HarvRESt project, Greener Farming with RES: the Catalan use case

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HarvRESt
Greener Farming with RES

Introduction

Competitive conflicts for land use between the food and energy sectors have appeared, which could be mitigated by the **vertical integration of Renewable Energy Systems (RES) in farms** through new circular business models. By this approach, farms will become climate neutral, optimizing their production and reducing their impact on natural resources and biodiversity, on top of providing energy services to communities and diversifying their economic income.

To this end, **the main goal of HarvRESt is to work on improving the existing knowledge on alternatives for farms decarbonisation, maximising synergies between agricultural and energy sectors**. As a result, HarvRESt will create a decision support system (DSS) capable of providing ad hoc recommendations to both farmers and policy makers that will improve production rates of renewable energy, food and feed.

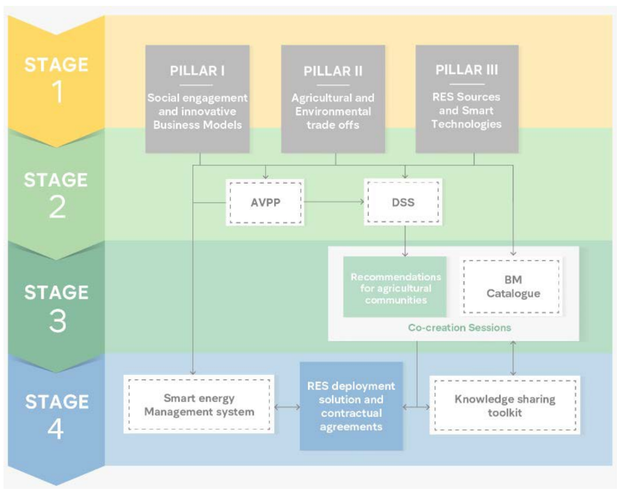
The Catalan Use Case: Noguera-Sorigué

Focusing on the Catalan scenario, Noguera-Sorigué, the consortium between Sorigué, Axpo and the "Torre Santamaría" farm, develops this Use Case in collaboration with the BETA Tech Centre. Currently, it has a **biogas production unit consisting of 4 digesters** that valorise agro-residues and produce digestates in the process.

The main interest is to collect data from the biorefinery to model and optimise biogas production from agro-residues. Furthermore, the **fertiliser potential of the nutrients recovered from the resulting by-product (the digestate)** will be assessed to mitigate the impact of renewable energy, increase circularity in the farm and diversify farm incomes.

Method

HarvRESt will implement a **transdisciplinary and holistic approach** based on three main pillars. The integration of the pillars will be materialized in the creation of an **Agricultural Virtual Power Plant (AVPP)** that combined with **Multi Criteria Decision Analysis (MCDA)** will provide the necessary information for HarvRESt **Decision Suport System (DSS)** to make recommendations of the best RES integration solutions and operation procedures.



Use Cases

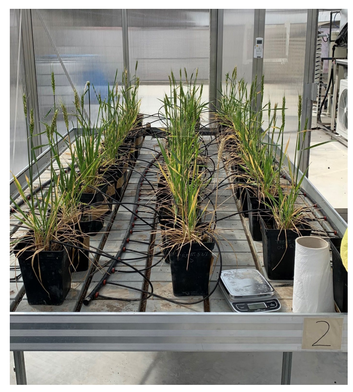
The development of HarvRESt models must be supported with **real data that validates the simulations** performed by the consortium. To this end, HarvRESt will count on real data from **5 associated use cases**:

- **Italian UC:** this UC will address RES integration at farm level with its 70 MW agro-PV, which will provide useful information for the development and validation of solutions.
- **Danish UC:** this UC builds on existing datasets on biogas production on farms. It will assess the current level of activity and potential for biogas production, along with its impact on greenhouse gases and nutrient balances.
- **Spanish UC:** it counts with 2 use cases.
  - Aragonese UC: effects on vineyard production through a digital based management and optimization of RES assets will be assessed.
  - Catalan UC: data from the biorefinery will be collected to model and optimise biogas production from agro-residues. Also, the fertiliser potential of the digestate will be assessed.
- **Norwegian UC:** this UC will manage the integration of the energy storage system interaction with the different renewable assets that supports the full decarbonization process of livestock farming.

Experimental Campaign

Different experimental activities will be carried out on an experimental campaign to achieve the objectives of the Catalan UC:

1. **Agronomic assays** will be performed under natural conditions in the **field** and controlled conditions in the **laboratory** through **pot-tests** using representative soil to analyse the capacity of the digestate for improving nutrient management, soil quality and crop yield and replace current mineral fertilizers in crops.
2. **N release dynamics** of the digestate will be assessed and compared with other similar fertilizers by **soil incubation assays** to determinate whether the product can be deemed as worthy substitute of current products in the market.
3. **Nutrient losses** will be evaluated through two approaches:
   - Nitrate residues & leaching risk will be assessed by the determination of NO_3-N residue in the simulated soil profile (0 – 90 cm) in the post-harvest period.
   - Gaseous emissions from digestate will be evaluated by calculating the emission of ammonia (NH_3) and greenhouse gases (N_2O, NO, and CO_2).



Expected Results

From the Catalan use case, the expected results are the following:

- The data collected from the biorefinery will help modelling the biogas production from agro-residues feeding in this way the HarvRESt AVPP.
- The valorization of the digestate including its fertilizer potential will be assessed. If the agronomic assays are promising, it will be used as a product on the farm.
- Additionally, the capacity for methane production from recycled CO_2 sources to be used as fuel itself or as an H_2 energy carrier will be evaluated theorically.

In this way, these results from the Catalan UC should contribute to the completion of several Key Exploitable Results (KERs) expected from the HarvRESt project:

- **KER2.** KPI's for Performance Monitoring.
- **KER3.** Soil quality methodology.
- **KER4.** Biogas planning tool.
- **KER8.** HarvRESt Agricultural Virtual Power Plant (AVVP).
- **KER9.** HarvRESt Decision Support System (DSS).

14 KEY EXPLOITABLE RESULTS

1	Mitigation measures catalogue
2	KPI's for performance monitoring
3	Soil quality methodology
4	Biogas planning tool
5	Forecasting algorithms
6	HarvRESt hybrid Models
7	HarvRESt smart energy system algorithms
8	HarvRESt AVPP
9	HarvRESt DSS
10	Strategy for multiactor engagement
11	Capacity building material
12	BM catalogue
13	Co-creation guidelines
14	Knowledge sharing toolkit

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