ~80-100 microns) as Storage Media
  - Quartz sand (SiO_2), Corundum (Al_2O_3) oder Siliconcarbide (SiC)
- Bucket conveyors and screws for transport
- Innovative fluidized bed HEX
- Different applications (CSP, ACAES, Thermal plant flexibilisation,…)
- Powerful design tool for Fluidized bed HEX
- Upfront labscale validation and CPFD (Barracuda) simulations
- Many system design studies
- 280kWth / 390° hot test rig



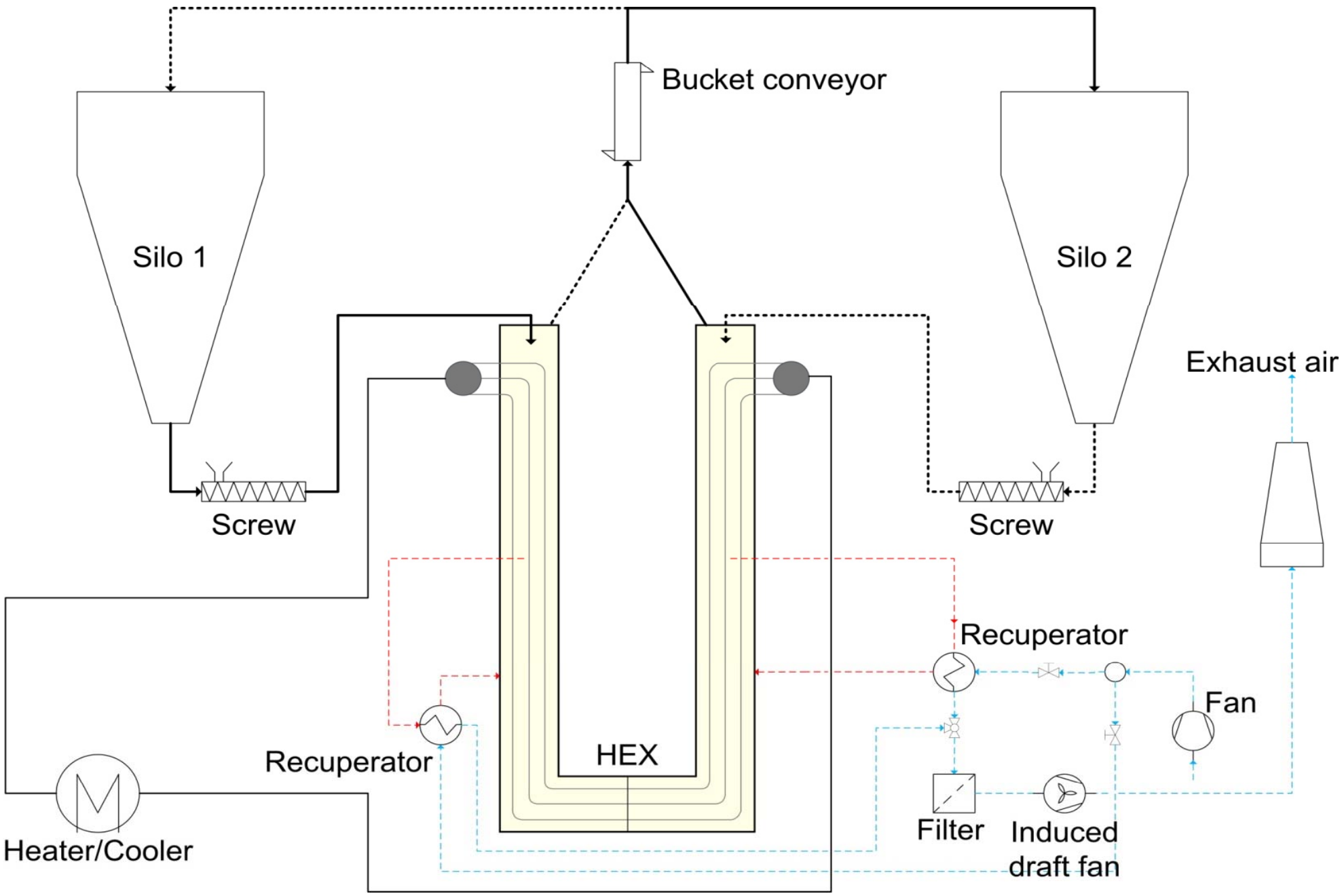
sandTES-Fluidized Bed HEX Technology

- Novel fluidized bed heat exchanger
- Plug flow
- Counter current
- Scalable
- Minimized Bed Inventory
- Rapid Flow Inversion possible

