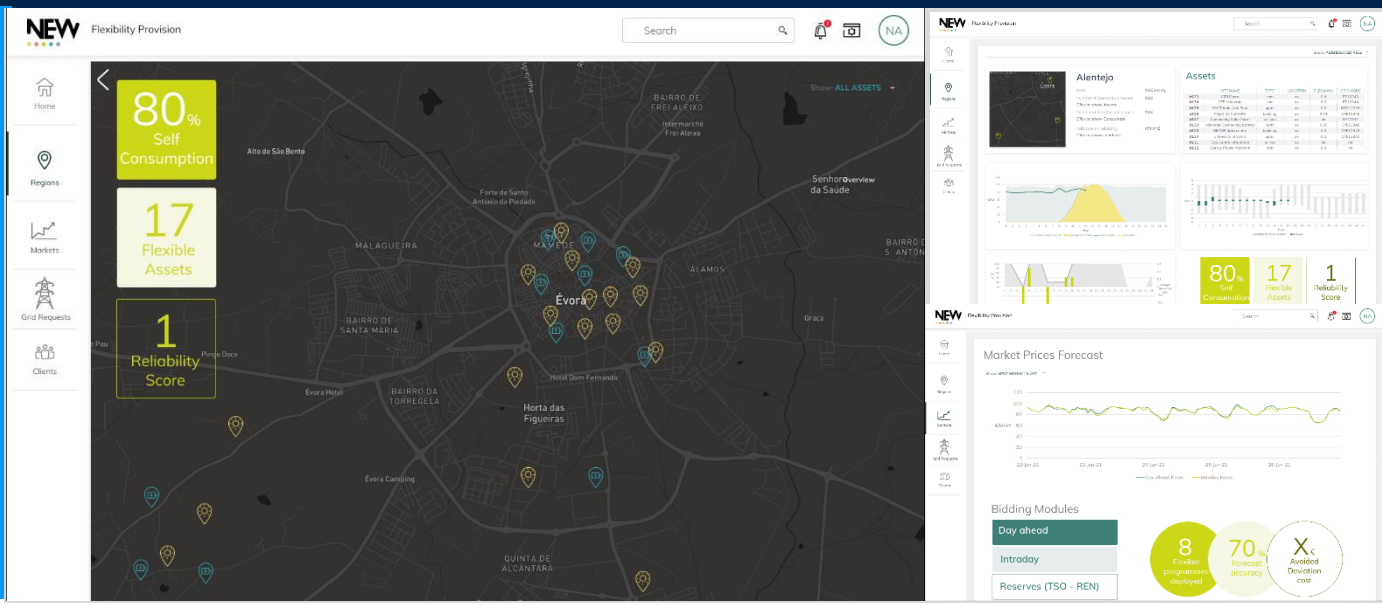
ETT2 - Flexibility

Market Oriented Building Flexibility Services



DESCRIPTION

MOB-FS is a simulation environment that calculates the value potential of the flexible assets in aggregated buildings across a PED district, with the view to maximise revenue in energy markets for an aggregator or community manager. The platform monitors market conditions and sends set point to control equipment to optimise the flexible load and generation available. Prerequisites to demonstrate this IE include a characterisation of the flexible loads across the district, monitoring equipment connected to load and generation assets, as well as actuation devices to be able to activate flexible assets when indicated. As of now, the IE is based on simulation, until appropriate legal and technical conditions allow.

INDICATORS

POTENTIAL DEGREE OF USEFULNESS

100% if key requirements are met

Already demonstrated in Lighthouse cities N

Cultural heritage compliance Y

PERFORMANCE

Calculate energy flexibility potential

Increase revenue for PED managers/aggregators

COST

(estimated) 1000€ per year - cloud server

DIMENSION

Larger dimension, more value

More applicable in countries with favourable regulation

TIME

Assume 15 min intervals of activating flexibility

SAFETY

GDPR must be carefully considered if implemented

SUSTAINABILITY

Ensure local renewable energy generation is fully utilised

KEY REQUIREMENTS

Need to have an entity who is capable of accessing energy markets – a retailer, aggregator or community manager who has access to appropriate market trading systems and legally entitled to do so.

A high volume of flexible assets in a district to be controlled is where value of this IE will come from. The monitoring and control of these assets (preferably automated) is required, alongside consent agreements with owners of assets on the flexibility schedules they must adhere to.

