Practice Abstract 6: Smart Energy Modelling for Farms – Balancing Renewable Supply, Demand and Cost

COUNTRY AND CLIMATIC ZONE

Pan-European

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3 BENEFITS OF THE PRACTICE

- Combines multiple data sources and modelling approaches for more accurate energy simulations in farming contexts.
- Supports better integration of renewable energy technologies at different scales.
- Offers scalable tools that can be adapted to varied agro-environmental conditions across Europe.

PRODUCTION SYSTEM

N/A

KEYWORDS

Agro-energy, Sustainable Agriculture, Energy Self-sufficiency, Rural Communities

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The HarvRESt project is developing hybrid simulation models to assess how different renewable energy technologies can be integrated into agricultural systems. These models combine technical, economic, and environmental data to inform smarter energy planning on farms.

LONGER DESCRIPTION – IN ENGLISH

As part of its goal to support the decarbonisation of agriculture, the HarvRESt project is building a set of hybrid models that simulate the interaction of renewable energy technologies within farm environments. These models are designed to evaluate how different configurations of solar, wind, biomass, and energy storage systems perform under varied agricultural and climatic conditions.

What makes these models "hybrid" is their combination of:

- Deterministic simulations (based on physical energy system behaviour)
- Data-driven approaches (using real farm data and scenario parameters)
- Economic modelling (to assess return on investment and financial viability)
- Environmental impact analysis (to estimate emission reductions and sustainability trade-offs)

These models serve both a diagnostic and a planning function. On one hand, they allow project partners to identify what system designs are most effective in real-world scenarios. On the other, they provide insights that can be embedded into tools such as the HarvRESt Decision Support System (DSS), ensuring that technical feasibility is reflected in strategic decision-making.

The hybrid models are also being calibrated with data from the HarvRESt Use Cases to ensure they reflect actual farming conditions. This allows for localised recommendations and highlights the flexibility of the approach – something especially valuable in a project with a pan-European scope.

The outputs will eventually feed into public-facing planning tools and policy discussions, showing how digital modelling can accelerate the uptake of renewable energy across agriculture.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description: HarvRESt Hybrid Simulation Models (forthcoming)

URL: TBD