12th International AIIA Conference: September 19-22, 2022 Palermo - Italy

"Biosystems Engineering towards the Green Deal"
Improving the resilience of agriculture, forestry and food systems in the post-Covid era

A pilot system to replace fossil energy with renewable sources in pig barns

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Keywords. Renewable energy, Livestock barn, Defossilising agriculture, Energy efficiency.

Abstract. The study was developed within the innovation project RES4LIVE "Energy Smart Livestock Farming towards Zero Fossil Fuel Consumption", running in the period 2020-2024 under the call "Defossilising agriculture – solutions and pathways for fossil-energy-free farming" of the European program Horizon 2020

Fossil fuel use in farming has negative effects as a major source of greenhouse gas (GHG) emissions, with significant contributions to global climate change. One of the most energy-consuming sectors of agriculture is intensive livestock that is mainly based on fossil fuel use. Both electricity and thermal energy are required to cover strongly diversified energy demand, such as cooling-heating of the indoor livestock buildings environment, powering equipment, lighting and ventilation systems. With declining costs and improvement of reliability and performance of key renewable energy sources (RES) technologies, the opportunities for farmers to engage in RES production are increasing. The objective of RES4LIVE is to develop integrated, cost-effective and case-sensitive RES solutions towards achieving fossil-free livestock farming. To that end, the project adapts and tests promising RES technologies in energy-intensive livestock farming for greatly reducing the fossil energy that is the main source to cover the energy demand. Dedicated, optimal designs combined with energy efficiency and other solutions are proposed, demonstrated in pilot farms, and evaluated technically, economically, environmentally, and socially.

The pilot case presented in this research is a swine farm located in Modena province (northern Italy), rearing 500 sows and 2500 weaners. The de-fossilization project focuses on the nursery barn and consists in the development and installation of an integrated RES system combining a photovoltaic-thermal plant, a geothermal storage, and a modular heat pump. A smart control system was also designed to be installed for indoor environment monitoring and energy management.

The project is presented, and the results of the design phase are reported. The results highlight that the energy demand of a livestock farm can be met by a mix of RES properly designed, which takes advantage of the renewable resources available in the farm context.