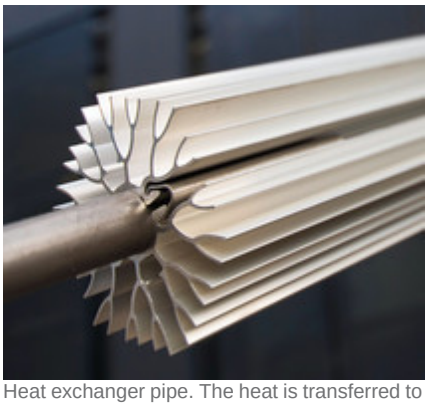
World’s largest high-temperature latent heat storage system leaves Bavaria for the Saarland.

High-temperature latent heat storage system 27.09.2018

Heat storage system replaces steam boiler

Arrival at Wellesweiler cogeneration plant. Test operation scheduled to commence in spring 2019.

The world’s largest high-temperature latent heat storage system reached its future deployment site, the Wellesweiler cogeneration plant of STEAG New Energies GmbH in the Saarland, upon a flatbed truck mid-September. The system is intended to ensure permanent steam supply to an adjacent plant for the production of plastic sheeting. To date, operation of an additional heating boiler has been required under continual minimal load. This currently takes over short-term steam supply in the event of a malfunction of the power plant turbine until a steam boiler is initiated.



Heat exchanger pipe. The heat is transferred to the salt via the fin structure.

The Wellesweiler cogeneration plant of STEAG New Energies GmbH also supplies steam to a plant manufacturing plastic sheeting alongside other industrial customers. As this production process is highly sensitive in terms of its response to parameter changes of steam, steam boilers have previously been used to back up the heat recovery boiler fired by the gas turbine. Using a heat storage system capable of assuming the supply of superheated steam within two minutes and of maintaining this for at least 15 minutes, the steam boilers could be initiated from the warm state and wouldn’t need to be permanently operated at minimum load.

In the TESIN research project, researchers from the DLR and their project partners investigated ways of making high temperature processes in industry more efficient and reliable using suitable latent heat storage systems. A principle aim of the research was to develop, design and test a research storage system by way of example for the cogeneration plant.

The specific requirements associated with the storage system made new fundamental product developments essential: The storage system is required to achieve an output of 6 MW over the quarter-hour operating time and to supply steam at a pressure of 26 bar and a temperature of at least 300 °C. The researchers calculated a minimum capacity of 1.5 MWh.

Melting salt stores heat

The German Aerospace Centre (DLR) took charge of the thermal design of the storage system and subsequently

tasked Seab GmbH with its detailed dimensioning and construction. The storage medium is sodium nitrate, which melts at around 305 °C and can absorb large amounts of energy (94 kWh/m³) for the melting process. The salt re-solidifies on emptying the storage system and re-releases the previously absorbed thermal energy. The storage concept is based on the concept of a pipe-bundle heat exchanger. Water or water vapour flows through the piping in the bundle and absorbs heat from the storage material. The storage material is located in the casing space of the pipe-bundle storage system. To ensure high implementation output is deliverable, fins are attached to the piping. Initial research is now possible in the power plant on a storage system on this scale.

Future prospects

Initial installation steps are scheduled for autumn 2018: Necessary first steps include connecting the piping from the cogeneration plant to the storage system and testing the function of sub-systems. The system will then get thermal insulation. It will then be possible to fill the storage system with sodium nitrate.

“We expect to be commissioning the latent heat storage system in power plant operation in the coming year,” explains project manager Maike Johnson, “initial trials and storage system analyses can then get under way.”

A project of the Energy Storage Funding Initiative

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