# OPEN DEI ENERGY PILOTS EXPLORER

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The energy system is crucial to deliver the targets of the Green Deal. The recent decline in the cost of renewable energy technologies, the digitalisation of our economy, and emerging technologies in batteries, heat pumps, electric vehicles, or hydrogen offer an opportunity to accelerate until 2030 a profound transformation of the energy system and its structure.

Around €1 billion in EU funding was made available through the Horizon 2020 programme for R&I efforts in pilots and platforms under the European Commission's Digitising European Industry (DEI) focus area. Major investments have been set out in establishing Large-Scale Pilots (LSPs) in order to provide answers to societal challenges in several areas, including data solutions for energy and mobility.

In order to accelerate the digital energy transition, the design of energy marketplaces supported by a vital data economy is essential, based on a clear and harmonised framework. For instance, a distribution system operator is at the centre of data exchange – and actors in the energy domain need ways to best exploit the value of data for the better integration of renewables, to balance demand, and to response and provide innovative services. Pilots in this booklet started to work on a harmonised conceptual data framework to identify the value of B2B data platforms, albeit a number of obstacles to data sharing arose that could prevent the full value of energy-related data being realised across different sectors and services. Work is supported by the OPEN DEI CSA and the BRIDGE initiative. This contributes to a digitalisation strategy to establish a data space as a baseline for a data economy in the energy sector.

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Head of Sector Internet of Things
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This booklet is the result of the OPEN DEI Energy Working Group "Use-Cases Explorer", the goal of which is the analysis of the pilot activities of the Innovation Actions projects involved – InterrConnect, INTERRFACE, BD4OPEM, and Platone.

The approach followed by this booklet refers to the so-called Design Thinking Methodology, a formal method of creative problem solving, with the intent of fostering innovation. It is characterised by three traits: (i) the leverage of creativity as a driver of innovation, (ii) a human-centred perspective, where innovators build empathy with users, and (iii) the intense use of experimentation as a rapid and effective source of communication and learning among stakeholders.

The Large-Scale Pilots of each participating project are described according to two representations:

- Manifesto, which envisions the values provided by the Pilot
- Ecosystem Map, which depicts pilot stakeholders, defines functionalities, and illustrates data flows

# LIST OF ACRONYMS

**aFRR:** automatic Frequency Restoration Reserve

**AMI-DER:** Advanced Metering Infrastructures – Distributed Energy Resources

**BESS:** Battery Energy Storage System

**CEMS:** Central Energy Management System

**CHP:** Combined Heat and Power

**DR:** Demand Response

**DSF:** Demand Side Flexibility

**DSO-CM:** Distribution System Operator – Congestion Management

**EES:** Electrical Energy Storage

**EMS:** Energy Management System

**ERMS:** Energy Reduction Maintenance Setting

**ESP:** Electric Service Provider

**EUPHEMIA:** Pan-European Hybrid Electricity Market Integration Algorithm

**EVSE:** Electric Vehicle Supply Equipment

**FCR:** Frequency Containment Reserve

**FSP:** Flexibility Service Provider

**GIS:** Geographical Information System

**GDPR:** General Data Protection Regulation

**GSMS:** Grid Services Management System

**IDN:** Intelligent Distribution Nodes

**IEGSA:** Interoperable pan-European Grid Services Architecture

**IoT:** Internet of Things

**LV:** Low Voltage

**mFRR:** manual Frequency Restoration Reserve

**MVP:** Minimum Viable Product

**P2P:** Peer-to-Peer

**PUN (Italian):** Uniform Purchase Price

**RES:** Renewable Energy Source

# interconnect

www.interconnectproject.eu

## INTEROPERABLE SOLUTIONS CONNECTING SMART HOMES, BUILDINGS, AND GRIDS

| 50 | 11 | 7 | €29.9 M | 2019-2023 |
|---|---|---|---|---|
| Partners | Countries | Pilot Sites | EU Contribution | Duration |

**InterConnect** project gathers 50 European entities to develop and demonstrate **advanced solutions for connecting and converging digital homes and buildings with the electricity sector**.

Its main goal is bringing **efficient energy management** within the reach of end users through **interoperable solutions connecting Smart Homes, Buildings, and Grids**. The project addresses the foundation of the future of smart energy management solutions using seven connected large-scale test sites, which are in Portugal, Belgium, Germany, the Netherlands, Italy, Greece, and France.

The solutions developed within the scope of InterConnect will enable the digitalisation of homes, buildings, and electric grids based on an Internet-of-Things (IoT) architecture. By including digital technologies (artificial intelligence, blockchain, cloud, and big data) based on open standards, such as SAREF, it will guarantee the interoperability of equipment, systems, and the privacy/cybersecurity of user data.

## INTERCONNECT PILOT SITES

**Belgium**
Residential and tertiary buildings in communities of multi-energy vectors

**France**
Residential and non-residential, with tertiary buildings and apartments

**Germany**
Groups of residential buildings and hotels

**Italy**
Residential social housing

**Greece**
Large residential community with smart appliances and EV integration

**Portugal**
Residential and geographically widespread tertiary buildings

**The Netherlands**
Residential and non-residential buildings

OPENDEI


## The Energy Land of Tomorrow

*Control your energy flows, home automation systems, energy storage, and smart heating*

*The borderless configuration of services from and to community members, aiming at maximising the value of flexibility for society without compromising community values*

### Distinctive Features

- Participative and borderless innovation
- Seamless configuration
- Dynamic contribution to the environment without compromising community values and targets

## Why

*The Pilot's motivations*

- Convenience and cost savings while allowing community to provide (energy and non-energy) services
- Energy efficiency by optimising consumption profiles
- Environmental footprint reduction by maximising the utilisation of locally generated energy

## What

*The Pilot's expectations*

- **Technical**: Centralised control and monitoring, a combination of different services, and flexible resources management to reduce power peaks
- **Business**: Energy cost reduction, the promotion of additional RES investments, and the addition of new sources of income (the utilisation of spaces)
- **Environmental**: CO2 reduction/contribution to the fight against global warming, and better RES forecasting
- **Privacy**: Private data used for community-related services with respect to values and GDPR

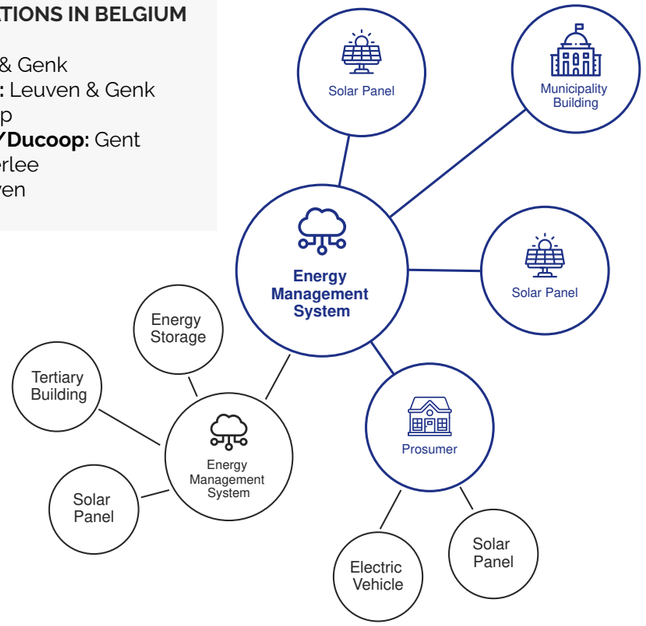
## Business Model

- InterConnect's Pilot in Belgium focuses on Energy communities. By maximising the usage of locally produced energy sources, the electricity bills of community members will be reduced. Neighbourhoods can also offer flexibility to support the national grid. These grid services can also be monetised.
- The proposed modification of legislation:
  - Enable P2P energy exchange
  - Include utilisation time in the cost

## KPIs Definition

- The proportion of the increase of self-consumption in the neighbourhood (energy produced that is then consumed in the same neighbourhood)
- Peak shaving (maximum power measured on the grid during a timeframe of 1 month)
- Customer energy awareness (a rise in customer energy awareness by measuring the increase of an energy awareness index through a survey)
- Reduced estimated greenhouse gas emission
- Customer economic impact (the difference between the average electricity bill before the project and the average electricity bill after the project)

**8 ENERGY COMMUNITY DEMONSTRATIONS IN BELGIUM**
**VUB:** Zellik
**Vito:** Hasselt & Genk
**Thermovault:** Leuven & Genk
**Imec:** Antwerp
**Openmotics/Ducoop:** Gent
**3E:** Oud Heverlee
**Th!nk E:** Leuven




## User Features

- Cost reductions for the neighbourhood as a whole
- Increased renewable energy sources in the local energy mix

## Grid Features

- Combining neighbourhood buildings to offer flexibility
- Peak shaving

## You are empowered to protect the environment… JOIN THE ENERGY COMMUNITIES!

*For those living in InterConnect communities, the management of devices at home is simpler, electricity bills are reduced, and the new energy challenges are understood*

Become an actor by contributing to efficient and eco-friendly energy management

### Distinctive Features

- Clients' energy-system optimisation
- Usage flexibility
- Bill reduction
- The management optimisation of local renewable energy for maximising collective self-consumption

## Why

*The Pilot's motivations*

- **Empower** the users to be part of an interconnected world
- **Simplify** energy management
- **Reduce** electricity bills
- **Consume and exchange** your own energy production

## What

*The Pilot's expectations*

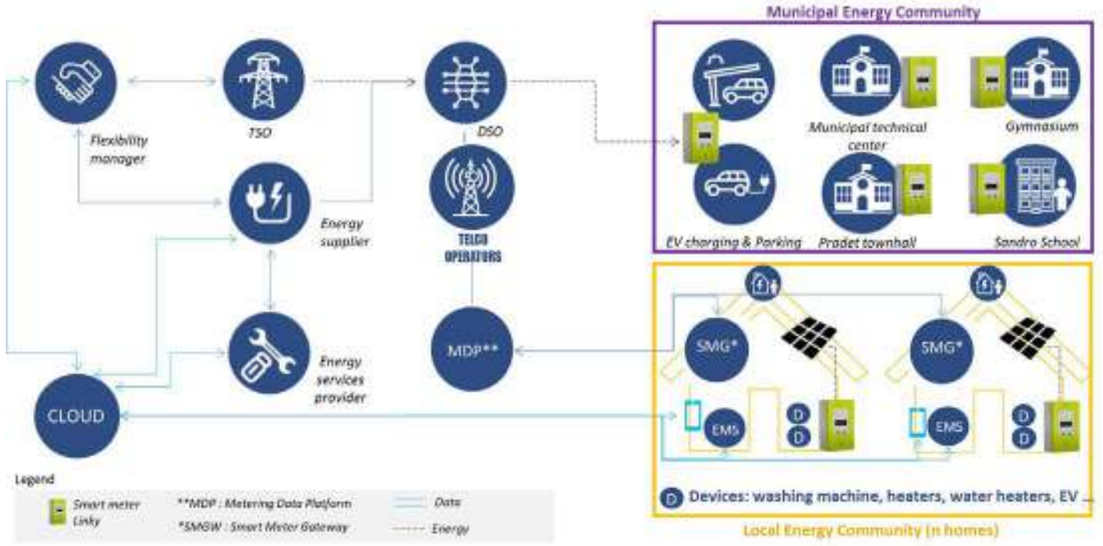
- **Technical**: Make individuals and the community able to control energy consumption through an ecosystem of interoperable products
- **Business**: Demonstrate the feasibility of business cases focused on a dynamic tariff/flexibility and self-consumption
- **Environmental**: Reduce energy consumption and maximise the potential of renewable energy
- **Social:**
  - Involve end-users in energy problems so that they understand them and adapt their behaviour.
  - Understand mechanisms and stimuli that may induce end-users to change their behaviours in order to fulfil specific requests by grid actors

## Business Model

- Enable customers to reduce their bills by providing a dynamic tariff, an automation system to optimise their behaviour to the tariff, and monitoring/information support
- The service provider enables customers to maximise the use of the local RES by automatically synchronising consumption with periods of renewable energy production
- Market: new energy roles for residents and the municipality as energy consumers/prosumers

## KPIs Definition

- The proportion of households participating in the Pilot (% of enrolled households compared with the total households contacted)
- The proportion of implicated households pursuing energy management with the app from the beginning to the end of the project
- Customer energy awareness (the rise in customer energy awareness measured by the increase in the energy awareness index through a survey)
- Customer satisfaction index: measuring customer experience on the completion and ease of setting up IoT equipment
- Customer/Municipality economic impact (the difference between the average electricity bill before the project and the average electricity bill after the project)




## User Features

- Piloting the different devices remotely/locally using interoperable interfaces
- Remaining in control of the service
- Controlling the devices based on the renewable energy period/dynamic tariff period

## Grid Features

- Flexibility manager for primary, secondary, and tertiary reserves

## Wind Energy as a Service

*An automated approach for home energy management through ESP/DSO – end customer collaboration*

Automation, transparency, and money saving are just some of the benefits of a new independent way of life

### Distinctive Features

- The harmonisation of energy consumption and CO2 neutral production
- No loss of comfort at lower energy price, despite flexible tariffs
- Transparency on energy supply and consumption (energy data, energy costs, etc.)
- Prevent grid expansion costs due to increased demand for mobility and heating transition

### Why

*The Pilot's motivations*

- **Convenience** and **comfort**
- **Transparency** on how much energy is used and energy costs to influence people's energy behaviour
- **Automatised cost optimisation** and CO2 friendly choices
- **Sustainability** of supply
- **Independence**

