Local Energy Communities with a positive net balance

Research area: Regulatory framework and market models
Research line: Analysis of regulatory barriers and future scenarios in energy market and the technical-economic feasibility of local energy communities.
Partners: Technological Institute of Energy (ITE), AICIA & CARTIF

Executive summary: This document summarises the results obtained in the research area "Regulatory Framework and Market Models" of the HySGrid+ consortium. In particular, the concept of local energy communities with a positive net balance (LECP) and the types of LECPs identified within the project are discussed below. It then briefly discusses the tools and technological enablers that will be necessary to achieve a positive net balance in this type of collaborative business model. Finally, the regulatory barriers that have been encountered when implementing local energy communities with these characteristics are specified.

What is a Local Energy Community with a positive net balance?

At HySGrid+ we are committed to this new citizen-centred energy model. It is defined as a grouping of citizens located in close proximity to create a cooperative energy model that aims to achieve a community-wide reduction of imported energy from the grid and CO_2 emissions, while generating additional renewable surpluses so that the **community's annual energy imports and CO_2 emissions are net zero** or even that **the annual energy exported by the community is greater than that imported**. As illustrated in Figure 1, to achieve this goal, LECPs require the optimal and collective management of distributed energy resources within the community, as well as the empowerment of the consumer as a key part of this model. Consumers participate actively, democratically and voluntarily in the community, **their main objective being the associated social and environmental benefit** rather than economic profitability.

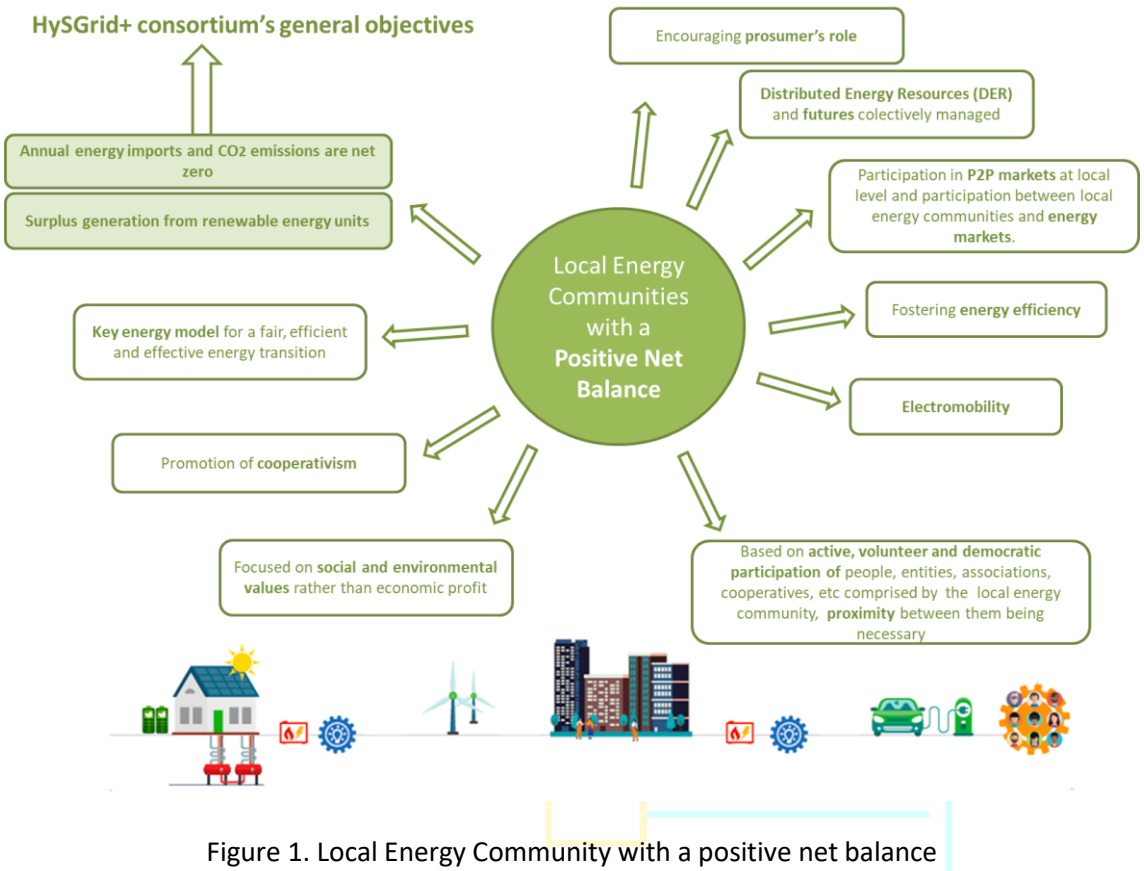

Figure 1. Local Energy Community with a positive net balance

Types of Local Energy Communities with a positive net balance

At HySGrid+ consortium, similar to the Positive Energy District (PED) concept, four archetypes of LECPs are established based on their geographical boundaries and interaction with the external grid:

