Policy Brief No11

Heat pumps for HVAC of agricultural constructions (RES4LIVE)

What is the challenge?

- According to the European Commission, the agricultural sector accounts for about **10% of total Greenhouse Gas (GHG) emissions** in the European Union. Of the total energy demand for heating and cooling applications, agriculture **uses about 6%**.
- Modern Heating, Ventilation, and Air-Conditioning (HVAC) applications play a crucial role in agriculture where maintaining **optimal temperature and humidity levels is essential** for animal welfare (livestock facilities) and crop productivity (greenhouses).
- Barriers to adopting sustainable HVAC systems in agriculture include **high initial investment costs**, **limited technical knowledge**, and **lack of policy support (mainly the adoption of EU level policies to the national level)**. However, opportunities exist to overcome these barriers through technological advancements and supportive policies.
- **Heat pumps** offer a promising solution for agricultural HVAC applications with reduced GHG emissions. As a RES, heat pumps can provide efficient heating and cooling and dehumidification, while significantly lowering carbon emissions.

Policy Recommendations

EU Level: Due to the fossil fuel dependence of European agriculture, as well as its potential for RES adoption, the EU can foster the widespread take-up of heat pumps in the agricultural sector, promoting sustainable farming practices, reducing GHG emissions, and enhancing energy efficiency. Based on the high efficiency of heat pumps (COP[29] > 4), we call on their promotion, further research, and development for HVAC applications in agricultural holdings. In more detail, we strongly recommend:

- **Assess the potential of heat pumps in different types of agricultural facilities to determine optimal systems for each location:**

Conduct feasibility studies and pilot projects to evaluate the efficiency and cost-effectiveness of heat pump installations in various agricultural contexts. Via energy auditing, identify specific agricultural applications where heat pumps can provide the greatest energy savings and emission reductions, such as in livestock barns, poultry houses, and greenhouse operations.

- **Implement monitoring and evaluation systems to track performance and energy efficiency, providing feedback to farmers and technicians on optimizing their systems:**

Encourage the development and adoption of smart monitoring technologies that allow farmers to monitor heat pump performance, total energy consumption, and environmental conditions in real time. Provide guidance on data analysis and interpretation, enabling farmers to identify areas for improvement and implement energy-saving measures accordingly.

- **Encourage the integration of heat pumps with other RES, such as solar or geothermal power, to elevate the COP, further reducing GHG emissions and energy costs:**

Promote the concept of hybrid, modular systems that combine heat pumps with other renewable energy technologies to maximize energy efficiency and minimize reliance on fossil fuels.

[29] Coefficient of Performance: A higher COP indicates a more efficient system, as it can provide more cooling or heating while using less energy. If a heat pump has a COP of 4, it means that for every unit of electrical energy it consumes, it produces four units of thermal energy (heating or cooling).

- **Support research and development efforts to design heat pump technologies specifically tailored for the agricultural sector, considering the unique challenges of high humidity in greenhouses and high humidity and corrosive environment in livestock buildings:**

Allocate funding for research institutions and industry collaborations to develop and test heat pump technologies that can withstand the harsh conditions commonly found in agricultural facilities[30]. Encourage the development of innovative materials, coatings, and components that improve the durability and longevity of heat pumps in agricultural settings.

- **Foster partnerships and collaborations between heat pump manufacturers, agricultural stakeholders, and research institutions to drive innovation and knowledge transfer:**

Facilitate forums, workshops, and networking events to promote dialogue and collaboration among heat pump manufacturers, farmers, researchers, and agricultural associations. Establish funding programs or grants to incentivize joint projects and knowledge-sharing initiatives aimed at advancing heat pump technology in the agricultural sector.

- **Establish guidelines and standards for the design, installation, and operation of heat pumps to ensure safety, reliability, and efficiency:**

Work with relevant stakeholders, including agricultural experts, heating and cooling professionals, and regulatory bodies, to develop "best practices" guidelines and standards specific to heat pump installations in agricultural constructions. Address considerations such as system sizing, integration with existing infrastructure, noise levels, and environmental impact to ensure optimal performance and compliance.