### What

*The Pilot's expectations*

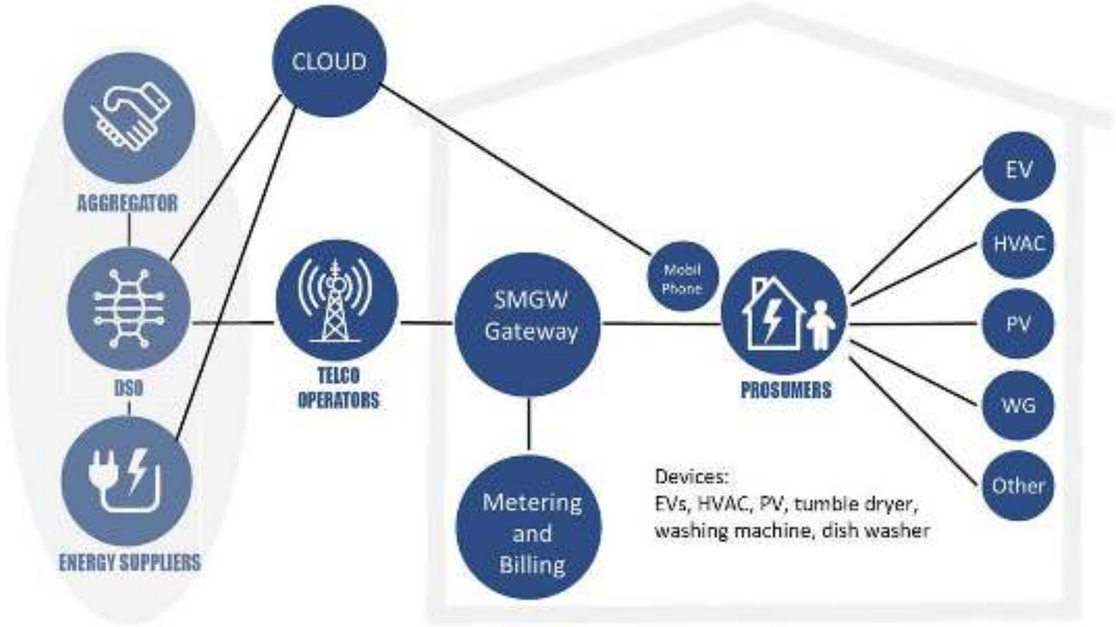
- **Technical:**
  - DSO/ESP/Device connectivity via gateways
  - Fully autonomous EMS operation
  - Using a mobile app and automated devices to conveniently manage energy consumption
  - The active role of the house in the grid
- **Business**: Selling flexibility while retaining planning security, comfortably lowering energy bill with no additional effort
- **Environmental**: Lower CO2 emissions and efficient usage of renewable energy
- **Other**: Energy transparency and interaction through a mobile app

## Business Model

- Tariff information: save energy costs for customers through a cheap and flexible DSO
- Pay as you go for features/services
- Fees for participating companies for offering products with which the customer can save money over time

## KPIs Definition

- The percentage of households participating in the pilot project
- The percentage of customers satisfied with the energy behaviour of the house
- CO2 saved by each customer over the pilot period
- Improved customers' energy awareness and bill reduction
- The improved forecasting of actual consumption




## User Features

- Price-optimised device operation
- Device operation in an underload scenario
- Indication to run devices manually if the price of energy is low
- Overload protection

## Grid Features

- Power limitation
- Flexible tariffs
- Power consumption/Energy forecasting

## Smart charging – safe for you, safe for the grid!

*Smart charging infrastructure for grid compatible and price-optimised integration and the operation of electric cars in hotels*

Grid compatible EV integration your guests have never seen before!
Connectivity between grid and hotel building operators, with new technologies paving the way for future EV infrastructure

### Distinctive Features

- Blackout prevention
- Price optimisation
- Transparency from building to grid level

### Why

*The Pilot's motivations*

- Building operators' desire to rely on **secure local power supply and stability**, while offering sufficient EV charging capacity to their guests
- **Transparency** on both the grid side and the building operator side
- **Price-optimised charging** based on dynamic tariffs
- **Dynamic tariffs** based on share of 'green power' in the power mix, as well as on current grid stability

### What

*The Pilot's expectations*

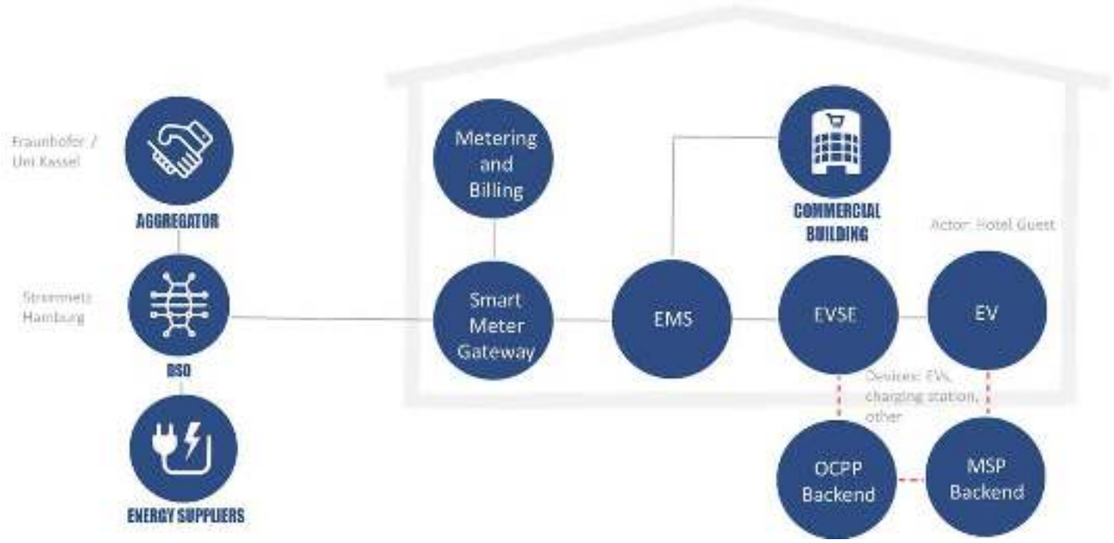
- **Technical:**
  - Interoperable connection via gateways, energy management systems, and the smart load management of EV charging points that communicate with the EMS
  - Buildings that interact/communicate with the grid operator
- **Business:** Enable local EV infrastructure at hotel buildings
- **Environmental:** Lower CO2 emissions, use renewable energy efficiently, and generate less power through partly flexible demand
- **Social:** Great reputation for the hotel to offer EV infrastructure and apply new innovative concepts

## Business Model

- Value/Revenues: Reduce energy costs by levelling out peaks of energy consumptions and, consequently, avoiding the expansion of grid infrastructure
- Action/Activity: The inclusion of EV charging points in hotel facilities, to be used by hotel guests
- Use Cases (Building): Energy management system to redistribute load consumption in the building: peak-shaving as well as improved overload protection
- Use Cases (Grid): The adoption of energy forecasting to influence power consumption by making use of flexible tariffs and power limitation
- Expenditures: The inclusion of costs of devices and systems (smart meter gateways, EMS, and charging points), costs for installation, and operating fee to use the EMS in the design phase

## KPIs Definition

- Decreased local blackouts caused by the overload of parallel EV charging processes
- Decreased overload scenarios in the distribution grid
- Improved power forecasting/load profiles for buildings
- The percentage of hotel operators satisfied with the energy performance of EV infrastructure
- An overall reduction of $CO_2$ of each hotel's power consumption
- Increased social awareness of smart and innovative EV infrastructure




## User Features

- Price-optimised device operation
- Device operation in an underload scenario
- An indication to use devices with low energy price
- Overload protection

## Grid Features

- Overload protection
- Price-optimised device operation

## The Energy Changer project

*Energy/Home monitoring for price-optimised device operation*

Play smart with energy to live better and save the environment and your pocket!

### Distinctive Features

- Unlock energy and cost savings
- Play with energy and get rewards
- Let the grid help users to increase their eco-awareness

## Why

*The Pilot's motivations*

- Make users **learn** how to save energy
- **Save the environment** and reduce users' CO2 emissions
- **Reduce electricity living costs** by exchanging excess energy
- Transforming users into **active grid players** that participate in energy efficiency

## What

*The Pilot's expectations*

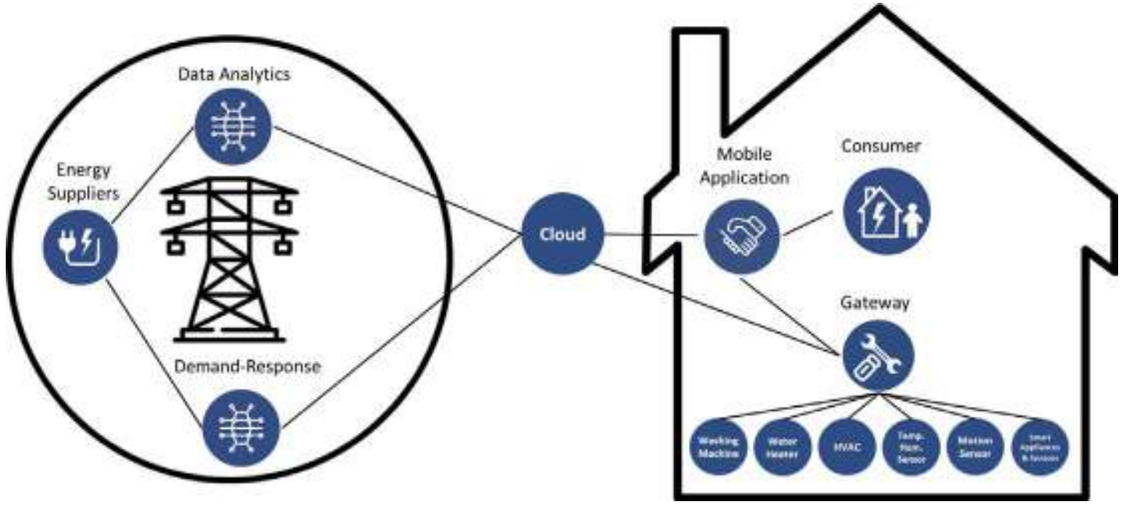
- **Technical:**
  - The collection of real-time energy consumption information from residential sensors
  - A mobile app for boosting and supporting user engagement
- **Business:**
  - Load shifting of users' energy consumption from peak to off-peak hours
  - Demand response during off-peak hours, when low market clearing prices are usually observed
- **Environmental & Social:**
  - The active engagement of residential end users for the continuous validation of user acceptance
  - Understanding consumer behaviour through a mobile app for actively engaging users through incentives (energy cost, social responsibility, etc.)

## Business Model

- Technology providers implement the solutions, while energy suppliers rely on the acquisition of new customers thanks to innovation

## KPIs Definition

- A measurable increase in user acceptance as a result of user-engagement approaches (events and loyalty benefits) and the provision of supporting services offered through mobile apps (incentives, loyalty benefits, gamification approaches, etc.).
- The ratio of acceptance of DR signals




## User Features

- Price-optimised device operation
- Device operation in an underload scenario
- Indication to use devices with low energy price
- Overload protection

## Grid Features

- Energy/Home monitoring
- Personalised recommendations
- Push notifications for energy events from home or grid (DR)
- A mobile app for monitoring and controlling a smart home

## LIVING IN FLOCKS

*Enrich life and rely on your neighbours' behaviours and practices to increase your individual impact on the larger InterConnect community*

Contribute to the future of the community by acting (energy) smarter today, without compromising your lifestyle

### Distinctive Features

- Automation
- Individual and community awareness
- End users' impact on the energy system

### Why

*The Pilot's motivations*

- Willingness to actively change behaviour to offer flexibility and to benefit from it (through individual challenges)
- **Social housing**
- **Contribution to sustainability** through community actions
- **Stimulate activeness** at the single-person level through awareness of community behaviours
- **Social aggregation** as a key to social, economic, and environmental improvement

### What

*The Pilot's expectations*

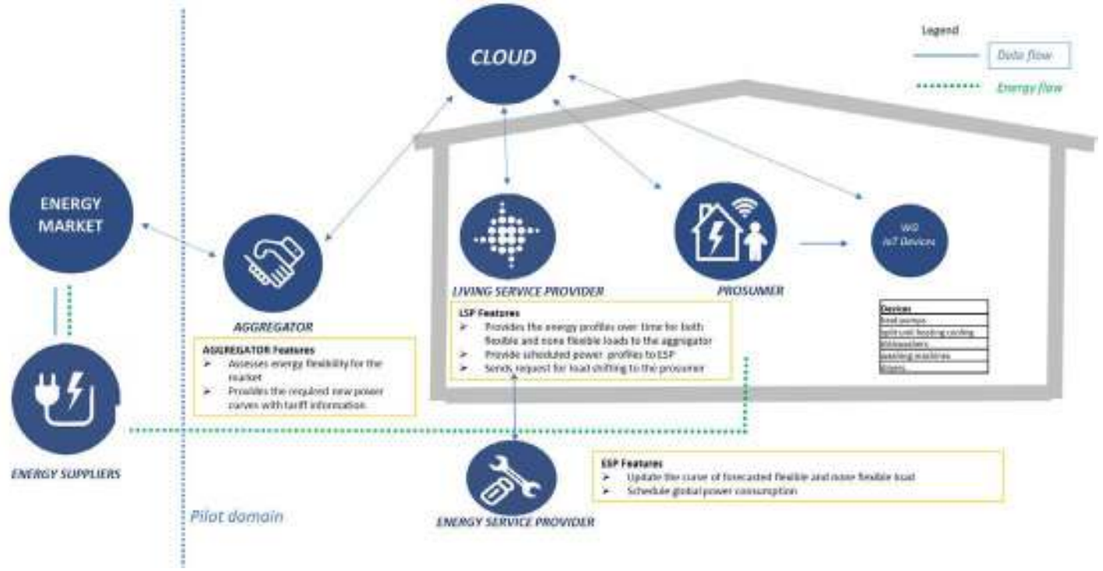
- **Technical:** Individual and community ability to control energy consumption through an ecosystem of interoperable products
- **Business:** Demonstrate, within the foreseen regulatory environment in Italy, that the aggregation of residential users can create a positive business case
- **Environmental:** Awareness of $CO_2$ emissions
- **Social:** Understand mechanisms and stimuli that may induce users to change their behaviours in order to fulfil specific requests by grid actors

## Business Model

- A living service provider obtains revenues from third-party companies that want to promote their products through rewards
- Companies can pay an initial fee to become part of the program and then a royalty for every product sold to users redeeming rewards

## KPIs Definition

- The proportion of households participating to the pilot (% of the enrolled households)
- The proportion of implicated households pursuing energy management using the app
- Customer energy awareness (the rise in customer energy awareness, as indicated in an energy awareness index supported by a survey)
- Customer satisfaction index: Net Promoter Score measuring customer experience (the difference in the percentage between promoters and detractors)
- Customer economic impact (the difference between the average electricity bill before the project and the average electricity bill after the project)




## User Features

- Price-optimised device operation
- Device operation in an underload scenario
- An indication to run devices manually if the price of energy is low
- Overload protection
- The selection of a flexible device
- Schedule cycle in the app

