Vienna types of energy storage

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Developing a technical solution able to overcome the current technological barriers that limit the penetration of RES in the DHC sector. Proposed technology allows to significantly increase the RES share and the reuse of energy waste from industry in DHC networks improving their competitiveness and environmental sustainability and promoting the involvement of stakeholder, consumers and industries, see Figure 2, eventually meeting the targets of the EU strategy for Heating and Cooling and the EU"s climate and energy goals.

CEN- Foundation CENER TUW - TU Wien POL - Politecnico di Milano TUR - Turboden EB - Enerbasque SIM - SemTech Simulation Technology AAL - Aalborg CSP SIG - Steinbeis Innovation GmbH AND - Andritz RD - S?dbayrisches Portland-Zementwerk Gebr. Wiesb?ck Co. GmbH UBB - Babes-Bolyai University PI - Prospex Institute vzw

The idea on which this project is based is to install thermochemical storages in ovens for heat recuperation and control. For the temperature range of this application, thermochemical material for the low-temperature range is used. Due to the high storage density of thermochemical storage materials, very compact systems can be built that can be easily integrated into ovens.

Thermal storage concepts for an oven are currently mostly based either on the conversion into latent heat or on the conversion into electrical energy. Latent heat conversion is designed for short-term use during the cooking process. In particular, the energy present in the (possibly water-laden) exhaust air should be transferred to the supply air. The conversion into electrical energy by means of a thermal generator requires a battery or something similar to store the energy.

To heat the food in the oven, not only the air in the oven but also the oven is heated. This requires a corresponding amount of energy, which is given off as heat to the environment, especially after the cooking process has ended.

The aim of this research project is to develop a functional model for thermochemical heat recuperation in an oven using different thermochemical substances and to carry out extensive investigations into the limitations of the system, the optimal process control, the applicability for the end customer, the practical potential and the challenges, in the real system to perform.

The Institute of Energy Systems and Thermodynamics (IET) has been working on the development of particle based high temperature heat storage systems (Thermal Energy Storage - TES). By 2020 this work has produced four (4) patents, ~15 publications, 6 laboratory scale test rigs, two (2) pilot plants and one (1) license agreement.

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The original idea targeted the thermal storage in adiabatic compressed air energy storages (ACAES). Very soon, it became evident that the concept is also applicable in Concentrated Solar Power (CSP), Electro-thermal Energy Storage (ETES) in conjunction with steam and sCO2 cycles (also named Carnot batteries or PTES - Pumped Thermal Energy Storage) and for industrial heat storage.

All mentioned applications need an indirect particle/fluid heat exchanger, which is optimized for (a) maximized overall thermal performance, hence counter-current characteristic; (b) minimized auxiliary power; (c) minimized costs, hence maximized heat transfer and heat transmission coefficients.

ETES cycles have the additional requirement (d) that the particle suspension flow has to be reversible in order to allow a fast switch from charge to discharge operation and that suspension plug flow is of utmost importance.

IET has developed two basic heat exchanger designs. The original concept, also named sandTES_1.0, was based on longitudinal flow of particles along the tubes. A more recent development called sandTES_2.0, is based on transversal flow across the tubes.

Both concepts use the patented approaches of a 2-stage fluidization grid (for stable and even distribution of fluidization air) and the use of valve-controlled air cushions downstream of the freeboard. The air cushions are obligatory for efficient reversal of particle flow in ETES applications. They are also essential for installing a plug-flow flow behavior on particle side.