

Borehole Thermal Energy Storage system for swine farm

Borehole thermal energy storage systems represent an effective solution to increase the energy efficiency of renewable energy plants. Still, they generally have to comply with strict regulatory frameworks, mainly due to the deliberate modification of the subsoil's natural state. RES4LIVE involved the design, installation testing, and monitoring of a borehole thermal energy storage (BTES) system able to exploit the excess solar heat from photovoltaic thermal collectors (PVT).



A specific procedure was developed to allow the balance between the underground solar thermal storage and the geothermal heat extraction, in a specific climatic and geological context, to achieve an almost 100% exploitation of renewable energy.



BTES implementation in a pilot farm

Characterization of the underground properties and analyses over, according to the following phases:

- investigation of geological, hydrogeological and geothermal conditions;
- numerical modeling of the flow and heat underground transport;
- Installation of test Borehole Heat Exchangers and dedicated piezometers;
- Thermal Response Test and quantification of the potential heat storage
- detailed design of the final system;
- system installation in the farm, commissioning and activation.



BTES performances



The data measured during one year of testing and monitoring of the installed system, showed the following results in terms of performances of the geothermal heat storage:

Underground seasonal storage of 40% of solar thermal energy producible through PVT panels;

- Increase of COP of heat pump to heat a pig barn from 3 (air source mode) to 5 (geothermal source mode with BTES)
- Replacement of a 34 kW LPG boiler with a heat pump requiring only 9 kW_{el}, which can be provided by the same PVT used to feed then BTES.
- Yearly emission reduction: 8621 kgCO₂eq for a 840 m² pig nursery barn.