## Grid Features

- Flexible tariffs
- Power consumption/Energy forecasting


## MAXIMIZING THE VALUE OF DEMAND FLEXIBILITY

*Consumer as active player in the electrical system: energy efficiency and flexibility management as a service*

Interoperable prosumers enabling new flexibility services for smart grids

### Distinctive Features

- Interoperable HEMS for residential buildings
- Advanced HEMS scheduling based in consumer load forecasting, preferences and comfort
- Standardized DSO interface for energy and flexibility market facilitation and participation
- Standardized implementation of grid support flexibility services provided by residential consumers
- P2P transactions in an energy community

### Why

*The Pilot's motivations*

- Belonging to a RES community that cares about energy efficiency and reduced environmental impact
- Interest in new plug & play services
- Data access and control
- Demand for transparency and freedom of choice

### What

*The Pilot's expectations*

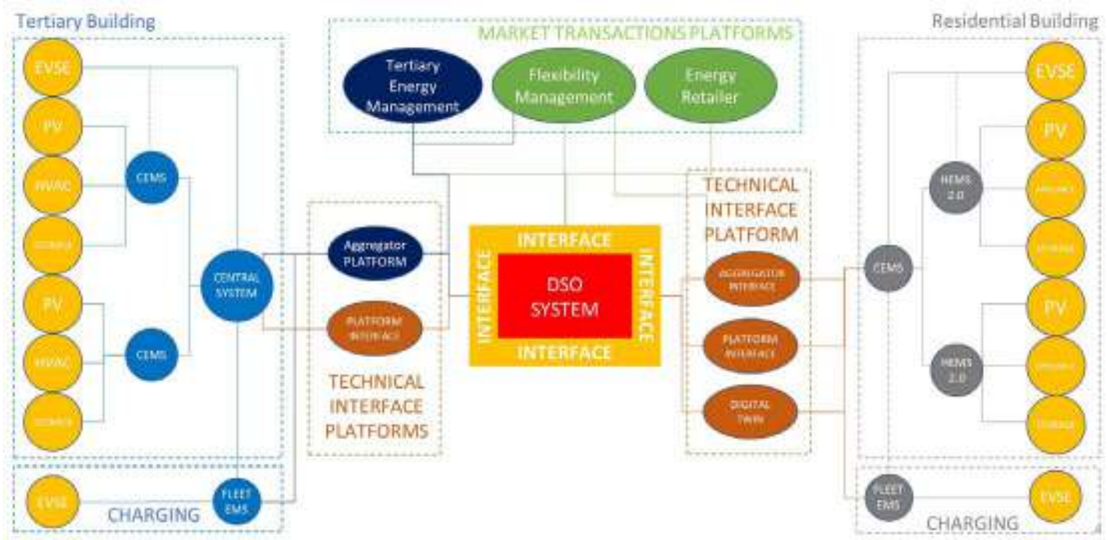
- **Technical:** Promote interoperability between smart homes, buildings and grids to sustain and foster energy transition
- **Business:** Explore advanced instruments for demand side flexibility, market facilitation and consumer empowerment
- **Environmental:** Interoperability as technical leverage mechanism to increase renewable penetration
- **Social:** Create citizen-centred value, by enhancing energy efficiency mechanisms, to generate social awareness and increase energy literacy.

## Business Model

- Main customers for flexibility are involved: DSOs, electricity providers and energy communities
- Exploitation of intermediation model based on tariff and bilateral contracts for energy trading market

## KPIs Definition

- Number of DSF activations
- Percentage of automated households appliances
- Amount of flexibility (energy) mobilized for grid support
- Number of building integrated in CEMS
- Share of energy consumption of the devices integrated in CEMS for actuation and data monitoring
- Total number of offers for grid flexibility to grid operator and the number of approved offers
- Energy savings achieved through CEMS and equivalent $CO_2$ emissions saved




## User Features

- Residential consumers deploy flexibility services through PV, storage, EV charging and smart appliances
- Use of intelligent management system in commercial buildings

## Grid Features

- Enhance the benefits of AMI/Smart metering
- Optimization of storage solutions
- Indirect observability

## Feel free to connect to our sustainable network.

*Climate goals achieved via Chameleon Homes with their automated platform*

No hassle, easy setup, plug & play — contribute to and enable a smart sustainable comfortable environment

### Distinctive Features

- An interoperable ecosystem that takes care of flexibility without you noticing

## Why

*The Pilot's motivations*

- End users want to contribute to a sustainable society
- End users want to benefit from innovative home automation services
- Building owners want to reduce costs in a sustainable way
- Building owners want to offer advanced services to enhance their value proposition: quality of life/ living comfort

## What

*The Pilot's expectations*

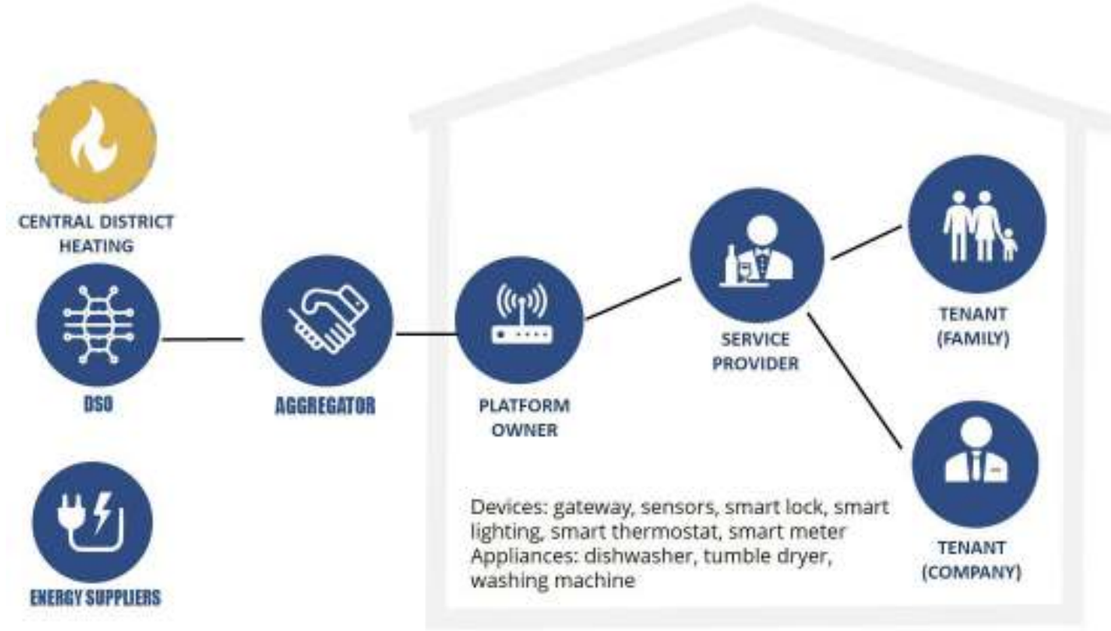
- **Technical:** A interconnected system (hardware and platform) that is able to connect in-house (smart) appliances (dishwasher, washing machine), devices (locks, lights), and systems (HEMS, HVAC) to external systems (power grid, PV panels, battery, EV charger)
- **Business:** A building owner needs to have a business case, a polluter-pays principle, and a new business model that goes beyond simply offering living space to offering a high quality of life
- **Environmental:** CO2 reduction by optimising external systems, with peak shaving enabling the use of the current power infrastructure, i.e. without the need for expansion
- **Other:** Energy insufficiency addressed by the better use of the energy system, with privacy addressed by the use of anonymised data

## Business Model

- A value-driven business model offering a higher quality of living
- Revenues generated from subscriptions and third-party service providers
- A focus on the market, but communities can play a key role in terms of collection and flexibility (one user is often less predictable)

## KPIs Definition

- The amount of distributed energy
- Own generated & consumed energy
- A price reduction reflected in energy bills
- Reduced congestion/grid peaks
- Shared energy within the community
- Types of non-energy data used
- The number of services offered
- The services used by users
- People experiencing a higher living quality




## User Features

- A single-user interface (i.e. an app) for all home devices
- Automate routine tasks
- Select additional services
- Reduce energy consumption

## Grid Features

- Flexible tariffs
- Power consumption/Energy forecasting
- Demand-side flexibility

INTERRFACE

www.interrface.eu

# TSO-DSO-CONSUMER INTERFACE ARCHITECTURE TO PROVIDE INNOVATIVE GRID SERVICES FOR AN EFFICIENT POWER SYSTEM

| 42 | 16 | 7 | €16.8 M | 2019-2022 |
|---|---|---|---|---|
| Partners | Countries | Pilot Sites | EU Contribution | Duration |

The **INTERRFACE** project aims to support greater **coordination between TSOs and DSOs** facing common challenges around the **procurement of distributed flexibility**. The coordinated procurement of balancing, congestion management, and other ancillary services at both the transmission level and the distribution level will enable **more efficient and effective network management** and **will increase the level of demand response** and capacity for renewable generation. **Digitalisation** is a key driver of coordination and **active system management** in the electricity grid, enabling TSOs and DSOs to optimise the use of distributed resources and ensure a cost-effective and secure supply of electricity, as well as **empowering end users to become active market participants**, supporting self-generation, and providing demand flexibility.

To support this transformation, the INTERRFACE project will design, develop, and exploit an **Interoperable pan-European Grid Services Architecture (IEGSA)** to act as the interface between power networks (TSOs and DSOs) and customers and to allow the seamless and coordinated operation of all stakeholders in their use and procurement of common services. State-of-the-art digital tools based on blockchains and big data management will provide new opportunities for electricity market participation and will thus engage consumers in INTERRFACE's proposed market structures designed to exploit Distributed Energy Resources.

## INTERRFACE PILOT SITES

**Italy**
DSO and Consumer Alliance

**Bulgaria**
Intelligent Distribution Nodes

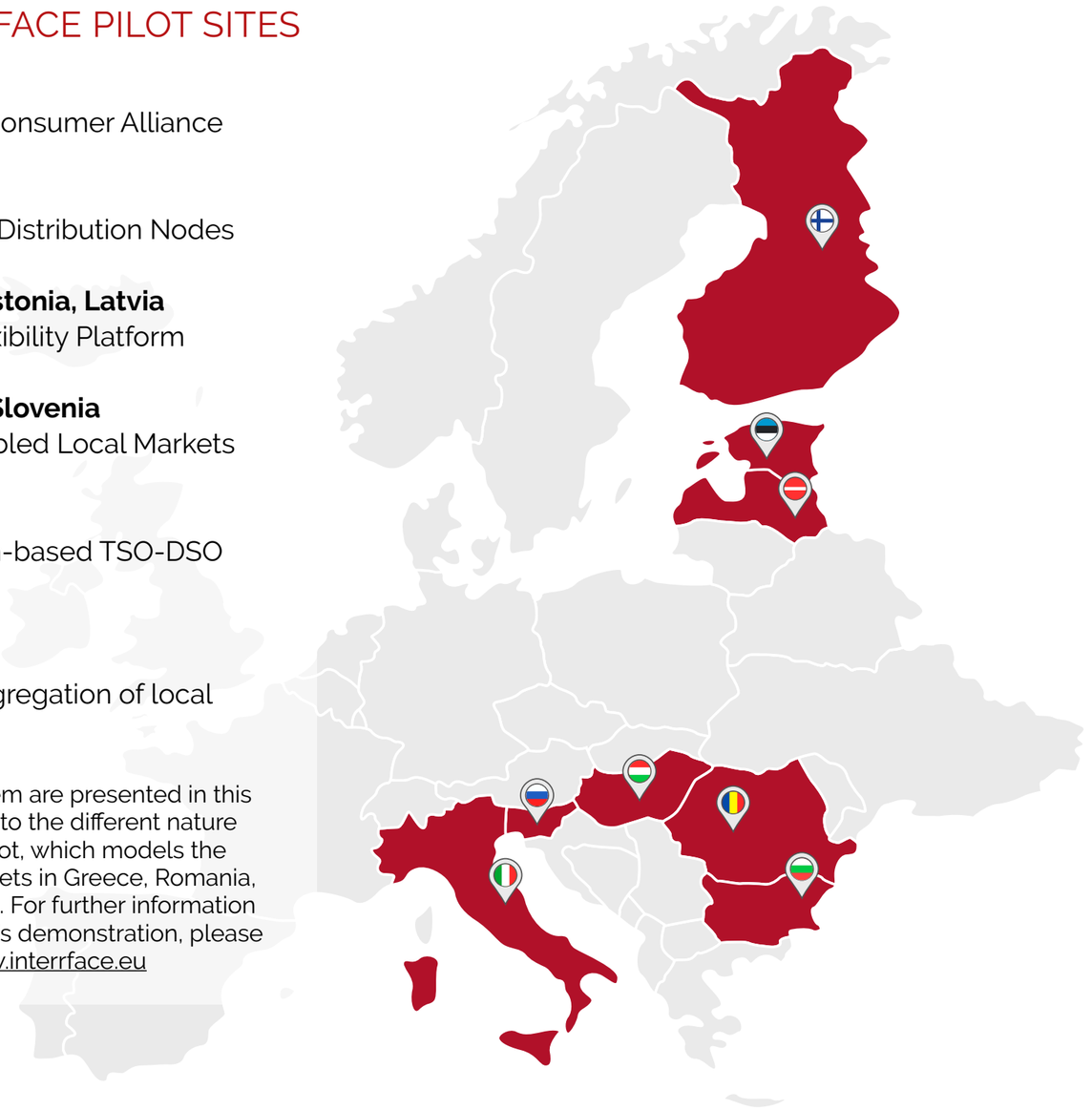
**Finland, Estonia, Latvia**
Single Flexibility Platform

**Hungary, Slovenia**
Asset-enabled Local Markets

**Bulgaria**
Blockchain-based TSO-DSO flexibility

**Romania**
Spatial Aggregation of local flexibility

Only 6 of them are presented in this booklet due to the different nature of the 7th pilot, which models the energy markets in Greece, Romania, and Bulgaria. For further information regarding this demonstration, please consult www.interrface.eu



## Asset-Enabled Local Markets

*Cooperation of an automated marketplace for local electricity transactions and an integrated asset condition management system*

Enabling an automated P2P marketplace that incentivises the participation of low- and medium-voltage-grid users based on the capabilities of the grids' assets

### Distinctive Features

- The functional specification of an automated marketplace for local electricity transactions
- Adapted market mechanisms for small electricity volumes
- An integrated asset-condition management system (IACMS)