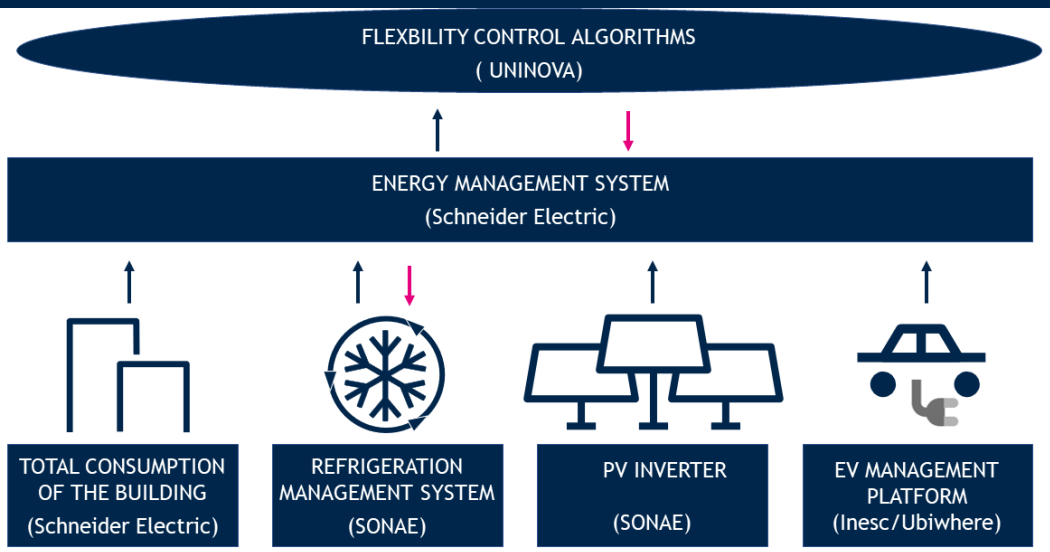
ENVISAGED DEMONSTRATION IN POCITYF

Simulation will develop the concept and values of aggregated flexibility from the Évora PEBs will be used to compute revenue potential of district, considering a set of assumptions.

IMPACT ON COMMUNITY

Direct involvement of community members/asset owners on energy management.

Flexibility Control Algorithms



DESCRIPTION

Flexibility Control Algorithms use the energy flexibility provided by new or existing controllable devices through APIs made available by the devices operators or other entities which enable the required monitoring and control activities. Flexibility Control Algorithms allow the characterisation and use of the available energy flexibility, at building and district levels, to achieve different objectives as defined by a specific DSM measure. This is achieved by modifying the controllable devices' energy consumption profiles while respecting the comfort needs and preferences of the involved consumers. During POCITYF, Flexibility Control Algorithms will be used in all PEBs to explore the available energy flexibility. For instance, in SONAE Commercial Building, this solution will explore energy flexibility provided by the refrigeration systems in order reduce electricity costs and improve the self-consumption of the future PV installation and therefore support the innovative element Freezing Storage in Store. The figure above presents the conceptual architecture of the solution to be deployed in SONAE Commercial Building.

INDICATORS

POTENTIAL DEGREE OF USEFULNESS

Context dependent

Already demonstrated in Lighthouse cities No

Cultural heritage compliance Yes

PERFORMANCE

Higher self-consumption

Lower electricity costs

COST

To be defined

DIMENSION

Software solution that can be applied at building level

TIME

Real-time operation

SAFETY

GDPR compliant

SUSTAINABILITY

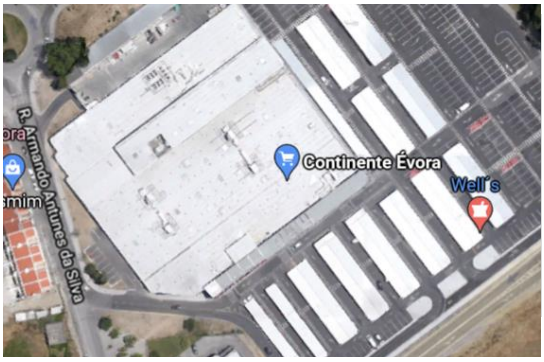
Promotes higher self-consumption of renewable energy resources

KEY REQUIREMENTS

There are several requirements to be fulfilled, from health and safety (e.g., ensuring that goods are kept within preestablished limits) to technical (e.g., integration of systems, data acquisition, connectivity) and business related (e.g., sustainable business models can be created and exploited). The main technical specification is related with the use of APIs made available by the controllable devices operators to conduct the required monitoring and control activities.