- **Develop training programs and materials for farmers and technicians on the installation, operation, and maintenance of heat pump systems:**

Collaborate with agricultural organizations, industry associations, and educational institutions to design and deliver training programs that cover the technical aspects of heat pump operation and maintenance. Provide educational material, such as manuals, videos, and online courses, to ensure accessibility and knowledge dissemination to a wide range of farmers and technicians.

- **Provide financial incentives and explore innovative financing models to offset initial investment costs[31] and incentivize farmers to adopt heat pump systems.**

Member States Level:

- An example is the Agroenergy Programme of Poland (subsidies for heat pumps and photovoltaics for farms from the Provincial Fund for Environmental Protection).
- In Italy, energy efficiency checks are mandatory only on heating systems higher than certain power: according to art. 8 of the state dpr concerns winter air conditioning systems with nominal useful thermal power starting from 10 kW and summer air conditioning systems with nominal useful thermal power starting from 12 kW. To

[30] RES4LIVE and TheGreefa are ongoing Horizon 2020 projects, that can provide further insight by the end of 2024. Only a few companies, such as INNO+, have started implementing heat pump solutions for specific applications in livestock buildings.

[31] Average manufacturing costs can vary quite broadly because of several factors, including the type of heat pump (such as air-source, ground-source, or water-source), its efficiency, capacity, and installation requirements. Additionally, prices may vary across different EU countries. For example, the cost of an air-source heat pump in Greece could range from ~300 to 700 €/kWth depending on the size and special characteristics of the facility (operation mode, installation location, etc.)

check if you are above these thresholds and therefore subject to these checks, the MISE-7 faq contains two important clarifications: (i) for refrigerating machines and/or heat pumps, even if sometimes used for heating, the 12 kW threshold applies: energy efficiency checks are mandatory if the useful power of the machine in one of the modes of use (winter air conditioning/ summer) is such or higher; (ii) b) in the case of the presence of several machines/generators, to check whether the power thresholds that involve the obligations relating to energy efficiency controls are exceeded, "the sum of the powers must be carried out only when the machines are at the service of the same subsystem of For individual appliances with power lower than the limit values shown in the aforementioned attachment A [10 kW for flame generators or those powered by district heating - 12 kW for refrigerating machines - 50 kW electrical for cogeneration plants] are not completed, therefore , energy efficiency audit reports".

- In the Netherlands, there are subsidies for stimulation sustainable/renewable energy production that include heating with heat pumps.
- In Denmark, subsidy for electrically powered heat pumps at basic amount plants outside the quota sector is supported by the Danish Energy Agency with DKK 23.4 million DKK in 2017 and 27.9 million DKK in 2018. The purpose is to counteract high heating price increases and to electrify heat supply. In addition, subsidy for individual heat pumps when scrapping oil, wood pellet and gas boilers (Scrap scheme) is provided aiming to phase out oil, wood pellet and gas boilers and instead promote the use of individual heat pumps for heating buildings and thus contribute to reducing Denmark's emissions of CO_2.

Expected Impacts

By implementing the recommended policies and supporting the widespread adoption of heat pumps in the EU agricultural sector, we can accelerate the transition towards sustainable farming practices, reducing GHG emissions, and promoting energy-efficient operations while ensuring the well-being of animals and crop productivity, as well as avoiding environmental degradation.

- Individual farmers can benefit from **reduced energy costs, improved energy efficiency, and lower carbon emissions**, resulting in long-term financial savings.
- The **EU agriculture sector can contribute to the overall reduction of GHG emissions**, helping to achieve climate change mitigation targets and promoting sustainable farming practices.
- Animals and plants in agricultural constructions can experience improved welfare and productivity through **precise temperature and humidity control**, enhancing their health and overall well-being.
- The energy produced within the short carbon cycles of circular agriculture can **make agriculture a prosumer** as well as an energy supplier for local communities, increasing the economic health of rural communities, improving their energy security, and making them more resilient to climate change and energy market fluctuations.

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