

SandTES - High Temperature Sand Thermal Energy Storage

Thermal Energy Storage (TES) | Sand | Fluidized Bed | Ash Cooler

Volatility of renewable energy generation asks for efficient thermal energy storage systems (TES). The novel TES of Vienna University of Technology (VUT) is based on sand and uses the fluidization principle, thus creating a highly efficient heat exchanger and storing heat at high temperature and large quantity in a cheap and uncritical storage medium.

Roland Eisl from ENRAG GmbH participated in this invention of VUT.

Background

TES systems are essential subsystem modules for energy efficiency improvement in renewable, industrial and residential energy systems. TES should be environmentally friendly and comprise features such as low investment costs, low operational costs and high availability.

Technology

The invention called SandTES consists of a fluidized bed with internal heat exchangers, two bunkers (hot and cold) and equipment for handling the storage material sand. The fluidized bed has the function of a counter flow heat exchanger between sand and primary fluid. Fluidization air is an auxiliary fluid needed for heat transfer and controlled transport. Compressor Energy for the fluidized bed is minimized. An appropriate fluidization air heat recovery concept minimizes exergy losses.

Benefits

- very low costs of the storage medium sand
- widely available natural material without hazard issues
- high specific heat capacity and density
- non-corrosive and stable over a very wide temperature range (100-800°C)

Potential Applications

- Concentrating Solar Power
- Adiabatic Compressed air storage (CAS)
- Industrial Heat recovery ("Ash Cooler" after a fluidized bed combustion chamber)

Development Status

A cold acrylic glass model allows for experimental testing, a 200kW prototype is under construction

A comprehensive mathematical design and simulation model is available to estimate performance and determine design parameters.

Current research:

- Minimization of fluidization energy and maximization of the heat exchange per volume unit of the heat exchanger unit
- Optimization of heat recovery
- Testing of material handling devices
- Testing of dynamic system behaviour (rapid changes from loading to unloading, system response after a long storage period, etc.)

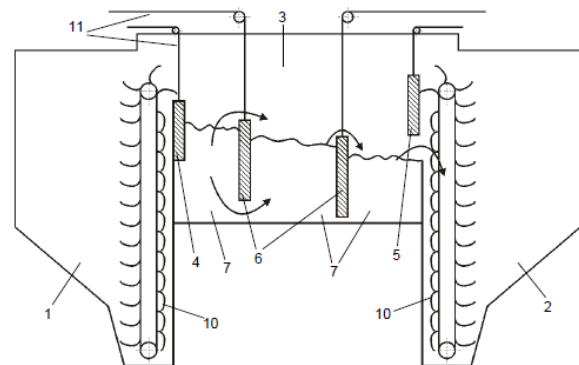


Fig1: Basic arrangement of sand system (primary fluid arrangement as well as heat recovery concept not shown)

Status of the IPR

AT510.897 granted in Austria, EP 2612098 validated in DE, ES, FI, FR, UK, IT, PL, and patents pending

Cooperation Options

License agreement, development partnership

Inventors

Roland Eisl, Markus Haider, Franz Holzleithner