ENVISAGED DEMONSTRATION IN POCITYF

Despite being demonstrated in all PEBs, this section presents information related to the demonstration at SONAE Commercial Building as an example.



LOCATION

SONAE store – Continente de Évora, Quinta do Moniz, 7000-172 Évora, Portugal

TIMELINE

Flexibility Control Algorithms will operate for, at least, two years in Évora PEBs. Implementation expected during first quarter of 2022.

DETAILS

Refrigeration systems are critical in food retail. The solution will rely on data collected at the building to control different operation modes of the refrigeration system (each mode with different temperature set points). Given the criticality of the system, additional safety layer was imposed by the means of an additional Loytec controller, that will interact with Schneider hardware, which gets the control signals through an API. This Loytec controller will ensure that any miscarried command will not be passed to the refrigeration system. Additionally, apart from exposing all necessary variables and receive the control signals, Loytec controller will also group different types of cabinets and displays allowing dedicated management strategies for different clusters of goods, increasing the impact of the solution while ensuring each specific limit is met.

TARGETED OUTPUT

This store will be equipped with an oversized PV plant. Recurring to the Flexibility Control Algorithms Sonae aims to maximize self-consumption, storing cold as much as possible during “free solar energy” hours, therefore reducing dependency of the grid, maximizing use of renewable energy. As energy price varies along the day, potential for additional savings can be also explored. Last but not least, peak shaving strategies can be applied inducing savings on the contracted power.

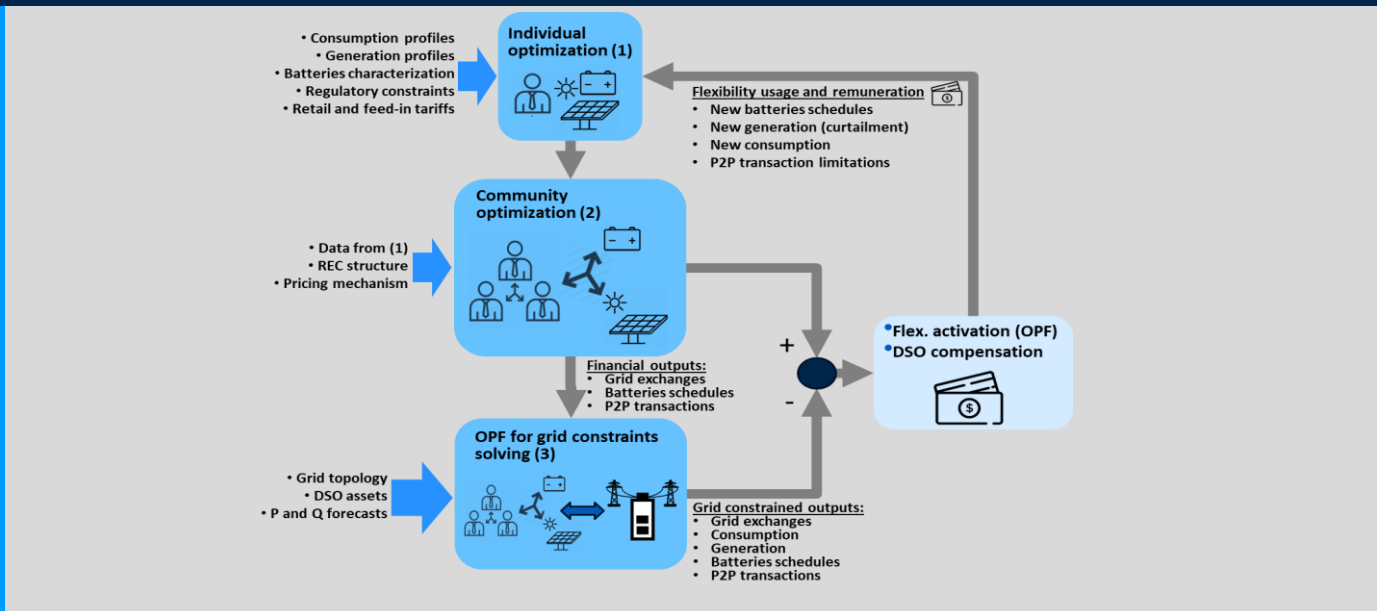
IMPACT ON COMMUNITY

Positive impacts on community include higher self-consumption and self-sufficiency ratios and lower reduction of electricity costs. No negative impacts are expected.

CULTURAL HERITAGE BUILDINGS COMPLIANT

Flexibility Control Algorithms refer to a software solution applied at tertiary buildings therefore with no negative impact on cultural heritage.