### Why

*The Pilot's motivations*

- Enable local energy communities
- Support congestion management in the DSO grid
- Improve supply reliability
- Provide flexibility and ancillary services to the DSO
- Increase the involvement of small non-controllable renewable generation, demand response, and storage
- Engage local P2P market transactions
- Increase amount of existing local PV generation

### What

*The Pilot's expectations*

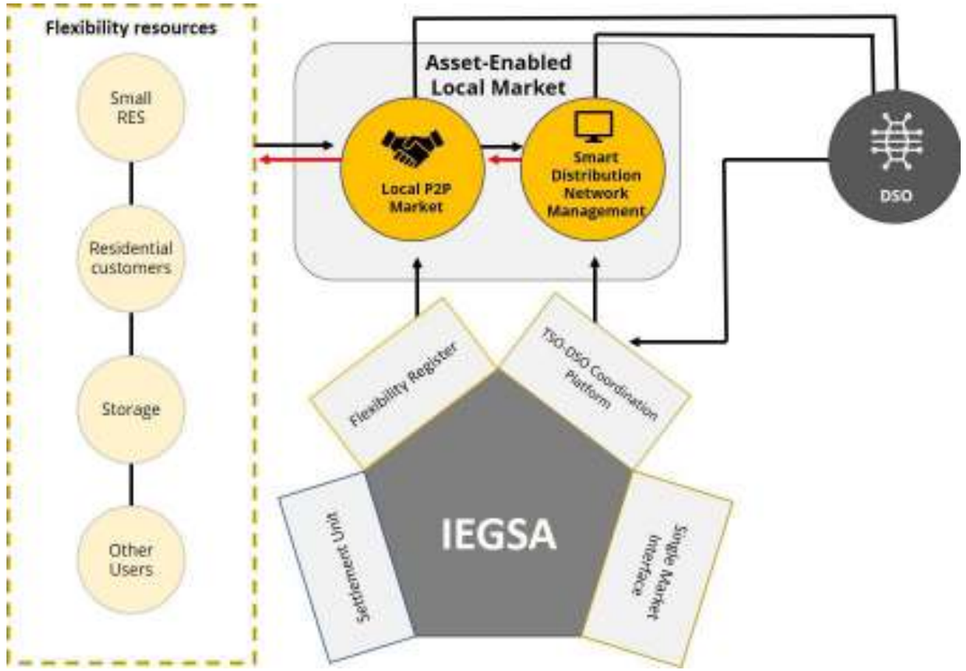
- **Technical:**
  - Smart asset management relying on IACMS
  - Bids with locational information (grid connection point/circuit)
  - Baseline calculations relying on quarter-hourly metering data
- **Business:**
  - Validation of a market model that is automated and adapted for small electricity volumes in an intraday timeframe
  - Use of a dynamic network-user tariff (DNUT)
  - P2P marketplace taking into account DSO grid topology
  - Entry simplification of small RES, demand response, and storage

## Business Model

- Cost-effective and transparent congestion management in an intraday timeframe
- Validating a decentralised market model for P2P trading
- Lowering barriers to the inclusion of demand response and small-scale DERs
- More efficiently allocating flexibility and maximising its value
- Upscaling the role of customers and creating new services and market rules within the local marketplace
- Deferring network investments

## KPIs Definition

- Renewable penetration achieved in the distribution grid
- The total number of offers offered in the marketplace
- The total number of offers accepted
- The number of congestion hours in the DSO grid




## User Features

- P2P market with intraday continuous trading
- A dynamic network-user tariff

## Grid Features

- An integrated asset-management system
- DSO grid topology fed into a market algorithm

## Single Flexibility Platform

*The cross-border exchange of flexibility to create more opportunities for optimal grid management for TSOs and DSOs, as well as increased balancing market for TSOs*

Increase the effectiveness of flexibility usage by introducing locational bid information in balancing offers

### Distinctive Features

- Cross-border demonstration implemented in Estonia, Latvia, and Finland
- A combination of existing products for balancing and frequency management with new products for congestion management
- Flexibility offered simultaneously across different markets

## Why

*The Pilot's motivations*

- Provide a common flexibility market framework for TSOs and DSOs and all stakeholders in the value chain
- Enable the cross-border exchange of flexibility
- Secure competition and the supply of flexibility
- Demonstrate coordination between TSOs and DSOs
- Standardise prequalification processes
- Increase liquidity in reserve and new congestion management markets
- Enable more integrated RES

## What

*The Pilot's expectations*

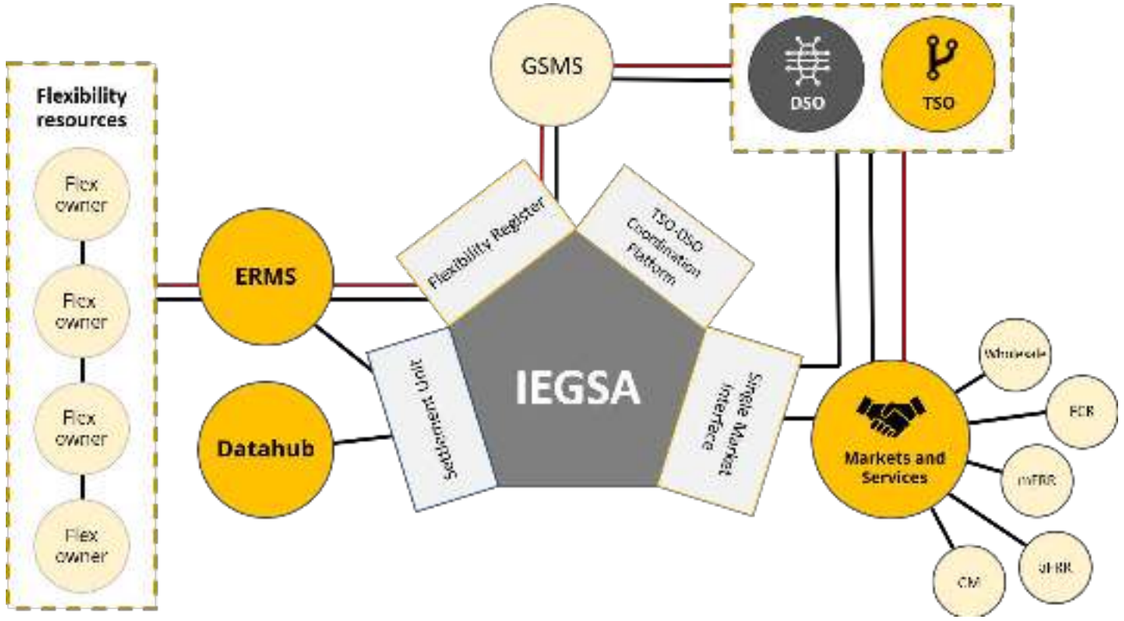
- **Business:**
  - The validation of a dynamic market model that promotes liquidity and exposes flexibility resources at all grid levels in different markets
  - Closer TSO-DSO cooperation, leading to a more reliable network and lower grid management costs
  - Increase the liquidity of existing reserve markets, as well as creating new flexibility products
  - Expand the opportunities for market participants to be involved in balancing and flexibility operations
  - Simplify the entry of demand response in balancing and other reserve markets
  - Demonstrated framework to facilitate the trading-based optimisation of grid resources
  - Demonstrated multi-level exposure of demand response and increased incentives for further resources

## Business Model

- To solve internal congestions for different timeframes, TSO/DSO could use flexibility with locational information
- Default balancing products, but used internally by TSOs/DSOs for congestion management operations, would boost liquidity and lead to an efficient allocation of flexibility resources
- By creating a single market interface, flexibility can be offered simultaneously to more than one system operator and across markets
- A flexibility register will enable the qualification of flexibility resources and products for all flexibility service providers
- A TSO-DSO coordination platform will ensure flexibility bids and will avoid congestion in electricity grids
- The digitalisation of the settlement processes of flexibility activation will take place in a settlement unit

## KPIs Definition

- Demand-side flexibility and small-scale DER participation in markets:
  - The total number of offers of grid flexibility to the grid operator and the number of offers approved
  - The amount of new flexibility offered to the DSO/TSO
  - Increased liquidity in euros in the reserve and new congestion-management markets




## Grid and Market Features

- The TSOs of all three countries – Estonia, Finland, and Latvia (Elering, Fingrid, and AST, respectively) – and DSOs in two of the countries — Finland and Estonia (Elenia and Elektrilevi, respectively) — working on common standards and processes
- A single market interface enabling simultaneous bid offers for different purposes
- The demonstration of cross-border usage of demand-side and small-scale DER flexibility

## Spatial Aggregation of Local Flexibility

*Zonal spatial information enabling local energy usage (flexibility) and solving grid-related constraints at the DSO level*

Achieve a wholesale market design with geolocational dimensions enabling collaboration between participants of various sizes

### Distinctive Features

- The introduction of a spatial dimension into the existing wholesale-market design
- The use of shadow prices to determine order clearing prices as an efficient way of solving grid-related constraints at the DSO level
- The adjustment of the existing EUPHEMIA algorithm to achieve a novel intraday electricity market structure

## Why

*The Pilot's motivations*

- Create an efficient way of solving grid-related constraints at the DSO level
- Holistic mathematical formulation for optimal market outcomes, linking consumers, DSOs, and TSOs
- Provide a common flexibility market framework for TSOs and DSOs and all stakeholders in the value chain
- Validate a congestion pricing model based on the differentiation of zones at DSO level (PUN)
- Secure competition and the supply of flexibility
- Demonstrate coordination between TSOs and DSOs
- Enable more integrated RES

## What

*The Pilot's expectations*

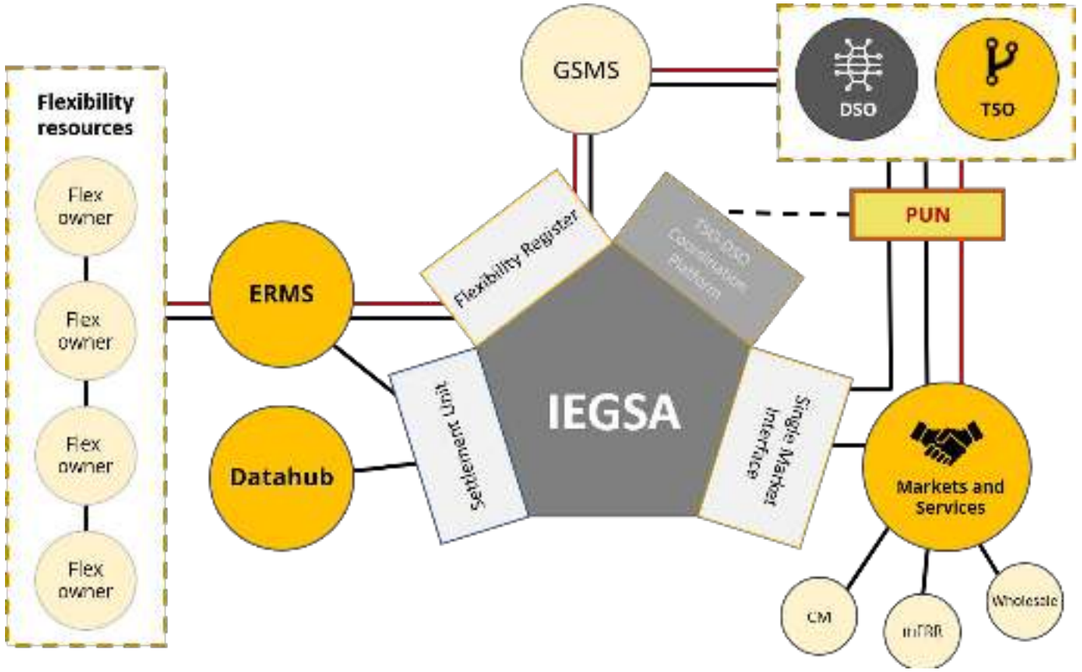
- **Technical:** Enable DSOs to use the intraday flexibility pool as a tool for congestion management
- **Business:**
  - The validation of a EUPHEMIA-based auction-type market in intraday, promoting aggregated flexibility bids
  - The introduction of shadow prices to determine clearing prices while reflecting local grid constraints in wholesale markets
  - Closer TSO-DSO cooperation, leading to a more reliable network and lower grid management costs
  - Expand the opportunities for market participants to be involved in balancing and flexibility markets
  - A demonstrated framework to facilitate the trading-based optimisation of grid resources
  - A demonstrated multi-level exposure of demand response and increased incentives for further resources

## Business Model

- Developing a prototype to introduce local flexibilities into the existing wholesale market
- Completing DSO grid mapping, connections with TSOs, and TSO-DSO and DSO-DSO transfer capacities
- PUN-like bid pricing to help alleviate cost distribution disincentives in low-liquidity local zones
- The aggregation of local flexibility up to the TSO wholesale market
- DSO usage of local flexibility based on the inclusion and resolution of a spatial dimension realised in simulation
- The new concept with zonal spatial information will enable local energy (flexibility) usage. Congestion management-aimed transactions are expected to result in new trades.

## KPIs Definition

- Demand-side flexibility and small-scale DER participation on wholesale markets:
  - The total number of offers for grid flexibility to grid operator and the number of offers approved.
  - The amount of new flexibility offered to the DSO/TSO.
  - Increased liquidity in euros in flexibility markets.