Autonomous or self-sufficient LECP	Positive energy balance within its geographical boundaries and is designed to be self-managing (without importing energy from external boundaries/grids) or can even help to manage/balance the external grid (with services that do not involve importing energy). The main characteristic of this self-sufficient LECP would be that it is always generating at least what it consumes.
Dynamic LECP	Positive energy balance within its geographical boundaries, exchanging with the external network to compensate for energy surpluses and deficits. Renewable energy from own generation outside the geographical boundaries, PPAs (Power Purchase Agreements) or certificates of origin are not recognised for the calculation of the balance, although these options exist.

Virtual LECP	Positive energy balance within its virtual boundaries, exchanging with the outside to compensate for energy surpluses and deficits. Only energy from renewable generation outside the geographical boundaries that is owned by the community is counted towards the balance, but not PPAs or certificates of origin.
pre-LECP	Positive energy balance by exchanging with external grid to compensate for energy surpluses and deficits. This energy comes from PPAs (Power Purchase Agreements) or certificates of origin. It can also have renewable generation outside the geographical boundaries of owned plants.

As indicated above, a LECP must meet the following requirements: (i) positive net energy balance and (ii) zero net CO_2 emissions. The first requirement can be assimilated by the first four types of LECPs, while the second requirement can only be fulfilled by stand-alone or pre-LECPs, since, in case of importing energy from the grid, it must be guaranteed to be of renewable origin.

Tools for Local Energy Communities to achieve Positive Net Balance and Enhance their features

In order to achieve a positive net balance, it is necessary to enhance consumer's participation and provide them with certain tools that allow them to play a more active role in the energy management of their resources and of the community.

An energy consumer who produces or co-produces his or her energy demand individually or through collective organisations is called a **prosumer**. This figure is closely linked to self-consumption. If, in addition, the prosumer participates in flexibility schemes, he or she is called an **active customer**.

The main tools that aim to convert the consumer into an active customer are defined below:

Demand Response	Change of electricity consumption by final customers from their normal or current consumption patterns in response to market signals or in response to the acceptance of the final customers' offer to sell a reduction or increase in demand at a price on an organised market, either individually or through aggregation. We can differentiate among: • **Implicit demand response:** the change in behaviour can be motivated by the evolution of prices in the market. This is the case in most countries, the implementation of which does not require any technological breakthrough, and is predictable but not controllable. • **Explicit demand response**: there is the possibility of selling the reduction or increase of the energy consumed. It requires the implementation of technological systems and is controllable, as it

	is necessary to participate in an eventual market for the provision of this service.
Aggregator	A function performed by a natural or legal person that combines multiple customer consumptions or generated electricity for sale, purchase or auction in any electricity market. It enables the effective participation of active customers in flexibility services (explicit demand response).
Energy Efficiency	Effective reduction of demand so that the Energy Community can more easily achieve the net positive balance target.
Peer-to-Peer (P2P) transactions in renewable energy	Sale of renewable energy between market economic operators by means of contracts with pre-determined terms and conditions governing the automated execution and settlement of the transaction, either directly between market economic operators or indirectly through a certified third party market operator, e.g. an aggregator.
Energy-as-a Service (EaaS)	It includes the active management of individual and/or community energy resources (including individual thermal resources or district networks) that are user-centred, have novel tariffs and can provide demand response services.

Implementation Barriers

As seen above, in order for a Local Energy Community to achieve a positive net balance, it is necessary to provide community users with certain enabling tools. However, there are barriers to the implementation of these tools and thus to the implementation of LECPs:

Prosumer	• Passive role in participation in electricity markets.
Explicit Demand Response	• The participation of demand in balancing services is currently beginning to be regulated, so there are still no real cases in the Spanish electricity system in this field. • The minimum supply capacity to participate in balancing services is 1 MW, so residential and commercial consumers need the association with and aggregator to be able to participate.
Aggregator	• The main barrier of the participation of the aggregator in an Energy Community is the absence of a specific regulatory framework for its functionalities and obligations towards the different parties.
Peer-to-Peer (P2P)	• The lack of regulation in this area is the main barrier for its development.

Energy-as-a Service (EaaS)	• The lack of regulation with respect to enablers such as time-of-use tariffs and other mechanisms to enable demand response management and the implementation of innovative billing models. • The lack of incentives to deploy smart devices to be managed by service providers.