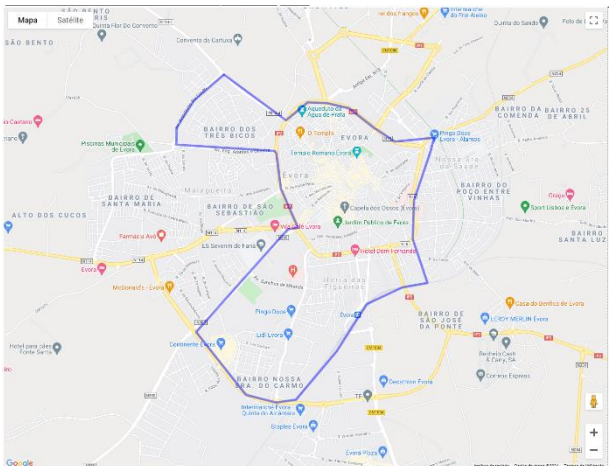
P2P Markets Analysis With Flexible Resources and Grid Constraints



DESCRIPTION

INESC TEC is developing a tool to validate the P2P electricity transactions of a local electricity markets of renewable energy communities (REC). The methodology is based on a three-stage model. In the first stage, each REC member, which can own a behind-the-meter battery and a generation unit and can also share a local generation facility with other REC members, optimizes its battery schedule to minimize its energy bill, according to its supply and feed-in tariffs. In the second stage, the REC energy bill is minimized, guaranteeing that all REC members face a new energy bill equal or less than their individual bill from stage 1. At this stage REC members can share locally their energy surplus and flexibility to obtain an additional benefit for belonging to the REC. The third stage is an optimal power flow (OPF) performed by the operator of the local distribution grid to solve any existing grid constraints. To do so, the grid operator activates the flexibility needed at minimum cost, assuming that the existing flexibility is the re-schedule of the prosumers' batteries, the curtailment of the local generation, or even the reduction of the prosumers' consumption if needed. In case an automatic energy management system is considered, stage 1 and 2 could run over a rolling window of 24 hours to continuously estimate the optimal batteries schedule and their set-point for the next delivery time. However, stages 1 and 2 can also be used to simulate the outcomes of a REC local energy market. For control or simulation purposes, a P2P pricing mechanism must be decided for stage 2 (such as the midpoint between retailers selling and buying tariffs).

ENVISAGED DEMONSTRATION IN POCITYF



LOCATION

Demonstration simulations are expected to be performed with Évora's Historic Centre (PEB1) MV grid.

TIMELINE

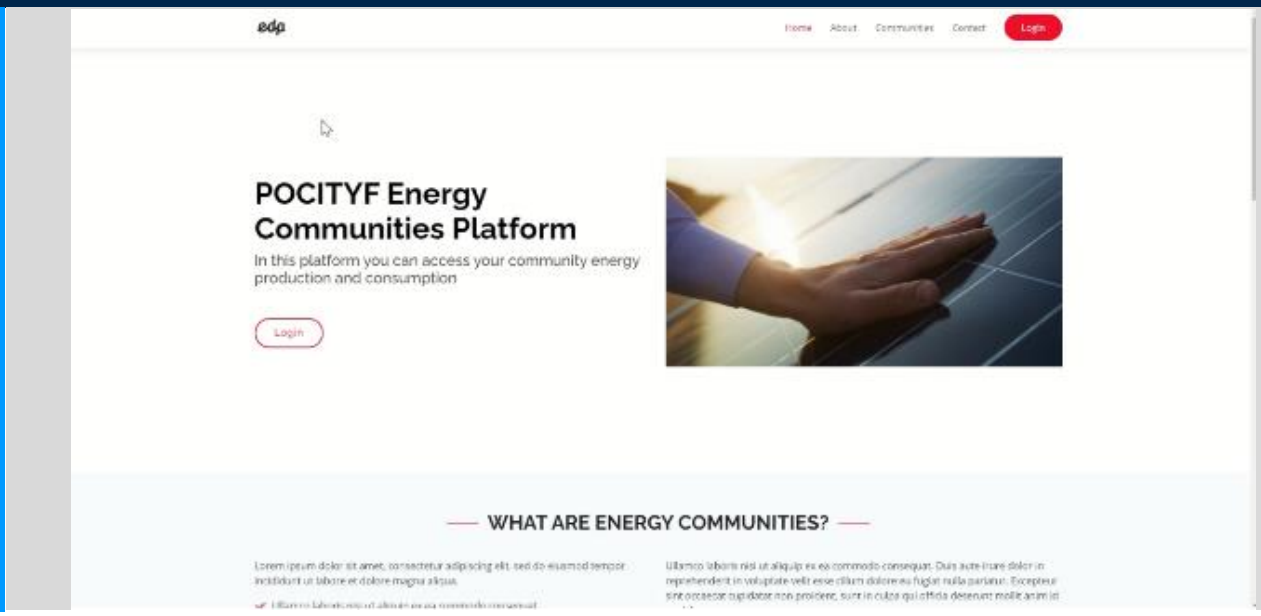
Final developments and simulation will be run during 2022.