## User Features

- Lowering barriers for the participation of the demand side and small-scale DER flexibility
- Local (zonal) pricing to incentivise local flexibility in intraday timeframes

## Grid and Market Features

- A EUPHEMIA-based platform with the introduction of a spatial dimension
- A platform based on existing wholesale marketplaces with already established products, liquidity, and proven algorithm solutions

## Intelligent Distribution Nodes

*An intelligent controller to demonstrate a common set of grid services for DSOs and TSOs, aiding a balancing-responsible party using a battery energy storage system (BESS)*

Operating the BESS to provide balancing services, congestion management, and non-frequency ancillary services to TSOs and DSOs

### Distinctive Features

- An advanced control system through the use of ICT services
- A new mechanism for end-user aggregators to provide grid services

## Why

*The Pilot's motivations*

- Reduce electricity costs by increasing revenue or reducing an associated penalisation cost
- Improve supply reliability
- Provide flexibility and ancillary services to the DSO and TSO
- Provide advanced energy services
- Increase the amount of existing local PV generation

## What

*The Pilot's expectations*

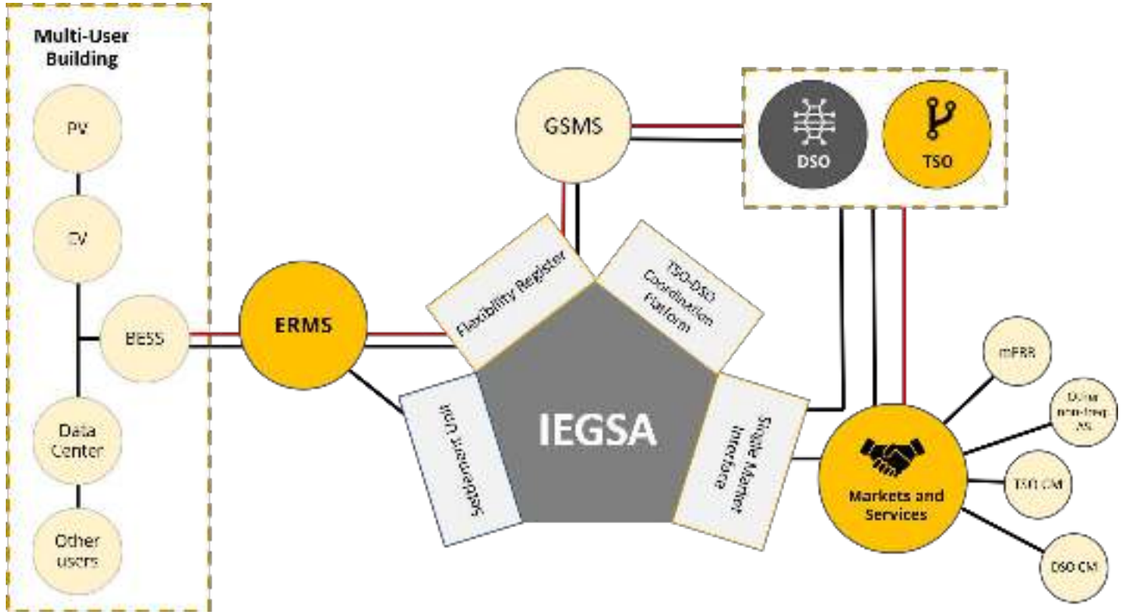
- **Business:**
  - A combination of local congestion management markets with wholesale and balancing markets
  - Ancillary services provision by aggregated end users, prosumers, and distributed generation
- **Technical:**
  - The management of small-scale assets at the distribution level
  - Predictive grid models of the subsidiary network under the IDN to be used by TSOs and DSOs
  - Foundations for new network codes, particularly on demand-response aggregated under IDNs
  - A new mechanism for end-user aggregators to provide grid services

## Business Model

- Using intelligent distribution nodes with energy storage and power-flow-managing capacity, the solution ensures energy balancing and congestion management.
- The demo-site building includes a BESS, PV, and EV chargers.
- It will also include a data centre working 24/7, thus requiring high power quality and reliable supply.
- In addition to flexibility services, other advanced ancillary services will also be demonstrated.
- An innovative control system will be enabled – notably, by the information hub.

## KPIs Definition

- An increase of renewable penetration achieved in the distribution grid
- The total number of offers of grid flexibility to the grid operators that are approved
- The duration of the DSF service and associated curtailment
- The quantified improvement of the BESS turnover thanks to participation in new markets
- The correctness of energy deployment forecasting from the information hub
- Improved revenue rates with more data collected and processed by the information hub




## User Features

- The demonstration of a multi-user building
- A decentralised local market
- A new mechanism for end-user aggregators to provide grid services

## Grid Features

- Valuing aggregated demand response for providing system flexibility and increasing the share of small-scale DERs
- Descriptive and predictive models of aggregated prosumers at the distribution level
- Appraising the efficacy of aggregated distribution nodes to provide ancillary services to system operators

## Blockchain-based TSO-DSO Flexibility

*Integration of an intelligent platform with blockchain-based technology, allowing the trading of flexibility services among prosumers at the TSO and DSO levels*

Enabling TSOs, DSOs, prosumers, BRPs, and suppliers to trade flexibility services in a transparent and cost-effective way

### Distinctive Features

- A blockchain-enabled procurement process allowing for greater visibility into all market parties
- The validation of assets' meter data and the settling of associated financial operations

## Why

*The Pilot's motivations*

- Unlock abundant flexibility services at the DSO level to provide flexibility and ancillary services to the DSO and TSO, respectively
- Easy onboarding and instantaneous settlements with micro-payments
- Reduce transaction costs and data sharing complexity with blockchain

## What

*The Pilot's expectations*

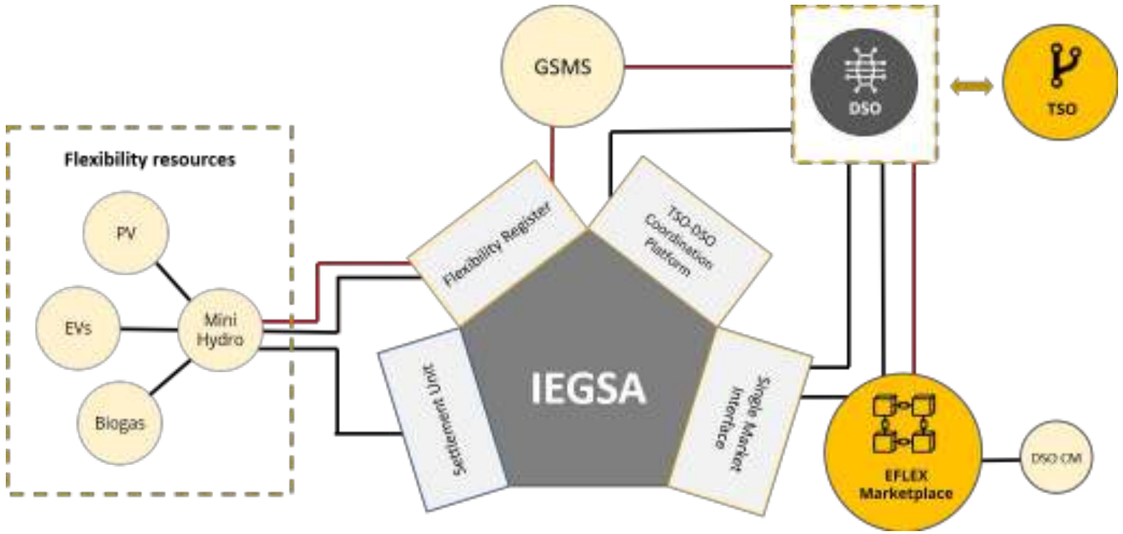
- **Technical:**
  - Flexibility asset registration with locational unit information
  - The long-term reservation of flexibility
  - The validation of metering data and settlement supported by smart contracts and distributed-ledger technology
- **Business:**
  - Expand the opportunities for market participants to be involved in balancing and flexibility markets
  - Simplify the entry of demand response to balancing and other reserve markets
  - A demonstrated framework to facilitate the trading-based optimisation of grid resources

## Business Model

- A registry of flexibility assets and products is based on unique identifications and immutable registrations in a blockchain.
- DSO defines congestion areas in the flexibility marketplace.
- Flexibility offers will be made with unit location information.
- EFLEX executes matching algorithms.
- Smart contracts will be integrated to support the settlement of trade transactions.
- TSO-DSO coordination is achieved via a distributed-ledger database.

## KPIs Definition

- Increased renewable penetration achieved in the distribution grid
- The total number of approved offers for grid flexibility to the grid operator
- The amount of new flexibility offered to the DSO
- The number of tokens released
- The number of congestion hours in the DSO grid
- The duration of the DSF service and associated curtailment




## User Features

- A decentralised local market
- A blockchain-based smart billing system

## Grid Features

- Geo services
- The reservation of flexibility to resolve constraints in the DSO grid
- A blockchain-enabled procurement process, allowing for greater visibility into all market parties

## DSO and Consumer Alliance (a centralised energy management system for microgrids)

*A combination of EESs and demand response involving both large and residential users*

Improve the quality of the local DSO network and implement an early-stage DR program to exploit synergies in a municipal-scale and multi-energy microgrid

### Distinctive Features

- Exploiting the high share of renewable generation in a city microgrid
- Smart management algorithms for an LV distribution grid

## Why

*The Pilot's motivations*

- Maximise flexibility to the DSO
- Integrate and coordinate large- and small-scale assets
- Exploit the potential of the multi-energy microgrid
- Reduce flowback of electricity to the TSO
- Increase power quality in LV network
- Implement an advanced control system
- Coordinate flexibility service providers' products/ programmes and DSOs' congestion-management issues

## What

*The Pilot's expectations*

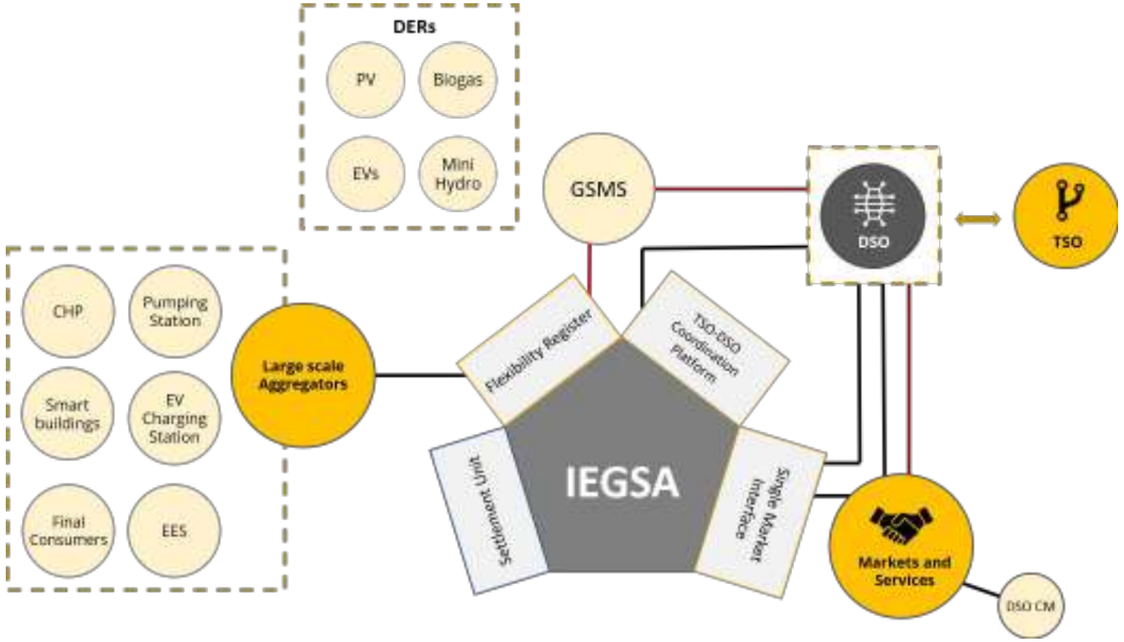
- **Technical:**
  - Increase the microgrid self-consumption of renewable energy, thus reducing the amount of power injected into the national grid at the point of common coupling with the national TSO
  - Improve the power quality of the microgrid by acting on the critical LV lines identified by the DSO
- **Business:** Promote final-user engagement in DR programs
- **Social:** Promote the development of local energy communities

## Business Model

- Reduce the flowback of electricity to the TSO
- Increase power quality in the LV network
- Use BESS to optimise power supply from distributed and non-programmable DERs
- Flexible and responsive users in rural branches of the network
- Compensate for sudden lacks of power production in the microgrid at specific times of the day
- Maximise the potential of distributed energy resources across sectors
- Increase the provision of flexibility

## KPIs Definition

- The quantification of monitored BESS performance
- The improvement of the monitored quality parameters of suburban branches
- The number of DR response hours in the year involving large users
- The number of MWh of flexibility provided by the CHP plant
- Lower congestion management costs for the DSO
- Hours operated in islanding mode
- The amount of excess electricity injected into the transmission network
- The number of hours for which electricity is injected into the transmission network – in both winter and summer
- The amount of flexibility provided by FSPs (and to which end users)




## User Features

- The involvement of the entire microgrid and its users
- Maximising the self-consumption of locally produced RE and grid connected assets
- Incentives for final users to take part in a DR programme
- Cooperation among prosumers

## Grid Features

- Short-term congestion management to the local DSO (15 minutes ahead)
- Improved power quality in countryside branches characterised by low consumption

BD4OPEM

www.bd4opem.eu

# BIG DATA FOR THE OPEN INNOVATION ENERGY MARKETPLACE

The **BD4OPEM** project aims to develop and deploy a reference architecture for large-scale multi-party data exchange, management & governance, and real-time processing in the energy sector. The main goal is constituted by the interconnection between data producers and data users to achieve an efficient and common electricity system that deploys efficiency, connectivity, and energy for all.

BD4OPEM will develop products and services to improve the planning, monitoring, operation, and maintenance of electricity distribution grids, all made available at in an open innovation marketplace.

The objectives are achieved considering different aspects: **technical**, by improving energy distribution; **business**, by proposing a new system for DSO and access to services for all; **environmental**, by incorporating renewable energies; and **social**, by understanding the mechanisms and stimuli that may induce users to change their behaviours. The process will be demonstrated at five pilot sites (Spain, Turkey, Slovenia, Belgium, and Denmark), which provide the initial input data and will also trial and validate the usefulness and the usability of the services being developed.

