Horizon 2020 project CHESTER: economic business case developments for the CHEST system and prototype success stories shared

The CHESTER project is now in its second year of development and many steps have been taken so far to ensure partner collaboration and rapid developments as the project takes on more demanding activities.

As Ispaster (Spain) case study has been selected as one of the most promising ones, an economic model has been developed by the partner PlanEnergi. The CHEST storage technology has been initially examined purely from the technical perspective. The system was tested in different European locations which varied by volumes of renewable energy and energy needs of the consumers. The latest achievement developed by PlanEnergi was placing this innovative electricity storage technology in realistic conditions and evaluating its economic performance. This aimed to understand how the CHEST system can be implemented at the electricity market and what are its competitive advantages over other alternative power storage options as for example hydrogen storage.

During the second year of the CHESTER project, the three prototypes being developed by German Aerospace Center (DLR), Research Center Tecnalia and Ghent University have leaped forward in developments too.

Ghent University (UGent) presented the Flexible Organic Rankine (ORC) during the first project year and now, based on a thermodynamic model, the selection of the main components and the working fluid have been made. The expander employed in the ORC prototype is a piston expander with variable valve timing (VVT). Varying the timing of the valves creates a varying expansion ratio which can be controlled to match the transient loads received by the CHEST system. A preliminary test-rig will be finished by November in order to test the expander and to validate the design model. The main components, including the electrical and control cabinet, for the final test-rig are in the lab and construction will commence October.

DLR is responsible for the development and manufacturing of the Thermal Energy Storage System (TESS) required for the CHESTER-prototype which consists of a Latent Heat Thermal Energy Storage (LH-TES) and a Sensible Heat Thermal Energy Storage (SH-TES) to minimize entropy production during charging and discharging. Since different refrigerants are considered for the High Temperature Heat Pump HT-HP and the ORC, a specific heat exchanger must be designed for LH-TES. Therefore, several simulations and a thermodynamic analysis as well as various simulations of the whole LH-TES unit have been carried out. For the SH-TES, a two tank configuration was chosen, which considers a hot and a cold tank with pressurized water. During charging and discharging the water will be shifted between the tanks for sub cooling (HT-HP) or rather for preheating (ORC) of the refrigerant in the appropriate circuit. Currently, both components of the TESS are in the tendering process.

During the last period of the CHESTER project TECNALIA have finsihed developing the detailed deign on the High Temperature Heat Pump (HTHP). The University of Ulster has installed a dedicated test rig for the analysis of the refrigerant-lubricant interactions. The latest results from this analysis will provide the necessary information on the mixture's behaviour at the CHESTER's operating conditions, which will be essential for the selection of the most suitable lubricant to be considered in the HTHP

prototype. On the other hand, the preliminary thermodynamic analysis and modelling of the HTHP that was performed by the University of Valencia has been validated with the experimental data gathered from the compressor's laboratory tests performed by Tecnalia. Since the compressor performed as expected and the preliminary sizing was validated, Tecnalia proceeded with the detailed design for manufacturing of the HTHP prototype and has already purchased all the main components. Thus, the HTHP prototype will be ready for being manufactured very soon. Finally, relevant progress on the electrical and control cabinet has also been made. The first version of the HTHP's control algorithm is already available, and during this month and it is expected that the control cabinet will be manufactured and supplied to Tecnalia very soon.

The CHESTER project aims at developing and validating an innovative system that will allow for energy management, storage and dispatchable supply of many different Renewable Energy Sources (RES) by combining the electricity and heat sectors.

Want to know more about the CHESTER project? Visit the project website: https://www.chester-project.eu and subscribe to CHESTER newsletter here to receive all the updates regarding this exciting project.

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