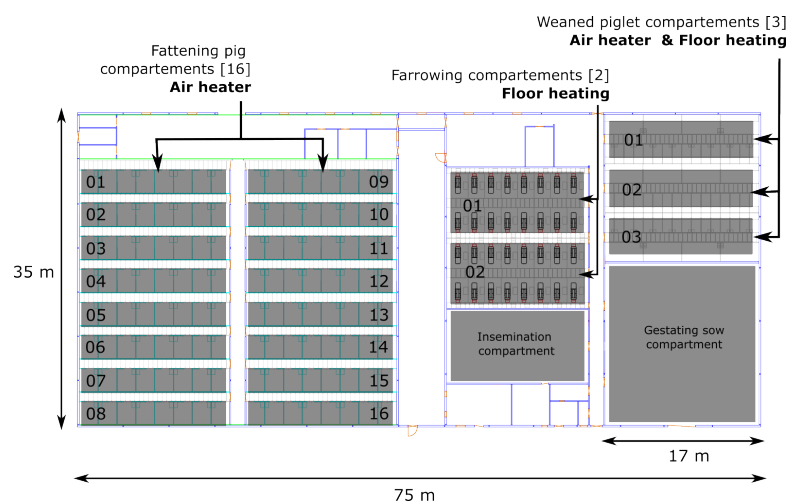
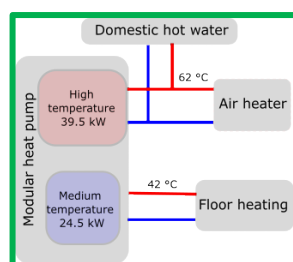


An integrated renewable energy source (RES) system for the decarbonization of experimental swine farm

An integrated renewable energy system (RES) was designed and implemented for an experimental swine farm as a sustainable alternative to the fossil-fuel-based heating system. The RES setup includes 24 photovoltaic thermal (PVT) collectors, two modular heat pumps, and a thermal energy storage tank. The control system monitors the heat energy supply, while a network of sensors tracks environmental conditions. Monitoring and evaluation results highlight the system's efficiency and effectiveness in replacing the farm's fossil fuel-based gas boilers, demonstrating the viability of this renewable solution for meeting the farm's heating needs.



The farm's heating requirements include air heating for the fattening pig compartments, floor heating for the farrowing compartments, and a combination of air and floor heating for the weaned piglet compartments. The entire heating demand is met year-round by the integrated renewable energy system (RES). Previously, a fossil-fuel gas boiler was used to heat circulating water to 70 °C for these needs. Now, two modular heat pumps have been installed: a high-temperature pump that heats the water to 62 °C and a low-temperature pump that heats it to 42°C. Additionally, the RES system offers a hybrid operation feature, allowing it to simultaneously utilize heat from both PVT panels and air sources, which enhances heating capacity and improves the system's coefficient of performance.



Integrated RES system at ILVO swine farm

- A PVT system with a solar station unit to generate 8.4 kW_{el} electrical energy, and 32.8 kW_{th} thermal energy.
- Thermal energy storage tank that stores the thermal energy from the PVT that is used to increase the heat pump coefficient of performance.
- Two modular heat pumps
 - 24.5 kW medium temperature
 - 39.5 kW high temperature
- Smart control and sensor system.