## BD4OPEM PILOT SITES

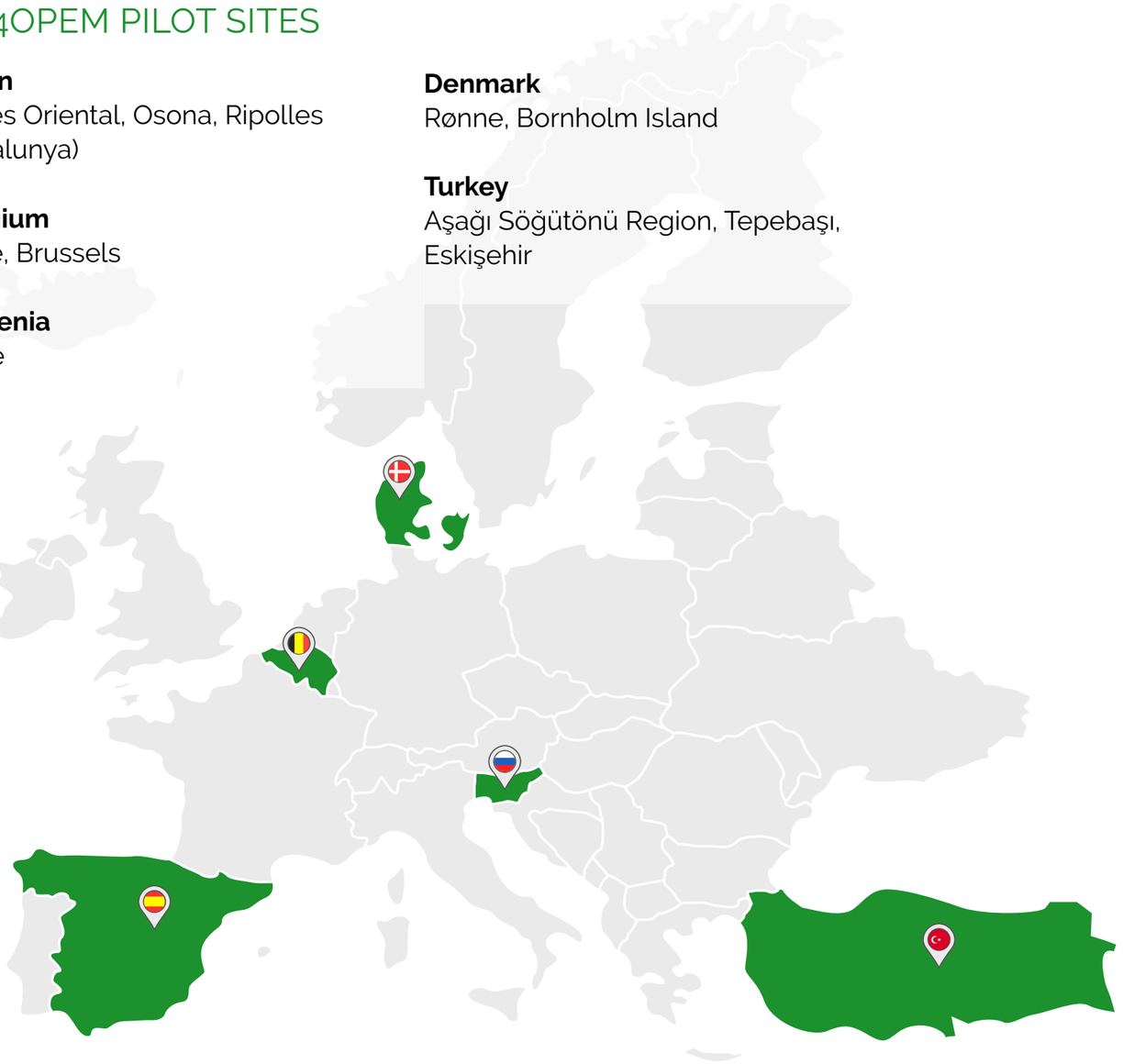
**Spain**
Valles Oriental, Osona, Ripolles (Catalunya)

**Belgium**
Jette, Brussels

**Slovenia**
Celje

**Denmark**
Rønne, Bornholm Island

**Turkey**
Aşağı Söğütönü Region, Tepebaşı, Eskişehir



## Evolve as a DSO and solve the challenges of energy transition

*Harness the power of technology to exploit all the potential of the already existing grid data*

Transforming ourselves and our surroundings

### Distinctive Features

- Move forward the energy digitalisation of Estabanell as both a DSO and retailer
- Grid observability to predict congestions and component failures
- Strategy development for grid expansion and investments

## Why

*The Pilot's motivations*

- Make use of new technologies to improve processes already established and proven to work in an industry more than a century old.
- Push out of the comfort zone and make use of the massive amount of available grid data not yet exploited.

## What

*The Pilot's expectations*

- **Technical:**
  - Involve Estabanell facilities, consisting of more than 1,100km of electricity grid that supplies more than 56,000 power points and distributes electricity through more than 800 secondary substations.
  - Improve network management efficiency and facilitate the adoption of advanced intelligent energy services.
- **Business:** Assess planning, energy efficiency, and flexibility on the demand side using machine learning and big data techniques.

## Business Model

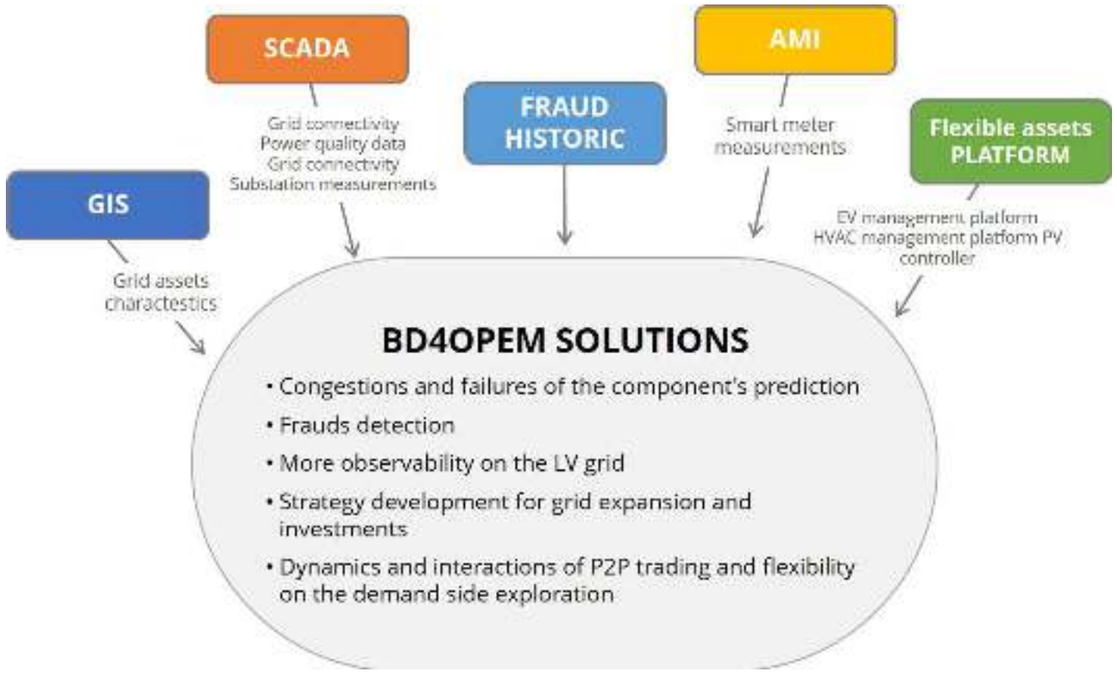
- The introduction of new services by the DSO to reduce its costs in planning and O&M
- The exploration of new markets, such as the flexibility market, to initiate a new source of revenue

## KPIs Definition

- Reduced technical and non-technical losses
- Decreased cost allocation for grid maintenance and expansion
- Decreased congestion events due to the use of flexibility

## User Features

- Manageable data
- Protected data
- Valuable data
- Quality data
- Ease of management




## Grid Features

- The use of high-volume data
- Data services
- Grid insights
- Energy efficiency
- Flexibility
- Grid management

## Data analysis to improve the energy profiles of client clustering

Develop and deploy a reference architecture for large-scale multi-party data exchange, management & governance, and real-time processing in the energy sector.
Make it green and environmentally friendly!

### Distinctive Features

- The deployment of innovative energy services for the BD4OPEM marketplace
- Foster data-driven solutions to support prosumers

### Why

*The Pilot's motivations*

- Support prosumers – who are getting smarter, more efficient, and environmentally friendly – in achieving their goals in all aspects of electricity.

### What

*The Pilot's expectations*

- **Technical:**
  - Empower the entire electricity supply chain with data-driven services to yield a better performance overall in many aspects of modern smart grids.
  - Harness the power of increasingly available technologies and implement advanced data solutions to enable reliable decisions.

## Business Model

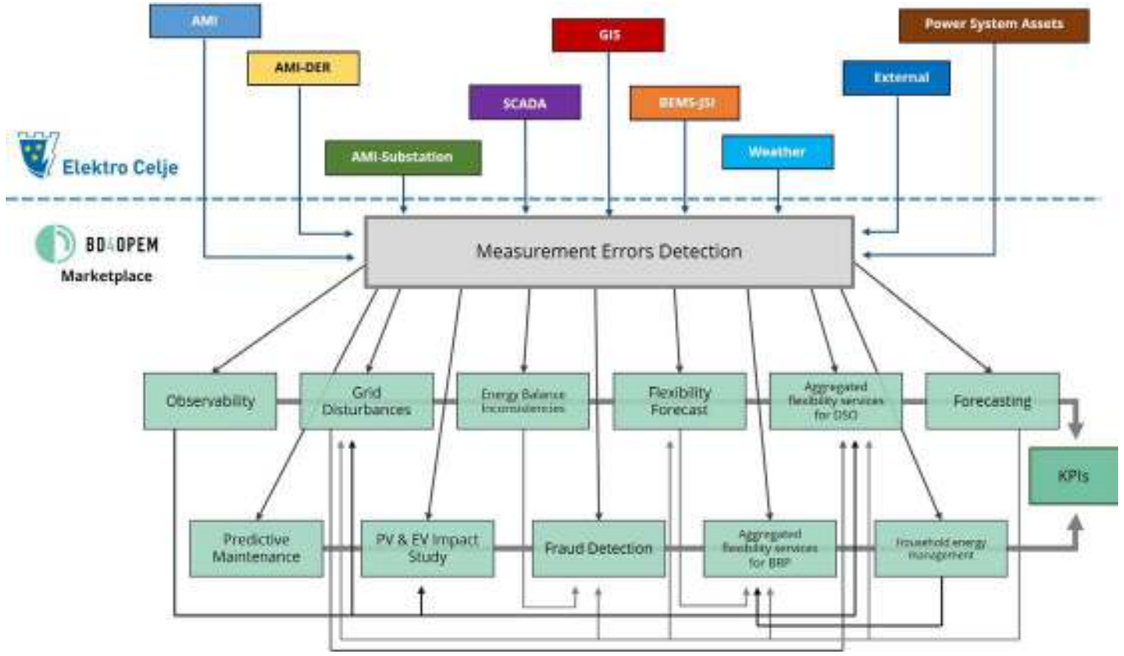
- Using analytical tools to support smart grid actions, thus delaying/ reducing gird reinforcement investments
- Supporting 'smart prosumers' to achieve full flexibility and providing services to the grid using data-driven functions
- Enabling higher RES penetration, reducing local grid losses, and increasing self-sufficient energy communities

## KPIs Definition

- Greater observability of grid points in the LV grid
- Reduced smart meter failures and increased maintenance practices
- A reduced number of congestions and a reduced number of voltage-profile violation events
- A decreased percentage of non-technical losses
- Increased accuracy of load and production forecasting
- The increased quality/accuracy of data-driven services available

## User Features

- Manageable data
- Protected data
- Valuable data
- Quality data
- Ease of management




## Grid Features

- The use of high-volume data
- Data services
- Grid insights
- Energy efficiency
- Flexibility
- Grid management

## Data processing for the energy company of the future

*A multi-stakeholder platform for data management and real-time business in the electricity distribution system*

Superior technologies and innovative markets to achieve stable distribution operations

### Distinctive Features

- Meeting supply and demand in the presence of very high PV penetration
- Topology analysis & advanced observability for the MV network

### Why

*The Pilot's motivations*

- Create value from present data to help DSOs with ESS, EV chargers, flexibility services, predictive maintenance, and grid-asset planning
- Foster the revision of energy actors' roles in the future, when operations will be based on big data
- Provide reliable grid performance in conjunction with increasing DER sources

### What

*The Pilot's expectations*

- **Technical:** Increased need to simultaneously process real-time data due to an increase in distributed energy, new load types, and the spread of technology

## Business Model

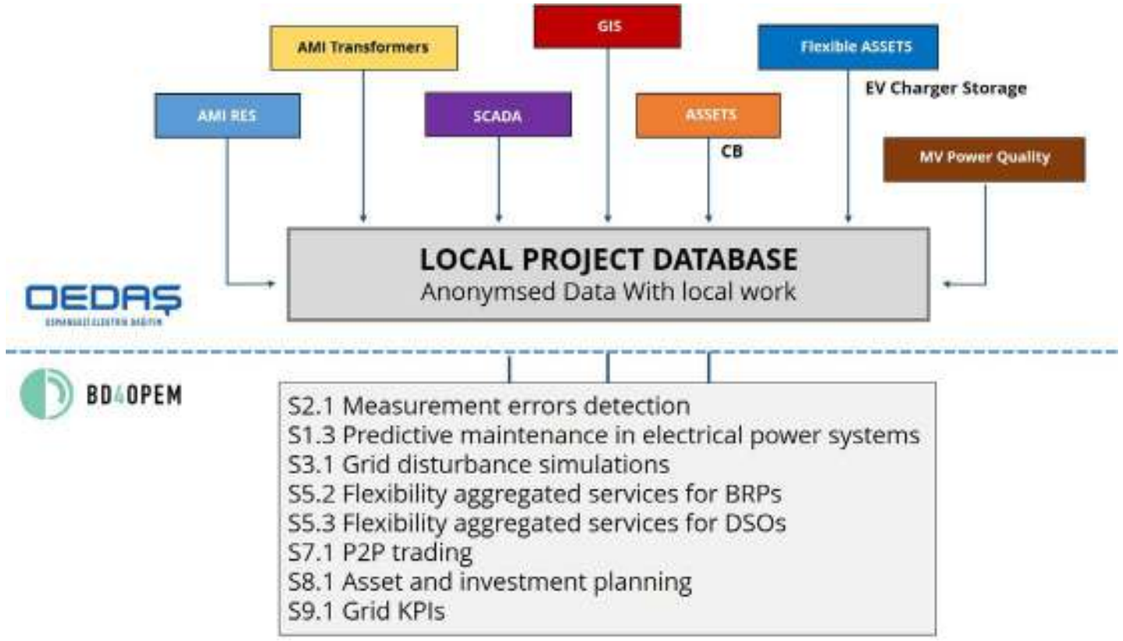
- Increase power quality in the LV network
- Use ESS to optimise power supply from distributed energy sources
- Increase the flexibility of the LV grid
- Maximise the potential of distributed energy resources

## KPIs Definition

- ESS performance
- Reduced energy demand for transformers and LV branches by load shifting
- Quality parameters in MV grid

## User Features

- Manageable and protected data
- Maximise the self-consumption of locally produced renewable energy
- Predictive maintenance
- Increasing power quality




## Grid Features

- Flexibility futures
- Managing the grid
- The use of high-volume data
- Data services and quality


## Drawing on electric vehicle data

*A renewable integrated power system operating in grid-connected and island modes*

We make electric vehicles greener.

