INTRODUCTION

Energy communities are a new model of energy management that aims to take advantage of local energy resources and involve the different social agents of the environment in order to obtain energy, environmental, social and economic benefits.

Information provided by the directives or available literature about energy communities is limited to the concept and its properties or shows some cases of similar configurations such as energy cooperatives but does not go into detail on the more technical necessary aspects to set up an energy community.

OBJECTIVE

To shed some light on the more technical aspects related to the design of energy communities, through the development of a methodology and its application to a practical case in the municipality of Vinalesa (Valencia, Spain) in order to support the sizing of the community’s generation assets and the design of the electricity tariff according to the conditions of the environment, as well as to study its technical and economic viability.

METHODOLOGY

The Methodology developed is a roadmap that considers the most important technical and economic parameters when designing an energy community which is connected to the grid, has renewable energy generation assets and makes an equitable distribution of the benefits obtained. It consists of 3 different phases depending on the decision to make. At each step you will get key information that will guide you to fine-tune the starting conditions until you achieve an Energy Community design that fits your needs.

Phase 1: Selection of generation technology and preliminary sizing.

- **Input parameters** → natural resources, consumption, electricity tariff, energy technologies and economic parameters. Design criteria.
- **Calculation tool** → Homer Grid
- **Analysis of results** → Net Present Cost, NPC (€) and Levelized Cost of Energy, LCOE (€/kWh), fraction of renewables, excess energy, payback period.

Phase 2: Final configuration and sizing of the power plant with commercial components.

- From phase 1, we obtain the most suitable generation technologies available and the order of magnitude of the power needed in order to search for commercial equipment and compare them by simulating again with Homer to choose the ones that best fit our needs.

Phase 3: Design of the new electricity tariff and economic feasibility analysis.

- The new community energy tariff will reflect the savings due to shared self-consumption.
- The power term and the tariff periods of the current tariff will be maintained, and the new one will be calculated based on the levelised cost of energy (LCOE) obtained in phase 2.

CONCLUSIONS

- The proposed tool for designing energy communities as it allows choosing and sizing renewable generation assets in a precise way as well as knowing its economic and technological feasibility. It also offers a simple calculation method to design new electricity tariffs for the members of the community based on the Levelised Cost of Energy obtained with the hybrid system.
- Thanks to this methodology, it has been possible to verify that with the installation of 870 kW of photovoltaic power and a storage capacity of 1.08 MWh in lithium-ion batteries, the residents of the municipality of Vinalesa could have additional savings of around 16.4% on their electricity bill, considering a payback period of 8.83 years for the power plant.