TARGETED OUTPUT

The expected output will be a simple methodology and prototype of an algorithm/tool for DSOs to integrate local P2P electricity markets into their grid operation and management procedures.

IMPACT ON COMMUNITY

Providing tools to DSOs to profit from existing local flexibility in REC will help them to better operate their distribution grids, integrate local electricity markets into their operation procedures, and contribute to maximize the decentralized renewable generation integration contributing to the energy decarbonization objectives.



DESCRIPTION

The Renewable Energy Communities Management Platform aims to enhance the communication and interaction between an energy community manager and its members.

The following features will be developed into the platform:

- Visualisation dashboard, showing energy and financial flows between the generation units and the consumers, and between consumers
- Gamification module to be applied between members of an energy community or between different energy communities. Challenges and achievements will be released for the users, both at individual and community-level
- Social media space for users to share their gains, see relevant news and energy tips, etc.

INDICATORS

POTENTIAL DEGREE OF USEFULNESS

N/A

Already demonstrated in Lighthouse cities **No**

Cultural heritage compliance **Yes**

PERFORMANCE

Increase energy efficiency awareness

Improve asset management

Improve self-consumption

Provide energy flexibility potential

COST

(estimated) 1000€ per year - cloud server

DIMENSION

District-level application

Replicability potential for any energy community

TIME

Energy management for 15-minute periods

SAFETY

GDPR compliant

SUSTAINABILITY

Improve energy efficiency

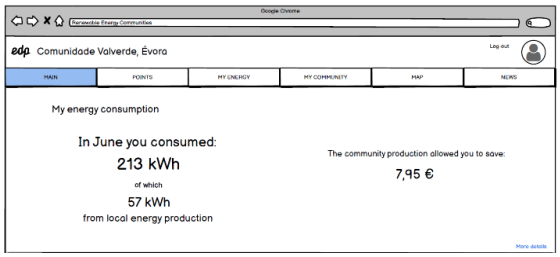
Increase energy awareness

Promote local renewable energy generation

KEY REQUIREMENTS

To implement the Renewable Energy Community Management Platform it is necessary that the renewable energy community is set-up, with an energy community manager entity that is entitle to manage the community assets.

ENVISAGED DEMONSTRATION IN POCITYF

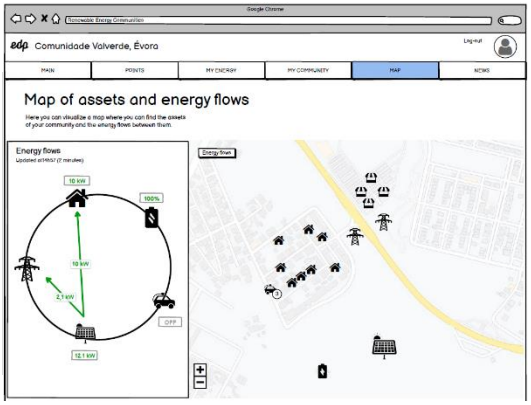


TIMELINE

The platform will be developed and implemented in Évora RECs during 2022.

DETAILS

The platform will provide a user-friendly frontend (image on the left) that will be used by energy community members to oversee their energy consumption and production.



TARGETED OUTPUT

Besides the energy management, tracking energy consumption and production at individual level within an energy community, the platform will have functionalities that help raise awareness to the energy topics, namely the gamification, the energy flow maps (image on the left), or the news section.

The solution aims to reduce energy consumption by improving energy efficiency and increase self-consumption. Studies made have pointed to a potential of reducing grid energy consumption by 7% for Valverde village, in Évora. This does not account for the nudging and awareness raising potential, meaning that it is expected that this platform would contribute to slightly more than 7% reduction in grid energy consumption when considered together with the possibility of performing peer-to-peer energy trading.