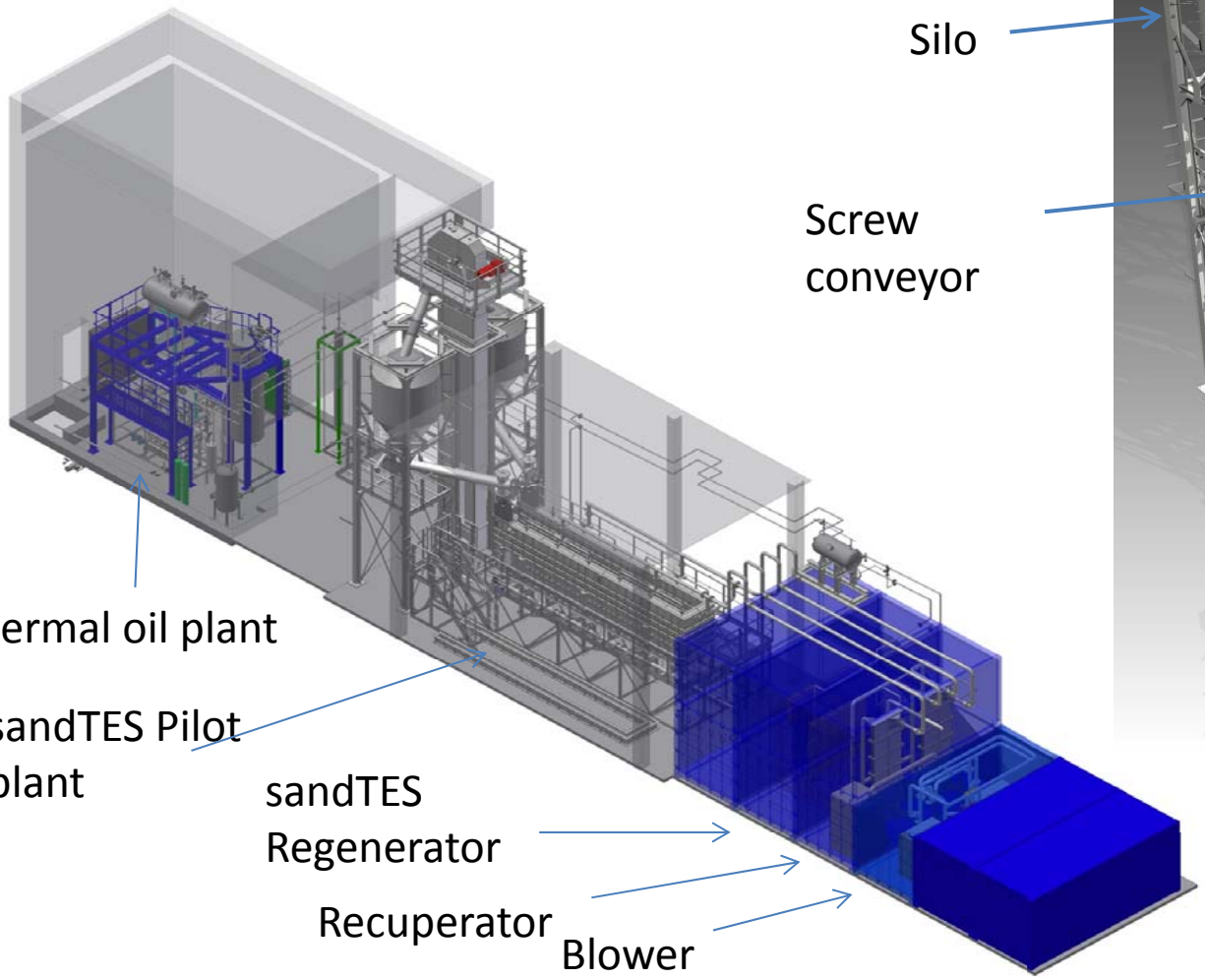


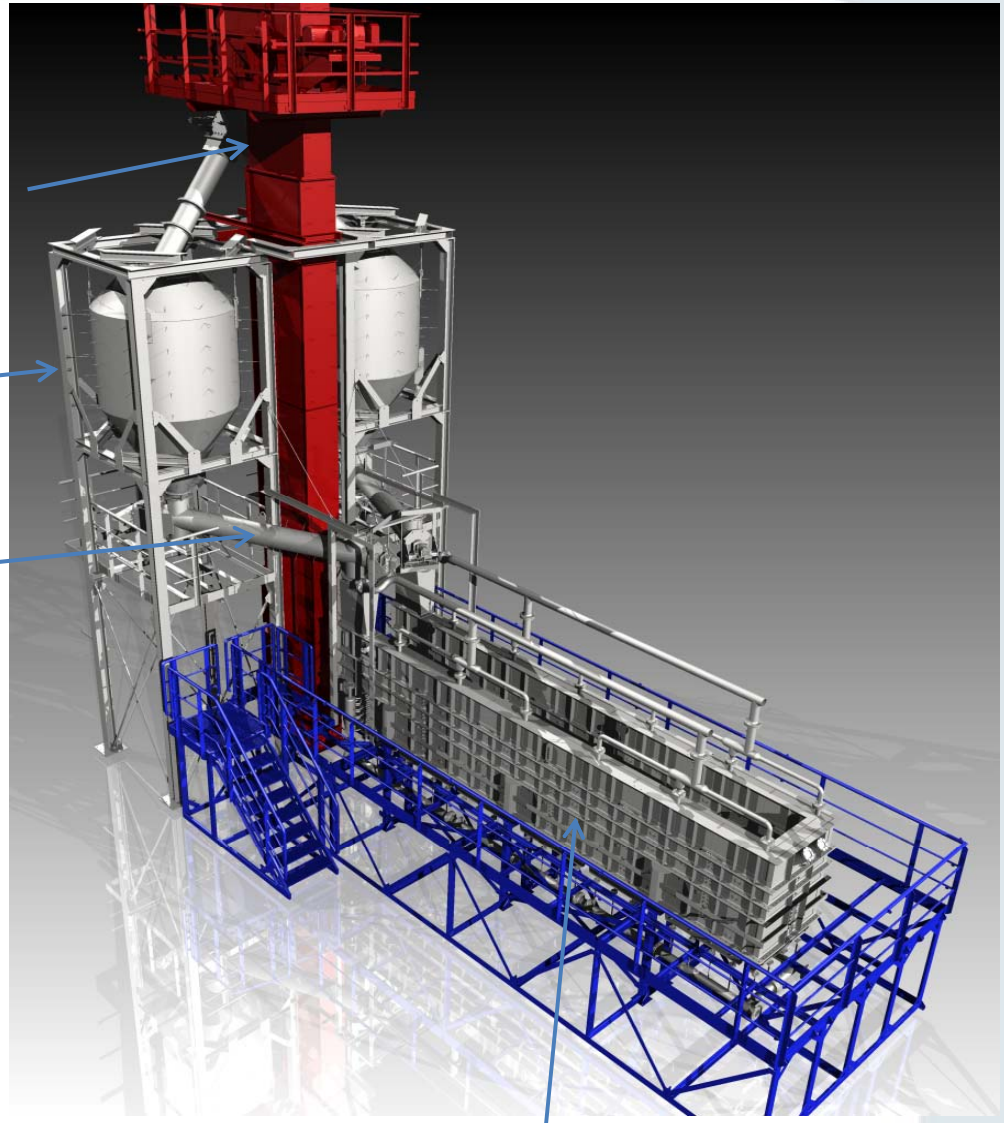
- ➢ Nozzle distributor floor (Patent 1)
  - Stable fluidization near the minimum fluidization velocity
- ➢ Air cussion technology (Patent 2)
  - Controll of the particle flow

SandTES test rig – Process flow sheet



Pilot plant - Overview





- Pilot plant start-up

Current and Future Work

Experimental Analysis

- **operational behaviour** (dependence on max mass flux density on fluidization grade),
- the **performanc**e data (heat transfer coefficients, segregation effects, plug flow quality)
- **scale up** factors (dependence on fluidized bed height and on particle type)
- Current particle material is 80µm sand.

Next generation design

is under development but cannot be disclosed yet (patent pending).

System Scale Up

and Application for Power 2Heat 2 Power- Projects in Austria

International Cooperation with Particle receiver groups

=>(Solids Flow Modelling, HEX design, heat transfer, particle transport…
=> bringing in the Fluidized bed HEX competence to international projects
=> (Steam Generator Designs available)

ABSTRACT

The Institute of Thermal Energy Systems at TU Wien in Austria has been working since 2011 on the development of a particle based TES system. We are concentrating our research efforts on system design, system modelling, and on the development of an advanced pure counter current fluidized bed heat exchanger with minimum solids inventory and minimized auxiliary power.

The research group is operating two hot test rigs and three cold test installations. The largest test rig has a thermal capacity of 200-280kWth and 1MWh of Energy, and a maximum operating temperature of 390°C (due to using thermal oil).

The current research effort is aiming at fully validating the operational behaviour, the performance data and the scale up factors. Current particle material is 80µm sand.

A next generation design is under development but cannot be disclosed yet (patent pending).

Beside experimental development, the research group has published several papers dealing with the optimum design of particle based CSP systems, of the design of ACAES systems and the application of particle based test in the flexibilisation of thermal power plants.