### Distinctive Features

- Bidirectional EV charging
- A high-level of control
- Versatile integration
- Management on the go

## Why

*The Pilot's motivations*

- Optimise energy asset operation through data-driven use cases
- Help define data services for utilities, energy suppliers, and grid operators
- Integrate transportation and energy by providing storage for renewable energy, services to grid operators, and the optimisation of EV charging on the grid by supporting a green transition
- Manage local assets more efficiently and dynamically by making use of distributed vehicle-to-grid (V2G) services
- Provide a solution for link and balance among stakeholders in flexibility markets

## What

*The Pilot's expectations*

- **Technical:** Improve energy distribution in a sector undergoing change by creating smart grids where EV can optimally support the current grids and integrate renewable energy
- **Business:**
  - Support the development of new flexibility energy markets that facilitate the work of the DSO
  - Improve existing and create new flexibility energy services to support markets and obtain new market value
- **Environmental:** With the incorporation of renewable energies, BD4OPEM engages in decarbonisation out of respect for the environment.
- **Social:** Understand mechanisms and stimuli that may induce users to change their behaviours in order to fulfil specific requests from grid actors

## Business Model

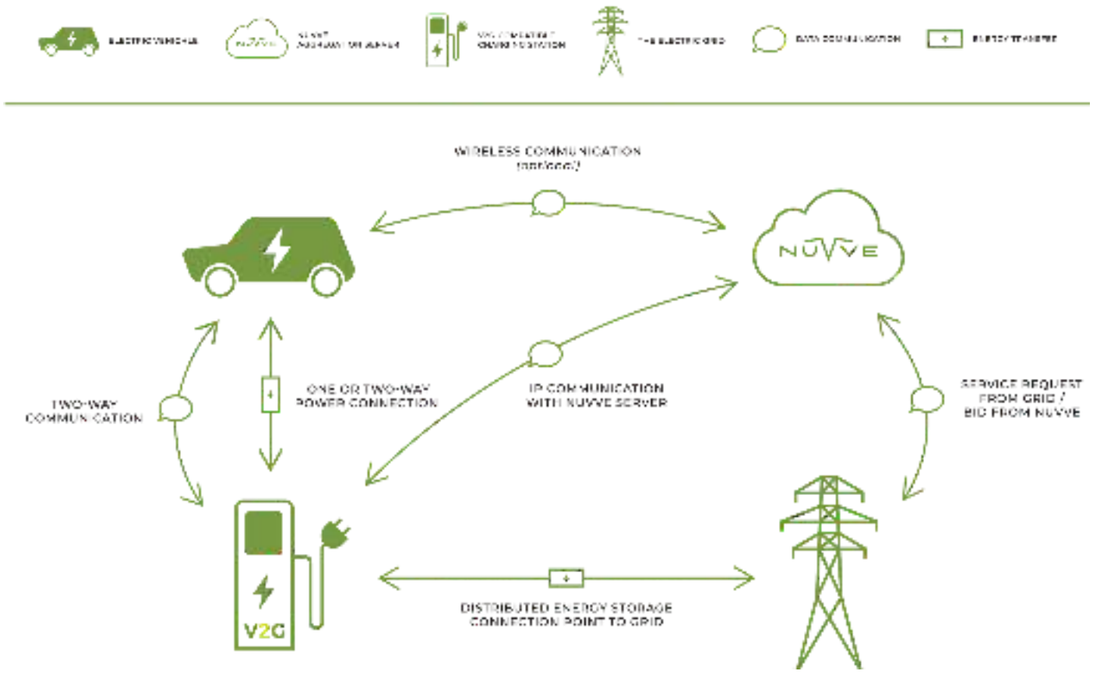
- Payment for a) availability and b) providing energy: In this pilot, potential coexistence or competitiveness with other services will be investigated.
- The 'time of use' service is behind the meter service, as a way to reduce costs.

## KPIs Definition

- The timely provision of energy based on forecasting to prevent grid failures or power drop-out
- The ability to follow tariff price signals with the satisfaction of customers' primary objectives

## User Features

- Manageable data
- Protected data
- Valuable data
- Quality data
- Ease of management




## Grid Features

- The use of high-volume data
- Data services
- Grid insights
- Energy efficiency
- Flexibility
- Grid management

## Fostering microgrid management through data

*An advanced energy island that exploits BD4OPEM platform capabilities*

Cutting-edge control technology and the maximum reliability of the building management system

### Distinctive Features

- Cutting-edge control technology and the maximum reliability of the islanding modes of microgrids
- A smart-meter data platform to control the algorithms of building management systems

### Why

*The Pilot's motivations*

- Follow the necessity of using more and more energy resources, together with their increasing applications
- Optimise energy operation and grid security with a high priority on the installed environment

### What

*The Pilot's expectations*

- **Technical:** The high prioritisation of grid security for DSO customers
- **Environmental:** Increase the share of energy that is locally produced from renewable sources

## Business Model

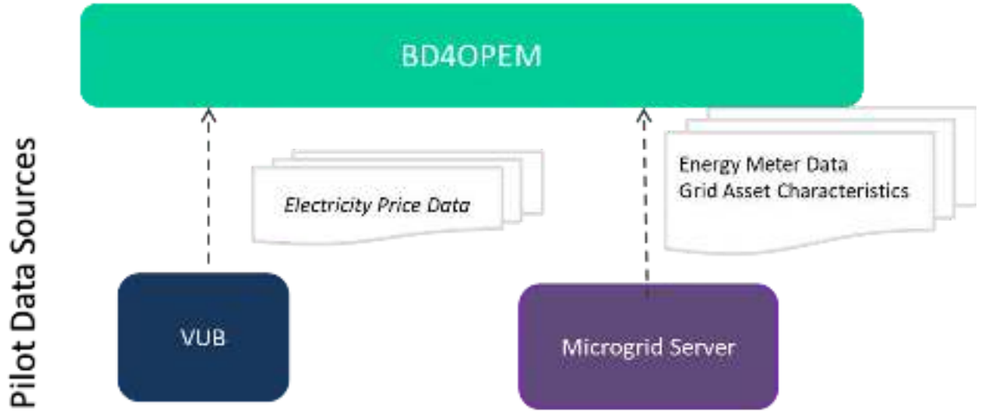
- System optimisation as an optimal scheduling problem, which determines the least-cost schedule of available resources (DERs and loads)
- The involvement of start-up and shut-down time and power output at each of the output units over a scheduled period
- The investigation of data from other services to develop the system-optimisation model

## KPIs Definition

- The progress services flexibility and system optimisation
- Energy resource forecasting based on short- and medium-term flexibility
- Power-quality measurements and phasor measurements in the MV network
- Parameters, including the lengths of overhead lines and cables, based on voltage and current constrains on the MV & LV grids
- Energy-related data on the grid to estimate and minimise operating costs

## User Features

- Manageable data
- Protected data
- Valuable data
- Quality Data
- Ease of management




| Data Object | Offered by | System | Communication Protocol | Data Format |
|---|---|---|---|---|
| Energy meter data | Microgrid Operator | Microgrid Server | HTTPS | CSV/XLSX/ JSON |
| Grid Asset Characteristics | | Microgrid Server | HTTPS | CSV/XLSX/ JSON |
| Retail electricity price | VUB | (Manual Input) | (Manual Input) | To be clarified |

## Grid Features

- The use of high-volume data
- Diverse energy sources
- Communication (SCADA)
- Digitisation & automation
- Grid optimisation
- Efficiency
- Flexibility

# Platone

www. platone-h2020.euh2020.eu

## PLATFORM FOR OPERATION OF DISTRIBUTION NETWORKS

| 12 | 4 | 3 | €10 M | 2019-2023 |
|---|---|---|---|---|
| Partners | Countries | Pilot Sites | EU Contribution | Duration |

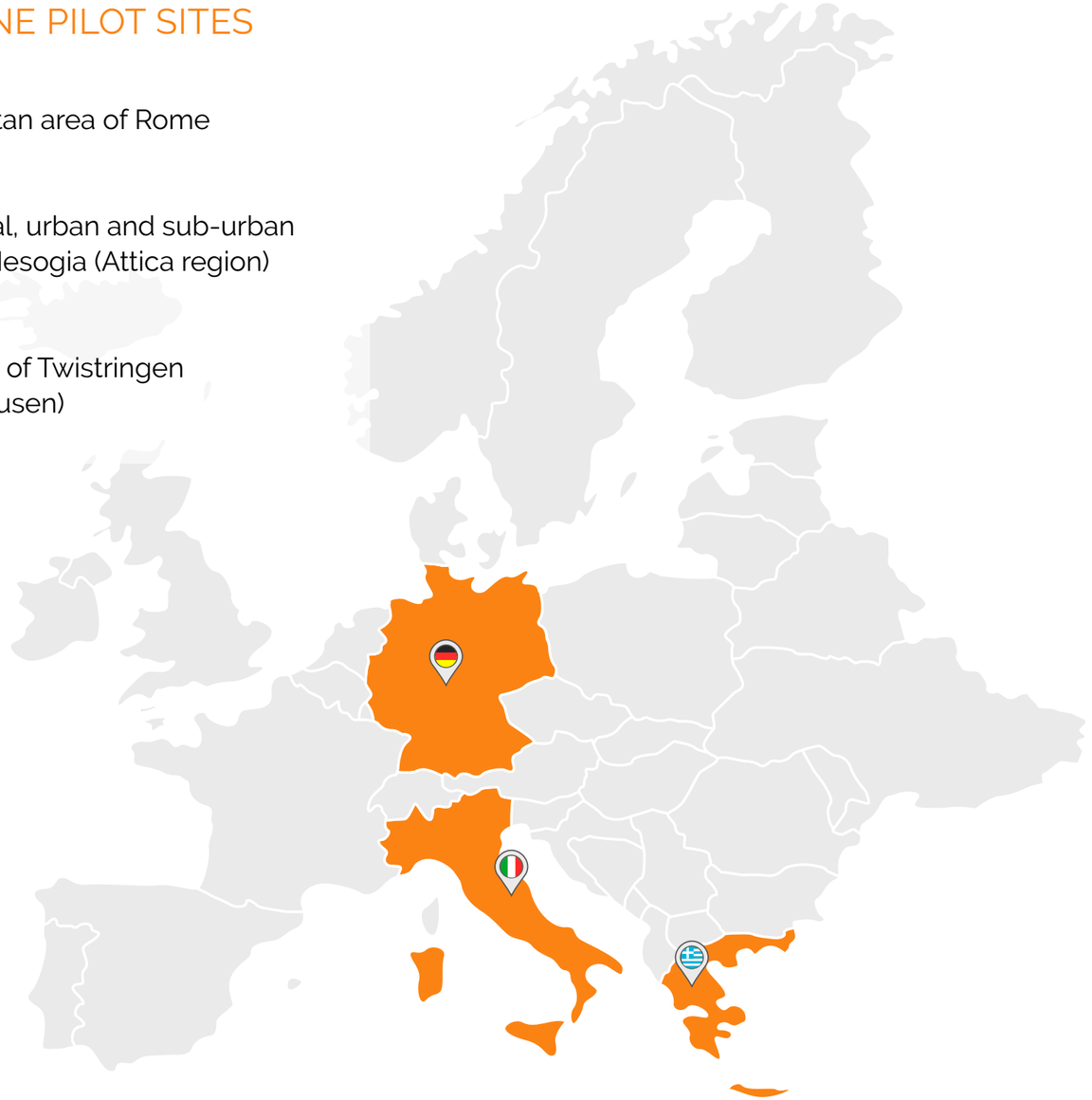
The **Platone** project aims to develop an architecture for testing and implementing a data acquisitions system based on a two-layer approach, an access layer, and a service layer to allow greater stakeholder involvement and enable efficient and smart network management. The tools used for this purpose will be based on platforms able to receive data from different sources, such as weather forecasting systems and distributed smart devices spread across an urban area. These platforms, by talking to each other and exchanging data, will enable the collection and elaboration of information that is useful for distribution-system operators (DSOs), transmission-system operators (TSOs), customers, aggregators, and other stakeholders, such as market operators, energy traders, and balance-responsible parties. In particular, the DSO will invest in open and non-discriminating standard economic dispute-settlement blockchain-based infrastructure to give both customers and the aggregator the possibility to easily become flexibility market players. This solution will see the DSO evolve into a new form – a market enabler for end users and a smarter observer of the distribution network.