IMPACT ON COMMUNITY

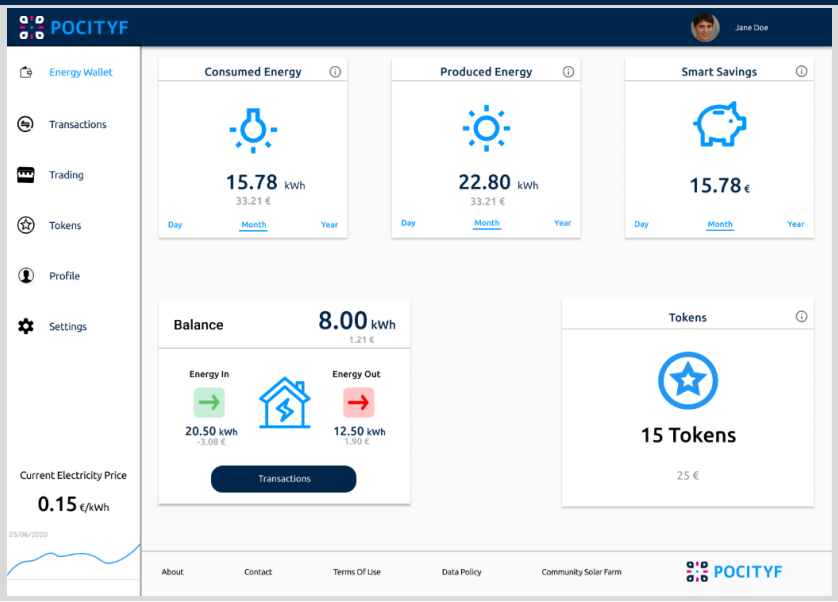
The REC management platform is developed to be directly used by the community. The members of the community will be able to participate in an individual and collective ranking system that may provide rewards. To improve the ranking, the community members must perform certain actions that aim at improving energy efficiency or make use of the available flexibility. This interaction with the community members will allow to nudge people to improve their energy efficiency and reduce energy costs. The energy consumption and production, as well as other visualisation features of the platform will provide additional awareness to energy efficiency in the community, contributing to further reduce energy consumption.

OTHER COMMENTS – OPEN CONSIDERATIONS

The REC management platform is connected to the Community Solar Farm as this solution relates with the set-up of a communitarian solar power plant and sharing of that energy. The REC management platform can support the manager of the solar farm to manage the production assets, providing optimal sharing coefficients between the different members and providing feedback conveyed from users on possible problems related with the solar farm.

ETT2 - Flexible and Sustainable Electricity Grid Networks with Innovative Storage Solutions

P2P Energy Trading Platform



DESCRIPTION

Kimatica will develop a state-of-the-art cloud platform, designed for energy donations and transactions that helps engage, retain and cultivate a community of energy donors with the ability to donate or sell energy and help alleviate energy poverty. We envision people to save energy in their homes to donate it to those in need. As well as an innovative P2P energy trading platform will be employed where the users/owners of the buildings can buy/sell energy to each other and sell flexibility to the DSO. The expected outcome is a campaign driven, social responsibility effort of Evora that will provide help with energy needs whilst protecting the environment and engaging the community. The platform increases engagement with gamification features through the concepts of birthday campaigns, save and donate energy or share your solar energy. An additional feature of the platform includes the tokens marketplace management system, users' sustainable behaviours are rewarded with tokens and can be exchanged for goods and services offered by local merchants and other entities.

INDICATORS

POTENTIAL DEGREE OF USEFULNESS

80%

Already demonstrated in Lighthouse cities Y

Cultural heritage compliance Y

PERFORMANCE

Gamification tools to promote engagement and save energy

Donations

Energy Trading

Tokens marketplace Management System

SUSTAINABILITY

Promotes sustainable practices

DIMENSION

N/A

TIME

N/A

SAFETY

Compliant with GDPR

SUSTAINABILITY

N/A

KEY REQUIREMENTS

The P2P energy donation platform needs to have the following interconnectivity with the systems.

- Energy consumption data
- Energy production data
- Energy savings data
- Energy flexibility

ELECTRICITY PRICING FOR THE USER ENVISAGED DEMONSTRATION IN POCITYF

TARGETED OUTPUT

The solution aims to empower prosumers with the knowledge of saving energy in their homes and buy/sell/donate it to those in need as well as promoting sustainable behaviours.

IMPACT ON COMMUNITY

The overall vision is to enable the giving of energy and empower prosumers of the energy network to interact by transacting units of energy. This will strengthen bonds of the community and create new business models for the prosumers.