## PLATONE PILOT SITES

**Italy**
Metropolitan area of Rome

**Greece**
Mix of rural, urban and sub-urban areas of Mesogia (Attica region)

**Germany**
Rural area of Twistringen (Abbenhausen)



## A new local energy flexibility market

*Ancillary services for the distribution grid, based on trust and the certification of transactions*

All the users are 'flex-users'

### Distinctive Features

- Enable medium-voltage and, in particular, low-voltage resources
- The use of an innovative device – the light node
- Blockchain technology
- A common TSO-DSO flexibility market
- A market-based approach

## Why

*The Pilot's motivations*

- Ensure reliable and secure power supply in the context of increasing DER penetration
- Improve grid operation through an advanced observability approach
- Unlock local flexibility markets to solve congestions and voltage stability issues
- Improve customers engagement and enable their fair participation in the market
- Increase the revenues of customers and decrease systems costs
- Increase trust in market exchanges

## What

*The Pilot's expectations*

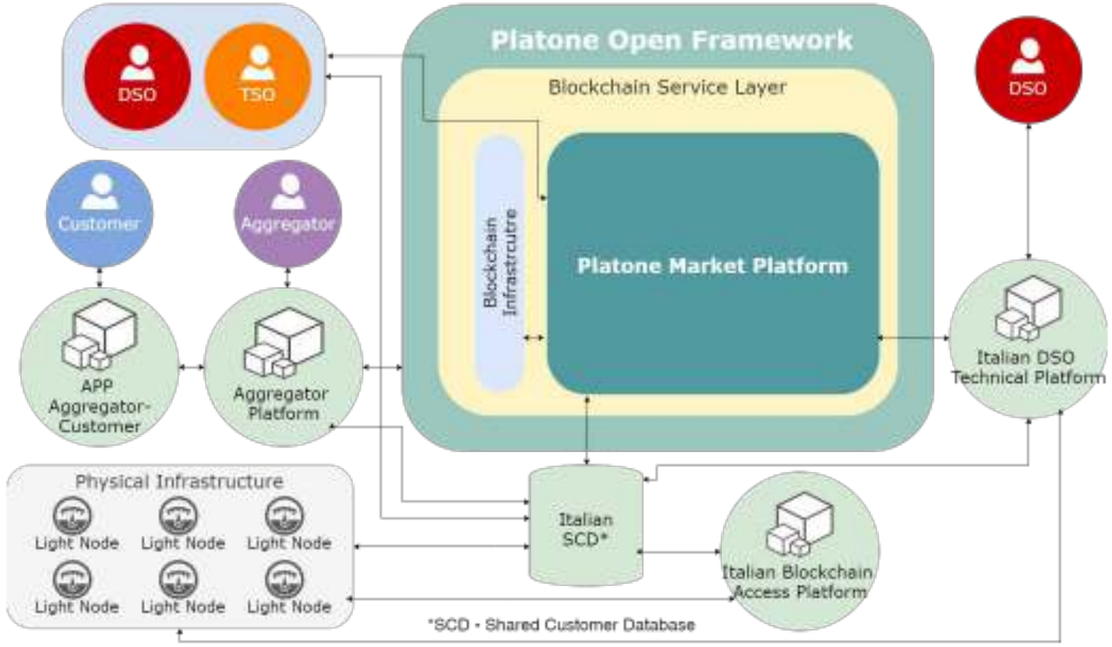
- **Technical:**
  - Support the TSO in using flexibility provided by the resources connected to the distribution network
  - Empower coordination between system operators
  - Activate flexibility to solve voltage violations and congestion issues in the distribution grid
- **Business:**
  - Ensure inclusive and non-discriminatory access to the market for all actors that provide grid services
  - Share flexibility data with all stakeholders
  - Certify data for market exchanges with blockchain technology

## Business Model

- The pilot focuses on the flexibility provided in medium and low voltage, using a multi-platform approach:
- An access layer, based on Blockchain, is used to involve the customers in the market.
- A common repository, named Shared Customer Database, for all flexibility data is accessible to the stakeholders.
- A market platform is used to match the SOs' requests and aggregators' offers, and also to perform the settlement phase on the blockchain service layer.
- The demo tests two new roles for the DSO – as a buyer of local flexibility and as an enabler of local flexibility – and unlocks user potential by installing devices able to transmit set points and retrieve real-time measurements.

## KPIs Definition

- Participants' recruitment
- Active participation
- Flexibility availability
- Flexibility effectiveness
- Forecasting reliability – customer profile
- Forecasting reliability – grid profile
- Market liquidity




## User Features

- The optimisation of energy prices
- Interaction with the aggregator via an app
- Participation in the local community

## Grid Features

- Generation and load forecasting
- Real-time topology updates
- Medium-voltage and low-voltage observability
- A flexibility enabler for end users
- An ability to increase the percentage of DER in the system

## Innovative flexibility services and advanced network observability

*Developing state estimation techniques for real-time grid monitoring and investigating a novel approach to a variable network*

Increasing the observability of the grid – unlocking flexibility

### Distinctive Features

- State estimation techniques
- Phasor measurement units (PMUs)
- Variable network tariffs
- Optimal dispatch

## Why

*The Pilot's motivations*

- Ensure reliable and secure power supplies in the context of increasing DER penetration
- Gain near real-time insight into the operation of the networks and to improve grid operation through an advanced observability approach
- Achieve optimal dispatching addressing local congestion and voltage-level issues using novel approaches to flexibility mechanisms at the DSO level
- Investigate the potential provision of ancillary services to the TSO by the users of the distribution network
- Assess the penetration limits of DERs for the better control and planning of the distribution network

## What

*The Pilot's expectations*

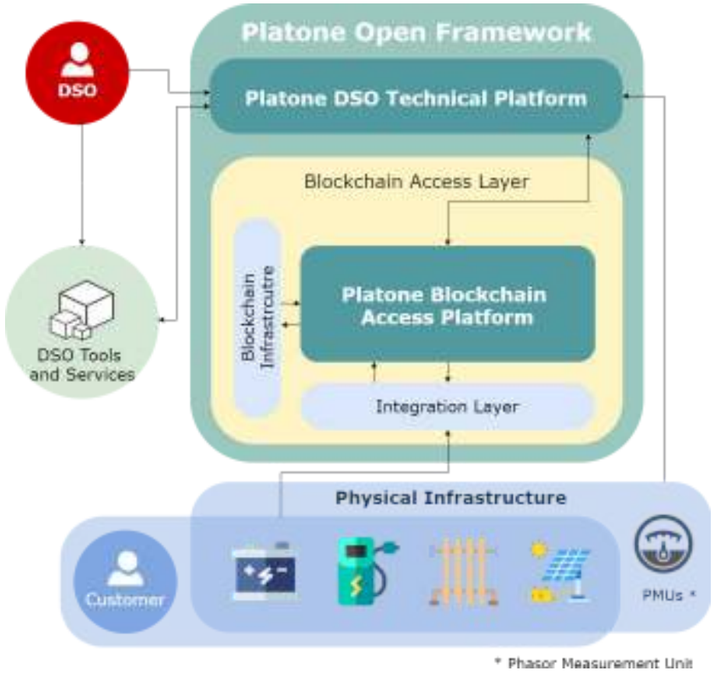
- **Technical:**
  - Develop state estimation techniques for near real-time grid monitoring purposes
  - Ensure the smooth incorporation of synchronised measurement data derived from PMUs with pre-existing conventional measurements
- **Business:** Investigate whether the novel approach of a variable network tariff scheme, instead of the traditional flat network tariff schemes, incentivises customers with flexible loads and leads to optimal dispatch for the distribution network
- **Social:** Explore the potential of the users of the distribution network to respond adequately to the TSO's request for frequency restoration reserve activation

## Business Model

- Financial gain for consumers and prosumers by modifying energy consumption and improving production patterns
- Optimised grid utilisation for the DSO due to peak shaving and load shifting, favouring less stress on equipment and, consequently, decreased infrastructure upgrades and maintenance costs
- Increased reliability of distribution systems due to advanced grid observability and the optimised integration of DERs
- TSO requests for frequency adjustments supported by the DSO

## KPIs Definition

- Relative root mean square/percentage error
- Accuracy metric for complex phasor voltage estimation
- Convergence metric in terms of objective function/estimated voltage magnitude/estimated voltage angle
- Generation/Demand curtailment
- Generation/Demand curtailment occurrences
- Network limit violation occurrences
- Frequency support not provided
- PMU field installation and integration
- Data visualisation
- Visualised outputs of tools and services, and network response handling




## Grid Features

- Grid observability
- Data visualisation
- Variable network tariffs (DA and balancing market)
- Handling the TSO's requests
- State estimation
- Power-consumption forecasting
- Optimal DER dispatch
- The integration of different grid data
- Load shifting

## Strengthening the abilities of energy communities

*Increasing the hosting capacity and efficiency of innovative distribution networks*

Energy Communities in Future Distribution Networks

### Distinctive Features

- Local balancing up to islanding
- Flexibility provision on demand
- Energy delivery and energy export in bulk

## Why

*The Pilot's motivations*

- Simulate the generation and consumption behaviour of future energy communities and their physical effect on the distribution network
- Ensure reliable and secure power supplies in the context of increasing DER penetration
- Gain near real-time insight into the operation of networks and improve grid operation through an advanced observability approach
- Improve customers' engagement and facilitate their participation in mechanisms for flexibility provision

## What

*The Pilot's expectations*

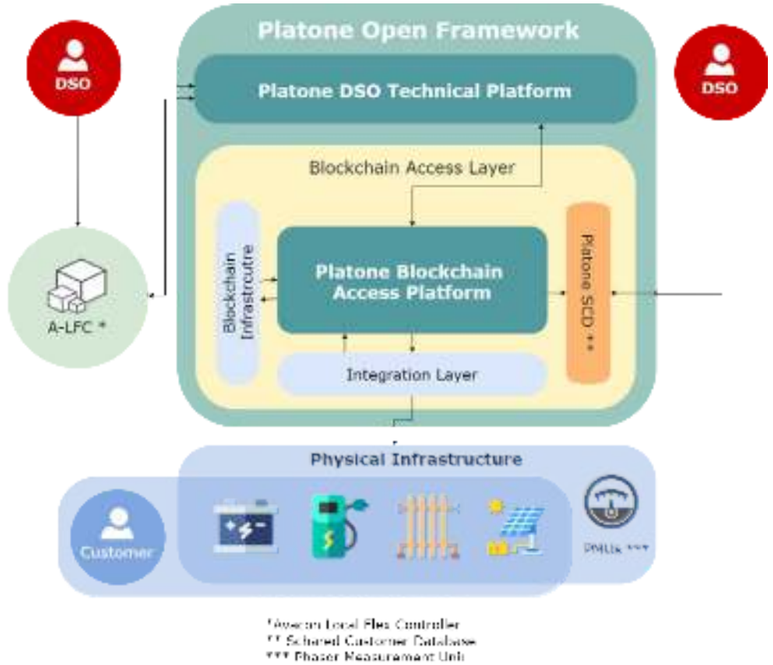
- **Technical:**
  - The monitoring and forecasting of the generation and demand of the community
  - Enabling the community to avoid power exchange along the MV/LV feeder (virtual islanding)
- **Social:**
  - Controlling the energy resources located within the community
  - Maximising the consumption of locally generated energy and minimising the demand satisfied by the public grid
  - Enabling the community to provide a fixed amount of power

## Business Model

- Community energy management
- Peak shaving
- Providing flexibility to markets or TSO/DSO for grid stabilisation
- Providing flexibility to TSO/DSO for increasing the hosting capacity and efficiency of existing networks
- Increasing the efficiency and reliability of energy supply in future grids with an increasing share of renewables and flexible loads

## KPIs Definition

- Reduced energy demand provided by the MV grid
- Reduced power recuperation peaks
- Increased self-consumption
- Maximised islanding duration
- Flexibility effectiveness
- Responsiveness
- The accuracy of the achievement of a given set point
- Participants' recruitment
- Active participation
- Forecast reliability – customer profiles
- Forecast reliability – grid profiles
- Distribution network hosting capacity
- The success of package-based energy provision
- Accuracy in forecasting deficits

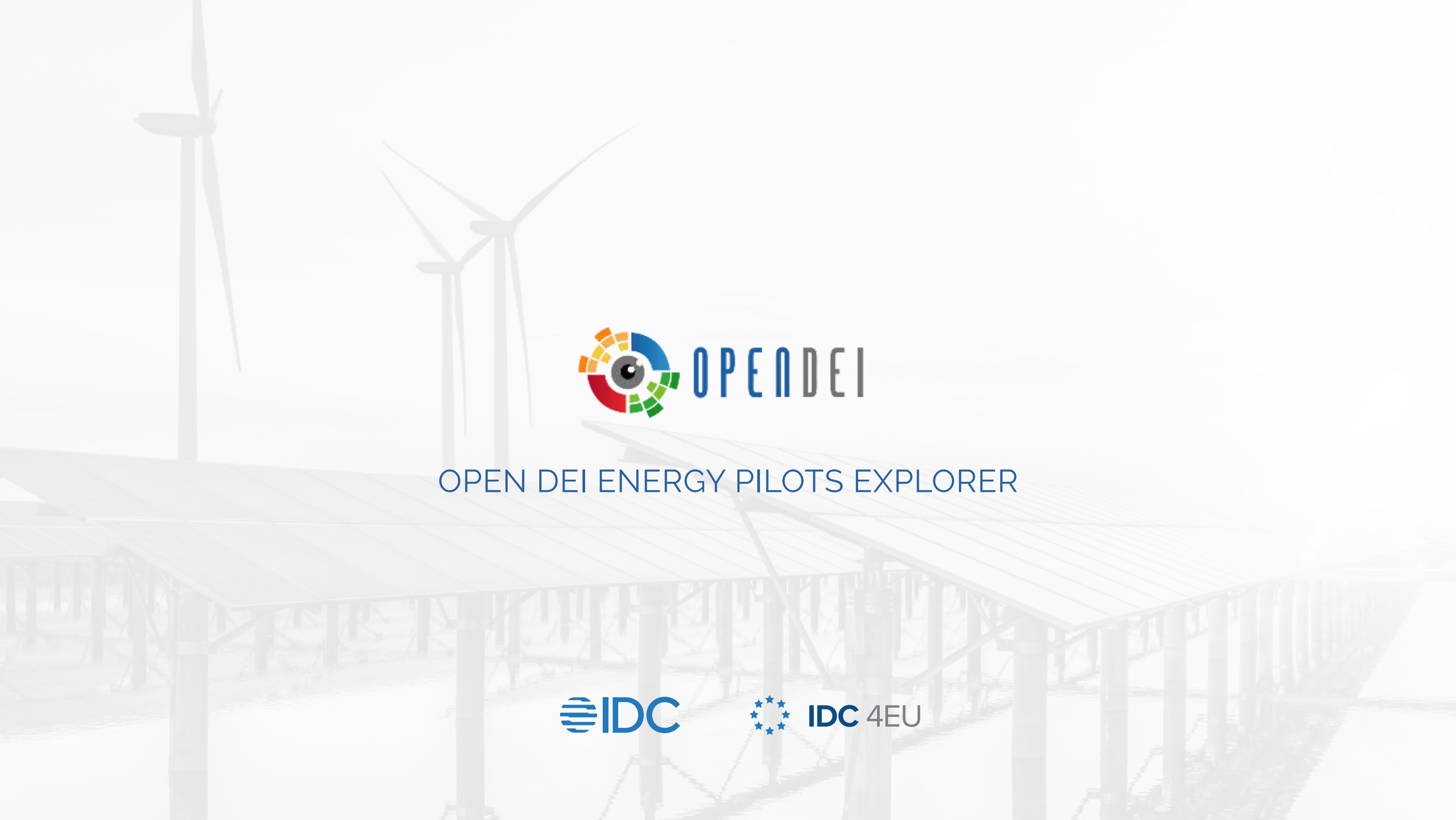



## User Features

- Combining surrounding buildings to offer flexibility
- Reducing energy consumption on a community level

## Grid Features

- Increase the share of renewable energy in total consumption
- Energy consumption – generation forecasting
- Power consumption – generation forecasting
- Demand-response service
- Peak shaving on community level/power limitation



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